ARMY *TM 1-2840-248-23
AIR FORCE *T.O. 2J-T700-6

TECHNICAL MANUAL

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL

ENGINE, AIRCRAFT TURBOSHAFT

MODELS T700-GE-700
T700-GE-701
T700-GE-701C
T700-GE-701D

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

*This manual supersedes TM 55-2840-248-23/T.O. 2J-T700-6, dated 28 April 1982, including all changes.

HEADQUARTERS, DEPARTMENTS OF THE ARMY AND THE AIR FORCE

1 JUNE 1999

WARNING AND FIRST AID DATA PAGE

For artificial respiration and other first aid data, refer to FM 21-11.

Personnel performing instructions involving operations, procedures, and practices which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, illness, death, or an aborted mission. Warnings for hazardous substances have been developed from dated manufacturer's Material Safety Data Sheets (MSDS), when available. Each Warning is valid as of its specific preparation date. To insure compliance with current precautionary information, always read and follow the hazardous materials labels posted on the container for the specific substance and the MSDSs supplied by the manufacturer.

WARNING

An operating procedure, practice, etc., which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

WARNING

Use of Cleaning Solvents

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator and goggles.

WARNING

Igniter Plugs

- Before energizing the ignition circuit, be certain that no fuel or oil is present. Have fire extinguishing equipment present.
- High voltage is present. Be certain the ignition unit and plugs are grounded before energizing the circuit.
- Never touch or make contact with the electrical output connector when operating any ignition component.
- Never hold or make contact with the igniter plug when energizing the ignition component.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that ignition lead(s) (igniter plug end) are correctly grounded.
- Do not attempt to ground ignition lead(s) to components made of composite material, such as the outer bypass duct. Composite materials do not conduct electricity.
- Ground lead(s) to the customer bleed duct.

WARNING

Removing Anti-Icing Bleed and Start Valve

- The anti-icing bleed and start valve can reach a temperature of about 300°F (149°C) during engine operation.
- If engine has been operating, allow valve to cool before removing it with bare hands.

WARNING

Engine Noise

- Exposure to engine noise may cause ringing in ears, and may cause temporary or permanent hearing loss.
- If ringing in ears or temporary loss of hearing persists, get medical attention.
- When testing engine in operation, stay in sound-insulated enclosed booth. If closer monitoring is required, wear approved hearing protection.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

WARNING

Using Hoisting Devices

- Hoisting shall only be done by designated personnel.
- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks or defects in hoisting system shall be performed on a regular basis.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

WARNING

Motoring Engine

- To prevent accidental starting, de-energize ignition switch before motoring engine.
- After motoring engine, do not attempt to start engine until residual fuel has drained from combustion chamber drain.

WARNING

Starting Engine

- The danger areas around the aircraft must be free of personnel, other aircraft, and all vehicles before engine is started.
- The high temperature and velocity of the exhaust are extremely dangerous.
- If liquid accumulation is evident by drainage from combustion chamber drain, the combustion chamber must be allowed to drain before a start is attempted.

WARNING

Viton Exposed to Fire Damage

- Combustion can produce highly toxic fumes of hydrogen fluoride and carbonyl fluoride at temperatures over 527°F (275°C).
- Water from firefighting efforts and moisture from eyes, sweaty skin, and lungs may combine with hydrogen fluoride gas or residue to form Hydrofluoric acid.
- Exposure to Hydrofluoric acid will cause blurred vision, pain, and breathing difficulty. In sufficient concentration, exposure may lead to permanent lung damage or death.
- If eyes or skin is exposed to hydrogen fluoride, immediately flush affected area thoroughly with water. Get immediate medical attention.
- Self-contained breathing apparatus, goggles, and protective clothing shall be worn when fighting fires associated with Viton.
- Wear neoprene gloves when handling refuse from a Viton fire, even if material is cool.
- Allow for adequate cool-down and air-out periods in a well ventilated area before repairing equipment damaged by a fire involving Viton.

WARNING

Fire-Extinguishing Agents

- Vapors of fire-extinguishing agents are toxic. Do not inhale.
- If agents touch eyes or skin, immediately flush affected area with running water; get medical attention.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

WARNING

Aerosol Cans

- Extremely flammable; do not use near flame.
- Do not puncture, incinerate, or store at temperature above 120°F (48.9°C).
- Use with adequate ventilation; avoid breathing vapor or mist.
- If spray gets in eyes, flush them with water and seek immediate medical attention.

WARNING

Aviation Turbine Fuel (Jet Fuel)

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Contact of skin with liquid can irritate skin. Contact of eyes with liquid can cause severe irritation and blurred vision. Inhalation of vapor can cause irritation, headache, nausea, and dizziness.
- If liquid contacts eyes, flush them thoroughly with water. Immediately remove fuel-saturated clothing. If vapors cause dizziness, go to fresh air. If liquid is swallowed, do not try to vomit; get medical attention.
- When handling large quantities of liquid (more than one gallon) at an unexhausted workbench, wear approved respirator and goggles or face shield.
- Dispose of liquid-soaked rags in approved metal container.
- Metal containers of fuel must be grounded to maintain electrical continuity.

WARNING

Flight Safety Critical Aircraft Parts

This manual contains procedures identifying critical characteristics of flight safety critical aircraft parts. Critical characteristics may be identified as dimensions, tolerances, finishes, materials, assembly procedures, or inspection procedures. Some processes may require qualified sources. Flight safety critical aircraft parts indicating a maximum allowable limit shall not be continued in use when limits have been exceeded. These parts must be replaced.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

WARNING

Electrical Shock Hazard

- Persons working on line electrical systems should have proper training before doing so. Use proper personal protective equipment.
- Use care when applying input power and when measuring voltage. Dangerous or possibly fatal voltage may be present.

TM 1-2840-248-23
T.O. 2J-T700-6
C7

Change

No. 7

HEADQUARTERS, DEPARTMENTS OF THE ARMY AND THE AIR FORCE
WASHINGTON, D.C., 31 August 2005

Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-GE-700, T700-GE-701, T700-GE-701C, T700-GE-701D

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A through D	A through D
- - - - -	E/(F Blank)
i through xviii	i through xviii
1-1 through 1-4	1-1 through 1-4
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1-21 and 1-22	1-21 and 1-22
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1-77 through 1-82	1-77 through 1-82
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- - - - -	1-86.1/(1-86.2 Blank)
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1-99 through 1-104	1-99 through 1-104
1-109 through 1-112	1-109 through 1-112
1-115 through 1-142	1-115 through 1-142
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1-233 through 1-266	1-233 through 1-266
1-273 through 1-286	1-273 through 1-286
1-286.1/(1-286.2 Blank)	1-286.1/(1-286.2 Blank)
1-289 through 1-296	1-289 through 1-296
1-303 through 1-312	1-303 through 1-312
1-315 through 1-328	1-315 through 1-328
1-328.1/(1-328.2 Blank)	1-328.1/(1-328.2 Blank)

Remove Pages	Insert Pages
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1-341 through 1-356	1-341 through 1-356
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1-368.1/(1-368.2 Blank)	1-368.1/(1-368.2 Blank)
1-373 and 1-374	1-373 and 1-374
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1-401 through 1-404	1-401 through 1-404
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1-429 through 1-434	1-429 through 1-434
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1-501 and 1-502	1-501 and 1-502
1-509 through 1-518	1-509 through 1-518
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1-539 through 1-550	1-539 through 1-550
1-553 through 1-562	1-553 through 1-562
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1-577 and 1-578	1-577 and 1-578
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1-637 and 1-638	1-637 and 1-638
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1-701 through 1-708	1-701 through 1-708
1-711 and 1-712	1-711 and 1-712
1-717 and 1-718	1-717 and 1-718
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2-13 through 2-16	2-13 through 2-16
2-21 and 2-22	2-21 and 2-22
2-29 and 2-30	2-29 and 2-30
2-35 and 2-36	2-35 and 2-36
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2-87 and 2-88	2-87 and 2-88
2-109 through 2-112	2-109 through 2-112
2-117 and 2-118	2-117 and 2-118
3-1 and 3-2	3-1 and 3-2
3-2.1/(3-2.2 Blank)	3-2.1/(3-2.2 Blank)
3-3 through 3-8	3-3 through 3-8

Remove Pages	Insert Pages
3-8.1/(3-8.2 Blank)	3-8.1/(3-8.2 Blank)
3-9 through 3-16	3-9 through 3-16
- - - - -	3-16.1/(3-16.2 Blank)
3-17 through 3-20	3-17 through 3-20
3-25 and 3-26	3-25 and 3-26
3-29 through 3-38	3-29 through 3-38
3-38.1/(3-38.2 Blank)	3-38.1/(3-38.2 Blank)
3-39 through 3-42	3-39 through 3-42
3-43 through 3-50	3-43 through 3-50
- - - - -	3-50.1/(3-50.2 Blank)
3-51 through 3-67/(3-68 Blank)	3-51 through 3-67/(3-68 Blank)
4-1 through 4-4	4-1 through 4-4
4-7 through 4-10	4-7 through 4-10
4-19 and 4-20	4-19 and 4-20
5-1 and 5-2	5-1 and 5-2
5-5 and 5-6	5-5 and 5-6
5-9 through 5-12	5-9 through 5-12
5-21 through 5-28	5-21 through 5-28
6-1 and 6-2	6-1 and 6-2
6-5 through 6-8	6-5 through 6-8
6-11 and 6-12	6-11 and 6-12
6-15 and 6-16	6-15 and 6-16
6-19 and 6-20	6-19 and 6-20
- - - - -	6-20.1/(6-20.2 Blank)
6-21 through 6-24	6-21 through 6-24
6-31 and 6-32	6-31 and 6-32
- - - - -	6-32.1/(6-32.2 Blank)
6-37 and 6-38	6-37 and 6-38
6-45 through 6-52	6-45 through 6-52
7-1 through 7-12	7-1 through 7-12
7-12.1/(7-12.2 Blank)	7-12.1/(7-12.2 Blank)
7-13 through 7-16	7-13 through 7-16
7-19 and 7-20	7-19 and 7-20
7-23 and 7-24	7-23 and 7-24
7-29 through 7-32	7-29 through 7-32
7-45 through 7-60	7-45 through 7-60
7-63 and 7-64	7-63 and 7-64
7-67 and 7-68	7-67 and 7-68
8-1 and 8-2	8-1 and 8-2
8-9 and 8-10	8-9 and 8-10
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8-43 and 8-44	8-43 and 8-44
8-47 and 8-48	8-47 and 8-48
8-65 through 8-82	8-65 through 8-82
10-1 and 10-2	10-1 and 10-2
10-23 through 10-33/(10-34 Blank)	10-23 through 10-33/(10-34 Blank)
A-1 and A-2	A-1 and A-2

Remove Pages	Insert Pages
A-1 and A-2	A-1 and A-2
B-5 through B-50	B-5 through B-50
C-1/(C-2 Blank)	C-1/(C-2 Blank)
D-1 and D-2	D-1 and D-2
E-1/(E-2 Blank)	E-1/(E-2 Blank)
F-1 and F-2	F-1 and F-2
F-15 and F-16	F-15 and F-16
G-1 through G-11/(G-12 Blank)	G-1 through G-11/(G-12 Blank)
H-7 and H-8	H-7 and H-8
H-19 and H-20	H-19 and H-20
H-25 and H-26	H-25 and H-26
H-29 through H-34	H-29 through H-34
INDEX 1 through INDEX 32	INDEX 1 through INDEX 32
FP-7/(FP-8 Blank)	FP-7/(FP-8 Blank)
Cover	Cover

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Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-GE-700, T700-GE-701, T700-GE-701C

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Remove page	Insert pages
A through C/(D Blank)	A through D
v through xviii	v through xviii
1-35 through 1-38	1-35 through 1-38
1-45 and 1-46	1-45 and 1-46
1-48.1/(1-48.2 Blank)	1-48.1/(1-48.2 Blank)
1-83 through 1-88	1-83 through 1-88
1-269 through 1-272	1-269 through 1-272
1-275 and 1-276	1-275 and 1-276
1-286.1/(1-286.2 Blank)	1-286.1/(1-286.2 Blank)
1-315 and 1-316	1-315 and 1-316
1-321 and 1-322	1-321 and 1-322
1-327 and 1-328	1-327 and 1-328
1-329 and 1-330	1-329 and 1-330
– – – – –	1-330.1/(1-330.2 Blank)
1-365 through 1-368	1-365 through 1-368
– – – – –	1-368.1/(1-368.2 Blank)
1-369 and 1-370	1-369 and 1-370
– – – – –	1-370.1/(1-370.2 Blank)
1-377 and 1-378	1-377 and 1-378
1-477 and 1-478	1-477 and 1-478
1-700.1/(1-700.2 Blank)	1-700.1/(1-700.2 Blank)
1-701 and 1-702	1-701 and 1-702
2-5 and 2-6	2-5 and 2-6
2-11 and 2-12	2-11 and 2-12
– – – – –	2-12.1/(2-12.2 Blank)

Remove page	Insert pages
2-13 and 2-14	2-13 and 2-14
2-21 through 2-26	2-21 through 2-26
– – – – –	2-26.1/(2-26.2 Blank)
2-27 through 2-30	2-27 through 2-30
2-105 and 2-106	2-105 and 2-106
2-106.1/(2-106.2 Blank)	2-106.1 and 2-106.2
– – – – –	2-106.3 through 2-206.7/(2-206.8 Blank)
2-107 and 2-108	2-107 and 2-108
3-35 through 3-38	3-35 through 3-38
3-38.1/(3-38.2 Blank)	1-38.1/(3-38.2 Blank)
3-47 and 3-48	3-47 and 3-48
5-7 and 5-8	5-7 and 5-8
– – – – –	5-8.1/(5-8.2 Blank)
6-5 and 6-6	6-5 and 6-6
6-15 and 6-16	6-15 and 6-16
6-21 and 6-22	6-21 and 6-22
7-11 and 7-12	7-11 and 7-12
7-12.1/(7-12.2 Blank)	7-12.1/(7-12.2 Blank)
7-23 and 7-24	7-23 and 7-24
7-73 and 7-74	7-73 and 7-74
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A-1 and A-2	A-1 and A-2
B-7 and B-8	B-7 and B-8
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B-23 and B-24	B-23 and B-24
D-1 through D-6	D-1 through D-6
F-1 and F-2	F-1 and F-2
F-2.1/(F-2.2 Blank)	F-2.1/(F-2.2 Blank)
F-19/(F-20 Blank)	F-19 and F-20
– – – – –	F-21 and F-22
G-1 through G-6	G-1 through G-6
H-19 through H-22	H-19 through H-22
H-27 through H-30	H-27 through H-30
GLOSSARY 7 and GLOSSARY 8	GLOSSARY 7 and GLOSSARY 8
INDEX 1 through INDEX 34	INDEX 1 through INDEX 34
FP-7/(FP-8 Blank)	FP-7/(FP-8 Blank)

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T.O. 2J-T700-6
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CHANGE

NO. 5

HEADQUARTERS, DEPARTMENTS OF THE
ARMY AND THE AIR FORCE
WASHINGTON, D.C., 31 October 2002

Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-G3-700, T700-GE-701, T700-GE-701C

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Remove page	Insert pages
A through C/(D blank)	A through C/(D blank)
i and ii	i and ii
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A-1 and A-2	A-1 and A-2
C-1/(C-2 Blank)	C-1/(C-2 Blank)

Remove page	Insert pages
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G-5 and G-6	G-5 and G-6
INDEX 15 and INDEX 16	INDEX 15 and INDEX 16
INDEX 33 and INDEX 34	INDEX 33 and INDEX 34

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NO. 4

HEADQUARTERS, DEPARTMENTS OF THE
ARMY AND THE AIR FORCE
WASHINGTON, D.C., 21 December 2001

Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-G3-700, T700-GE-701, T700-GE-701C

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Remove page	Insert pages
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1-291 and 1-292	1-291 and 1-292
1-325 through 1-328	1-325 through 1-328
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1-667 and 1-668	1-667 and 1-668
2-63 through 2-68	2-63 through 2-68
3-25 and 3-26	3-25 and 3-26
3-35 through 3-38	3-35 through 3-38
3-39 and 3-40	3-39 and 3-40
3-59 and 3-60	3-59 and 3-60
5-19 through 5-22	5-19 through 5-22
5-27 through 5-30	5-27 through 5-30
6-27 and 6-28	6-27 and 6-28
7-7 and 7-8	7-7 and 7-8

Remove page	Insert pages
7-11 and 7-12	7-11 and 7-12
- - - - -	7-12.1/(7-12.2 Blank)
8-5 and 8-6	8-5 and 8-6
8-61 and 8-62	8-61 and 8-62
10-31 and 10-32	10-31 and 10-32
A-1 and A-2	A-1 and A-2
D-1 and D-2	D-1 and D-2
D-5 and D-6	D-5 and D-6
H-19 through H-30	H-19 through H-30
INDEX 1 and INDEX 2	INDEX 1 and INDEX 2
INDEX 7 and INDEX 8	INDEX 7 and INDEX 8
INDEX 17 and INDEX 18	INDEX 17 and INDEX 18

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TM 1-2840-248-23
T.O. 2J-T700-6
C3

CHANGE

NO. 3

HEADQUARTERS, DEPARTMENTS OF THE
ARMY AND THE AIR FORCE
WASHINGTON, D.C., 31 January 2001

Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-G3-700, T700-GE-701, T700-GE-701C

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Remove page	Insert pages
A through C/(D blank)	A through C/(D blank)
i through xiv	i through xiv
1-29 and 1-30	1-29 and 1-30
1-47 and 1-48	1-47 and 1-48
- - - - -	1-48.1/(1-48.2 blank)
1-49 and 1-50	1-49 and 1-50
- - - - -	1-50.1 through 1-50.4
1-51 and 1-52	1-51 and 1-52
1-57 and 1-58	1-57 and 1-58
1-77 through 1-88	1-77 through 1-88
1-149 and 1-150	1-149 and 1-150
1-227 and 1-228	1-227 and 1-228
1-247 and 1-248	1-247 and 1-248
1-269 and 1-270	1-269 and 1-270
1-281 and 1-282	1-281 and 1-282
1-285 and 1-286	1-285 and 1-286
- - - - -	1-286.1/(1-286.2 blank)
1-295 and 1-296	1-295 and 1-296
- - - - -	1-296.1/(1-296.2 blank)
1-311 through 1-314	1-311 through 1-314
- - - - -	1-314.1/(1-314.2 blank)
1-317 through 1-320	1-317 through 1-320
1-323 and 1-324	1-323 and 1-324
- - - - -	1-328.1/(1-328.2 blank)
1-329 through 1-334	1-329 through 1-334

Remove page	Insert pages
1-341 through 1-344	1-341 through 1-344
1-347 and 1-348	1-347 and 1-348
1-351 through 1-356	1-351 through 1-356
1-359 and 1-360	1-359 and 1-360
1-367 through 1-370	1-367 through 1-370
1-375 and 1-376	1-375 and 1-376
1-391 and 1-392	1-391 and 1-392
1-421 and 1-422	1-421 and 1-422
1-431 and 1-432	1-431 and 1-432
1-451 and 1-452	1-451 and 1-452
1-463 through 1-466	1-463 through 1-466
1-469 through 1-474	1-469 through 1-474
1-477 through 1-480	1-477 through 1-480
1-483 and 1-484	1-483 and 1-484
1-493 through 1-518	1-493 through 1-518
- - - - -	1-581.1/(1-518.2 blank)
1-519 through 1-528	1-519 through 1-528
1-531 and 1-532	1-531 and 1-532
1-535 and 1-536	1-535 and 1-536
1-541 and 1-542	1-541 and 1-542
1-569 through 1-572	1-569 through 1-572
1-693 and 1-694	1-693 and 1-694
- - - - -	1-700.1/(1-700.2 blank)
1-701 and 1-702	1-701 and 1-702
2-3 through 2-6	2-3 through 2-6
2-13 and 2-14	2-13 and 2-14
2-17 through 2-22	2-17 through 2-22
2-53 and 2-54	2-53 and 2-54
2-57 and 2-58	2-57 and 2-58
2-65 and 2-66	2-65 and 2-66
- - - - -	2-78.1/(2-78.2 blank)
2-79 through 2-82	2-79 through 2-82
2-105 and 2-106	2-105 and 2-106
- - - - -	2-106.1/(2-106.2 blank)
2-107 and 2-108	2-107 and 2-108
3-1 and 3-2	3-1 and 3-2
- - - - -	3-2.1/(3-2.2 blank)
3-7 and 3-8	3-7 and 3-8
- - - - -	3-8.1/(3-8.2 blank)
3-11 and 3-12	3-11 and 3-12
3-33 and 3-34	3-33 and 3-34

Remove page	Insert pages
3-49 and 3-50	3-49 and 3-50
3-61 and 3-62	3-61 and 3-62
3-65 and 3-66	3-65 and 3-66
4-23 and 4-24	4-23 and 4-24
5-17 and 5-18	5-17 and 5-18
5-27 through 5-32	5-27 through 5-32
6-25 and 6-26	6-25 and 6-26
6-33 and 6-34	6-33 and 6-34
7-11 through 7-14	7-11 through 7-14
10-25 and 10-26	10-25 and 10-26
10-29 through 10-32	10-29 through 10-32
A-1 and A-2	A-1 and A-2
B-47 and B-48	B-47 and B-48
H-27 and H-28	H-27 and H-28
INDEX 1 through INDEX 4	INDEX 1 through INDEX 4
INDEX 13 through INDEX 18	INDEX 13 through INDEX 18
INDEX 21 through INDEX 28	INDEX 21 through INDEX 28
INDEX 31 through INDEX 34	INDEX 31 through INDEX 34

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T.O. 2J-T700-6
C2

CHANGE

NO. 2

HEADQUARTERS, DEPARTMENTS OF THE
ARMY AND THE AIR FORCE
WASHINGTON, D.C., 1 May 2000

Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-G3-700, T700-GE-701, T700-GE-701C

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Remove page	Insert pages
A through C/(D blank)	A through C/(D blank)
1-53 and 1-54	1-53 and 1-54
1-271 and 1-272	1-271 and 1-272
1-327 through 1-330	1-327 through 1-330
1-373 and 1-374	1-373 and 1-374
3-33 and 3-34	3-33 and 3-34
3-37 and 3-38	3-37 and 3-38
- - - - -	3-38.1/(3-38.2 blank)
3-55 and 3-56	3-55 and 3-56
10-23 and 10-24	10-23 and 10-24

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TM 1-2840-248-23
T.O. 2J-T700-6
C1

CHANGE
NO. 1

HEADQUARTERS, DEPARTMENTS OF THE
ARMY AND THE AIR FORCE
WASHINGTON, D.C., 15 August 1999

Aviation Unit and Intermediate Maintenance Manual

ENGINE, AIRCRAFT, TURBOSHAFT
MODELS T700-G3-700, T700-GE-701, T700-GE-701C

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Remove pages	Insert pages
- - - - -	A through C/(D blank)
xiii and xiv	xiii anad xiv
xvii and xviii	xvii and xviii
1-29 and 1-30	1-29 and 1-30
1-33 and 1-34	1-33 and 1-34
1-77 through 1-80	1-77 through 1-80
1-83 and 1-84	1-83 and 1-84
1-91 and 1-92	1-91 and 1-92
- - - - -	1-91.1 and 1-92.2
1-311 through 1-318	1-311 through 1-318
1-355 through 1-360	1-355 through 1-360
1-459 and 1-460	1-459 and 1-460
1-463 through 1-466	1-463 through 1-466
1-469 through 1 -480	1-469 through 1-480
1-483 through 1-488	1-483 through 1-488
1-493 through 1-500	1-493 through 1-500
1-511 and 1-512	1-511 and 1-512
1-515 and 1-516	1-515 and 1-516
1-539 through 1-558	1-539 through 1-558
1-563 through 1-576	1-563 through 1-576
1-581 through 1-588	1-581 through 1-588
1-591 through 1-594	1-591 through 1-594
1-597 through 1-604	1-597 through 1-604
1-607 through 1-610	1-607 through 1-610
1-613 through 1-620	1-613 through 1-620
1-623 through 1-628	1-623 through 1-628
1-635 through 1-642	1-635 through 1-642
1-645 through 1-654	1-645 through 1-654
1-657 through 1-666	1-657 through 1-666

Remove pages	Insert pages
1-669 through 1-676	1-669 through 1-676
1-685 through 1-694	1-685 through 1-694
1-699 through 1-702	1-699 through 1-702
1-705 and 1-706	1-705 and 1-706
1-711 and 1-712	1-711 and 1-712
1-715 through 1-718	1-715 through 1-718
3-1 and 3-2	3-1 and 3-2
3-25 and 3-26	3-25 and 3-26
3-39 and 3-40	3-39 and 3-40
- - - - -	3-42.1/(3/42.2 blank)
3-57 through 3-62	3-57 through 3-62
3-65 and 3-66	3-65 and 3-66
4-21 and 4-22	4-21 and 4-22
5-9 through 5-12	5-9 through 5-12
7-37 and 7-38	7-37 and 7-38
7-73 and 7-74	7-73 and 7-74
A-1 and A-2	A-1 and A-2
INDEX 1 through INDEX 34	INDEX 1 through INDEX 34

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LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: On a changed page, the portion of text affected by the change is indicated by a vertical line or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original	0	1 Jun 99
Change	1	15 Aug 99
Change	2	1 May 00
Change	3	31 Jan 01
Change	4	21 Dec 01
Change	5	31 Oct 02
Change	6	15 Oct 04
Change	7	31 Aug 05

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1520 CONSISTING OF THE FOLLOWING:

Page No.	# Change No.
a - d	0
A - D	7
E Added	7
F Blank Added	7
i - xv	7
xvi	0
xvii - xviii	7
1-1 - 1-4	7
1-5 - 1-6	0
1-7	7
1-8	0
1-9	7
1-10 - 1-11	0
1-12 - 1-13	7
1-14	0
1-15	7
1-16	0
1-17	7
1-18 - 1-20	0
1-21 - 1-22	7
1-23 - 1-24	0
1-25 - 1-27	7
1-28 - 1-29	0
1-30 - 1-31	7
1-32	0
1-33	1
1-34	0
1-35	7
1-36	6
1-37	7
1-38 - 1-39	0
1-40	7
1-41	0
1-42	7
1-43	0
1-44 - 1-45	7
1-46 - 1-47	0
1-48	7
1-48.1	6
1-48.2 Blank	6
1-49	0
1-50	3
1-50.1 - 1-50.4	3
1-51 - 1-52	3
1-53	0
1-54	2
1-55 - 1-60	7
1-61 - 1-76	0
1-77	7
1-78	1
1-79	0
1-80 - 1-81	7
1-82	5
1-83 - 1-85	6
1-86	7
1-86.1 Added	7
1-86.2 Blank Added	7
1-87	7
1-88	3
1-89 - 1-98 Deleted	3
1-99 - 1-104	7
1-105 - 1-109	0
1-110 - 1-112	7
1-112.1 - 1.112.2	5
1-113 - 1-114	0
1-115 - 1-117	7
1-118	0
1-119 - 1-122	7
1-123	0
1-124	7
1-125	4
1-126 - 1-127	7
1-128 - 1-129	0
1-130 - 1-131	7
1-132 - 1-133	0
1-134	7
1-135	0
1-136	7
1-137	0
1-138 - 1-139	7
1-140	0
1-141	5
1-142	7
1-143 - 1-145	0
1-146	7
1-147 - 1-148	0
1-149	3
1-150	7
1-151	0
1-152	7
1-153 - 1-155	0
1-156 - 1-159	7
1-160	0
1-161 - 1-171	7
1-172	0
1-173	4
1-174 - 1-177	7
1-178	0
1-179	7
1-180 - 1-202	0
1-203	7
1-204	4
1-205 - 1-210	0
1-211 - 1-212	7
1-213 - 1-216	0
1-217 - 1-219	7
1-220 - 1-221	0
1-222 - 1-224	7
1-225 - 1-226	0
1-227	7
1-228	0
1-229	7
1-230 - 1-232	0
1-233	7
1-234 - 1-235	0
1-236 - 1-245	7
1-246	0
1-247	7
1-248	3
1-249 - 1-265	7
1-266 - 1-269	0
1-270 - 1-271	6
1-272	0
1-273 - 1-284	7
1-285	0
1-286	7
1-286.1	7
1-286.2 Blank	7
1-287 - 1-288	0
1-289	7
1-290 - 1-291	0
1-292 - 1-293	7

Zero in this column indicates an original page.

LIST OF EFFECTIVE PAGES (Cont)

Page No.	# Change No.
1-294 - 1-295	0
1-296	7
1-296.1	3
1-296.2 Blank	3
1-297 - 1-302	0
1-303	7
1-304 - 1-305	0
1-306 - 1-307	7
1-308	0
1-309 - 1-312	7
1-313 - 1-314	3
1-314.1	3
1-314.2 Blank	3
1-315	0
1-316 - 1-320	7
1-321	0
1-322 - 1-325	7
1-326	4
1-327 - 1-328	7
1-328.1	7
1-328.2 Blank	7
1-329 - 1-330	7
1-330.1	6
1-330.2 Blank	6
1-331 - 1-332	7
1-333 - 1-334	3
1-335	7
1-336	4
1-337 - 1-340	0
1-341	7
1-342	0
1-343 - 1-344	7
1-345	0
1-346 - 1-348	7
1-349	0
1-350 - 1-351	7
1-352 - 1-353	3
1-354 - 1-355	7
1-356	3
1-357 - 1-358	1
1-359	3
1-360	5
1-361	7
1-362 - 1-363	0
1-364	7
1-365	0
1-366 - 1-368	7
1-368.1	7
1-368.2 Blank	7
1-369	5
1-370	6
1-370.1 Added	6
1-370.2 Blank Added	6
1-371 - 1-373	0
1-374	7
1-375	0
1-376	3
1-377	6
1-378 - 1-391	0
1-392	7
1-393 - 1-397	0
1-398	4
1-399 - 1-400	0
1-401	7
1-402	0
1-403	7
1-404 - 1-407	0
1-408	7
1-409	0
1-410 - 1-412	7
1-413 - 1-420	0
1-421 - 1-422	7
1-423	0
1-424	7
1-425 - 1-429	0
1-430 - 1-434	7
1-435 - 1-437	0
1-438 - 1-441	7
1-442 - 1-445	0
1-446 - 1-451	7
1-452	3
1-453 - 1-454	0
1-455 - 1-456	7
1-457	0
1-458 - 1-460	7
1-461 - 1-462	0
1-463	7
1-464 - 1-466	3
1-467 - 1-468	0
1-469	3
1-470 - 1-474	7
1-475	1
1-476 - 1-479	7
1-480 - 1-483	0
1-484 - 1-498	7
1-499	3
1-500 - 1-501	0
1-502	7
1-503	3
1-504	0
1-505 - 1-508	3
1-509	7
1-510	0
1-511 - 1-517	7
1-518	3
1-518.1	3
1-518.2 Blank	3
1-519 - 1-522	3
1-523	0
1-524	3
1-525 - 1-527	7
1-528	3
1-529 - 1-531	7
1-532 - 1-533	0
1-534 - 1-535	7
1-536 - 1-538	0
1-539 - 1-544	7
1-545	1
1-546 - 1-548	7
1-549	1
1-550	7
1-551	0
1-552 - 1-553	1
1-554	7
1-555	0
1-556 - 1-557	7
1-558	0
1-559	7
1-560	0
1-561 - 1-562	7
1-563	0
1-564	1
1-565	0
1-566 - 1-567	7
1-568	1
1-569 - 1-573	7
1-574 - 1-575	0
1-576	1
1-577	7
1-578 - 1-580	0
1-581	7
1-582	1
1-583	0
1-584 - 1-585	1
1-586	0
1-587 - 1-591	7
1-592	1
1-593	0
1-594 - 1-597	7
1-598	1
1-599 - 1-610	7
1-611	0
1-612	7
1-613	1
1-614 - 1-616	7
1-617 - 1-618	1
1-619 - 1-620	7
1-621 - 1-623	0
1-624 - 1-628	1
1-629 - 1-634	0
1-635 - 1-637	1
1-638	7
1-639 - 1-642	1
1-643 - 1-644	0
1-645	1
1-646 - 1-647	7
1-648 - 1-649	0
1-650 - 1-651	7

Zero in this column indicates an original page.

LIST OF EFFECTIVE PAGES (Cont)

Page No.	# Change No.
1-652	1
1-653 - 1-657	7
1-658	1
1-659 - 1-668	7
1-669	0
1-670 - 1-672	1
1-673	0
1-674	1
1-675	0
1-676	1
1-677 - 1-690	7
1-691	0
1-692 - 1-696	7
1-697	0
1-698 - 1-700	7
1-700.1	6
1-700.2 Blank	6
1-701	7
1-702	0
1-703	7
1-704	0
1-705	7
1-706 - 1-707	0
1-708	7
1-709 - 1-710	0
1-711 - 1-712	7
1-713 - 1-715	0
1-716	1
1-717	7
1-718	1
1-719	0
1-720 Blank	0
2-1 - 2-2	7
2-3 - 2-4	3
2-5	5
2-6	6
2-7 - 2-8	0
2-9	7
2-10	0
2-11 - 2-12	7
2-12.1	6
2-12.2 Blank	6
2-13	7
2-14 - 2-15	0
2-16	7
2-17	0
2-18 - 2-19	3
2-20	0
2-21	7
2-22	0
2-23	6
2-24	0
2-25	6
2-26	0
2-26.1	6
2-26.2 Blank	6
2-27	6
2-28 - 2-29	0
2-30	7
2-31 - 2-34	0
2-35 - 2-36	7
2-37 - 2-38	0
2-39	5
2-40	0
2-41	5
2-42 - 2-48	0
2-49 - 2-50	7
2-51 - 2-52	0
2-53	3
2-54 - 2-56	0
2-57	3
2-58 - 2-63	0
2-64	4
2-65	0
2-66 - 2-68	4
2-69	0
2-70	7
2-71 - 2-78	0
2-78.1	3
2-78.2 Blank	3
2-79 - 2-81	3
2-82 - 2-86	0
2-87	7
2-88 - 2-105	0
2-106	6
2-106.1 - 2-106.7	6
2-106.8 Blank	6
2-107	6
2-108	0
2-109 - 2-112	7
2-113 - 2-117	0
2-118	7
3-1 - 3-2	7
3-2.1	7
3-2.2 Blank	7
3-3	0
3-4 - 3-5	7
3-6	0
3-7 - 3-8	7
3-8.1	7
3-8.2 Blank	7
3-9	7
3-10	0
3-11	7
3-12	0
3-13	7
3-14	0
3-15 - 3-16	7
3-16.1 Added	7
3-16.2 Blank Added	7
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FP-8 Blank	7	FP-13	0		
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TECHNICAL MANUAL
NO. 1-2840-248-23

HEADQUARTERS
DEPARTMENT OF THE
ARMY AND THE AIR FORCE
WASHINGTON, D.C., 1 June 1999

AVIATION UNIT AND INTERMEDIATE MAINTENANCE MANUAL

ENGINE, AIRCRAFT, TURBOSHAFT MODELS T700-GE-700, T700-GE-701, T700-GE-701C AND T700-GE-701D

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

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*This manual supersedes TM 55-2840-248-23/T.O. 2J-T700-6, dated 28 April 1982.

LIST OF ILLUSTRATIONS

LIST OF TABLES

The following list includes:

1. Cross-Reference List of Nomenclature on Cockpit Instrument Panels and Controls
2. Cross-Reference List of Part Nomenclature
3. List of Abbreviations

1. Cross-Reference List of Nomenclature on Cockpit Instrument Panels and Controls

In areas where a difference between the nomenclature on UH-60A and AH-64A cockpit instrument panels and controls are found, common nomenclature is used.

Common Nomenclature	UH-60A Nomenclature	AH-64A Nomenclature
engine anti-ice switch	ENG ANTI-ICE switch	ANTI-ICE switch
engine ignition switch	ENGINE IGNITION switch	MASTER IGN switch
engine oil pressure	ENG OIL PRESS	ENG OIL PSI × 10
power control lever (PCL)	ENG POWER CONT lever	PWR lever
% rpm Np	% RPM	ENG-RTR RPM %
% torque	% TRQ	TORQUE%
fuel filter bypass	FUEL FLTR BYPASS	FUEL FTR BYP
engine chip detector	CHIP ENGINE	CHIPS ENG
oil filter bypass	OIL FILTR BYPASS	OIL FTR BYP
flight idle	FLY	FLY
ground idle	IDLE	IDLE

2. Cross-Reference List of Part Nomenclature

Except for the Accessory Gearbox, Compressor Section, Combustion Section, and Power Turbine, the part names listed in the official nomenclature column are taken from engineering drawings. Since nomenclature from engineering drawings is at times misunderstood and inconsistent with Army terminology, the common names for parts are used throughout this manual.

Common Name	Official Nomenclature
Accessory section module	Accessory gearbox
Bypass valve assembly	Relief valve assembly
Carbon seal	Axis-B encased flanged seal
Carbon seal	Axis-E encased flanged seal
Carbon seal	Axis-G encased plain seal
Cold section module	Compressor section
Fuel filter impending bypass indicator assembly	Differential pressure indicator
Fuel pressure sensor	Fuel pressure switch
Gearbox-to-HMU hose assembly	Gearbox-to-fuel control hose assembly
Hot section module	Combustion section
Np sensor	Power turbine speed and torque sensor assembly (Np sensor)
Oil cooler	Lube oil cooler
Oil cooler seal	Lube oil cooler seal
Oil drain plug	Machine thread plug
Oil filter	Lube filter
Oil filter bowl	Lube filter bowl
Oil filter element	Filter element
Oil filter impending bypass indicator	Differential pressure indicator
Oil level indicator	Fluid level indicator

Common Name	Official Nomenclature
Oil manifold assembly	Lube manifold assembly
Oil manifold	Lube manifold
Oil pressure sensor	Oil pressure transmitter
Oil and scavenge pump	Lube and scavenge pump
Oil temperature sensor	Oil temperature detector
Power turbine module	Power turbine
Radial drive shaft cover assembly	Axis-A cover assembly
Radial drive shaft cover boot	Axis-A boot
Seal mating ring	Axis-B seal mating ring
Seal mating ring	Axis-E seal mating ring
Seal mating ring	Axis-G seal mating ring
Stage 1 forward cooling plate	Stage 1 front cooling plate
Stage 1 turbine shroud sectors	Stage 1 turbine shroud segments
Torque and overspeed sensor	Power turbine speed and torque sensor assembly (torque and overspeed sensor)

3. List of Abbreviations

This list includes abbreviations used throughout the manual.

A/C	Aircraft
AGB	Accessory gearbox
ASSY	Assembly
AVIM	Aviation intermediate maintenance
AVM	Air vehicle manufacturer
AVUM	Aviation unit maintenance
BITE	Built-in test equipment
C	Celsius
cc/hr	cubic centimeter per hour
cc/min	cubic centimeter per minute
CETS	Compact engine test system
DEC	Digital electronic control
DIR	Direct
ECU	Electrical control unit
EOH	Engine operating hours
ETF	Engine torque factor
EVLTN	Evaluation
F	Fahrenheit
FAT	Free air temperature
FEDS	Flexible engine diagnostic system
Fed spec	Federal specification
FOD	Foreign object damage
FPOG	Flat pitch on-ground
FSCAP	Flight Safety Critical Aircraft Parts
Fwd	Forward
GG	Gas generator
GRD	Ground
HIT	Health indicator test
HMU	Hydromechanical control unit
HSP	Hot start prevention
Hz	Hertz
ID	Inside diameter
IFSD	In-flight shutdown
IGN	Ignition
IGV	Inlet guide vane
in. Hg.	Inches of mercury
IRP	Intermediate rated power
KIAS	Knots indicator air speed
KN	Alumel
KP	Chromel
LAR	Logistics Assistance Representative
Lb/hr	Pounds per hour
LCF	Low-cycle fatigue
LDS	Load demand spindle
LMT	Locally manufactured tool
LRU	Line replaceable unit
LVDT	Linear variable displacement transducer
MAC	Maintenance allocation chart
MAX	Maximum
METS	Modular engine test system
MTOE	Modified table of organization and equipment
Ng	Gas generator turbine rotor speed
Ng	Gas generator turbine rotor speed corrected for square root of theta
Np	Power turbine rotor speed
Nr	Helicopter rotor speed
Nr/Np	Nr and Np
OD	Outside diameter
ODV	Overspeed and drain valve
OVRD	Override

P3	Compressor discharge air pressure
PA	Pressure altitude
PAS	Power available spindle
PCL	Power control lever (aircraft part)
POU	Pressurizing and overspeed unit
PS3	Static pressure at compressor discharge
psi	Pounds per square inch
psia	Pounds per square inch absolute
psig	Pounds per square inch gage
PT	Power turbine
QCA	Quick-change assembly
rpm	Revolutions per minute
RPM R	Revolutions per minute-rotor
RPSTL	Repair Parts and Special Tools List
R/W	Reworked
SDC	Signal Data Converter
SHP	Shaft horsepower
SN	Serial number
STR	Specification torque ratio
T0	Engine inlet temperature on METS
T2	Engine inlet temperature
TBC	Thermal Barrier Coating
TBO	Time between overhaul
TDI	Transient droop improvement
TGT	Turbine gas temperature
TGT_{REF}	Reference turbine gas temperature
THIR	Ten-hour/Fourteen-day inspection requirements
TM	Technical manual
TMDE	Test, measurement, and diagnostic equipment
TRQ	Torque
TRQ_{ADJ}	Adjusted torque
TTV	Target torque value
Vac	Alternating-current volts
Vdc	Direct-current volts
VG	Variable geometry
Wf	Fuel flow
XFD	Crossfeed

CHAPTER 1

ENGINE GENERAL

1-1. CHAPTER OVERVIEW.

This chapter contains general information, equipment descriptions and instructions regarding support equipment, servicing of engine upon receipt, preventive maintenance checks, troubleshooting, general maintenance, and engine testing.

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

Data common to all engine models is not identified.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

1-2. CHAPTER INDEX.

This chapter is divided into the following eight sections:

Section I. GENERAL INFORMATION

1-3. SCOPE.

1-4. Maintenance of Army aviation equipment is performed at three levels: Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM), and Depot Maintenance.

1-5. (T700) Repair parts, special tools, and support equipment are listed in Repair Parts and Special Tools List (RPSTL) TM 1-2840-248-23P.

1-6. (T701) Repair parts, special tools, and support equipment are listed in Repair Parts and Special Tools List (RPSTL) TM 1-2840-238-23P.

1-7. (T701C, T701D) Repair parts, special tools, and support equipment are listed in Repair Parts and Special Tool List (RPSTL) TM 1-2840-258-23P.

1-8. MAINTENANCE CONCEPT.

1-9. (T700) Under the modular maintenance concept, the T700-GE-700 turboshaft engine (fig. 1-1) is divided into four modules (fig. 1-2):

- Accessory Section Module (Accessory Gearbox)
- Cold Section Module (Compressor Section)
- Hot Section Module (Combustion Section)
- Power Turbine Module (Power Turbine)

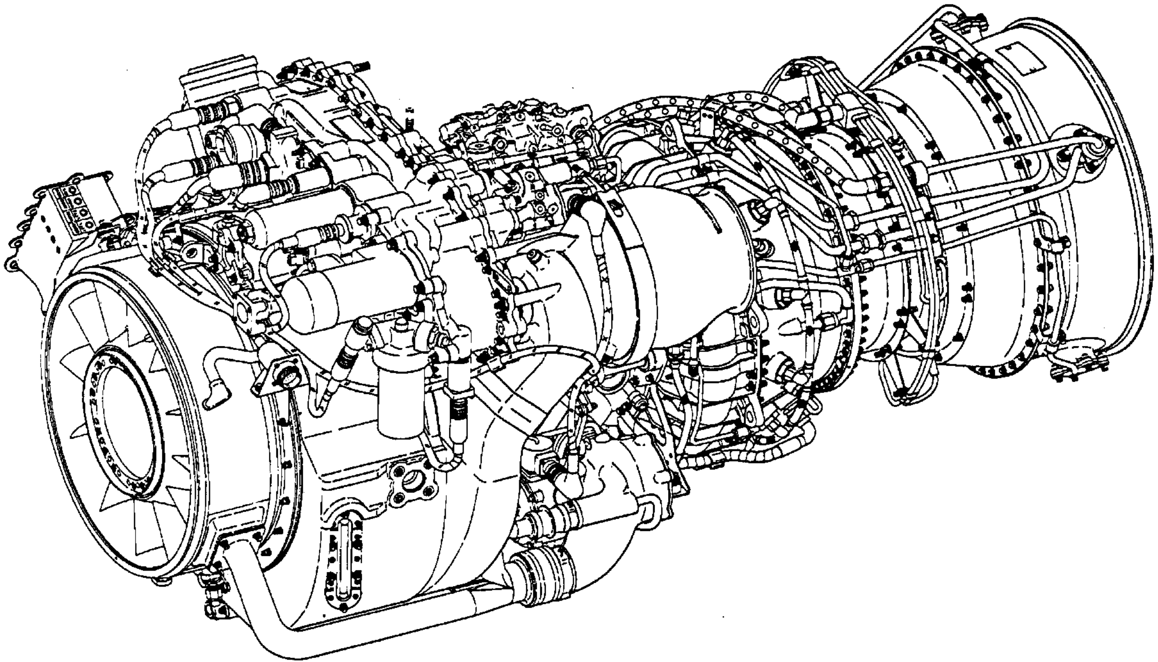


Figure 1-1. T700-GE-700, T700-GE-701C, and T700-GE-701D Turboshaft Engine (Typical)

1-10. (T701, T701C, T701D) Under the modular maintenance concept, the T700-GE-701, T700-GE-701C, and T700-GE-701D turboshaft engines (fig. 1-3) or (fig. 1-1) are divided into four modules **(T701)** (fig. 1-4) or **(T701C, T701D)** (fig. 1-2):

- Accessory Section Module (Accessory Gearbox)
- Cold Section Module (Compressor Section)
- Hot Section Module (Combustion Section)
- Power Turbine Module (Power Turbine)

1-11. The engine can be disassembled into the four modules. There are no special tools required to disassemble and assemble the engine at AVUM and at AVIM levels of maintenance.

1-12. The engine has several line replaceable units (LRU's). An LRU is a part which can be removed and replaced at AVUM level, with another like-part. See paragraph 1-27 for a list of LRU's.

1-13. The maintenance tasks, assigned to each level of maintenance, are listed in the Maintenance Allocation Chart (MAC) in Appendix B.

1-14. MAINTENANCE FORMS, RECORDS, AND REPORTS.

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-751. The Army Maintenance Management System (TAMMS).

1-15. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Procedures for destroying Army materiel to prevent enemy use are listed in TM 750-244-1-5.

1-16. ADMINISTRATIVE STORAGE.

Instructions are provided in Section VII of this chapter.

1-17. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC).

Refer to FM 1-411 for information about quality assurance and quality control.

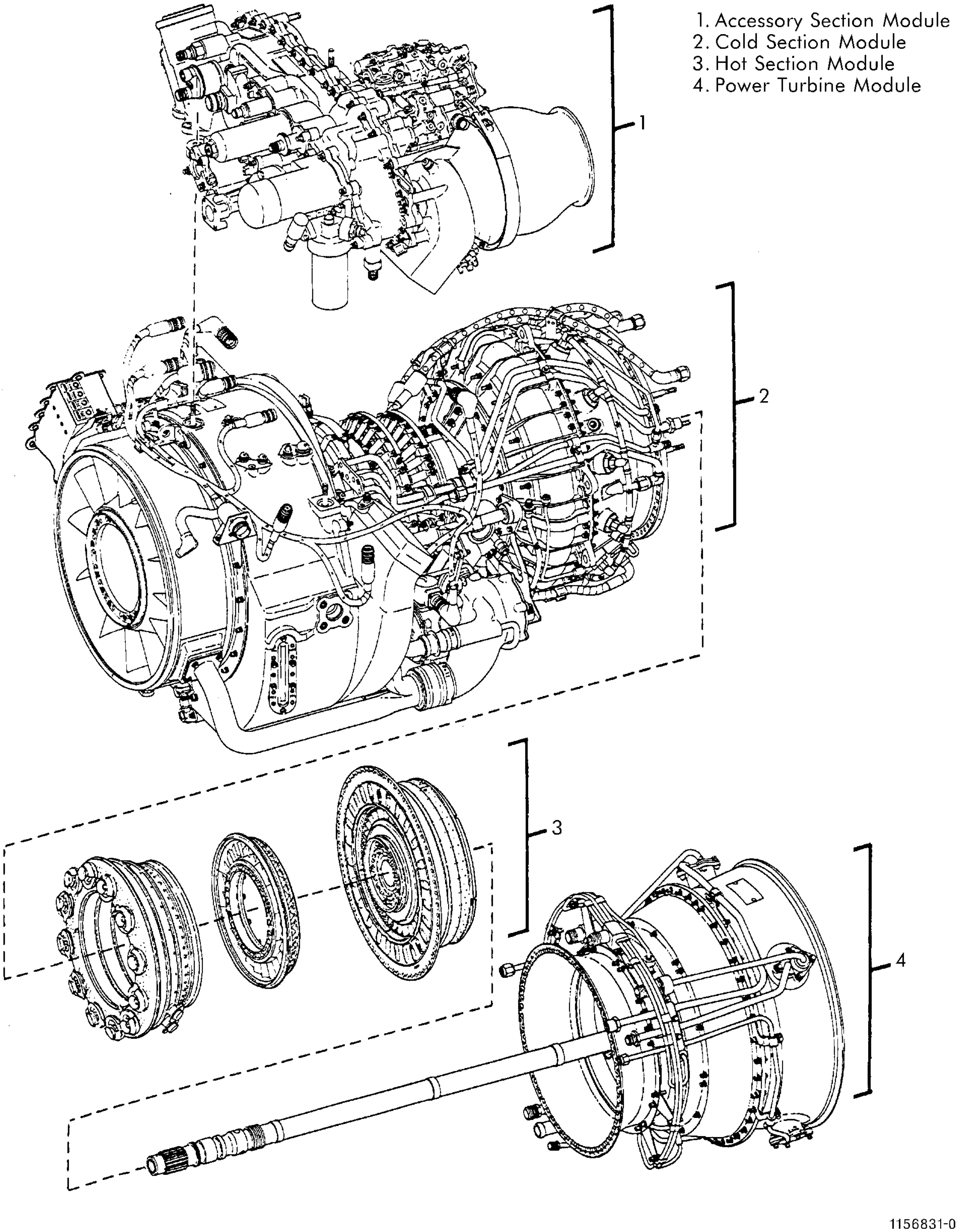


*Figure 1-2. **(T700, T701C, T701D)** Engine Modules (Typical)*

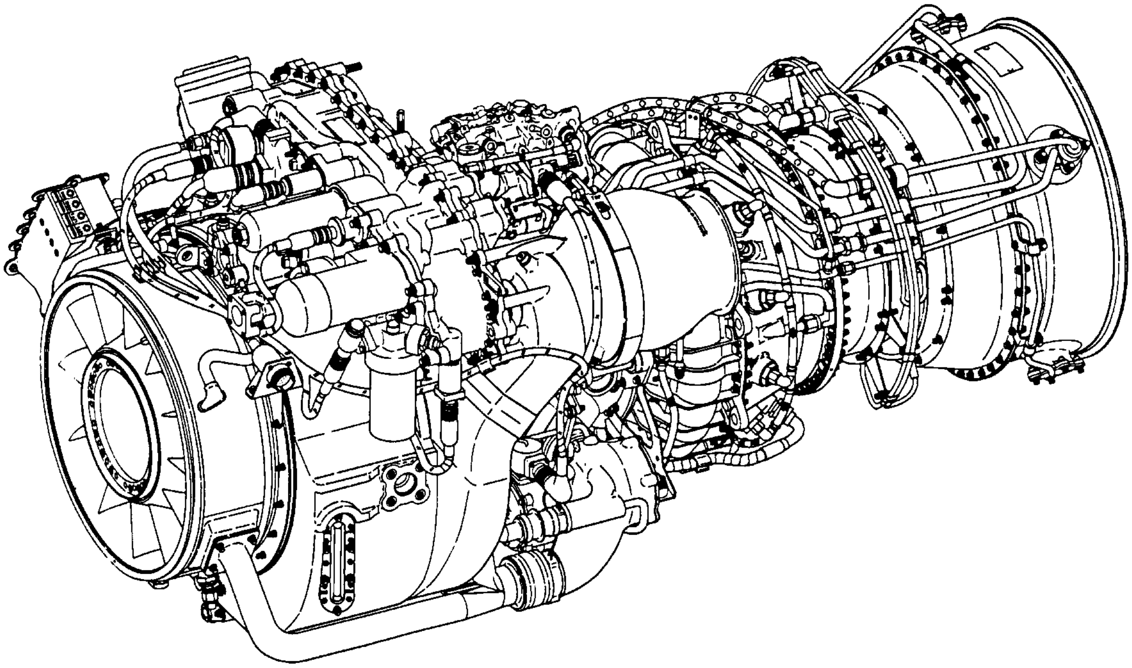


Figure 1-3. T700-GE-701 Turboshaft Engine

1-18. DIRECTIONAL REFERENCES.

See figure 1-5 for a view of directional references.

1-19. ARMY FLIGHT SAFETY CRITICAL AIRCRAFT PARTS PROGRAM.

Parts, assemblies, or installations identified under the Flight Safety Critical Aircraft Parts Program, require special handling during time at AVUM/AVIM maintenance. Throughout the TM procedures, warnings appear emphasizing critical instructions to be followed. These warnings are identified as FLIGHT SAFETY CRITICAL AIRCRAFT PARTS warnings and are inserted whenever and wherever necessary.

a. A flight safety critical aircraft part (FSCAP) is defined as any part, assembly, or installation whose failure, malfunction, or absence could cause an uncommanded engine shutdown, and/or a catastrophic engine failure resulting in loss or serious damage to an aircraft and/or serious injury or death to the occupants. This definition as applied to the T700-GE-700/-701/-701C/-701D engines used in the UH-60 and AH-64 helicopters is limited to:

(1) Components/parts whose failure could result in uncontained components.

(2) Components/parts which could cause an external fire in the engine bay.

(3) Components/parts which have a predicted or actual in-flight shutdown (IFSD) rate greater than one event per 200,000 engine flight hours.

b. A critical characteristic is any feature throughout the life cycle of a FSCAP which, if nonconforming, missing, or degraded, could cause failure or malfunction of the FSCAP. Critical characteristics include dimensions, tolerances, finish, materials, or assembly, manufacturing, and inspection processes. Life cycle covers manufacturing operations, field maintenance, and overhaul through normal service life of the part.

c. FSCAPs and their critical characteristics are listed in table 1-1.

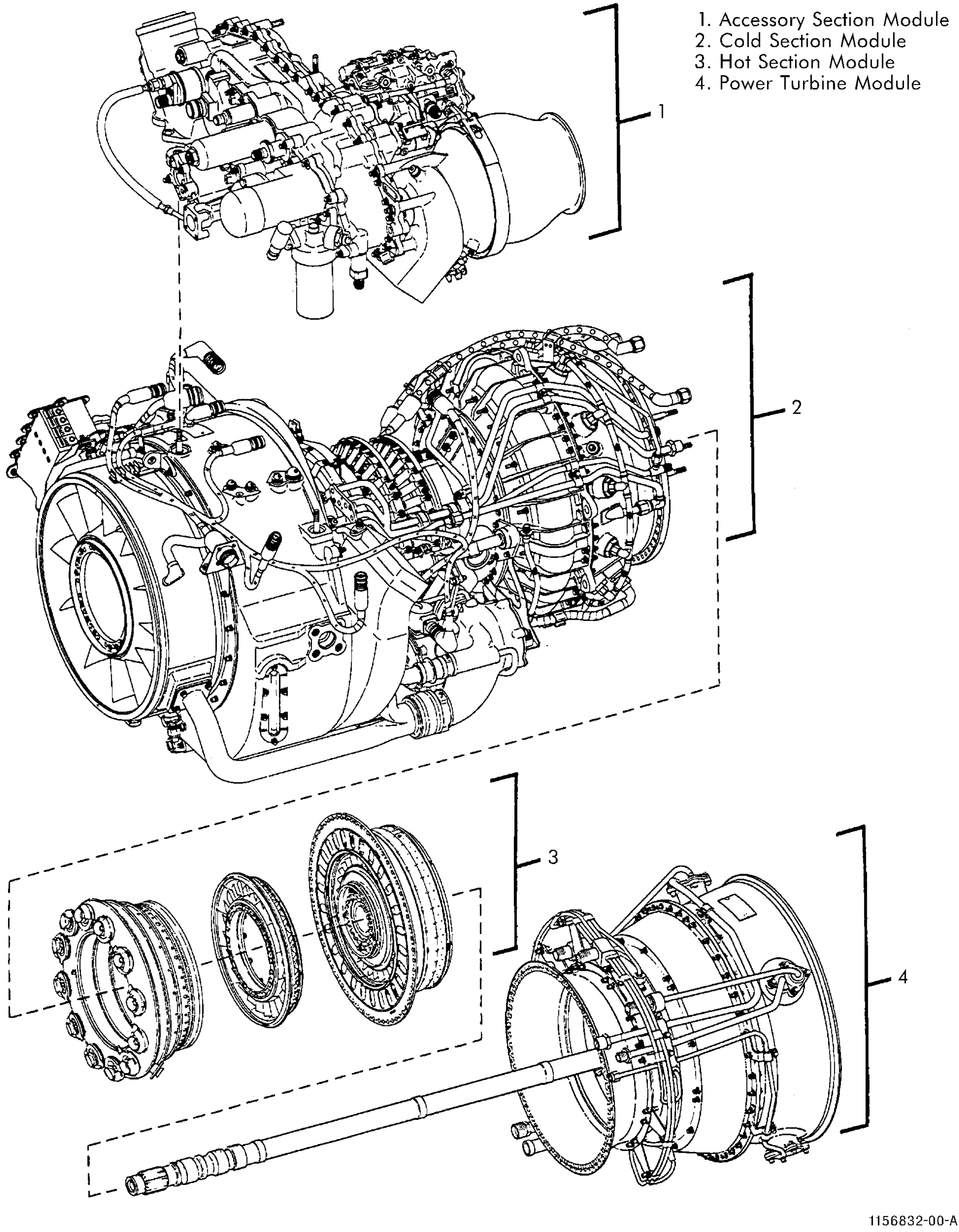


Figure 1-4.** (T701) **Engine Modules

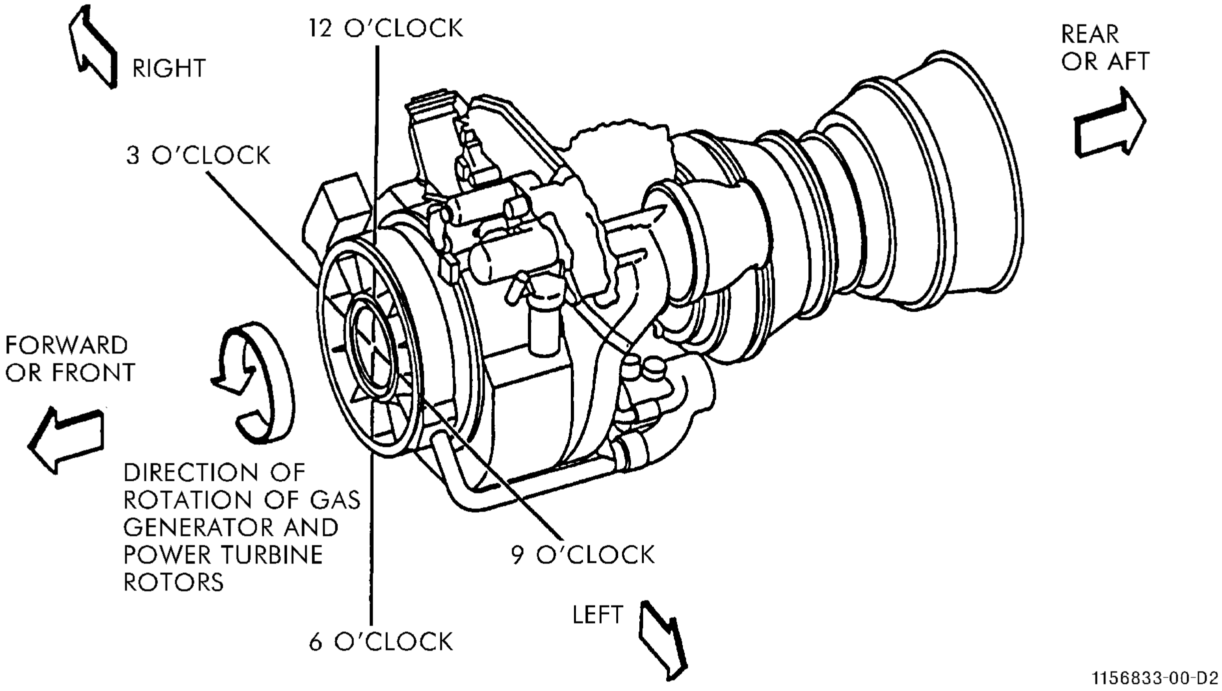


Figure 1-5. Directional References

Table 1-1. Army Flight Safety Critical Aircraft Parts and Their Critical Characteristics

Chapter No.	Paragraph No.	Nomenclature	Critical Characteristics
1	1-112	Oil Tank Cap and Adapter (PN 6038T99P01) **(T700, T701)**	Self-Sealing Feature
2	NA	Stage 1 Compressor Rotor Blade-Disk	Not disassembled at field level
2	NA	Stage 2 Compressor Rotor Blade-Disk	Not disassembled at field level
2	NA	Stages 3 and 4 Compressor Rotor Blade-Disk	Not disassembled at field level
2	NA	Stage 5 Compressor Rotor Blade-Disk	Not disassembled at field level
2	NA	Compressor Centrifugal Impeller	Not disassembled at field level
3	3-5	Stage 1 Turbine Disk	Life Limits
3	3-5	Stage 2 Turbine Disk	Life Limits
2	NA	Gas Generator Turbine Shaft	Not disassembled at field level
4	NA	Stage 3 Turbine Disk	Not disassembled at field level
4	NA	Stage 4 Turbine Disk	Not disassembled at field level

Table 1-1. Army Flight Safety Critical Aircraft Parts and Their Critical Characteristics (Cont)

Chapter No.	Paragraph No.	Nomenclature	Critical Characteristics
4	4-4	Power Turbine Module	Installation of stage 4 turbine stator ring
3	3-5	Stage 2 Turbine Nozzle Static Seal	Cracks in seal backing ring
3	NA	Midframe Assembly	Not disassembled at field level
2	NA	No. 4 Bearing Support	Not disassembled at field level
2	NA	No. 4 Trilobe Roller Bearing	Not disassembled at field level
2	2-28	Power Takeoff Drive Assembly	Installation of Damping Ring
5	5-4	Accessory Drive Gearbox Assembly	Fuel Leaks
5	5-46	Fuel Connector	Fuel Leaks
6	6-39	Hydromechanical Control Unit Assembly	Fuel Leaks
6	6-74	Valve, Overspeed (**(T700)** Pressurizing and Overspeed, **(T701, T701C, T701D)** Overspeed and Drain Valve)	Fuel Leaks
6	6-33	Fuel Boost Pump	Fuel Leaks
6	6-51, 6-45	Fuel Filter	Fuel Leaks
8	8-4	Lube Oil Cooler Assembly	Fuel Leaks
6	6-79	Manifold Assembly (ODV, POU)	Fuel Leaks
6	6-9	Main Fuel Manifold	Fuel Leaks
6	6-56	Gearbox-to-Fuel Control Hose Assembly	Fuel Leaks
6	6-62	Fuel Pressure Switch	Fuel Leaks

1-20. PRELIMINARY INSTRUCTIONS.

a. Warnings for hazardous substances have been developed from dated manufacturer's Material Safety Data Sheets (MSDSs), when available. Each warning is valid as of its specific preparation date. To ensure compliance with current precautionary information:

- Read and follow specific instructions in MSDS for types of personal protective equipment (safety glasses, gloves, apron, etc.), for use of ventilators or respirators, for types of fire extinguishers, and for treating medical emergencies.
- Read and follow the hazardous materials label posted on the container for the specific substance and the MSDS supplied by the manufacturer.
- Follow established shop practices and procedures when using, handling, and storing hazardous materials.
- Dispose of hazardous materials by complying with existing federal, state, or local regulations.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

b. Some parts of this engine may contain asbestos, which is highly toxic to skin, eyes, and respiratory tract. Before proceeding, adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

c. Asbestos parts are identified in the RPSTLs by the symbol ▲, which is directly after the part number in both the GAPL and the Part Number Index.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-21. EQUIPMENT CAPABILITIES AND FEATURES.

The T700-GE-700, T700-GE-701, T700-GE-701C and T700-GE-701D engines are front-driven, turboshaft engines, that have four modules. See figure 1-2 for **T700**, **T701C**, and **T701D** modules and figure 1-4 for **T701** modules. The **T700, T701, T701C**, and **T701D** modules are described in paragraphs 1-23 thru 1-26. Refer to paragraph 1-41 for equipment data for **T700** engines and to paragraph 1-42 for **T701, T701C**, and **T701D** engines.

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

1-22. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

See figure 1-6 for illustrations of major T700-GE-700 engine components. See figure 1-7 for illustrations of major T700-GE-701, T700-GE-701C, and T700-GE-701D engine components.

1-23. Cold Section Module. This module includes the following components: swirl frame, A-sump output shaft assembly, front frame, main frame, scroll case, compressor section, and diffuser and midframe casing assembly. An inlet particle separator is in the forward end of the module. A blower, mounted on the accessory drive gearbox provides suction for particle separator operation. The following is a description of these components.

a. Inlet Particle Separator. The inlet particle separator contains three engine frames: swirl frame (2, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**), front frame (4), and main frame (5). The rest of the inlet particle separator consists of a scroll case, an inlet duct, a particle separator blower, and an aircraft discharge duct. The inlet particle separator provides clean air to the engine as follows:

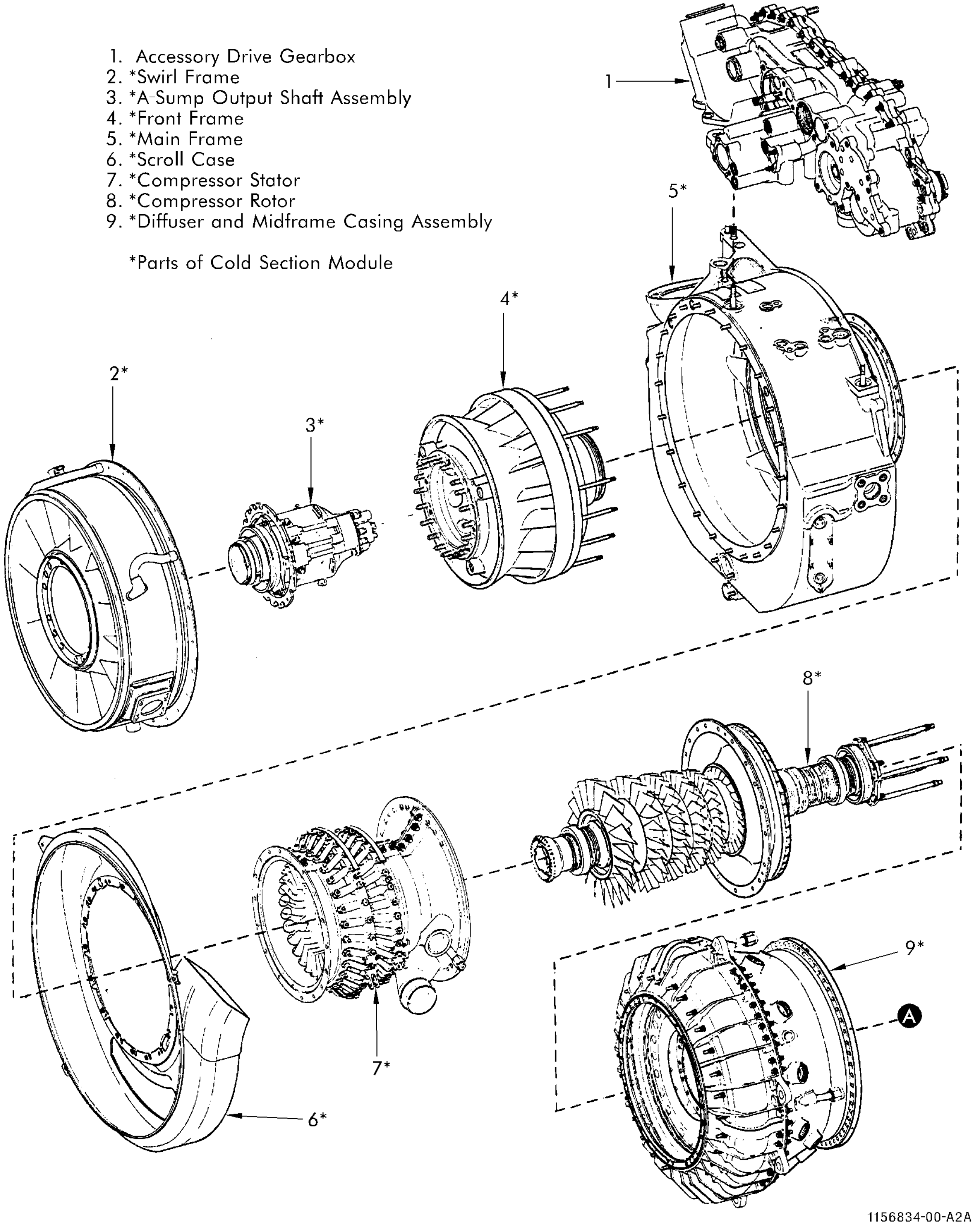
(1) Air enters the engine through the swirl frame (fig. 1-8). Swirl vanes direct the air into a rotating or swirling pattern. Sand, dust, and other foreign objects are separated by centrifugal action. These objects are carried to the outer section of the main frame and into the scroll case. Particles are drawn from the scroll case by the blower and are blown out the aircraft discharge duct.

(2) The relatively clean air that remains after particles are separated is carried to the front frame deswirl vanes, which straighten the air flow before it enters the compressor inlet.

b. Swirl Frame. The swirl frame (2, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) contains the swirl vanes and is the forward structure of the engine. The forward flange of the swirl frame mates with the aircraft inlet duct.

c. A-sump Output Shaft Assembly. The A-sump output shaft assembly (3, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) is housed in the front frame (4). It provides a housing for the no. 1 and no. 2 main bearings. The output shaft is driven by the power turbine and supplies power through shafting to the helicopter transmission. The output shaft connects to the power turbine drive shaft assembly through a splined joint.

d. Front Frame. The front frame (4, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) is housed in the main frame (5) and contains the A-sump and deswirl vanes. It supports the A-sump output shaft assembly and provides an inner flowpath for air entering the compressor inlet.



1. Accessory Drive Gearbox
2. *Swirl Frame
3. *A-Sump Output Shaft Assembly
4. *Front Frame
5. *Main Frame
6. *Scroll Case
7. *Compressor Stator
8. *Compressor Rotor
9. *Diffuser and Midframe Casing Assembly

*Parts of Cold Section Module

Figure 1-6. *(T700)* ***Major Engine Components (Sheet 1 of 2)***

10. ★ Combustion Liner
11. ★ Stage 1 Nozzle Assembly
12. ★ Stage 1 Gas Generator Turbine Rotor
13. ★ Gas Generator Stator
14. ★ Stage 2 Gas Generator Turbine Rotor
15. ● Turbine Case
16. ● Power Turbine Drive Shaft Assembly
17. ● Power Turbine Rotor Assembly
18. ● Exhaust Frame
19. ● C-Sump Housing

★ Parts of the Hot Section Module
● Parts of the Power Turbine Module

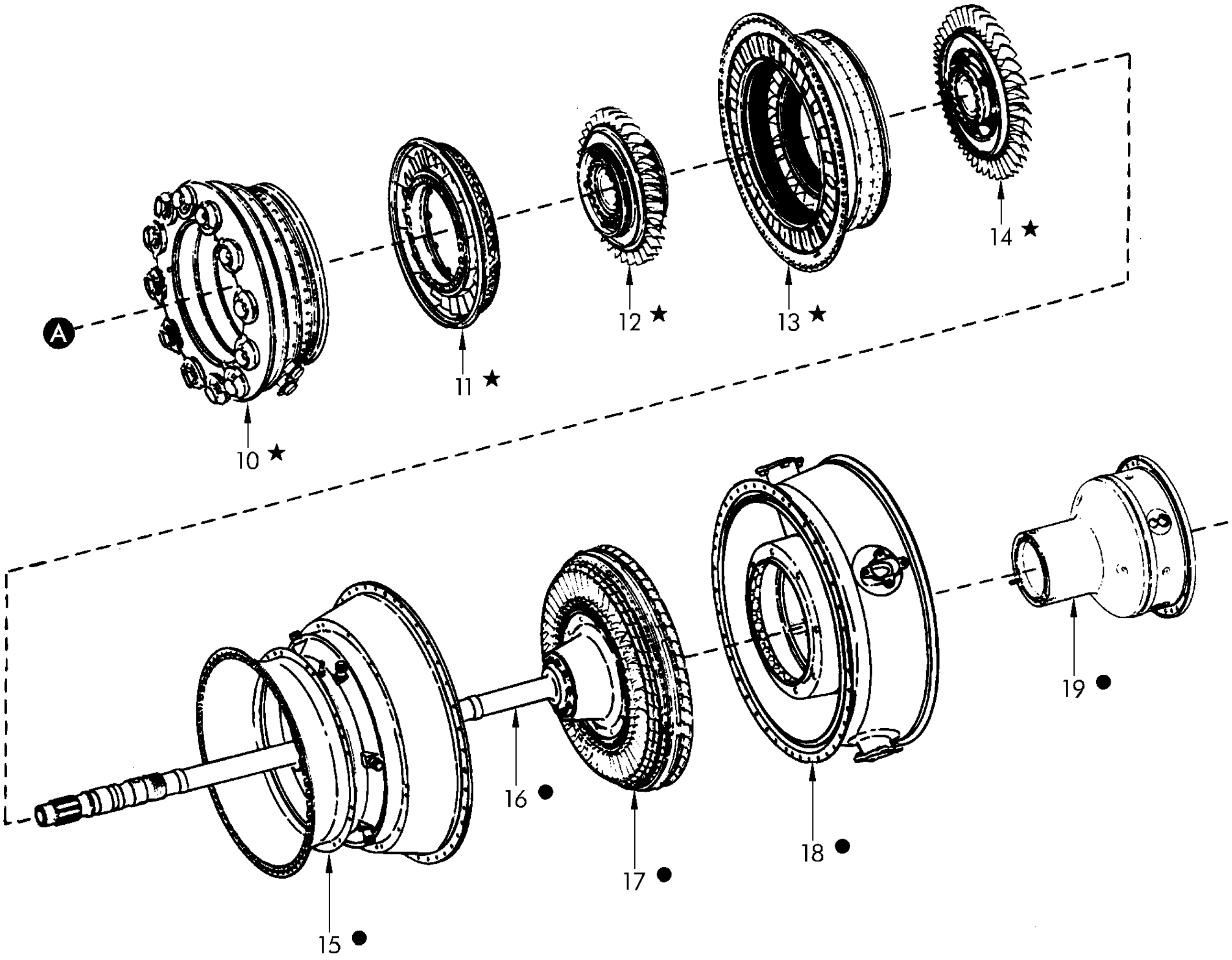


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Figure 1-6. *(T700)* **Major Engine Components (Sheet 2 of 2)**

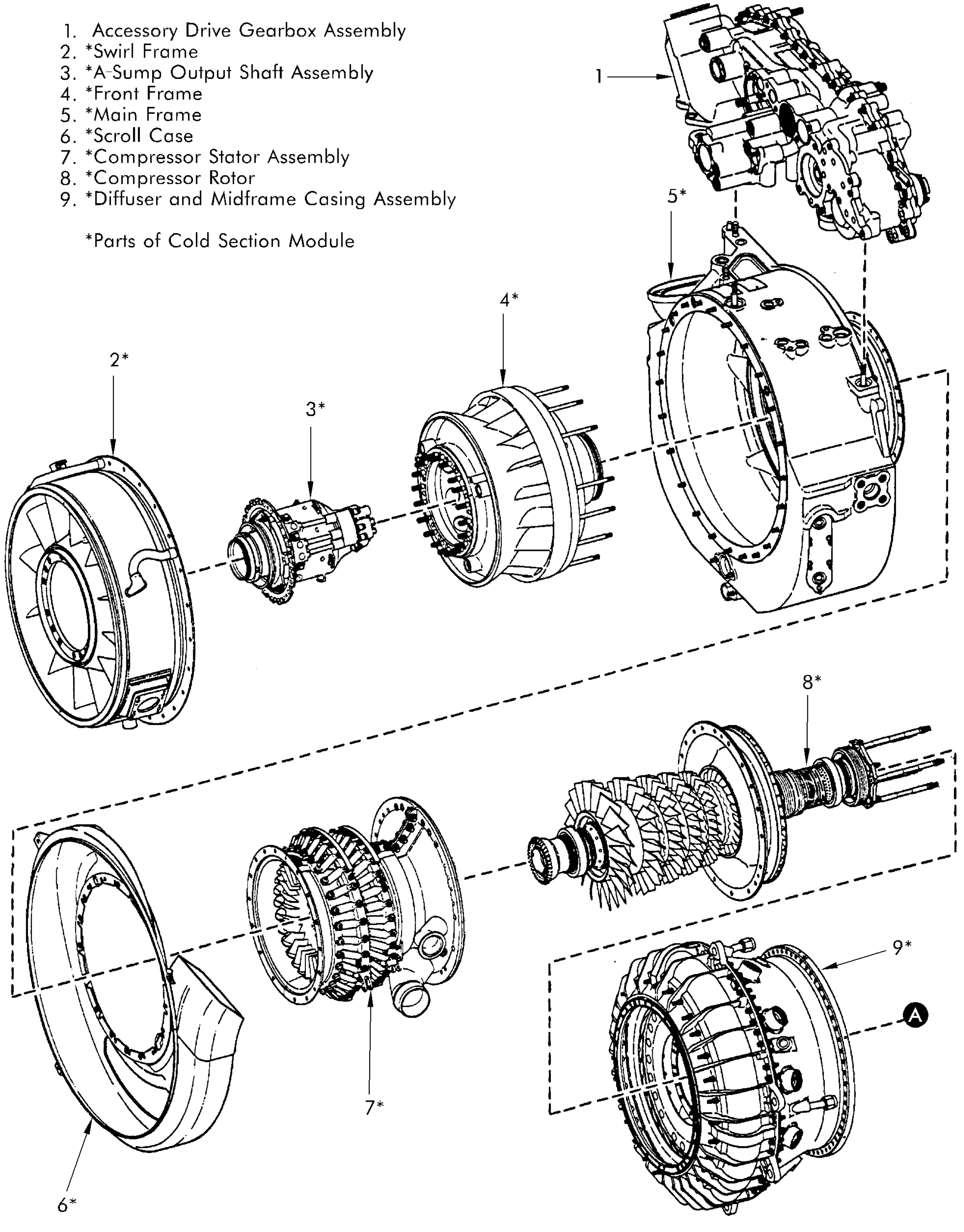

Figure 1-7. ***(T701, T701C, T701D)*** *Major Engine Components (Typical) (Sheet 1 of 2)*

10. ★ Combustion Liner
11. ★ Stage 1 Nozzle Assembly
12. ★ Stage 1 Gas Generator Turbine Rotor
13. ★ Gas Generator Stator
14. ★ Stage 2 Gas Generator Turbine Rotor
15. ● Turbine Case
16. ● Power Turbine Drive Shaft Assembly
17. ● Power Turbine Rotor Assembly
18. ● Exhaust Frame
19. ● C-Sump Housing

★ Parts of the Hot Section Module
● Parts of the Power Turbine Module

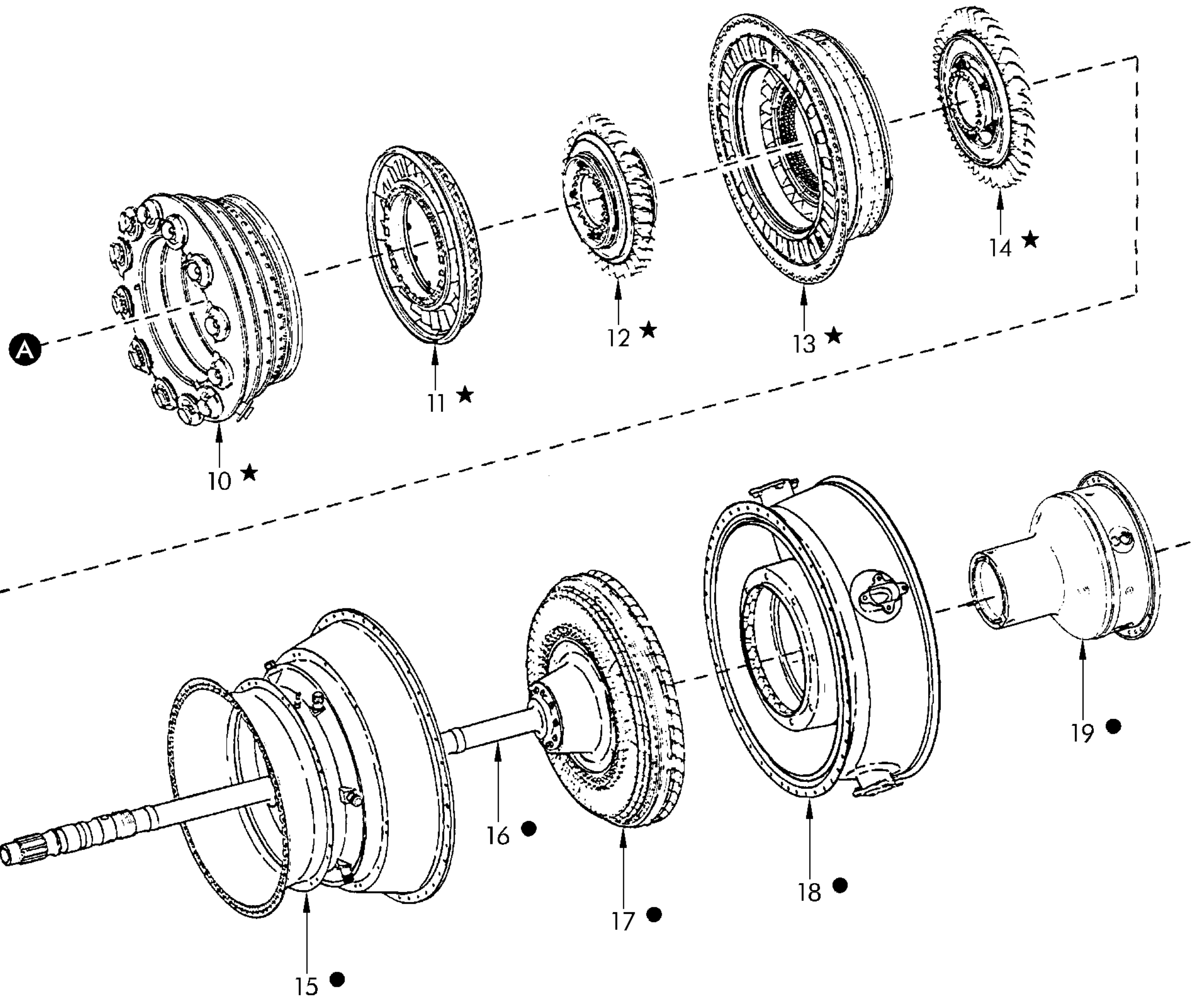

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Figure 1-7. ***(T701, T701C, T701D)*** *Major Engine Components (Typical) (Sheet 2 of 2)*

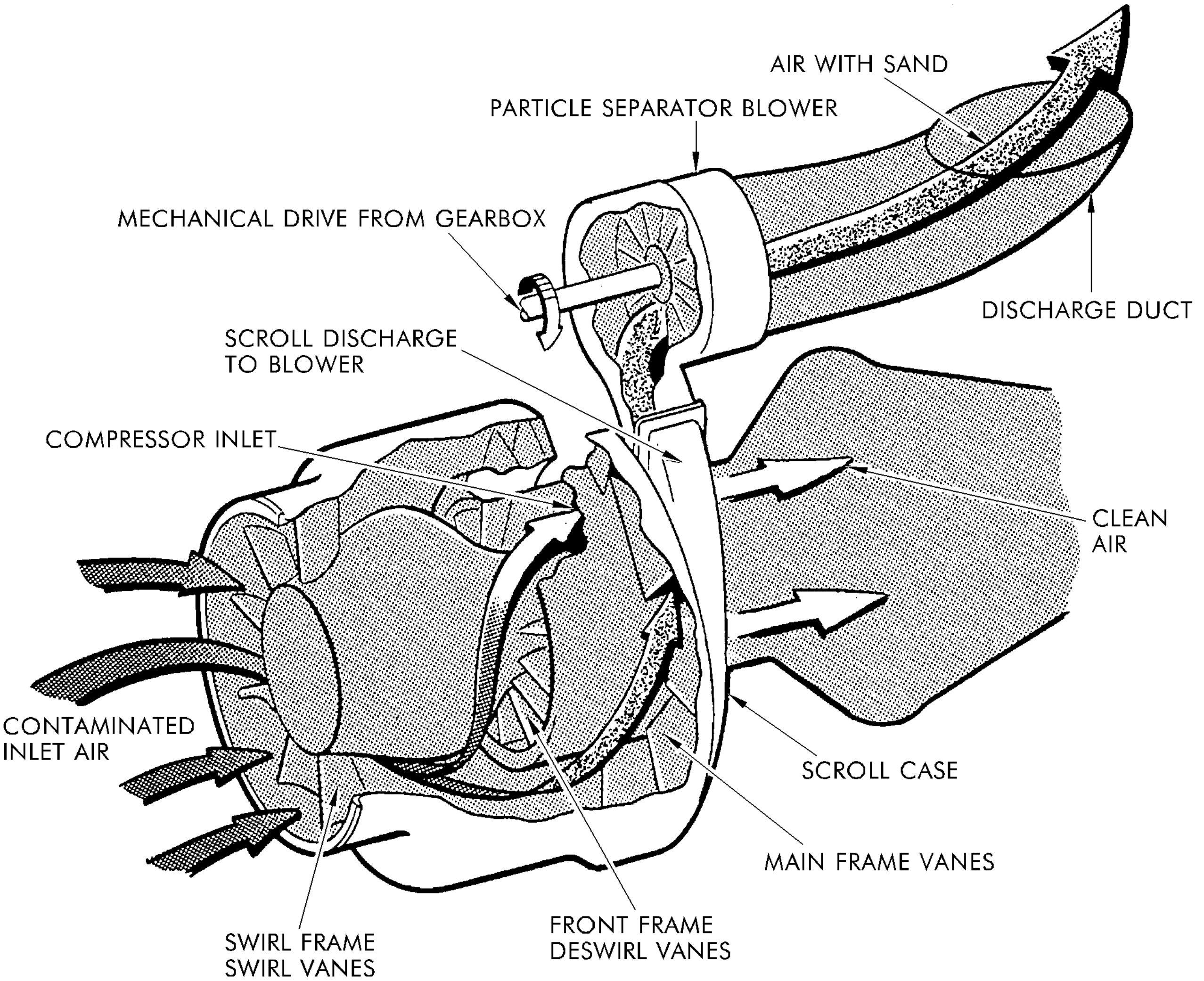


Figure 1-8. Inlet Particle Separator Flow Diagram

e. Main Frame. The main frame (5, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) is a one-piece casting consisting of an outer and inner portion. The outer portion contains the oil tank, the accessory gearbox support, the scroll seal and support, and the forward engine mounts. The inner portion contains the scroll vanes, the front frame mating flange, the inlet guide vane supports, and the flange that attaches to the compressor. The aft inner portion of the frame forms the outer surface of the compressor inlet flowpath. The variable inlet guide vanes are supported in this frame. By removing a borescope plug, inlet guide vanes and stage 1 compressor rotor blades can be inspected.

f. Scroll Case. The scroll case (6, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) is a fiberglass shell attached to the aft side of the main frame. The scroll case collects sand, dust, and other particles from the airflow and directs them, and the particle separator blower removes them. An opening at the 6 o'clock position provides cooling air for the **(T700, T701)** ECU or **(T701C, T701D)** DEC and access for foreign object removal.

g. Compressor Section. The compressor section has five axial stages and one centrifugal stage (stage 6). The axial stages have variable stage 1 and stage 2 vanes. The centrifugal stage has an impeller with backswept vanes. The compressor rotor (8, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) is supported by bearings at the front and rear. Access is obtained for borescoping the stage 5 rotor blades and the centrifugal impeller by removing the borescope cap or plug from port on compressor case. Stage 5 bleed air is taken from three bleed ports on the compressor stator (7). One port supplies air for the anti-icing bleed and start valve; the other two ports provide customer bleed air.

h. Diffuser and Midframe Casing Assembly. The diffuser and midframe casing assembly (9, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) is a matched assembly that includes the diffuser, the diffuser case, and the midframe assembly. The following is a description of these components.

(1) The diffuser increases the compressor discharge area and reduces the speed of the centrifugal impeller airflow, causing the air pressure to increase. This pressurized air is directed to the combustor through the diffuser case.

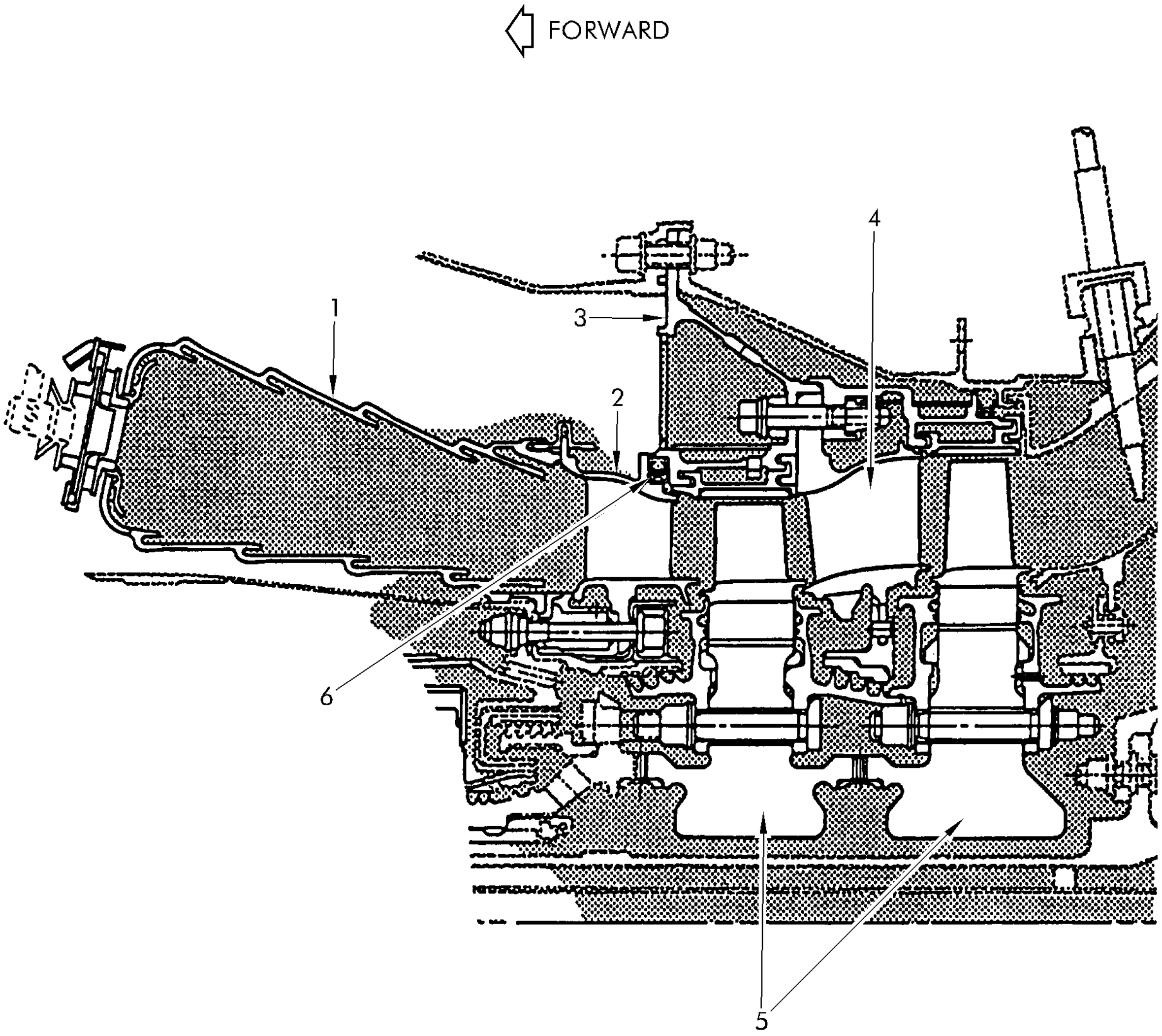
(2) The diffuser case mounts on the rear flange of the compressor stator. It directs compressor discharge air to the combustion chamber. A port at the 6 o'clock position on the diffuser case serves as a drain for the combustion chamber.

(3) The midframe assembly houses the combustion liner and contains the B-sump. The **T700** midframe has ports for attaching fuel injectors, primer nozzles, and igniter plugs. The **T701**, **T701C**, and **T701D** midframe has ports for attaching fuel injectors and igniter plugs. For **T700** engines, access is obtained for borescoping the combustion liner, the fuel injectors, and the stage 1 nozzle assembly by removing the borescope plug from a port on the midframe. For **T701**, **T701C**, and **T701D** engines, access is obtained through the igniter ports for borescoping the combustion liner, the fuel injectors, and the stage 1 nozzle assembly. The midframe has four service tubes: one supplies oil to the B-sump; one scavenges oil from the B-sump; one drains the B-sump seal pressure cavity; and one conducts compressor discharge seal leakage air to the turbine case. On **T700** engines, the port at the 10:30 o'clock position provides compressor discharge air (P3) to the POU and to the HMU. On **T701**, **T701C**, and **T701D** engines, the port at the 10:30 o'clock position provides compressor discharge air (P3) to the HMU.

1-24. Hot Section Module. This module includes the following components: combustion liner, stage 1 nozzle assembly, stages 1 and 2 gas generator turbine rotor, and gas generator stator. The following is a description of these components.

a. Combustion Liner. The combustion liner (1, fig. 1-9) is a one-piece welded assembly. Twelve fuel injectors are installed into swirlers in the liner dome. The swirlers break up and atomize the fuel discharged from the injectors into the liner. The liner is cooled by a film of air on the inner and outer walls, and by air striking the dome and shell. This design reduces the amount of cooling air mixed with the hot gas stream. **(T701D)** Thermal barrier coating (TBC) has been applied to the inner liner, outer liner, and splash plate.

b. Stage 1 Nozzle Assembly. The stage 1 nozzle assembly (2, fig. 1-9) contains 12 air-cooled nozzle segments. The nozzle assembly directs gas flow from the combustor discharge to the stages 1 and 2 gas generator turbine rotor (5) and gas generator stator (3). **(T701D)** TBC has been added to the stage 1 nozzle assembly.



1. Combustion Liner
2. Stage 1 Nozzle Assembly
3. Gas Generator Stator
4. Stage 2 Turbine Nozzle Segments
5. Stages 1 and 2 Gas Generator Turbine Rotor
6. Face-type Seal

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Figure 1-9. Hot Section Module (Typical)

c. Stages 1 and 2 Gas Generator Turbine Rotor.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Cracks on stage 1 and stage 2 turbine disks are critical characteristics.

The stages 1 and 2 gas generator turbine rotor (5, fig. 1-9) is an air-cooled rotor. Each rotor stage consists of individual blades, a disk, and forward and aft cooling plates. The cooling plates are attached to each disk by five bolts. **(T701D)** TBC has been applied to the stage 1 turbine rotor blades.

d. Gas Generator Stator.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Cracks on the backing ring of the **(T700, T701)** stage 2 turbine nozzle air seal are critical characteristics.

The gas generator stator (3, fig. 1-9) houses the stages 1 and 2 gas generator turbine rotor (5) and the stage 2 turbine nozzle segments (4). The stage 2 turbine nozzle segments are located between the stage 1 and stage 2 disks.

1-25. Power Turbine Module. This module includes the following components: turbine case, power turbine rotor assembly, power turbine drive shaft assembly, exhaust frame, and C-sump housing. The following is a description of these components.

a. Exhaust Frame. The exhaust frame (5, fig. 1-10) supports the C-sump housing (6). It contains the no. 5 carbon seal (12) and the no. 5 and no. 6 bearing support (9).

b. Power Turbine Rotor Assembly. The power turbine rotor assembly (10, fig. 1-10) consists of the stage 3 and stage 4 turbine disks (13, 8) and the stage 4 seal and turbine nozzle (4). The rotor assembly mounts on the power turbine drive shaft assembly (14). The no. 5 and no. 6 bearings (11, 7) support the aft end of the drive shaft; the forward end is supported by a splined joint from the output shaft.

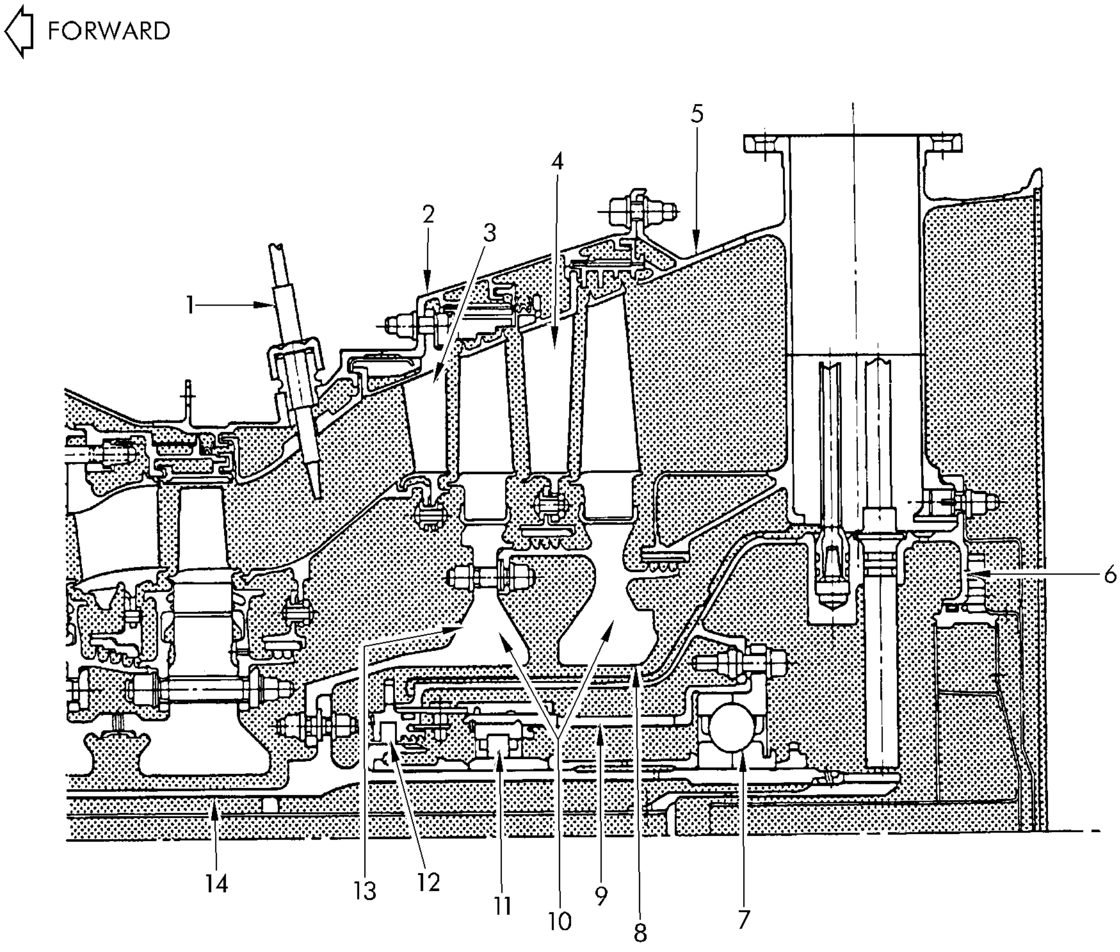
c. Turbine Case. The turbine case (2, fig. 1-10) houses the power turbine rotor assembly (10) and the stage 3 turbine nozzle segments (3). The thermocouple assembly (1) is installed on the turbine case.

d. Power Turbine Drive Shaft Assembly. Output power is delivered by the power turbine drive shaft assembly; it extends forward through the engine to a splined joint on the output shaft. The power turbine drive shaft assembly is made up of a drive shaft (3, fig. 1-11) and torque sensor tube (9). The torque sensor tube is secured by a pin (1) to the front of the drive shaft (3). The rear of the tube (9) is free and not secured to the rear of the power turbine shaft. The torque and overspeed sensor (5) and the Np sensor (7) contain a magnet and a wire coil which produce an electrical pulse each time a shaft tooth (8) or a reference tooth (6) rotates past. Because the electrical pulses have a different relationship with changes in load, the output torque of the engine can be measured. The greater the load, the greater the twist in the shaft. The two sensors (5, 7) transmit these pulses to the ECU or DEC. Paragraph 1-35 provides a more detailed description of the ECU or DEC and the sensors (5, 7).

1-26. Accessory Section Module. This module includes a top-mounted accessory drive gearbox and attached components. The accessory section module is driven by the compressor rotor through the power takeoff bevel gear and radial drive shaft assembly.

a. Accessory Drive Gearbox. The accessory drive gearbox (1, fig. 1-6 **(T700)** or 1-7 **(T701, T701C, T701D)**) transmits torque from the engine starter during starting and drives the components that mount on the gearbox pads. The gearbox has internal passages that carry oil and fuel. These passages minimize the number of external hoses and tubes on the engine.

b. Components of the Accessory Section Module. See figure 1-12 for **T700** component locations on the accessory section module. See figure 1-13 for **T701, T701C, T701D** component locations on the accessory section module. These components are described in paragraphs 1-29 thru 1-36.



1. Thermocouple Assembly
2. Turbine Case
3. Stage 3 Turbine Nozzle Segments
4. Stage 4 Seal and Turbine Nozzle
5. Exhaust Frame
6. C-Sump Housing
7. No. 6 Bearing
8. Stage 4 Turbine Disk
9. No. 5 and No. 6 Bearing Support
10. Power Turbine Rotor Assembly
11. No. 5 Bearing
12. No. 5 Carbon Seal
13. Stage 3 Turbine Disk
14. Power Turbine Drive Shaft Assembly

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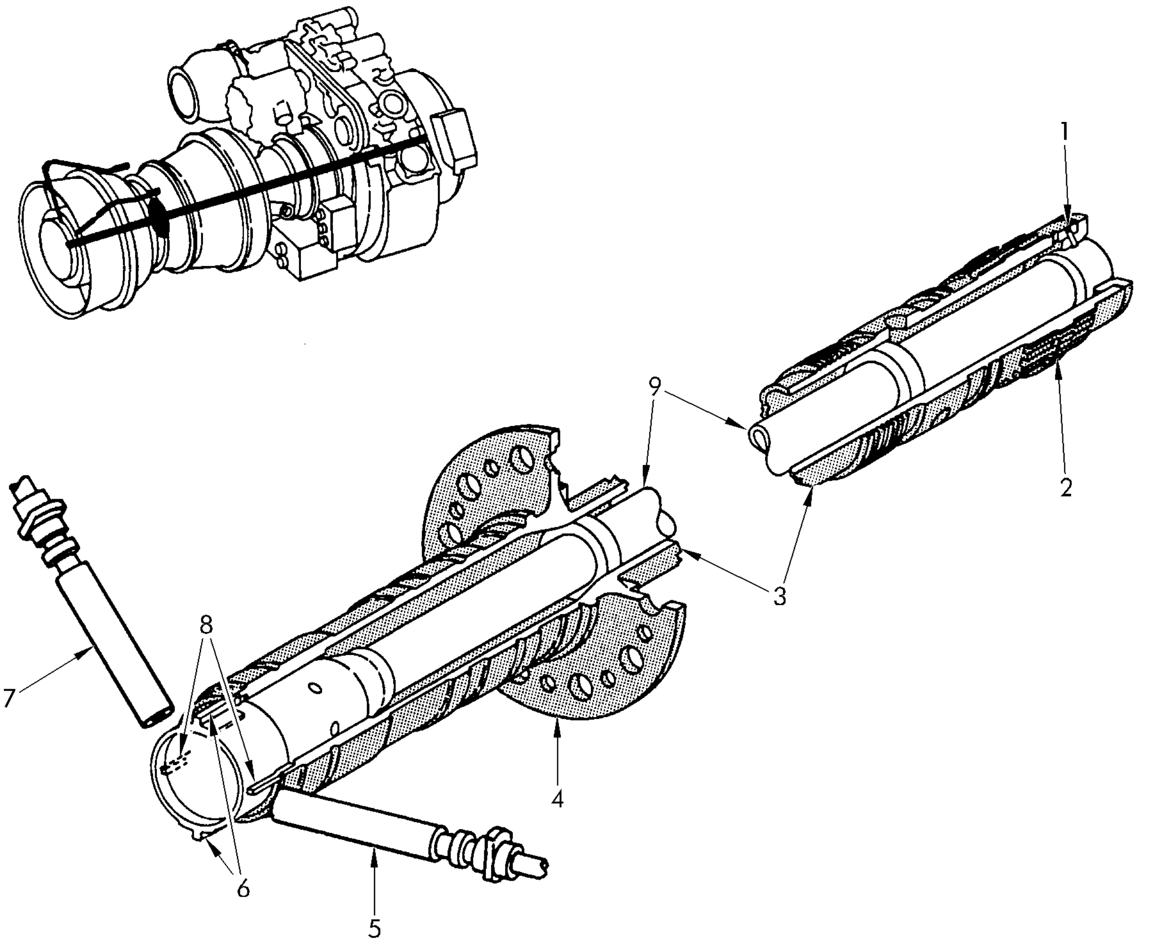
Figure 1-10. Power Turbine Module (Typical)



1. Pin
2. Drive Shaft Spline
3. Drive Shaft
4. Disk Mounting Flange
5. Torque and Overspeed Sensor
6. Reference Teeth
7. Np Sensor
8. Shaft Teeth
9. Torque Sensor Tube

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Figure 1-11. Power Turbine Drive Shaft Assembly

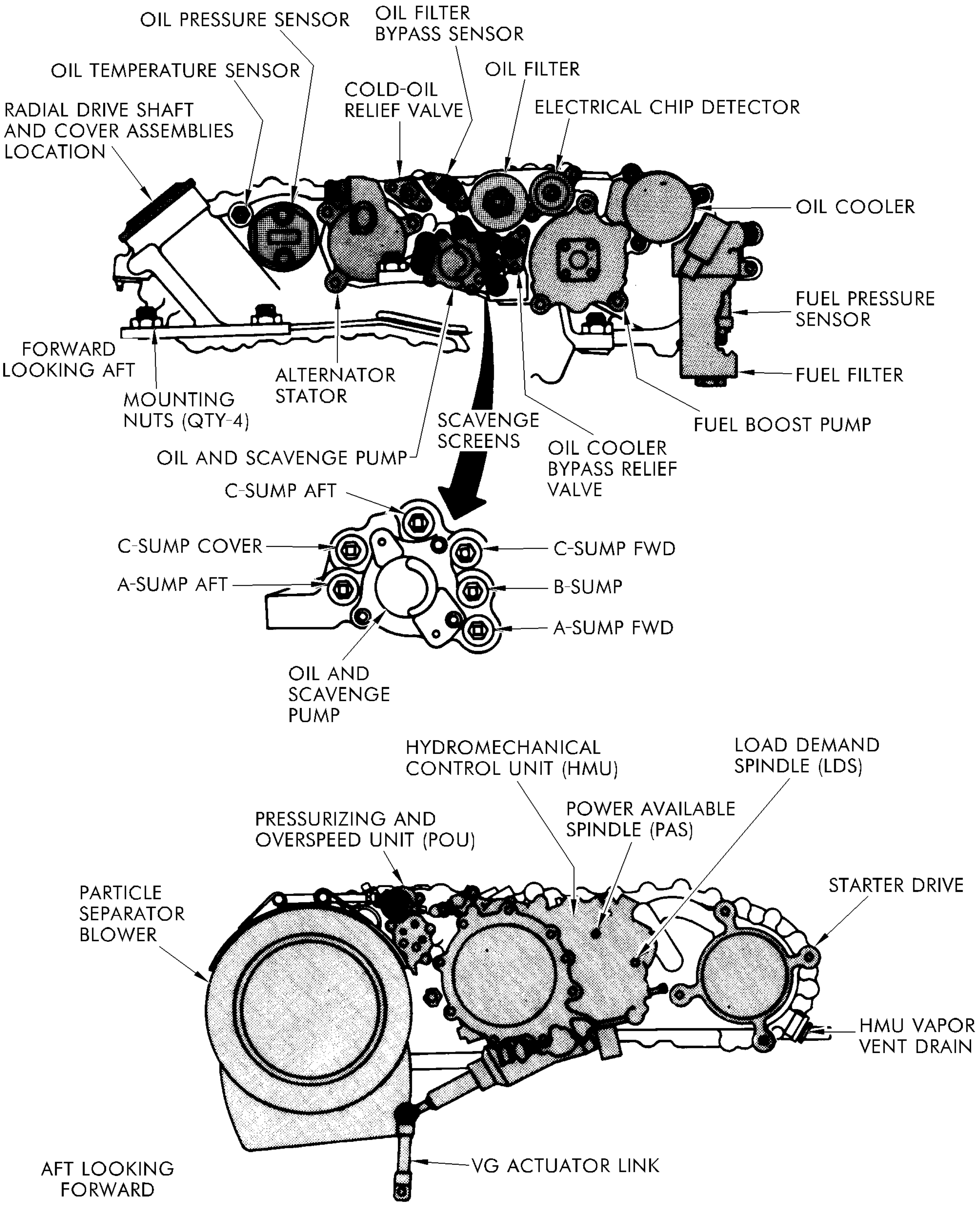
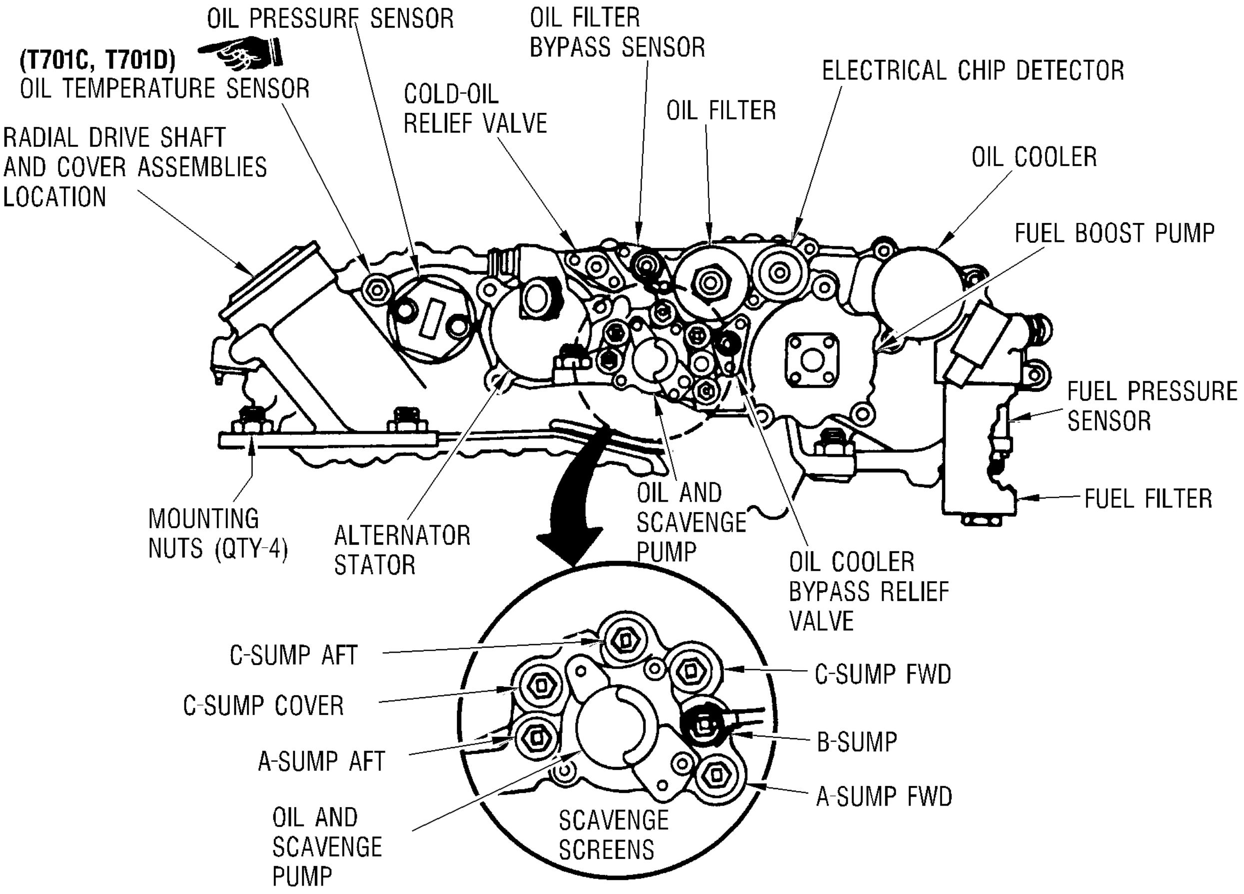
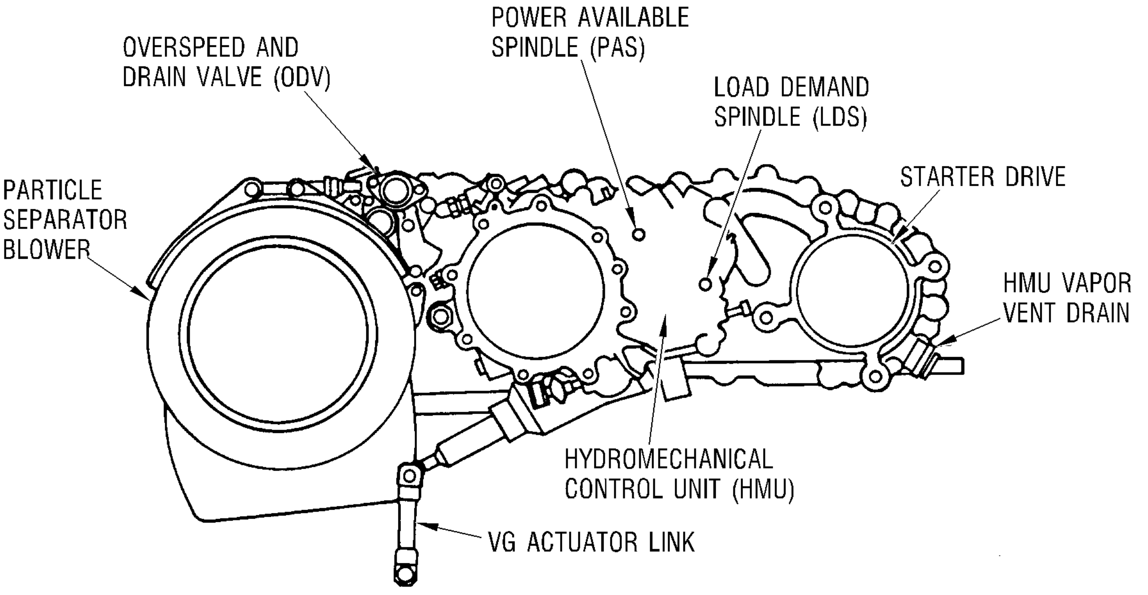


Figure 1-12.** (T700) **Component Locations on Accessory Section Module



VIEW FORWARD LOOKING AFT



VIEW AFT LOOKING FORWARD

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*Figure 1-13. **(T701, T701C, T701D)** Component Locations on Accessory Section Module*

1-27. Line Replaceable Units (LRU's). The following is a list of major LRU’s that can be removed and installed at AVUM. Other items such as tubes, hoses, and fittings can also be changed at AVUM.

WARNING

Electrical Components

Be sure that power source is disconnected before working with electrical components. Dangerous or possibly fatal voltage may be present.

WARNING

Electrical Shock Hazard

- Persons working on line electrical systems should have proper training before doing so. Use proper personal protective equipment.
- Use care when applying input power and when measuring voltage. Dangerous or possibly fatal voltage may be present.

CAUTION

Ensure that aircraft electrical power is OFF before attempting any engine work involving removal of LRUs from engine while engine is installed in aircraft.

ACCESSORY SECTION MODULE LRU's
  Particle Separator Blower
  Radial Drive Shaft Assembly

FUEL SYSTEM LRU's
  (T700) Primer Nozzles
  Fuel Boost Pump
  Hydromechanical Control Unit (HMU)
  (T700) Pressurizing and Overspeed Unit (POU)
  (T701, T701C, T701D) Overspeed and Drain Valve (ODV)
  Fuel Filter
  Fuel Pressure Sensor

ELECTRICAL SYSTEM LRU's
  Igniter Plugs
  (T700, T701) Electrical Control Unit (ECU)
  (T701C, T701D) Digital Electronic Control (DEC)
  (T701C, T701D) History Counter
  (T700, T701) History Recorder
  Ignition Leads
  Exciter Assembly
  Green Electrical Cable
  Yellow Electrical Cable
  Blue Electrical Cable
  Alternator Stator
  Thermocouple Assembly
  Power Turbine Speed and Torque Sensor Assemblies

OIL SYSTEM LRU's
  Oil Cooler
  Oil and Scavenge Pump
  Scavenge Screens
  Oil Filter Bypass Sensor
  Oil Filter
  Electrical Chip Detector
  Oil Pressure Sensor
  (T700, T701C, T701D) Oil Temperature Sensor

AIR SYSTEM LRU's
  Anti-Icing Bleed and Start Valve

1-28. DESCRIPTION OF ENGINE SYSTEMS.

The engine has four basic systems: fuel, electrical, oil, and air. The systems and their components are described in paragraphs 1-29 thru 1-37.

1-29. (T700) Fuel System.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

NOTE

The HMU is designed to be adjusted at depot only. Adjustments to the HMU are safety wired to prevent adjustment at AVUM and AVIM.

1-30. (T700) The fuel system consists of the following: primer nozzles, main fuel manifold, fuel injectors, fuel start feed tube, fuel start manifold tube, fuel boost pump, HMU, POU, fuel filter, and fuel pressure sensor.

1-31. **(T700)** The fuel system operates with the engine electrical system to provide proper fuel flow to the engine during starting, acceleration, deceleration, and steady-state operation. The system maintains constant power turbine rotor speed (Np) and provides load-sharing between engines.

a. **(T700)** Fuel System Flow. (See fig. 1-14.)

(1) Fuel enters the engine at the fuel boost pump. It then flows through passages in the accessory drive gearbox to the fuel filter. Filtered fuel then flows to the HMU.

(2) Fuel from the HMU passes through an external hose to the gearbox. From there it passes through the oil cooler and enters the POU through passages in the gearbox.

(3) The POU sends fuel through the fuel start feed tube and fuel start manifold tube to the two primer nozzles for lightoff and starting. Then fuel is sent through the main fuel manifold to the 12 fuel injectors for starting, for acceleration, and for all engine operation.

b. **(T700)** Primer Nozzles. Two primer nozzles spray fuel into the combustion section during engine lightoff and starting.

c. **(T700)** Main Fuel Manifold. The main fuel manifold delivers fuel from the POU to the 12 fuel injectors.

d. **(T700)** Fuel Injectors. Twelve fuel injectors spray fuel into the combustion section to maintain engine operation.

e. **(T700)** Fuel Start Manifold Tube. The fuel start manifold tube delivers fuel from the POU to the two primer nozzles. The primer nozzle flow is shut off by the POU just before the engine reaches idle speed.

f. **(T700)** Fuel Boost Pump. The fuel boost pump is an engine-mounted, suction-type pump. It is not self-priming.

g. **(T700)** HMU.

(1) The HMU schedules fuel for combustion. It contains a high-pressure pump. The HMU has an actuator that positions the inlet guide vanes, stages 1 and 2 compressor variable vanes, and anti-icing bleed and start valve.

(2) The HMU responds to engine inlet air temperature (T2), to compressor discharge air pressure (P3), and to a trim signal from the ECU to set fuel flow and variable vane positioning.

(3) The HMU also responds to two separate inputs from the aircraft. The HMU load demand spindle (LDS) is connected to the aircraft collective pitch linkage. The LDS moves when the operator selects a different collective pitch angle. The HMU power available spindle (PAS) is connected to the ENG POWER CONT lever in the cockpit. It is used to start the engine, to manually set gas generator speed from ground idle to maximum power, and to shut down the engine.

(4) A variable electrical trim signal from the ECU is used in the HMU to vary fuel flow, controlling engine power. Some ECU failures can be overridden from the cockpit by momentarily moving the ENG POWER CONT lever into LOCKOUT and manually controlling engine power by positioning of the lever.

(5) The engine fuel system must be primed after an engine is installed in the aircraft or whenever the fuel system has been opened for maintenance purposes. When the ENG POWER CONT lever is advanced to LOCKOUT, a valve in the HMU will open, allowing fuel flow to purge the system of air. The aircraft fuel pump is used to pump fuel from the aircraft fuel tanks to the HMU. When the aircraft and engine fuel inlet system is full, fuel will flow from the overboard drain. ENG POWER CONT lever is then moved to OFF.

h. **(T700)** Pressurizing and Overspeed Unit (POU). The POU has four functions. First, it sends some of the fuel through the fuel start manifold tube to the primer nozzles for lightoff; the rest of the fuel is sent through the main fuel manifold to the fuel injectors for starting acceleration and for engine operation. Second, it purges fuel from the primer nozzles after lightoff. It does this by directing compressor discharge air (P3 air) through the primer nozzles. This prevents coking of the nozzles. Third, it uses P3 air to purge fuel from the main fuel manifold on shutdown. This prevents coking of the fuel injectors. Fourth, it controls Np overspeed by cutting back engine fuel flow while overspeed is present.

i. **(T700)** Fuel Filter. The main parts of the fuel filter are: a disposable filter element, an impending bypass indicator button, a bypass relief valve, and an actual filter bypass sensor. The following is a description of the operation of the fuel filter.

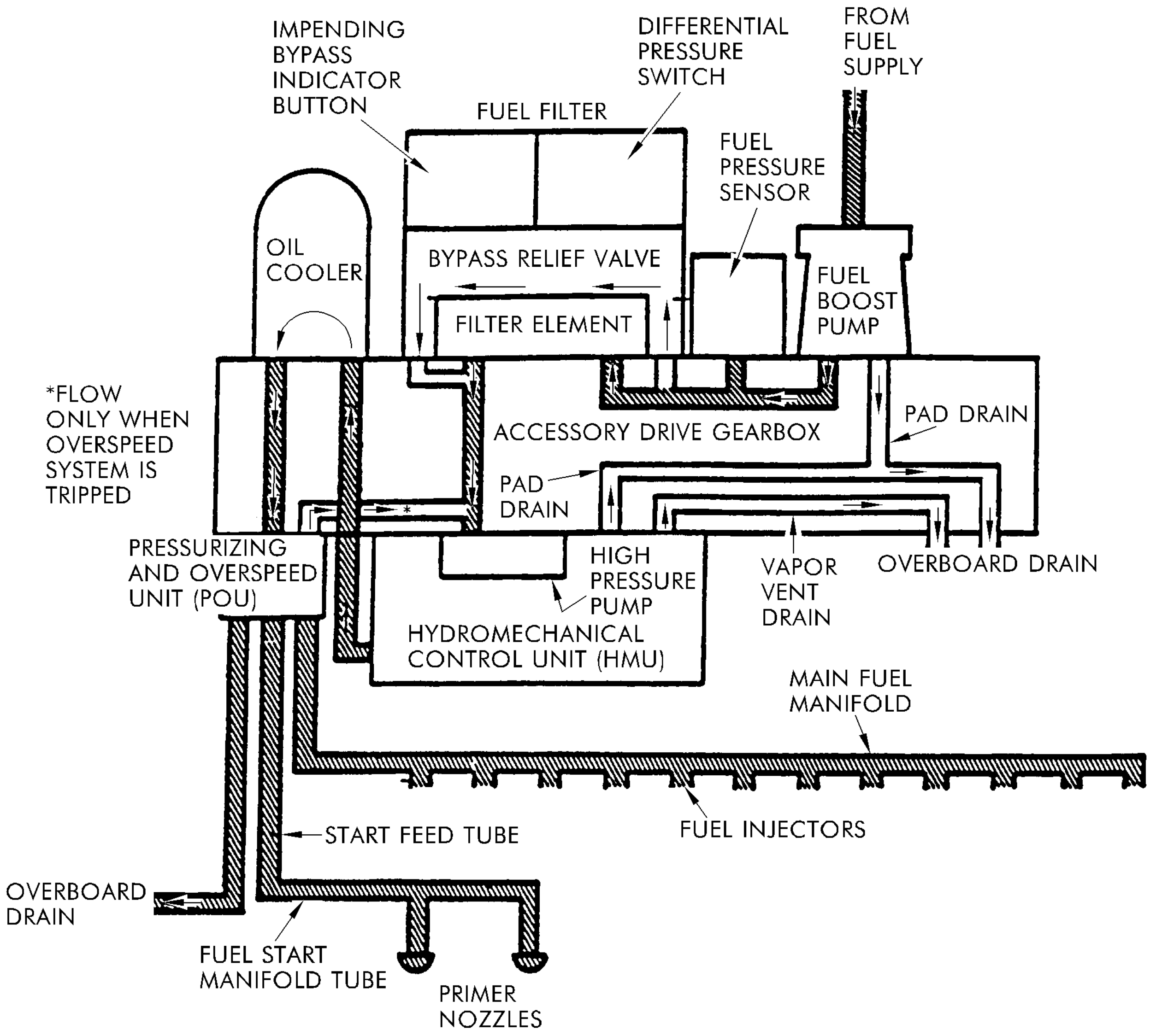

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Figure 1-14. *(T700)* ***Fuel System Schematic***

(1) The impending bypass indicator shows when the fuel filter element needs changing. When the pressure drop across the filter element increases due to a restricted flow, a button on the indicator pops out and latches. Once popped, the button can be reset by pushing it in. If button stays in, operation can be continued. If button will not stay in, filter element must be replaced.

(2) If the fuel filter has clogged, a bypass relief valve will open and allow fuel to flow past the filter. When the valve opens, it closes a switch in the bypass sensor. The closed switch turns on a FUEL FLTR BYPASS caution light in the cockpit. The bypass caution light cannot be reset until the filter bowl and element are removed.

j. **(T700)** Fuel Pressure Sensor. The fuel pressure sensor mounts on the accessory gearbox (fig. 1-12). When fuel pressure decreases to 8.5 ±0.5 psig or less, a switch closes and transmits a signal that lights the low fuel pressure caution light.

1-32. (T701, T701C, T701D) Fuel System.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

NOTE

The HMU is designed to be adjusted at depot only. Adjustments to the HMU are safety wired to prevent adjustment at AVUM and AVIM.

1-33. (T701, T701C, T701D) The fuel system consists of the overspeed and drain valve (ODV) manifold, main fuel manifold, fuel injectors, fuel boost pump, fuel pressure sensor, HMU, ODV, and fuel filter.

1-34. (T701, T701C, T701D) The fuel system operates with the engine electrical system to provide proper fuel flow to the engine during starting, acceleration, deceleration, and steady-state operation. The system maintains constant power turbine rotor speed (Np) and provides load-sharing between engines.

a. **(T701, T701C, T701D)** Fuel System Flow. (fig. 1-15).

(1) Fuel enters the engine at the fuel boost pump. It then flows through the passages in the accessory drive gearbox to the fuel filter. Filtered fuel then flows to the hydromechanical control unit (HMU).

(2) Fuel from the HMU passes through an external hose to the gearbox. From there it passes through the oil cooler and enters the overspeed and drain valve (ODV) through passages in the gearbox.

(3) The ODV sends fuel through the ODV manifold and the main fuel manifold to the fuel injectors for starting, for acceleration, and for all other engine operating conditions.

b. **(T701, T701C, T701D)** Main Fuel Manifold. The main fuel manifold delivers fuel from the ODV manifold to the 12 fuel injectors.

c. **(T701, T701C, T701D)** Fuel Injectors. The 12 fuel injectors spray fuel into the combustion section to maintain engine operation.

d. **(T701, T701C, T701D)** Fuel Boost Pump. The fuel boost pump is an engine-mounted, suction-type pump. It is not self-priming.

e. **(T701, T701C, T701D)** HMU.

(1) The HMU schedules fuel for combustion. It contains a high-pressure pump. The HMU has an actuator that positions the inlet guide vanes, stages 1 and 2 compressor variable vanes, and anti-icing bleed and start valve.

(2) The HMU responds to engine inlet air temperature (T2), to compressor discharge air pressure (P3), and to a trim signal from the **(T701)** ECU or **(T701C, T701D)** DEC to set fuel flow and variable vane positioning.

(3) The HMU also responds to two separate inputs from the aircraft. The HMU load demand spindle (LDS) is connected to the aircraft collective pitch linkage. The LDS moves when the operator selects a different collective pitch angle. The HMU power available spindle (PAS) is connected to the PWR control lever in the cockpit. It is used to start the engine, to manually set gas generator speed from ground idle to maximum power, and to shut down the engine.

(4) A variable electrical trim signal from the **(T701)** ECU or **(T701C, T701D)** DEC is used in the HMU to vary fuel flow, controlling engine power. Some **(T701)** ECU or **(T701C, T701D)** DEC failures can be overridden from the cockpit by momentarily moving the PWR control lever into LOCKOUT and manually controlling engine power by positioning of the lever.

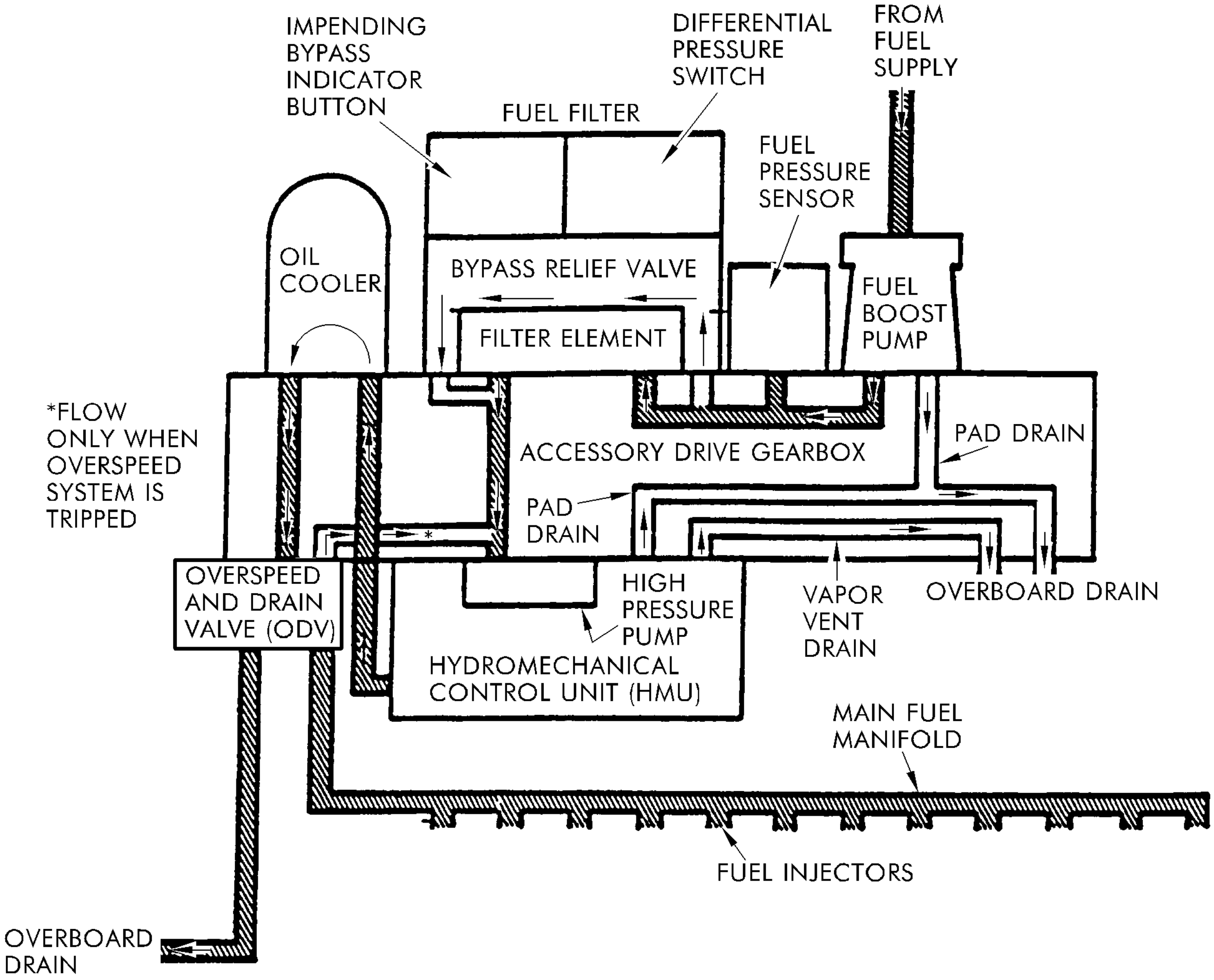

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Figure 1-15. **(T701, T701C, T701D)** Fuel System Schematic

(5) The engine fuel system must be primed after an engine is installed in the aircraft or whenever the fuel system has been opened for maintenance purposes. When the PWR control lever is advanced to LOCKOUT, a valve in the HMU will open, allowing fuel flow to purge the system of air. The aircraft fuel pump is used to pump fuel from the aircraft fuel tanks to the HMU. When the aircraft and engine fuel inlet system is full, fuel will flow from the overboard drain. PWR control lever is then moved to OFF.

f. **(T701, T701C, T701D)** Overspeed and Drain Valve (ODV). The ODV has three functions. First, it sends fuel through the main fuel manifold to the fuel injectors for starting, for acceleration, and for engine operation. Second, it purges the fuel injectors of fuel when the engine is shut down. It does this by allowing compressor discharge air (P3) to flow through the injectors. Third, it controls Np overspeed by shutting off engine fuel flow while overspeed is present.

g. **(T701, T701C, T701D)** Fuel Filter. The main parts of the fuel filter are: a disposable filter element, an impending bypass indicator, a bypass relief valve, and an actual filter bypass sensor. The following is a description of the operation of the fuel filter.

(1) The impending bypass indicator shows when the fuel filter element needs changing. When the pressure drop across the filter element increases due to a restricted flow, a button on the indicator pops out and latches. Once popped, the button cannot be reset until the filter bowl and element are removed.

(2) If the fuel filter has clogged, a bypass relief valve will open and allow fuel to flow past the filter. When the valve opens, it closes a switch in the bypass sensor. The closed switch turns on a FUEL FTR BYP caution light in the cockpit. The bypass caution light will remain on as long as the filter bypass valve is open. When filter differential pressure drops below the set pressure value of the fuel filter, the bypass valve will close and the cockpit caution light will go off.

h. **(T701, T701C, T701D)** Fuel Pressure Sensor. The fuel pressure sensor mounts on the accessory gearbox (fig. 1-13). When fuel pressure decrease to 8.5 ±0.5 psig or less, a switch closes and transmits a signal that lights the low fuel pressure caution light.

1-35. Electrical System. The electrical system consists of the following: ignition system, **(T700, T701)** ECU or **(T701C, T701D)** DEC, **(T700, T701)** history recorder **(T701C, T701D)** history counter, alternator, thermocouple assembly, power turbine rotor speed (Np) sensor and torque and overspeed sensor assemblies, and interconnecting electrical cable assemblies. The power sources and the components are described below.

a. Electrical System Power Sources. These sources include the following:

- Alternator winding no. 1, which is used for the ignition exciter assembly
- Alternator winding no. 2, which is used for the ECU or DEC and the Np overspeed protection system
- Alternator winding no. 3, which is used for the Ng signal in the cockpit
- Aircraft 115v 400Hz, which is used for the history recorder or history counter and backup power for the DEC and Np overspeed protection system
- Aircraft 28v dc, which is used for the anti-icing bleed and start valve, the oil filter bypass sensor, the fuel filter bypass sensor, the electrical chip detector, the oil pressure sensor, the **(T700, T701C, T701D)** oil temperature sensor, and the fuel pressure sensor.

b. Ignition System. The ignition system is a noncontinuous, ac-powered, capacitor discharge type. It includes two igniter plugs, two electrical ignition leads, and an ignition exciter assembly. Power is supplied to the ignition exciter assembly by the engine's alternator during starting only. There is a switch in the cockpit for turning ignition on or off. If the aircraft cable connector is disconnected from the green electrical cable, the ignition circuit will not operate. During starts and engine motoring, the duty cycle of the ignition exciter assembly is 2 minutes on, 3 minutes off, 2 minutes on, 23 minutes off. This prevents overheating of the ignition exciter assembly.

c. **(T700)** ECU. The ECU is a solid-state device mounted below the compressor case. The forward face of the ECU protrudes into the scroll case. It is cooled by airflow through the scroll case. There are four electrical connectors on the rear of the ECU. They connect to other engine control components, to aircraft systems, and to diagnostic equipment. Figure FO-2 shows the connectors and their circuits. The functions of the four connectors and functions of the ECU are as follows:

(1) Connector S39. This connector is used for troubleshooting the engine or electrical control system while the aircraft is on the ground.

(2) Connector E1. The aircraft cable attaches to this connector.

(3) Connector J2. This connector is for the yellow cable and is used to carry signals between the ECU, speed sensor, HMU, thermocouple assembly, history recorder, and alternator.

(4) Connector J3. This connector is for the blue cable and is used to carry signals between the torque and overspeed sensor and the POU.

(5) Np Governing System. The power turbine rotor speed (Np) governing system monitors the signal sent from the Np sensor. It varies fuel flow by actuating the torque motor in the HMU. Constant Np is governed to within ±1% of sensed Np.

(6) Turbine Gas Temperature (TGT) Limiting System. The TGT limiting system overrides the Np governing system and the load sharing system when TGT reaches its limiting reference temperature. It limits fuel flow to hold its limiting reference temperature by actuating the torque motor in the HMU. The TGT limiting system is accurate to within ±5° C. TGT limiting system does not prevent overtemperature caused by compressor stall during engine starts. The ENG POWER CONT lever must be quickly retarded to control TGT.

(7) Np Overspeed Protection System.

(a) The Np overspeed protection system (fig. 1-16) receives a power turbine speed signal from the torque and overspeed sensor. When Np exceeds 22,200 rpm, output from the protection system activates a solenoid in the POU. This reduces fuel flow. When speed falls below 22,200 rpm, the solenoid closes until flow requirements are re-established.

(b) The Np overspeed protection system receives power from one of two independent sources: either from the engine alternator, or, if the alternator fails, backup power from the aircraft. Either source has enough power to operate the system, making it independent of the Np governing system.

(c) The Np overspeed protection system includes two overspeed sensing circuits (A and B). Each circuit closes a solid-state switch when Np reaches 22,200 ±200 rpm. Both switches must be closed before the solenoid in the POU is energized.

(d) Cockpit test buttons are provided for both the A and B circuits. The test buttons permit the Np overspeed protection system to be checked while the engine is running in normal power turbine speed range. In the test mode, with both buttons pressed and held in, the Np overspeed protection system will trip, causing cycling (deceleration and acceleration) until the test buttons are released. An Np overspeed protection check must not be done during flight, because power loss will result.

(8) Load-Sharing System. In twin-engine installations, the ECU's compare torque signals for automatic load-sharing.

(9) Output Signals. Figure FO-2 shows the output signals from the ECU.

d. **(T701)** ECU. The ECU is a solid-state device mounted below the compressor case. The forward face of the ECU protrudes into the scroll case. It is cooled by airflow through the scroll case. There are four electrical connectors on the rear of the ECU. They connect to other engine control components, to aircraft systems, and to diagnostic equipment. Figure FO-2 shows the connectors and their circuits. The functions of the four connectors and of the ECU are as follows:

(1) Connector S39. This connector is used for troubleshooting the engine or electrical control system while the aircraft is on the ground.

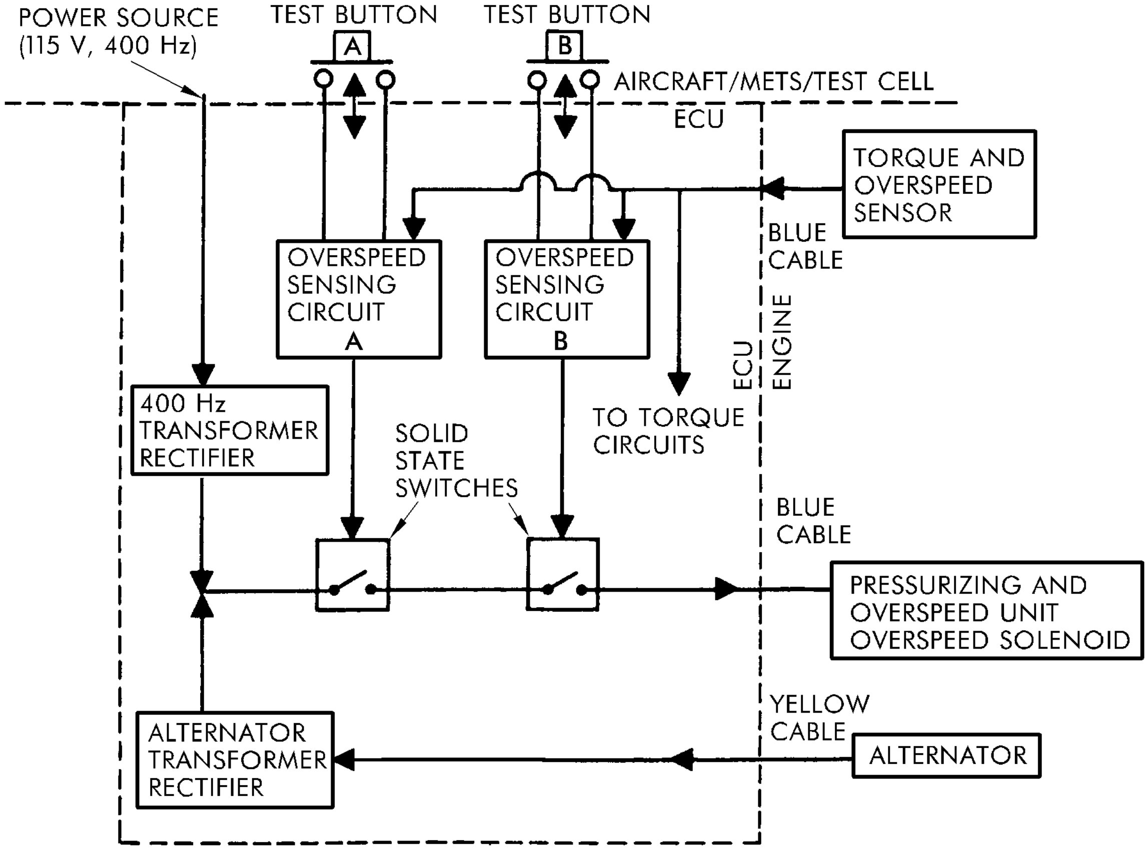
(2) Connector E1. The test cell or aircraft cable attaches to this connector.

(3) Connector J2. The connector is for the yellow cable is attached. The cable carries signals between the DEC, speed sensor, HMU, thermocouple assembly, history counter, and alternator.

(4) Connector J3. The connector is for the blue cable. The cable carries signals between the torque and overspeed sensor and the ODV.

(5) Np governing system. The power turbine rotor speed (Np) governing system compares the signal sent from the Np sensor with the Np selected by the operator. It varies fuel flow by actuating the torque motor in the HMU. Constant Np is governed to within ±1% of required Np.

(6) Turbine gas temperature TGT limiting system. The TGT limiting system overrides the Np governing system and the load-sharing system when TGT reaches its limiting reference temperature. It limits fuel flow to hold its limiting reference temperature by actuating the torque motor in the HMU. TGT limiting system is accurate



NOTE
SWITCHES CLOSE WHEN Np
EXCEEDS TRIP SPEED (106±1% IN
RUNNING POSITION AND 99±1%
IN TEST POSITION).

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Figure 1-16. (T700) ***Np Overspeed Protection System*** to within ±5°C. TGT limiting system does not prevent overtemperature caused by compressor stall during engine starts. The PWR control lever must be quickly retarded to control TGT.

(7) Np Overspeed Protection System.

(a) The Np overspeed protection system (fig. 1-17) receives a power turbine speed signal from the torque and overspeed sensor. When Np exceeds 25,000 ±250 rpm (119.6 ± 1%), output from the protection system activates a solenoid in the ODV. This shuts off fuel flow, causing the engine to shut down.

(b) The Np overspeed protection system receives power from one of two independent sources: either from the engine alternator, or, if the alternator fails, backup power from the aircraft. Either source has enough power to operate the system, making it independent of the Np governing system.

(c) The Np overspeed protection system includes two overspeed sensing circuits (A and B). Each circuit closes a solid-state switch when Np reaches 25,000 ±250 rpm (119.6 ± 1%). Both switches must be closed before the solenoid in the ODV is energized.

(d) Cockpit test buttons are provided for both the A and B circuits. The test buttons permit the Np overspeed protection system to be checked while the engine is running in normal power turbine speed range. In the test mode, with both buttons pressed and held in, the Np overspeed protection system will trip. To prevent engine shutdown, the ignition circuit must be activated during the overspeed check. Ignition activating is made automatic upon closing of both test circuits A and B. The ignition circuit must remain activated for 5 seconds after opening of circuits A and B.

(8) Load-Sharing System. In twin-engine installations, the ECU's compare torque signals for automatic load-sharing.

(9) Output Signals. Figure FO-2 shows the output signals from the ECU.

(10) **(T701)** Contingency Power. Contingency power is an automatic operating condition that is limited to 2.5 minutes. It is automatically activated when the output torque of one engine decreases to 180 foot-pounds or less. With contingency power, the engine that is operating at higher torque can operate at power that is higher than maximum power. To achieve contingency power, the ECU works through the torque motor in the HMU to increase fuel flow.

e. **(T701C, T701D)** Digital Electronic Control (DEC). The digital electronic control (DEC) is a solid state device mounted below the compressor casing. The forward face of the DEC protrudes into the scroll case. The DEC does not have an insulation blanket. It is cooled by airflow through the scroll case. There are four electrical connectors on the rear of the DEC. They connect to other engine control components, to test cell systems, and to diagnostic equipment. Figure FO-2 shows the connectors and their circuits. The functions of the four connectors and of the DEC are as follows:

(1) Connector S39. The connector used for troubleshooting the engine or electrical control system while the aircraft is on the ground.

(2) Connector E1. The aircraft cable attaches to this connector.

(3) Connector J2. This connector is for the yellow cable and is used to carry signals between the DEC, speed sensor, HMU, thermocouple assembly, history recorder, and alternator.

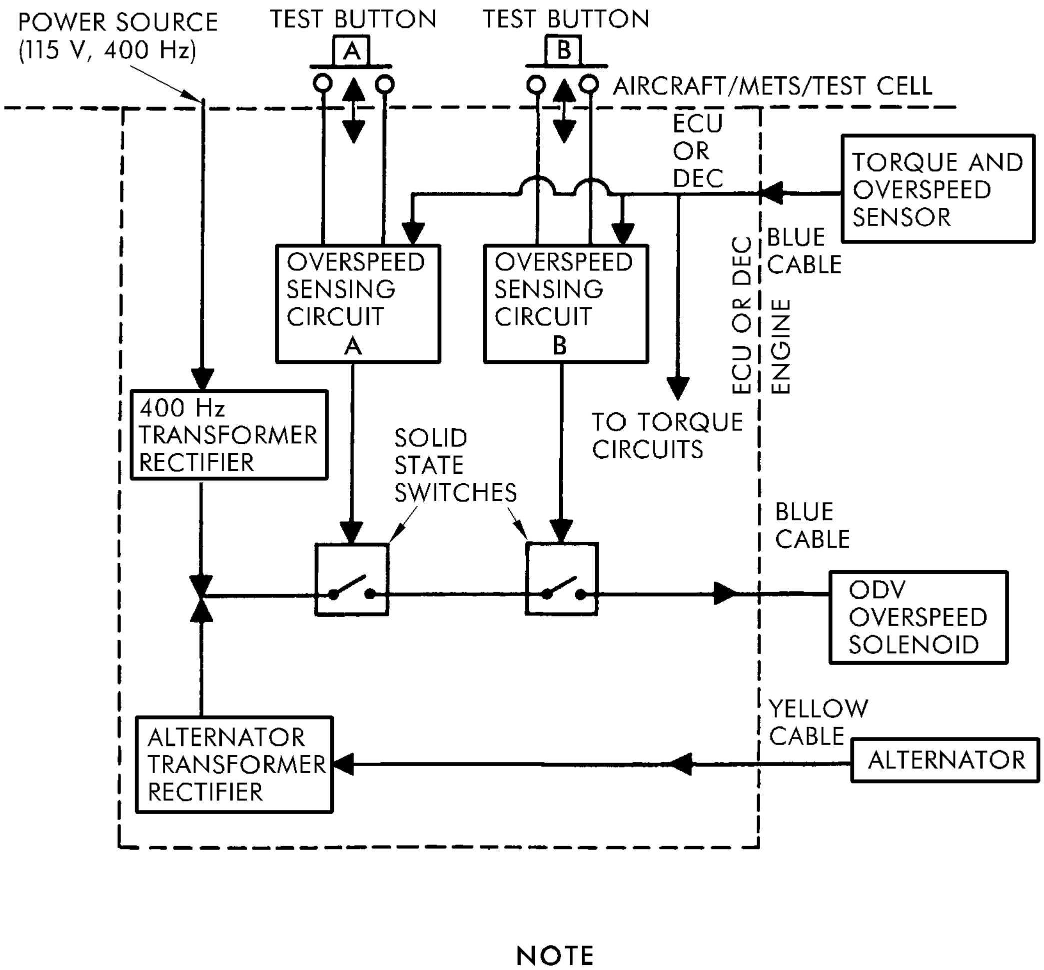
(4) Connector J3. This connector is for the blue cable and is used to carry signals between the torque and overspeed sensor and the ODV.

(5) Np Governing System. The power turbine rotor speed (Np) governing system monitors the signal sent from the Np sensor. It varies fuel flow by actuating the torque motor in the HMU. Constant Np is governed to within ±1% of sensed Np.

(6) Turbine Gas Temperature (TGT) Limiting System. The TGT limiting system overrides the Np governing system and the load-sharing system when TGT reaches its limiting reference temperature. It limits fuel flow to hold its limiting reference temperature by actuating the torque motor in the HMU. The TGT limiting system is accurate to within ±5° C.

(7) Np overspeed protection system.

(a) The Np overspeed protection system (fig. 1-17) receives a power turbine speed signal from the torque and overspeed sensor. When Np exceeds 25,000 ±250 rpm (119.6 ± 1%), output from the protection system activates a solenoid in the ODV. This shuts off fuel flow, causing the engine to shut down.



NOTE
SWITCHES CLOSE WHEN Np EXCEEDS TRIP SPEED (119.6±1% IN RUNNING POSITION AND 95.7±1% IN TEST POSITION).

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*Figure 1-17. **(T701, T701C, T701D)** Np Overspeed Protection System*

(b) The Np overspeed protection system receives power from one of two independent sources: either from the engine alternator, or, if the alternator fails, backup power from the test cell or aircraft. Either source has enough power to operate the system, making it independent of the Np governing system.

(c) The Np overspeed protection system includes two overspeed sensing circuits (A and B). Each circuit closes a solid-state switch when Np reaches 25,000 ±250 rpm. Both switches must be closed before the solenoid in the ODV is energized.

(d) Cockpit buttons are provided for both the A and B circuits. The test buttons permit the Np overspeed protection system to be checked while the engine is running in normal power turbine speed range. In the test mode, with both buttons pressed and held in, the Np overspeed protection system will trip. To prevent engine shutdown, the ignition circuit must be activated during the overspeed check. Ignition activating is made automatic upon closing of both test circuits A and B. The ignition circuit remains activated for 5 seconds after opening circuits A and B.

(8) Load-sharing system. In twin-engine installations, the DECs compare torque signals for automatic load sharing.

(9) Output signals. Figure FO-2 shows the output signals from the DEC.

(10) Contingency Power. Contingency power is an automatic operating condition that is limited, by the pilot, to 2.5 minutes. It is activated when the output torque of one engine decreases to 180 foot-pounds or less. With contingency power, the engine that is operating at higher torque can operate at power that is higher than maximum power.

(11) Hot start prevention (HSP). The HSP system prevents overtemperature during engine start such as compressor stall during engine starts. The HSP system receives power turbine speed signal, gas generator speed signal, and turbine gas temperature (TGT). When Np and Ng are below their respective hot start reference, and TGT exceeds 900°C (1652°F), an output from the HSP system activates a solenoid in the ODV. This shuts off fuel flow and causes the engine to shut down.

(a) The HSP system will not operate if no aircraft 400 Hz power is provided to the DEC. During an emergency, HSP can be disabled by pressing and holding either one of the overspeed test buttons during the starting sequence.

(b) A self test of the HSP system is performed while conducting a normal Np overspeed protection system test. In the event of an HSP system failure, a fault code will be displayed on the engine torque indicator. Refer to table 1-2 for fault code.

(12) Fault Indication. The DEC contains signal validation for selected input signals within the electrical control system. Signals are continuously validated when the engine is operating at flight idle and above. If a failure has occurred on a signal, the failed component or related circuit will be identified by a pre-selected fault code (table 1-2). It is possible to have more than one fault detected. Each code should be treated as an individual fault. It should be noted that the signal validation does not recognize aircraft instrument failure.

(a) Fault codes will be displayed on the engine torque indicator starting with the lowest code for 4 seconds on, 2 seconds off, rotating through all codes and then repeating the cycle. The fault codes will not be displayed on the engine torque indicator until all of the following conditions are met:

- Ng speed is less than 20%.
- Np speed is less than 35%.
- Other engine is shutdown.
- Aircraft 400 Hz power is available.

(b) The fault codes can be suppressed by depressing either one of the engine overspeed test buttons. The fault codes can also be recalled by again depressing either one of the overspeed test buttons. Any fault code that appeared on the engine torque indicator should be recorded on form 2408-13. Refer to table 1-13 for the appropriate troubleshooting procedure. If the problem has been corrected, the fault code will be cleared. To verify the fixes following corrective action, it is required to operate the engine at flight idle. If the problem has not been corrected, the fault code will again flash on the engine torque indicator when the above conditions are met.

f. **(T700, T701)** History Recorder. The history recorder (fig. 1-18) mounts at the 2 o'clock position on the swirl frame. Signals are sent to the history recorder by the ECU. The recorder displays two readouts of low cycle fatigue (LCF) events, a time-temperature index, and engine operating hours. These readouts cannot be reset to zero. Screws under the display windows hold the indicators in place. They are not adjustment or reset screws.

Table 1-2. Digital Electronic Control (DEC) Signal Validation-Fault Codes

Signal Failed	Engine Torque Indicator (± 3% Tolerance)
DEC	15%
Np Demand Channel	25%
Load Share Channel	35%
TGT Channel	45%
Alternator Power	55%
Ng Channel	65%
Np Channel	75%
Torque and Overspeed Channel	85%
Hot Start Prevention Channel	95%
Aircraft 400Hz Power	105%
Collective Channel	115%
(Black Hawk) Nr Rotor Speed	125%

NOTE

- Refer to table 1-13 for aircraft symptom index and troubleshooting procedure.
- Refer to table 1-45 for METS/FEDS/CETS symptom index and troubleshooting procedure.

NOTE

Silicone lubricant may be visible in the windows of the history recorder. This is normal.

(1) LCF 1 Indicator (1, fig. 1-18). This indicator displays the actual number of times engine parts experience a critical level of mechanical stress associated with Ng from shutdown to above 95% and from 95% to shutdown. It can display up to 99,999 mechanical stress events. When engine exceeds 95% gas generator turbine rotor speed (Ng), a count is made on the indicator. The indicator will not make an additional count until Ng drops below 40% and then increases to exceed 95% again.

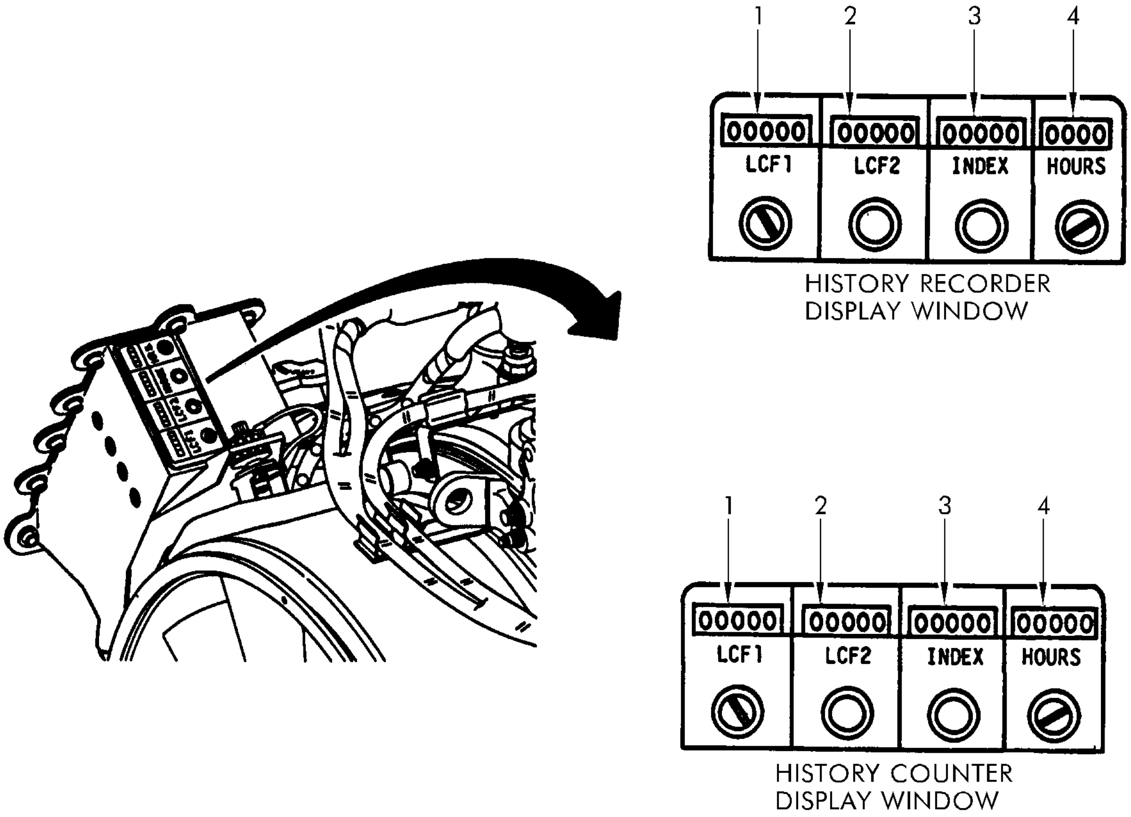
(2) LCF 2 Indicator (2). This indicator displays the actual number of times engine parts experience a reduced level of mechanical stress associated with a narrower Ng range. It can display up to 99,999 high-temperature stress events. When Ng exceeds 95%, a count is made on the indicator. The indicator will not make an additional count until Ng drops below 86% and then increases to exceed 95% again.

(3) Time-Temperature Index Indicator (3). This indicator displays numbers up to 99,999. The index counter advances when TGT reaches approximately 90% of the maximum continuous power value (775°C). The number of index counts is a function of time and temperature. It advances faster as temperature increases.

(4) Hours Indicator (4). This indicator displays actual running time up to 9999 hours. Running time is not accumulated until Ng exceeds 50%. The counter stops when Ng drops below 40% (below ground idle).

NOTE

- THE HOURS INDICATOR ON THE HISTORY RECORDER DISPLAY WINDOW DISPLAYS UP TO 9999 HOURS.
- THE HOURS INDICATOR ON THE HISTORY COUNTER DISPLAY WINDOW DISPLAYS UP TO 99999 HOURS.



1. Low Cycle Fatigue 1 Indicator
2. Low Cycle Fatigue 2 Indicator
3. Time-Temperature Index Indicator
4. Hours Indicator

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Figure 1-18. History Recorder or History Counter

g. **(T701C, T701D)** History Counter. The history counter mounts at the 2 o'clock position on the swirl frame. Signals are sent to the history counter by the DEC. The counter displays two readouts of low cycle fatigue (LCF) events, a time-temperature index, and engine operating hours. These readouts cannot be reset to zero. Screws under the display windows hold the indicators in place. They are not adjustment or reset screws.

NOTE

Silicone lubricant may be visible in the windows of the history counter. This is normal.

(1) Low cycle fatigue 1 indicator (1). This indicator displays the actual number of times engine parts experience a level of mechanical stress associated with Ng from shutdown to above 95% and from 95% to shutdown. It can display up to 99,999 mechanical stress events. When engine speed exceeds 95% Ng, a count is made on the indicator. The indicator will not make an additional count until Ng drops below 40% and then increases to exceed 95%.

(2) Low cycle fatigue 2 indicator (2). This indicator displays the actual number of times engine parts experience a reduced level of mechanical stress associated with a narrower Ng range. It can display up to 99,999 high-temperature stress events. When Ng exceeds 95%, a count is made on the indicator. The indicator will not make an additional count until Ng drops below 86% and then increases to exceed 95%.

(3) Time-temperature index indicator (3). This indicator displays numbers up to 99,999. The index counter advances when T4.5 reaches approximately 90% of the maximum continuous power value (775°C). The number of index counts is a function of time and temperature. It advances faster as temperature increases.

(4) Hours indicator (4). This indicator displays actual running time up to 99,999 hours. Running time is not accumulated until Ng exceeds 60%. The counter stops when Ng drops below 55% (below ground idle).

(5) In addition to the four history counts displayed by the history counter, the DEC internally tracks several other key indicators on engine history. These can be accessed by the S39 test connector and include:

- Cumulative time at temperature
- Four cycle counts for more precise measure of LCF
- HPT bucket stress rupture life (two)
- Number of starts
- Max. T4.5, Ng, Np per flight
- Time spent above exceedence values of T4.5 per flight

h. Alternator. The alternator consists of a rotor and a stator. The alternator rotor has a set of permanent magnets and mounts on a shaft extending from the accessory gearbox. The alternator stator encloses the rotor and mounts on the front of the accessory gearbox. The alternator has three separate windings. These windings supply power to the **(T700, T701)** ECU or **(T701C, T701D)** DEC and Np overspeed protection system and to the ignition exciter assembly. The alternator also supplies an Ng signal to an indicator in the cockpit.

i. Thermocouple Assembly. The thermocouple assembly (fig. 1-19) is a seven-probe harness with KP-KN junctions. Resistance checks for open or grounded circuits can be made through the S39 connector, using the ECU/DEC circuit continuity switch box. The temperature of the gases is measured at the power turbine inlet. From there a signal is sent to the TGT limiting system in the ECU/DEC. The ECU/DEC relays the signal to a TGT indicator in the cockpit and to the history recorder/history counter.

j. Np Sensor and Torque and Overspeed Sensor. These are identical and interchangeable sensors which sense power turbine speed and torque. The sensors are located in the exhaust frame. The Np sensor extends through the strut at the 10:30 o'clock position, and the torque and overspeed sensor extends through the strut at the 1:30 o'clock position. The sensors send pulses generated by teeth on the power turbine drive shaft.

(1) Np Sensor. The Np sensor sends a pulsed signal to the ECU or DEC where it is computed into a speed signal. This signal is used by the Np governing system for basic power turbine speed control. The ECU or DEC also relays the signal to the Np indicator in the cockpit.

(2) Torque and Overspeed Sensor. The torque and overspeed sensor sends a pulsed signal to the ECU or DEC where it is computed to a torque signal and a speed signal. The speed signal is used by the Np overspeed protection system. The torque signal is relayed by the ECU or DEC to an indicator in the cockpit. In twin-engine aircraft, the torque signals are relayed between the ECUs or DECs of both engines for load sharing.

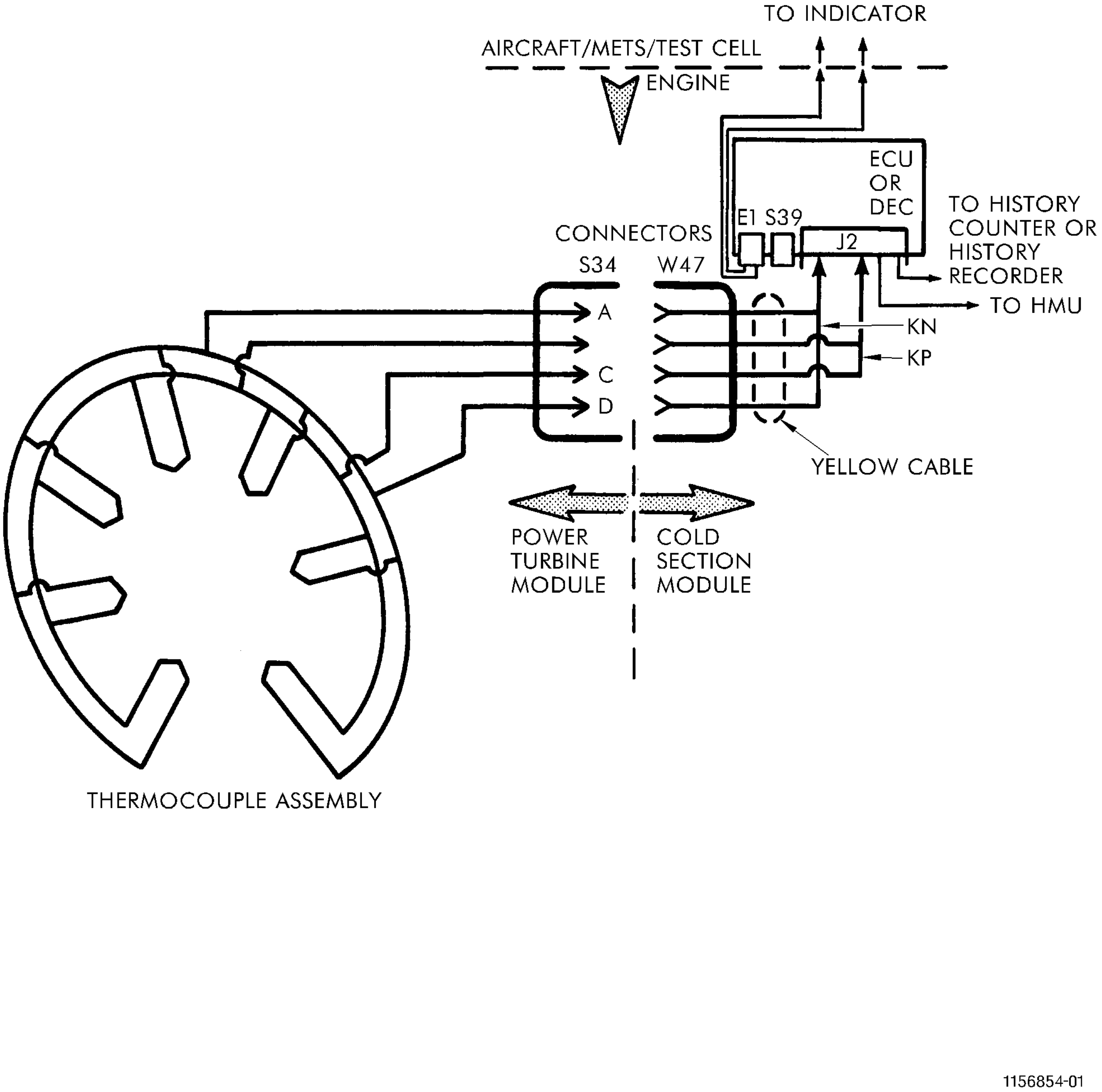

Figure 1-19. Turbine Gas Temperature Electrical Schematic

k. Interconnecting Electrical Cable Assemblies. The interconnecting electrical cables are color-coded yellow, blue, and green to aid the mechanic in identifying electrical connectors when performing maintenance or troubleshooting.

(1) Yellow Electrical Cable. The yellow electrical cable is completely confined on the engine with no aircraft connections. It provides wiring for operating the engine ignition system, for powering and transferring signals from the ECU or DEC to the history recorder, or history counter for providing TGT and Ng signals to the ECU or DEC, and for transferring control signals from the ECU or DEC to the HMU.

(2) **(T700)** Blue Electrical Cable. The blue electrical cable is also confined to the engine without any aircraft interface. It transfers a signal to the ECU or DEC for torque and Np overspeed determination and transfers the actuation signal from the ECU or DEC to the POU for reducing fuel flow when a power turbine overspeed occurs.

(3) **(T701, T701C, T701D)** Blue Electrical Cable. The blue electrical cable is also confined to the engine without any aircraft interface. It transfers a signal to the ECU or DEC for torque and Np overspeed determination and transfers the actuation signal from the ECU or DEC to the overspeed and drain valve for reducing fuel flow when a power turbine overspeed occurs.

(4) **(T700, T701C, T701D)** Green Electrical Cable. The green electrical cable connects to the E3 electrical connector and conducts instrumentation signals for Ng, fuel filter bypass indication, oil filter bypass indication, engine chip detector signal, oil temperature and pressure signal, anti-icing valve position indication, and provides the wiring for turning on the engine ignition system.

(5) **(T701)** Green Electrical Cable. The green electrical cable connects to the E3 electrical connector and conducts instrumentation signals for Ng, fuel filter bypass indication, oil filter bypass indication, engine chip detector signal, oil pressure signal, anti-icing valve position indication, and provides the wiring for turning on the engine ignition system.

1-36. Oil System. The oil system consists of the following: oil cooler, oil and scavenge pump, scavenge screens, oil filter bypass sensor, oil filter, oil cooler bypass relief valve, cold-oil relief valve, electrical chip detector, oil pressure sensor, **(T700, T701C, T701D)** oil temperature sensor, and oil tank.

a. Oil System Flow. (See fig. 1-20 **(T700)** or 1-21 **(T701)** or 1-22 **(T701C, T701D)**).

(1) Oil flow is drawn from the tank to the oil and scavenge pump. From the pump, pressurized oil flows through the oil filter and into passages in the accessory gearbox. Inside the gearbox, the flow divides and flows to the A-, B-, and C-sumps and to the gearbox.

(2) Oil enters the A-sump through the strut at the 3 o'clock position on the swirl frame. The A-sump forward and aft scavenge lines are housed in the struts at the 10 and 2 o'clock positions on the swirl frame. Oil is supplied to and scavenged from the A-sump entirely through these internal lines.

(3) Oil is supplied to and scavenged from the B- and C-sumps through the oil manifold assembly, which connects to the rear of the gearbox. Oil flow passes from the oil manifold assembly through the oil supply tubes and the B-sump check valve. It enters the B-sump through a tube in the strut at the 1 o'clock position on the midframe. Oil is scavenged from the B-sump through a tube in the strut at the 9 o'clock position on the midframe.

(4) Oil flows to the C-sump from the oil manifold assembly through the C-sump oil supply tube. This tube is located in the strut at the 7:30 o'clock position on the exhaust frame. Oil is scavenged from the C-sump through the C-sump forward scavenge tube (2 o'clock position), aft scavenge tube (10 o'clock position), and through the seal pressure and scavenge tube assembly (4:30 o'clock position) which are located in the struts on the exhaust frame.

(5) If the oil system fails, the bearings will be lubricated by an oil mist from the emergency oil system (fig. 1-23). Small internal oil reservoirs in the A- and B-sumps are kept full during normal operation. Oil from these reservoirs passes through the primary oil nozzles and the oil mist nozzle to lubricate the bearings. When oil pressure is lost, the oil mist nozzles continue to supply oil from the reservoirs to the bearings in the A- and B-sumps. The emergency oil system is intended to maximize the time an engine can operate at reduced power conditions with partial loss of oil. Figure 1-24 is a diagram of the engine main bearings and sumps.

(6) Scavenge oil from the oil and scavenge pump flows through the electrical chip detector. Then it flows through the oil cooler and into the main frame. Scavenge oil enters a manifold at the top of the main frame. It then flows through the scroll vanes and into the oil tank.

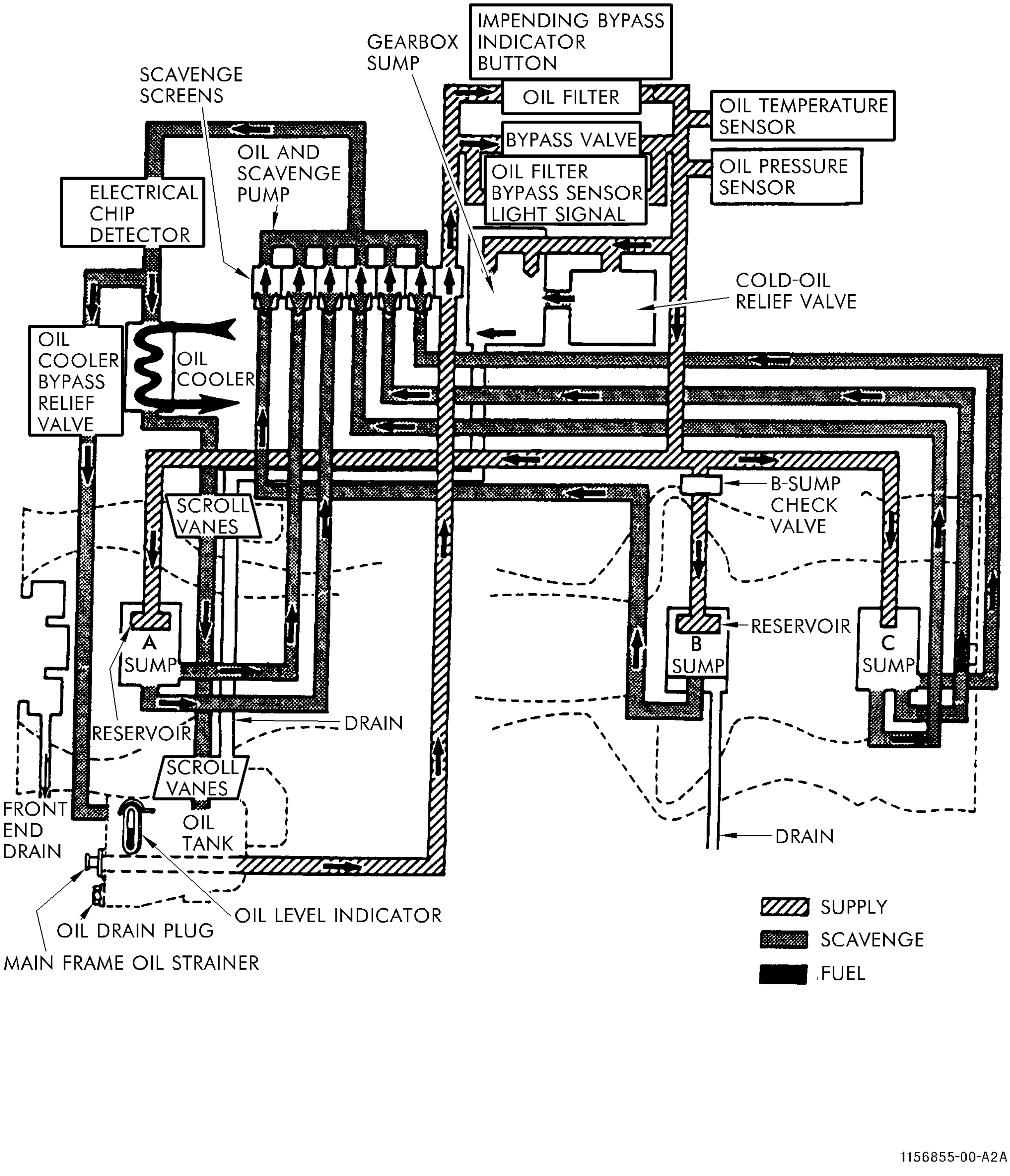

Figure 1-20. (T700) *Oil System Schematic*

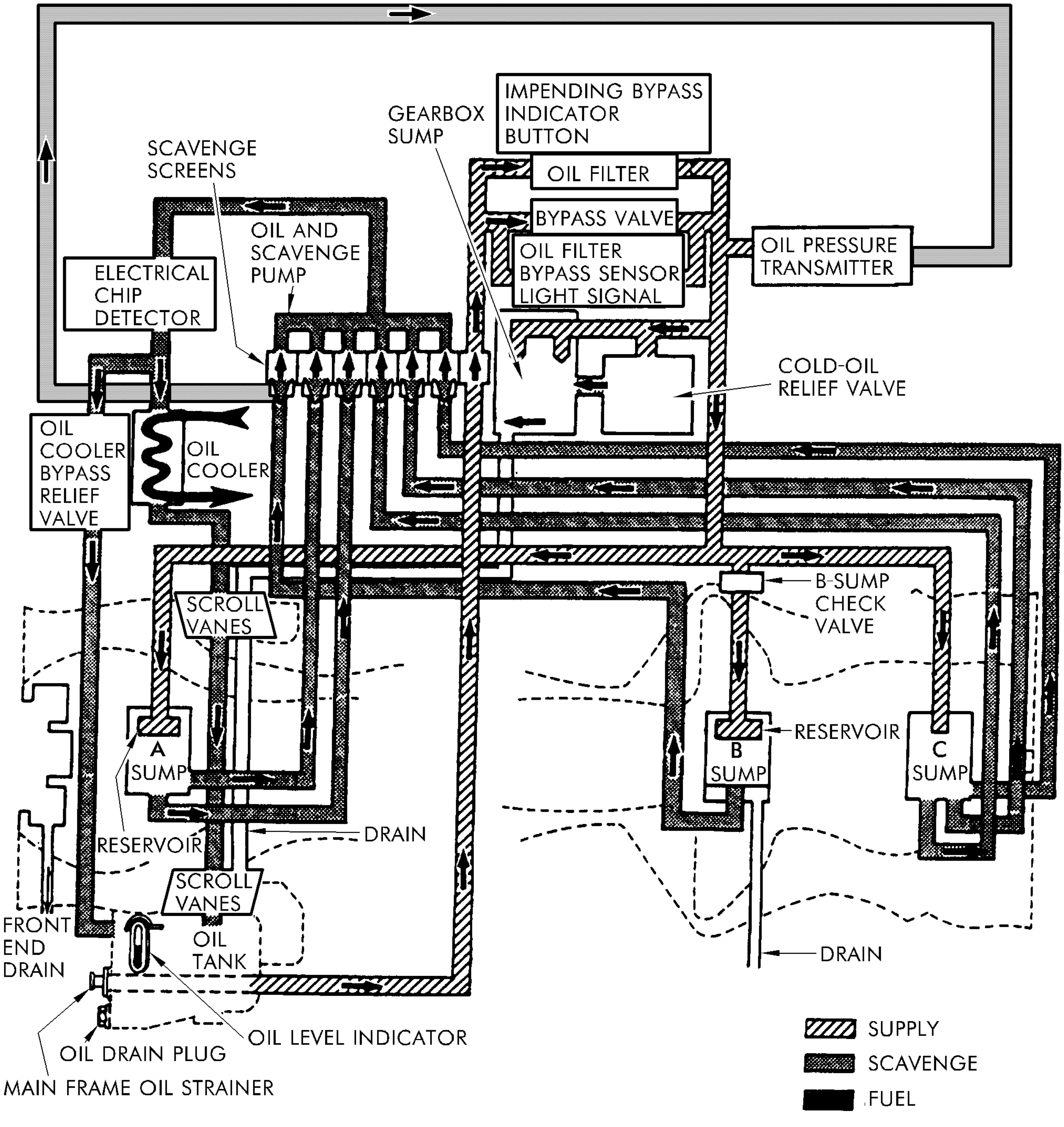

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Figure 1-21. (T701) ***Oil System Schematic***

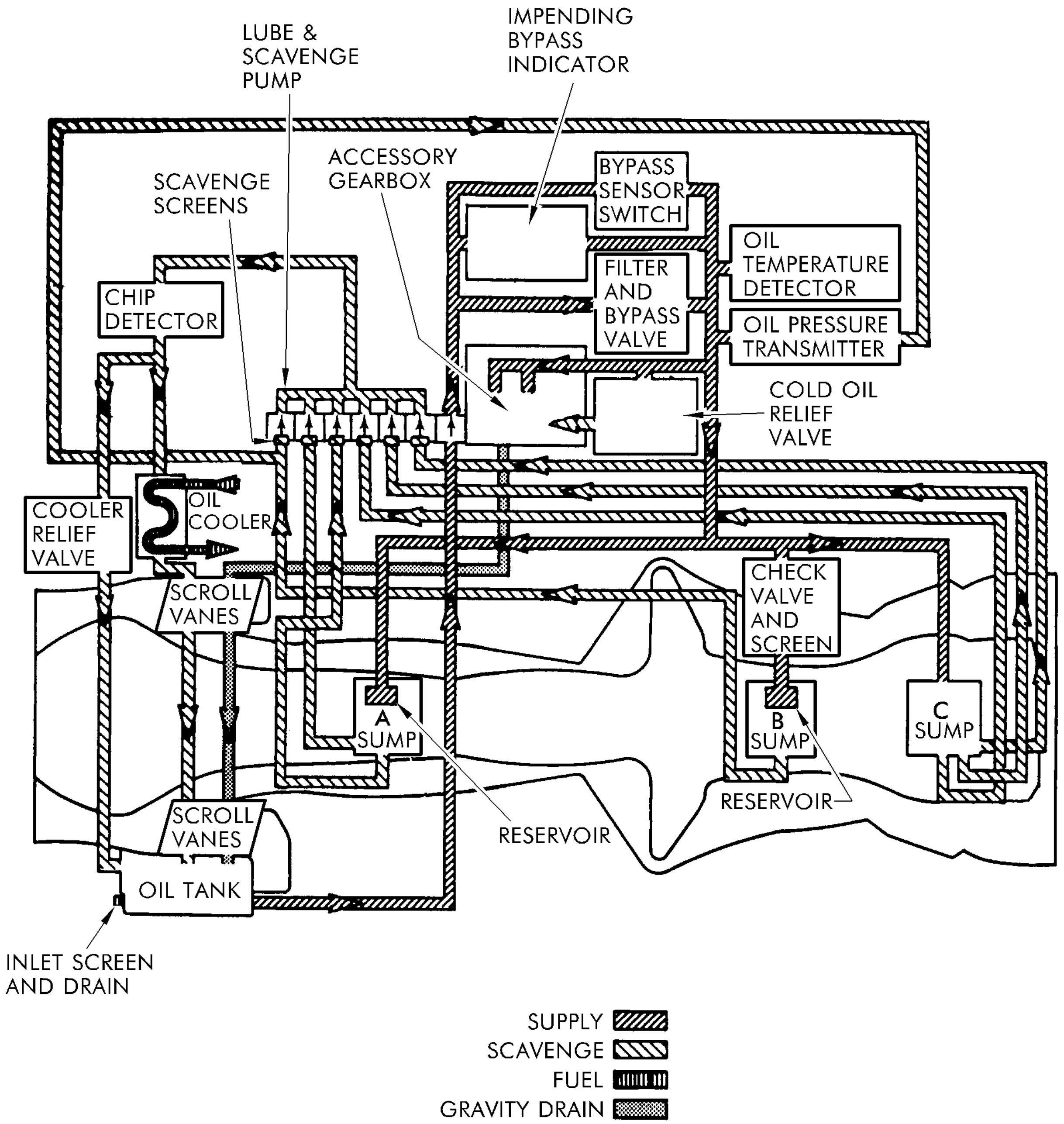

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Figure 1-22. ***(T701C, T701D)*** *Oil System Schematic*

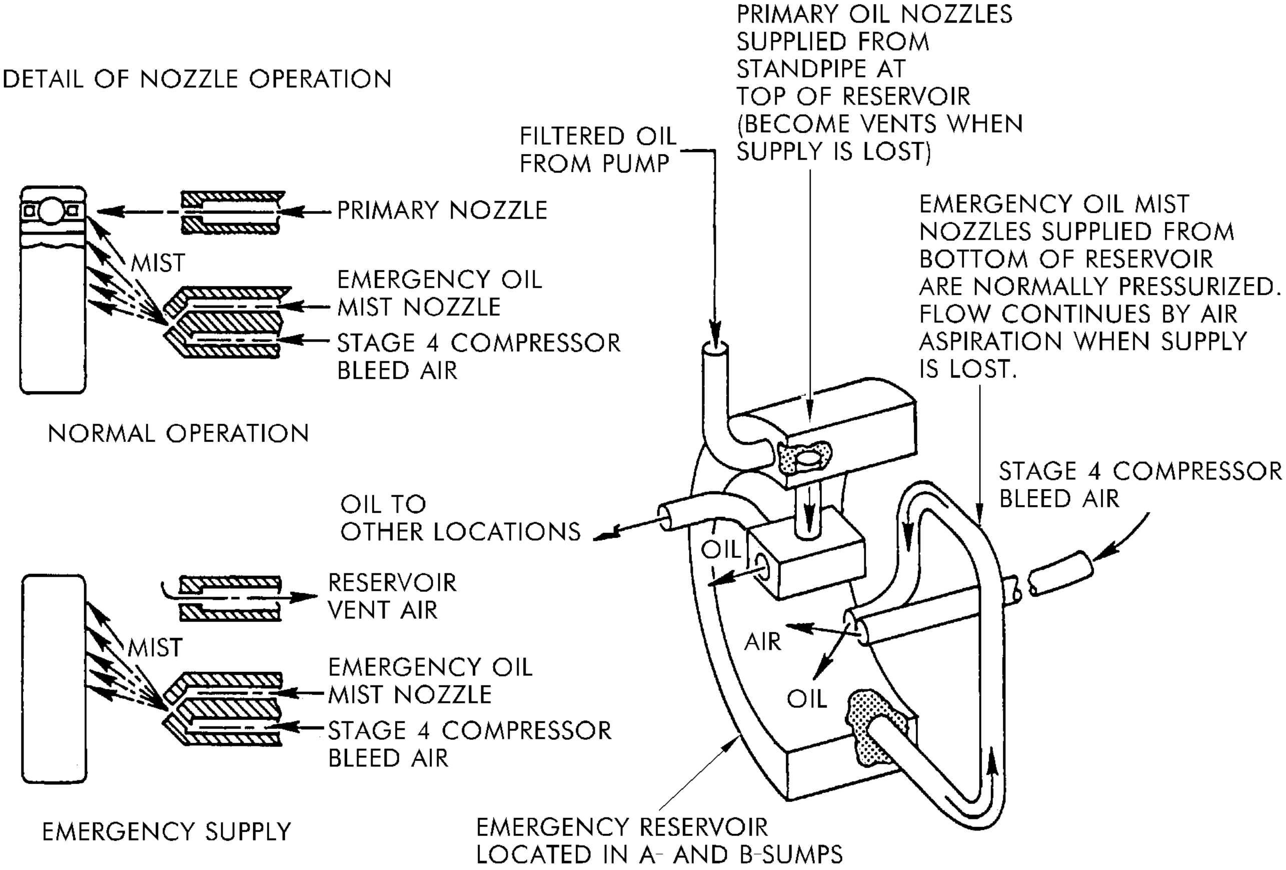

Figure 1-23. Emergency Oil System

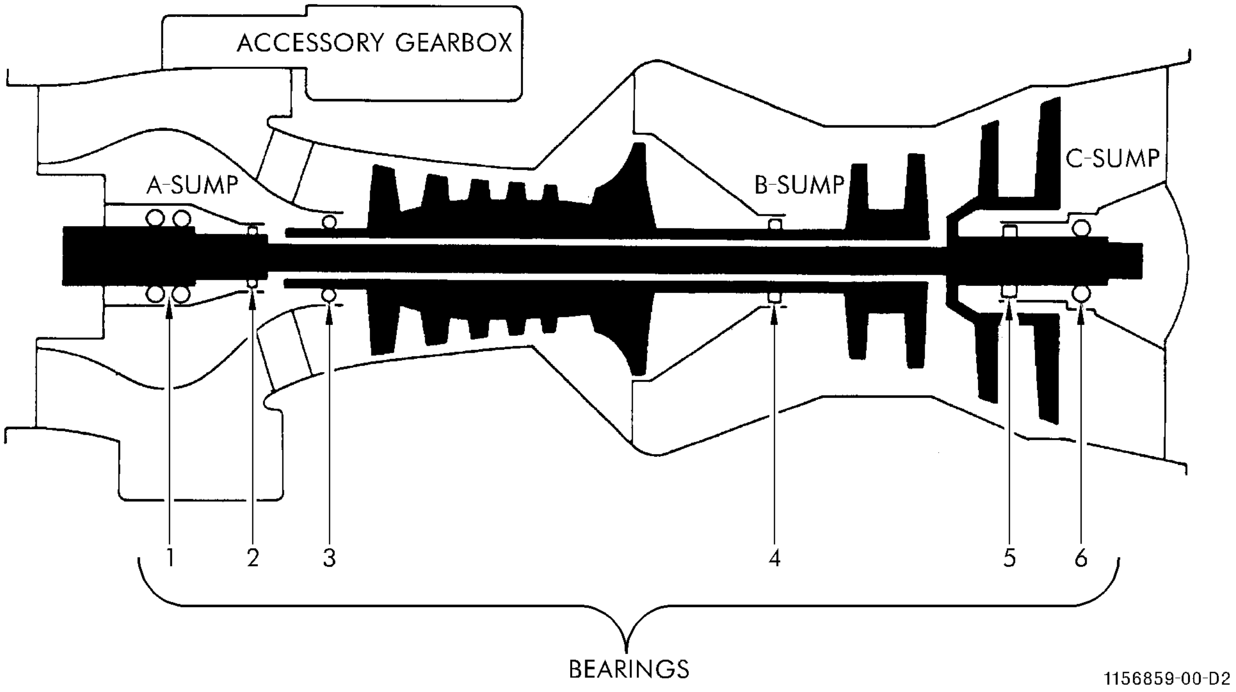

Figure 1-24. Main Bearings and Sump

b. Oil Cooler.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

The oil cooler mounts on the front of the accessory gearbox (fig. 1-12 **(T700)** or 1-13 **(T701, T701C, T701D)**). It transfers heat from the oil to the fuel. It is a tube-in-shell heat exchanger.

c. Oil and Scavenge Pump. The oil and scavenge pump (fig. 1-25 **(T700)** or 1-26 **(T701, T701C, T701D)**) is housed in the forward side of the accessory gearbox. It is a seven-element, gerotor-type pump. The gerotor elements are arranged in tandem on the common drive shaft. The drive shaft bearings separate the high-pressure supply element and the B-sump high-pressure scavenge element from the other scavenge elements.

d. Scavenge Screens. Six scavenge screens are located on the front of the accessory gearbox (fig. 1-12 **(T700)** or 1-13 **(T701, T701C, T701D)**). They collect particles before they enter the scavenge sections of the oil and scavenge pump. These screens prevent damage to the pump. The six screens are individually labeled to show which sump the particles came from.

e. Oil Filter Bypass Sensor. The oil filter bypass sensor mounts on the front of the accessory gearbox (fig. 1-12 **(T700)** or 1-13 **(T701, T701C, T701D)**). The sensor has a switch that closes and completes a circuit to an oil filter bypass caution light when oil pressure is too high. When the caution light is on, oil is bypassing the filter. However, during engine starting with oil temperature below the normal operating range, the pressure drop, across the filter element, can be high enough to close the switch. In this situation, the caution light will remain on until the oil warms up and oil pressure decreases. If the filter element needs changing, the caution light will remain on after engine oil temperature stabilizes. The switch in the bypass sensor doesn't latch and will open, turning off the caution light, when the engine is shut down.

f. Oil Filter. The oil filter consists of a bowl with an impending bypass indicator, a throw away filter element, and a bypass valve assembly. The bowl threads into the forward side of the accessory gearbox. The bypass valve assembly threads into the accessory gearbox and supports the aft end of the filter element.

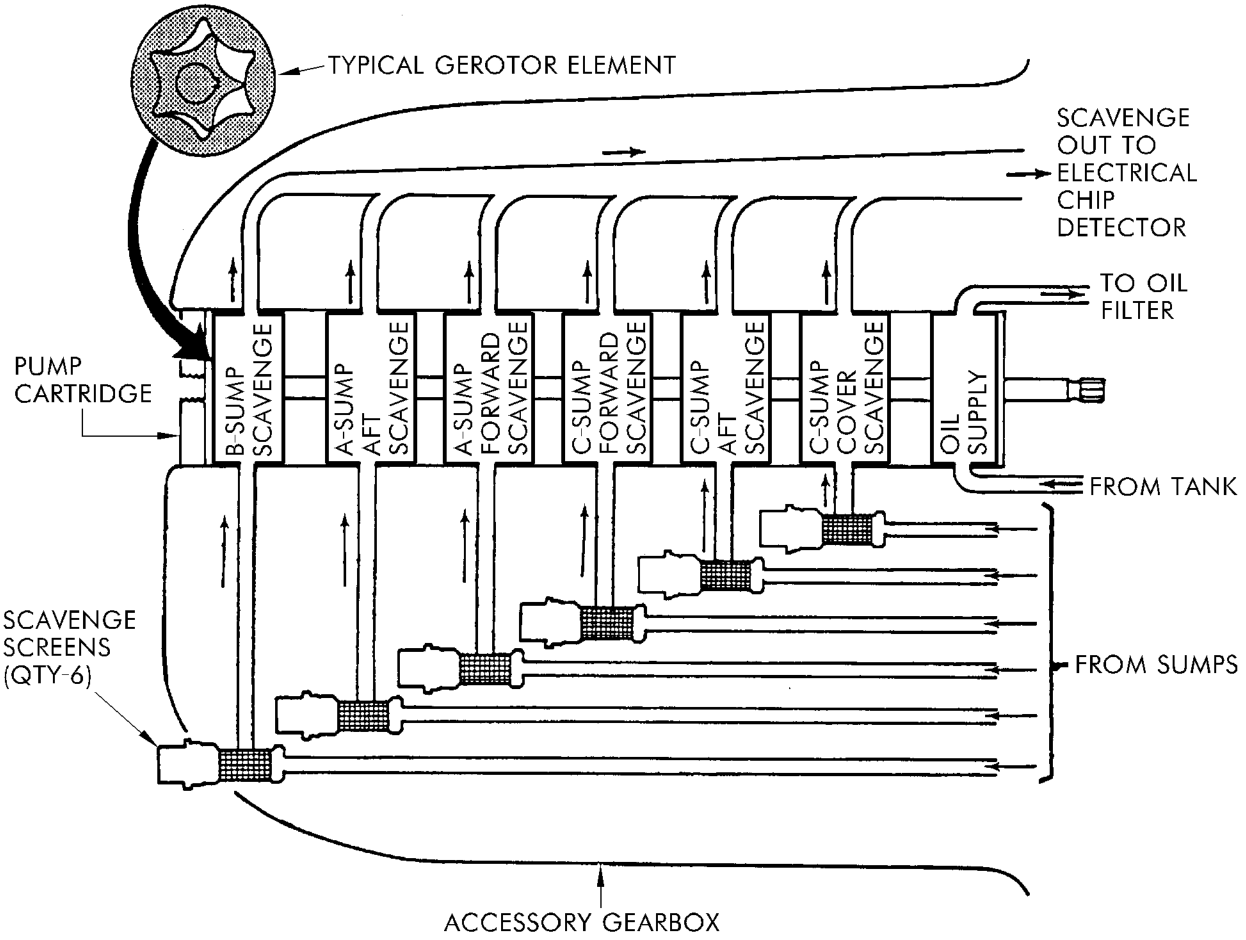

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Figure 1-25. (T700) ***Oil and Scavenge Pump***

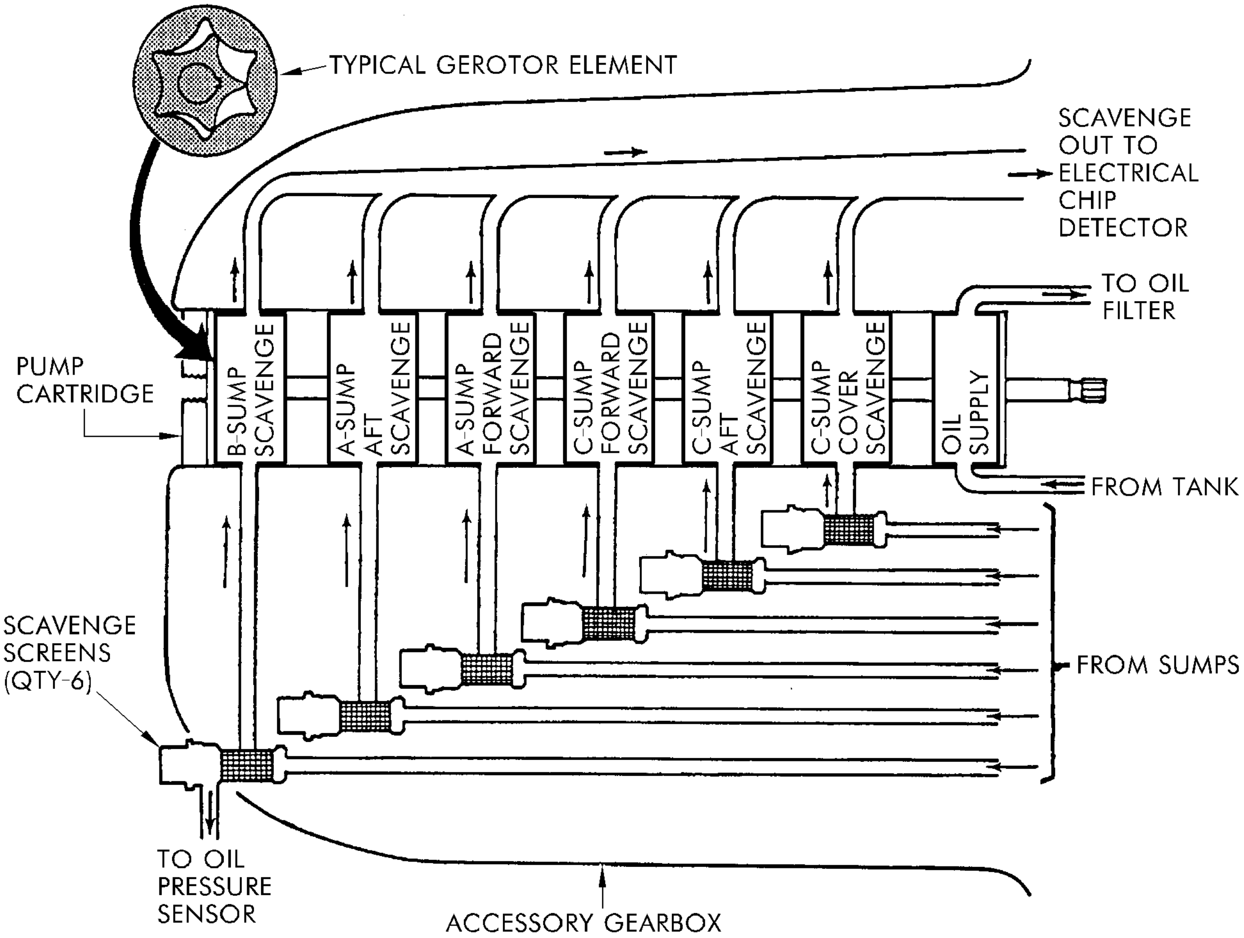

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Figure 1-26. ***(T701, T701C, T701D)*** *Oil and Scavenge Pump*

(1) Impending Bypass Indicator. If the impending bypass indicator button pops, it means that the filter element is dirty and that it needs to be replaced. Once the button has popped, it cannot be reset until the bowl and the element are removed. If oil is cold during engine starting, pressure is high enough to cause oil to be bypassed. A thermal lockout prevents the button from popping when oil temperature is below 100° F (38° C).

(2) Bypass Valve Assembly. The bypass valve assembly opens when oil pressure is too high. This means that filter element is dirty or that the oil is still cold. If the valve assembly opens because of cold oil, it will close when the oil warms to 100° F (38° C) and when pressure decreases.

g. Oil Cooler Bypass Relief Valve. The oil cooler bypass relief valve mounts on the front of the accessory gearbox (fig. 1-12 **(T700)** or 1-13 **(T701, T701C, T701D)**). It dumps scavenged oil directly into the oil tank if the oil cooler becomes clogged. During cold starts, the valve dumps part of the oil flow into the oil tank until oil warms up and until pressure drop across the oil cooler is reduced.

h. Cold-Oil Relief Valve. The cold-oil relief valve mounts on the front of the accessory gearbox (fig. 1-12 **(T700)** or 1-13 **(T701, T701C, T701D)**), downstream of the oil filter. It protects the oil supply system from excessive pressure. During cold starts, the valve opens and discharges excess oil to the gearbox. The oil discharged to the gearbox is churned in the gears to assist in reducing warmup time.

i. Electrical Chip Detector. The electrical chip detector (fig. 1-27) mounts on the front of the accessory gearbox and is a part of the scavenge oil return system to the tank. It has an outer shell with an internal magnet, an electrical connector, and a removable screen. The magnet attracts magnetic particles to the detector. When these particles bridge the gap between the magnet and outer shell, they complete a circuit which turns on an engine chip detector caution light in the cockpit.

j. **(T700)** Oil Pressure Sensor. The oil pressure sensor mounts on the front of the accessory gearbox (fig. 1-12). The sensor measures the pressure of oil circulating within the engine and transmits a voltage indication to the engine oil pressure indicator.

k. **(T701, T701C, T701D)** Oil Pressure Sensor. The oil pressure sensor mounts on the front of the accessory gearbox (fig. 1-13). The sensor measures oil supply pressure, minus B-sump scavenge pressure, circulating within the engine. The sensor then transmits a voltage indication to the ENG OIL PSI x 10 indicator.

l. **(T700, T701C, T701D)** Oil Temperature Sensor. The oil temperature sensor mounts on the front of the accessory gearbox (fig. 1-12 **(T700)** or 1-13 **(T701C, T701D)**). The sensor senses temperature and transmits engine oil temperature signals to the engine temperature indicator (if installed).

m. Oil Tank. The oil tank (fig. 1-28) is an internal part of the main frame. The oil tank holds 7 quarts of oil. The tank has a gravity fill port (5) at the 2 o'clock position on the main frame. It also has an oil drain plug (4) and a main frame oil strainer (3) at the 6 o'clock position on the main frame. The oil strainer keeps large debris from entering the oil and scavenge pump inlet. Oil level indicators (2) have ADD and FULL lines which permit an easy check of oil level. Transfer sleeves (1) allow oil to pass between the main frame and accessory gearbox without external leakage.

1-37. Air System (See figure FO-1.). The air system provides the following:

- Turbine and combustor cooling air
- **(T700)** Compressor discharge air (P3 air) to HMU and to POU
- **(T701, T701C, T701D)** Compressor discharge air (P3 air) to HMU
- Aircraft bleed air
- Anti-icing bleed and start valve air
- Seal pressurization and power turbine balance piston air
- Sump venting
- Engine inlet air to T2 sensor of HMU

a. Turbine and Combustor Cooling Air. Diffuser discharge air cools the stage 1 nozzle and shrouds. Stage 2 nozzle segments and shrouds are cooled with compressor impeller tip bleed air, routed through three internal tubes in the midframe casing. Cooling plates on the gas generator turbine rotor assembly direct cooling air through the rotor blades. Inner balance piston leakage air flows under the turbine disks. This air cools and dilutes hot gas from the turbine flow path. The airflow re-enters the flow path through the baffle seal at the stage 3 turbine inlet. Stage 3 shrouds are cooled by compressor discharge seal leakage air piped externally from the midframe.

b. **(T700)** Compressor Discharge Air (P3 Air). P3 air is supplied to the HMU for use in setting the flow of fuel to the engine. Also, P3 air is supplied to the POU for purging the fuel manifolds and nozzles. This P3 air comes from a pressure tap at the 10:30 o'clock position on the midframe.

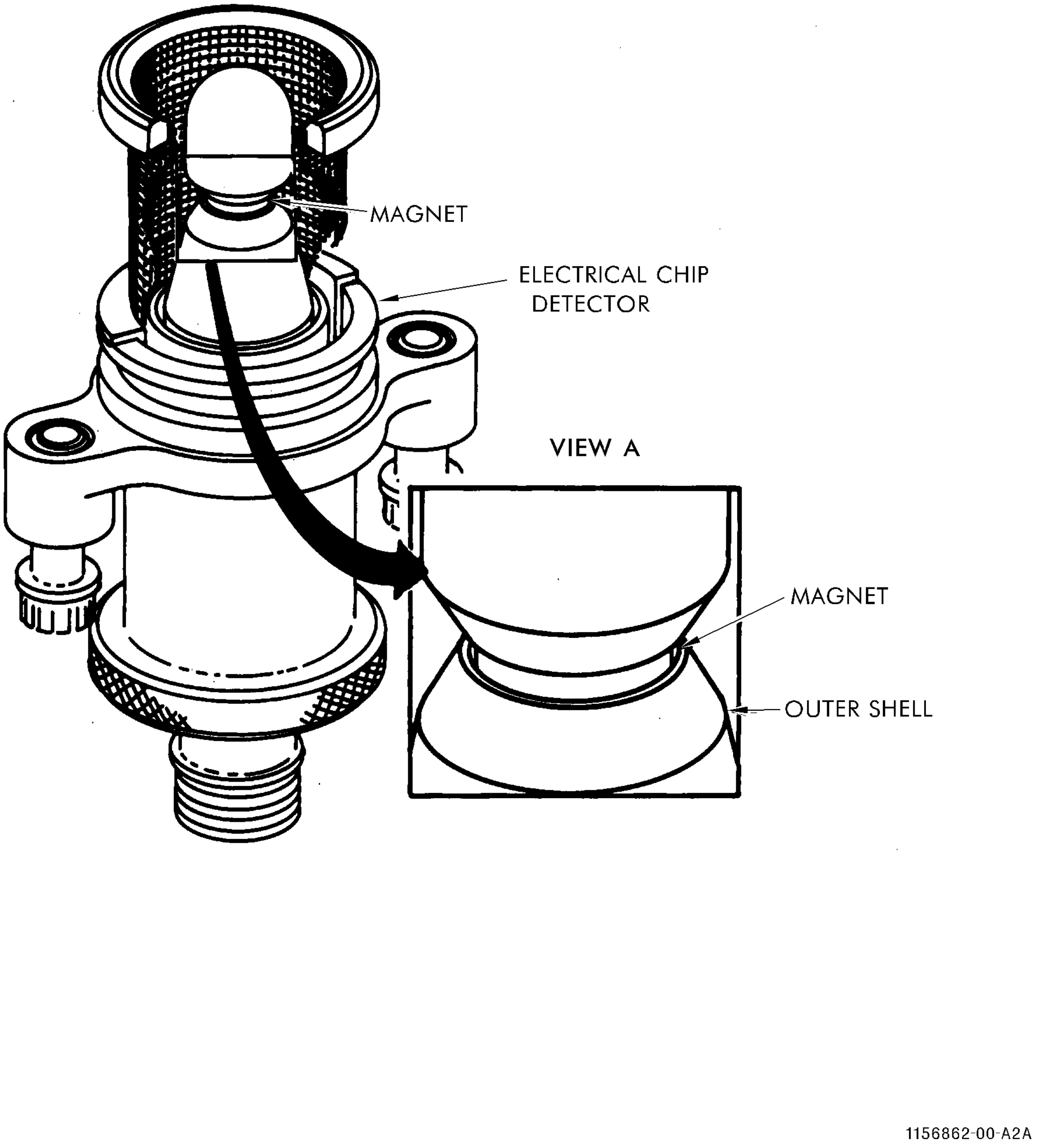


Figure 1-27. Electrical Chip Detector

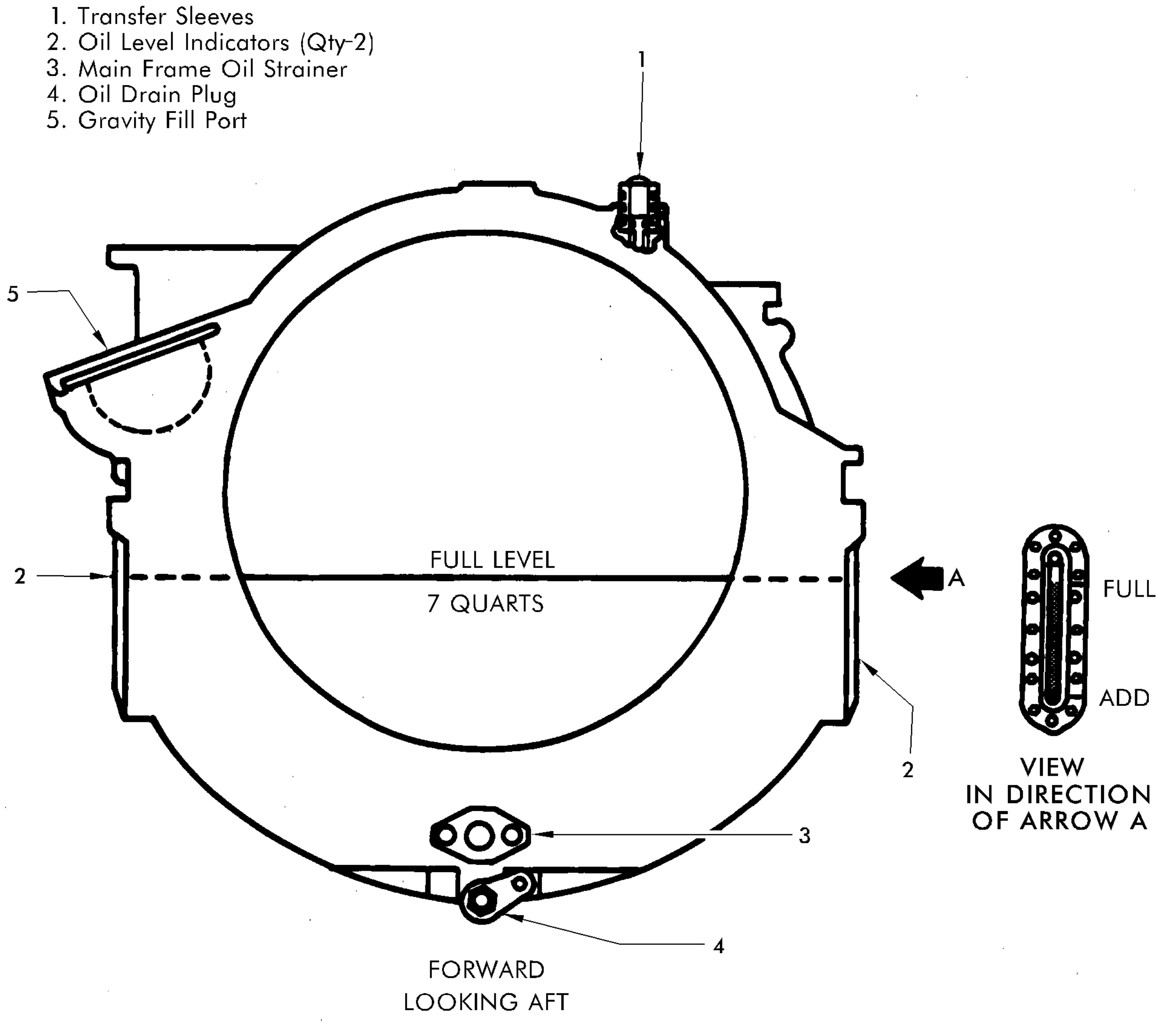


Figure 1-28. Oil Tank

c. **(T701, T701C, T701D)** Compressor Discharge Air (P3 Air). P3 air is supplied to the HMU for use in setting the flow of fuel to the engine. This P3 air comes from a pressure tap at the 11 o'clock position on the midframe.

d. Aircraft Bleed Air. Two bleed air ducts at the 3 and 9 o'clock positions at the rear of the compressor stator case supply the aircraft with compressor bleed air.

e. **(Eaton)** Anti-Icing Bleed and Start Valve Air. The anti-icing system prevents ice from forming in the flow path of the engine inlet. The valve also bleeds air from the compressor during engine starting. This reduces back pressure on the axial compressor at lower speeds and prevents compressor stall.

(1) Anti-icing takes place in two ways. Hot axial compressor discharge bleed air flows through the swirl vanes and inlet guide vanes (IGV) (fig. 1-29). This is suplemented by hot scavenge oil which flows through the internal passages in the scroll vanes.

(2) Anti-icing air is controlled by a solenoid valve (fig. 1-30) operated by a switch in the cockpit. When the switch is off, electrical power is on to the solenoid valve. With electrical power on, the solenoid valve closes the vent. This pressurizes the pneumatic servo and closes the metering valve, stopping anti-icing airflow. (See figure 1-30, view 1.) When the switch in the cockpit is on, electrical power to the solenoid valve is off. When the engine is operating at or above 87% NG, with electrical power off, the solenoid valve opens the vent. This stops the pressure on the pneumatic servo and opens the metering valve, allowing anti-icing air to flow. (See figure 1-30, view 2.)

(3) During engine starting and low power operation below 87% NG (depending on compressor inlet temperature (T0))bleeding of air from the compressor is controlled by a camplate (fig. 1-31) in the anti-icing bleed and start valve. The variable geomery (VG) linkage actuating shaft, controlled by the HMU actuator, positions the cam plate in the down position. This holds the metering valve open. However, as engine power is increased, the valve will close if the cockpit anti-icing switch is off. If the switch is on, as engine power is increased, the valve will stay open, continuing airflow for engine anti-icing. This assures that the compressor flow path will have anti-icing protection at low engine speeds.

(4) The sensing switch in the anti-icing bleed and start valve completes a circuit to a light in the cockpit. The light indicates when the valve is open for anti-icing or for start bleed during starts up to limits given in figure 1-118.

f. **(AlliedSignal)** Anti-Icing Bleed and Start Valve (AI/SBV) Air. The anti-icing system prevents ice from forming in the flow path of the engine inlet. The valve also bleeds air from the compressor during engine starting. This reduces back-pressure on the axial compressor at lower speeds and prevents compressor stall.

(1) Anti-icing takes place in two ways. Hot axial compressor discharge bleed air flows through the swirl vanes and inlet guide vanes (IGV) (fig. 1-29). This is supplemented by hot scavenge oil which flows through the internal passages in the scroll vanes.

(2) Anti-icing air is controlled by a solenoid valve located in the AI/SBV, operated by a switch in the cockpit. When the switch is off, electrical power is on to the solenoid valve. With electrical power on, the solenoid valve closes allowing chamber “A” (fig. 1-31.1) to pressurize, keeping the actuator piston in the closed position and stopping secondary metered anti-icing airflow. A down-stream facing probe provides clean air to the solenoid and chamber “A”. When the cockpit switch is on, electrical power to the solenoid is off. With electrical power off, the solenoid valve opens to vent and allows chamber “A” (fig. 1-31.2) pressure to bleed to ambient. The secondary metered pressure in chamber “B”, acting on the actuator piston annular area, strokes the actuator open allowing anti-icing air to flow. With the actuator piston in the open position, anti-ice flow plus starting bleed flow, which is established by the mechanical input position, is routed to the discharge ports, providing additional solenoid controlled anti-ice mode flow. An electrical position switch provides an indication of piston position to the airframe cockpit.

(3) During engine starting and low-power operation, bleed air is mechanically controlled by the position of the metering sleeve in the AI/SBV (fig. 1-31.3 or fig. 1-31.4). The variable geometry crankshaft, controlled by the HMU actuator, positions the metering sleeve in the down position to provide maximum bleed. As engine power is increased, the valve will close as the mechanical input shaft and metering sleeve is pulled toward the up position thereby reducing air flow through the valve. With anti-ice off (fig. 1-31.3), the valve will close at approximately 87% to prevent further bleed.

(4) Anti-icing air is discharge through two ports in the AI/SBV. Air is ducted via external piping and internal passages to heat the swirl frame vanes and front frame splitter nose. The air discharges from the splitter nose into the inlet particle separator airflow, and from the swirl vanes into the engine inlet. Air is also piped to a manifold, formed by the mainframe assembly, where it enters each IGV through holes provided in the vane spindles. The air flows through the hollow IGVs and discharges into the engine airflow via trailing edge vane slots.

(5) The sensing switch in the anti-icing bleed and start valve completes a circuit to a light in the cockpit. The light indicates when the valve is open for anti-icing or for start bleed during starts up to limits given in figure 1-118.

g. Seal Pressurization. Seal pressurization limits oil loss from the sumps by controlling the airflow into them. Pressurization also keeps hot gases, dust, and moisture out of the sumps by providing a high-pressure air barrier to inward airflow.

(1) Air for pressurizing the A- and B-sump seals is bled from stage 4 on the compressor rotor. Bleed air enters the rotor through curvic coupling teeth aft of the stage 4 rotor blades. Once inside the rotor, the flow divides, flowing both forward and aft.

(2) Air flows forward in the compressor rotor to the A-sump aft labyrinth seals. It enters the space between the seals through holes in the stage 1 blade-disk. A small amount of air from this space pressurizes the no. 1 carbon seal and the oil mist nozzle. Some air enters the A-sump through the no. 1 carbon seal, and some returns to the compressor inlet through the no. 3 labyrinth seal.

(3) The air that flows aft goes to the B-sump forward labyrinth seals. It enters the forward space between the seals through holes in the compressor rear shaft. The air then flows to the aft space between the seals through an internal passage. A small amount of air flows into the B-sump to prevent oil loss. The remaining air cools the sump and keeps hot leakage air from entering. Air leaks out of the forward space between the seals to join compressor discharge seal leakage air. This air flows out through the strut at the 5 o'clock position on the midframe and then aft to the turbine case, where it cools the stage 3 shrouds.

(4) Stage 4 bleed air also pressurizes the no. 5 carbon seal and the power turbine balance piston seal in the C-sump. It is piped externally from the 5 o'clock position on the compressor stator to the 4:30 o'clock position on the exhaust frame. This pressure causes a forward force on the rotor area to reduce some of the thrust load on the no. 6 bearing.

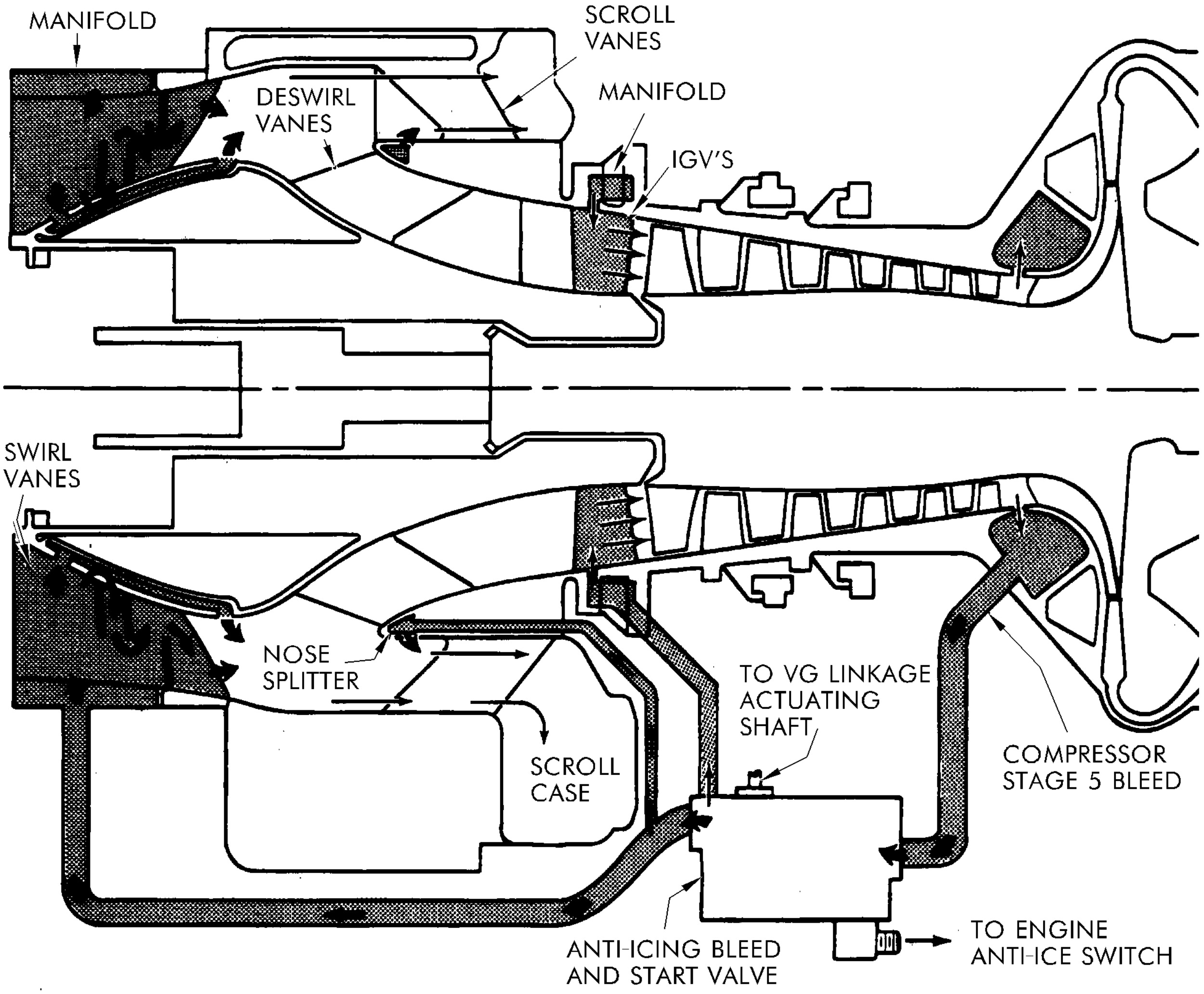
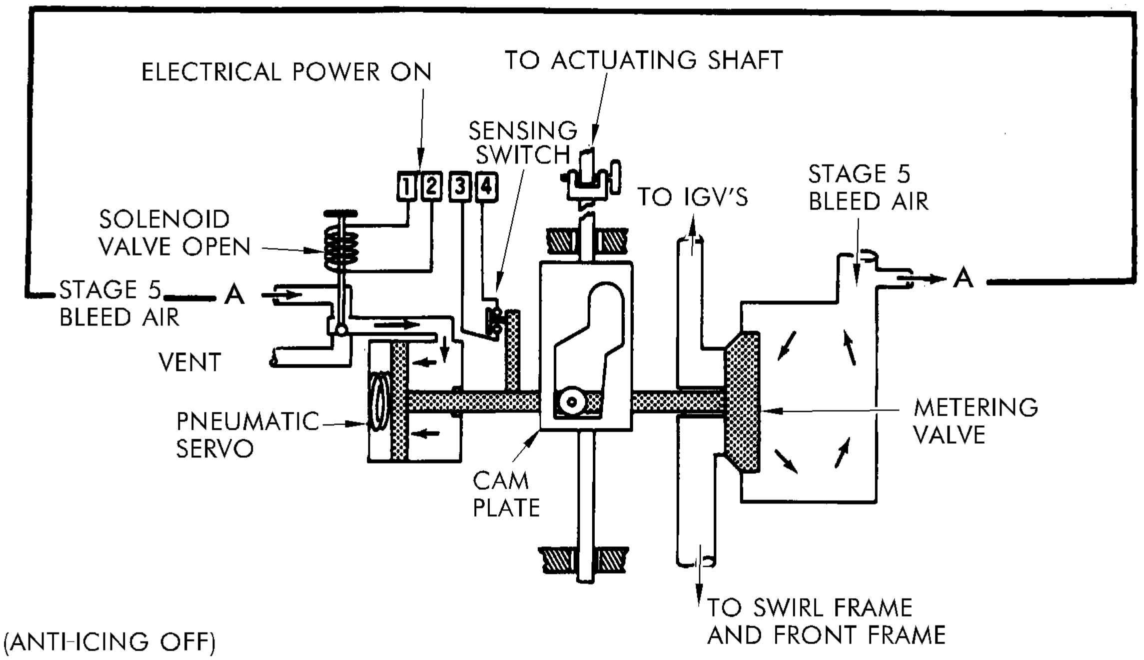
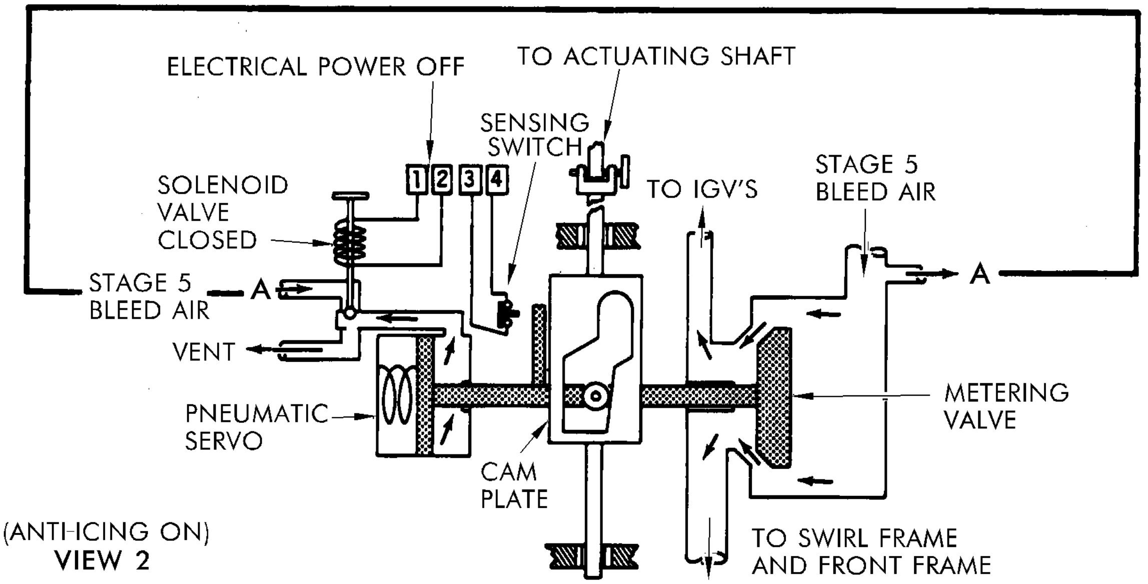


Figure 1-29. Anti-Icing Airflow Schematic



(ANTI-ICING OFF)
VIEW 1



(ANTI-ICING ON)
VIEW 2

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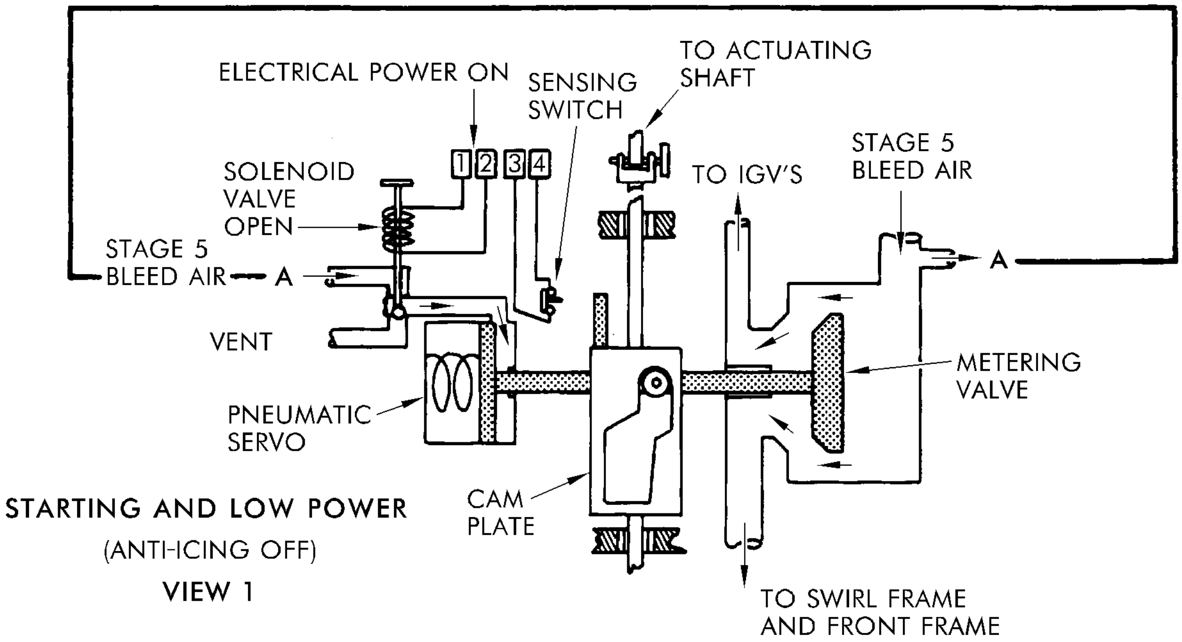
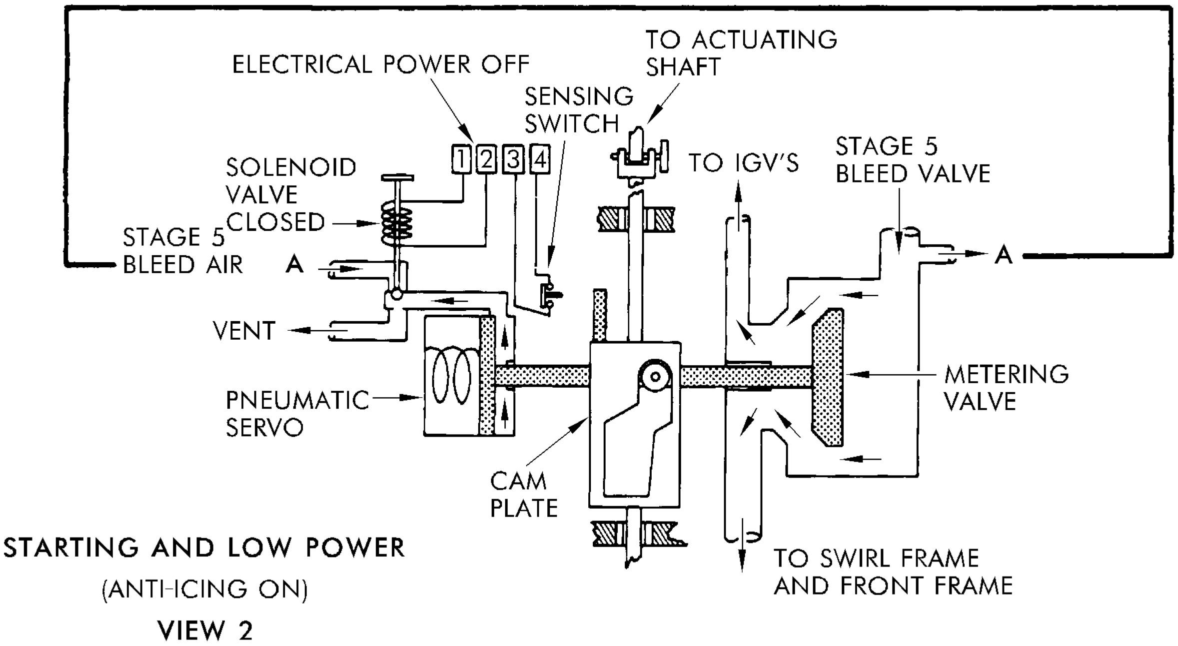
Figure 1-30. (Eaton Configuration) Anti-Icing Bleed and Start Valve (At or Above 87% Ng)



STARTING AND LOW POWER
(ANTI-ICING OFF)
VIEW 1



STARTING AND LOW POWER
(ANTI-ICING ON)
VIEW 2

Figure 1-31. (Eaton Configuration) Anti-Icing Bleed and Start Valve (Starting and Low-Power)

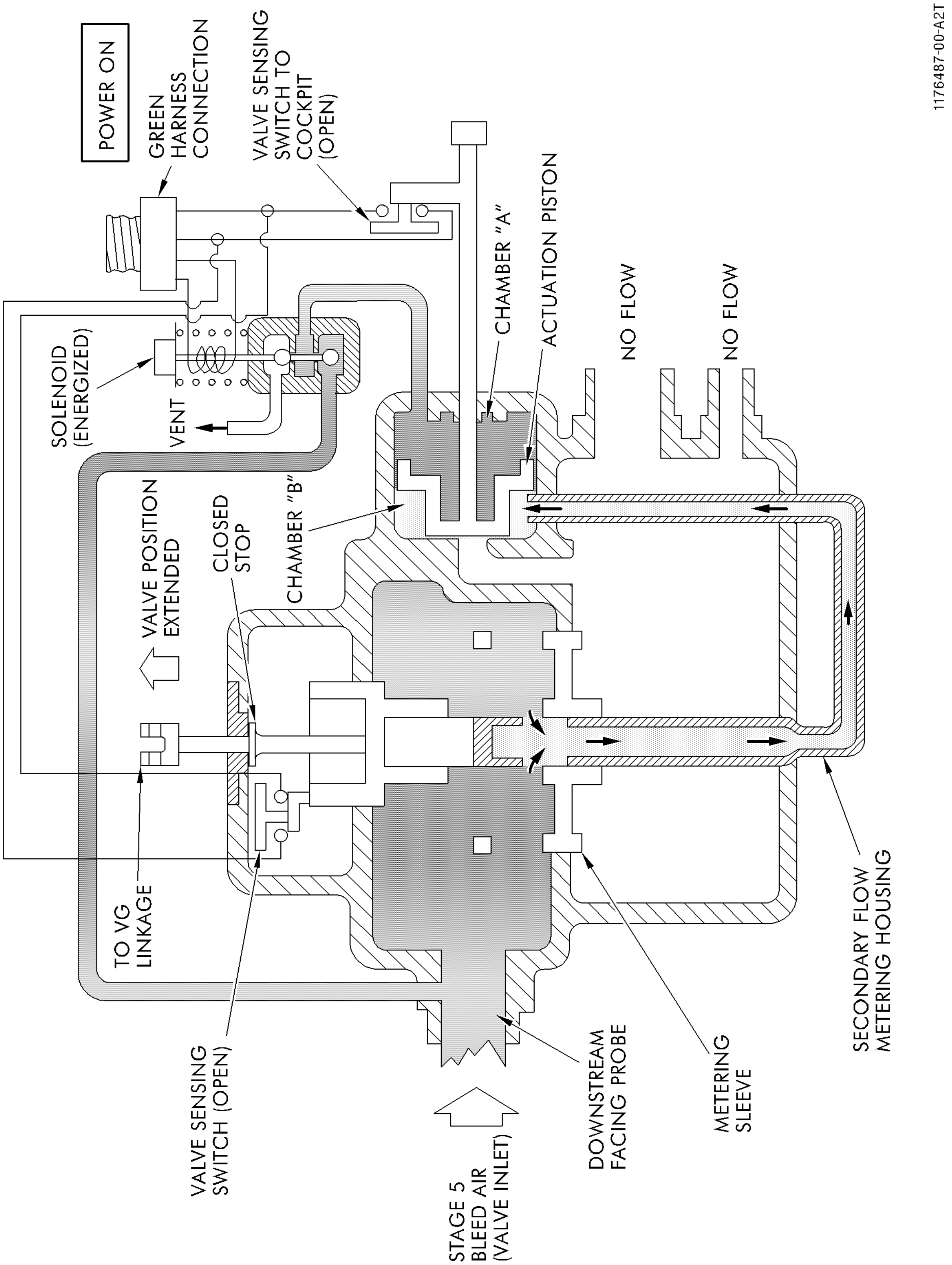


Figure 1-31.1 (AlliedSignal Configuration) Anti-Ice/Start Bleed Valve (Alternate) (At or Above 87% Ng - Anti-Ice Off)

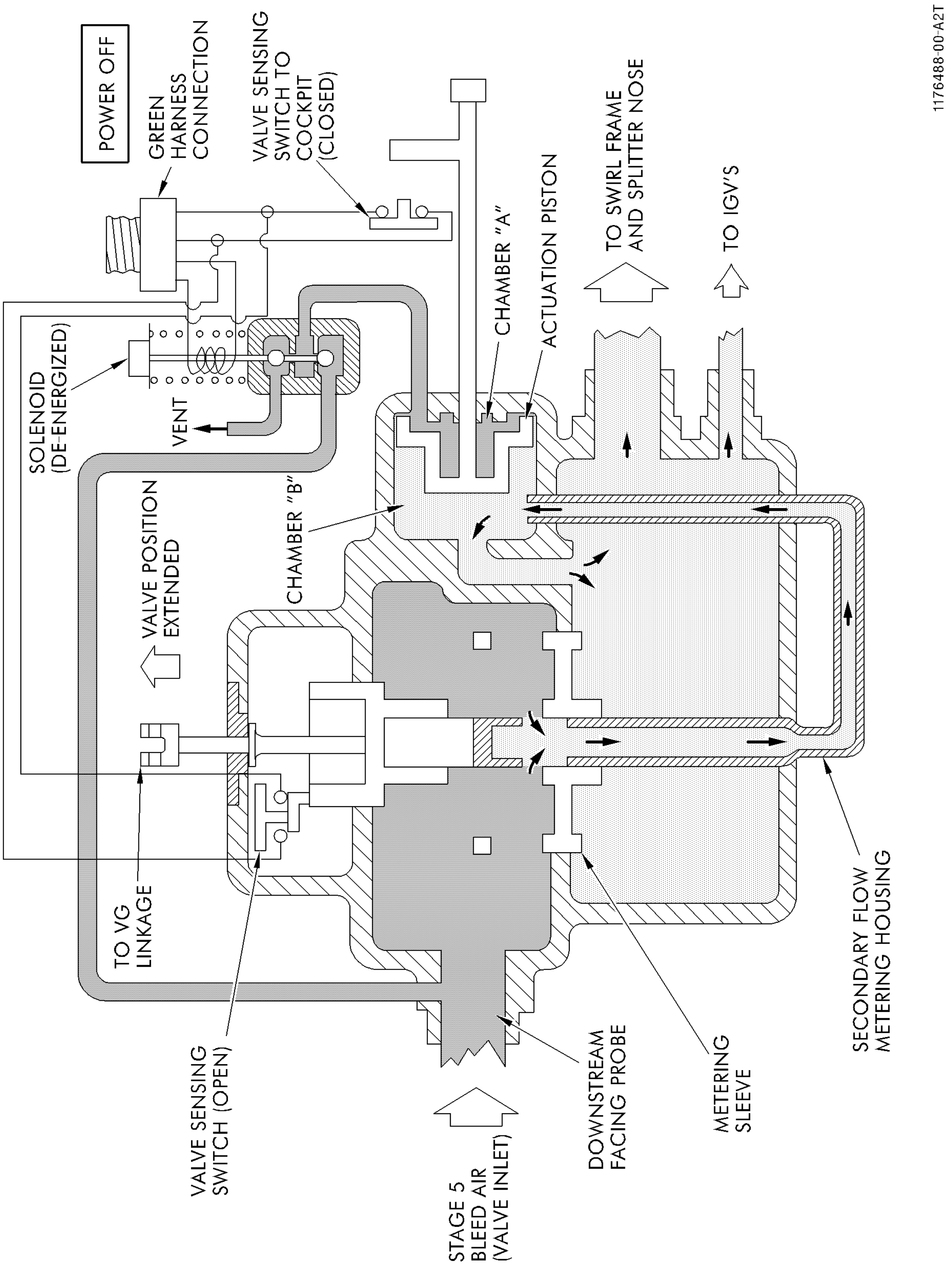


Figure 1-31.2 (AlliedSignal Configuration) Anti-Ice/Start Bleed Valve (Alternate) (At or Above 87% Ng - Anti-Ice On)

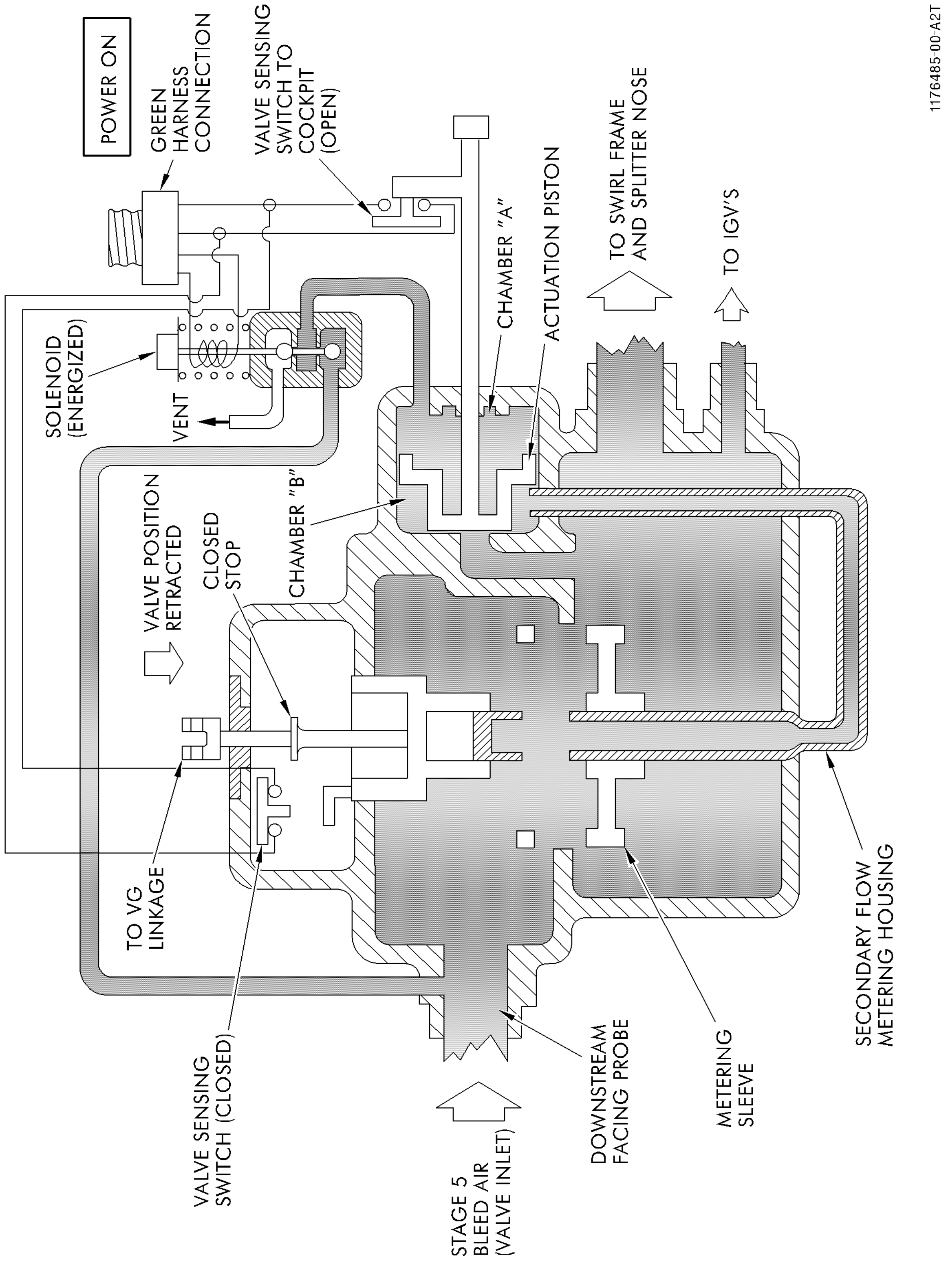


Figure 1-31.3 (AlliedSignal Configuration) Anti-Ice/Start Bleed Valve (Alternate) (Starting and Low-Power - Anti-Ice Off)

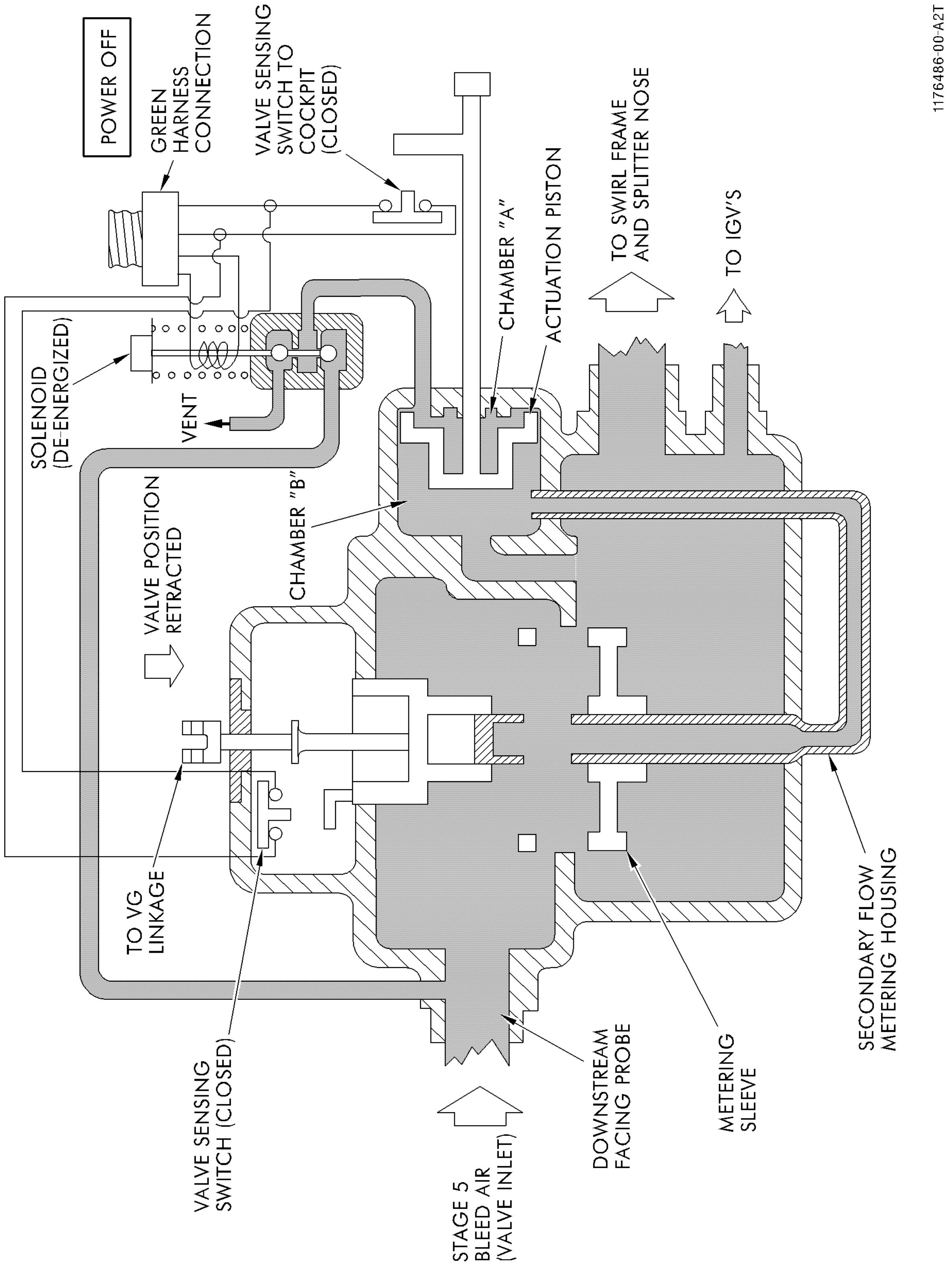


Figure 1-31.4 (AlliedSignal Configuration) Anti-Ice/Start Bleed Valve (Alternate) (Starting and Low-Power - Anti-Ice On)

h. Sump Venting. Air from the sump is vented through holes in the shafts. The air leaves the engine through a common outlet in the C-sump cover. This venting process (called centerventing) provides a way to separate oil from the vent air by the rotary motion of the high-speed shafts.

(1) A-sump air flows aft between the compressor forward shaft and the power turbine drive shaft. From there it flows through holes in the power turbine drive shaft and then forward into the torque reference shaft. This path captures oil vapor and pumps it back into the C-sump. From there the air flows aft and vents out through the C-sump cover.

(2) B-sump air flows through holes in the compressor discharge seal and enters the intershaft space through large holes in the compressor rear shaft. This flow path lowers air pressure and increases the force of the centrifugal field. Air venting from the B-sump flows forward in the intershaft space to pressurize the intershaft seal at the A-sump. Some of this venting air flows aft in the intershaft space and joins the leakage flow from the inner balance piston seal.

(3) C-sump air vents forward through the aft end of the power turbine drive shaft. Then it flows into a standpipe connected to the C-sump cover. A small dam in the torque reference shaft traps any oil remaining in the vent air. The trapped oil returns to the C-sump through small weep holes. Oil mist-free air from an opening in the C-sump cover blows overboard into the engine exhaust.

i. Engine Inlet Air to T2 Sensor of HMU. Engine inlet air from the swirl frame flows through tubes to the T2 sensor. From the sensor, air flows back into the engine at the compressor inlet. See figure 1-32 for a view of T2 sensor airflow.

1-38. Variable Geometry Linkage System. The VG linkage system includes: the IGV's in the main frame, the stage 1 and stage 2 compressor variable vanes, three actuating rings (one for each stage), the vane actuator levers, which connect the individual vanes to their actuating rings, and an actuating shaft.

a. The three actuating rings, the vane levers, and the vanes are actuated and synchronized by the actuating shaft. The actuating shaft also opens and closes the anti-icing bleed and start valve. The VG actuator, in the HMU, positions the actuating shaft.

b. The actuator is positioned by a servo-system contained in the HMU. The servo-system responds to Ng, T2, and the physical position of the actuating shaft.

1-39. Engine Internal Washing System. The engine wash manifold is an internal part of the swirl frame. It has a series of jets aimed at the compressor inlet area. The wash manifold fitting is located at the 7 o'clock position on the swirl frame.

1-40. AUTHORIZED EQUIPMENT CONFIGURATION CHANGES.

Authorized equipment configuration changes are listed in table 1-3.

Table 1-3. Authorized Equipment Configuration Changes

Change Document	Part or Model No. to be Modified	Description
	NONE AUTHORIZED	

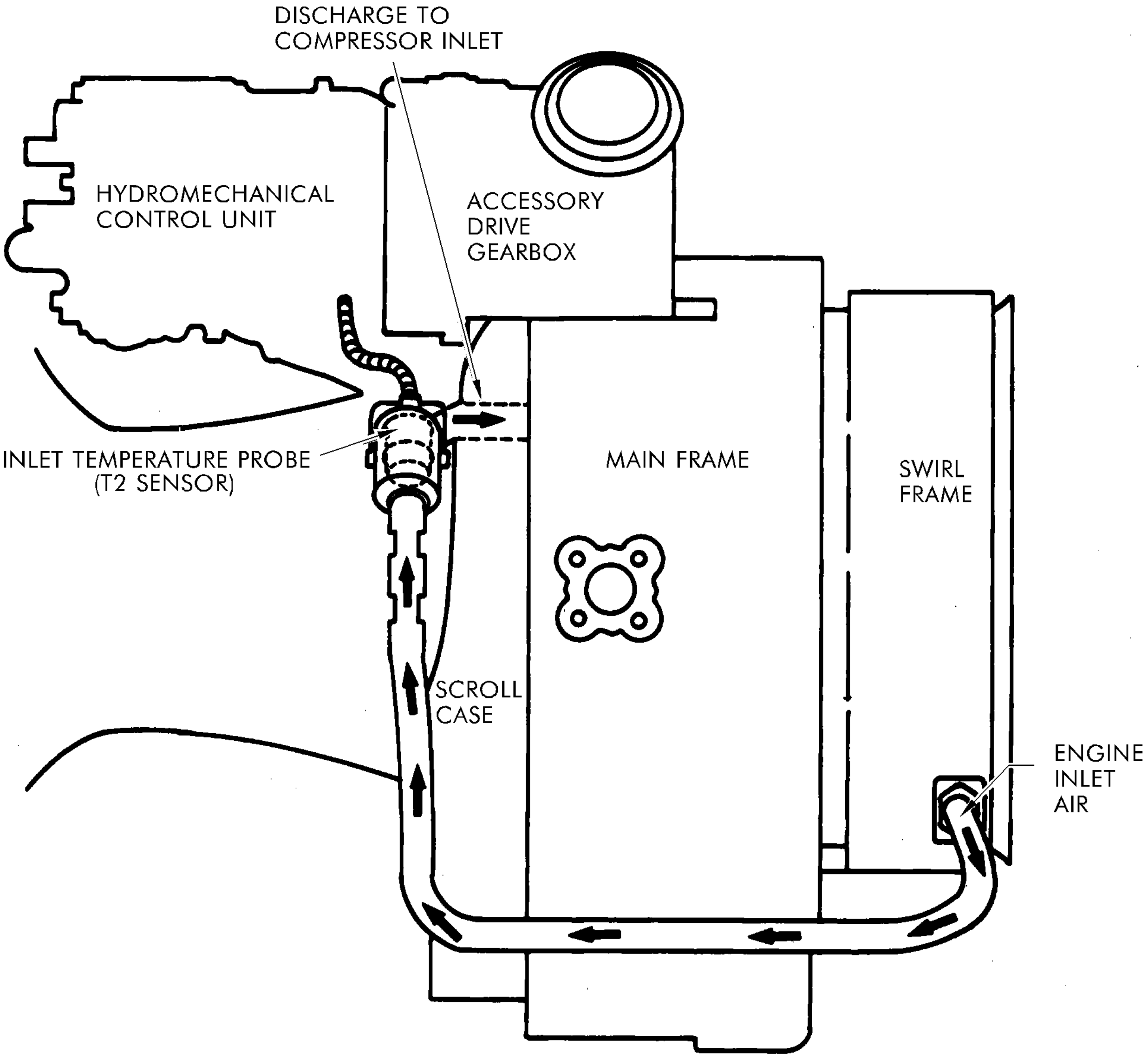


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Figure 1-32. T2 Airflow Schematic

1-41. (T700) EQUIPMENT DATA.

Equipment data for T700-GE-700 engines is listed in table 1-4.

Table 1-4. (T700) Equipment Data

Item	Engine Characteristics/Data	Metric Equivalent
Manufacturer	GE Aircraft Engines - Lynn	–
Model	T700-GE-700	–
Type of Engine	Turboshaft	–
Intermediate Rated Power (IRP)	1622 shaft horsepower (SHP) at sea level, standard day conditions at 20,900 rpm Np	–
Type of Compressor	Combined axial/centrifugal	–
Number of Compressor Stages	6 stages (5 axial, and 1 centrifugal)	–
Variable Geometry	Inlet guide vanes, stage 1 and 2 stator vanes	–
Type of Combustion Chamber	Single annular chamber with axial flow	–
Gas Generator Turbine Stages	2	–
Power Turbine Stages	2	–
Direction of Engine Rotation (both gas generator and power turbine rotors)	Clockwise (aft looking forward)	
Engine Weight (Dry)	437 lbs max	198 kg
Engine Length	47 in.	119 cm
Max Engine Diameter	25 in.	63 cm
Fuel:		
Primary	JP-4 (MIL-T-5624), NATO Code F-40, or JET B	–
Alternate	JP-5 (MIL-T-5624), or JP-8 (MIL-T-83133), NATO Code F-44, or NATO Code F-34, JET A, or JET A-1	

Table 1-4. ***(T700)*** *Equipment Data (Cont)*

Item	Engine Characteristics/Data	Metric Equivalent
Lubricating Oil:		
Primary	MIL-PRF-23699, NATO Code 0-156, or Type II	–
Alternate	MIL-PRF-7808, NATO Code 0-148, or Type I	–
Aircraft Electrical Power Requirements:		
History recorder and Np overspeed protection	40w, 115v, 400 Hz	–
Anti-icing bleed and start valve, fuel filter bypass indication, oil filter bypass indication, electrical chip detector, oil pressure sensor, oil temperature sensor, and fuel pressure sensor.	1 amp, 28 vdc maximum.	–

1-42. (T701, T701C, T701D) EQUIPMENT DATA.

Equipment data for T700-GE-701, T700-GE-701C, and T700-GE-701D engines is listed in table 1-5.

Table 1-5. ***(T701, T701C, T701D)*** *Equipment Data*

Item	Engine Characteristics/Data	Metric Equivalent
Manufacturer	GE Aircraft Engines - Lynn	–
Models	T700-GE-701, T700-GE-701C, and T700-GE-701D	–
Type of Engine	Turboshaft	–
Intermediate Rated Power (IRP)	**(T701)** 1690, or **(T701C, T701D)** 1800 Shaft horsepower (SHP) at sea level, standard day conditions at 20,900 rpm Np	
Type of Compressor	Combined axial/centrifugal	–
Number of Compressor Stages	6 stages (5 axial, and 1 centrifugal)	–
Variable Geometry	Inlet guide vanes, stage 1 and 2 stator vanes	–
Type of Combustion Chamber	Single annular chamber with axial flow	–
Gas Generator Turbine Stages	2	–

Table 1-5. ***(T701, T701C, T701D)*** *Equipment Data (Cont)*

Item	Engine Characteristics/Data	Metric Equivalent
Power Turbine Stages	2	–
Direction of Engine Rotation (both gas generator and power turbine rotors)	Clockwise (aft looking forward)	–
Engine Weight (Dry)	**(T701)** 437 lbs max **(T701C, T701D)** 456 lbs max	198 kg 207 kg
Engine Length	46.12 in.	117 cm
Max Engine Diameter	25 in.	63 cm
Fuel:		
Primary	JP-4 (MIL-DTL-5624), NATO Code F-40, or JET B	–
Alternate	JP-5 (MIL-DTL-5624), or JP-8 (MIL-DTL-83133), NATO Code F-44, or NATO Code F-34, JET A, or JET A-1	–
Lubricating Oil:		
Primary	MIL-PRF-23699, NATO Code 0-156, or Type II	–
Alternate	MIL-PRF-7808, NATO Code 0-148, or Type I	
Aircraft Electrical Power Requirements	–	
History recorder or History Counter and Np overspeed protection	40w, 115v, 400 Hz	–
Digital Electronic Control	100w, 115v, 400hz	–
Anti-icing bleed and start valve, fuel filter bypass indication, oil filter bypass indication, electrical chip detector, oil pressure sensor, and fuel pressure sensor	1 amp, 28v dc maximum	–

Section III. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

1-43. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-701, T700-GE-701C and T700-GE-701D	**(T701, T701C, T701D)**

1-44. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

Table 1-6 lists special tools and support equipment. Table 1-7 lists test, measurement, and diagnostic equipment (TMDE).

Table 1-6. Special Tools and Support Equipment

Figure	Nomenclature	Part Number
1-75	Wash Unit, Universal	21C2438G01
1-39	Adapter, Maintenance Stand	21C7071G01
1-34, 1-35	Sling, Lifting	21C7081G02
1-37, 1-38	Adapter, Engine Transportation	21C7082G02
6-11	Adapter, Plug	21C7086P01
2-27	Guide, No. 1 Carbon Seal Assembly	21C7109G01/G02
–	Support, Dummy Compressor Casing Bar	21C7112G01
5-14	Puller, Carbon Seal, Axis-G	21C7239G01/G02
3-3	**(T701, T701C, T701D)** Adapter, Gas Generator Rotor/Midframe Lock/Support	21C7247G01
4-7	Container, Power Turbine Module Shipping and Storage	21C7300G01
5-20, 5-21	Container, Accessory Section Module Shipping and Storage	21C7301G01

Table 1-6. Special Tools and Support Equipment (Cont)

Figure	Nomenclature	Part Number
1-108	Case, Shipping and Storage	21C7302P01
1-108	Case, Shipping and Storage	21C7303P01
1-108	Case, Shipping and Storage	21C7304P01
3-4	Bar, Gas Generator Rotor Antirotation	21C7399G01
2-9	Bench Set, Compressor Rotor Stage 1 Blade-Disk (Bridge 17A8744P04)	21C7419G01
2-13	Lock, Compressor Rotor	21C7422G01
2-55	Adapter, Cold Section Module Shipping	21C7437G01
2-54	Adapter, Gas Generator Shaft Tie-Bolts Restraining	21C7439P01
2-5	Set Dresser, Leading Edge, Stage 1 Blade-Disk	21C7478G01
5-14	Puller, Seal Mating Ring	21C7702G01
1-79	Fixture, Stage 1 Gas Generator Rotor Forward Pressure Flushing	21C7729G01
1-80	Fixture, Stage 2 Gas Generator Rotor Forward Pressure Flushing	21C7730G01
1-84	Fixture, Stage 1 Nozzle Assembly Forward Pressure Flushing (17A8820G01)	21C7731G02
1-85	Fixture, Stage 1 Nozzle Assembly Reverse Pressure Flushing (17A8819G01)	21C7731G02
1-83	**(T700, T701)** Fixture, Gas Generator Stator Pressure Flushing	21C7732G01
7-3	**(T701, T701C, T701D)** Fixture, Igniter Removal	21C7765G01
1-81	Fixture, Stage 1 Gas Generator Rotor Reverse Pressure Flushing	21C7786G01
1-82	Fixture, Stage 2 Gas Generator Rotor Reverse Pressure Flushing	21C7787G01

Table 1-7. Test, Measurement, and Diagnostic Equipment (TMDE)

Figure	Nomenclature	Part Number
–	Analyzer, Vibration	1784471-901 (FSCM 56232)
1-49, 1-147	Switch Box, **(T700)** ECU or **(T701C, T701D)** DEC Circuit Continuity	21C7085G01
1-49, 1-147	**(T701)** Switch Box, ECU Circuit Continuity	21C7085G02
1-89	**(T700)** Borescope Kit	21C7190P01
1-90	**(T701, T701C, T701D)** Borescope Kit	21C7190P02
1-91	**(T700)** Borescope Kit	21C7744P01
1-92	**(T700)** Borescope Kit	21C7744P02
1-92	Borescope Kit	21C7744P03
1-93	Borescope Kit	21C7700P03
1-94	Borescope Kit	21C7779P03
1-49, 1-147	Multimeter	TS-352 B/U

1-45. SPARES AND REPAIR PARTS.

Spares and repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL) TM 1-2840-248-23P for T700-GE-700 engines, in TM 1-2840-238-23P for T700-GE-701 engines and in TM 1-2840-258-23P for T700-GE-701C and T700-GE-701D engines.

Section IV. SERVICE UPON RECEIPT

1-46. SHIPPING AND STORAGE CONTAINER 8145CON004-1.

1-47. Preliminary Instructions. Use a forklift when moving the shipping and storage container. The entire container, with or without the engine, must not be moved by pushing or pulling.

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-701, T700-GE-701C and T700-GE-701D	**(T701, T701C, T701D)**

1-48. Dimensions and Weights of Shipping and Storage Container 8145CON004-1.

Length	75 inches
Width	40 inches
Height	44 inches
(T700) Weight (with engine)	1097 pounds
(T701) Weight (with engine)	1097 pounds
(T701C, T701D) Weight (with engine)	1116 pounds
Weight (empty)	660 pounds
Cubic Displacement	76.3 cubic feet

1-49. REMOVAL OF SHIPPING AND STORAGE CONTAINER COVER.

a. Remove engine records from record receptacle (9, fig. 1-33) on container.

b. Read humidity indicator (8). Record indication in engine records.

WARNING

Removing Shipping Container Cover

To prevent personal injury, do not loosen nuts and bolts that secure cover until shipping container has been depressurized.

c. Depressurize container by pressing center of air-filler valve (7) until air can no longer be heard escaping from container; then remove core of air-filler valve (7).

d. After pressure has been released, reinstall core of air-filler valve (7).

e. Remove 30 bolts (4) and 30 nuts (5) from container flanges.

f. Attach lifting cable (1) to lifting eyes (2).

WARNING

Using Hoisting Devices

- Hoisting shall only be done by designated personnel.
- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks or defects in hoisting system shall be performed on a regular basis.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

g. Attach hoist to lifting cable (1). Raise container cover (3) and place it on the floor.

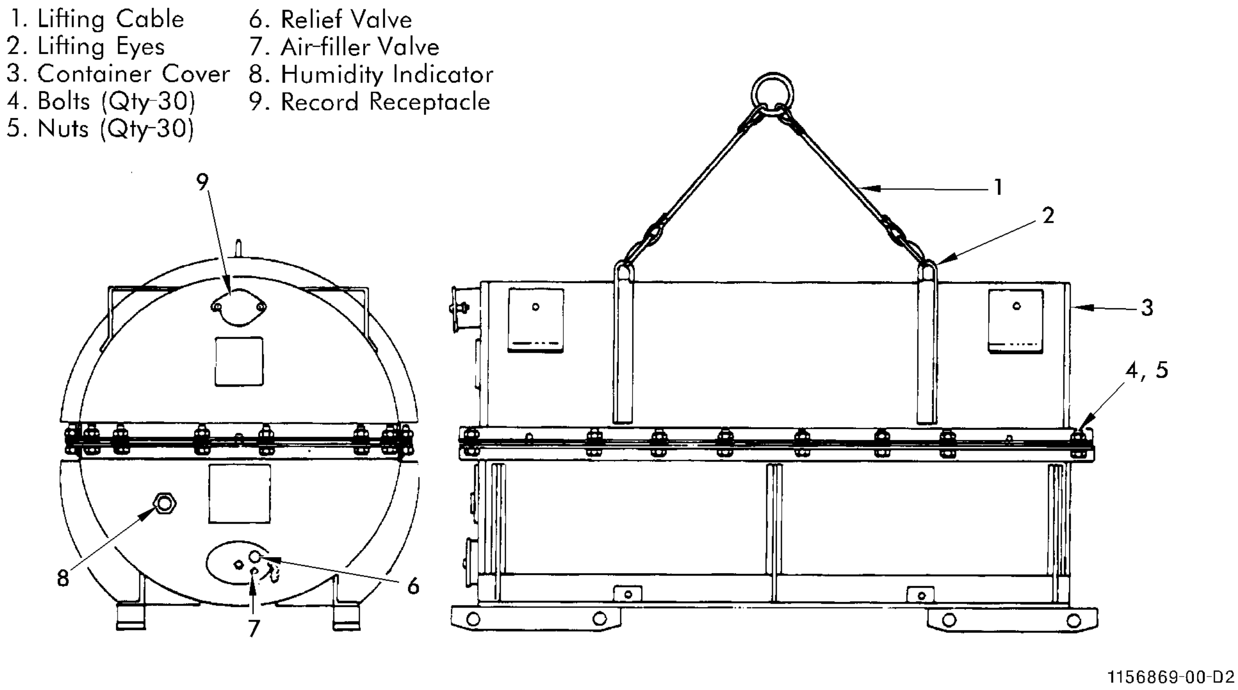


Figure 1-33. Shipping and Storage Container 8145CON004-1; Removal and Installation of Cover

1-50. REMOVAL OF ENGINE OR COLD SECTION MODULE FROM SHIPPING AND STORAGE CONTAINER 8145CON004-1.

1-51. General Information.

a. Lifting sling 21C7081G02 (fig. 1-34) is used for lifting the engine into or out of the shipping and storage container. The sling can also be used to lift a bare engine, a cold section module, a cold section module with shipping adapter 21C7437G01 installed, or an engine with QCA equipment installed.

b. The maximum lift capacity of the sling is 700 lbs.

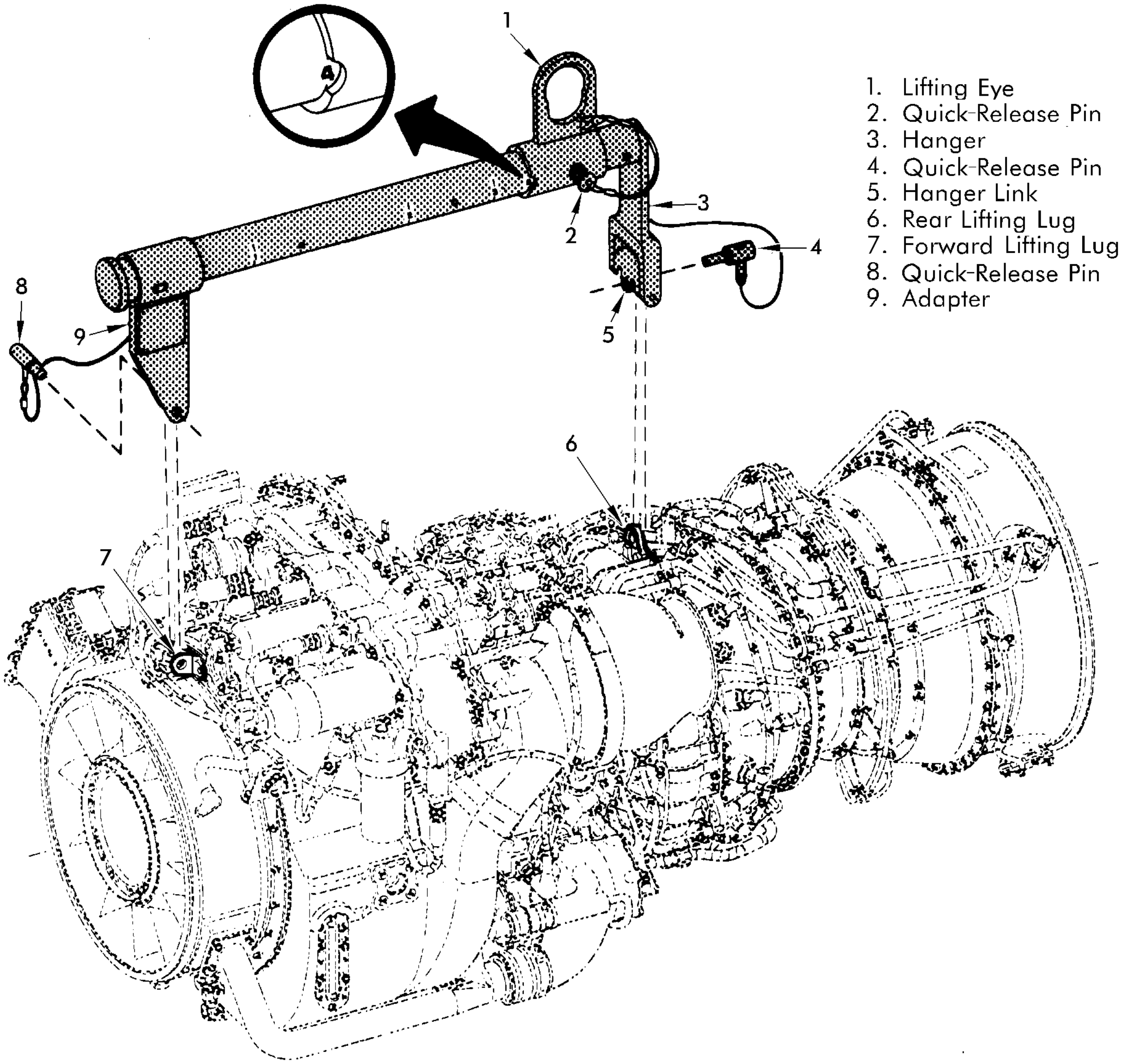
CAUTION

When lifting an engine with QCA equipment installed, the load must be properly balanced.

c. The tube of the lifting sling has four numbered positions at which the lifting eye can be placed to maintain center of gravity in each lifting mode. See figure 1-35 for lifting modes.

d. Quick-release pins (2, 4, 8, fig. 1-34) are used to secure the lifting eye (1), hanger link (5), and adapter (9) as applicable. The buttons on pins (2, 4, 8) must be pressed to install or to remove the pins.

e. Lanyards are used to secure pins (2, 4, 8) to lifting eye (1), hanger link (5), and adapter (9) as applicable.



1. Lifting Eye
2. Quick-Release Pin
3. Hanger
4. Quick-Release Pin
5. Hanger Link
6. Rear Lifting Lug
7. Forward Lifting Lug
8. Quick-Release Pin
9. Adapter

Figure 1-34. Lifting Sling 21C7081G02; Installation

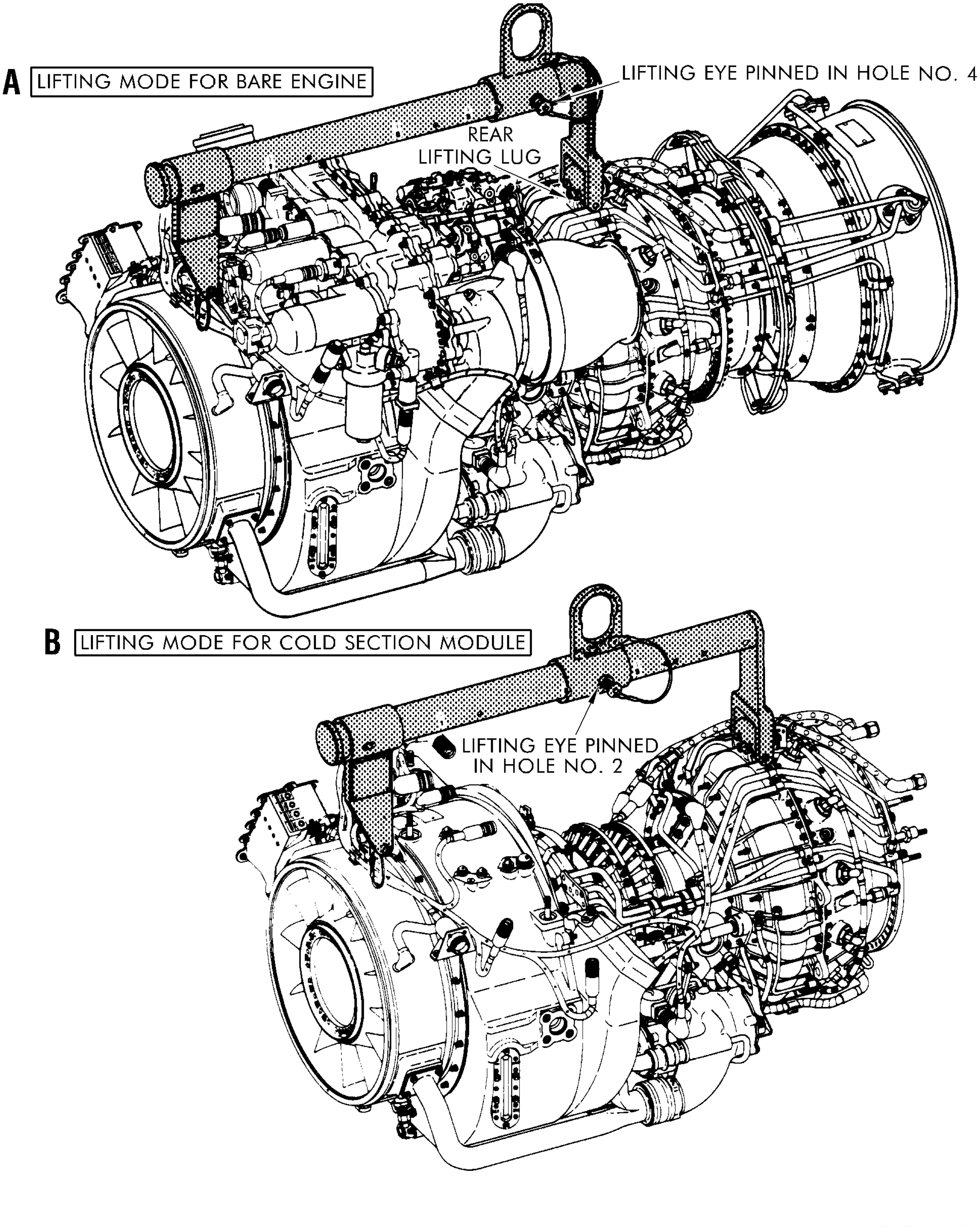


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Figure 1-35. Lifting Modes; Using Lifting Sling 21C7081G02 (Sheet 1 of 2)

C LIFTING MODE FOR COLD SECTION MODULE WITH SHIPPING ADAPTER 21C7437G01 INSTALLED

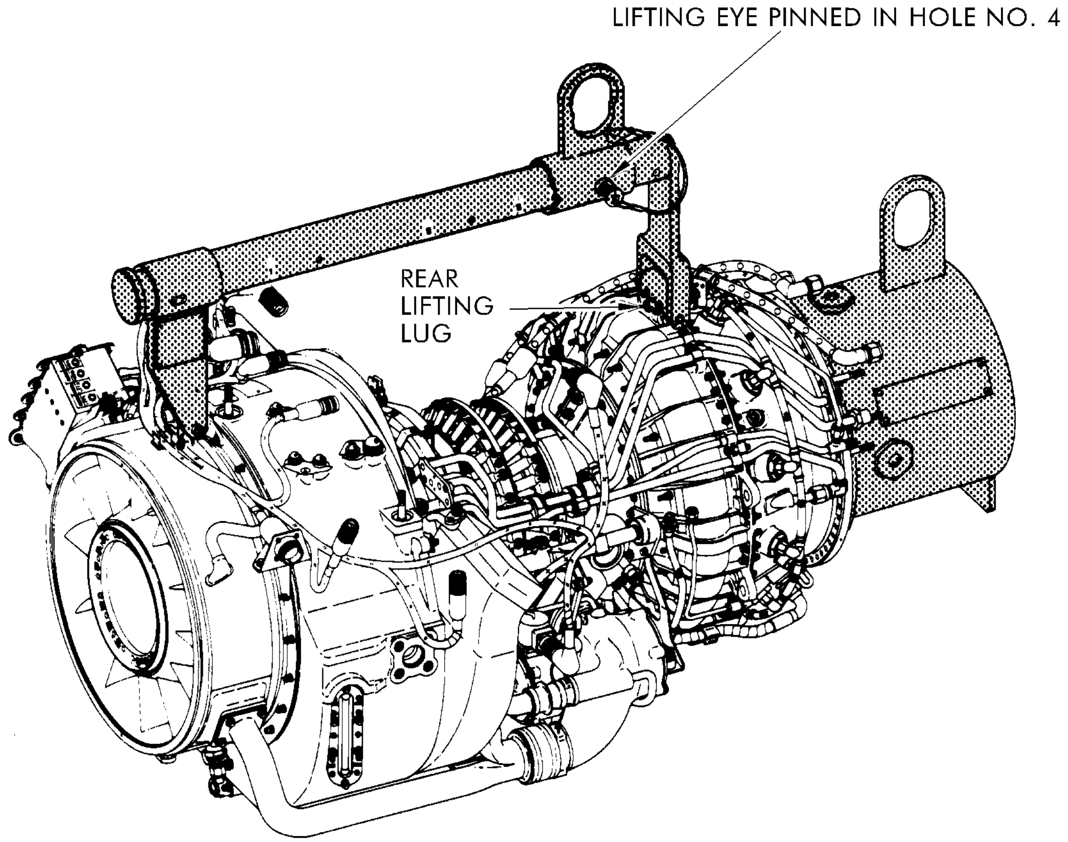

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Figure 1-35. Lifting Modes; Using Lifting Sling 21C7081G02 (Sheet 2 of 2)

1-52. Engine or Module Hoisting.

WARNING

Using Hoisting Devices

- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks and defects in hoisting system shall be performed on a regular basis, and according to applicable safety and inspection requirements manual.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

CAUTION

Dropped Engine or Cold Section Module

- Engines or modules that are dropped during handling will be returned to Depot.
- Do not lift engine or module with bottom of shipping and storage container attached or with stand attached.

a. Slide lifting eye (1, fig. 1-34) of engine lifting sling 21C7081G02 until the number 4 (marked on the tube) can be seen in cutout of lifting eye (1); then secure eye (1) using quick-release pin (2).

CAUTION

Lifting lug on cold section module shipping adapter 21C7437G01 is for lifting adapter only. Do not use adapter lifting lug to lift or to transport cold section module.

b. Place adapter (9) onto forward lifting lug (7); secure it using quick-release pin (8) from the right side.

c. Place hanger link (5) onto rear lifting lug (6) (ear of diffuser case); using quick-release pin (4), secure link (5) from the aft side.

d. Remove four bolts (6, fig. 1-36), eight washers (5), and four nuts (11) from two front supports (10).

e. Remove four bolts (6), eight washers (5), and four nuts (11), from two aft supports (12).

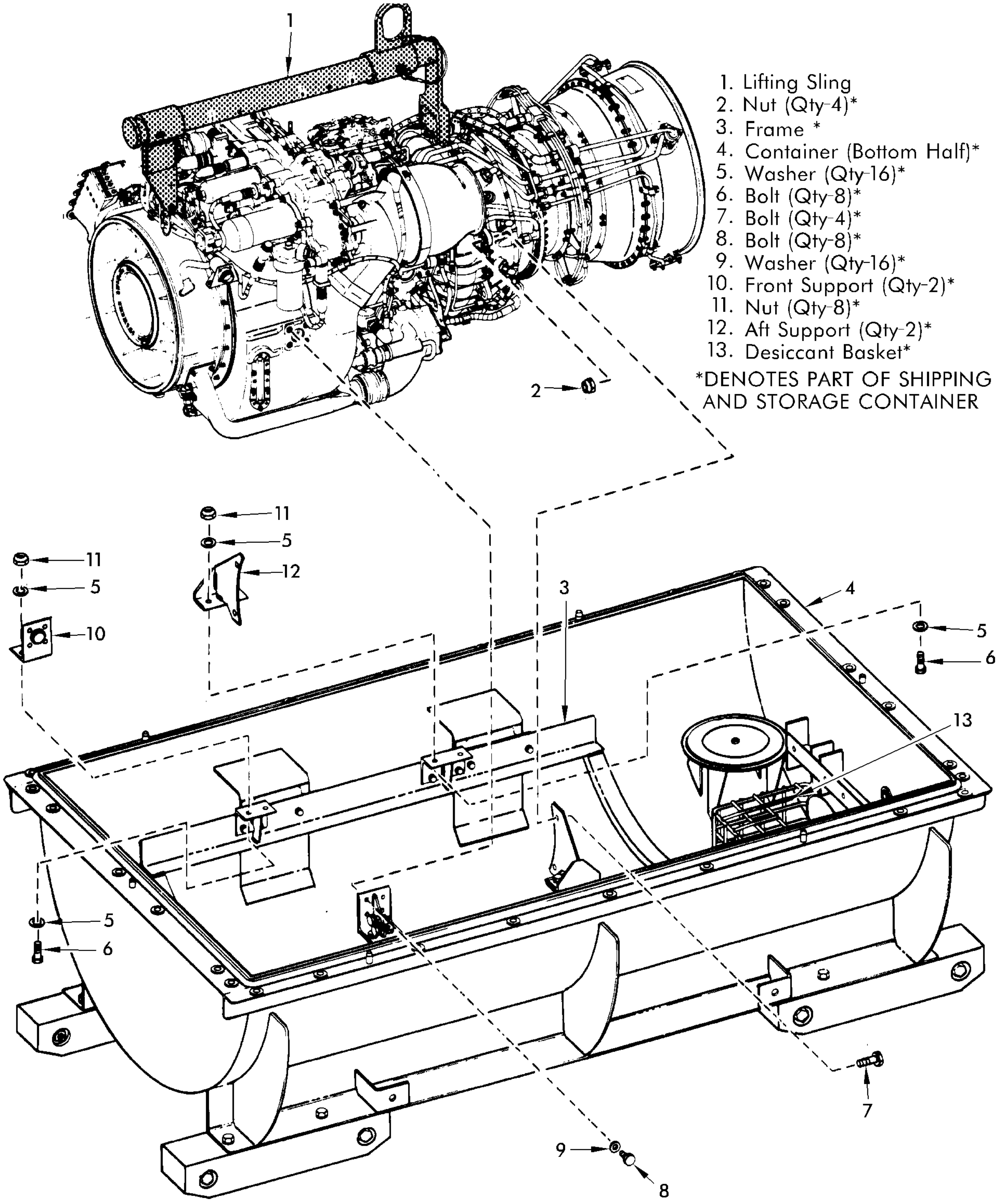
f. Lift engine or cold section module clear of container bottom half (4).

g. Remove eight bolts (8), and 16 washers (9) from two front supports (10).

h. Mount front supports (10) onto frame (3). Using four bolts (6), eight washers (5), and four nuts (11), secure front supports (10) to frame (3).

i. Remove four bolts (7) and four nuts (2) from two aft supports (12).

j. Mount aft supports (12) onto frame (3). Using four bolts (6) eight washers (5), and four nuts (11), secure aft supports (12) to frame (3).



1. Lifting Sling
2. Nut (Qty-4)*
3. Frame *
4. Container (Bottom Half)*
5. Washer (Qty-16)*
6. Bolt (Qty-8)*
7. Bolt (Qty-4)*
8. Bolt (Qty-8)*
9. Washer (Qty-16)*
10. Front Support (Qty-2)*
11. Nut (Qty-8)*
12. Aft Support (Qty-2)*
13. Desiccant Basket*

*DENOTES PART OF SHIPPING AND STORAGE CONTAINER

Figure 1-36. Shipping and Storage Container 8145CON004-1; Removal and Installation of Engine or Cold Section Module

1-53. ACTIVATING ENGINE AFTER REMOVAL FROM SHIPPING AND STORAGE CONTAINER.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

NOTE

Protective covers should not be removed until QCA hardware is to be installed. Covers should be retained for re-use.

a. Remove any barrier material and tape. Remove tape residue using dry cleaning solvent (item 99, Appendix D).

b. Clean external engine surfaces as necessary.

c. Check engine and historical records for any components that may not have been installed or that may have been removed. Be sure that any components that had not been installed or that had been removed or disconnected have been installed or connected. Refer to paragraph 1-200 for preinstallation buildup instructions.

1-54. INSTALLATION OF ENGINE OR COLD SECTION MODULE INTO ENGINE TRANSPORTATION ADAPTER 21C7082G02.

WARNING

Using Hoisting Devices

- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks and defects in hoisting system shall be performed on a regular basis, and according to applicable safety and inspection requirements manual.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

a. With engine or cold section module supported by hoist and lifting sling 21C7081G02, install two adapters (8, fig. 1-37) at 3 and 9 o'clock positions on main frame. Tighten four captive screws on each adapter (8).

b. Secure rail adapter rollers to rails by tightening handwheel clamps (2).

c. Chock wheels of trailer (3, fig. 1-38) to prevent adapter movement.

d. Pull T-handle (1, fig. 1-37) up to remove quick-disconnect pins (7) from center area of adapter.

e. Using hoist, carefully lower engine or module into center of adapter. Aft end of engine must be near center of trailer.

f. Aline flanges of adapters (8) with mating slots. Push captive screws (6) in place.

g. Install two quick-disconnect pins (7) to lock adapters (8).

1. T-Handle
2. Handwheel Clamp
3. Adapter Aft Mount
4. Quick-Disconnect Pin
5. Aft Engine Mount
6. Captive Screws
7. Quick-Disconnect Pins
8. Adapters

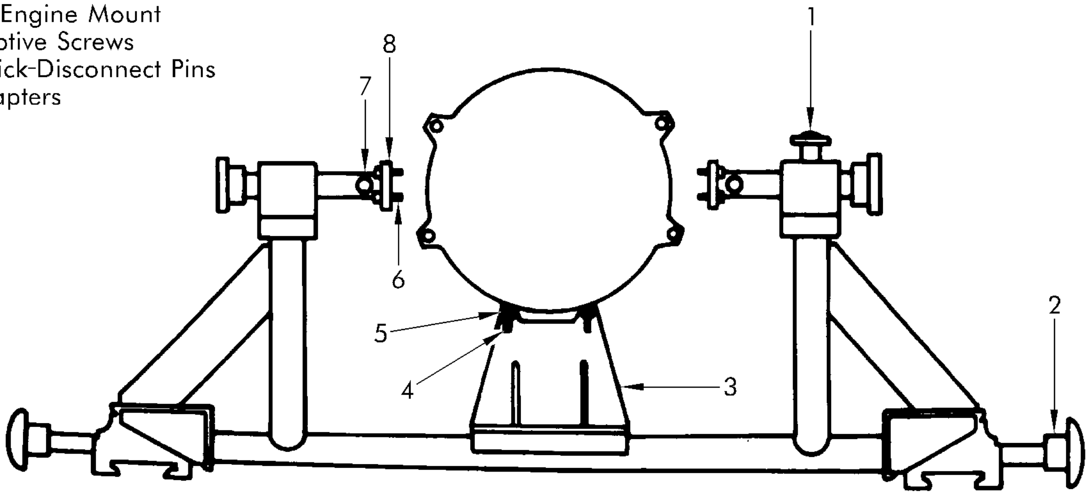


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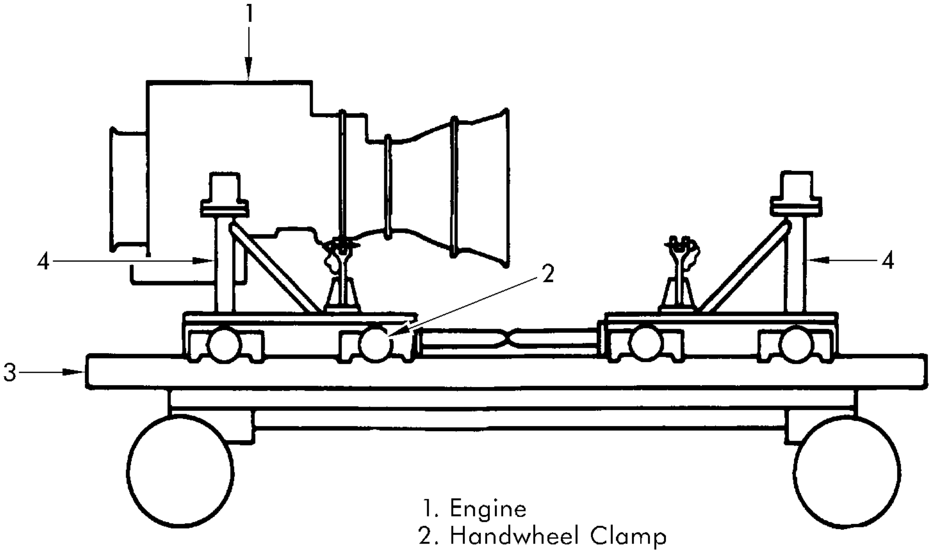
Figure 1-37. Engine Transportation Adapter 21C7082G02; Removal and Installation of Engine or Cold Section Module



1. Engine
2. Handwheel Clamp
3. Trailer
4. Transportation Adapters (Qty-2)

1156875-00-D2

Figure 1-38. Two Transportation Adapters and Bare Engine on Trailer

h. Lower the engine or module and aline aft engine mount (5) with adapter aft mount (3).

i. Install two quick-disconnect pins (4) to secure aft engine mount (5).

j. Remove lifting sling. Remove trailer wheel chock if adapter is to be moved.

1-55. REMOVAL OF ENGINE OR COLD SECTION MODULE FROM ENGINE TRANSPORTATION ADAPTER 21C7082G02.

a. Be sure that rail adapter rollers are locked to the rails. Tighten handwheel clamp (2, fig. 1-38).

WARNING

Using Hoisting Devices

- Hoisting shall only be done by designated personnel.
- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks or defects in hoisting system shall be performed on a regular basis.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

b. Attach lifting sling 21C7081G02 to engine or to cold section module (para 1-51). Using hoist, take up slack to partially support weight of engine or module.

c. Remove quick-disconnect pins (7, fig. 1-37) from adapters (8) at 3 and 9 o'clock positions.

d. Remove two quick-disconnect pins (4) from aft engine mounts (5).

e. Lift engine or module clear of transportation adapters (4, fig. 1-38).

f. Remove adapters (8, fig. 1-37) from engine or module and return them to transportation adapter.

g. If engine is to be installed in shipping and storage container, refer to paragraph 1-58 for instructions.

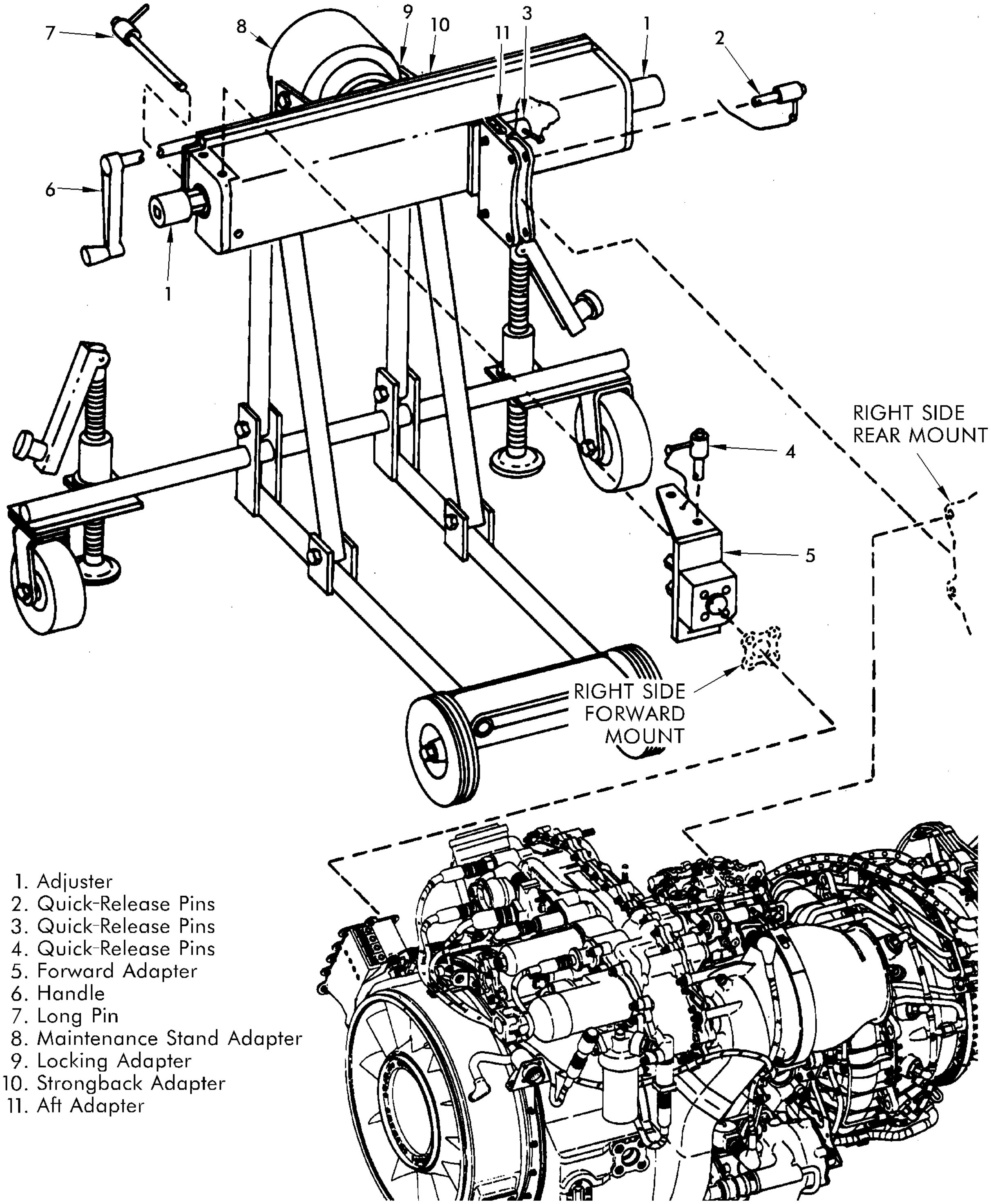
h. If cold section module is to be installed in shipping and storage container, refer to paragraph 2-80 for instructions.

1-56. INSTALLATION OF ENGINE OR COLD SECTION MODULE ONTO MAINTENANCE STAND ADAPTER 21C7071G01.

CAUTION

Do not use Maintenance Stand Adapter 21C7071G01 when doing compressor repair. Otherwise, shim damage will occur.

a. Using a 1/2-inch drive ratchet, turn adjuster (1, fig. 1-39) until scale on strongback adapter (10) reads 6-1/2. Be sure that strongback adapter (10) is in the horizontal position. Use handle (6) if necessary.



1. Adjuster
2. Quick-Release Pins
3. Quick-Release Pins
4. Quick-Release Pins
5. Forward Adapter
6. Handle
7. Long Pin
8. Maintenance Stand Adapter
9. Locking Adapter
10. Strongback Adapter
11. Aft Adapter

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Figure 1-39. Maintenance Stand Adapter 21C7071G01; Removal and Installation of Engine or Cold Section Module

WARNING

Using Hoisting Devices

- Hoisting shall only be done by designated personnel.
- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks or defects in hoisting system shall be performed on a regular basis.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

CAUTION

Lifting lug on cold section module shipping adapter 21C7437G01 is for lifting adapter only. Do not use adapter lifting lug to lift or to transport cold section module.

CAUTION

Dropped Engine or Cold Section Module

- Engines or modules that are dropped during handling will be returned to Depot.
- Do not lift engine or module with bottom of shipping and storage container attached or with stand attached.

b. Using lifting sling 21C7081G02 (para 1-51), lift engine or cold section module.

CAUTION

Captive bolts in forward adapter are special high-strength bolts. Do not use any other bolts in forward adapter.

c. Attach forward adapter (5, fig. 1-39) to 3 o'clock mounting pad on main frame using four captive bolts. Leave bolts loose.

d. Secure ears of aft adapter (11) to ears of diffuser case at the 3 o'clock position using two quick-release pins (2). Install pins from forward side of adapter.

e. Position engine or module in front of stand, and secure it to strongback adapter (10) as follows:

(1) Guide forward and aft adapters (5, 11) into position.

(2) Connect forward adapter (5) to strongback adapter (10) by installing three quick-release pins in the following sequence:

(a) Install long pin (7) through rear of strongback adapter and into forward adapter.

(b) Install remaining two quick-release pins (4) through top of forward adapter and into strongback adapter.

(3) Connect aft adapter (11) to strongback adapter (10) using two quick-release pins (2); install top pin first. Install pins from forward side of adapter.

(4) Tighten four bolts on forward adapter (5). Torque bolts to 45-50 inch-pounds.

f. Lower the engine or module until weight is off lifting sling, and check balance. Turn handle (6) and adjuster (1), and adjust stand as needed to maintain balance.

g. Engage locking adapter (9).

h. Be sure that all quick-release pins are in place and that four bolts on forward adapter are torqued.

i. Remove lifting sling from engine or from module.

j. If cold section module is to be placed in service, refer to paragraph 2-85.

1-57. REMOVAL OF ENGINE OR COLD SECTION MODULE FROM MAINTENANCE STAND ADAPTER 21C7071G01.

WARNING

Using Hoisting Devices

- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks and defects in hoisting system shall be performed on a regular basis, and according to applicable safety and inspection requirements manual.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

CAUTION

Lifting lug on cold section module shipping adapter 21C7437G01 is for lifting adapter only. Do not use adapter lifting lug to lift or to transport cold section module.

a. Attach lifting sling 21C7081G02 to engine or to cold section module (para 1-51).

b. Attach hoist to lifting sling. Take up slack, but do not lift yet.

c. Remove two quick-release pins (3, fig. 1-39) to release aft adapter (11) from strongback adapter (10).

d. Remove long pin (7) from forward adapter (5).

e. Remove two quick-release pins (4) from top of forward adapter (5).

f. Move stand away from engine or from module.

g. Remove aft adapter (11) from engine or from module by removing two quick-release pins (2).

h. Release forward adapter (5) from engine or from module by unscrewing four captive bolts on adapter.

i. Install aft adapter (11) onto strongback adapter (10) using four pins (2, 3); install forward adapter (5) on adapter (10) using two pins (4) and pin (7), to prevent misplacement or loss of these parts.

1-58. INSTALLATION OF ENGINE OR COLD SECTION MODULE INTO SHIPPING AND STORAGE CONTAINER 8145CON004-1.

a. Preserve engine as directed in paragraph 1-206, step b.

b. If installing cold section module, refer to paragraph 2-80 for installation of cold section module shipping adapter 21C7437G01 and gas generator shaft tiebolts restraining adapter 21C7439P01.

WARNING

Using Hoisting Devices

- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks and defects in hoisting system shall be performed on a regular basis, and according to applicable safety and inspection requirements manual.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

c. Attach lifting sling 21C7081G02 to engine or to cold section module (para 1-51).

d. Attach hoist to lifting sling. Take up slack, but do not lift yet.

e. Remove engine or module from maintenance stand adapter (para 1-57) or from transportation adapter (para 1-55).

CAUTION

Dropped Engine or Cold Section Module

- Engines or modules that are dropped during handling will be returned to Depot.
- Do not lift engine or module with bottom of shipping storage container attached or with stand attached.

f. Using hoist, lift engine or module clear of transportation adapter or maintenance stand. Then move trailer or maintenance stand out of way.

g. Secure two front supports (10, fig. 1-36) on main frame pads at 3 and 9 o'clock positions using four bolts (8) and washers (9). Torque bolts to 100-130 inch-pounds.

CAUTION

Bolts (7) must be installed so that bolt-heads face aft to prevent damaging engine mount lug hole.

h. Install two aft supports (12) on rear side of diffuser flange at 3 and 9 o'clock positions. Install two bolts (7) (boltheads facing aft) and nuts (2) for each support. Torque bolts to 480-570 inch-pounds.

CAUTION

When lowering engine, be sure that yellow cable, T2 sensor tube, and anti-icing bleed duct clear front support pads.

i. Place bottom half of container (4) under engine or module. Lower the engine or module into container, alining supports (12, 10) with mating flanges of frame (3) in container.

j. Secure front supports (10) to container frame (3) using four bolts (6), washers (5), and nuts (11). Torque bolts to 140-160 inch-pounds.

k. Secure aft supports (12) to container frame (3) using four bolts (6), washers (5), and nuts (11). Torque bolts to 140-160 inch-pounds.

l. Release and remove hoist; remove lifting sling (1) from engine or module.

NOTE

For engines preserved in accordance with paragraph 1-207, place an additional one to four 16-unit bags of desiccant in desiccant basket (13). Place desiccant in desiccant basket only.

m. Place four 16-unit bags of desiccant (item 70, Appendix D) in desiccant basket (13).

n. Replace humidity indicator card if it is lavender or pink-colored as follows:

(1) Remove hex insert (14, fig. 1-40) with an open-end wrench.

(2) Remove retaining clip and card.

(3) Install new card and retaining clip.

(4) Reinstall and hand-tighten hex insert. Be sure printed sections (30, 40, 50) can be read from outside of container.

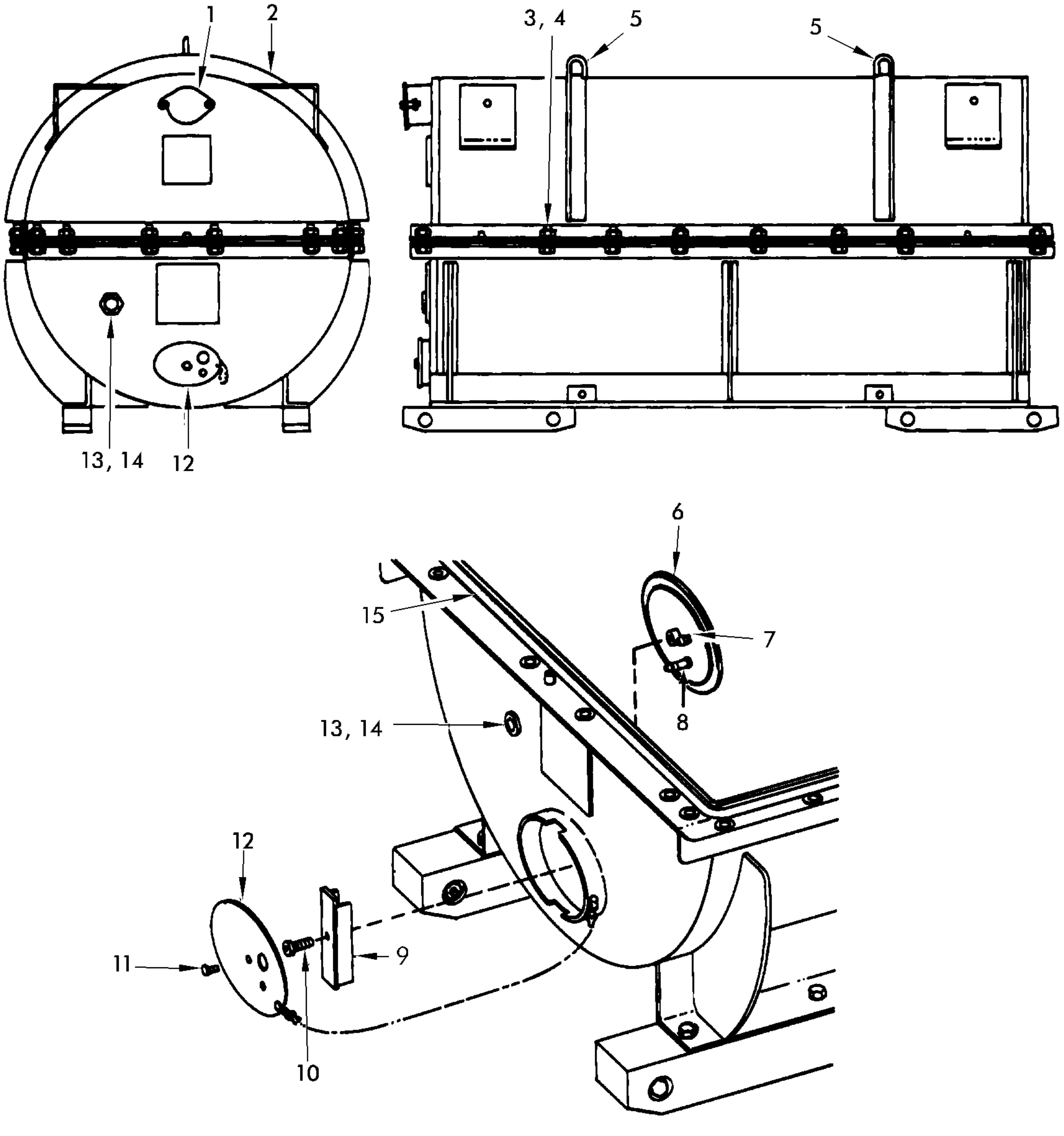
1-59. INSTALLATION OF SHIPPING AND STORAGE CONTAINER COVER.

WARNING

Using Hoisting Devices

- Do not exceed load capacity rating marked on hoist.
- Inspection and testing for cracks and defects in hoisting system shall be performed on a regular basis, and according to applicable safety and inspection requirements manual.
- Use only pins, links, and hooks recommended for hoisting specific components.
- Before hoisting, balance the load.
- Do not stand under load while it is being moved from one area to another on a hoist. Do not stand under load to do maintenance work.
- Hoisting devices made of nylon, polyester, polypropylene, or aluminum shall not be used in areas where caustics are handled.

a. Attach lifting cable (1, fig. 1-33) to lifting eyes (2).



1. Records Receptacle
2. Container Cover
3. Bolts (Qty-30)
4. Nuts (Qty-30)
5. Lifting Eyes
6. Desiccant Cover (Hand-Hole)
7. Relief Valve
8. Air-Filler Valve
9. Clamping Bar
10. Bolt
11. Bolt
12. Access Cover
13. Humidity Indicator
14. Hex Insert
15. Gasket

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Figure 1-40. Shipping and Storage Container 8145CON004-1; Inspection of Relative Humidity Indicator

b. Attach hoist to lifting cable. Raise container cover (3) to a position directly over bottom half of container.

c. Wipe mating flanges and gasket of container halves with clean cloth to remove any dirt or particles which could prevent pressure sealing. Inspect gasket (15) for nicks, cuts, and gouges. If gasket is damaged, replace it. Then lower hoist until container halves are joined.

d. Secure container halves using 30 bolts (4), installed head down, and 30 nuts (5). Torque bolts to 70-75 foot-pounds.

e. Store engine records in record receptacle (9).

f. Pressurize container to 5 psig at air-filler valve (7) using dry, filtered, compressed air.

g. Using Leak Test Oxygen System Solution, (item 98, Appendix D) inspect container for leaks at the following locations:

- At air filler valve (7)
- At humidity indicator (8)
- Between container mating flanges

h. If leak is seen between container mating flanges, check torque (70-75 foot-pounds) on bolts (4). Then repeat leak check. If a leak is still seen, depressurize container (para 1-49), replace gasket (15, fig. 1-40), and pressurize container (step f). Repeat leak check.

i. If leak is seen at other inspection locations (step g), depressurize container (para 1-49), replace defective part, and pressurize container (step f). Repeat leak check.

1-60. INSPECTION OF RELATIVE HUMIDITY INDICATOR IN SHIPPING AND STORAGE CONTAINER 8145CON004-1.

a. Check relative humidity not later than 30 days following engine installation into shipping and storage container, or as prescribed by the Unit Commander.

b. Examine relative humidity by checking color of humidity indicator (13, fig. 1-40) (see paragraph 1-206, step c).

c. If relative humidity is less than 40%, but greater than 30%, record inspection in engine records, but change inspection interval to 1 week.

d. If relative humidity is 40% but less than 50%, record inspection in engine records, depressurize container (para 1-49), and replace desiccant as follows:

WARNING

Depressurizing Shipping and Storage Container

- Do not loosen nuts and bolts that secure cover until container has been depressurized.
- Do not remove valve core until air can no longer be heard escaping from container.

(1) Depressurize container by pressing center of air filler valve (7) until air can no longer be heard escaping from container; then remove core of air filler valve.

(2) After pressure has been released, reinstall core of air filler valve.

(3) Remove bolt (11).

(4) Remove access cover (12).

(5) Remove bolt (10) and clamping bar (9).

(6) Remove desiccant cover (6).

(7) Remove old desiccant.

(8) Place four 16-unit bags of desiccant (item 70, Appendix D) in basket (13, fig. 1-36).

(9) Install desiccant cover (6, fig. 1-40).

(10) Install clamping bar (9) and bolt (10). Torque bolt to 35-42 inch-pounds.

(11) Install access cover (12) and bolt (11). Torque bolt to 30-60 inch-pounds.

(12) Apply 5 psig of air pressure to air-filler valve (8) using a source of dry, filtered, compressed air.

(13) Using Leak Test Oxygen System Solution (item 98, Appendix D), inspect container for leaks at the following locations:

- At air filler valve (8)
- At humidity indicator (13)
- Between container mating flanges

(14) If leak is seen between container mating flanges, check torque (70-75 foot-pounds) on bolts (3). Then repeat leak check. If a leak is still seen, depressurize container (para 1-49), replace gasket (15, fig. 1-40), and pressurize container (step (12)). Repeat leak check.

(15) If leak is seen at other inspection locations (step (13)), depressurize container (para 1-49), replace defective part, and pressurize container (step (12)). Repeat leak check.

e. If relative humidity is 50% do the following:

(1) Remove container cover (para 1-49).

(2) Inspect gasket (15) for nicks, cuts, and gouges. If gasket is damaged, replace it.

(3) Carefully inspect engine exterior for signs of corrosion:

(a) If there are no signs of corrosion, change desiccant (step d), replace humidity indicator card (para 1-58, step n), and reinstall container cover (para 1-59).

(b) If there are signs of corrosion, change desiccant (step d), reinstall container cover (para 1-59), and send engine to Depot for detailed inspection and repair.

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

1-61. TEN-HOUR/FOURTEEN-DAY INSPECTION REQUIREMENTS (THIR).

1-62. This paragraph contains the ten-hour/fourteen-day inspection requirements for the T700-GE-700, T700-GE-701, T700-GE-701C, or for the T700-GE-701D turbine engine. It does not contain instructions for repair, adjustment, or correcting any problems, nor does it contain instructions for troubleshooting. Specific tolerances, limits, etc., can be found in applicable chapters. A ten-hour inspection is done every ten flight hours or every fourteen days, whichever comes first. The ten-hour flight intervals may be extended to complete the day's mission, but the ten-hour inspection must be done before starting the next day's flight. The inspection requirements listed in table 1-8 are to make sure that defects are found and corrected before malfunctions or serious trouble happens.

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-701, T700-GE-701C and T700-GE-701D	**(T701, T701C, T701D)**

1-63. DA Form 2408-13-1 (Aircraft Inspection and Maintenance Record) will be used to record all problems found during ten-hour/fourteen-day inspection.

Table 1-8. Ten-Hour/Fourteen-Day Inspection Checks

Item	Inspect
1.	Oil tank level.
2.	Oil tank filler cap for proper installation (cap release is down and locked).
3.	Electrical cables for chafing, and for broken, or missing brackets or clamps.
4.	Connectors for security.
5.	Fuel, oil, and air tubes and hoses for security, evidence of chafing, or leakage. Broken or missing clamps.
6.	PAS and LDS actuation controls for security. Anti-ice bleed and start valve clips are in place.
7.	V-band clamps on HMU, particle separator blower, and customer bleed piping for security.
8.	Exterior of engine, HMU and oil cooler for oil, fuel, and evidence of air leaks, missing or broken bolts and nuts.
9.	Oil filter for impending bypass indication. (Button must not be popped.)
10.	Fuel filter for impending bypass indication. (Button must not be popped.)
11.	Engine mounts for security.

Table 1-8. Ten-Hour/Fourteen-Day Inspection Checks (Cont)

Item	Inspect
12.	Manually check full engagement of quick-release pins in HMU and anti-ice bleed and start valve linkage. Pull on quick-release pin and rotate pin 360° in approximately 30° arc segments. If quick-release pins are loose (release pin “c” rings offer little or no resistance to removal of the pin) inspect connecting linkage pin holes for elongation.
13.	Engine inlet (refer to limits in para 1-284) and exhaust for foreign objects or foreign object damage (FOD).
14.	P3 line to HMU for cracks.
15.	**(T700, T701)** Turbine case for cracks and for loose or broken (check by hand only) stage 3 turbine nozzle bolts.
16.	Oil cooler PNs 6044T95P01 or 6044T95P02 for fuel or oil leak from the weep hole at the 12 o'clock position.

1-64. PERIODIC INSPECTION REQUIREMENTS.

1-64.1. (250 FLIGHT HOUR INSPECTION) The requirements for the 250 flight hour inspection is to check the HMU P3 fitting (para 1-138) on Hamilton Standard HMUs with the following part numbers:

Hamilton Standard PN	GE PN
763700-1	4046T52G01
763700-3	4046T52G04
763700-7	4046T52G06
763700-10	4046T52G08
763700-11	4046T52G10
763700-12	4046T52G09
763700-14	4046T52G12
763700-15	4046T52G11
763700-17	4046T52G14

1-65. (500 FLIGHT HOUR INSPECTION) A periodic inspection will be made after engine has run for 500 flight hours since the last periodic inspection. It can be made with the engine installed in the aircraft or on the maintenance trailer. The inspection consists of checking certain components, areas, and systems of the engine. The periodic inspection will be made to find out whether there are conditions which, if not corrected, could result in failure of a component. During the inspection, maintenance personnel should observe both the engine and other components in the engine bay area for obvious defects. These defects will also be reported and corrected.

1-66. The requirements for periodic 500 flight hour inspection are as follows:

a. Clean compressor (para 1-165).

b. Do the tasks of ten-hour/fourteen-day inspection (table 1-8).

CAUTION

Do not immerse particle separator blower in dry cleaning solvent. Otherwise, packed bearing will be damaged.

c. Check particle separator blower for damage to the blower impeller by removing blower and visually inspecting impeller (para 5-13).

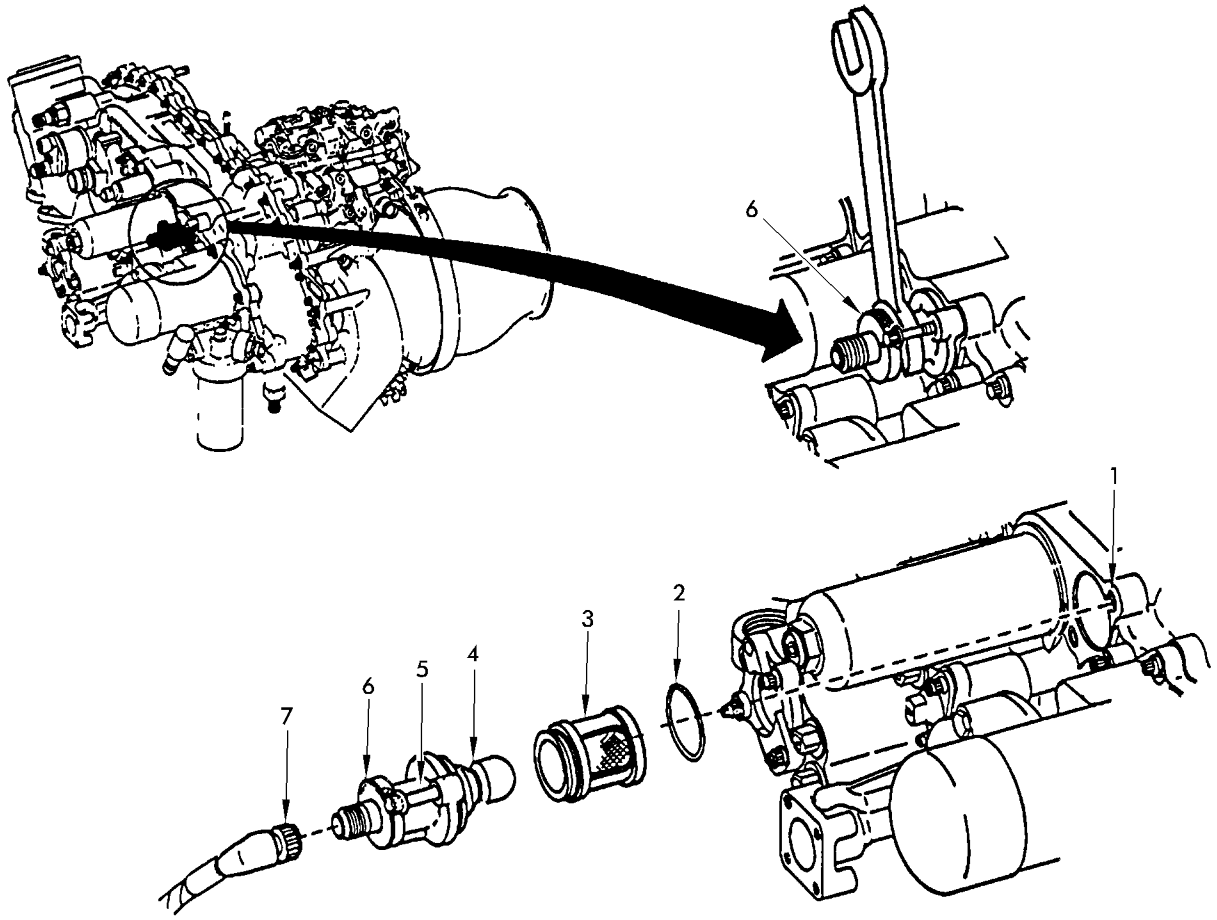
d. Remove, inspect, clean, and reinstall electrical chip detector (6, fig. 1-41) as follows:

(1) Disconnect electrical connector (green cable) (7).

(2) Cover electrical connector (green cable) (7) using clean, dry protective cap (item 28, Appendix D). Cover electrical connector of chip detector (6) using clean, dry protective cap (item 24, Appendix D).

(3) Loosen two captive bolts (5).

(4) Grasp knurled end of chip detector (6); pull and remove chip detector. If necessary, insert a 15/16-inch, open-end wrench between knurled flange and seating flange on chip detector. Hold wrench firmly in one hand and tap wrench with the other until electrical chip detector can be removed.



1. Gearbox Mounting Flange
2. Preformed Packing
3. Screen
4. Detecting Gap
5. Captive Bolt (Qty-2)
6. Electrical Chip Detector
7. Electrical Connector (Green Cable)

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Figure 1-41. Electrical Chip Detector; Removal and Installation

(5) Remove and discard preformed packing (2).

CAUTION

Handle electrical chip detector carefully to avoid disturbing any debris that may be on detector.

(6) Grasp knurled end of electrical chip detector in one hand and grasp screen (3) in the other. Unscrew the screen counterclockwise.

(7) If debris is on detector, troubleshoot as directed in troubleshooting procedure 46. Check detector to be sure that electrical circuit of chip detector is working (para 1-90).

(8) Clean chip detector (para 8-53).

(9) Install electrical chip detector as follows:

(a) Thread screen (3) into chip detector and hand-tighten it.

(b) Install packing (2) onto chip detector.

(c) Insert chip detector into gearbox mounting flange (1).

(d) Install two captive bolts (5). Torque bolts to 45-50 inch-pounds.

(e) Remove caps from electrical connector (green cable) (7) and from connector on electrical chip detector.

(f) Connect electrical connector (7) to chip detector (6).

e. Do the circuit checks at S39 connector on ECU or DEC (para 1-79).

f. Do an alternator check (para 1-82, step b) and yellow cable check (para 1-82, step c).

g. Do an idle speed leakage check (para 1-139).

h. Deleted.

1-67. RETIREMENT SCHEDULE FOR LIFE-LIMITED PARTS.

Table 1-9 lists life-limited parts which have an established operating interval before they are retired from service.

Table 1-9. Retirement Interval for Life-Limited Parts

WARNING

Flight Safety Critical Aircraft Parts
(Critical Characteristics)

T700 engines contain Flight Safety Critical Aircraft Parts, primarily rotating parts, which if not removed at their life limit could result in their castastrophic, uncontained failure leading to the possible loss of aircraft and/or crew. Service life is a critical characteristic.

Engine	Part Number	NSN	Retirement Interval
T700-GE-700	6035T00G01	2840-01-070-1003	See table 1-10
T700-GE-701	6044T06G01	2840-01-114-2211	See table 1-11
T700-GE-701C	6071T24G01	2840-01-284-4011	See table 1-11.1
T700-GE-701D	5130T00G01	2840-01-503-1701	See table 1-11.2

1-68. Life-Limit Procedures.

a. The purpose of this paragraph is to provide instructions for determining and recording T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D engine life-limited components. These instructions are effective until all life-limited components listed in tables 1-10 **(T700)**, 1-11 **(T701)**, 1-11.1 **(T701C)**, and 1-11.2 **(T701D)** are removed from service.

b. History: Life of **T700** component parts was previously tracked by a combination of engine hours and Low Cycle Fatigue (LCF) counts since new. This data was determined from readings on the engine history recorder **(T700, T701)** or the history counter **(T701C, T701D)**. Whichever of these values occurred first was cause for part removal. However, only the **T700** and **T701** stages 1 and 2 gas generator rotors and the inlet particle separator blower had published LCF curves; therefore, all other component parts were tracked solely by engine hours since new.

c. Current: Determining component life through use of history recorder LCF readings is no longer a requirement. However, tracking of history recorder/counter readings are still necessary for future periodic engineering life assessment to prevent overly conservative life analysis assumptions. The life-limit values shown in the tables below are based solely on engine operating time since new as determined from each engine's history counter/recorder “Operating Hour” index window.

(1) Life limits shown in tables 1-10, 1-11, 1-11.1, and 1-11.2 may be adjusted by up to plus/minus 100 engine operating hours at the Unit Maintenance Officer's discretion to accommodate other periodic or unscheduled maintenance activities. Units may not exceed plus 100 hours without written approval from AMCOM engineering. If required, contact the nearest AMCOM LAR for guidance.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

T700 Engines contain Flight Safety Critical Aircraft Parts (FSCAP), primarily rotating parts, which if not removed at their life limit could result in their catastrophic, uncontained failure leading to the possible loss of aircraft and/or crew. Service life is a critical characteristic.

(2) Most of the life-limited parts listed in tables 1-10, 1-11, 1-11.1, and 1-11.2 are Flight Safety Critical Aircraft Parts (FSCAP). All FSCAP are not shown in these tables. FSCAP applicable to AVUM and AVIM can be found in table 1-1 of this TM. FSCAP applicable to depot maintenance can be found in DMWR 1-2840-248-1/-2, which includes tables 1-10, 1-11, 1-11.1, and 1-11.2.

(3) Gas generator stators are not life limited and are removed and replaced whenever the gas generator rotors are removed and replaced. Life-limit removal time for the rotors is dictated by the lowest life installed component such as cooling plate or rotor disk. Likewise, other engine modules or assemblies are removed at the lowest life of any installed part such as a blisk, shaft, etc.

WARNING

If a nomenclature component in table 1-10, 1-11, 1-11.1, or 1-11.2 is found in service with a part number not listed in the tables, contact the nearest AMCOM LAR for guidance.

d. Procedure: Determine the engine operating hours from the engine history recorder **(T700, T701)** or the history counter **(T701C, T701D)**. If the history recorder/counter is not the original installed on the engine, determine from the engine records the corrected total engine operating time since new (current recorder or counter time plus previous operating time). If the history recorder or counter is inoperative, see paragraph 1-70 for upgrading the readings. Compare operating hours from original recorder/counter, or corrected operating hours if recorder/counter is not original, or updated operating hours if recorder/counter was inoperative, against the values specified in life tables. Remove the life-limited component at the specified time, plus/minus 100 engine hours. Frequent monitoring of the recorder or counter may be required to comply with the established life limits.

NOTE

ULLS-A users will use applicable “E” Forms.

e. The following forms are applicable to Life Tracking and are to be completed IAW DA PAM 738-751, dated: 15 MAR 99.

(1) DA Form 2408-5-1 (Equipment Modification Record (Engine)).

(2) DA Form 2408-13 (Aircraft Status Information Record).

(3) DA Form 2408-13-1 (Aircraft Inspection and Maintenance Record).

(4) DA Form 2408-15 (Historical Record For Aircraft).

(5) DA Form 2408-16-1 (Engine Component Historical Record).

(6) DA Form 2410 (Component Removal and Repair/Overhaul Record) (If Engine, Assembly, or Component Removed).

(7) DD Form 1574/DD Form 1574-1 (Serviceable Tag/Label - Materiel (Color Yellow)).

(8) DD Form 1575/DD Form 1575-1 (Suspended Tag/Label - Materiel (Color Brown)).

(9) DD Form 1577/DD Form 1577-1 (Unserviceable (Condemned) Tag/Label - Materiel (Color Red)).

(10) DD Form 1577-2/DD Form 1577-3 (Unserviceable (Reparable) Tag/Label - Materiel (Color Green)).

Table 1-10. T700-GE-700 Engine Life-Limited Components

Nomenclature	Part Number	Service Life-Hours
Particle Separator Blower	6034T62P11	1,000
Particle Separator Blower	6034T62P15	1,000
Stage 1 Blisk	6032T26G08	5,000
Stage 1 Blisk	6032T26G09	5,000
Stage 2 Blisk	6032T27P07	5,000
Stage 2 Blisk	6032T27P08	5,000
Stage 3 and 4 Blisk	6038T08P03	5,000
Stage 3 and 4 Blisk	6038T08P04	5,000
Stage 5 Blisk	6038T09P02	5,000
Stage 5 Blisk	6038T09P03	5,000
Stage 5 Blisk	6038T09P04	5,000
Stage 1 and 2 Spacer	4045T08P01	10,000
Stage 1 and 2 Spacer	4045T08P02	10,000
Stage 1 and 2 Spacer	5066T79P01	10,000
Tie Rod	5043T04P02	10,000
Impeller	6038T74P01	5,000
Impeller	6055T59P01	5,000
Rear Shaft	6035T83P01	5,000
GG Turbine (Forward) Shaft	6035T88P02	11,000
GG Turbine (Forward) Shaft	6035T88P03	11,000
GG Turbine (Forward) Shaft	6035T88P04	11,000
GG Turbine (Forward) Shaft	6035T88P07	11,000
Power Turbine Shaft	5125T92G01	5,000
Power Turbine Shaft	6032T75G12	5,000
Power Turbine Shaft	6043T35G01	5,000
Stage 1 Forward Cooling Plate	6039T53P03	4,000
Stage 1 Forward Cooling Plate	6039T53P04	4,000
Stage 1 Forward Cooling Plate	6039T53P06	4,000
Stage 1 Forward Cooling Plate	6039T53P07	4,000
Stage 1 Forward Cooling Plate	6064T81P01*	5,000
Stage 2 Forward Cooling Plate	6039T52P03	4,000
Stage 2 Forward Cooling Plate	6039T52P05	4,000
Stage 2 Forward Cooling Plate	6039T52P06	4,000
Stage 2 Forward Cooling Plate	6064T83P01*	5,000

Table 1-10. T700-GE-700 Engine Life-Limited Components (Cont)

Nomenclature	Part Number	Service Life-Hours
Stage 1 Aft Cooling Plate	6039T50P03	4,000
Stage 1 Aft Cooling Plate	6039T50P04	4,000
Stage 1 Aft Cooling Plate	6039T50P06	4,000
Stage 1 Aft Cooling Plate	6039T50P07	4,000
Stage 1 Aft Cooling Plate	6064T82P01*	5,000
Stage 2 Aft Cooling Plate	6039T51P03	2,500
Stage 2 Aft Cooling Plate	6039T51P05	2,500
Stage 2 Aft Cooling Plate	6039T51P06	2,500
Stage 2 Aft Cooling Plate	6064T84P02*	5,000
Stage 1 Disk	6043T62P02	2,500
Stage 1 Disk	6043T62P03	1,100
Stage 1 Disk	6043T62P04	1,100
Stage 1 Disk	6064T85P01*	5,000
Stage 1 Disk	6064T85P02*	5,000
Stage 2 Disk	6043T63P01	2,500
Stage 2 Disk	6043T63P02	1,100
Stage 2 Disk	6043T63P03	1,100
Stage 2 Disk	6064T86P01*	5,000
Stage 2 Disk	6064T86P02*	5,000
Stage 3 Disk	6038T32P01	5,000
Stage 3 Disk	6038T32P02***	5,000
Stage 4 Disk	6038T34P02	5,000
Stage 4 Disk	6038T34P03	5,000
Stage 4 Disk	6038T34P05	5,000
Stage 4 Disk	6038T34P06***	5,000
Stator, Gas Generator	6039T57GXX All	**

* Denotes 270 Mesh R95 Material

** Denotes Stator has no life limits. Remove and replace with replacement of Gas Generator Rotor as an assembly.

*** Denotes disk is shot peened.

Table 1-11. T700-GE-701 Engine Life-Limited Components

Nomenclature	Part Number	Service Life-Hours
Particle Separator Blower	6034T62P11	1,000
Particle Separator Blower	6034T62P15	1,000
Stage 1 Blisk	6043T56G01	5,000
Stage 1 Blisk	6043T56G02	5,000
Stage 2 Blisk	6032T27P07	5,000
Stage 2 Blisk	6032T27P08	5,000
Stage 3 and 4 Blisk	6038T08P03	5,000
Stage 3 and 4 Blisk	6038T08P04	5,000
Stage 5 Blisk	6038T09P02	5,000
Stage 5 Blisk	6038T09P03	5,000
Stage 5 Blisk	6038T09P04	5,000
Stage 1 and 2 Spacer	4045T08P01	10,000
Stage 1 and 2 Spacer	4045T08P02	10,000
Stage 1 and 2 Spacer	5066T79P01	10,000
Tie Rod	5043T04P02	10,000

Table 1-11. T700-GE-701 Engine Life-Limited Components (Cont)

Nomenclature	Part Number	Service Life-Hours
Impeller	6038T74P01	5,000
Impeller	6055T59P01	5,000
Rear Shaft	6035T83P01	5,000
Rear Shaft	6035T83P03	5,000
Rear Shaft	6080T48P01	5,000
GG Turbine (Forward) Shaft	6035T88P03	11,000
GG Turbine (Forward) Shaft	6035T88P04	11,000
GG Turbine (Forward) Shaft	6035T88P05	11,000
GG Turbine (Forward) Shaft	6068T44P01	11,000
GG Turbine (Forward) Shaft	6068T44P02	11,000
Power Turbine Shaft	5125T92G01	5,000
Power Turbine Shaft	6043T34G01	5,000
Stage 1 Forward Cooling Plate	6044T88P02	3,500
Stage 1 Forward Cooling Plate	6044T88P03	3,500
Stage 1 Forward Cooling Plate	6064T08P01*	7,000
Stage 2 Forward Cooling Plate	6055T25P01	2,800
Stage 2 Forward Cooling Plate	6064T10P01*	5,000
Stage 1 Aft Cooling Plate	6044T92P03	2,800
Stage 1 Aft Cooling Plate	6064T09P01*	7,000
Stage 2 Aft Cooling Plate	6055T24P01	2,800
Stage 2 Aft Cooling Plate	6064T07P02*	5,000
Stage 2 Aft Cooling Plate	6064T07P05*	5,000
Stage 1 Disk	6053T18P03	7,000
Stage 1 Disk	6064T06P01*	7,000
Stage 1 Disk	6064T06P03*	7,000
Stage 2 Disk	6053T19P04	5,000
Stage 2 Disk	6064T12P01*	7,000
Stage 2 Disk	6064T12P03*	7,000
Stage 3 Disk	6038T32P01	5,000
Stage 3 Disk	6038T32P02***	5,000
Stage 4 Disk	6038T34P02	5,000
Stage 4 Disk	6038T34P03	5,000
Stage 4 Disk	6038T34P05	5,000
Stage 4 Disk	6038T34P06***	5,000
Stator, Gas Generator	6053T36GXX All	**

* Denotes 270 Mesh R95 Material

** Denotes Stator has no life limits. Remove and replace with replacement of Gas Generator Rotor as an assembly.

*** Denotes disk is shot peened.

NOTE

The following constitute a small number of T700-GE-701 parts fielded during the very early engine production run for the Apache aircraft. These parts are life limited but should no longer be in service. If any of these parts are discovered to be in service, contact your local LAR immediately for guidance or contact AMCOM Propulsion Engineering at AC 256-313-4982/4983/4985 or DSN 897-4982/4983/4985. Cooling plates can be identified from their part number alone. Bolts and counter-balance weights that are life limited can be identified by referring to the gas generator rotor assembly part number. All PN 6053T40G01 and P/N 6053T40G04 rotor assemblies contain these life-limited parts.

Table 1-11. T700-GE-701 Engine Life-Limited Components (Cont)

Nomenclature	Part Number	Service Life-Hours
Plate, Cooling Turbine Rear Stage 1	2840-01-140-6736	PN 6044T92P02
Plate, Cooling Turbine Forward Stage 2	2840-01-140-6733	PN 6044T93P02
Plate, Cooling Turbine Rear Stage 2	2840-01-140-6734	PN 6044T94P02
Bolt, Shoulder Stage 1	5306-01-137-5732	PN 4069T77P01
Weight, Counter-Balance Stage 1	2840-01-143-3366 Thru 2840-01-143-3368 2840-01-143-3376 Thru 2840-01-143-3382	PN 4076T08P01 Thru PN 4076T08P10

Table 1-11.1 T700-GE-701C Engine Life-Limited Components

Nomenclature	Part Number	Service Life-Hours
Particle Separator Blower	6034T62P11	1,000
Particle Separator Blower	6034T62P15	1,000
Stage 1 Blisk	6043T56G01	5,000
Stage 1 Blisk	6043T56G02	5,000
Stage 2 Blisk	6032T27P08	5,000
Stage 3 and 4 Blisk	6038T08P04	5,000
Stage 5 Blisk	6038T09P03	5,000
Stage 5 Blisk	6038T09P04	5,000
Stage 1 and 2 Spacer	4045T08P01	10,000
Stage 1 and 2 Spacer	5066T79P01	10,000
Tie Rod	5043T04P02	10,000
Impeller	6055T59P03	5,000
Rear Shaft	6035T83P03	5,000
Rear Shaft	6080T48P01	5,000
GG Turbine (Forward) Shaft	6035T88P05	11,000
GG Turbine (Forward) Shaft	6068T44P01	11,000
GG Turbine (Forward) Shaft	6068T44P02	11,000
Power Turbine Shaft	5125T92G01	5,000
Power Turbine Shaft	6043T35G01	5,000
Stage 1 Forward Cooling Plate	6064T08P01	7,000
Stage 2 Forward Cooling Plate	6064T10P01	5,000
Stage 1 Aft Cooling Plate	6064T09P01	7,000
Stage 2 Aft Cooling Plate	6064T07P02	5,000
Stage 2 Aft Cooling Plate	6064T07P05	5,000
Stage 1 Disk	6064T06P01	7,000
Stage 1 Disk	6064T06P03	7,000
Stage 2 Disk	6064T12P01	7,000
Stage 2 Disk	6064T12P03	7,000
Stage 3 Disk	6038T32P01	5,000
Stage 3 Disk	6038T32P02***	5,000
Stage 4 Disk	6038T34P05	5,000
Stage 4 Disk	6038T34P06***	5,000
Stator, Gas Generator	6068T48GXX All	**

** Denotes Stator has no life limits. Remove and replace with replacement of Gas Generator Rotor as an assembly.
*** Denotes disk is shot peened.

Table 1-11.2 T700-GE-701D Engine Life-Limited Components

Nomenclature	Part Number	Service Life-Hours
Particle Separator Blower	6034T62P11	1,000
Particle Separator Blower	6034T62P15	1,000
Stage 1 Blisk	6043T56G01	5,000
Stage 1 Blisk	6043T56G02	5,000
Stage 2 Blisk	6032T27P08	5,000
Stage 3 and 4 Blisk	6038T08P04	5,000
Stage 5 Blisk	6038T09P03	5,000
Stage 5 Blisk	6038T09P04	5,000
Stage 1 and 2 Spacer	4045T08P01	10,000
Stage 1 and 2 Spacer	5066T79P01	10,000
Tie Rod	5043T04P02	10,000
Impeller	6055T59P03	5,000
Rear Shaft	6035T83P03	5,000
Rear Shaft	6080T48P01	5,000
GG Turbine (Forward) Shaft	6035T88P05	11,000
GG Turbine (Forward) Shaft	6068T44P01	11,000
GG Turbine (Forward) Shaft	6068T44P02	11,000
Power Turbine Shaft	5125T92G01	5,000
Power Turbine Shaft	6043T35G01	5,000
Stage 1 Forward Cooling Plate	6064T08P03	7,000
Stage 2 Forward Cooling Plate	4106T80P01	5,000
Stage 1 Aft Cooling Plate	6064T09P01	7,000
Stage 2 Aft Cooling Plate	6064T07P06	5,000
Stage 1 Disk	6064T06P01	7,000
Stage 1 Disk	6064T06P03	7,000
Stage 2 Disk	6064T12P01	7,000
Stage 2 Disk	6064T12P03	7,000
Stage 3 Disk	6038T32P01	5,000
Stage 3 Disk	6038T32P02***	5,000
Stage 4 Disk	6038T34P05	5,000
Stage 4 Disk	6038T34P06***	5,000
Stator, Gas Generator	6068T48GXX All	**

** Denotes Stator has no life limits. Remove and replace with replacement of Gas Generator Rotor as an assembly.

*** Denotes disk is shot peened.

1-69. (T700) Life-Limits for Particle Separator Blowers PN 6034T62P11 and PN 6034T62P15.

These early production blowers were susceptible to Low Cycle Fatigue (LCF) and their life was tracked by cumulative LCF1 and LCF2 History Recorder Counts compared to a LCF curve and by total accrued operating hours as determined from the recorder. These blowers should no longer be in service. If encountered, they may continue to be used provided their total operating time has not exceeded the revised value shown in the tables above. LCF tracking is no longer a requirement and therefore the LCF curve has been deleted. These life-limited blowers have also been added to the engine Table 1-11.1 **(T701C)** or 1-11.2 **(T701D)** because of their interchangeability with all other blowers.

1-70. Correction of History Recorder or History Counter Readings.

a. Readings must be corrected if:

(1) The history recorder or counter is not the original installed on the engine.

(2) The recorder or counter has been inoperative. Uncorrected readings are in general, meaningless, and should not be transmitted outside the organization. Further, they can distort engine data calculations needed for legitimate purposes such as life or logistics planning.

b. Use DA Form 2408-16-1 to determine the total cumulative LCF-l and LCF-2 counts. If there is no DA Form 2408-16-1, contact AMCOM, AMSAM-MMC-MA-NM, DSN 897-2410, 788-6092, 788-6098, or 788-6091 or Commercial (256) 313-2410 for recorder or counter readings from historical DA Form 2410 file.

c. Calculate the total cumulative counts of LCF-1 and LCF-2 as follows:

(1) Subtract counts of line 2 on DA Form 2408-16-1 from latest (monitored) history recorder or counter reading.

(2) Add answer to step (1) to counts on line 1. The total is the actual cumulative counts on the component.

d. Updating readings after a history recorder or counter failure.

(1) If both history recorders (or counters) have failed and replacement recorders (or counters) are not available, go to step e.

(2) When one history recorder (or counter) fails, do the following:

(a) Record the following information in block 14 of the engine DA Form 2408-16-1:

- Faulty history recorder serial number_______________________
- Date failed _________________________
- Aircraft hours ______________________

Record the following X readings:

- LCF-1 = ___________________________
- LCF-2 = ___________________________
- INDEX = __________________________
- HOURS = _________________________
- Functioning history recorder (or counter) serial number ______________________

Record the following Y readings:

- LCF-1 =___________________________
- LCF-2 =___________________________
- INDEX =__________________________
- HOURS =__________________________

(b) To determine the readings of the faulty history recorder (or counter) after engine has run for a period of time, subtract the above Y readings from current Y readings and add the difference to the X readings.

(c) When the faulty history recorder (or counter) is replaced, subtract the above Y readings from the current Y readings and add the difference to the X readings and enter on DA Form 2408-16-1, line 3.

(d) When Depot facilities discover a faulty history recorder (or counter), contact AMCOM, AMSAM-MMC-MA-NM, DSN 897-2410, 788-6092, 788-6098, or 788-6091 or Commercial (256) 313-2410 to reconstruct the history recorder (or counter) readings from AMCOM databases.

e. If both recorders (or counters) have failed and replacements are not available in supply, perform the following tasks:

(1) Determine when the recorder (or counter) failed. Make an entry in block 14 of the engine DA Form 2408-16-1 for each engine, recording the date failed, history recorder (counter) serial number, aircraft hours, LCF-1, LCF-2, index, and operating hours at time of failure.

(2) Subtract the aircraft hours at failure from the current aircraft hours. Use these hours with the following formula to determine history recorder (or counter) counts since failure.

LCF-1 = 1 count per hour

LCF-2 = 2 counts per flying hour

Engine Hours = 1.1 x Aircraft Hour

INDEX =

(T700) 4 counts per flying hour

(T701) 11 counts per flying hour

(T701C, T701D) 4 counts per flying hour

(T701C, T701D) 11 counts per flying hour

(3) Add the results of the factoring to the readings on the failed recorders (or counters). This is the calculated current history recorder or counter readings.

(4) Go to the DA Form 2408-16-1 and subtract line 2 from the calculated history recorder (or counter) reading. Add to the entries on line 1. This is the total cumulative counts.

f. For technical information contact the nearest AMCOM LAR for guidance.

Figures 1-42 through 1-47 Deleted.

Pages 1-89 through 1-98 Deleted.

Section VI. TROUBLESHOOTING (ENGINE INSTALLED IN AIRCRAFT)

1-71. GENERAL INFORMATION.

Troubleshooting procedures are used to locate and correct faults. Use of these procedures and the following information will reduce delays and maintenance downtime, and will also reduce unnecessary replacement of engine parts.

NOTE

Two basic things have been assumed in these procedures:

- The correct operating procedures have been followed.
- The fault is caused by a single failure.

a. Troubleshooting procedures are in logic-diagram format and ask a question which is answered by a yes or no. The answer will lead either to another question or to a final solution.

b. The aircraft inspection and maintenance form 2408-13 will best describe the main point of the problem. Get as much information as possible from this form. In many cases, this information will describe the fault completely. If possible, the fault should be confirmed by a ground run, providing there is no danger of causing engine damage.

c. The troubleshooting procedure lists the parts which might cause the fault. The cockpit readings can often reveal which of these parts is causing the fault.

d. Use caution to avoid problems caused by false cockpit readings. In most cases, you can find a false reading by checking it against other readings.

e. The troubleshooting procedure lists the action to be taken to correct the fault.

f. Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

g. Preserve the engine (para 1-206) before removing it from aircraft.

h. Refer to applicable aircraft maintenance manual which contains aircraft troubleshooting procedures.

i. See figure FO-2 (located directly after alphabetical index) for a schematic diagram of the engine electrical system and location of electrical connectors.

j. In areas where a difference between the nomenclature on UH-60A, UH-60L, and AH-64A cockpit instrument panels and controls is found, common nomenclature is used (refer to table 1-12).

k. Any fluctuation or spiking of engine related parameters, such as Ng speed, Np speed, Torque, or TGT may be due to dirty or inadequately secured electrical connectors. Such engine and airframe electrical connectors will be disconnected, inspected, and cleaned prior to the next engine test and prior to any LRU component removal.

l. The following is an outline of procedures to follow when troubleshooting.

(1) If possible, confirm the reported fault with a ground test run.

(2) Troubleshoot according to the symptoms.

(3) Complete the checks required in paragraph 1-127.

(4) Confirm fault has been fixed with a ground run.

m. If aircraft has a failed aircraft high speed output driveshaft, do maintenance required in paragraph 1-283.

Table 1-12. Cross-Reference List of Nomenclature on Cockpit Instrument Panels and Controls

Common Nomenclature	UH-60A, UH-60L Nomenclature	AH-64A Nomenclature
engine anti-ice switch	ENG ANTI-ICE switch	ANTI-ICE switch
engine ignition switch	ENGINE IGNITION switch	MASTER IGN switch
engine oil pressure	ENG OIL PRESS	ENG OIL PSI × 10
power control lever (PCL)	ENG POWER CONT lever	PWR lever
% rpm Np	% RPM	ENG-RTR RPM %
% torque	% TRQ	TORQUE %
fuel filter bypass	FUEL FILTER BYPASS	FUEL FTR BYP
engine chip detector	CHIP ENGINE	CHIPS ENG
oil filter bypass	OIL FLTR BYPASS	OIL FTR BYP
flight idle	FLY	FLY
ground idle	IDLE	IDLE

1-72. SYMPTOM INDEX (AIRCRAFT).

See table 1-13 for a list of troubleshooting symptoms.

Table 1-13. Symptom Index (Aircraft)

Symptom	Troubleshooting Procedure
ANTI-ICING SYSTEM	
Engine Anti-Ice Advisory Light OFF with Engine Anti-Ice Switch ON and with % Ng at or Slightly Above Limit Line of Figure 1-118	1
Engine Anti-Ice Advisory Light Remains ON at HIT Check or at Higher Power with Engine Anti-Ice Switch OFF	2
ENGINE	
Engine Flames Out During Ground Operation (combustion stops indicated by a drop in TGT)	3 3.1
NOTE Hydromechanical Unit flameouts are more likely to occur when fuel is hot and the HMU is heat soaked.	
Engine Flames Out During In-Flight Operation (combustion stops indicated by a drop in TGT)	4
(T700) Engine Flames Out During Np Overspeed Check (combustion stops indicated by a drop in TGT)	5
Gas Generator Speed (Ng)	
Ng Does Not Accelerate Above Ground Idle Speed	6
(T701, T701C, T701D) Ng High at Ground Idle Speed	7
*Ng Instrument Fluctuating or Not Indicating (all other instruments normal)	8

* - Refer to paragraph 1-71, step k before starting troubleshooting procedure.

Table 1-13. Symptom Index (Aircraft) (Cont)

Symptom	Troubleshooting Procedure
Ng Low at Ground Idle Speed (idle speed is below limits in Table 1-17 **(T700)** and Table 1-18 **(T701, T701C, T701D)**)	9
Uncontrolled Deceleration (Ng) (Ng and TGT decrease without retarding PCL or collective pitch)	10
(T700, T701) History Recorder or **(T701C, T701D)** History Counter	
(T700, T701) History Recorder Malfunction (engine time function inoperative).	11
(T701C, T701D) History Counter Malfunction (engine time function inoperative)	12
(T700, T701) History Recorder Malfunction (LCF function inoperative)	13
(T701C, T701D) History Counter Malfunction (LCF 1 function inoperative)	14
(T701C, T701D) History Counter Malfunction (LCF 2 function inoperative)	15
(T700, T701) History Recorder Malfunction (one or more functions inoperative)	16
(T701C, T701D) History Counter Malfunction (more than one function inoperative)	17
(T700, T701) History Recorder Malfunction (time temperature function inoperative)	18
History Counter Malfunction (time temperature function inoperative)	19
Power Turbine Speed (Np)	
Abnormal Np/Nr Rollback During Collective Application (with engines not at power limit condition)	23
No Np Governing When Advancing PCL to “FLY”	20
Np Does Not Respond to Np Demand Trim (with torque matching normal, Np does not respond to normal Np/Nr trim)	21
*Np Instrument Not Indicating or Fluctuating (all other instruments normal)	22
Stalls	
Stall Above Ground Idle Speed (acceleration or deceleration above ground idle speed)	24
Starting Stalls (audible popping or whining during Ng acceleration to ground idle speed)	25
Starting	
Abnormally High TGT During Start	26
Combustor Rumble During Start	27
No Start (fuel mist seen coming from tailpipe; no rise in TGT)	28
No Start (no compressor rotor rotation).	29
(T700) No Start (no fuel mist seen coming from tailpipe; no rise in TGT)	30
(T700, T701C, T701D) No Start (no fuel mist seen coming from tailpipe; no rise in TGT)	31
Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and idle.)	32
Uncontrolled Acceleration (Ng) (gas generator continues to accelerate beyond ground idle speed)	33

* - Refer to paragraph 1-71, step k before starting troubleshooting procedure.

Table 1-13. Symptom Index (Aircraft) (Cont)

Symptom	Troubleshooting Procedure
Turbine Gas Temperature (TGT)	
Engine Exceeds TGT Operating Limits in “Replace Engine” Area of Figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55	34
Engine Exceeds TGT Operating Limits and is in “Troubleshoot” Area of figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55	35
Engine Overtemperature (exceeds TGT operating limits)	36
TGT Exceeds Limiter Setting (TGT exceeds **(T700, T701)** ECU or **(T701C, T701D)** DEC limiter setting at FAT above **(T700, T701)** 4°C (40°F) or **(T701C, T701D)** –14°C (7°F))	37
*TGT Fluctuates at Ground Idle Speed (idle speed or TGT drifts above and below limits in paragraph 1-125)	38
*TGT Instrument Roll-Back, not Indicating or Fluctuating (TGT roll-back is a differential greater than 30°C. All other instruments normal)	39
<u>FUEL SYSTEM</u>	
Excessive Fuel Leaking from Overboard Drain While Engine is Operating at Ground Idle Speed	40
No Fuel Mist Seen Coming from the Aircraft Common Drain During Engine Prime or Vapor Vent	41
Fuel Filter Bypass Light ON	42
Low Fuel Pressure Caution Light ON Below Flight Idle Speed	43
Low Fuel Pressure Caution Light ON at or Above Flight Idle Speed	44
<u>OIL SYSTEM</u>	
Electrical Chip Detector Light Does Not Go ON During Electrical Chip Detector Circuit Test (para 1-90)	45
Electrical Chip Detector Light ON During Engine Operation	46
Electrical Chip Detector Light ON and No Debris Found	47
Excessive Oil Leakage at Overboard Drain (out-of-Limits)	48
Excessive Oil Leakage at Service Port Scupper	49
High Oil Consumption (over limits)	50
High Oil Level (oil level above full mark on sight glass)	51
High Oil Pressure	52
No Oil Pressure	53
(T700, T701C, T701D) No Oil Temperature	54
Oil Filter Bypass Light Comes ON	55
Oil Pressure Below Limits	56
*Oil Pressure Fluctuates	57
(T700, T701C, T701D) Oil Temperature Exceeds Limits (exceeds normal operating temperature for affected engine)	58
Smoke in Exhaust	59

* - Refer to paragraph 1-71, step k before starting troubleshooting procedure.

Table 1-13. Symptom Index (Aircraft) (Cont)

Symptom	Troubleshooting Procedure
OVERSPEED TEST SYSTEM	
Overspeed (Engine Flames Out) (See Troubleshooting Procedure 5)	
Overspeed Cuts in with One Test Button Depressed	60
Overspeed Test System Will Not Operate (overspeed test system fails to cut back Ng and Np)	61
STEADY-STATE OPERATION - FLIGHT POWER RANGE	

NOTE

- If HMU PN 4046T52G28 or 4046T52G29 (6068T97P07 or 6068T97P08) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU, the opposite engine must be configured with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU. Additionally, both engines must be configured with 5078T29G02 (6080T56P03) or higher DECs.
- If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with 4046T52G30 (6068T97P09) or 4046T52G38 (6068T97P13) HMUs.

ECU or DEC Lockout Mode Inoperative (engine will not respond to ECU or DEC lockout when PCL is advanced to maximum position or engine will not reset from lockout)	62
Low Engine Performance (verified by maximum power check)	63
Stable Operation with ECU or DEC Locked Out (Ng, TGT, and Np fluctuated above and below limits when ECU or DEC was not locked out)	64
TGT Margin Out-of-Limits (from HIT check done according to procedures in applicable aircraft maintenance manual)	65
*Torque and/or TGT Erratic/Fluctuating High/Low or Spiking (not accompanied by engine power changes)	66
***(T700, T701)** ECU Torque and/or TGT Erratic	67
*Torque Instrument Not Indicating or Fluctuating (all other instruments normal)	68
Torque Split (control system malfunctions, which results in a torque split of greater than 5% when both engines are operating below TGT limiter or topping)	69
Torque Split (Engine Goes to Lower Power) (Np/Nr decreases below Np demand setting. Affected engine reduces power and does not respond to an increase in collective pitch.).	70
*Torque Split (Engine Goes to Maximum Power) (Np/Nr exceeds demand setting. Engine goes to maximum power of 97-102% Ng.)	71
*Torque Split (Intermittent)	72
Torque Split (occurs at high power only, both engines not on TGT limiter)	73
Torque Split (occurs throughout power range).	74
Torque Split (torque hangup)	75
Uncontrolled Acceleration above Ground Idle Speed (all engine parameters indicating)	76
*Unstable Operation	77

* - Refer to paragraph 1-71, step k before starting troubleshooting procedure.

Table 1-13. Symptom Index (Aircraft) (Cont)

Symptom	Troubleshooting Procedure
*Unstable Operation with **(T700, T701)** ECU, or **(T701C, T701D)** DEC locked out (Ng, TGT, torque, and Np fluctuate greater than 5% with **(T700, T701)** ECU, or **(T701C, T701D)** DEC locked out)	78
<u>**(T701C, T701D)** DEC - ENGINE TORQUE INDICATOR FAULT CODES</u>	
NOTE The tolerance on all fault code indications is ±3%.	
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 15% (±3%) (check DEC)	79
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 25% (±3%) (Np demand channel)	80
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 35% (±3%) (load share channel)	81
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 45% (±3%) (TGT channel)	82
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 55% (±3%) (alternator power)	83
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 65% (±3%) (Ng channel)	84
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 75% (±3%) (Np channel)	85
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 85% (±3%) (torque and overspeed channel)	86
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 95% (±3%) (hot start prevention channel)	87
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 105% (±3%) (aircraft 400 Hz power)	88
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 115% (±3%) (collective channel)	89
(T701C, T701D Black Hawk) DEC - Engine Torque Indicator Fault Code - 125% (±3%) (Nr channel)	90
Both Engines Oscillate at FLY while at Low Collective Pitch Settings on the Ground (torque fluctuates beyond the ±5% limit with other engine parameters following)	91

* - Refer to paragraph 1-71, step k before starting troubleshooting procedure.

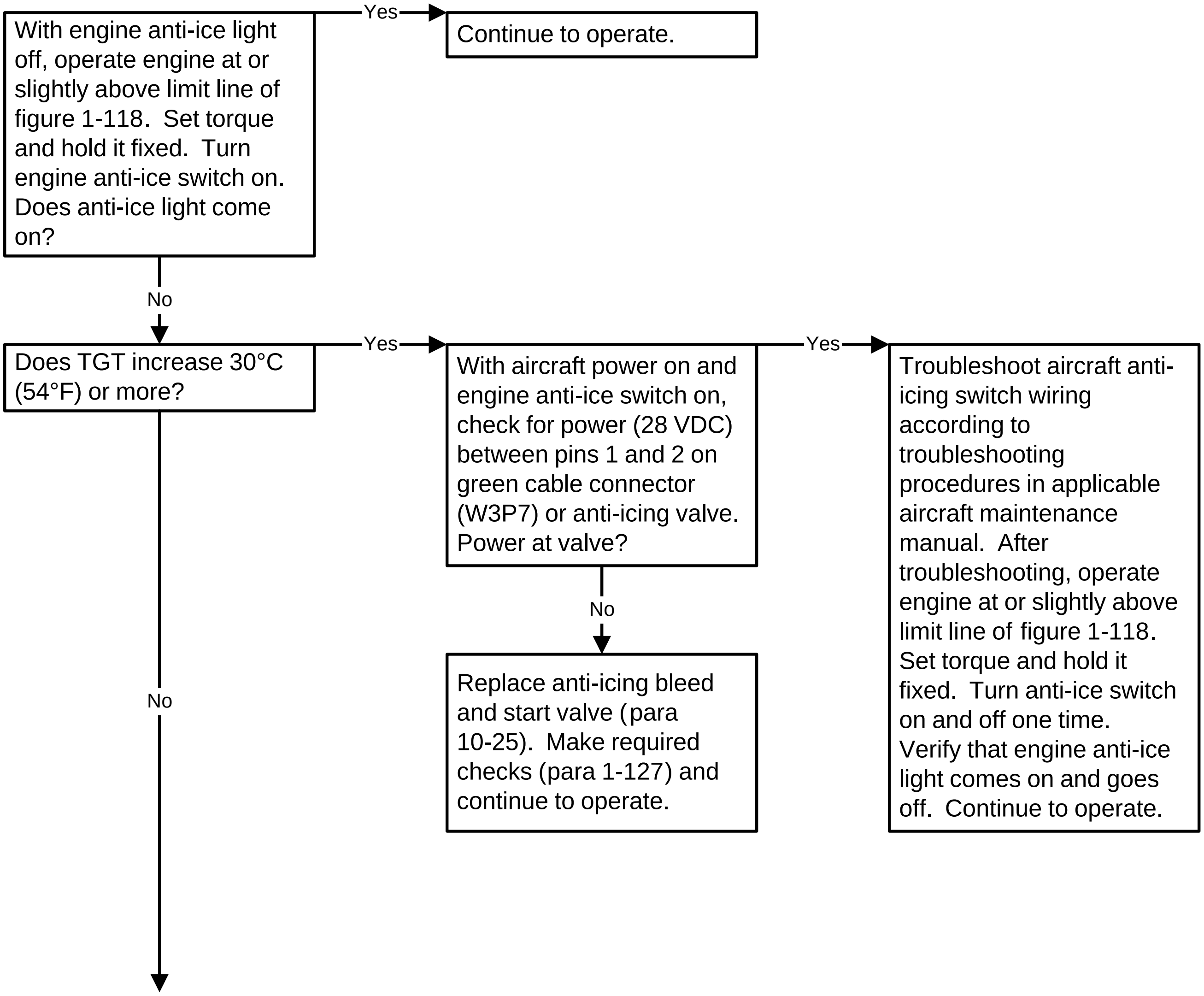
Troubleshooting Procedure 1. Engine Anti-Ice Advisory Light OFF with Engine Anti-Ice Switch ON and with % Ng at or Slightly Above Limit Line of Figure 1-118

WARNING

Do not cycle anti-ice bleed and start valve more than once to determine proper operation. Valve malfunction can cause engine flameout at low power settings or during rapid collective movements. Do not fly the aircraft if TGT rise is less than 30°C (54°F), or switch cycling is required.

NOTE

- Anti-icing system is off when 28 VDC power is applied to valve.
- If anti-icing system is switched on with engine operating at high power, engine may be limited by the ECU or DEC TGT limiter or by HMU acceleration schedule. Rotor droop may then develop. If one anti-icing system fails to operate, a torque split may also occur.



With engine anti-ice light off, operate engine at or slightly above limit line of figure 1-118. Set torque and hold it fixed. Turn engine anti-ice switch on. Does anti-ice light come on?

Continue to operate.

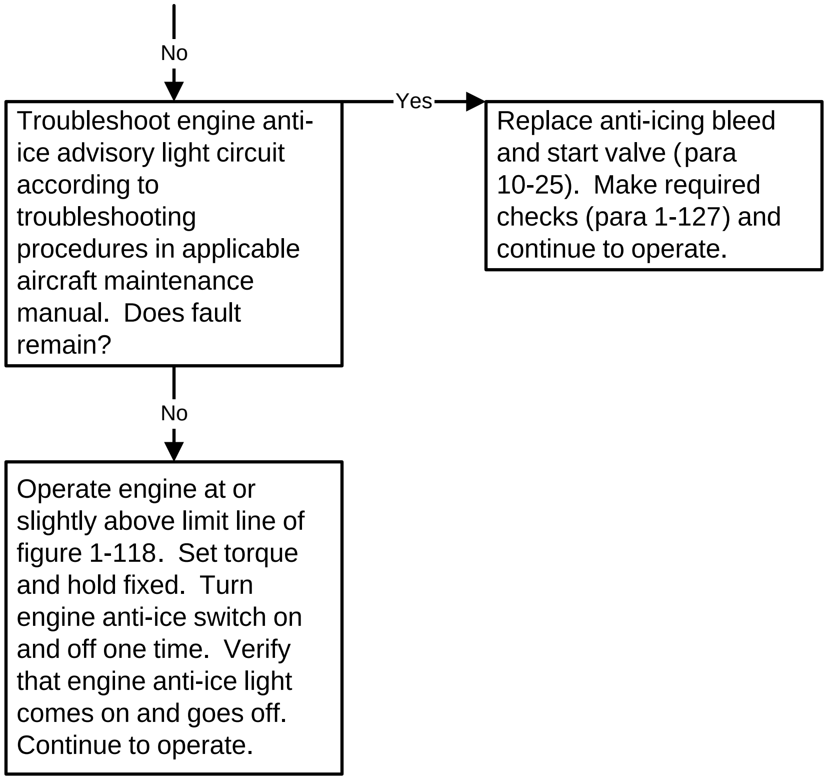
Does TGT increase 30°C (54°F) or more?

With aircraft power on and engine anti-ice switch on, check for power (28 VDC) between pins 1 and 2 on green cable connector (W3P7) or anti-icing valve. Power at valve?

Troubleshoot aircraft anti-icing switch wiring according to troubleshooting procedures in applicable aircraft maintenance manual. After troubleshooting, operate engine at or slightly above limit line of figure 1-118. Set torque and hold it fixed. Turn anti-ice switch on and off one time. Verify that engine anti-ice light comes on and goes off. Continue to operate.

Replace anti-icing bleed and start valve (para 10-25). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 1. ***Engine Anti-Ice Advisory Light OFF with Engine Anti-Ice Switch ON and with % Ng at or Slightly Above Limit Line of Figure 1-118 (Cont)***



Troubleshoot engine anti-ice advisory light circuit according to troubleshooting procedures in applicable aircraft maintenance manual. Does fault remain?

Replace anti-icing bleed and start valve (para 10-25). Make required checks (para 1-127) and continue to operate.

Operate engine at or slightly above limit line of figure 1-118. Set torque and hold fixed. Turn engine anti-ice switch on and off one time. Verify that engine anti-ice light comes on and goes off. Continue to operate.

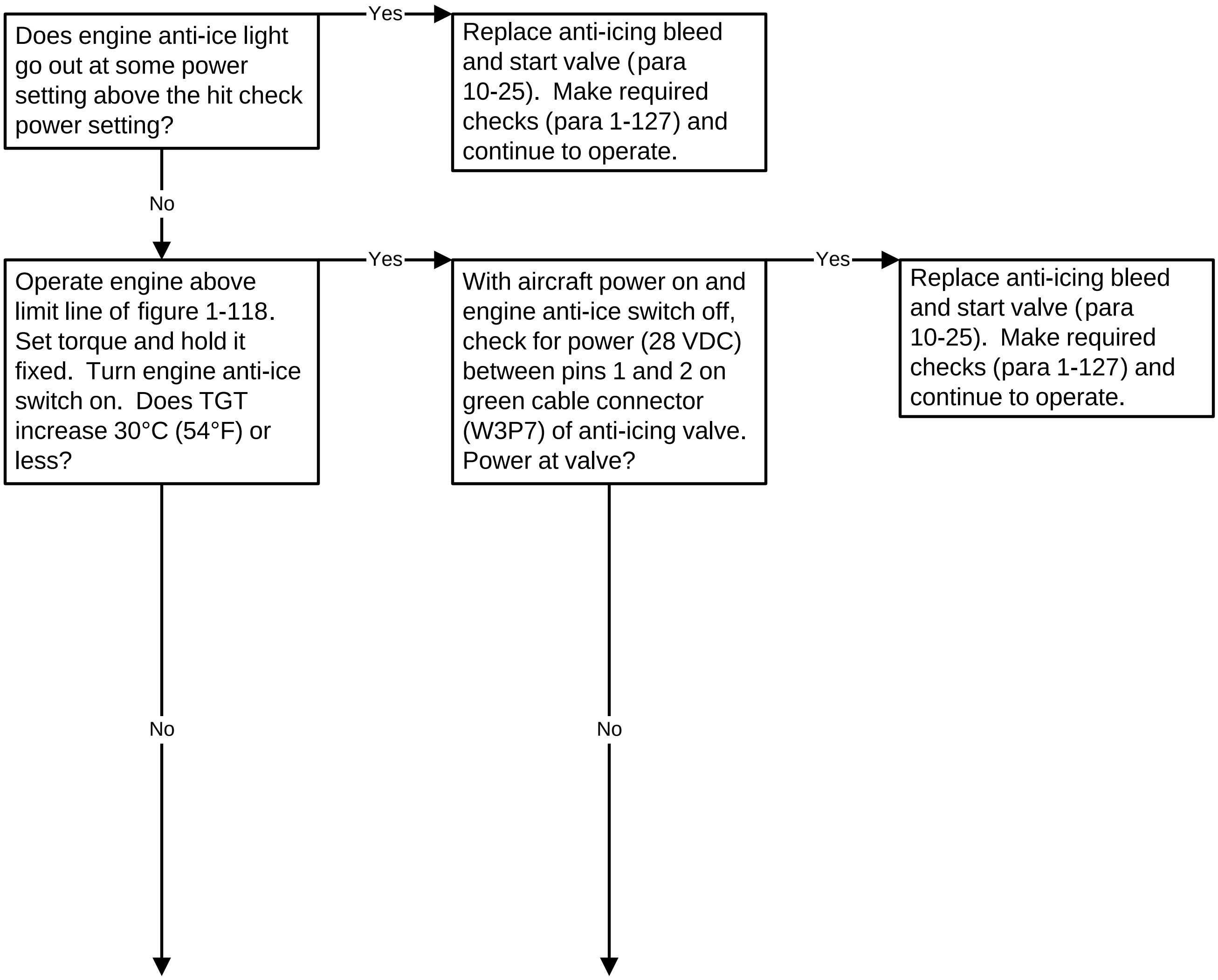
Troubleshooting Procedure 2. Engine Anti-Ice Advisory Light Remains ON at HIT Check or at Higher Power with Engine Anti-Ice Switch OFF

WARNING

Do not cycle anti-ice bleed and start valve more than once to determine proper operation. Valve malfunction can cause engine flameout at low power settings or during rapid collective movements. Do not fly the aircraft if TGT rise is less than 30°C (54°F), or switch cycling is required.

NOTE

- Anti-icing system is off when 28 VDC power is applied to valve.
- If anti-icing system is switched on with engine operating at high power, engine may be limited by the ECU or DEC TGT limiter or by HMU acceleration schedule. Rotor droop may then develop. If one anti-icing system fails to operate, a torque split may also occur.



Does engine anti-ice light go out at some power setting above the hit check power setting?

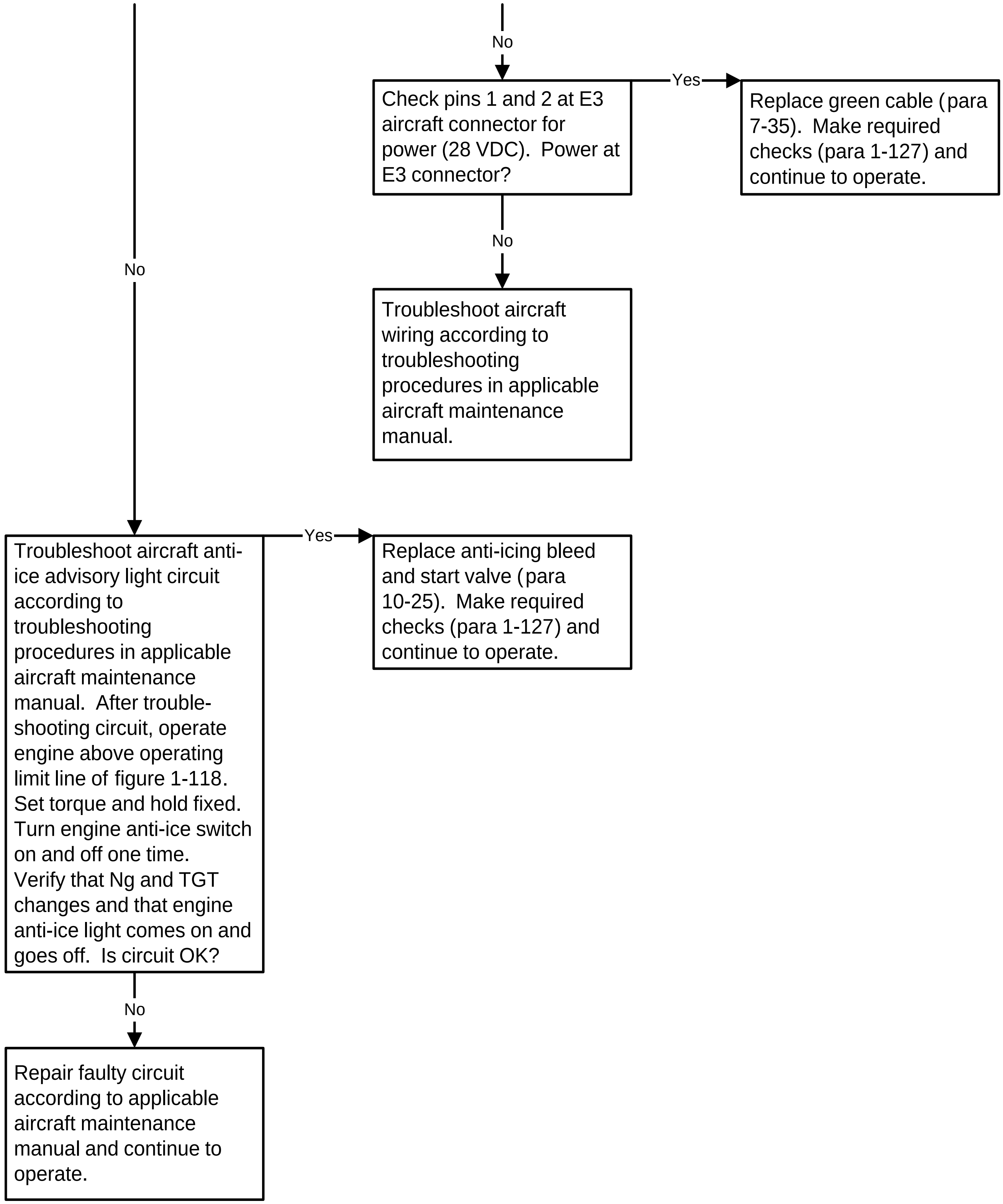
Replace anti-icing bleed and start valve (para 10-25). Make required checks (para 1-127) and continue to operate.

Operate engine above limit line of figure 1-118. Set torque and hold it fixed. Turn engine anti-ice switch on. Does TGT increase 30°C (54°F) or less?

With aircraft power on and engine anti-ice switch off, check for power (28 VDC) between pins 1 and 2 on green cable connector (W3P7) of anti-icing valve. Power at valve?

Replace anti-icing bleed and start valve (para 10-25). Make required checks (para 1-127) and continue to operate.

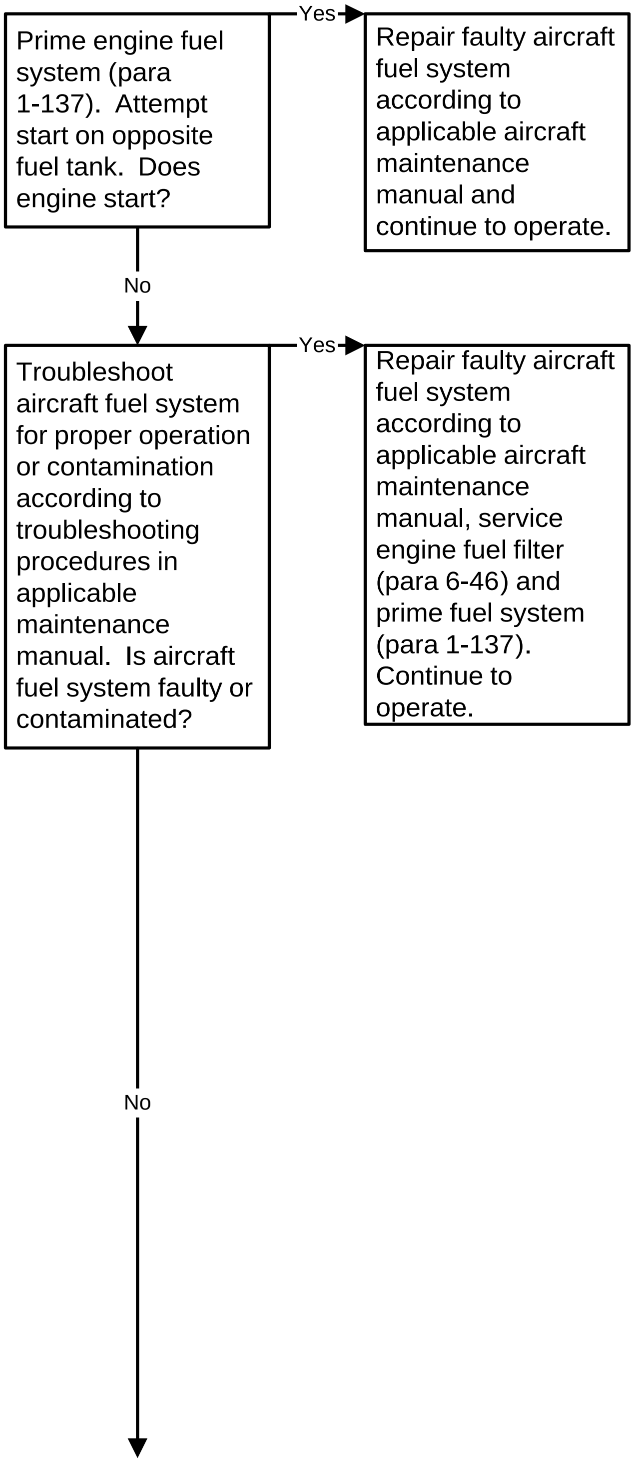
Troubleshooting Procedure 2. Engine Anti-Ice Advisory Light Remains ON at HIT Check or at Higher Power with Engine Anti-Ice Switch OFF (Cont)



Troubleshooting Procedure 3. Engine Flames Out During Ground Operation (combustion stops indicated by a drop in TGT)

NOTE

Flameout can be caused by a compressor stall.



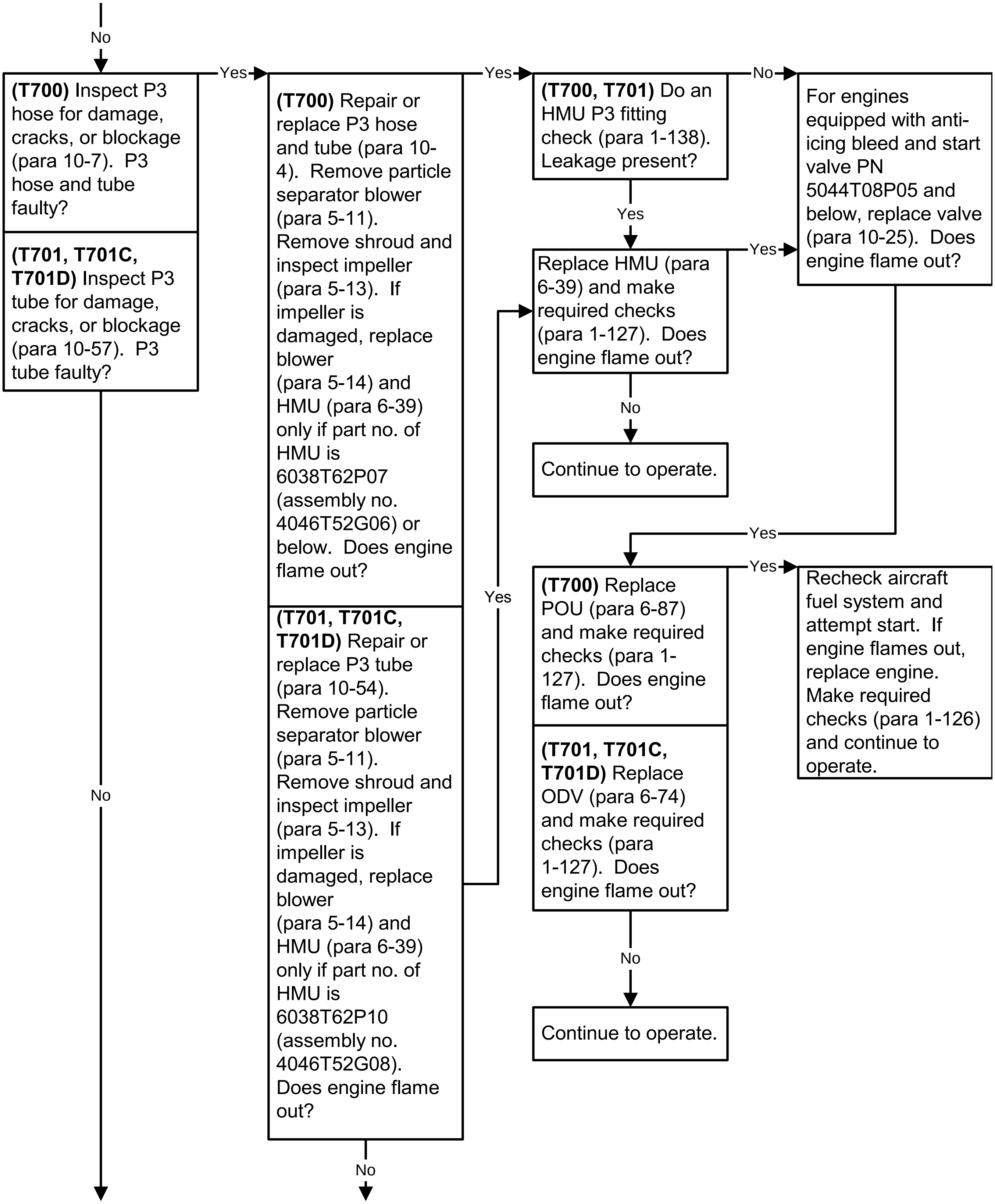
Prime engine fuel system (para 1-137). Attempt start on opposite fuel tank. Does engine start?

Repair faulty aircraft fuel system according to applicable aircraft maintenance manual and continue to operate.

Troubleshoot aircraft fuel system for proper operation or contamination according to troubleshooting procedures in applicable maintenance manual. Is aircraft fuel system faulty or contaminated?

Repair faulty aircraft fuel system according to applicable aircraft maintenance manual, service engine fuel filter (para 6-46) and prime fuel system (para 1-137). Continue to operate.

Troubleshooting Procedure 3. Engine Flames Out During Ground Operation (combustion stops indicated by a drop in TGT) (Cont)



(T700) Inspect P3 hose for damage, cracks, or blockage (para 10-7). P3 hose and tube faulty?

(T701, T701C, T701D) Inspect P3 tube for damage, cracks, or blockage (para 10-57). P3 tube faulty?

(T700) Repair or replace P3 hose and tube (para 10-4). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). If impeller is damaged, replace blower (para 5-14) and HMU (para 6-39) only if part no. of HMU is 6038T62P07 (assembly no. 4046T52G06) or below. Does engine flame out?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). If impeller is damaged, replace blower (para 5-14) and HMU (para 6-39) only if part no. of HMU is 6038T62P10 (assembly no. 4046T52G08). Does engine flame out?

(T700, T701) Do an HMU P3 fitting check (para 1-138). Leakage present?

Replace HMU (para 6-39) and make required checks (para 1-127). Does engine flame out?

Continue to operate.

For engines equipped with anti-icing bleed and start valve PN 5044T08P05 and below, replace valve (para 10-25). Does engine flame out?

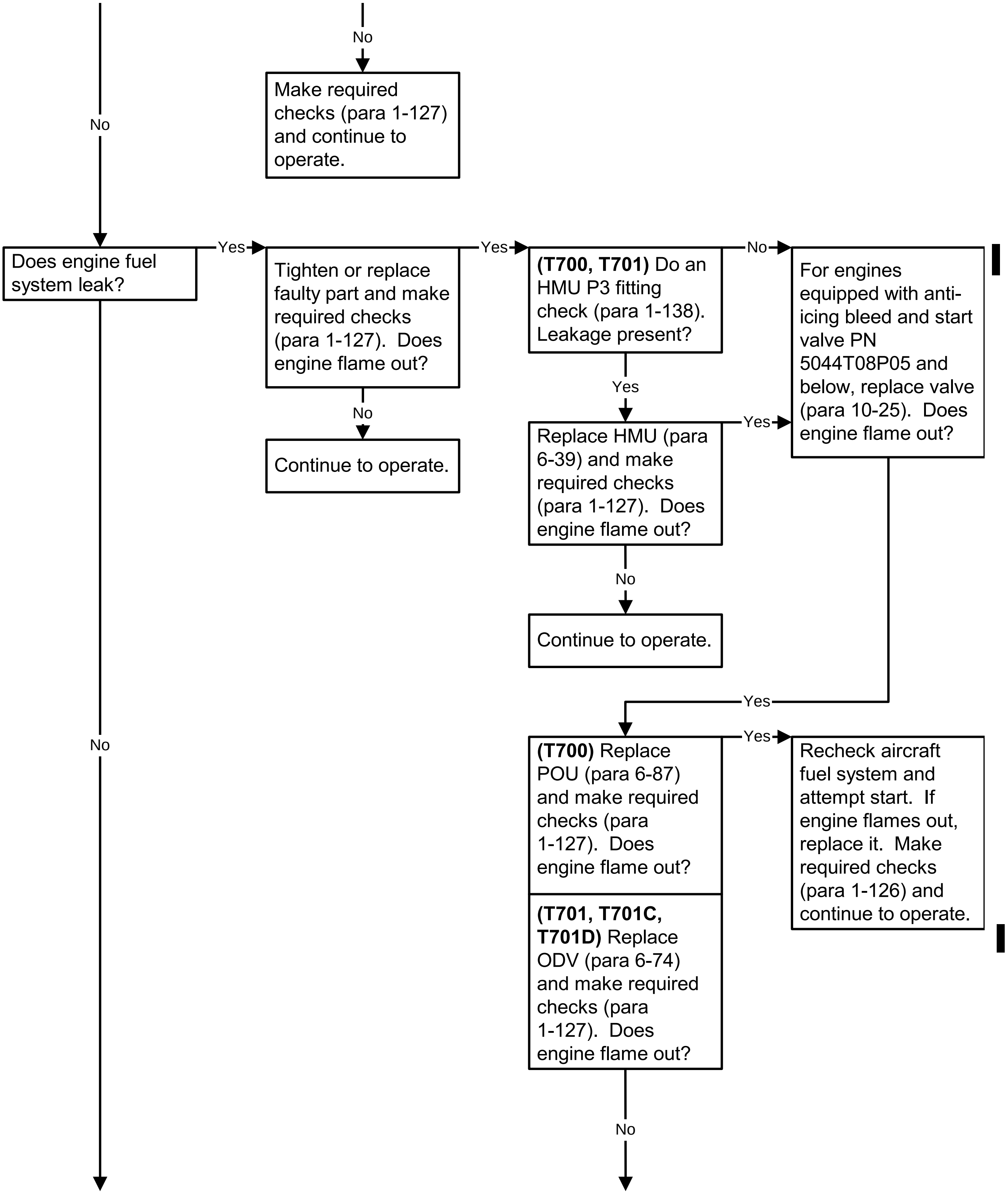
(T700) Replace POU (para 6-87) and make required checks (para 1-127). Does engine flame out?

(T701, T701C, T701D) Replace ODV (para 6-74) and make required checks (para 1-127). Does engine flame out?

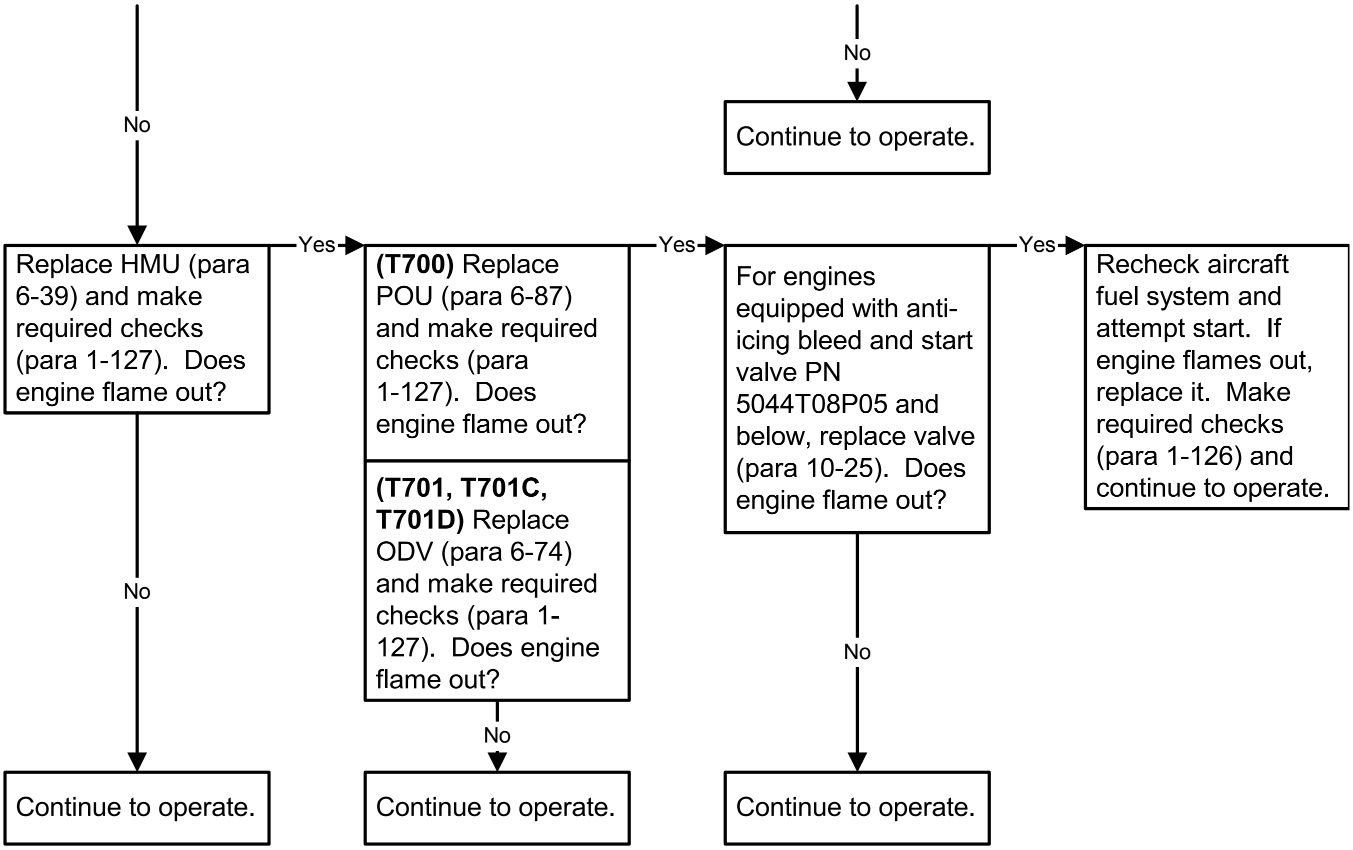
Continue to operate.

Recheck aircraft fuel system and attempt start. If engine flames out, replace engine. Make required checks (para 1-126) and continue to operate.

Troubleshooting Procedure 3. Engine Flames Out During Ground Operation (combustion stops indicated by a drop in TGT) (Cont)



Troubleshooting Procedure 3. Engine Flames Out During Ground Operation (combustion stops indicated by a drop in TGT) (Cont)



Continue to operate.

Replace HMU (para 6-39) and make required checks (para 1-127). Does engine flame out?

(T700) Replace POU (para 6-87) and make required checks (para 1-127). Does engine flame out?

(T701, T701C, T701D) Replace ODV (para 6-74) and make required checks (para 1-127). Does engine flame out?

For engines equipped with anti-icing bleed and start valve PN 5044T08P05 and below, replace valve (para 10-25). Does engine flame out?

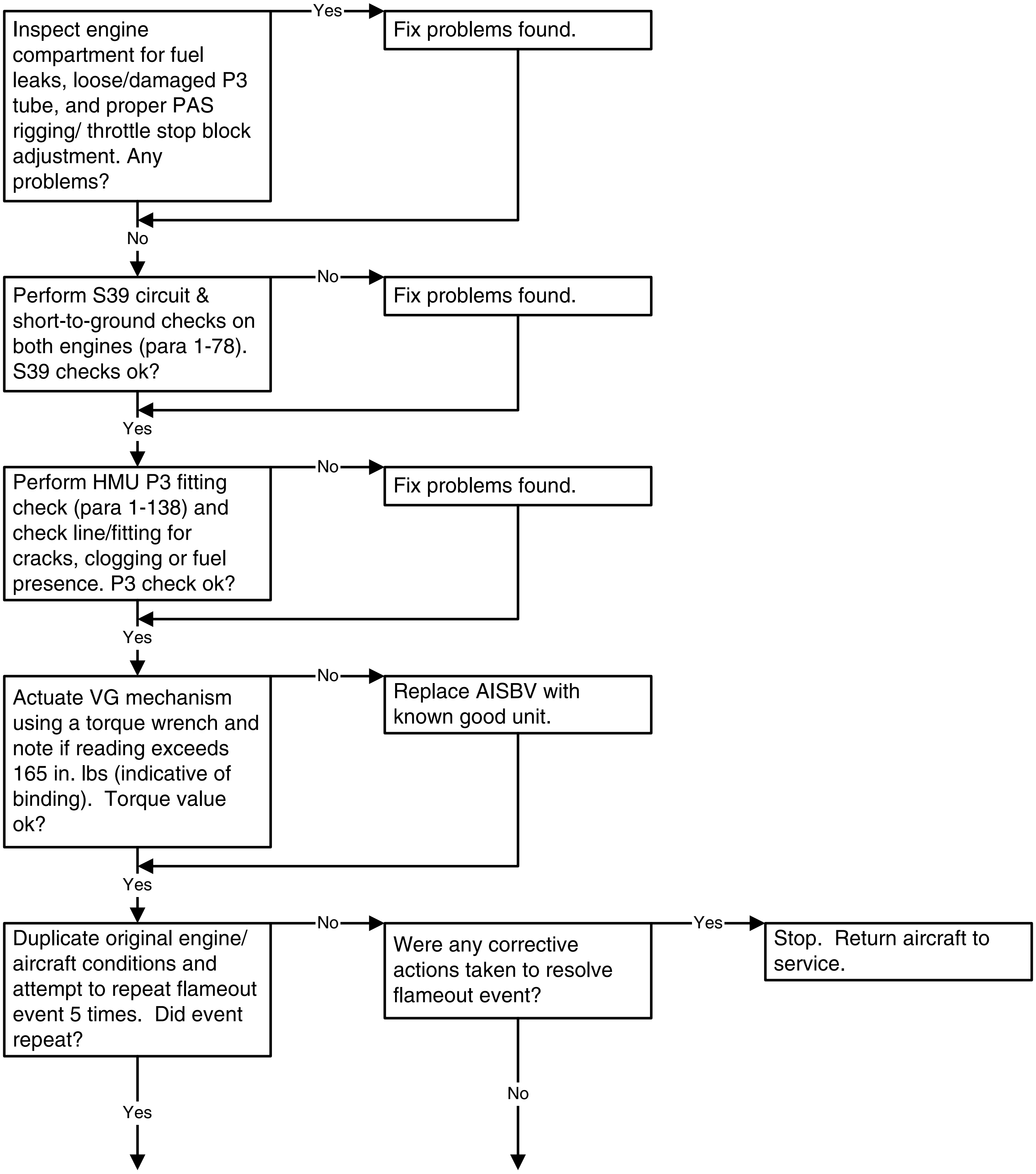
Recheck aircraft fuel system and attempt start. If engine flames out, replace it. Make required checks (para 1-126) and continue to operate.

Continue to operate.

Continue to operate.

Continue to operate.

Troubleshooting Procedure 3.1. ***(T700) Engine Flames Out During PCL Movement from Fly to Idle (fuel pressure warning light not illuminated)***



Inspect engine compartment for fuel leaks, loose/damaged P3 tube, and proper PAS rigging/ throttle stop block adjustment. Any problems?

Fix problems found.

Perform S39 circuit & short-to-ground checks on both engines (para 1-78). S39 checks ok?

Fix problems found.

Perform HMU P3 fitting check (para 1-138) and check line/fitting for cracks, clogging or fuel presence. P3 check ok?

Fix problems found.

Actuate VG mechanism using a torque wrench and note if reading exceeds 165 in. lbs (indicative of binding). Torque value ok?

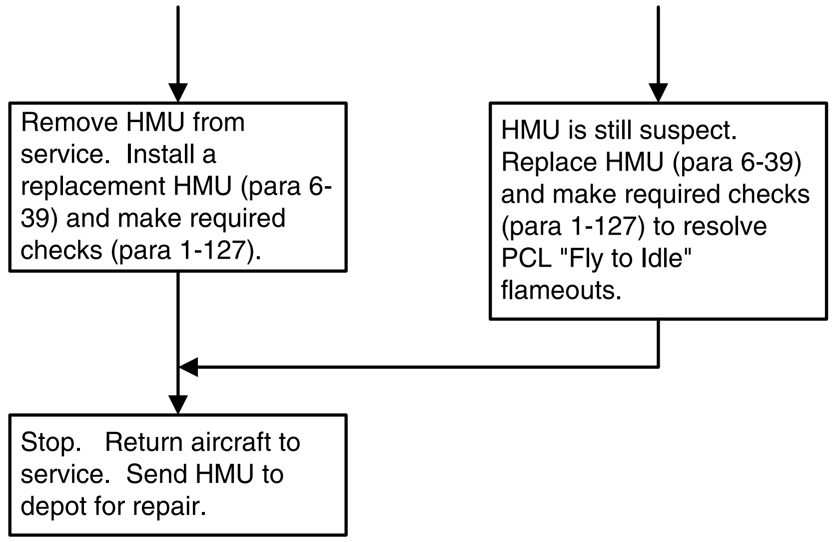
Replace AISBV with known good unit.

Duplicate original engine/ aircraft conditions and attempt to repeat flameout event 5 times. Did event repeat?

Were any corrective actions taken to resolve flameout event?

Stop. Return aircraft to service.

Troubleshooting Procedure 3.1. (T700) Engine Flames Out During PCL Movement from Fly to Idle (fuel pressure warning light not illuminated) (Cont)



Remove HMU from service. Install a replacement HMU (para 6-39) and make required checks (para 1-127).

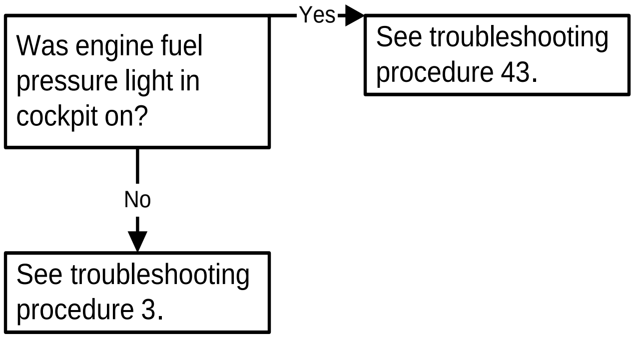
HMU is still suspect. Replace HMU (para 6-39) and make required checks (para 1-127) to resolve PCL "Fly to Idle" flameouts.

Stop. Return aircraft to service. Send HMU to depot for repair.

Troubleshooting Procedure 4. Engine Flames Out During In-Flight Operation (combustion stops indicated by a drop in TGT)

NOTE

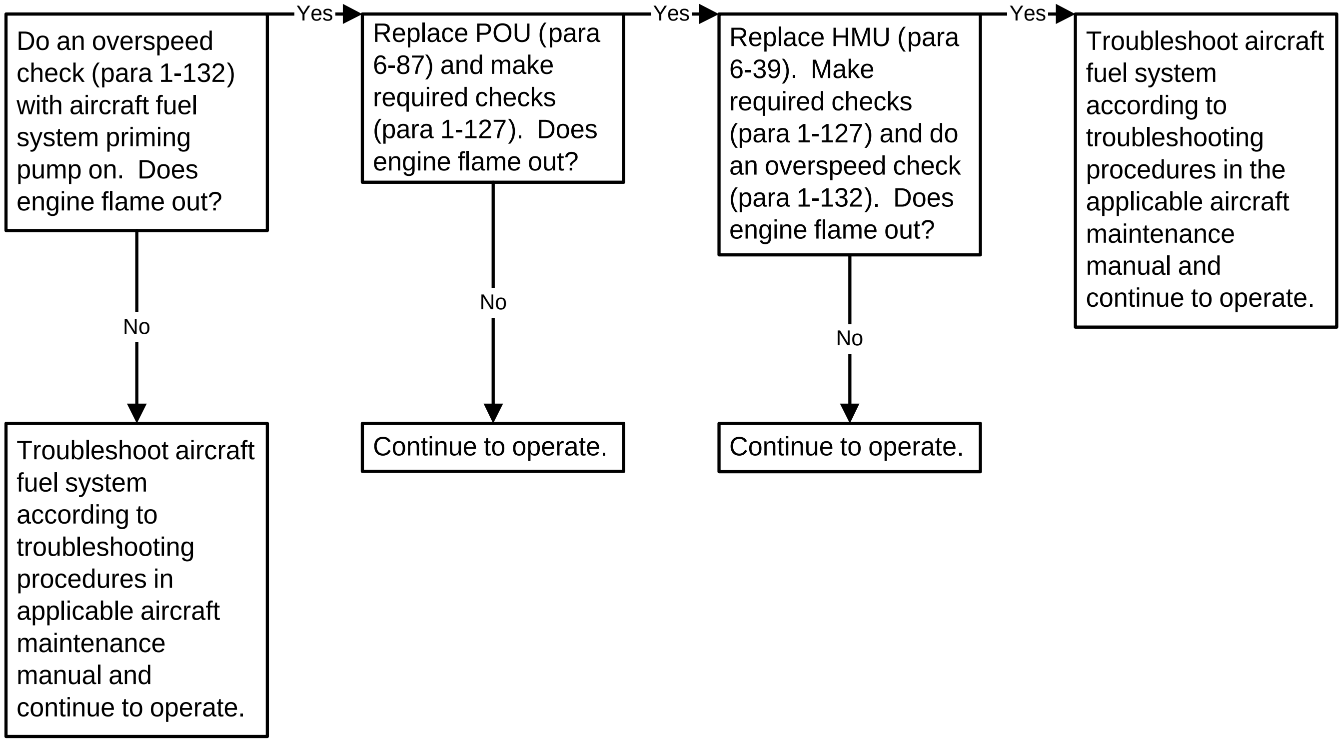
Flameout can be caused by a compressor stall.



Troubleshooting Procedure 5. (T700) Engine Flames Out During Np Overspeed Check (combustion stops indicated by a drop in TGT)

NOTE

Flameout can be caused by a compressor stall.



Do an overspeed check (para 1-132) with aircraft fuel system priming pump on. Does engine flame out?

Replace POU (para 6-87) and make required checks (para 1-127). Does engine flame out?

Replace HMU (para 6-39). Make required checks (para 1-127) and do an overspeed check (para 1-132). Does engine flame out?

Troubleshoot aircraft fuel system according to troubleshooting procedures in the applicable aircraft maintenance manual and continue to operate.

Troubleshoot aircraft fuel system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

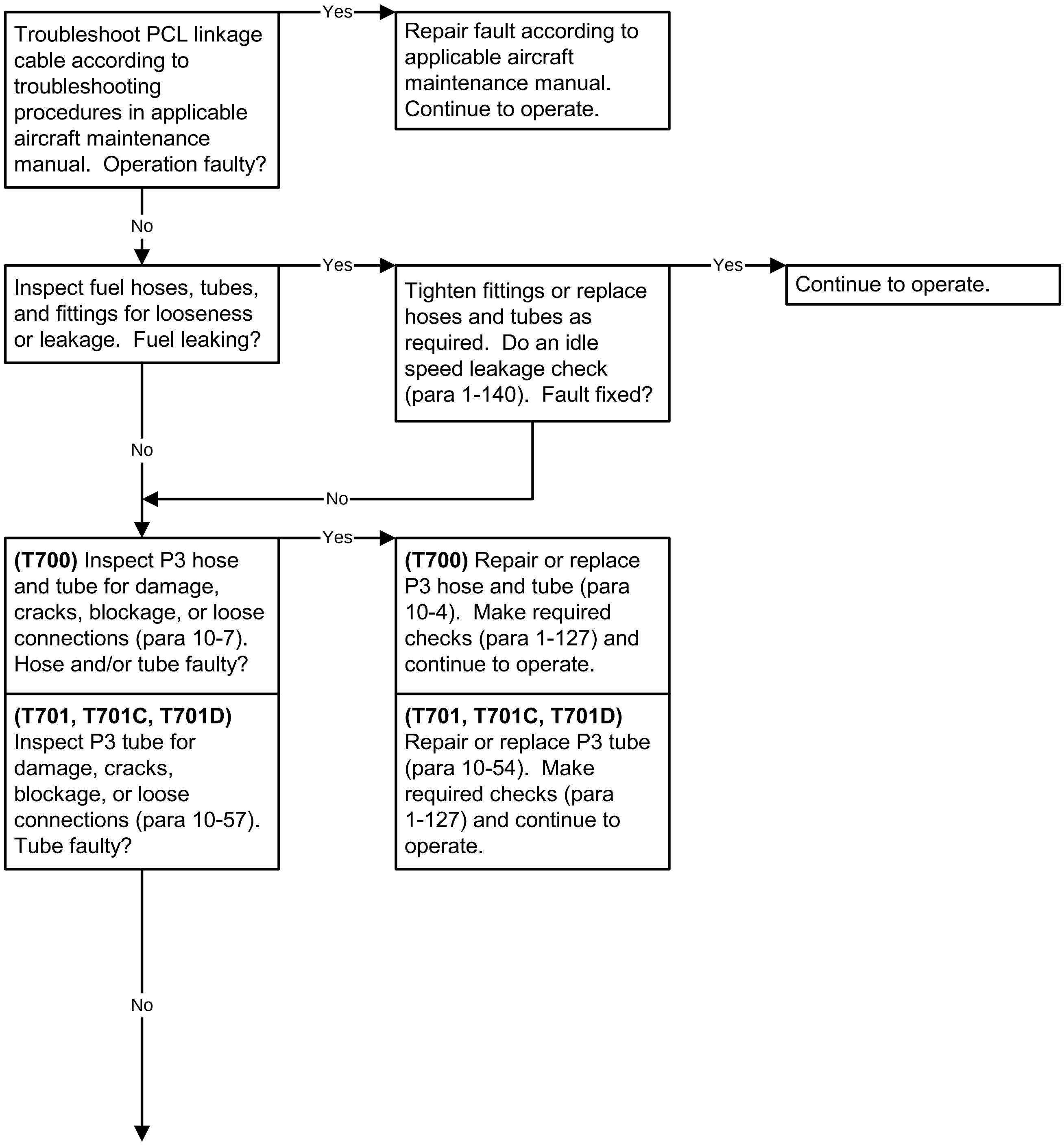
Continue to operate.

Continue to operate.

Troubleshooting Procedure 6. Ng Does Not Accelerate Above Ground Idle Speed

CAUTION

(T701, T701C, T701D Apache) Make sure chop collar system is not activated.


Troubleshoot PCL linkage cable according to troubleshooting procedures in applicable aircraft maintenance manual. Operation faulty?

Repair fault according to applicable aircraft maintenance manual. Continue to operate.

Inspect fuel hoses, tubes, and fittings for looseness or leakage. Fuel leaking?

Tighten fittings or replace hoses and tubes as required. Do an idle speed leakage check (para 1-140). Fault fixed?

Continue to operate.

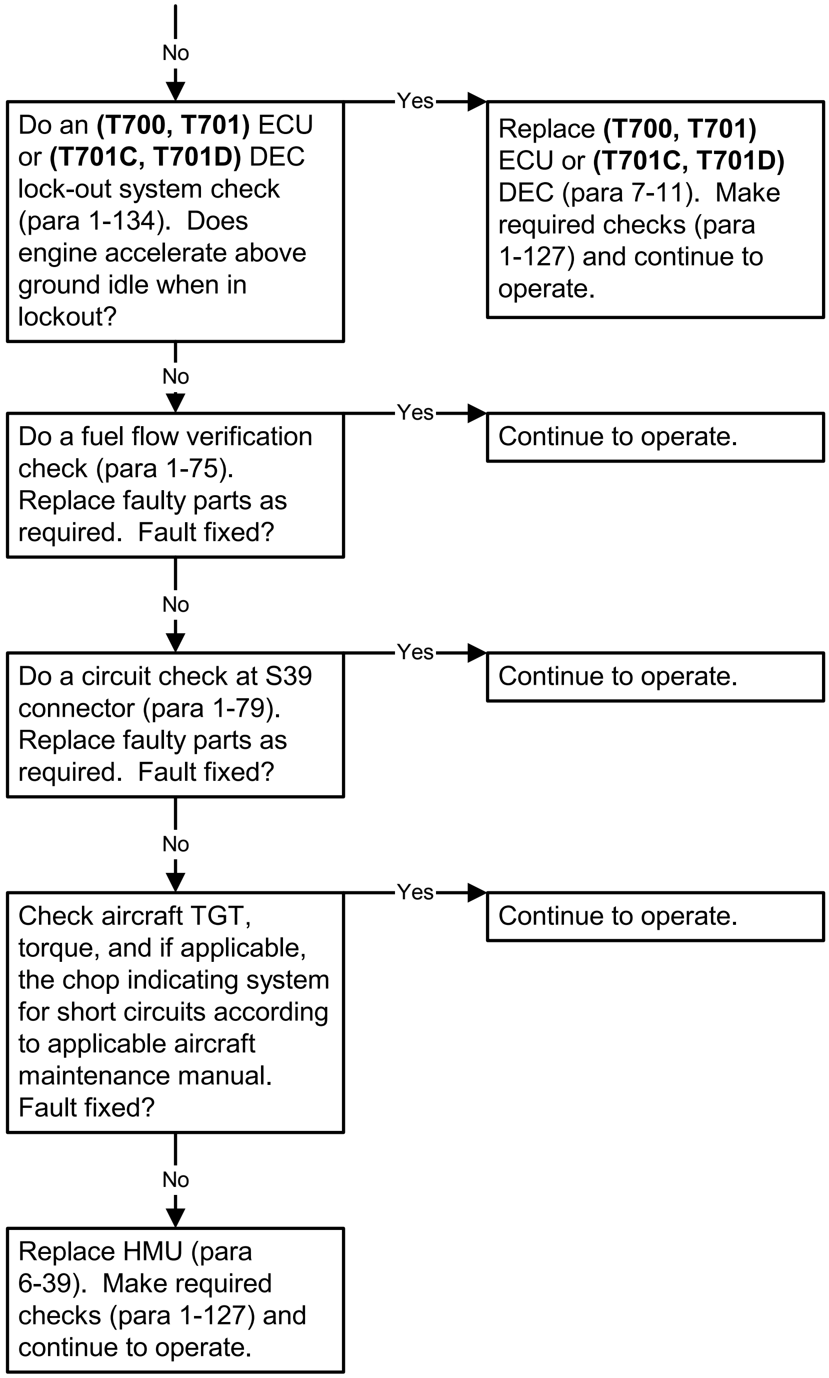
(T700) Inspect P3 hose and tube for damage, cracks, blockage, or loose connections (para 10-7). Hose and/or tube faulty?

(T701, T701C, T701D) Inspect P3 tube for damage, cracks, blockage, or loose connections (para 10-57). Tube faulty?

(T700) Repair or replace P3 hose and tube (para 10-4). Make required checks (para 1-127) and continue to operate.

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 6. Ng Does Not Accelerate Above Ground Idle Speed (Cont)



Do an **(T700, T701)** ECU or **(T701C, T701D)** DEC lock-out system check (para 1-134). Does engine accelerate above ground idle when in lockout?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Do a fuel flow verification check (para 1-75). Replace faulty parts as required. Fault fixed?

Continue to operate.

Do a circuit check at S39 connector (para 1-79). Replace faulty parts as required. Fault fixed?

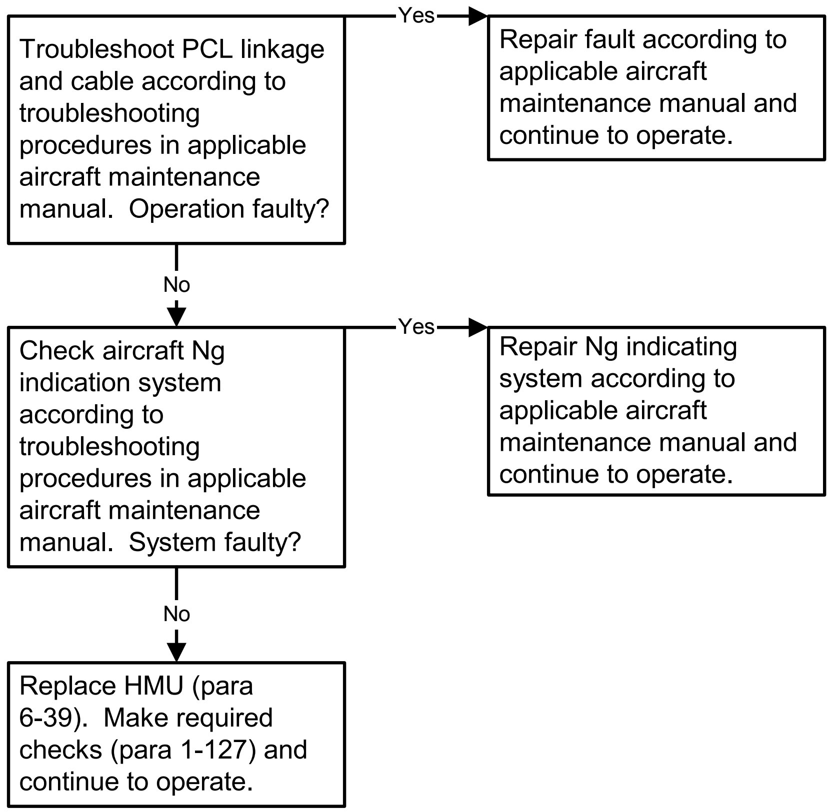
Continue to operate.

Check aircraft TGT, torque, and if applicable, the chop indicating system for short circuits according to applicable aircraft maintenance manual. Fault fixed?

Continue to operate.

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 7. **(T701, T701C, T701D)** Ng High at Ground Idle Speed*



Troubleshoot PCL linkage and cable according to troubleshooting procedures in applicable aircraft maintenance manual. Operation faulty?

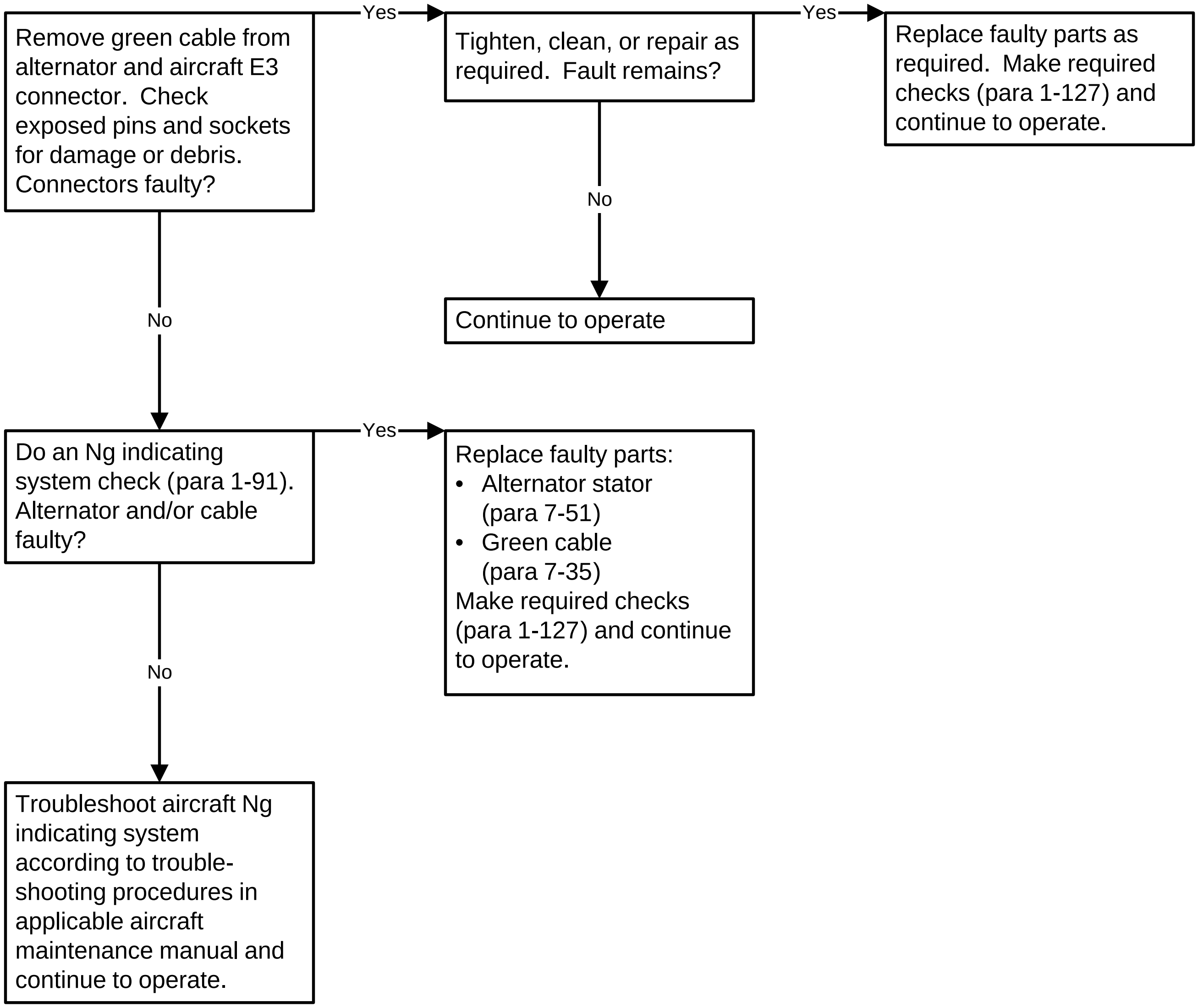
Repair fault according to applicable aircraft maintenance manual and continue to operate.

Check aircraft Ng indication system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair Ng indicating system according to applicable aircraft maintenance manual and continue to operate.

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 8. Ng Instrument Fluctuating or Not Indicating (all other instruments normal)



Remove green cable from alternator and aircraft E3 connector. Check exposed pins and sockets for damage or debris. Connectors faulty?

Tighten, clean, or repair as required. Fault remains?

Replace faulty parts as required. Make required checks (para 1-127) and continue to operate.

Continue to operate

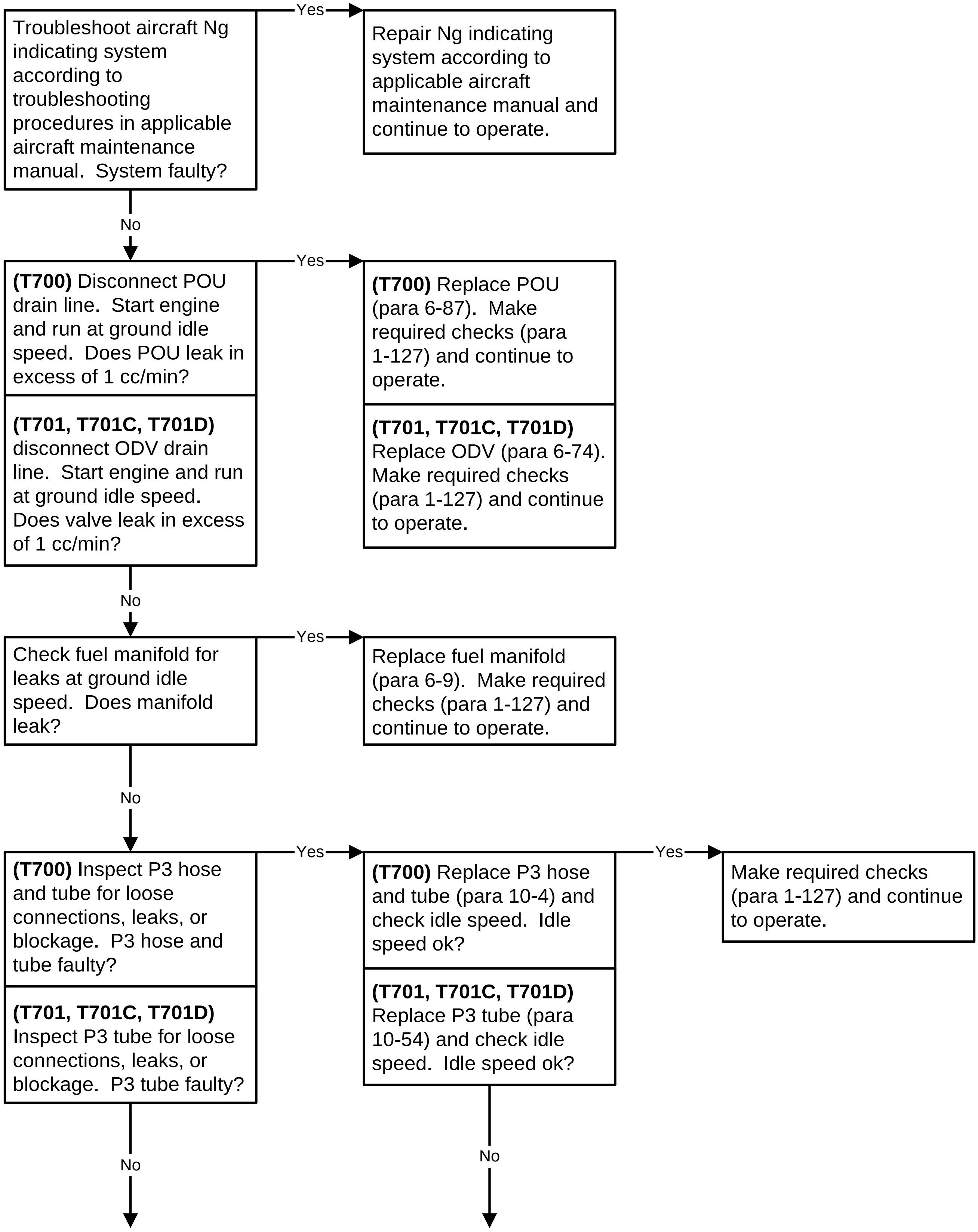
Do an Ng indicating system check (para 1-91). Alternator and/or cable faulty?

Replace faulty parts:
- Alternator stator (para 7-51)
- Green cable (para 7-35)

Make required checks (para 1-127) and continue to operate.

Troubleshoot aircraft Ng indicating system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 9. ***Ng Low at Ground Idle Speed (idle speed is below limits in Table 1-17 (T700) and Table 1-18 (T701, T701C, T701D))***



Troubleshoot aircraft Ng indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair Ng indicating system according to applicable aircraft maintenance manual and continue to operate.

(T700) Disconnect POU drain line. Start engine and run at ground idle speed. Does POU leak in excess of 1 cc/min?

(T701, T701C, T701D) disconnect ODV drain line. Start engine and run at ground idle speed. Does valve leak in excess of 1 cc/min?

(T700) Replace POU (para 6-87). Make required checks (para 1-127) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-127) and continue to operate.

Check fuel manifold for leaks at ground idle speed. Does manifold leak?

Replace fuel manifold (para 6-9). Make required checks (para 1-127) and continue to operate.

(T700) Inspect P3 hose and tube for loose connections, leaks, or blockage. P3 hose and tube faulty?

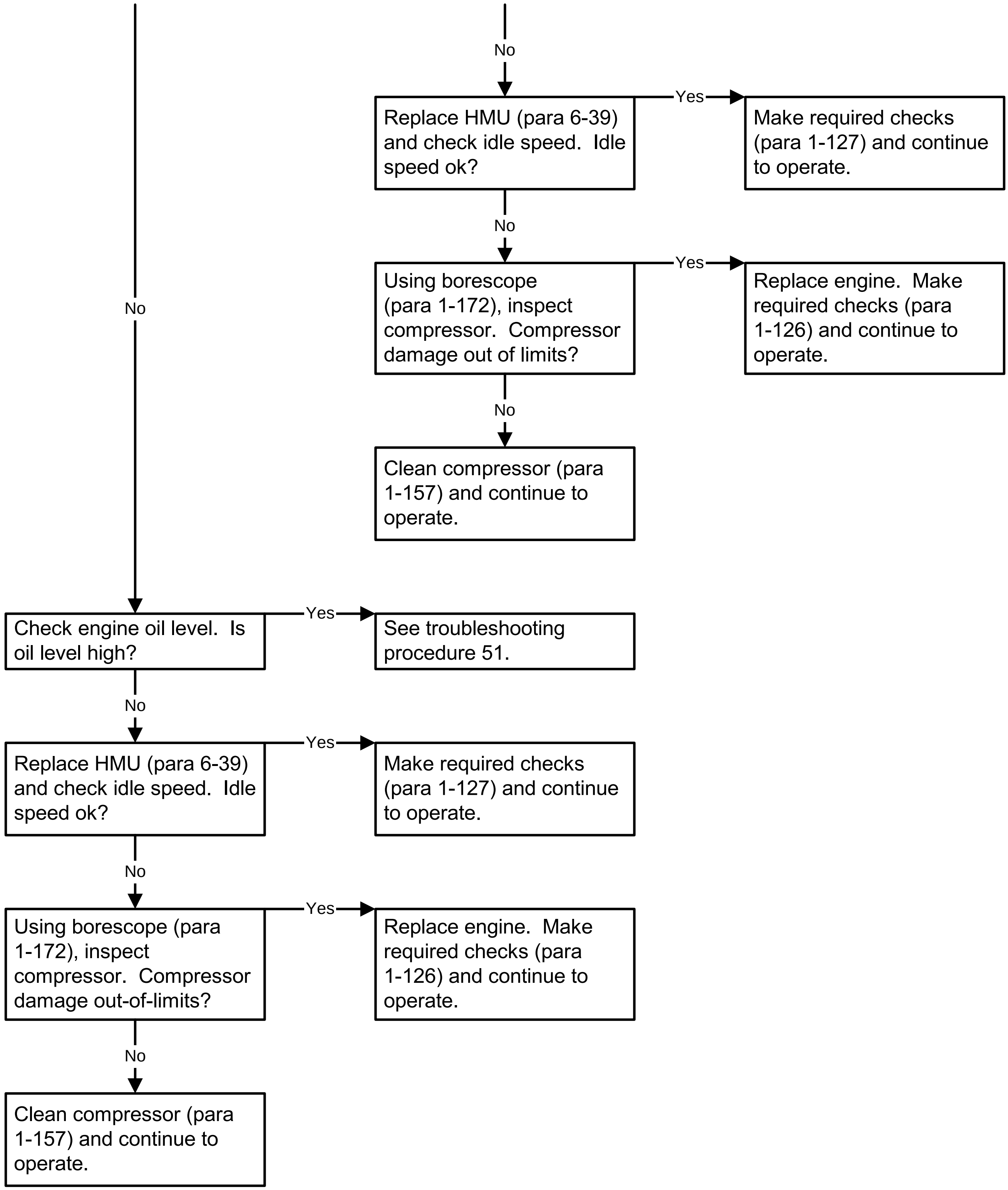
(T701, T701C, T701D) Inspect P3 tube for loose connections, leaks, or blockage. P3 tube faulty?

(T700) Replace P3 hose and tube (para 10-4) and check idle speed. Idle speed ok?

(T701, T701C, T701D) Replace P3 tube (para 10-54) and check idle speed. Idle speed ok?

Make required checks (para 1-127) and continue to operate.

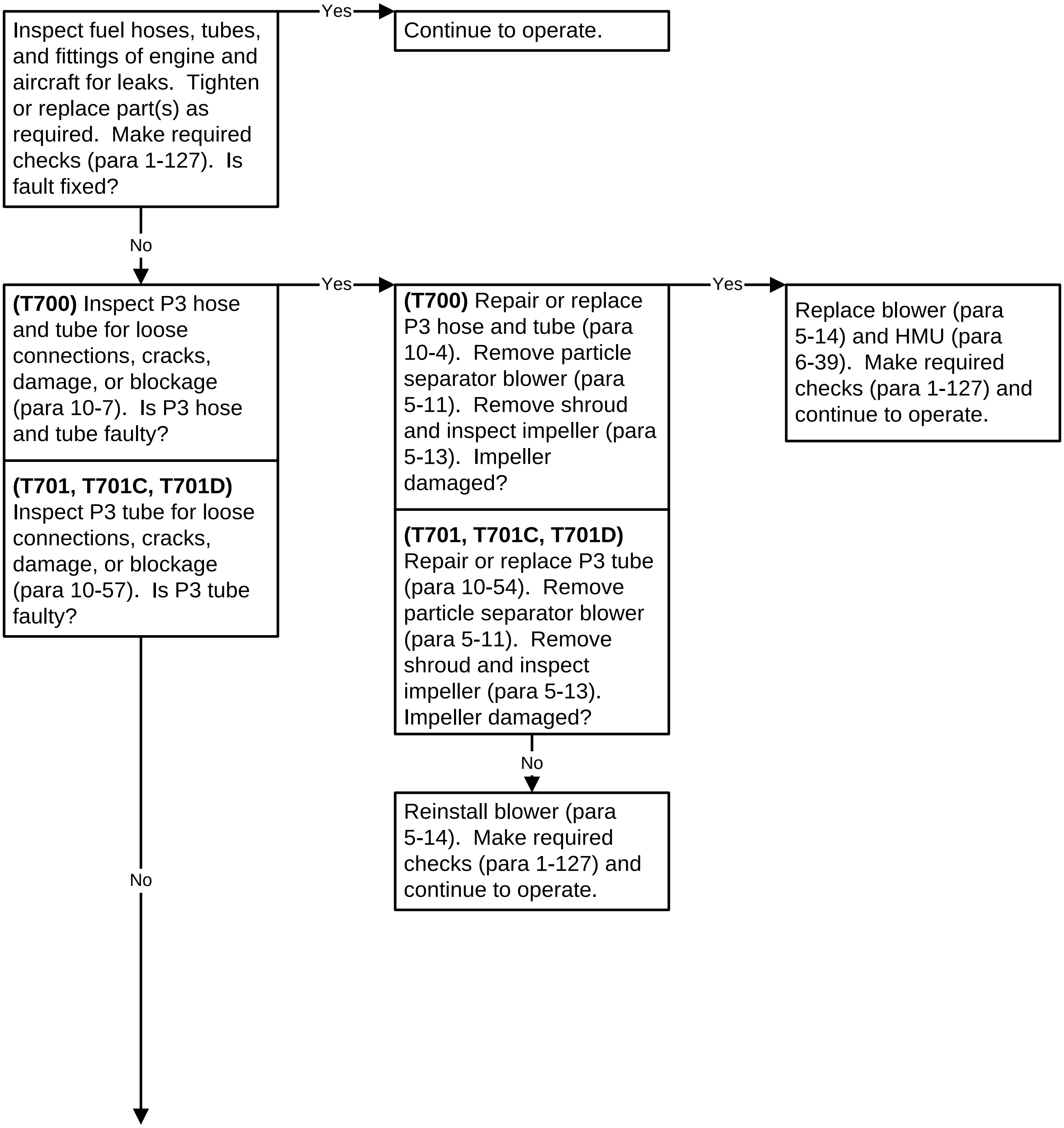
*Troubleshooting Procedure 9. Ng Low at Ground Idle Speed (idle speed is below limits in Table 1-17 (**T700**) and Table 1-18 (**T701, T701C, T701D**)) (Cont)*



Troubleshooting Procedure 10. Uncontrolled Deceleration (Ng) (Ng and TGT decrease without retarding PCL or collective pitch)

NOTE

Check to determine if fault is corrected by operating with ECU/DEC locked out. If fault is corrected, the most likely cause of the fault is a faulty aircraft cable that connects to **(T700, T701)** ECU or **(T701C, T701D)** DEC receptacle E1. See troubleshooting procedure 70.



Inspect fuel hoses, tubes, and fittings of engine and aircraft for leaks. Tighten or replace part(s) as required. Make required checks (para 1-127). Is fault fixed?

Continue to operate.

(T700) Inspect P3 hose and tube for loose connections, cracks, damage, or blockage (para 10-7). Is P3 hose and tube faulty?

(T701, T701C, T701D) Inspect P3 tube for loose connections, cracks, damage, or blockage (para 10-57). Is P3 tube faulty?

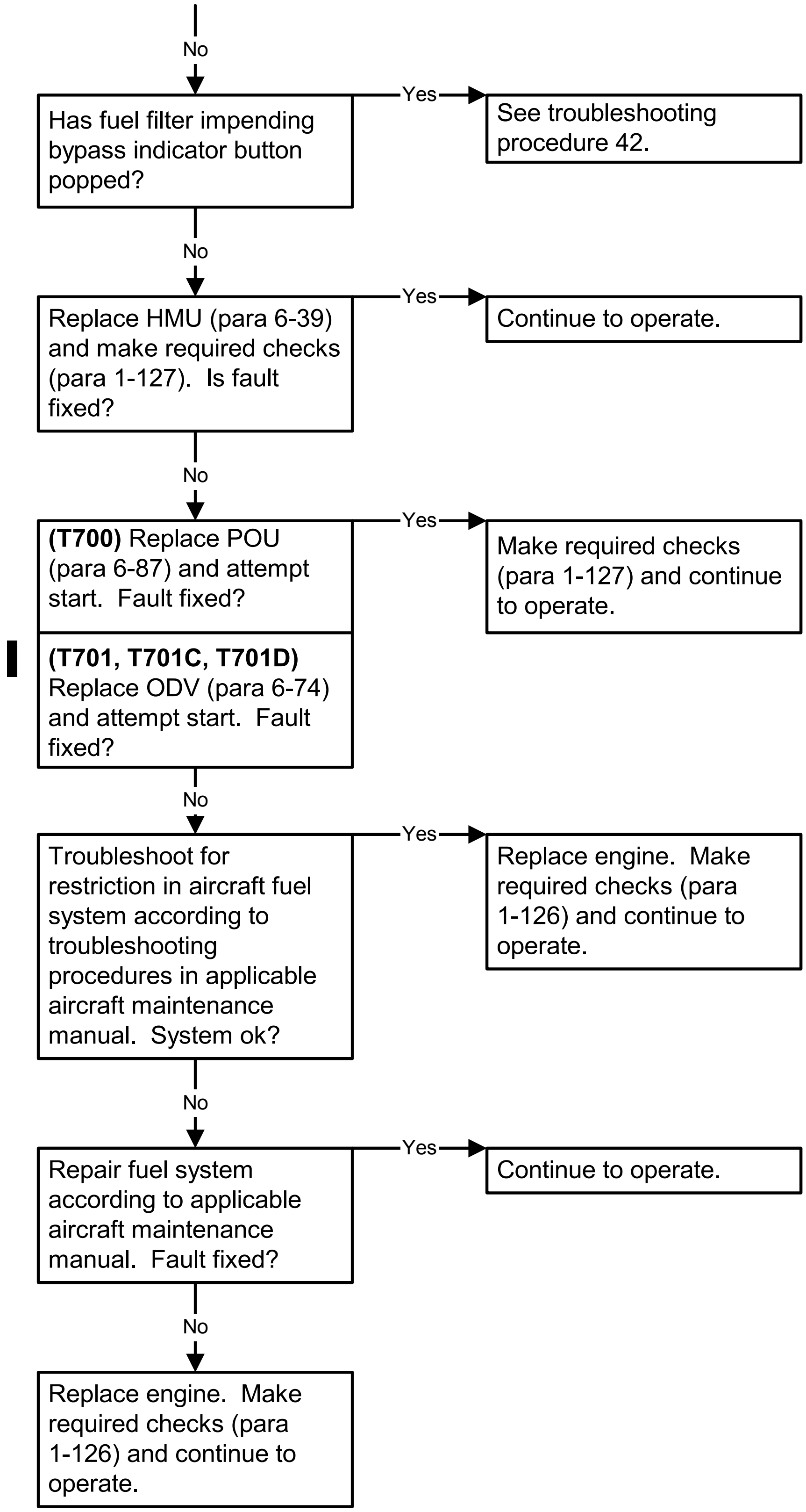
(T700) Repair or replace P3 hose and tube (para 10-4). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

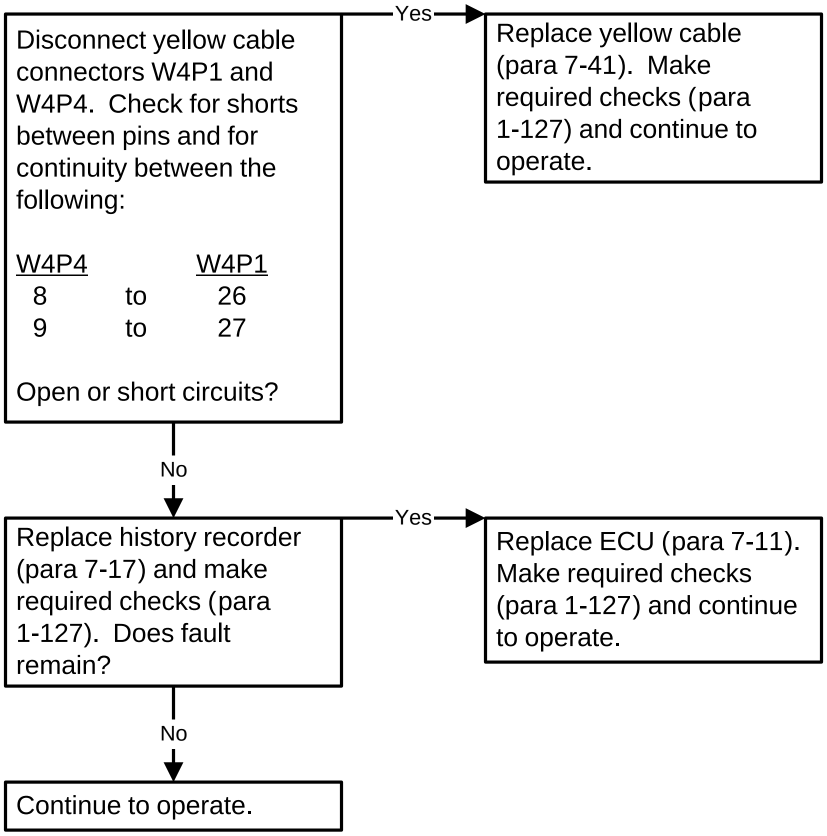
Replace blower (para 5-14) and HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Reinstall blower (para 5-14). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 10. Uncontrolled Deceleration (Ng) (Ng and TGT decrease without retarding PCL or collective pitch) (Cont)



Troubleshooting Procedure 11. *(T700, T701)* ***History Recorder Malfunction (engine time function inoperative)***



Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
8	to	26
9	to	27

Open or short circuits?

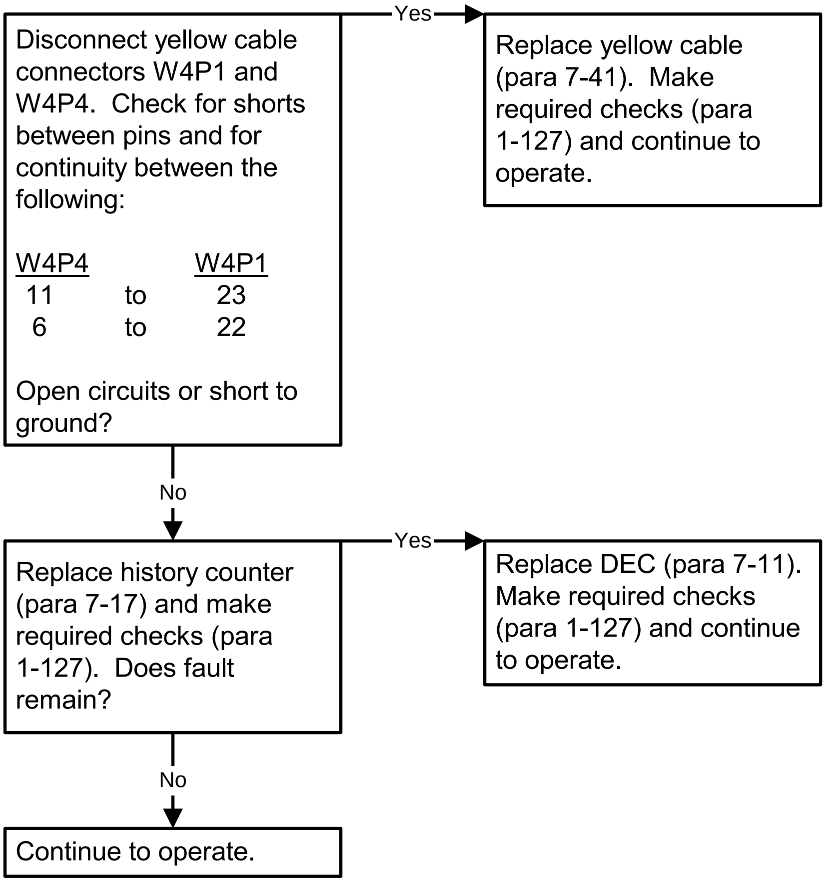
Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace history recorder (para 7-17) and make required checks (para 1-127). Does fault remain?

Replace ECU (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 12. ***(T701C, T701D)*** *History Counter Malfunction (engine time function inoperative)*



Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
11	to	23
6	to	22

Open circuits or short to ground?

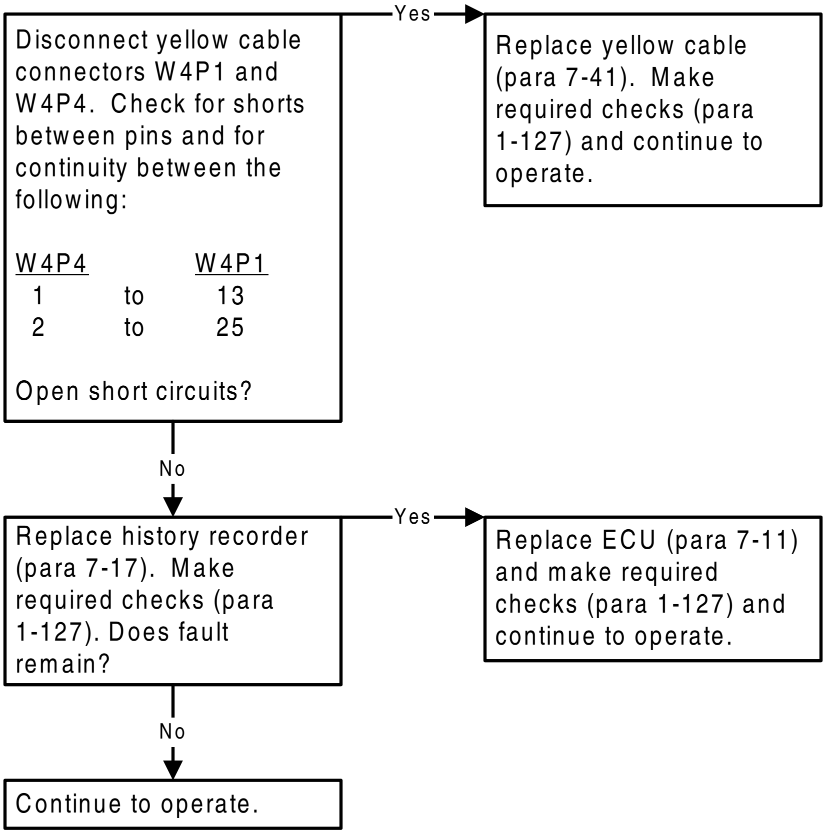
Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace history counter (para 7-17) and make required checks (para 1-127). Does fault remain?

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 13. ***(T700, T701)*** *History Recorder Malfunction (LCF function inoperative)*



Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
1	to	13
2	to	25

Open short circuits?

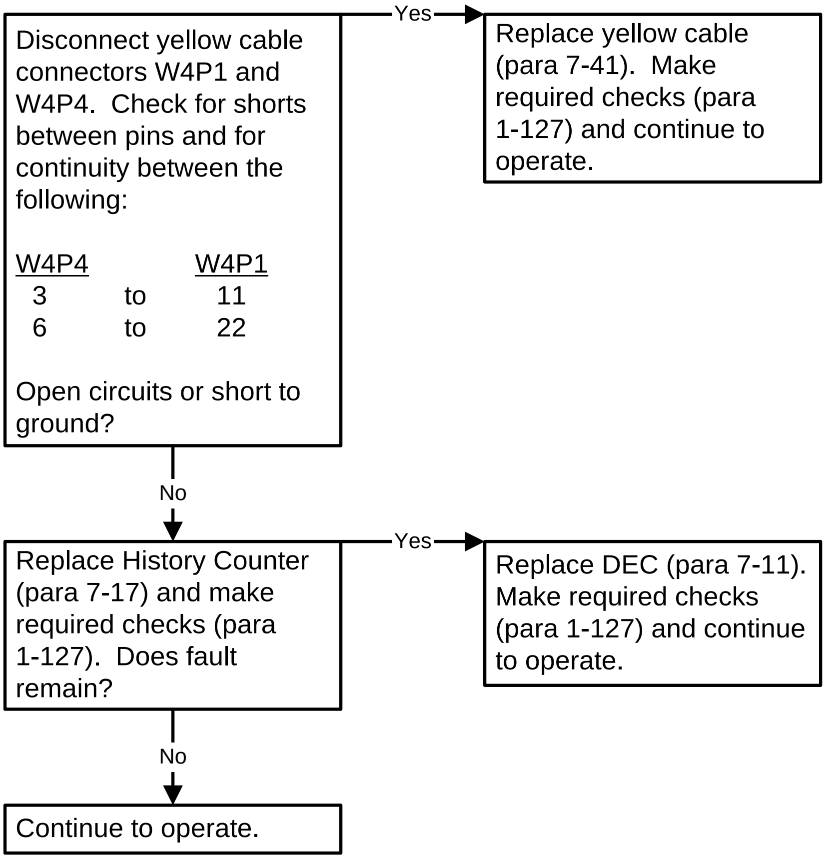
Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace history recorder (para 7-17). Make required checks (para 1-127). Does fault remain?

Replace ECU (para 7-11) and make required checks (para 1-127) and continue to operate.

Continue to operate.

*Troubleshooting Procedure 14. **(T701C, T701D)** History Counter Malfunction (LCF 1 function inoperative)*



Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
3	to	11
6	to	22

Open circuits or short to ground?

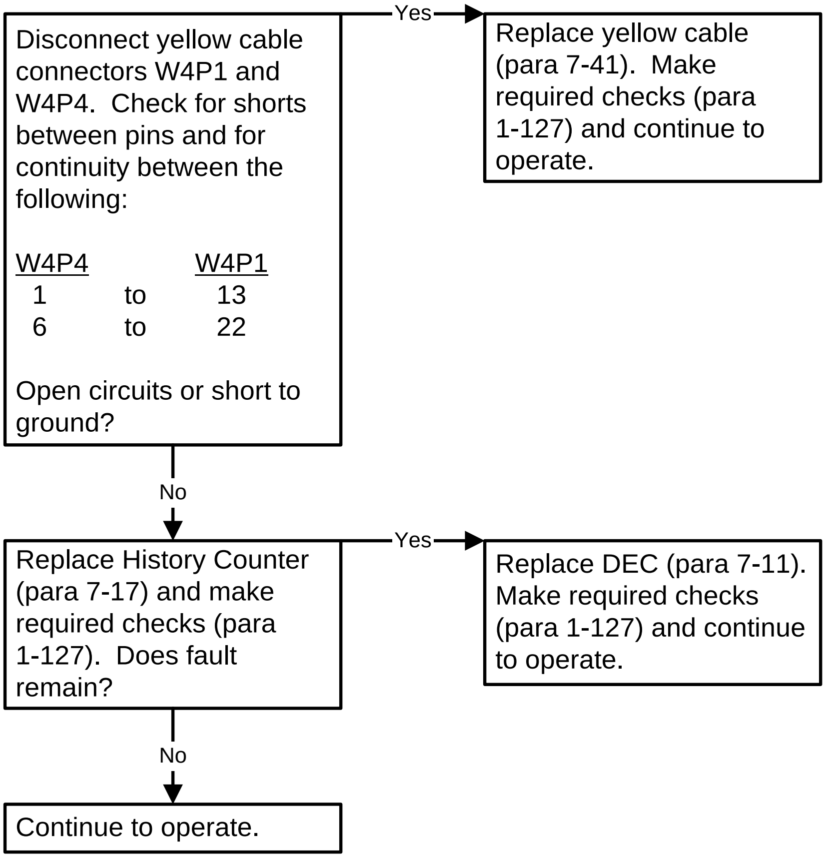
Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace History Counter (para 7-17) and make required checks (para 1-127). Does fault remain?

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

*Troubleshooting Procedure 15. **(T701C, T701D)** History Counter Malfunction (LCF 2 function inoperative)*



Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
1	to	13
6	to	22

Open circuits or short to ground?

Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace History Counter (para 7-17) and make required checks (para 1-127). Does fault remain?

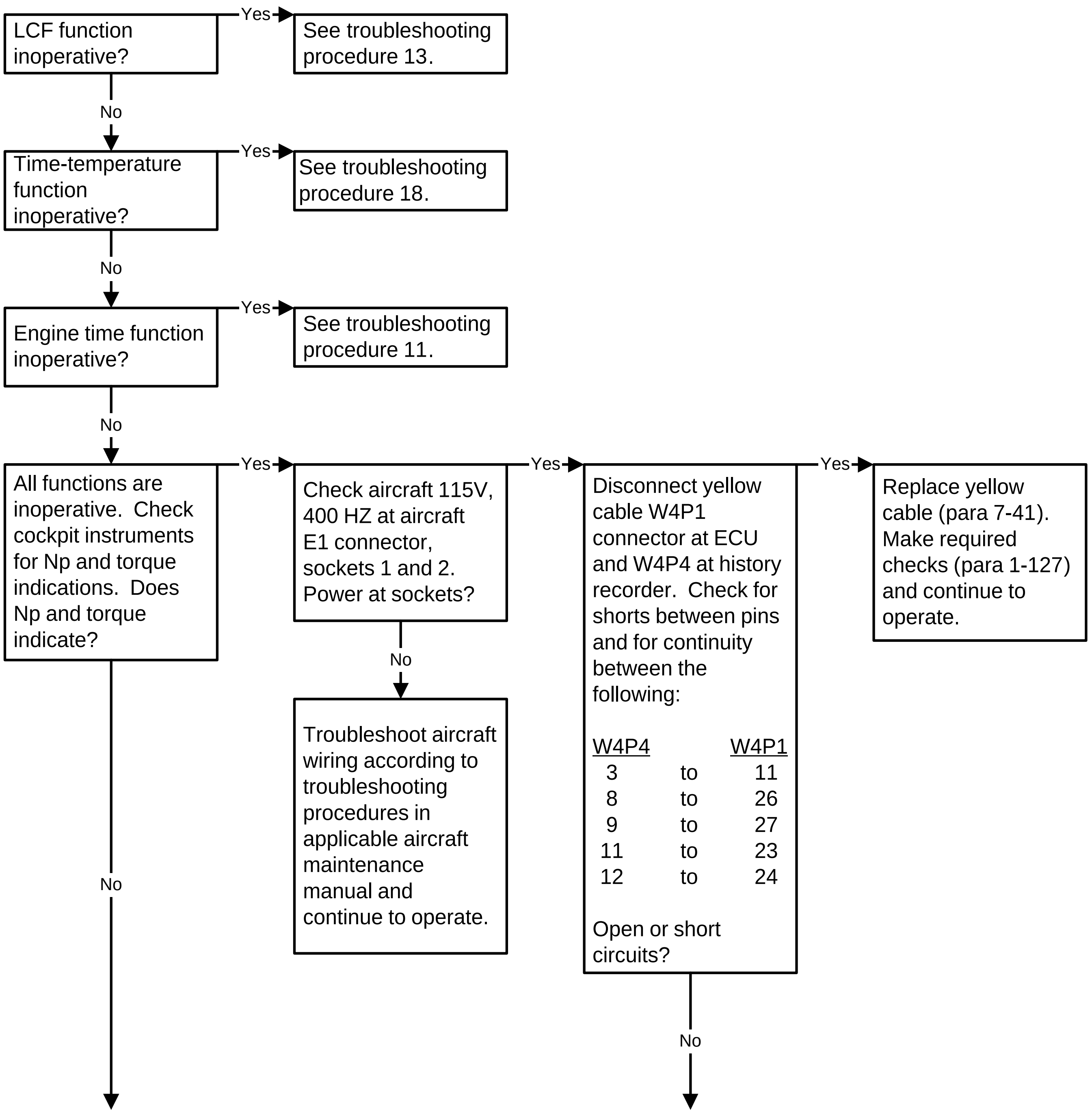
Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 16. (T700, T701) *History Recorder Malfunction (one or more functions inoperative)*

NOTE

- Check yellow cable connectors at ECU, alternator stator, and history recorder for tightness. When removing connectors, check pins and sockets for damage.
- During ground idle operations, check history recorder hours indicator window to justify that there is 115V, 400 HZ power at history recorder.



LCF function inoperative?

See troubleshooting procedure 13.

Time-temperature function inoperative?

See troubleshooting procedure 18.

Engine time function inoperative?

See troubleshooting procedure 11.

All functions are inoperative. Check cockpit instruments for Np and torque indications. Does Np and torque indicate?

Check aircraft 115V, 400 HZ at aircraft E1 connector, sockets 1 and 2. Power at sockets?

Troubleshoot aircraft wiring according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

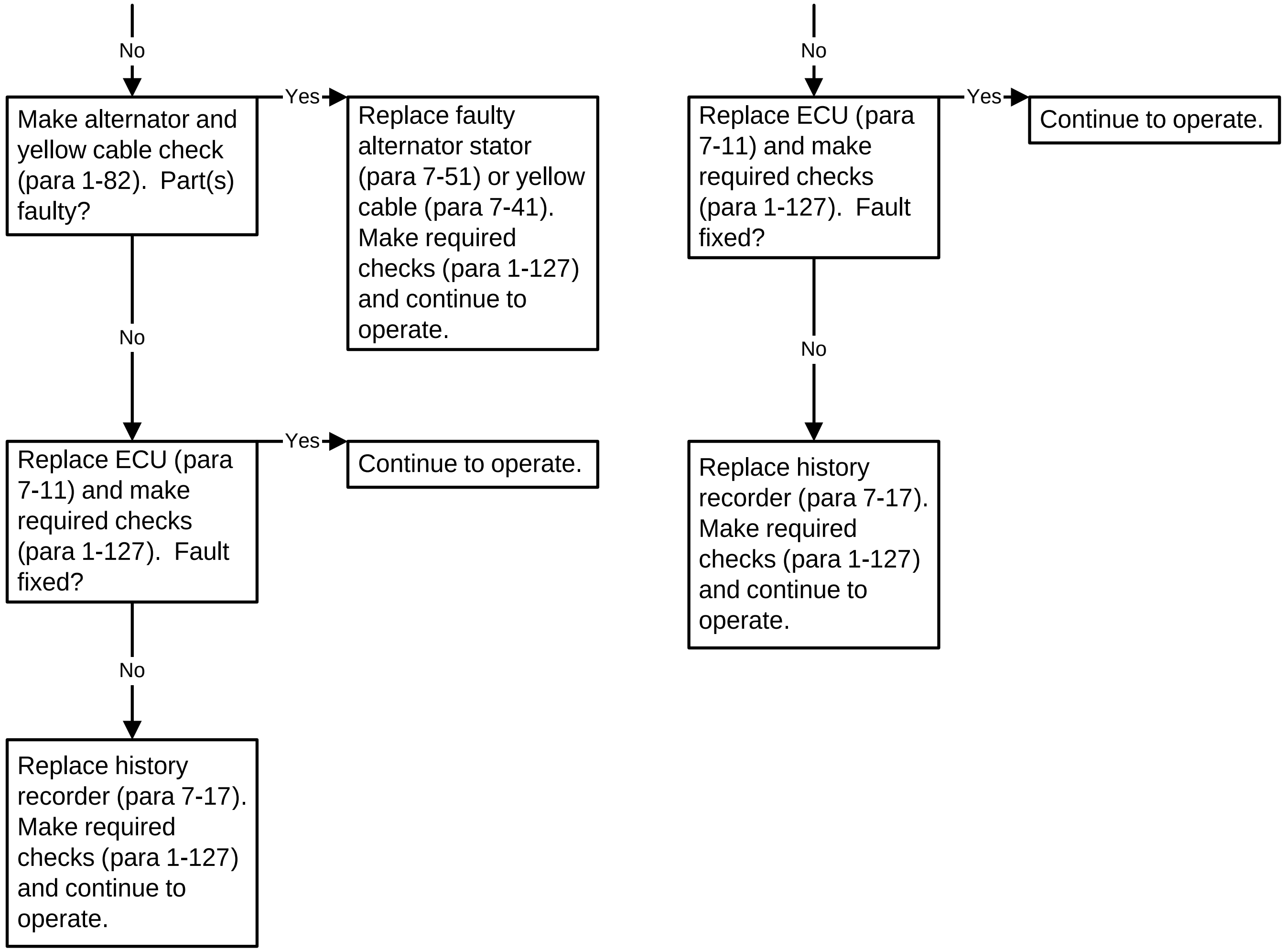
Disconnect yellow cable W4P1 connector at ECU and W4P4 at history recorder. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
3	to	11
8	to	26
9	to	27
11	to	23
12	to	24

Open or short circuits?

Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

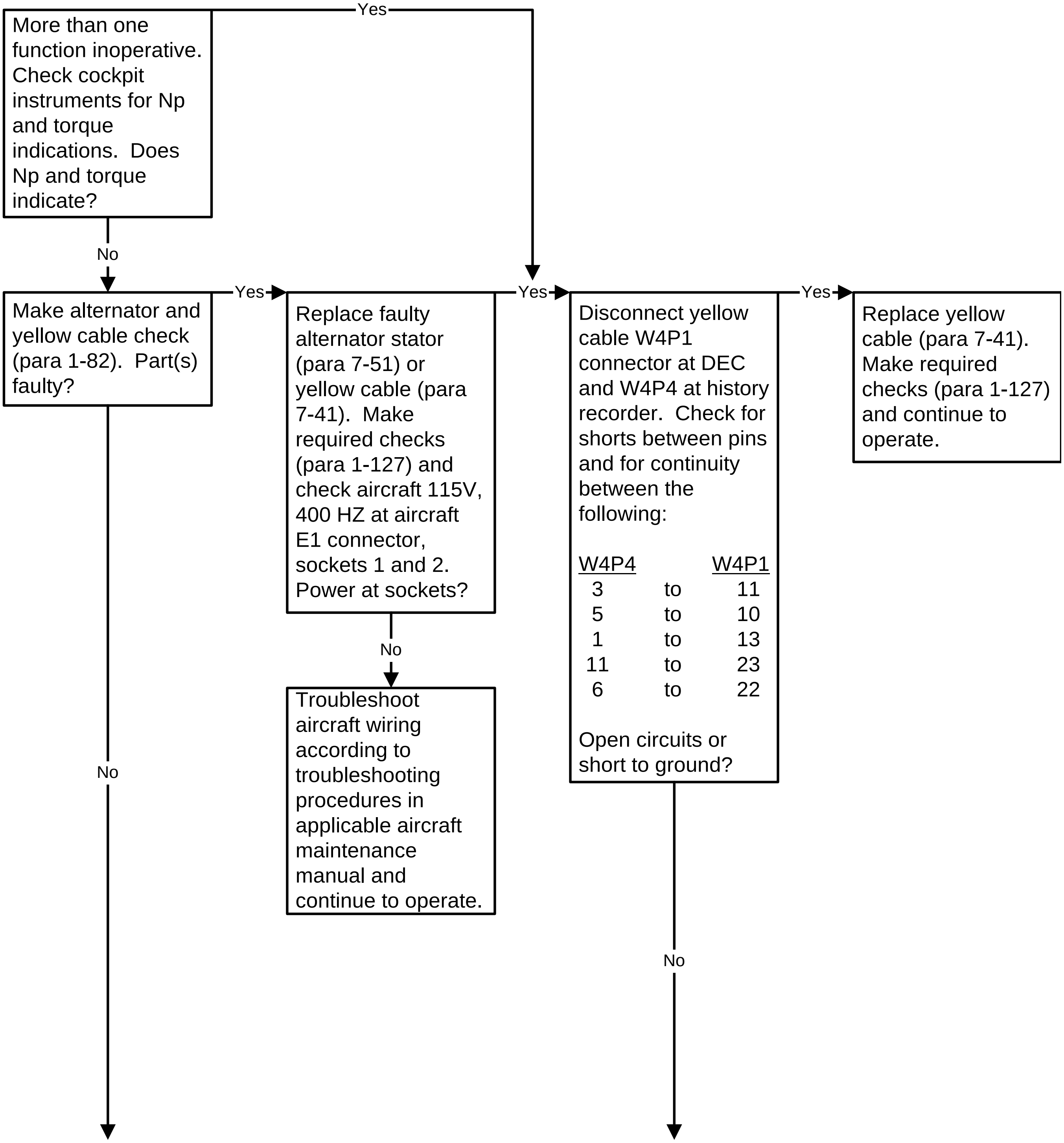
Troubleshooting Procedure 16. (T700, T701) History Recorder Malfunction (one or more functions inoperative) (Cont)



Troubleshooting Procedure 17. ***(T701C, T701D)*** *History Counter Malfunction (more than one function inoperative)*

NOTE

Check yellow cable connectors at DEC, alternator stator, and history counter for tightness. When removing connectors, check pins and sockets for damage.



More than one function inoperative. Check cockpit instruments for Np and torque indications. Does Np and torque indicate?

Make alternator and yellow cable check (para 1-82). Part(s) faulty?

Replace faulty alternator stator (para 7-51) or yellow cable (para 7-41). Make required checks (para 1-127) and check aircraft 115V, 400 HZ at aircraft E1 connector, sockets 1 and 2. Power at sockets?

Troubleshoot aircraft wiring according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

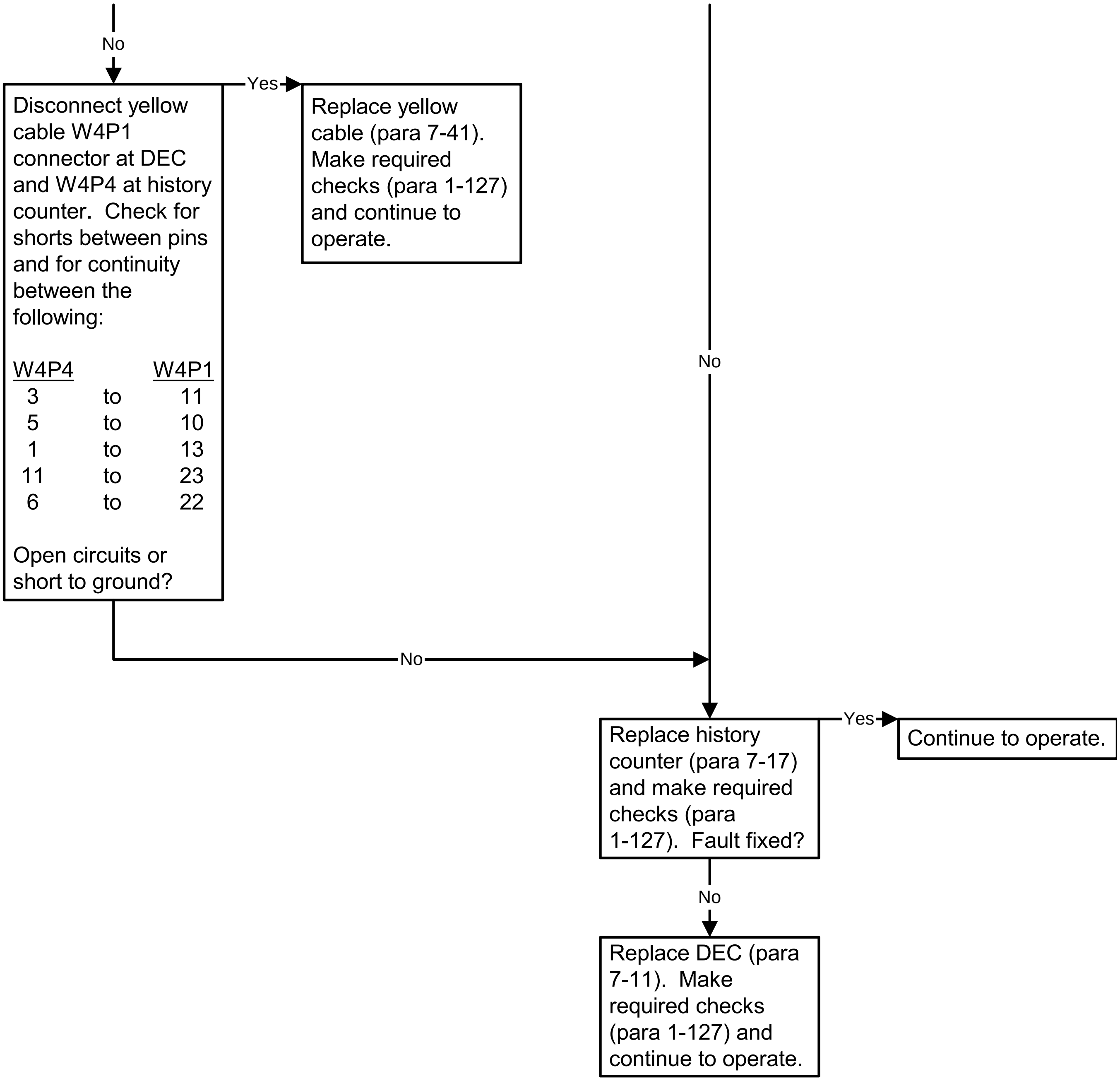
Disconnect yellow cable W4P1 connector at DEC and W4P4 at history recorder. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
3	to	11
5	to	10
1	to	13
11	to	23
6	to	22

Open circuits or short to ground?

Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 17. **(T701C, T701D)** History Counter Malfunction (more than one function inoperative) (Cont)*



Disconnect yellow cable W4P1 connector at DEC and W4P4 at history counter. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
3	to	11
5	to	10
1	to	13
11	to	23
6	to	22

Open circuits or short to ground?

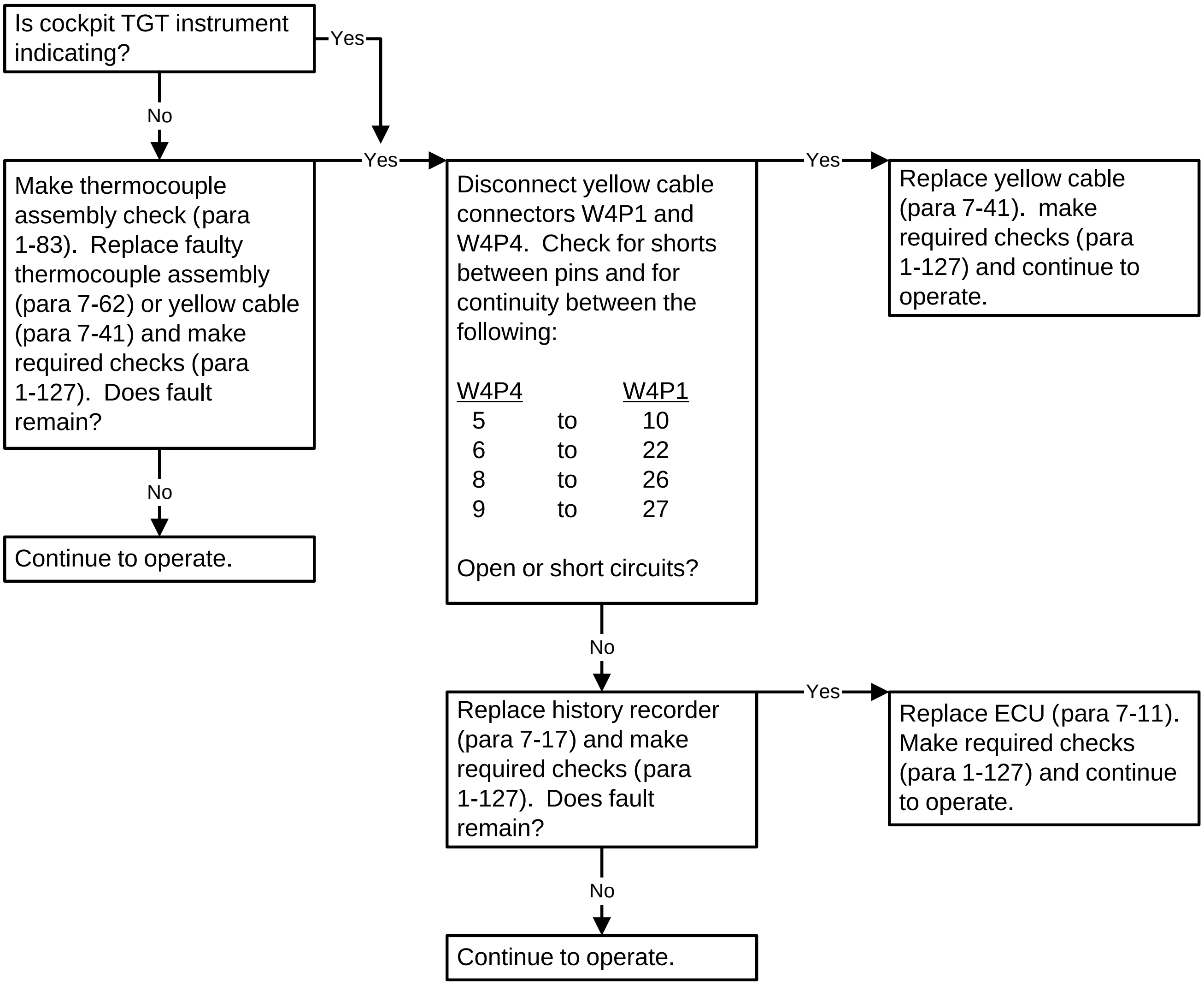
Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace history counter (para 7-17) and make required checks (para 1-127). Fault fixed?

Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 18. *(T700, T701)* ***History Recorder Malfunction (time temperature function inoperative)***



Is cockpit TGT instrument indicating?

Make thermocouple assembly check (para 1-83). Replace faulty thermocouple assembly (para 7-62) or yellow cable (para 7-41) and make required checks (para 1-127). Does fault remain?

Continue to operate.

Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
5	to	10
6	to	22
8	to	26
9	to	27

Open or short circuits?

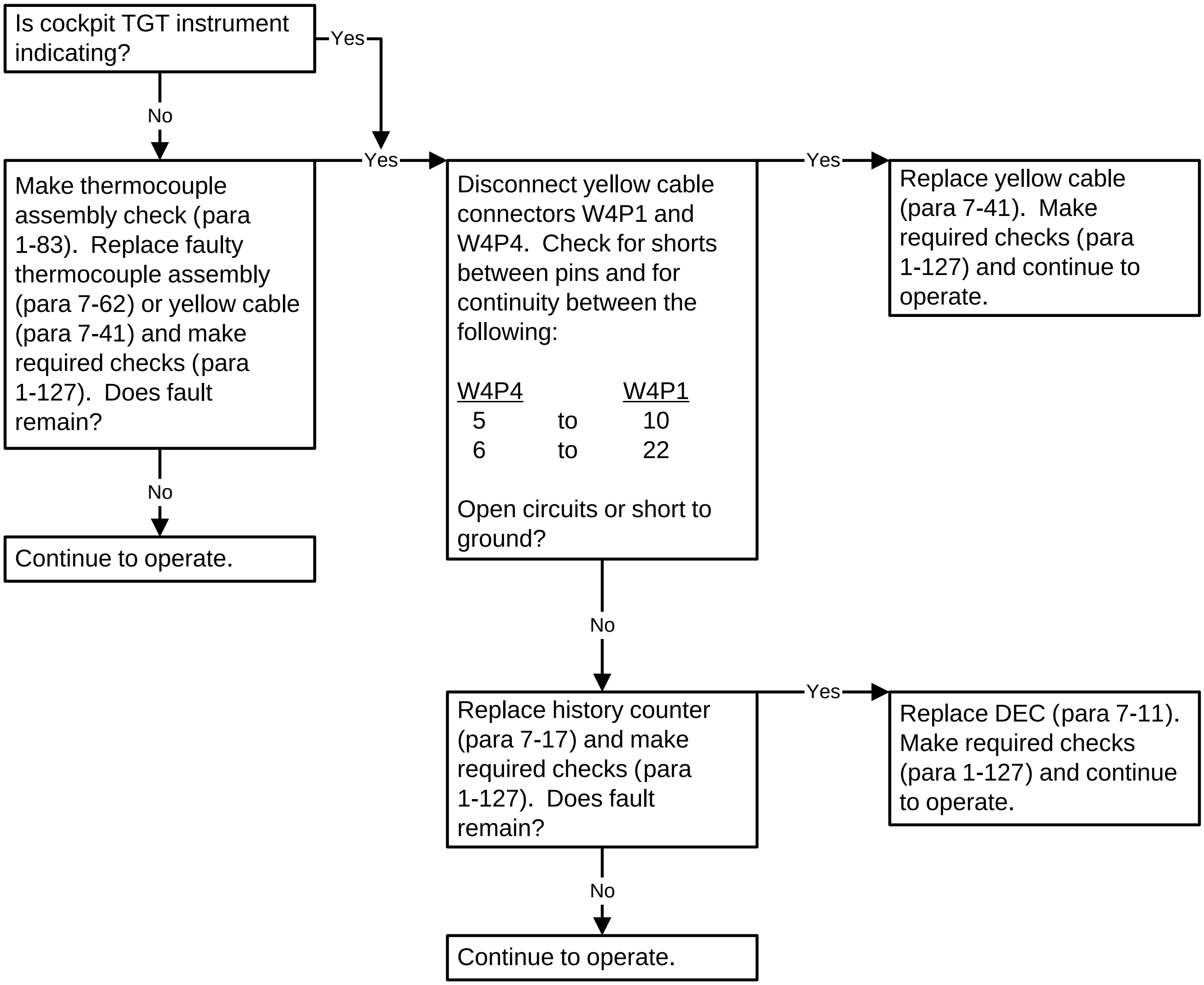
Replace yellow cable (para 7-41). make required checks (para 1-127) and continue to operate.

Replace history recorder (para 7-17) and make required checks (para 1-127). Does fault remain?

Replace ECU (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 19. History Counter Malfunction (time temperature function inoperative)



Is cockpit TGT instrument indicating?

Make thermocouple assembly check (para 1-83). Replace faulty thermocouple assembly (para 7-62) or yellow cable (para 7-41) and make required checks (para 1-127). Does fault remain?

Continue to operate.

Disconnect yellow cable connectors W4P1 and W4P4. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
5	to	10
6	to	22

Open circuits or short to ground?

Replace yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Replace history counter (para 7-17) and make required checks (para 1-127). Does fault remain?

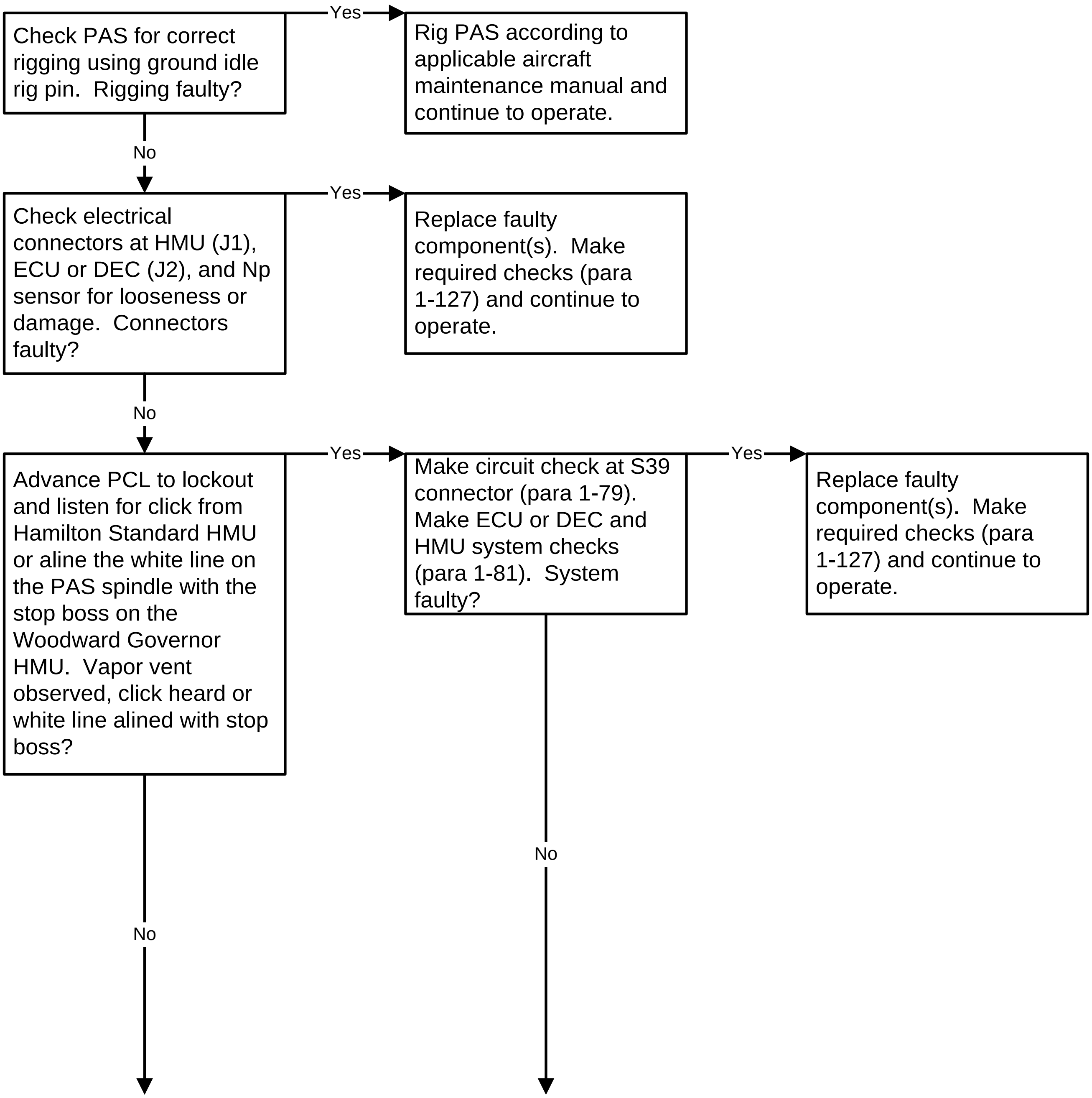
Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 20. No Np Governing When Advancing PCL to “FLY”

NOTE

- Np may increase as follows:
  - **(T700)** 105-106%
  - **(T701, T701C, T701D)** 118-120%, tripping Np overspeed system.
- ECU or DEC is reset from lockout when PCL is slightly forward of ground idle detent. Be sure that lack of Np governing is not just failure to retard PCL far enough to reset ECU or DEC operation.



Check PAS for correct rigging using ground idle rig pin. Rigging faulty?

Rig PAS according to applicable aircraft maintenance manual and continue to operate.

Check electrical connectors at HMU (J1), ECU or DEC (J2), and Np sensor for looseness or damage. Connectors faulty?

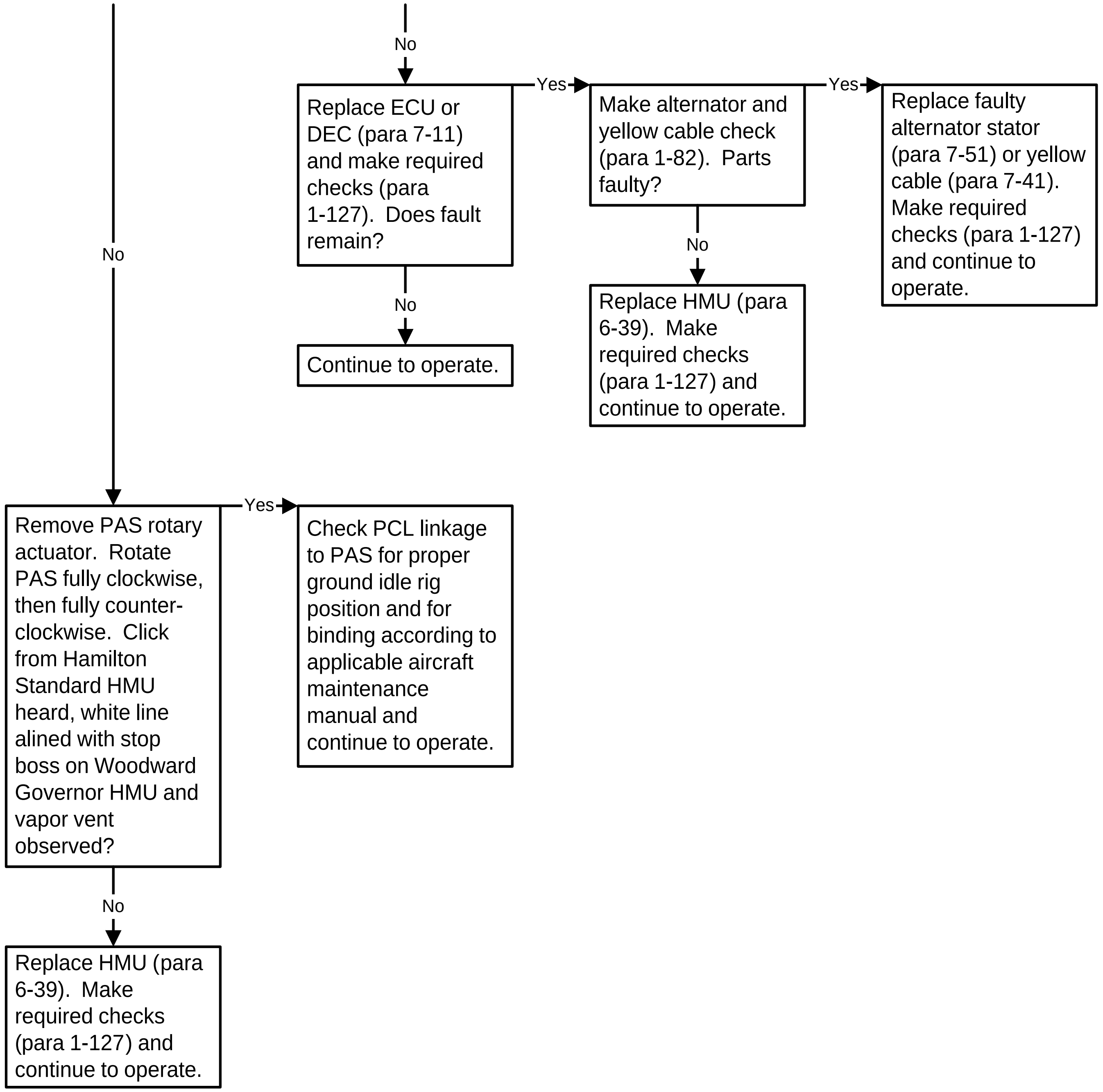
Replace faulty component(s). Make required checks (para 1-127) and continue to operate.

Advance PCL to lockout and listen for click from Hamilton Standard HMU or aline the white line on the PAS spindle with the stop boss on the Woodward Governor HMU. Vapor vent observed, click heard or white line alined with stop boss?

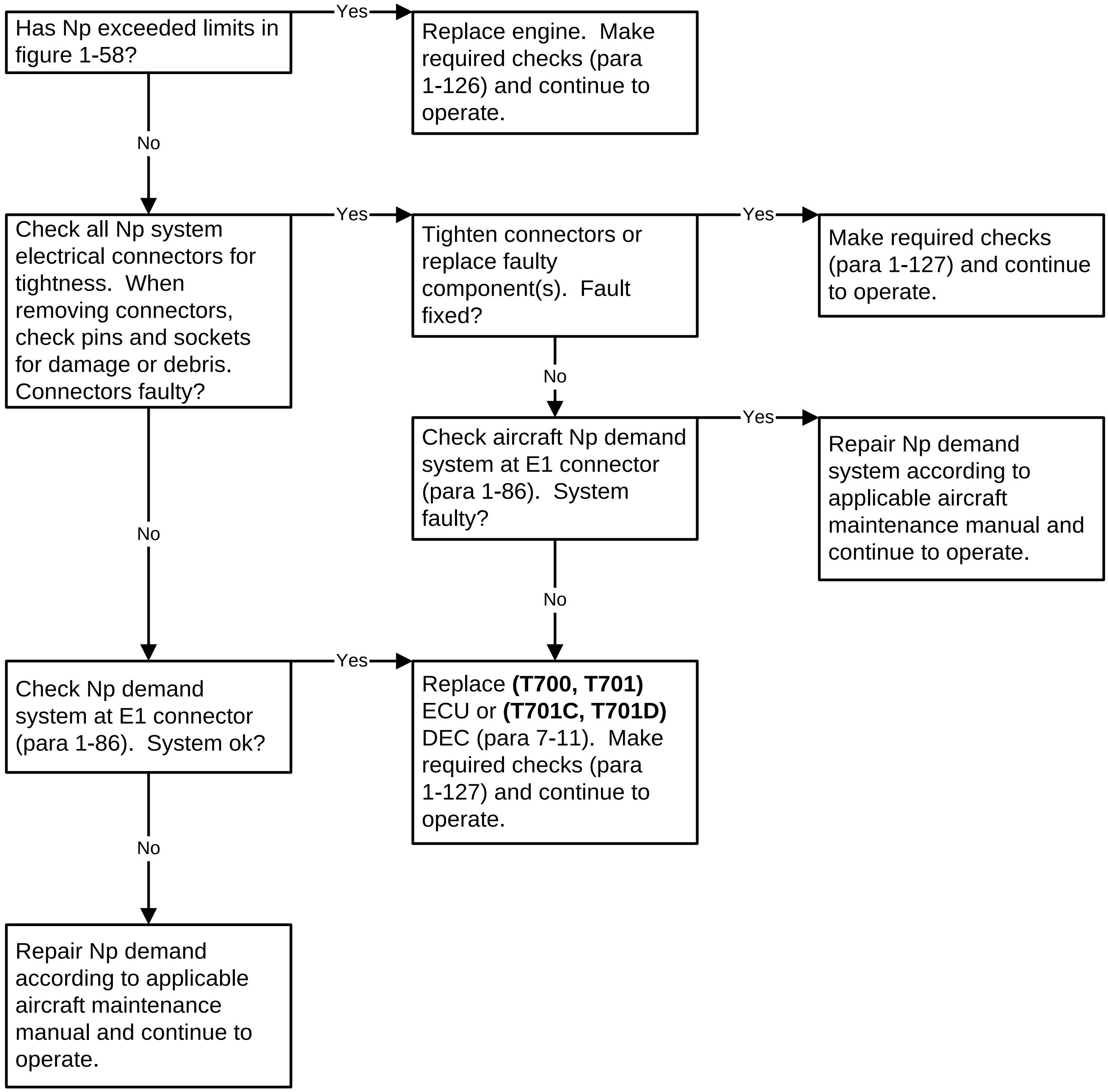
Make circuit check at S39 connector (para 1-79). Make ECU or DEC and HMU system checks (para 1-81). System faulty?

Replace faulty component(s). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 20. No Np Governing When Advancing PCL to “FLY” (Cont)



Troubleshooting Procedure 21. Np Does Not Respond to Np Demand Trim (with torque matching normal, Np does not respond to normal Np/Nr trim)



Has Np exceeded limits in figure 1-58?

Replace engine. Make required checks (para 1-126) and continue to operate.

Check all Np system electrical connectors for tightness. When removing connectors, check pins and sockets for damage or debris. Connectors faulty?

Tighten connectors or replace faulty component(s). Fault fixed?

Make required checks (para 1-127) and continue to operate.

Check aircraft Np demand system at E1 connector (para 1-86). System faulty?

Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Check Np demand system at E1 connector (para 1-86). System ok?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Repair Np demand according to applicable aircraft maintenance manual and continue to operate.

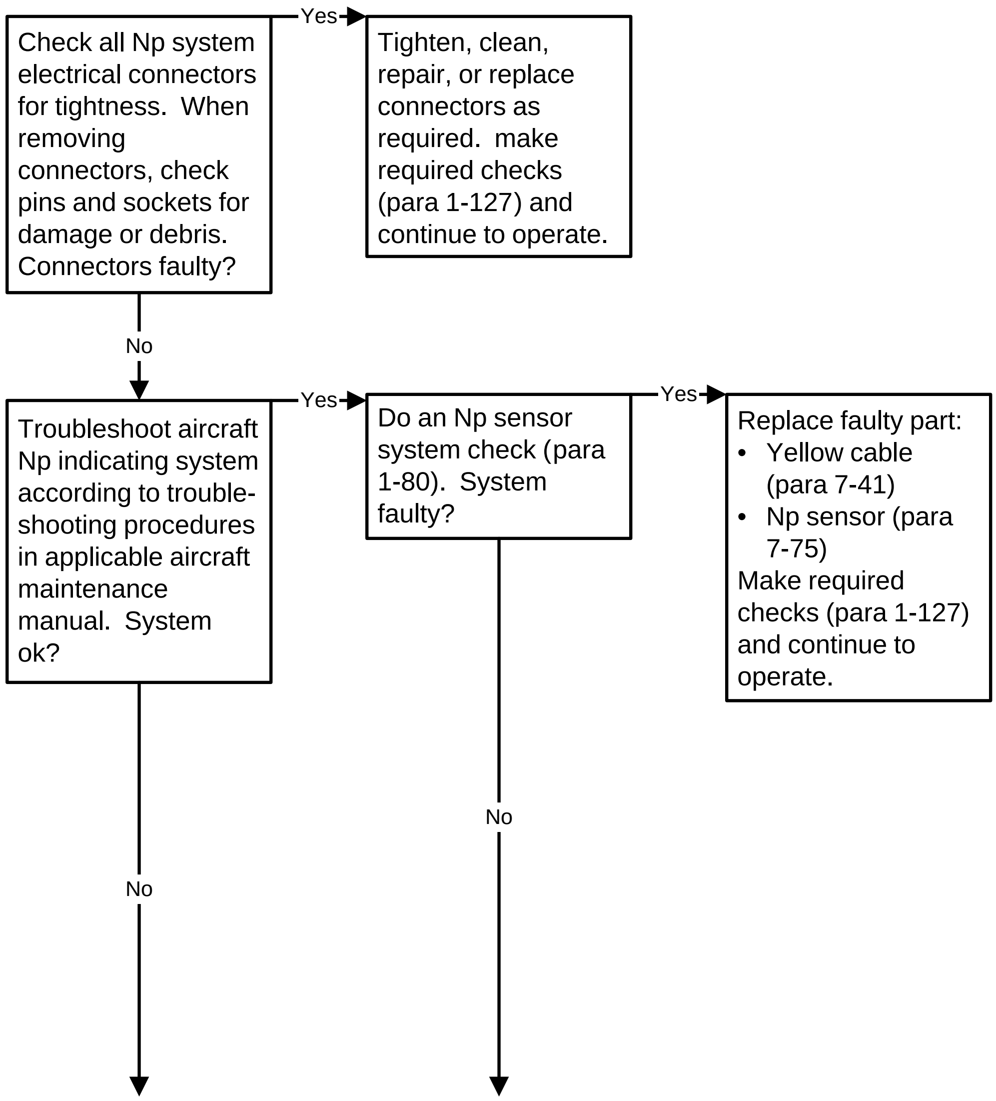
Troubleshooting Procedure 22. Np Instrument Not Indicating or Fluctuating (all other instruments normal)

CAUTION

- It may be necessary to rotate the main rotor by hand in the reverse direction. If so, be sure power turbine rotor is free to rotate.
- If power turbine rotor is seized, rotating the main rotor in the reverse direction will apply enough force to damage power turbine rotor.

NOTE

A slight audible metal-to-metal rubbing noise coming from within the power turbine module after extended operation at high power is normal.



Check all Np system electrical connectors for tightness. When removing connectors, check pins and sockets for damage or debris. Connectors faulty?

Tighten, clean, repair, or replace connectors as required. make required checks (para 1-127) and continue to operate.

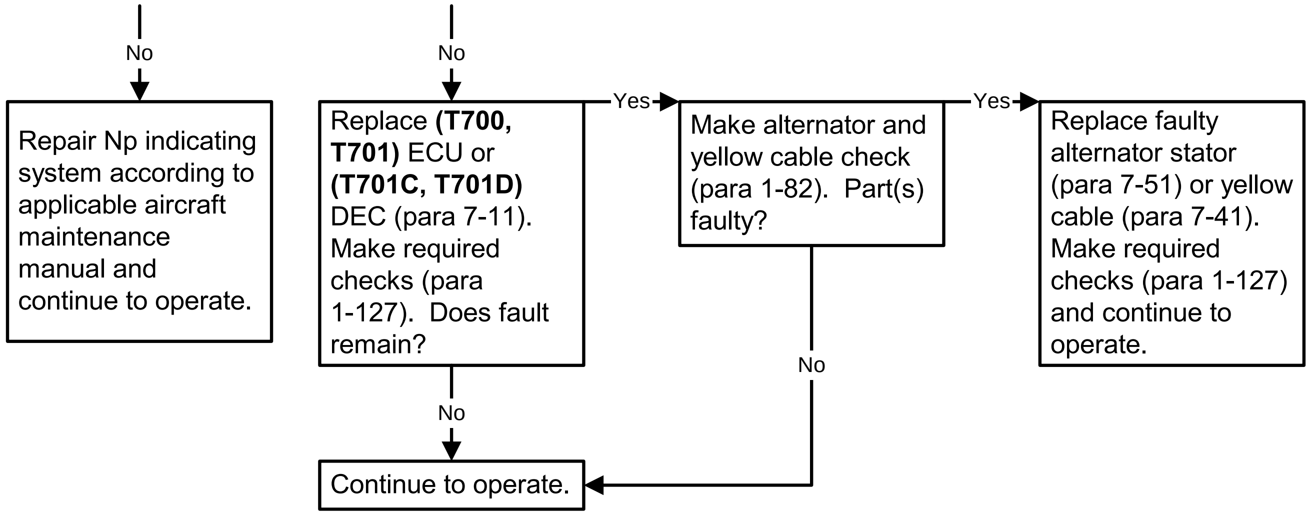
Troubleshoot aircraft Np indicating system according to trouble-shooting procedures in applicable aircraft maintenance manual. System ok?

Do an Np sensor system check (para 1-80). System faulty?

Replace faulty part:
- Yellow cable (para 7-41)
- Np sensor (para 7-75)

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 22. Np Instrument Not Indicating or Fluctuating (all other instruments normal) (Cont)



Repair Np indicating system according to applicable aircraft maintenance manual and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127). Does fault remain?

Make alternator and yellow cable check (para 1-82). Part(s) faulty?

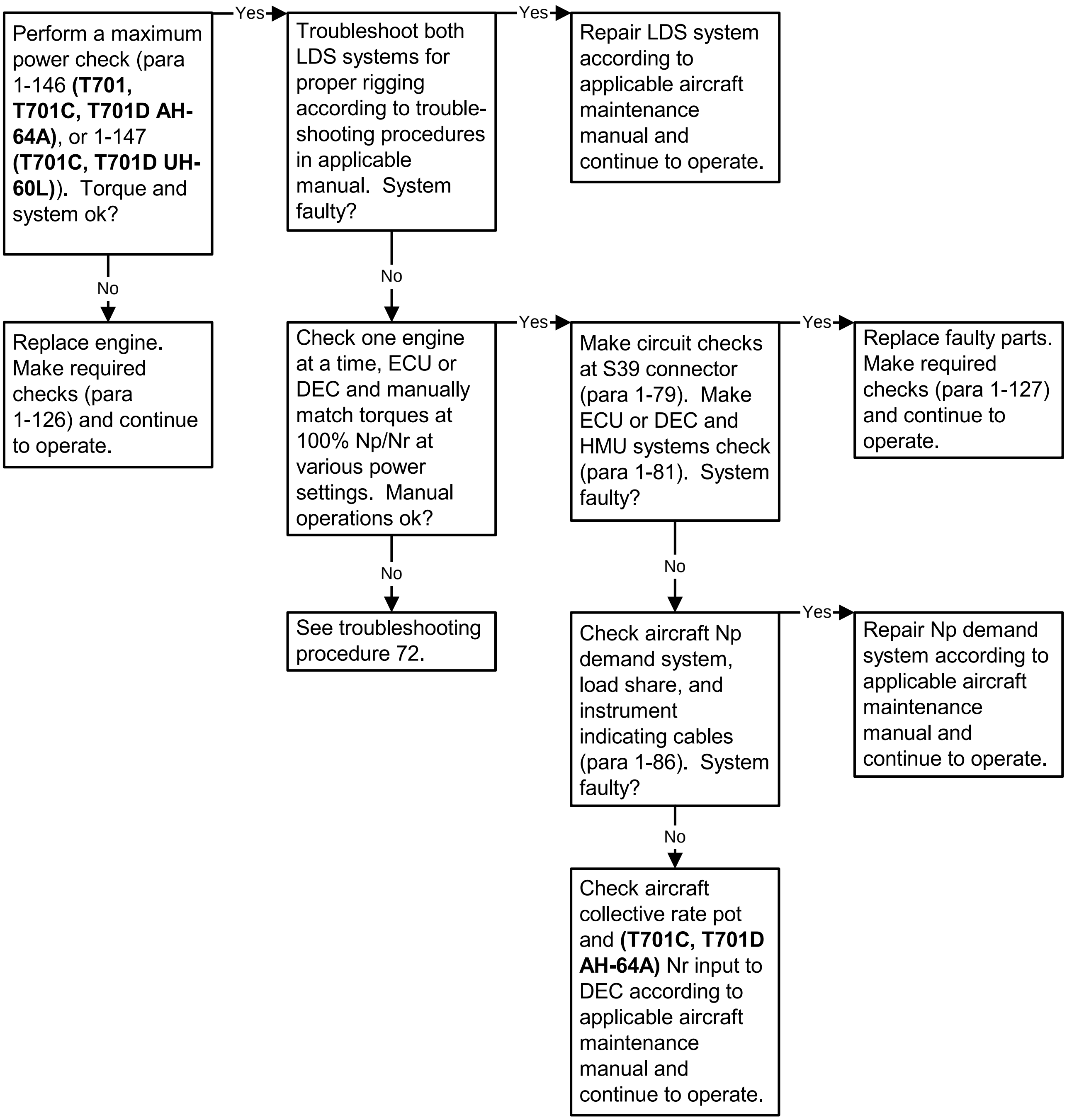
Replace faulty alternator stator (para 7-51) or yellow cable (para 7-41). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 23. Abnormal Np/Nr Rollback During Collective Application (with engines not at power limit condition)

NOTE

Steady-state and transient matching is working, but causing abnormal Np/Nr upspeed or underspeed.



Perform a maximum power check (para 1-146 **(T701, T701C, T701D AH-64A)**, or 1-147 **(T701C, T701D UH-60L)**). Torque and system ok?

Replace engine. Make required checks (para 1-126) and continue to operate.

Troubleshoot both LDS systems for proper rigging according to troubleshooting procedures in applicable manual. System faulty?

Repair LDS system according to applicable aircraft maintenance manual and continue to operate.

Check one engine at a time, ECU or DEC and manually match torques at 100% Np/Nr at various power settings. Manual operations ok?

See troubleshooting procedure 72.

Make circuit checks at S39 connector (para 1-79). Make ECU or DEC and HMU systems check (para 1-81). System faulty?

Replace faulty parts. Make required checks (para 1-127) and continue to operate.

Check aircraft Np demand system, load share, and instrument indicating cables (para 1-86). System faulty?

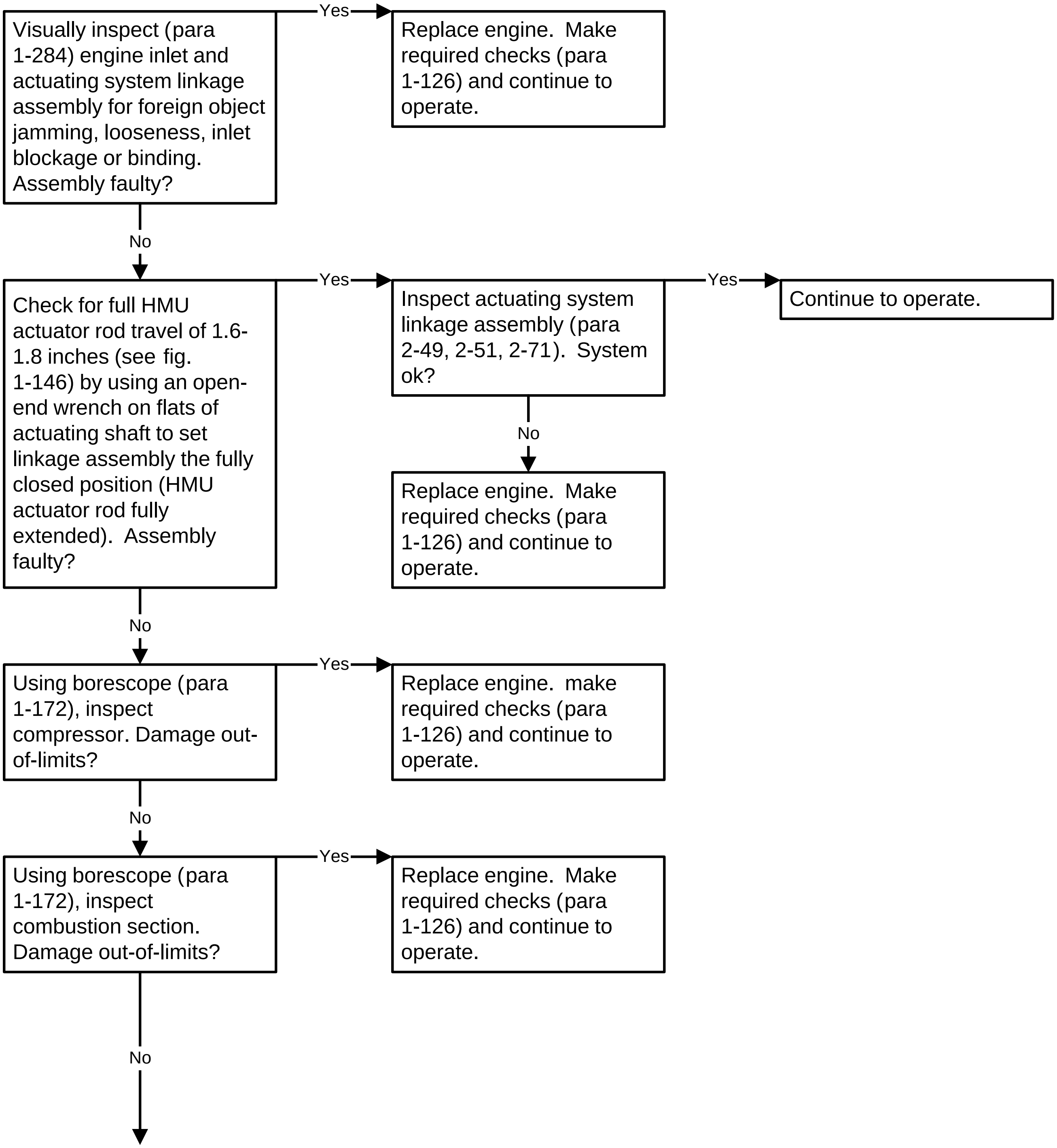
Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Check aircraft collective rate pot and **(T701C, T701D AH-64A)** Nr input to DEC according to applicable aircraft maintenance manual and continue to operate.

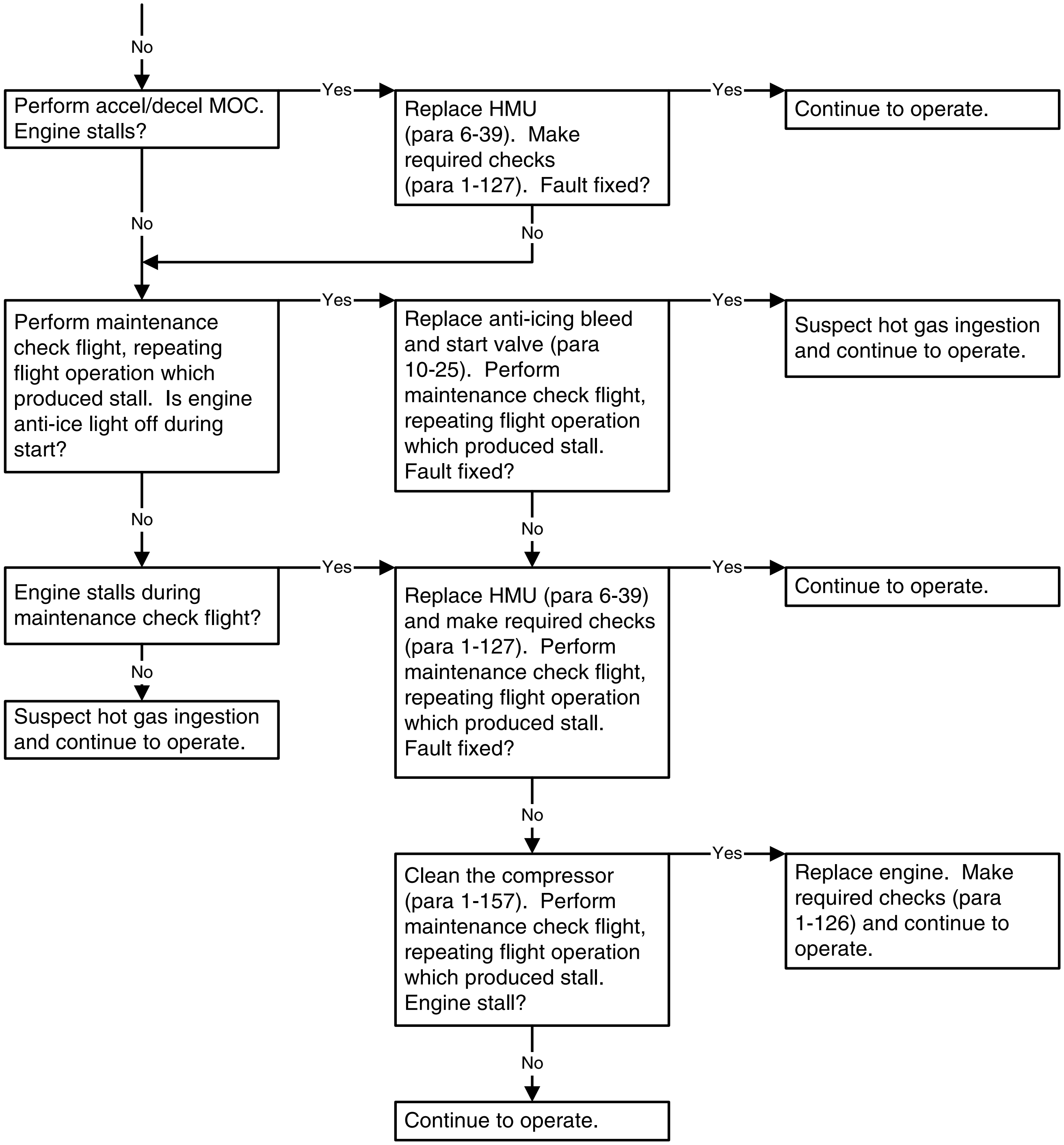
Troubleshooting Procedure 24. Stall Above Ground Idle Speed (acceleration or deceleration above ground idle speed)

NOTE

- A stall is indicated by an audible rumble or bang and may not cause a rise in TGT.
- If an unusually high-pitched whining sound is heard, see paragraph 1-87.



Troubleshooting Procedure 24. Stall Above Ground Idle Speed (acceleration or deceleration above ground idle speed) (Cont)



Troubleshooting Procedure 25. Starting Stalls (audible popping or whining during Ng acceleration to ground idle speed)

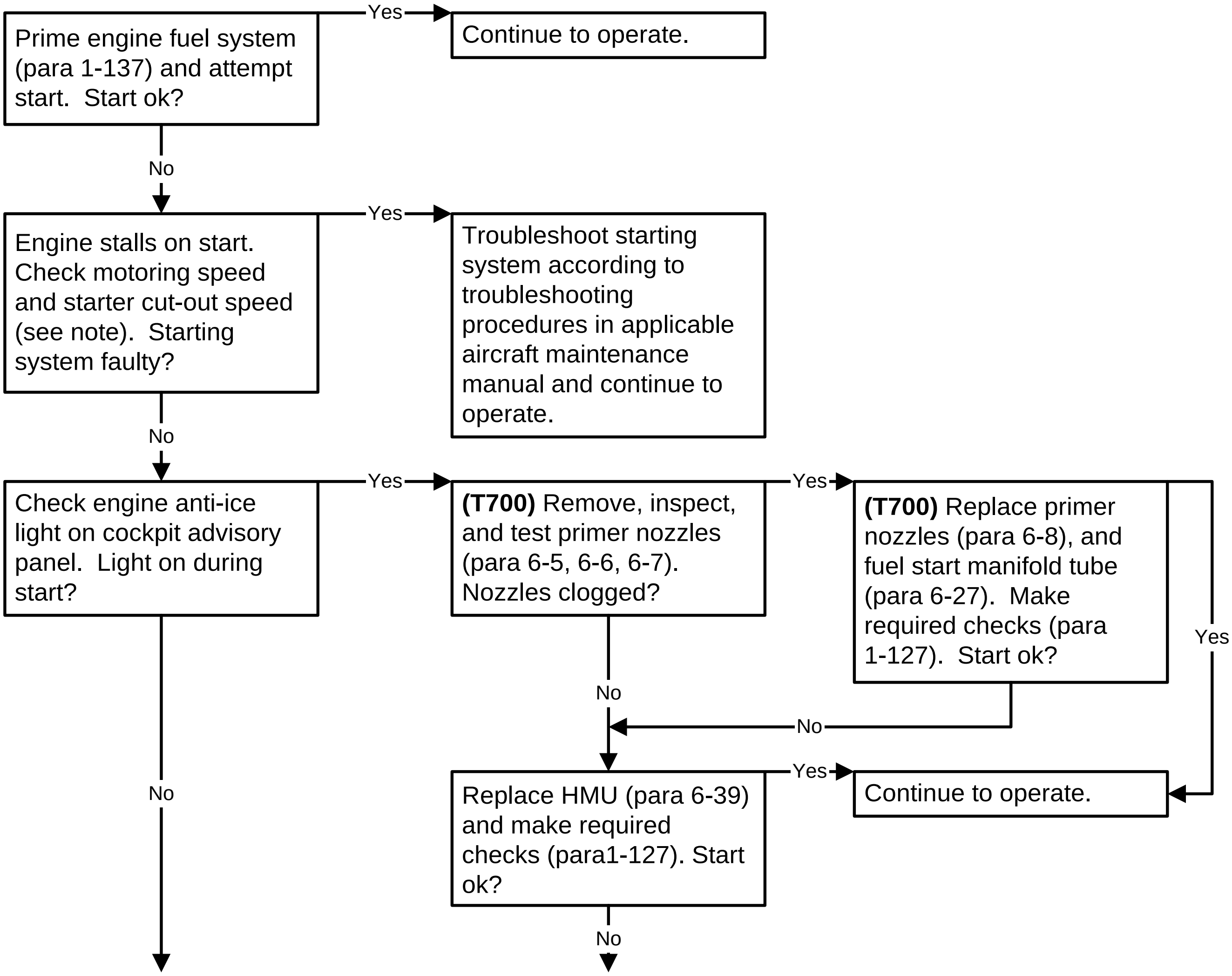
CAUTION

If TGT exceeds the following,
- **(T700)** 850°C (1562°F)
- **(T701)** 869°C (1596°F)
- **(T701C, T701D)** 851°C (1564°F)

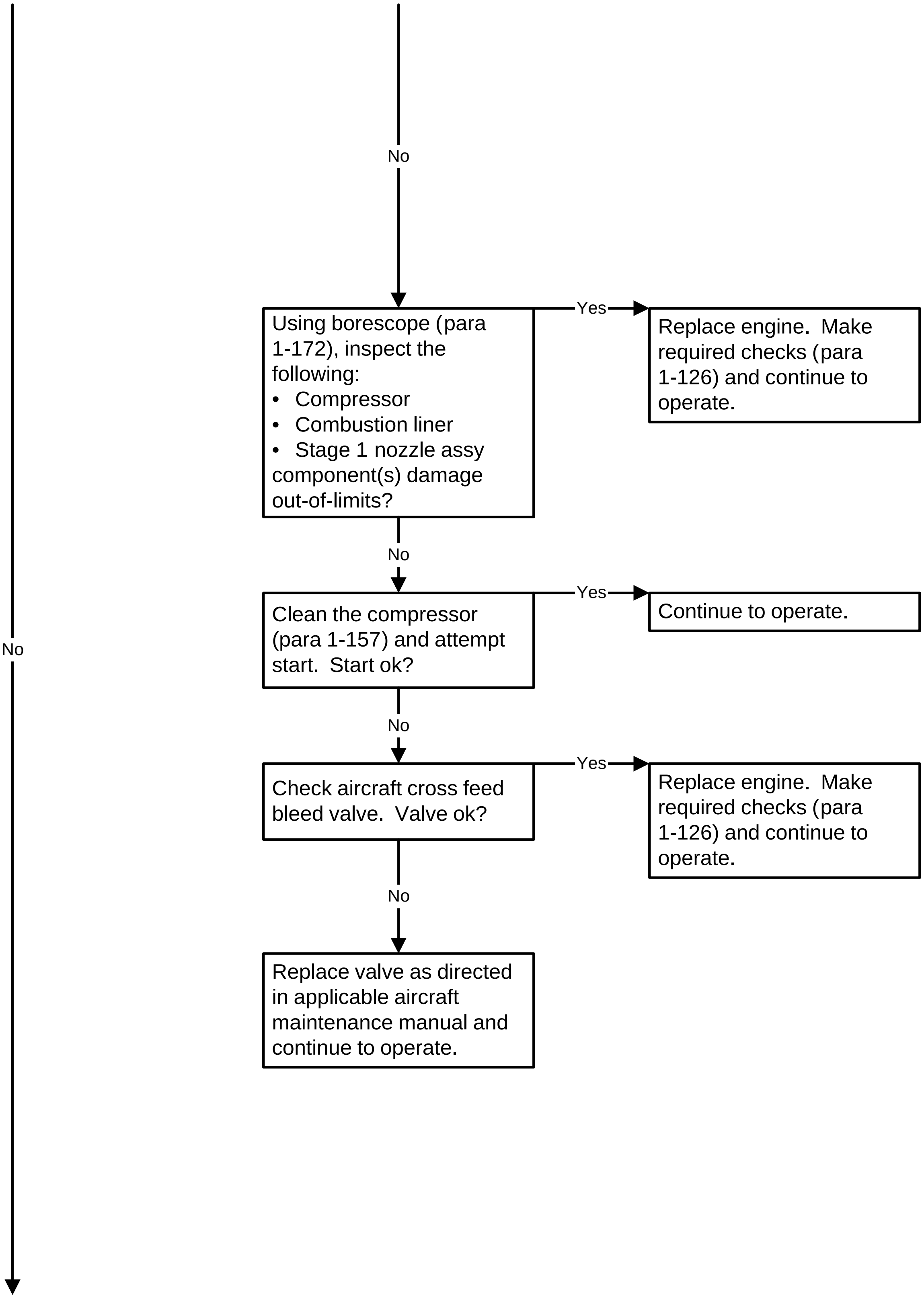
before idle speed is reached, retard PCL to off. Turn ignition switch off. Motor engine until TGT decreases below 538°C (1000°F).

NOTE

Starting system should be able to motor engine to at least 24% Ng (10,728 RPM). Starter must not cut out below 52% Ng (23,244 RPM). This can be checked by using cockpit instruments.



Troubleshooting Procedure 25. Starting Stalls (audible popping or whining during Ng acceleration to ground idle speed) (Cont)



Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion liner
- Stage 1 nozzle assy

component(s) damage out-of-limits?

Replace engine. Make required checks (para 1-126) and continue to operate.

Clean the compressor (para 1-157) and attempt start. Start ok?

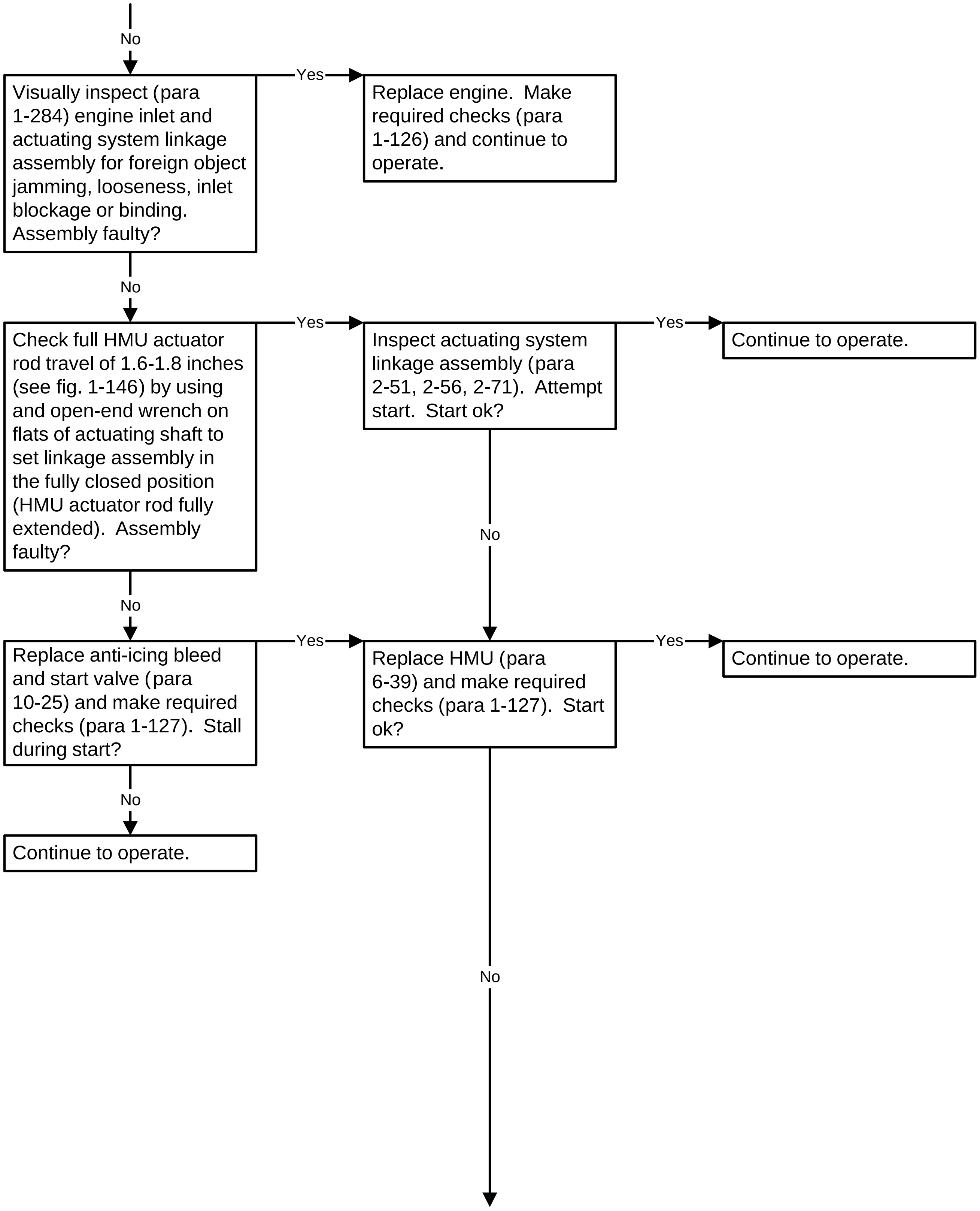
Continue to operate.

Check aircraft cross feed bleed valve. Valve ok?

Replace engine. Make required checks (para 1-126) and continue to operate.

Replace valve as directed in applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 25. Starting Stalls (audible popping or whining during Ng acceleration to ground idle speed) (Cont)



Visually inspect (para 1-284) engine inlet and actuating system linkage assembly for foreign object jamming, looseness, inlet blockage or binding. Assembly faulty?

Replace engine. Make required checks (para 1-126) and continue to operate.

Check full HMU actuator rod travel of 1.6-1.8 inches (see fig. 1-146) by using and open-end wrench on flats of actuating shaft to set linkage assembly in the fully closed position (HMU actuator rod fully extended). Assembly faulty?

Inspect actuating system linkage assembly (para 2-51, 2-56, 2-71). Attempt start. Start ok?

Continue to operate.

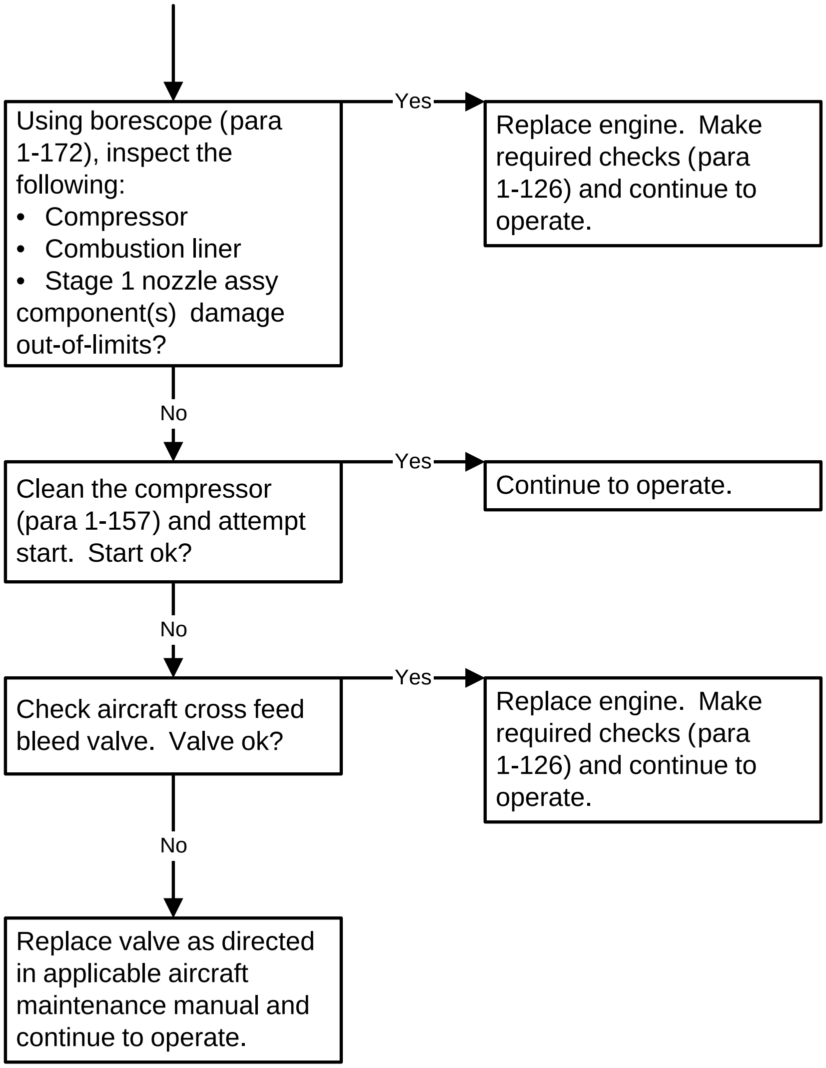
Replace anti-icing bleed and start valve (para 10-25) and make required checks (para 1-127). Stall during start?

Replace HMU (para 6-39) and make required checks (para 1-127). Start ok?

Continue to operate.

Continue to operate.

Troubleshooting Procedure 25. Starting Stalls (audible popping or whining during Ng acceleration to ground idle speed) (Cont)



Troubleshooting Procedure 26. Abnormally High TGT During Start

CAUTION

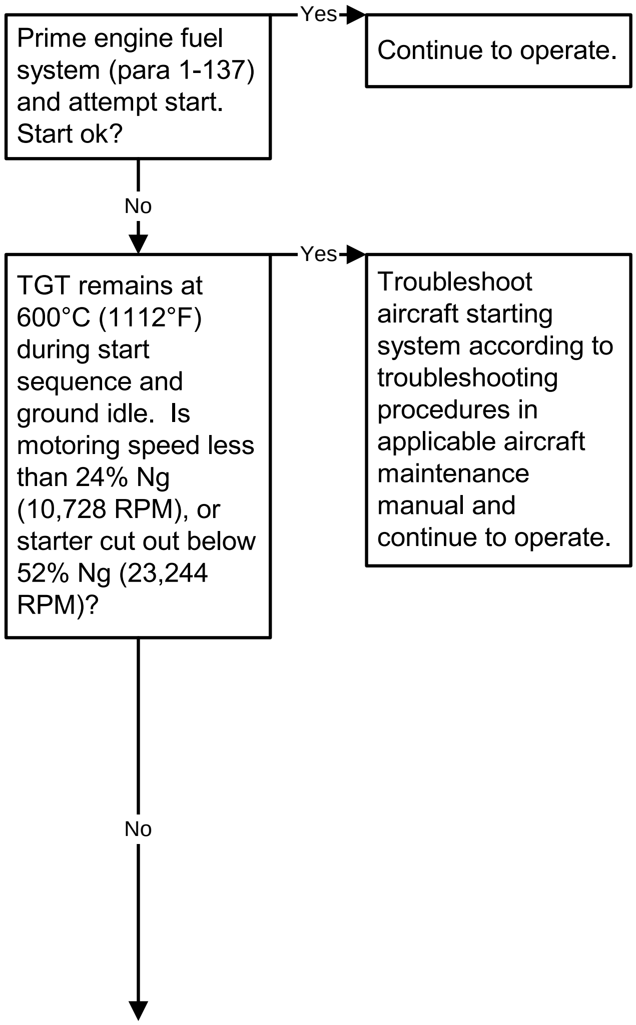
If TGT exceeds the following, but within the troubleshooting area of figures 1-50, 1-51, or 1-52,

- **(T700)** 850°C (1562°F)
- **(T701)** 869°C (1596°F)
- **(T701C, T701D)** 851°C (1564°F)

before idle speed is reached, retard PCL to off. Turn ignition switch off. Motor engine until TGT decreases below 538°C (1000°F).

NOTE

Starting system should be able to motor engine to at least 24% Ng (10,728 RPM). Starter must not cut out below 52% Ng (23,244 RPM). This can be checked by using cockpit instruments.



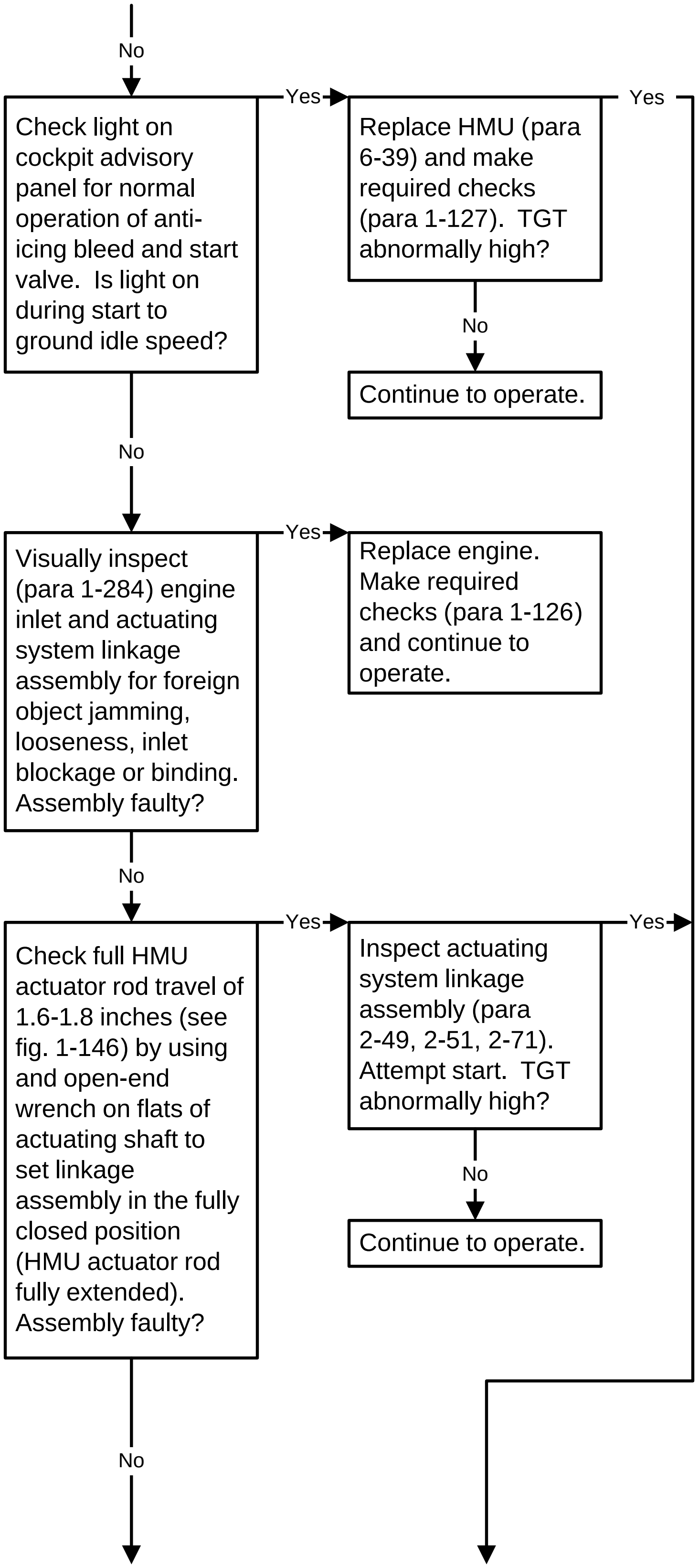
Prime engine fuel system (para 1-137) and attempt start. Start ok?

Continue to operate.

TGT remains at 600°C (1112°F) during start sequence and ground idle. Is motoring speed less than 24% Ng (10,728 RPM), or starter cut out below 52% Ng (23,244 RPM)?

Troubleshoot aircraft starting system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 26. Abnormally High TGT During Start (Cont)



Check light on cockpit advisory panel for normal operation of anti-icing bleed and start valve. Is light on during start to ground idle speed?

Replace HMU (para 6-39) and make required checks (para 1-127). TGT abnormally high?

Continue to operate.

Visually inspect (para 1-284) engine inlet and actuating system linkage assembly for foreign object jamming, looseness, inlet blockage or binding. Assembly faulty?

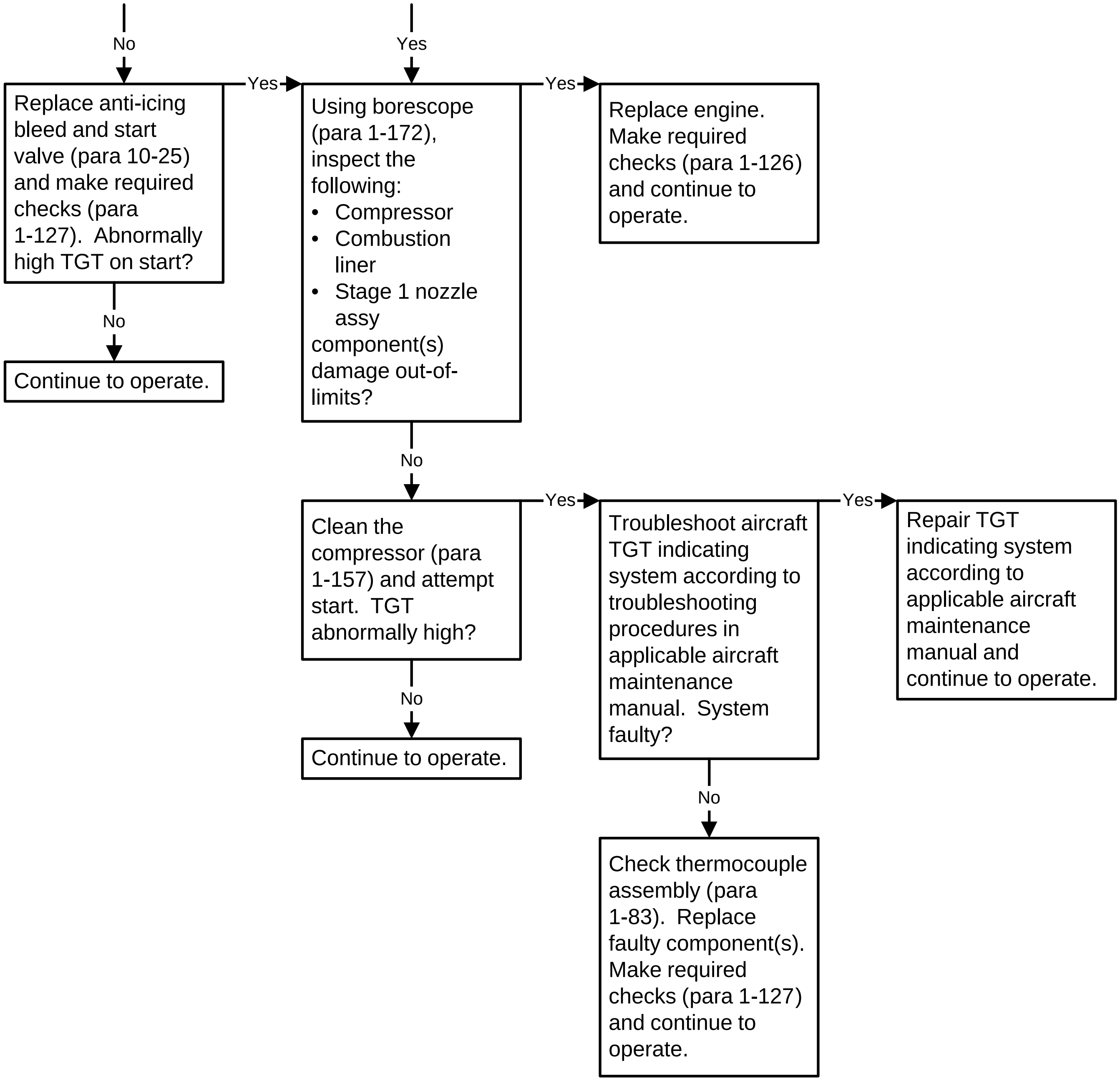
Replace engine. Make required checks (para 1-126) and continue to operate.

Check full HMU actuator rod travel of 1.6-1.8 inches (see fig. 1-146) by using and open-end wrench on flats of actuating shaft to set linkage assembly in the fully closed position (HMU actuator rod fully extended). Assembly faulty?

Inspect actuating system linkage assembly (para 2-49, 2-51, 2-71). Attempt start. TGT abnormally high?

Continue to operate.

Troubleshooting Procedure 26. Abnormally High TGT During Start (Cont)



Replace anti-icing bleed and start valve (para 10-25) and make required checks (para 1-127). Abnormally high TGT on start?

Continue to operate.

Using borescope (para 1-172), inspect the following:

- Compressor
- Combustion liner
- Stage 1 nozzle assy

component(s) damage out-of-limits?

Replace engine. Make required checks (para 1-126) and continue to operate.

Clean the compressor (para 1-157) and attempt start. TGT abnormally high?

Continue to operate.

Troubleshoot aircraft TGT indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

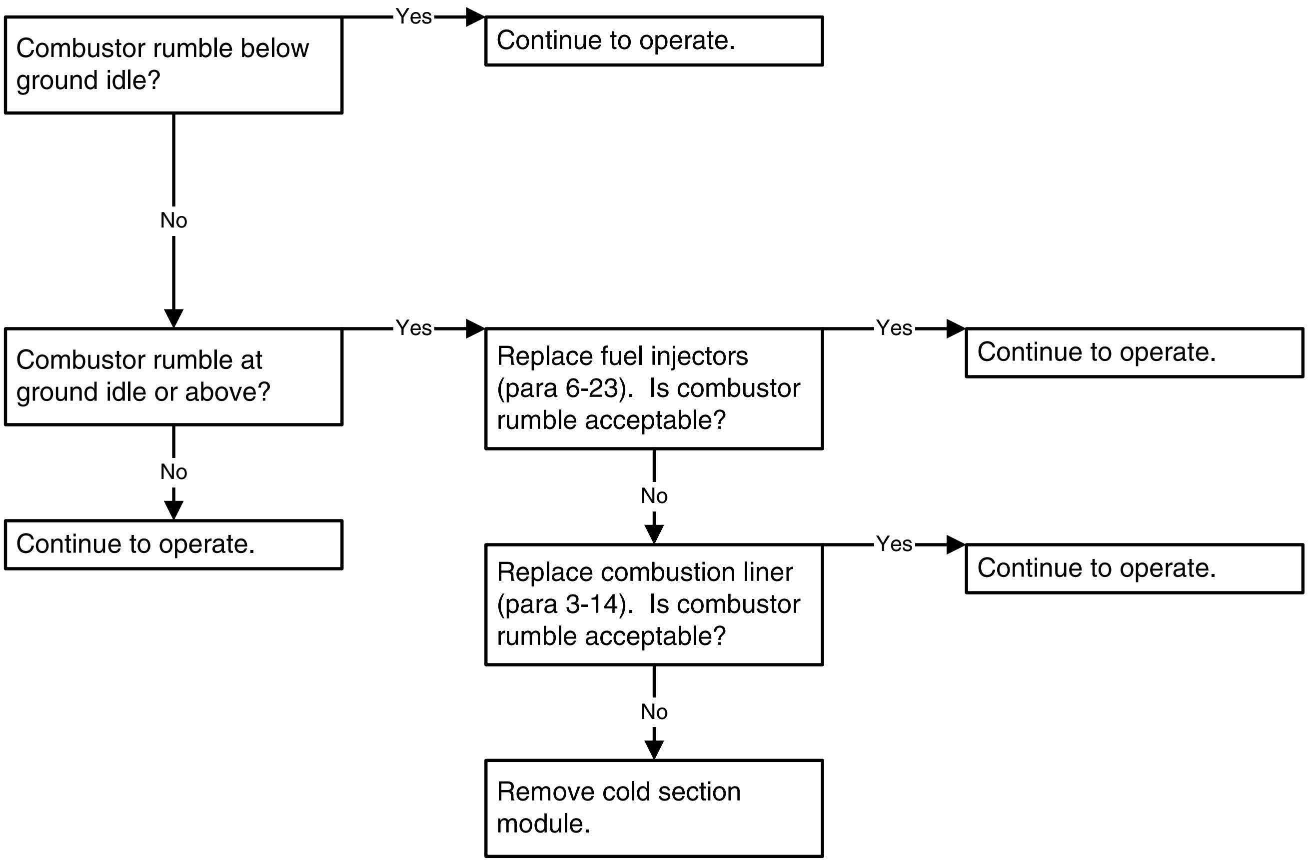
Repair TGT indicating system according to applicable aircraft maintenance manual and continue to operate.

Check thermocouple assembly (para 1-83). Replace faulty component(s). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 27. Combustor Rumble During Start

NOTE

- Combustor rumble is a low frequency noise often described as a howl that may be heard intermittently during engine start.
- Combustor rumble may be more pronounced during cold weather and/or during engine acceleration to ground idle.

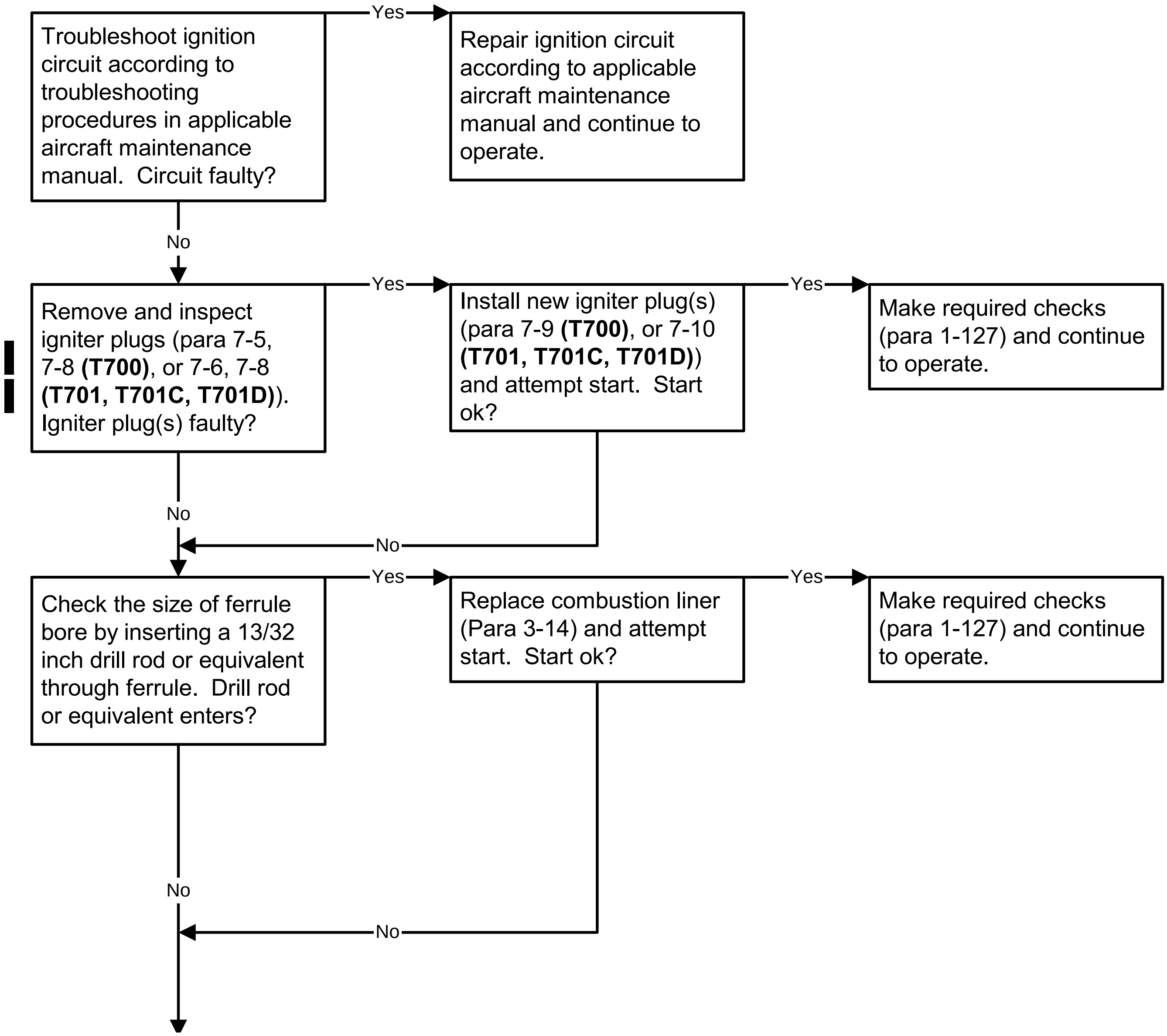


Troubleshooting Procedure 28. No Start (fuel mist seen coming from tailpipe; no rise in TGT)

WARNING

Igniter Plugs

- Before energizing the ignition circuit, be certain that no fuel or oil is present. Have fire extinguishing equipment present.
- High voltage is present. Be certain the ignition unit and plugs are grounded before energizing the circuit.
- Never touch or make contact with the electrical output connector when operating any ignition component.
- Never hold or make contact with the igniter plug when energizing the ignition component.



Troubleshoot ignition circuit according to troubleshooting procedures in applicable aircraft maintenance manual. Circuit faulty?

Repair ignition circuit according to applicable aircraft maintenance manual and continue to operate.

Remove and inspect igniter plugs (para 7-5, 7-8 **(T700)**, or 7-6, 7-8 **(T701, T701C, T701D)**). Igniter plug(s) faulty?

Install new igniter plug(s) (para 7-9 **(T700)**, or 7-10 **(T701, T701C, T701D)**) and attempt start. Start ok?

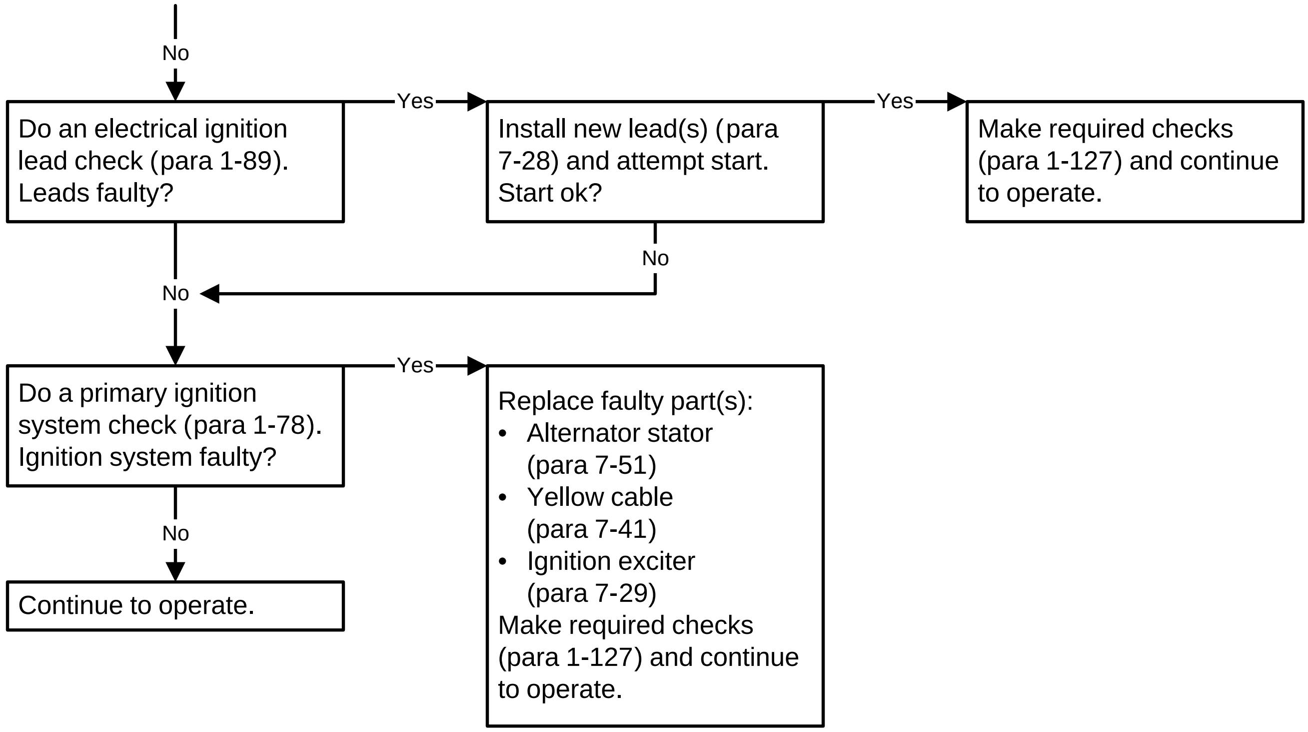
Make required checks (para 1-127) and continue to operate.

Check the size of ferrule bore by inserting a 13/32 inch drill rod or equivalent through ferrule. Drill rod or equivalent enters?

Replace combustion liner (Para 3-14) and attempt start. Start ok?

Make required checks (para 1-127) and continue to operate.

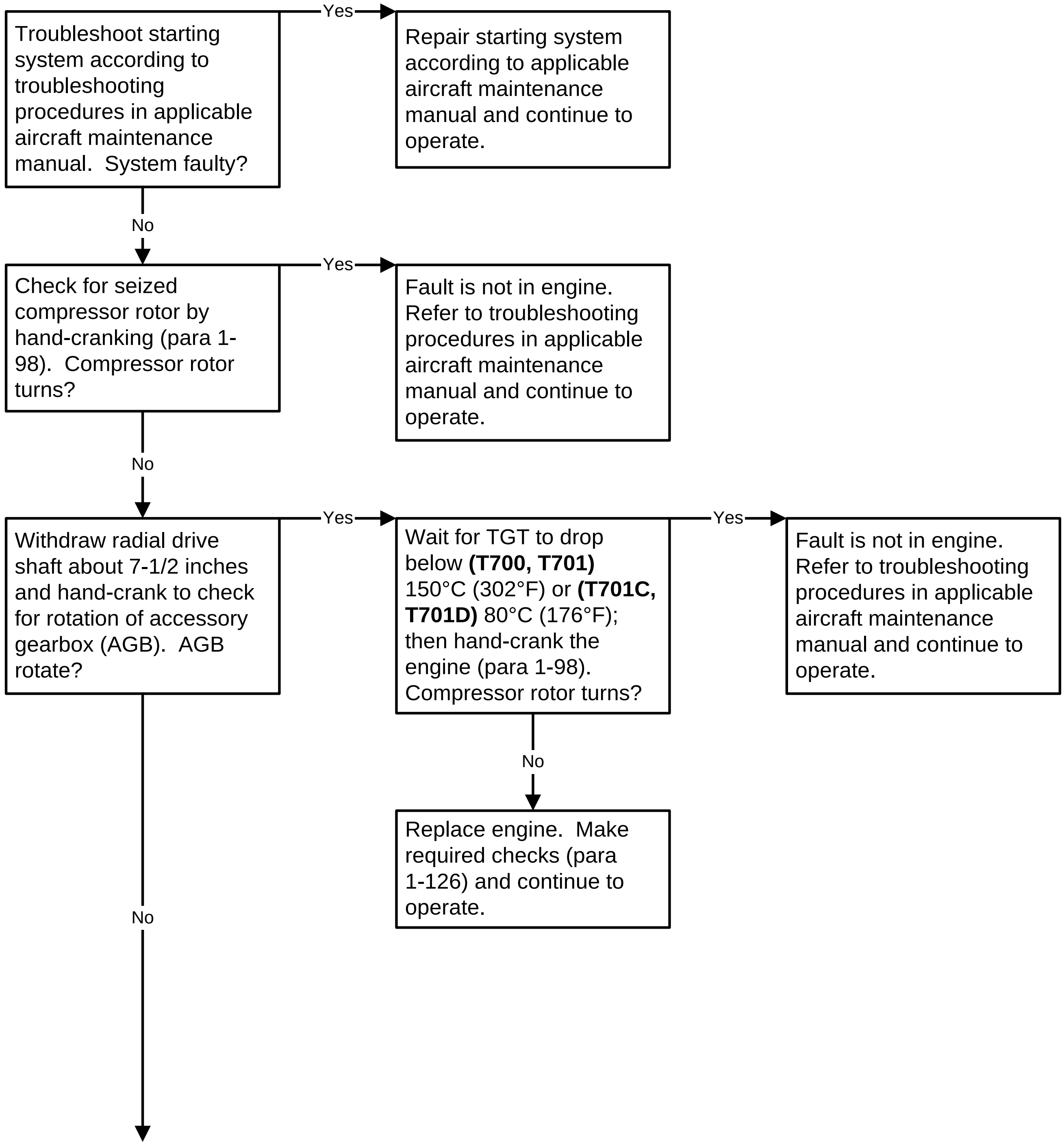
Troubleshooting Procedure 28. No Start (fuel mist seen coming from tailpipe; no rise in TGT) (Cont)



Troubleshooting Procedure 29. No Start (no compressor rotor rotation)

NOTE

Starting system should be able to motor engine to at least 24% Ng (10,728 rpm). Starter must not cut out below 52% Ng (23,244 rpm). This can be checked by using cockpit instruments.



Troubleshoot starting system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair starting system according to applicable aircraft maintenance manual and continue to operate.

Check for seized compressor rotor by hand-cranking (para 1-98). Compressor rotor turns?

Fault is not in engine. Refer to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

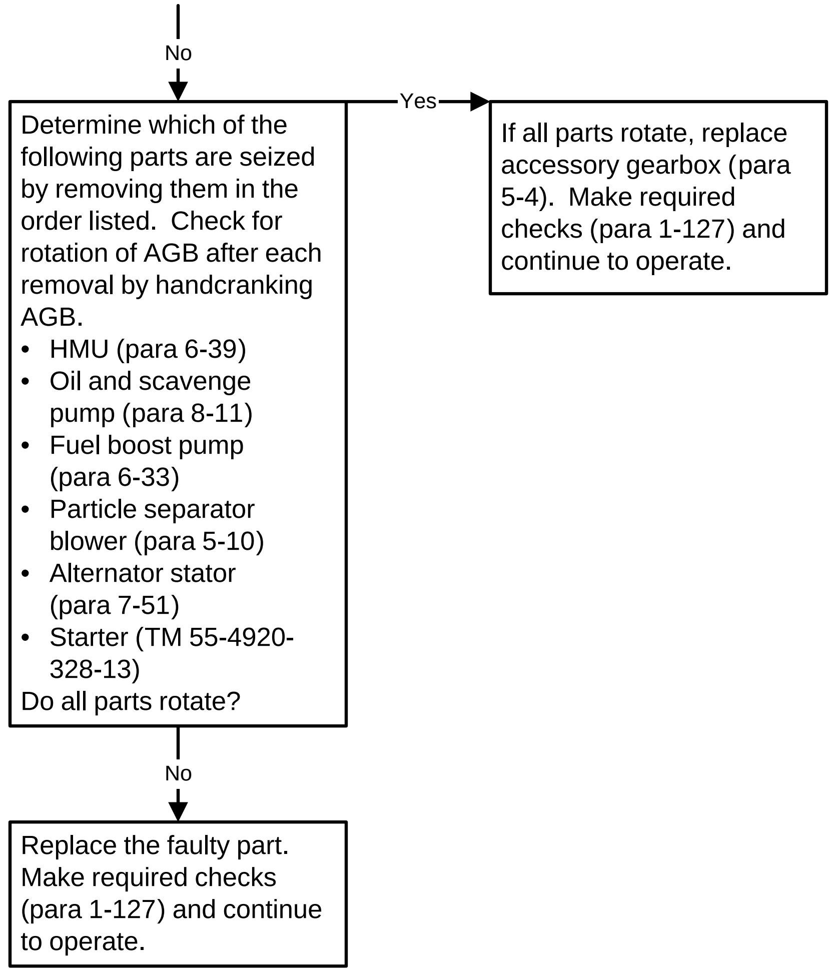
Withdraw radial drive shaft about 7-1/2 inches and hand-crank to check for rotation of accessory gearbox (AGB). AGB rotate?

Wait for TGT to drop below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F); then hand-crank the engine (para 1-98). Compressor rotor turns?

Fault is not in engine. Refer to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Replace engine. Make required checks (para 1-126) and continue to operate.

Troubleshooting Procedure 29. No Start (no compressor rotor rotation) (Cont)



Determine which of the following parts are seized by removing them in the order listed. Check for rotation of AGB after each removal by handcranking AGB.

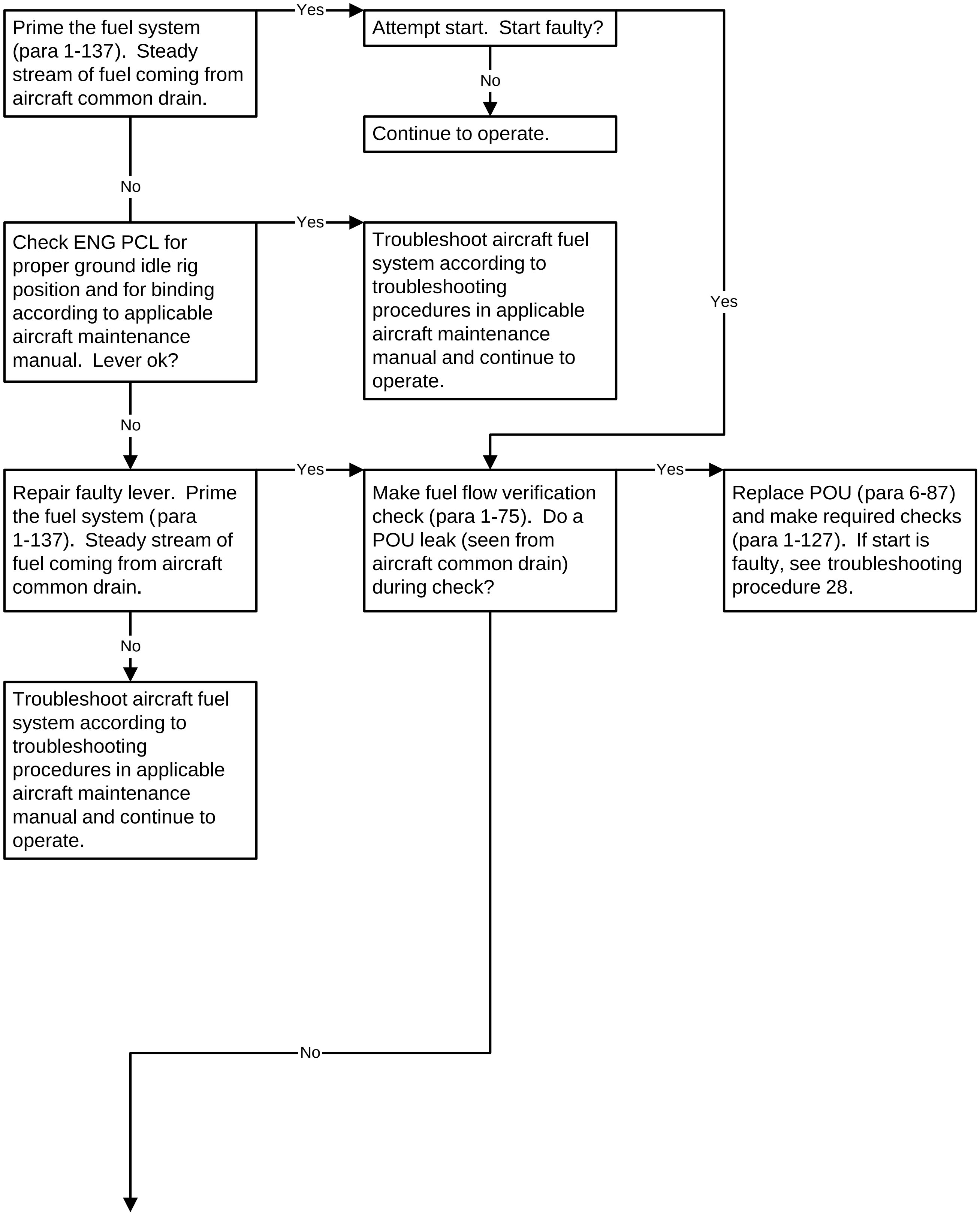
- HMU (para 6-39)
- Oil and scavenge pump (para 8-11)
- Fuel boost pump (para 6-33)
- Particle separator blower (para 5-10)
- Alternator stator (para 7-51)
- Starter (TM 55-4920-328-13)

Do all parts rotate?

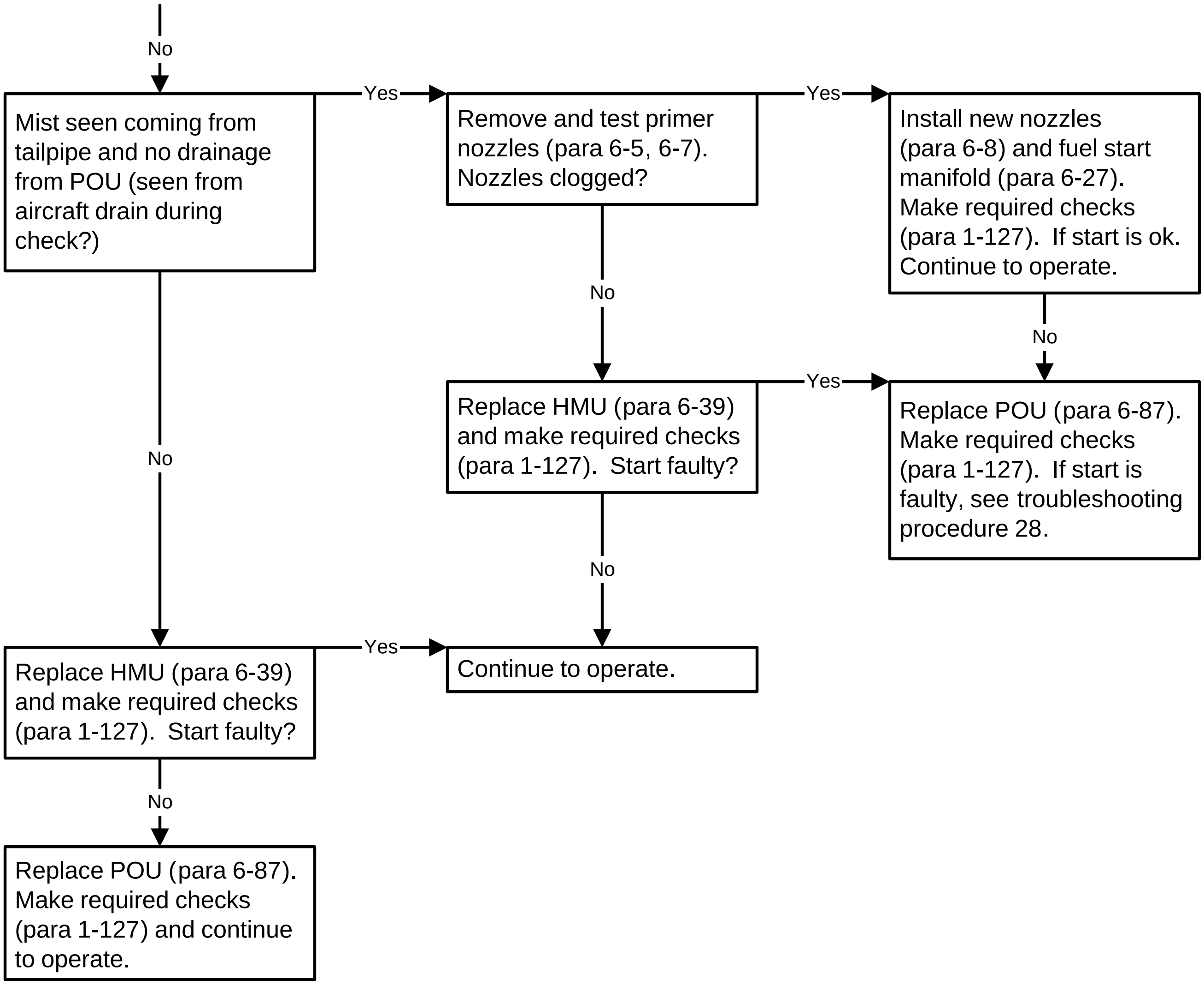
If all parts rotate, replace accessory gearbox (para 5-4). Make required checks (para 1-127) and continue to operate.

Replace the faulty part. Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 30. *(T700) No Start (no fuel mist seen coming from tailpipe; no rise in TGT)*



Troubleshooting Procedure 30. *(T700)* ***No Start (no fuel mist seen coming from tailpipe; no rise in TGT) (Cont)***



Mist seen coming from tailpipe and no drainage from POU (seen from aircraft drain during check?)

Remove and test primer nozzles (para 6-5, 6-7). Nozzles clogged?

Install new nozzles (para 6-8) and fuel start manifold (para 6-27). Make required checks (para 1-127). If start is ok. Continue to operate.

Replace HMU (para 6-39) and make required checks (para 1-127). Start faulty?

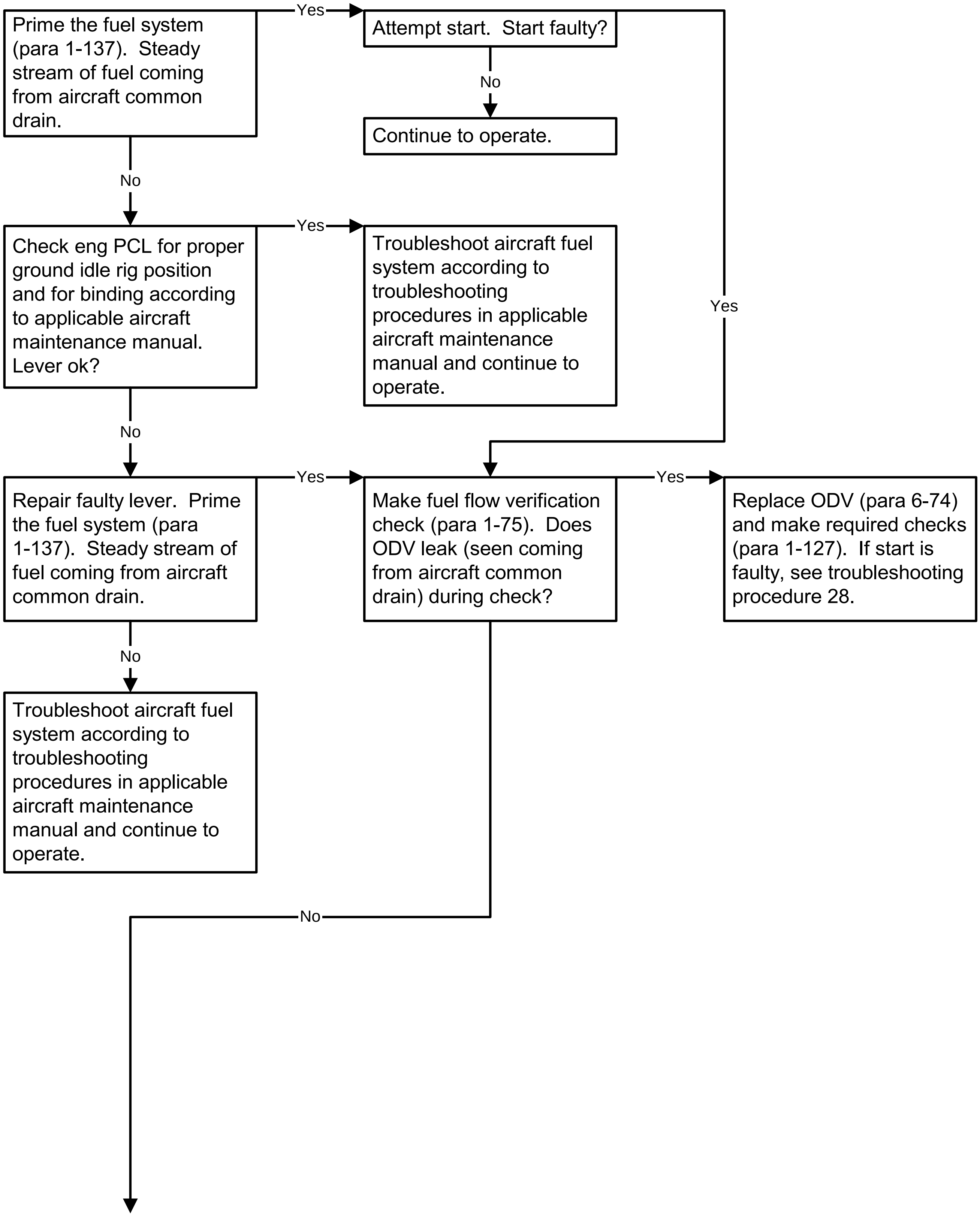
Replace POU (para 6-87). Make required checks (para 1-127). If start is faulty, see troubleshooting procedure 28.

Replace HMU (para 6-39) and make required checks (para 1-127). Start faulty?

Continue to operate.

Replace POU (para 6-87). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 31. ***(T700, T701C, T701D)*** *No Start (no fuel mist seen coming from tailpipe; no rise in TGT)*



Prime the fuel system (para 1-137). Steady stream of fuel coming from aircraft common drain.

Attempt start. Start faulty?

Continue to operate.

Check eng PCL for proper ground idle rig position and for binding according to applicable aircraft maintenance manual. Lever ok?

Troubleshoot aircraft fuel system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

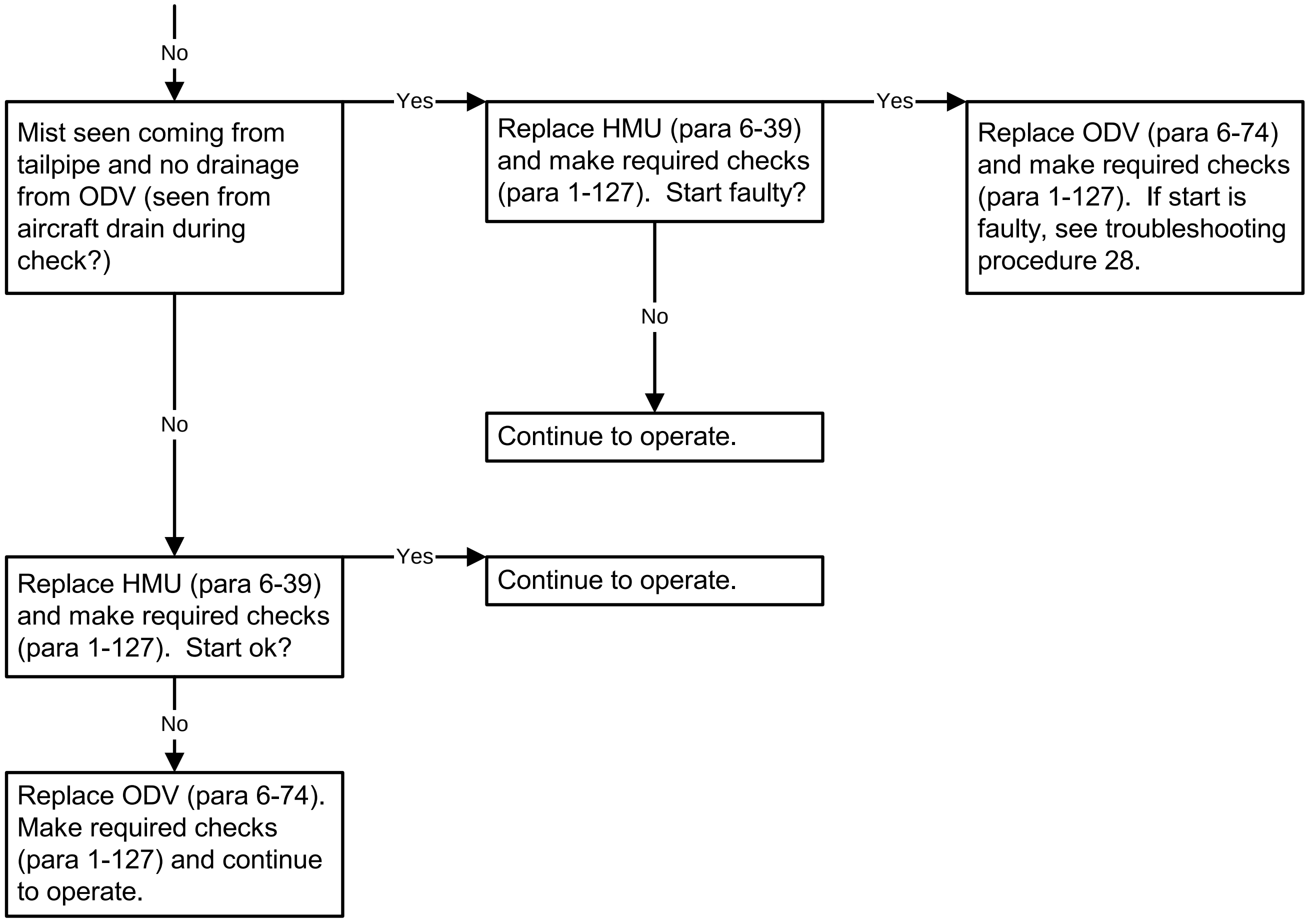
Repair faulty lever. Prime the fuel system (para 1-137). Steady stream of fuel coming from aircraft common drain.

Make fuel flow verification check (para 1-75). Does ODV leak (seen coming from aircraft common drain) during check?

Replace ODV (para 6-74) and make required checks (para 1-127). If start is faulty, see troubleshooting procedure 28.

Troubleshoot aircraft fuel system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

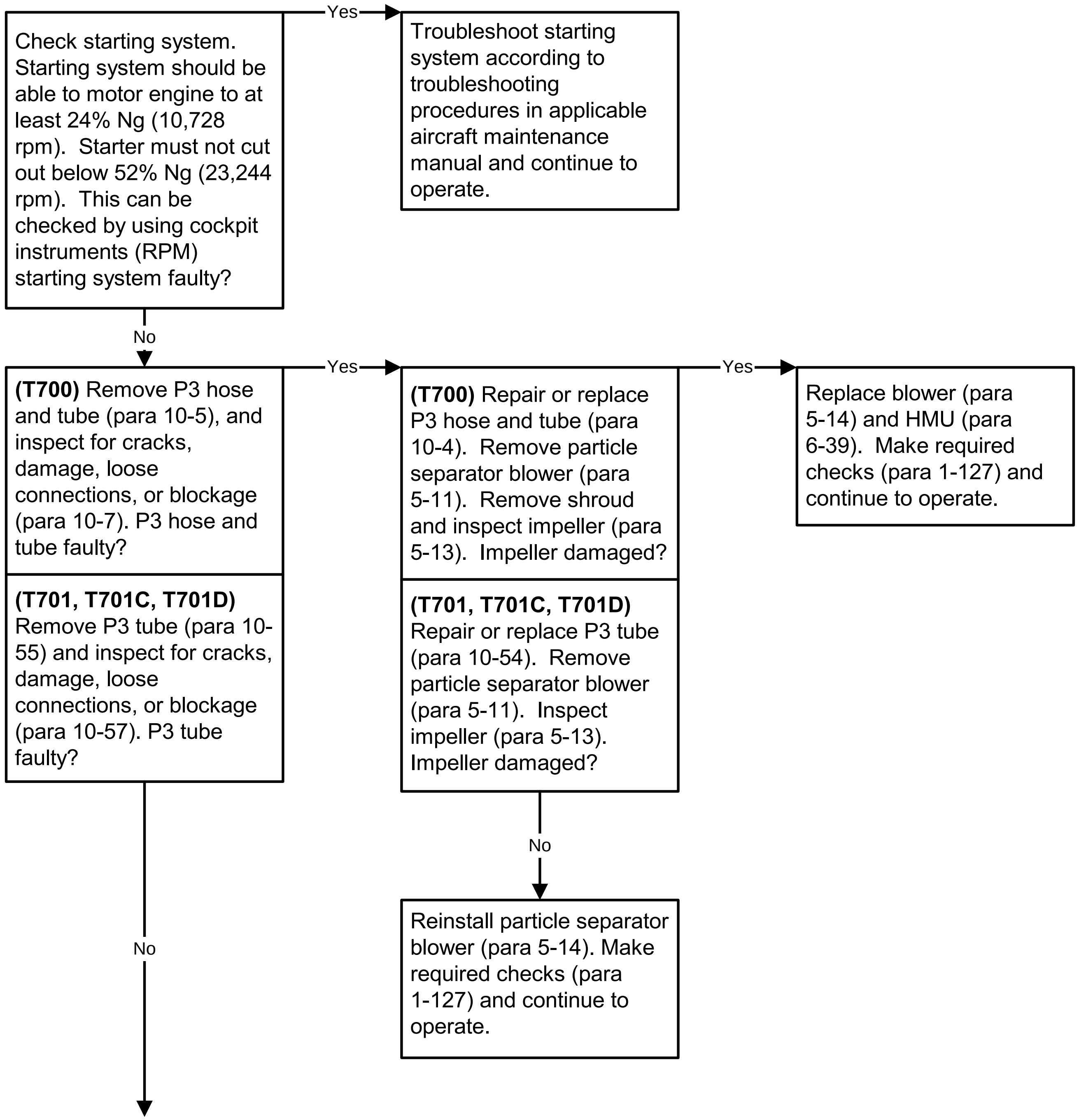
*Troubleshooting Procedure 31. **(T700, T701C, T701D)** No Start (no fuel mist seen coming from tailpipe; no rise in TGT) (Cont)*



Troubleshooting Procedure 32. ***Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and idle.)***

NOTE

- If anti-icing bleed and start valve does not open, compressor will probably stall at about 40% Ng (17,880 rpm). When compressor stalls, a rumble or bang will be heard, but TGT may not rise.
- If an unusually high-pitched whining sound is heard see paragraph 1-87.



Check starting system. Starting system should be able to motor engine to at least 24% Ng (10,728 rpm). Starter must not cut out below 52% Ng (23,244 rpm). This can be checked by using cockpit instruments (RPM) starting system faulty?

Troubleshoot starting system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

(T700) Remove P3 hose and tube (para 10-5), and inspect for cracks, damage, loose connections, or blockage (para 10-7). P3 hose and tube faulty?

(T701, T701C, T701D) Remove P3 tube (para 10-55) and inspect for cracks, damage, loose connections, or blockage (para 10-57). P3 tube faulty?

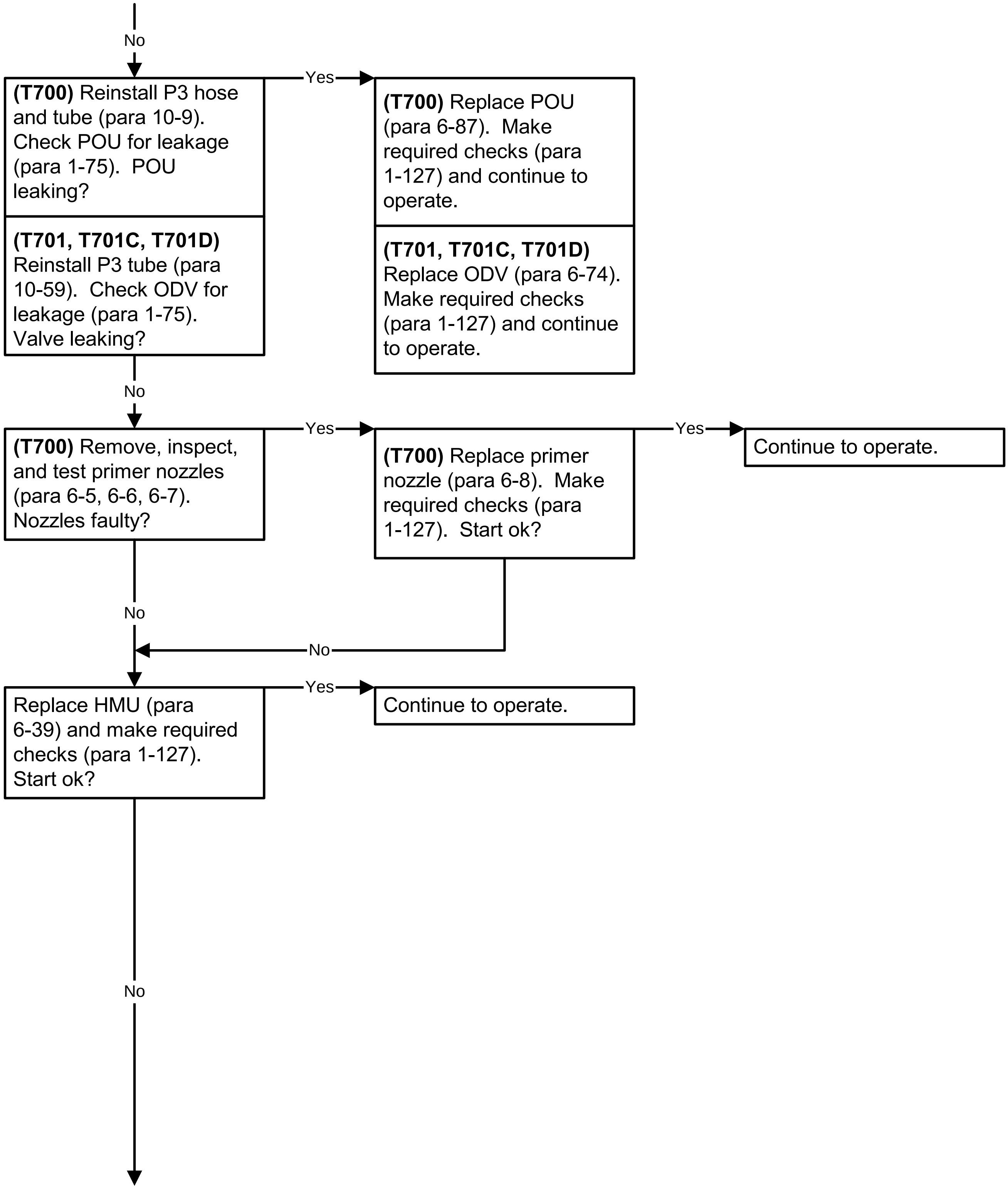
(T700) Repair or replace P3 hose and tube (para 10-4). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Remove particle separator blower (para 5-11). Inspect impeller (para 5-13). Impeller damaged?

Replace blower (para 5-14) and HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Reinstall particle separator blower (para 5-14). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 32. Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and idle.) (Cont)



(T700) Reinstall P3 hose and tube (para 10-9). Check POU for leakage (para 1-75). POU leaking?

(T701, T701C, T701D) Reinstall P3 tube (para 10-59). Check ODV for leakage (para 1-75). Valve leaking?

(T700) Replace POU (para 6-87). Make required checks (para 1-127) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-127) and continue to operate.

(T700) Remove, inspect, and test primer nozzles (para 6-5, 6-6, 6-7). Nozzles faulty?

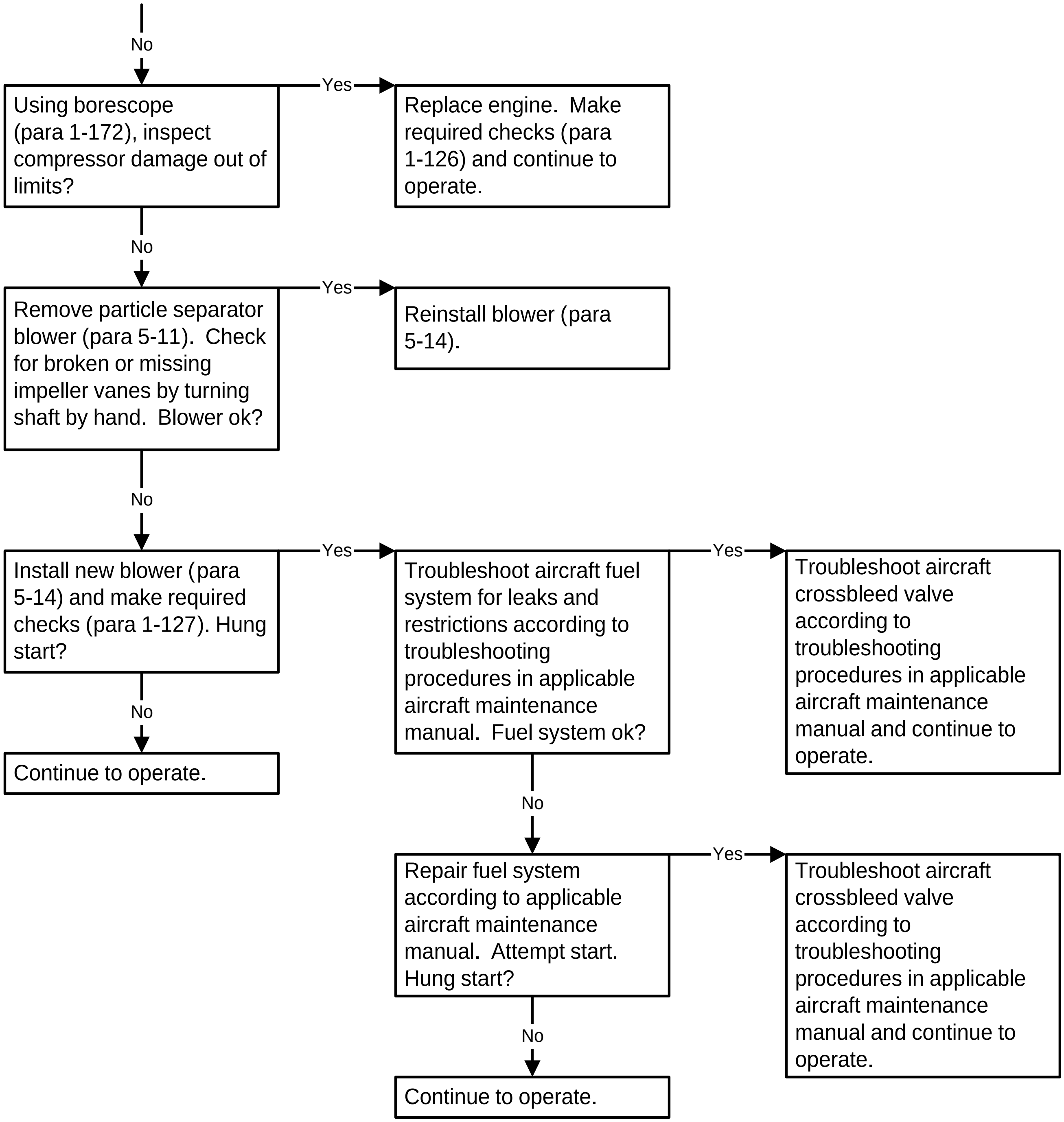
(T700) Replace primer nozzle (para 6-8). Make required checks (para 1-127). Start ok?

Continue to operate.

Replace HMU (para 6-39) and make required checks (para 1-127). Start ok?

Continue to operate.

Troubleshooting Procedure 32. Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and idle.) (Cont)



Using borescope (para 1-172), inspect compressor damage out of limits?

Replace engine. Make required checks (para 1-126) and continue to operate.

Remove particle separator blower (para 5-11). Check for broken or missing impeller vanes by turning shaft by hand. Blower ok?

Reinstall blower (para 5-14).

Install new blower (para 5-14) and make required checks (para 1-127). Hung start?

Continue to operate.

Troubleshoot aircraft fuel system for leaks and restrictions according to troubleshooting procedures in applicable aircraft maintenance manual. Fuel system ok?

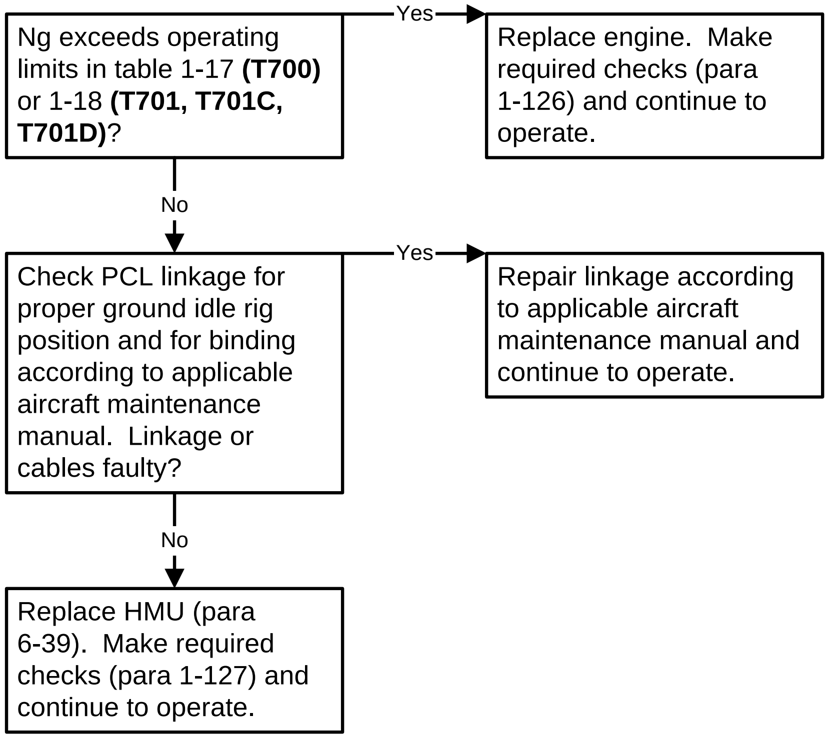
Troubleshoot aircraft crossbleed valve according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Repair fuel system according to applicable aircraft maintenance manual. Attempt start. Hung start?

Troubleshoot aircraft crossbleed valve according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Continue to operate.

Troubleshooting Procedure 33. Uncontrolled Acceleration (Ng) (gas generator continues to accelerate beyond ground idle speed)



Ng exceeds operating limits in table 1-17 **(T700)** or 1-18 **(T701, T701C, T701D)**?

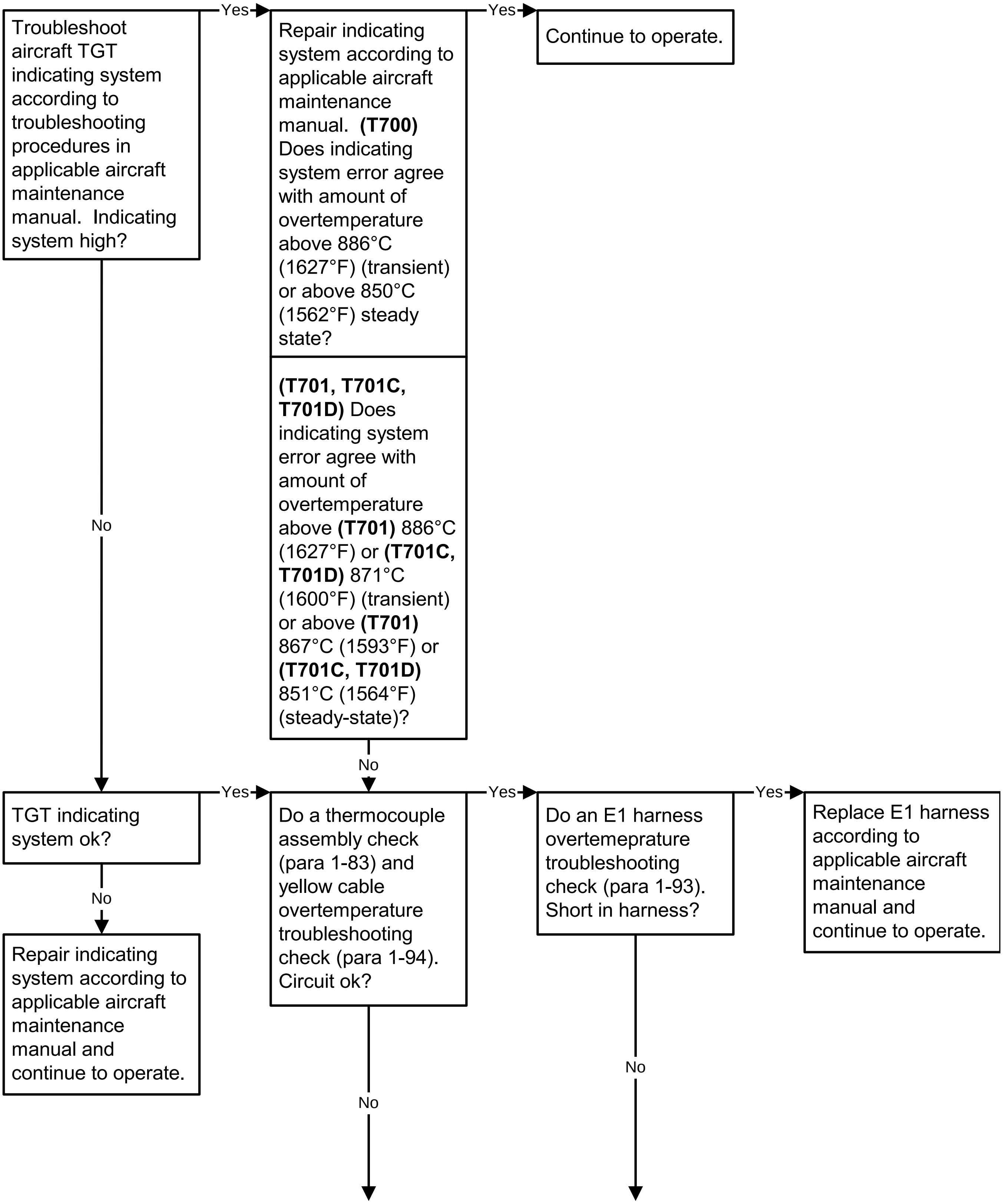
Replace engine. Make required checks (para 1-126) and continue to operate.

Check PCL linkage for proper ground idle rig position and for binding according to applicable aircraft maintenance manual. Linkage or cables faulty?

Repair linkage according to applicable aircraft maintenance manual and continue to operate.

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 34. Engine Exceeds TGT Operating Limits in “Replace Engine” Area of Figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55*



Troubleshoot aircraft TGT indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. Indicating system high?

Repair indicating system according to applicable aircraft maintenance manual. **(T700)** Does indicating system error agree with amount of overtemperature above 886°C (1627°F) (transient) or above 850°C (1562°F) steady state?

(T701, T701C, T701D) Does indicating system error agree with amount of overtemperature above **(T701)** 886°C (1627°F) or **(T701C, T701D)** 871°C (1600°F) (transient) or above **(T701)** 867°C (1593°F) or **(T701C, T701D)** 851°C (1564°F) (steady-state)?

Continue to operate.

TGT indicating system ok?

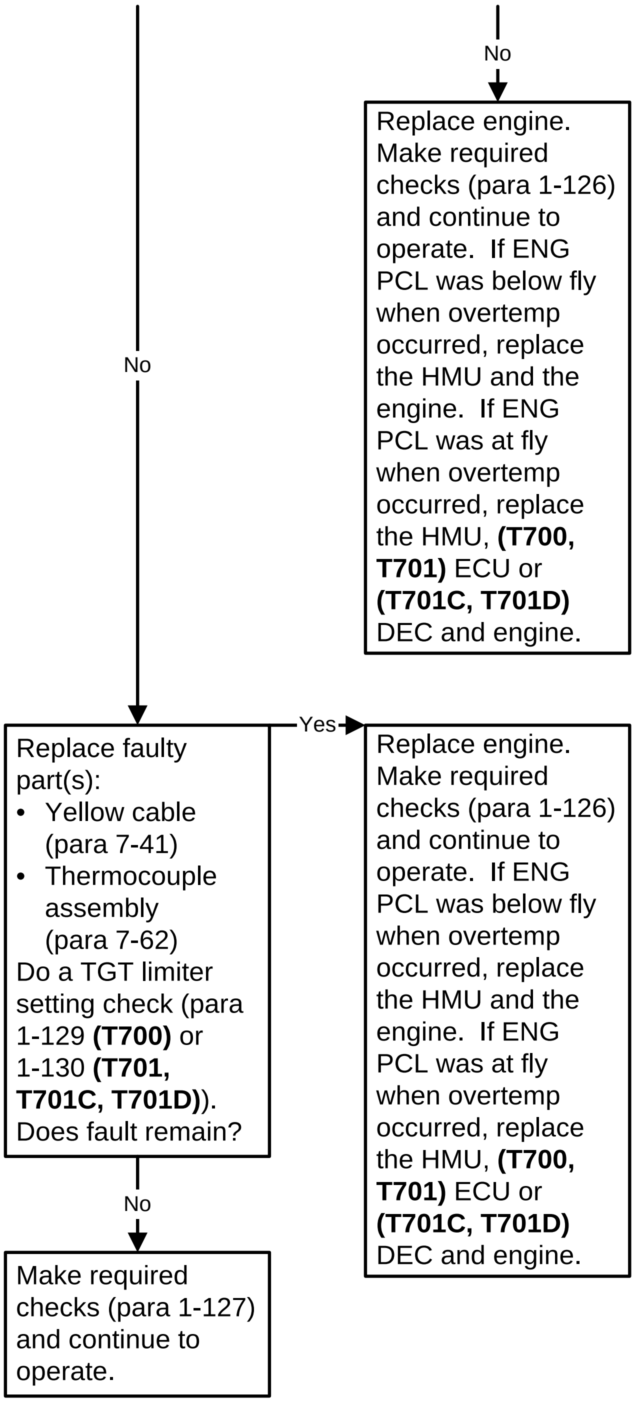
Repair indicating system according to applicable aircraft maintenance manual and continue to operate.

Do a thermocouple assembly check (para 1-83) and yellow cable overtemperature troubleshooting check (para 1-94). Circuit ok?

Do an E1 harness overtemepratre troubleshooting check (para 1-93). Short in harness?

Replace E1 harness according to applicable aircraft maintenance manual and continue to operate.

*Troubleshooting Procedure 34. Engine Exceeds TGT Operating Limits in “Replace Engine” Area of Figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55 (Cont)*



Replace engine. Make required checks (para 1-126) and continue to operate. If ENG PCL was below fly when overtemp occurred, replace the HMU and the engine. If ENG PCL was at fly when overtemp occurred, replace the HMU, **(T700, T701)** ECU or **(T701C, T701D)** DEC and engine.

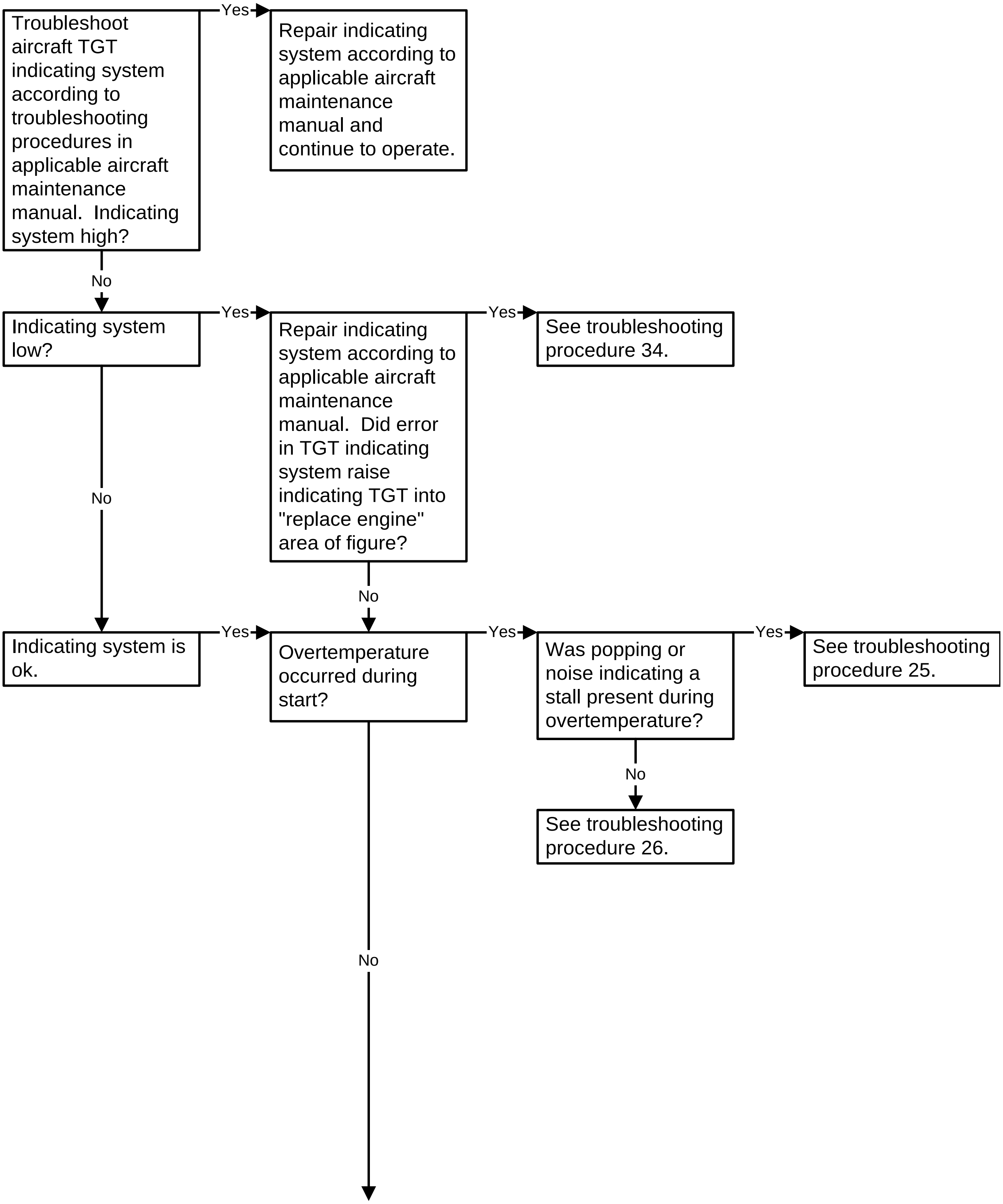
Replace faulty part(s):
- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Do a TGT limiter setting check (para 1-129 **(T700)** or 1-130 **(T701, T701C, T701D)**). Does fault remain?

Replace engine. Make required checks (para 1-126) and continue to operate. If ENG PCL was below fly when overtemp occurred, replace the HMU and the engine. If ENG PCL was at fly when overtemp occurred, replace the HMU, **(T700, T701)** ECU or **(T701C, T701D)** DEC and engine.

Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 35. Engine Exceeds TGT Operating Limits and is in "Troubleshoot" Area of figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55*



Troubleshoot aircraft TGT indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. Indicating system high?

Repair indicating system according to applicable aircraft maintenance manual and continue to operate.

Indicating system low?

Repair indicating system according to applicable aircraft maintenance manual. Did error in TGT indicating system raise indicating TGT into "replace engine" area of figure?

See troubleshooting procedure 34.

Indicating system is ok.

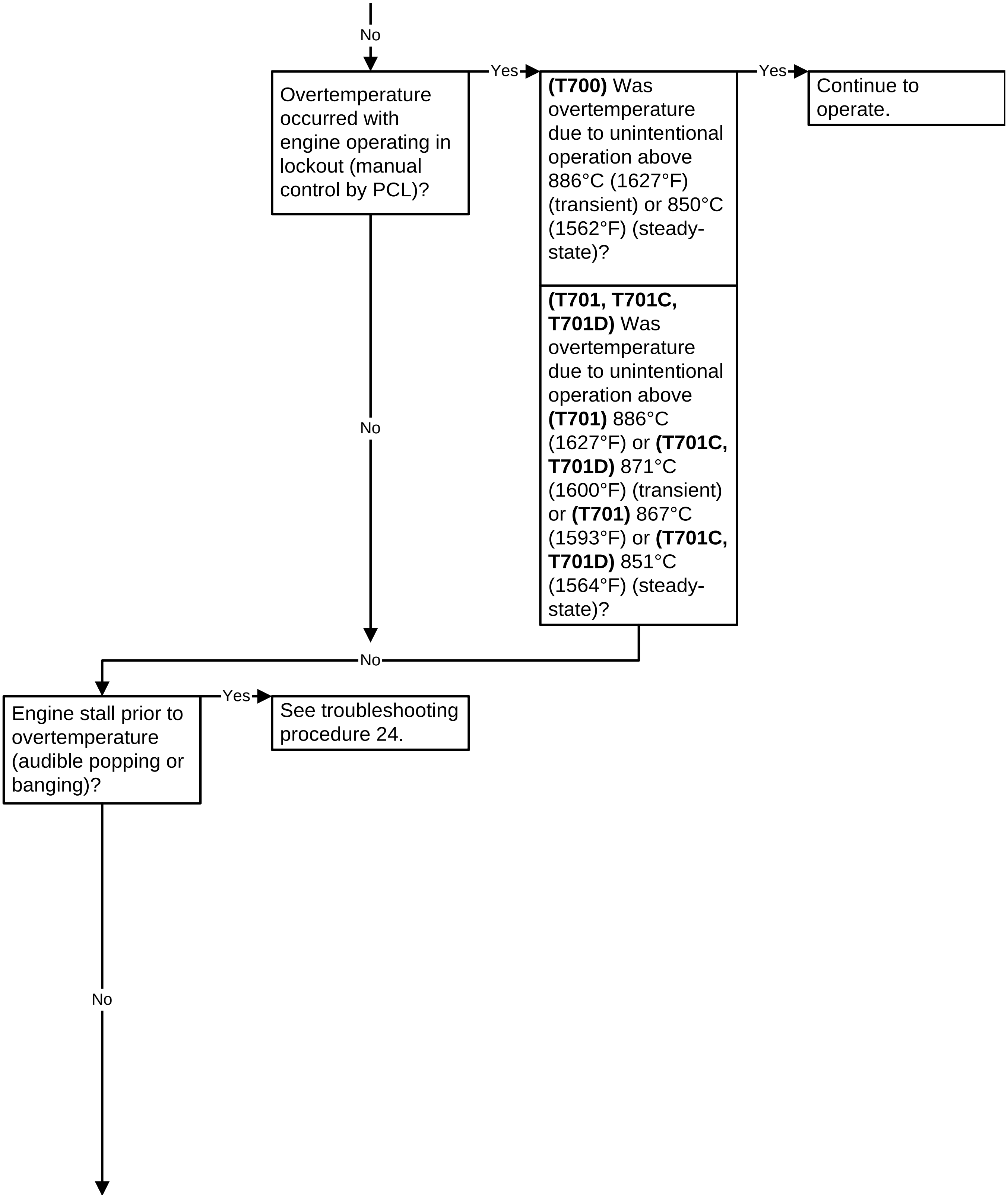
Overtemperature occurred during start?

Was popping or noise indicating a stall present during overtemperature?

See troubleshooting procedure 25.

See troubleshooting procedure 26.

*Troubleshooting Procedure 35. Engine Exceeds TGT Operating Limits and is in “Troubleshoot” Area of figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55 (Cont)*



Overtemperature occurred with engine operating in lockout (manual control by PCL)?

(T700) Was overtemperature due to unintentional operation above 886°C (1627°F) (transient) or 850°C (1562°F) (steady-state)?

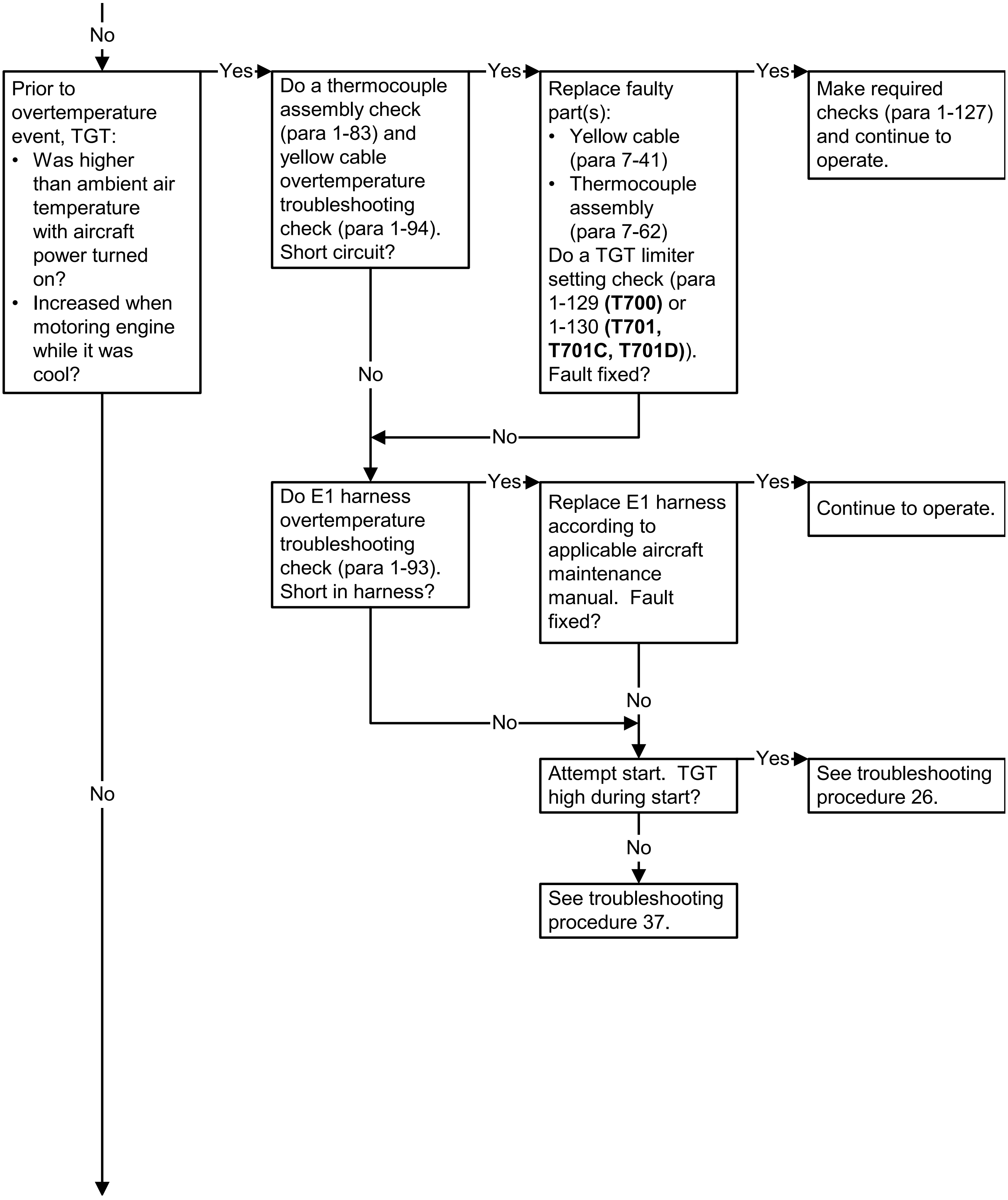
(T701, T701C, T701D) Was overtemperature due to unintentional operation above **(T701)** 886°C (1627°F) or **(T701C, T701D)** 871°C (1600°F) (transient) or **(T701)** 867°C (1593°F) or **(T701C, T701D)** 851°C (1564°F) (steady-state)?

Continue to operate.

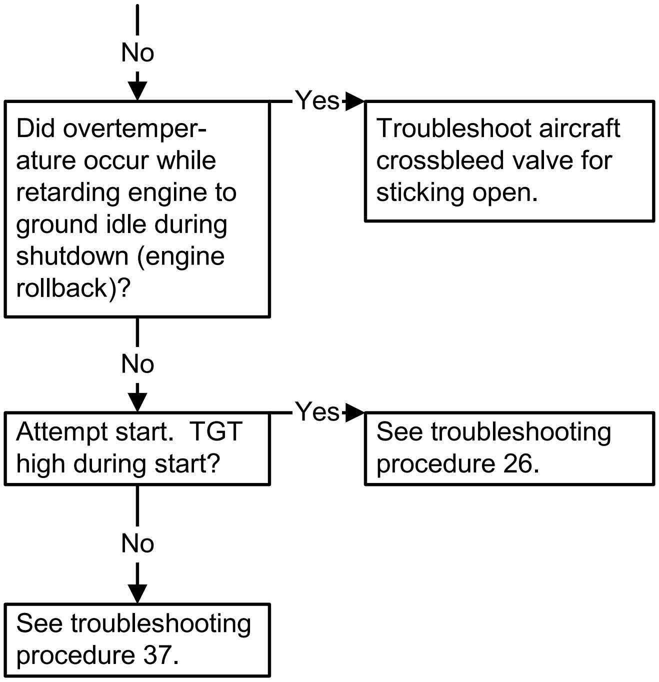
Engine stall prior to overtemperature (audible popping or banging)?

See troubleshooting procedure 24.

Troubleshooting Procedure 35. Engine Exceeds TGT Operating Limits and is in "Troubleshoot" Area of figure: ***(T700)*** *Figure 1-50 or 1-53,* ***(T701)*** *Figure 1-51 or 1-54,* ***(T701C, T701D)*** *Figure 1-52 or 1-55 (Cont)*



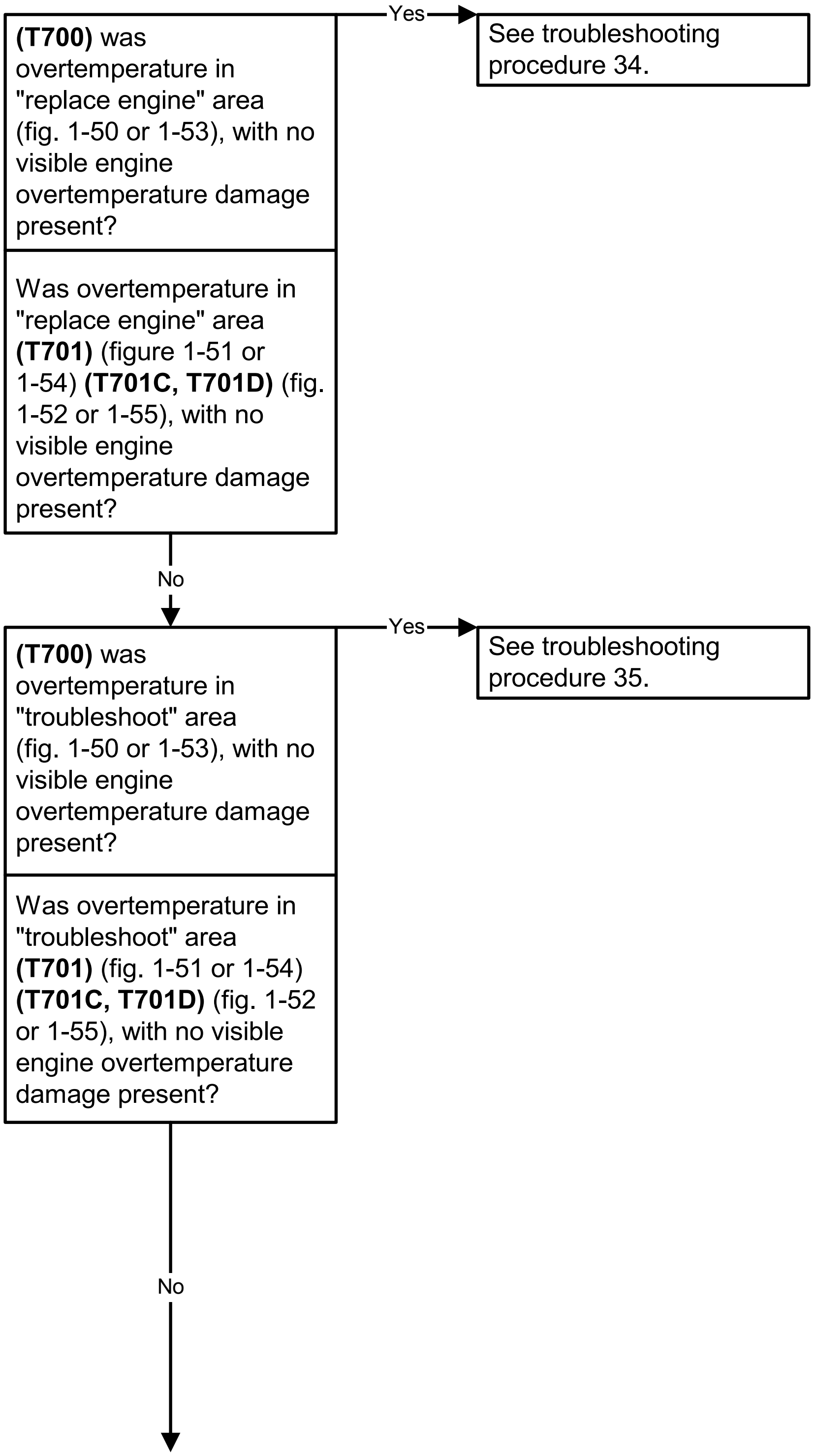
*Troubleshooting Procedure 35. Engine Exceeds TGT Operating Limits and is in “Troubleshoot” Area of figure: **(T700)** Figure 1-50 or 1-53, **(T701)** Figure 1-51 or 1-54, **(T701C, T701D)** Figure 1-52 or 1-55 (Cont)*



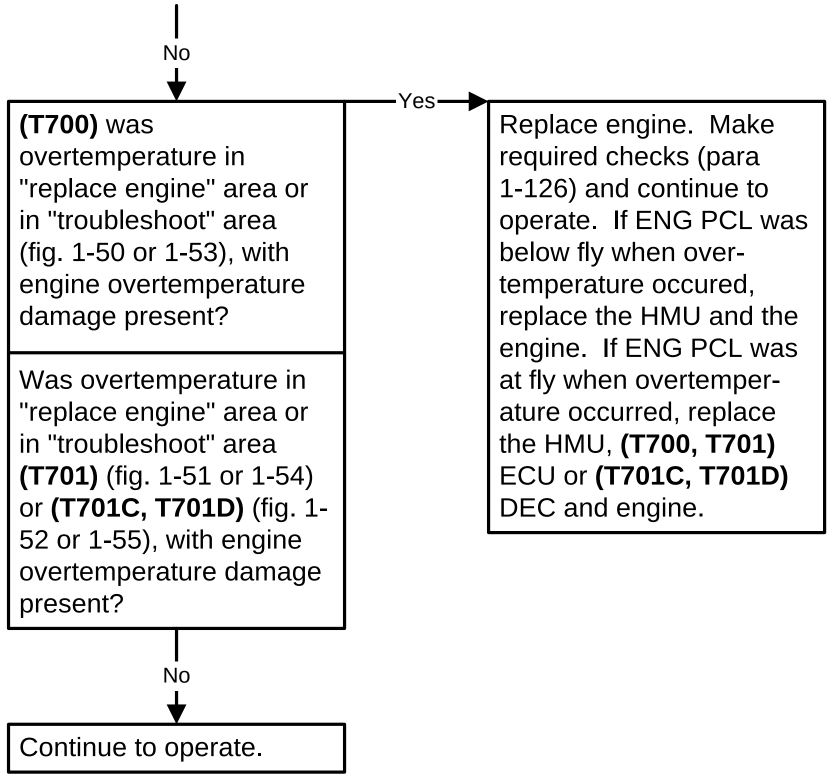
Troubleshooting Procedure 36. Engine Overtemperature (exceeds TGT operating limits)

NOTE

See overtemperature checklist (para 1-92) before troubleshooting.



Troubleshooting Procedure 36. Engine Overtemperature (exceeds TGT operating limits) (Cont)



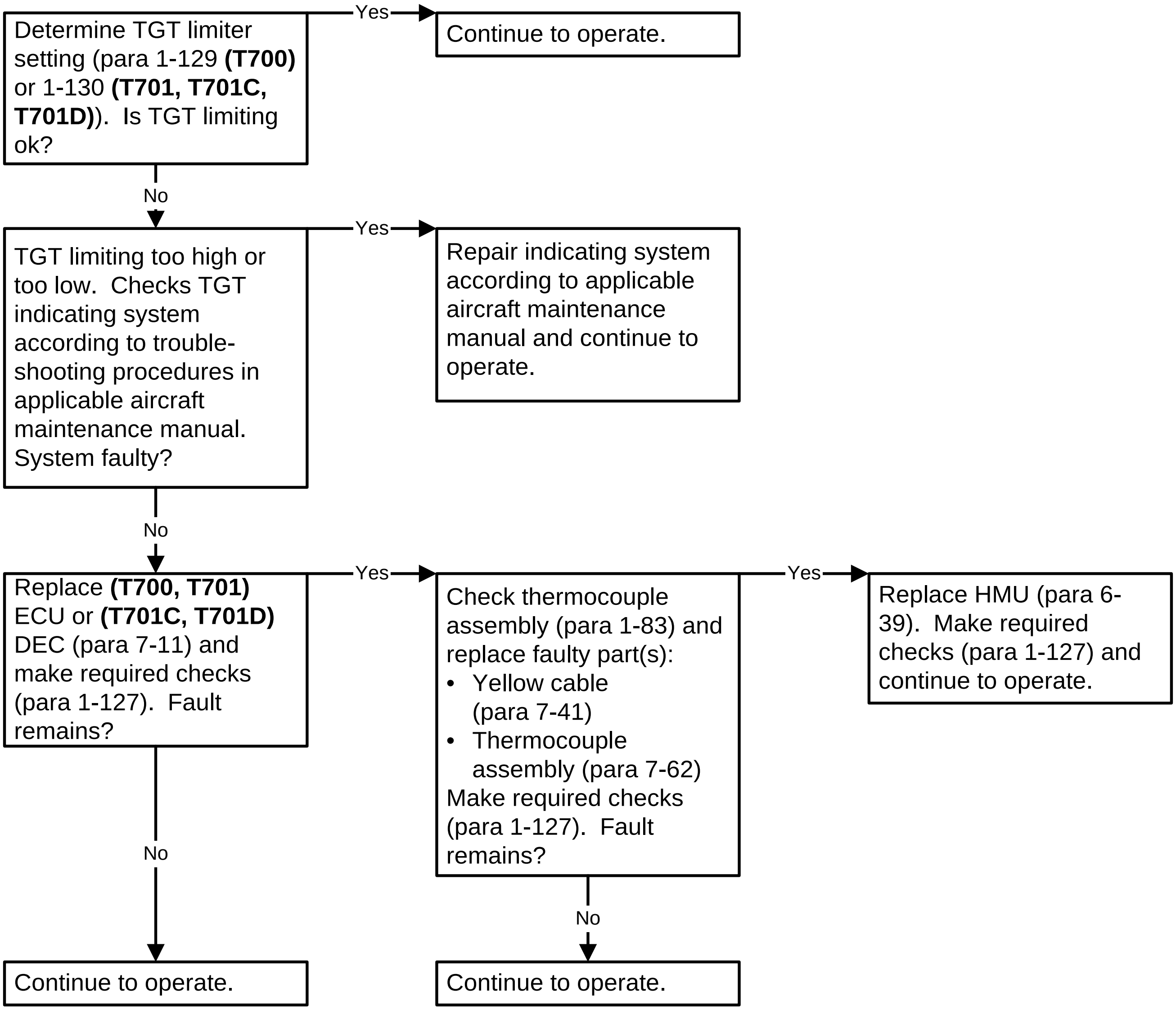
(T700) was overtemperature in "replace engine" area or in "troubleshoot" area (fig. 1-50 or 1-53), with engine overtemperature damage present?

Was overtemperature in "replace engine" area or in "troubleshoot" area **(T701)** (fig. 1-51 or 1-54) or **(T701C, T701D)** (fig. 1-52 or 1-55), with engine overtemperature damage present?

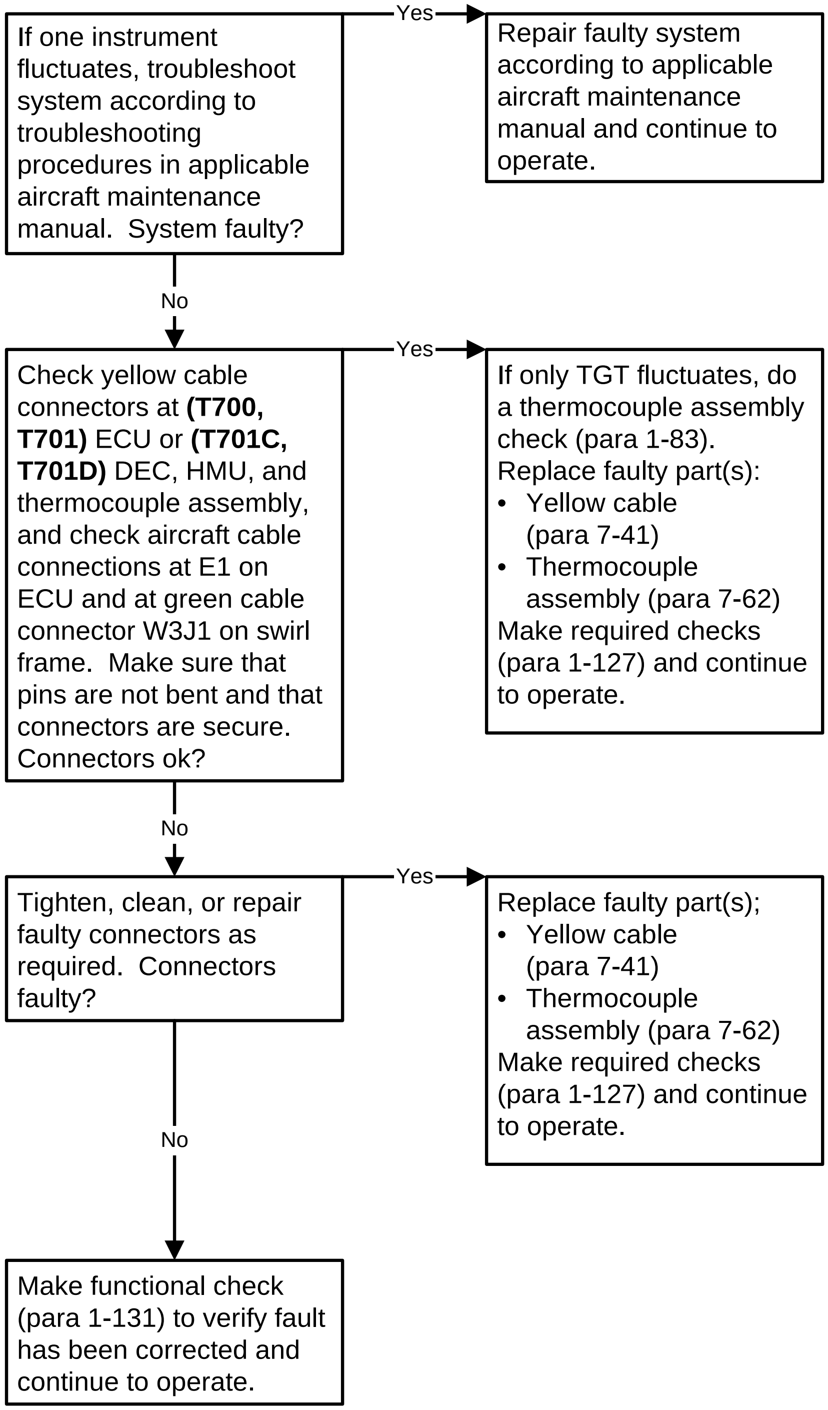
Replace engine. Make required checks (para 1-126) and continue to operate. If ENG PCL was below fly when overtemperature occured, replace the HMU and the engine. If ENG PCL was at fly when overtemperature occurred, replace the HMU, **(T700, T701)** ECU or **(T701C, T701D)** DEC and engine.

Continue to operate.

Troubleshooting Procedure 37. ***TGT Exceeds Limiter Setting (TGT exceeds (T700, T701) ECU or (T701C, T701D) DEC limiter setting at FAT above (T700, T701) 4°C (40°F) or (T701C, T701D) –14°C (7°F))***



Troubleshooting Procedure 38. TGT Fluctuates at Ground Idle Speed (idle speed or TGT drifts above and below limits in paragraph 1-125)



If one instrument fluctuates, troubleshoot system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair faulty system according to applicable aircraft maintenance manual and continue to operate.

Check yellow cable connectors at **(T700, T701)** ECU or **(T701C, T701D)** DEC, HMU, and thermocouple assembly, and check aircraft cable connections at E1 on ECU and at green cable connector W3J1 on swirl frame. Make sure that pins are not bent and that connectors are secure. Connectors ok?

If only TGT fluctuates, do a thermocouple assembly check (para 1-83).
Replace faulty part(s):
- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Make required checks (para 1-127) and continue to operate.

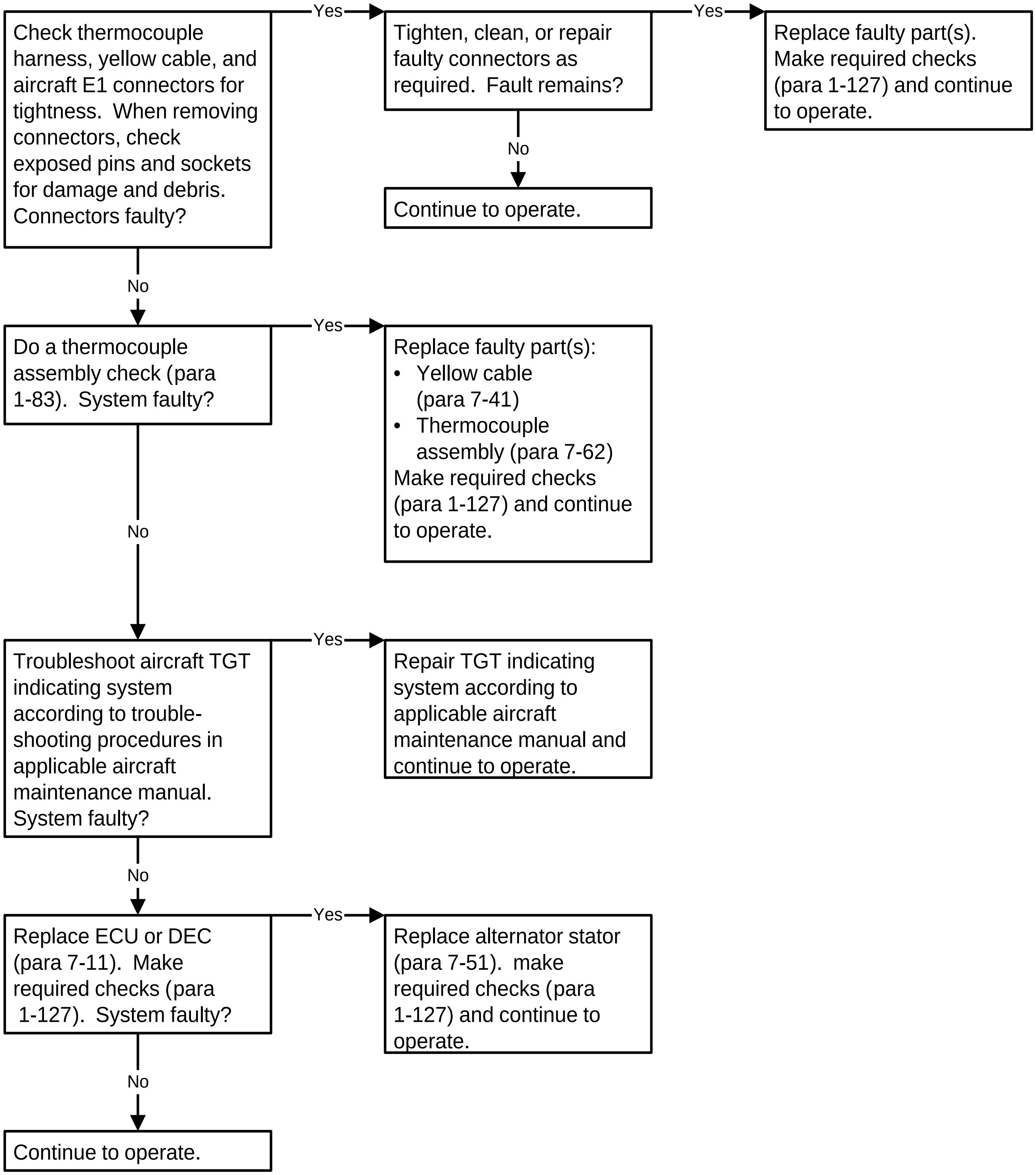
Tighten, clean, or repair faulty connectors as required. Connectors faulty?

Replace faulty part(s);
- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Make required checks (para 1-127) and continue to operate.

Make functional check (para 1-131) to verify fault has been corrected and continue to operate.

Troubleshooting Procedure 39. TGT Instrument Roll-Back, not Indicating or Fluctuating (TGT roll-back is a differential greater than 30°C. All other instruments normal)



Check thermocouple harness, yellow cable, and aircraft E1 connectors for tightness. When removing connectors, check exposed pins and sockets for damage and debris. Connectors faulty?

Tighten, clean, or repair faulty connectors as required. Fault remains?

Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Do a thermocouple assembly check (para 1-83). System faulty?

Replace faulty part(s):
- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Make required checks (para 1-127) and continue to operate.

Troubleshoot aircraft TGT indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair TGT indicating system according to applicable aircraft maintenance manual and continue to operate.

Replace ECU or DEC (para 7-11). Make required checks (para 1-127). System faulty?

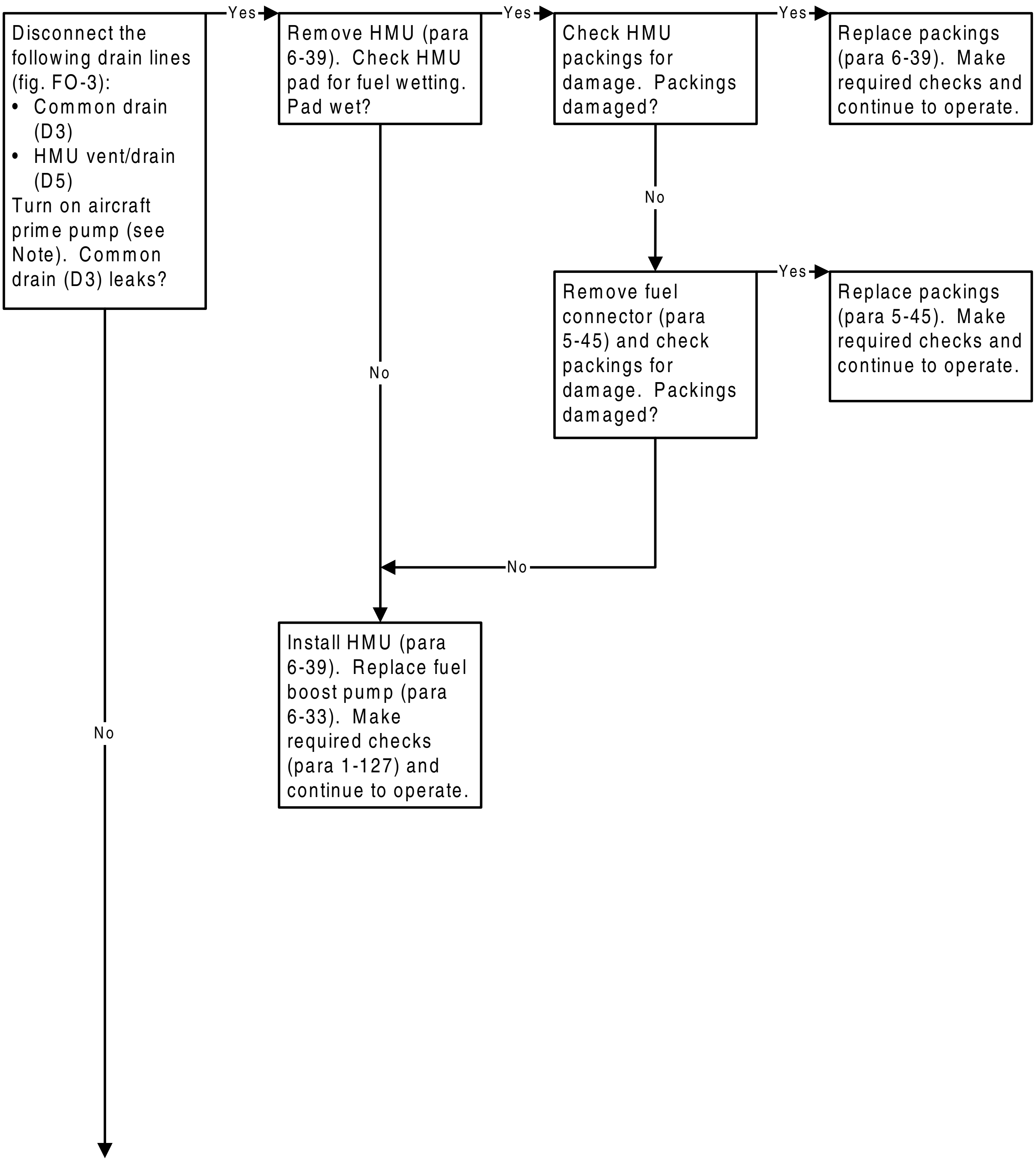
Replace alternator stator (para 7-51). make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 40. Excessive Fuel Leaking from Overboard Drain While Engine is Operating at Ground Idle Speed

NOTE

Make sure aircraft selector valve is on and PCL is at idle.



Disconnect the following drain lines (fig. FO-3):

- Common drain (D3)
- HMU vent/drain (D5)

Turn on aircraft prime pump (see Note). Common drain (D3) leaks?

Remove HMU (para 6-39). Check HMU pad for fuel wetting. Pad wet?

Check HMU packings for damage. Packings damaged?

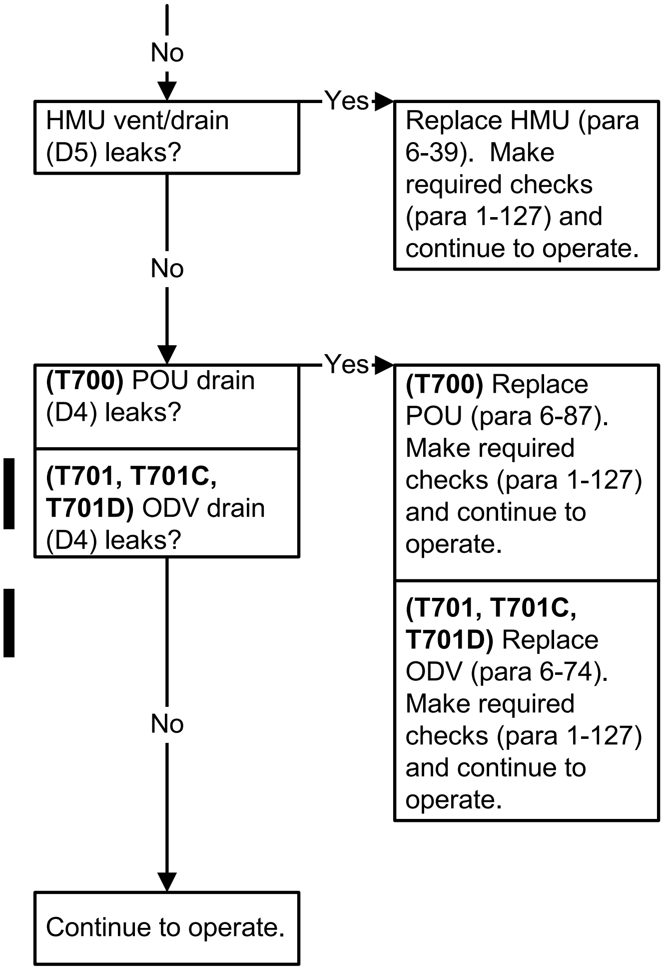
Replace packings (para 6-39). Make required checks and continue to operate.

Remove fuel connector (para 5-45) and check packings for damage. Packings damaged?

Replace packings (para 5-45). Make required checks and continue to operate.

Install HMU (para 6-39). Replace fuel boost pump (para 6-33). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 40. Excessive Fuel Leaking from Overboard Drain While Engine is Operating at Ground Idle Speed (Cont)



HMU vent/drain (D5) leaks?

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

(T700) POU drain (D4) leaks?

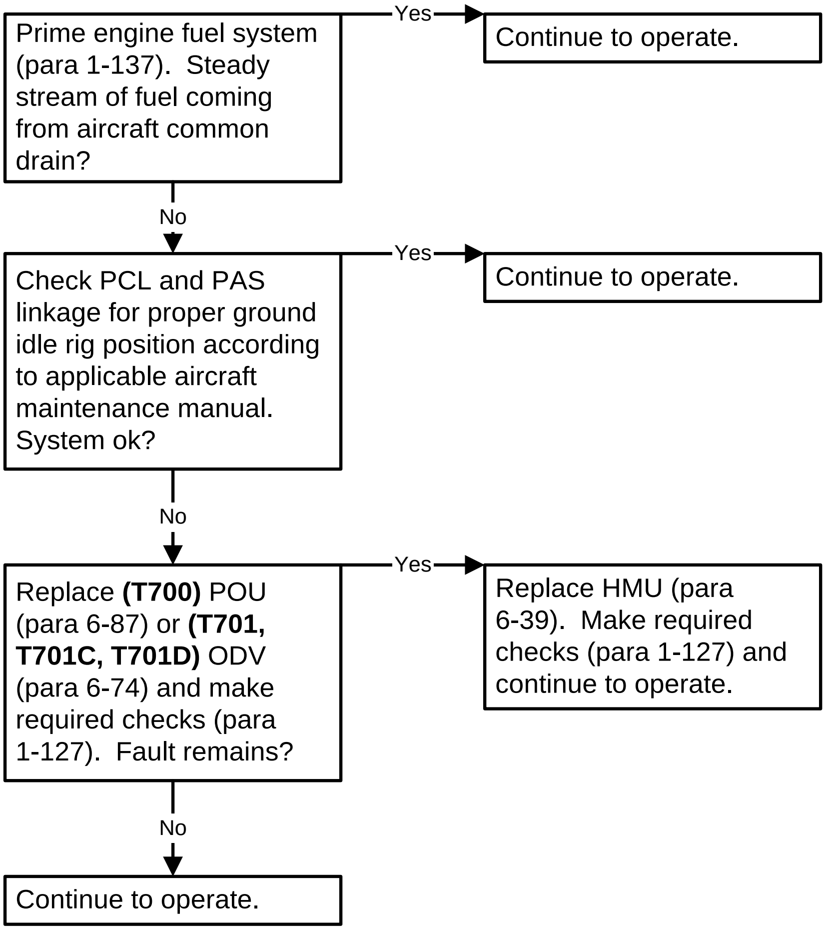
(T701, T701C, T701D) ODV drain (D4) leaks?

(T700) Replace POU (para 6-87). Make required checks (para 1-127) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 41. No Fuel Mist Seen Coming from the Aircraft Common Drain During Engine Prime or Vapor Vent



Prime engine fuel system (para 1-137). Steady stream of fuel coming from aircraft common drain?

Continue to operate.

Check PCL and PAS linkage for proper ground idle rig position according to applicable aircraft maintenance manual. System ok?

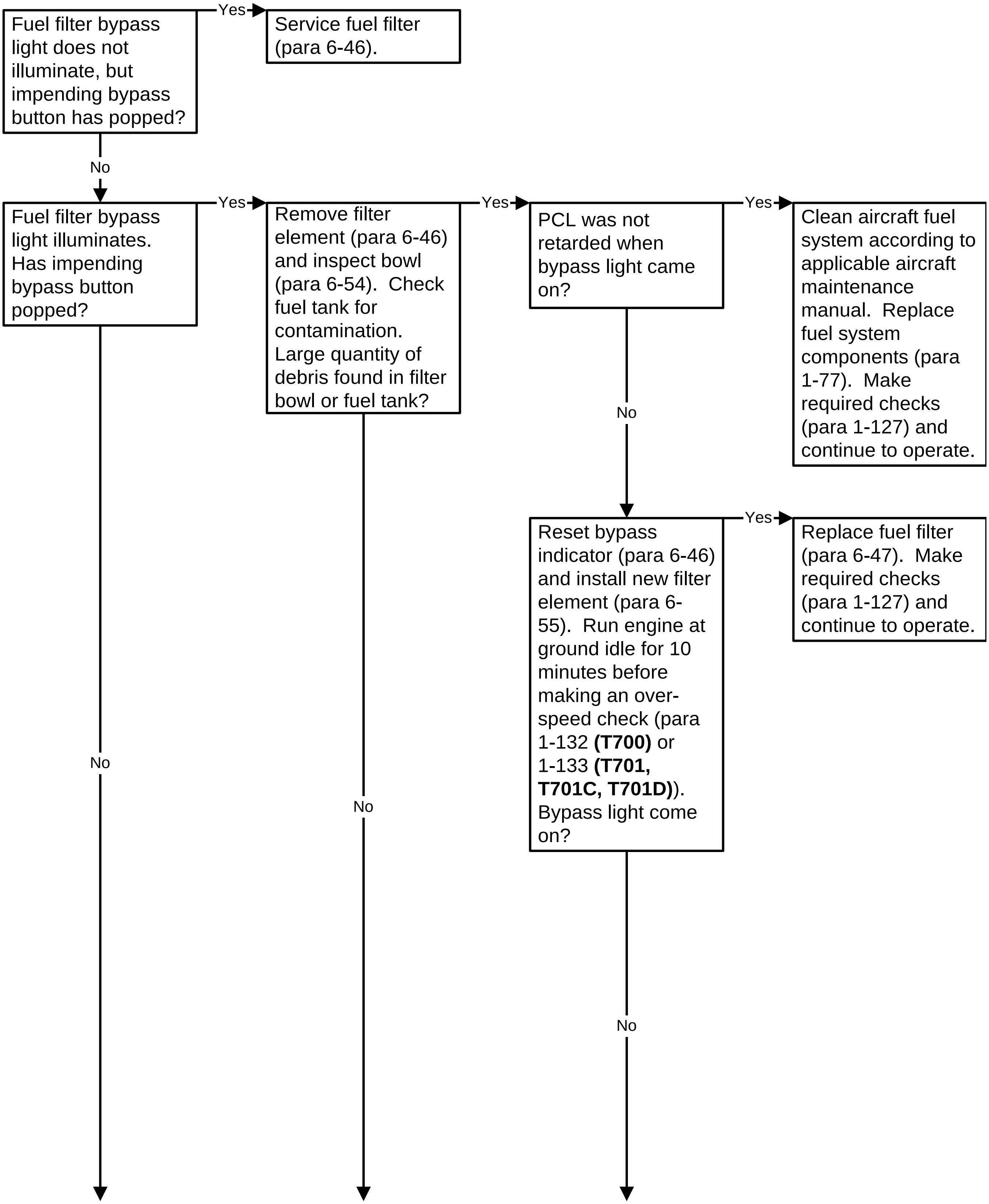
Continue to operate.

Replace **(T700)** POU (para 6-87) or **(T701, T701C, T701D)** ODV (para 6-74) and make required checks (para 1-127). Fault remains?

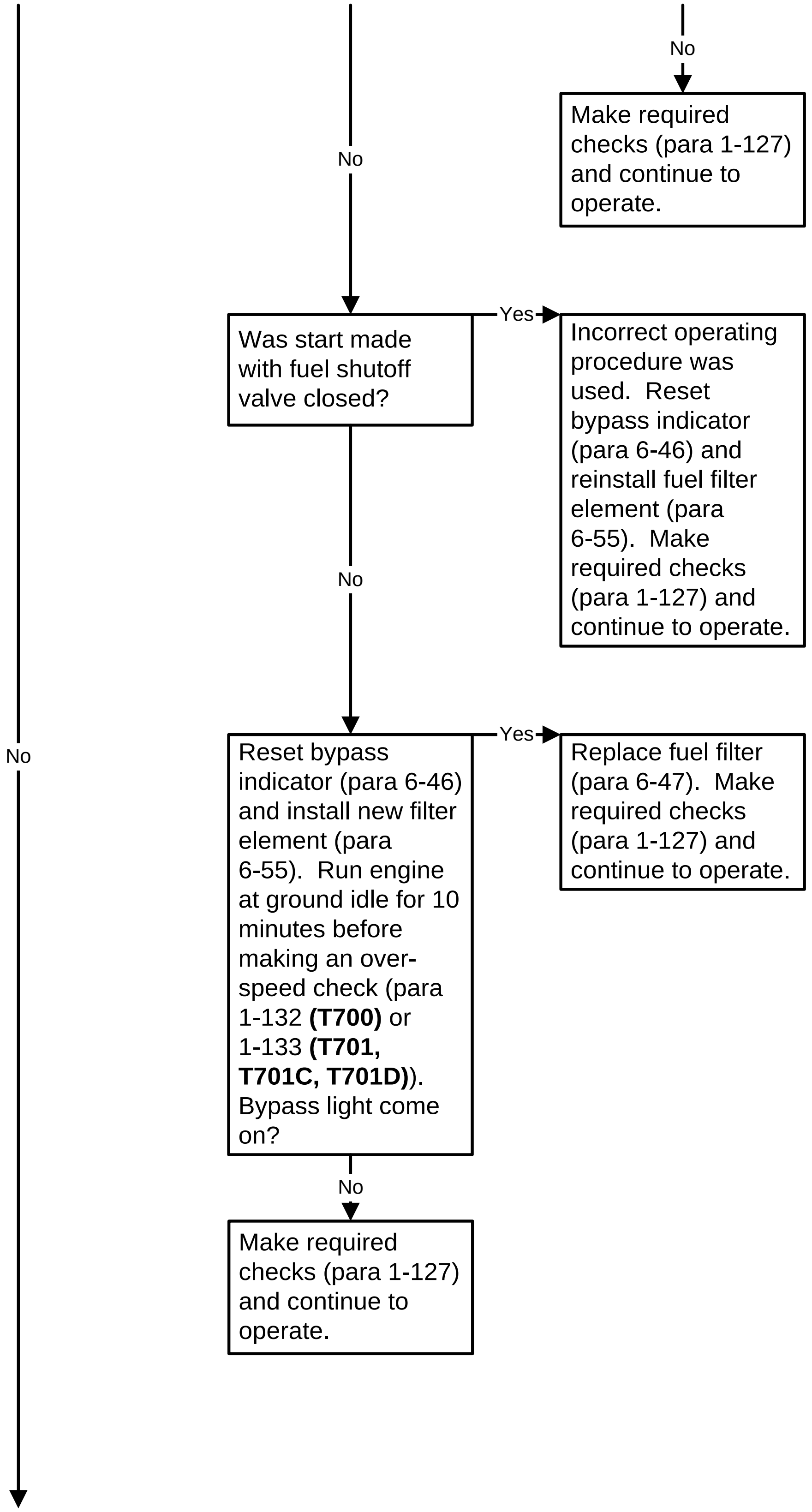
Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 42. Fuel Filter Bypass Light ON



Troubleshooting Procedure 42. Fuel Filter Bypass Light ON (Cont)



Make required checks (para 1-127) and continue to operate.

Was start made with fuel shutoff valve closed?

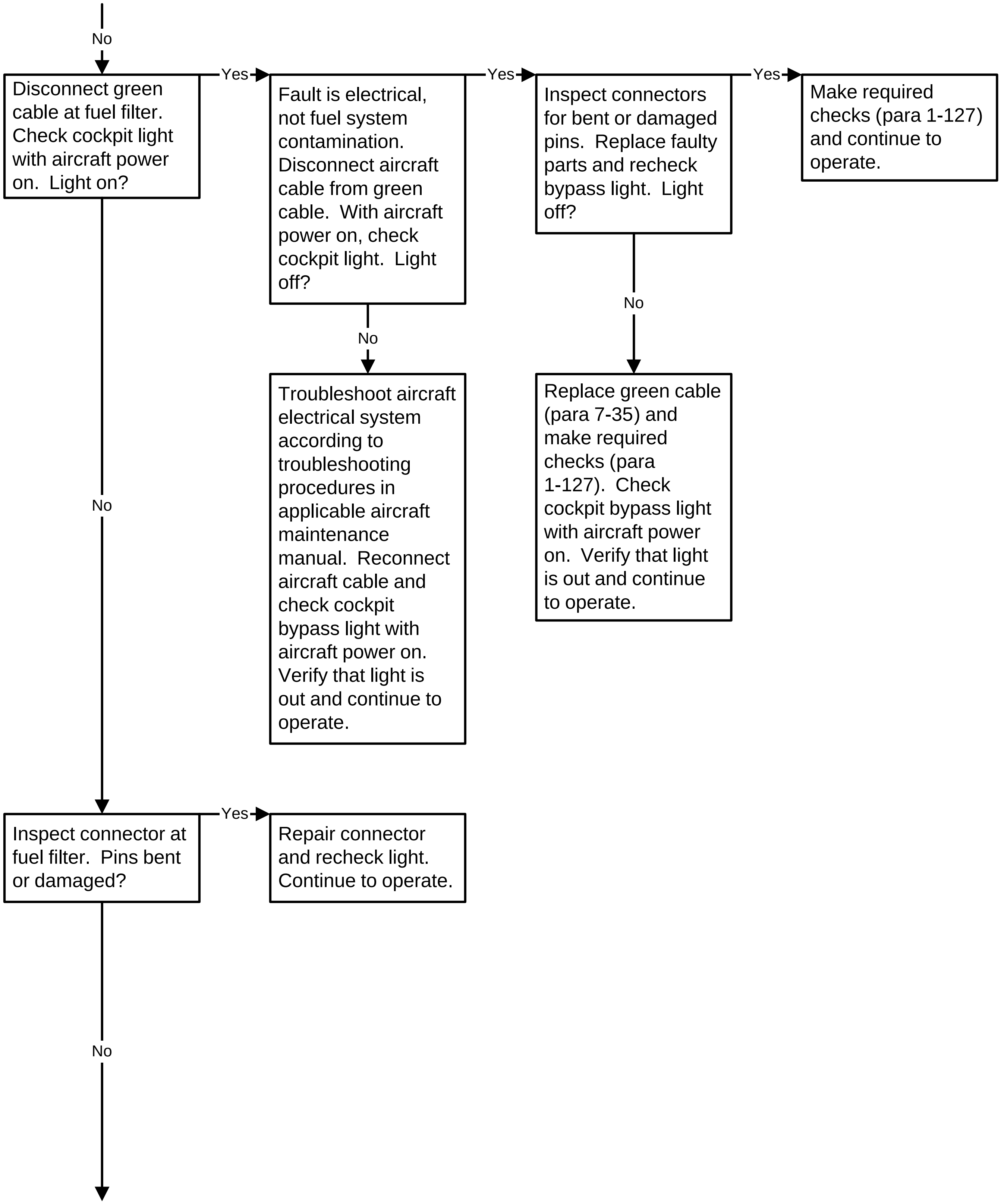
Incorrect operating procedure was used. Reset bypass indicator (para 6-46) and reinstall fuel filter element (para 6-55). Make required checks (para 1-127) and continue to operate.

Reset bypass indicator (para 6-46) and install new filter element (para 6-55). Run engine at ground idle for 10 minutes before making an overspeed check (para 1-132 **(T700)** or 1-133 **(T701, T701C, T701D)**). Bypass light come on?

Replace fuel filter (para 6-47). Make required checks (para 1-127) and continue to operate.

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 42. Fuel Filter Bypass Light ON (Cont)



Disconnect green cable at fuel filter. Check cockpit light with aircraft power on. Light on?

Fault is electrical, not fuel system contamination. Disconnect aircraft cable from green cable. With aircraft power on, check cockpit light. Light off?

Inspect connectors for bent or damaged pins. Replace faulty parts and recheck bypass light. Light off?

Make required checks (para 1-127) and continue to operate.

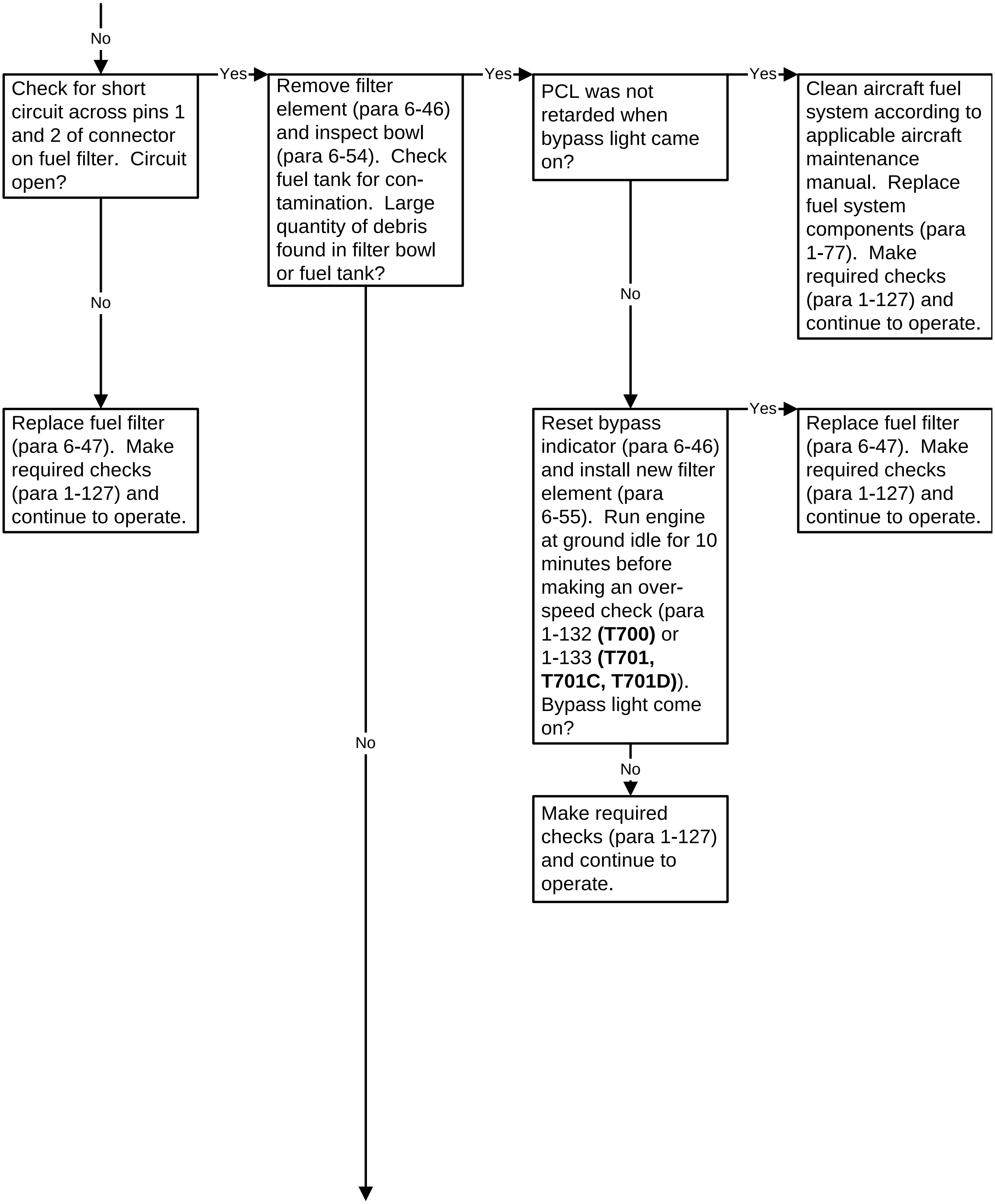
Troubleshoot aircraft electrical system according to troubleshooting procedures in applicable aircraft maintenance manual. Reconnect aircraft cable and check cockpit bypass light with aircraft power on. Verify that light is out and continue to operate.

Replace green cable (para 7-35) and make required checks (para 1-127). Check cockpit bypass light with aircraft power on. Verify that light is out and continue to operate.

Inspect connector at fuel filter. Pins bent or damaged?

Repair connector and recheck light. Continue to operate.

Troubleshooting Procedure 42. Fuel Filter Bypass Light ON (Cont)



Check for short circuit across pins 1 and 2 of connector on fuel filter. Circuit open?

Replace fuel filter (para 6-47). Make required checks (para 1-127) and continue to operate.

Remove filter element (para 6-46) and inspect bowl (para 6-54). Check fuel tank for contamination. Large quantity of debris found in filter bowl or fuel tank?

PCL was not retarded when bypass light came on?

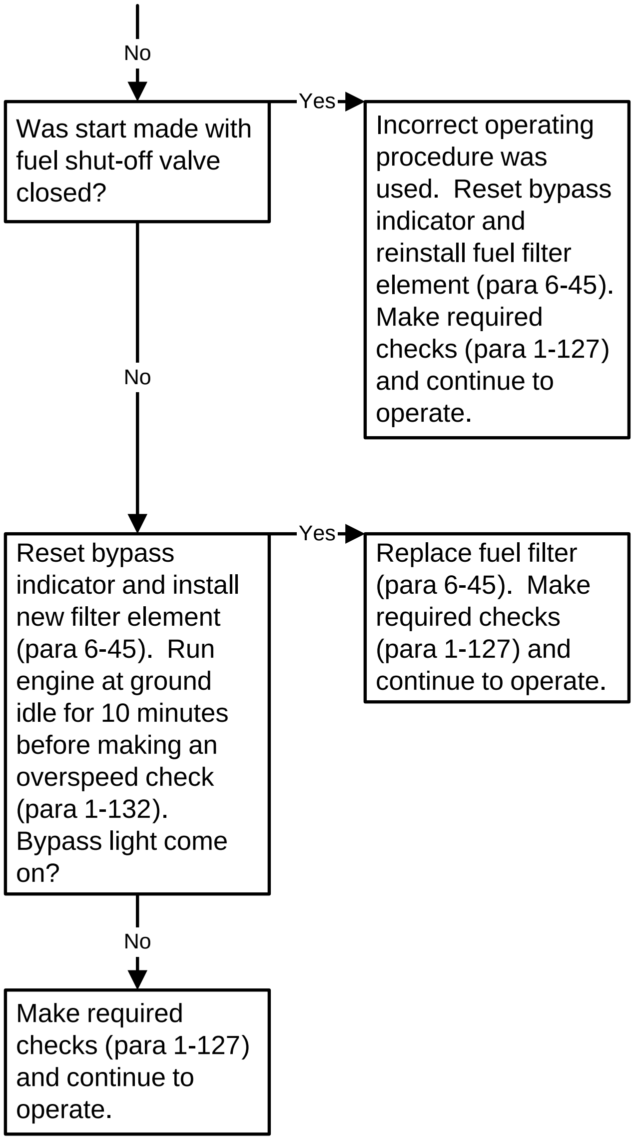
Clean aircraft fuel system according to applicable aircraft maintenance manual. Replace fuel system components (para 1-77). Make required checks (para 1-127) and continue to operate.

Reset bypass indicator (para 6-46) and install new filter element (para 6-55). Run engine at ground idle for 10 minutes before making an overspeed check (para 1-132 **(T700)** or 1-133 **(T701, T701C, T701D)**). Bypass light come on?

Replace fuel filter (para 6-47). Make required checks (para 1-127) and continue to operate.

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 42. Fuel Filter Bypass Light ON (Cont)



Was start made with fuel shut-off valve closed?

Incorrect operating procedure was used. Reset bypass indicator and reinstall fuel filter element (para 6-45). Make required checks (para 1-127) and continue to operate.

Reset bypass indicator and install new filter element (para 6-45). Run engine at ground idle for 10 minutes before making an overspeed check (para 1-132). Bypass light come on?

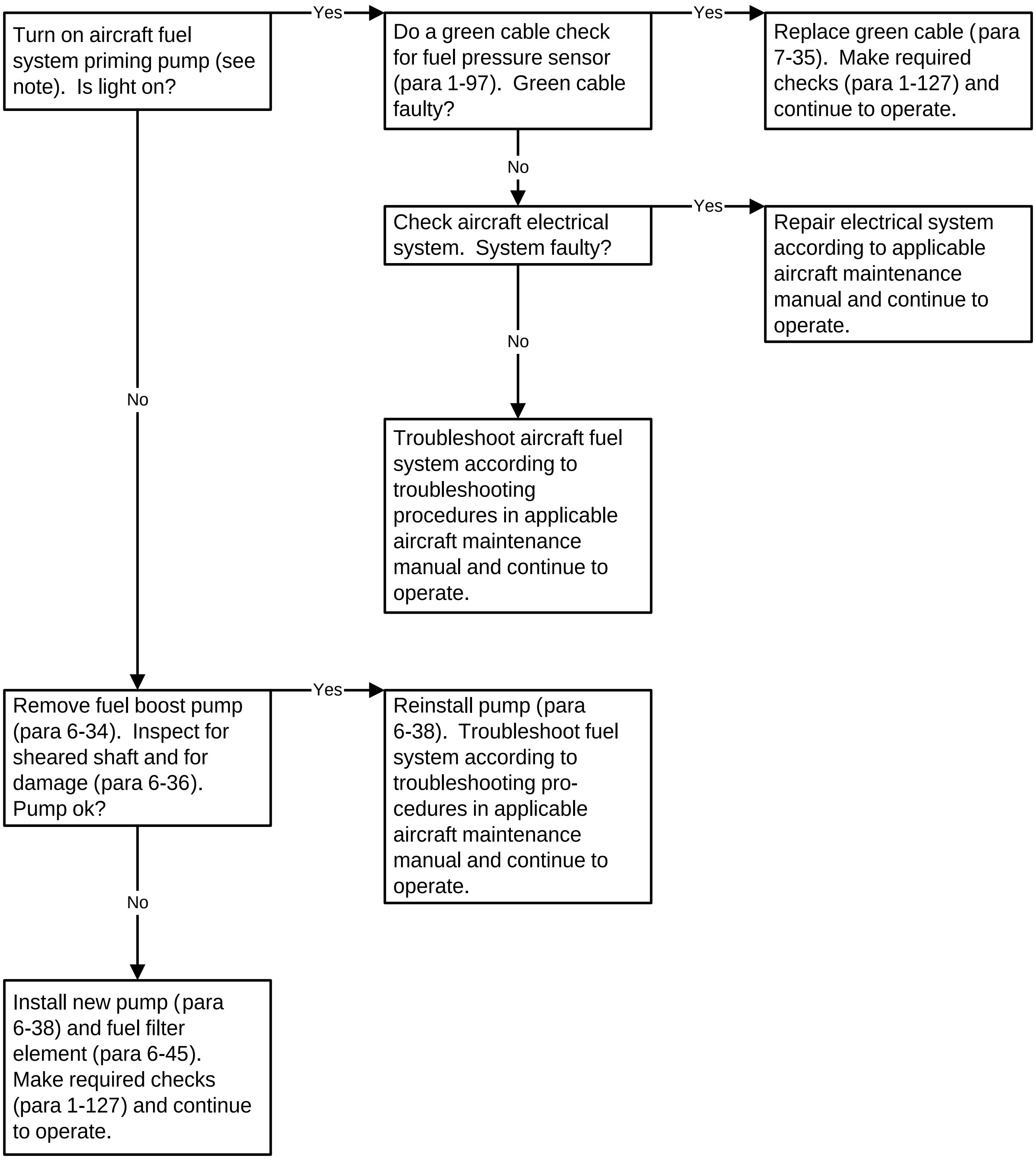
Replace fuel filter (para 6-45). Make required checks (para 1-127) and continue to operate.

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 43. Low Fuel Pressure Caution Light ON Below Flight Idle Speed

NOTE

Engine and/or APU should not be on during test.



Turn on aircraft fuel system priming pump (see note). Is light on?

Do a green cable check for fuel pressure sensor (para 1-97). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

Check aircraft electrical system. System faulty?

Repair electrical system according to applicable aircraft maintenance manual and continue to operate.

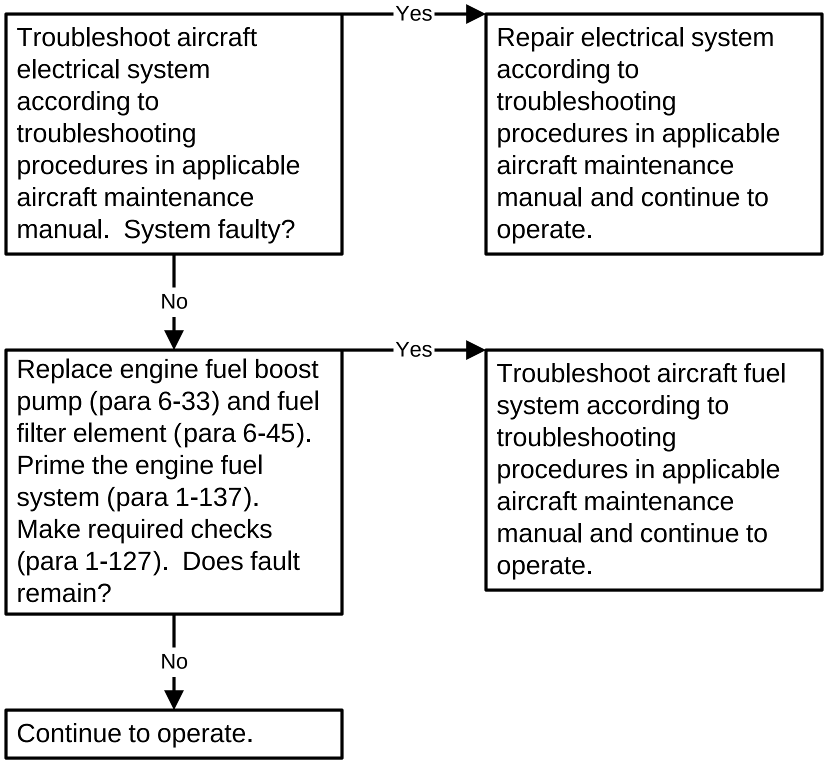
Troubleshoot aircraft fuel system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Remove fuel boost pump (para 6-34). Inspect for sheared shaft and for damage (para 6-36). Pump ok?

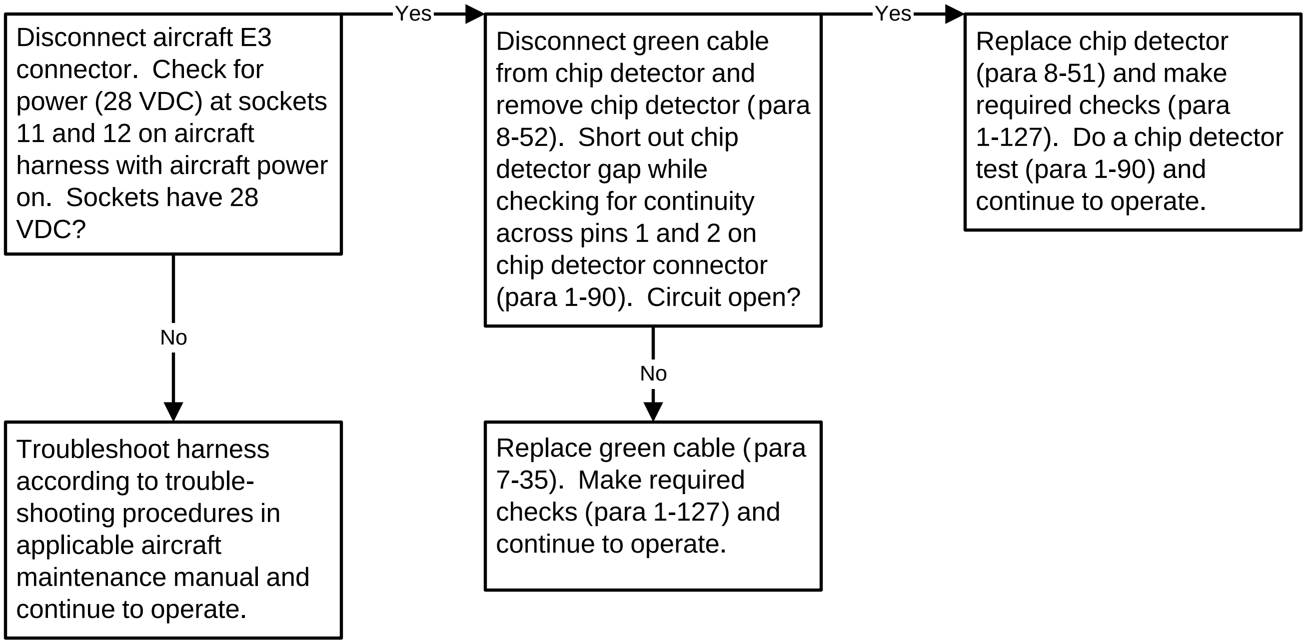
Reinstall pump (para 6-38). Troubleshoot fuel system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Install new pump (para 6-38) and fuel filter element (para 6-45). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 44. Low Fuel Pressure Caution Light ON at or Above Flight Idle Speed



Troubleshooting Procedure 45. Electrical Chip Detector Light Does Not Go ON During Electrical Chip Detector Circuit Test (para 1-90)



Disconnect aircraft E3 connector. Check for power (28 VDC) at sockets 11 and 12 on aircraft harness with aircraft power on. Sockets have 28 VDC?

Disconnect green cable from chip detector and remove chip detector (para 8-52). Short out chip detector gap while checking for continuity across pins 1 and 2 on chip detector connector (para 1-90). Circuit open?

Replace chip detector (para 8-51) and make required checks (para 1-127). Do a chip detector test (para 1-90) and continue to operate.

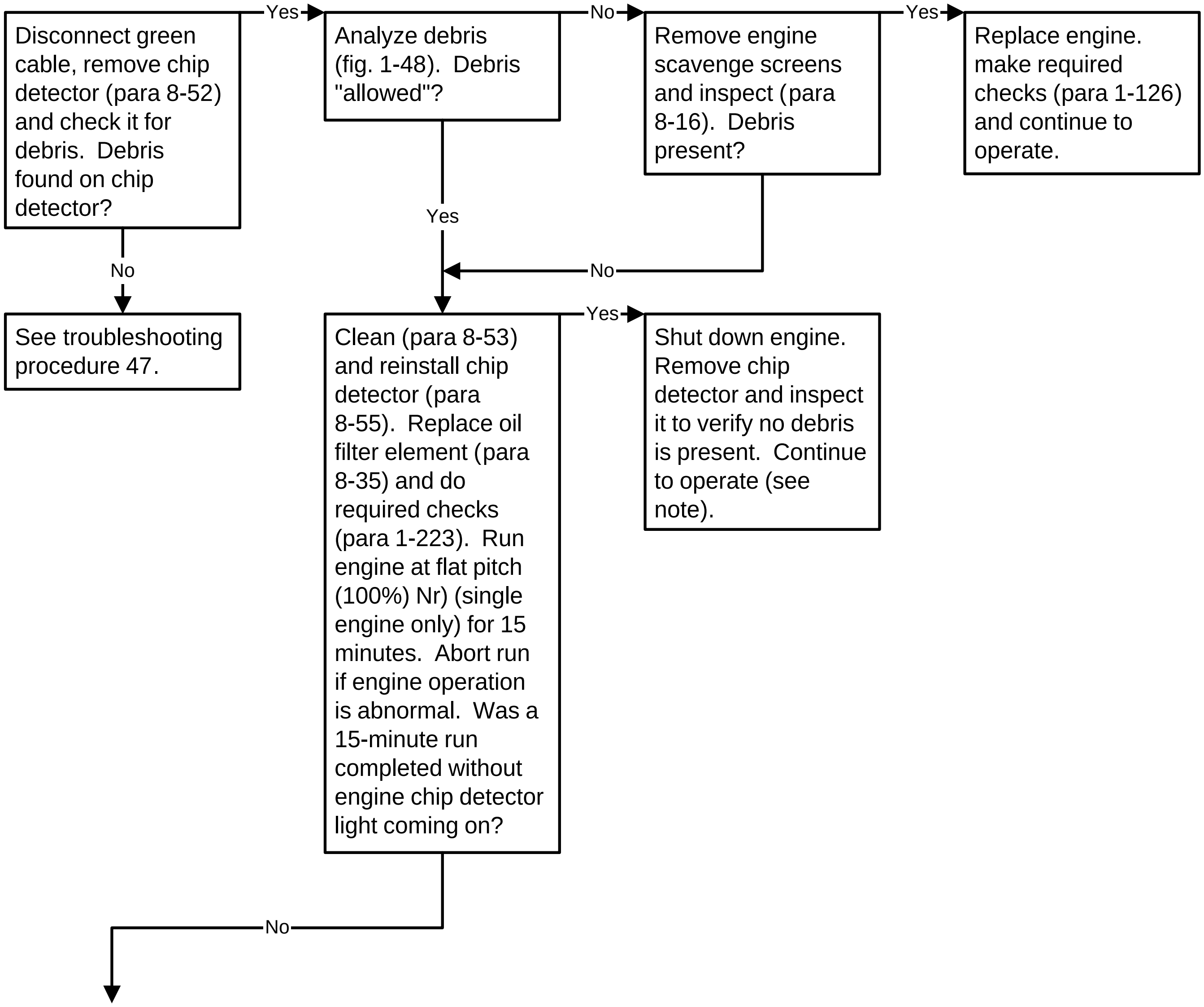
Troubleshoot harness according to trouble-shooting procedures in applicable aircraft maintenance manual and continue to operate.

Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

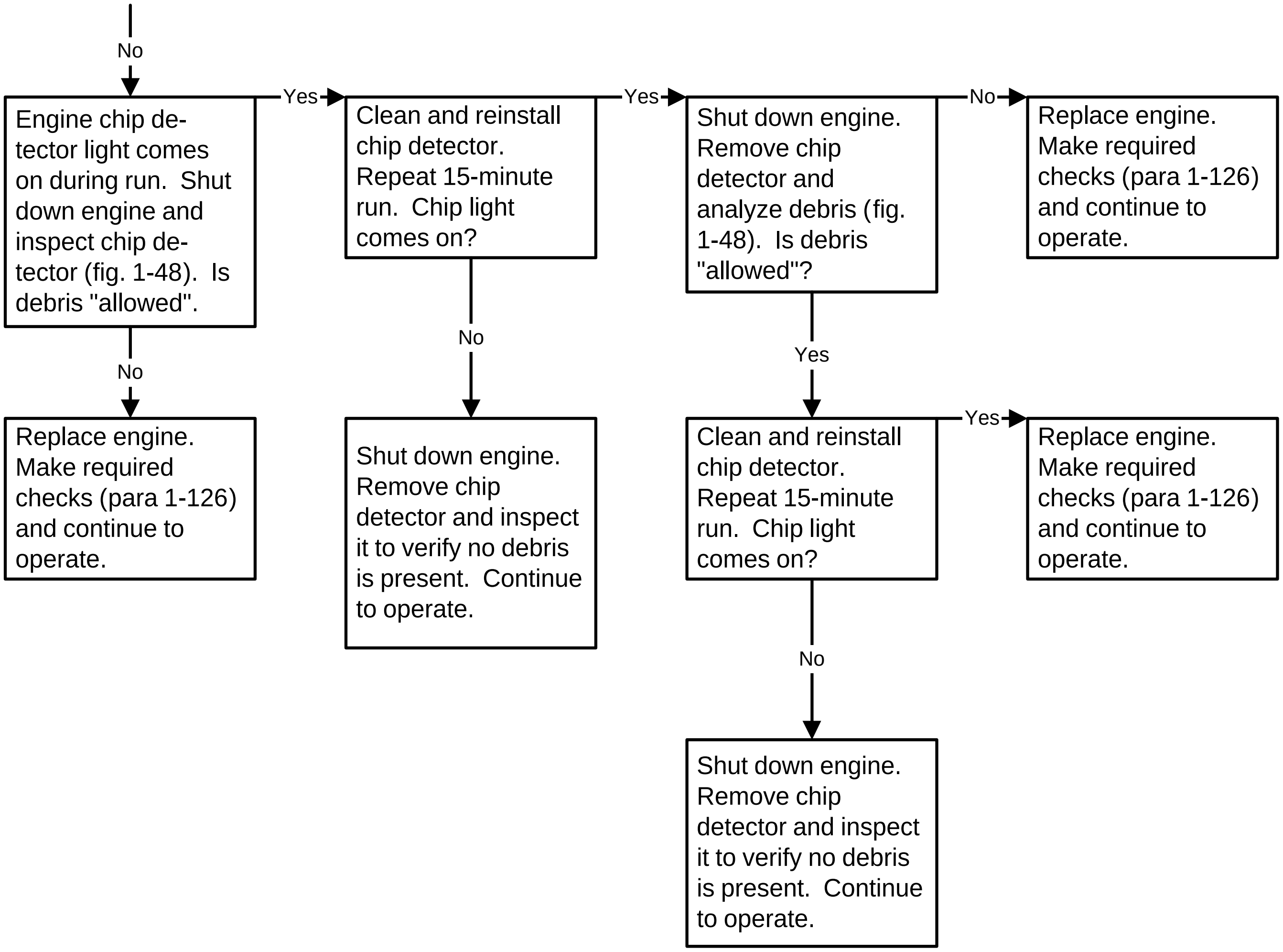
Troubleshooting Procedure 46. Electrical Chip Detector Light ON During Engine Operation

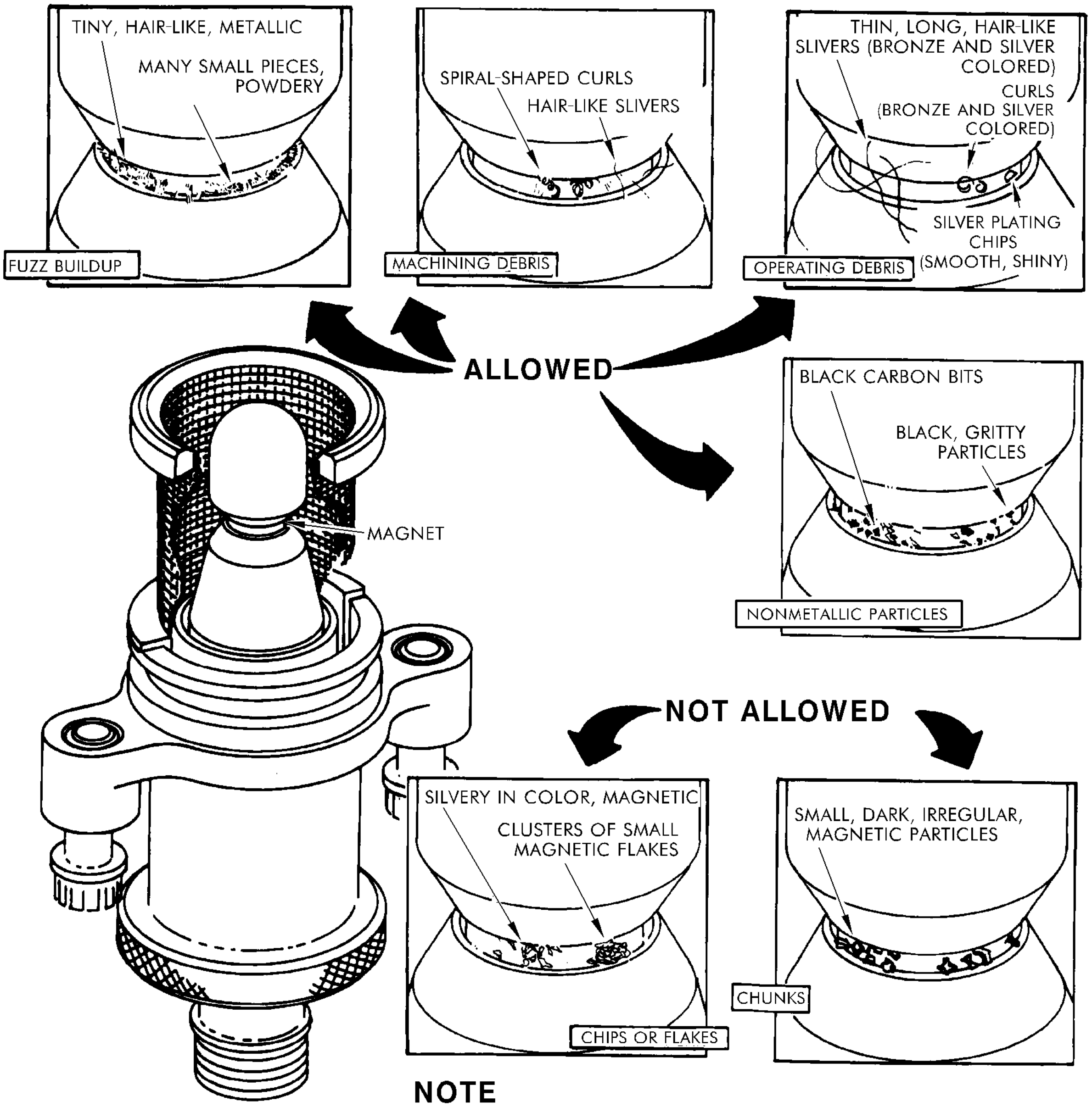
NOTE

- If engine chip detector light comes on, and if debris is "allowed" (fig. 1-48), a series of up to three 15-minute ground runs at flat pitch, 100% Nr must be made to clean engine oil system of debris.
- If engine chip detector light comes on, and debris is "allowed", continue making runs until a 15-minute run is made without engine chip detector light coming on.
- If engine chip detector light comes on for 3 runs, replace engine.
- If no engine chip detector light comes on during a 15-minute run, continue to operate.
- If engine chip detector light comes on and debris is "not allowed", replace engine.
- Repetitive chip light occurences, after being cleared by 15-minute runs is cause to reject the engine.



Troubleshooting Procedure 46. Electrical Chip Detector Light ON During Engine Operation (Cont)





NOTE

1. DURING NORMAL OPERATION, SOME BUILDUP OF MATERIALS THAT ARE "ALLOWED"MAY BE FOUND ON CHIP DETECTOR. THE AMOUNT WILL VARY BUT IS NOT CAUSE FOR ENGINE REMOVAL.
2. CHARACTERISTICS FOR IDENTIFYING TYPES OF CHIPS THAT ARE "NOT ALLOWED" ARE AS FOLLOWS:
   - MAGNETIC MATERIAL. (DETERMINE IF SMALL CHIPS ARE MAGNETIC BY PLACING CHIPS ON THIN PAPER AND BY OBSERVING IF CHIPS MOVE WHEN MAGNET IS MOVED UNDER PAPER.)
   - MANY CHIPS OF SIMILAR SIZE AND SHAPE.
   - SMOOTH AND REFLECTIVE ON ONE SIDE, ROUGH ON THE OTHER SIDE, MAGNETIC.
   - ROUGHLY CIRCULAR OR ELLIPTICAL FLAKES, THINNER AROUND THE EDGES, MAGNETIC.

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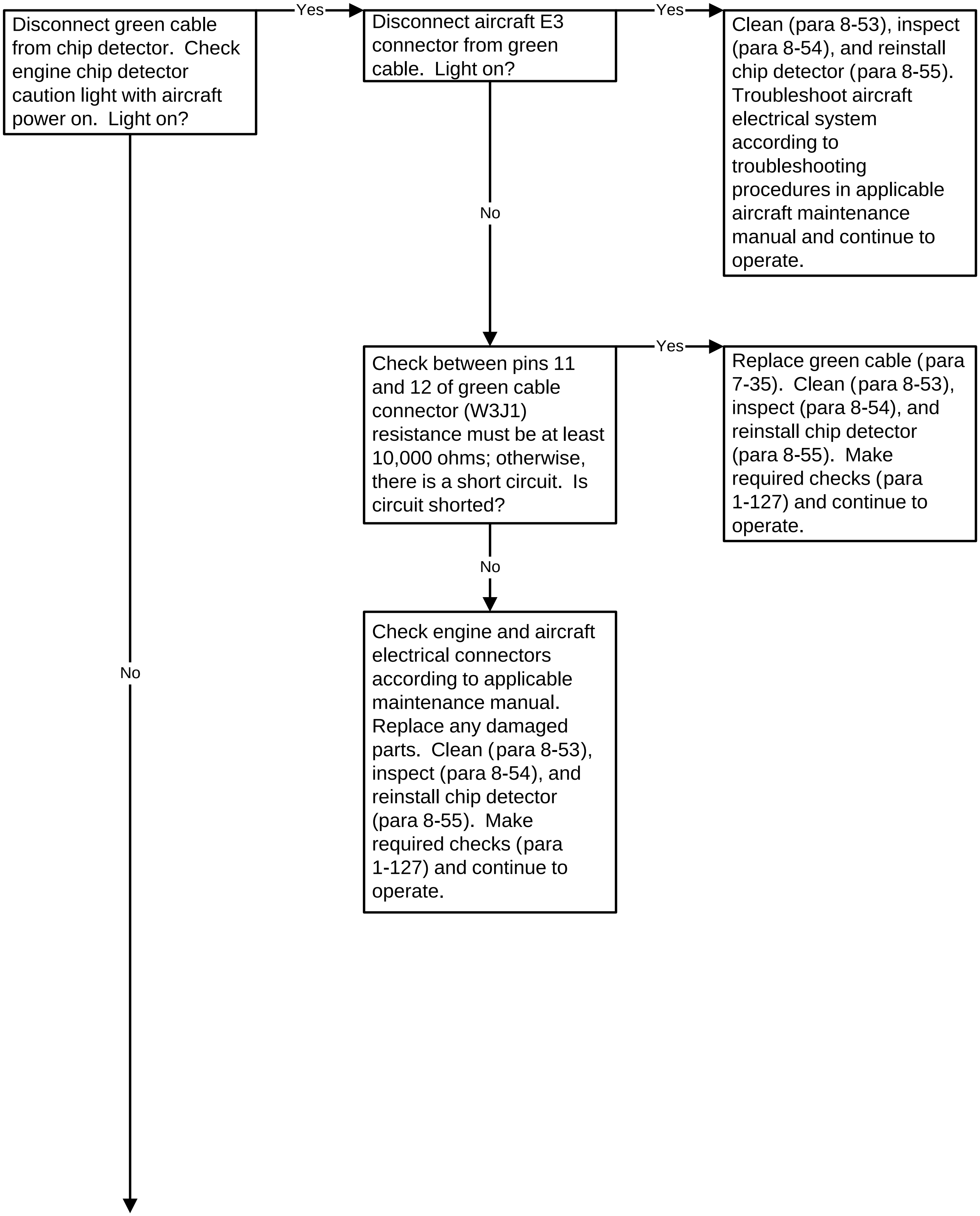
Figure 1-48. Electrical Chip Detector Debris; Analysis

Troubleshooting Procedure 47. Electrical Chip Detector Light ON and No Debris Found



Disconnect green cable from chip detector. Check engine chip detector caution light with aircraft power on. Light on?

Disconnect aircraft E3 connector from green cable. Light on?

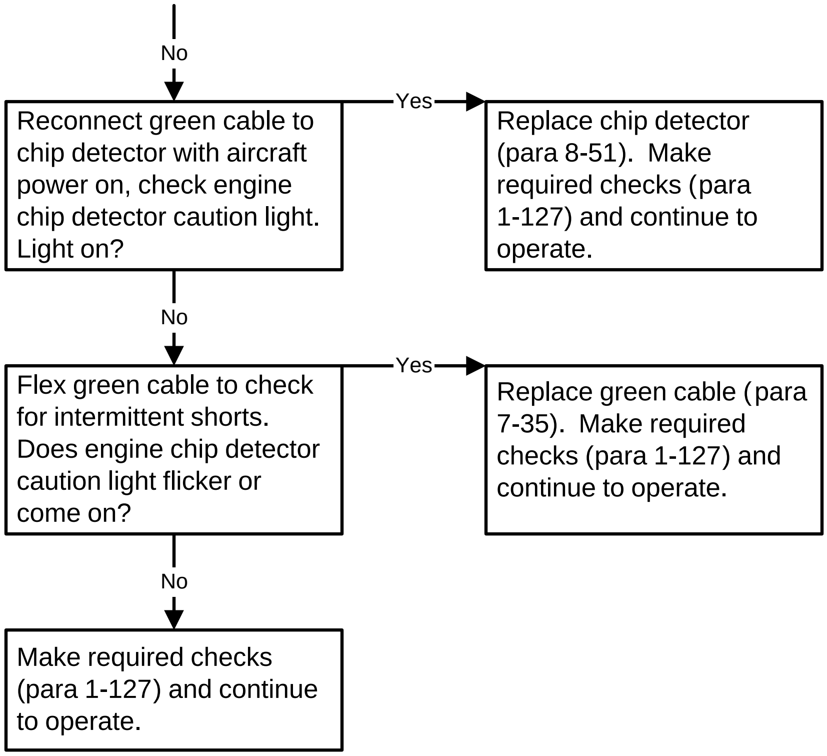
Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55). Troubleshoot aircraft electrical system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Check between pins 11 and 12 of green cable connector (W3J1) resistance must be at least 10,000 ohms; otherwise, there is a short circuit. Is circuit shorted?

Replace green cable (para 7-35). Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55). Make required checks (para 1-127) and continue to operate.

Check engine and aircraft electrical connectors according to applicable maintenance manual. Replace any damaged parts. Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55). Make required checks (para 1-127) and continue to operate.

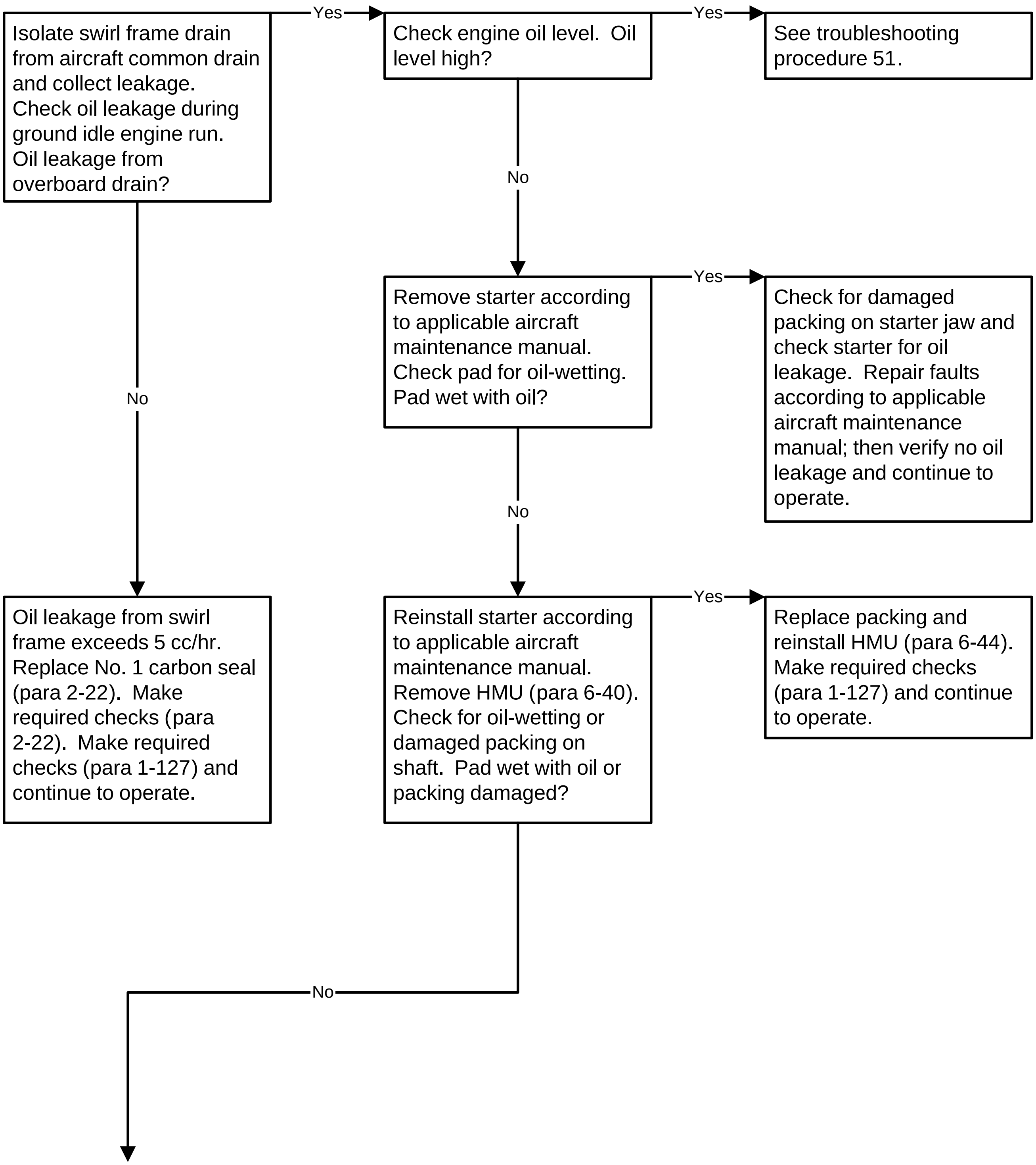
Troubleshooting Procedure 47. Electrical Chip Detector Light ON and No Debris Found (Cont)



Troubleshooting Procedure 48. Excessive Oil Leakage at Overboard Drain (out-of-Limits)

NOTE

Overboard drain collects fluids from both engine and aircraft systems.



Isolate swirl frame drain from aircraft common drain and collect leakage. Check oil leakage during ground idle engine run. Oil leakage from overboard drain?

Check engine oil level. Oil level high?

See troubleshooting procedure 51.

Remove starter according to applicable aircraft maintenance manual. Check pad for oil-wetting. Pad wet with oil?

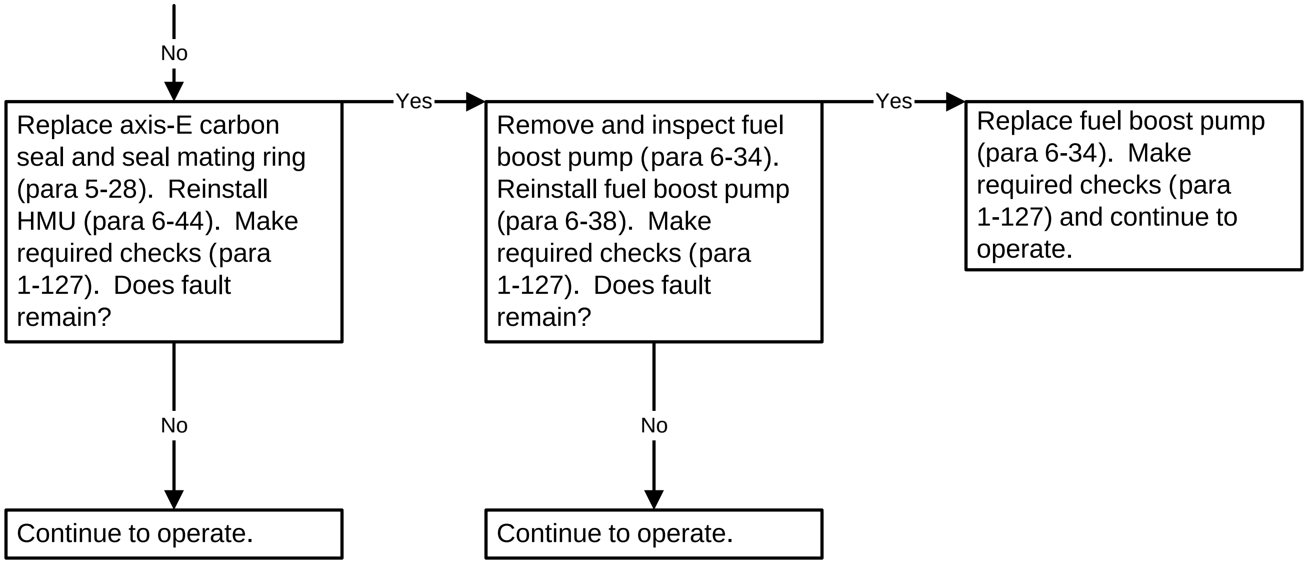
Check for damaged packing on starter jaw and check starter for oil leakage. Repair faults according to applicable aircraft maintenance manual; then verify no oil leakage and continue to operate.

Oil leakage from swirl frame exceeds 5 cc/hr. Replace No. 1 carbon seal (para 2-22). Make required checks (para 2-22). Make required checks (para 1-127) and continue to operate.

Reinstall starter according to applicable aircraft maintenance manual. Remove HMU (para 6-40). Check for oil-wetting or damaged packing on shaft. Pad wet with oil or packing damaged?

Replace packing and reinstall HMU (para 6-44). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 48. Excessive Oil Leakage at Overboard Drain (out-of-Limits) (Cont)



Replace axis-E carbon seal and seal mating ring (para 5-28). Reinstall HMU (para 6-44). Make required checks (para 1-127). Does fault remain?

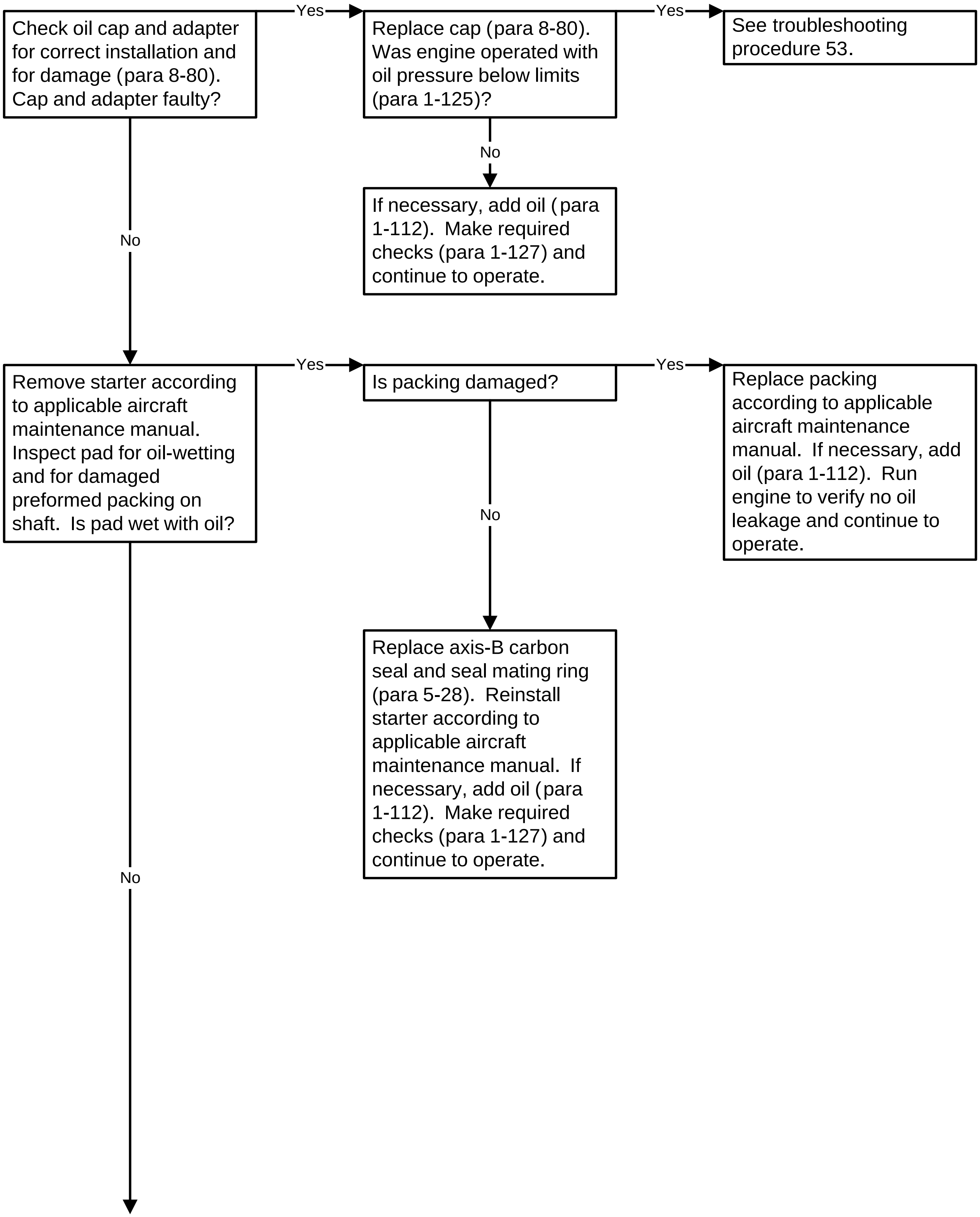
Remove and inspect fuel boost pump (para 6-34). Reinstall fuel boost pump (para 6-38). Make required checks (para 1-127). Does fault remain?

Replace fuel boost pump (para 6-34). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Continue to operate.

Troubleshooting Procedure 49. Excessive Oil Leakage at Service Port Scupper



Check oil cap and adapter for correct installation and for damage (para 8-80). Cap and adapter faulty?

Replace cap (para 8-80). Was engine operated with oil pressure below limits (para 1-125)?

See troubleshooting procedure 53.

If necessary, add oil (para 1-112). Make required checks (para 1-127) and continue to operate.

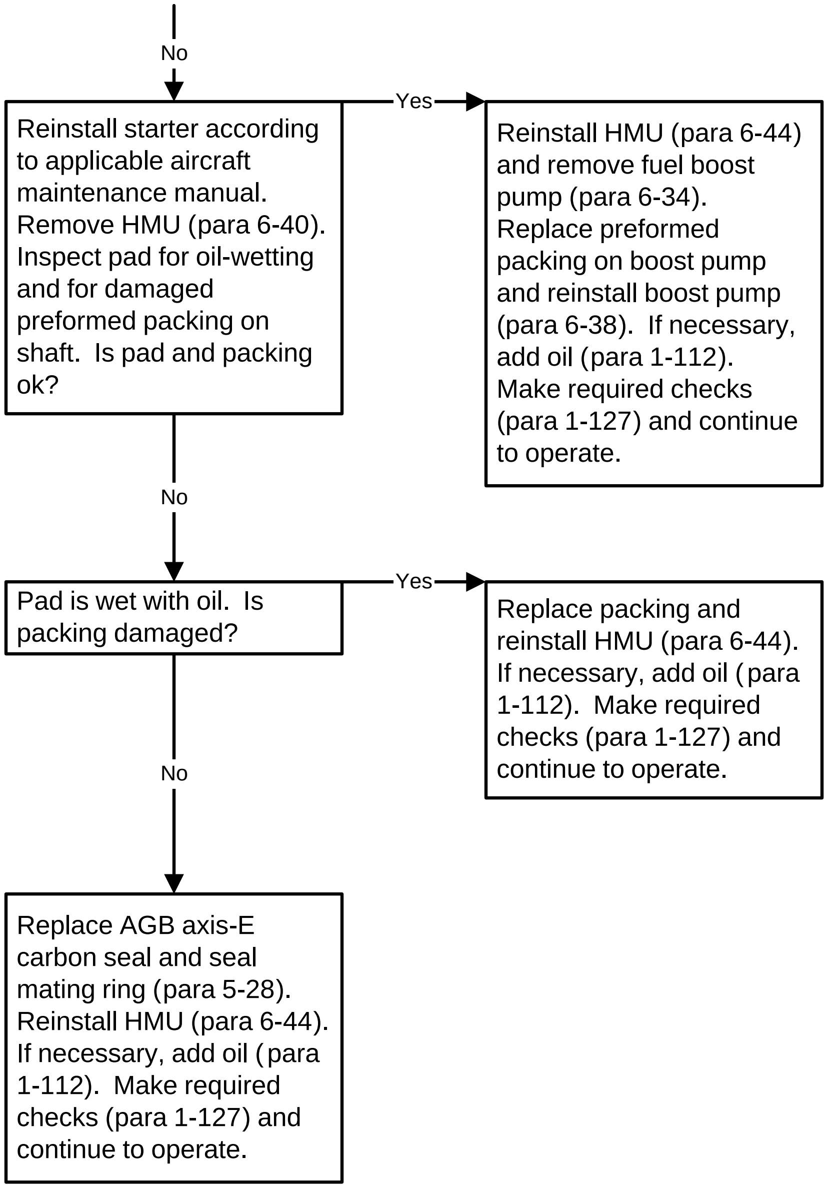
Remove starter according to applicable aircraft maintenance manual. Inspect pad for oil-wetting and for damaged preformed packing on shaft. Is pad wet with oil?

Is packing damaged?

Replace packing according to applicable aircraft maintenance manual. If necessary, add oil (para 1-112). Run engine to verify no oil leakage and continue to operate.

Replace axis-B carbon seal and seal mating ring (para 5-28). Reinstall starter according to applicable aircraft maintenance manual. If necessary, add oil (para 1-112). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 49. Excessive Oil Leakage at Service Port Scupper (Cont)



Reinstall starter according to applicable aircraft maintenance manual. Remove HMU (para 6-40). Inspect pad for oil-wetting and for damaged preformed packing on shaft. Is pad and packing ok?

Reinstall HMU (para 6-44) and remove fuel boost pump (para 6-34). Replace preformed packing on boost pump and reinstall boost pump (para 6-38). If necessary, add oil (para 1-112). Make required checks (para 1-127) and continue to operate.

Pad is wet with oil. Is packing damaged?

Replace packing and reinstall HMU (para 6-44). If necessary, add oil (para 1-112). Make required checks (para 1-127) and continue to operate.

Replace AGB axis-E carbon seal and seal mating ring (para 5-28). Reinstall HMU (para 6-44). If necessary, add oil (para 1-112). Make required checks (para 1-127) and continue to operate.

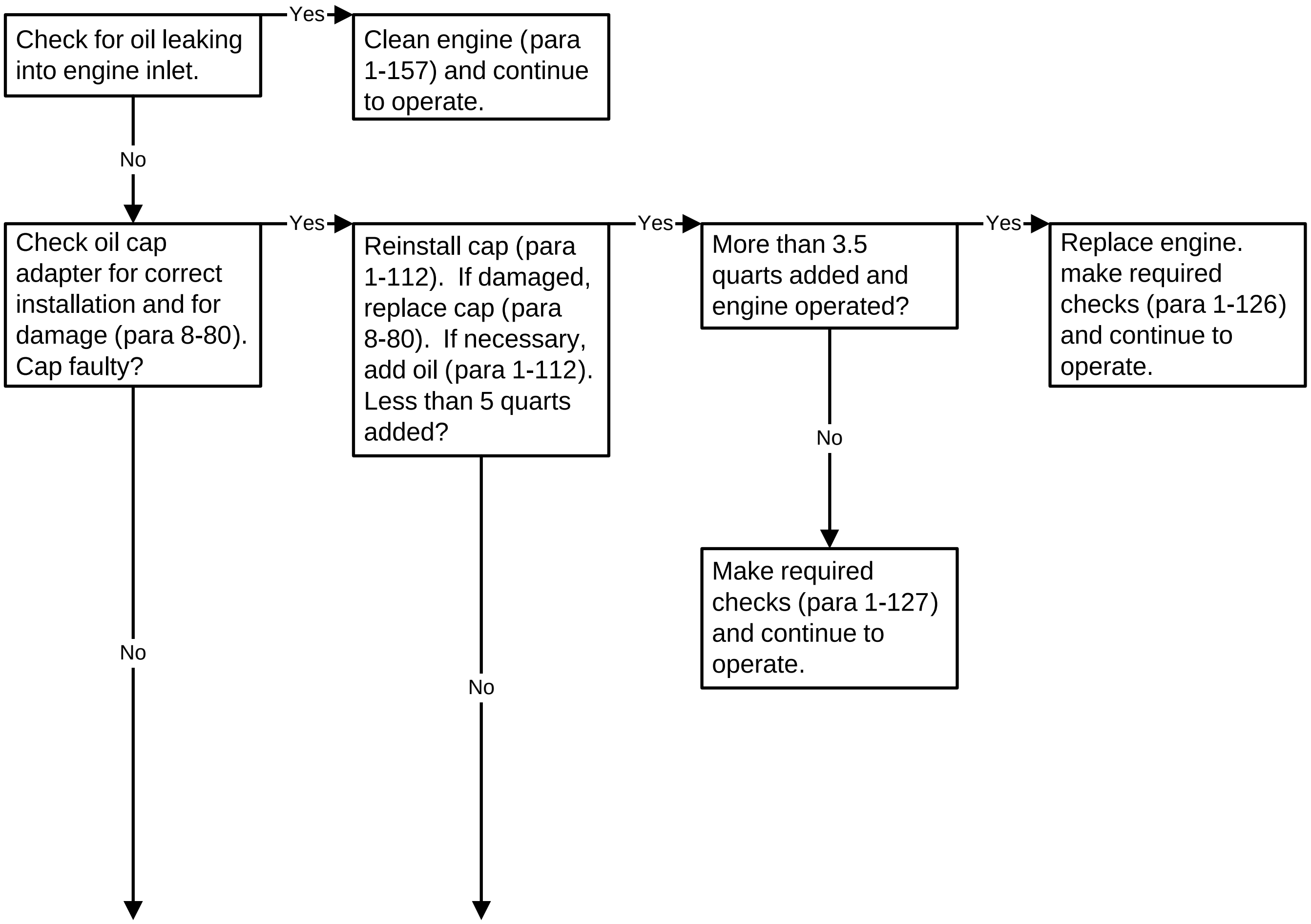
Troubleshooting Procedure 50. High Oil Consumption (over limits)

CAUTION

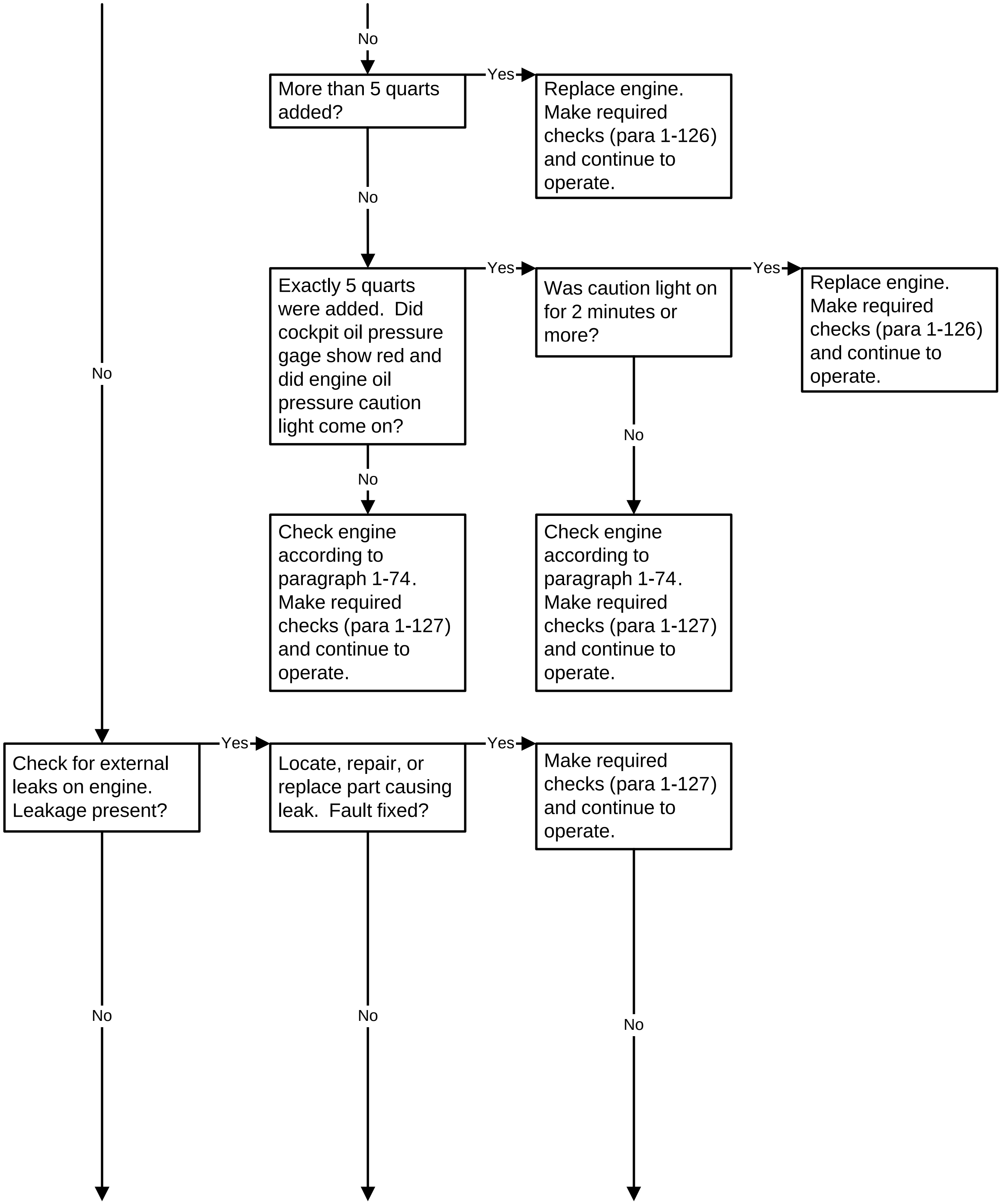
If engine requires more than 3.5 quarts of oil, and engine was operated, engine bearings may be damaged.

NOTE

- According to standard procedure, addition of oil in whole quart quantities may result in apparent high oil consumption. If excessive oil consumption is suspected, maintain a log of quarts of oil used and of engine operating time. See paragraph 1-125 for limits.
- If engine oil system is serviced and engine is tipped during removal or installation, oil will seep (oil forming drops, puddles, or streaks) from A-sump, down stage 1 blades, and into bottom of the main frame. This is no cause to reject the engine.



Troubleshooting Procedure 50. High Oil Consumption (over limits) (Cont)



More than 5 quarts added?

Replace engine. Make required checks (para 1-126) and continue to operate.

Exactly 5 quarts were added. Did cockpit oil pressure gage show red and did engine oil pressure caution light come on?

Was caution light on for 2 minutes or more?

Replace engine. Make required checks (para 1-126) and continue to operate.

Check engine according to paragraph 1-74. Make required checks (para 1-127) and continue to operate.

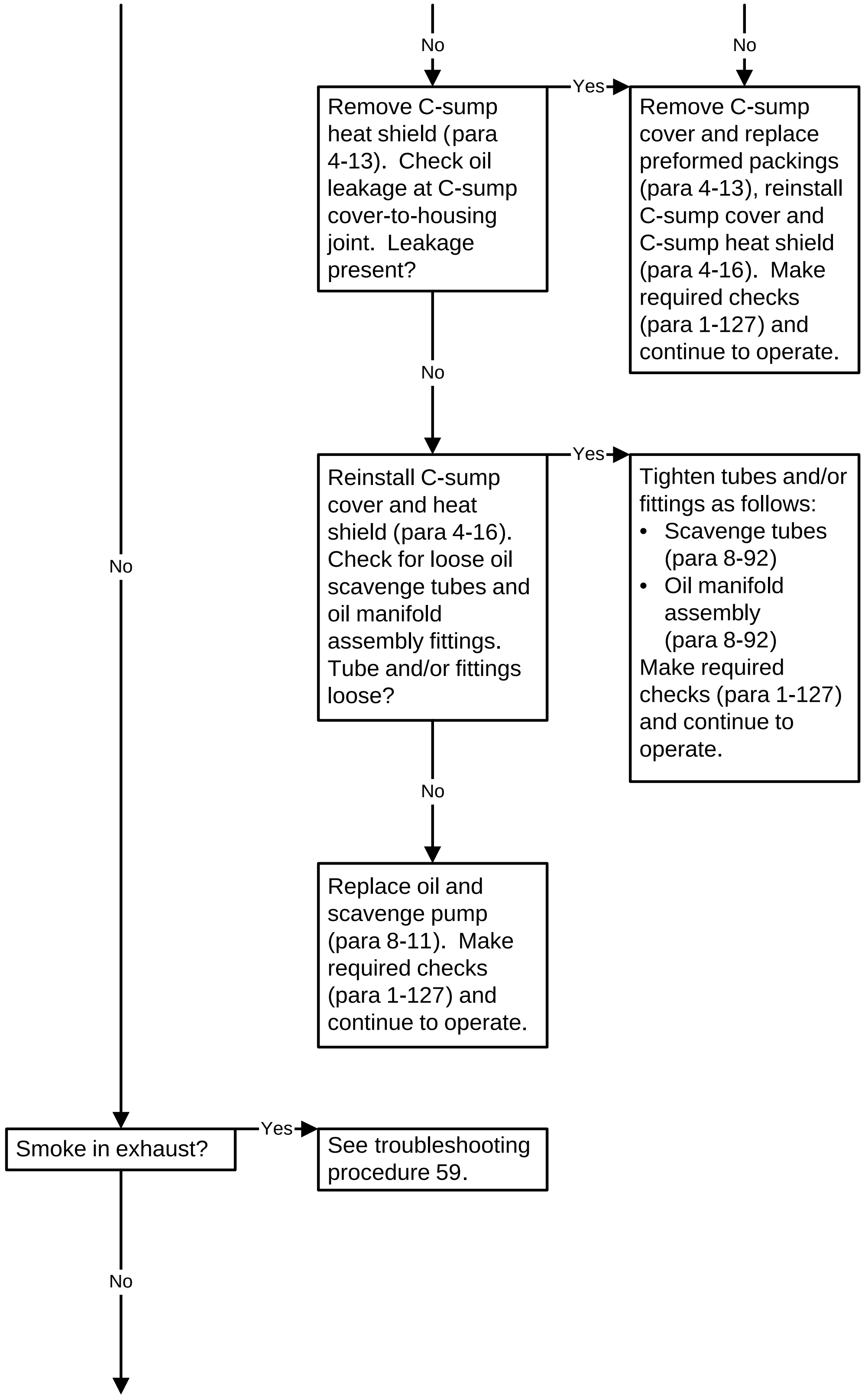
Check engine according to paragraph 1-74. Make required checks (para 1-127) and continue to operate.

Check for external leaks on engine. Leakage present?

Locate, repair, or replace part causing leak. Fault fixed?

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 50. High Oil Consumption (over limits) (Cont)



Remove C-sump heat shield (para 4-13). Check oil leakage at C-sump cover-to-housing joint. Leakage present?

Remove C-sump cover and replace preformed packings (para 4-13), reinstall C-sump cover and C-sump heat shield (para 4-16). Make required checks (para 1-127) and continue to operate.

Reinstall C-sump cover and heat shield (para 4-16). Check for loose oil scavenge tubes and oil manifold assembly fittings. Tube and/or fittings loose?

Tighten tubes and/or fittings as follows:
- Scavenge tubes (para 8-92)
- Oil manifold assembly (para 8-92)

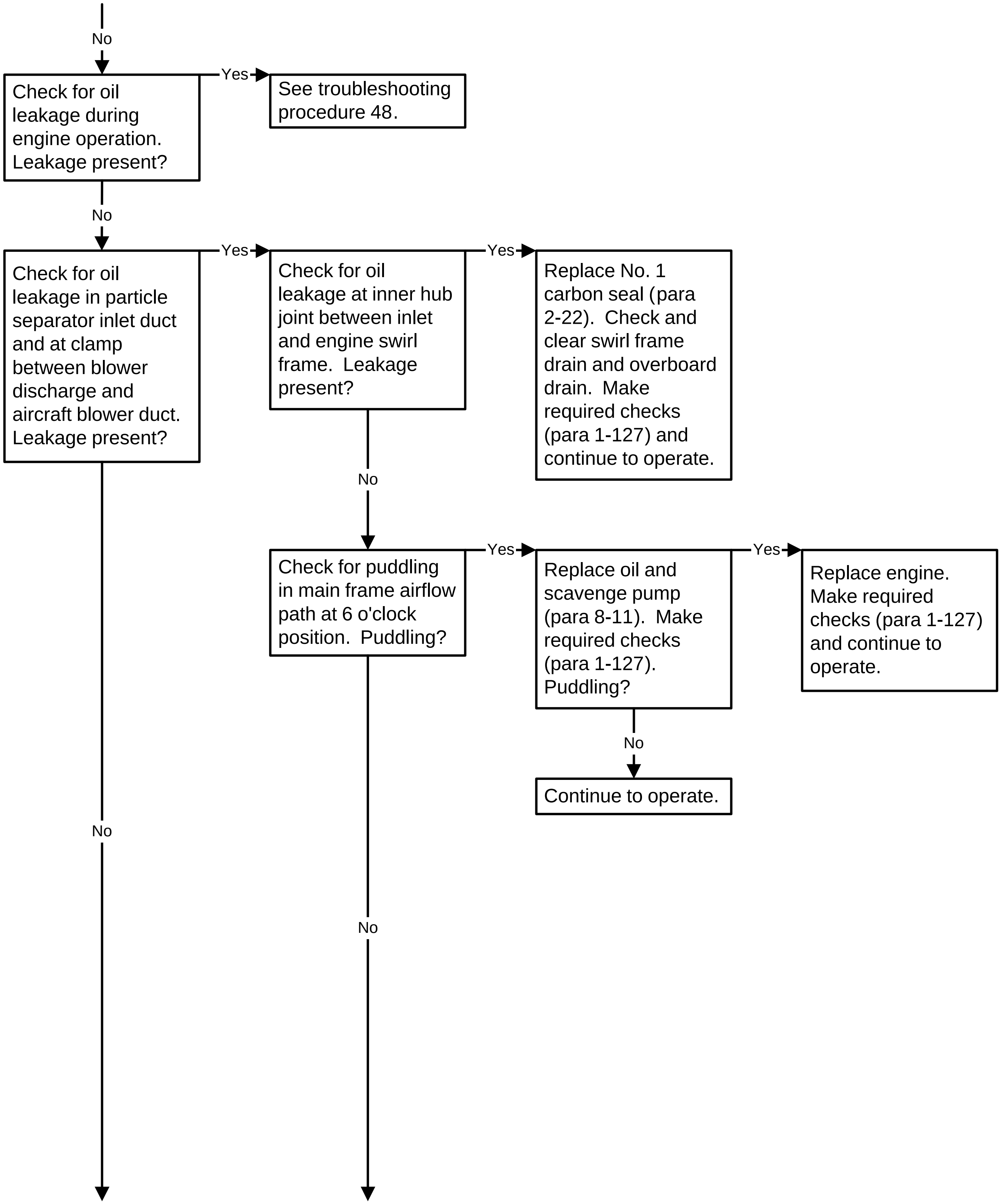
Make required checks (para 1-127) and continue to operate.

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-127) and continue to operate.

Smoke in exhaust?

See troubleshooting procedure 59.

Troubleshooting Procedure 50. High Oil Consumption (over limits) (Cont)



Check for oil leakage during engine operation. Leakage present?

See troubleshooting procedure 48.

Check for oil leakage in particle separator inlet duct and at clamp between blower discharge and aircraft blower duct. Leakage present?

Check for oil leakage at inner hub joint between inlet and engine swirl frame. Leakage present?

Replace No. 1 carbon seal (para 2-22). Check and clear swirl frame drain and overboard drain. Make required checks (para 1-127) and continue to operate.

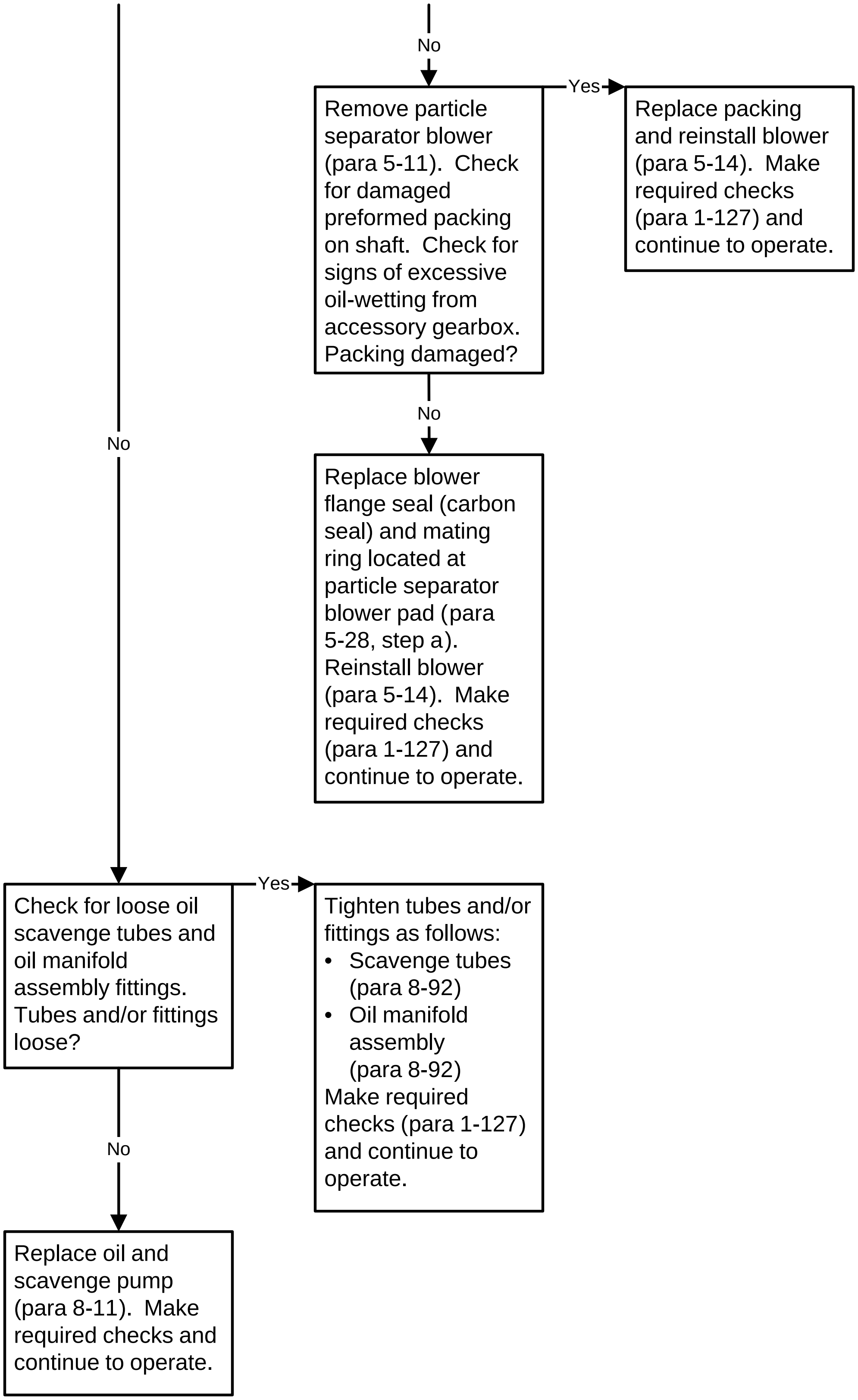
Check for puddling in main frame airflow path at 6 o'clock position. Puddling?

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-127). Puddling?

Replace engine. Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 50. High Oil Consumption (over limits) (Cont)



Remove particle separator blower (para 5-11). Check for damaged preformed packing on shaft. Check for signs of excessive oil-wetting from accessory gearbox. Packing damaged?

Replace packing and reinstall blower (para 5-14). Make required checks (para 1-127) and continue to operate.

Replace blower flange seal (carbon seal) and mating ring located at particle separator blower pad (para 5-28, step a). Reinstall blower (para 5-14). Make required checks (para 1-127) and continue to operate.

Check for loose oil scavenge tubes and oil manifold assembly fittings. Tubes and/or fittings loose?

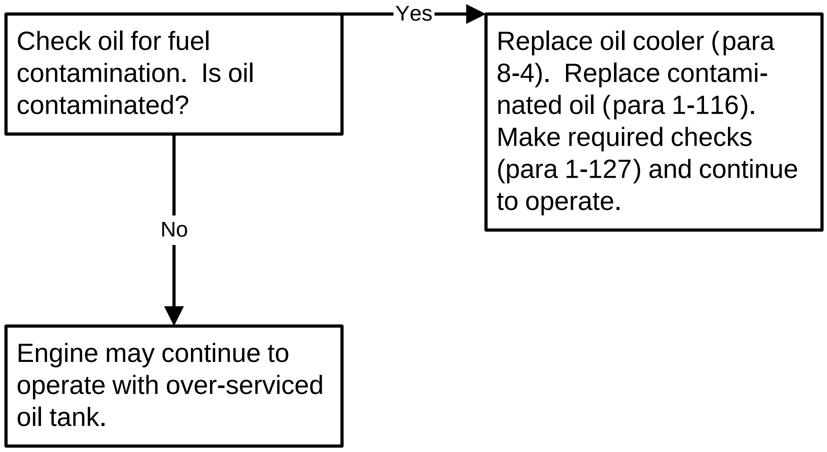
Tighten tubes and/or fittings as follows:

- Scavenge tubes (para 8-92)
- Oil manifold assembly (para 8-92)

Make required checks (para 1-127) and continue to operate.

Replace oil and scavenge pump (para 8-11). Make required checks and continue to operate.

Troubleshooting Procedure 51. High Oil Level (oil level above full mark on sight glass)



Check oil for fuel contamination. Is oil contaminated?

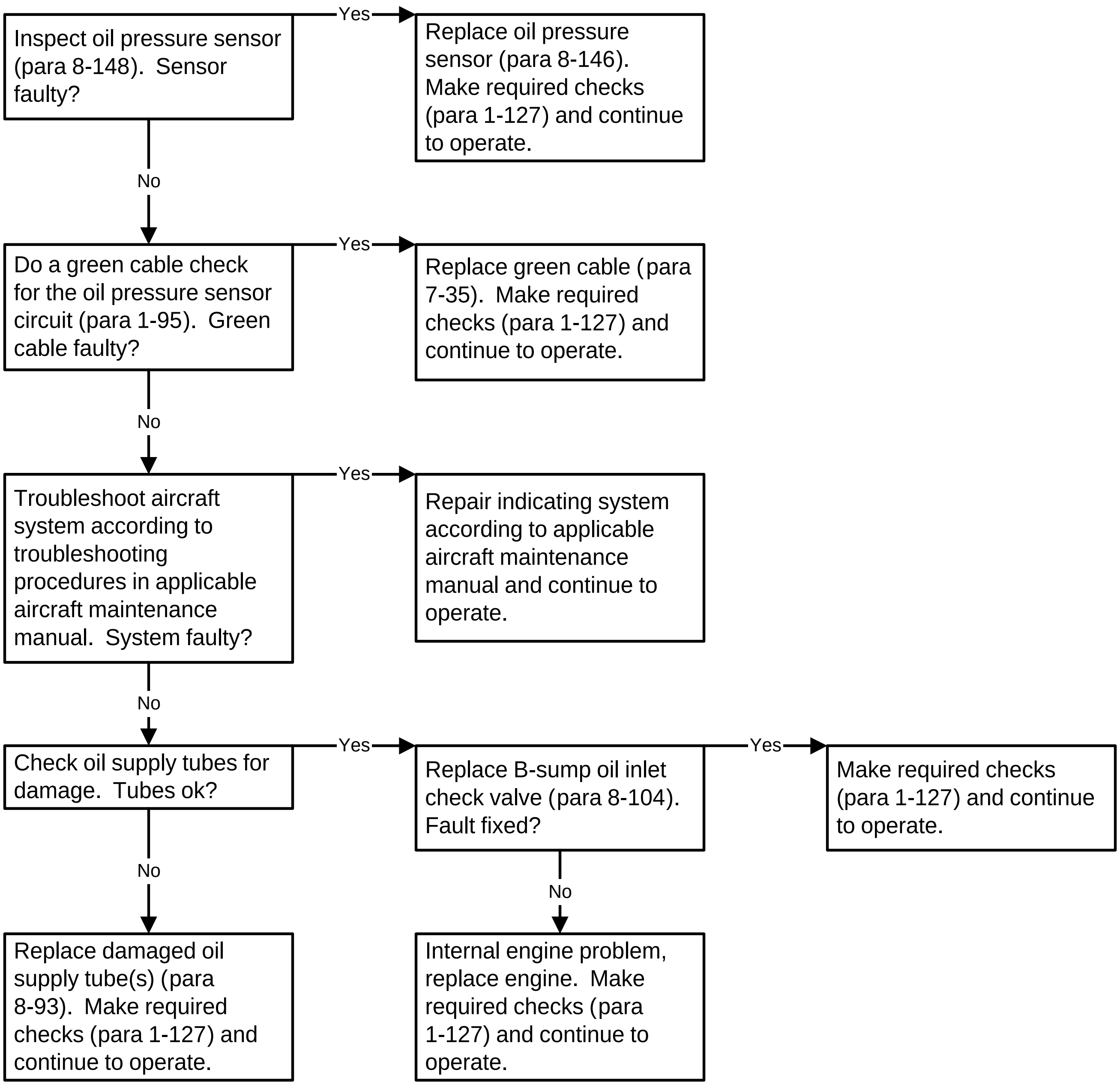
Replace oil cooler (para 8-4). Replace contaminated oil (para 1-116). Make required checks (para 1-127) and continue to operate.

Engine may continue to operate with over-serviced oil tank.

Troubleshooting Procedure 52. High Oil Pressure

NOTE

A sudden increase in oil pressure of 10 psig over normal engine pressure is cause for investigation. Do not change oil and scavenge and pump, because it cannot cause high oil pressure. Oil pressure during initial start (cold oil) should return to normal after 5 minutes at idle speed.



Inspect oil pressure sensor (para 8-148). Sensor faulty?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-127) and continue to operate.

Do a green cable check for the oil pressure sensor circuit (para 1-95). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

Troubleshoot aircraft system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair indicating system according to applicable aircraft maintenance manual and continue to operate.

Check oil supply tubes for damage. Tubes ok?

Replace B-sump oil inlet check valve (para 8-104). Fault fixed?

Make required checks (para 1-127) and continue to operate.

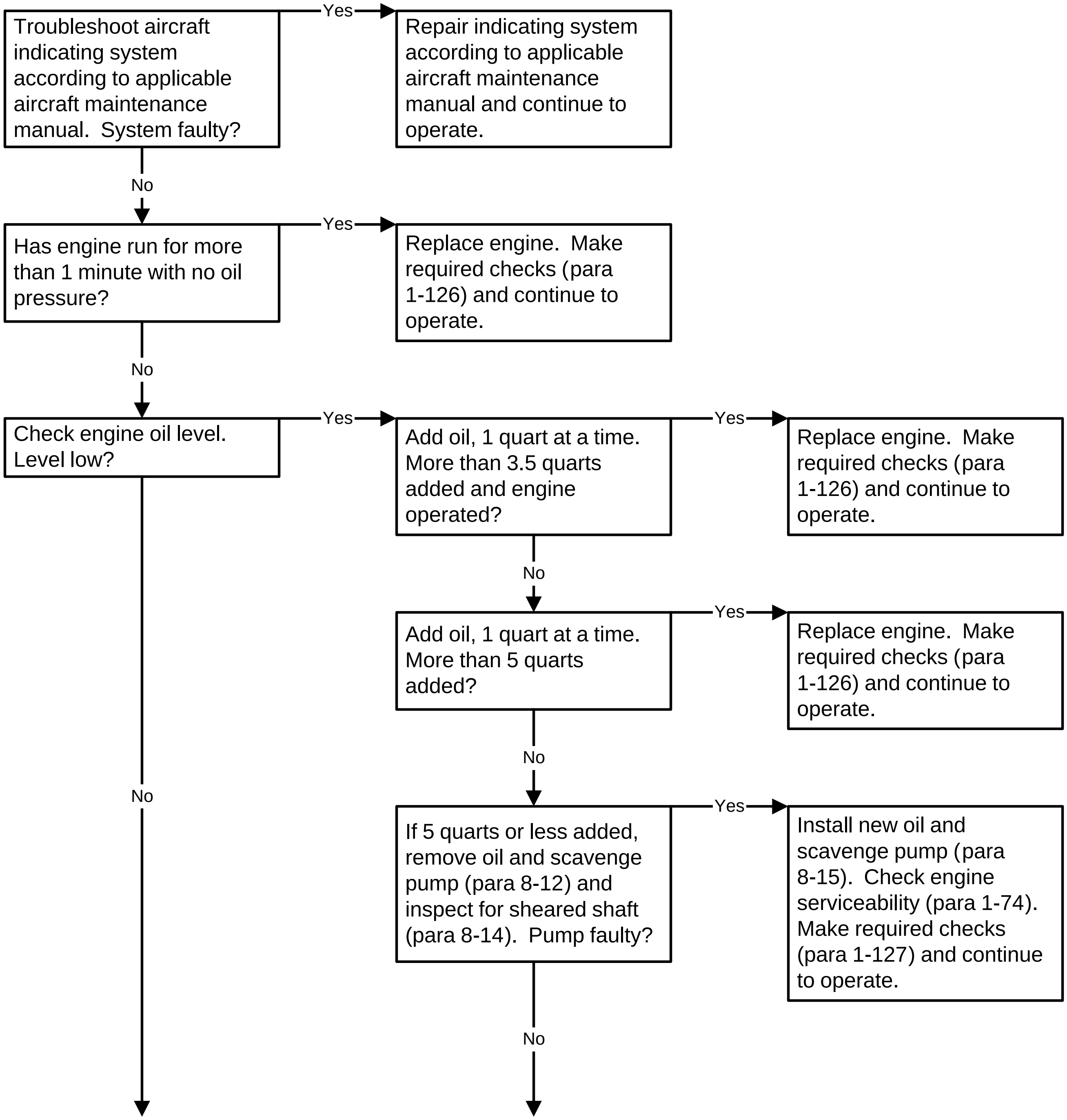
Replace damaged oil supply tube(s) (para 8-93). Make required checks (para 1-127) and continue to operate.

Internal engine problem, replace engine. Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 53. No Oil Pressure

CAUTION

If engine requires more than 3.5 quarts of oil, and engine was operated, engine bearings may be damaged.



Troubleshoot aircraft indicating system according to applicable aircraft maintenance manual. System faulty?

Repair indicating system according to applicable aircraft maintenance manual and continue to operate.

Has engine run for more than 1 minute with no oil pressure?

Replace engine. Make required checks (para 1-126) and continue to operate.

Check engine oil level. Level low?

Add oil, 1 quart at a time. More than 3.5 quarts added and engine operated?

Replace engine. Make required checks (para 1-126) and continue to operate.

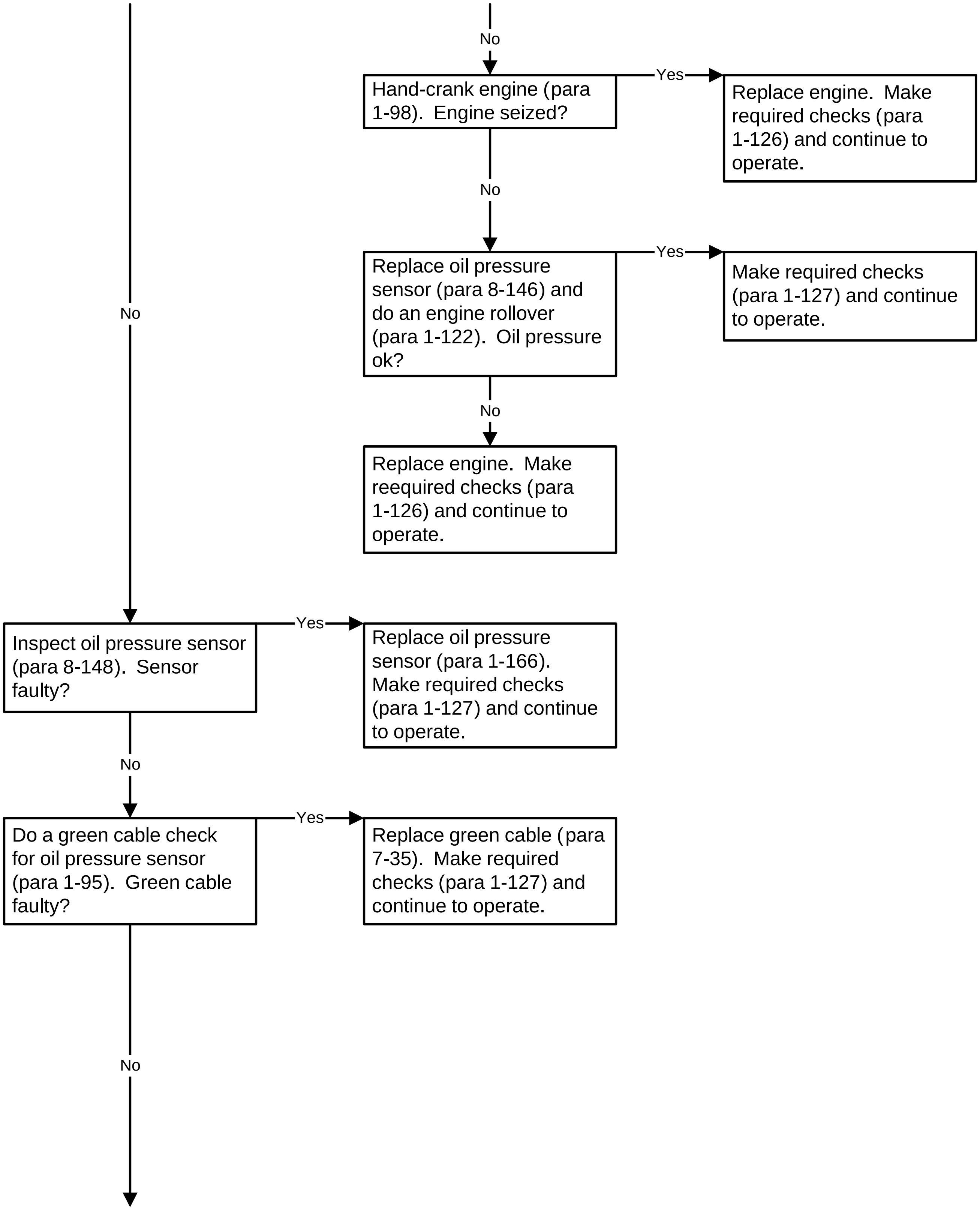
Add oil, 1 quart at a time. More than 5 quarts added?

Replace engine. Make required checks (para 1-126) and continue to operate.

If 5 quarts or less added, remove oil and scavenge pump (para 8-12) and inspect for sheared shaft (para 8-14). Pump faulty?

Install new oil and scavenge pump (para 8-15). Check engine serviceability (para 1-74). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 53. No Oil Pressure (Cont)



Hand-crank engine (para 1-98). Engine seized?

Replace engine. Make required checks (para 1-126) and continue to operate.

Replace oil pressure sensor (para 8-146) and do an engine rollover (para 1-122). Oil pressure ok?

Make required checks (para 1-127) and continue to operate.

Replace engine. Make reequired checks (para 1-126) and continue to operate.

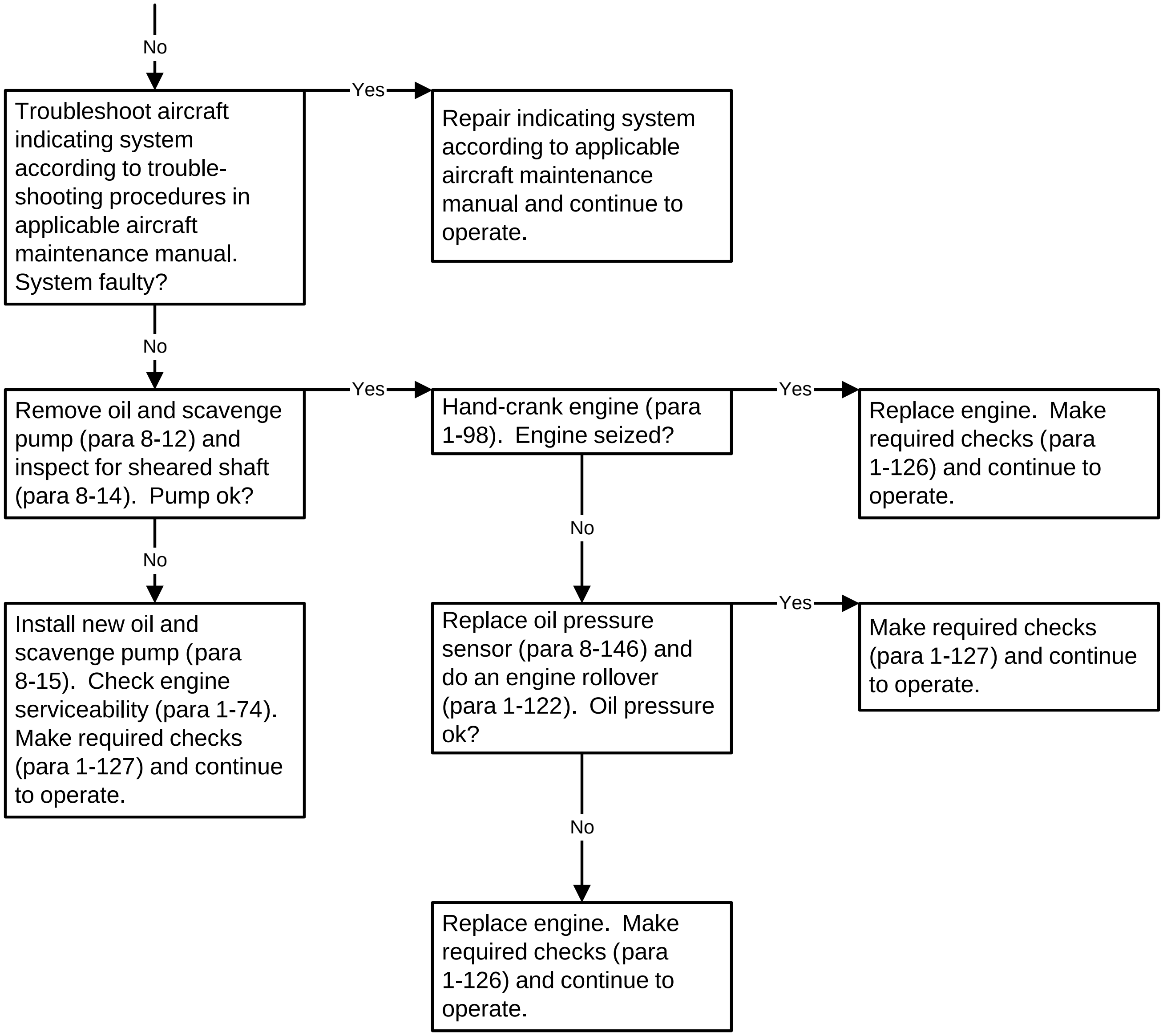
Inspect oil pressure sensor (para 8-148). Sensor faulty?

Replace oil pressure sensor (para 1-166). Make required checks (para 1-127) and continue to operate.

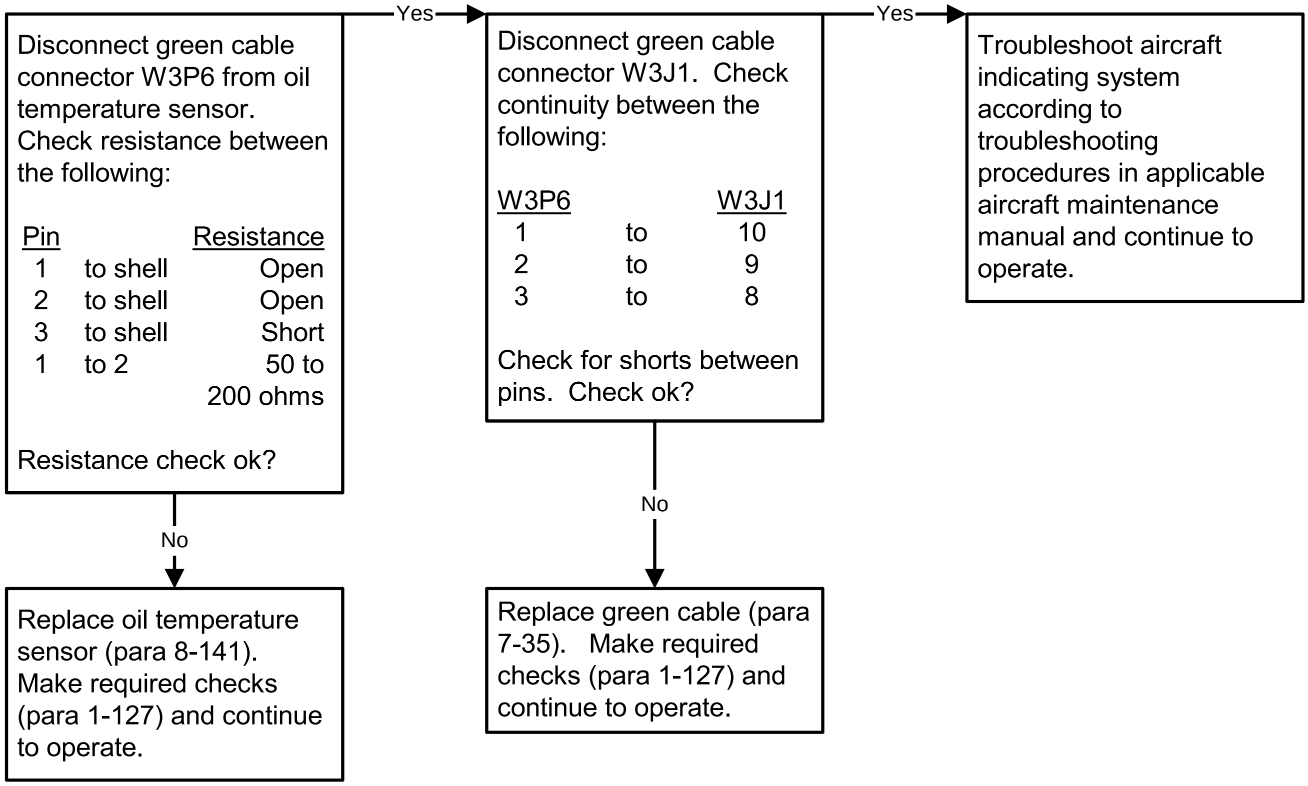
Do a green cable check for oil pressure sensor (para 1-95). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 53. No Oil Pressure (Cont)



Troubleshooting Procedure 54. ***(T700, T701C, T701D)*** *No Oil Temperature*



Disconnect green cable connector W3P6 from oil temperature sensor. Check resistance between the following:

Pin		Resistance
1	to shell	Open
2	to shell	Open
3	to shell	Short
1	to 2	50 to 200 ohms

Resistance check ok?

Replace oil temperature sensor (para 8-141). Make required checks (para 1-127) and continue to operate.

Disconnect green cable connector W3J1. Check continuity between the following:

W3P6		W3J1
1	to	10
2	to	9
3	to	8

Check for shorts between pins. Check ok?

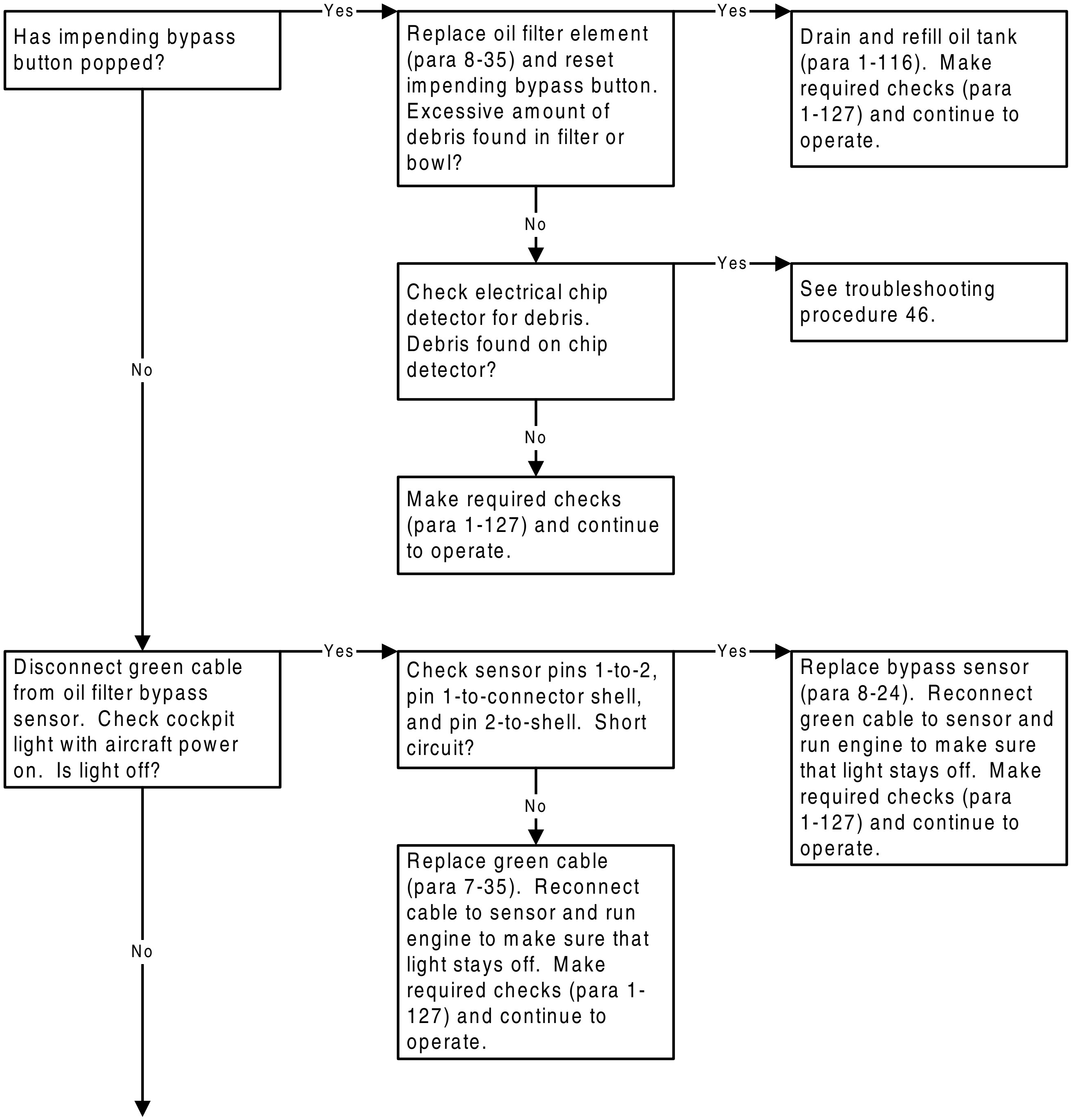
Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

Troubleshoot aircraft indicating system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 55. Oil Filter Bypass Light Comes ON

NOTE

During engine starting when engine oil is below normal operating temperature, cockpit oil filter bypass light may come on and may remain on until oil reaches 38°C (100°F). If oil filter is too dirty, light will remain on after oil temperature is stable.



Has impending bypass button popped?

Replace oil filter element (para 8-35) and reset impending bypass button. Excessive amount of debris found in filter or bowl?

Drain and refill oil tank (para 1-116). Make required checks (para 1-127) and continue to operate.

Check electrical chip detector for debris. Debris found on chip detector?

See troubleshooting procedure 46.

Make required checks (para 1-127) and continue to operate.

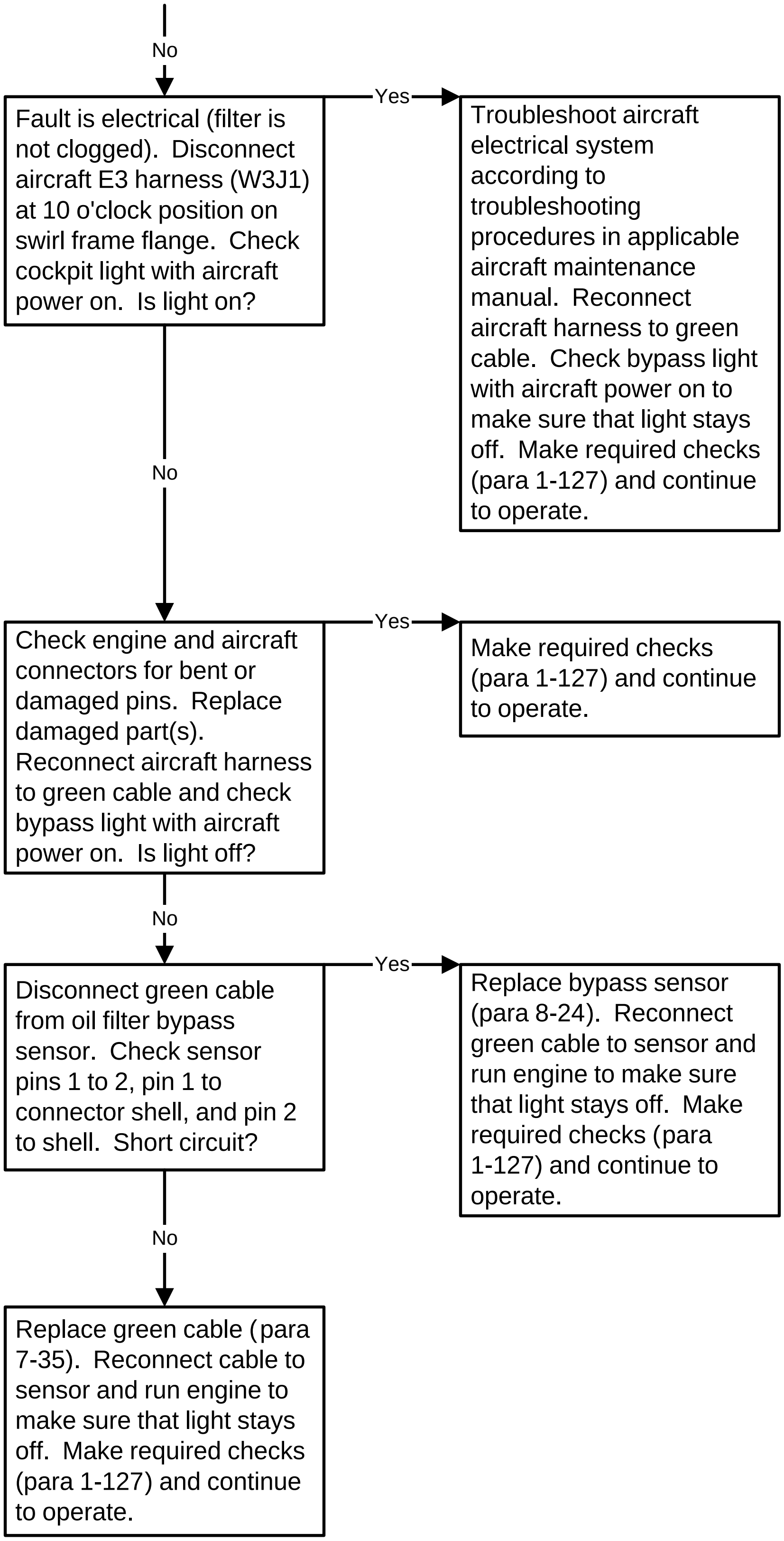
Disconnect green cable from oil filter bypass sensor. Check cockpit light with aircraft power on. Is light off?

Check sensor pins 1-to-2, pin 1-to-connector shell, and pin 2-to-shell. Short circuit?

Replace bypass sensor (para 8-24). Reconnect green cable to sensor and run engine to make sure that light stays off. Make required checks (para 1-127) and continue to operate.

Replace green cable (para 7-35). Reconnect cable to sensor and run engine to make sure that light stays off. Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 55. Oil Filter Bypass Light Comes ON (Cont)



Fault is electrical (filter is not clogged). Disconnect aircraft E3 harness (W3J1) at 10 o'clock position on swirl frame flange. Check cockpit light with aircraft power on. Is light on?

Troubleshoot aircraft electrical system according to troubleshooting procedures in applicable aircraft maintenance manual. Reconnect aircraft harness to green cable. Check bypass light with aircraft power on to make sure that light stays off. Make required checks (para 1-127) and continue to operate.

Check engine and aircraft connectors for bent or damaged pins. Replace damaged part(s). Reconnect aircraft harness to green cable and check bypass light with aircraft power on. Is light off?

Make required checks (para 1-127) and continue to operate.

Disconnect green cable from oil filter bypass sensor. Check sensor pins 1 to 2, pin 1 to connector shell, and pin 2 to shell. Short circuit?

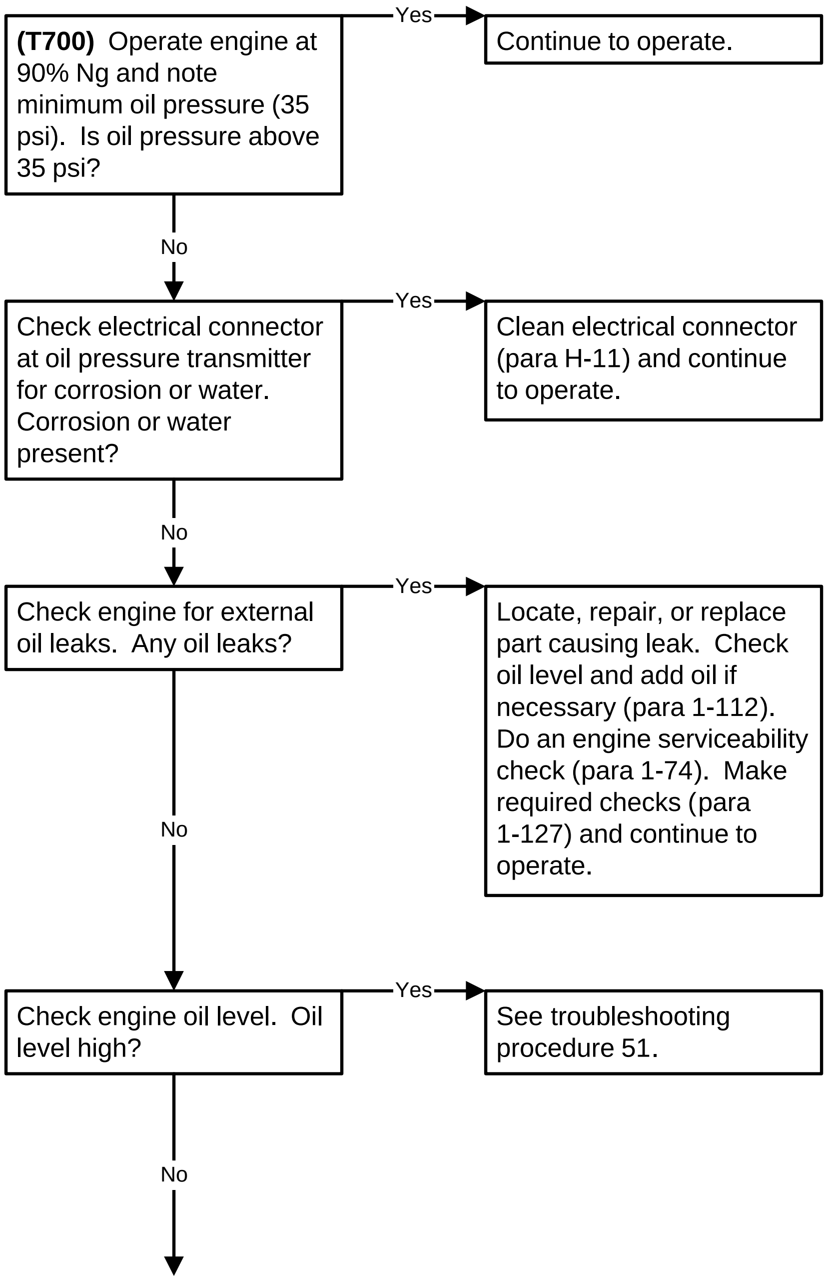
Replace bypass sensor (para 8-24). Reconnect green cable to sensor and run engine to make sure that light stays off. Make required checks (para 1-127) and continue to operate.

Replace green cable (para 7-35). Reconnect cable to sensor and run engine to make sure that light stays off. Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 56. Oil Pressure Below Limits

CAUTION

- If engine runs for more than 1 minute with oil pressure below minimum limits (para 1-125) and of aircraft indicating system is ok, replace engine. Make required checks (para 1-126) and continue to operate.
- If engine requires more than 3.5 quarts of oil, and engine was operated, engine bearings may be damaged.



(T700) Operate engine at 90% Ng and note minimum oil pressure (35 psi). Is oil pressure above 35 psi?

Continue to operate.

Check electrical connector at oil pressure transmitter for corrosion or water. Corrosion or water present?

Clean electrical connector (para H-11) and continue to operate.

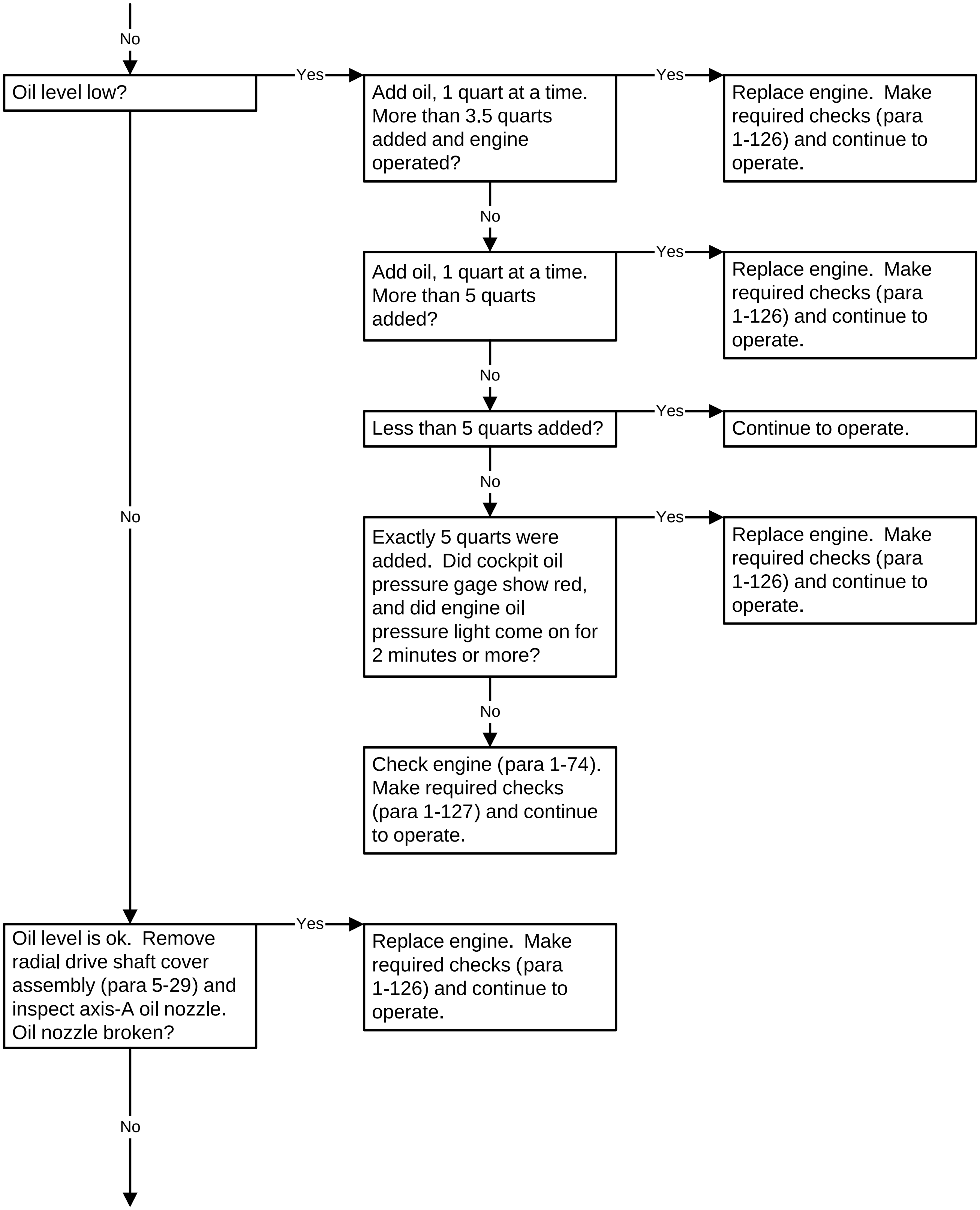
Check engine for external oil leaks. Any oil leaks?

Locate, repair, or replace part causing leak. Check oil level and add oil if necessary (para 1-112). Do an engine serviceability check (para 1-74). Make required checks (para 1-127) and continue to operate.

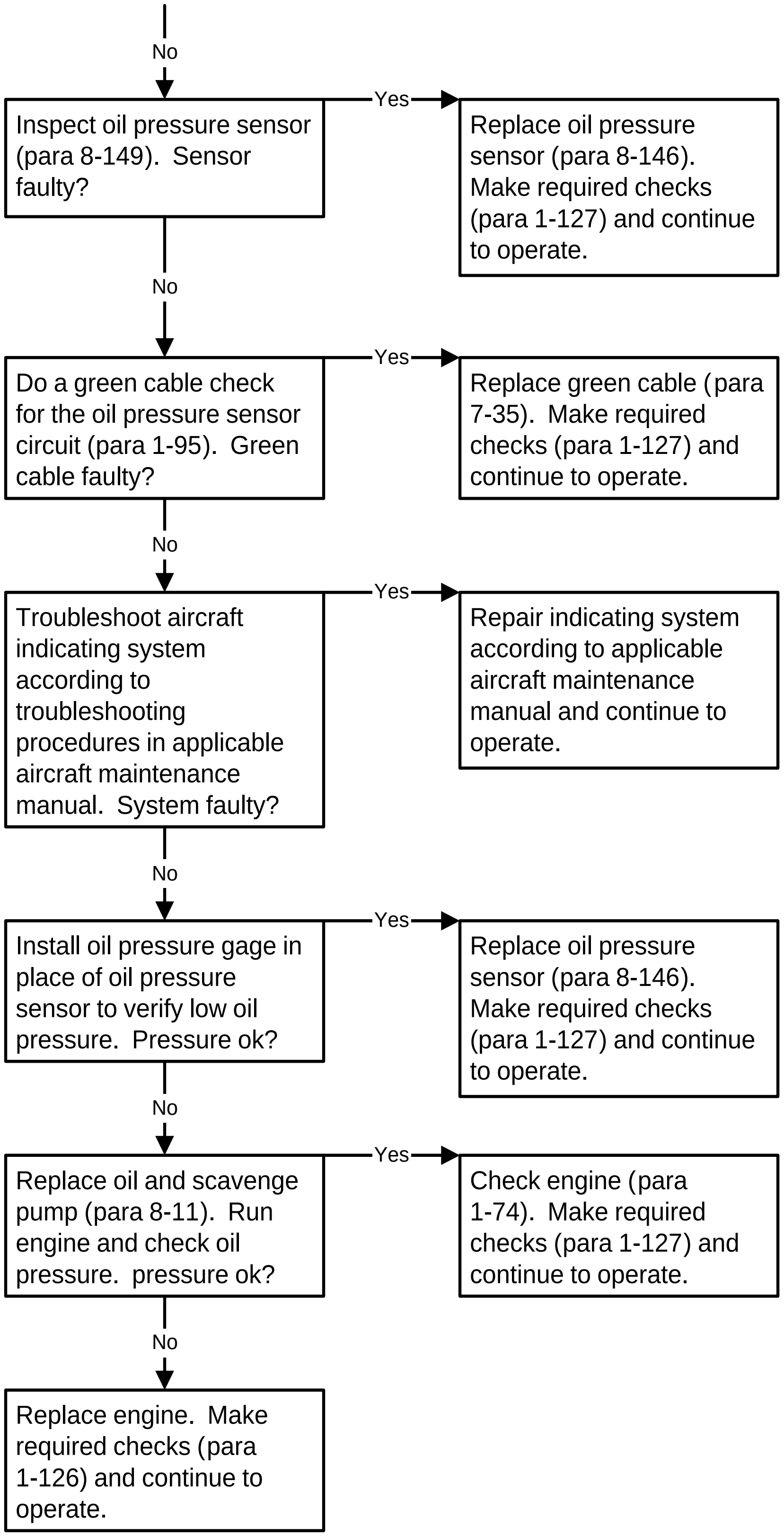
Check engine oil level. Oil level high?

See troubleshooting procedure 51.

Troubleshooting Procedure 56. Oil Pressure Below Limits (Cont)



Troubleshooting Procedure 56. Oil Pressure Below Limits (Cont)



Inspect oil pressure sensor (para 8-149). Sensor faulty?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-127) and continue to operate.

Do a green cable check for the oil pressure sensor circuit (para 1-95). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

Troubleshoot aircraft indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair indicating system according to applicable aircraft maintenance manual and continue to operate.

Install oil pressure gage in place of oil pressure sensor to verify low oil pressure. Pressure ok?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-127) and continue to operate.

Replace oil and scavenge pump (para 8-11). Run engine and check oil pressure. pressure ok?

Check engine (para 1-74). Make required checks (para 1-127) and continue to operate.

Replace engine. Make required checks (para 1-126) and continue to operate.

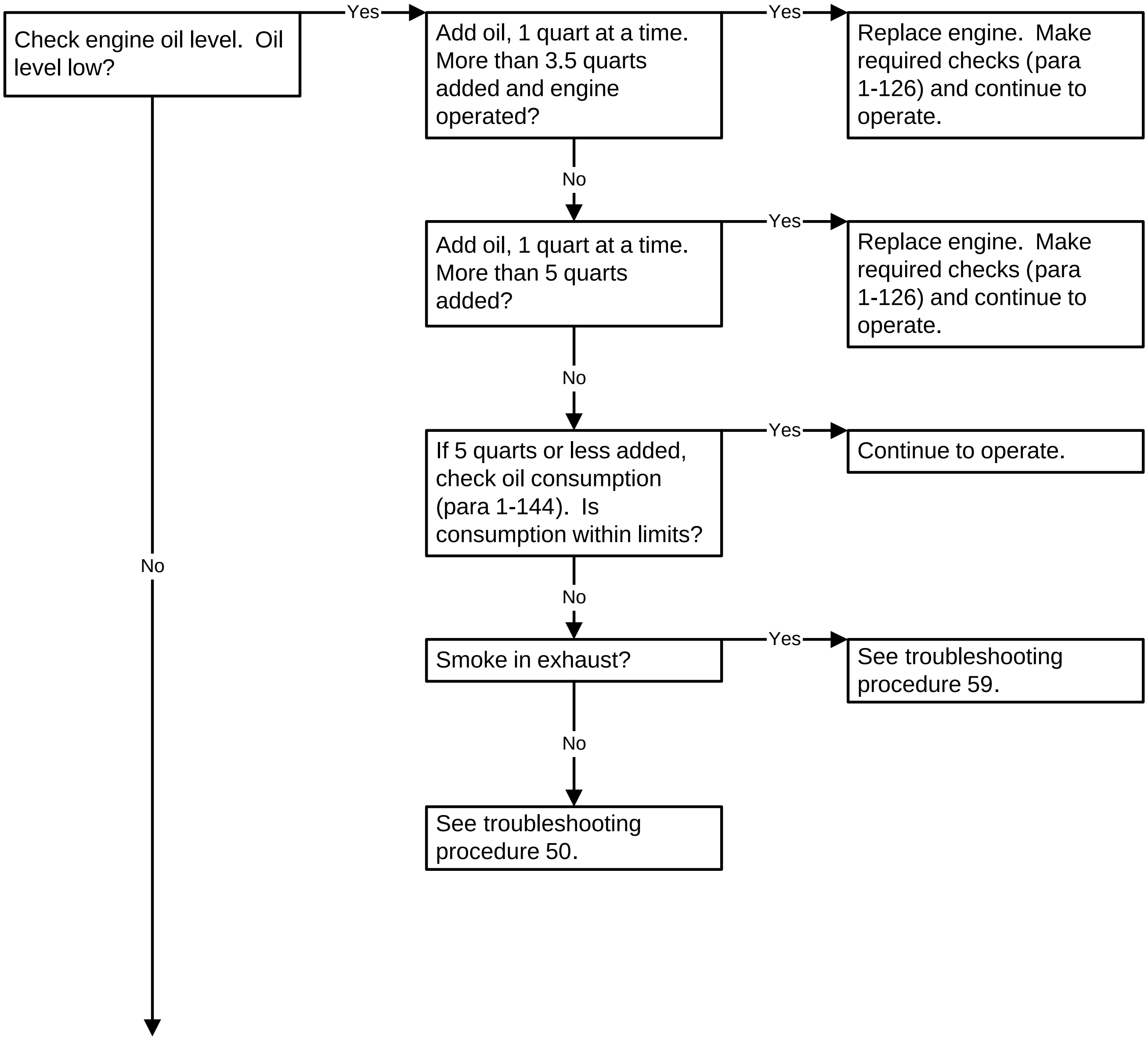
Troubleshooting Procedure 57. Oil Pressure Fluctuates

CAUTION

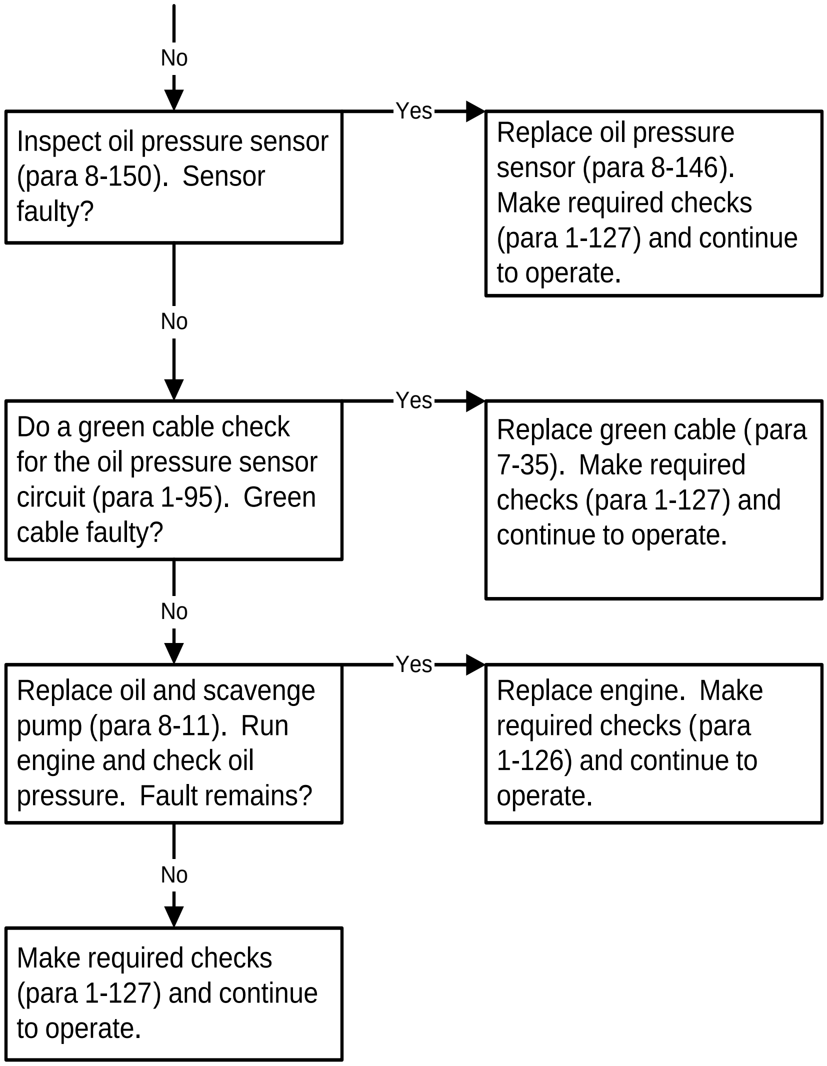
If engine requires more than 3.5 quarts of oil and engine was operated, engine bearings may be damaged.

NOTE

A change of ±5 PSIG is cause for investigation. Oil pressure will change during transient conditions. These changes should stop about 1 minute after return to steady-state Ng conditions.



Troubleshooting Procedure 57. Oil Pressure Fluctuates (Cont)



Inspect oil pressure sensor (para 8-150). Sensor faulty?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-127) and continue to operate.

Do a green cable check for the oil pressure sensor circuit (para 1-95). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-127) and continue to operate.

Replace oil and scavenge pump (para 8-11). Run engine and check oil pressure. Fault remains?

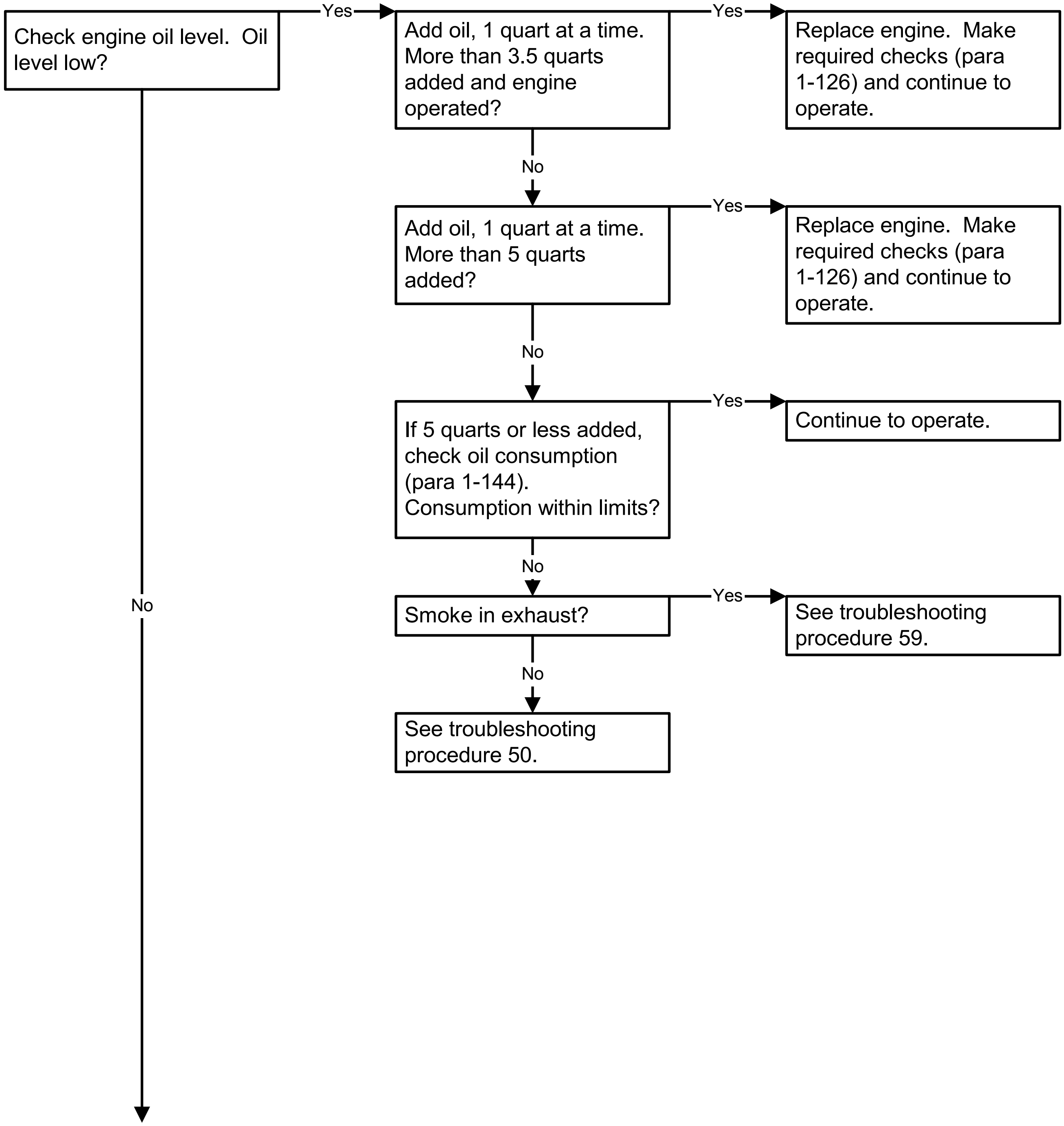
Replace engine. Make required checks (para 1-126) and continue to operate.

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 58. ***(T700, T701C, T701D)*** *Oil Temperature Exceeds Limits (exceeds normal operating temperature for affected engine)*

CAUTION

If engine requires more than 3.5 quarts of oil and engine was operated, engine bearings may be damaged.



Check engine oil level. Oil level low?

Add oil, 1 quart at a time. More than 3.5 quarts added and engine operated?

Replace engine. Make required checks (para 1-126) and continue to operate.

Add oil, 1 quart at a time. More than 5 quarts added?

Replace engine. Make required checks (para 1-126) and continue to operate.

If 5 quarts or less added, check oil consumption (para 1-144). Consumption within limits?

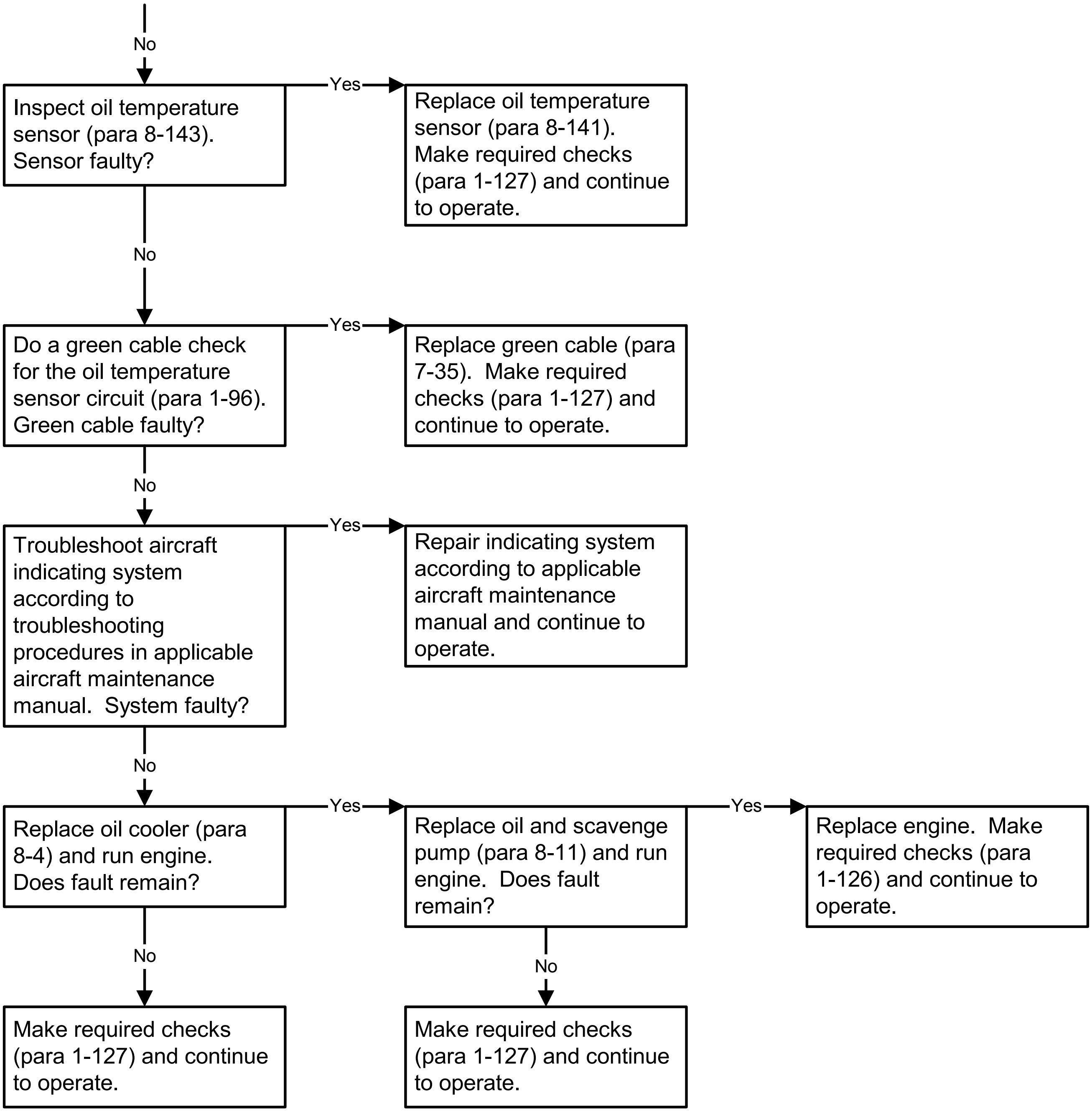
Continue to operate.

Smoke in exhaust?

See troubleshooting procedure 59.

See troubleshooting procedure 50.

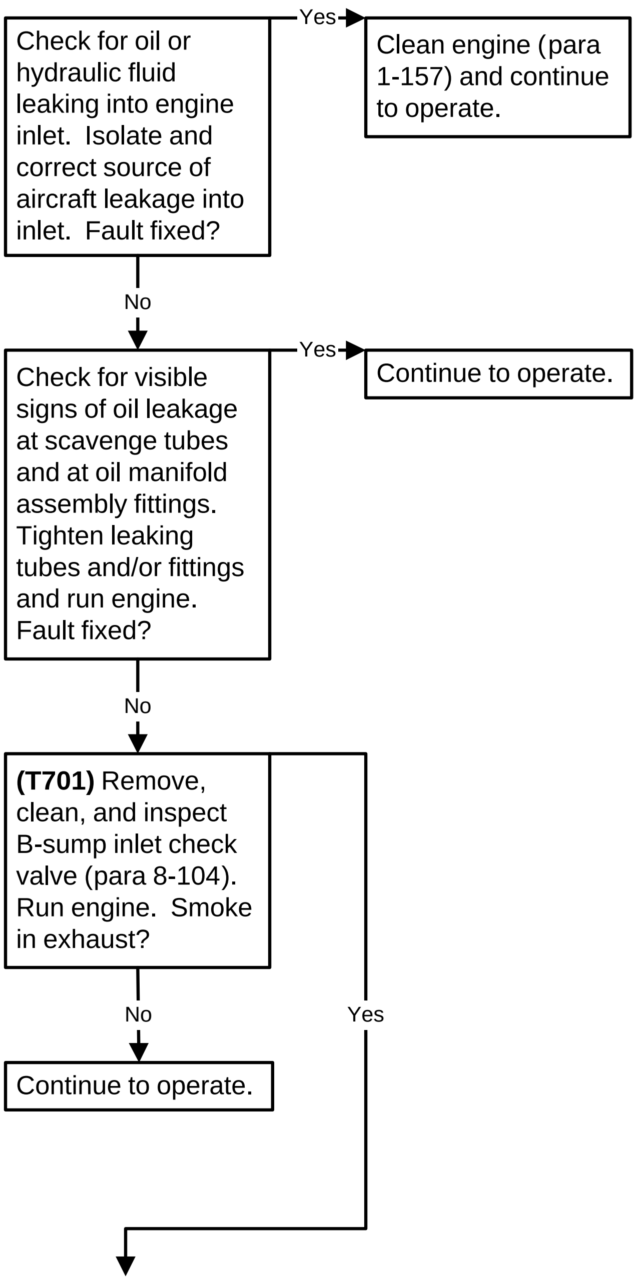
Troubleshooting Procedure 58. ***(T700, T701C, T701D)*** *Oil Temperature Exceeds Limits (exceeds normal operating temperature for affected engine) (Cont)*



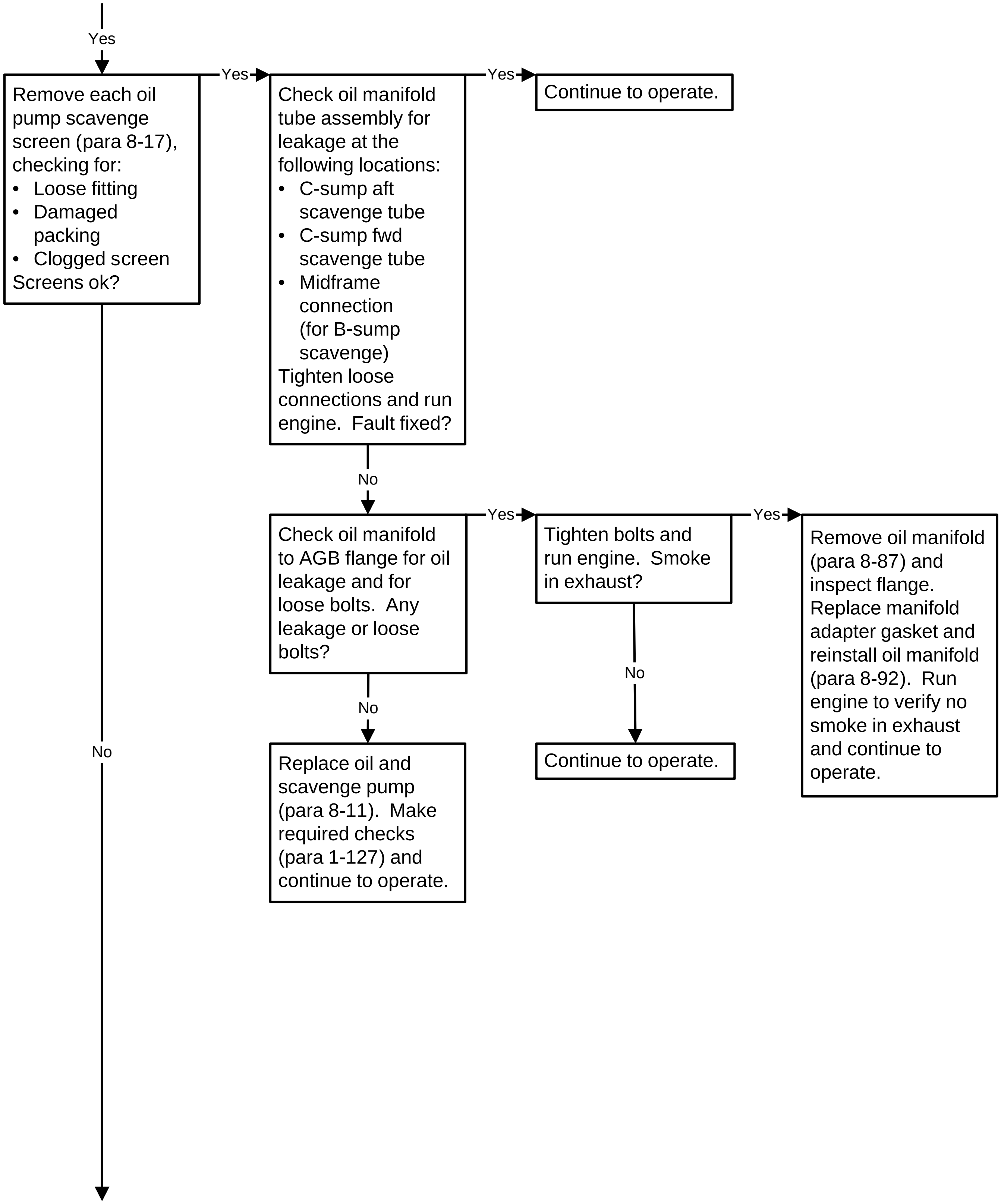
Troubleshooting Procedure 59. Smoke in Exhaust

NOTE

- White mist coming out of tailpipe prior to engine lightoff is fuel mist.
- Smoke may be visible during the start cycle, especially at low ambient temperatures.
- During locked rotor operation, exhaust smoke may be present.
- If engine oil system is serviced and engine is tipped during removal or installation, oil will seep from A-sump, down stage 1 blades, and into bottom of the main frame. This is no cause to reject the engine.



Troubleshooting Procedure 59. Smoke in Exhaust (Cont)



Remove each oil pump scavenge screen (para 8-17), checking for:
- Loose fitting
- Damaged packing
- Clogged screen

Screens ok?

Check oil manifold tube assembly for leakage at the following locations:
- C-sump aft scavenge tube
- C-sump fwd scavenge tube
- Midframe connection (for B-sump scavenge)

Tighten loose connections and run engine. Fault fixed?

Continue to operate.

Check oil manifold to AGB flange for oil leakage and for loose bolts. Any leakage or loose bolts?

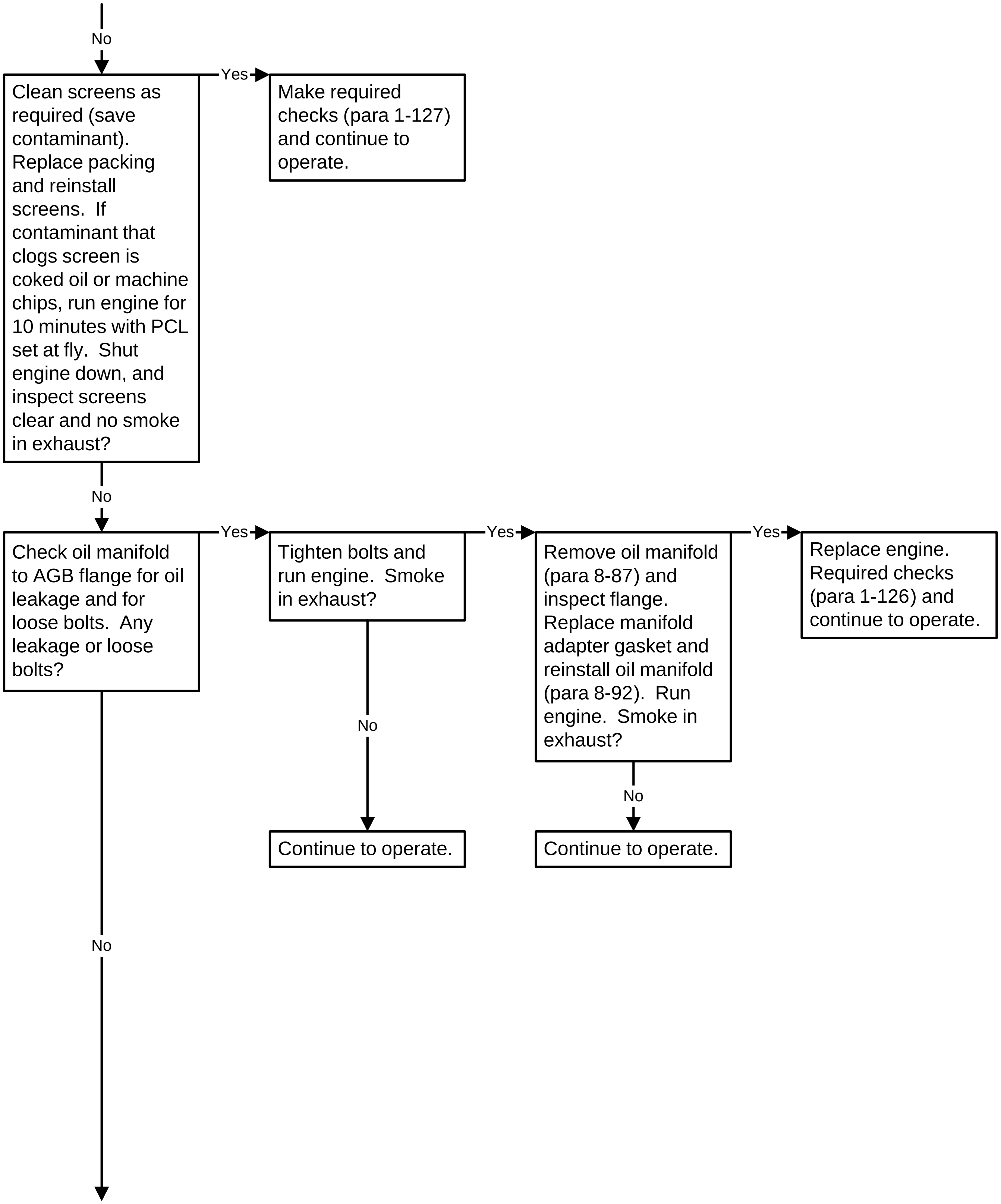
Tighten bolts and run engine. Smoke in exhaust?

Remove oil manifold (para 8-87) and inspect flange. Replace manifold adapter gasket and reinstall oil manifold (para 8-92). Run engine to verify no smoke in exhaust and continue to operate.

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 59. Smoke in Exhaust (Cont)



Clean screens as required (save contaminant). Replace packing and reinstall screens. If contaminant that clogs screen is coked oil or machine chips, run engine for 10 minutes with PCL set at fly. Shut engine down, and inspect screens clear and no smoke in exhaust?

Make required checks (para 1-127) and continue to operate.

Check oil manifold to AGB flange for oil leakage and for loose bolts. Any leakage or loose bolts?

Tighten bolts and run engine. Smoke in exhaust?

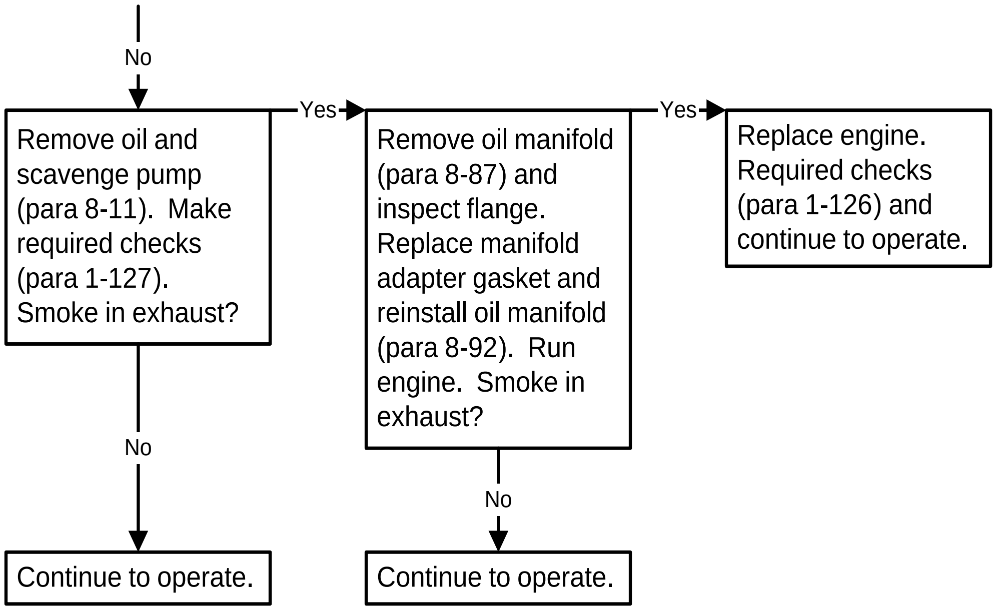
Remove oil manifold (para 8-87) and inspect flange. Replace manifold adapter gasket and reinstall oil manifold (para 8-92). Run engine. Smoke in exhaust?

Replace engine. Required checks (para 1-126) and continue to operate.

Continue to operate.

Continue to operate.

Troubleshooting Procedure 59. Smoke in Exhaust (Cont)



Remove oil and scavenge pump (para 8-11). Make required checks (para 1-127). Smoke in exhaust?

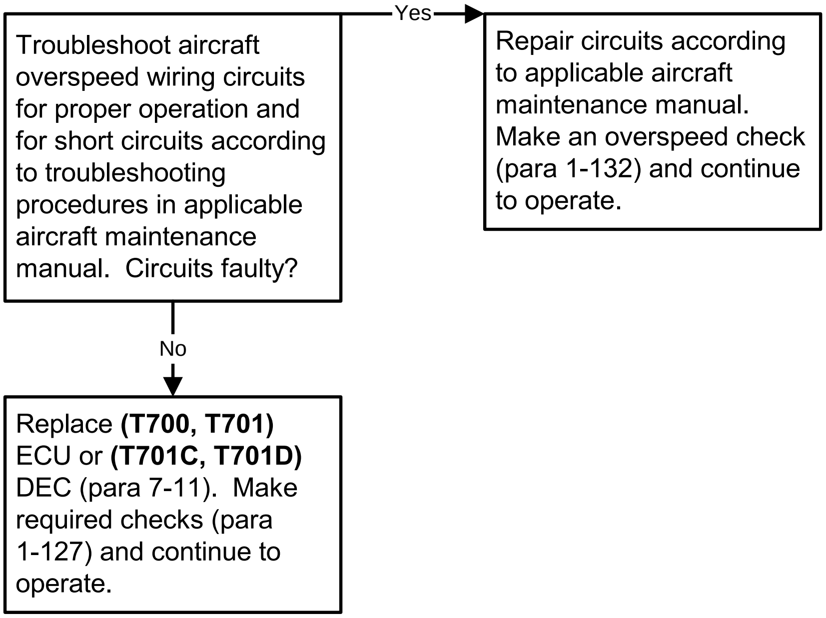
Remove oil manifold (para 8-87) and inspect flange. Replace manifold adapter gasket and reinstall oil manifold (para 8-92). Run engine. Smoke in exhaust?

Replace engine. Required checks (para 1-126) and continue to operate.

Continue to operate.

Continue to operate.

Troubleshooting Procedure 60. Overspeed Cuts in with One Test Button Depressed



Troubleshoot aircraft overspeed wiring circuits for proper operation and for short circuits according to troubleshooting procedures in applicable aircraft maintenance manual. Circuits faulty?

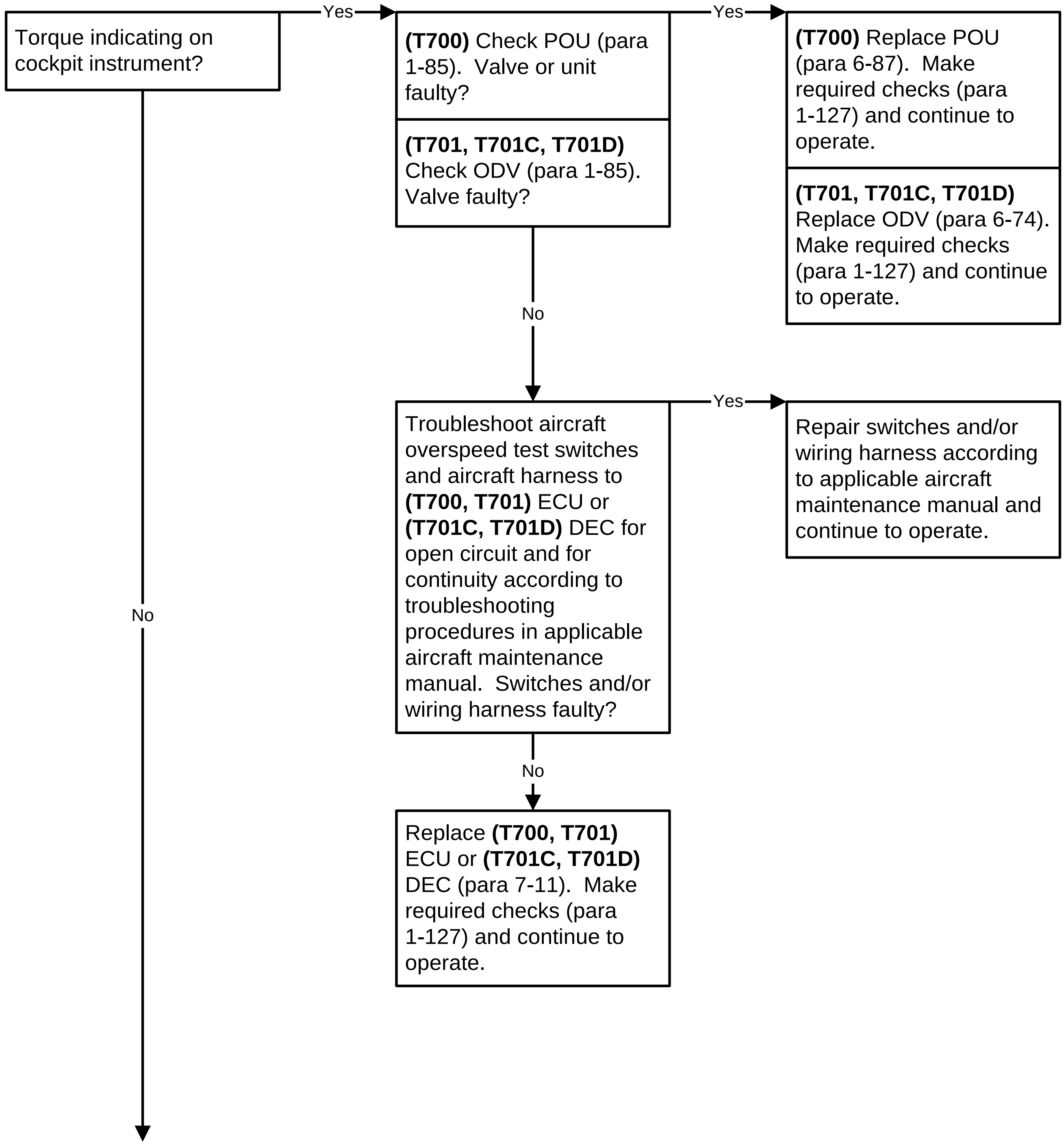
Repair circuits according to applicable aircraft maintenance manual. Make an overspeed check (para 1-132) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 61. Overspeed Test System Will Not Operate (overspeed test system fails to cut back Ng and Np)

NOTE

If the overspeed test is performed with both PCL's in "fly" position, cutback in Np may not be indicated on the aircraft instruments and may appear to be always at 100%. However, Ng must decrease.



Torque indicating on cockpit instrument?

(T700) Check POU (para 1-85). Valve or unit faulty?

(T701, T701C, T701D) Check ODV (para 1-85). Valve faulty?

(T700) Replace POU (para 6-87). Make required checks (para 1-127) and continue to operate.

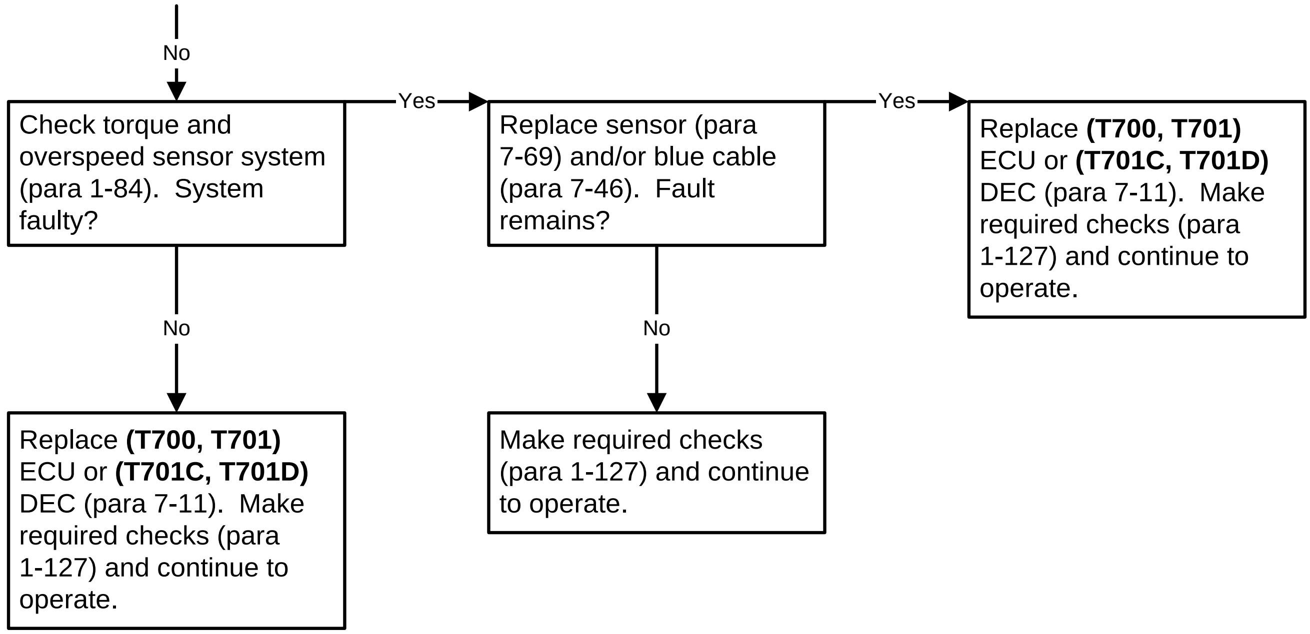
(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-127) and continue to operate.

Troubleshoot aircraft overspeed test switches and aircraft harness to **(T700, T701)** ECU or **(T701C, T701D)** DEC for open circuit and for continuity according to troubleshooting procedures in applicable aircraft maintenance manual. Switches and/or wiring harness faulty?

Repair switches and/or wiring harness according to applicable aircraft maintenance manual and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 61. Overspeed Test System Will Not Operate (overspeed test system fails to cut back Ng and Np) (Cont)



Check torque and overspeed sensor system (para 1-84). System faulty?

Replace sensor (para 7-69) and/or blue cable (para 7-46). Fault remains?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

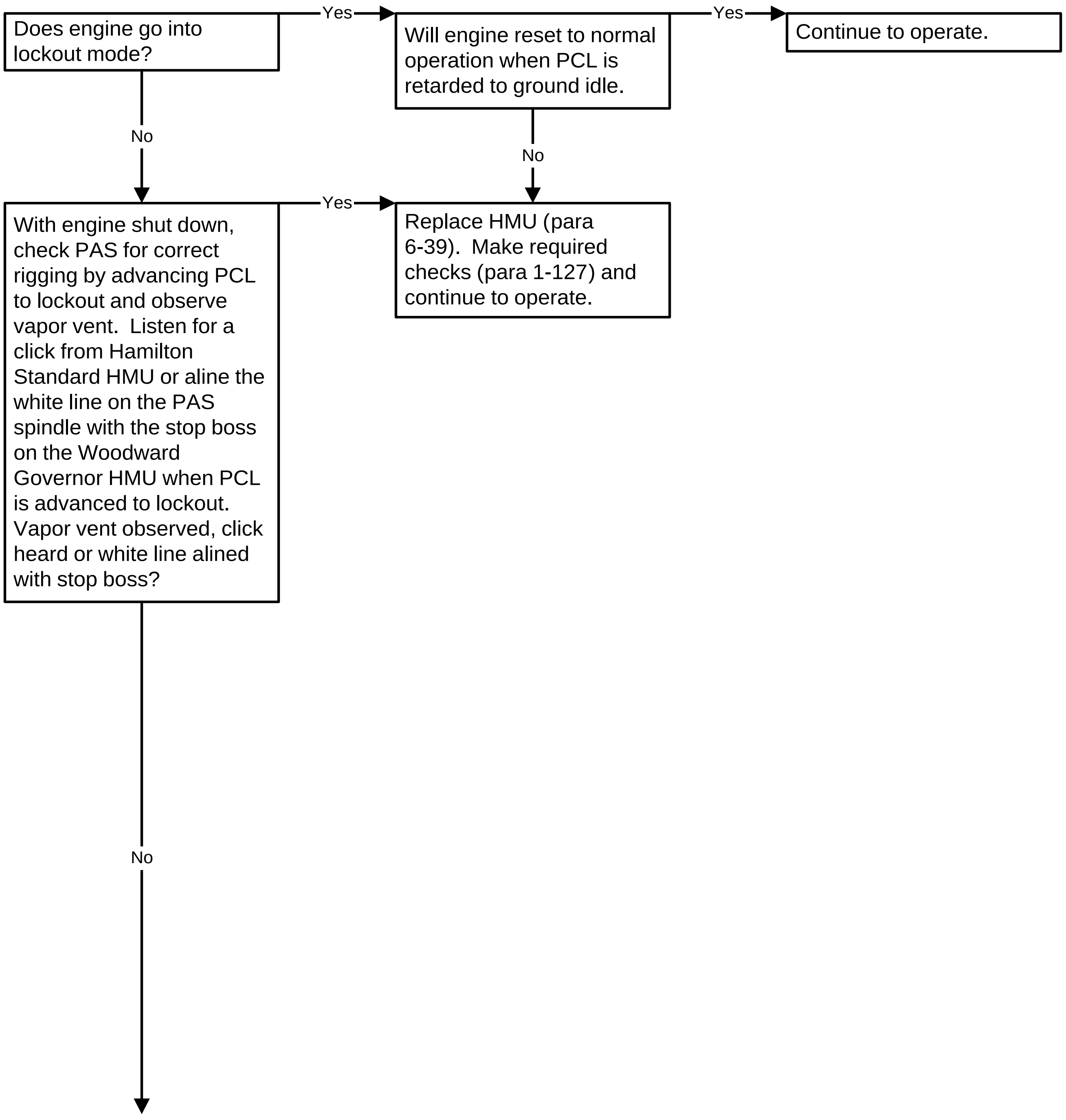
Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 62. ECU or DEC Lockout Mode Inoperative (engine will not respond to ECU or DEC lockout when PCL is advanced to maximum position or engine will not reset from lockout)

NOTE

During normal operation, when PCL is advanced to maximum position, a rapid increase in% Ng will occur. Manual control of PCL is required to maintain 100% Np (20,900 RPM) and balanced torques.



Does engine go into lockout mode?

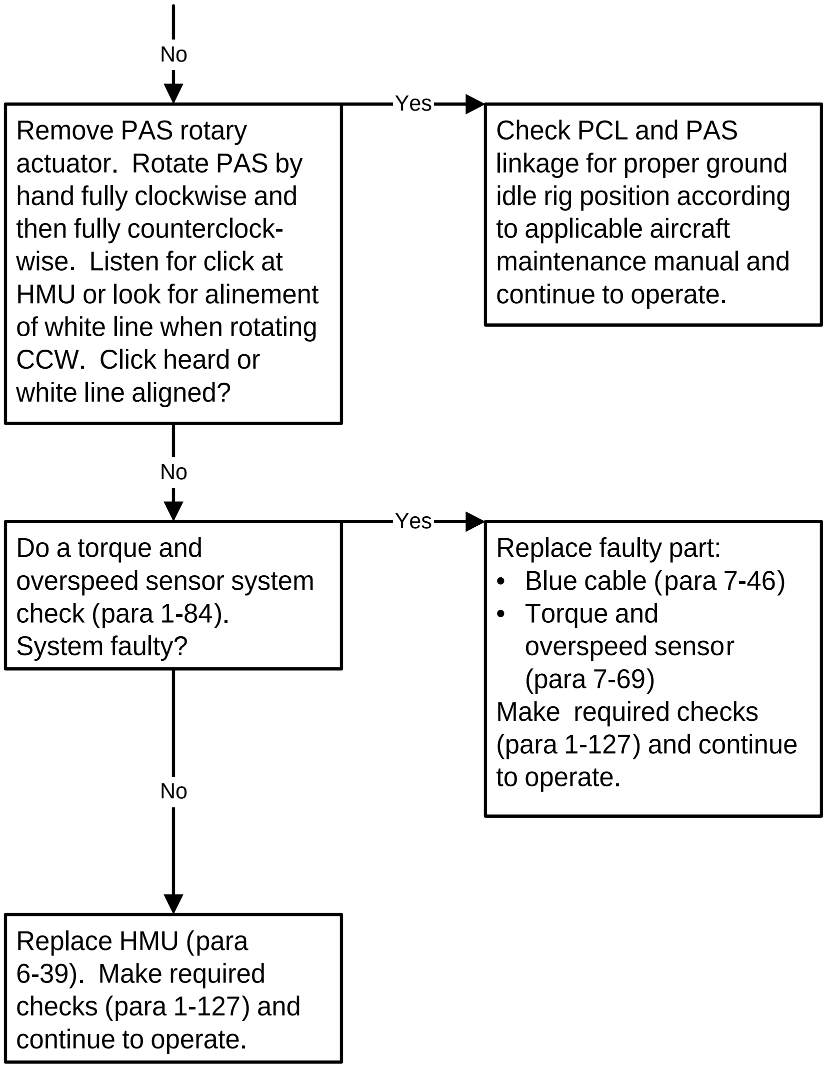
Will engine reset to normal operation when PCL is retarded to ground idle.

Continue to operate.

With engine shut down, check PAS for correct rigging by advancing PCL to lockout and observe vapor vent. Listen for a click from Hamilton Standard HMU or aline the white line on the PAS spindle with the stop boss on the Woodward Governor HMU when PCL is advanced to lockout. Vapor vent observed, click heard or white line alined with stop boss?

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 62. ECU or DEC Lockout Mode Inoperative (engine will not respond to ECU or DEC lockout when PCL is advanced to maximum position or engine will not reset from lockout) (Cont)



Remove PAS rotary actuator. Rotate PAS by hand fully clockwise and then fully counterclockwise. Listen for click at HMU or look for alinement of white line when rotating CCW. Click heard or white line aligned?

Check PCL and PAS linkage for proper ground idle rig position according to applicable aircraft maintenance manual and continue to operate.

Do a torque and overspeed sensor system check (para 1-84). System faulty?

Replace faulty part:
- Blue cable (para 7-46)
- Torque and overspeed sensor (para 7-69)

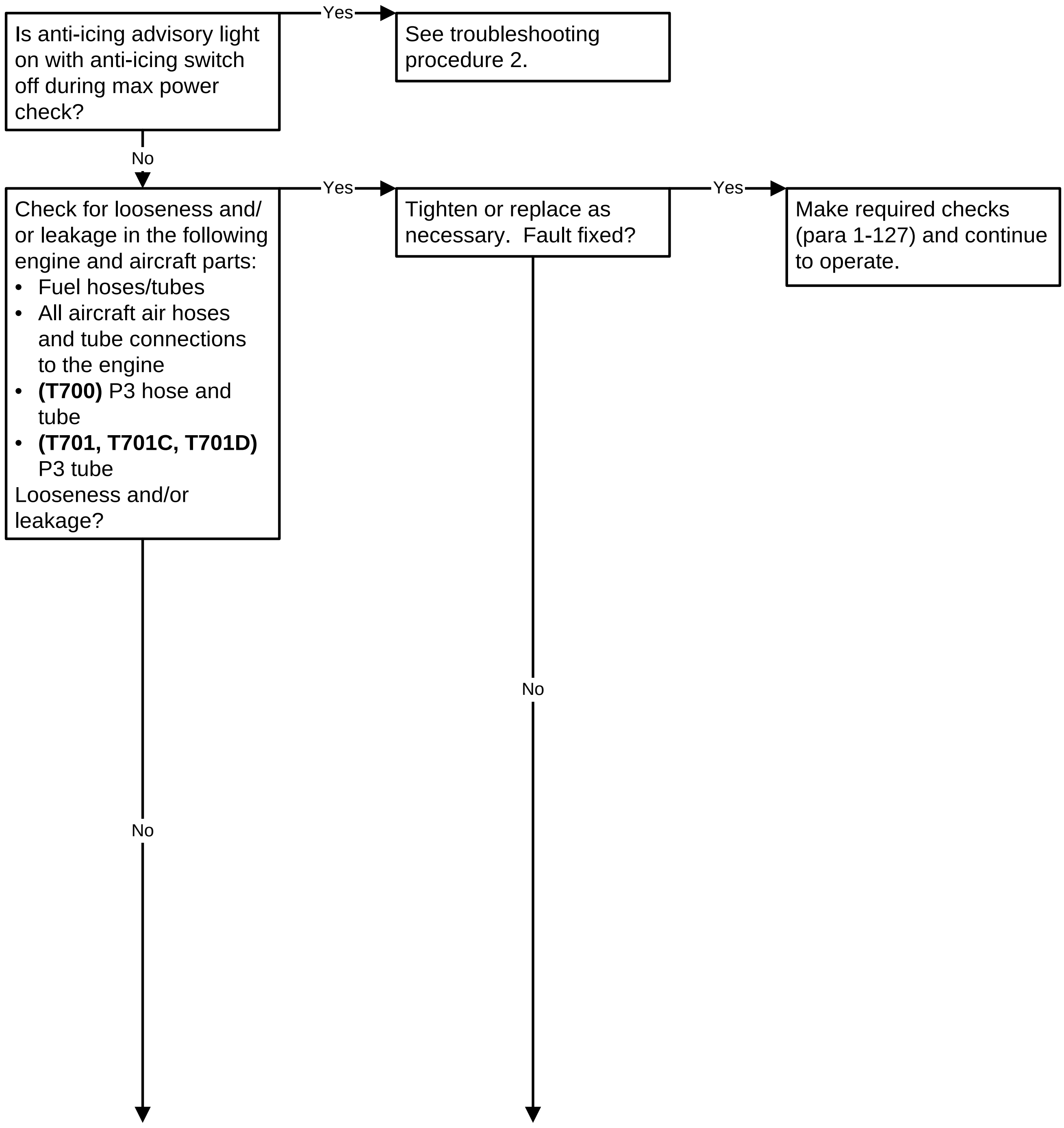
Make required checks (para 1-127) and continue to operate.

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 63. Low Engine Performance (verified by maximum power check)

NOTE

When one engine is low in power and is operating on its TGT limiter or topping limit, it is normal to observe an indicated torque difference between engines. This torque difference may exceed 5%. The total torque difference will depend on the individual health of each engine.



Is anti-icing advisory light on with anti-icing switch off during max power check?

See troubleshooting procedure 2.

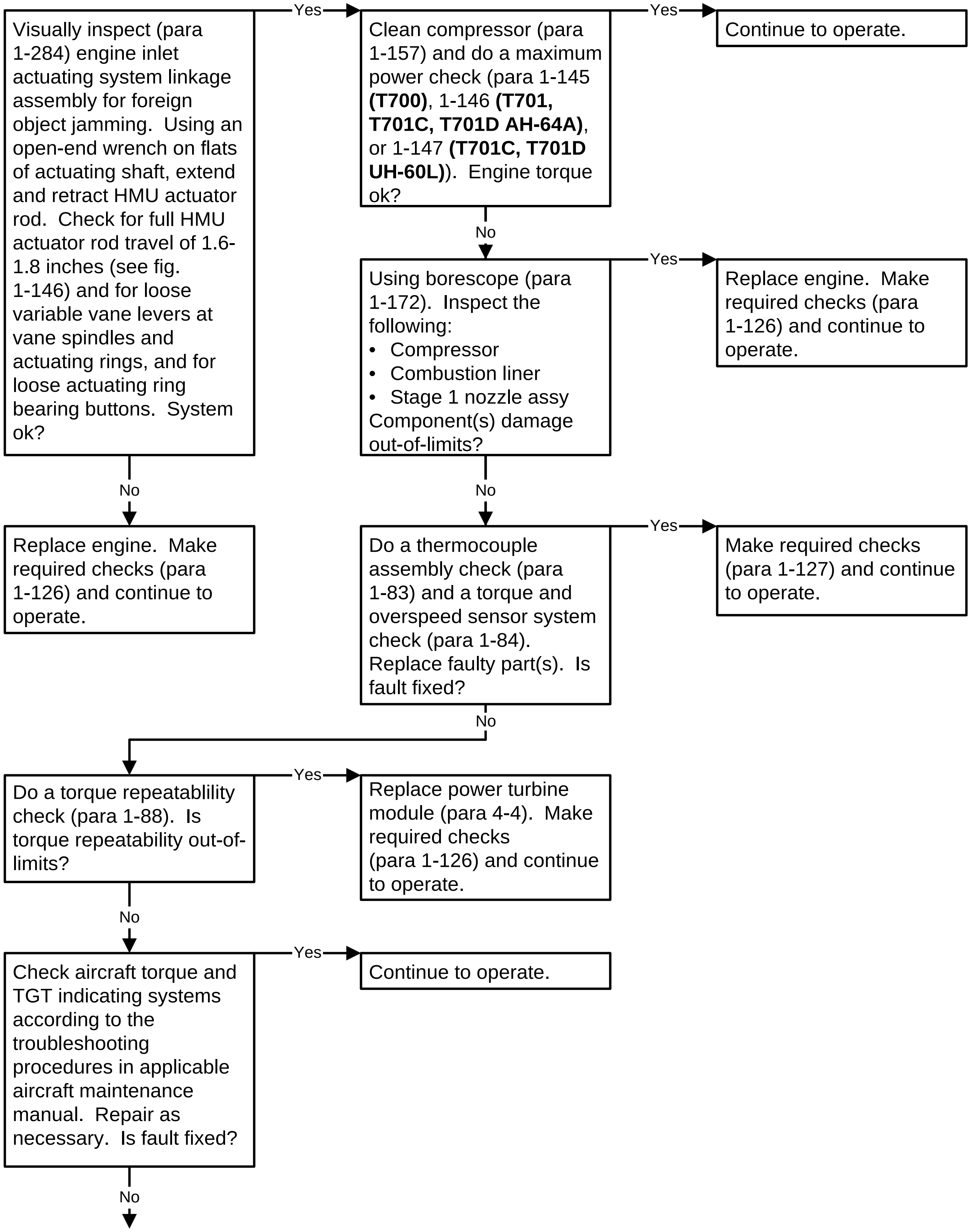
Check for looseness and/or leakage in the following engine and aircraft parts:
- Fuel hoses/tubes
- All aircraft air hoses and tube connections to the engine
- **(T700)** P3 hose and tube
- **(T701, T701C, T701D)** P3 tube

Looseness and/or leakage?

Tighten or replace as necessary. Fault fixed?

Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 63. Low Engine Performance (verified by maximum power check) (Cont)



Visually inspect (para 1-284) engine inlet actuating system linkage assembly for foreign object jamming. Using an open-end wrench on flats of actuating shaft, extend and retract HMU actuator rod. Check for full HMU actuator rod travel of 1.6-1.8 inches (see fig. 1-146) and for loose variable vane levers at vane spindles and actuating rings, and for loose actuating ring bearing buttons. System ok?

Clean compressor (para 1-157) and do a maximum power check (para 1-145 **(T700)**, 1-146 **(T701, T701C, T701D AH-64A)**, or 1-147 **(T701C, T701D UH-60L)**). Engine torque ok?

Continue to operate.

Using borescope (para 1-172). Inspect the following:

- Compressor
- Combustion liner
- Stage 1 nozzle assy

Component(s) damage out-of-limits?

Replace engine. Make required checks (para 1-126) and continue to operate.

Replace engine. Make required checks (para 1-126) and continue to operate.

Do a thermocouple assembly check (para 1-83) and a torque and overspeed sensor system check (para 1-84). Replace faulty part(s). Is fault fixed?

Make required checks (para 1-127) and continue to operate.

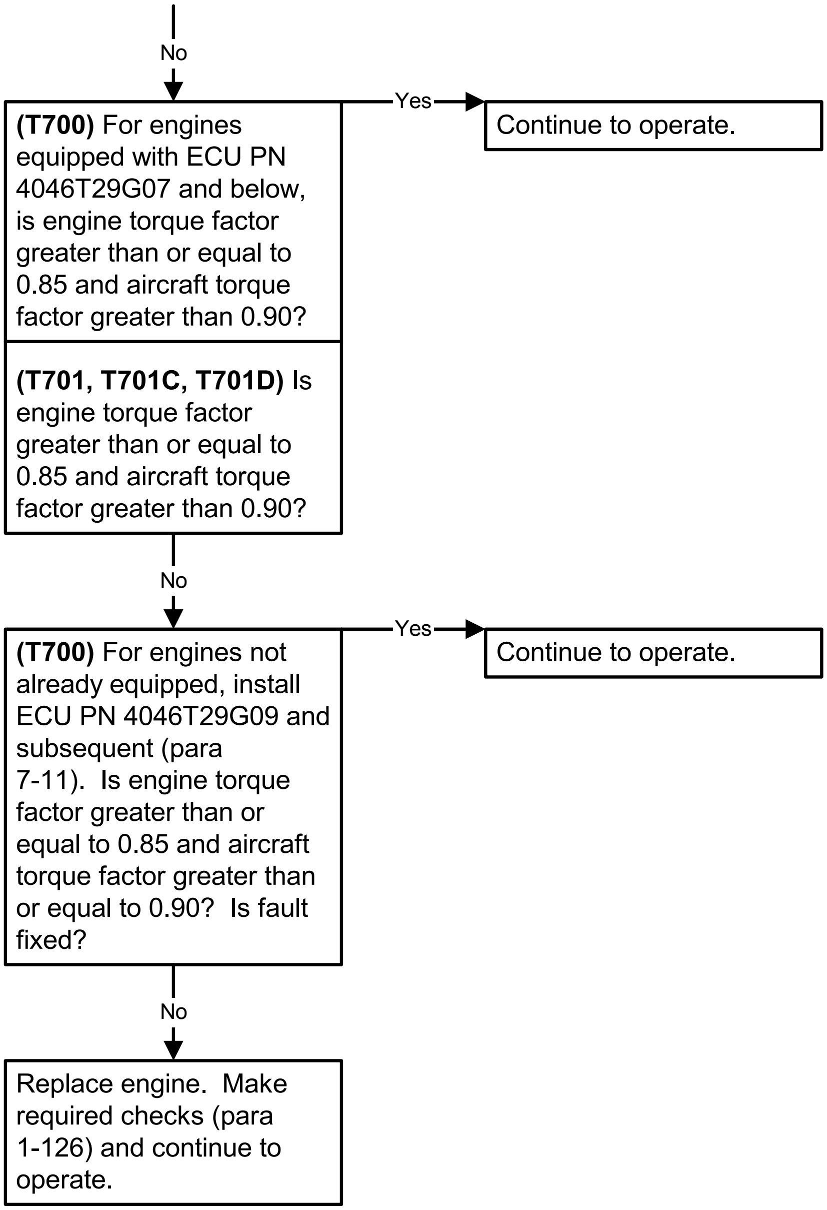
Do a torque repeatablility check (para 1-88). Is torque repeatability out-of-limits?

Replace power turbine module (para 4-4). Make required checks (para 1-126) and continue to operate.

Check aircraft torque and TGT indicating systems according to the troubleshooting procedures in applicable aircraft maintenance manual. Repair as necessary. Is fault fixed?

Continue to operate.

Troubleshooting Procedure 63. Low Engine Performance (verified by maximum power check) (Cont)



(T700) For engines equipped with ECU PN 4046T29G07 and below, is engine torque factor greater than or equal to 0.85 and aircraft torque factor greater than 0.90?

(T701, T701C, T701D) Is engine torque factor greater than or equal to 0.85 and aircraft torque factor greater than 0.90?

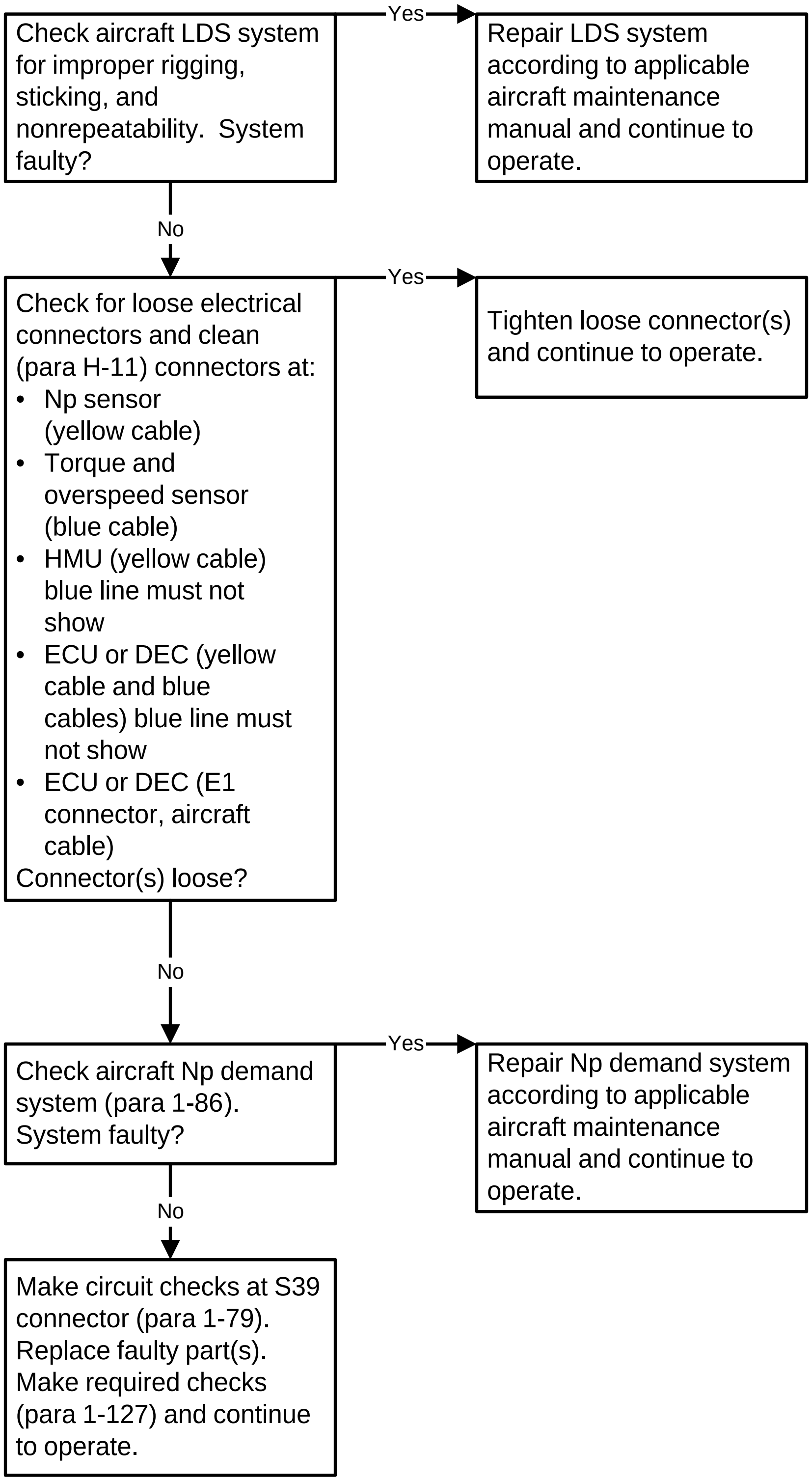
Continue to operate.

(T700) For engines not already equipped, install ECU PN 4046T29G09 and subsequent (para 7-11). Is engine torque factor greater than or equal to 0.85 and aircraft torque factor greater than or equal to 0.90? Is fault fixed?

Continue to operate.

Replace engine. Make required checks (para 1-126) and continue to operate.

Troubleshooting Procedure 64. Stable Operation with ECU or DEC Locked Out (Ng, TGT, and Np fluctuated above and below limits when ECU or DEC was not locked out)



Check aircraft LDS system for improper rigging, sticking, and nonrepeatability. System faulty?

Repair LDS system according to applicable aircraft maintenance manual and continue to operate.

Check for loose electrical connectors and clean (para H-11) connectors at:
- Np sensor (yellow cable)
- Torque and overspeed sensor (blue cable)
- HMU (yellow cable) blue line must not show
- ECU or DEC (yellow cable and blue cables) blue line must not show
- ECU or DEC (E1 connector, aircraft cable)

Connector(s) loose?

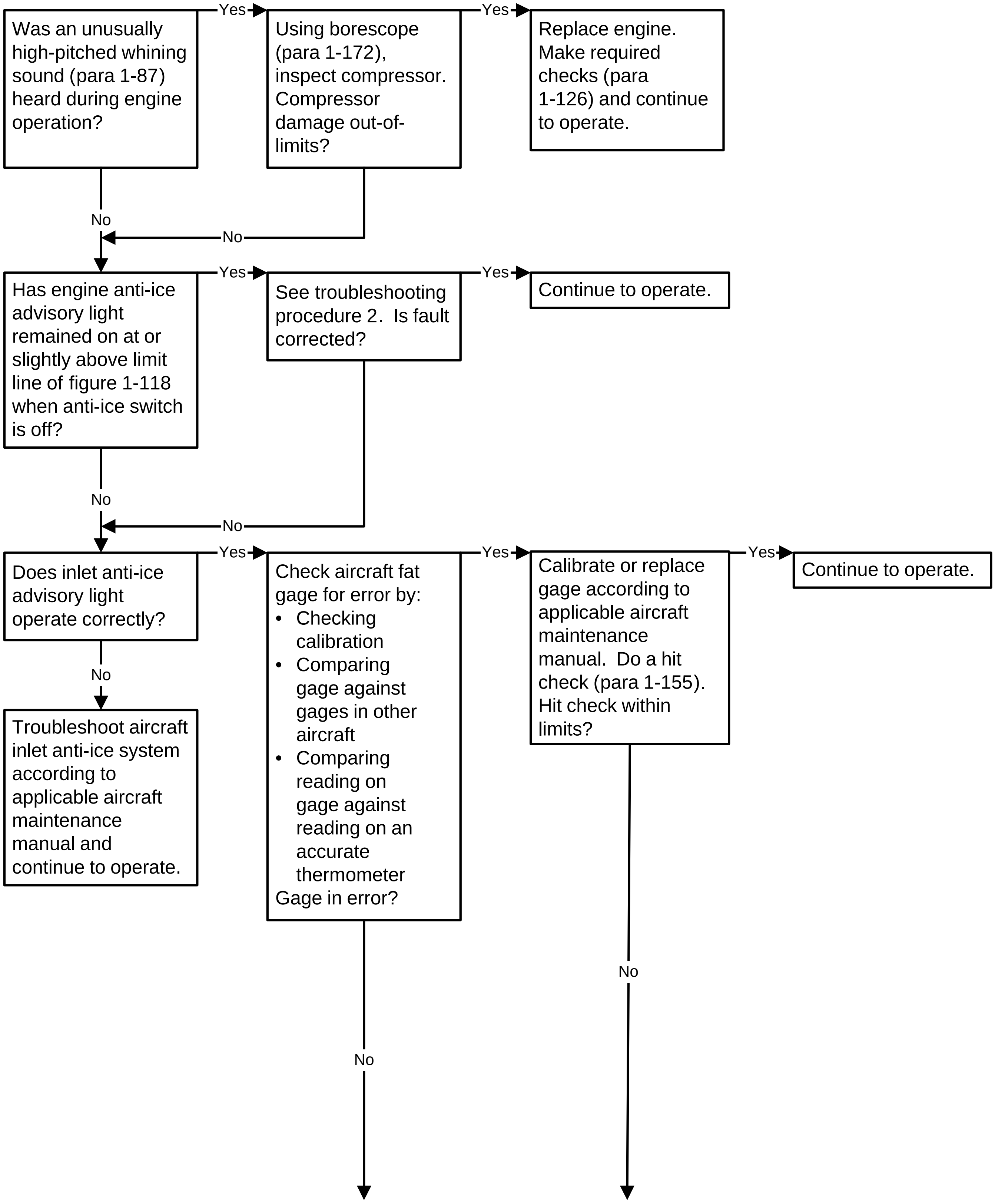
Tighten loose connector(s) and continue to operate.

Check aircraft Np demand system (para 1-86). System faulty?

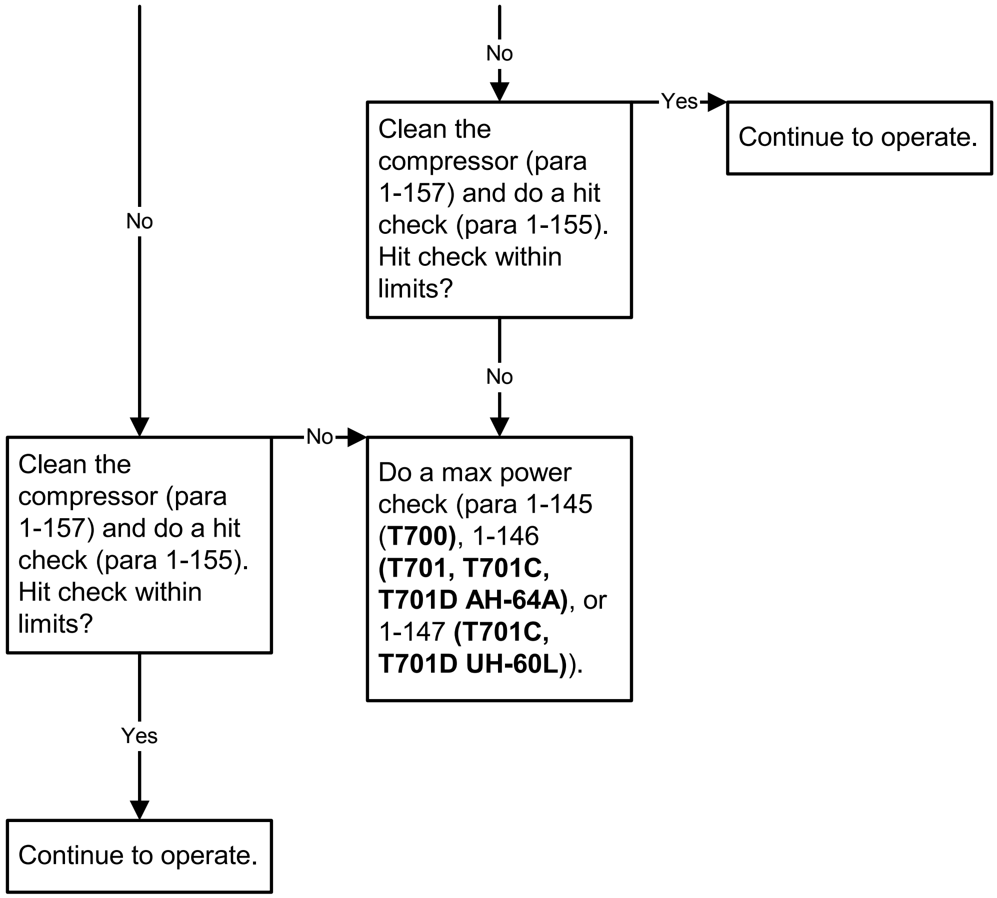
Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Make circuit checks at S39 connector (para 1-79). Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 65. TGT Margin Out-of-Limits (from HIT check done according to procedures in applicable aircraft maintenance manual)



Troubleshooting Procedure 65. ***TGT Margin Out-of-Limits (from HIT check done according to procedures in applicable aircraft maintenance manual) (Cont)***



Clean the compressor (para 1-157) and do a hit check (para 1-155). Hit check within limits?

Continue to operate.

Clean the compressor (para 1-157) and do a hit check (para 1-155). Hit check within limits?

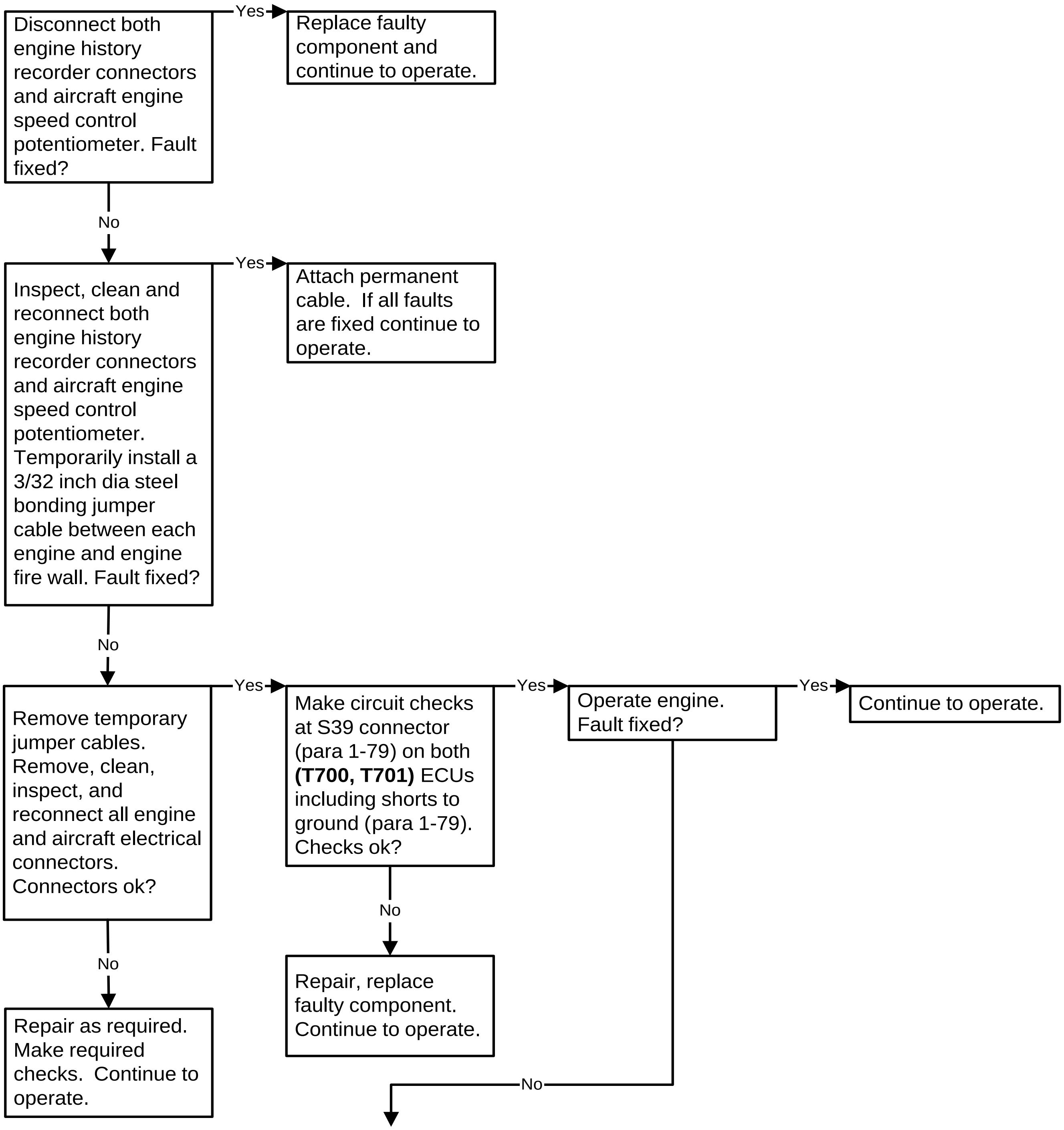
Do a max power check (para 1-145 (**T700)**, 1-146 **(T701, T701C, T701D AH-64A)**, or 1-147 **(T701C, T701D UH-60L)**).

Continue to operate.

Troubleshooting Procedure 66. Torque and/or TGT Erratic/Fluctuating High/Low or Spiking (not accompanied by engine power changes)

NOTE

- Erratic TRQ or TGT not accompanied by engine power changes.
- Some engine history recorder malfunctions can affect either or both engine TRQ or TGT.
- Prior experience has shown that the interface between the engine and the VIDS is sensitive to airframe induced transient voltages.



Disconnect both engine history recorder connectors and aircraft engine speed control potentiometer. Fault fixed?

Replace faulty component and continue to operate.

Inspect, clean and reconnect both engine history recorder connectors and aircraft engine speed control potentiometer. Temporarily install a 3/32 inch dia steel bonding jumper cable between each engine and engine fire wall. Fault fixed?

Attach permanent cable. If all faults are fixed continue to operate.

Remove temporary jumper cables. Remove, clean, inspect, and reconnect all engine and aircraft electrical connectors. Connectors ok?

Make circuit checks at S39 connector (para 1-79) on both **(T700, T701)** ECUs including shorts to ground (para 1-79). Checks ok?

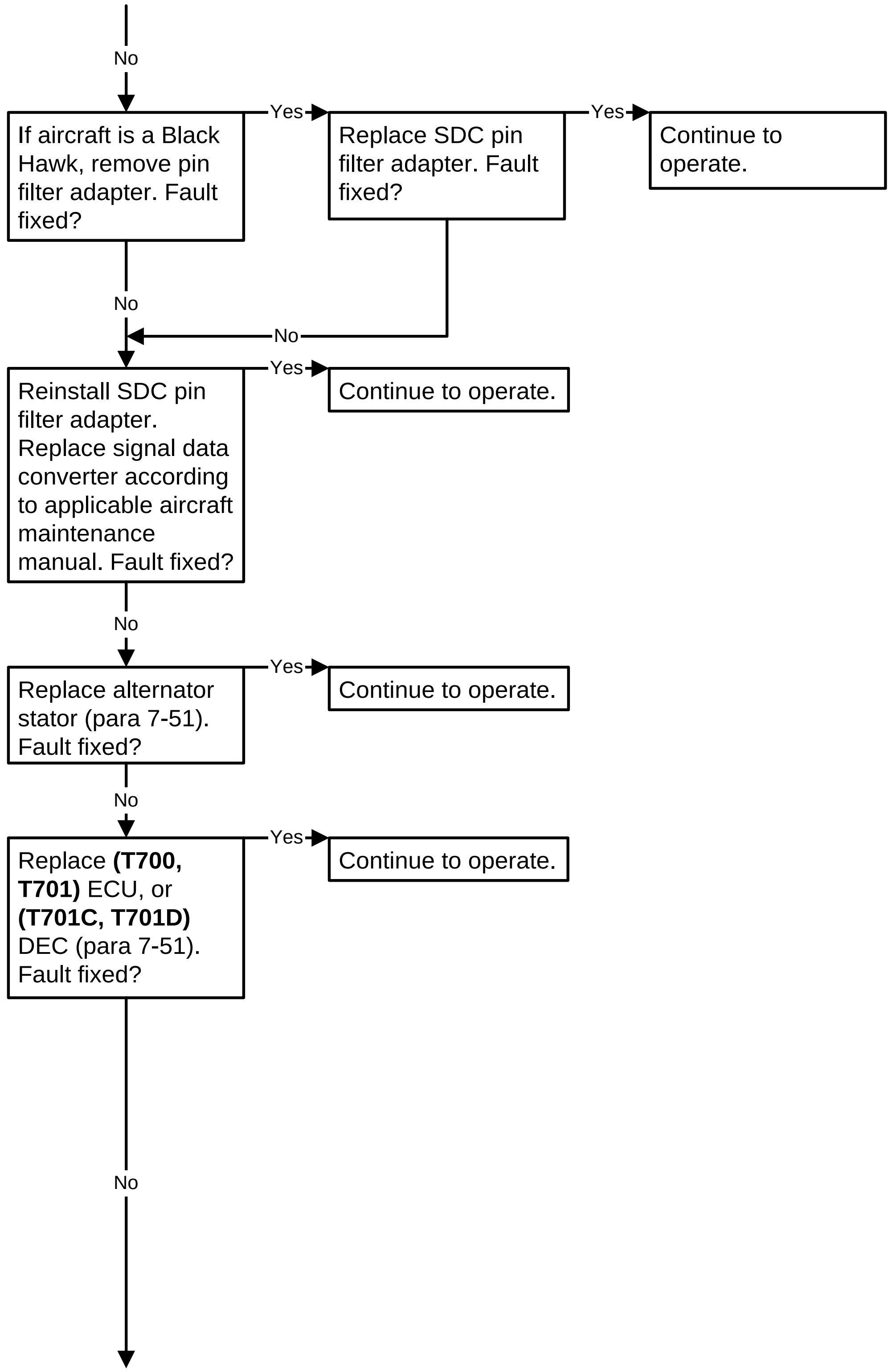
Operate engine. Fault fixed?

Continue to operate.

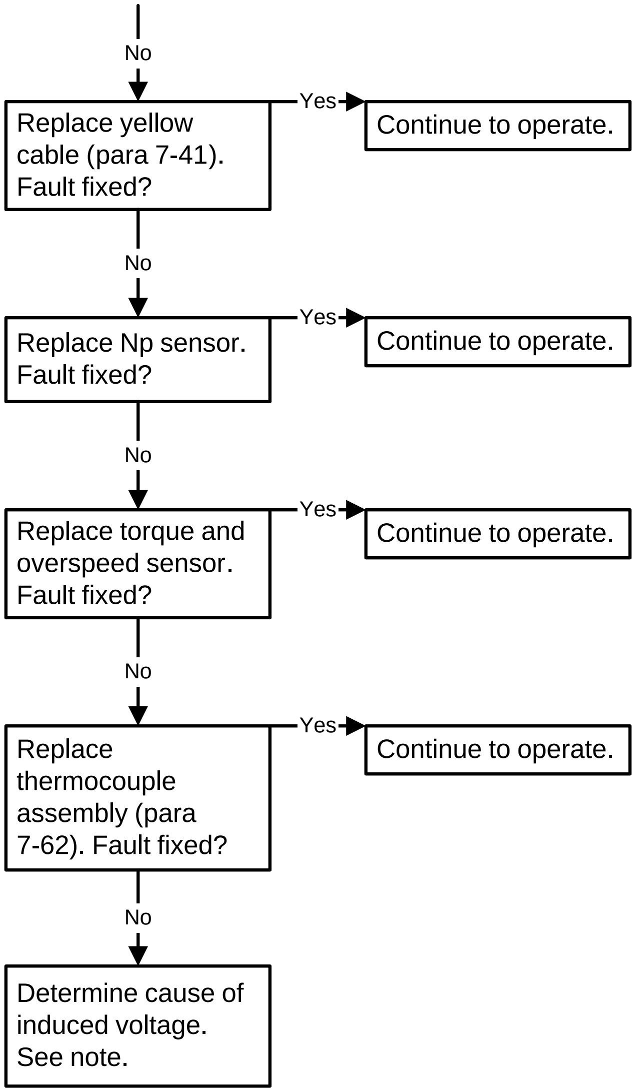
Repair as required. Make required checks. Continue to operate.

Repair, replace faulty component. Continue to operate.

Troubleshooting Procedure 66. Torque and/or TGT Erratic/Fluctuating High/Low or Spiking (not accompanied by engine power changes) (Cont)



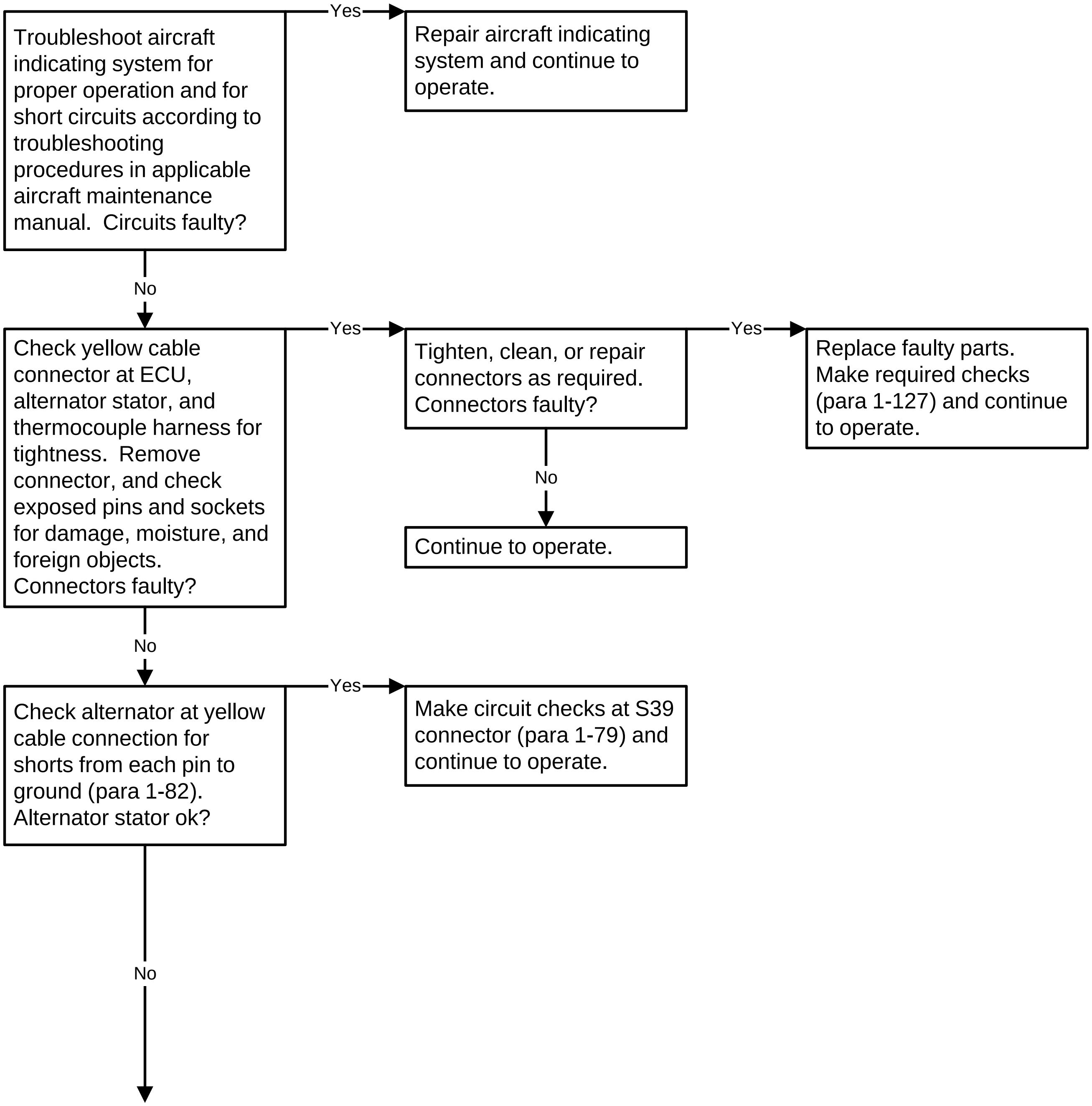
Troubleshooting Procedure 66. Torque and/or TGT Erratic/Fluctuating High/Low or Spiking (not accompanied by engine power changes) (Cont)



Troubleshooting Procedure 67. *(T700, T701)* ***ECU Torque and/or TGT Erratic***

NOTE

(T700) Electrical control units (ECUs) with PN 4046T29G10 (7042M12G09) and lower are often damaged when the alternator is shorted. These ECUs should be rejected. ECUs with PN 4046T29G11 (7042M12G07) and up incorporate a design improvement to prevent such damage. Therefore, there is no cause to reject these ECUs.



Troubleshoot aircraft indicating system for proper operation and for short circuits according to troubleshooting procedures in applicable aircraft maintenance manual. Circuits faulty?

Repair aircraft indicating system and continue to operate.

Check yellow cable connector at ECU, alternator stator, and thermocouple harness for tightness. Remove connector, and check exposed pins and sockets for damage, moisture, and foreign objects. Connectors faulty?

Tighten, clean, or repair connectors as required. Connectors faulty?

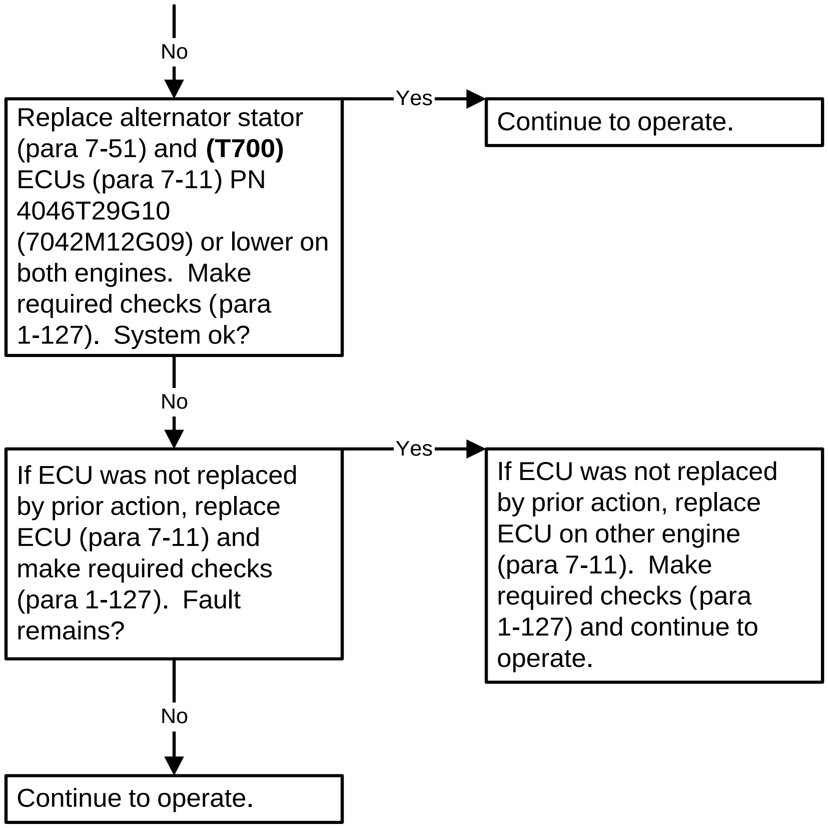
Replace faulty parts. Make required checks (para 1-127) and continue to operate.

Continue to operate.

Check alternator at yellow cable connection for shorts from each pin to ground (para 1-82). Alternator stator ok?

Make circuit checks at S39 connector (para 1-79) and continue to operate.

Troubleshooting Procedure 67. *(T700, T701)* ***ECU Torque and/or TGT Erratic (Cont)***



Replace alternator stator (para 7-51) and **(T700)** ECUs (para 7-11) PN 4046T29G10 (7042M12G09) or lower on both engines. Make required checks (para 1-127). System ok?

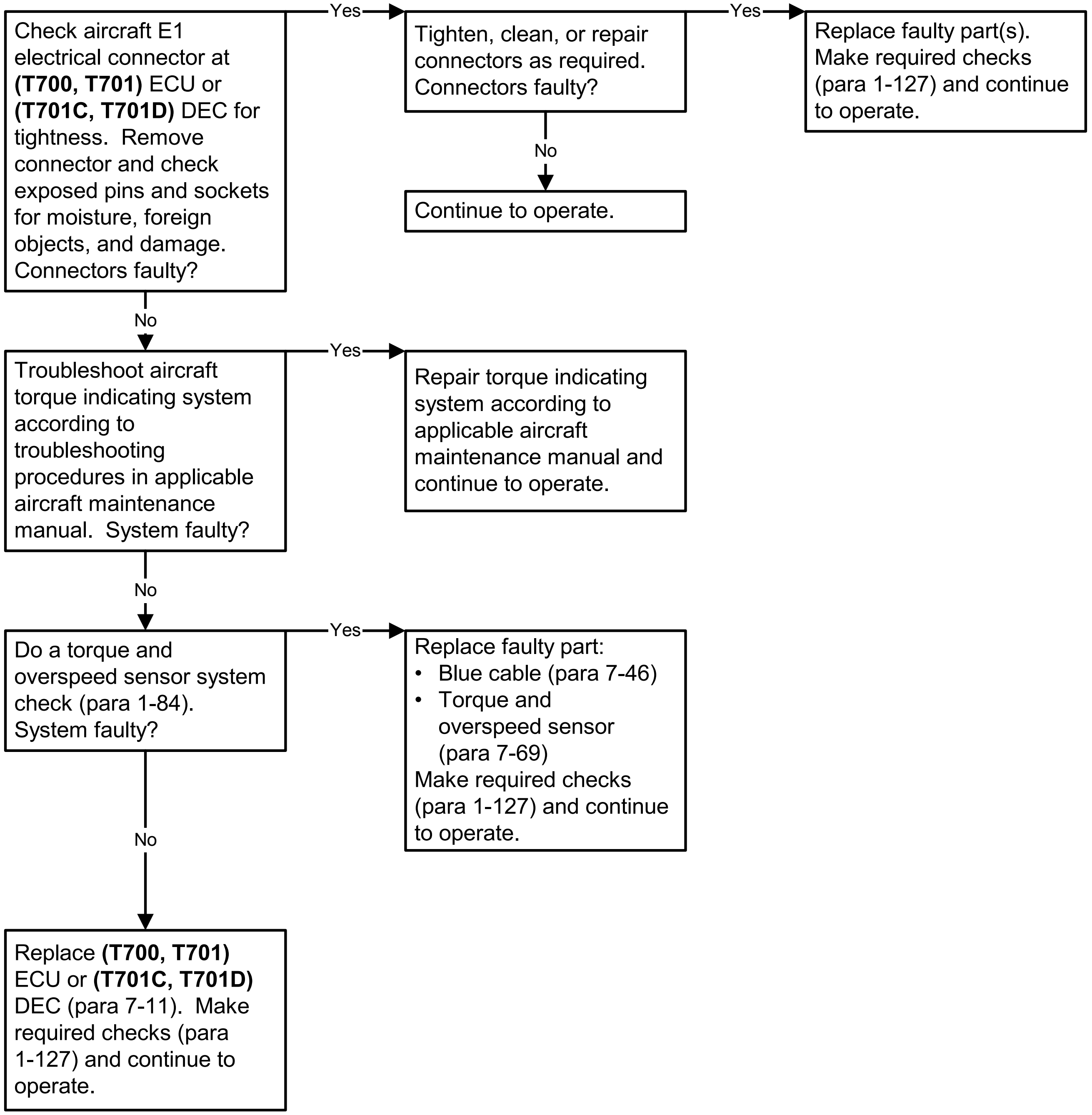
Continue to operate.

If ECU was not replaced by prior action, replace ECU (para 7-11) and make required checks (para 1-127). Fault remains?

If ECU was not replaced by prior action, replace ECU on other engine (para 7-11). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshooting Procedure 68. Torque Instrument Not Indicating or Fluctuating (all other instruments normal)



Check aircraft E1 electrical connector at **(T700, T701)** ECU or **(T701C, T701D)** DEC for tightness. Remove connector and check exposed pins and sockets for moisture, foreign objects, and damage. Connectors faulty?

Tighten, clean, or repair connectors as required. Connectors faulty?

Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Troubleshoot aircraft torque indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair torque indicating system according to applicable aircraft maintenance manual and continue to operate.

Do a torque and overspeed sensor system check (para 1-84). System faulty?

Replace faulty part:
- Blue cable (para 7-46)
- Torque and overspeed sensor (para 7-69)

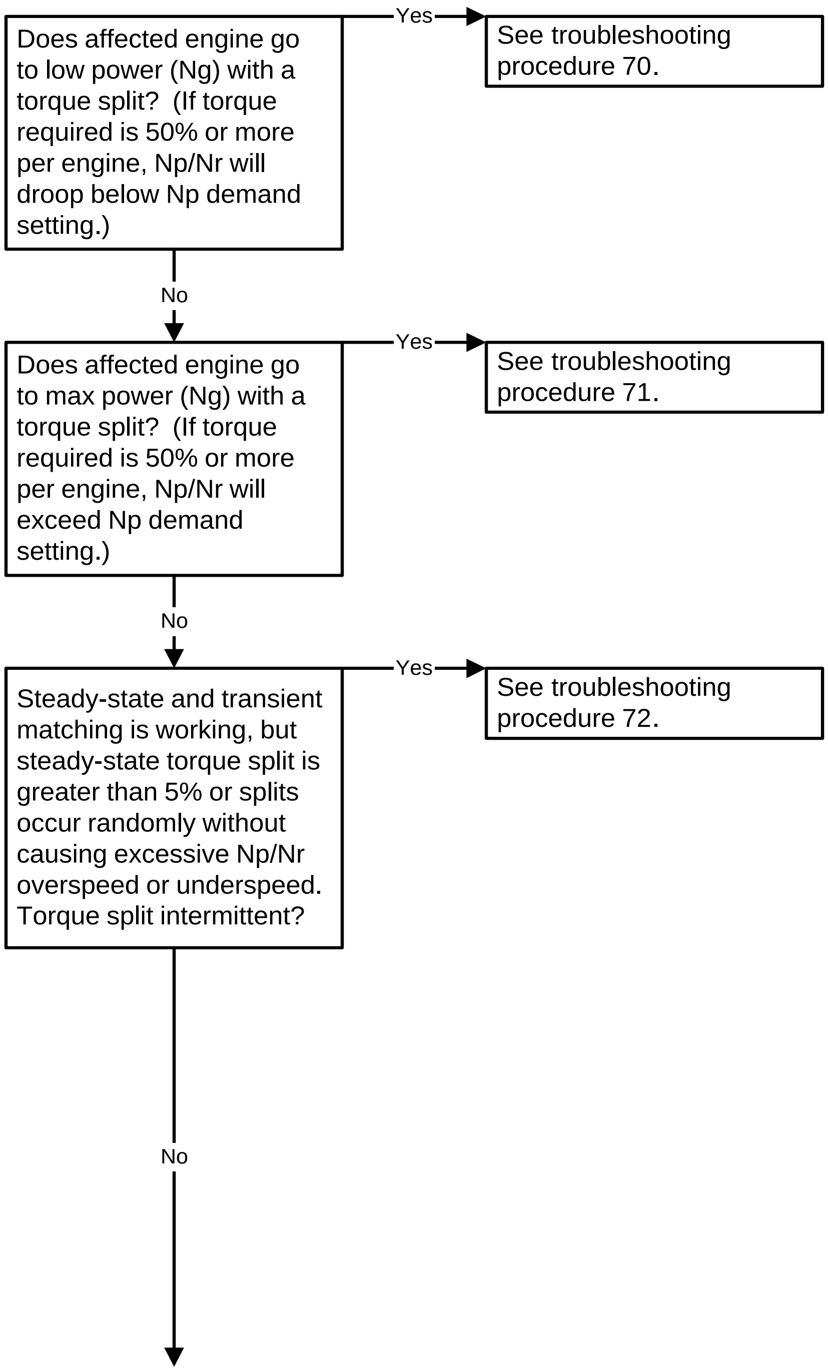
Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 69. Torque Split (control system malfunctions, which results in a torque split of greater than 5% when both engines are operating below TGT limiter or topping)

NOTE

Differences in % torque between engines may be indicated at max power if one engine is TGT control-limited or is topping limited. This is acceptable if the engine with the lower % torque meets minimum power check requirements.



Does affected engine go to low power (Ng) with a torque split? (If torque required is 50% or more per engine, Np/Nr will droop below Np demand setting.)

Yes: See troubleshooting procedure 70.

No:

Does affected engine go to max power (Ng) with a torque split? (If torque required is 50% or more per engine, Np/Nr will exceed Np demand setting.)

Yes: See troubleshooting procedure 71.

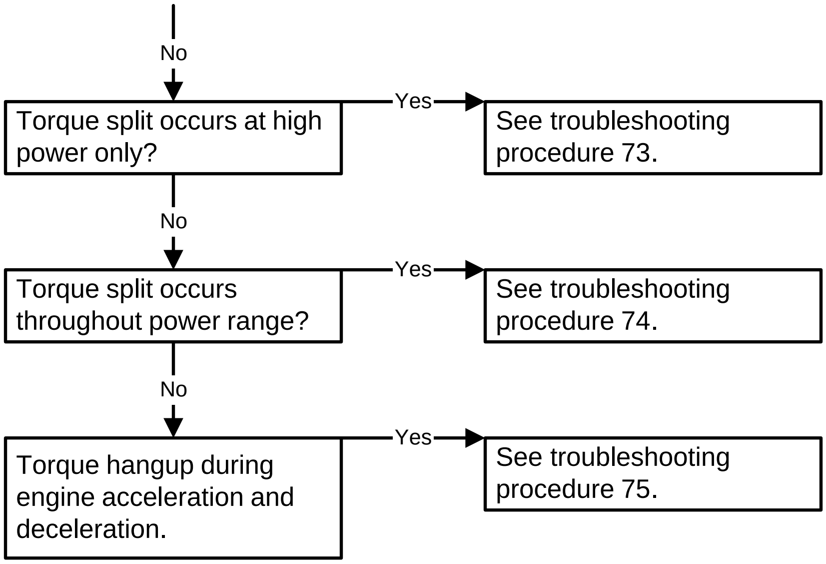
No:

Steady-state and transient matching is working, but steady-state torque split is greater than 5% or splits occur randomly without causing excessive Np/Nr overspeed or underspeed. Torque split intermittent?

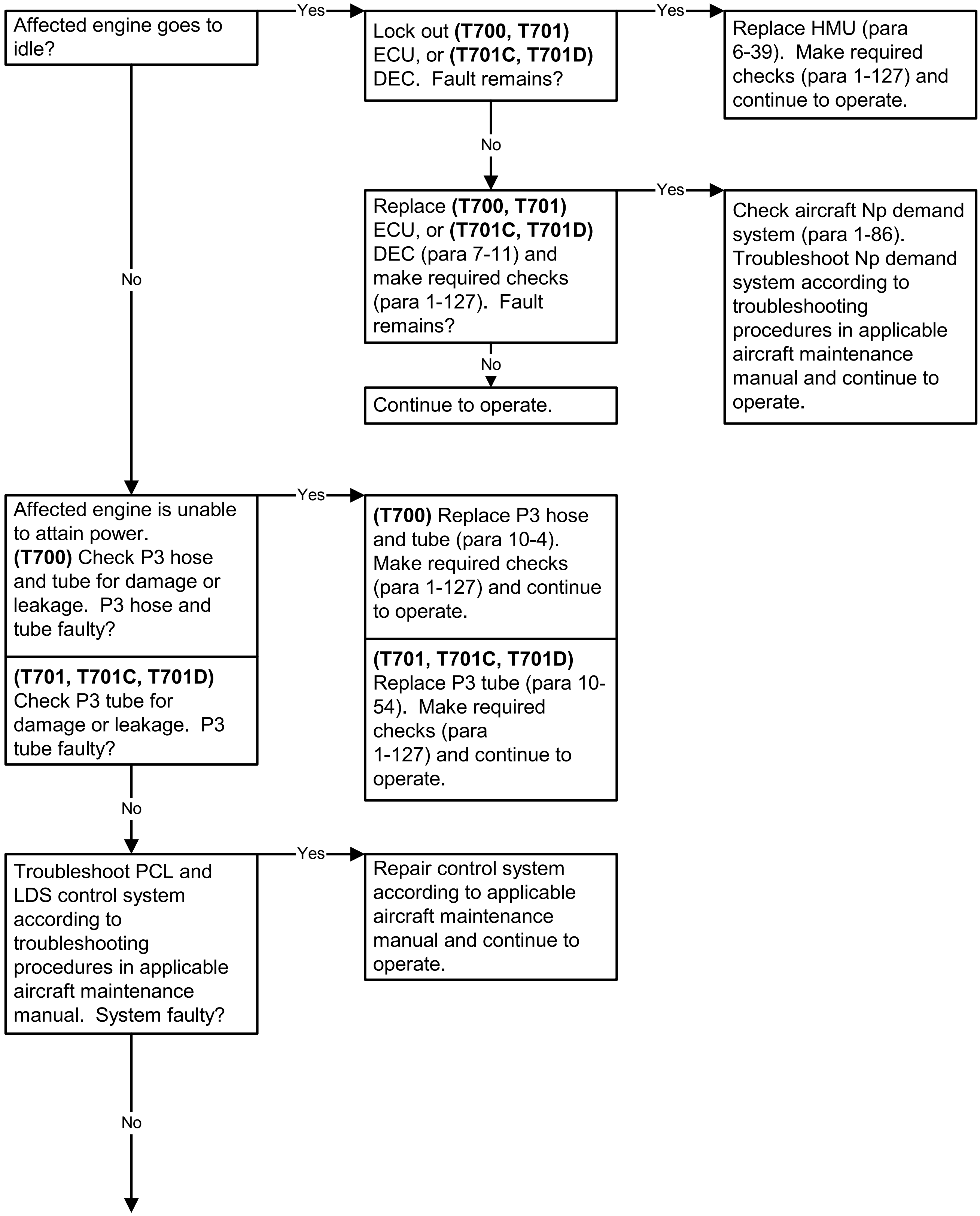
Yes: See troubleshooting procedure 72.

No

Troubleshooting Procedure 69. Torque Split (control system malfunctions, which results in a torque split of greater than 5% when both engines are operating below TGT limiter or topping) (Cont)



Troubleshooting Procedure 70. Torque Split (Engine Goes to Lower Power) (Np/Nr decreases below Np demand setting. Affected engine reduces power and does not respond to an increase in collective pitch.)



Affected engine goes to idle?

Lock out **(T700, T701)** ECU, or **(T701C, T701D)** DEC. Fault remains?

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11) and make required checks (para 1-127). Fault remains?

Check aircraft Np demand system (para 1-86). Troubleshoot Np demand system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

Continue to operate.

Affected engine is unable to attain power. **(T700)** Check P3 hose and tube for damage or leakage. P3 hose and tube faulty?

(T701, T701C, T701D) Check P3 tube for damage or leakage. P3 tube faulty?

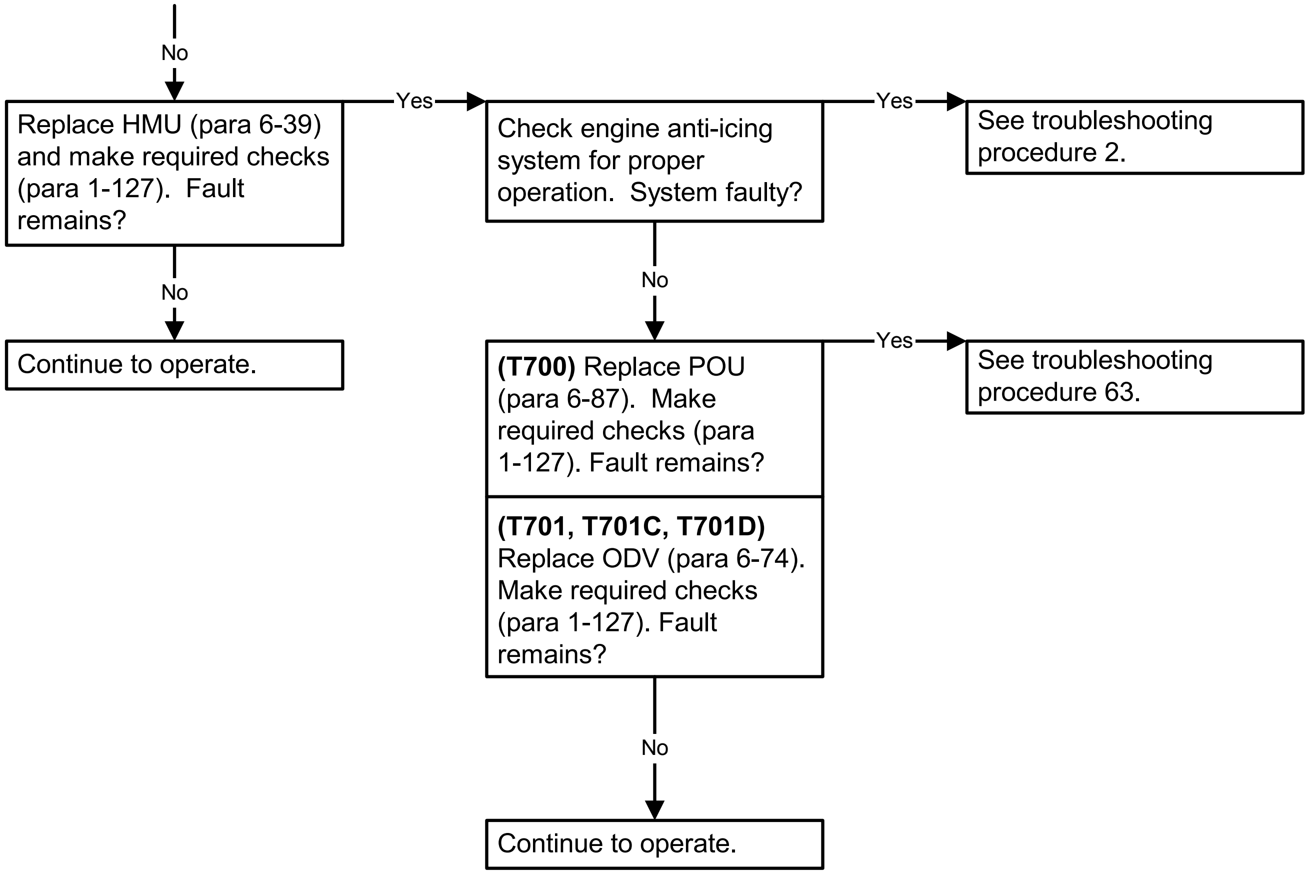
(T700) Replace P3 hose and tube (para 10-4). Make required checks (para 1-127) and continue to operate.

(T701, T701C, T701D) Replace P3 tube (para 10-54). Make required checks (para 1-127) and continue to operate.

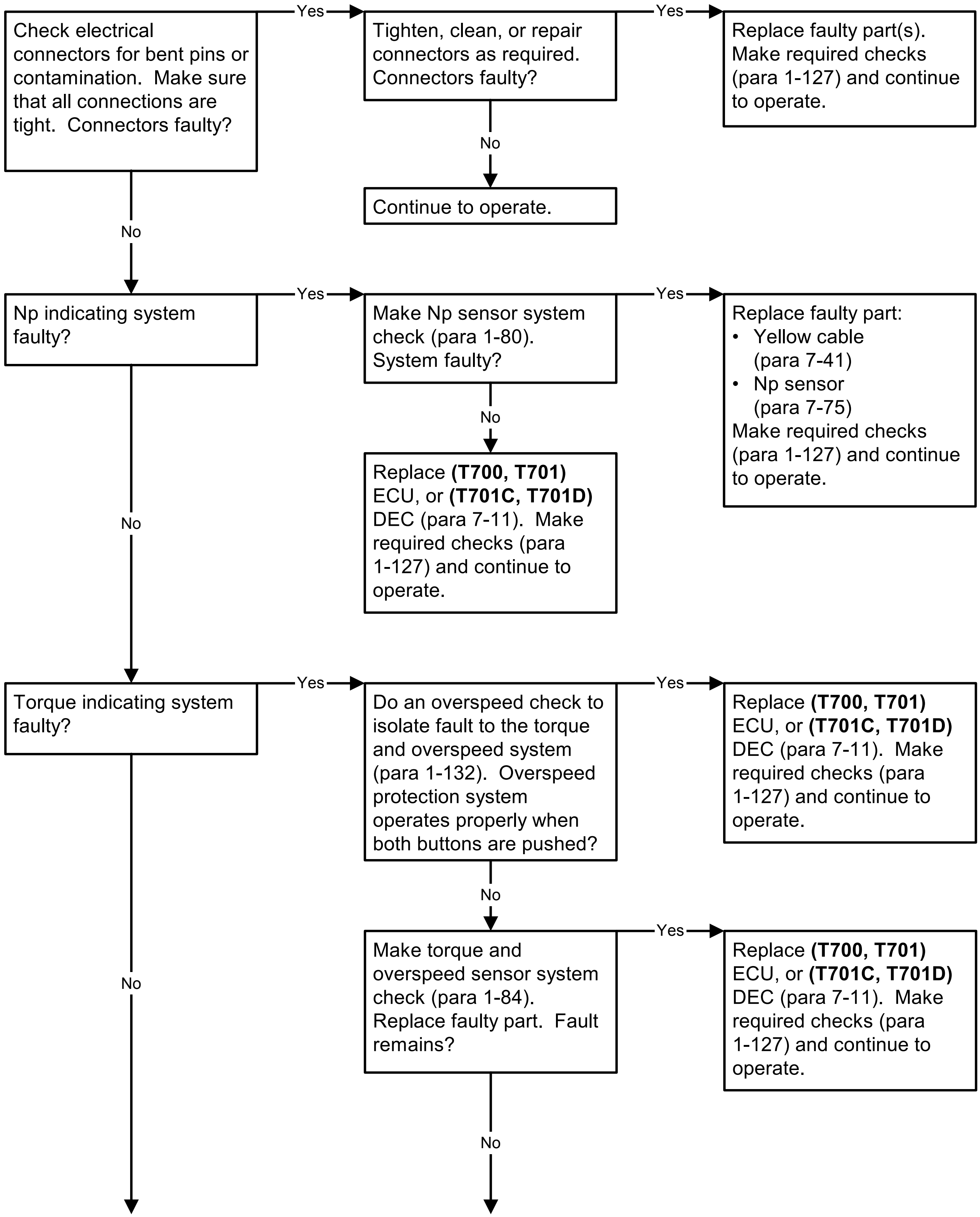
Troubleshoot PCL and LDS control system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair control system according to applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 70. ***Torque Split (Engine Goes to Lower Power) (Np/Nr decreases below Np demand setting. Affected engine reduces power and does not respond to an increase in collective pitch.) (Cont)***



Troubleshooting Procedure 71. Torque Split (Engine Goes to Maximum Power) (Np/Nr exceeds demand setting. Engine goes to maximum power of 97-102% Ng.)



Check electrical connectors for bent pins or contamination. Make sure that all connections are tight. Connectors faulty?

Tighten, clean, or repair connectors as required. Connectors faulty?

Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Continue to operate.

Np indicating system faulty?

Make Np sensor system check (para 1-80). System faulty?

Replace faulty part:
- Yellow cable (para 7-41)
- Np sensor (para 7-75)

Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Torque indicating system faulty?

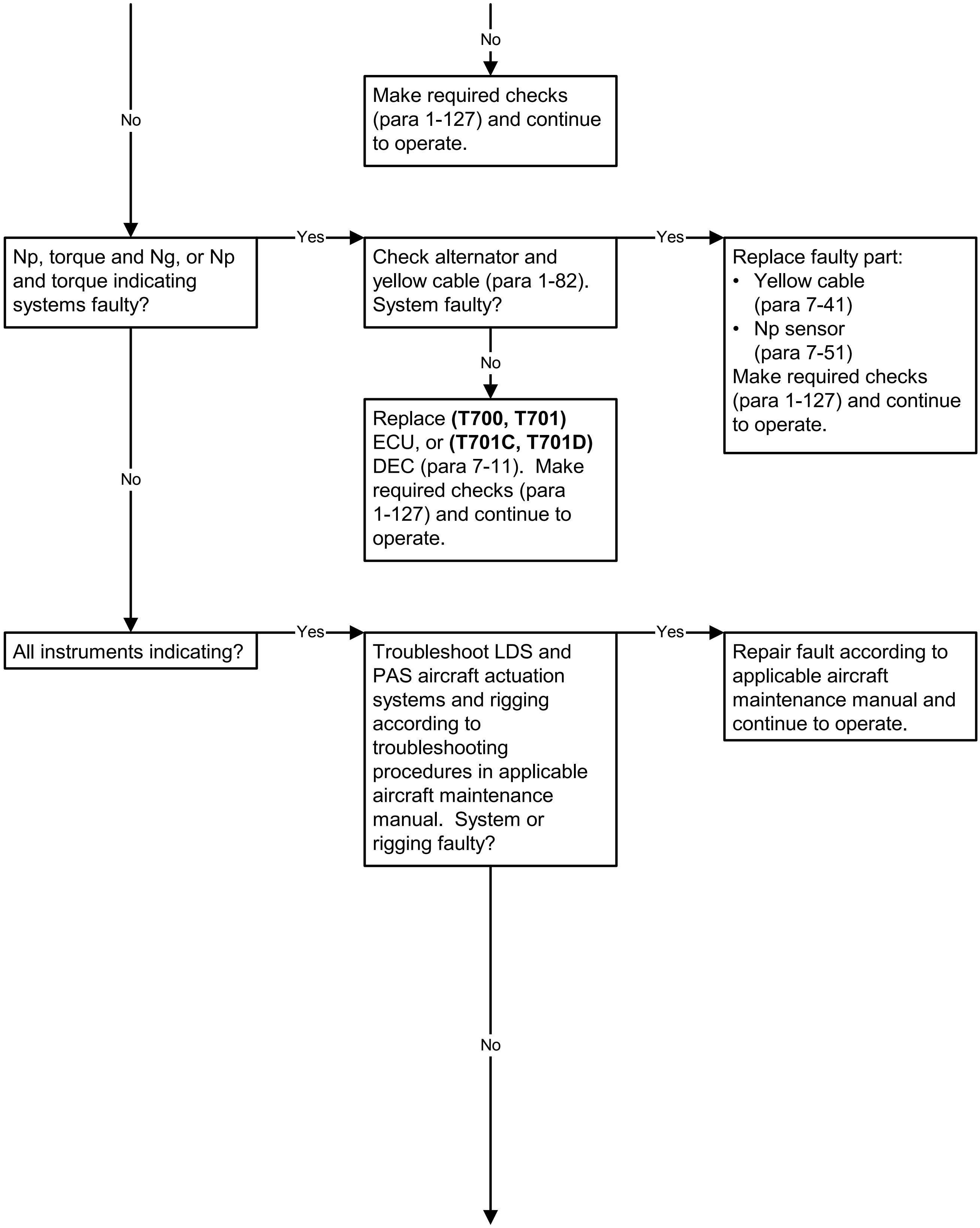
Do an overspeed check to isolate fault to the torque and overspeed system (para 1-132). Overspeed protection system operates properly when both buttons are pushed?

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Make torque and overspeed sensor system check (para 1-84). Replace faulty part. Fault remains?

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 71. Torque Split (Engine Goes to Maximum Power) (Np/Nr exceeds demand setting. Engine goes to maximum power of 97-102% Ng.) (Cont)



Make required checks (para 1-127) and continue to operate.

Np, torque and Ng, or Np and torque indicating systems faulty?

Check alternator and yellow cable (para 1-82). System faulty?

Replace faulty part:
- Yellow cable (para 7-41)
- Np sensor (para 7-51)

Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

All instruments indicating?

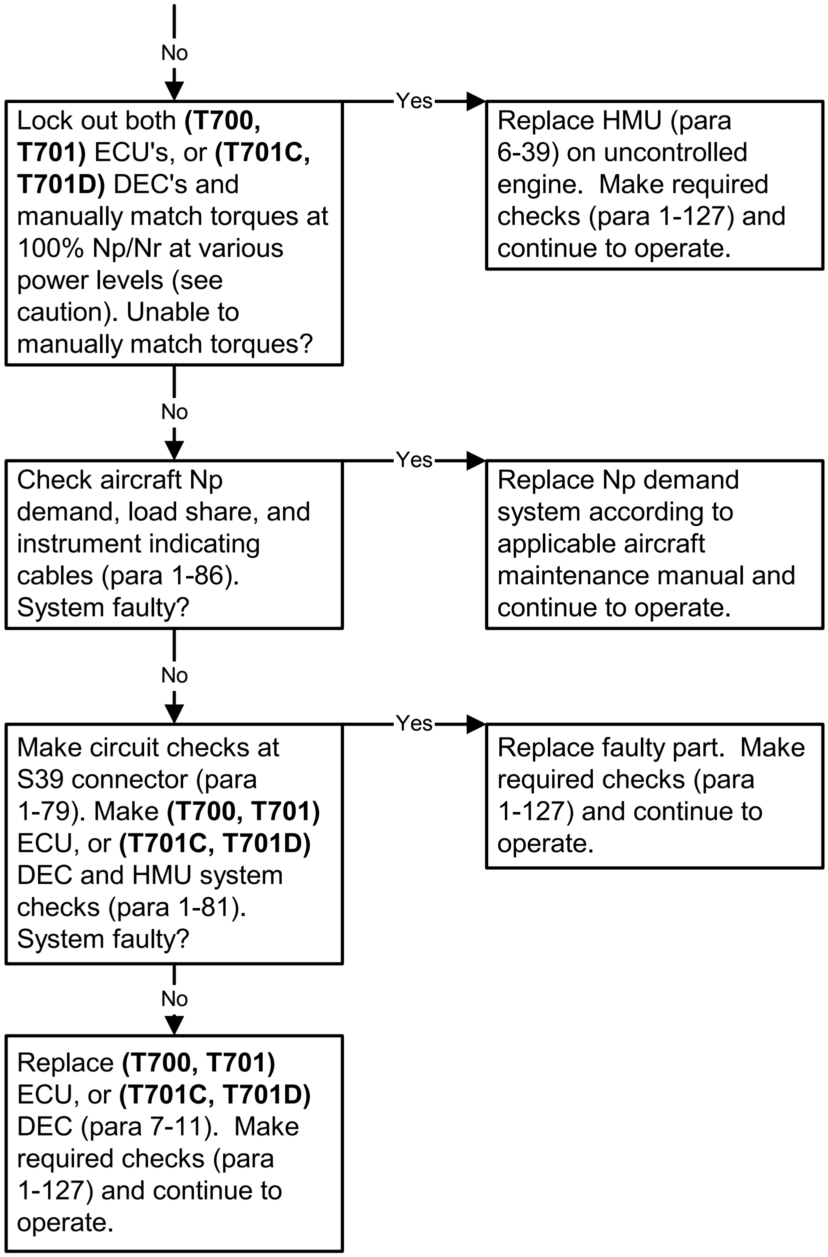
Troubleshoot LDS and PAS aircraft actuation systems and rigging according to troubleshooting procedures in applicable aircraft maintenance manual. System or rigging faulty?

Repair fault according to applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 71. ***Torque Split (Engine Goes to Maximum Power) (Np/Nr exceeds demand setting. Engine goes to maximum power of 97-102% Ng.) (Cont)***

CAUTION

Affected engine may have uncontrolled acceleration.



Lock out both **(T700, T701)** ECU's, or **(T701C, T701D)** DEC's and manually match torques at 100% Np/Nr at various power levels (see caution). Unable to manually match torques?

Replace HMU (para 6-39) on uncontrolled engine. Make required checks (para 1-127) and continue to operate.

Check aircraft Np demand, load share, and instrument indicating cables (para 1-86). System faulty?

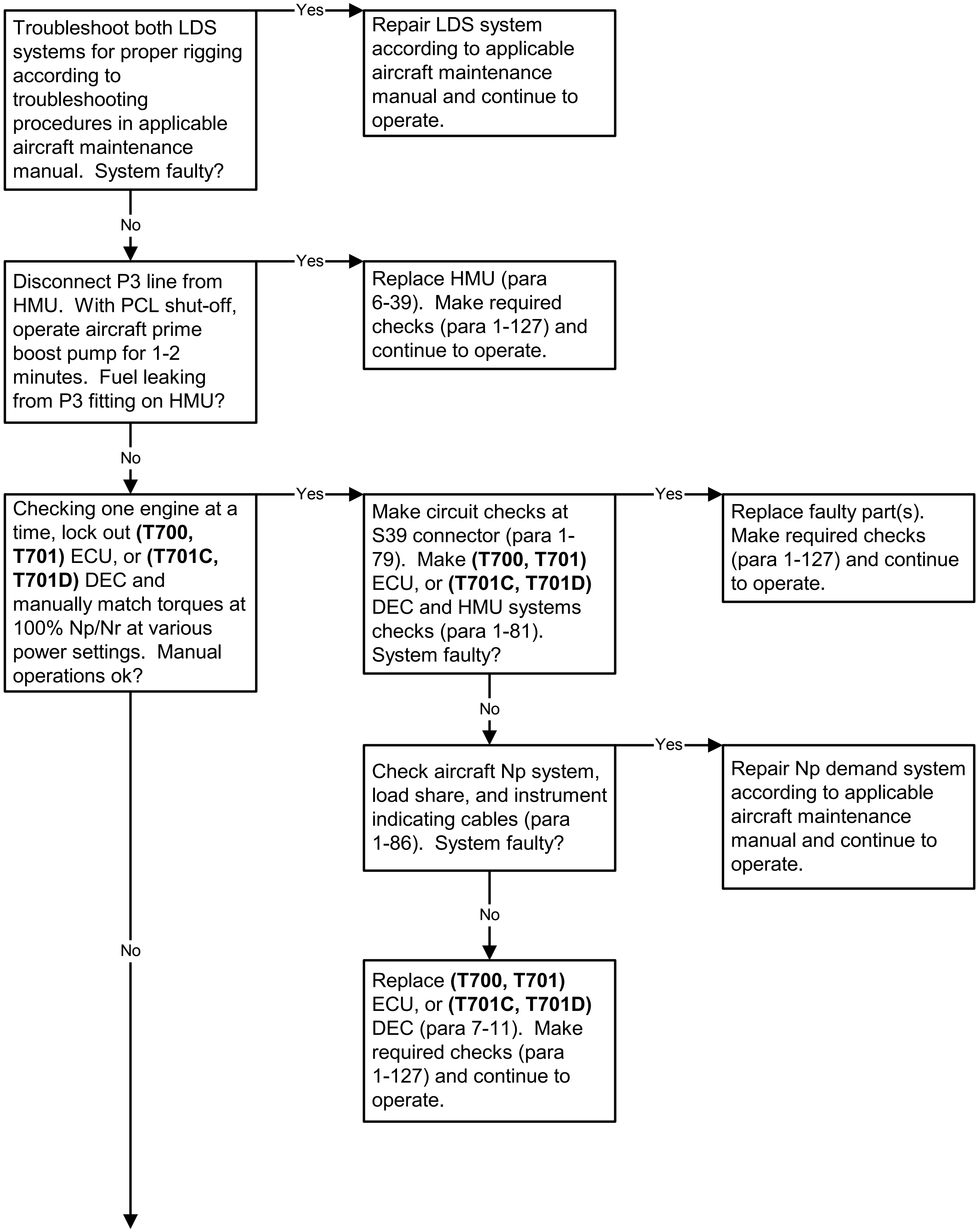
Replace Np demand system according to applicable aircraft maintenance manual and continue to operate.

Make circuit checks at S39 connector (para 1-79). Make **(T700, T701)** ECU, or **(T701C, T701D)** DEC and HMU system checks (para 1-81). System faulty?

Replace faulty part. Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 72. Torque Split (Intermittent)



Troubleshoot both LDS systems for proper rigging according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair LDS system according to applicable aircraft maintenance manual and continue to operate.

Disconnect P3 line from HMU. With PCL shut-off, operate aircraft prime boost pump for 1-2 minutes. Fuel leaking from P3 fitting on HMU?

Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

Checking one engine at a time, lock out **(T700, T701)** ECU, or **(T701C, T701D)** DEC and manually match torques at 100% Np/Nr at various power settings. Manual operations ok?

Make circuit checks at S39 connector (para 1-79). Make **(T700, T701)** ECU, or **(T701C, T701D)** DEC and HMU systems checks (para 1-81). System faulty?

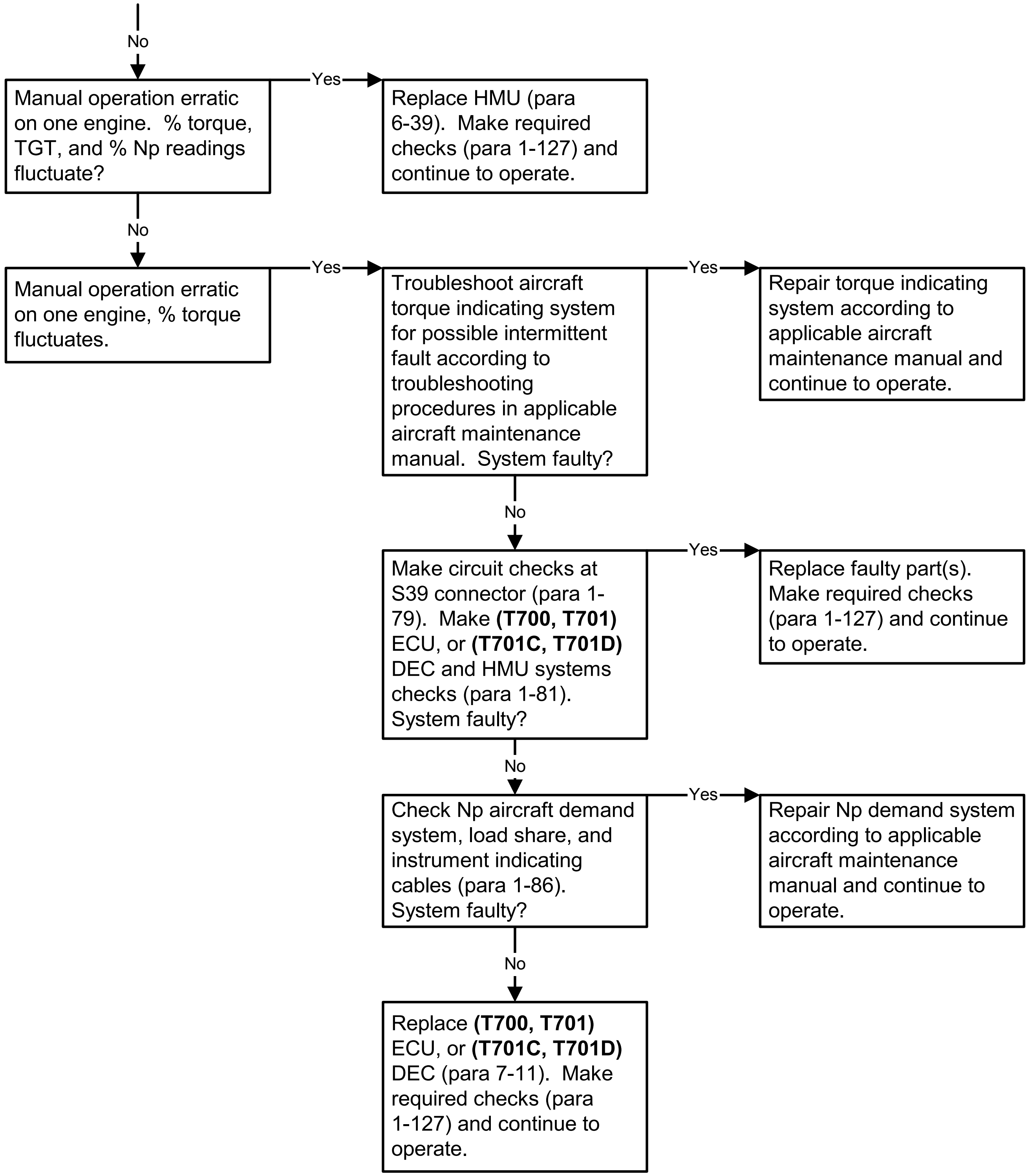
Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Check aircraft Np system, load share, and instrument indicating cables (para 1-86). System faulty?

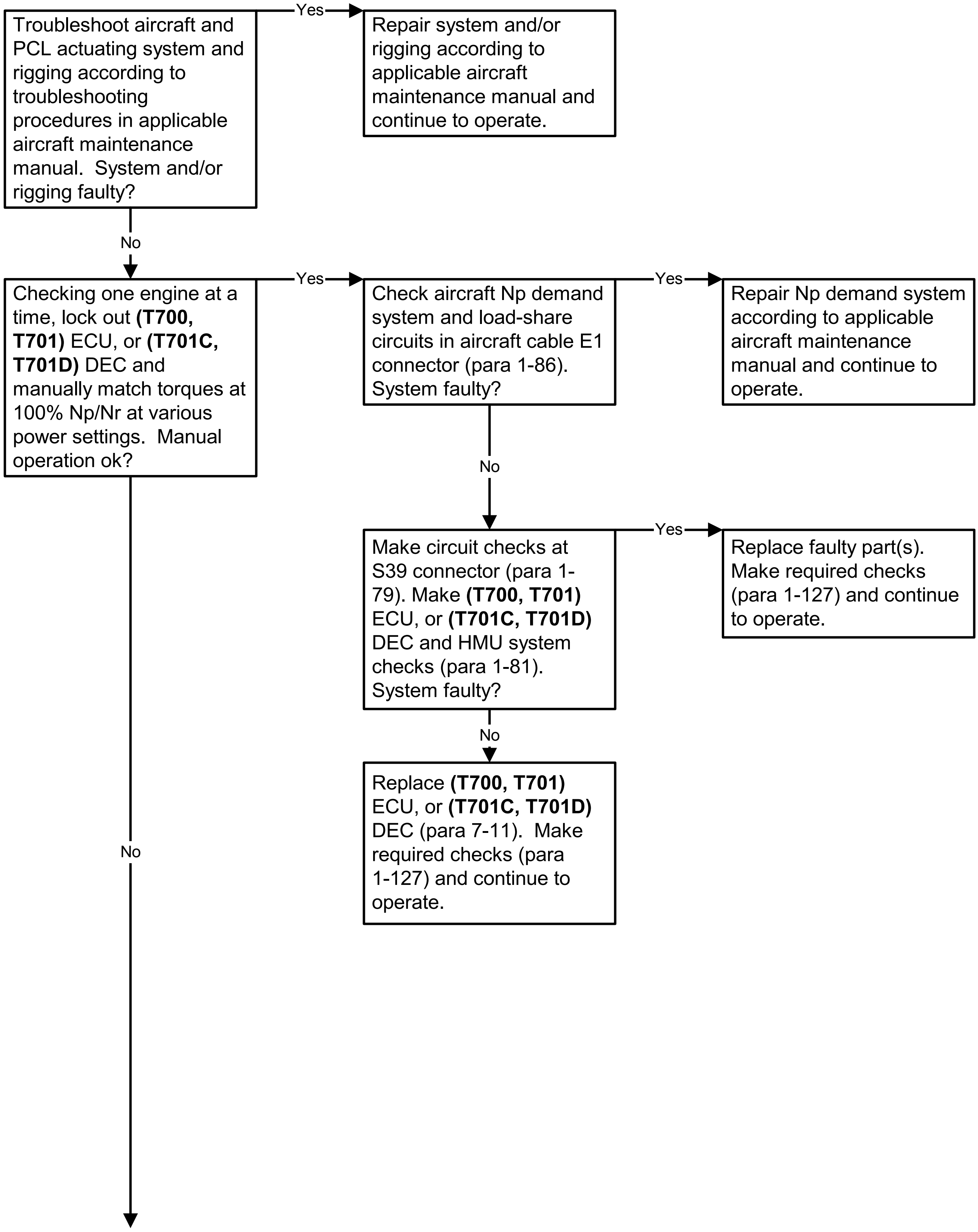
Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 72. Torque Split (Intermittent) (Cont)



Troubleshooting Procedure 73. Torque Split (occurs at high power only, both engines not on TGT limiter)



Troubleshoot aircraft and PCL actuating system and rigging according to troubleshooting procedures in applicable aircraft maintenance manual. System and/or rigging faulty?

Repair system and/or rigging according to applicable aircraft maintenance manual and continue to operate.

Checking one engine at a time, lock out **(T700, T701)** ECU, or **(T701C, T701D)** DEC and manually match torques at 100% Np/Nr at various power settings. Manual operation ok?

Check aircraft Np demand system and load-share circuits in aircraft cable E1 connector (para 1-86). System faulty?

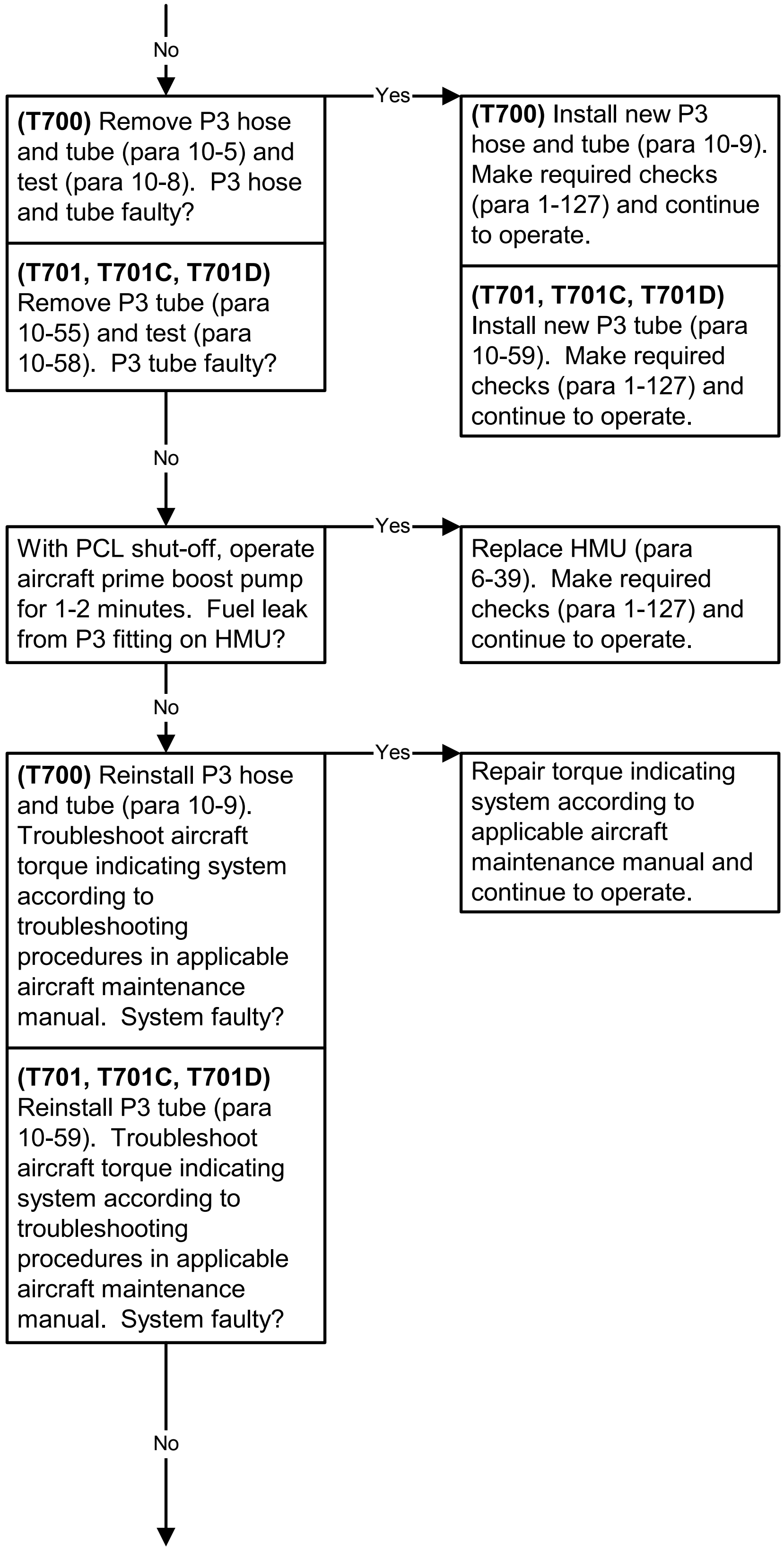
Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Make circuit checks at S39 connector (para 1-79). Make **(T700, T701)** ECU, or **(T701C, T701D)** DEC and HMU system checks (para 1-81). System faulty?

Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 73. Torque Split (occurs at high power only, both engines not on TGT limiter) (Cont)



(T700) Remove P3 hose and tube (para 10-5) and test (para 10-8). P3 hose and tube faulty?

(T701, T701C, T701D) Remove P3 tube (para 10-55) and test (para 10-58). P3 tube faulty?

(T700) Install new P3 hose and tube (para 10-9). Make required checks (para 1-127) and continue to operate.

(T701, T701C, T701D) Install new P3 tube (para 10-59). Make required checks (para 1-127) and continue to operate.

With PCL shut-off, operate aircraft prime boost pump for 1-2 minutes. Fuel leak from P3 fitting on HMU?

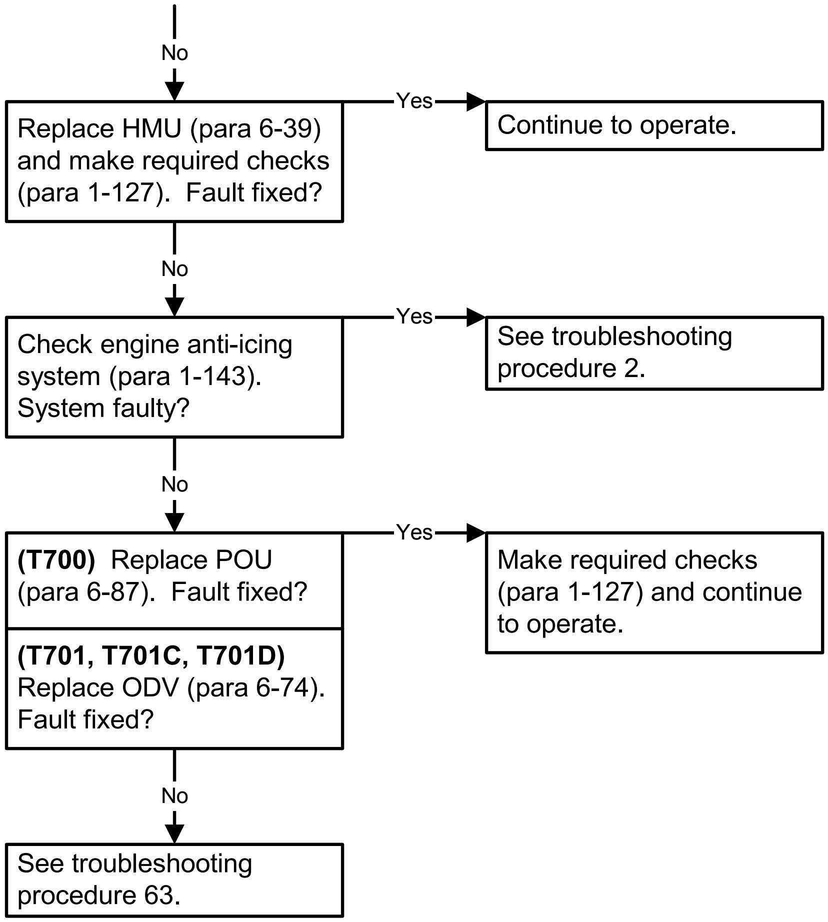
Replace HMU (para 6-39). Make required checks (para 1-127) and continue to operate.

(T700) Reinstall P3 hose and tube (para 10-9). Troubleshoot aircraft torque indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

(T701, T701C, T701D) Reinstall P3 tube (para 10-59). Troubleshoot aircraft torque indicating system according to troubleshooting procedures in applicable aircraft maintenance manual. System faulty?

Repair torque indicating system according to applicable aircraft maintenance manual and continue to operate.

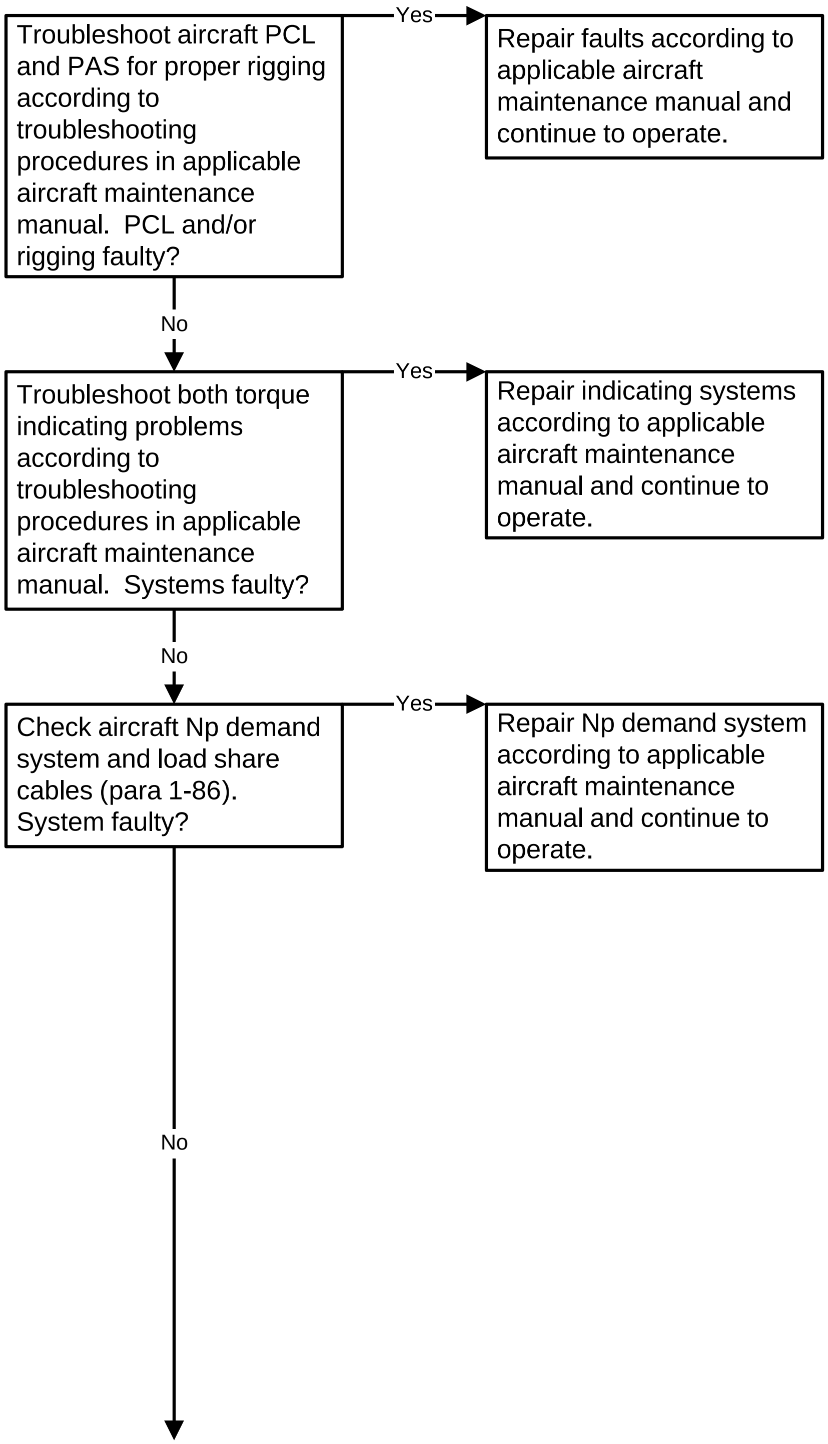
Troubleshooting Procedure 73. Torque Split (occurs at high power only, both engines not on TGT limiter) (Cont)



Troubleshooting Procedure 74. Torque Split (occurs throughout power range)

NOTE

Torque matching is operational, but split is more than 5%. Split occurs throughout power range.



Troubleshoot aircraft PCL and PAS for proper rigging according to troubleshooting procedures in applicable aircraft maintenance manual. PCL and/or rigging faulty?

Repair faults according to applicable aircraft maintenance manual and continue to operate.

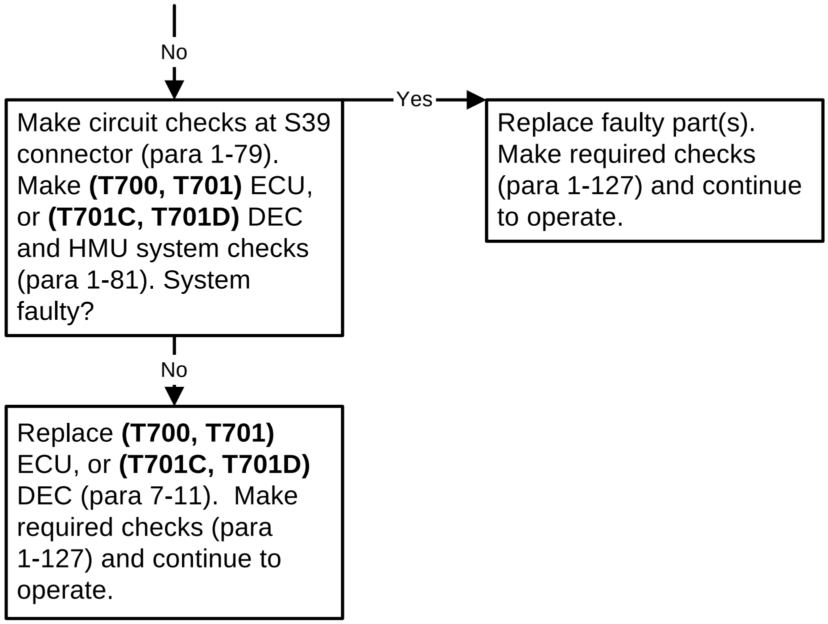
Troubleshoot both torque indicating problems according to troubleshooting procedures in applicable aircraft maintenance manual. Systems faulty?

Repair indicating systems according to applicable aircraft maintenance manual and continue to operate.

Check aircraft Np demand system and load share cables (para 1-86). System faulty?

Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Troubleshooting Procedure 74. Torque Split (occurs throughout power range) (Cont)



Make circuit checks at S39 connector (para 1-79). Make **(T700, T701)** ECU, or **(T701C, T701D)** DEC and HMU system checks (para 1-81). System faulty?

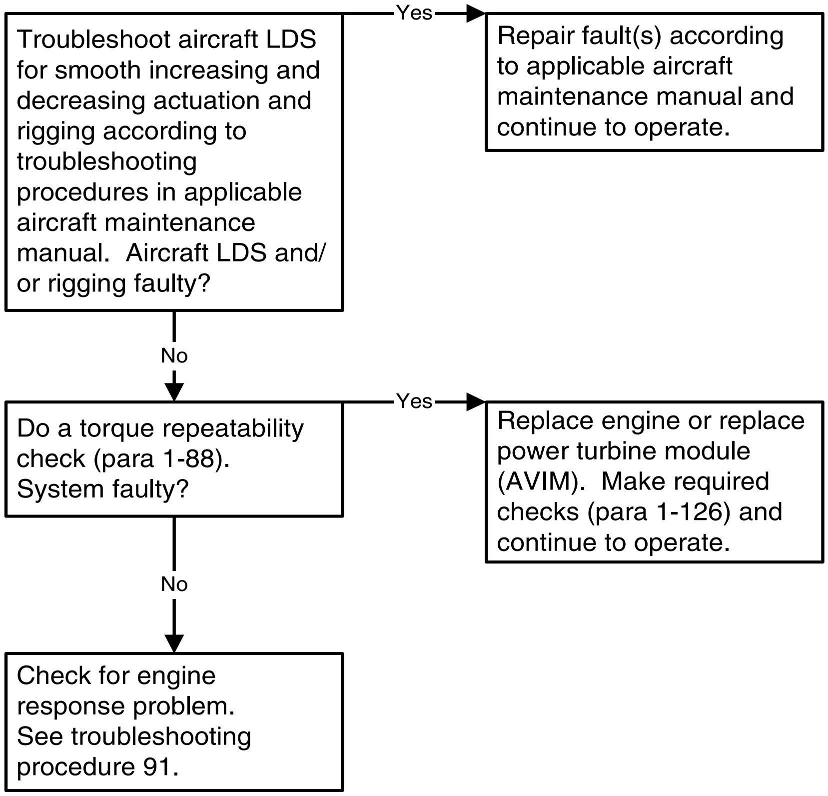
Replace faulty part(s). Make required checks (para 1-127) and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

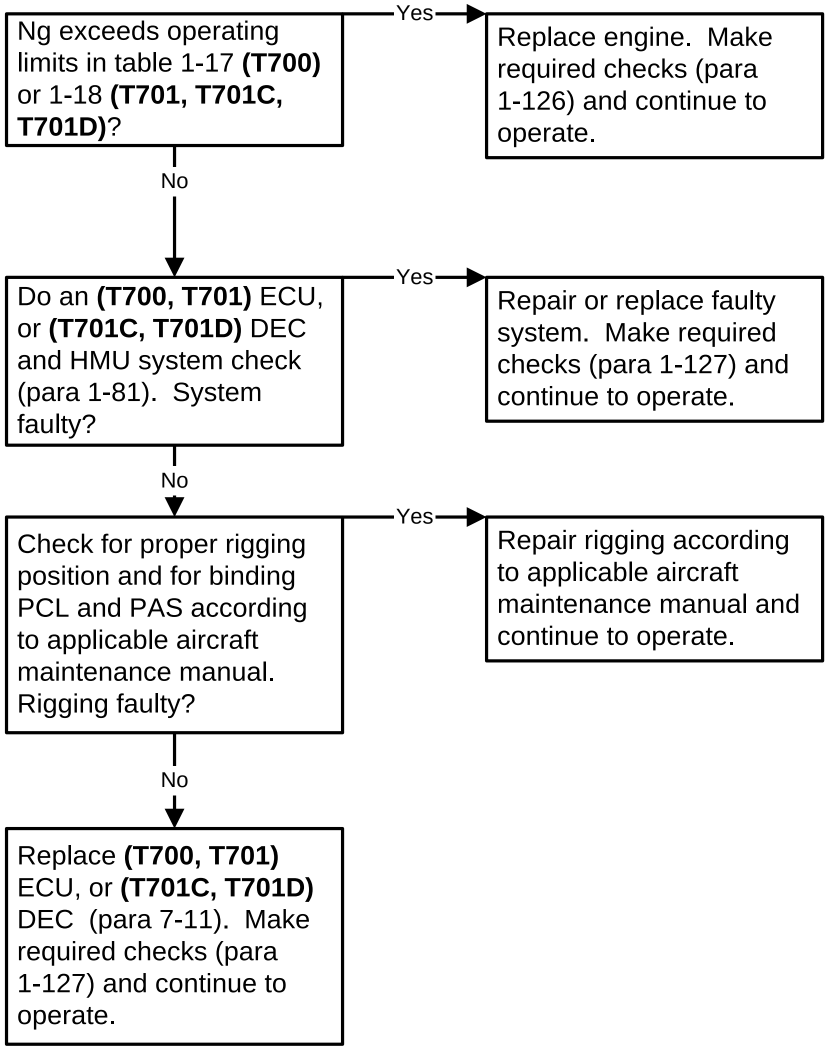
Troubleshooting Procedure 75. Torque Split (torque hangup)

NOTE

Torque matching is operational, but split is more than 5%. Torque hangup during engine acceleration and deceleration.



Troubleshooting Procedure 76. Uncontrolled Acceleration above Ground Idle Speed (all engine parameters indicating)



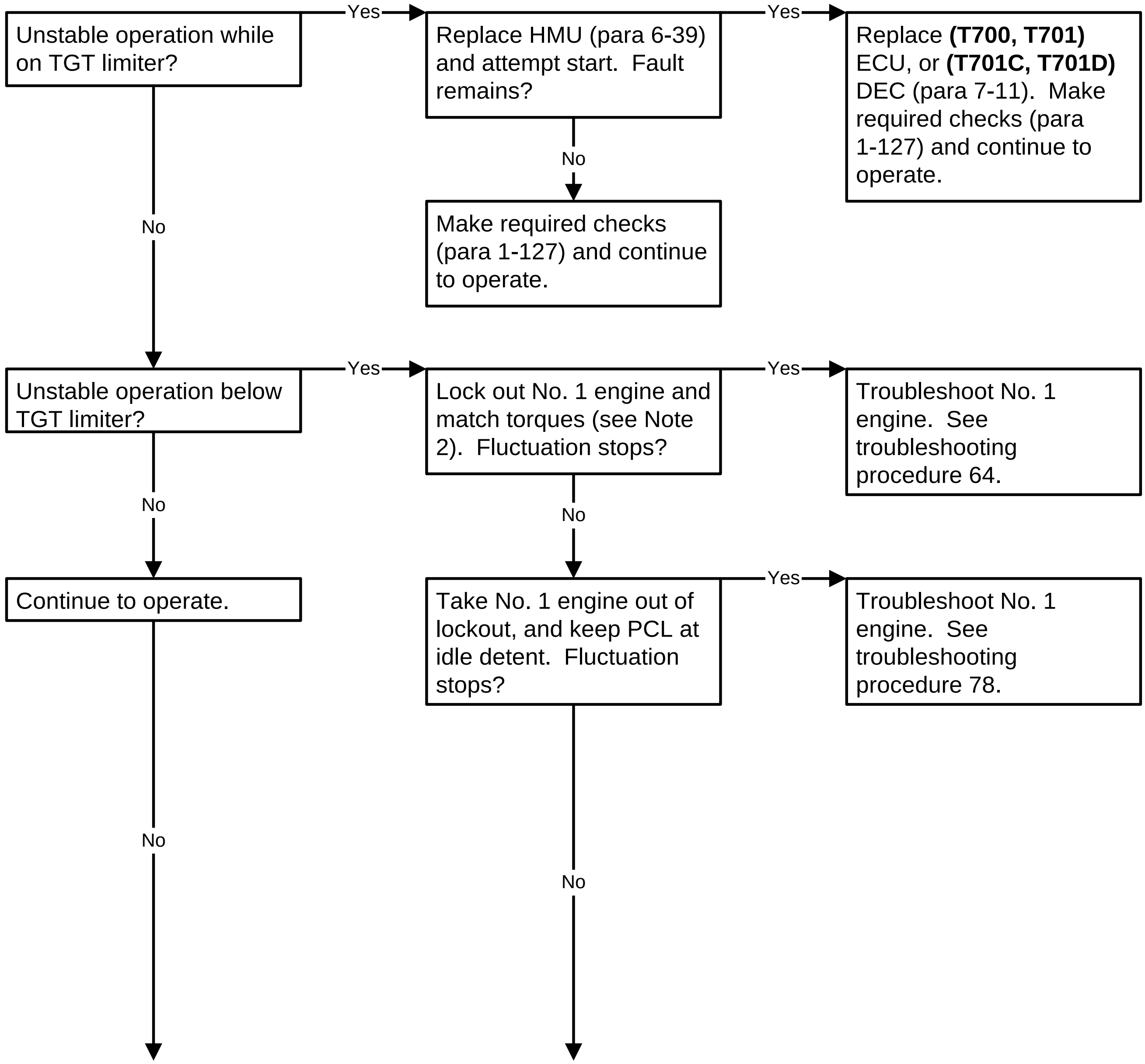
Troubleshooting Procedure 77. Unstable Operation

NOTE 1

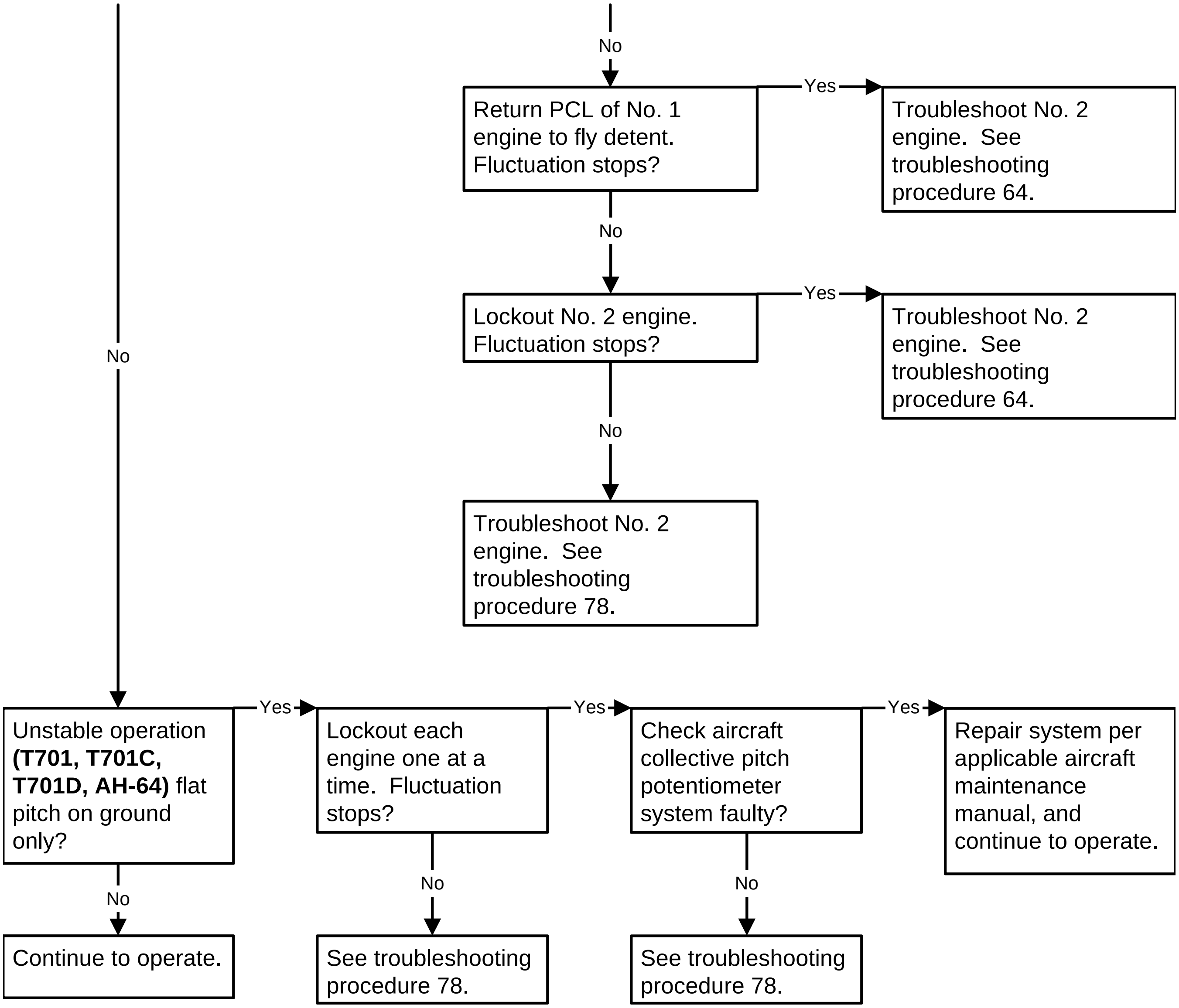
If a problem of fluctuation occurs on one instrument only (either Ng, Np, or torque), the most likely cause is the indicating system. Troubleshoot aircraft indicating system according to troubleshooting procedures in applicable aircraft maintenance manual.

NOTE 2

This and the following steps will identify which engine is faulty and will provide the corrective action. (Maintenance test flight required.)



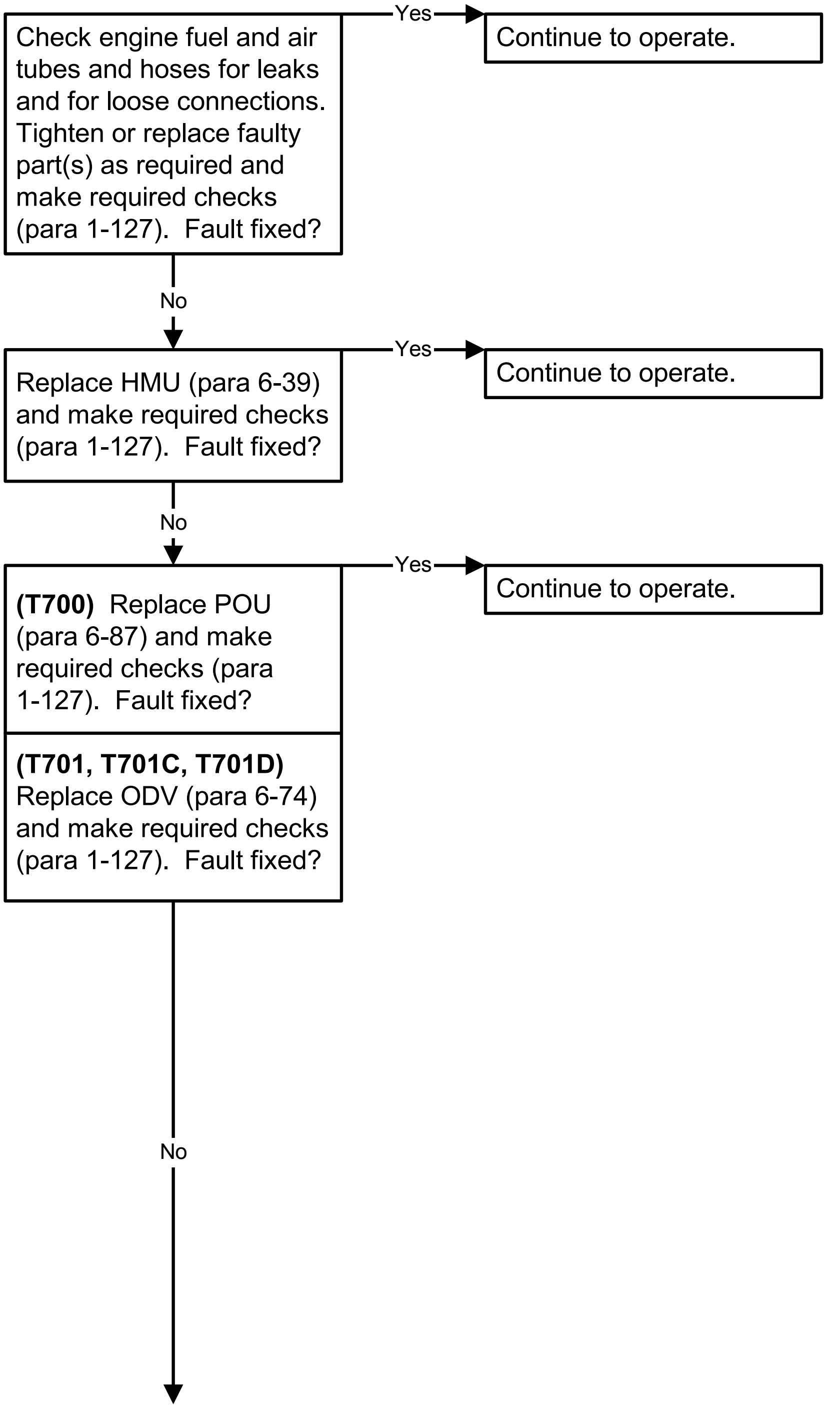
Troubleshooting Procedure 77. Unstable Operation (Cont)



*Troubleshooting Procedure 78. Unstable Operation with **(T700, T701)** ECU, or **(T701C, T701D)** DEC locked out (Ng, TGT, torque, and Np fluctuate greater than 5% with **(T700, T701)** ECU, or **(T701C, T701D)** DEC locked out)*

NOTE

If fuel filter bypass light is on, or if low fuel pressure caution light is on at flight idle or above, troubleshoot according to troubleshooting procedures 42 and 44.



Check engine fuel and air tubes and hoses for leaks and for loose connections. Tighten or replace faulty part(s) as required and make required checks (para 1-127). Fault fixed?

Continue to operate.

Replace HMU (para 6-39) and make required checks (para 1-127). Fault fixed?

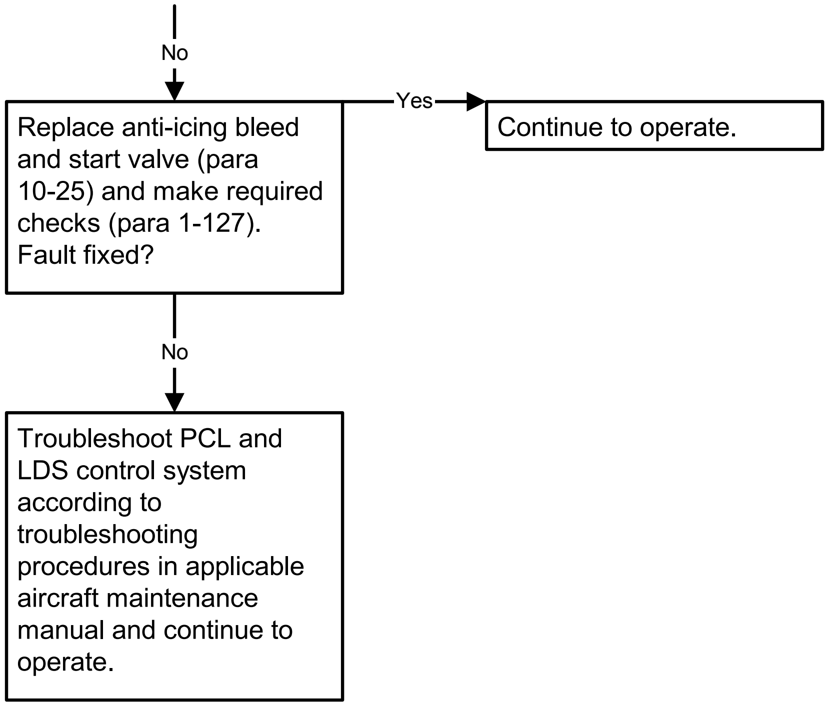
Continue to operate.

(T700) Replace POU (para 6-87) and make required checks (para 1-127). Fault fixed?

(T701, T701C, T701D) Replace ODV (para 6-74) and make required checks (para 1-127). Fault fixed?

Continue to operate.

Troubleshooting Procedure 78. Unstable Operation with ***(T700, T701)*** *ECU, or* ***(T701C, T701D)*** *DEC locked out (Ng, TGT, torque, and Np fluctuate greater than 5% with* ***(T700, T701)*** *ECU, or* ***(T701C, T701D)*** *DEC locked out) (Cont)*

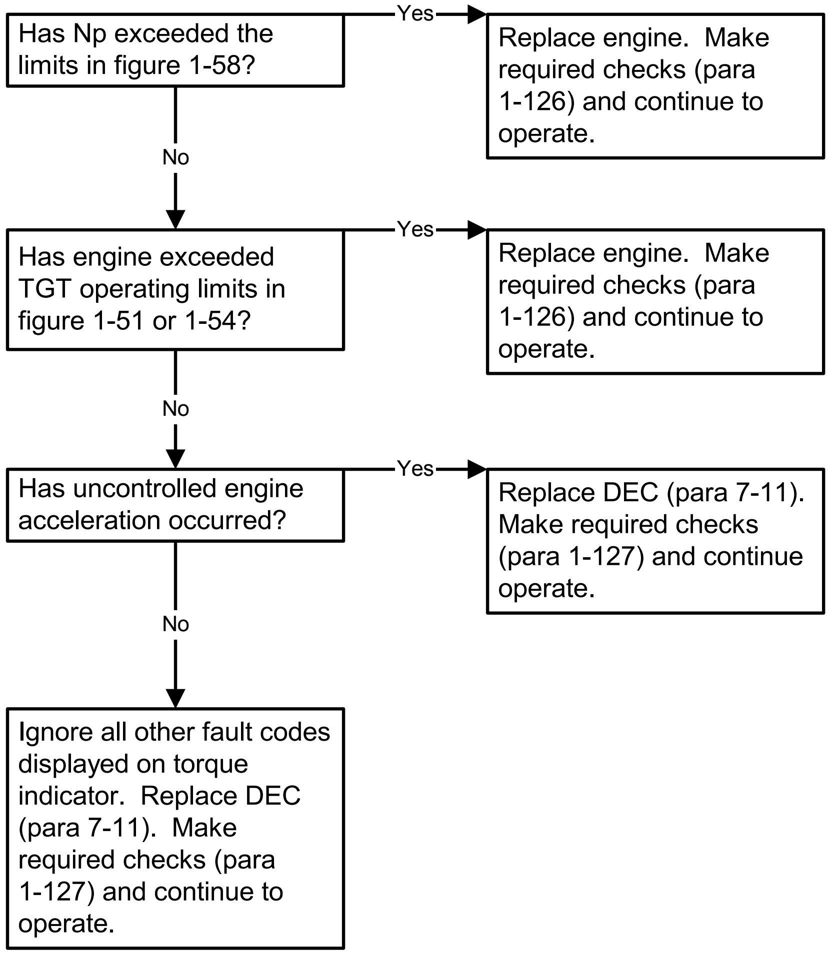


Replace anti-icing bleed and start valve (para 10-25) and make required checks (para 1-127). Fault fixed?

Continue to operate.

Troubleshoot PCL and LDS control system according to troubleshooting procedures in applicable aircraft maintenance manual and continue to operate.

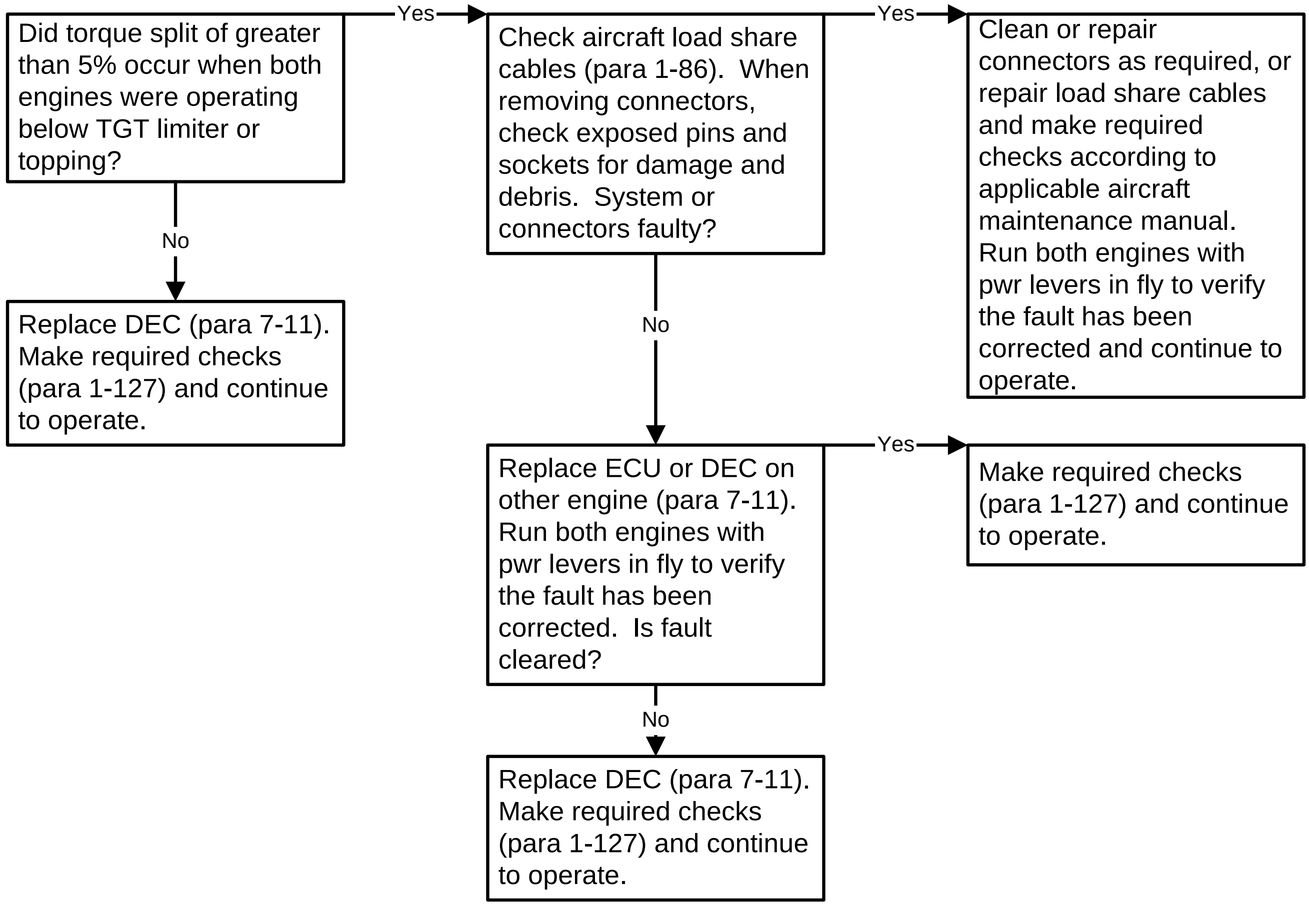
*Troubleshooting Procedure 79. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 15% (±3%) (check DEC)*



*Troubleshooting Procedure 80. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 25% (±3%) (Np demand channel)*

See troubleshooting procedure 21.

*Troubleshooting Procedure 81. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 35% (±3%) (load share channel)*



Did torque split of greater than 5% occur when both engines were operating below TGT limiter or topping?

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Check aircraft load share cables (para 1-86). When removing connectors, check exposed pins and sockets for damage and debris. System or connectors faulty?

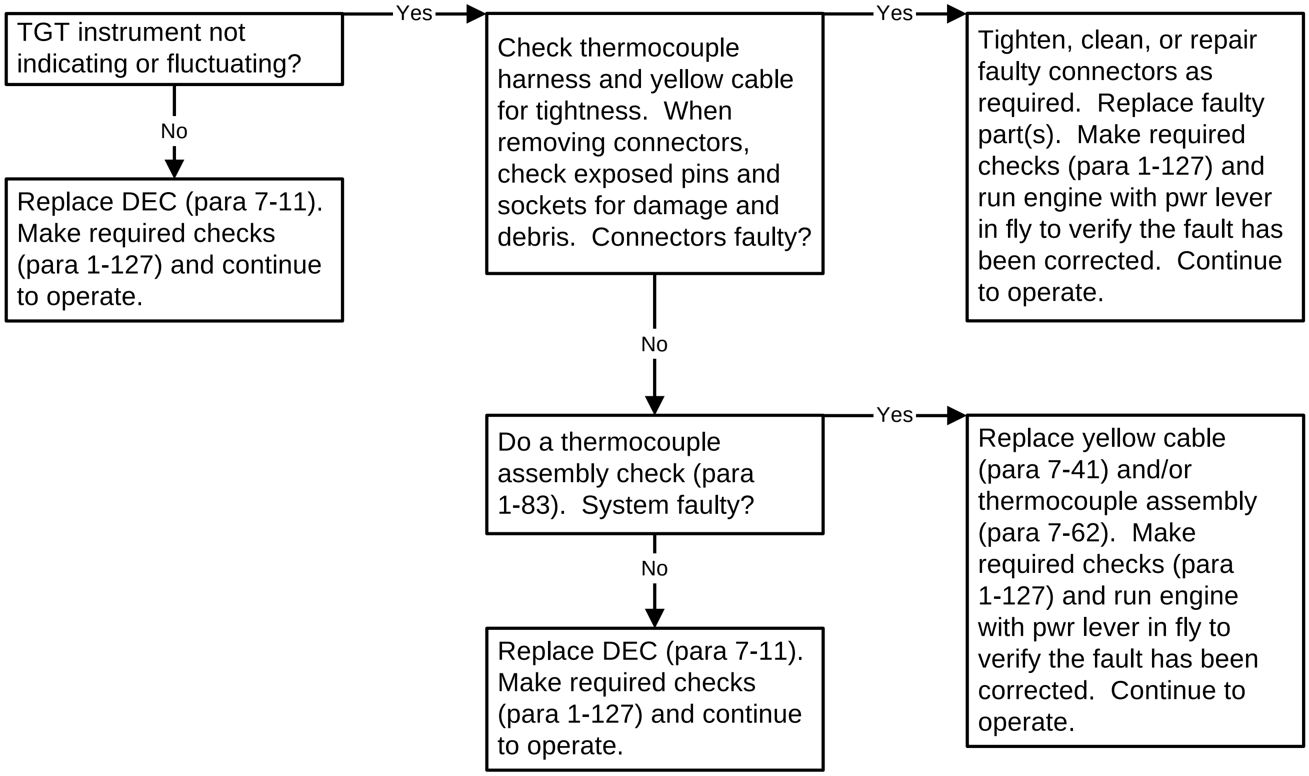
Clean or repair connectors as required, or repair load share cables and make required checks according to applicable aircraft maintenance manual. Run both engines with pwr levers in fly to verify the fault has been corrected and continue to operate.

Replace ECU or DEC on other engine (para 7-11). Run both engines with pwr levers in fly to verify the fault has been corrected. Is fault cleared?

Make required checks (para 1-127) and continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 82. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 45% (±3%) (TGT channel)*



TGT instrument not indicating or fluctuating?

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Check thermocouple harness and yellow cable for tightness. When removing connectors, check exposed pins and sockets for damage and debris. Connectors faulty?

Tighten, clean, or repair faulty connectors as required. Replace faulty part(s). Make required checks (para 1-127) and run engine with pwr lever in fly to verify the fault has been corrected. Continue to operate.

Do a thermocouple assembly check (para 1-83). System faulty?

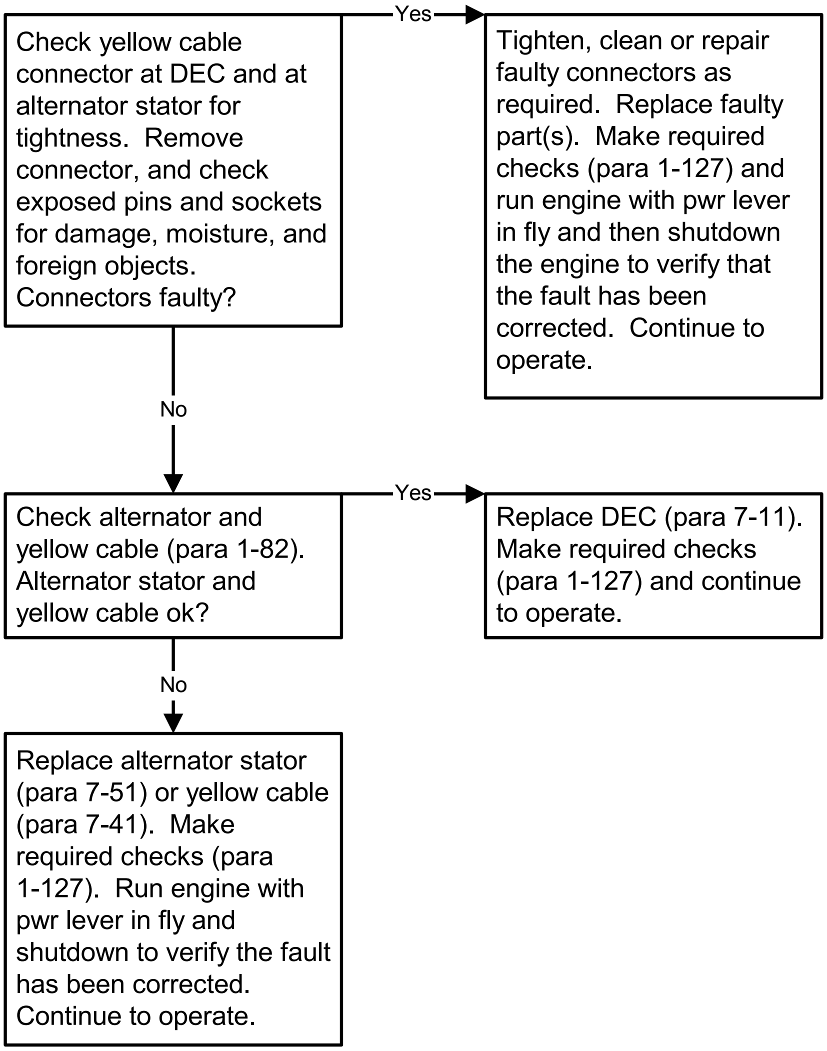
Replace yellow cable (para 7-41) and/or thermocouple assembly (para 7-62). Make required checks (para 1-127) and run engine with pwr lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 83. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 55% (±3%) (alternator power)*

NOTE

Fault code 55% may be displayed after an aborted start. If this occurs, ignore the fault and clear the code, and continue to operate.



Check yellow cable connector at DEC and at alternator stator for tightness. Remove connector, and check exposed pins and sockets for damage, moisture, and foreign objects. Connectors faulty?

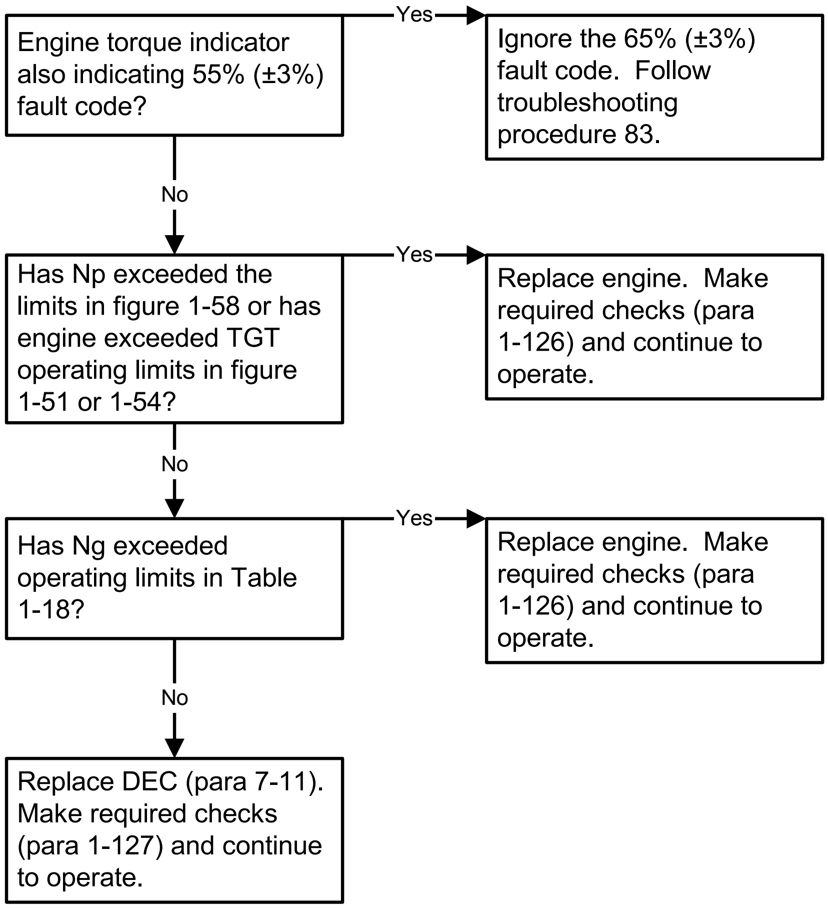
Tighten, clean or repair faulty connectors as required. Replace faulty part(s). Make required checks (para 1-127) and run engine with pwr lever in fly and then shutdown the engine to verify that the fault has been corrected. Continue to operate.

Check alternator and yellow cable (para 1-82). Alternator stator and yellow cable ok?

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Replace alternator stator (para 7-51) or yellow cable (para 7-41). Make required checks (para 1-127). Run engine with pwr lever in fly and shutdown to verify the fault has been corrected. Continue to operate.

*Troubleshooting Procedure 84. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 65% (±3%) (Ng channel)*



Engine torque indicator also indicating 55% (±3%) fault code?

Ignore the 65% (±3%) fault code. Follow troubleshooting procedure 83.

Has Np exceeded the limits in figure 1-58 or has engine exceeded TGT operating limits in figure 1-51 or 1-54?

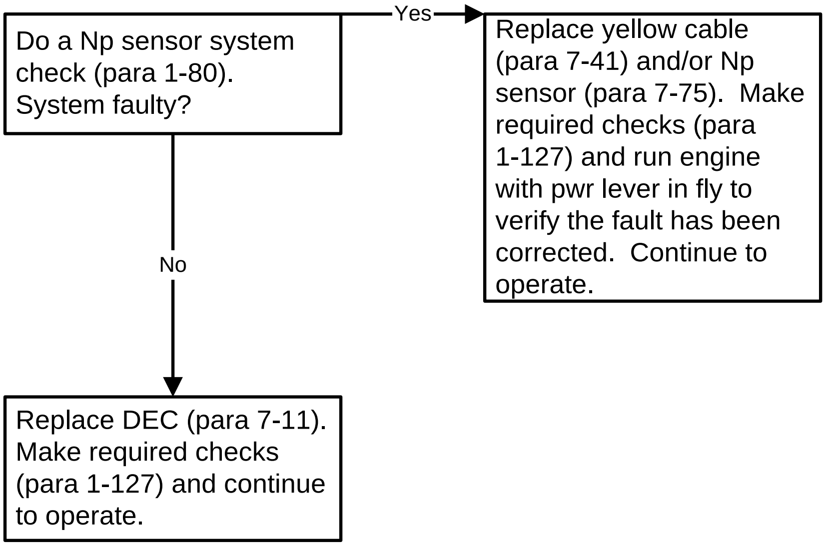
Replace engine. Make required checks (para 1-126) and continue to operate.

Has Ng exceeded operating limits in Table 1-18?

Replace engine. Make required checks (para 1-126) and continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 85. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 75% (±3%) (Np channel)*

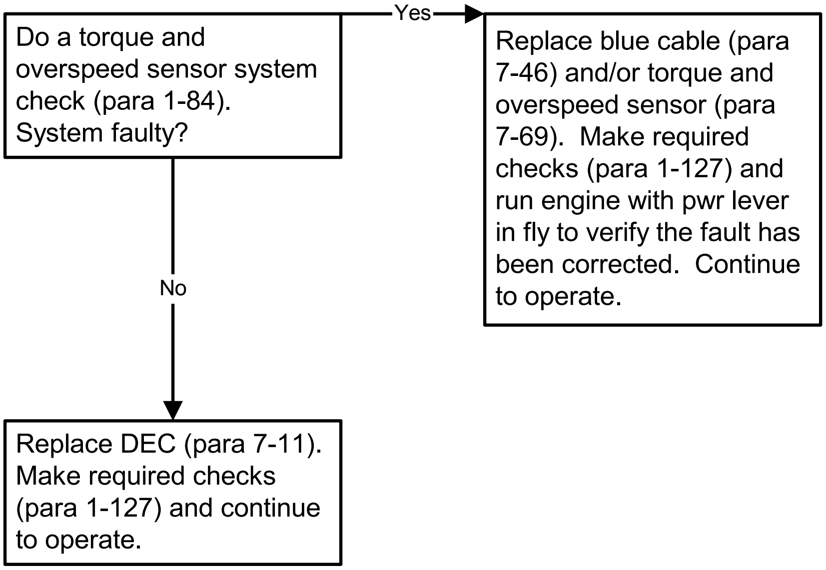


Do a Np sensor system check (para 1-80). System faulty?

Replace yellow cable (para 7-41) and/or Np sensor (para 7-75). Make required checks (para 1-127) and run engine with pwr lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

*Troubleshooting Procedure 86. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 85% (±3%) (torque and overspeed channel)*

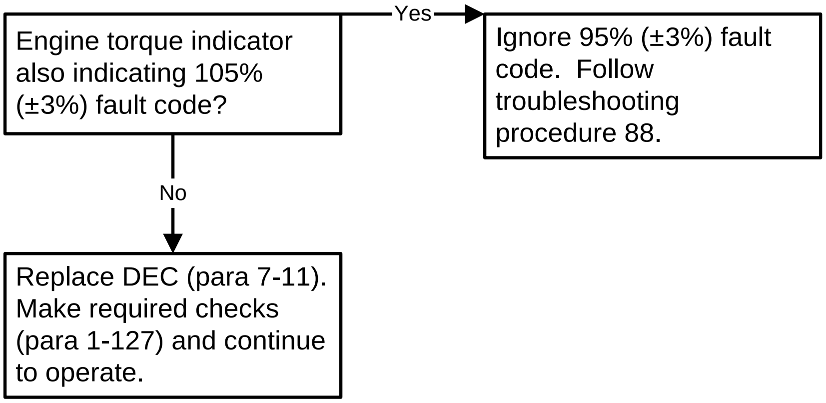


Do a torque and overspeed sensor system check (para 1-84). System faulty?

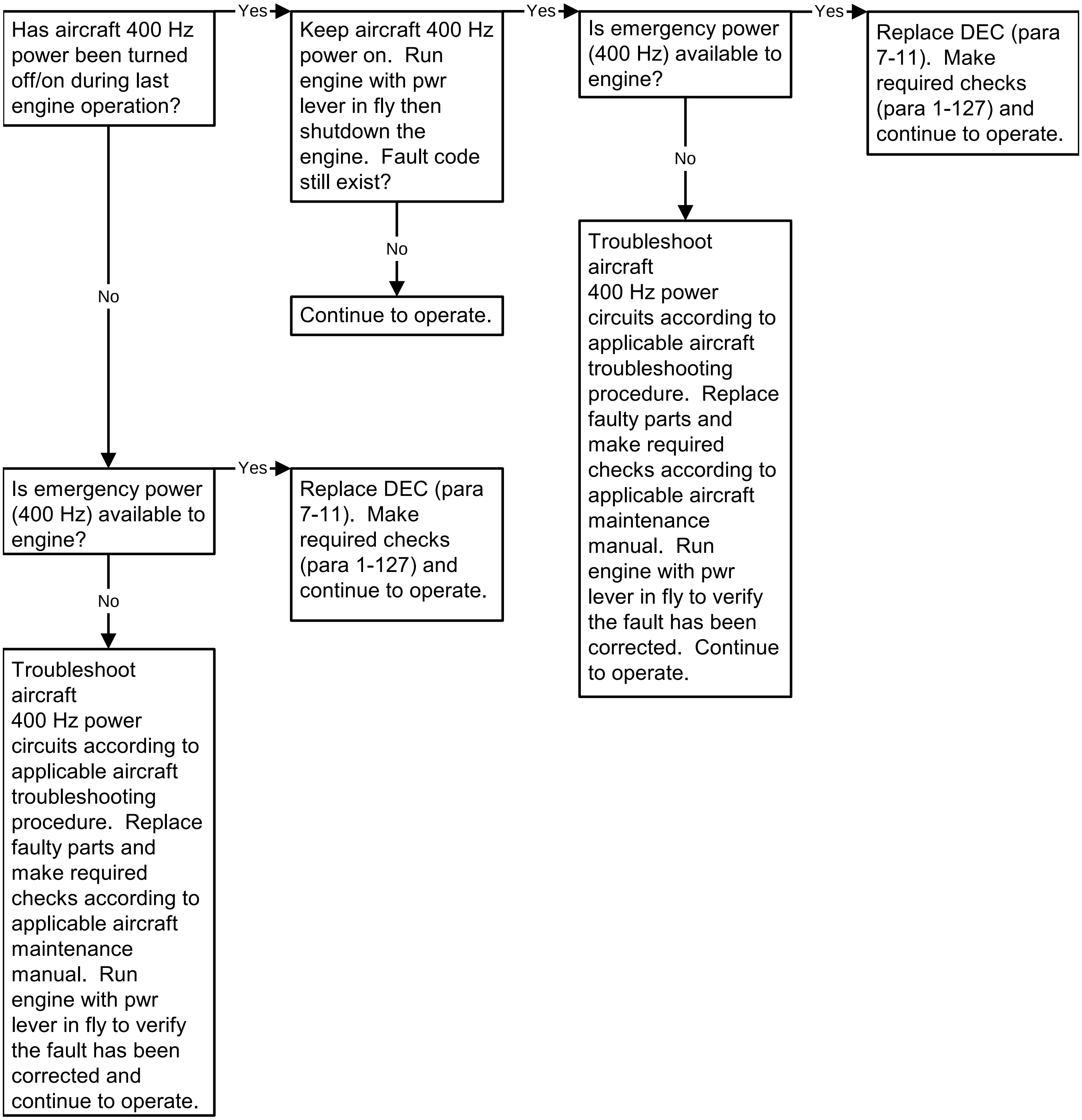
Replace blue cable (para 7-46) and/or torque and overspeed sensor (para 7-69). Make required checks (para 1-127) and run engine with pwr lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

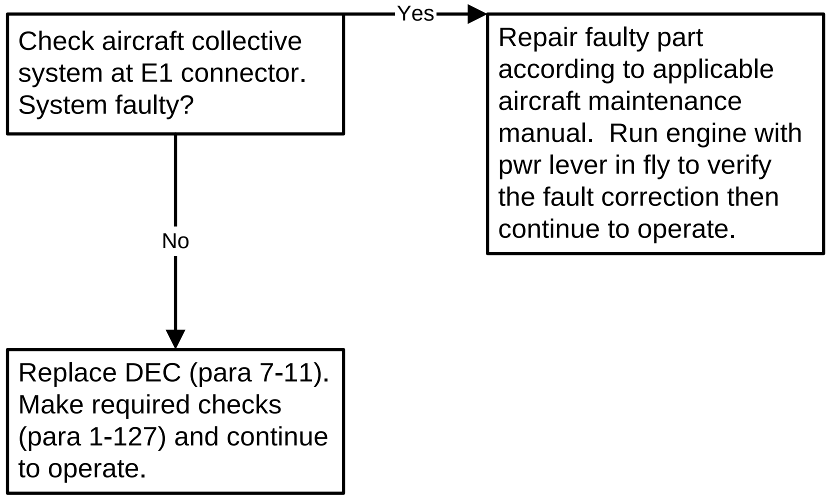
*Troubleshooting Procedure 87. **(T701C, T701D)** DEC - Engine Torque Indicator Fault Code - 95% (±3%) (hot start prevention channel)*



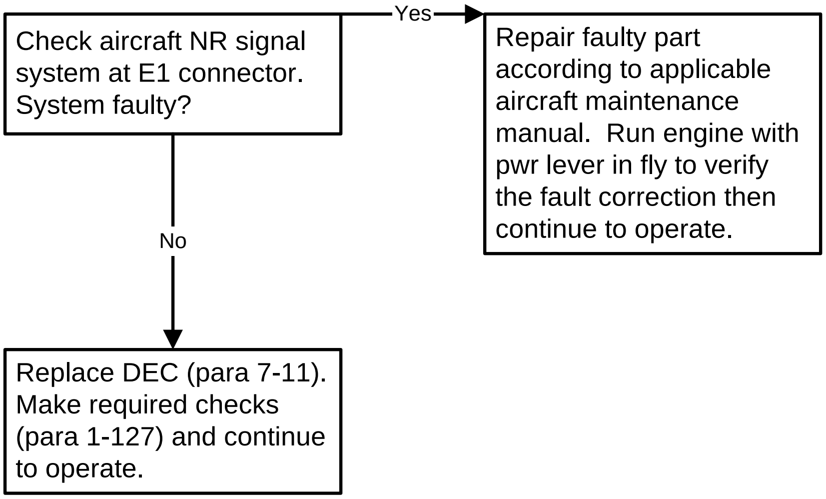
Troubleshooting Procedure 88. ***(T701C, T701D)*** *DEC - Engine Torque Indicator Fault Code - 105% (±3%) (aircraft 400 Hz power)*



Troubleshooting Procedure 89. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 115% (±3%) (collective channel)



Troubleshooting Procedure 90. (T701C, T701D Black Hawk) DEC - Engine Torque Indicator Fault Code - 125% (±3%) (Nr channel)



Check aircraft NR signal system at E1 connector. System faulty?

Repair faulty part according to applicable aircraft maintenance manual. Run engine with pwr lever in fly to verify the fault correction then continue to operate.

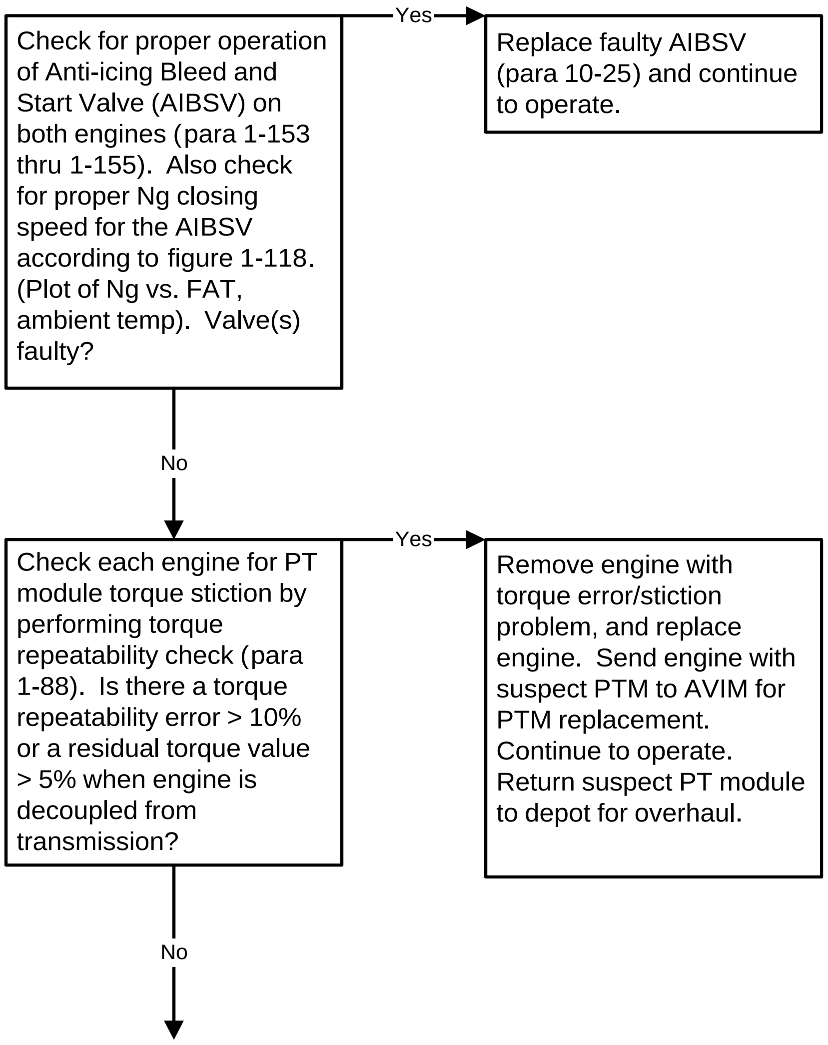
Replace DEC (para 7-11). Make required checks (para 1-127) and continue to operate.

Troubleshooting Procedure 91. Both Engines Oscillate at FLY while at Low Collective Pitch Settings on the Ground (torque fluctuates beyond the ±5% limit with other engine parameters following)

NOTE

This procedure is directed at the FPOG condition characterized by the following observations:

- When one engine torque, TGT, and Ng is increasing, the opposite engine parameters are decreasing a like amount. This behavior will continue as both engines cycle up and down out of phase. The amplitude of the fluctuation is approximately ±5 to 15% of torque. Period of oscillation is approximately 15 seconds from peak value to peak value.
- Both engines must exhibit the instability an approximately equal amount.
- Increasing collective pitch will reduce the oscillations significantly.
- Activating engine anti-ice and customer bleed air diminishes the oscillations.
- The condition is repeatable, returning when collective pitch is decreased.
- The oscillation disappears if lock out is selected for either engine, or either engine is shut down while other engine is operating.
- The Tq oscillations/split does not occur while in flight.



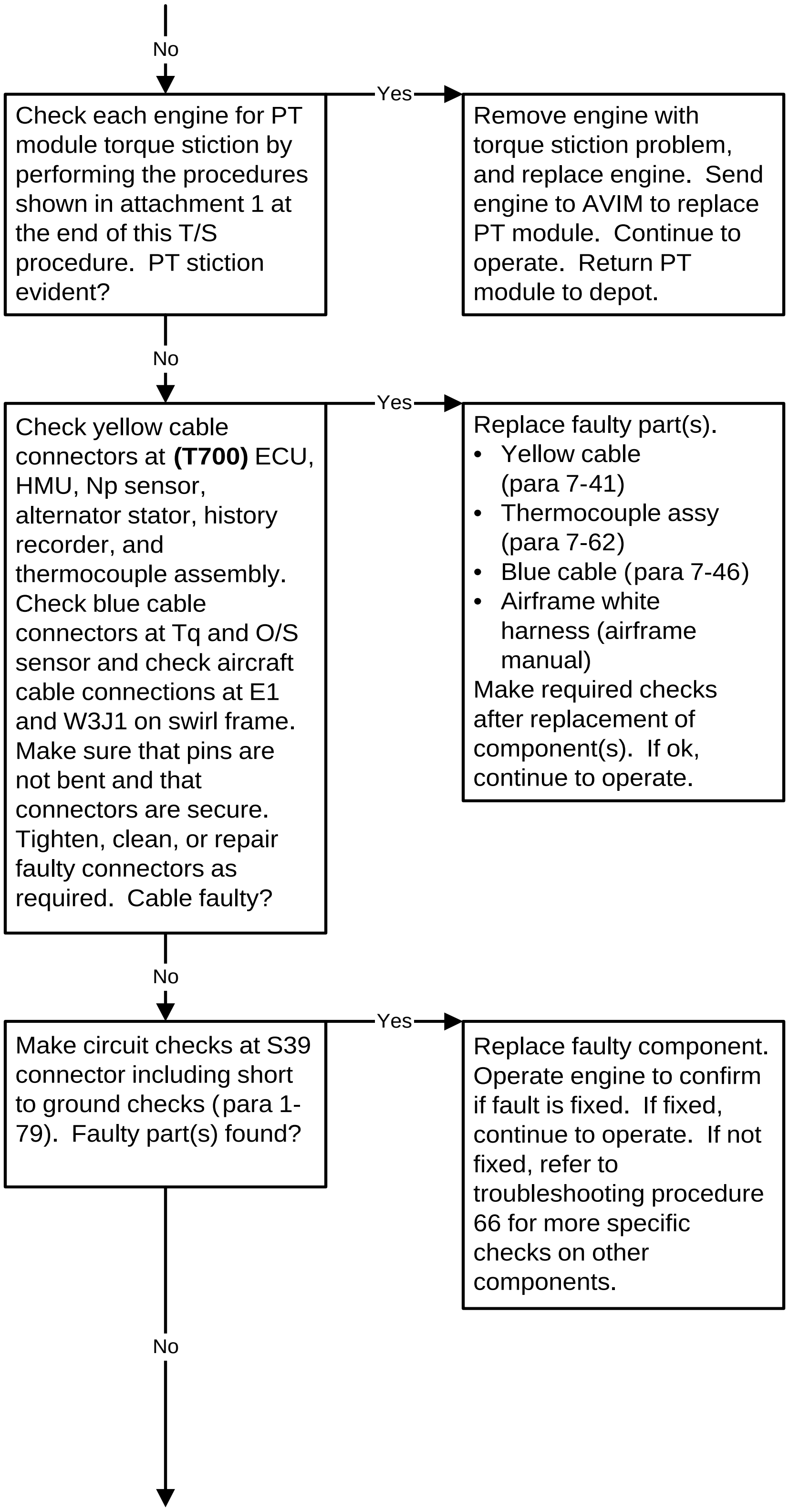
Check for proper operation of Anti-icing Bleed and Start Valve (AIBSV) on both engines (para 1-153 thru 1-155). Also check for proper Ng closing speed for the AIBSV according to figure 1-118. (Plot of Ng vs. FAT, ambient temp). Valve(s) faulty?

Replace faulty AIBSV (para 10-25) and continue to operate.

Check each engine for PT module torque stiction by performing torque repeatability check (para 1-88). Is there a torque repeatability error > 10% or a residual torque value > 5% when engine is decoupled from transmission?

Remove engine with torque error/stiction problem, and replace engine. Send engine with suspect PTM to AVIM for PTM replacement. Continue to operate. Return suspect PT module to depot for overhaul.

Troubleshooting Procedure 91. ***Both Engines Oscillate at FLY while at Low Collective Pitch Settings on the Ground (torque fluctuates beyond the ±5% limit with other engine parameters following) (Cont)***



Check each engine for PT module torque stiction by performing the procedures shown in attachment 1 at the end of this T/S procedure. PT stiction evident?

Remove engine with torque stiction problem, and replace engine. Send engine to AVIM to replace PT module. Continue to operate. Return PT module to depot.

Check yellow cable connectors at **(T700)** ECU, HMU, Np sensor, alternator stator, history recorder, and thermocouple assembly. Check blue cable connectors at Tq and O/S sensor and check aircraft cable connections at E1 and W3J1 on swirl frame. Make sure that pins are not bent and that connectors are secure. Tighten, clean, or repair faulty connectors as required. Cable faulty?

Replace faulty part(s).

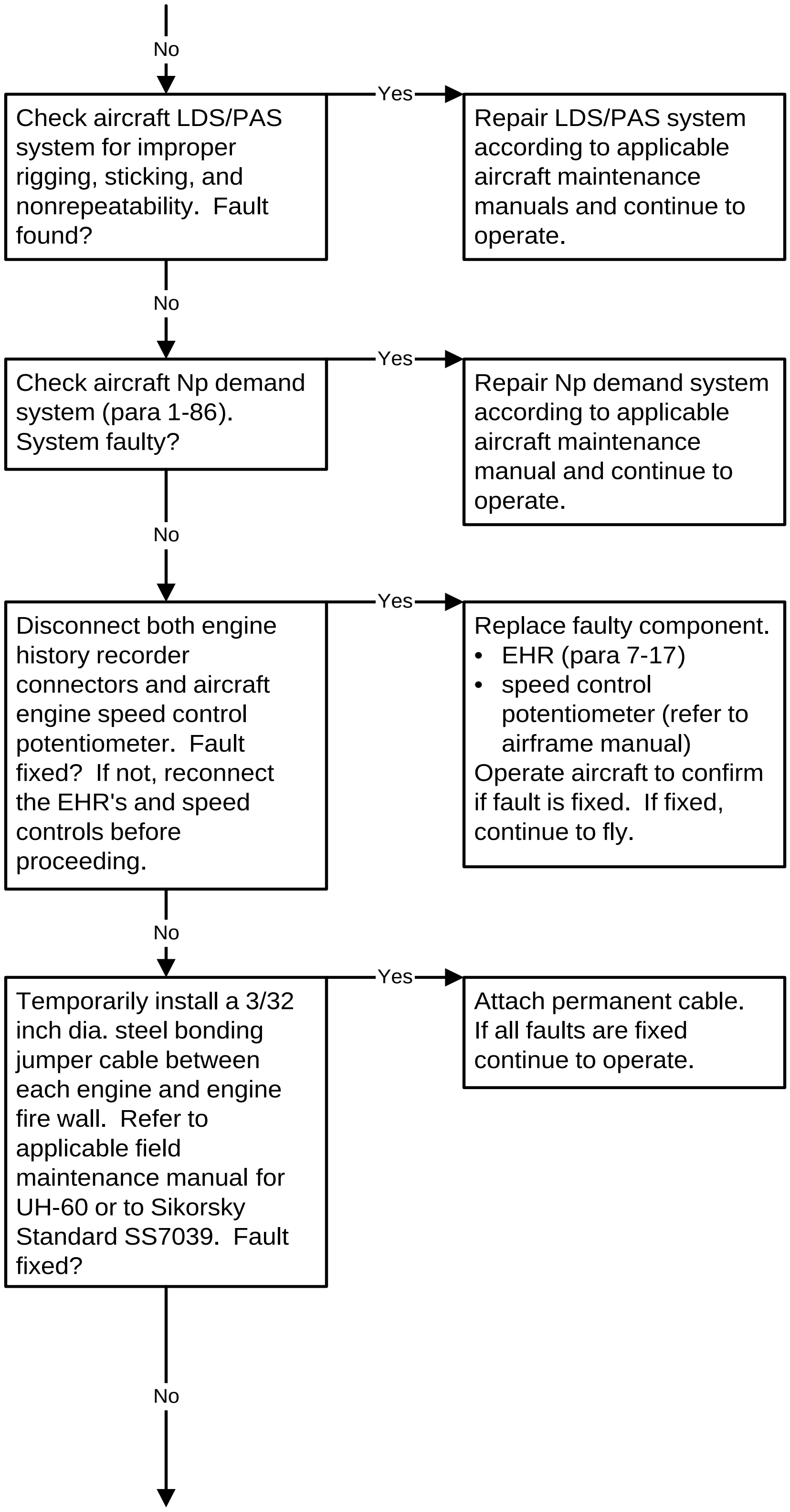
- Yellow cable (para 7-41)
- Thermocouple assy (para 7-62)
- Blue cable (para 7-46)
- Airframe white harness (airframe manual)

Make required checks after replacement of component(s). If ok, continue to operate.

Make circuit checks at S39 connector including short to ground checks (para 1-79). Faulty part(s) found?

Replace faulty component. Operate engine to confirm if fault is fixed. If fixed, continue to operate. If not fixed, refer to troubleshooting procedure 66 for more specific checks on other components.

Troubleshooting Procedure 91. Both Engines Oscillate at FLY while at Low Collective Pitch Settings on the Ground (torque fluctuates beyond the ±5% limit with other engine parameters following) (Cont)



Check aircraft LDS/PAS system for improper rigging, sticking, and nonrepeatability. Fault found?

Repair LDS/PAS system according to applicable aircraft maintenance manuals and continue to operate.

Check aircraft Np demand system (para 1-86). System faulty?

Repair Np demand system according to applicable aircraft maintenance manual and continue to operate.

Disconnect both engine history recorder connectors and aircraft engine speed control potentiometer. Fault fixed? If not, reconnect the EHR's and speed controls before proceeding.

Replace faulty component.
- EHR (para 7-17)
- speed control potentiometer (refer to airframe manual)

Operate aircraft to confirm if fault is fixed. If fixed, continue to fly.

Temporarily install a 3/32 inch dia. steel bonding jumper cable between each engine and engine fire wall. Refer to applicable field maintenance manual for UH-60 or to Sikorsky Standard SS7039. Fault fixed?

Attach permanent cable. If all faults are fixed continue to operate.

Troubleshooting Procedure 91. Both Engines Oscillate at FLY while at Low Collective Pitch Settings on the Ground (torque fluctuates beyond the ±5% limit with other engine parameters following) (Cont)

No

Try to isolate which engine has the smallest TORQUE excursions (smallest delta Tq) during oscillations. Record Max and Min Tq and calculate delta Tq for each engine. Remove the engine with the smallest delta Tq from aircraft. If it is not possible to discern any difference in the two engines, then arbitrarily pick one of the two engines for removal. Remove an engine. Next, either swap this engine with another installed engine from another aircraft or replace with a spare engine. The removed engine can be used as a serviceable spare on another aircraft.

Continue to operate.

If replacing the one engine does not correct the problem, or if the problem returns, replace the opposite engine and continue to operate.

If problem is not resolved by following all steps in this procedure and replacing both engines, call AMCOM, GE, and/or Sikorsky for assistance.

Engine No. 1	Engine No. 2
Max Tq = ____________	Max Tq = ____________
Min Tq = ____________	Min Tq = ____________
Delta Tq = Max - Min = ____________	Delta Tq = Max - Min = ____________

****

AMCOM Engineering
Assistance

Tel. 256-313-4983
DSN 897-4983

****

GE Aircraft Engines
Customer Support
Assistance

See Point of Contact table in Attachment 1 to this troubleshooting procedure.

****

Sikorsky Aircraft
Customer Support
Assistance

Tel. 203-386-4611

****

Attachment 1 to Troubleshooting Procedure 91

PT Shaft Torque Stiction Check Instructions

This procedure requires ground run on aircraft with both engines operating.

1. With both engine PCL's in FLY detent, set NR speed to 100% via NR trim beeper.
2. With No. 2 PCL in FLY detent, slowly retard No. 1 PCL until No. 1 TRQ is approximately 10%. Note that No. 2 engine TRQ will increase to maintain rotor speed. Record OAT and the engine parameters (NG1, NG2, NP1, NP2, TRQ1, TRQ2, TGT1 (same as T4.5), TRQ2, NR) in blocks on table 1-14.
3. Repeat step 2 by retarding No. 1 PCL to decrease No. 1 TRQ to 5%. Record engine parameters. Retard No. 1 PCL to the GI detent. Record engine parameters.
4. With No. 2 PCL still in FLY detent, slowly advance No. 1 PCL to approximately 5% TRQ. Record engine parameters. Advance No. 1 PCL to approximately 10% TRQ. Record engine parameters. Advance No. 1 PCL to FLY.
5. Repeat steps 1 through 4 above on engine No. 2, recording engine parameters at each power setting.

NOTE

It is extremely important to maintain a consistent direction of PCL motion. If in decel direction, do not go below desired point and try to readjust in the accel direction. It is not important to set the TRQ value precisely, rather be consistent in direction. This will prevent masking any potential TRQ hysteresis this procedure is trying to isolate.

The engine parameter data recorded above can be used to generate a TRQ vs. Ng graph, which is used to check for torque hysteresis. A shift in the accel and decel lines indicates hysteresis. The engine exhibiting the shift has torque stiction.

GE can provide assistance in assessing results if data table is faxed to:

Area	Name of POC	Location	Telephone
CONUS-S/SW	Dexton Clarke	Ft. Hood, TX	(254) 532-8006 Office (254) 681-4805 Cell (254) 532-3732 Fax DSN 738-2647 dexton.clarke@ae.ge.com
CONUS-W/NW	Joseph Squarzoni	Ft. Carson, CO	(719) 540-9758 Office (719) 332-8099 Cell (719) 526-0264 Fax DSN 691-0264 joseph.squarzoni@ae.ge.com
CONUS-East	Carl Unger	Ft. Bragg, NC	(910) 436-0788 Office (910) 977-2158 Cell (910) 436-0036 Fax DSN 236-2731 carl.unger@ae.ge.com

Area	Name of POC	Location	Telephone
Ft. Campbell	Dewayne Rudolph	Ft. Campbell, KY	(502) 439-3432 Office (931) 216-7728 Cell (502) 439-7888 Fax DSN 635-1057 dewayne.rudolph@ae.ge.com
Ft. Rucker	Jerry Keeton	Ft. Rucker, AL	(334) 298-0588 Office (334) 298-8823 Fax DSN jerry.keeton@ae.ge.com
USAREUR	Scot Blenman	Seckenheim, Germany	49-621-477306 Office 49-173-7019763 Cell 49-621-477306 Fax DSN 375-6629 scot.blenman@ae.ge.com
USAF Korea	Garry Welch	Camp Humphries	82-31-7134347 Office 82-11-3719978 Cell 82-31-7134347 Fax DSN 753-7082 garry.welch@ae.ge.com

Table 1-14. Engine Ground Run Parameters

A/C TAIL NO. _____________________				PT SHAFT STICTION CHECKS			ENGINE 1 S/N ______________________				
DATE __________________		OAT __________ °C					ENGINE 2 S/N ______________________				
SET:	COLLECTIVE FULL DOWN										
	ROTOR SPEED = 100% WITH BOTH ENGINES IN FLY										
	PCL MUST BE MOVED IN A CONSISTENT DIRECTION SO HYSTERESIS WILL NOT BE ELIMINATED										
	TORQUE CAN BE SET APPROXIMATELY TO MAINTAIN DIRECTION OF PCL										
READING NO.	PCL 1	NG 1	NP 1	TORQUE 1	T45 1	PCL 2	NG 2	NP 2	TORQUE 2	T45 2	ROTOR SPEED
1	FLY					FLY					
2	APPROX 10% TOR					FLY					
3	APPROX 5% TOR					FLY					
4	GI					FLY					
5	APPROX 5% TOR					FLY					
6	APPROX 10% TOR					FLY					
7	FLY					FLY					
8	FLY					APPROX 10% TOR					
9	FLY					APPROX 5% TOR					
10	FLY					GI					
11	FLY					APPROX 5% TOR					
12	FLY					APPROX 10% TOR					
13	FLY					FLY					

1-73. TROUBLESHOOTING CHECKS (AIRCRAFT).

NOTE

- If HMU PN 4046T52G28 or 4046T52G29 (6068T97P07 or 6068T97P08) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU, the opposite engine must be configured with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU. Additionally, both engines must be configured with 5078T29G02 (6080T56P03) or higher DECs.
- If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with 4046T52G30 (6068T97P09) or 4046T52G38 (6068T97P13) HMUs.

1-74. Engine Serviceability Test for No or Low (Below Minimum Limits) Oil Pressure.

a. Remove scavenge screens (para 8-17 **(T700)** or 8-18 **(T701, T701C, T701D)**), one at a time, and inspect for contamination. Place any particles in suitable containers. Attach tag to container. Tag should identify sump where particles were found. Re-install scavenge screens (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).

b. Remove electrical chip detector (para 8-52). Inspect it for contamination. Place any allowable debris (fig. 1-48) in container. Attach tag to container. Re-install electrical chip detector (para 8-55).

c. If impending bypass indicator button has popped, remove oil filter bowl and indicator assembly (para 8-31). Inspect it for debris. Place any debris found in a suitable container. Attach tag to container; tag should identify where debris was found. Re-install oil filter bowl assembly (para 8-34).

d. During engine run, watch for the following:

- Oil filter bypass advisory light coming on.
- Engine chip detector advisory light coming on.
- Unusual changes in engine vibration levels.
- An uncommanded deceleration in Ng and rise in TGT, indicating a possible bearing seizure.

e. Record oil pressures and **(T700, T701C, T701D)** oil temperatures versus Ng for power settings used, and check them against engine history.

NOTE

Refer to instructions in Aircraft Operator's Manual when starting engines.

f. Start faulty engine. Run at ground idle speed for 2 minutes.

g. Advance power control lever to FLY. Increase collective pitch to a torque just below that which will lift helicopter off ground (single engine). Note torque and run at this condition for 10 minutes.

h. Decrease collective pitch and return power control lever to IDLE. Run at this speed for 2 minutes.

i. Advance power control lever to FLY. Increase collective pitch to the torque level noted in step g. Run at this condition for 10 minutes.

j. Decrease collective pitch and return power control lever to IDLE. Run at this condition for 2 minutes.

k. Repeat steps i and j three more times to complete 1 hour engine run.

l. Shut down engine.

m. Remove electrical chip detector (para 8-52 and scavenge screens (para 8-17 **(T700)** or 8-18 **(T701, T701C, T701D)**). Remove oil filter-bowl and indicator assembly (para 8-31) if impending bypass indicator button has popped. Inspect them for allowable debris (fig. 1-48).

(1) If only allowable debris is found and engine has run for 60 minutes with all conditions normal, clean and reinstall chip detector (para 8-55), scavenge screens (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**), and oil filter bowl assembly (para 8-34). Operation can be continued.

(2) If debris is present in large quantities, remove engine from aircraft. Send engine and particles found on chip detector and scavenge screens to Depot.

n. Discard allowable debris found in scavenge screens, chip detector, and oil filter bowl (steps a, b, and c).

1-75. Fuel Flow Verification Checks.

a. Preliminary Information. Procedures in steps b and c can be used to:

(1) Verify fuel flow to engine.

(2) Check the following for faulty operation:

(a) **(T700)** pressurizing and overspeed unit (POU).

(b) **(T701, T701C, T701D)** overspeed and drain valve (ODV).

(3) It is important to understand the following before doing this check:

(a) Step b verifies that fuel is flowing to engine. Fuel should drain from **(T700)** POU, or from **(T701, T701C, T701D)** ODV, out the aircraft common drain, when the power control lever is retarded to OFF.

(b) Step c is a check for faulty operation of **(T700)** POU, or faulty operation of **(T701, T701C, T701D)** ODV. A steady stream of fuel should not drain from the POU, or ODV, out the aircraft common drain, when the power control lever is at IDLE and the engine is motoring. It is normal to observe some leakage, but not a steady stream of fuel from the drain during initial rollover.

(c) Do steps in steps b and c at the same time.

b. Fuel Flow Verification. Fuel is flowing to engine if mist can be seen coming from tailpipe during wet rollover. Verify fuel flow as follows:

(1) Place engine ignition switch to OFF.

(2) Advance power control lever to IDLE.

(3) Motor engine to maximum speed (at least 24% Ng).

(4) Look for fuel mist coming from tailpipe. If no fuel mist is seen, troubleshoot HMU.

(5) After 30 seconds with engine motoring at maximum speed, retard power control lever to OFF.

(6) Within 10 seconds after power control lever is retarded to OFF, about 1/3 ounce (10cc) of fuel should drain from **(T700)** POU manifold assembly, or from **(T701, T701C, T701D)** ODV manifold assembly, out of aircraft common drain.

(7) De-energize starter after a total of 40 seconds.

(8) If fuel does not drain as specified in step (6), replace the following:

- **(T700)** POU (para 6-87)
- **(T701, T701C, T701D)** ODV (para 6-74)

c. **(T700)** POU, or **(T701, T701C, T701D)** ODV Check.

(1) If fuel system has been recently primed, do this check two times. Residual fuel from fuel system priming may flow from overboard drain, giving false indication of a defective **(T700)** POU, or **(T701, T701C, T701D)** ODV. The second check will be a more reliable indicator of **(T700)** POU, or **(T701, T701C, T701D)** ODV operation.

(2) Check for a faulty **(T700)** POU, or **(T701, T701C, T701D)** ODV while doing test in paragraph b (fuel flow verification). If a steady stream of fuel comes from valve at aircraft common drain during motoring with power control lever at IDLE, replace the following:

- **(T700)** POU (para 6-87)
- **(T701, T701C, T701D)** ODV (para 6-74)

1-76. Fuel Filter Bypass Valve Check.

a. Remove fuel filter element and bowl (para 6-52).

b. Push on the bypass valve poppet (sockethead screw) inside fuel filter housing. If it does not move freely, replace fuel filter (para 6-45).

1-77. Checkout of Engine Fuel System. When fuel filter bypass caution light comes on and a lot of debris is found in filter bowl (showing that engine fuel system is dirty), do the following after aircraft fuel system has been flushed.

a. If impending bypass button did not pop out, impending bypass sensor failed. Replace fuel filter (para 6-45).

b. If impending bypass button has popped, clean out filter bowl (para 6-53) and install new filter element (para 6-46). Reset bypass indicator.

c. With external power on, vapor-vent the fuel system for 2 minutes to flush any debris from fuel passages. Then repeat the procedure for 2 more minutes.

d. Because flushing may not remove all debris from internal parts of HMU, replace HMU (para 6-39).

e. Flush out debris from the **(T700)** POU manifold assembly, or **(T701, T701C, T701D)** ODV manifold assembly as follows:

(1) **(T700)** Disconnect POU manifold assembly (para 6-82) from main fuel manifold and fuel start feed tube. Connect drain hoses to coupling nuts and to fitting of manifold assembly.

(2) **(T701, T701C, T701D)** Disconnect ODV manifold assembly (para 6-69) from main fuel manifold. Connect drain hoses to coupling nut and to fitting of ODV manifold assembly.

(3) Place engine ignition switch to OFF.

CAUTION

Do not exceed starter duty cycle. Refer to applicable aircraft maintenance manual for operating limits.

(4) Place ends of drain hoses in a container and make two, 2-minute rollovers with power control lever at IDLE.

(5) **(T700)** Reconnect POU manifold assembly to main fuel manifold and to fuel start feed tube. Tighten (60° wrench arc) coupling nuts.

(6) **(T701, T701C, T701D)** Reconnect ODV manifold assembly to main fuel manifold. Tighten (60° wrench arc) coupling nuts.

(7) Replace the following:

- **(T700)** POU (para 6-87)
- **(T701, T701C, T701D)** ODV (para 6-74)
- Oil cooler (para 8-4)

NOTE

Refer to instructions in Aircraft Operator's Manual when starting engines.

f. Start faulty engine.

g. Run engine for 10 minutes at ground idle speed. Make sure that there are no problems. Make required checks (para 1-127).

h. Shut down engine. Check impending bypass button.

i. If fuel filter bypass caution light did not come on during the 10-minute run and if impending bypass button did not pop, engine can continue in operation.

1-78. Primary Ignition System Check.

The following checks test the circuits in the alternator stator, yellow cable, and ignition exciter assembly. These checks determine which of these components should be replaced.

WARNING

Testing Ignition System

To avoid possible electrical shock, the BAT switch and EXT PWR RESET switch must be OFF.

a. Use a multimeter for this check.

b. Be sure that all electrical connectors are tight.

c. Disconnect aircraft cable from electrical connector (W3J1 - green cable) on flange of swirl frame.

d. Measure resistance between pins 17 and 18 in electrical connector (W3J1 - green cable). Resistance must be 10-15 ohms. If resistance is within limits, go to step k. If resistance is out-of-limits, go to step e.

e. Remove electrical connector (W3P1 - green cable) from alternator stator.

f. Check socket-to-pin continuity between electrical connector (W3P1) and electrical connector (W3J1) on flange of swirl frame (see following list). No open circuits allowed.

W3P1 Sockets		W3J1 Pins
1	to	17
2	to	18
3	to	19
4	to	20
5	to	21

g. Check for socket-to-ground shorts between five sockets in electrical connector (W3P1) and ground. No short circuits allowed.

h. If green cable fails continuity checks, replace it (para 7-35). If green cable passes continuity checks, go to step i.

i. Measure resistance between pins 1 and 2 in alternator stator connector (J1) (where green cable was disconnected). Resistance must be:

- **(T700)** 10 - 15 ohms
- **(T701, T701C, T701D)** 1.5 - 3.0 ohms

j. If resistance is out-of-limits, circuit is open or shorted; replace alternator stator (para 7-49). If resistance is within limits, go to step k.

k. Measure resistance between pins 2 and 3 in alternator stator connector (J1) (where green cable was disconnected). Resistance must be:

- **(T700)** 1.5 - 3.0 ohms
- **(T701, T701C, T701D)** 1.0 - 3.0 ohms

l. If resistance is out-of-limits, circuit is open or shorted. Go to step m.

m. Isolate fault to yellow cable or ignition exciter assembly as follows:

(1) Disconnect yellow cable from alternator stator and ignition exciter assembly.

(2) Check socket-to-socket continuity between the two disconnected connectors - electrical connector (W4P5 - yellow cable) and electrical connector (W4P6 - yellow cable) (see following list). No open circuits allowed.

W4P5 Sockets		W4P6 Pins
1	to	1
2	to	2

(3) Check either connector for short circuit between sockets 1 and 2. No short circuits allowed.

(4) If yellow cable fails continuity or short-circuit checks, replace it (para 7-41). If yellow cable passes continuity and short-circuit checks, replace ignition exciter assembly (para 7-29).

1-79. Circuit Checks at S39 Connector on ECU or DEC.

ECU or DEC circuit continuity switch boxes 21C7085G01 and 21C7085G02 (fig. 1-49) are provided so that circuits can be checked through the S39 connector on the ECU or DEC.

- **(T701)** - Use switch box 21C7085G02.
- **(T700, T701C, T701D)** - Use switch box 21C7085G01. Refer to Preinstallation Buildup (para 1-200) to determine aircraft configuration.

The following steps outline the general procedure and provide limits. All limits are sufficient when circuit checks are done at moderate temperatures. However, readings may vary if checks are performed when temperatures are more extreme.

a. Use a multimeter for this check.

b. Connect switch box to S39 connector as follows:

(1) Remove cover from S39 connector.

(2) Connect switch box cable to S39 connector.

CAUTION

Do not exceed 1.5 volts dc on multimeter, because the ECU, or DEC will be damaged.

(3) Connect multimeter to red and black terminals on switch box.

c. Check circuits for resistance as follows:

NOTE

- External power shall be off while performing switch position checks 1 thru 9, and 11.
- When measuring resistance on a **(T701C, T701D)** DEC installed in a **UH-60L** model aircraft, external power must be applied to increase trim to both maximum and minimum positions (switch position 10). Once trim is in either maximum or minimum positions, remove power by either turning off the aircraft power or pulling the overspeed circuit breaker (which removes aircraft power from the DEC).

(1) Position selector switch to select the circuit to be tested. The following list identifies circuits and provides resistance limits:

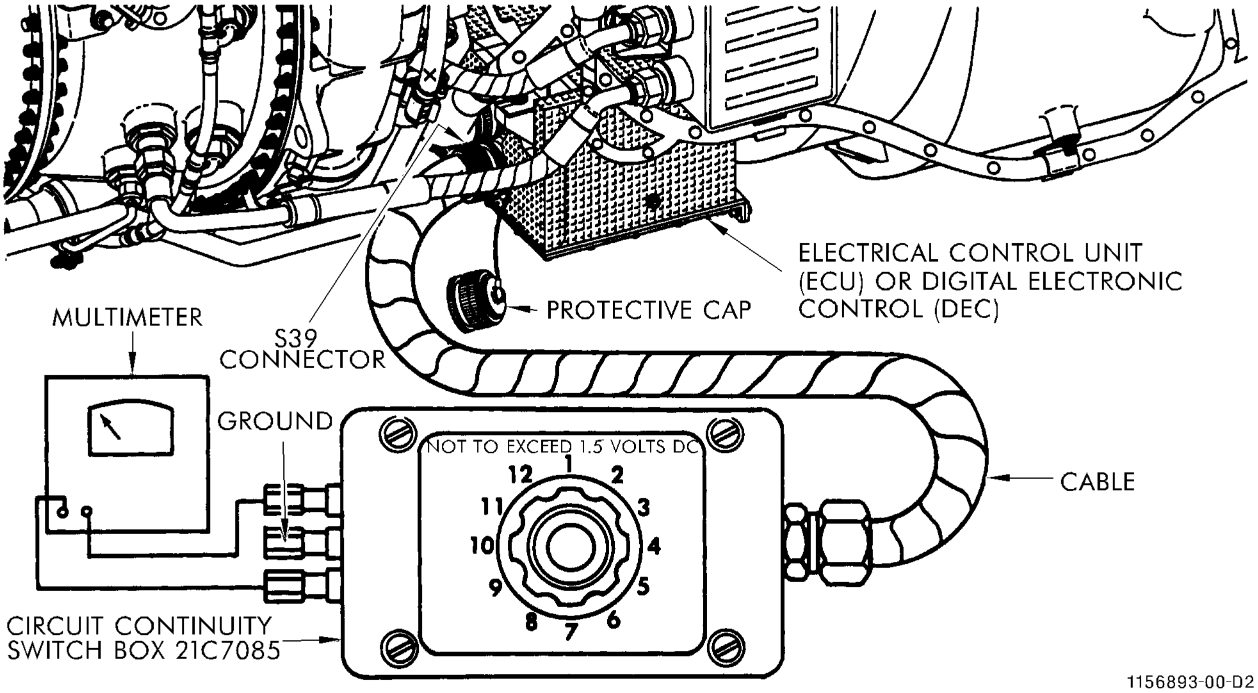


Figure 1-49. ECU/DEC Circuit Continuity Switch Box for S39 Connector

Switch Position	Circuit	Resistance Limits In Ohms Min	Resistance Limits In Ohms Max
1	Alternator ECU, or DEC power winding:		
	(T700)	2.0	4.0
	(T701, T701C, T701D)	1.5	4.0
2	Thermocouple assembly	1.0	5.0
3	HMU linear variable displacement transducer (LVDT)	3	35
4	Np sensor	13	21
5	Torque and overspeed sensor	13	21
6	Overspeed solenoid valve:		
	(T700) POU	18	24
	(T701, T701C, T701D) ODV	18	24
7	HMU torque motor	45	90
8	Do not use	--	--
9	Do not use	--	--

NOTE

- Aircraft demand must be set to the minimum and maximum trim positions during the following check. The E1 harness must also be connected.
- External power may be on while performing switch position check 10.

Switch Position	Circuit	Resistance Limits In Ohms Min	Resistance Limits In Ohms Max
10	Np demand to common ground Trim limits are:		
	(T700) ECU:	125±20	881±95
	(T701C, T701D) DEC:	203±20	959±95
	(T701, T701C, T701D AH-64A) Np demand to common ground (Adjust Turbine Speed Control Unit located in aft avionics bay. Record initial multimeter reading before breaking locknut and turning adjuster to the maximum position (250 ohms). Then, turn adjuster to the minimum position (2300 ohms). Turn adjuster to the initial (recorded) setting.)		
11	Loadshare-to-aircraft ground	Short to ground check only	
12	Do not use	--	--

(2) Check each circuit for resistance limits. (If resistance checks are within limits, proceed to step d). If resistance is out-of-limits, troubleshoot fault according to the following individual circuit checks as outlined in paragraphs listed below:

Circuit Checks	Paragraph
Np Sensor	1-80
HMU	1-81
Alternator	1-82
Thermocouple Assembly	1-83
Torque and Overspeed Sensor	1-84
Overspeed System:	
(T700) POU	1-85
(T701, T701C, T701D) ODV	1-85
Np Demand and Load Share	1-86

d. Check each circuit for shorts-to-ground as follows:

(1) Remove test lead connected to red terminal, and connect lead to green terminal.

(2) Check each circuit listed in step c(1) at the corresponding switch position; no short circuits allowed. Minimum resistance to ground will be 1 megohm. If a short circuit is found, disconnect E1 connector from both ECUs/DECs to isolate fault to aircraft wiring system or to engine.

(3) If short circuit remains with both E1 harnesses disconnected, isolate fault by removing electrical connector (W4P1 - yellow cable) from ECU/ DEC. If short circuit remains, problem is in blue cable system and fault must be isolated to one of the following components:

- Blue cable or torque and overspeed sensor (para 1-84)
- **(T700)** POU overspeed solenoid (para 1-85)
- **(T701, T701C, T701D)** ODV overspeed solenoid (para 1-85)

(4) If short circuit is no longer present, problem is in yellow cable system and fault must be isolated to either yellow cable or connecting sensors. Reconnect electrical connector (W4P1 - yellow cable) to ECU/DEC.

(5) Isolate fault to either yellow cable or component by disconnecting electrical connectors (yellow cable) one at a time from each of the following components:

- Np sensor
- HMU
- Alternator
- Thermocouple Assembly
- History Recorder

(6) Troubleshoot fault according to the following individual circuit checks in paragraphs listed below, if necessary.

Circuit Checks	Paragraph
Np sensor	1-80
HMU	1-81
Alternator	1-82
Thermocouple Assembly	1-83
ECU/DEC	1-81

(7) If the above circuit checks and the respective yellow cable checks are within limits, fault is either in W4P4 yellow cable or history recorder, or history counter. Check yellow cable as follows:

(a) Disconnect yellow cable at ECU/DEC and at history recorder, or history counter.

(b) Check socket-to-socket continuity between electrical connector (W4P1 - yellow cable) and electrical connector (W4P4 - yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P4 Sockets
13	to	1
25	to	2
11	to	3
23	to	11
24	to	12
10	to	5
22	to	6
26	to	8
27	to	9

(c) Check for short circuits between sockets 1, 2, 3, 11, 12, 5, 6, 8, and 9 in electrical connector (W4P4). No short circuits allowed.

(d) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(e) If yellow cable is faulty, replace it (para 7-41).

(f) If yellow cable is not faulty, fault is in history recorder or history counter. Replace history recorder, or history counter (para 7-17).

(8) Repeat steps (1) thru (4).

1-80. Np Sensor System Check. The following checks will determine whether the Np sensor or the yellow cable is faulty.

a. Using switch box **(T701)** 21C7085G02 or **(T700, T701C, T701D)** 21C7085G01, make circuit resistance and short circuit checks (see paragraph 1-79 for instructions and limits) through S39 connector on ECU/DEC. Set selector switch at position number 4. If reading is out of limits, circuit is open or shorted. Do steps b and c to isolate fault to either Np sensor or yellow cable.

b. Check Np sensor as follows:

(1) Disconnect yellow cable from Np sensor.

(2) Measure resistance between pins A and C and between pins B and D in connector (J1) on Np sensor. See figure FO-2 (located directly after alphabetical index) for pin locations. Normal resistance for both readings is 13 to 21 ohms.

(3) Check each pin for short circuit-to-ground. No short circuits allowed.

(4) If readings are out-of-limits, circuit is faulty. Replace Np sensor (para 7-75).

c. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/ DEC and Np sensor.

(2) Check socket-to-socket continuity between electrical connector (W4P1 - yellow cable) and electrical connector (W4P2 - yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P2 Pins
9	to	A
8	to	B
20	to	C
21	to	D

(3) Check for short circuits between sockets A, B, C, and D or 9, 8, 20, and 21. No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If yellow cable is faulty, replace it (para 7-41).

(6) If yellow cable is not faulty, reconnect it to ECU/DEC and Np sensor.

(7) After completion of final testing, seal connectors (para H-9, Appendix H).

1-81. ECU/DEC and HMU System Check. The following checks test the circuits for the torque motor and LVDT in the HMU, and also check the circuits in the yellow cable that connect the ECU/DEC to the HMU. These checks determine whether the ECU/DEC, HMU, or the yellow cable should be replaced.

a. Using switch box **(T701)** 21C7085G02 or **(T700, T701C, T701D)** 21C7085G01, make circuit resistance and short circuit checks (see paragraph 1-79 for instructions and limits) through S39 connector on ECU/DEC. Set selector switch at position numbers 3 and 7. If readings are out-of-limits or if an open or short circuit is found, do steps b and c to isolate fault to either HMU or yellow cable.

b. Check HMU as follows:

(1) Disconnect yellow cable from HMU.

CAUTION

If HMU is installed on engine, pins could be bent when measuring resistance between them, and when checking each one for short circuit-to-ground. Therefore, a mating plug should be used to prevent damage to pins.

(2) Measure resistance between pins in connector (J1) on HMU. The resistance will be as follows:

Pins on HMU	Resistance (ohms)	
	Hamilton Std	Woodward Governor
Pins 1 and 2 (torque motor)	105-165	135-155
Pins 3 and 4 (torque motor)	105-165	135-155
Pins 6 and 7 (LVDT primary)	10-25	5-35
Pins 7 and 8 (LVDT primary)	10-25	15-25
Pins 6 and 8 (LVDT primary)	20-50	30-50
Pins 9 and 10 (LVDT secondary)	20-45	30-50
Pins 11 and 12 (LVDT secondary)	20-45	30-50

(3) Check each pin for short circuit-to-ground. No short circuits allowed.

(4) If readings are out of limits, circuit is faulty. Replace HMU (para 6-39). If readings are within limits, continue to step c.

c. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/DEC and HMU.

(2) Check socket-to-socket continuity between electrical connector (W4P1 - yellow cable) and electrical connector (W4P3 - yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P3 Pins
1	to	1
2	to	2
3	to	3
4	to	4
5	to	6
6	to	7
7	to	8
15	to	9
16	to	10
17	to	11
18	to	12

(3) Check for short circuits between sockets 1, 2, 3, 4, 5, 6, 7, 15, 16, 17, and 18 in electrical connector (W4P1). No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If yellow cable is faulty, replace it (para 7-41).

(6) If yellow cable is not faulty, reconnect it to ECU/DEC and HMU.

1-82. Alternator and Yellow Cable Check. The following checks test the alternator windings and the circuits in yellow cable that connect the ECU/ DEC to the alternator. These checks determine whether the alternator stator or the yellow cable should be replaced.

a. Using switch box **(T701)** 21C7085G02 or **(T700, T701C, T701D)** 21C7085G01, make circuit resistance and short circuit checks (see paragraph 1-79 for instructions and limits) through S39 connector on ECU/DEC. Set selector switch at position number 1. If reading is out of limits or if an open or short circuit is found, do steps b and c to isolate fault to either alternator or yellow cable.

b. Check alternator as follows:

(1) Disconnect yellow and green cables from alternator.

CAUTION

When measuring pin-to-pin resistance, use care to prevent bending of individual pins.

(2) Measure resistance between pins 3 and 5 in connector (J2) on alternator. Resistance must be:

- **(T700)** 2.0 - 4.0 ohms
- **(T701, T701C, T701D)** 1.0 - 2.5 ohms

(3) Check each pin for short circuit-to-ground. Minimum resistance shall be 20 megohms.

(4) Measure pin-to-pin resistance of the J2 connector between pins 1 and 2, 3, 4, 5 respectively and between pins 2 and 3, 4, 5 respectively. Minimum resistance shall be 20 megohms.

(5) If reading is out-of-limits, circuit is faulty. Replace alternator stator (para 7-51). If reading is within limits, continue to step c.

c. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/DEC, alternator, and at ignition exciter.

(2) Check socket-to-socket continuity between electrical connector (W4P1 - yellow cable) and electrical connector (W4P5 - yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P5 Pins
30	to	3
31	to	4
19	to	5

(3) Check for short circuits between sockets 3, 4, and 5 in electrical connector (W4P5). No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If yellow cable is faulty, replace it (para 7-41).

(6) If yellow cable is not faulty, reconnect it to ECU/DEC, alternator, and ignition exciter.

d. If neither alternator nor yellow cable is faulty, replace ECU/DEC (para 7-11).

1-83. Thermocouple Assembly Check. The following checks test the circuits in the thermocouple assembly and the circuits in the yellow cable that connect the thermocouple assembly to the ECU/ DEC. These checks determine whether the thermocouple assembly or the yellow cable should be replaced.

a. Using switch box **(T701)** 21C7085G02 or **(T700, T701C, T701D)** 21C7085G01, make circuit resistance and short circuit checks (see paragraph 1-79 for instructions and limits) through S39 connector on ECU/DEC. Set selector switch at position number 2. If reading is out of limits, or if an open or short circuit is found, do steps b and c to isolate the fault to either thermocouple assembly or yellow cable.

b. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/DEC and at thermocouple assembly.

(2) Check socket-to-socket continuity between electrical connector (W4P7 - yellow cable) and electrical connector (W4P1 - yellow cable) (see following list). No open circuits allowed.

W4P7 Sockets		W4P1 Sockets
A or D	to	28
B or C	to	29

CAUTION

When measuring pin-pin resistance, use care to prevent bending of individual pins.

(3) Insert contact pin PN M39029/4-111 in pin A or D of thermocouple connector W4P7 and contact pin PN M39029/4-110 in pin 28 of DEC/ECU connector W4P1.

NOTE

The digital multimeter or equivalent should be sensitive to milli-ohms to ensure small resistance changes will be indicated.

(4) Check for circuit resistance between pin A or D of thermocouple connector W4P7 and pin 28 of ECU/DEC connector W4P1. Circuit resistance shall be less than 0.50 ohms.

NOTE

Make sure connections are secure while flexing cable to prevent premature cable rejection.

(5) Hold yellow electrical cable 3 inches from thermocouple connector W4P7. Flex cable in smooth 75 to 90 degree bend, once in each clock position; 3, 6, 9, and 12 o'clock. Circuit resistance shall remain steady during flexing. A change in circuit resistance of 5.0 ohm or greater is cause for rejection.

CAUTION

When measuring pin-pin resistance, use care to prevent bending of individual pins.

(6) Insert contact pin PN M39029/4-111 in pin B or C of thermocouple connector W4P7 and contact pin PN M39029/4-110 in pin 29 of ECU/DEC connector W4P1.

(7) Check for circuit resistance between pin B or C of thermocouple connector W4P1. Circuit resistance shall be less than 1.00 ohms

(8) Flex thermocouple connector W4P7 as in step (5).

(9) Check pins 28 and 29 of ECU/DEC connector W4P1 for short circuit to outer metal braid of yellow electrical cable while flexing cable (step (5)). No short circuit allowed. Minimum resistance shall be 1 megohm.

(10) Check pins 28 and 29 of ECU/DEC connector W4P1 for short circuit while flexing cable (step (5)). No short circuit allowed. Minimum resistance shall be 1 megohm.

(11) If yellow cable is faulty, replace it (para 7-41).

c. Check thermocouple assembly as follows:

(1) Check pins C and D for short circuit to outer metal braid of cable. No short circuits allowed.

(2) If thermocouple assembly is faulty, replace it (para 7-62).

(3) Remove contact pins from connectors W4P1 and W4P7. Connect yellow electrical cable connectors to thermocouple assembly and ECU/DEC connectors.

1-84. Torque and Overspeed Sensor System Check. The following checks test the circuits in the torque and overspeed sensor and circuits in the blue cable that connect the sensor to the ECU/DEC. These checks determine whether the sensor or the blue cable should be replaced.

a. Using switch box **(T701)** 21C7085G02 or **(T700, T701C, T701D)** 21C7085G01, make circuit resistance and short circuit checks (see paragraph 1-79 for instructions and limits) through S39 connector on ECU/DEC. Set selector switch at position number 5. If reading is out-of-limits, or if an open or short circuit is found, do steps b and c to isolate fault to either torque and overspeed sensor or blue cable.

b. Check torque and overspeed sensor as follows:

(1) Disconnect blue cable from sensor.

(2) Measure resistance between pins A and C and between pins B and D in connector (J1) on sensor. Normal resistance for both readings is 13 to 21 ohms.

(3) Check each pin for short circuit-to-ground. No short circuits allowed.

(4) If readings are out-of-limits, circuit is faulty. Replace torque and overspeed sensor (para 7-69).

c. Check blue cable as follows:

(1) Disconnect blue cable at ECU/DEC.

(2) Check socket-to-socket continuity between electrical connector (W5P1 - blue cable) and electrical connector (W5P3 - blue cable) (see following list). No open circuits allowed.

W5P1 Sockets		W5P3 Sockets
3	to	D
10	to	C
11	to	B
12	to	A

(3) Check for short circuits between sockets 3, 10, 11, and 12 or A, B, C, and D. No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If blue cable is faulty, replace it (para 7-46).

(6) If blue cable is not faulty, reconnect it to ECU/DEC and torque and overspeed sensor.

(7) After completion of final testing, seal connectors (para H-9, Appendix H).

1-85. Overspeed System Check for (T700) Pressurizing and Overspeed Unit (POU), and (T701, T701C, T701D) Overspeed and Drain Valve (ODV). The checks in this paragraph test the circuits in the following:

- **(T700)** POU
- **(T701, T701C, T701D)** ODV
- blue cable that connects the ECU/ DEC to the **(T700)** POU, or **(T701, T701C, T701D)** ODV

These checks determine whether the valve or the blue cable should be replaced.

a. Using switch box **(T701)** 21C7085G02 or **(T700, T701C, T701D)** 21C7085G01, make circuit resistance and short circuit checks (see paragraph 1-79 for instructions and limits) through S39 connector. Set selector switch at position number 6. If reading is out-of-limits, the circuit is open or shorted. Do steps b and c to isolate fault to either the valve or blue cable.

b. Check **(T700)** POU, or **(T701, T701C, T701D)** ODV as follows:

(1) Disconnect blue cable from the valve.

(2) Measure resistance between pins 1 and 3 and between pins 2 and 4 in connector (J1) on valve. Normal resistance for both readings is 18 to 24 ohms.

(3) Check each pin for short circuit-to-ground. No short circuit allowed.

(4) If readings are out of limits, circuit is faulty. Replace the following:

- **(T700)** POU (para 6-87)
- **(T701, T701C, T701D)** ODV (para 6-74)

c. Check blue cable as follows:

(1) Disconnect blue cable at **(T700, T701)** ECU, or **(T701C, T701D)** DEC.

(2) Check socket-to-socket continuity between electrical connector (W5P1 - blue cable) and electrical connector (W5P2 - blue cable) (see following list). No open circuits allowed.

W5P1 Sockets		W5P2 Sockets
5	to	1
6	to	2
7	to	3
8	to	4

(3) Check for short circuit between sockets 1, 2, 3, and 4 in electrical connector (W5P2). No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If blue cable is faulty, replace it (para 7-46).

(6) If blue cable is not faulty, reconnect it to **(T700, T701)** ECU, or **(T701C, T701D)** DEC and to POU or ODV.

1-86. Checking Aircraft Np Demand System, Load Share, and Instrument Indicating Cables. This procedure outlines aircraft checks for both engine systems to determine whether the fault is in the Np potentiometer or in the aircraft cable that connects to the E1 connector on the engine **(T700, T701)** ECU, or **(T701C, T701D)** DEC.

WARNING

Testing Ignition System

To avoid possible electrical shock or damage to test equipment, the BAT switch and EXT PWR RESET switch must be OFF.

a. Use a multimeter for these checks.

b. Check aircraft cables for loose connectors and for damaged pins or sockets according to applicable aircraft maintenance manual.

c. Check Np demand system as follows:

(1) Disconnect aircraft cable connector (E1) from **(T700, T701)** ECU, or **(T701C, T701D)** DEC connector.

(2) Check the aircraft cable connector (E1) for:

(a) Short circuits between sockets 18 and 20; and between 19 and 20. No short circuits allowed.

(b) Short circuits between aircraft ground and sockets 3, 18, 19, 20, 21, and 22. No short circuits allowed.

(c) Resistance between sockets 18 and 20; 19 and 20; 21 and 20. (See applicable aircraft maintenance manual for limits and circuitry.) If an open circuit is found during these checks, check continuity in cable between sockets 18, 19, 20, and 21, and corresponding pin at other end of circuit.

(d) **(T700)** Proper operation of beeper trim system at four or more settings from min beep to max beep. Resistance between pins 20 and 21 (common to wiper) on both engine systems must not differ from one another by more than 300 ohms for a given trim setting. If resistance differs by more than 300 ohms, there is probably a fault in the aircraft trim system. Correct the fault. (Refer to applicable aircraft maintenance manual.)

d. Check load share system as follows:

(1) Disconnect both aircraft cable connectors (E1) from both **(T700, T701)** ECUs, or **(T701C, T701D)** DECs.

(2) Check for continuity in the load share circuits between engines as follows: from socket 23 of number one engine to socket 24 of number two engine; from socket 23 of number two engine to socket 24 of number one engine. No open circuits allowed.

(3) Check for short circuits between aircraft ground and sockets 23 and 24 in each connector. No short circuits allowed. Minimum resistance will be 1 megohm.

e. Check instrument indicating cables as follows:

(1) Disconnect both aircraft cable connectors (E1) from both **(T700, T701)** ECUs, or both **(T701C, T701D)** DECs.

(2) Check for short circuits between aircraft ground and sockets 3, 6, 8, 9, 10, 11, 12, 14, 16, 17, and 22 in each connector. No short circuits allowed. Minimum resistance will be 1 megohm, with exception as indicated in following note.

NOTE

Sockets 9 and 11 may indicate continuity to aircraft ground if aircraft instrumentation is grounded (designed that way). See applicable aircraft maintenance manual for circuit details and resistance values.

(3) Check both connectors separately by checking for short circuits between each connector socket, and each socket within that connector (sockets 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 18, 19, 20, 21, 22, 23, and 24). No short circuits allowed except as allowed by the following steps:

(a) Sockets 1 and 2 (aircraft generator circuits) will indicate continuity if the generator is directly connected and/or if the circuit breaker is not open. (Refer to applicable aircraft maintenance manual for circuit details and resistance value.)

(b) Sockets 3 and 22 are load share circuit commons, and will show continuity.

1-87. Unusual Engine Noise.

a. If an unusual high-pitched whining sound is heard, do the following:

NOTE

- Certain compressor damage can cause a high-pitched whining sound. The noise will vary with gas generator speed and should be much higher than usual engine noise level.
- Compressor rotors with repaired stage 1 blades produce a higher pitched noise than is present on undamaged compressor rotors. This higher pitch is not harmful to personnel or material, and should not be cause for engine removal from an aircraft.

(1) Reduce power and stop running the engine as soon as practical to avoid damaging compressor.

(2) Review engine records to determine if stage 1 compressor rotor blades have been repaired (para 2-6).

(3) If stage 1 blades have not been repaired, borescope the compressor (para 1-172).

b. The Woodward Governor HMU emits a louder noise (than Hamilton Standard) during all levels of engine operation.

c. A new (before break-in) gas generator rotor and stator could emit a rubbing sound, from the outer balance piston seal, this is normal.

1-88. Torque Repeatability Check.

a. This check may be done on the ground or at altitude. If it is done on the ground, aircraft should be headed into the wind to reduce the effects of exhaust gas ingestion. If it is done at altitude, all steps will be done at the same altitude. In either case, all steps will be done at the same FAT and % Np.

b. Check the torque system for repeatability as follows:

NOTE

Refer to instructions in Aircraft Operator's Manual when starting engines.

(1) Start engine and slowly increase engine power until TGT reaches 650°C (1202°F). If temperature exceeds 650°C (1202°F), reduce power until TGT is below 600°C (1112°F) and then slowly approach 650°C (1202°F) again by slowly increasing engine power.

(2) Stabilize TGT at 650°C (1202°F) for 1 minute and record torque, Ng, and TGT.

(3) Increase power until TGT is 700°-750°C (1292°-1382°F).

(4) Slowly reduce power until TGT is 650°C (1202°F). If temperature is below 650°C (1202°F), increase power until TGT is 700°-750°C (1292°-1382°F) then slowly reduce power until TGT is 650°C (1202°F).

(5) Stabilize TGT at 650°C (1202°F) for 1 minute and record torque, Ng, and TGT.

(6) With aircraft on the ground, reduce power quickly to ground idle speed. Record torque, Ng, and TGT with engine stabilized at ground idle speed.

(7) Compare the torque value recorded in step (2) with that recorded in step (5). The difference between the two values is the repeatability error.

c. If the torque repeatability error determined in step b(7) is more than 10%, go to troubleshooting procedure 75.

1-89. Electrical Ignition Lead Check.

a. Use a multimeter for this check.

b. Remove electrical ignition leads (para 7-24).

c. Check socket on one end of ignition lead to socket on other end of ignition lead for continuity. If continuity is not indicated, replace ignition lead (para 7-28).

d. Check ignition lead for short-to-ground by testing socket of one end of ignition lead to metal braid. If ignition lead is shorted, replace it (para 7-28).

e. Repeat steps c and d for other ignition lead.

1-90. Electrical Chip Detector Circuit Test.

a. Leaving electrical connector (green cable) attached to chip detector, remove electrical chip detector as follows:

(1) Loosen two captive bolts.

(2) Using open-end wrench, loosen and remove electrical chip detector.

(3) Unscrew and remove screen on chip detector.

(4) Remove and discard preformed packing.

WARNING

Testing Electrical Chip Detectors

Electrical chip detectors are powered by aircraft DC electrical power. To prevent electrical shock, do not hold detector by its metal housing when doing the following test.

b. Hold detector by insulated electrical cable.

c. Turn on aircraft power to electrical chip detector circuit.

d. Place an insulated screwdriver across gap of chip detector, to short out gap of detector; then ground detector to engine.

e. Check to see that cockpit chip detector caution light comes on. If caution light fails to come on refer to troubleshooting procedure 45.

f. If caution light comes on, reinstall electrical chip detector as follows:

(1) Turn off aircraft power to electrical chip detector circuit.

(2) Re-install screen onto chip detector.

(3) Install preformed packing onto chip detector.

(4) Insert chip detector into gearbox mounting flange.

(5) Tighten two captive bolts. Torque bolts to 45-50 inch-pounds.

1-91. Ng Indicating System Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect aircraft cable connector (E3) from electrical connector (W3J1 - green cable) on swirl frame.

c. Measure resistance between pins 20 and 21 in electrical connector (W3J1). Resistance will be 2.0 to 3.5 ohms. If reading is out-of-limits, check for short or open circuit as follows:

(1) Remove green cable from alternator connector.

(2) Measure resistance between pins 4 and 5 on alternator connector (J1). Resistance will be:

- **(T700)** 2.0 - 3.5 ohms
- **(T701, T701C, T701D)** 2.5 - 4.0 ohms

(3) If reading is within limits, replace green cable (para 7-35). If reading is out-of-limits, replace alternator stator (para 7-51).

1-92. Overtemperature Checklist.

CAUTION

If an emergency start is conducted without the aid of cockpit engine parameter display and a hung start or hot start occurs, do not attempt any further starts. Continued operation of engine will result in further engine damage. Remove and mark engine components as outlined in paragraph 1-280.

a. When reviewing reported overtemperature problems, check for the following to verify that an overtemperature problem exists:

(1) Stall (audible popping and banging).

(2) High TGT at shutdown requiring cooling rollover.

(3) Engine rollback and warning light activation if at ground idle speed.

(4) Engine was being operated in lockout mode.

b. Determine extent of overtemperature as follows:

(1) Determine maximum TGT reached.

(2) **(T700)** Determine time spent at 950°C (1742°F) or below if overtemperature occurred above ground idle; on start-to-ground idle, or ground idle-to-shutdown.

(3) **(T701, T701C, T701D)** Determine time spent at **(T701)** 965°C (1769°F) or **(T701C, T701D)** 949°C (1740°F) or below if overtemperature occurred above ground idle; or determine time spent at **(T701)** 950°C (1742°F), or **(T701C, T701D)** 934°C (1714°F) or below if overtemperature occurred on start or shutdown.

c. Inspect engine for visual signs of overtemperature damage as follows:

(1) Indications that molten metal has passed through and has adhered to the vanes.

(2) Seized power turbine or gas generator rotor. If seized, allow TGT to cool below 150°C (302°F) and then recheck for seizure.

(3) Borescope engine (para 1-172) as follows:

(a) Check for compressor rotor damage (para 1-182).

(b) Check for burned or missing stage 1 gas generator turbine rotor blade tips. (View through stage 1 turbine nozzle.)

(c) Check for presence of burning on stage 1 turbine nozzle.

(d) Check combustion liner for signs of overtemperature damage.

d. Compare maximum TGT reached and time spent at maximum TGT with the engine overtemperature limits in **(T700)** figures 1-50 and 1-53, **(T701)** figures 1-51 and 1-54, or **(T701C, T701D)** figures 1-52 and 1-55 to determine if maintenance action is required.

1-92.1. Maintenance Required Following Sudden Engine Stoppage. Engine removal is required if sudden engine stoppage is suspected. Sudden stoppage involves stopping or significantly decelerating the engine's core or power turbine (PT) shaft via external mechanical forces such as air vehicle drive train failure/lock-up or forces from a crash or hard landing that stops or abnormally decelerates the airframe's main rotor, potentially causing engine damage. Sudden stoppage does not result from termination of fuel flow nor does it result from emergency stopping where restart and reuse of the engine is allowable. The following events are cause for engine sudden stoppage removal and inspection of the engine.

a. A high deceleration rotor incident resulting in removal of the main transmission, input modules, and/or nose gearboxes.

b. The event caused damage to engine mounts or attaching hardware.

c. The event caused unusual engine noise or rubs.

d. If it is determined that a sudden stoppage has occurred, remove engine(s). Refer to paragraph 1-274.

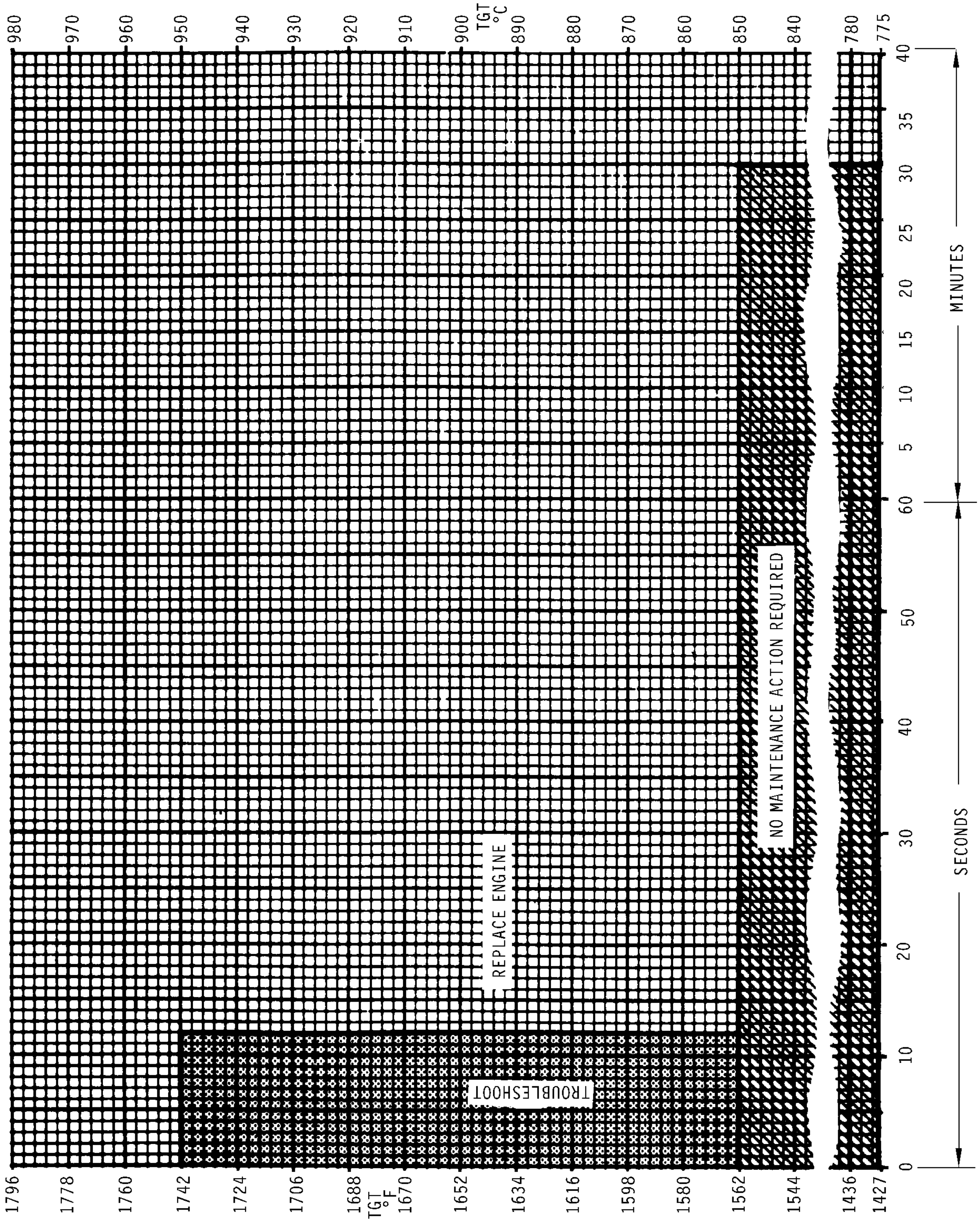


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Figure 1-50. *(T700)* ***Engine Maintenance Requirements for Overtemperature Operation from Start-to-Ground Idle and from Ground Idle-to-Shutdown***

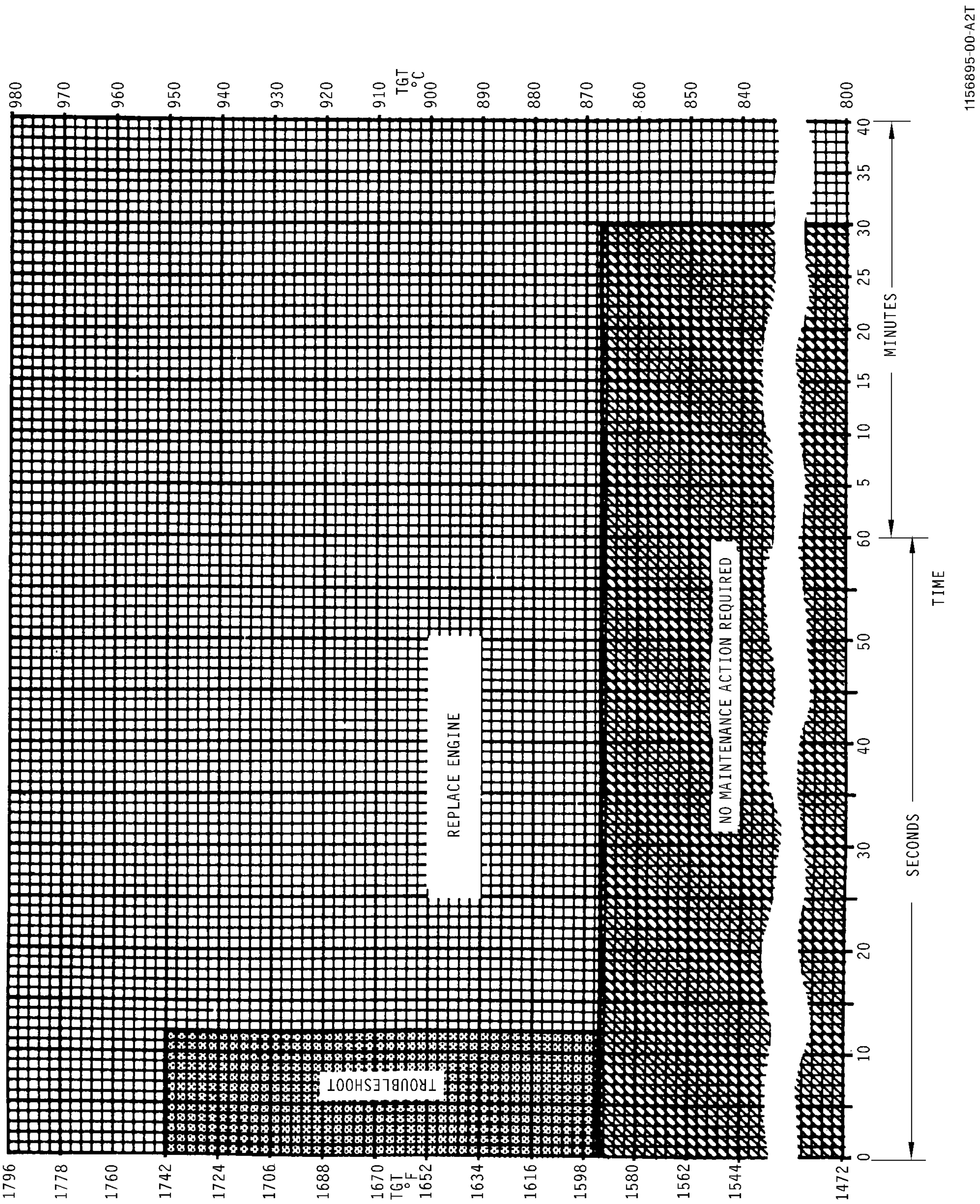

Figure 1-51. (T701) Engine Maintenance Requirements for Overtemperature Operation from Start-to-Ground Idle and from Ground-Idle-to-Shutdown

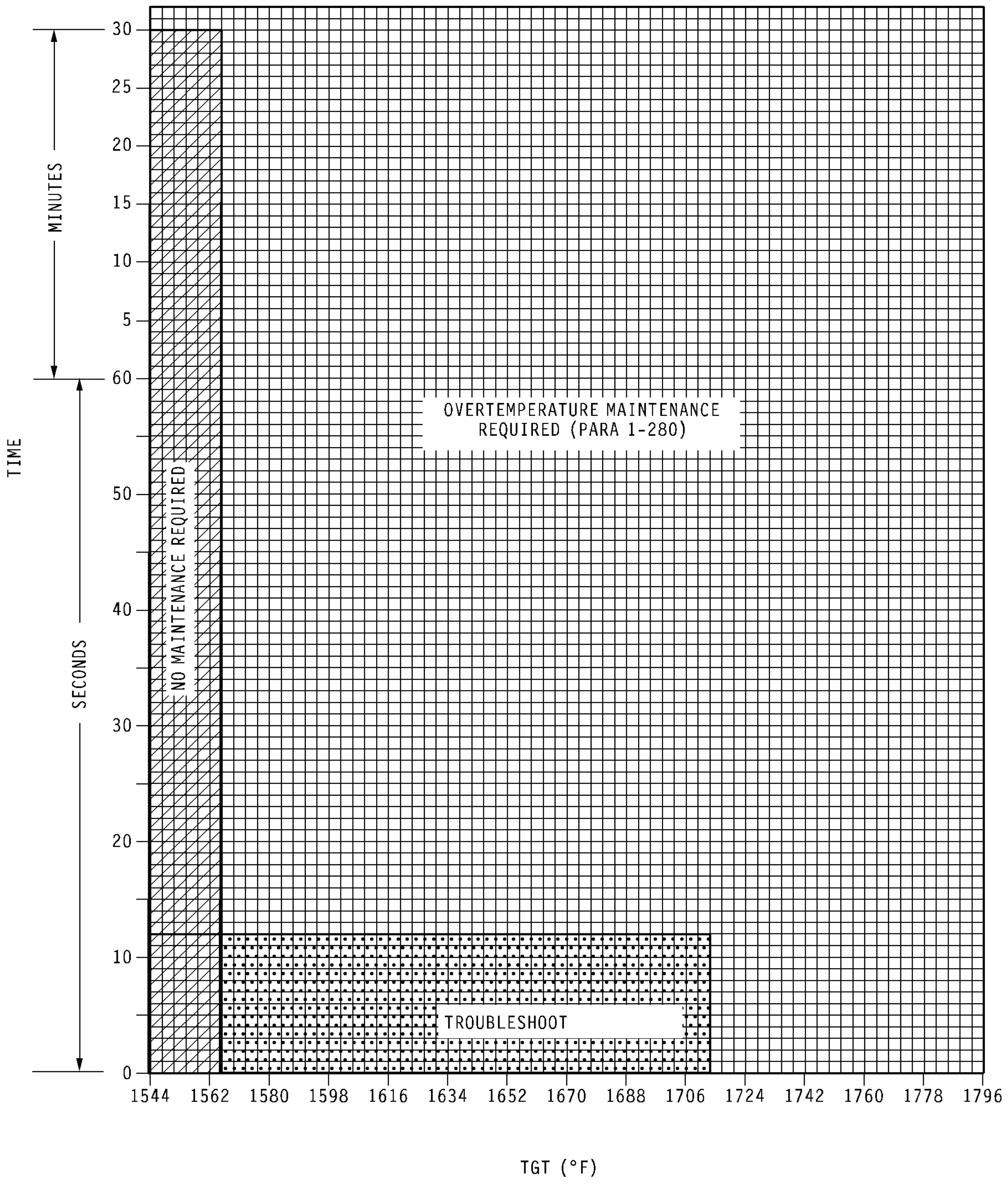

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Figure 1-52. ***(T701C, T701D)*** *Engine Maintenance Requirements for Overtemperature Operation from Start-to-Ground Idle and from Ground-Idle-to-Shutdown*

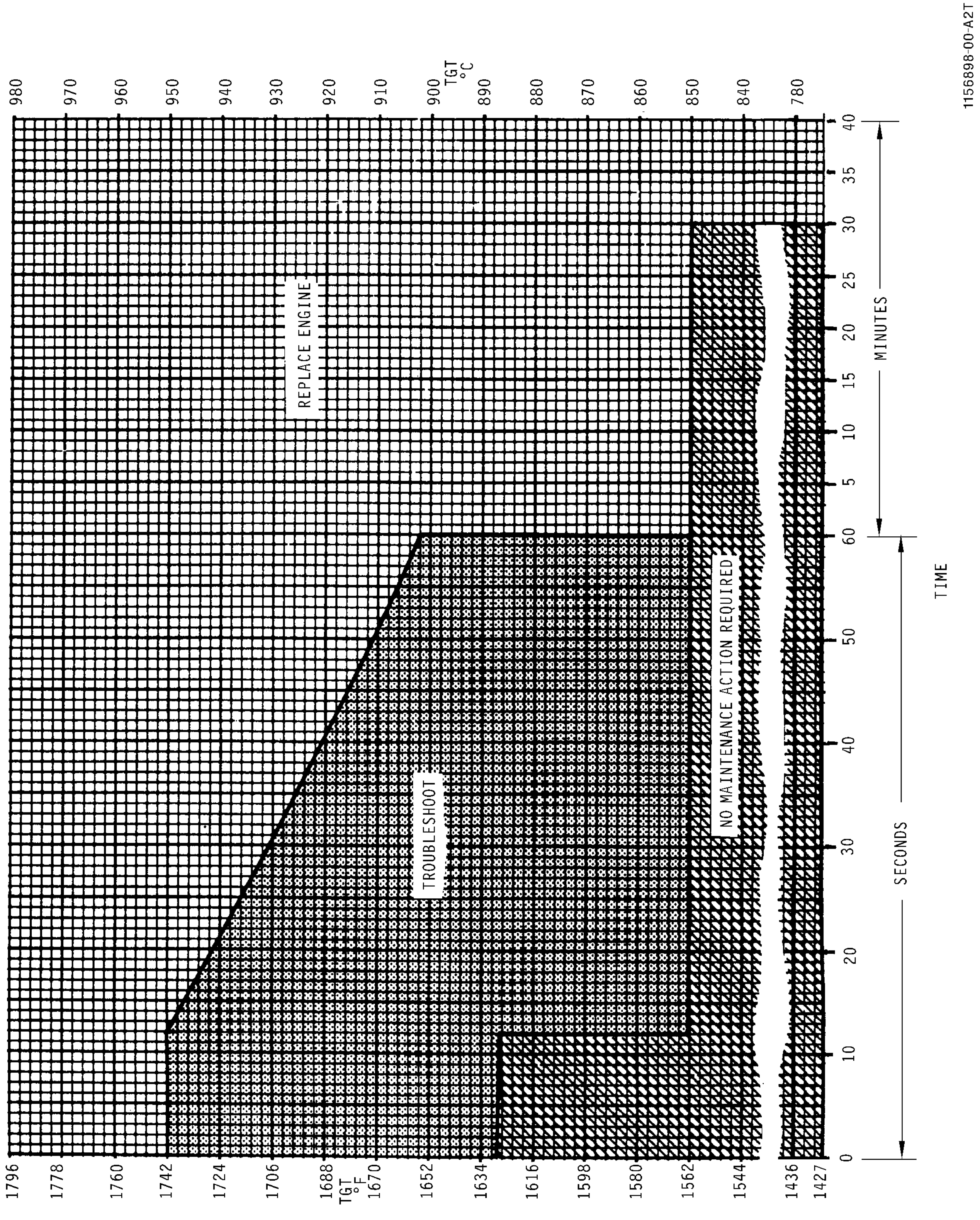


Figure 1-53. (T700) Engine Maintenance Requirements for Overtemperature Operation Above Ground Idle

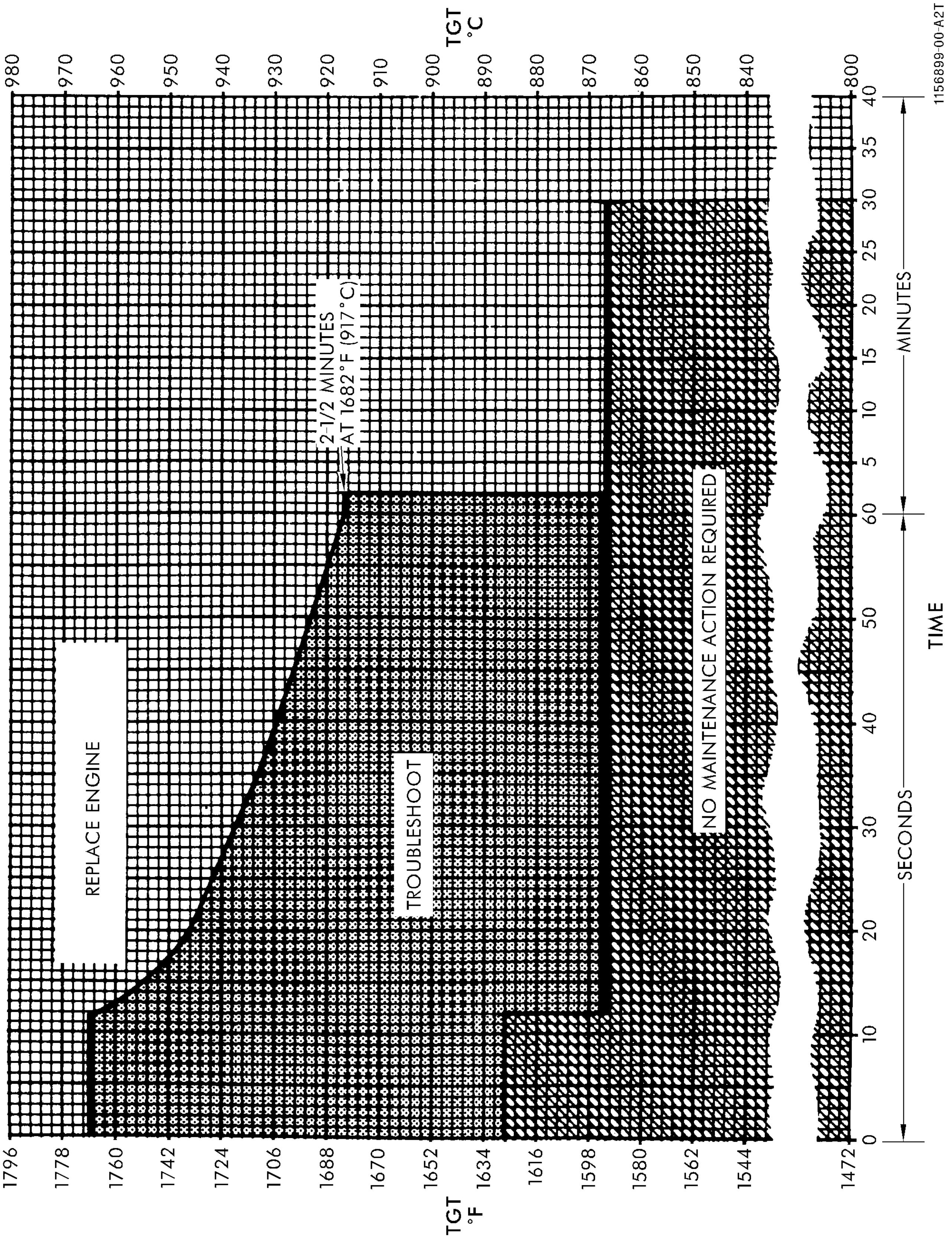


Figure 1-54. (T701) Engine Maintenance Requirements for Overtemperature Operation Above Ground Idle

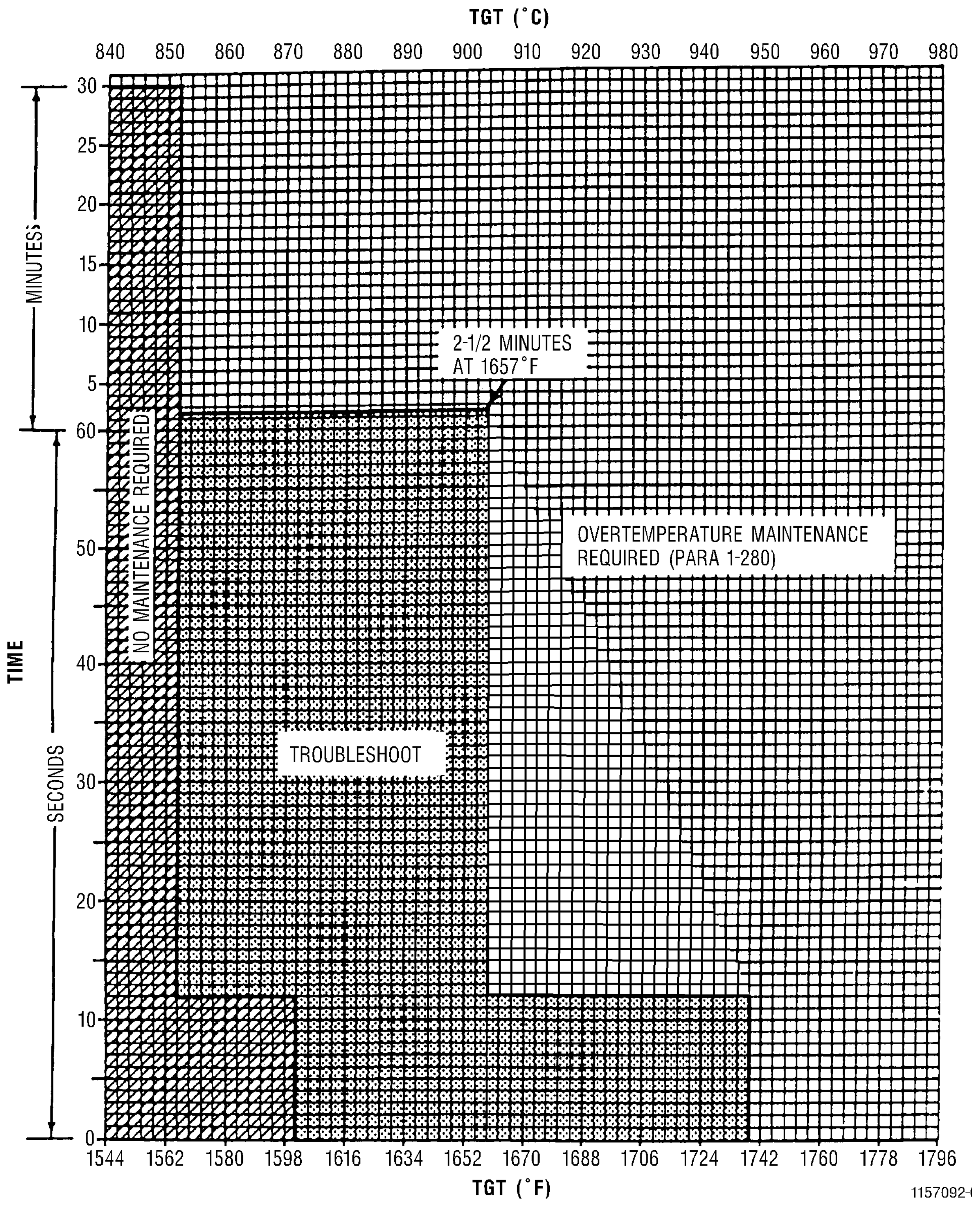


Figure 1-55. ***(T701C, T701D)*** *Engine Maintenance Requirements for Overtemperature Operation Above Ground Idle*

1-93. E1 Harness (Aircraft) Overtemperature Troubleshooting Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect E1 harness from **(T700, T701)** ECU or **(T701C, T701D)** DEC on both the number one and the number two engines.

c. Check for short circuit between sockets 24 to 16 and 23 to 16 on each connector. No short circuits allowed.

d. Check for short circuits to aircraft ground or for socket-to-socket short circuit in E1 connector; see para 1-86, steps e(2) and e(3).

1-94. Yellow Cable Overtemperature Troubleshooting Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connectors (yellow cable) at the following:

- **(T700, T701)** ECU, or **(T701C, T701D)** DEC (W4P1)
- History recorder
- Np sensor
- Thermocouple assembly
- HMU
- Ignition exciter

c. Check electrical connector (W4P1 - yellow cable) for short circuits between all sockets to the outer metal braid of yellow cable. No short circuits allowed.

d. Check for shorts between all sockets. None allowed.

e. If yellow cable is faulty, replace it (para 7-41).

f. If yellow cable is not faulty, reconnect all connectors that were removed.

g. After completion of final testing, seal connectors (para H-9, Appendix H).

1-95. Oil Pressure Sensor Green Cable Circuit Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connector (W3P2 - green cable) at oil pressure sensor and disconnect aircraft cable connector (E3) at electrical connector (W3J1 green cable) on swirl frame.

c. Check continuity of green cable from connectors W3P2 to W3J1 as follows (no open circuits allowed):

W3P2 Sockets		W3J1 Pins
1	to	7
2	to	6
3	to	5

d. Check electrical connector (W3P2) for short circuits between sockets 1, 2, and 3. No short circuits allowed.

e. Check electrical connector (W3P2) for short circuits to aircraft ground from sockets 1, 2, and 3. No short circuits allowed.

f. If green cable is faulty, replace it (para 7-35).

g. If green cable is not faulty, reconnect it to oil pressure sensor, and reconnect aircraft cable connector (E3) to electrical connector (W3J1 - green cable) on swirl frame.

1-96. (T700, T701C, T701D) Oil Temperature Sensor Green Cable Circuit Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connector (W3P6 - green cable) at oil temperature sensor and disconnect aircraft cable connector (E3) at electrical connector (W3J1 green cable) on swirl frame.

c. Check continuity of green cable from connectors W3P6 to W3J1 as follows (no open circuits allowed):

W3P6 Sockets		W3J1 Pins
1	to	10
2	to	9
3	to	8

d. Check electrical connector (W3P6) for short circuits between sockets 1, 2, and 3. No short circuits allowed.

e. Check electrical connector (W3P6) for short circuits to aircraft ground from sockets 1, 2, and 3. No shorts circuits allowed.

f. If green cable is faulty, replace it (para 7-35).

g. If green cable is not faulty, reconnect it to oil temperature sensor, and reconnect aircraft cable connector (E3) to electrical connector (W3J1 - green cable) on swirl frame.

1-97. Green Cable Fuel Pressure Sensor Circuit Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connector (W3P8 - green cable) at fuel pressure sensor and disconnect aircraft cable connector (E3) at electrical connector (W3J1 green cable) on swirl frame.

c. Check continuity of green cable from connectors W3P8 to W3J1 as follows (no open circuits allowed):

W3P8 Sockets		W3J1 Pins
1	to	22
2	to	23
3	to	24

d. Check electrical connector (W3P8) for short circuits between sockets 1, 2, and 3. No short circuits allowed.

e. Check electrical connector (W3P8) for short circuits to aircraft ground from sockets 1, 2, and 3. No short circuits allowed.

f. If green cable is faulty, replace it (para 7-35).

g. If green cable is not faulty, reconnect it to fuel pressure sensor, and reconnect aircraft cable connector (E3) to electrical connector (W3J1 - green cable) on swirl frame.

1-98. HAND-CRANKING THE ENGINE.

CAUTION

When removing or installing components, use extreme care to prevent damage to axis-A oil nozzle.

a. Remove radial drive shaft cover boot (fig. 1-56), retaining ring, and radial drive shaft cover assembly.

b. Inspect packing for nicks, cuts, or looseness. Replace defective packing.

c. Crank radial drive shaft assembly as shown in figure 1-56, using a 5/16-inch socket, an extension, and a ratchet.

CAUTION

To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

d. Install cover assembly, retaining ring, and boot.

1-99. HAND-CRANKING THE ACCESSORY GEARBOX.

CAUTION

When removing or installing components, use extreme care to prevent damage to axis-A oil nozzle.

a. Remove radial drive shaft cover boot (fig. 1-56), retaining ring, and radial drive shaft cover assembly.

b. Inspect packing for nicks, cuts, or looseness. Replace defective packing.

c. Withdraw radial drive shaft assembly about 7-1/2 inches so that power takeoff drive spline (lower spline) on radial drive shaft engages spline within accessory gearbox.

d. Crank radial drive shaft assembly, using a 5/16-inch socket and ratchet. Gearbox drive train will turn without turning the compressor rotor.

CAUTION

To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

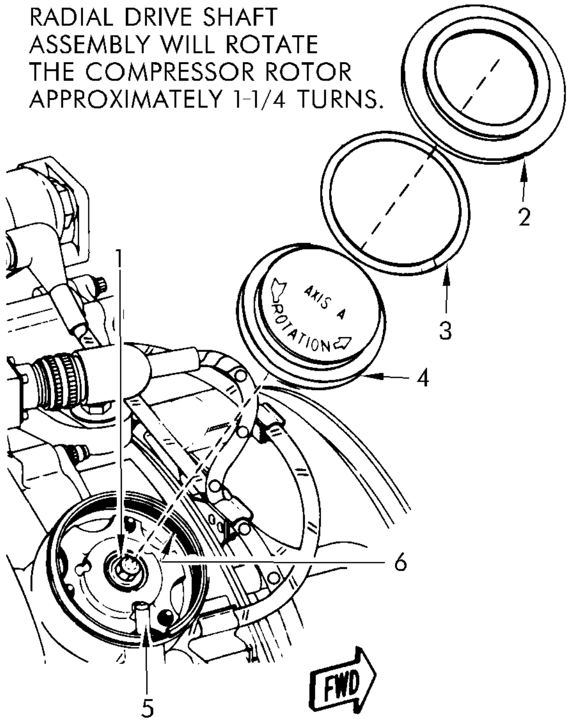
e. Install cover assembly, retaining ring, and boot.

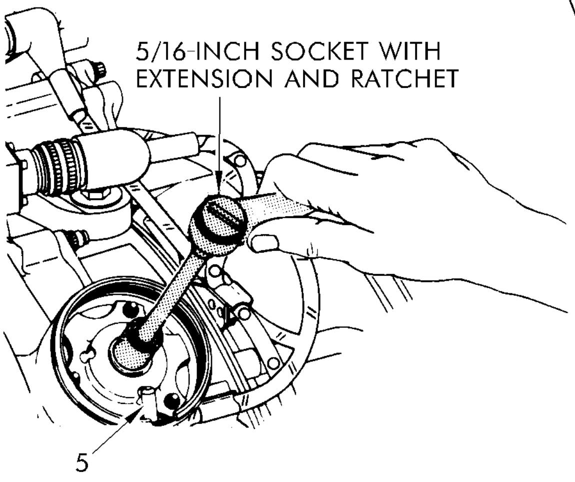
CAUTION

- WHEN HANDCRANKING ENGINE THROUGH AXIS-A RADIAL DRIVE SHAFT, USE EXTREME CARE TO AVOID CONTACT AND DAMAGE TO AXIS-A OIL JET.
- DO NOT USE BOX OR OPEN END WRENCH TO HANDCRANK ENGINE.
- WHEN REMOVING AND INSTALLING AXIS-A COVER ASSEMBLY, USE EXTREME CARE TO AVOID CONTACT AND DAMAGE TO THE AXIS-A OIL NOZZLE.
- TO PREVENT ANY OIL LOSS AND POSSIBLE IN-FLIGHT SHUTDOWN BE SURE AXIS-A COVER IS REINSTALLED PROPERLY.

NOTE

- TURNING WRENCH COUNTERCLOCKWISE WILL TURN ROTOR CLOCKWISE (AFT LOOKING FORWARD).
- ONE TURN OF THE RADIAL DRIVE SHAFT ASSEMBLY WILL ROTATE THE COMPRESSOR ROTOR APPROXIMATELY 1-1/4 TURNS.





1. Radial Drive Shaft Assembly
2. Radial Drive Shaft Cover Boot
3. Retaining Ring
4. Radial Drive Shaft Cover Assembly
5. Axis-A Oil Nozzle
6. Packing

Figure 1-56. Hand-Cranking the Engine or the Accessory Gearbox

Section VII. GENERAL MAINTENANCE PROCEDURES

1-100. GENERAL MAINTENANCE INFORMATION.

1-101. Appendix G provides torque values for bolts, nuts, and connectors used for components and modular assemblies of the engine.

1-102. Some engine hardware is tightened using the wrench-arc method. Refer to paragraph H-14, in Appendix H for descriptions of the wrench-arc procedures.

1-103. In this section the hydromechanical unit is identified as HMU, the **(T700, T701)** electrical control unit is identified as **(T700, T701)** ECU, and the **(T701C, T701D)** digital electronic control is identified as **(T701C, T701D)** DEC. The **(T700)** pressurizing and overspeed unit is identified as **(T700)** POU, and the **(T701, T701C, T701D)** overspeed and drain valve is identified as **(T701, T701C, T701D)** ODV. The power available spindle (on HMU) is identified as PAS.

1-104. GENERAL PRACTICES AND PRECAUTIONS.

Maintenance personnel will become familiar with the following general practices and precautions before attempting to work on the engine or on any of the engine subassemblies or components.

a. Before starting any of the following procedures, read the general maintenance practices in Appendix H.

b. Maintenance actions and procedures are limited to the actions and the procedures contained in this manual.

c. Engines removed for unscheduled repair require only that portion of work necessary to return the engine to service.

CAUTION

Be sure stage 1 nozzle face-type seal (3, fig. 3-1 or 3-2) is installed. If module or engine is found to have been operated without stage 1 nozzle face-type seal installed, the stage 1 and stage 2 turbine blades and dampers may have been subjected to excessive excitation force. Engines operated without stage 1 nozzle face-type seal installed must have the stage 1 and stage 2 turbine blades and dampers replaced.

d. During disassembly, examine all parts and assemblies for serviceability. Look for indications of work done incorrectly during previous maintenance or overhaul. Report any such indications in accordance with current practice.

CAUTION

- Never allow fuel or oil to contact electrical connectors. Use only specified solvent to clean connectors. Other solvents might damage connectors.
- Do not use pliers to tighten connectors.

e. Use extreme care when disconnecting electrical leads. Cap all ends to prevent entrance of dirt, oil, and moisture. Use only the recommended protector caps. Be sure that caps are clean and dry. Never cover electrical connectors with plastic bags. See paragraph H-7, Appendix H, for detailed instructions on electrical connectors used on this engine.

f. Before disconnecting tubes and hoses, remove locknuts and bolts from cushioned clamps. This prevents damage to fittings. If the same lines are going to be reinstalled, reassembly will be easier if clamps are not removed from lines. Remove locknut and bolt that secure the clamp; free the clamp, then reinstall bolt and locknut loosely in the clamp.

g. When connecting or disconnecting tubes and hoses, use caution to avoid twisting action which could cause damage. When possible, use a backup wrench on fittings. As tubes and hoses are disconnected, or components removed, cap or cover openings to keep out foreign material. Do not use tape to cover openings. Tape adhesive is soluble in oil and can cause contamination. When connecting tubes and hoses, use wrench-arc tightening method in paragraph H-14, Appendix H.

h. To aid in reassembly, keep bolts together as they are removed from each bolt circle.

i. Dispose of unserviceable parts in accordance with current regulations. Discard all preformed packings (O-rings) and gaskets that are removed during disassembly. Do not discard adapter gasket (sheetmetal plate with integral seals) used on **(T700)** POU, on **(T701, T701C, T701D)** ODV, on oil cooler, or on oil manifold unless sealing material is damaged.

j. Do not damage preformed packing grooves when removing or installing packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings.

k. Keywashers are not reusable. Once used, they will be replaced by new keywashers in all applications.

l. All used locknuts will be tried for self-locking capabilities before being reused. Manually thread used locknut onto bolt or stud until it stops turning. Replace locknut if bolt or stud threads go past end of locknut. (Refer to TM 1-1500-204-23-1 for more detailed information.)

m. Use care when assembling bolts to shank-type locknuts. Aline the bolts and engage the first few threads manually to avoid dislodging the locknut from its seat.

n. During assembly, be careful not to drop nuts, washers, or other objects into the subassembly. If an object is dropped, do not proceed further until it is removed.

o. Do not use excessive force to assemble mating parts. If excessive force appears necessary, inspect mating surfaces for burrs or pickups. Remove any such defects and repair or replace defective parts.

p. The special tools identified in this manual are designed specifically for use on this engine. Avoid the use of makeshift tools.

CAUTION

Do not use brass or lead tools when installing or disassembling hot section parts. Brass and lead contaminants can ultimately lead to part failure.

q. Before using tools, be sure that they are clean and free from nicks, dents, or burrs that could damage engine parts.

CAUTION

Do not use cadmium-plated tools on titanium parts. Doing so may cause parts to fail during subsequent use.

r. Titanium parts require special care. When cadmium-plated tools are used on titanium parts, it is possible for particles of cadmium to become embedded in the titanium. At temperatures above 600°F (316°C), the cadmium can cause the titanium to become brittle, resulting in overstressed areas and possible cracking. Therefore, cadmium-plated tools will not be used on titanium parts.

s. Do not use screw drivers or sharp metal rods to separate engine parts. If engine parts are bound or seized, use wooden wedges to separate them.

t. Do not use hammers with metal heads to drive any tool on any part of the engine; instead, use hammers with plastic, nylon, or rawhide heads when driving is required.

u. Do not leave tools or parts on any part of the engine, particularly near inlet, during maintenance. Return each tool to its proper place immediately after use.

v. Always wear approved, clean, thermally insulated gloves when handling hot or chilled engine parts.

w. Lift all heavy parts with proper lifting devices to prevent damage to the part or injury to personnel. Do not use engine components as handles when moving the engine.

CAUTION

Never mark engine parts with a lead pencil. Such deposits can cause corrosion and burn-out of parts. Do not use either the electrolytic-etch or electric-arc scribe methods to mark engine parts.

x. Use marker (item 82, Appendix D) or equivalent to temporarily mark engine parts.

y. Unless otherwise specified in this manual, all bolts must protrude through their respective attaching nuts by at least the length of the chamfer on the end of the bolt, plus one full thread. (Refer to TM 1-1500-204-23-1.)

1-105. MAINTENANCE PROCEDURE FOR ENGINES IMMERSED IN SALT WATER OR EXPOSED TO FIRE-EXTINGUISHING AGENTS.

1-106. Preliminary Information.

a. This procedure explains the maintenance required for engines that have been immersed in salt water or have been involved in crashes or in fires where fire-extinguishing agents have been used.

b. Refer to table 1-15 for corrective action required to return engine to service if:

(1) Exposure to fire-extinguishing agent was the result of accidental release of the agent.

(2) The nacelle/engine had fire indications but was not exposed to flames or heat.

(3) The fire-extinguishing agent was not ingested into the engine or injected into the exhaust.

Table 1-15. Maintenance and Cleaning Requirements for Engines Exposed to Fire-Extinguishing Agents (External Exposure Only)

Item	Extinguishing Agent	Military or Federal Specification	Chemical Composition	Initial Action	Maintenance Required To Make Engine Serviceable
1.	Animal Protein	0-F-555C	--------	Water-wash outside of engine to remove residue. Steam-clean engine if required. Use a clean cloth dampened with water to remove deposits on engine inlet and engine exterior. Avoid getting steam or water on electrical connectors.	Water-wash engine to remove residue. Steam-clean engine if required. Clean engine (para 1-108).
2.	Carbon Dioxide	BB-C-101B	CO_2	No action required if engine was not running. If engine was running, refer to table 1-16.	No cleanup required. CO_2 leaves no residue.
3.	Detergent Foam	None	--------	Same as Item 1.	Same as Item 1.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

Table 1-15. Maintenance and Cleaning Requirements for Engines Exposed to Fire-Extinguishing Agents (External Exposure Only) (Cont)

<table>
<tr><th>Item</th><th>Extinguishing Agent</th><th>Military or Federal Specification</th><th>Chemical Composition</th><th>Initial Action</th><th>Maintenance Required To Make Engine Serviceable</th></tr>
<tr><td colspan="6">WARNING
Isobutyl Alcohol
TT-I-730
• Flammable - do not use near welding areas, near open flames or sparks, or on hot surfaces.
• Use only with adequate ventilation.
• Prolonged or repeated breathing of vapors may cause drowsiness, dizziness, or headache.
• Prolonged or repeated contact with skin may cause dermatitis and irritation.
• Wear approved gloves when handling.
• Store in approved metal safety containers. Keep container tightly covered when not in use.</td></tr>
<tr><td>4.</td><td>Dry Chemical “PKP”</td><td>MIL-F-22287A</td><td>Potassium Bicarbonate covered with silicone (methyl polysilidoxane) to prevent absorption of moisture.</td><td>As soon as possible, remove as much loose powder as possible to stop corrosion. Use either vacuum tools or compressed air at 30 psig.</td><td>Remove glaze from surfaces using a mixture of 60% isopropyl alcohol and 40% isobutyl alcohol. Then steam-clean engine. Avoid getting steam on electrical connectors.</td></tr>
<tr><td>5.</td><td>Halon 1011</td><td>MIL-B-4394D</td><td>Bromochloromethane CH_2BrC1</td><td>Clean outside of engine with a mixture of 60% isopropyl alcohol and 40% isobutyl alcohol. Steam-clean engine if required. Avoid getting steam on electrical connectors.</td><td>Same as Initial Action column.</td></tr>
<tr><td>6.</td><td>Halon 1211</td><td>MIL-B-38741</td><td>Bromochloro-difluoromethane CF_2C1Br</td><td>Above 25°F (–2°C), no action is required. At 25°F (–2°C) and below, run engine at idle speed for 5 to 10 minutes to evaporate liquid. External heat sources may be used if engine cannot be started.</td><td>No cleanup is required. Halon 1211 leaves no residue.</td></tr>
<tr><td>7.</td><td>Halon 1301</td><td>MIL-B-12218B</td><td>Bromotrifluro-methane CF_3Br</td><td>No action is required.</td><td>No cleanup required. Halon 1301 leaves no residue.</td></tr>
<tr><td>8.</td><td>“Light Water”*
Foam (AFFF)
or
ANSUL AAF</td><td>MIL-F-24385A</td><td>Proprietary to 3M Company.
Proprietary to ANSUL Corp.</td><td>Same as Item 1.</td><td>Same as Item 1.</td></tr>
</table>

* Registered Trademark of 3M Company

WARNING

Viton Exposed to Fire Damage

- Combustion can produce highly toxic fumes of hydrogen fluoride and carbonyl fluoride at temperatures over 527°F (275°C).
- Water from firefighting efforts and moisture from eyes, sweaty skin, and lungs may combine with hydrogen fluoride gas or residue to form Hydrofluoric acid.
- Exposure to Hydrofluoric acid will cause blurred vision, pain, and breathing difficulty. In sufficient concentration, exposure may lead to permanent lung damage or death.
- If eyes or skin is exposed to hydrogen fluoride, immediately flush affected area thoroughly with water. Get immediate medical attention.
- Self-contained breathing apparatus, goggles, and protective clothing shall be worn when fighting fires associated with Viton.
- Wear neoprene gloves when handling refuse from a Viton fire, even if material is cool.
- Allow for adequate cool-down and air-out periods in a well ventilated area before repairing equipment damaged by a fire involving Viton.

c. If engine inspection reveals internal or external fire damage, or if fire-extinguishing agent was ingested when the engine was operating or was injected into engine exhaust immediately after engine was shutdown, refer to table 1-16.

d. Preservation will be done as soon as possible after recovery of engine from water or after extinguishing of fire. No preservation will be done before obtaining release of engine from any board of inquiry involved with accident. However, it is extremely important that this preservation be done as soon as possible. This will reduce the increased chance of corrosion caused by water and presence of residues of fire-extinguishing agent. Use fresh water, steam, or both, followed by prompt application of water-displacing preservatives such as MIL-C-16173, and thoroughly dry parts and assemblies using heaters, ovens, or any other available means where temperature can be controlled.

e. When engines are involved in salt water crashes, assume that all internal areas are contaminated. The engine will be cleaned and preserved as directed in paragraph 1-107 to prevent further corrosion.

1-107. Preservation Procedure.

NOTE

- Under certain circumstances, PKP and Halon 1011 can combine with moisture, which can cause severe corrosion damage to engine components. Consequently, disposition of engines to Depot should be on an expedited basis.
- If engine has been subjected to internal or external fires extinguished by use of dry chemical fire extinguisher containing potassium bicarbonate (PKP) or bromochloromethane CH_2BrC1 (Halon 1011) and if the extinguishing agent found its way into the inside of the engine, refer to table 1-16 for cleaning instructions. The engine will be tagged with an appropriate salt water-crash-fire damage tag and sent to Depot for further disposition.

a. Tag all parts removed from engine with an appropriate salt water-crash-fire damage tag. This tag will remain with part until disposal action is complete or until overhaul of part or assembly involved is accomplished. The tag will specify:

WATER-CRASH-FIRE DAMAGE PART

Engine Serial no. . . . .
Part no. . . . .
Nomenclature . . . .
Serial Number . . . .
Preserved Method . . . .
Date . . . .
Name of Activity. . . . .

EXPEDITE HANDLING

b. Surfaces cleaned during preservation will not remain uncoated due to lack of any specified preservatives. In an emergency, use any preservative available. If no preservative is at hand, substitute any clean, light, unused oil. Applying a non-preservative light oil will be better than allowing part to remain uncoated because of lack of a specified preservative.

Table 1-16. Maintenance and Cleaning Requirements for Engines Exposed to Fire-Extinguishing Agents (External and Internal Exposure)

Item	Extinguishing Agent	Military or Federal Specification	Chemical Composition	Initial Action	Maintenance Required To Make Engine Serviceable
1.	Animal Protein	0-F-555C	--------	Preserve engine (para 1-206)	None. Return engine to Depot.
2.	Carbon Dioxide (gas)	BB-C-101B	CO_2	Replace engine if CO_2 was ingested while engine was at operating temperature or if CO_2 was injected immediately after shutdown.	None. Return engine to Depot.
3.	Detergent Foam	None	--------	Same as Item 1.	Same as Item 1.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

WARNING

Isobutyl Alcohol
TT-I-730

- Flammable - do not use near welding areas, near open flames or sparks, or on hot surfaces.
- Use only with adequate ventilation.
- Prolonged or repeated breathing of vapors may cause drowsiness, dizziness, or headache.
- Prolonged or repeated contact with skin may cause dermatitis and irritation.
- Wear approved gloves when handling.
- Store in approved metal safety containers. Keep container tightly covered when not in use.

Table 1-16. Maintenance and Cleaning Requirements for Engines Exposed to Fire-Extinguishing Agents (External and Internal Exposure) (Cont)

Item	Extinguishing Agent	Military or Federal Specification	Chemical Composition	Initial Action	Maintenance Required To Make Engine Serviceable
4.	Dry Chemical “PKP”	MIL-F-22287A	Potassium Bicarbonate covered with silicone (methyl polysilidoxane) to prevent absorption of moisture.	Replace Engine. As soon as possible, remove as much loose powder as possible to stop corrosion. Use either vacuum tools or compressed air at 30 psig. Clean external surfaces by using mixture of 60% isopropyl alcohol and 40% isobutyl alcohol. Steam-clean engine. Motor engine with ignition and PCL OFF for 30 seconds to dry engine.	None. Return engine to Depot.
5.	Halon 1011	MIL-B-4394D	Bromochloromethane CH_2BrC1	Replace engine. Clean externally and internally as much as possible using a mixture of 60% isopropyl alcohol and 40% isobutyl alcohol. Steam-clean the exterior. Dry motor engine to dry interior.	None. Return engine to Depot.
6.	Halon 1211	MIL-B-38741	Bromochloro-difluoromethane CF_2C1Br	Above 25°F (–2°C), no action is required. At 25°F (–2°C) and below, run engine at idle speed for 5 to 10 minutes to evaporate liquid. External heat sources may be used if engine cannot be started.	No cleanup is required. Halon 1211 leaves no residue.
7.	Halon 1301	MIL-B-12218B	Bromotrifluro-methane CF_3Br	No action is required.	No cleanup required. Halon 1301 leaves no residue.
8.	“Light Water”* Foam (AFFF) or ANSUL AAF	MIL-F-24385A	Proprietary to 3M Company. Proprietary to ANSUL Corp.	Same as Item 1.	Same as Item 1.

* Registered Trademark of 3M Company

c. To protect salvageable components of an engine during preservation, observe the following procedures:

(1) Thoroughly clean exterior of engine using steam or fresh hot water or fresh cold water, in that order of preference. Continue steam-cleaning or flushing engine until all visible salt or other chemical deposits have been removed.

CAUTION

If PT module is being removed, be careful not to cause further damage to engine.

(2) If possible (AVIM) remove PT module to expose internal contaminated surfaces. Be careful during disassembly to prevent additional damage to engine.

(3) Thoroughly clean PT module and removed components; use steam or fresh hot water or fresh cold water, in that order of preference. If possible, immerse the rest of the engine in fresh hot water agitated sufficiently to flush all components. If engine cannot be completely immersed, flood it with large quantities of fresh water. Direct the stream of water into engine internals through swirl frame, through customer bleed ports at 3 and 9 o'clock positions on compressor casing, through blower discharge, around gas generator rotor-stator, and into midframe. If PT was not removed, direct water into exhaust frame. Allow water to flow through engine, cleaning the internal passages as much as possible.

WARNING

Corrosion Preventive Compound
MIL-PRF-16173

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact with skin can cause irritation and dermatitis. Prolonged inhalation of vapor can cause dizziness, headache, and intoxication.
- If there is any prolonged contact with skin, wash affected area with soap and water. If liquid contacts eyes, flush eyes thoroughly with water. Remove contaminated clothing. If vapors cause light-headedness, go to fresh air. If liquid is swallowed, do not try to vomit. Get medical attention.
- When handling liquid, wear approved gloves and goggles (or face shield).
- Dispose of liquid-soaked rags in approved metal container.

(4) After engine and components have been thoroughly flushed of all chemical and salt deposits, drain and dry all parts thoroughly. Then apply water-displacing corrosion preventive compound (item 62, Appendix D) to all surfaces.

(5) **(T700)** Remove HMU (para 6-39) and POU (para 6-87) from engine. Preserve HMU according to paragraph 1-209, steps a(1) through a(10). Preserve POU as directed in paragraph 1-209, steps c(1) through c(5). Reinstall HMU and POU on engine.

(6) **(T701, T701C, T701D)** Remove HMU and ODV from engine. Preserve HMU according to paragraph 1-209, steps a(1) through a(10), and preserve ODV as directed in paragraph 1-209, steps d(1) through d(5).

(7) Reassemble engine so that it may be installed in engine container.

(8) Attach salt water-crash-fire tag (described in step a) to engine.

(9) Install engine in shipping and storage container 8145CON004-1 (para 1-58). Double the amount of desiccant normally used.

d. Engines preserved after salt water immersion or fire-fighting damage will have the outside of shipping container plainly marked in at least two locations with an appropriate salt water-crash-fire damage tag requesting: EXPEDITE HANDLING.

1-108. EXTERNAL ENGINE CLEANING FOR ENGINE INSTALLED IN AIRCRAFT.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

CAUTION

- Do not allow solvent to remain on plastic or rubber parts for more than 10 minutes.
- Never use water-based cleaning compound on engines.
- Never use high-pressure water, compressed air or steam to clean engines. Otherwise, the electrical connectors could become contaminated.

a. Using a pail containing dry cleaning solvent (item 99, Appendix D) and a sponge or wiping cloth (item 113, Appendix D), apply solvent and let it remain for five minutes to loosen any dirt.

b. Remove solvent with clean wiping cloths (item 113, Appendix D).

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

CAUTION

Use low-velocity (15 psig) air as high-velocity air may damage rubber seals.

c. Blow area dry using clean, filtered, low-velocity (15 psig) compressed air, especially in area of rubber seals and in engine bay.

1-109. ACTIVATING ENGINE AFTER SHORT-TERM STORAGE.

a. Remove protective covers.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Remove any barrier material and tape. Remove tape residue, using dry cleaning solvent (item 99, Appendix D).

c. Clean external engine surfaces.

d. Check the aircraft or engine logbook for a record of any components that may have been removed or disconnected. Be sure that all removed or disconnected components have been reinstalled.

e. Follow the inspection requirements in paragraph 1-61.

f. Record the date the engine was prepared for service in the aircraft logbook.

1-110. ACTIVATING ENGINE AFTER INTERMEDIATE STORAGE.

a. Remove protective covers.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Remove any barrier material and tape. Remove tape residue, using dry cleaning solvent (item 99, Appendix D).

c. Wipe external engine surfaces, with dry towel (item 113, Appendix D).

d. Check the aircraft or engine logbook for a record of any components that may not have been installed or that may have been removed. Be sure that any removed, uninstalled, or disconnected components have been installed.

e. Follow inspection requirements in paragraph 1-61.

f. Depreserve engine fuel system as follows:

(1) With aircraft fuel system pressurized in accordance with applicable aircraft maintenance manual, advance power control lever to LOCKOUT for at least 1 minute or until a steady stream of fuel drains from engine common drain into a suitable container.

(2) Return power control lever to OFF.

NOTE

After engine depreservation or after replacement of either HMU, oil cooler, **(T700)** POU, or **(T701, T701C, T701D)** ODV, the first engine start may have a delayed lightoff and longer-than-normal start time. Some smoke may also be noticed, but no visible smoke should appear after preservative oil is burned off.

1-111. CLEANLINESS.

a. Keep dirt and other foreign material out of engine. Use recommended covers to seal openings in dismantled engine and in disassembled parts.

b. Place each engine part on a clean surface as it is removed from engine. Wrap small parts in barrier material (item 12, Appendix D), seal with tape (item 107, Appendix D) and tag (or otherwise identify) the package with engine and module serial number, part nomenclature, and part number.

c. Do not remove wrappings, protectors, or covers until the part is ready to be installed.

1-112. SERVICING OF ENGINE OIL TANK.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

CAUTION

- To prevent oil from being forced out of the engine, do not add oil to FULL line of sight glass without waiting a minimum of 20 minutes after engine shutdown.
- To prevent oil from being forced out of the engine, do not add oil above the FULL line.

NOTE

- Do not use DOD-PRF-85734 oil in turbine engines. DOD-PRF-85734 oil is to be used in transmissions and gearboxes only.
- If DOD-PRF-85734 is inadvertently added to the engine, and engine ran, drain and refill engine with correct oil.
- Oil does not have to be changed periodically.
- If the type of oil in the engine oil tank is not available, authorized type of oil may be added if the engine is to be operated in ambient temperatures above –30°F (–34°C). It is not necessary to drain the system and refill with one type of oil. (See table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)** for approved oils.) No mixing of engine oils is allowed if ambient temperatures are below –30°F (–34°C).

a. Wait a minimum of 20 minutes after engine shutdown to allow oil to drain back into oil tank before checking engine oil tank level in oil level indicator. If oil is contaminated, drain oil and refill tank (para 1-116).

CAUTION

- Lubricating oil MIL-PRF-7808 or Type I will be used when engine is operated in ambient temperatures below –30°F (–34°C). No mixing of lubricating oil is allowed for cold weather operation.
- Aircraft must be level to get an accurate reading of oil level indicator; otherwise, the reading could be wrong by as much as 2 quarts.
- Before beginning an extended flight with auxiliary fuel tanks installed on aircraft, oil tank will be filled to FULL line of sight glass.

b. If oil level is below midpoint of sight glass, add oil until level is at FULL line of sight glass.

CAUTION

Do not operate engine when engine requires more than 3.5 quarts of oil during a single oil servicing. Otherwise, engine bearings may be damaged.

c. If engine requires 3.5 quarts or more of oil during a single oil servicing, and has been operated, replace engine.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Self-sealing feature on oil tank cap and adapter PN 6038T99P01 is a critical characteristic.

d. Install oil tank cap (fig. 1-57) as follows:

(1) With locking lever in up position, turn lever counterclockwise to OPEN (view A, fig. 1-57).

(2) Seat cap firmly in oil tank opening (view B).

(3) Turn locking lever clockwise to CLOSE. Locking lever opening should be between the 9 and 12 o'clock positions (view C).

(4) Grasp locking lever firmly and pull upward. If properly positioned, the cap will remain seated firmly in tank.

CAUTION

Improperly secured oil tank cap will result in loss of oil.

(5) Press down firmly on lever to lock (view D).

1-113. DRAINING OF ENGINE OIL TANK.

a. If engine is installed in aircraft, see applicable aircraft maintenance manual for oil draining instructions.

b. If engine has been running, wait at least 20 minutes after engine shutdown to allow oil to drain back into oil tank before draining oil.

WARNING

Draining of Oil Tank

To prevent being burned by hot oil, wear protective gloves when draining oil.

c. For engines not installed in aircraft, drain the oil tank as follows:

(1) Place an empty 2-gallon (minimum) container under oil drain plug at six o'clock position on main frame.

(2) Remove plug from oil drain insert and drain oil into container. Remove and discard packing.

(3) Allow oil to drain into container for at least 10 minutes.

(4) Install new packing on plug; then thread plug into oil drain insert.

(5) Tighten (15° wrench-arc) plug.

(6) Check for oil leaks at oil drain plug at next engine run.

1-114. ENGINE OIL TANK DRAIN AND REFILL PROCEDURES FOR UNUSUAL CONDITIONS.

See table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)** for types of approved oils. Refer to paragraph 1-112, step d for installation of oil tank cap.

1-115. Replacing Oil of One Specification with that of Another. When changing oil of one oil specification to that of another, do the following:

WARNING

Draining of Oil Tank

To prevent being burned by hot oil, wear protective gloves when draining oil.

a. Drain oil from oil tank (para 1-113).

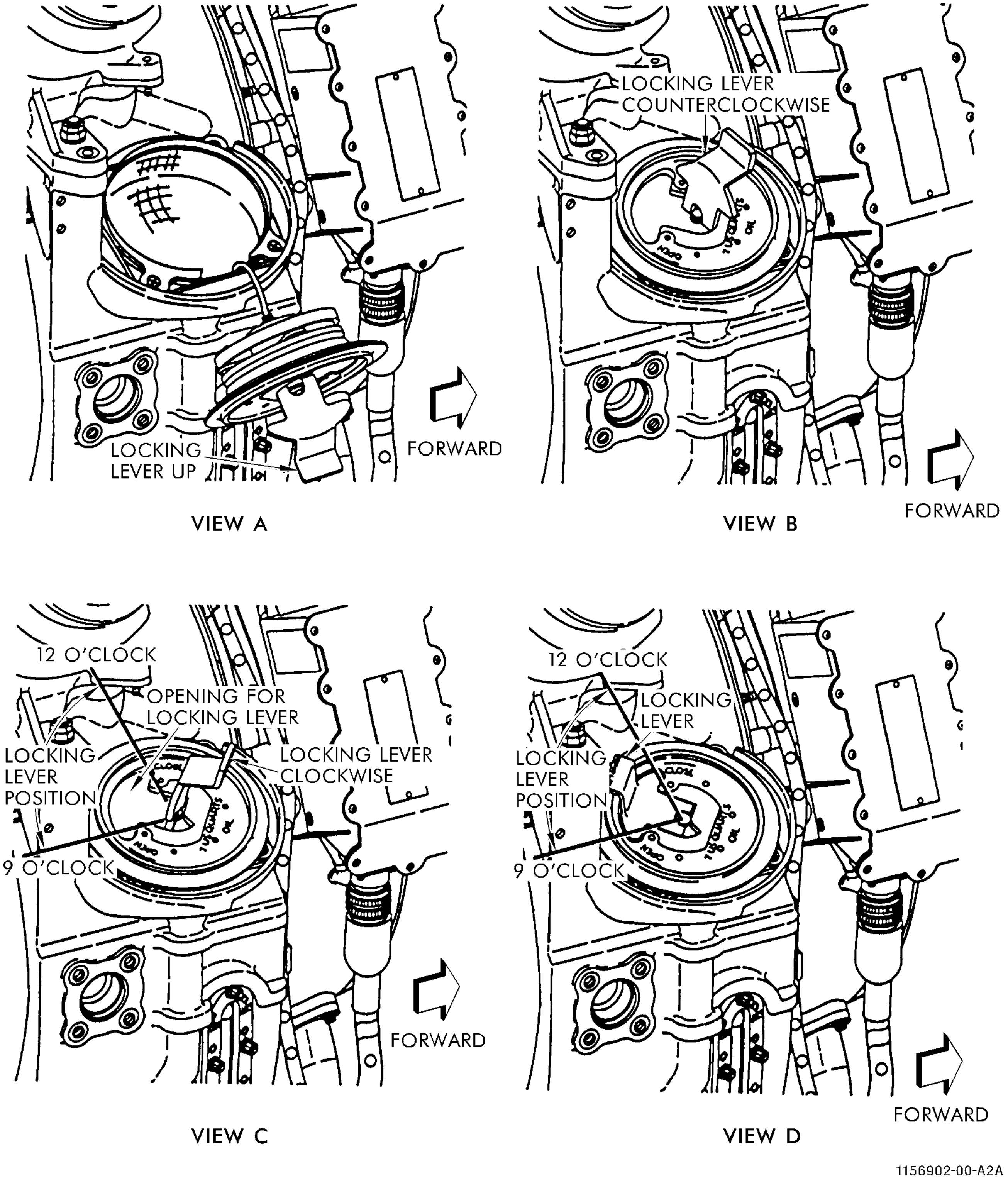


Figure 1-57. Oil Tank Cap; Correct Installation

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

CAUTION

Lubricating oil MIL-PRF-7808 (Type 1) will be used when engine is operated in ambient temperatures below –30°F (–34°C). No mixing of lubricating oil is allowed for cold weather operation.

b. Fill oil tank with 7 quarts of oil listed in table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)**.

1-116. Replacing Oil Which Has Been Contaminated. When replacing oil which has been contaminated, do the following:

WARNING

Draining of Oil Tank

To prevent being burned by hot oil, wear protective gloves when draining oil.

a. Drain oil from oil tank (para 1-113).

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

CAUTION

Lubricating oil MIL-PRF-7808 (Type I) will be used when engine is operated in ambient temperatures below –30°F (–34°C). No mixing of lubricating oil is allowed for cold weather operation.

NOTE

- Do not use DOD-PRF-85734 oil in turbine engines. DOD-PRF-85734 oil is to be used in transmissions and gearboxes only.
- If DOD-PRF-85734 is inadvertently added to the engine, and engine ran, drain and refill engine with correct oil.

b. Fill oil tank with 7 quarts of oil listed in table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)**.

c. Refer to instructions in Aircraft Operator's Manual when starting engines. Start engine and run at ground idle for 5 minutes.

d. Shut down engine.

e. Drain oil from oil tank (para 1-113).

f. Fill oil tank with 7 quarts of oil listed in table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)**.

1-117. Servicing Oil Tank After Replacement of a Failed Oil Cooler. When purging engine oil system after replacement of oil cooler, do the following:

WARNING

Draining of Oil Tank

To prevent being burned by hot oil, wear protective gloves when draining oil.

CAUTION

After replacing a failed oil cooler, it is necessary to drain and flush the engine oil system to purge all oil sumps of fuel before operating the engine.

a. Drain oil from oil tank (para 1-113).

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

CAUTION

Lubricating oil MIL-PRF-7808 (Type I) will be used when engine is operated in ambient temperatures below –30°F (–34°C). No mixing of lubricating oil is allowed for cold weather operation.

b. Fill oil tank with 7 quarts of oil listed in table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)**.

CAUTION

- Do not exceed starter operating limits. Observe required starter cooling time interval between duty cycles.
- The power control lever must be stopcocked and ignition switch must be OFF while motoring engine.

c. Depress engine starter button and motor engine to maximum starter speed for 2 minutes.

d. Release engine starter button and wait 5 minutes.

e. Repeat step c.

f. Release engine starter button. Allow engine to coast to a stop; then drain oil from oil tank (para 1-113).

g. Fill oil tank with 7 quarts of oil listed in table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)**.

NOTE

Refer to instructions in Aircraft Operator's Manual when starting engines.

h. Start engine and run at ground idle speed for 30 minutes.

i. Shut down engine; then drain oil from oil tank (para 1-113).

j. Fill oil tank with 7 quarts of oil listed in table 1-4 **(T700)** or 1-5 **(T701, T701C, T701D)**.

1-118. SERVICING WHEN IMPENDING BYPASS BUTTON POPS.

a. When oil filter impending bypass button pops, refer to paragraph 8-30.

b. When fuel filter impending bypass button pops, refer to paragraph 6-46.

1-119. OPERATIONAL CHECKS (ENGINE TESTING: ENGINE INSTALLED IN AIRCRAFT).

The following paragraphs give instructions for functional testing during troubleshooting, following repair or replacement of parts, and following replacement of engine. Engine is tested while installed in the aircraft.

1-120. Preparation for Test.

CAUTION

Engine air inlet areas will be checked for presence of ice before starting engine.

Before attempting engine start in cold weather, visually inspect engine air inlet areas for deposits of ice. If ice is present, thaw it; do not chip it away.

1-121. Instrumentation Requirements. Use standard aircraft instruments to monitor the following parameters:

- Turbine gas temperature (TGT)
- Output shaft torque
- Oil pressure
- Gas generator turbine rotor speed (Ng)
- Power turbine rotor speed (Np)
- **(T700, T701C, T701D)** Oil temperature

1-122. Engine Rollover (Dry Motoring).

a. Set the power control lever to OFF (stopcock).

b. Place collective stick to full-down (flat pitch) position.

c. Make sure that engine ignition switch is at OFF.

d. Depress and hold starter button to motor engine. Release button to stop motoring.

1-123. Engine Starting Procedures.

CAUTION

At any time during engine operation, if PAS is reduced below ground idle and there is a decreasing indication of Ng, Np, T4.5, torque, Wf, P3, or oil pressure, immediately chop PAS to stopcock/shutoff and shut down engine. Advancing PAS from below ground idle during engine deceleration may result in a stall or engine overtemperature. See emergency shutdown procedure.

NOTE

During engine starting, a combustor rumbling may be heard before reaching ground idle. This rumbling is acceptable as long as it stops before reaching ground idle.

If combustor rumbling persists at or above ground idle, refer to troubleshooting procedure 27 (table 1-13). Refer to instructions in the Aircraft Operator's Manual.

1-124. Engine Operating Procedures. Refer to instructions in the Aircraft Operator's Manual.

1-125. Engine Operating Parameters. Observe engine operating limits in table 1-17 **(T700)** or 1-18 **(T701, T701C, T701D)** during all phases of engine testing.

Table 1-17. **(T700)** *Engine Operating Limits (In Aircraft)*

Item	Limits	Remarks
	NOTE • 100% Ng = 44,700 rpm • 100% Np = 20,900 rpm • Overspeed trips at 106 ±1% Np (22,200 rpm) • Overspeed test position trips at 99 ±1% Np (20,600 ±200 rpm)	
Ng:		
a. Max continuous	99% (44,253 rpm)	Ng overspeed replacement limits are; Ng exceeds 47,000 rpm (105%) for 12 seconds or longer or exceeds 46,000 rpm (103%) for 2 1/2 minutes or longer, replace engine. Make required checks (para 1-126) and continue to operate.
b. Intermediate (30 minutes)	102% (45,594 rpm)	
c. Transient (12 seconds)	105% (46,935 rpm)	
d. Ground idle (minimum)	63% (28,161 rpm)	

Table 1-17. **(T700)** *Engine Operating Limits (In Aircraft) (Cont)*

Item	Limits	Remarks
Np:		
a. No time limit	105% (22,000 rpm)	For power turbine overspeed replacement limits, see figure 1-58.
b. Transient (12 seconds)	121% (25,300 rpm)	
TGT:		
a. Max continuous	775°C (1427°F)	
b. Max steady-state (red line)	850°C (1562°F)	
c. Transient (12 seconds)	886°C (1626°F)	
Time limits at temperature:		
a. No time limit	775°C (1427°F)	For engine overtemperature replacement limits, see figures 1-50 and 1-53.
b. 30 minutes	850°C (1562°F)	
c. Transient (12 seconds)	886°C (1626°F)	
d. No operation allowed	Above 886°C (1626°F)	
Output shaft torque:		
a. Max continuous	410 foot-pounds	Do not exceed aircraft transmission torque limits. For engine torque limits, see figure 1-59.
b. Intermediate (30 minutes)	500 foot-pounds	
c. Transient (12 seconds)	700 foot-pounds	
Free air temperature (FAT).	–54° to 55°C (–65° to 131°F)	
Fuel leakage.	2 cc/min maximum (approximately 10 drops per minute).	Leakage from all drains with engine running
HMU vent drain leakage:		
a. running	50 cc/hr	
b. static (excluding leakage during priming of HMU)	50 cc/hr (about 4 drops per minute)	
Oil cooler (PNs 6044T95P01 or 6044T95P02) weephole.	No leakage allowed.	

*Table 1-17. **(T700)** Engine Operating Limits (In Aircraft) (Cont)*

Item	Limits	Remarks
POU drain (at shutdown)	75 cc maximum 20 cc minimum	
Swirl frame drain (running)	5 cc/hr	
All drains after a false start	200 cc maximum	
Ignition exciter duty cycle	2 minutes ON 3 minutes OFF. 2 minutes ON 23 minutes OFF.	
Starting:		
a. Time between ground starts	30 seconds minimum.	• If engine does not light off, abort start. Motor engine on starter (ignition at OFF, power control lever at OFF) for 30 seconds to purge system of fuel. • If power turbine does not rotate within 30 seconds after reaching ground idle speed, abort start. Try to turn power turbine by hand, and listen for unusual noises or any other indication of problems.
b. Time-to-idle	See figure 1-61.	
c. Time-to-lightoff	30 seconds.	

CAUTION

At any time during engine operation, if PAS is reduced below ground idle and there is a decreasing indication of Ng, Np, T4.5, torque, Wf, P3, or oil pressure, immediately chop PAS to stopcock/shutoff and shut down engine. Advancing PAS from below ground idle during engine deceleration may result in a stall or engine overtemperature. See emergency shutdown procedure.

*Table 1-17. **(T700)** Engine Operating Limits (In Aircraft) (Cont)*

Item	Limits	Remarks
Oil pressure:		

CAUTION

Do not use lubricating oil MIL-L-23699 (TYPE II) when operating engine in FAT below –34°C (–30°F); otherwise, engine may be damaged.

Engine Power Setting	Normal Pressure Range (psig)	Max Pressure (psig)	Min Pressure (psig)	
GROUND and FLIGHT IDLE	20-40	40	20	• Oil pressure limits apply to both MIL-L-7808 (Type I) and MIL-L- 23699 (Type II) oils. • It is normal for oil pressure to be high during first start when oil is cold. Oil pressure should return to normal after 5 minutes operation at idle speed. During these 5 minutes do not accelerate above ground idle speed until oil pressure can be held to maximum limit throughout acceleration. • Normal oil pressure is defined as the pressure reading obtained during stabilized power settings with a clean lubrication system and with normal operating oil temperatures.
90% Ng to INTERMEDIATE	35-100	120	35	

Oil pressure fluctuation	±5 psi maximum.	

CAUTION

Do not operate engine when engine requires more than 3.5 quarts of oil during a single oil servicing. Otherwise, engine bearings may be damaged.

Oil consumption	133 cc/hr (0.3 lb/hr) maximum	• Oil consumption of 0.3 lb/hr is equal to consumption of one quart in 6.5 hours. For an accurate oil consumption check, add up the engine running time for each of the last 3 quarts of oil added. Divide this total by 3. The result shall not be less than 6.5 hours per quart. • See paragraph 1-144 for example of calculating oil consumption in cc/hr.

Table 1-17. ***(T700)*** ***Engine Operating Limits (In Aircraft) (Cont)***

Item	Limits			Remarks
Oil temperature (at pump discharge):				
Engine Power Setting	Normal Temp Range	Max Temp	Min Temp	
All	35°-136°C (95°-275°F)	149°C (300°F)	None	• Oil temperature limits apply to both MIL-L-7808 (Type I) and MIL-L- 23699 (Type II) oils. • If oil temperature is out-of-limits, troubleshoot problem as directed in troubleshooting procedures (para 1-72). • Do not run engine when oil temperatures are above maximum limit.
Anti-icing bleed and start valve closing	The engine anti-ice advisory light in the cockpit will be off at 60% torque (HIT CHECK) and above unless engine anti-ice is turned on.			(**UH-60A**) If any part of engine anti-icing check fails, do not fly helicopter.

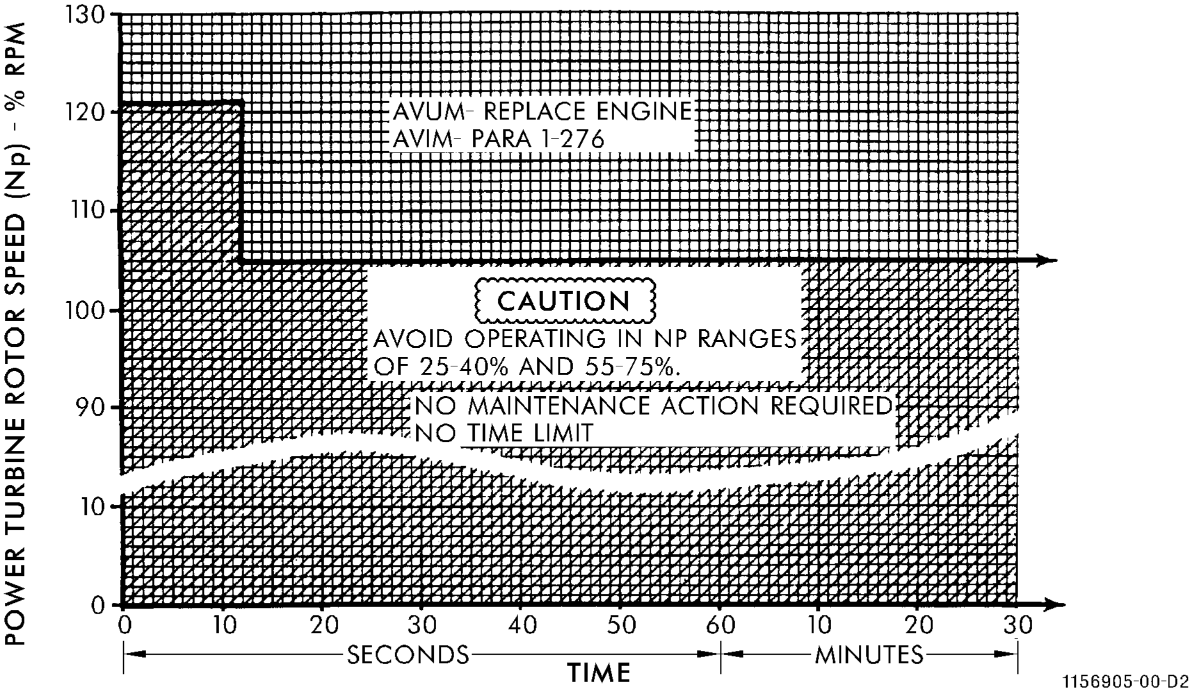


Figure 1-58. Maintenance Requirements following Np Overspeed (Above 22,000 rpm)

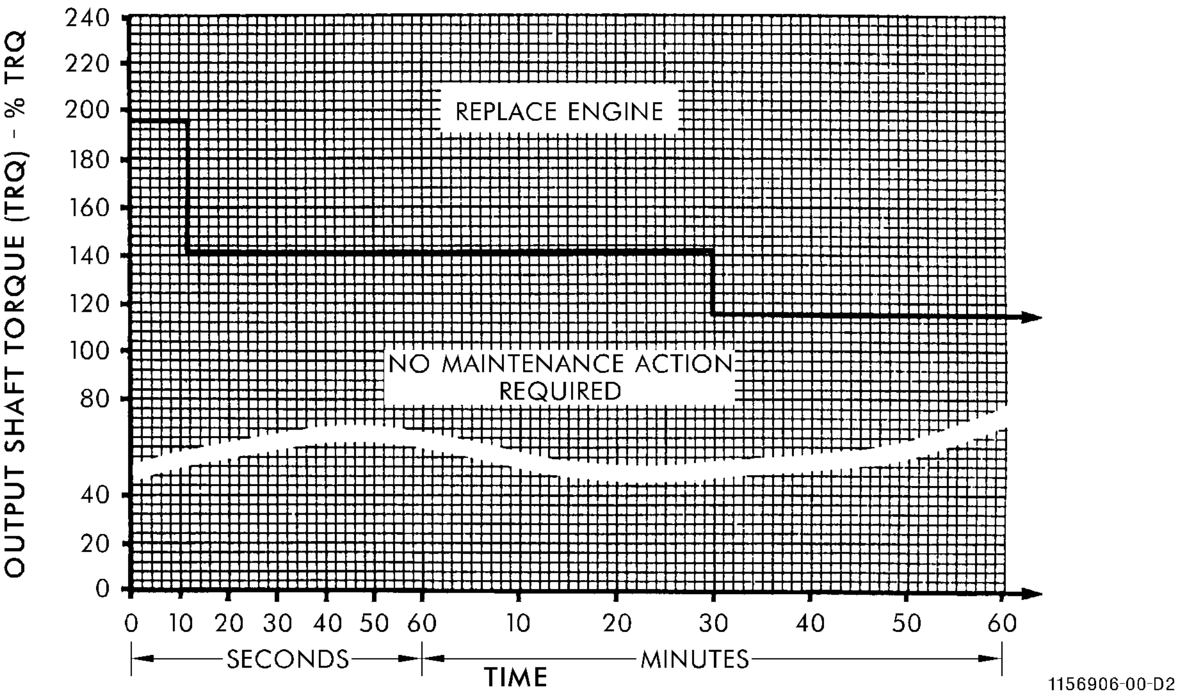


Figure 1-59. (T700, T701) Maintenance Requirements Following Engine Overtorque (Above 116%)

*Table 1-18. **(T701, T701C, T701D)** Engine Operating Limits (In Aircraft)*

NOTE

- 100% Ng = 44,700 rpm
- 100% Np = 20,900 rpm
- Overspeed trips at 119.6 ±1% Np (25,000 rpm)
- Overspeed test position trips at 95.7 ±1% Np (20,000 ±200 rpm)

Item	Limits	Remarks
Ng:		
a. Max continuous	99% (44,253 rpm)	Ng overspeed replacement limits are; Ng exceeds 47,000 rpm (105%) for 12 seconds or longer or exceeds 46,000 rpm (103%) for 2 1/2 minutes or longer, replace engine. Make required checks (para 1-126) and continue to operate.
b. **(T701C, T701D)** Intermediate **(T701)** Intermediate (30 minutes)	102% (45,594 rpm)	
c. Transient (12 seconds)	105% (46,935 rpm)	
d. Ground idle (minimum)	63% (28,161 rpm)	
Np:		
a. No time limit	105.2% (22,000 rpm)	For power turbine overspeed replacement limits, see figure 1-58.
b. Transient (12 seconds)	121% (25,300 rpm)	
TGT:		
a. Max continuous	**(T701)** 807°C (1485°F) **(T701C, T701D)** 810°C (1490°F)	
b. Intermediate (30 minutes)	**(T701)** 869°C (1596°F) **(T701C, T701D)** 851°C (1564°F)	
c. Maximum (10 minutes)	**(T701C, T701D)** 878°C (1612°F)	
d. Contingency (2.5 minutes)	**(T701)** 917°C (1683°F) **(T701C, T701D)** 903°C (1657°F)	
e. Transient (12 seconds)	**(T701)** 965°C (1769°F) **(T701C, T701D)** 949°C (1740°F)	
f. Starting transient	**(T701)** 869°C (1596°F) **(T701C, T701D)** 851°C (1564°F)	
g. Shutdown	538°C (1000°F).	

*Table 1-18. **(T701, T701C, T701D)** Engine Operating Limits (In Aircraft) (Cont)*

Item	Limits	Remarks
Time limits at temperature:		
a. No time limit	**(T701)** Up to 807°C (Up to 1484°F) **(T701C, T701D)** Up to 810°C (1490°F)	For engine overtemperature replacement limits, see figures **(T701)** 1-51 or **(T701C, T701D)** 1-52 and **(T701)** 1-54 or **(T701C, T701D)** 1-55.
b. 30 minutes	**(T701)** 869°C (1596°F) **(T701C, T701D)** 851°C (1564°F)	
c. 10 minutes	**(T701C , T701D)** 878°C (1612°F)	
d. 2.5 minutes	**(T701)** 917°C (1683°F) **(T701C, T701D)** 903°C (1657°F)	
e. Transient (12 seconds)	**(T701)** 965°C (1769°F) **(T701C, T701D)** 949°C (1740°F)	
f. No operation allowed	**(T701)** Above 965°C (1769°F) **(T701C, T701D)** Above 949°C (1740°F)	
Output shaft torque (foot-pounds):		

NOTE

355 foot-pounds = 100% torque for the **T701, T701C, and T701D**.

	(T701)	**(T701C, T701D)**	
a. Max continuous	410	500	Do not exceed aircraft transmission torque limits. For engine torque limits, see **(T701)** figure 1-59 or **(T701C, T701D)** figure 1-60.
b. Intermediate (30 minutes)	500	543	
c. Transient (12 seconds)	700	700	

Free air temperature (FAT)	–54° to 57°C (–65° to 135°F)	
Fuel leakage	2 cc/min maximum (approximately 10 drops per minute)	Leakage from all drains with engine running.
HMU vent drain leakage:		
a. Running 50 cc/hr		
b. Static (excluding leakage during priming of HMU)	50 cc/hr (about 4 drops per minute)	
Oil cooler (PNs 6044T95P01 or 6044T95P02) weephole	No leakage allowed	

*Table 1-18. **(T701, T701C, T701D)** Engine Operating Limits (In Aircraft) (Cont)*

Item	Limits	Remarks
ODV drain (running)	5 cc/hr maximum	
Swirl frame drain (running)	5 cc/hr maximum	
All drains after a false start	200 cc maximum	
Ignition exciter duty cycle	2 minutes ON 3 minutes OFF. 2 minutes ON 3 minutes OFF. 2 minutes ON 48 minutes OFF.	

CAUTION

At any time during engine operation, if PAS is reduced below ground idle and there is a decreasing indication of Ng, Np, T4.5, torque, Wf, P3, or oil pressure, immediately chop PAS to stopcock/shutoff and shut down engine. Advancing PAS from below ground idle during engine deceleration may result in a stall or engine overtemperature. See emergency shutdown procedure.

Item	Limits	Remarks
Starting:		
a. Time between ground starts	30 seconds minimum.	• **(T701C, T701D Apache)** Time-to-lightoff commences when Ng begins to rise after a bump start.
b. Time-to-idle	See figure 1-61.	• If engine does not light off, abort start. Motor engine on starter (ignition at OFF, power control lever at OFF) for 30 seconds to purge system of fuel.
c. Time-to-lightoff	30 seconds.	• If power turbine does not rotate within 30 seconds after reaching ground idle speed, abort start. Try to turn power turbine by hand, and listen for unusual noises or any other indication of problems.

*Table 1-18. **(T701, T701C, T701D)** Engine Operating Limits (In Aircraft) (Cont)*

Item	Limits	Remarks
Oil pressure:		

CAUTION

To avoid engine damage, do not use lubricating oil MIL-PRF-23699 (TYPE II) when operating engine in FAT below –34°C (–30°F).

Engine Power Setting	Min Pressure (psig)	Max Pressure (psig)	Remarks
All power settings	22.5	120	• Oil pressure limits apply to both MIL-PRF-7808 (Type I) and MIL-PRF-23699 (Type II) oils. • It is normal for oil pressure to be high during first start when oil is cold. Oil pressure should return to normal after 5 minutes operation at idle speed. During these 5 minutes, do not accelerate above ground idle speed until oil pressure can be held to maximum limit throughout acceleration. • Normal oil pressure is defined as the pressure reading obtained during stabilized power settings with a clean lubrication system.

Item	Limits	Remarks
Oil pressure fluctuation	±5 psi maximum	

CAUTION

Do not operate engine when engine requires more than 3.5 quarts of oil during a single oil servicing. Otherwise, engine bearings may be damaged.

Item	Limits	Remarks
Oil consumption	133 cc/hr (0.3 lb/hr) maximum	• Oil consumption of 0.3 lb/hr is equal to consumption of one quart in 6.5 hours. For an accurate oil consumption check, add up the engine running time for each of the last 3 quarts of oil added. Divide this total by 3. The result shall not be less than 6.5 hours per quart. • See paragraph 1-144 for example of calculating oil consumption in cc/hr.
Anti-icing bleed and start valve closing	The engine anti-icing advisory light in the cockpit will be off at 60% torque (HIT CHECK) and above unless engine anti-ice is turned on.	• **(AH-64A, UH-60L)** If any part of engine anti-ice valve check fails, do not fly helicopter.

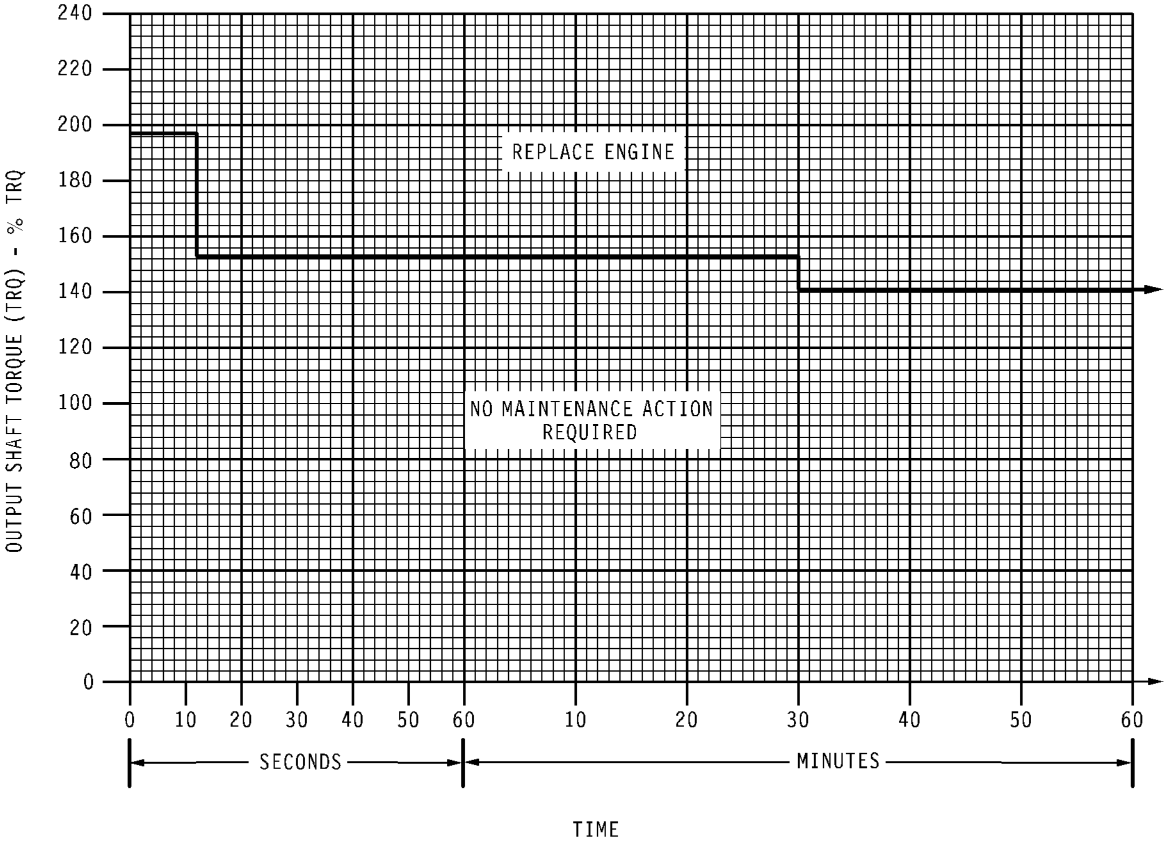


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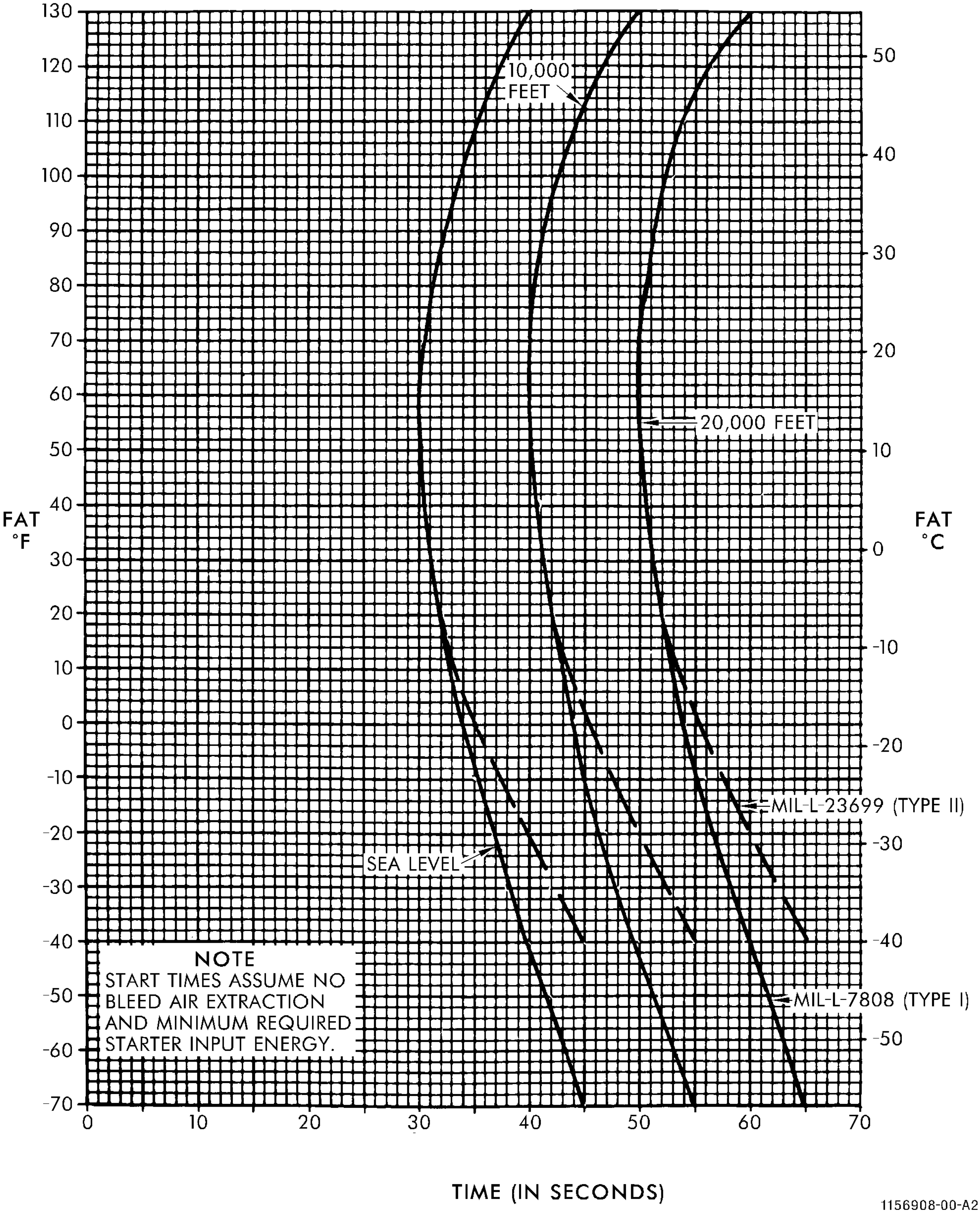
Figure 1-60. ***(T701C, T701D)*** ***Maintenance Requirements Following Engine Overtorque (Above 141%)***



NOTE
START TIMES ASSUME NO BLEED AIR EXTRACTION AND MINIMUM REQUIRED STARTER INPUT ENERGY.

Figure 1-61. Time-to-Idle Limits

1-126. Checkout Procedure for New and Reinstalled Engines.

a. Perform engine electrical chip detector test per paragraphs 1-90, 8-51, and 8-55.

b. Motor engine with starter for 30 seconds.

c. Prime the engine fuel system (para 1-137).

d. Refer to instructions in Aircraft Operator's Manual when starting engines.

e. Do the following:

- Idle speed check (para 1-140)
- Idle speed leakage check (para 1-139)
- Np governing check (para 1-141)
- Torque matching check (para 1-142)
- **(T700)** Overspeed check (para 1-132)
- **(T701, T701C, T701D)** Overspeed check (para 1-133)
- **(T700, T701)** ECU or **(T701C, T701D)** DEC lock-out system check (para 1-134)
- **(T700)** Maximum power check for **UH-60A** (para 1-145)
- **(T701, T701C, T701D)** Maximum power check for **AH-64A** (para 1-146)
- **(T701C, T701D)** Maximum power check for **UH-60L** (para 1-147)
- **(T700)** TGT limiter setting check (para 1-129)
- **(T701, T701C, T701D)** TGT limiter setting/Contingency power check (para 1-130)

1-127. Engine Checks Required Following Replacement of Parts.

NOTE

- If HMU PN 4046T52G28 or 4046T52G29 (6068T97P07 or 6068T97P08) is removed from a T700-GE-701C or a T700-GE-701D powered **AH-64A** Apache and replaced with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU, the opposite engine must be configured with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU. Additionally, both engines must be configured with 5078T29G02 (6080T56P03) or higher DECs.
- If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or a T700-GE-701D powered AH-64A Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with 4046T52G30 (6068T97P09) or 4046T52G38 (6068T97P13) HMUs.

a. Table 1-19 lists the checks that have to be made after engine parts have been replaced or removed to gain access to other parts or other areas.

b. If two or more checks are required, they can be done during the same run.

c. Checks listed in table 1-19 are described in paragraphs 1-88, 1-90, 1-123, 1-129, 1-130, 1-132, 1-133, 1-134, 1-137, 1-139, 1-140, 1-141, 1-142, 1-143 and 1-144.

1-128. Engine Checks Required After a Lightning Strike.

If lightning strikes aircraft, do the following:

a. Check both engines, including components, for physical damage. If engine is damaged, determine level of maintenance and fill out appropriate forms or tags or both.

NOTE

If engine parts are repaired or replaced, make required checks after doing step e.

b. Repair or replace damaged component.

c. Check associated wiring for physical damage such as burn marks or broken wires.

d. Repair or replace wiring as required.

e. Check both engines and control systems for proper operation by doing the following checks:

- Circuit checks at S39 connector on ECU or DEC (para 1-79 or 1-262).
- Overspeed check (para 1-132 or 1-229 **(T700)** or para 1-133 or 1-230 **(T701)**).
- TGT limiter setting check (para 1-129 or 1-232 **(T700)** or para 1-233 **(T701, T701C, T701D)**).
- **(T701, T701C, T701D)** TGT limiter setting/ Contingency power check (para 1-130).
- Torque matching check (para 1-142 or 1-234).

Table 1-19. Checks Required Following Replacement of Parts with Engine in Aircraft

NOTE:
Engine designation is as follows:

(A) = **(T700)**
(B) = **(T701C, T701D)**
(C) = **(T700, T701)**
(D) = **(T701, T701C, T701D)**
(E) = **(T700, T701C, T701D)**

Item	Part Replaced	Torque Repeatability (Para 1-88)	Engine Start (Para 1-123)	TGT Limiter Setting/Contingency Power Check (D) (Para 1-130)	TGT Limiter Setting (A) (Para 1-129)	Overspeed (A) (Para 1-132) (D) (Para 1-133)	(C) ECU or (B) Lockout System Check (Para 1-134)	Priming (Para 1-137)	Idle Speed Leakage (Para 1-139)	Idle Speed (Para 1-140)	Np Governing (Para 1-141)	Torque Matching (Para 1-142)	Anti-Icing Bleed and Start Valve (Para 1-143)	Oil Consumption (Para 1-144)	Max Power Check (Refer to applicable aircraft maintenance manual)	DCU/ECU Lockout Cycling (Para 1-134)	Perform Accel/Decel MOC (Refer to applicable aircraft maintenance test flight manual)	Remarks
1.	Accessory Gearbox															•		
2.	Alternator Stator		•			•			•	•	•							
3.	Anti-Icing Bleed and Start Valve		•						•				•					Do not fly helicopter if any part of engine anti-ice test fails.
4.	B-Sump Drain Tube		•						•									
5.	B-Sump Oil Inlet Check Valve		•						•									
6.	Blue Electrical Cable (W5)		•			•						•						
7.	C-Sump Cover and C-Sump Heat Shield		•						•					•				
8.	Compressor Leakage Air Tube		•						•									
9.	(C) ECU or (B) DEC		•	•	•	•			•		•	•			•			Operate engine within limits of paragraph 1-125.
10.	Electrical Chip Detector		•						•									No chip detector light.
11.	Electrical Ignition Leads		•															
12.	Fuel Boost Pump		•					•	•									
13.	Fuel Filter		•					•	•									
14.	Fuel Filter Element and Bowl		•					•	•									
15.	Fuel Injectors		•					•	•									
16.	Fuel Pressure Sensor		•					•	•									
17.	Fuel Start Feed Tube		•					•	•									
18.	(A) Fuel Start Manifold Tube		•					•	•									
19.	Gearbox-to-HMU Hose Assembly		•					•	•									
20.	Green Electrical Cable (W3)		•							•			•					
21.	(C) History Recorder or (B) History Counter		•															
22.	HMU		•				•	•	•	•	•		•			•	•	Operate engine within limits of paragraph 1-125.
23.	Igniter Plugs		•															
24.	Ignition Exciter Assembly		•															
25.	Inlet Separator Boot		•						•									
26.	Main Frame Oil Strainer		•						•									
27.	No. 1 Carbon Seal		•						•					•				

Table 1-19. Checks Required Following Replacement of Parts with Engine in Aircraft (Cont)

NOTE:
Engine designation is as follows:

(A) = **(T700)**
(B) = **(T701C, T701D)**
(C) = **(T700, T701)**
(D) = **(T701, T701C, T701D)**
(E) = **(T700, T701C, T701D)**

Item	Part Replaced	Torque Repeatability (Para 1-88)	Engine Start (Para 1-123)	TGT Limiter Setting/Contingency Power Check (D) (Para 1-130)	TGT Limiter Setting (A) (Para 1-129)	Overspeed (A) (Para 1-132) (D) (Para 1-133)	(C) ECU or (B) Lockout System Check (Para 1-134)	Priming (Para 1-137)	Idle Speed Leakage (Para 1-139)	Idle Speed (Para 1-140)	Np Governing (Para 1-141)	Torque Matching (Para 1-142)	Anti-Icing Bleed and Start Valve (Para 1-143)	Oil Consumption (Para 1-144)	Max Power Check (Refer to applicable aircraft maintenance manual)	DCU/ECU Lockout Cycling (Para 1-134)	Perform Accel/Decel MOC (Refer to applicable aircraft maintenance test flight manual)	Remarks
28.	Np Sensor		•						•		•							
29.	Oil and Scavenge Pump		•						•					•				Oil pressure and temperature must be within limits of paragraph 1-125.
30.	Oil Cooler		•					•	•					•				Oil pressure and temperature must be within limits of paragraph 1-125.
31.	Oil Drain Insert		•						•									
32.	Oil Drain Plug		•						•									
33.	Oil Filter Bowl and Indicator Assembly		•						•									
34.	Oil Filter Bypass Sensor		•						•									No bypass light.
35.	Oil Filter Element		•						•									
36.	Oil Level Indicator		•						•									
37.	Oil Pressure Sensor		•						•									
38.	Oil Scavenge Screens		•						•									
39.	Oil Supply Tubes (Left-Hand and Right-Hand)		•						•									
40.	Oil Tank Cap and Adapter		•						•									
41.	(E) Oil Temperature Sensor		•						•									
42.	(A) P3 Hose and Tube Assembly or (D) P3 Tube		•						•									
43.	Particle Separator Blower		•						•	•				•				
44.	(A) Primer Nozzles		•					•	•									
45.	Radial Drive Shaft Assembly		•						•	•								
46.	Radial Drive Shaft Cover Assembly		•						•									
47.	Radial Drive Shaft Cover Boot		•						•									
48.	Sensing Tube		•							•								
49.	(A) POU, or (D) ODV		•			•		•	•									
50.	Thermocouple Assembly		•	•	•				•									
51.	Torque and Overspeed Sensor	•	•			•			•			•						
52.	Yellow Electrical Cable (W4)		•	•	•	•					•							

1-129. (T700) Determining (Aircraft) TGT Limiter Setting.

NOTE

If unable to reach TGT limits on ground, this check can be combined with Maximum Power Check (para 1-145).

If FAT is below 4°C (40°F), it may not be possible to determine TGT limiter setting. If ambient conditions make it impossible to determine TGT limiter setting, it may be possible (depending on how cold it is) to reach TGT limiter setting by turning the engine anti-ice switch ON. If TGT limiter setting cannot be reached, note this on log sheet and continue with next required test. If weather conditions prevent obtaining the TGT limiter setting, perform the check as soon as weather conditions permit; the aircraft may remain in flightworthy status. Make an entry in the aircraft logbook, “Aircraft TGT Limiter Setting Determination Due”.

NOTE

This procedure is done on one engine at a time.

a. Retard ENG POWER CONT lever on engine not being checked until a 0% TRQ is indicated.

NOTE

Transient overshoot up to 886°C (1627°F) for a maximum duration of 12 seconds may be observed, followed by TGT stabilizing at the normal limiting range of 837°C to 849°C (1538° to 1561°F).

b. Slowly increase collective pitch until TGT gage peaks at 837°- 849°C (1538°- 1561°F). Do not exceed 849°C (1561°F).

c. Allow at least 10 seconds for system to stabilize. Note Np and TGT.

d. Slowly increase collective pitch until Nr/Np has dropped at least 2%.

e. Wait 5 seconds and record TGT and Nr/Np. TGT observed is the setting and is normally 837°-849°C (1538°-1561°F).

f. TGT must be 837°- 849°C (1538°- 1561°F). If not, see troubleshooting procedure 37 in table 1-13.

1-130. (T701, T701C, T701D) Determining (Aircraft) TGT Limiter Setting/Contingency Power Check. If FAT is below (ECU) 4°C (40°F) or (DEC) –14°C (7°F), it may not be possible to determine TGT limiter setting. If ambient conditions make it impossible to determine TGT limiter setting, it may be possible (depending on how cold it is) to reach TGT limiter setting by turning the engine anti-ice switch ON. If TGT limiter setting cannot be reached, it will be impossible to determine if the engine will operate in contingency power. Note this on log sheet and continue with next required check. If weather conditions prevent obtaining the TGT limiter setting, perform the check as soon as weather conditions permit; the aircraft may remain in flightworthy status. Make an entry in the aircraft logbook, “Aircraft TGT Limiter Setting Determination Due”.

WARNING

Power Checks Above Ground Level (AGL)

A safe altitude must be maintained to allow for sufficient reaction time if the engine being tested fails, or if other emergency situations occur.

a. With both PWR levers in FLY, establish 110 KIAS level flight, 100% Nr/Np.

CAUTION

To avoid torque oscillations, when making performance checks, the torque on the engine not being checked must be at least 10% below the torque on the engine being checked.

NOTE

The torque on the engine not being checked must not be reduced below 51% at any time during the TGT limiter setting.

b. Slowly increase collective to approximately 80% torque on both engines, ambient conditions permitting.

c. Retard PWR lever on engine not being checked to establish a torque split between engines of at least 10%, but not less than 60% torque on the engine not being checked.

d. While maintaining no greater than 75% torque on the engine not being tested, increase collective to reach a TGT limiter setting and 2% NR/NP droop, or single engine torque limit, whichever comes first.

e. Allow indications to stabilize for at least 10 seconds. Record TGT reading. TGT observed should be between (ECU) 851°- 869°C (1564°- 1596°F) or (DEC) 857°- 875°C (1575°- 1607°F).

f. Reduce collective until a combined torque value less than the limiting torque value of the engine being checked is reached.

g. Retard PWR lever for the engine not being tested to IDLE in order to activate the contingency mode.

h. Increase collective until TGT is approximately 10°C (50°F) above the TGT reading recorded in step e. Do not exceed any aircraft limitations.

i. Reduce collective pitch, and advance the PWR lever for the engine not being checked to the FLY position.

j. Repeat steps a thru i for the other engine.

k. If TGT limiter setting was not between (ECU) 851°-869°C (1564°-1596°F) or (DEC) 857°-875°C (1575°-1607°F) or contingency power was not attained, refer to table 1-13, troubleshooting procedure 37.

1-131. Functional Check.

a. Be sure that replacement of line replaceable unit (LRU) has been recorded in proper engine records.

b. Using instructions in Aircraft Operator's Manual, start engine and accelerate to ground idle speed.

c. Run engine at ground idle speed for 5 minutes; be sure that engine is operating within limits (para 1-125).

d. Operate engine as required to verify that fault has been corrected.

e. Shut down engine.

1-132. (T700) Overspeed Check.

a. This check will be made to verify that the overspeed protection system is working properly.

b. The overspeed check will be made with both engines running.

c. Conduct a power turbine overspeed protection system check as follows:

CAUTION

Do not exceed engine or aircraft limitations.

(1) Set power control lever at IDLE position.

(2) Set collective pitch in full-down (flat pitch) position.

(3) Advance the power control lever for both engines to FLY.

(4) If Nr/Np is not at 100%, it may be set by using ENG RPM speed trim switch on the collective grip.

(5) Note Ng; press and hold in overspeed system test button A for engine being checked. Ng should not decrease. If Ng decreases, a failure has occurred in the overspeed circuit and must be investigated (troubleshoot according to table 1-13).

(6) Release test button A. Press and hold in test button B. Ng should not decrease. If Ng decreases, the overspeed circuit has failed and must be investigated (troubleshoot according to table 1-13). Release button B.

NOTE

When the overspeed test is done with both power control levers in FLY, cutback in Np may not be indicated on the aircraft instruments and may appear to always be at 100%. However, Ng must decrease.

(7) Press and hold in both buttons A and B. A noticeable transient decrease in both Ng and Np should occur. If this does not happen, the overspeed protection system has failed and must be investigated (troubleshoot according to table 1-13).

NOTE

With both engines running, Ng of the engine not being checked will increase to maintain constant Np.

(8) Release both test buttons A and B. Ng should return to speed noted in step (5).

(9) If both engines are being checked, repeat steps (5) through (8) for other engine.

1-133. (T701, T701C, T701D) Overspeed Check.

a. This check will be made to verify that the overspeed protection system is working properly.

b. The overspeed check will be made with both engines running.

CAUTION

To avoid damage to ignition exciter, do not exceed ignition exciter duty cycle (refer to table 1-18).

c. Set MASTER IGN switch to ON for this check.

d. Conduct a power turbine overspeed protection system check as follows:

CAUTION

Do not exceed engine or aircraft limitations.

(1) Set power control lever at IDLE position.

(2) Set collective pitch in full-down (flat pitch) position.

(3) Advance the power control lever for both engines to FLY.

(4) If Nr/Np is not at 100%, adjust rheostat for turbine speed reference unit (TM 1-1520-238-23).

CAUTION

To avoid engine damage, TGT must be monitored during overspeed check.

(5) If TGT rises above (ECU) 867°C (1593°F) or (DEC) 870°C (1598°F), shut engine down (PCL to OFF) immediately. Motor engine on starter (ENG START switch to IGN OVRD) until TGT decreases below 538°C (1000°F). Wait 5 minutes or until TGT decreases below (ECU) 150°C (302°F) or below (DEC) 80°C (176°F) before attempting an engine restart.

(6) Push CKT A switch to OVSP TEST position for the engine being checked. Ng should not decrease. If Ng decreases, a failure has occurred in the overspeed circuit and must be investigated (troubleshoot according to table 1-13). Release CKT A switch.

(7) Push CKT B switch to the OVSP TEST position for the engine being checked. Ng should not decrease. If Ng decreases, a failure has occurred in the overspeed circuit and must be investigated (troubleshoot according to table 1-13). Release CKT B switch.

CAUTION

Delay in release of CKT A and CKT B switches may result in Ng recycling below IDLE, subsequent engine stall, and TGT increase.

NOTE

- For **T701C**, **T701D** engines used on **UH-60**, when both CKT A and CKT B switches are pressed simultaneously, engine should re-light after release of buttons.
- For **T701C**, **T701D** engines used on **AH-64**, when both CKT A and CKT B switches are pressed simultaneously, it is acceptable for the engine to flameout and not automatically re-light.

(8) Push both CKT A and CKT B switches for the engine being checked to the OVSP TEST position. When Ng starts to decrease, immediately release both switches. If Ng does not decrease, a failure has occurred in the overspeed protection system and must be investigated (troubleshoot according to table 1-13).

(9) If both engines are being checked, repeat steps (4) thru (8) for the other engine.

1-134. ECU or DEC Lock-out System Check. If a ECU or DEC lock-out check is required, do the following:

a. Make sure that aircraft is at a flat pitch on the ground, that parking brakes are set, and that tail wheel is locked.

CAUTION

To avoid the possibility of an overtemperature, the main rotor must be in flat pitch, because there is no TGT limiter in ECU or DEC lockout mode. In ECU or DEC lockout mode, manual control of the engine is required.

b. Set power control levers so that both engines equal 100% Np.

CAUTION

Uncommanded % RPMR increasing will result from an engine control failing high side, and uncommanded % RPMR decreasing will result from an engine control failing low side.

c. Anytime an HMU or AGB is removed and a replacement is installed, perform a minimum of 5 cycles of DEC or ECU lockout. Lockout without an uncommanded acceleration or deceleration should occur. If an uncommanded acceleration or deceleration occurs, see troubleshooting procedure 10 or 33 as appropriate.

d. On engine being checked, advance power control lever to LOCKOUT. Immediately retard same power control lever to a position midway between FLY and IDLE.

e. Slowly advance power control lever to a position where both engine % torques are matched at 100% Np.

f. On engine being checked, slowly advance the power control lever until a torque split of approximately 10% is reached, and an increase in Np is noticed. If this cannot be done, see troubleshooting procedure 62, in table 1-13.

CAUTION

To avoid engine damage, do not operate engine steady-state between 24%-38% Np (5,000-8,000 rpm) or 53%-67% Np (11,000-14,000 rpm) range.

g. Re-engage ECU or DEC by retarding power control lever to IDLE and then by advancing lever to FLY.

h. Repeat check for other engine.

1-135. Engine Shutdown Procedure (Normal).

Before moving power control lever to OFF position, engine must be cooled for 2 minutes at an Ng speed of 90% or less. If an engine is shut down from a high power setting (above 90% Ng) without being cooled for 2 minutes, and it is necessary to restart the engine, refer to paragraph 1-136 (Emergency Shutdown Procedure) for restart instructions.

CAUTION

- Do not exceed starter operating limits.
- TGT must be brought below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F) before attempting engine restart.
- Engine must be cooled for 2 minutes at an Ng speed of 90% or less.

a. Before attempting a restart, be sure that power control lever and ignition are at OFF positions. Motor engine until TGT decreases below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F).

b. If there is evidence of combustion after shutdown, if TGT rises rapidly, or if TGT is greater than 538°C (1000°F), make sure that power control lever and ignition are at OFF positions. Motor engine until TGT indicates combustion has stopped or until TGT is below 538°C (1000°F). Continue to monitor TGT to be sure combustion or temperature greater than 538°C (1000°F) does not occur. If it does, continue motoring the engine even if starter limitations must be exceeded.

c. If there is evidence of fire inside the engine, extinguish fire with CO_2 by spraying it into engine air inlet while motoring engine. Starter limitations may be exceeded. Refer to table 1-16 (item 2) for required maintenance data.

1-136. Emergency Shutdown Procedure.

An emergency shutdown is one in which the engine is shutdown from high power (over 90% Ng) without first being cooled for 2 minutes at idle speed.

a. After an emergency shutdown, do not try to restart engine until fault has been found and corrected.

b. If an abnormal engine condition such as a compressor stall, flameout, or overtemperature occurs, shut down the engine immediately. During compressor rotor coastdown, listen for any unusual noises or for signs of a mechanical failure.

c. Before attempting restart after emergency shutdown, do the following:

CAUTION

- Do not exceed starter operating limits.
- TGT must be brought below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F) before attempting engine restart.
- Attempted restart must be made within 5 minutes of emergency shutdown.

(1) With power control lever and ignition at OFF positions, motor engine until TGT decreases below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F).

(2) Make restart attempt within 5 minutes of emergency shutdown.

(3) If restart attempt cannot be made within 5 minutes of emergency shutdown, wait 4 hours minimum before attempting engine restart.

(4) Hand-crank engine (para 1-98) to verify that the gas generator rotor is not seized.

d. If there is evidence of combustion after shutdown, if TGT rises rapidly, or if TGT is greater than 538°C (1000°F), make sure that power control lever and ignition are at OFF positions. Motor engine until TGT indicates combustion has stopped or until TGT is below 538°C (1000°F). Continue to monitor TGT to be sure combustion or temperature greater than 538°C (1000°F) does not occur. If it does, continue motoring the engine even if starter limitations must be exceeded.

e. If there is evidence of fire inside the engine, extinguish fire with CO_2 by spraying it into engine air inlet while motoring engine. Starter limitations may be exceeded. Refer to table 1-16 (item 2) for required maintenance action.

f. If engine is equipped with a DEC, record the fault code displayed 30 seconds after engine shutdown. If no fault is detected, the torque reading will be 0.00. If fault is detected, refer to table 1-13 and troubleshoot DEC.

1-137. Engine Fuel System Priming.

a. **(UH-60)** Move the fuel selector valve on the engine control quadrant to either the direct (DIC) or crossfeed (XFD) position. **(AH-64A)** Move the fuel switch on the fuel control panel to the ON position.

b. With aircraft fuel system pressurized, advance power control lever to LOCKOUT (maximum position) until a steady stream of fuel, free of air and preserving oil, is draining from engine overboard drain.

c. Return power control lever to OFF.

d. **(UH-60)** Move the fuel selector valve on the engine control quadrant to OFF. **(AH-64A)** Move the fuel switch on the fuel control panel to OFF.

e. Engine priming is done for the following conditions:

(1) When troubleshooting.

(2) After disconnecting engine or aircraft fuel lines.

(3) After replacing oil cooler, fuel boost pump, fuel filter element, fuel filter, or HMU.

NOTE

- After engine has been depreserved, or after **(T700)** POU, **(T701, T701C, T701D)** ODV, oil cooler, or HMU have been replaced, the first engine start may be delayed (delayed lightoff). It may also take longer than normal to reach idle speed (ground idle). Some smoke may be noticed, but visible smoke should disappear after preservation oil is burned off.
- After initial installation of a new engine, a pinkish-colored fuel may drain during vapor vent or shutdown. This is due to the presence of residual dye used during factory fuel system leakage checks. This fuel coloring is normal under these circumstances; it is not harmful to the engine fuel system, will not cause operational difficulties, and will disappear as the engine is operated.

(4) When depreserving engine after installing it in aircraft.

1-138. HMU P3 Fitting Check.

a. Prepare aircraft for safe ground maintenance in accordance with applicable aircraft maintenance manual.

b. Deleted.

c. Read fuel system preliminary instructions (para 6-3).

d. Remove **(T700)** P3 hose and tube assembly or **(T701, T701C, T701D)** P3 tube from HMU (para 6-40).

e. **(T701, T701C, T701D, AH-64A)** Fuel selector shall be in cross feed normal position.

f. Pressurize aircraft fuel system in accordance with applicable aircraft maintenance manual.

g. Advance the power control lever to lockout (maximum position) until a steady stream of fuel, free from air and preserving oil, is draining from engine overboard drain.

h. Return power control lever to IDLE.

i. With system pressurized, inspect the P3 fitting on the HMU for leakage for 3 minutes. No leakage allowed.

j. Return power control lever to OFF.

k. If leakage is observed, replace HMU (para 6-40).

l. If leakage is not observed, install **(T700)** P3 hose and tube assembly or **(T701, T701C, T701D)** P3 tube onto HMU (para 6-40).

m. Inspect for FOD and secure work area.

n. Repeat steps a through m for other engine.

1-139. Idle Speed Leakage Check. This check will be made to be sure there are no fuel, air, or oil leaks present after replacing engine fuel system, air system, or oil system components. If oil or fuel is noticed in engine bay area, this check will also be made to be sure that leakage is not coming from weephole of oil cooler PN 6044T95P01 or PN 6044T95P02.

a. Operate engine at ground idle speed for 5 minutes and look for oil, air, and/or fuel leaks. Abort run if oil or fuel leakage is noted. Check overboard drain for excessive oil or fuel leakage.

b. Check for air leakage using either of the following methods:

WARNING

Working Near Hot Sections

Keep hands away from hot sections.

(1) The preferred method is to apply Leak Test Oxygen System Solution (item 98, Appendix D) on surfaces where air leaks are suspected. Solution will bubble if there is leakage.

(2) An alternate method is to place hand approximately 6-12 inches away from air system components, connections, compressor case splitline flanges, and other engine mating flanges.

(3) The following inspection criteria shall be utilized:

(a) No air leakage is allowed around the P3 line/connections or around other threaded fitting torqued connections.

(b) Air leakage around the anti-icing bleed and start valve and attaching fittings is acceptable if bare hand can be held within 6 inches of the air leak.

(c) Air leakage around the engine compressor case splitline flanges, other engine mating flanges, slip joint connections, or metal to metal sealing surfaces is acceptable if bare hand can be held within 12 inches of the air leak.

c. Check for air leaks in the following areas:

- **(T700)** primer nozzles retaining nuts (3, fig. 6-1)
- fuel injector retaining nuts (7, fig. 6-5)
- **(T700)** igniter plug retaining nuts (4, fig. 7-1)
- **(T701, T701C, T701D)** igniter plug (1, fig. 7-2)

CAUTION

Retaining nuts and **(T701, T701C, T701D)** igniter plugs are installed to specific torque values. Do not apply additional torque to the nuts; otherwise, midframe ports may crack.

(1) If air leaks are found at the primer nozzle retaining nut or igniter plug retaining nut **(T700)** or at the igniter plug **(T701, T701C, T701D)**, inspect the hardware seating surface, reinstall hardware following prescribed procedures, and recheck for leaks.

(2) If leaks continue in these areas, do the following:

(a) Switch the primer nozzle **(T700)** or igniter plug with an adjacent port in order to isolate the problem.

(b) Repeat the leak test.

(c) If the leak follows the switched hardware, replace the primer nozzle **(T700)** or the igniter plug.

(d) If the leak presists on the original port, the issue is with the midframe and the CSM will require replacement.

d. Shut engine down. Look for oil and/or fuel leakage on hardware that has been reinstalled. Check the following items where appropriate.

(1) Hose and tubes and other connections that were opened.

(2) Mating flange joints between accessory drive gearbox assembly and components, specifically between the AGB and the mainframe.

(3) Total surface area of the mainframe.

(4) Area between fuel filter bowl and filter housing.

(5) If there is a leak from the weephole at 12 o'clock position of oil cooler PN 6044T95P01 or 6044T95P02, replace oil cooler (para 8-4).

(6) Overboard drain for excessive oil or fuel leakage.

e. Correct all leaks by repeating installation steps of appropriate procedures.

1-140. Idle Speed Check.

NOTE

This test may be done using one or both engines.

a. With collective set in a full down position, start engine.

b. Set power control lever to IDLE.

c. Ground idle speed must be within limits in table 1-17 **(T700)** or table 1-18 **(T701, T701C, T701D)**.

1-141. Np Governing Check.

a. Set power control lever to IDLE.

b. Set collective to full down position.

c. Slowly advance power control lever to FLY.

NOTE

The engine control system is designed to maintain a constant Np speed, usually 100% (20,900 rpm). If Np stabilizes below 96% (20,064 rpm) or above 101% (21,109 rpm), the Np governing system is not governing.

d. If Np governing system is not governing, troubleshoot the following:

(1) Np governing system according to troubleshooting procedure 20.

(2) Turbine speed control unit according to aircraft maintenance manual TM 1-1520-238-23.

e. If Nr/Np is between 96 and 101%, use one of the following to set Nr/Np at 100%:

(1) **(T700)** Use the ENG RPM speed trim switch on the collective grip.

(2) **(T701, T701C, T701D)** Use the applicable aircraft maintenance manual TM 1-1520-238-23.

f. If power control lever is set at FLY and if Nr/Np is at 100%. Np governing system is operating normally.

1-142. Torque Matching Check.

a. Set both power control levers to FLY.

b. Set collective to full down position.

c. Set minimum Nr/Np speed, using one of the following:

(1) **(T700)** Use the ENG RPM speed trim switch on the collective grip.

(2) **(T701, T701C, T701D)** Use the applicable aircraft maintenance manual TM 1-1520-238-23.

d. If the torques of both engines are within 5% of each other, then torque matching is operating properly.

1-143. Anti-Icing Bleed and Start Valve Check.

CAUTION

(UH-60A) If any part of engine anti-ice check fails, do not fly helicopter.

NOTE

During engine start, engine anti-ice advisory light must be on and must remain on as power control lever is advanced to IDLE.

a. Advance power control lever to FLY.

b. Slowly increase collective pitch until engine anti-ice advisory light goes off.

c. Turn on engine anti-ice switch. If the engine anti-ice advisory light comes on, anti-icing system is working.

1-144. Oil Consumption Check.

a. Go to engine records, maintenance request, and table 1-19 or table 1-39 (AVIM) to determine if an oil consumption check is required. If a check is required, it may be combined with other engine tests to reduce engine operating time.

b. Start engine and operate it until oil temperature has stabilized. Shut down engine, and wait 20 minutes; then check oil level. If necessary, add oil to bring level to full.

c. Start engine and operate it for 20 to 60 minutes to complete whatever operational checks are required.

d. Shut down engine and record operating time. After 20 minutes, check oil level. If necessary, add oil to bring level to FULL. Record the number of cubic centimeters (cc) added.

e. Calculate oil consumption in cc/hr, using the following formula:

$$\frac{\text{cc of oil added}}{\text{Recorded operating time in minutes}} \times \frac{60\ \text{min}}{1\ \text{hr}}$$

EXAMPLE:

During test, the engine was run for one hour and ten minutes, and 48 cc of oil was added to bring oil level in tank to FULL.

Recorded operating time (step d) = 70 min
cc of oil added (step d) = 48 cc

Oil Consumption =

$$\frac{48\ \text{cc}}{70\ \text{min}} \times \frac{60\ \text{min}}{1\ \text{hr}} = \frac{2880}{70} = 41.1\ \text{cc/hr}$$

f. See table 1-17 **(T700)** or 1-18 **(T701, T701C, T701D)** for acceptable oil consumption limits.

1-145. (T700) Maximum Power Check for UH-60A.

The torque factor method provides an accurate indication of available power by incorporating ambient temperature effects into the power available calculation.

When an engine is reinstalled or installed for the first time, or after an engine fails the Health Indicator Test (HIT) Check not caused by a faulty anti-icing start and bleed valve or a dirty compressor, an in-flight check will be made to ensure that the engine meets minimum power requirements and to establish/re-establish the Engine Torque Factor (ETF). Performance data will be taken at an engine limiting condition while maintaining approximately 120 KIAS forward flight speed. Engine Anti-Ice and Heater will be off and altimeter will be set to 29.92 in. Hg. Data will be taken on one engine at a time.

If the maximum power check is being performed because of a single engine installation/re-installation or failed HIT Check, it is the Maintenance Officer's discretion to obtain new ETF data for the other engine.

CAUTION

To avoid torque oscillations when making performance checks, a torque split of at least 10% will be held between engines. If flight conditions prevent setting the performance point at 120 knots and keeping the 10% torque split, allow forward flight speed to increase or decrease; however, a torque split of at least 10% must be maintained.

a. Establish a new HIT baseline (para 1-154). HIT baseline must be established during initial ground run, prior to first take-off of the day.

b. With both ENG POWER CONT Levers in FLY, establish 120 knots level flight, 100% RPM R.

WARNING

Engine Torque Limit (UH60A)

Dual engine torque limit of 100% may be exceeded only if the torque applied by the other engine is less than 90%. Do not exceed the single engine torque limit of 110%.

c. Retard the ENG POWER CONT lever on the engine not being checked until RPM R is reduced by 2%; then, do the following:

(1) If engine being checked reaches the aircraft single engine torque limit of 110% before any reduction of RPM R, perform the power check at a higher altitude.

(2) If weather conditions prevent obtaining a higher altitude, delay the maximum power check.

CAUTION

If, and only if, max power check is being performed because of a failed HIT check, and weather conditions prevent a higher altitude, perform troubleshooting procedure 65 before using the alternatives of step (3).

NOTE

Some units are grounding aircraft when weather is inclement, and some units are assuming an ETF of 1.0, which could lead to serious planning errors.

(3) If the maximum power check is delayed an alternative to grounding is to use one of the following ETF's:

(a) Last calculated ETF if it was less than 0.95.

(b) Use 0.95 if last calculated ETF was greater than 0.95.

(4) Perform the maximum power check as soon as weather conditions permit to establish the true ETF.

(5) Observe TGT on engine being checked.

NOTE

- Transient overshoot up to 886°C (1627°F) for a maximum duration of 12 seconds may be observed, followed by TGT stabilizing at the normal limiting range of 837°C to 849°C (1538° to 1561°F).
- TGT should not exceed the normal TGT limiter setting. If TGT exceeds the normal limiter setting, discontinue the maximum power check and refer to troubleshooting procedure 37 (table 1-13).

(6) Slowly advance the ENG POWER CONT lever of the engine not being checked only enough to re-establish% RPM R to 100% without any change in TGT on engine being checked.

(7) Wait 30 seconds and record Ng, TGT,% TRQ, FAT, and pressure altitude.

d. During step c, if the engine not being checked indicated 0% TRQ without any reduction in% RPM R, do the following:

(1) Increase collective pitch until a reduction of 2% RPM R is observed.

(2) Maintain a constant pressure altitude by allowing forward airspeed to increase beyond 120 knots until a reduction of 2% RPM R is observed.

(3) Observe TGT on engine being checked. TGT should not exceed the normal TGT limiter setting of 837°C to 849°C (1538° to 1561°F). Transient overshoot up to 866°C (1627°F) for a maximum of 12 seconds may be observed, followed by TGT stabilizing at the normal limiting range of 837°C to 849°C (1538° to 1561°F). If TGT exceeds the normal limiter setting, discontinue the check and see troubleshooting procedure 37 (table 1-13).

(4) Slowly decrease collective pitch to allow % RPM R to return to 100% without any change in TGT on engine being checked.

(5) Wait 30 seconds and record Ng, TGT,% TRQ, FAT, and pressure altitude.

e. Advance the ENG POWER CONT lever on the engine not being checked to FLY.

f. If required, repeat steps a thru e for the other engine.

g. Establish the Engine Torque Factor (ETF) as follows:

NOTE

Round off all calculations to the nearest 0.001. Round up from 0.00050 to 0.00099. Round down from 0.00049 to 0.00001.

EXAMPLE: 0.97050 through 0.97099 =0.971
0.97001 through 0.97049 =0.970

(1) Calculate the Adjusted Torque (TRQ_{ADJ}) as follows:

(a) When FAT is greater than –12°C, TRQ_{ADJ} = % TRQ measured if TGT is in the normal TGT limiter range. If TGT is not within range refer to paragraph 1-129.

(b) When FAT is less than or equal to –12°C, obtain TGT_{REF} from figure 1-62.

$$TRQ_{ADJ} = \%\,TRQ + 0.2\,TGT_{REF} - 0.2\,TGT$$

EXAMPLE:

KNOWN		FOUND (fig. 1-62)
PRESSURE ALTITUDE	= 6,000 FT	
FAT	= –16°C	TGT_{REF} 827°C
% TRQ	= 97.0%	
TGT	= 820°C	
TRQ_{ADJ}	= 97.0 + 0.2 (827) – 0.2 (820)	
	= 97.0 + (165.4 – 164.0)	
	= 97.0 + 1.4	
	= 98.4%	

(2) Obtain Target Torque Value (TTV) from figure 1-63.

EXAMPLE: Using FAT = –16°C and PRESSURE

ALTITUDE = 6,000 FT, therefore, TTV = 101.5%

(3) Calculate Specification Torque Ratio (STR) by dividing Adjusted Torque (TRQ_{ADJ}) by Target Torque Value (TTV). For engines with Hover Infrared Suppressor System (HIRSS) and with baffles or cruise suppressors installed, add 1.0 to adjusted torque (TRQ_{ADJ}).

$$STR = \frac{TRQ_{ADJ} + 1.0 \text{ (for HIRSS and baffles)}}{TTV}$$

EXAMPLE: $STR = \frac{(98.4 + 1.0)}{101.5} = 0.98$

(4) For engines with HIRSS and without baffles or cruise suppressors installed, add nothing (0.00) to adjusted torque (TRQ_{ADJ}).

$$STR = \frac{TRQ_{ADJ}}{TTV}$$

EXAMPLE: $STR = \frac{(98.4)}{101.5} = 0.97$

(5) Obtain Engine Torque Factor (ETF) from figure 1-64. When STR is greater than or equal to 1.0, assume ETF to be 1.0.

EXAMPLE: KNOWN
FAT = –16°C (3.2°F)
STR = 0.97.
FOUND
Enter figure 1-64 on left (STR axis) at 0.97. Move right to intersection of 0.97 line and ≤ (less than or equal to) –5°C line. Move straight down to read 0.93 ETF.

h. Using the value for ETF obtained in step g(5) above, go to table 1-20 to determine if any additional troubleshooting is required.

i. Repeat steps g and h for other engine, if required.

j. Calculate Aircraft Torque Factor (ATF) as follows;

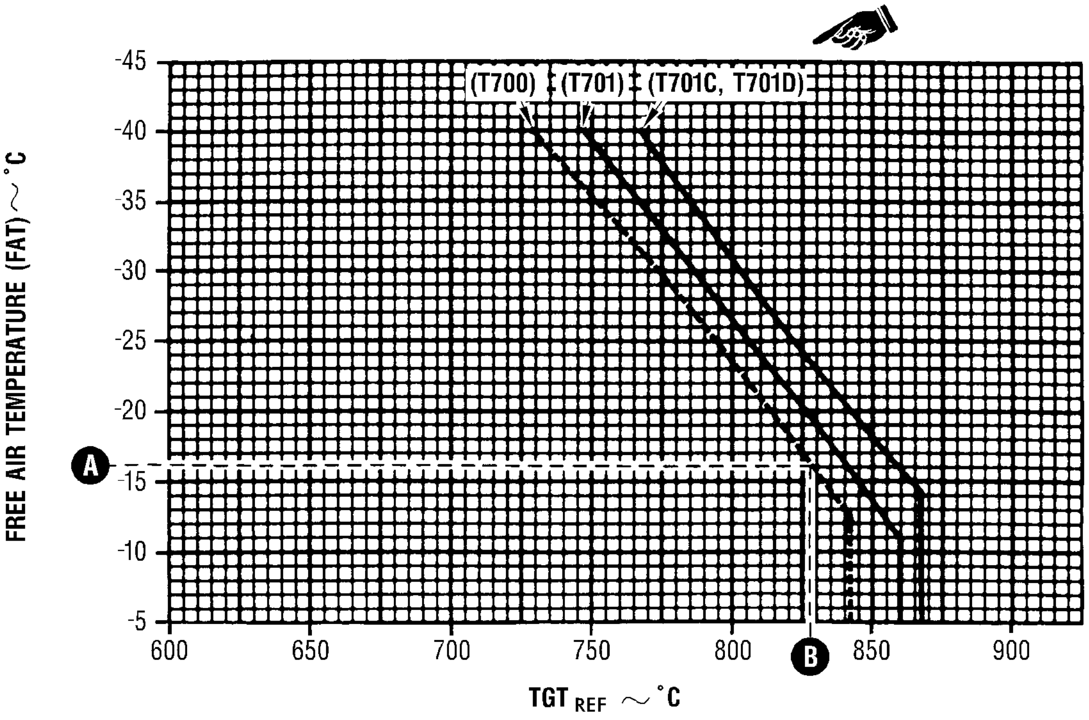
KNOWN ETF:
No. 1 Engine = 0.93
No. 2 Engine = 0.95

$$ATF = \frac{\text{No. 1 Engine ETF + No. 2 Engine ETF}}{2}$$

EXAMPLE: $ATF = \frac{0.93 + 0.95}{2} = 0.94$

k. Record the ATF in applicable block of figure 1-65, sheet 1. The form in figure 1-65 may be locally reproduced and used in the aircraft logbook. Minimum allowable ATF is 0.90.

l. After completing maximum power check and if engine performance is satisfactory, record new upper and lower limits (from the baseline established in step a) on HIT log in helicopter.

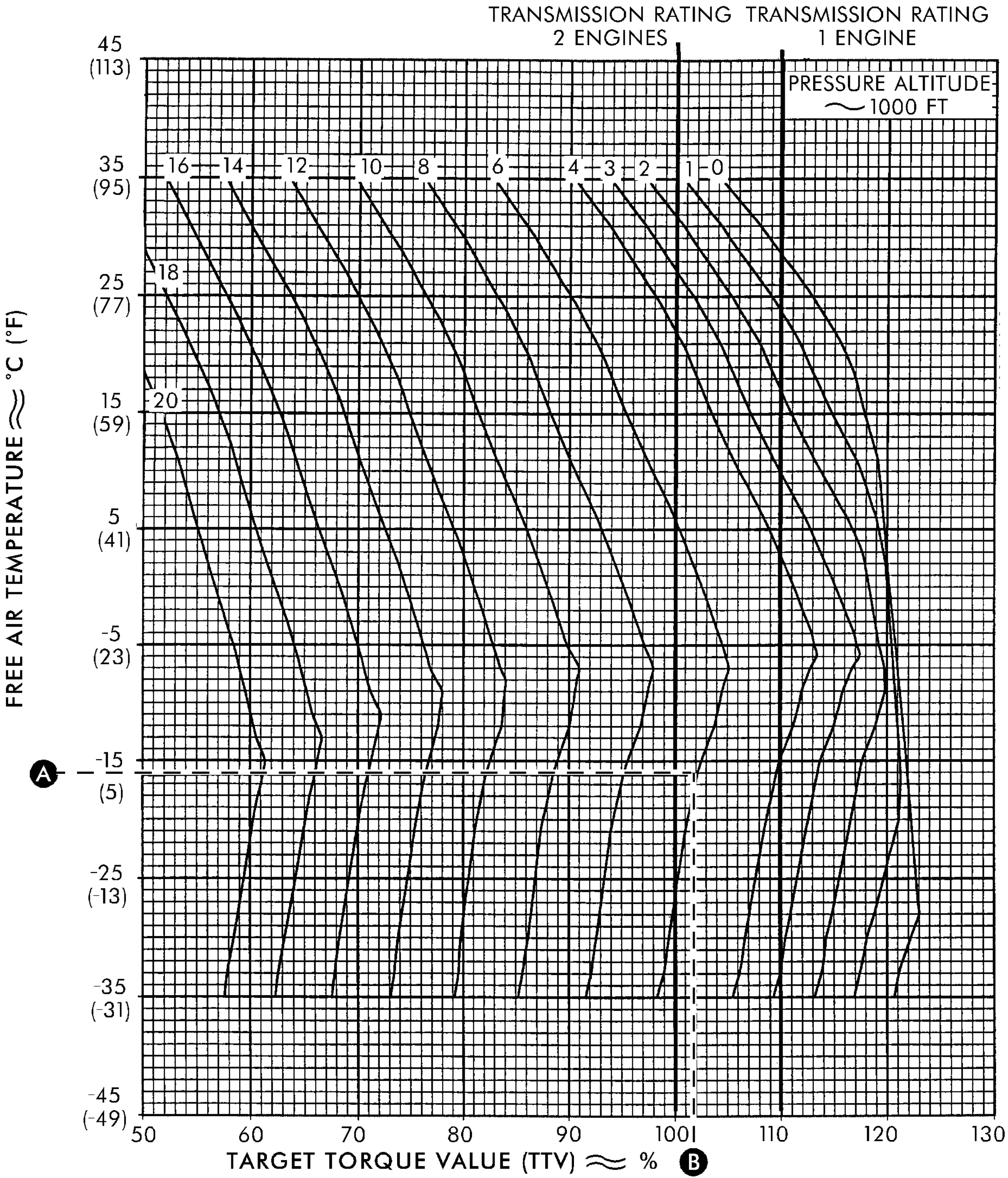


EXAMPLE

WANTED	KNOW	METHOD
TGT REFERENCE (TGT_{REF})	FAT = -16°C (1.4°F)	ENTER CHART ON LEFT AT -16°C (3.2°F) — A MOVE RIGHT TO INTERSECTION OF -16°C (3.2°F) LINE AND TGT_{REF} LINE. MOVE STRAIGHT DOWN TO READ 827°C (1521°F) — B

1156921-01

Figure 1-62. Determining TGT Reference (TGT_{REF})



EXAMPLE

WANTED
TARGET TORQUE VALVE

KNOWN
FAT = -16°C (3.2°F)
PRESSURE ALTITUDE = 6,000 FT
% TRQ = 97
TGT = 820°C (1508°F)

METHOD
ENTER CHART ON LEFT AT
-16°C (3.2°F) FAT – – – – – – – – Ⓐ
MOVE RIGHT TO INTERSECTION
OF -16°C (3.2°F) LINE AND 6,000
FOOT LINE
MOVE STRAIGHT DOWN TO
READ 101.5% – – – – – – – – – Ⓑ

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Figure 1-63. **(T700)** Determining Target Torque Value (TTV) for UH-60A

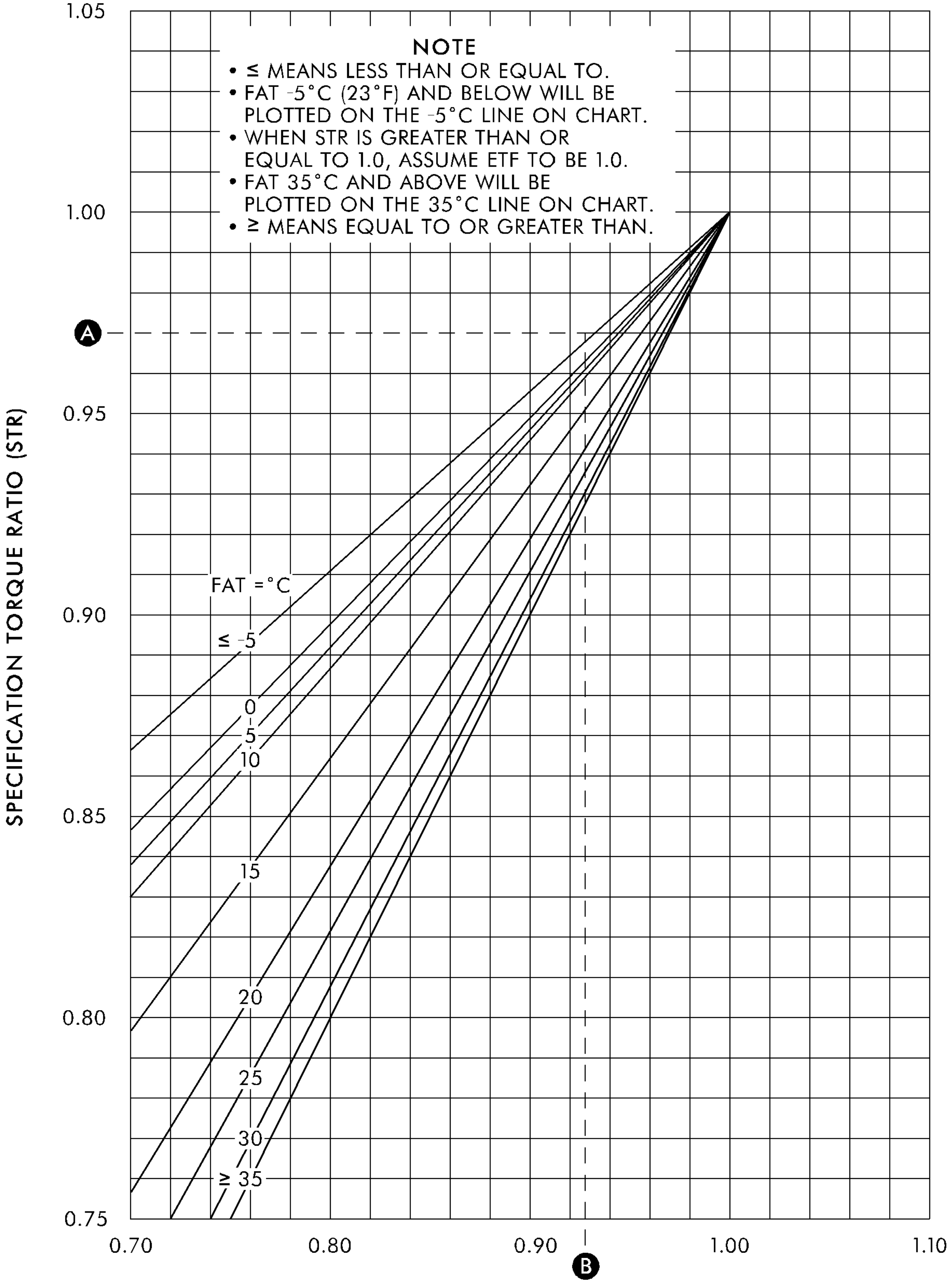
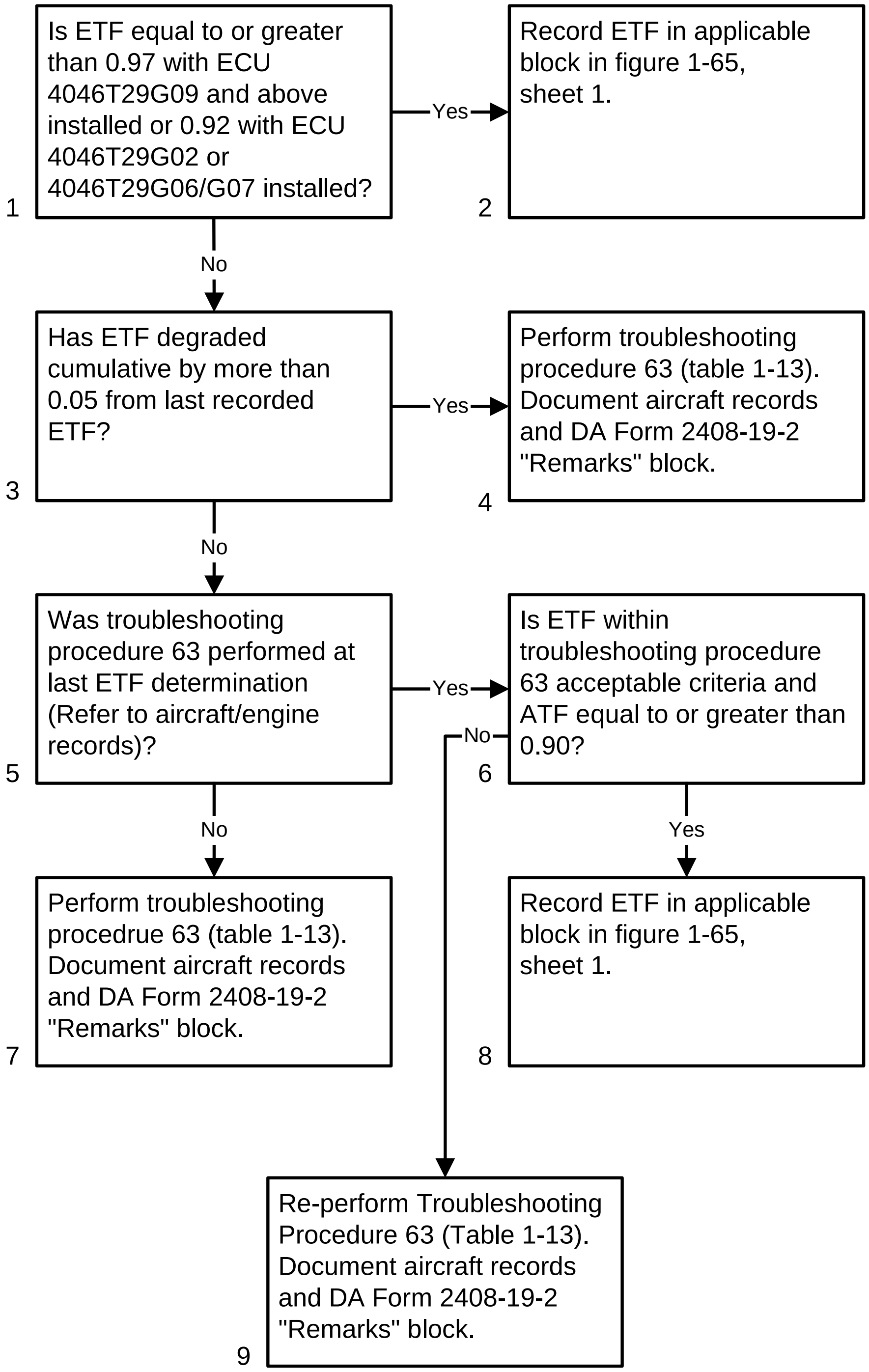


Figure 1-64. (T700) ***Determining Engine Torque Factor (ETF) for UH-60A***

Table 1-20. Max Power ETF Degradation Check



ALL DIMENSIONS
ARE IN INCHES

ENGINE MODEL	A/C SERIAL NUMBER	ENGINE NUMBER	ENGINE SERIAL NUMBER	PAGE NO.	NO. OF PAGES

DATE								

ENGINE INSTALLED AT ____________________ A/C HOURS; ____________________ ENGINE HOURS

ETF / ATF								
LIMITS °C / °C								
AIR SPEED / TORQUE								
TGT LIMITS °C / °C								

DATE A/C HOURS	FAT	PA	TABLE TGT ②	IND. TGT ①	TGT MARGIN ① – ②
LATEST HIT CHECK	23°C	500 FT	690°C	715°C	+25°C

DATE A/C HOURS	FAT	PA	TABLE TGT ②	IND. TGT ①	TGT MARGIN ① – ②

1156926-00-A2T

Figure 1-65. Engine Health Indicator Test Log (Sheet 1 of 2)

ENGINE MODEL	A/C SERIAL NUMBER	ENGINE NUMBER	ENGINE SERIAL NUMBER	PAGE NO.	NO. OF PAGES

DATE A/C HOURS	FAT	PA	TABLE TGT ②	IND. TGT ①	TGT MARGIN ① – ②	DATE A/C HOURS	FAT	PA	TABLE TGT ②	IND. TGT ①	TGT MARGIN ① – ②

1156927-00-A2T

Figure 1-65. Engine Health Indicator Test Log (Sheet 2 of 2)

1-146. (T701, T701C, T701D) Maximum Power Check for AH-64A. The torque factor method provides an accurate indication of available power by incorporating ambient temperature effects into the power available calculation.

Establishing an Engine Torque Factor (ETF) is required when an engine is installed or fails the Health Indicator Test (HIT) Check, if the failure was not the result of a faulty anti-icing start and bleed valve or a dirty compressor section. Performance data will be taken at a TGT limiting condition at or below 100% engine torque, while maintaining approximately 110 knots indicated air speed (KIAS) at a constant pressure altitude (altimeter set to 29.92 in. Hg). Engine Anti-Ice and Heater will be off. Data will be taken on one engine at a time with the other engine set at approximately 60% torque. If the maximum power check is being performed because of a single engine installation or a failed HIT Check, it is the Maintenance Officer's discretion to obtain new ETF data for the other engine.

NOTE

> The normal engine TGT limiter setting is **(T701)** 851° - 869°C (Intermediate Rated Power), or **(T701C, T701D)** 857° - 875°C (Maximum Rated Power). The normal engine TGT limiter is a steady state limiter and is only in effect when contingency power is not enabled.

The most accurate maximum power check will be obtained when the engine is checked at an altitude which will allow the TGT to reach the normal engine TGT limiter setting with engine power at or below 100% torque. This is the preferred procedure, but may require aircraft equipped with a -701C or -701D engine to climb as high as 10,000 ft density altitude.

The maximum power check may be performed using a non-limiting procedure (step l) when conditions restrict the aircraft to flight below an altitude at which the normal TGT limiting or Ng limiting may be reached.

All performance charts for the maximum power check were developed for 110 KIAS forward flight speed at a constant pressure altitude. Airspeed may be adjusted as necessary to maintain constant altitude while performing the maximum power check procedure. When airspeed varies from 110 KIAS, the Torque Speed Factor (TSF) identified in figure 1-66 minimizes error by adjusting indicated Torque % by a forward airspeed factor.

a. Establish a new HIT baseline (para 1-154). HIT baseline must be established during initial ground run, prior to first take-off of the day.

b. Establish a climb at 100% dual engine torque. Periodic collective control increase will be required throughout the climb to maintain 100% torque. Continue climb at 100% torque until one of the three following conditions occur:

NOTE

> One engine may reach the normal engine TGT limiter or Ng limiting setting before the other engine. The climb should continue until the engine being checked reaches the TGT limiter or Ng limiting at 100% torque. This may result in the engine not being checked indicating less than 100% torque. This does not effect the maximum power check on the other engine.

(1) The engine being checked reaches the normal engine TGT limiter setting and it is identified by power limiting at the TGT limit.

(2) The engine being checked reaches a fuel flow limit as a result of Ng limiting and it is identified by power limiting at TGTs below the TGT limit. Ng limiting is a Mach number limitation in the compressor and it occurs at colder ambient temperatures.

(3) If ambient conditions prevent flight to altitudes where the power limiting conditions will occur, then go to step l.

c. Stop the climb at the power limiting (step b) altitude and establish level cruise flight with ENG-RTR RPM at **(T701)** 100% or **(T701C, T701D)** 101%.

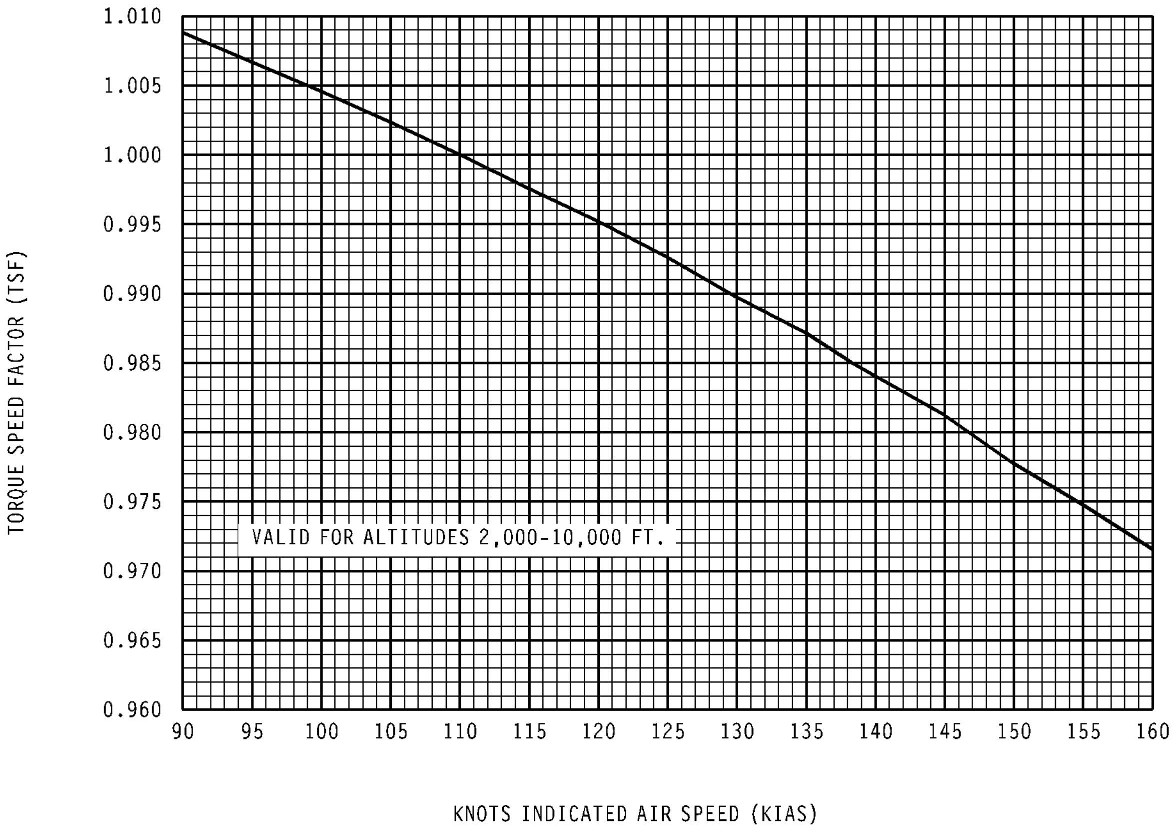
d. Set torque at approximately 80% - 85%.

e. Retard the PWR CONTROL lever (PCL) on the engine not being checked until:

(1) The engine not being checked reaches 60% torque.

(2) The engine being checked reaches 100% torque.

(3) TGT on the engine being checked reaches the normal engine TGT limiter setting or Ng limiting.



1156928-00-A2A

Figure 1-66. Determining Torque Speed Factor

CAUTION

- Do not exceed 100% torque.
- To avoid torque oscillations when making performance checks, a minimum torque split of 10% must be held between engines.
- Do not reduce the PCL to a position which will allow less than 60% torque on the engine not being checked. Contingency power is enabled below 51% torque and will prevent the engine being checked from limiting power at the normal dual engine TGT limiter setting.

f. Establish an ENG-RTR RPM droop of approximately 2% using either a small increase in collective pitch or a small reduction of the PCL on the engine not being checked. Either procedure may be used, but the ENG-RTR RPM droop is usually more easily controlled with collective pitch. An ENG-RTR RPM droop confirms that the engine being checked is limiting power at the normal dual engine TGT limiter setting or due to Ng limiting.

g. If a 2% droop is not achieved, do the following:

(1) Increase collective pitch while maintaining approximately 60% torque on non-test engine until a reduction of 2% ENG-RTR RPM is observed.

(2) Maintain a constant pressure altitude by adjusting forward air speed as necessary.

h. If a 2% droop is still not achieved, go to step l.

NOTE

When the engine is TGT limited, the TGT may momentarily exceed the normal dual engine TGT limiter setting.

i. Observe TGT on the engine being checked. If TGT does not stabilize at the normal dual engine TGT limit in 10 to 15 seconds after the last collective pitch or PCL input, discontinue the maximum power check and initiate troubleshooting procedure 37 (table 1-13).

j. Slowly reduce collective pitch or advance PCL on the engine not being checked to re-establish ENG-RTR RPM at **(T701)** 100% or **(T701C, T701D)** 101%. The TGT on engine being checked should remain constant.

k. Wait 30 seconds and record AIRSPEED (KAIS), Ng (%), TGT (°C), TORQUE (%), OAT (°C), and PRESSURE ALTITUDE (FT).

l. If steps e through k were successfully completed, proceed to step q. If steps e through k could not be completed due to weather conditions, establish level cruise flight at the highest possible altitude that will allow the engine being checked to develop 100% torque with ENG-RTR RPM at **(T701)** 100% or **(T701C, T701D)** 101%.

m. Adjust collective pitch at approximately 80-85% torque.

NOTE

The non-limiting procedure assumes a power setting of 100% torque on the engine being checked and is designed to allow a maximum power check to be performed at TGTs less than the normal dual engine TGT limiter setting. It is not necessary to droop the ENG-RTR RPM to perform this non-limiting procedure.

n. Retard the PCL on the engine not being checked until the engine being checked reaches 100% torque with ENG-RTR RPM at **(T701)** 100% or **(T701C, T701D)** 101%. Do not reduce the PCL on the engine not being checked to a position that will result in less than 60% torque.

CAUTION

Do not exceed 100% torque.

o. If 100% torque is not achieved, do the following:

(1) Increase collective pitch while maintaining approximately 60% torque on non-test engine until 100% torque is observed on the test engine.

(2) Maintain a constant pressure altitude by adjusting forward airspeed as necessary.

CAUTION

To allow an accurate power check and avoid torque oscillations, a torque split of at least 10% will be held between engines.

p. Wait 60 seconds and record AIRSPEED (KAIS), Ng (%), TGT (°C), TORQUE (%), OAT (°C), and PRESSURE ALTITUDE (FT).

q. If required, repeat steps a through p as required for the other engine.

r. Establish the Engine Torque Factor (ETF) as follows:

NOTE

Round off all calculations to the nearest 0.001. Round up from 0.00050 to 0.00099. Round down from 0.00049 to 0.00001.

EXAMPLE: 0.97050 through 0.97099 = 0.971
0.97001 through 0.97049 = 0.970

(1) Calculate the torque adjusted for indicated airspeed (Torque Speed Factor, $\%TRQ_{TSF}$) as follows:

NOTE

If indicated airspeed is 110 knots then TORQUE % = $\%TRQ_{TSF}$.

(a) Obtain Torque Speed Factor (TSF). Refer to figure 1-66.

EXAMPLE: KNOWN
KIAS = 130 knots
TORQUE % = 100%

FOUND

Enter figure 1-66 on KIAS axis at 130. Move up to intersection of 130 and 0.990 (TSF axis).

(b) Calculate the % TRQ_{TSF} by multiplying TORQUE % by TSF.

$\%TRQ_{TSF}$ = TORQUE % x TSF
= 100 × 0.990
= 99%

(2) Calculate the Adjusted Torque (TRQ_{ADJ}) as follows:

(a) Obtain the Target TGT_{REF} from **(T701)** figure 1-67 or **(T701C, T701D)** figure 1-68.

EXAMPLE: KNOWN
PRESSURE
ALTITUDE = 6,000 FT
FAT = –16°C
ENGINE = T701C
TGT = 736°C

FOUND

Enter figure 1-68 on FAT axis at –16°C. Move right to intersection of 6000 FT PRESSURE ALTITUDE line. Move straight down to read Target TGT_{REF}.

Target TGT_{REF} = 728°C

NOTE

If the FAT and the PRESSURE ALTITUDE lines do not intersect before the chart TGT limit temperature **(T701)** 860°C or **(T701C, T701D)** 866°C, then the target TGT_{REF} is equal to the chart TGT limit temperature.

(b) Calculate the ΔTGT by subtracting the measured TGT from the target TGT_{REF}.

$\Delta TGT = TGT_{REF} - TGT$
= 728°C –736°C
= –8°C

(c) Obtain the ΔTRQ/ΔTGT factor from figure 1-69.

EXAMPLE: KNOWN
PRESSURE ALTITUDE = 6,000 FT

FOUND
Enter figure 1-69 on PRESSURE ALTITUDE axis at 6000 ft. Move straight up to intersection of ΔTRQ/ΔTGT line. Move straight left to read ΔTRQ/ΔTGT factor.

ΔTRQ/ΔTGT = 0.17

(d) Calculate the TGT Adjusted Torque (TRQ_{ADJ}) by multiplying the ΔTGT by the ΔTRQ/ΔTGT factor and adding to the $\%TRQ_{TSF}$.

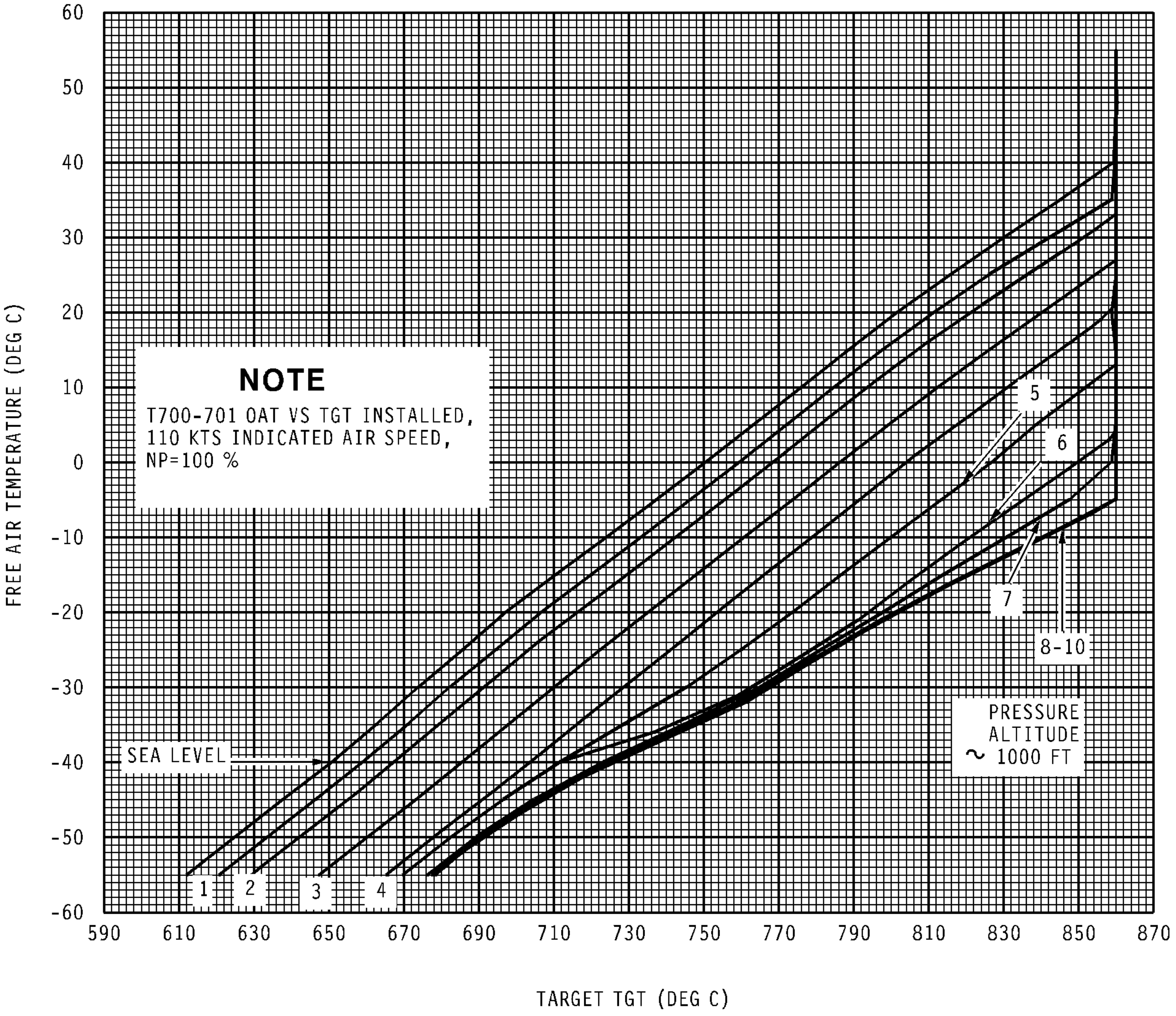


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Figure 1-67. (T701) Determining Target Torque Value for AH-64A

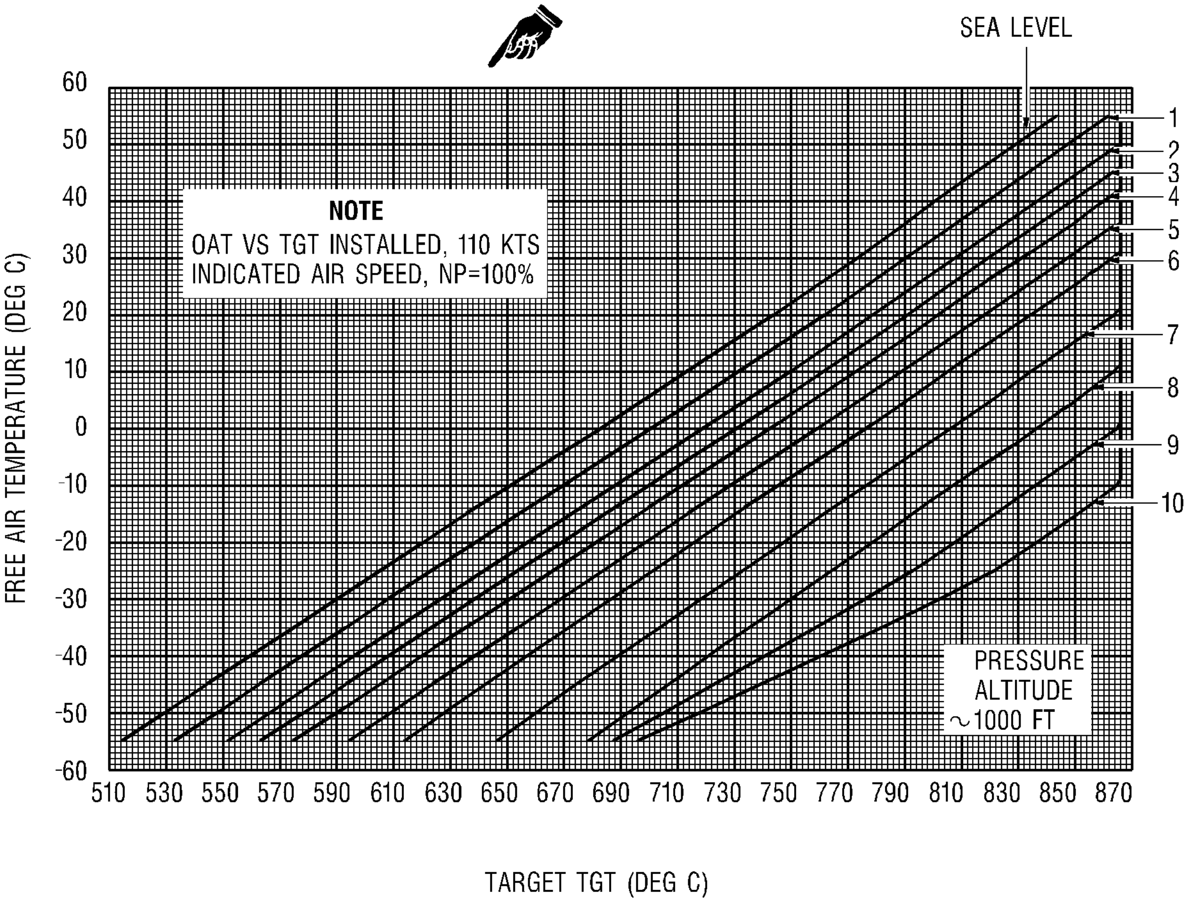

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Figure 1-68. ***(T701C, T701D)*** *Determining Target Torque Value for AH-64A*

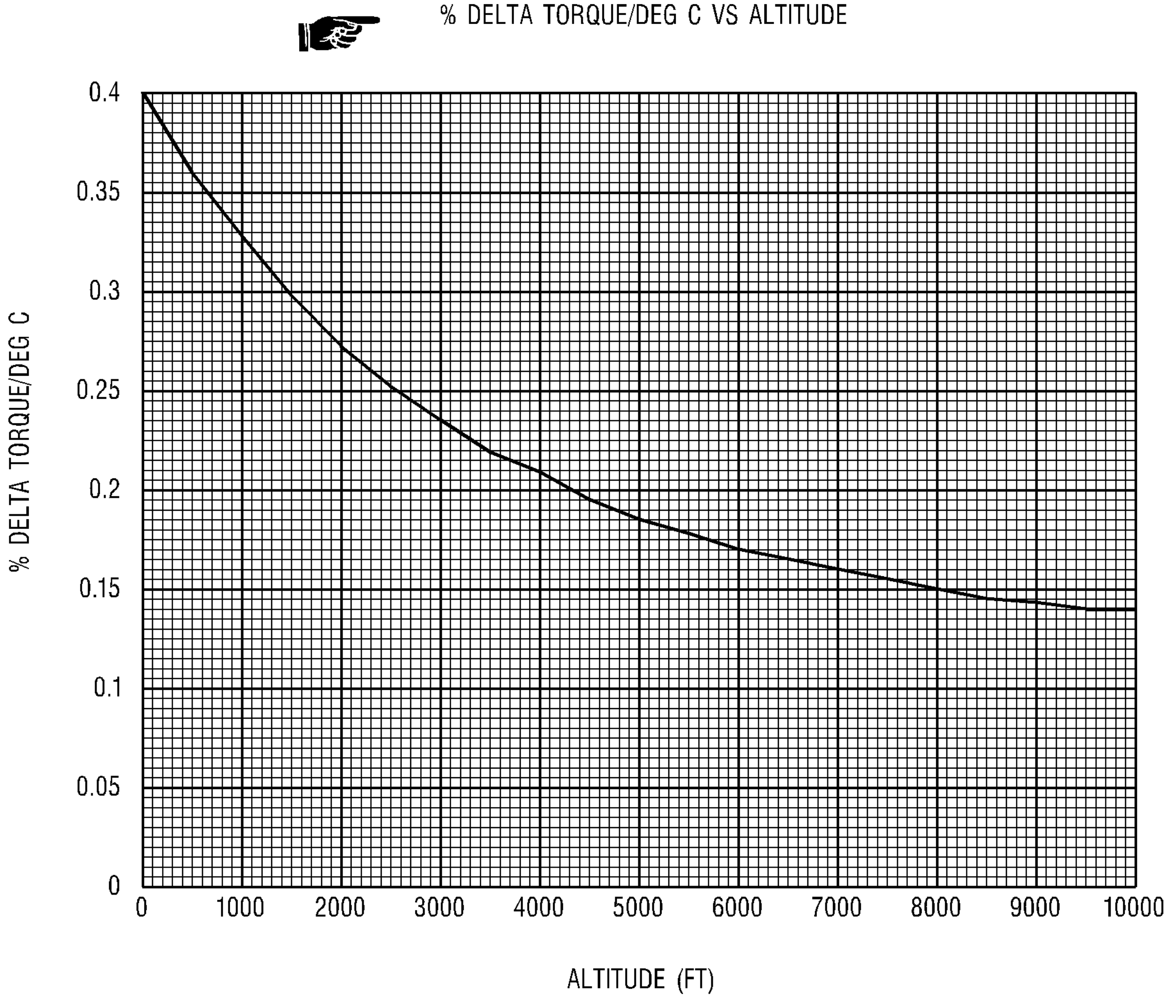

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Figure 1-69. ***(T701, T701C, T701D)*** *Determining Δ Torque/Δ TGT Factor for AH-64A*

$$\begin{aligned} TRQ_{ADJ} &= \%TRQ_{TSF} + \Delta TRQ/\Delta TGT \times \Delta TGT \\ &= 99.0\% + (0.17 \times -8°C) \\ &= 97.640\% \end{aligned}$$

(3) Obtain the Target Torque Value (TTV) for engine. Refer to **(T701)** figure 1-70 or **(T701C, T701D)** figure 1-71.

EXAMPLE: KNOWN

PRESSURE
ALTITUDE = 6,000 FT
FAT = –16°C
ENGINE = T701C

FOUND

Enter figure 1-71 on FAT axis at –16°C. Move right to intersection of 6000 ft pressure altitude line. Move straight down to read TTV.

TTV = 100%

(4) Calculate Specification Torque Ratio (STR) by dividing TGT Adjusted Torque (TRQ_{ADJ}) by Target Torque Value (TTV).

$$\begin{aligned} STR &= \frac{TRQ_{ADJ}}{TTV} \\ &= \frac{97.640\%}{100\%} \\ &= 0.98 \end{aligned}$$

(5) Obtain the Engine Torque Factor (ETF) from figure 1-72.

EXAMPLE: KNOWN

FAT = –16°C
STR = 0.98

FOUND

Enter figure 1-72 on STR axis at 0.98. Move right to intersection of 0.98 line and ≤ (less than or equal to) –5°C line. Move straight down to read 0.93 ETF.

s. The intent of the Engine Torque Factor (ETF) is to provide to the pilot a numerical engine health value upon which mission planning can be based using appropriately derived performance charts. All newly manufactured engines as well as depot overhauled engines should have an ETF of 1.0 or greater before being installed in an airframe. Once a new or overhauled engine is installed in an airframe and delivered to the customer, a minimum ETF value for a new engine installation is 0.97. If the newly installed engine is below 0.97 ETF, troubleshooting should be performed. Once the engine has degraded below 0.97 ETF and troubleshooting has been completed, further troubleshooting after additional performance checks is not required unless either of the following conditions has occurred:

- The ETF has degraded 0.05 or more since the last recorded ETF.
- The ETF is less than 0.85.

If the ETF is satisfactory, record in the applicable block of figure 1-65, sheet 1. If the ETF is not satisfactory, refer to troubleshooting procedure 63 (table 1-13). If ETF is greater than or equal to 0.85, record in applicable block figure in figure 1-65, sheet 1.

t. Repeat steps q and r for other engine, if required.

u. Calculate Aircraft Torque Factor (ATF) as follows;

KNOWN ETF: No. 1 Engine = 0.93
No. 2 Engine = 0.98

$$ATF = \frac{\text{No. 1 Engine ETF + No. 2 Engine ETF}}{2}$$

EXAMPLE: $AFT = \frac{0.93 + 0.98}{2} = 0.96$

v. Record the ATF in applicable block of figure 1-65, sheet 1. The form in figure 1-65 may be locally reproduced and used in the aircraft logbook. Minimum allowable ATF is 0.90.

w. After completing maximum power check and if engine performance is satisfactory, record new upper and lower limits (from the baseline established in step a) on HIT log in helicopter.

1-147. (T701C, T701D) Maximum Power Check for UH-60L. The torque factor method provides an accurate indication of available power by incorporating ambient temperature effects into the power available calculation.

When an engine is reinstalled or installed for the first time, or after an engine fails the Health Indicator Test (HIT) Check not caused by a faulty anti-icing start and bleed valve or a dirty compressor, an in-flight check will be made to ensure that the engine meets minimum power requirements

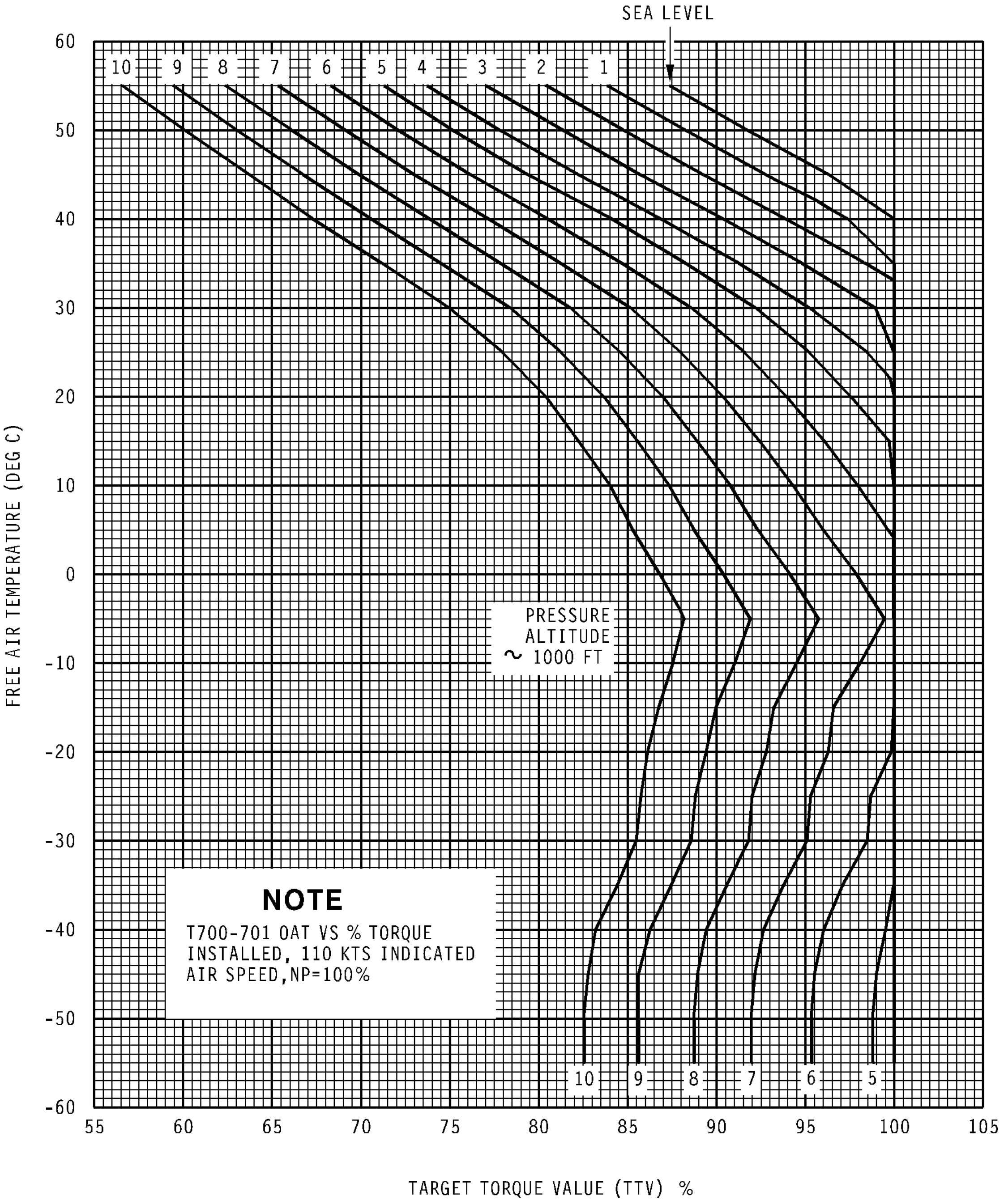

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Figure 1-70. (T701) ***Determining Target Torque Value for AH-64A***

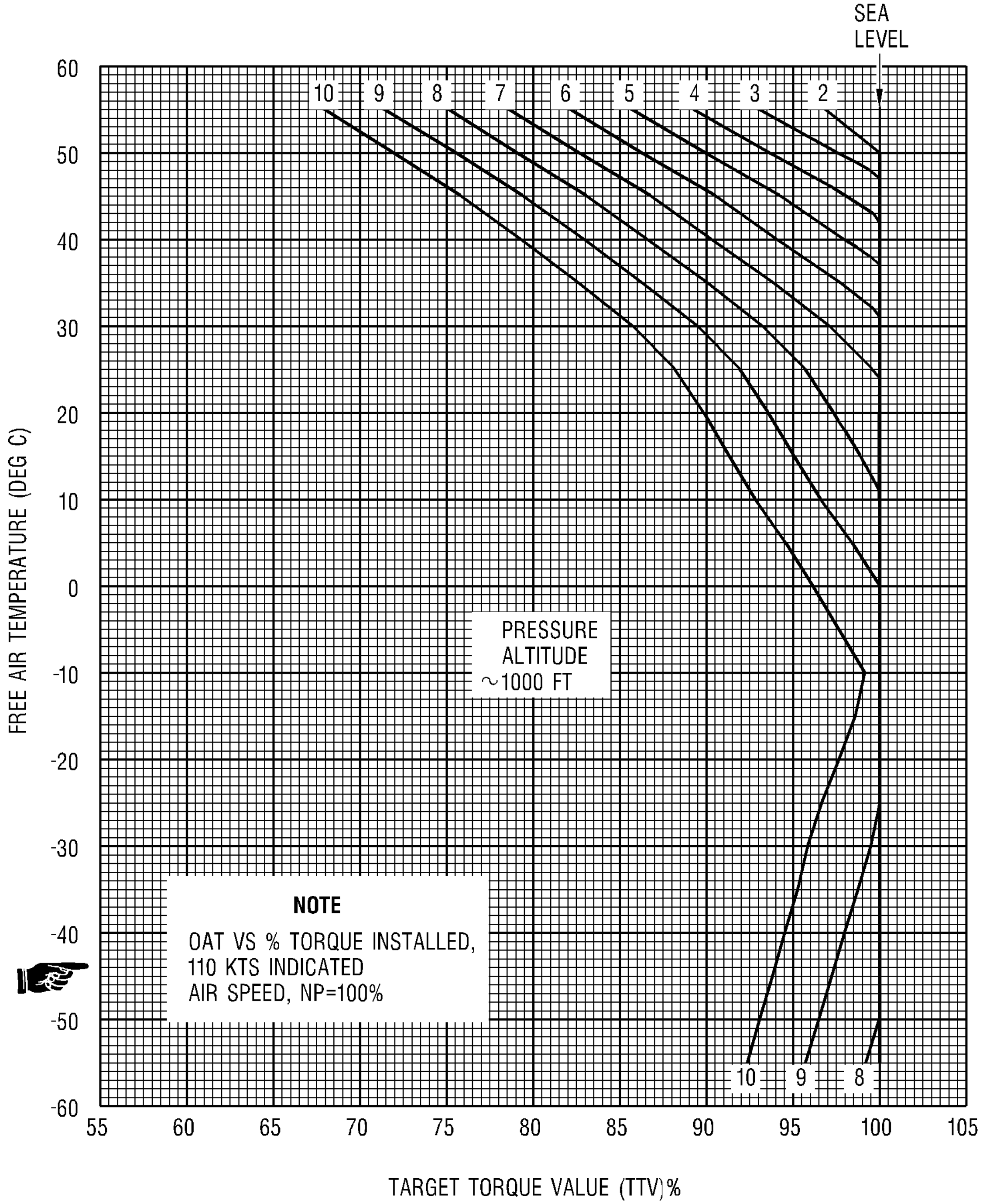

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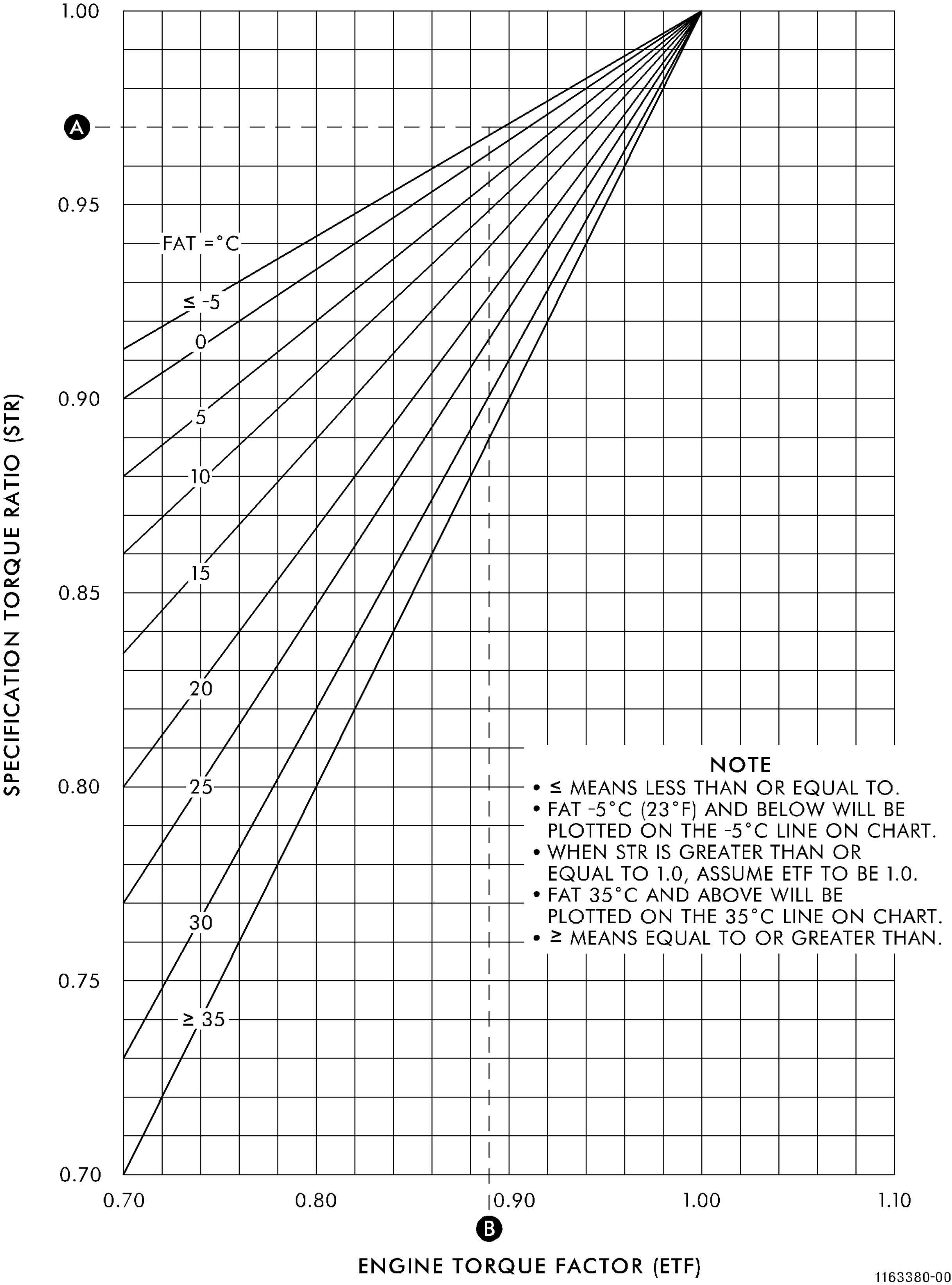
Figure 1-71. **(T701C, T701D)** Determining Target Torque Value for AH-64A



NOTE

- ≤ MEANS LESS THAN OR EQUAL TO.
- FAT -5°C (23°F) AND BELOW WILL BE PLOTTED ON THE -5°C LINE ON CHART.
- WHEN STR IS GREATER THAN OR EQUAL TO 1.0, ASSUME ETF TO BE 1.0.
- FAT 35°C AND ABOVE WILL BE PLOTTED ON THE 35°C LINE ON CHART.
- ≥ MEANS EQUAL TO OR GREATER THAN.

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Figure 1-72. ***(T701, T701C, T701D)*** *Determining Engine Torque Factor (ETF) for UH-60L and AH-64A* and to establish/re-establish the Engine Torque Factor (ETF). Performance data will be taken at an engine limiting condition while maintaining approximately 120 KIAS forward flight speed. Engine Anti-Ice and Heater will be off and altimeter will be set to 29.92 in. Hg. Data will be taken on one engine at a time.

If the maximum power check is being performed because of a single engine installation/re-installation or failed HIT Check, it is the Maintenance Officer's discretion to obtain new ETF data for the other engine.

CAUTION

To avoid torque oscillations when making performance checks, a torque split of at least 10% will be held between engines. If flight conditions prevent setting the performance point at 120 knots and keeping the 10% torque split, allow forward flight speed to increase or decrease; however, a torque split of at least 10% must be maintained.

a. Establish a new HIT baseline (para 1-154). HIT baseline must be established during initial ground run, prior to first take-off of the day.

b. With both ENG POWER CONT Levers in FLY, establish 120 knots level flight, 100% RPM Rotor Speed.

WARNING

Engine Torque Limit (UH60L)

Dual engine torque limit of 100% may be exceeded only if the torque applied by the other engine is less than 100%. Do not exceed the single engine torque limit of 135%.

NOTE

Torque on engine not being checked should not be less than 60% to ensure that the 2.5 minute contingency TGT limiter is not activated.

c. Retard the ENG POWER CONT lever on the engine not being checked until approximately 60% TRQ is indicated or until TGT on engine being checked is the normal TGT limiter setting of 857°- 875°C (1575°-1607°F) and a 2% RPM R reduction is observed.

d. If engine being checked reaches the aircraft single engine torque limit of 135% before any reduction of RPM R, perform the power check at a higher altitude.

CAUTION

If max power check is being performed because of a failed HIT check, and weather conditions prevent a higher altitude, perform troubleshooting procedure 65 before using the alternatives of step f.

e. If weather conditions prevent obtaining a higher altitude delay the maximum power check.

NOTE

Some units are grounding aircraft when weather is inclement, and some units are assuming an ETF of 1.0, which could lead to serious planning errors.

f. If the maximum power check is delayed, an alternative to grounding is to use one of the following ETF's:

(1) Last calculated ETF if it was less than 0.95.

(2) Use 0.95 if last calculated ETF was greater than 0.95.

g. Perform the maximum power check as soon as weather conditions permit to establish the true ETF.

h. Observe TGT on engine being checked.

NOTE

TGT should not exceed the normal TGT limiter setting. If TGT exceeds the normal TGT limiter setting, discontinue the maximum power check and refer to troubleshooting procedure 37 (table 1-13).

i. Slowly advance the ENG POWER CONT lever of the engine not being checked only enough to re-establish % RPM R to 100% without any change in TGT on engine being checked.

j. Wait 30 seconds and record Ng, TGT, % TRQ, FAT, and pressure altitude.

k. During step c, if the engine not being checked indicated 60% TRQ without any reduction in % RPM R, do the following:

(1) Increase collective pitch until a reduction of 2% RPM R is observed.

(2) Maintain a constant pressure altitude by allowing forward airspeed to increase beyond 120 knots until a reduction of 2% RPM R is observed.

(3) Note TGT on engine being checked. TGT should not exceed the normal TGT limiter setting. If TGT exceeds the normal limiter setting, discontinue the check and see troubleshooting procedure 37 (table 1-13).

(4) Slowly decrease collective pitch to allow % RPM R to return to 100% without any change in TGT on engine being checked.

(5) Retard engine not being checked to ground idle.

(6) Increase collective until engine being checked is at TGT noted in step (3). Establish steady state flight condition.

(7) Wait 30 seconds and record Ng, TGT, % TRQ, FAT, and pressure altitude.

l. If the engine not being checked is at ground idle, and the engine being checked has reached the aircraft single engine torque limit of 135% without any reduction of RPM R, wait 30 seconds at 135% torque and record Ng, TGT,% TRQ, FAT, and pressure altitude.

m. Advance the ENG POWER CONT lever on the engine not being checked to FLY.

n. If required, repeat steps a thru j for the other engine.

o. Establish the Engine Torque Factor (ETF) as follows:

NOTE

Round off all calculations to the nearest 0.001. Round up from 0.00050 to 0.00099. Round down from 0.00049 to 0.00001.

EXAMPLE: 0.97050 through 0.97099 = 0.971
0.97001 through 0.97049 = 0.970

(1) Calculate the Adjusted Torque (TRQ_{ADJ}) as follows:

(a) When FAT is greater than –14°C, TRQ_{ADJ} = % TRQ measured if TGT is in the normal TGT limiter range. If TGT is not within range refer to paragraph 1-130.

(b) When FAT is less than or equal to –14°C, obtain TGT_{REF} from figure 1-62.

$$TRQ_{ADJ} = \%\ TRQ + 0.2\ TGT_{REF} - 0.2\ TGT$$

EXAMPLE:

KNOWN		FOUND (fig. 1-62)
PRESSURE ALTITUDE	= 6,000 FT	
FAT	= –16°C	TGT_{REF}858°C
% TRQ	= 106.0%	
TGT	= 836°C	
TRQ_{ADJ}	= 106.0 + 0.2 (858) – 0.2 (836)	
	= 106.0 + (171.6 – 167.2)	
	= 106.0 + 4.4	
	= 110.4%	

(2) Obtain Target Torque Value (TTV) for engines with Hover Infrared System (HIRSS) and with baffles or cruise suppressors installed refer to figure 1-73, sheet 1. For engines with HIRSS and without baffles or cruise suppressors installed refer to figure 1-73, sheet 2.

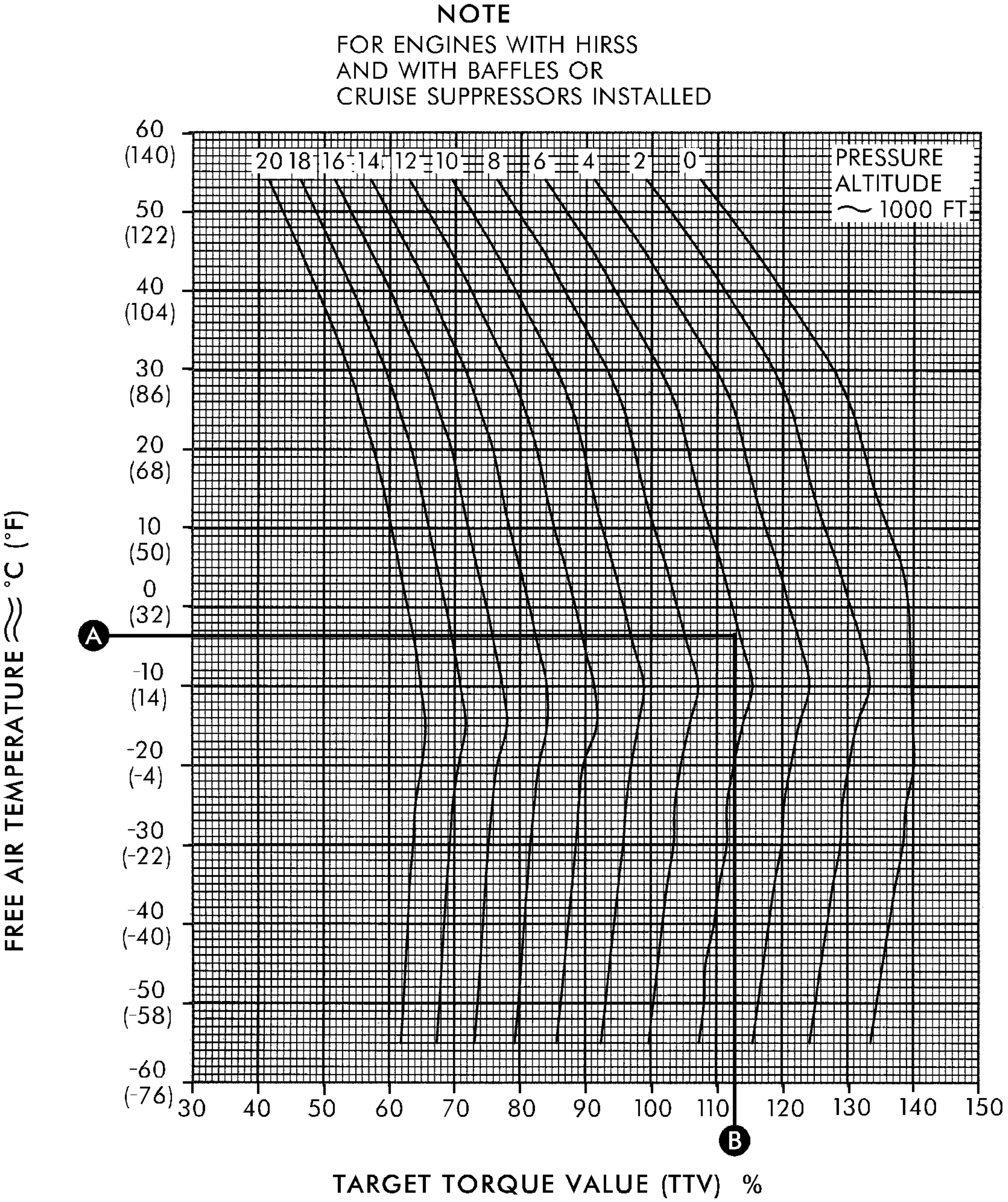
EXAMPLE: Using FAT = –16°C
and
PRESSURE ALTITUDE = 6,000 FT,
therefore,
TTV = 113.8%

(3) Calculate Specification Torque Ratio (STR) by dividing Adjusted Torque (TRQ_{ADJ}) by Target Torque Value (TTV).

$$STR = \frac{TRQ_{ADJ}}{TTV}$$

EXAMPLE: $STR = \frac{(110.4)}{113.8} = 0.97$

(4) Obtain Engine Torque Factor (ETF) from figure 1-72. When STR is greater than or equal to 1.0, assume ETF to be 1.0.



WANTED	KNOWN	METHOD
TARGET TORQUE VALUE	FAT = -16°C (3.2°F) PRESSURE ALTITUDE = 6,000 FT ENGINE %RPM 1 OR 2 = 100 % TRQ = 106 TGT = 836°C (1537°F)	ENTER CHART ON LEFT AT -16°C (3.2°F) FAT – – – – – – – – Ⓐ MOVE RIGHT TO INTERSECTION OF -16°C (3.2°F) LINE AND 6,000 FOOT LINE MOVE STRAIGHT DOWN TO READ 113.8% – – – – – – – – – Ⓑ

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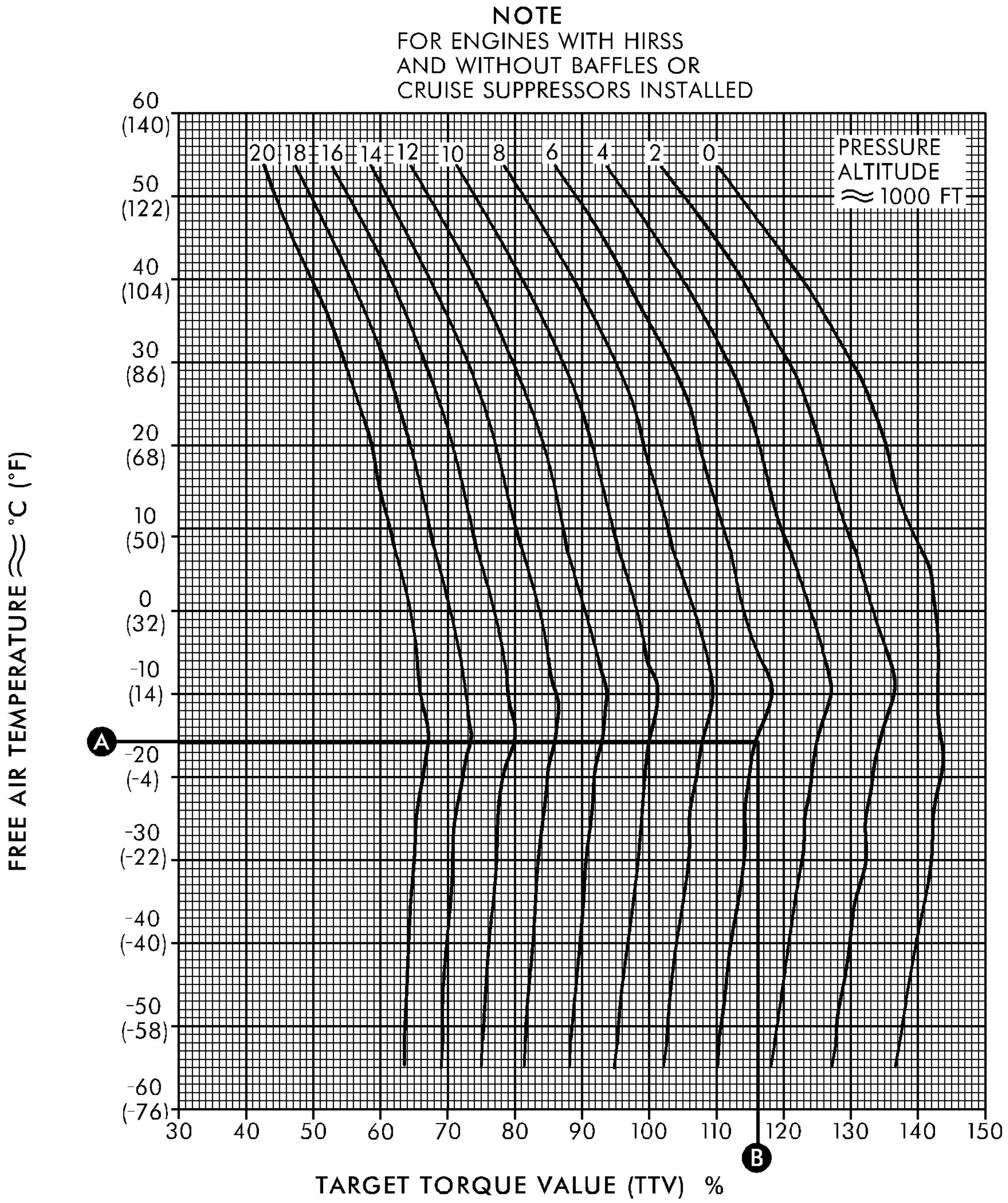
*Figure 1-73. **(T701C, T701D)** Determining Target Torque Value (TTV) for UH-60L (Sheet 1 of 2)*


NOTE
FOR ENGINES WITH HIRSS
AND WITHOUT BAFFLES OR
CRUISE SUPPRESSORS INSTALLED

WANTED	KNOWN	METHOD
TARGET TORQUE VALUE	FAT = -16°C (3.2°F) PRESSURE ALTITUDE = 6,000 FT ENGINE %RPM 1 OR 2 = 100 % TRQ = 106 TGT = 836°C (1537°F)	ENTER CHART ON LEFT AT -16°C (3.2°F) FAT - — — — — — — — Ⓐ MOVE RIGHT TO INTERSECTION OF -16°C (3.2°F) LINE AND 6,000 FOOT LINE MOVE STRAIGHT DOWN TO READ 116% - — — — — — — — — — — Ⓑ

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Figure 1-73. ***(T701C, T701D)*** *Determining Target Torque Value (TTV) for UH-60L (Sheet 2 of 2)*

EXAMPLE: KNOWN

FAT = –16°C (3.2°F)
STR = 0.97

FOUND

Enter figure 1-72 on left (STR axis) at 0.97. Move right to intersection of 0.97 line and ≤ (less than or equal to) –5°C line. Move straight down to read 0.89 ETF.

p. If ETF has degraded by more than 0.050 from last recorded ETF, refer to troubleshooting procedure 63 (table 1-13). If ETF is greater than or equal to 0.97 or has not degraded by more than 0.050 since last recorded ETF, record ETF in applicable block in figure 1-65, sheet 1.

q. Repeat steps o and p for other engine, if required.

r. Calculate Aircraft Torque Factor (ATF) as follows;

KNOWN ETF: No. 1 Engine = 0.89
No. 2 Engine = 0.99

$$\text{ATF} = \frac{\text{No. 1 Engine ETF} + \text{No. 2 Engine ETF}}{2}$$

EXAMPLE: $\text{ATF} = \frac{0.89 + 0.99}{2} = 0.94$

s. Record the ATF in applicable block of figure 1-65, sheet 1. The form in figure 1-65 may be locally reproduced and used in the aircraft logbook. Minimum allowable ATF is 0.90.

t. After completing maximum power check and if engine performance is satisfactory, record new upper and lower limits (from the baseline established in step a) on HIT log in helicopter.

1-148. Break-In Run. A break-in run is required whenever the gas generator rotor and stator are replaced.

1-149. Single Engine Break-In Run UH-60.

CAUTION

Prior to starting the break-in procedure, the engine must not be advanced beyond ground idle power.

NOTE

A qualified maintenance test pilot or functional check pilot will be required to perform this procedure in support and under direction of intermediate maintenance level personnel.

Use this break-in procedure when only one engine has had the gas generator rotor and stator replaced.

a. Perform normal engine starts to ground idle.

b. Leave the engine not receiving the break-in run at ground idle speed.

c. Set the break-in engine minimum Nr/Np speed, using the ENG RPM INCR/DECR switch on the collective grip.

CAUTION

If the engine requiring break-in approaches 84% Ng, stop advancing that power control lever. Slowly advance the opposite engine power control lever toward FLY allowing the break-in engine to remain below 84% Ng. Continue the break-in procedure.

d. With minimum collective, slowly advance power control lever to FLY.

e. Slowly increase Nr/Np to 100%, using the ENG RPM INCR/DECR switch on the collective grip.

f. Using collective, vary collective position to slowly set the Ng speeds shown in table 1-21. Use 10 seconds to set each point; then use 10 seconds to reduce Ng. Continue increasing collective in setting points until aircraft is light on wheels. Note maximum Ng speed reached at this point.

g. Reduce collective to minimum.

h. Advance other power control lever to FLY.

Table 1-21. Break-In Run

Move Ng From	Set Ng To	Time of Change	Set Ng To	Time of Change	Time At Final Ng Point
84%	88%	10 Seconds	87%	10 Seconds	30 Seconds
87%	91%	10 Seconds	90%	10 Seconds	30 Seconds
90%	93%	10 Seconds	92%	10 Seconds	30 Seconds
92%	88%	10 Seconds	92%	10 Seconds	30 Seconds
92%	95%	10 Seconds	94%	10 Seconds	30 Seconds
94%	97%	10 Seconds	96%	10 Seconds	30 Seconds
96%	98%	10 Seconds	97%	10 Seconds	30 Seconds
97%	99%	10 Seconds	98%	10 Seconds	30 Seconds
98%	101%	10 Seconds	99%	10 Seconds	30 Seconds
99%	92%	10 Seconds	--	--	--

CAUTION

Do not exceed the normal TGT limiter setting. If TGT limiter is reached, consider limiter the maximum speed obtainable and the break-in run complete.

i. Conduct engine overspeed check (para 1-132).

j. If possible, make minimum power takeoff where Ng on newly installed engines are kept below maximum Ng speed reached in step f.

k. When stabilized flight has been reached, continue setting Ng speeds as called out in table 1-21, starting a maximum Ng speed reached in step f. After completion of last point in table 1-21, reduce collective and continue with remaining flight plan.

1-150. Dual Engine Break-In Run UH-60. Use this break-in procedure when both engines have had the gas generator rotors and stators replaced.

a. Perform normal engine starts to ground idle.

b. Leave the engine not receiving the break-in run at ground idle speed.

c. Set the break-in engine minimum Nr/Np speed, using the ENG RPM INCR/DECR switch on the collective grip.

CAUTION

If the engine requiring break-in approaches 84% Ng, stop advancing that power control lever. Slowly advance the opposite engine power control lever toward FLY allowing the break-in engine to remain below 84% Ng. Continue the break-in procedure.

d. With minimum collective, slowly advance the break-in engine power control lever to FLY.

e. Slowly increase Nr/Np to 100%, using the ENG RPM INCR/DECR switch on the collective grip.

f. Using collective, vary collective position to slowly set the Ng speeds shown in table 1-21. Use 10 seconds to set each point; then use 10 seconds to reduce Ng. Continue increasing collective in setting points until aircraft is light on wheels. Note maximum Ng speed reached at this point.

g. Reduce collective to minimum.

h. Retard the power control lever of the break-in engine to ground idle.

i. Retard the power control lever of the engine that did not receive the break-in run to ground idle.

j. Repeat steps b through g for other engine.

k. Advance other power control lever to FLY.

l. Conduct engine overspeed checks on both engines (para 1-132).

m. If possible, make minimum power takeoff where Ng on newly installed engines are kept below maximum Ng speed reached in step f.

n. When stabilized flight has been reached, continue setting Ng speeds as called out in table 1-21, starting a maximum Ng speed reached in step f. After completion of last point in table 1-21, reduce collective and continue with remaining flight plan.

1-151. Single Engine Break-In Run AH-64. Use this procedure when only one engine has had the gas generator rotor and stator replaced.

a. Perform normal engine starts to ground idle.

b. Move power control lever for engine not requiring the break-in run to FLY 100%.

CAUTION

The engine requiring the break-in run should not be advanced above 84% Ng prior to initiating the procedure shown in table 1-21.

c. With minimum collective, slowly advance power control lever to 84% Ng and proceed with the break-in run until power contol reaches the FLY detent.

d. With the power control lever at FLY, vary collective position to slowly set the Ng speeds shown in table 1-21. Use 10 seconds to set each point; then use 10 seconds to reduce Ng. Continue increasing collective in setting points until aircraft is light on wheels. Note maximum Ng speed reached at this point.

e. Reduce collective to minimum.

f. Conduct engine overspeed check (para 1-133).

g. If possible, make minimum power takeoff where Ng on newly installed engine is kept below maximum Ng speed reached in step d.

h. When stabilized flight is reached, continue setting Ng speeds as called out in table 1-21, starting at maximum Ng speed reached in step d. After completion of last point in table 1-21 reduce collective and continue with remaining flight plan.

1-152. Dual Engine Break-In Run AH-64. Use this break-in procedure when both engines have had the gas generator rotors and stators replaced.

a. Perform normal engine starts to ground idle.

b. Set engine not receiving the break-in run at ground idle speed.

CAUTION

If the engine requiring break-in approaches 84% Ng, stop advancing the power control lever.

c. Slowly advance the power control lever of the engine being checked toward FLY, but do not exceed 84% Ng and follow table 1-21 until power control lever reaches the FLY detent.

d. With the power control lever at FLY, using collective, vary collective position to slowly set the Ng speeds shown in table 1-21. Use 10 seconds to set each point, then use 10 seconds to reduce Ng. Continue increasing collective in setting points until aircraft is light on wheels. Note maximum Ng speed reached at this point.

e. Reduce collective to minimum.

f. Retard the power control lever of the break-in engine to ground idle.

CAUTION

If the engine requiring break-in approaches 84% Ng, stop advancing the power control lever.

g. With minimum collective, slowly advance the power control lever of the second engine being checked toward FLY, but do not exceed 84% and follow table 1-21 until power control lever reaches the FLY detent.

h. With the power control lever at FLY, using collective, vary collective position to slowly set the Ng speeds shown in table 1-21. Use 10 seconds to set each point, then use 10 seconds to reduce Ng. Continue increasing collective in setting points until aircraft is light on wheels. Note maximum Ng speed reached at this point.

i. Reduce collective to minimum.

j. Advance other power control lever to FLY.

k. Conduct engine overspeed checks on both engines (para 1-133).

l. If possible, make minimum power takeoff where Ng speeds are kept below maximum Ng speed reached in steps d and h.

m. When stabilized flight has been reached, continue setting Ng speeds as called out in table 1-21. Starting at maximum Ng speeds reached in steps d and h. After completion of last point in table 1-21, reduce collective and continue with remaining flight plan.

1-153. Health Indicator Test (HIT) Check Procedure.

WARNING

Anti-Ice Bleed and Start Valve

Do not cycle anti-ice bleed and start valve more than once to determine proper operation. Valve malfunction can cause engine flameout at low power settings or during rapid collective movements. Do not fly the aircraft if TGT rise is less than 30°C (54°F), or switch cycling is required.

CAUTION

If any part of engine anti-ice check fails, do not fly helicopter.

a. The HIT check is an operational check done on the ground to find a significant performance shift, to trend engine performance, and to verify proper operation of the anti-icing bleed and start valve. Good results in passing HIT checks does not guarantee that engine will meet IRP performance. An in-flight maximum power check is the only way to ensure that the engine meets torque factor requirements.

b. A HIT baseline is established according to procedures in applicable aircraft maintenance manual when the engine is first installed in the aircraft. The operational maintenance pilots perform HIT checks and compare the results against the baseline.

c. When an engine fails a HIT check as a result of a faulty anti-icing bleed and start valve or a dirty compressor, do the following:

(1) Replace anti-icing bleed and start valve (para 10-31) or clean engine for performance recovery (para 1-157).

(2) Repeat HIT check (para 1-154). If engine returns to the previously established baseline, a new HIT baseline and in-flight maximum power check are not required.

d. When an operational HIT check TGT margin is equal to or less than 5°C from limits established during the baseline, an entry will be made on DA Form 2408-13 to notify the Maintenance Officer. The Maintenance Officer will then decide if troubleshooting or preventative maintenance procedures such as compressor cleaning for performance recovery (para 1-157) should be accomplished. Factors which may influence his decision are:

- Has a trend been established?
- Has the operational environment changed?
- How much time has elapsed since last compressor cleaning?
- Has there been a change in Maximum Power Check?
- Has the engine had recent maintenance which might influence its performance?

e. If, in step d, the Maintenance Officer decided to do a compressor cleaning, a HIT check (para 1-154) is required.

1-154. HIT Baseline Check and Engine Performance Data Checks for UH-60A, UH-60L and AH-64A.

CAUTION

- If icing conditions exist, do not keep anti-icing off for longer than is necessary to do HIT check.
- If any part of engine anti-ice check fails, do not fly helicopter.

a. Prior to completing maximum power check, a new HIT baseline is established by the maintenance test pilot and used if engine performance is satisfactory on the maximum power check. During initial HIT check, the maintenance pilot compensates for the particular engine characteristic and establishes the TGT limits to be used in the operational HIT check. The operational pilot will compare engine performance to this baseline to check engine performance.

NOTE

The HIT baseline must be established prior to the maximum power check, prior to first take-off, to replicate daily HIT check procedures.

b. Position helicopter into prevailing wind to minimize hot gas ingestion.

c. Set **(UH-60A, UH-60L)** ENG ANTI-ICE or **(AH-64A)** ANTI-ICE and HEATER switches at OFF. Set altimeter to 29.92 in. Hg.

d. Set both engines **(UH-60A, UH-60L)** % RPM or **(AH-64A)** ENG-RTR RPM at 100%.

e. **(UH-60A, UH-60L)** Retard ENG POWER CONT lever of engine not being checked until a 0%-5% TRQ at 92%-98% (Np) RPM is reached. **(AH-64A)** Retard ENG POWER CONT lever of engine not being checked to idle.

f. Increase collective pitch to 60% TRQ and hold it there for at least 30 seconds.

NOTE

If helicopter is equipped with two FAT gages, and the readings are different, the higher reading must be used.

g. Note FAT and pressure altitude.

h. Record A/C HOURS, FAT, pressure altitude, and indicated TGT on HIT baseline worksheet (fig. 1-74).

NOTE

Steps i, j, and k contain instructions for performing the Anti-Ice check.

i. **(AH-64A)** If Ng is less than 90% and FAT is 15°C or below, then increase collective to 90%. If Ng is less than 90% and FAT is above 15°C, then increase collective to 94%. **(UH-60A, UH-60L)** If the ENG ANTI-ICE advisory light remains on at 60% TRQ, increase collective to a maximum of 94% Ng, or until the advisory light is off.

WARNING

Anti-Ice Bleed and Start Valve

Do not cycle anti-ice bleed and start valve more than once to determine proper operation. Valve malfunction can cause engine flameout at low power settings or during rapid collective movements. Do not fly the aircraft if TGT rise is less than 30°C (54°F), or switch cycling is required.

j. For engine being checked, set **(AH-64A)** ENG INLET or **(UH-60A, UH-60L)**, ENG ANTI-ICE switch to ON and note the following:

- Increase in TGT of at least 30°C
- **(AH-64A)** ENG 1 and ENG 2 advisory lights come on. **(UH-60A, UH-60L)** ENG ANTI-ICE advisory lights come on.
- **(AH-64A)** ENG 1 and ENG 2 ANTI-ICE fail lights remain on until the fairing electrical heaters reach 96°C (205°F) and the engine inlets reach 66°C (150°F) (approximately 40 seconds).
- **(UH-60A, UH-60L)** ENG INLET ANTI-ICE advisory light comes on after inlet fairing temperature reaches 93°C (200°F) and if FAT is less than 4°C (39°F).

WARNING

Anti-Ice Bleed and Start Valve

Do not cycle anti-ice bleed and start valve more than once to determine proper operation. Valve malfunction can cause engine flameout at low power settings or during rapid collective movements. Do not fly the aircraft if TGT rise is less than 30°C (54°F), or switch cycling is required.

NOTE

(UH-60A, UH-60L) ENG INLET ANTI-ICE advisory light may or may not come on between 4°C (39°F) and 13°C (55°F).

k. Set **(AH-64A)** ENG INLET or **(UH-60A, UH-60L)** ENG ANTI-ICE switch to OFF and note the following:

- Decrease in TGT to approximate value in step h.
- **(AH-64A)** ENG 1 and ENG 2 advisory lights go off. **(UH-60A, UH-60L)** ENG ANTI-ICE advisory light goes off.
- **(AH-64A)** ENG 1 and ENG 2 ANTI-ICE fail lights go off after fairing and inlet heaters cool (approximately 90 seconds).
- **(UH-60A, UH-60L)** ENG INLET ANTI-ICE advisory light goes off after inlet fairing temperature goes below 93°C (200°F).

l. If any part of the engine inlet ANTI-ICE check fails, do not fly the helicopter.

m. Repeat steps c through h twice. This completes logging of data. Remaining steps can be done after engine is shut down.

n. Using HIT baseline worksheet shown in figure 1-74, calculate average indicated TGT for above three readings.

NOTE

When using TGT reference table, FAT must be rounded up, and pressure altitude must be rounded off to the nearest value, if applicable.

EXAMPLE:

(1) If FAT is 14°C, use 15°C. Or, if FAT is 46°C, use 47°C.

(2) If pressure altitude is between –249 FT and 249 FT, use 0 FT. Or, if pressure altitude is between 250 FT and 749 FT, use 500 FT.

o. Find table TGT in referenced **(T700)** table 1-22, **(T701C, T701D)** table 1-23, or **(T701)** table 1-24 to determine actual TGT for recorded FAT and pressure altitude.

p. Subtract table TGT on HIT baseline worksheet (fig. 1-74) from average indicated TGT.

q. Establish TGT upper and lower limits by adding 20°C (68°F) to answer in step p, and by subtracting 20°C (68°F) from answer in step p. Record upper and lower limits on HIT log sheet, figure 1-65 in helicopter log book.

r. During operational checks, the HIT TGT margin will fall within the upper and lower limits.

s. The following is an example of a **(T700)** HIT baseline calculation:

(1) FAT = 15°C

(2) PRESS ALT = 500 FT

(3) TGT = 665°, 668°, 667°C

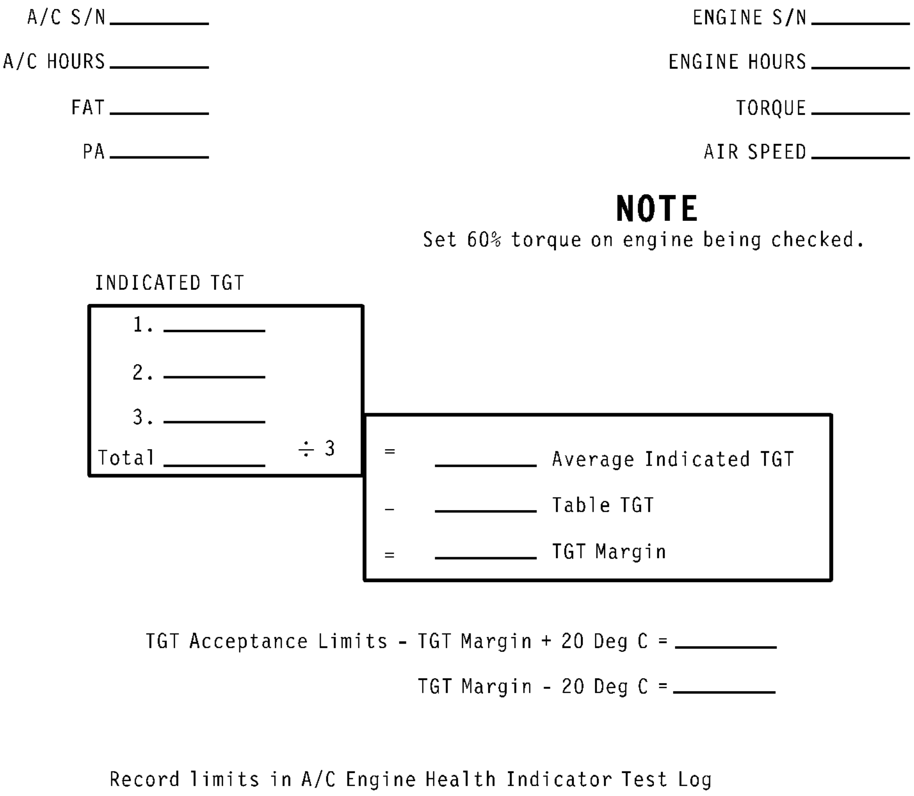
(4) Average TGT $= \frac{665 + 668 + 667}{3} =$ 667°C

(5) Table value of TGT (for 15°C FAT and + 500 FT altitude) = 684°C

(6) Average TGT minus table TGT= 667°C – 684°C = –17°C

(7) TGT acceptance limit
–17°C + 20°C = +3°C
–17°C – 20°C = –37°C.

(8) Therefore, an operational HIT check (TGT margin) that is less than +3°C and greater than –37°C is acceptable.



A/C S/N ________

A/C HOURS ________

FAT ________

PA ________

ENGINE S/N ________

ENGINE HOURS ________

TORQUE ________

AIR SPEED ________

NOTE

Set 60% torque on engine being checked.

INDICATED TGT

1. ________
2. ________
3. ________

Total ________ ÷ 3

= ________ Average Indicated TGT

– ________ Table TGT

= ________ TGT Margin

TGT Acceptance Limits - TGT Margin + 20 Deg C = ________

TGT Margin - 20 Deg C = ________

Record limits in A/C Engine Health Indicator Test Log

1156953-00-A2A

Figure 1-74. HIT Baseline Worksheet

Table 1-22.** (T700) **TGT Reference Table for 60% Torque at 100% RPM

FAT °C	PRESSURE ALTITUDE-FT																	
	–1000	–500	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	7000	8000	9000	10000
55	781	786	789	793	797	802	806	811	815	821	826	832	---	---	---	---	---	---
53	776	781	784	788	782	796	800	805	809	815	820	826	---	---	---	---	---	---
51	770	775	778	782	786	791	795	800	804	810	814	820	825	836	---	---	---	---
49	765	770	773	777	781	785	789	794	798	804	809	815	819	830	---	---	---	---
47	759	784	767	771	775	780	784	789	793	799	803	809	814	825	---	---	---	---
45	754	759	762	766	770	774	778	783	787	793	797	803	808	819	830	---	---	---
43	749	753	756	760	764	768	772	777	781	787	791	797	802	813	824	836	---	---
41	744	748	751	755	759	763	767	772	776	781	786	791	796	807	818	830	---	---
39	738	742	746	750	754	758	762	766	770	776	780	786	791	801	812	824	---	---
37	733	737	740	744	748	752	756	760	765	770	775	780	785	795	806	818	830	---
35	728	732	735	739	743	747	750	755	759	764	769	774	779	790	800	812	824	---
33	722	726	730	733	737	741	745	749	753	759	763	768	773	784	794	806	818	831
31	717	721	724	728	732	736	739	744	748	753	758	763	767	778	788	800	812	825
29	711	716	719	723	726	730	734	738	742	748	752	757	762	772	782	794	805	818
27	706	710	713	717	721	725	728	732	737	742	746	751	756	766	777	780	799	812
25	701	705	708	712	715	719	723	727	731	736	741	746	750	760	771	782	793	806
23	695	699	703	706	710	714	717	721	726	731	735	740	744	754	765	776	787	800
21	690	694	697	701	704	708	712	716	720	725	729	734	739	745	759	770	781	793
19	684	688	692	695	699	703	706	710	714	720	724	728	733	743	753	764	775	787
17	679	683	686	690	693	697	701	705	709	714	718	723	727	737	747	758	769	781
15	673	677	680	684	688	692	695	699	703	708	712	717	721	731	741	752	763	775
13	668	672	675	679	682	686	690	694	698	703	707	711	716	725	735	746	757	768
11	663	667	670	673	676	681	684	688	692	697	701	705	710	719	729	740	751	762
9	657	661	664	668	671	675	679	683	687	691	695	700	704	713	723	734	745	756
7	652	656	659	662	666	670	673	677	681	686	689	694	698	708	717	728	738	750
5	647	651	654	657	660	665	668	672	676	680	684	688	692	702	711	722	732	744
3	642	645	648	652	655	659	663	667	670	675	678	683	687	696	705	716	727	737
1	636	640	643	647	650	654	657	661	665	669	673	677	681	690	699	709	720	731
–1	631	635	638	641	645	649	652	656	660	664	667	672	676	684	693	703	714	725
–3	626	630	633	636	640	643	647	651	654	659	662	666	670	679	687	697	707	718
–5	621	625	628	631	634	638	642	645	649	653	657	661	665	673	682	692	701	712
–7	616	619	623	626	629	633	636	640	644	648	651	656	659	668	676	686	696	706
–9	610	614	617	621	624	628	631	635	639	643	646	650	654	662	670	680	690	700
–11	605	609	612	615	619	623	626	630	633	637	641	645	649	657	665	674	684	694
–13	600	604	607	610	613	617	621	624	628	632	636	640	643	651	659	668	678	688
–15	594	598	601	605	608	612	615	619	622	627	630	634	638	646	654	663	672	682
–17	589	593	596	599	603	606	610	614	617	621	625	629	632	640	648	657	666	676
–19	584	587	590	594	597	601	604	608	611	616	619	623	627	635	643	652	661	670
–21	578	582	585	588	592	595	599	603	606	610	614	618	621	629	637	646	655	665
–25	568	571	574	578	581	585	588	591	595	599	602	606	610	618	626	635	644	653
–30	554	558	561	564	567	571	574	578	581	585	588	592	596	604	612	620	629	638
–35	541	545	548	551	554	558	560	564	567	571	575	578	582	590	597	606	614	623
–40	528	532	534	538	541	544	547	550	554	557	561	564	568	575	583	592	600	609
–45	515	519	522	525	528	531	534	537	540	544	547	551	554	561	569	578	586	594
–50	502	506	508	511	514	518	520	524	527	531	534	537	540	546	555	563	571	579
–55	489	493	495	498	501	504	507	510	513	517	520	524	527	534	541	549	557	565

Table 1-23. ***(T701C, T701D)*** *TGT Reference Table for 60% Torque at 100% RPM*

FAT °C	PRESSURE ALTITUDE-FT																		
	–1000	–500	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	7000	8000	9000	10000
55	736	740	744	748	753	758	763	769	775	781	787	792	796	801	805	814	825	835	846
53	730	734	738	742	747	751	757	762	768	774	780	785	790	796	800	809	819	830	840
51	724	728	732	736	740	745	750	756	761	767	773	779	785	791	795	804	814	825	835
49	718	721	725	729	734	738	744	749	755	761	767	772	778	785	789	799	808	819	829
47	712	715	719	723	727	732	737	743	748	754	760	766	771	778	782	794	803	814	824
45	706	709	713	717	721	725	731	736	741	747	753	759	764	771	776	788	798	808	818
43	701	703	707	711	715	719	725	729	734	740	746	752	757	764	769	781	792	803	813
41	695	698	702	706	710	713	718	723	728	733	739	745	751	757	762	775	786	797	807
39	690	692	696	700	704	707	712	716	721	726	732	738	744	750	755	768	780	792	802
37	684	687	690	694	698	702	706	710	714	720	725	731	737	743	748	761	773	787	796
35	679	681	685	689	692	696	700	704	709	713	719	724	730	736	741	754	766	779	791
33	673	676	679	683	687	690	694	698	703	707	712	717	723	729	735	746	759	772	786
31	668	670	674	677	681	685	689	692	697	702	707	711	716	722	727	739	752	765	779
29	662	665	668	671	675	679	683	687	691	696	701	705	710	715	720	732	745	758	771
27	657	659	662	666	670	673	677	681	685	690	695	700	704	709	714	725	737	750	764
25	651	654	657	660	664	667	671	675	680	684	689	694	698	703	707	718	730	743	756
23	645	648	651	655	658	662	666	669	674	678	683	688	692	697	701	711	723	736	749
21	639	642	645	649	652	656	660	664	668	672	677	682	686	691	695	705	715	728	742
19	634	636	640	643	647	650	654	658	662	667	671	676	680	685	689	699	709	721	734
17	628	631	634	638	641	644	648	652	656	661	665	670	674	679	683	693	703	714	727
15	623	625	629	632	635	638	642	646	650	655	659	664	668	673	677	686	697	708	719
13	617	620	623	626	630	633	636	640	644	649	654	658	662	666	671	680	690	701	712
11	612	614	618	621	624	627	631	634	638	643	647	652	656	660	665	674	684	695	706
9	606	609	612	616	619	622	625	629	633	637	641	646	650	654	659	668	678	689	699
7	600	603	607	610	613	616	620	623	627	631	635	640	644	648	652	662	671	682	693
5	595	598	601	605	608	611	614	618	621	625	630	634	637	642	646	656	665	676	687
3	589	592	595	599	602	605	609	612	616	620	624	628	631	636	640	649	659	669	680
1	584	586	590	593	597	600	603	607	610	614	618	622	626	629	634	643	653	663	674
–1	577	579	583	586	590	593	596	600	603	607	611	615	618	622	626	635	645	655	666
–3	571	574	577	581	584	587	591	594	598	602	606	609	613	617	620	629	639	649	659
–5	566	568	572	575	578	581	585	589	592	596	600	604	607	611	615	623	632	642	652
–7	560	563	566	569	573	576	579	583	587	590	594	598	601	605	609	617	626	636	646
–9	554	557	560	564	567	570	574	577	581	585	589	592	596	599	603	611	620	630	639
–11	549	552	555	558	561	564	568	571	575	579	583	586	590	594	597	606	614	623	633
–13	543	546	549	553	556	559	562	566	569	573	577	581	584	588	591	600	608	617	627
–15	538	540	544	547	550	553	556	560	564	567	571	575	578	582	586	594	602	611	620
–17	532	535	538	541	544	547	551	555	558	562	565	569	572	576	580	588	596	605	614
–19	526	529	532	536	539	542	545	549	552	556	559	563	566	570	574	582	591	599	608
–21	521	523	527	530	533	536	539	543	546	550	554	557	560	564	568	577	585	593	602
–23	515	518	521	524	527	530	534	537	540	544	548	551	555	558	562	571	579	587	596
–25	510	512	515	519	522	524	528	531	535	538	542	545	549	552	556	565	573	581	589
–27	504	507	510	513	516	519	522	526	529	532	536	539	543	547	550	559	567	575	583
–29	498	501	504	507	510	513	516	520	523	526	530	534	537	541	545	553	561	569	577
–31	492	495	498	501	504	507	511	514	517	521	524	528	531	535	539	547	554	563	571
–33	487	490	493	496	499	501	505	508	511	515	518	522	525	529	533	541	548	556	565
–35	482	484	487	490	493	496	499	502	506	509	512	516	519	523	527	535	542	550	558
–37	476	478	481	484	487	490	493	497	500	503	506	510	513	517	521	529	536	544	552
–39	470	473	476	479	482	484	487	491	494	497	500	504	507	511	515	523	530	538	546
–45	453	456	459	462	465	467	470	473	476	479	483	486	489	493	497	505	512	519	527
–50	439	441	444	447	450	453	456	459	462	465	468	471	475	478	482	490	497	504	512
–55	425	427	430	433	436	438	441	444	447	450	454	457	460	464	467	475	481	489	496

Table 1-24. (T701) TGT Reference Table for 60% Torque at 100% RPM

FAT °C	PRESSURE ALTITUDE-FT																	
	–1000	–500	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	6000	7000	8000	9000	10000
55	765	768	772	776	780	785	789	793	798	804	809	814	820	831	---	---	---	---
53	760	763	767	771	775	779	784	788	793	798	803	808	814	825	---	---	---	---
51	755	758	762	765	769	774	778	782	787	793	798	803	808	819	831	843	---	---
49	749	752	756	760	764	768	773	777	782	787	792	797	803	814	825	837	849	863
47	744	747	751	754	758	763	767	771	776	782	787	792	797	808	819	831	843	857
45	739	742	746	749	753	757	762	766	771	776	781	786	791	802	813	825	837	851
43	733	737	740	744	748	752	756	760	765	770	775	780	785	796	807	819	831	844
41	728	732	735	739	743	747	751	755	760	764	769	775	780	790	801	813	825	838
39	723	726	730	734	737	741	745	749	754	759	764	769	774	784	795	807	819	832
37	717	721	725	728	732	736	740	744	748	753	758	763	768	778	789	801	813	826
35	712	716	719	723	727	730	734	738	743	748	753	758	762	772	783	795	807	819
33	707	710	714	717	721	725	729	733	738	742	747	752	757	767	777	789	801	813
31	701	705	708	712	716	719	723	727	732	737	741	746	751	761	772	783	794	807
29	696	700	703	707	710	714	718	722	726	731	736	741	745	755	766	777	788	800
27	691	694	698	701	705	709	712	716	721	726	730	735	740	749	760	771	782	794
25	685	689	692	696	699	703	707	711	715	720	724	729	734	744	754	765	776	788
23	680	684	687	690	694	698	701	705	710	714	719	724	728	738	748	759	770	782
21	675	678	681	685	689	692	696	700	704	709	713	718	722	732	742	753	764	776
19	669	673	676	679	683	687	691	694	699	703	708	712	717	726	736	747	758	769
17	664	667	671	674	678	681	685	689	693	698	702	707	711	720	730	741	752	763
15	659	662	665	669	672	676	679	683	688	692	696	701	705	715	724	735	746	757
13	654	657	660	663	667	670	674	678	682	687	691	695	700	709	718	729	739	751
11	649	652	655	658	662	665	668	672	677	681	685	689	694	703	712	723	733	745
9	644	647	650	653	659	660	663	667	671	675	679	684	688	697	707	717	727	738
7	639	642	645	648	651	655	658	662	666	670	674	678	682	691	701	711	721	732
5	634	637	640	643	646	649	653	656	661	665	669	673	677	685	695	705	715	726
3	629	632	635	638	641	644	648	651	655	659	663	667	671	680	689	699	709	720
1	624	627	630	633	636	639	643	646	650	654	658	662	666	674	683	693	703	713
–1	619	622	625	628	631	634	637	641	645	649	653	657	661	669	677	687	697	707
–3	614	617	620	623	626	629	633	636	640	644	647	651	655	663	672	681	691	701
–5	609	612	615	618	621	624	628	631	635	638	642	646	650	658	666	676	685	695
–7	604	607	610	613	616	619	623	626	630	633	637	641	645	653	661	670	679	689
–9	598	602	605	608	611	614	617	621	625	628	632	636	640	647	655	664	674	683
–11	593	596	600	603	606	609	612	616	620	623	627	631	634	642	650	659	668	677
–13	588	591	594	597	601	604	607	611	614	618	622	626	629	637	645	654	662	671
–15	583	586	589	592	595	598	602	605	609	613	616	620	624	632	640	648	657	666
–17	577	580	583	587	590	593	596	600	604	607	611	615	619	626	634	643	652	660
–19	572	575	578	581	585	588	591	595	598	602	606	609	613	621	629	637	646	655
–21	567	570	573	576	579	582	586	589	593	597	600	604	608	615	624	632	640	649
–25	557	560	563	566	569	572	575	579	582	586	589	593	597	604	612	621	629	638
–30	544	547	550	553	556	559	562	566	569	573	576	580	583	591	598	606	615	623
–35	532	534	537	540	543	546	549	552	556	559	563	566	570	577	585	593	600	609
–40	519	522	525	528	531	533	536	539	543	546	549	553	557	564	571	579	586	594
–45	507	509	512	515	518	521	524	527	530	533	537	540	544	551	558	565	572	580
–50	494	497	499	502	505	508	511	514	517	520	524	527	530	537	545	552	559	566
–55	481	484	487	490	493	495	498	501	504	508	511	514	517	524	531	538	545	553

1-155. Operational Engine HIT and Anti-Ice Check.

a. The procedures in **(UH-60A, UH-60L)** table 1-25, **(T701,T701C,T701D AH-64D)** table 1-25.1, **(T701C, T701D AH-64A)** table 1-26, or **(T701)** table 1-27, will be used to check engine performance during normal ground operation. Table **(T700)** 1-22, **(T701C, T701D)** table 1-23 or **(T701)** table 1-24 shows indicated TGT at various free air temperatures (FAT) and at pressure altitudes for 60% TRQ.

b. The HIT check provides engine performance information for the flight crew and guidance for determining troubleshooting and maintenance action if required. Perform the HIT check as directed in **(UH-60A, UH-60L)** table 1-25, **(T701,T701C,T701D AH-64D)** table 1-25.1, **(T701C,T701D AH-64A)** table 1-26, or **(T701)** table 1-27**.**

1-156. In-Flight HIT Check for Desert Operation.

NOTE

This in-flight HIT CHECK data procedure may be used in a desert environment to minimize engine sand ingestion in a heavy sand environment, and shall be accomplished at an altitude where there is minimum sand intrusion.

a. Recommendations are as follows:

(1) Clean the engine using cleaning procedures (para 1-164 and 1-167) prior to establishing a new in-flight baseline data point (step b).

(2) Establish a HIT CHECK routine during return to base.

(3) The procedure is for evaluating trends in performance, not actual engine performance. Actual performance can only be determined at unit level through accomplishment of maximum power checks.

b. Procedure for baseline HIT CHECK.

(1) Perform a maximum power check in accordance with paragraphs 1-145 **(UH-60A)**, 1-146 **(T701, T701C, T701D AH-64A)**; and 1-147 **(T701C, T701D UH-60L)**.

(2) Re-establish a new baseline for the HIT CHECK as follows:

(a) Establish a forward airspeed of 80 knots and a constant pressure altitude with both **(UH-60A, UH-60L)** ENG POWER CONT or **(AH-64A)** PWR CONTROL levers in fly position.

(b) Set ENG ANTI-ICE and HEATER switches to OFF.

(c) Allow forward airspeed to increase until approximately 62% TRQ is read on both engine torque displays.

(d) Hold for 30 seconds. Record FAT, pressure altitude, indicated TGT, percent TORQUE, and forward airspeed.

(e) Use the HIT Baseline Worksheet (fig. 1-74), and compute the new baseline limits. Record airspeed and percent TORQUE on the HIT Baseline Worksheet.

c. Procedure for daily and return flight/last flight of each day HIT CHECK.

(1) Establish forward airspeed and torque as shown on the HIT Baseline Worksheet.

(2) Wait 30 seconds and record FAT, pressure altitude and indicated TGT.

(3) Use the Engine Health Indicator Test Log (fig. 1-65) to determine if the TGT margin is within the baseline limits.

*Table 1-25. (**T700, T701C, T701D**) Operational Engine HIT and Anti-Ice Check Procedure for UH-60A, UH-60L*

STEP	PROCEDURE
1.	Position helicopter into prevailing wind.
2.	Set ENG ANTI-ICE, HEATER, and AIR SOURCE HEAT/START switches to OFF.
3.	Set both engine % RPM and RPM R to 100%.
4.	Retard ENG POWER CONT lever on engine not being checked to 0%-5% TRQ at 92%-98% RPM (Np).
5.	Increase collective pitch to 60% TRQ.
	NOTE If helicopter is equipped with two FAT gages and the readings are different, the higher reading must be used.
6.	Re-adjust ENG POWER CONT lever (on engine not being checked) to attain 92%-98% RPM (NP), and hold for at least 30 seconds.
7.	Record date, A/C hours, FAT, pressure altitude, and TGT on figure 1-65.
8.	If the ENG ANTI-ICE advisory light remains on at 60% TRQ, increase collective to a minimum of 90% Ng, or until the advisory light is off.
	WARNING Do not cycle anti-ice bleed and start valve more than once. Valve malfunction can cause engine flameout at low-power settings or during rapid collective movements. Do not fly the aircraft if the ENG ANTI-ICE light will NOT go off.
9.	Set AIR SOURCE HEAT/START switch to ENG. If TGT rises more than 5 degrees, troubleshoot bleed air system for leaks.
10.	Set AIR SOURCE HEAT/START switch OFF.
	NOTE Steps 11 and 12 contain instructions for performing the Anti-Ice System Check.
11.	For engine being checked, set ENG ANTI-ICE switch to ON and note the following: a. Increase in TGT of at least 30°C but less than 110°C. If TGT rise is not within these limits the engine or airframe inlet valve may be faulty. b. ENG ANTI-ICE advisory light comes ON. c. ENG INLET ANTI-ICE advisory light comes on after inlet fairing temperature reaches 93°C (200°F) and if OAT is less than 4°C (39°F).
	NOTE A malfunctioning engine anti-ice and engine inlet anti-ice system may result in power losses as much as 40% maximum torque available at 30-minute TGT demands. If any part of the engine inlet anti-ice check fails, do not fly the helicopter.
12.	Set ENG ANTI-ICE switch to OFF and note the following: a.Decrease in TGT to approximate value in step 7. b.ENG ANTI-ICE advisory light goes OFF. c.ENG INLET ANTI-ICE advisory light goes OFF after inlet fairing temperature goes below 93°C (200°F).
13.	Readjust collective to 60% TRQ if necessary.
14.	Set ENG POWER CONT lever of engine not being checked to FLY.
15.	Set ENG POWER CONT lever on opposite engine to 0% -5% TRQ at about 92% to 98% RPM (Np). (TRQ on the other engine should be 60% ±5%.)
16.	Readjust collective pitch to 60% TRQ if necessary, and hold for at least 30 seconds.
17.	Repeat steps 7, 8, 9, 10, 11, and 12 for other engine.
18.	Set collective pitch to full down.
19.	Set ENG POWER CONT lever of engine not being checked to FLY.
20.	Check TGT reference table, **(T700)** (table 1-22) or **(T701C T701D)** (table 1-23). Section V, for TGT corresponding to recorded FAT and pressure altitude, record on HIT LOG 2. Compare table TGT 2 with indicated TGT 1 and record TGT margin on HIT LOG. TGT margin is indicated TGT 1, minus table TGT 2.
	NOTE When using HIT table, round FAT up, and pressure altitude to nearest value.
21.	If TGT margin is 5°C or less from the limit, make appropriate entry on DA Form 2408-13-1.
22.	If TGT margin is outside acceptance limits, repeat check. Make sure all procedures are followed.
23.	If TGT margin is still outside acceptance limits, do not fly the helicopter. Make appropriate entry on DA Form 2408-13-1.
24.	If any part of the engine anti-ice valve check fails, do not fly the helicopter.

Table 1-25.1 (T701, T701C, T701D) Operational Engine HIT and Anti-Ice Check Procedure for AH-64D

STEP	PROCEDURE
1.	Position helicopter in the prevailing wind.
2.	Set ANTI-ICE – MANUAL.
3.	Set ENG ANTI-ICE INLET – OFF.
4.	Set BLEED AIR 1 and 2 – OFF.
5.	A/C PERF page – Select HIT.
6.	BASELINE page – Select and verify TGT REF margin information matches HIT check log.
7.	POWER levers – Set to FLY. Verify NP/NR is 101%.
8.	Retard POWER lever on engine not being checked to IDLE.
9.	Adjust collective pitch (as necessary) to 60% TRQ and allow TGT to stabilize for 30 seconds. If conducting AUTO HIT check perform step 10. If conducting MANUAL HIT check perform step 11.
10.	AUTO HIT check: a.ENG 1 button – Select. Check TRQ on test engine 60%, NP/NR 101% and TGT stabilized. b.CALCULATE HIT button – Select c. MPD – Note PASS/FAIL. d. Aircraft HIT log – Record HIT data. e. A/C UTIL page – Select Steps g. thru h. contain instructions for performing the ANTI-ICE check. f. ANTI-ICE INLET – ON. TGT should increase at least 30°C. The SP monitors the engine anti-ice start bleed valve for proper operation. Valve malfunction will be indicated by a CAUTION message ENG 1 / 2 A-ICE displayed on the UFD. The DMS Fault page must be viewed, while anti-ice inlet is on, to confirm valve malfunction. With a valve malfunction engine flameout may occur at low power settings or rapid collective movements. Do not fly the aircraft if TGT rise is less than 30°C. Do not cycle the ANTI-ICE INLET valve more than once.
	g.ANTI-ICE INLET – OFF. TGT should decrease to the approximate value noted in step 5. h.POWER lever, non test ENG advance to – FLY. verify torque matching within 5%. i.Repeat step 8-11, for ENG 2. j.Decrease COLLECTIVE – FULL DOWN. k.ANTI-ICE – As Required. l.BLEED AIR – ON.
11.	When using TGT reference table, FAT and pressure altitude must be rounded up to the nearest value. Manual HIT check: a.Manually calculate and record HIT data. b.ANTI-ICE INLET – ON. TGT should increase at least 30°C. c.ANTI-ICE INLET – OFF. TGT should decrease to the approximate value noted in step 5. d.POWER lever, non test ENG advance to – FLY. verify torque matching within 5%. e.Repeat step 9-12 for ENG 2.
12.	f.Decrease COLLECTIVE – FULL DOWN. g.ANTI-ICE – As Required. h.BLEED AIR – ON.
13.	If TGT margin is within acceptable limits, engine performance is satisfactory. If margin is 5°C or less from the limit, make appropriate entry in the remarks section of DA form 2408-13-1. If TGT margin is out of the limits, repeat check. Ensure that all procedures are followed. If TGT margin is still out of the limits, do not fly the helicopter. Make appropriate entry in the remarks section of DA form 2408-13-1.

Table 1-26. (T701C, T701D) Operational Engine HIT and Anti-Ice Check Procedure for AH-64A

STEP	PROCEDURE
1.	Position helicopter into prevailing wind.
2.	Set ENG ANTI-ICE and HEATER switches to OFF.
3.	Set both engine ENG RTR RPM to 100%.
4.	Retard ENG POWER CONT lever on engine not being checked to IDLE.
5.	Increase collective pitch to 60% TRQ and hold for 30 seconds.
6.	If helicopter is equipped with two FAT gages and the readings are different, the higher reading must be used.
7.	Record date, A/C hours, FAT, pressure altitude, and TGT on figure 1-65.
	If the ENG ANTI-ICE advisory light remains on at 60% TRQ, increase collective to minimum of 90% Ng, or until the advisory light is off.
	Do not cycle anti-ice/start bleed valve more than once. Valve malfunction can cause engine flameout at low-power settings or during rapid collective movements. Do not fly the aircraft if the ENG ANTI-ICE light will NOT go off.
	Steps 8 and 9 contain instructions for performing the Anti-Ice Check.
	Set ENG INLET toggle switch to ON and note the following: a.Increase in TGT of at least 30°C. b.ENG 1 and ENG 2 advisory lights come on.
8.	c.ENG 1 and ENG 2 ANTI-ICE fail lights remain on until the fairing electrical heaters reach 96°C (205°F) and the engine inlets reach 66°C (150°F) (approximately 40 seconds).

STEP	PROCEDURE
9.	Set ENG INLET toggle switch to OFF and note the following:
	a.Decrease in TGT to approximate value in step 6. b.ENG 1 and ENG 2 advisory lights go off.
10.	c.ENG 1 and ENG 2 ANTI-ICE fail lights go off after fairing and inlet heaters cool (approximately 90 seconds).
11.	
12.	Repeat steps 3 thru 9 for other engine.
	Adjust collective pitch to full down position.
	Set ENG POWER CONT lever of engine not being checked to FLY.
13.	When using TGT reference table, FAT must be rounded up and pressure altitude must be rounded off to the nearest value.
14. 15.	Check TGT reference (table 1-23) for TGT corresponding to the recorded FAT and pressure altitude. Record in 2 figure 1-65. Compare indicated TGT 1 with table TGT 2 and record the TGT margin in figure 1-65 (HIT Log). TGT margin is indicated TGT 1 minus table TGT 2.
	Repeat step 13 for other engine.
16. 17.	If TGT margin is within acceptable limits (fig. 1-65), engine performance is satisfactory. If margin is 5°C or less from the limit, make appropriate entry in remarks section of DA Form 2408-13-1.
	If TGT margin is out of limits, repeat check. Be sure all procedures are followed.
18.	If TGT margin is still out of limits, do not fly the helicopter. Make appropriate entry in remarks section of DA Form 2408-13-1.
	If any of the engine anti-ice valve check fails, do not fly helicopter.

Table 1-27. (T701) Operational Engine HIT and Anti-Ice Check Procedure for AH-64A

STEP	PROCEDURE
1.	Position helicopter into prevailing wind.
2.	Set ENG ANTI-ICE and HEATER switches to OFF.
3.	Set both engine ENG RTR RPM to 100%.
4.	Retard ENG POWER CONT lever on engine not being checked to IDLE.
5.	Increase collective pitch to 60% TRQ and hold for 30 seconds.
	NOTE If helicopter is equipped with two FAT gages and the readings are different, the higher reading must be used.
6.	Record date, A/C hours, FAT, pressure altitude, and TGT on figure 1-65.
7.	If the ENG ANTI-ICE advisory light remains on at 60% TRQ, increase collective to minimum of 90% Ng, or until the advisory light is off.
	WARNING Do not cycle anti-ice/start bleed valve more than once. Valve malfunction can cause engine flameout at low-power settings or during rapid collective movements. Do not fly the aircraft if the ENG ANTI-ICE light will NOT go off.
	NOTE Steps 8 and 9 contain instructions for performing the Anti-Ice Check.
8.	Set ENG INLET toggle switch to ON and note the following: a. Increase in TGT of at least 30°C. b. ENG 1 and ENG 2 advisory lights come on. c. ENG 1 and ENG 2 ANTI-ICE fail lights remain on until the fairing electrical heaters reach 96°C (205°F) and the engine inlets reach 66°C (150°F) (approximately 40 seconds).
9.	Set ENG INLET toggle switch to OFF and note the following: a. Decrease in TGT to approximate value in step 6. b. ENG 1 and ENG 2 advisory lights go off. c. ENG 1 and ENG 2 ANTI-ICE fail lights go off after fairing and inlet heaters cool (approximately 90 seconds).
10.	Repeat steps 3 thru 9 for other engine.
11.	Adjust collective pitch to full down position.
12.	Set ENG POWER CONT lever of engine not being checked to FLY.
	NOTE When using TGT reference table, FAT must be rounded up and pressure altitude must be rounded off to the nearest value.
13.	Check TGT reference (table 1-24) for TGT corresponding to the recorded FAT and pressure altitude. Record in 2 figure 1-65. Compare indicated TGT 1 with table TGT 2 and record the TGT margin in figure 1-65 (HIT Log). TGT margin is indicated TGT 1 minus table TGT 2.
14.	Repeat step 13 for other engine.
15.	If TGT margin is within acceptable limits (fig. 1-65), engine performance is satisfactory. If margin is 5°C or less from the limit, make appropriate entry in remarks section of DA Form 2408-13-1.
16.	If TGT margin is out of limits, repeat check. Be sure all procedures are followed.
17.	If TGT margin is still out of limits, do not fly the helicopter. Make appropriate entry in remarks section of DA Form 2408-13-1.
18.	If any of the engine anti-ice valve check fails, do not fly helicopter.

1-157. CLEANING FOR PERFORMANCE RECOVERY.

1-158. Preliminary Information. Periodic cleaning of the engine is an effective way to minimize performance loss due to dirt buildup in the compressor. Factory operation and field experience show that periodic engine cleaning provides performance recovery with little impact on field operations. Cleaning is also an effective method for recovering performance whenever the engine fails a HIT check or is approaching the acceptance limits established during the baseline (para 1-154).

1-159. Periodic Cleaning Interval. The local maintenance officer shall establish a cleaning interval best-suited for operational requirement and conditions. Unless the engines are operated under the special conditions listed within paragraph 1-160, a 100 hour compressor cleaning interval shall be established which may be adjusted if teardown analysis of the units engines or local engines operated under similar conditions indicate that an adjustment to the 100 hour interval is justified. Aircraft should not be grounded for failure to meet the cleaning intervals, so long as HIT checks are within limits but an entry shall be made on DA Form 2408-13 indicating that engine cleaning is due.

1-160. Adjusting Periodic Cleaning 100-Hour Interval for Special Conditions. Operating conditions that would allow a change to the 100-hour periodic cleaning interval are as follows:

a. Limited Water Supply. The 100-hour cleaning interval may be postponed to conserve water or postponed until water is more readily available.

b. Cold Weather.

NOTE

If 100-hour cleaning interval is postponed, enter ENGINE WASH DUE in Aircraft Logbook.

Postpone engine cleaning if ambient temperatures are below –15°C (5°F). Postpone cleaning if local maintenance facilities and waterwash equipment cannot keep water-alcohol or water-alcohol-cleaner solution at 4°C (40°F) in accordance with paragraph 1-163, step b.

c. Oil or Hydraulic Fluid in Engine Inlet. Oil or hydraulic fluid will mix with other substances (sand, dust, etc.) in the air, forming a sludge, which will solidify if not cleaned from compressor. Therefore, clean engine at 100-hour interval, or more frequently, depending upon the severity of the condition.

d. Salt Water Environment or Volcanic Activity. Perform water-rinse (para 1-165, step c) as soon as possible after shutdown when any of the following conditions exist:

NOTE

Operators should be aware that salt laden air could be encountered up to 150 miles from the source under certain weather conditions. If there is any doubt about the condition in which the engines are operated, the compressor should be rinsed after shutdown. Water will not damage the engine, but salt will.

(1) Engine has operated within 200 miles of volcanic activity or within 10 miles and 1000 ft AGL of salt water.

(2) Engine has ingested salt water or salt water mist.

(3) Engine performance loss is observed after operating near salt water.

(4) Salt deposits are noted on engine inlets or other external surfaces of the aircraft. These deposits indicate possible salt buildup within compressor.

e. Desert or Sandy Environment. Although sand erodes airfoils, it also acts as an abrasive to clean airfoil surfaces. Therefore, 100-hour cleaning interval may be extended in a sandy environment if compressor is free of any oil deposits (para 1-161).

f. Dusty/Dirty Environment. Operation for prolonged period (more than 50-hours) from unimproved surfaces, i.e., dry stream beds, Mt. St. Helen's, arid areas or any area where 'brown out' occurs, can cause build up within the engine gas generator flow path, clog cooling passages and elevate engine internal operating temperatures which could result in premature component failures. Under these conditions, a 50-hour compressor cleaning interval (para 1-165) coupled with a 50-hour hot section cleaning (para 1-167) interval is required.

1-161. Compressor Cleaning in Desert Environments. Generally, turbine engines operating in a sandy environment require less frequent compressor cleaning if airfoils are free of oil. Sand actually acts as an abrasive cleaner, unless oil is present on airfoils.

a. If an engine fails a HIT check (para 1-155), clean the compressor (para 1-165) (even if compressor looks clean).

b. Repeat the HIT check (para 1-155).

c. If engine fails a HIT check, perform borescope inspection of stage 1 area (para 1-172).

d. Perform inflight maximum power check (para 1-165, 1-146, or 1-147).

e. Establish new HIT check baseline (para 1-154).

f. If Technical Inspector determines that airfoils are oil-wetted and grimy, clean engine.

1-162. Materials Required. The following materials are required to clean the engine:

- Cleaning compounds (item 57, 58, 59, 61, 60, Appendix D)
- Water supply with enough volume and pressure to provide a flow rate of 2 gallons per minute for 3 minutes
- Isopropyl alcohol or Methanol (item 3 or 84, Appendix D)

1-163. Chemical Cleaning Solution.

WARNING

B&B 3100 Cleaner-Water Solution

- B&B 3100 cleaner shall be mixed with water (or water antifreeze solution) only in the proportions specified.
- For engines installed in aircraft, close off appropriate air bleed ducts to cockpit/cabin to prevent entrance of cleaning solution or gases during washing and drying cycles.
- For engines installed in aircraft, make sure that compressor is rinsed and dried for the periods specified so that cleaning solution is not trapped in passages, crevices, and other areas of the engine.
- Solution irritates eyes. Wear splashproof goggles or face shield when using solution.
- Use protective gloves and clothing. Repeated or prolonged contact will dry the skin and will cause irritation and dermatitis.
- If clothing becomes contaminated with cleaning solution, remove affected clothing. Wash affected skin areas with plenty of water.
- Use solution with adequate ventilation. Repeated or prolonged breathing of vapors may irritate mucous membranes and may cause headaches and dizziness.
- Persons with known respiratory irritation should get medical advice before using cleaning solution.
- Avoid open flames, heat, smoking, or other ignition sources in the areas of storage and use.
- Spills should be immediately cleaned up (using squeegee or absorbent material) to prevent evaporation of vapors and slippery floors. Dispose of spillage according to local safety regulations.

NOTE

- B&B 3100 (MIL-C-85704, Type I) is the primary cleaner for Army turbine engines and remains an approved cleaner for locales where environmental restrictions permit. Engine cleaners that conform to MIL-C-85704, Type II and Type IIA are also acceptable engine cleaners and meet EPA environmental requirements. Continue use of B&B 3100 where not restricted. Where restrictions apply use MIL-C-85704, Type II and Type IIA cleaners. Approved Type II and Type IIA cleaners shall be used in accordance with the existing washing procedure. Type IIA cleaners do not require dilution with water. Both types of cleaners are less effective than Type I cleaners. Therefore more frequent engine washes may be required to achieve satisfactory results.
- Cleaning solutions MIL-C-85704 Type IIA, items 61 and 60, Appendix D, are premixed and do not require dilution.

a. The cleaning solution is a mixture of one part cleaning compound (items 57, 58, 59, Appendix D) and four parts water. About 1 gallon of compound, combined with 4 gallons of water, or 5 gallons of undiluted compound (item 61 or 60, Appendix D) will be used to clean one engine. About 3 gallons of water or water-alcohol solution will be required to rinse cleaning solution from one engine in the time specified (para 1-165).

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

WARNING

Methanol
O-M-232

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Prolonged or repeated inhalation of vapor can cause eye irritation, drowsiness, and headache. Ingestion may be fatal or may cause eye damage.
- If vapor contacts eyes, immediately flush eyes with large amounts of water. Immediately remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling or applying liquid at air-exhausted workbench, wear approved goggles.
- When handling or applying liquid at unexhausted workbench, wear approved respirator and goggles.
- Solution of 40% methanol and 60% water is combustible.

NOTE

- Do not allow the water-alcohol solution or water-alcohol-cleaner solution to cool below 4°C (40°F).
- Do not clean the compressor if air temperature is below –15°C (5°F), because water-alcohol solution will freeze.

b. When air temperature is between –15°C (5°F) and 4°C (40°F), a mixture of 60% water and 40% isopropyl alcohol or Methanol (item 3 or 84, Appendix D) (for example: 3 gallons of water and 2 gallons alcohol) will be used in place of plain water in the cleaning solution, and for rinsing after cleaning.

1-164. Support Equipment Required. Preliminary Information. The equipment required for cleaning the engine is a universal wash unit 21C2438G01 (1, fig. 1-75). It consists of a positive displacement pump that pumps a mixture of cleaning compound (items 57, 58, 59, Appendix D) and water or unmixed compound (item 61 or 60, Appendix D), or water-alcohol solution from a container through an inlet strainer, a suction hose, and a discharge hose, into the swirl frame. An added feature of the wash unit is the capability of attaching a wand assembly 21C2438P80 to the quick-disconnect fitting on the discharge hose. This feature is useful for applying anti-icing solution and for washing the aircraft fuselage.

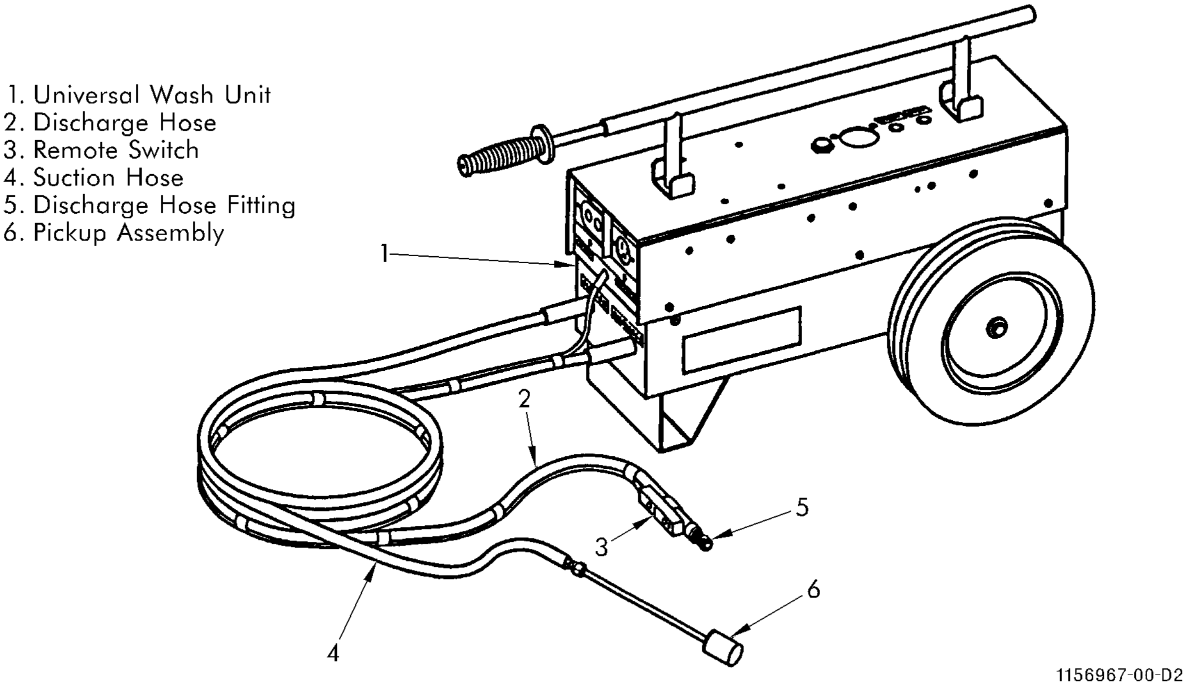


Figure 1-75. Universal Wash Unit 21C2438G01; Compressor Cleaning

1-165. Compressor Cleaning (Water-Wash) Using the Universal Wash Unit 21C2438G01 and Premixed Cleaning Solution.

a. Cleaning Solution.

WARNING

B&B 3100 Cleaner-Water Solution

- B&B 3100 cleaner shall be mixed with water (or water antifreeze solution) only in the proportions specified.
- For engines installed in aircraft, close off appropriate air bleed ducts to cockpit/cabin to prevent entrance of cleaning solution or gases during washing and drying cycles.
- For engines installed in aircraft, make sure that compressor is rinsed and dried for the periods specified so that cleaning solution is not trapped in passages, crevices, and other areas of the engine.
- Solution irritates eyes. Wear splashproof goggles or face shield when using solution.
- Use protective gloves and clothing. Repeated or prolonged contact will dry the skin and will cause irritation and dermatitis.
- If clothing becomes contaminated with cleaning solution, remove affected clothing. Wash affected skin areas with plenty of water.
- Use solution with adequate ventilation. Repeated or prolonged breathing of vapors may irritate mucous membranes and may cause headaches and dizziness.
- Persons with known respiratory irritation should get medical advice before using cleaning solution.
- Avoid open flames, heat, smoking, or other ignition sources in the areas of storage and use.
- Spills should be immediately cleaned up (using squeegee or absorbent material) to prevent evaporation of vapors and slippery floors. Dispose of spillage according to local safety regulations.

(1) Prepare cleaning solution in accordance with paragraph 1-163, step a or b, depending on temperature.

(2) An additional 3 gallons of water (or water-alcohol solution) will be required to rinse cleaning solution from engine.

b. Compressor Cleaning Procedure.

WARNING

Washing Engine with B&B 3100
Cleaner-Water Solution

Observe warning in step a.

WARNING

Turbine Engine Gas Path Cleaning
Compound (Full Strength)
MIL-PRF-85704

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Dispose of liquid-soaked rags in approved metal container.
- Contains aromatic solvents. Prolonged contact of skin with liquid can cause irritation. Inhalation of vapor can cause headache and light-headedness.
- If there is any prolonged contact with skin, wash affected area with soap and water. If liquid contacts eyes, flush them thoroughly with water. Remove solvent-saturated clothing. If vapors cause light-headedness, go to fresh air.
- When liquid is handled or applied at an air-exhausted workbench, wear approved gloves, and wear goggles or face shield.
- When liquid is handled or applied at an unexhausted workbench, wear approved respirator and gloves, and wear goggles or face shield.

(1) If swirl frame vanes have a buildup of carbon, salt, dirt, or oil-based deposits, clean them using a clean cloth moistened with a solution of 1 part cleaning compound (items 57, 58, and 59, Appendix D) and 4 parts water or unmixed cleaning compound (item 61 and 60, Appendix D). Wipe deposits from inside of inlet and from swirl vanes. Then wipe inlet and swirl vanes with a cloth moistened with fresh water. If aircraft inlet duct has a buildup of carbon, salt, dirt, or oil-based deposits, clean duct (see applicable aircraft maintenance manual).

(2) Place suction hose (4, fig. 1-75) into a container of 5 gallons of cleaning solution.

(3) Remove cap assembly on wash manifold fitting (fig. 1-76), and connect discharge hose (2, fig. 1-75) to fitting (fig. 1-76).

(4) Connect one end of power cable to wash unit (1, fig. 1-75) and connect the other end to either of the following:

- **(T700, T701C, T701D UH-60)** Aircraft 115-volt, 400 Hz utility power receptacle.
- **(T701, T701C, T701D AH-64)** Aircraft 115-volt, 400 Hz utility power receptacle.
- External power source of 120-volt, 60 Hz receptacle or 28 vdc.

(5) Before motoring engine, refer to applicable aircraft maintenance manual to do the following:

(a) **(T700, T701C, T701D UH-60)** Place power control lever OFF.

(b) **(T700, T701C, T701D UH-60)** Turn engine ignition switch OFF.

(c) **(T700, T701C, T701D UH-60)** Turn engine anti-ice switch ON.

(d) **(T701, T701C, T701D AH-64)** Place power levers to OFF.

(e) **(T701, T701C, T701D AH-64)** Place collective control to FULL DOWN.

(f) **(T701, T701C, T701D AH-64)** Turn master ignition switch to ON.

(g) **(T701, T701C, T701D AH-64)** Turn No. 1 Engine start switch to IGN ORIDE.

(h) **(T701, T701C, T701D AH-64)** Turn No. 2 Engine start switch to IGN ORIDE.

(i) **(T701, T701C, T701D AH-64)** Turn engine anti-ice switch ON.

(6) Turn on 28 vdc power source, if used.

(7) Check for pressure in hose (4) by gently pressing start button either on remote switch (3) or on wash unit (1) until light on wash unit (1) comes on. If wash unit (1) starts, turn it off immediately.

(8) Close off appropriate air bleed ducts to cockpit/cabin to prevent water vapor from entering during washing and rinsing cycles.

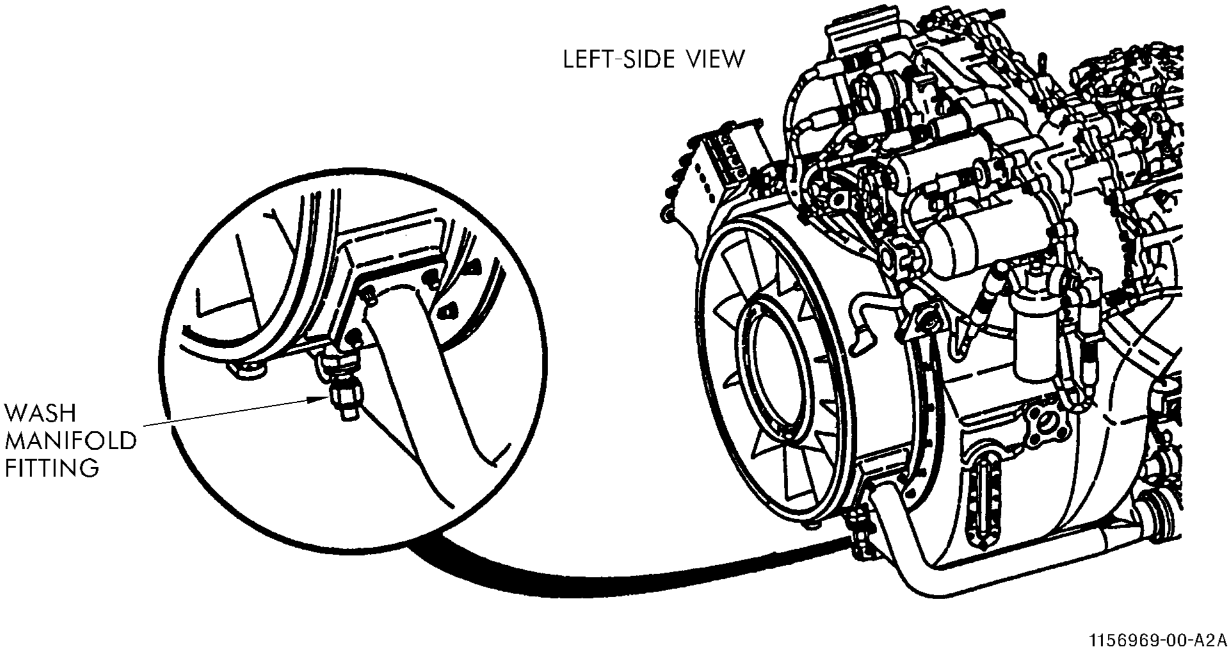


Figure 1-76. Location of Wash Manifold Fitting

(9) Be sure to wash engine for periods specified in this procedure so that cleaning solution and debris are not trapped in passages, crevices, and other areas of the engine.

(10) Start auxiliary power unit (APU) according to applicable aircraft maintenance manual.

CAUTION

- The engine must be shut down and allowed to cool (engine may be motored to expedite cooling) to TGT of 125°C (257°F), or below, before cleaning solution is sprayed into engine.
- Water supply to swirl frame must not exceed 45 psig at a flow rate of 2 to 3 gallons per minute.
- Do not exceed starter operating limits.
- Observe required starter cooling intervals between duty cycles.

(11) Engage engine starter to override position, and motor engine to maximum starter speed.

CAUTION

While ingesting water, do not allow Ng speed to drop below 16% (7,000 RPM). Operating engine lower than 16% Ng, while water washing, can cause damage to compressor blades.

(12) Start wash unit (1), and allow cleaning solution to flow through engine for 1-2 minutes, depending on condition of water exiting; do not exceed starter duty cycle. Do not allow Ng to drop below 16% (7000 rpm).

(13) Turn wash unit off, and disengage starter.

(14) If a 28 vdc power source is used, turn it off.

(15) Allow cleaning solution to soak for 15-30 minutes. If starter duty cycle permits, 15 minutes soaking time is preferred.

(16) After initial soak, repeat step (6) if required, and steps (9) thru (15).

(17) Remove hose (4) from container, and rinse cleaning solution from container.

c. Compressor Rinsing Procedure.

(1) If air temperature is greater than 4°C (40°F), fill container with 3 gallons of water.

(2) If air temperature is –15°C (5°F) and 4°C (40°F), fill container with 3 gallons of a mixture of water and isopropyl alcohol (item 3, Appendix D) or Methanol (item 84, Appendix D). Refer to paragraph 1-163, step b for mixing proportions.

(3) Place suction hose (4) into container.

(4) Before motoring engine, check the following:

(a) Power control lever is in the OFF position.

(b) Engine ignition switch is OFF.

(c) Engine anti-ice switch is ON.

(5) If switches and control lever are not in the required positions, set them according to applicable aircraft maintenance manual.

(6) If a 28 vdc power source is used, turn it on.

(7) Check for pressure in hose (4) by gently pressing start button on remote switch (3) or on wash unit (1) until light on wash unit (1) comes on. If wash unit (1) starts, turn it off immediately.

(8) Check that appropriate air bleed ducts to cockpit/cabin are closed. If any ducts are open, close them.

(9) Be sure to rinse engine for periods specified so that cleaning solution, rinsing solution, or debris are not trapped in passages, crevices, and other areas of the engine.

(10) Start auxiliary power unit (APU) according to applicable aircraft maintenance manual.

CAUTION

- The engine must be shut down and allowed to cool (engine may be motored to expedite cooling) to TGT of 125°C (257°F), or below, before water or water-alcohol solution is sprayed into engine.
- Water supply to swirl frame must not exceed 45 psig at a flow rate of 2 to 3 gallons per minute.
- Do not exceed starter operating limits.
- Observe required starter cooling interval between duty cycles.

(11) Engage engine starter to override position, and motor engine to maximum starter speed.

CAUTION

While ingesting water, do not allow Ng speed to drop below 16% (7,000 RPM). Operating engine lower than 16% Ng, while water washing, can cause damage to compressor blades.

NOTE

MIL-C-85704, Type II and Type IIA cleaners produce foam at very low concentrations and give the appearance during rinse of insufficient rinse solution application. Rinse solution used for Type I is sufficient for Type II and IIA.

(12) Start wash unit (1), and allow rinsing solution to flow through engine for 1-2 minutes, depending on condition of water exiting; do not exceed starter duty cycle. Do not allow Ng to drop below 16% (7000 RPM).

(13) Turn off wash unit (1), and disengage engine starter.

(14) Rinse compressor again (steps (11) thru (13)).

(15) Turn off APU.

(16) Repeat compressor cleaning and rinsing procedures (steps b and c) as specified in MIL-PRF-85704. This cycle must be repeated three times.

(17) Disconnect discharge hose (2) from wash manifold fitting (fig. 1-76) on swirl frame. Allow rinsing solution to drain from fitting; then, install cap assembly onto fitting.

(18) Remove hose (4, fig. 1-75) from container.

d. Fill container with sufficient water or water-alcohol solution to rinse cleaning solution or debris from fuselage of aircraft.

e. Place hose (4) into container.

f. Connect wand assembly 21C2438P80 to the quick-disconnect fitting on hose (2).

g. Start wash unit (1), and wash any cleaning solution or debris from fuselage of aircraft.

h. Turn off wash unit (1). If a 28 vdc power source is used, turn it off.

CAUTION

- Do not exceed starter operating limits.
- Observe required starter cooling interval between duty cycles.
- Instructions for starting engines are in Aircraft Operator's Manual.

i. Engage engine starter and motor engine to maximum starter speed for 30 seconds; then make normal engine start.

j. Run the engine for a minimum of 2 minutes with the anti-ice switches ON followed by 2 minutes with the anti-ice switches OFF, all at 90% NG or more.

k. Shut engine down.

l. Disconnect wand assembly from hose (2) and store wand assembly. Remove hose (4) from container.

m. Repeat steps d thru l for other engine.

n. Remove power cable on wash unit (1) from power source.

1-166. Off Wing Hot Section Cleaning of Engines Operating in a “Dirty” Environment. The purpose of cleaning is to remove any accumulation of particles which may impede cooling air flow through hot section parts. This causes excessive temperatures in the hot section, which can cause material fatigue, decreased parts clearances, and corrosion. Periodic cleaning will also help maintain hot section efficiency, resulting in better performance, fuel conservation, preservation of parts, and lower operation cost. The period at which cleaning should be done will vary with severity of the operating environment, and can be established by experience. More frequent cleaning will be required where airborne particles are unusually heavy, such as flying in volcanic ash, which contains both grit and sulphur.

a. Remove the following engine components:

- Power turbine module (Chapter 4).
- Gas generator rotor/stator assembly (Chapter 3)
- Stage 1 nozzle assembly (Chapter 3)
- Combustion liner (Chapter 3)
- Face type seal (Chapter 3)

b. The power turbine module does not require cleaning as there are no internal cooling passages in the rotor or stator assemblies. A visual inspection of overall module for cracks, nicks, dents, leaks, etc. may be done at this time. The seven thermocouple harness probes should be inspected for cleanliness. They can be cleaned, if necessary, by brushing with a soft bristle brush (item 16, Appendix D).

c. The primary cleaning method for hot section parts is the flushing fixtures and a water supply having a minimum capacity of 12 gallons per minute at a pressure of 30 pounds per square inch. The secondary method is the flushing fixtures and the universal wash cart 21C2438G01. If the primary and secondary methods are not available then, handwash the hot section parts. The stage one nozzle cannot be cleaned with the universal wash cart. Either the primary method or handwashing shall be used on the stage one nozzle.

d. If the following tools are available, go to step f:

- Stage 1 gas generator rotor forward pressure flushing fixture 21C7729G01
- Stage 2 gas generator rotor forward pressure flushing fixture 21C7730G01
- **(T700, T701)** Gas generator stator pressure flushing fixture 21C7732G01
- Stage 1 gas generator rotor reverse pressure flushing fixture 21C7786G01
- Stage 2 gas generator rotor reverse pressure flushing fixture 21C7787G01
- Stage 1 nozzle assembly forward pressure flushing fixture 17A8820G01 (part of 21C7731G02)
- Stage 1 nozzle assembly reverse pressure flushing fixture 17A8819G01 (part of 21C7731G02)

e. If the above listed tools are not available, do the following:

(1) Mix one cup of liquid dish-washing detergent (item 71, Appendix D) with four gallons of clean, hot, tap water in a 5-gallon plastic container (item 67, Appendix D).

NOTE

Do not allow parts to hit each other. Use additional containers as necessary.

(2) Submerge gas generator stages 1 and 2 rotor assemblies, gas generator stator, stage 1 nozzle assembly, and combustion liner in detergent for at least 60 minutes. Agitating the detergent by placing a shop air hose into pails

and flowing low pressure air will loosen dirt faster than only soaking.

(3) Remove parts from containers and scrub all surfaces with a soft bristle brush (item 16, Appendix D) and detergent. Pay particular attention to the following on:

(a) Stage 1 nozzle assembly (fig. 1-77).

1 Cooling holes along airfoil surfaces and trailing edges.

2 Remove all traces of dirt from entire assembly.

(b) Combustion liner (fig. 1-77).

1 Dome area on interior of liner and holes in inner and outer surfaces.

2 Inner and outer surfaces may be scrubbed with a Scotch Brite pad (item 89, Appendix D).

(c) Gas generator turbine stator (fig. 1-77).

1 Cooling holes all around exterior.

2 Clean external surfaces with a Scotch Brite pad (item 89, Appendix D).

(d) Stages 1 and 2 gas generator rotor (fig. 1-77).

1 Inner areas of assembly, being sure to remove all visible traces of dirt from around cooling plate ridges, nuts, and bolts.

2 Continually resubmerge rotor assembly in and out of detergent to soften dirt accumulation while scrubbing with brush.

(4) Rinse all cleaned parts with clean running tap water, being sure all detergent solution is removed. Run water through all cooling holes and air passages to be sure they are not plugged. Special care should be taken to be sure that turbine blade cooling holes are not plugged by dirt or sand loosened by cleaning. This can be done by using a flexible hose attached to a water supply. Direct water into forward cooling plate air passages of stages 1 and 2 rotor assemblies. Observe water flow from individual holes in blade tips and trailing edges (fig. 1-78).

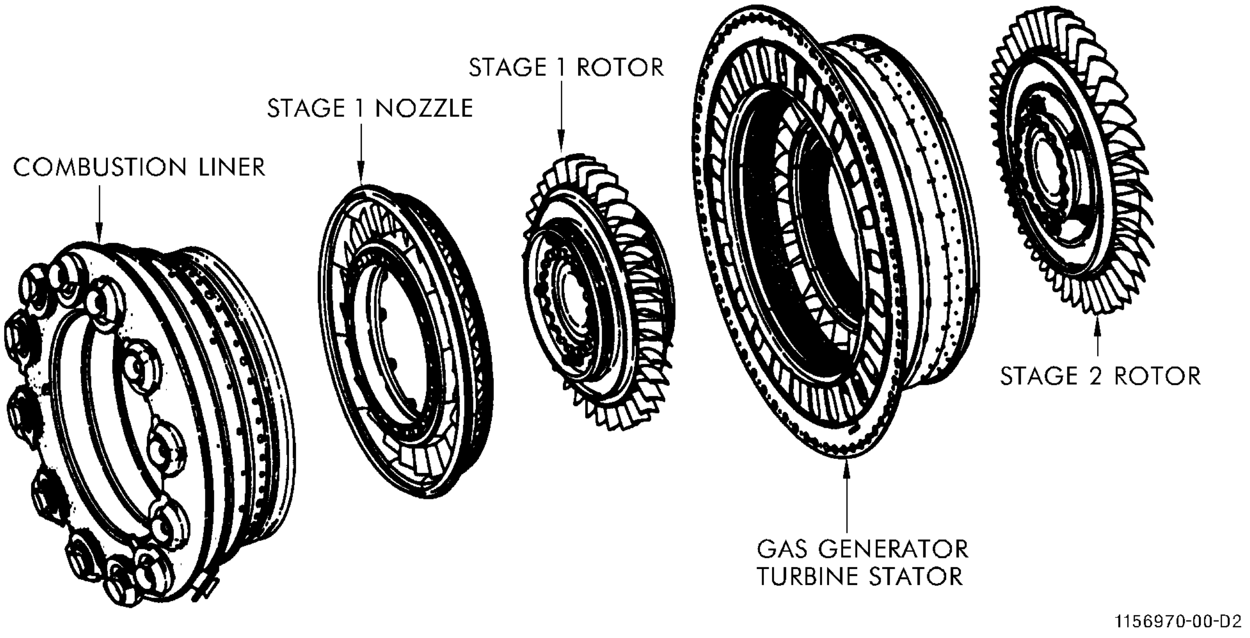


Figure 1-77. Hot Section Module; Cleaning

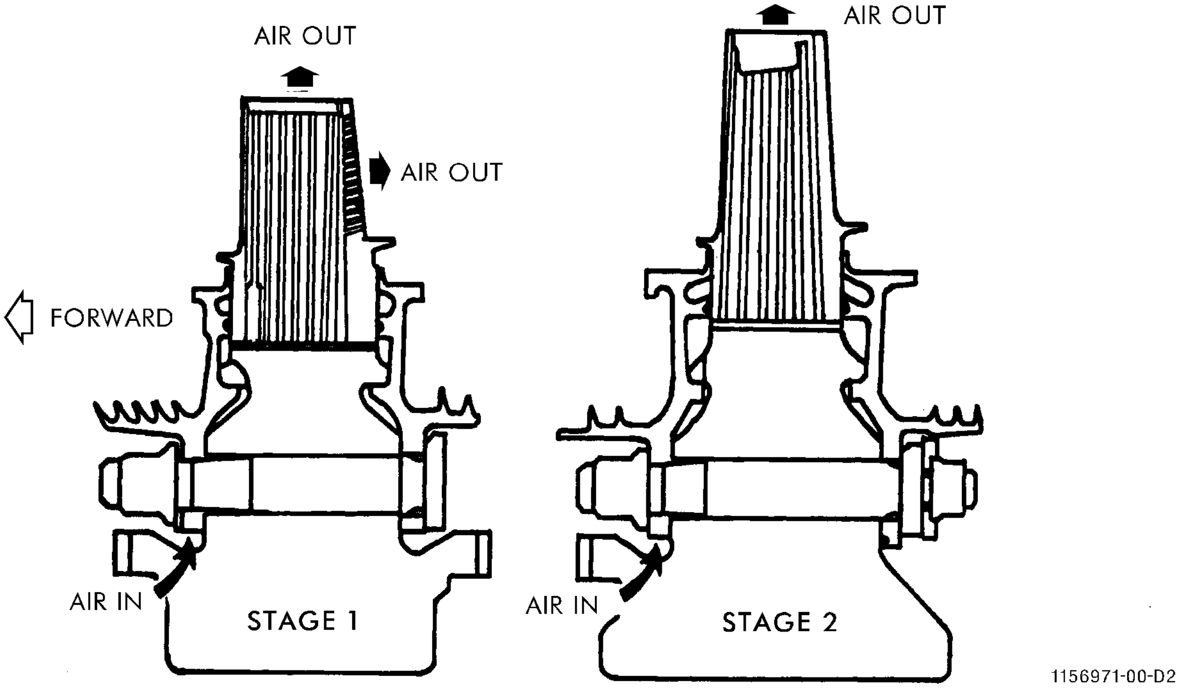


Figure 1-78. Cooling Air Flow Through Stages 1 and 2 Gas Generator Rotor Assemblies

(5) If any turbine blade cooling holes are plugged, do the following:

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(a) Blow dirt or sand out of holes with clean, dry, filtered, compressed shop air. If compressed air does not remove all particles, use thin wire inserted into hole to break particles loose (hole sizes in blade trailing edge are 0.10 inch and blade top holes are 0.020 inch). Blow out all passages with clean, dry, filtered, compressed air.

(b) Repeat water flushing through gas generator rotor blades as directed in step (4). Then, do steps k thru o.

NOTE

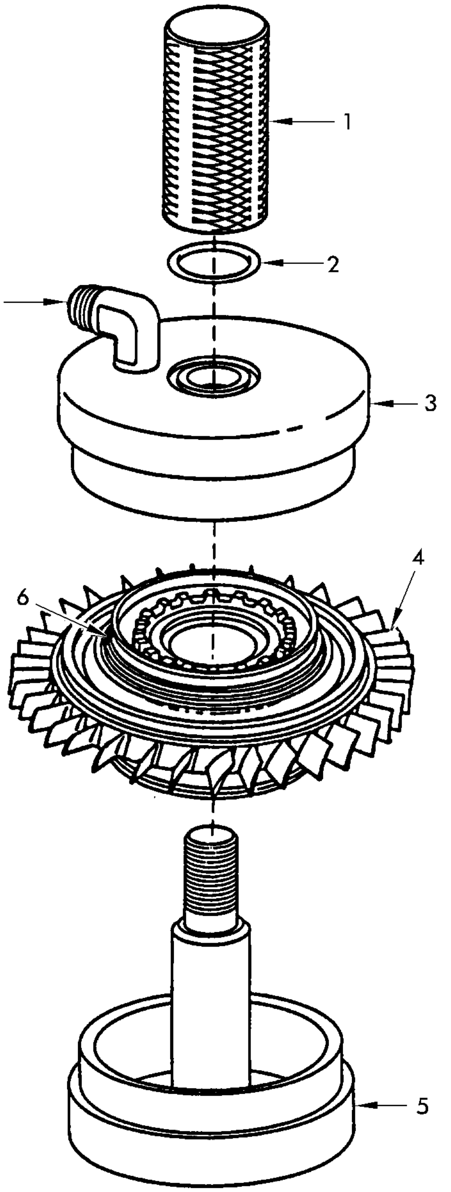
The primary method (tap water pressure) is the preferred method. However, if tap water is not available, use the secondary method (universal wash unit 21C2438G01).

f. Using tap water pressure or universal wash unit 21C2438G01 (fig. 1-75), forward pressure flush the stage 1 gas generator rotor (6, fig. 1-79) or stage 2 gas generator rotor (6, fig. 1-80) as follows:

NOTE

Forward pressure flushing will identify the cooling passages that are plugged.

(1) Remove retaining knob (1) from stage 1 gas generator rotor forward pressure flushing fixture 21C7729G01 (fig. 1-79) or stage 2 gas generator rotor forward pressure flushing fixture 21C7730G01 (fig. 1-80).



1. Retaining Knob
2. Packing
3. Cover
4. Trailing Edge
5. Base
6. Stage 1 Gas Generator Rotor
7. Fixture Inlet Fitting

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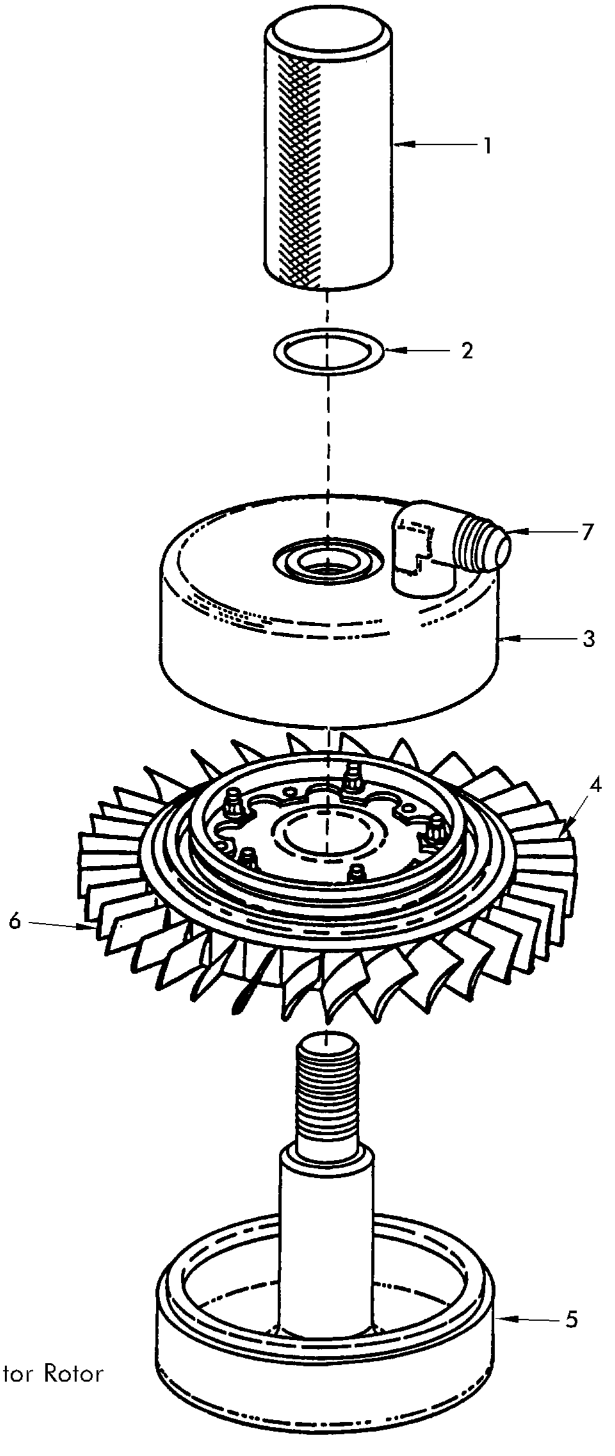
Figure 1-79. Stage 1 Gas Generator Rotor Forward Pressure Flushing Fixture 21C7729G01



1. Retaining Knob
2. Packing
3. Cover
4. Trailing Edge
5. Base
6. Stage 2 Gas Generator Rotor
7. Fixture Inlet Fitting

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Figure 1-80. Stage 2 Gas Generator Rotor Forward Pressure Flushing Fixture 21C7730G01

(2) Remove cover (3) from fixture.

(3) Using a paper towel (item 113, Appendix D), clean the sealing surfaces that mate with the rotor assembly.

(4) Inspect packing (2) PN M83248/1-129 (part of 21C7730G01) for wear and replace if necessary.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(5) Install rotor (6) onto center hub of base (5) so that trailing edges (4) of blades are facing up.

(6) Install cover (3) and secure it with retaining knob (1).

(7) If using tap water pressure, go to step (8). If using the universal water wash unit 21C2438G01 do the following:

(a) Remove the quick disconnect from the discharge hose fitting (5, fig. 1-75).

(b) Connect the discharge hose fitting (5, fig. 1-75) to the fixture inlet fitting (7, fig. 1-79 or 1-80).

(c) Immerse the fixture into a bucket or pan of water and liquid dishwashing detergent (item 71, Appendix D) (4 parts water to 1 part detergent).

(d) Install the pickup assembly (6, fig. 1-75) into the bucket or pan of detergent.

(e) Using the remote switch (3), start the universal wash unit (1) and circulate the detergent/water solution for 15-30 minutes.

(f) Raise the fixture (fig. 1-79 or 1-80) slightly above the detergent. Then, observe the flow from the cooling air holes at the tips and trailing edges of the blades.

(g) If any cooling air holes are plugged, stop the wash unit (1, fig. 1-75).

(h) Using a 0.010 inch diameter pin, remove foreign material from plugged hole.

(i) Repeat steps (c) thru (h) until all holes are unplugged.

(8) If using tap water pressure, do the following:

(a) Connect tap water to fixture inlet fitting (7, fig. 1-79 or 1-80).

(b) Make sure the water control valve is off.

(c) Place fixture into a sink or large container.

(d) Turn on tap water and allow the water to circulate for 15-30 minutes.

(e) Observe the flow from the cooling air holes at the tips and trailing edges of the blades.

(f) If any cooling air holes are plugged, turn the tap water off.

(g) Using a 0.010 inch diameter pin, remove foreign material from plugged hole.

(h) Repeat steps (d) thru (g) until all holes are unplugged.

(9) Disconnect tap water or discharge hose fitting (5, fig. 1-75) from fixture inlet fitting (7, fig. 1-79 or 1-80).

(10) Remove retaining knob (1) and cover (3) from fixture.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(11) Remove rotor (6) from the fixture.

g. Reverse pressure flush the stage 1 or stage 2 gas generator rotor as follows:

(1) Remove retaining knob (1, fig. 1-81 or 1-82) from stage 1 gas generator rotor reverse pressure flushing fixture 21C7786G01 (fig. 1-81) or stage 2 gas generator rotor reverse pressure flushing fixture 21C7787G01 (fig. 1-82).

(2) Remove cover (3) from fixture.

NOTE

The stage 2 gas generator rotor reverse pressure flushing fixture 21C7787G01 has a lifting ring (5) to be used with the stage 2 rotor.

(3) Remove lifting ring (5) from fixture.

(4) Using a paper towel (item 113, Appendix D), clean the sealing surfaces that mate with the rotor assembly.

(5) Inspect packing, (5, fig. 1-81) PN M83248/1-273 (part of 21C7786G01) or (6, fig. 1-82) PN M83248/1-273 (part of 21C7787G01) for wear and replace if necessary.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(6) Install stage 1 rotor (7, fig. 1-81) into base (6) so that trailing edge (4) of blades are facing up.

(7) Install stage 2 rotor (8, fig. 1-82) into lifting ring (5) so that trailing edge (4) of blades is facing up.

(8) Install lifting ring (5) and stage 2 rotor (8) onto center hub of base (7).

(9) Install and secure cover (3, fig. 1-81 or 1-82) with retaining knob (1).

(10) If using tap water pressure, go to step (11). If using the universal water wash unit 21C2438G01, do the following:

(a) Connect the discharge hose fitting (5, fig. 1-75) to the fixture inlet fitting (2, fig. 1-81 or 1-82).

(b) Immerse the fixture into a bucket or pan of water and liquid dishwashing detergent (item 71, Appendix D) (4 parts water to 1 part detergent).

(c) Install the pickup assembly (6, fig. 1-75) into the bucket or pan of detergent.

(d) Using the remote switch (3), start the universal wash unit (1) and circulate the detergent/water for 15-30 minutes.

(e) Turn remote switch (3) to off.

(f) Remove pickup assembly (6) and fixture from the bucket or pan.

(11) If using tap water pressure, do the following:

(a) Connect tap water to fixture inlet fitting (2, fig. 1-81 or 1-82).

(b) Turn on tap water and allow water to circulate for 15-30 minutes.

(12) Disconnect tap water from fixture inlet fitting (2, fig. 1-81 or 1-82).

(13) Remove retaining knob (1) and cover (3) from base (6, fig. 1-81) or (7, fig. 1-82).

WARNING

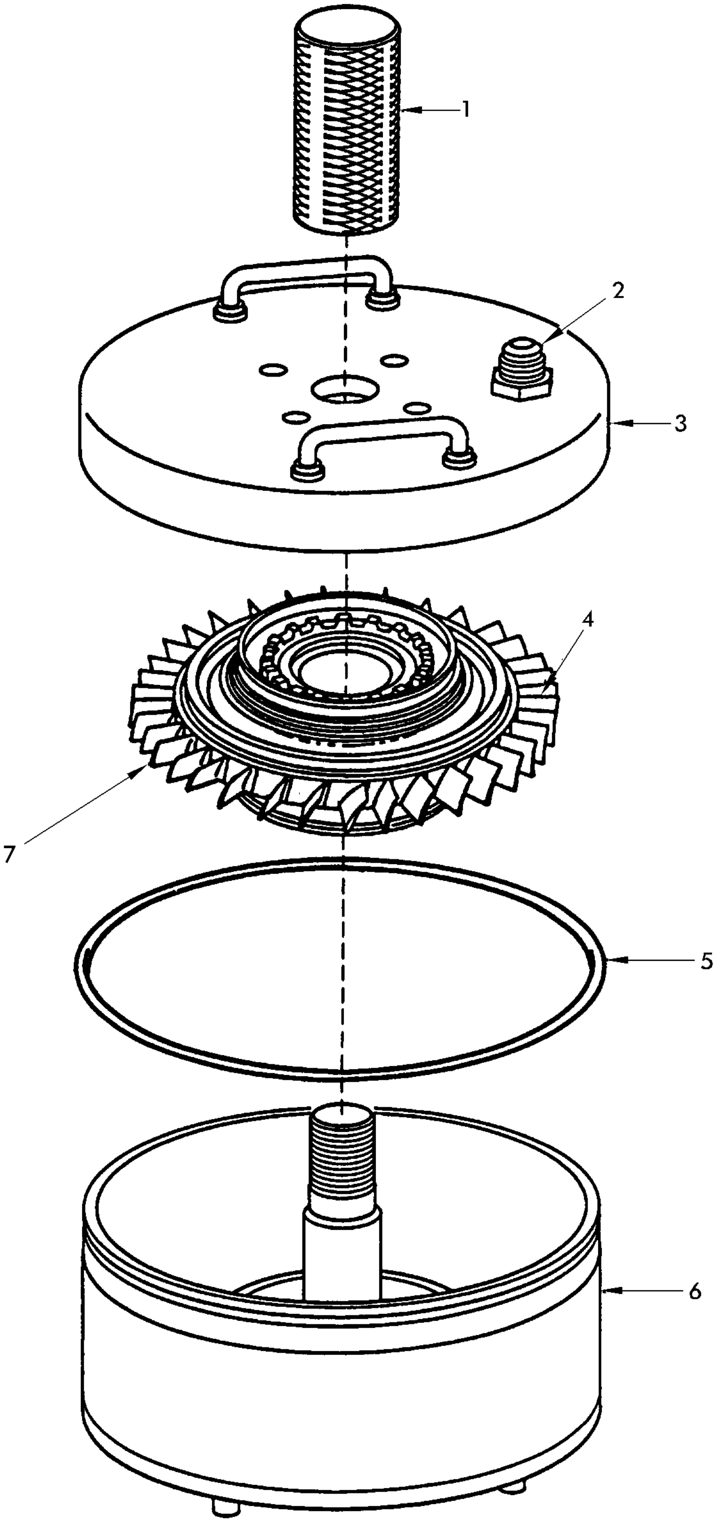
Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(14) Remove rotor from base (6, fig. 1-81).

(15) Using lifting ring (5, fig. 1-82), remove rotor from base (7). Then do steps k thru m.

h. **(T700, T701)** Forward pressure flush gas generator stator as follows:



1. Retaining Ring
2. Fixture Inlet Fitting
3. Cover
4. Trailing Edge
5. Packing
6. Base
7. Stage 1 Rotor

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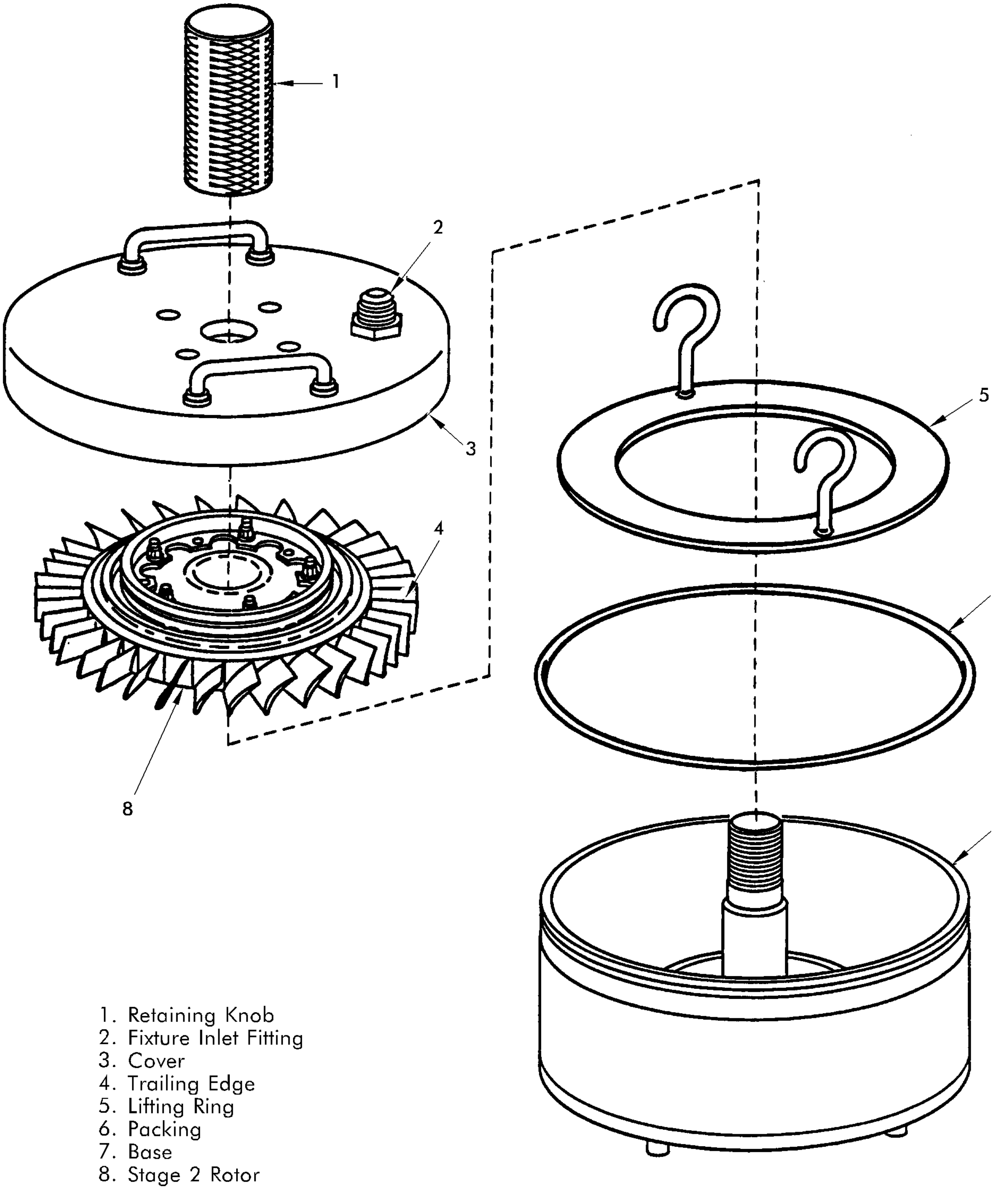
Figure 1-81. Stage 1 Gas Generator Rotor Reverse Pressure Flushing Fixture 21C7786G01



1. Retaining Knob
2. Fixture Inlet Fitting
3. Cover
4. Trailing Edge
5. Lifting Ring
6. Packing
7. Base
8. Stage 2 Rotor

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Figure 1-82. Stage 2 Gas Generator Rotor Reverse Pressure Flushing Fixture 21C7787G01

NOTE

The following procedure does not replace any other procedure such as soft-bristle brush cleaning or scrubbing with a Scotch Brite pad.

(1) Remove six cap screws (3, fig. 1-83) and protector ring (4) from base (6).

(2) Using a paper towel (item 113, Appendix D), clean the sealing surfaces that mate with the gas generator stator (5).

(3) Lubricate the neoprene seals (9) with liquid dishwashing detergent (item 71, Appendix D).

CAUTION

Make sure that the face-type seal falls below the neoprene seal and that it does not damage the neoprene.

(4) Install stator (5) onto base (6), forward face contacting seals (9).

(5) Aline holes in protector ring (4) with threaded holes in base (6), then hand-tighten cap screws (3).

(6) Assemble the ring (1) to stator (5) as follows:

(a) Tape (item 108, Appendix D) outside diameter and aft surface of stage 2 shroud retainers.

(b) Loosen cap screws (2) until a 0.25 - 0.50 inch gap exists between the split-line flanges.

(c) Install ring (1) over stator (5) until aft lip of ring contacts taped edge of shroud retainers.

(d) Alternating between sides, evenly, hand-tighten cap screws (2), until flanges come together.

(7) If using tap water pressure, go to step (9). If using universal water wash unit 21C2438G01, do the following:

(a) Remove the quick disconnect from the discharge hose fitting (5, fig. 1-75).

(b) Connect fitting (5) to the stage 1 shroud cooling holes elbow (8, fig. 1-83) or stage 2 shroud cooling holes fitting (11).

(c) Immerse the fixture into a bucket or pan of water and liquid dishwashing detergent (item 71, Appendix D) (4 parts water and 1 part detergent).

(d) Install the pickup assembly (6, fig. 1-75) into the bucket or pan of detergent.

NOTE

- Stage 1 and 2 shroud support cooling holes require flushing only.
- If leakage is present when flushing the stage 2 shroud support cooling holes (aft inlet fitting), tighten the two cap screws (2). This will reduce (not eliminate) the leakage past the shroud retainers.

(e) Using the remote switch (3), start the universal wash unit (1) and circulate the detergent/water for 15-30 minutes.

(f) Stop the wash unit and remove the fixture from the bucket or pan.

(g) Disconnect fitting (5) from elbow (8, fig. 1-83) or fitting (11).

(h) Repeat steps (b) thru (g) to flush stage 2 shroud cooling holes, then go to step (10). For flushing stage 2 nozzle cooling holes go to next step.

(i) Connect fitting (5, fig. 1-75) to stage 2 nozzle cooling holes fitting (10, fig. 1-83).

(j) Place the fixture into a bucket or pan.

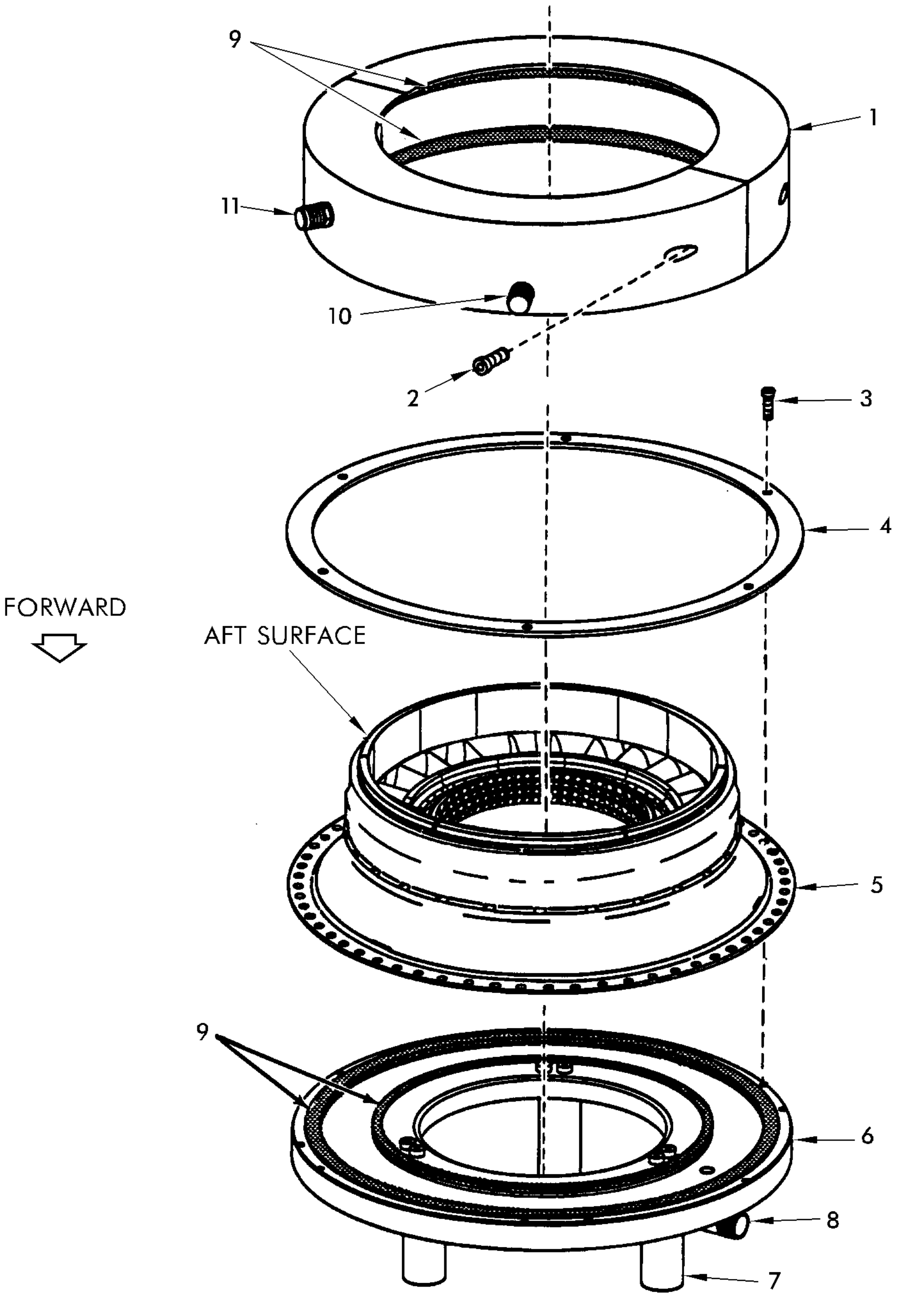
(k) Using the remote switch (3, fig. 1-75), start the universal wash unit (1) and circulate the detergent 15-30 minutes.

(l) Raise fixture slightly above detergent. Then, observe the flow from stage 2 nozzle cooling holes.

(m) If any cooling holes are plugged, stop the wash unit.

(n) Using a 0.010 inch diameter pin, remove foreign material from plugged hole.

(o) Repeat steps (j) thru (n) until all holes are unplugged.



1. Ring
2. Cap Screw (Qty-2)
3. Cap Screw (Qty-6)
4. Protector Ring
5. Gas Generator Stator
6. Base
7. Leg
8. Stage 1 Shroud Cooling Holes Elbow
9. Neoprene Seal
10. Stage 2 Nozzle Cooling Holes Fitting
11. Stage 2 Shroud Cooling Holes Fitting

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Figure 1-83. *(T700, T701)* ***Gas Generator Stator Pressure Flushing Fixture 21C7732G01***

(8) Disconnect fitting (5) from fitting (10, fig. 1-83). Go to step (10).

(9) If using tap water pressure, do the following:

(a) Connect tap water to stage 1 shroud cooling holes elbow (8, fig. 1-83) or stage 2 shroud cooling holes fitting (11).

(b) Place the fixture into a bucket, pan or sink.

NOTE

- Stage 1 and 2 shroud support cooling holes require flushing only.
- If leakage is present when flushing the stage 2 shroud support cooling holes (aft inlet fitting), tighten the two cap screws (2). This will reduce (not eliminate) the leakage past the shroud retainers.

(c) Turn the tap water supply on. Allow distribution of water for 15-30 minutes.

(d) Turn the tap water off.

(e) Disconnect tap water from elbow (8) or fitting (11).

(f) Repeat steps (a) thru (d) to flush stage 2 shroud cooling holes, then go to step (10). For flushing stage 2 nozzle cooling holes fitting (10), go to next step.

(g) Connect tap water to stage 2 nozzle cooling holes fitting (10).

(h) Do steps (b) thru (f).

(i) Turn the tap water on. Allow distribution of water for 15-30 minutes.

(j) Observe the flow from the stage 2 nozzle cooling holes.

(k) If any cooling hose are plugged turn tap water off.

(l) Using a 0.010 inch diameter pin, remove foreign material from plugged hole.

(m) Repeat steps (h) thru (l) until all holes are unplugged.

(10) Loosen cap screws (2) until a 0.25 - 0.50 inch gap exists between the split-line flange.

(11) Remove ring (1).

(12) Remove six cap screws (3) and protector ring (4).

(13) Remove tape.

(14) Remove stator (5) from base (6). Then, do steps k thru p.

i. Forward pressure flush the stage 1 nozzle as follows:

NOTE

The following procedures do not replace other procedures such as gritblasting or soft-bristle brush cleaning.

(1) If the water supply is not capable of producing 12 gallons per minute at 30 pounds per square inch then, handwash the nozzle, step e. Otherwise, proceed to step (2).

(2) Remove retaining bolts (1, fig. 1-84) and cover (2) from stage 1 nozzle assembly forward pressure flushing fixture 17A8820G01 (part of 21C7731G02).

NOTE

Forward pressure flushing will identify the cooling passages that are plugged.

(3) Using a paper towel (item 113, Appendix D), clean the sealing surfaces that mate with the nozzle assembly.

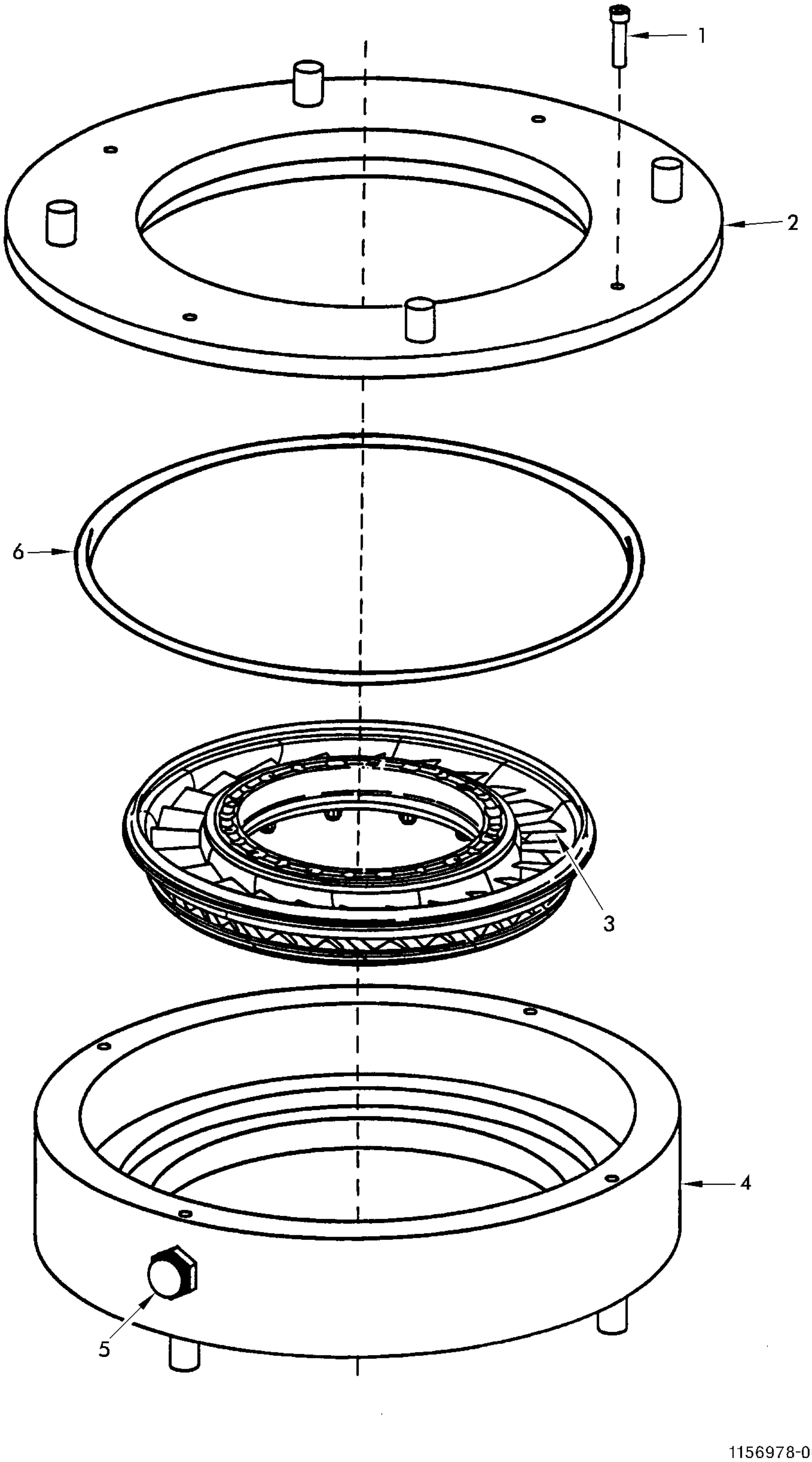
(4) Inspect packing, (6) PN M83248/1-177 (Part of 21C7731G02) for wear and replace if necessary.

(5) Install nozzle assembly, leading edge (3) facing up, into base (4) of fixture.

(6) Aline holes in cover (2) with threaded holes in base (4). Secure cover by tightening retaining bolts (1) until cover is flush with the base (4).

(7) Using tap water pressure, do the following:

(a) Connect tap water to fixture inlet fitting (5).



1. Retaining Bolt
2. Cover
3. Leading Edge
4. Base
5. Fixture Inlet Fitting
6. Packing

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Figure 1-84. Stage 1 Nozzle Assembly Forward Pressure Flushing Fixture 17A8820G01 (Part of 21C7731G02)

(b) Make sure the water control valve is off.

(c) Place the fixture into a sink or large container.

(d) Turn tap water on and allow the water to circulate for 15 - 30 minutes.

(e) Observe the flow from the cooling air holes in the leading and trailing edges.

(f) If any cooling holes are plugged, turn off tap water.

(g) Using a 0.010 inch diameter pin, remove foreign material from plugged hole.

(h) Repeat steps (d) thru (g) until all holes are unplugged.

(8) Disconnect discharge tap water from fixture inlet fitting.

(9) Remove retaining bolts (1).

(10) Remove cover (2) by evenly walking your hands around the circumference of the fixture.

(11) Remove stage 1 nozzle from the base (4) of the fixture. Then, do steps k thru m.

j. Reverse pressure flush the stage 1 nozzle as follows:

NOTE

The following procedures do not replace other procedures such as gritblasting or soft-bristle brush cleaning.

(1) If the water supply is not capable of producing 12 gallons per minute at 30 pounds per square inch then, handwash the nozzle, step e. Otherwise, proceed to step (2).

(2) Remove center retaining bolt (1, fig. 1-85) and cover (2) from the stage 1 nozzle reverse pressure flushing fixture 17A8819G01 (part of 21C7731G02).

(3) Using a paper towel (item 113, Appendix D), clean the sealing surfaces that mate with the nozzle assembly.

(4) Inspect packing, (5) PN M83248/1-043 (part of 21C7731G02) for wear and replace if necessary.

(5) Install nozzle assembly, leading edge (3) facing up, into base (4) of fixture.

(6) Install cover (2) and secure it with retaining bolt (1).

(7) Connect tap water to the fixture inlet fitting (6, fig. 1-85) and do steps i(7)(a) thru (f).

(8) Observe the flow from the outer ring of stage 1 nozzle. The water should flow equally from all openings.

(9) If the detergent does not flow equally, forward pressure flush the stage 1 nozzle (step i).

(10) If detergent does flow equally, turn tap water off, and remove fixture from sink, bucket or pan.

(11) Remove center retaining bolt (1, fig. 1-85), and cover (2) from base (4).

(12) Remove stage 1 nozzle from base (4).

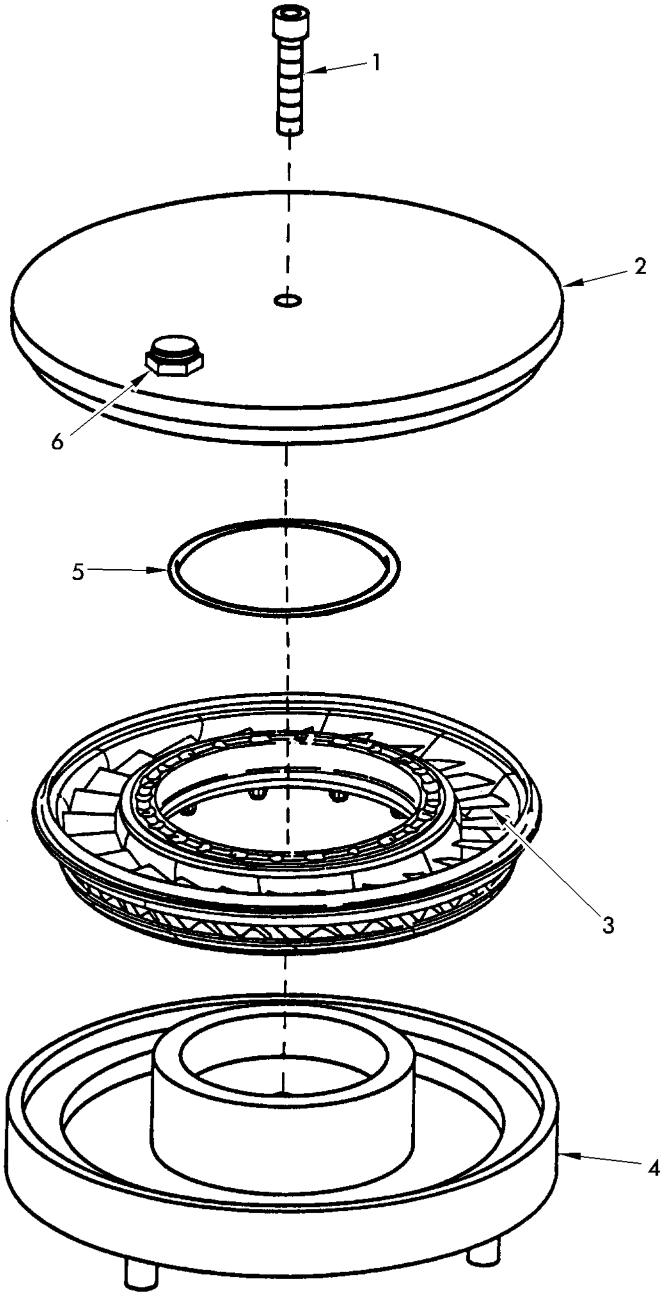
k. Rinse all cleaned parts with clean running tap water, being sure all detergent is removed.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

l. Dry all parts with clean, dry, filtered, compressed air. Use a high-pressure air nozzle to blow loose particles from air passages and from under cooling plates and rotor blades. It is very important that all particles are removed. It may require several applications of compressed air to remove all traces of dirt and sand. Oven drying of parts is not required.



1. Center Retaining Bolt
2. Cover
3. Leading Edge
4. Base
5. Packing
6. Fixture Inlet Fitting

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Figure 1-85. Stage 1 Nozzle Assembly Reverse Pressure Flushing Fixture 17A8819G01 (Part of 21C7731G02)

m. Carefully inspect each part to assure it is well cleaned, free of detergent solution, and dry before assembly.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

n. Apply a few drops of lubricating oil (item 85 or 87, Appendix D) onto each of the injector swirlers on combustion liner, and reassemble engine as instructed in this manual.

o. Make required checks listed in table 1-19 or in table 1-39 (AVIM).

p. Record engine hours and cleaning compliance on engine form DA 2408-15, in remarks block.

1-167. Hot Section Cleaning of Engines (in Aircraft) Operating in a “Dirty” Environment (To Be Done at 50 Hour Cleaning Interval or Sooner if Required (para 1-159)).

NOTE

- This procedure requires about 15 minutes per engine to accomplish, and requires standard cleaning chemicals, clean water, and a sprayer which an operator should be able to fabricate in his own shop.
- Including this hot section wash with the normal periodic chemical wash is recommended so that no additional starter engagements are required.
- If cleaning solution is not available, clean water only may be used.

a. Prepare cleaning solution in accordance with paragraph 1-163, step a or b, depending on temperature.

b. Preferred method: using hot section wash kit LMT 942 (**(T700)** (fig. F-12) or LMT 943 **(T701, T701C, T701D)** (fig. F-13), Appendix F), spray-wash hot section as follows:

(1) Fill water-wash supply tank with cleaning solution. Attach sprayer to supply line.

CAUTION

Do not use excessive force/torque when removing or installing an igniter plug. Excessive force/torque will damage the igniter plug boss and may cause the midframe to rupture.

(2) Remove the 4 and 8 o'clock igniter plugs.

(3) Insert engine wash nozzles into combustion liner (through 4 and 8 o'clock igniter ports) (fig. 1-86).

(4) Spray-wash entire interior of combustion liner and stage 1 nozzle and midframe casing surfaces for a minimum of one minute.

(5) Motor engine (para 1-165, step b) for 30 seconds while continuing to spray.

(6) Continue to spray wash the entire interior of the combustion liner and stage 1 nozzle and midframe casing surfaces for a minimum of one minute.

(7) Allow wash solution to soak the hot section parts for 10 minutes, then rinse the washed areas with clean water. Run the rinse water until clean water is observed running out the engine tailpipe. Motor engine on starter for 1 minute while doing rinse procedure.

(8) Remove engine wash nozzles at 4 and 8 o'clock igniter ports.

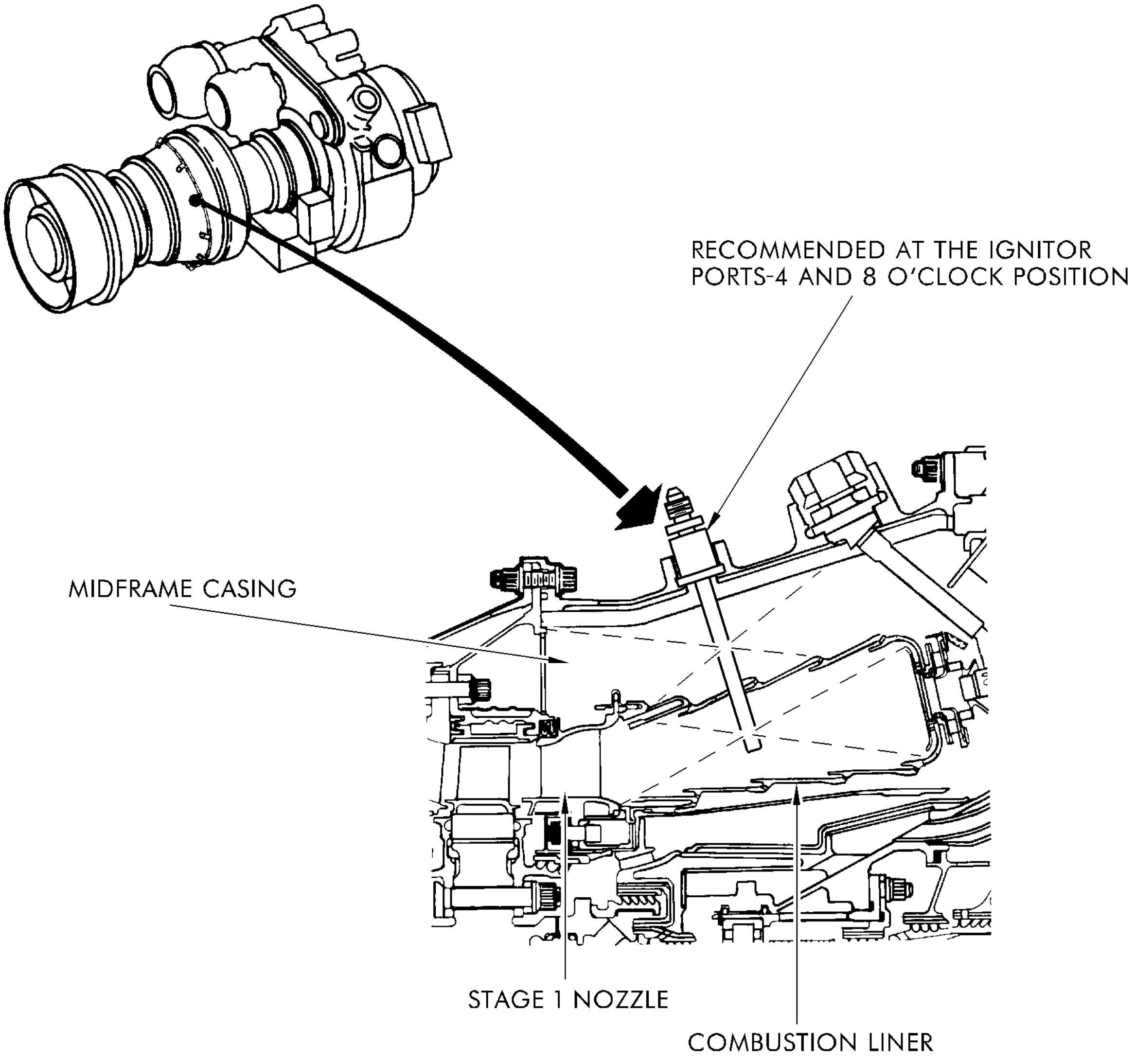


Figure 1-86. Spray Washing Combustion Liner, Stage 1 Nozzle, and Midframe Casing

CAUTION

Do not use excessive force/torque when removing or installing an igniter plug. Excessive force/torque will damage the igniter plug boss and may cause the midframe to rupture.

(9) Install igniter plugs and ignition leads into the 4 and 8 o'clock igniter plug ports.

(10) Torque igniter plugs (para 7-9 or 7-10).

(11) Run washed engines above ground idle speed for 5 minutes; if possible, dry at NG speed above 90%.

c. Alternate method: using hot section module sprayer LMT 777 (fig. F-5, Appendix F), spray-wash hot section as follows:

(1) Fill water-wash supply tank with cleaning solution. Attach sprayer to supply line.

(2) Remove either the 4 or 8 o'clock igniter plug.

(3) Insert sprayer into combustion liner (through either 4 or 8 o'clock igniter port) (fig. 1-87).

(4) Spray-wash entire interior of combustion liner and stage 1 nozzle surfaces for a minimum of one minute while rotating sprayer 360 degrees.

(5) Motor engine (para 1-165, step b) for 30 seconds while continuing to spray.

(6) Continue to spray wash the entire interior of the combustion liner and stage 1 nozzle surfaces for a minimum of one minute by rotating sprayer 360 degrees.

(7) Reposition sprayer so that spray tip is between combustion liner and midframe casing (fig. 1-88). Spray-wash entire area by rotating sprayer 360 degrees.

(8) Allow wash solution to soak the hot section parts for 10 minutes, then rinse the washed areas with clean water. Run the rinse water until clean water is observed running out the engine tailpipe. Motor engine on starter for 1 minute while doing rinse procedure.

(9) Remove sprayer.

(10) Install igniter plug and ignition lead into either the 4 or 8 o'clock igniter plug port.

(11) Run washed engines above ground idle speed for 5 minutes; if possible, dry at NG speed above 90%.

1-168. INSPECTION.

The following general instructions apply to inspection procedures and data in this manual:

a. If the engine has been disassembled for any reason, all parts which are handled will be inspected for damage.

b. This section lists inspection and repair methods allowable for aviation unit maintenance (AVUM) and aviation intermediate maintenance (AVIM) of the engine. Where the manual specifies that repair is Not Allowed, it means that repair is not allowed at the levels of maintenance covered by this manual. Refer to the Maintenance Allocation Chart (MAC, Appendix B) for the level of maintenance assigned to engine parts.

c. Keep inspection area, inspection benches, and tools thoroughly clean. Cover work benches with clean, dry covers. Keep components free of dirt, dust, and grease using plastic storage bags (items 7 thru 6, Appendix D) or similar containers. Cap openings in components.

d. Inspect parts under adequate light; only the most thorough inspection can properly evaluate damage. Tag each component to indicate whether it has to be repaired or replaced. More than one method of inspection may be needed to determine the extent of damage.

e. Defect limits are usually given as depth dimensions because this is the dimension that affects strength. Refer to TM55-1500-204-25/1 (General Aircraft Maintenance Manual) for appropriate depth measuring tools to determine depth of defect.

1-169. Inspection Table Column Headings. This paragraph explains how to interpret the information in the various columns of each inspection table.

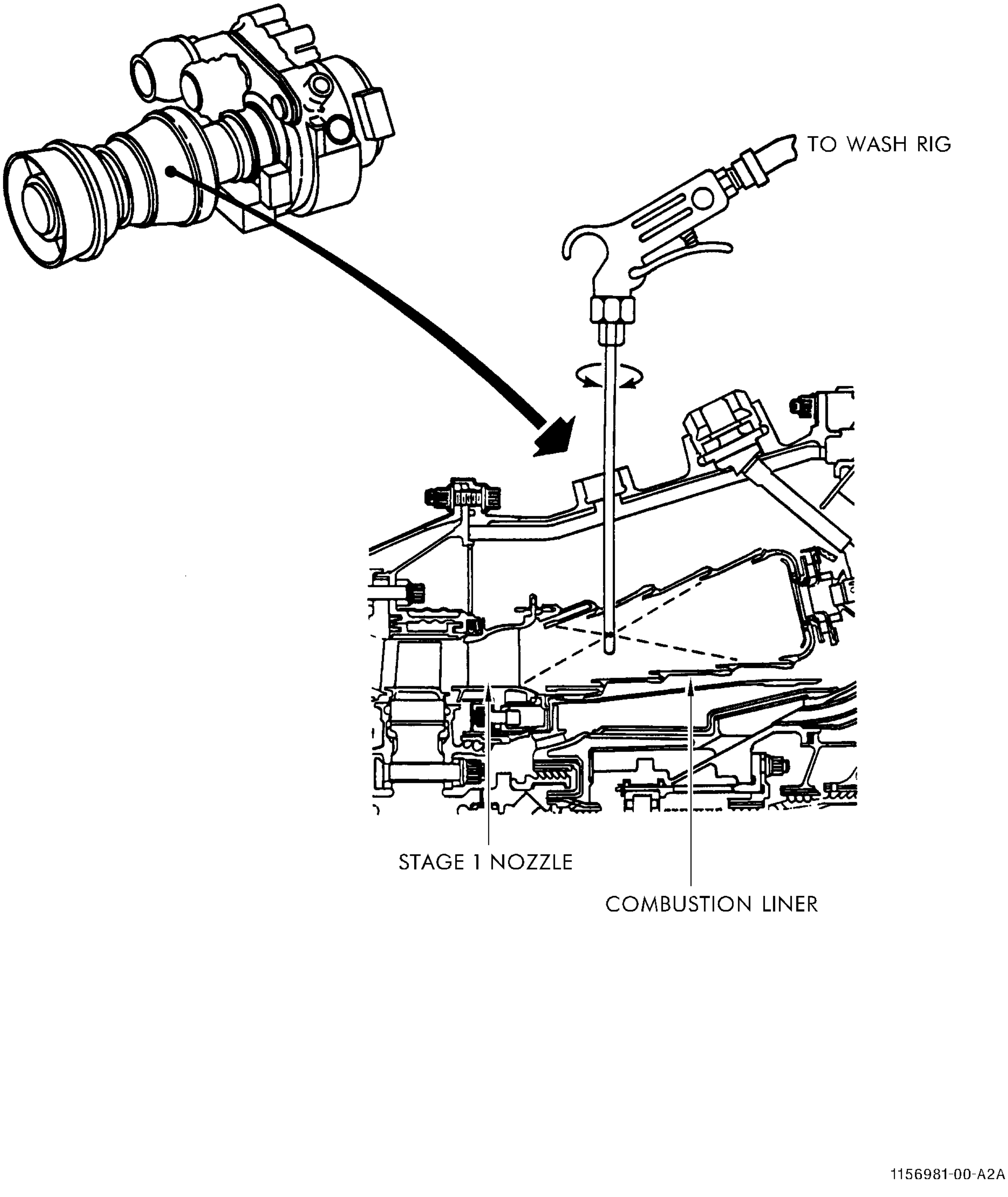


Figure 1-87. Washing Combustion Liner and Stage 1 Nozzle

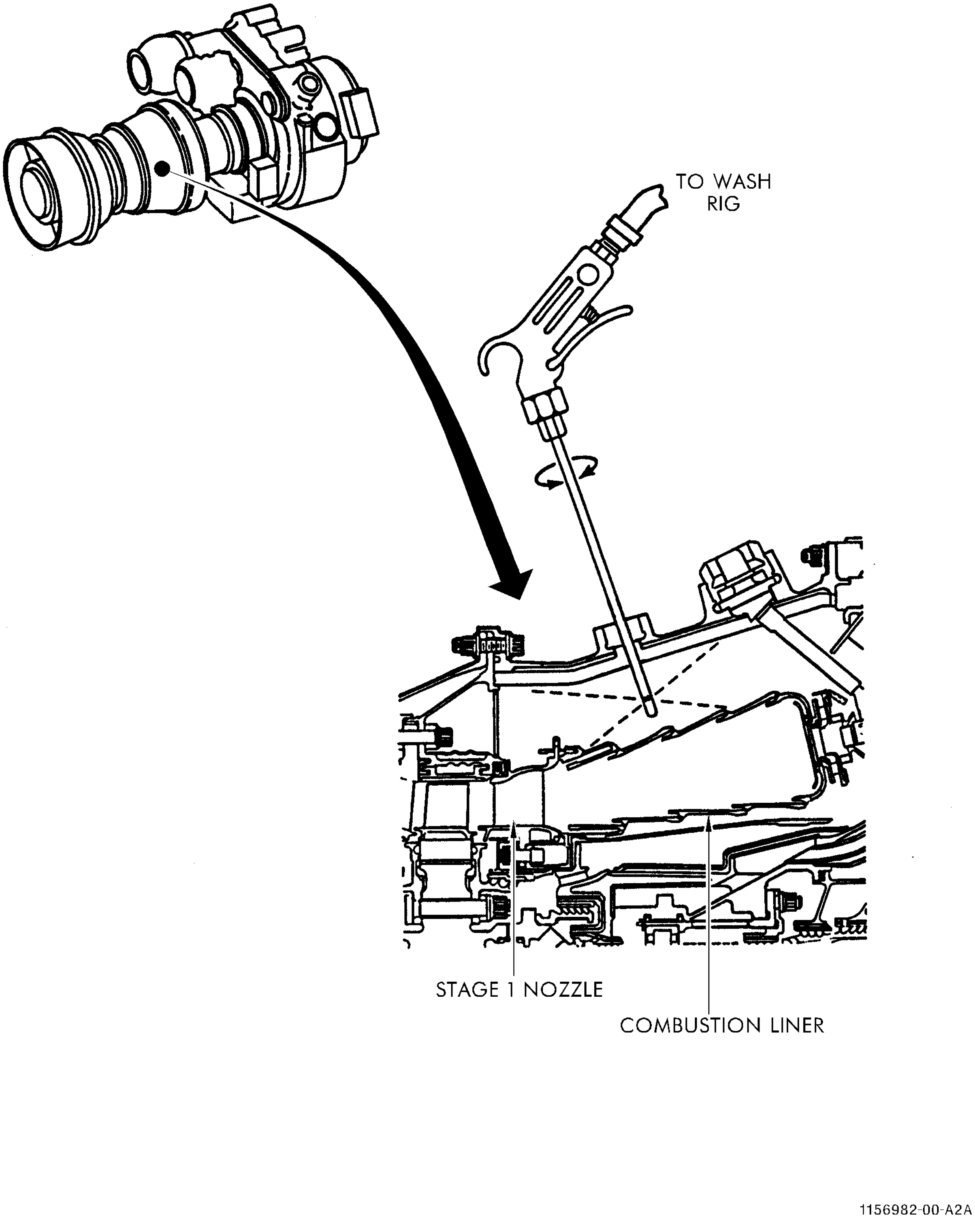


Figure 1-88. Washing Area Between Combustion Liner and Midframe Casing

NOTE

Inspection tables for specific components are presented under the paragraph heading for that component.

a. Inspect. Refer to visual or other inspection based upon availability of equipment. Unless otherwise specified, visual inspection is implied.

b. Usable Limits. That limit which is allowable without repairing or replacing part.

(1) The part can be maintained in service if this limit is not exceeded.

(2) If this limit is exceeded, and part cannot be repaired at this level of maintenance, replace part. Refer to MAC (Appendix B) and RPSTL for disposition.

c. Max Repairable Limit. That limit (always greater than the usable limit) which is allowable if the defect is to be repaired according to the instructions in Corrective Action column.

(1) If usable limits are exceeded, but repairable limits have not been exceeded, the part can remain in service only if that repair which removes the defect is made.

(2) If the repairable limits are exceeded, the part must be replaced. Refer to MAC (Appendix B) and RPSTL for disposition.

d. Corrective Action. Action to be followed if maximum limits have been exceeded.

(1) Because corrective actions such as blending, removing high metal, cold-working, hand-polishing, chasing threads, straightening electrical connector pins, etc. are considered to be standard operating procedures rather than repair procedures, they are not listed as repairs in the MAC (Appendix B) or in the RPSTL.

(2) If action calls for blending, see paragraph H-21, Appendix H, for general blending procedures.

(3) If action calls for removing high metal (or pickup), use an abrasive stone (item 104, Appendix D) to rework material to original contour.

(4) If action calls for cold-working, it means to rework material to original contour without applying heat to material. After cold-working part, reinspect immediate area for cracks, using information in applicable inspection paragraph.

CAUTION

Do not use crocus cloth on carbon seals.

(5) If action calls for hand-polishing, use crocus cloth (item 55, Appendix D).

(6) If action calls for a repair procedure, part will be repaired; otherwise, it will be replaced.

(7) If action requires that defective part be replaced, return defective part to next higher level of maintenance.

(8) In some instances, the entire engine will be replaced due to balancing requirements or to loss of performance, etc.

1-170. Definition of Inspection Terms. Refer to table 1-28. The first column lists terms used to describe deviations from normal conditions in engine parts. The second column defines the terms. The third column lists the causes of the defined terms.

Table 1-28. Definitions of Inspection Terms

Term	Definition	Causes
Abrasion	Roughened surface. May vary from light to severe.	Foreign material between moving parts.
Bend	Distortion in a part. Curvature out of proper contour.	Severe use of heat, or excessive force.
Blister	Raised portions of the surface, usually where the surface has separated from the base. Generally found on surface-treated parts (plated or painted surfaces).	Poor original bond with base. Possible aggravation by heat or pressure.
Break	Separation of part.	Severe force, pressure or overload.
Brinelling	Indentation of the surface, usually found on ball or roller bearings.	Incorrect assembly or disassembly procedure used on bearings, or application of excessive force on bearing free race.
Brittleness	Loss of resiliency in base material.	Severe use of heat or cold or possible chemical action.
Buckling	Large deformation of contour; a bulge in a surface.	Severe pressure, impact of a foreign object, or heat distortion.
Burnishing	Smoothing of a metal surface by mechanical action, but without a loss of material, generally found on plain bearing surfaces. Surface discoloration is sometimes present around outer edges. Normal burnishing from operational service is not detrimental if coverage approximates carrying load and there is no evidence of burns.	Operation of mechanical parts.
Burr	Rough edge or sharp projection.	Excessive wear or poor machining.
Chafing	Surface deformation.	Rubbing action between parts.
Chatter Mark	Surface irregularity.	Machining process, minor defect.
Chipping	Breaking away of small metallic particles.	Heavy impact of foreign object.
Coking	Buildup of carbon deposits.	Deterioration of lubricants or incomplete combustion.
Corrosion	Formation of many small pits which cumulatively create a wide cavity (usually shallow) in surface of part.	Oxidation of particles.
Crack	Parting of parent material or of metal in a welded zone with or without deformation of adjacent areas.	Severe stress from overloading or shock; possible extension of a scratch. Also caused by thermal expansion, vibration, and material fatigue.

Table 1-28. Definitions of Inspection Terms (Cont)

Term	Definition	Causes
Crazing	A mesh of minute hairlike cracks on glazed or baked-on surfaces which do not penetrate into parent metal.	Temperature changes or deformation of parent metal.
Dent	Smooth cavity in surface. Material is displaced, not separated.	Careless handling or striking of the part; operational wear with foreign object interference.
Electrolytic Action	Surface breakdown.	Galvanic action between dissimilar metals.
Erosion	Metal carried away.	Sand, gas or liquids.
Fatigue Failure	Progressive yielding to repeated stress of one or more local areas, caused by the cumulative effect of scratches, sharp indentations, cracks, tool marks, and inclusions. As the stress is repeated, cracks develop, then spread, usually from the surface (or near the surface) of the particular section. Finally, so little sound material remains that the normal stress on the part exceeds the strength of the remaining material. This results in separation. It is not caused by metal crystallization and can easily be determined by visual inspection of the part. There will be evidence of several more or less concentric lines. The center (or focus) of the lines indicates the origin of the failure.	Cracks, tool marks, sharp corners, nicks, galling, inclusions, corrosion, insufficient tightening of studs, or bolts.
Flaking	Pieces of a plated or painted surface breaking away.	Imperfect bond or severe load.
Fracture	Same as Break.	
Fretting	Loss of fine particles of metal.	Rubbing action between parts.
Galling	Accumulation of foreign material deposited on surfaces.	Movement of two surfaces in contact with one another under severe pressure.
Glazing	Covering of hard, glossy surface on plain bearing areas (sometimes a desirable condition)	Pressure, oil, and heat in combination.
Gouging	Wide, rough scratching or group of scratches, usually accompanied by one or more sharply impressed corners, and sometimes by deformation or removal of material.	Presence of a rather large foreign body between parts in motion.
Grooving	Long, narrow, continuous channels having no sharp edges.	Concentrated wear due to abnormal-relative motion of parts.
High Metal	Displaced surface metal.	Nicks, scratches, gouges, or dents.

Table 1-28. Definitions of Inspection Terms (Cont)

Term	Definition	Causes
Hot Gas Corrosion	The corrosion of unprotected metal (with no coating) that has been exposed to hot gases. When first exposed, the surface becomes rough and appears to be pitted and pockmarked. Also, there is a noticeable difference in the colors of the exposed and unexposed surfaces. Further exposure of surface to hot gases cause it to blister and, in time, flake off in layers.	This kind of corrosion differs from that normally found on surfaces attacked only by salt in the atmosphere. In hot-gas corrosion, the hot gases convert sulphur to sulfide in the presence of salt. The metal is attacked by the resulting deposits.
Mushrooming	Displacement of metal, curling outward from the center of part, that leaves edge or tip of part shaped like a mushroom.	Blade tip rubs.
Nick	Sharp indentation.	Negligent handling of parts or foreign object damage during engine operation.
Peening	Surface deformation.	Foreign object damage.
Pickup	A burr, subject to being transferred from one part to another.	Insufficient lubrication, unbroken edges of press-fitted parts. Seizure of rotating parts during operation. Improper manufacture.
Pitting	Minute depressions of cavities, without sharp, high-stress corners.	Chemical action: oxidation of surface; electrolytic action. Mechanical action: chipping of loaded surfaces due to improper clearances and overloading; presence of foreign material.
Scoring	Deep scratches or elongated gouging.	Presence of chips between loaded surfaces that have relative motion.
Scratch	Long, narrow, sharp-cornered impression.	Movement of a sharp object across the surface.
Spalling	Sharply roughened area, characteristic of progressive chipping or peeling of surface material.	Surface crack, inclusions, or similar surface injury that causes a progressive breaking away of the parent material.

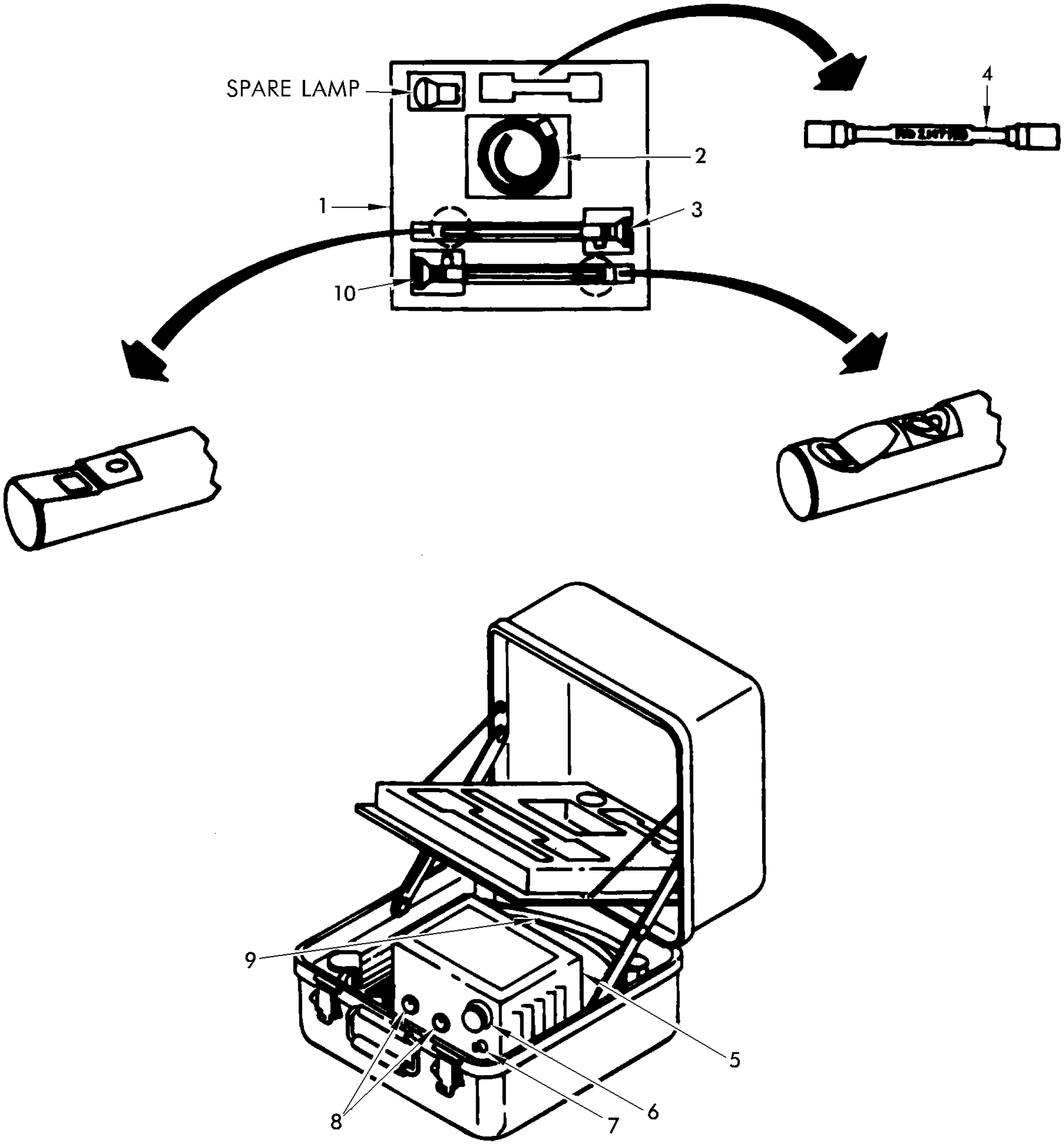
Table 1-28. Definitions of Inspection Terms (Cont)

Term	Definition	Causes
Stress	A cause of several types of engine part failures, generally divided into five groups, according to cause: compression, shear, shock, tension, and torsion.	• Compression: action of two directly opposed forces which tend to squeeze, bend, twist, stretch or otherwise apply abnormal pressures to a part. • Shear: action of two opposed parallel forces. • Shock: instantaneous application of stress. • Tension: action of two directly opposed forces which act to pull apart. • Torsion: action of two opposed forces around a common axis.
Tear	A forcible, somewhat crude pulling or wrenching away of material so that ragged or irregular edges result.	Negligent handling of parts, or foreign object damage during engine operation.

1-171. DIAGNOSTIC EQUIPMENT.

The following diagnostic equipment is used:

- **(T700)** Borescope Kit 21C7190P01 (fig. 1-89)
- **(T701, T701C, T701D)** Borescope Kit 21C7190P02 (fig. 1-90)
- **(T700)** Borescope Kit 21C7744P01 (fig. 1-91)
- Borescope Kit 21C7744P02 **(T700)** and 21C7744P03 (fig. 1-92)
- Borescope Kit 21C7700P03 (fig. 1-93)
- Borescope Kit 21C7779P03 (fig. 1-94)
- **(T700)** ECU Circuit Continuity Switch Box 21C7085G01 (figs. 1-49 and 1-147)
- **(T701)** ECU Circuit Continuity Switch Boxes 21C7085G01 and 21C7085G02 (figs. 1-49 and 1-147)
- **(T701C, T701D)** DEC Circuit Continuity Switch Box 21C7085G02 (figs. 1-49 and 1-147)



1. Insert Cover
2. Light Carrier
3. Right-Angle Rigid Borescope
4. Adapter Cable
5. Light Supply
6. Light Intensity Control
7. ON/OFF Switch
8. Light Supply Port
9. Power Cord
10. Retrospective Rigid Borescope

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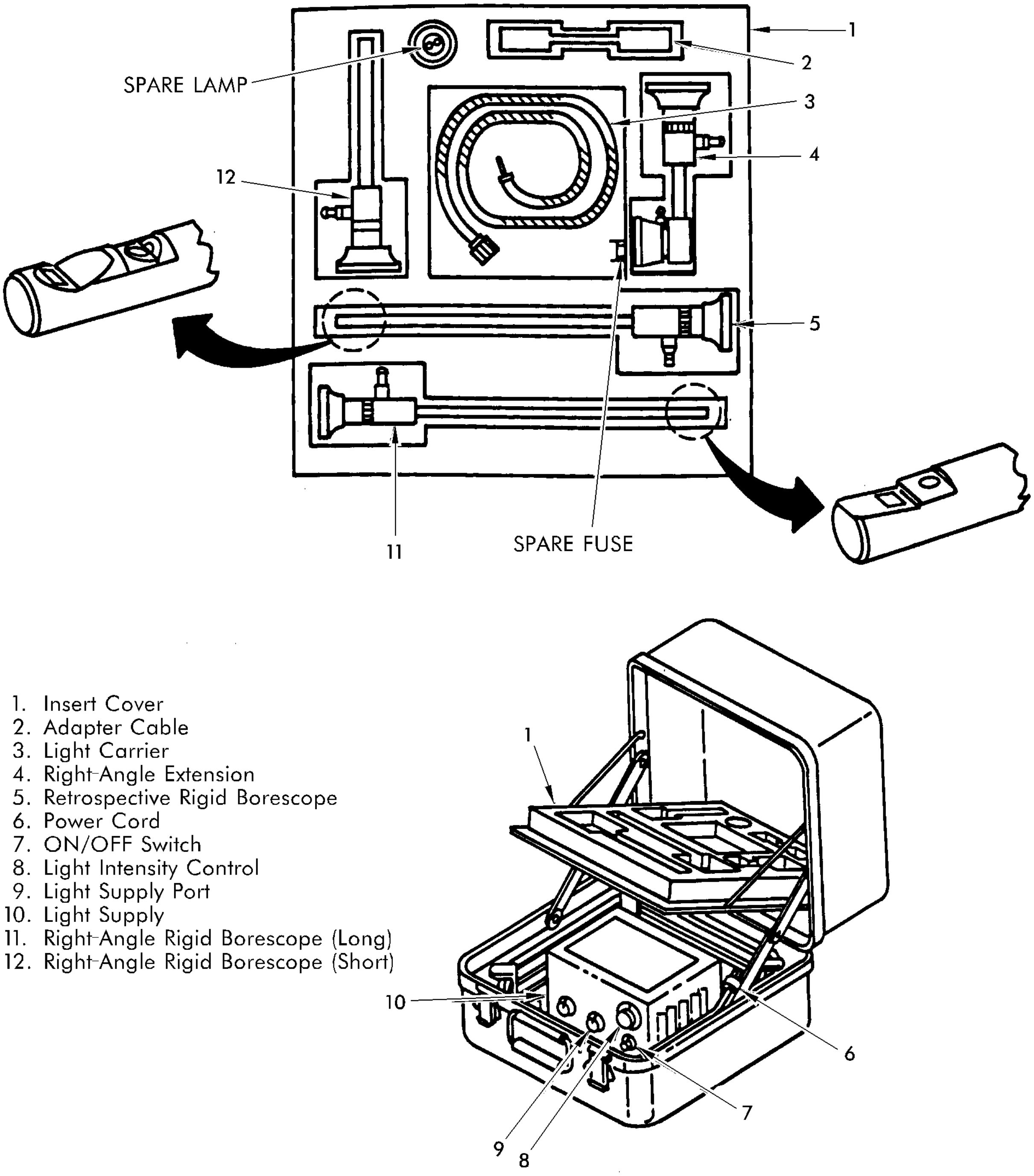
Figure 1-89. *(T700)* **Borescope Kit 21C7190P01**



1. Insert Cover
2. Adapter Cable
3. Light Carrier
4. Right-Angle Extension
5. Retrospective Rigid Borescope
6. Power Cord
7. ON/OFF Switch
8. Light Intensity Control
9. Light Supply Port
10. Light Supply
11. Right-Angle Rigid Borescope (Long)
12. Right-Angle Rigid Borescope (Short)

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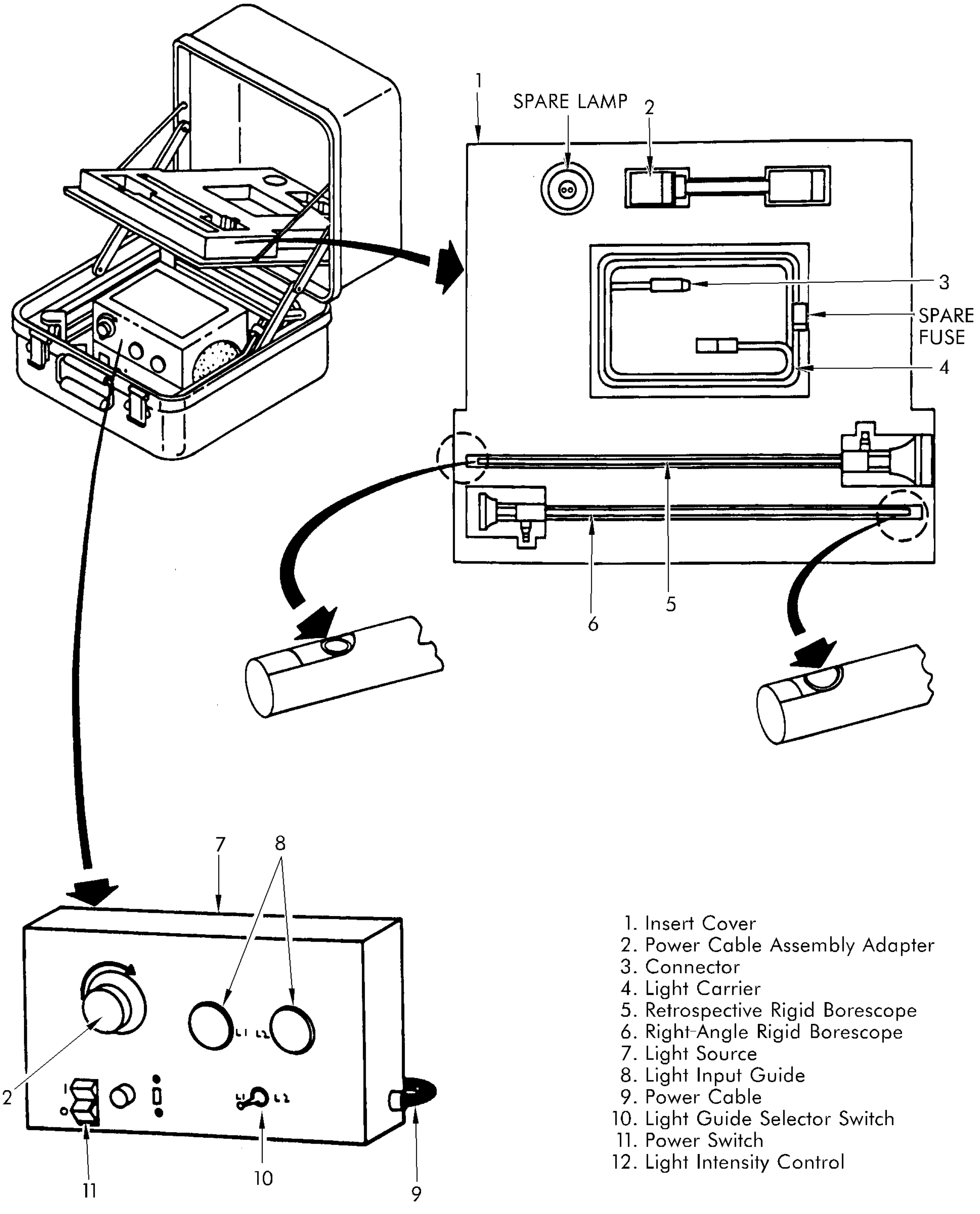
Figure 1-90. ***(T701, T701C, T701D)*** *Borescope Kit 21C7190P02*



1. Insert Cover
2. Power Cable Assembly Adapter
3. Connector
4. Light Carrier
5. Retrospective Rigid Borescope
6. Right-Angle Rigid Borescope
7. Light Source
8. Light Input Guide
9. Power Cable
10. Light Guide Selector Switch
11. Power Switch
12. Light Intensity Control

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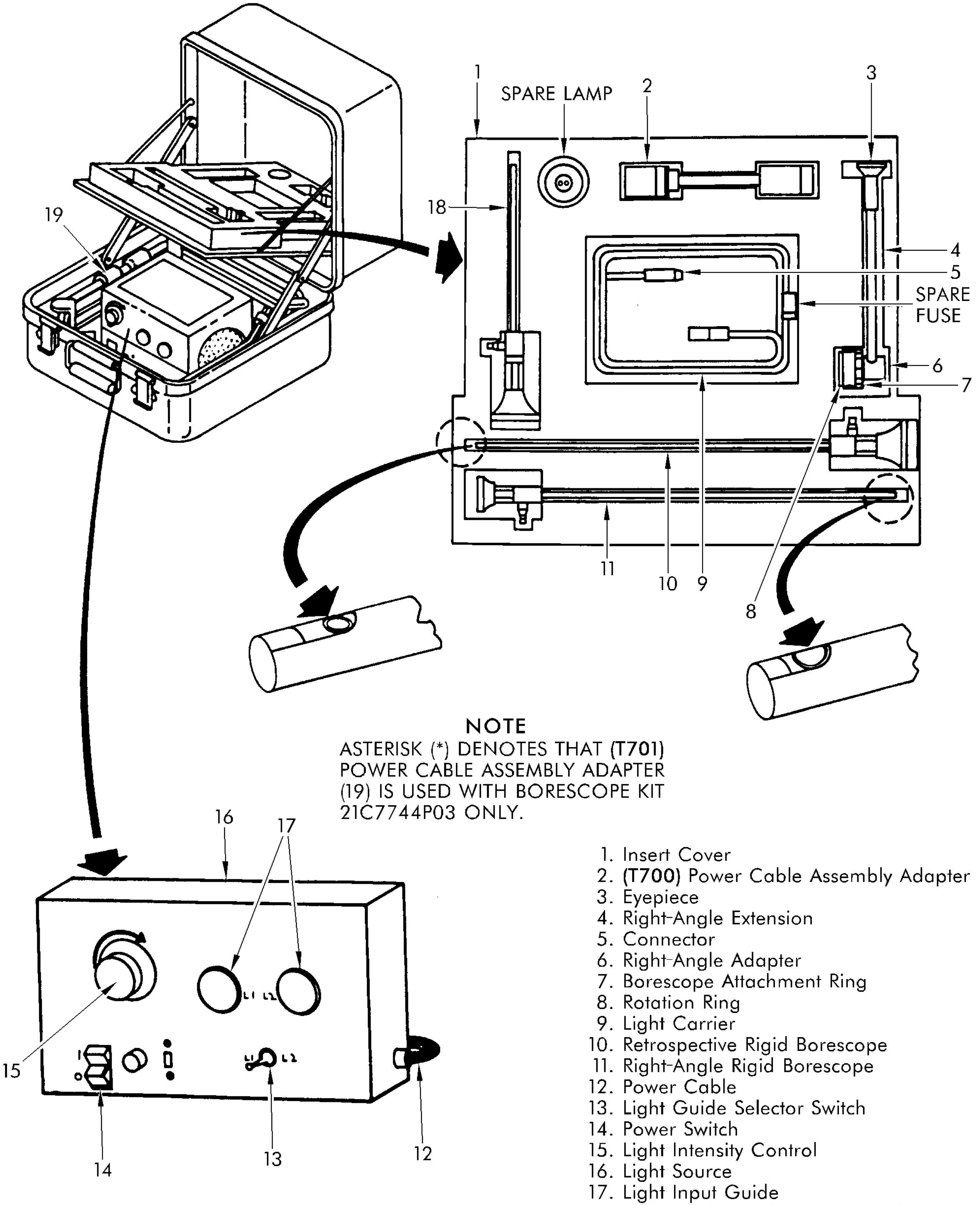
Figure 1-91. *(T700)* ***Borescope Kit 21C7744P01***



NOTE
ASTERISK (*) DENOTES THAT **(T701)** POWER CABLE ASSEMBLY ADAPTER (19) IS USED WITH BORESCOPE KIT 21C7744P03 ONLY.

1. Insert Cover
2. **(T700)** Power Cable Assembly Adapter
3. Eyepiece
4. Right-Angle Extension
5. Connector
6. Right-Angle Adapter
7. Borescope Attachment Ring
8. Rotation Ring
9. Light Carrier
10. Retrospective Rigid Borescope
11. Right-Angle Rigid Borescope
12. Power Cable
13. Light Guide Selector Switch
14. Power Switch
15. Light Intensity Control
16. Light Source
17. Light Input Guide
18. Right-Angle Rigid Borescope (Short)

*19. **(T701)** Power Cable Assembly Adapter

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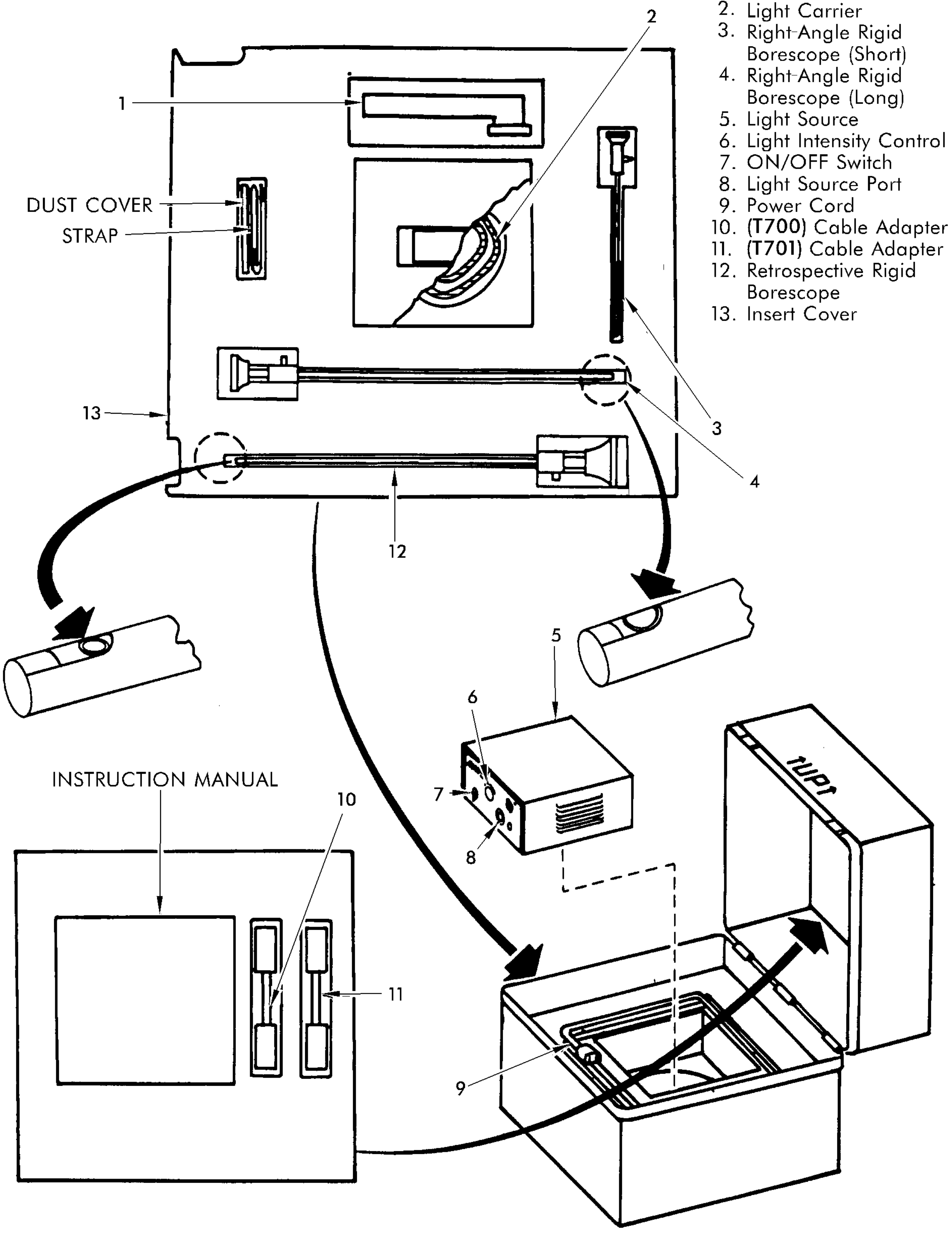
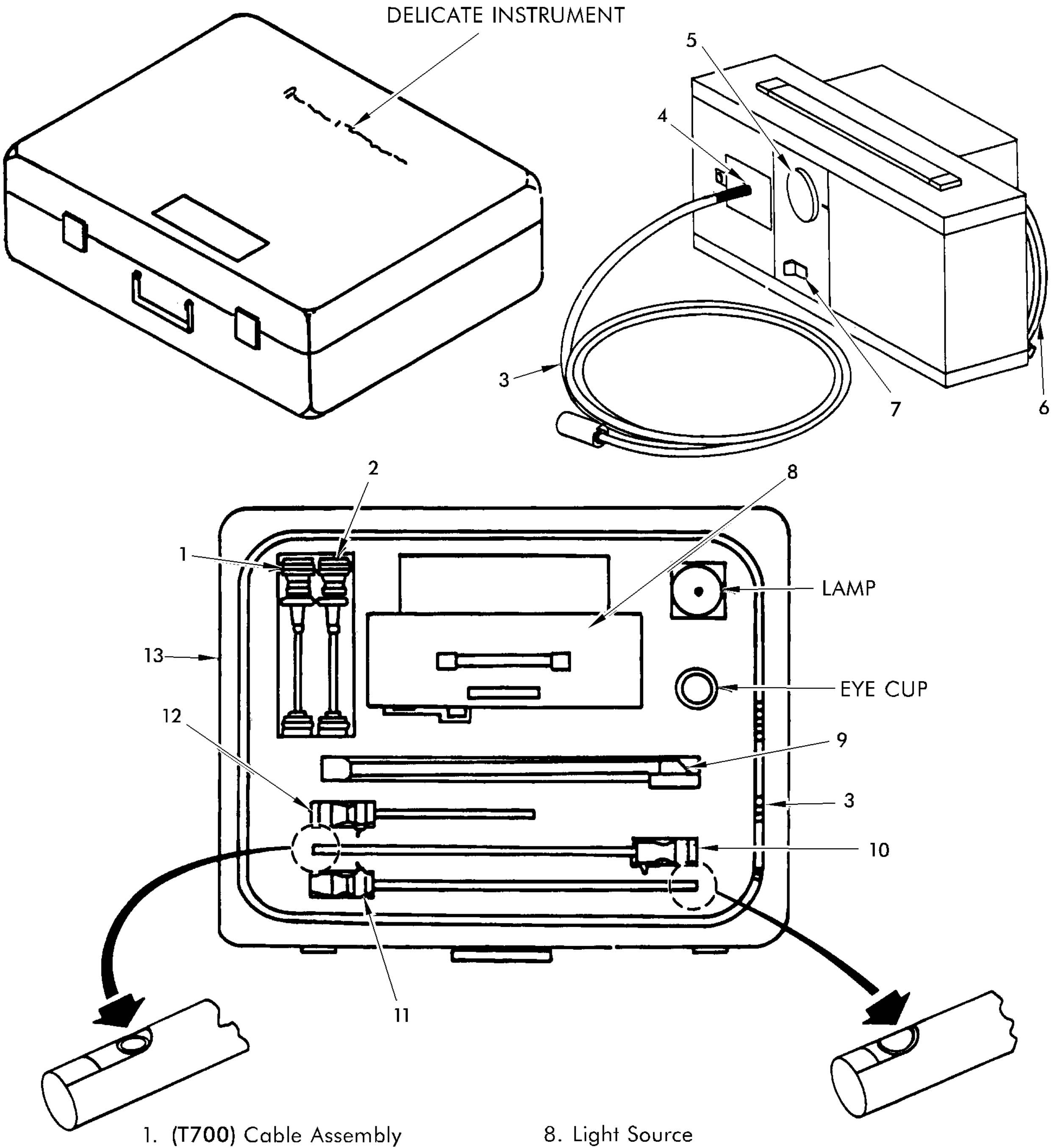
Figure 1-92. Borescope Kits 21C7744P02 (T700) and 21C7744P03



1. Right-Angle Extension
2. Light Carrier
3. Right-Angle Rigid Borescope (Short)
4. Right-Angle Rigid Borescope (Long)
5. Light Source
6. Light Intensity Control
7. ON/OFF Switch
8. Light Source Port
9. Power Cord
10. **(T700)** Cable Adapter
11. **(T701)** Cable Adapter
12. Retrospective Rigid Borescope
13. Insert Cover

Figure 1-93. Borescope Kit 21C7700P03



1. **(T700)** Cable Assembly
2. **(T701)** Cable Assembly
3. Light Carrier
4. Light Source Port
5. Light Intensity Control
6. Power Cord
7. ON/OFF Switch
8. Light Source
9. Viewing Adapter
10. Right-Angle Rigid Borescope (Long)
11. Retrospective Rigid Borescope
12. Right-Angle Rigid Borescope (Short)
13. Transit Case

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Figure 1-94. Borescope Kit 21C7779P03

1-172. BORESCOPING ENGINE USING (T700) BORESCOPE KIT 21C7190P01, 21C7744P01, OR 21C7744P02, OR (T701, T701C, T701D) BORESCOPE KIT 21C7190P02 OR BORESCOPE KIT 21C7700P03, 21C7744P03, OR 21C7779P03.

1-173. (T700) Preliminary Information.

WARNING

Replacing Borescope Light Bulb

- Be sure that borescope is disconnected before working with electrical components. Dangerous or possibly fatal voltage may be present.
- When light source is turned off, the light source unit remains hot and may cause a severe burn. Allow a minimum of 15 minutes for unit to cool.

CAUTION

Borescopes are delicate instruments. To avoid damaging borescope, handle all pieces carefully and return them to protective case when not in use.

a. Inspection of the engine using borescope kit 21C7190P01, 21C7744P01, or 21C7744P02 is done at the following three areas (see figure 1-95 **(T700)**) for borescope port locations):

(1) Compressor forward and aft areas (paras 1-177 using borescope 21C7190P01, or 1-185 using borescope 21C7744P01, or 1-188 using borescope 21C7744P02): At the compressor forward areas, inspect compressor flowpath coating, stage 1 compressor blades, and visible portions of inlet guide vanes through port no. 2. At the compressor aft areas, inspect compressor flowpath coating and compressor blades and vanes through port no. 3 or no. 5.

(2) Combustion section area (paras 1-178 using borescope 21C7190P01, or 1-186 using borescope 21C7744P01, or 1-189 using borescope 21C7744P02): combustion liner dome, inner shell, outer shell, and stage 1 turbine nozzle are inspected. View through ports no. 1, no. 4, or no. 7.

b. On installed engines, some ports cannot be reached due to mounting of QCA equipment. Do not remove QCA equipment to use such ports.

c. For engines installed on left side of aircraft, ports no. 3 and no. 7 cannot be used. Use port no. 5 instead of no. 3 and use port no. 4 instead of port no. 7. For engines on right side of aircraft, use port no. 3 instead of port no. 5, and use port no. 7 instead of port no. 4.

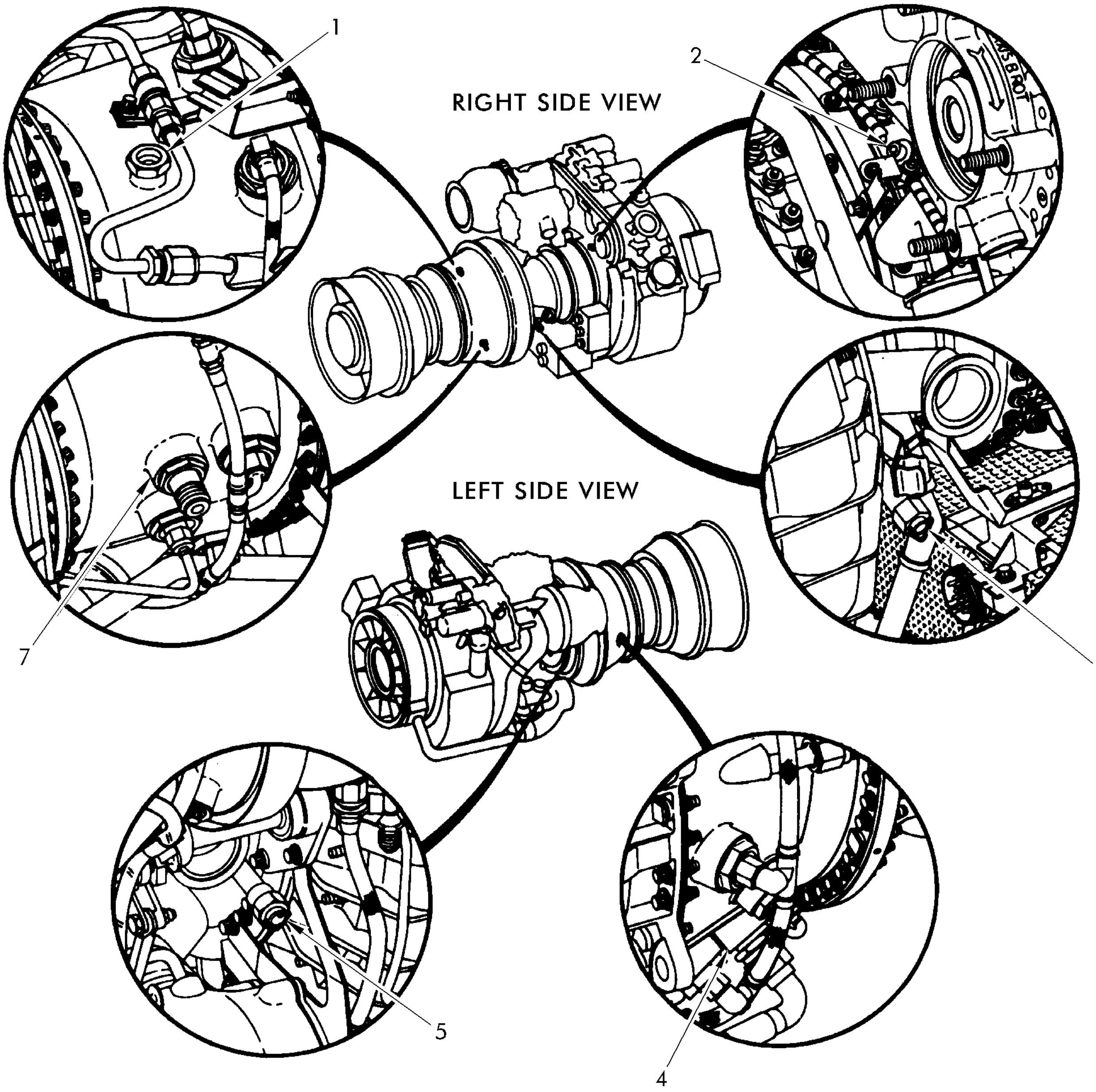
WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

d. Clean eyepiece, probe tip (lens), and end of light bundle using isopropyl alcohol (item 3, Appendix D).

e. Refer to paragraph 1-98 for instructions for hand-cranking the engine. One turn of the radial drive shaft assembly will rotate compressor rotor approximately 1-1/4 turns.



PORT NO.	LOCATION	INSPECTION
1	Midframe Casing, 12:30 O'Clock Position	Combustion Section
2	Main Frame, 1 O'Clock Position	Compressor Forward
3	Compressor Casing, 4 O'Clock Position	Compressor Aft
4	Igniter Port, 8 O'Clock Position	Combustion Section
5	Compressor Casing, 8 O'Clock Position	Compressor Aft
6	(Deleted)	
7	Igniter Port, 4 O'Clock Position	Combustion Section

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Figure 1-95. *(T700)* ***Borescope Port Locations***

1-174. (T701, T701C, T701D) Preliminary Borescope Information.

WARNING

Replacing Borescope Light Bulb

- Be sure that borescope is disconnected before working with electrical components. Dangerous or possibly fatal voltage may be present.
- When light source is turned off, the light source unit remains hot and may cause a severe burn. Allow a minimum of 15 minutes for unit to cool.

CAUTION

Borescopes are delicate instruments. To avoid damaging borescope, handle all pieces carefully and return them to protective case when not in use.

a. Inspection of the engine using borescope kit 21C7190P02 is done at the following three areas (see figure 1-96 for borescope port locations):

(1) Compressor forward and aft areas (para 1-180 using borescope 21C7190P02): At the compressor forward areas, inspect compressor flowpath coating, stage 1 compressor blades, and visible portions of inlet guide vanes through port no. 2. At the compressor aft areas, inspect compressor flowpath coating and compressor blades and vanes through port no. 3 or no. 5.

(2) Combustion section area (para 1-181 using borescope 21C7190P02): combustion liner dome, inner shell, outer shell, and stage 1 turbine nozzle are inspected. View through port no. 4 or no. 7.

b. On installed engines, some ports cannot be reached due to mounting of QCA equipment. Do not remove QCA equipment to use such ports.

c. For engines installed on left side of aircraft, ports no. 3 and no. 7 cannot be used. Use port no. 5 instead of no. 3 and use port no. 4 instead of port no. 7. For engines on right side of aircraft, use port no. 3 instead of port no. 5, and use port no. 7 instead of port no. 4.

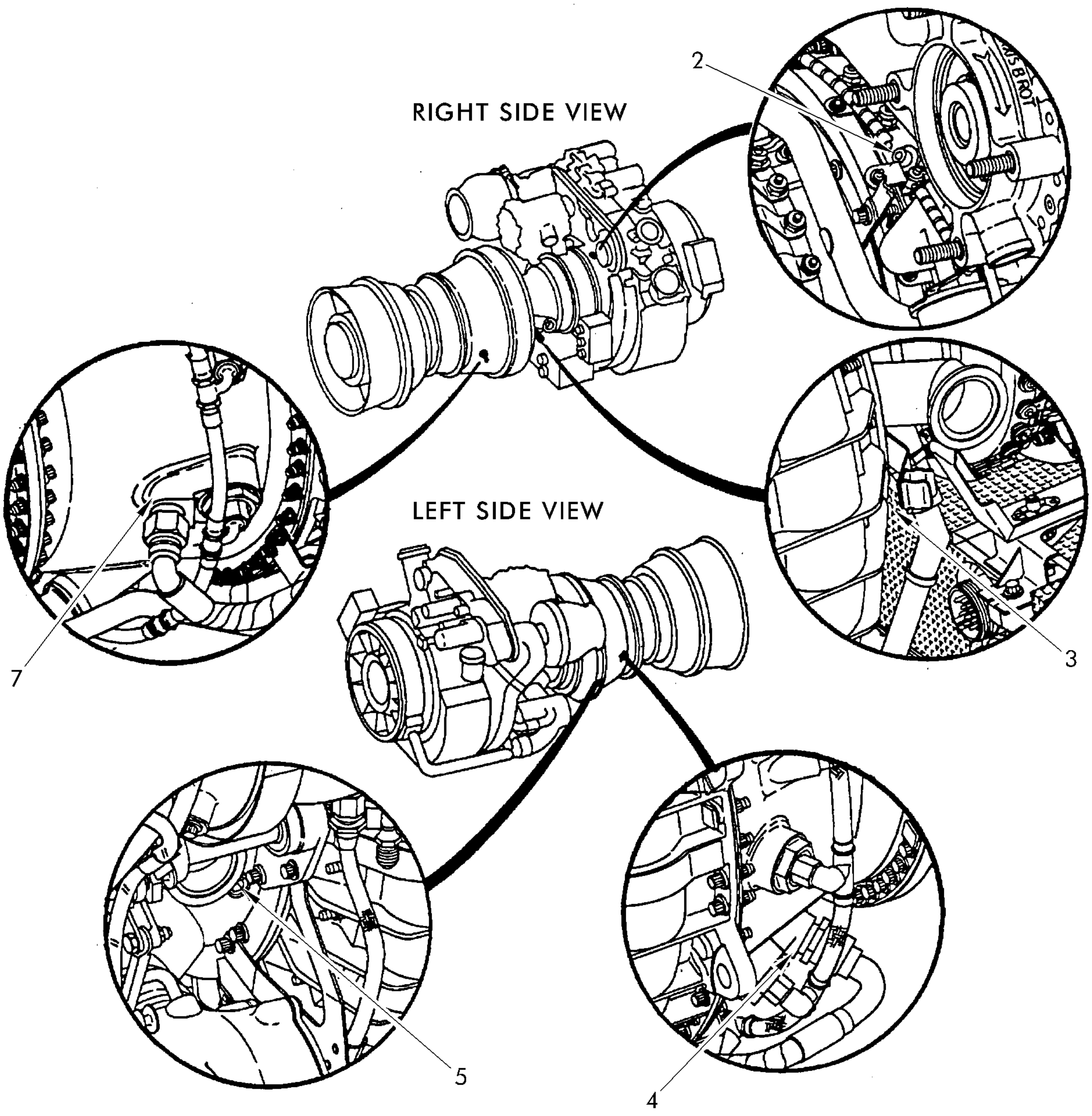
WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

d. Clean eyepiece, probe tip (lens), and end of light bundle using isopropyl alcohol (item 3, Appendix D).

e. Refer to paragraph 1-98 for instructions for hand-cranking the engine. One turn of the radial drive shaft assembly will rotate compressor rotor approximately 1-1/4 turns.



PORT NO.	LOCATION	INSPECTION
1	(Deleted)	
2	Main Frame, 1 O'Clock Position	Compressor Forward
3	Compressor Casing, 4 O'Clock Position	Compressor Aft
4	Igniter Port, 8 O'Clock Position	Combustion Section
5	Compressor Casing, 8 O'Clock Position	Compressor Aft
6	(Deleted)	
7	Igniter Port, 4 O'Clock Position	Combustion Section

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Figure 1-96. ***(T701, T701C, T701D)*** *Borescope Port Locations*

1-175. Preliminary Information.

WARNING

Replacing Borescope Light Bulb

- Be sure that borescope is disconnected before working with electrical components. Dangerous or possibly fatal voltage may be present.
- When light source is turned off, the light source unit remains hot and may cause a severe burn. Allow a minimum of 15 minutes for unit to cool.

CAUTION

Borescopes are delicate instruments. To avoid damaging borescope, handle all pieces carefully and return them to protective case when not in use.

a. Inspection of the engine using borescope kit 21C7700P03 or 21C7779P03 is done at the following areas (see figure 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)** for borescope port locations):

(1) Compressor forward and aft areas (paras 1-193 using borescope 21C7700P03 or 1-198 using borescope 21C7779P03): At the compressor forward areas, inspect compressor flowpath coating, stage 1 compressor blades, and visible portions of inlet guide vanes through port no. 2. At the compressor aft areas, inspect compressor flowpath coating and compressor blades and vanes through port no. 3 or no. 5.

(2) Combustion section area (para 1-194 using borescope 21C7700P03 or 1-199 using borescope 21C7779P03): combustion liner dome, inner shell, outer shell, and stage 1 turbine nozzle are inspected. View through port no. 1 **(T700)**, no. 4, or no. 7.

b. On installed engines, some ports cannot be reached due to mounting of QCA equipment. Do not remove QCA equipment to use such ports.

c. For engines installed on left side of aircraft, ports no. 3 and no. 7 cannot be used. Use port no. 5 instead of no. 3 and use port no. 4 instead of port no. 7. For engines on right side of aircraft, use port no. 3 instead of port no. 5, and use port no. 7 instead of port no. 4.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

d. Clean eyepiece, probe tip (lens), and end of light bundle using isopropyl alcohol (item 3, Appendix D).

e. Refer to paragraph 1-98 for instructions for hand-cranking the engine. One turn of the radial drive shaft assembly will rotate compressor rotor approximately 1-1/4 turns.

1-176. (T700) Light Supply Setup (21C7190P01).

a. Open borescope kit 21C7190P01 and pull down insert cover (1, fig. 1-89) with stored borescopes.

b. Turn light intensity control (6) completely counterclockwise.

CAUTION

Be sure that ON/OFF switch (7) is at OFF before connecting light supply (5) to power cord (9); otherwise, light supply (5) will be damaged.

NOTE

Adapter cable (4) is used to adapt the light supply (5) to the aircraft 115-volt, 400 Hz utility power receptacle (J257).

c. Connect one end of power cord (9) to light supply (5). Connect the other end of power cord (9) to either of the following:

- Aircraft 115 volt, 400Hz utility power receptacle (J257), using adapter cable (4).
- 115 volt, 60 to 400Hz power source.

1-177. (T700) Borescope Inspection of Compressor Forward and Aft Areas Using Borescope 21C7190P01. The instructions in this paragraph require the use of the right-angle rigid borescope (3, fig. 1-89). At the compressor forward area, borescope inspection of compressor flowpath coating, compressor rotor, stage 1 blades and inlet vanes is done through port no. 2 (fig. 1-97). See paragraphs 1-182 and 2-53 for inspection limits. At the compressor aft area, borescope inspection of compressor flowpath coating, compressor rotor, stage 5 blades and vanes is done through port no. 3 (fig. 1-95) for right-hand engine installations where the inboard port no. 5 is not accessible. For left-hand engine installation, use port no. 5. See paragraphs 1-190 and 2-53 for inspection limits.

a. Set up light supply (para 1-176).

b. Borescope-inspect compressor forward area as follows:

(1) Open the inlet guide vanes using an open-end wrench on flat of actuating shaft. Inlet guide vanes are open when hydromechanical unit (HMU) actuator rod is fully retracted.

(2) Connect one end of light carrier (2, fig. 1-89) to right-angle rigid borescope (3). Connect the other end of carrier (2) to light supply port (8).

(3) Remove borescope plug from port no. 2 (fig. 1-95) using 1/4-inch ratchet and extension. Inspect borescope plug (para 1-183).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine to avoid damaging borescope.

(4) Place ON/OFF switch (7, fig. 1-89) to either L1 or L2, and adjust light intensity control (6) to give best viewing. Insert borescope into port no. 2 (fig. 1-97).

(5) Position probe so that stage 1 blades and flowpath coating can be seen through inlet guide vanes (fig. 1-97). Light carrier should be pointing towards front of engine.

(6) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect all stage 1 blades (there are 20 of them) and flowpath coating. Move probe in and out, so that entire length of blade can be seen. Look closely at leading edge and tips of blades. To provide a reference for determining size of tears or nicks in blades, compare depth of crack or tear to distance from the forward edge of stage 1 disk to the edge of fillet radius of leading edge of blade (which is 1/16 inch (or 2/32-inch)) (fig. 1-98).

(7) Rotate probe and inspect all visible inlet guide vanes. Move probe in and out to inspect as many inlet guide vanes as possible.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (6, fig. 1-89) counterclockwise, and place ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope plug with antiseize thread compound or synthetic graphite grease GP460 (antiseize) (MIL-T-5544) (item 56, Appendix D) and reinstall plug in port no. 2 (fig. 1-95) using a 1/4-inch ratchet and extension. Torque plug to 90-110 inch-pounds.

(10) Reinstall radial drive shaft cover assembly, retaining ring, and cover boot (para 5-36).

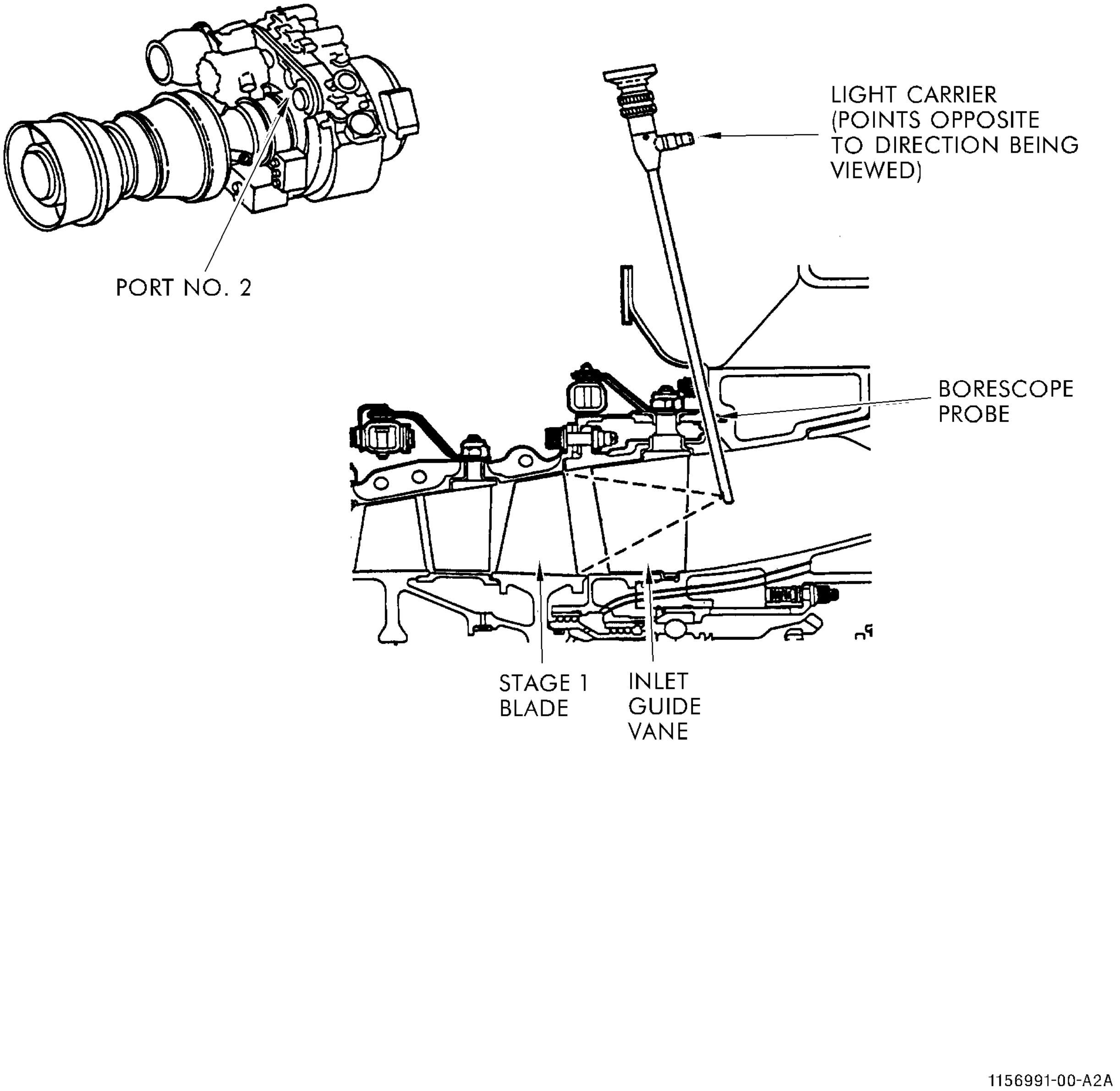
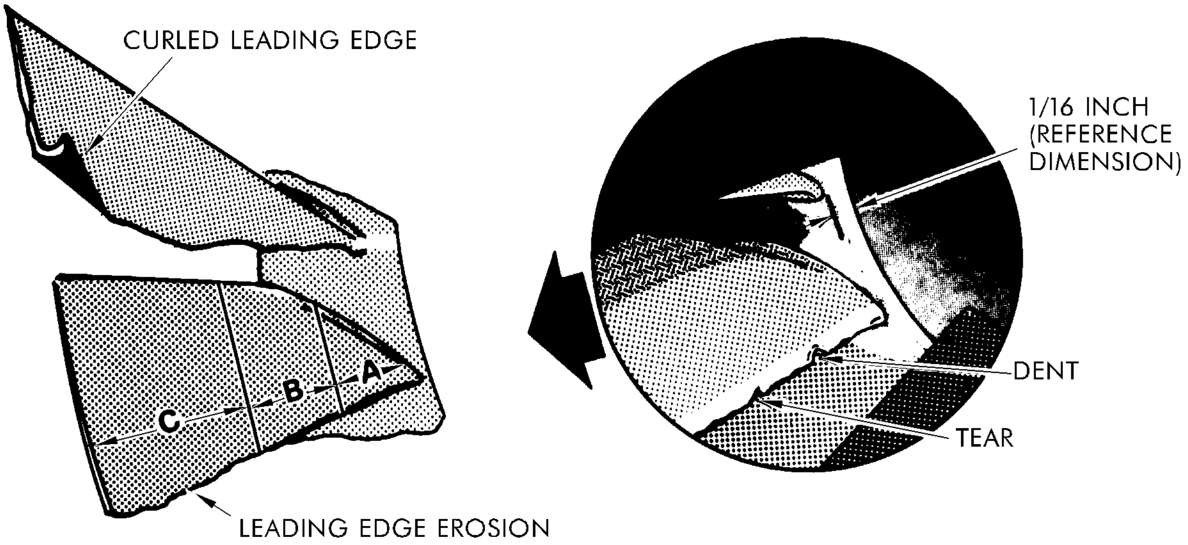
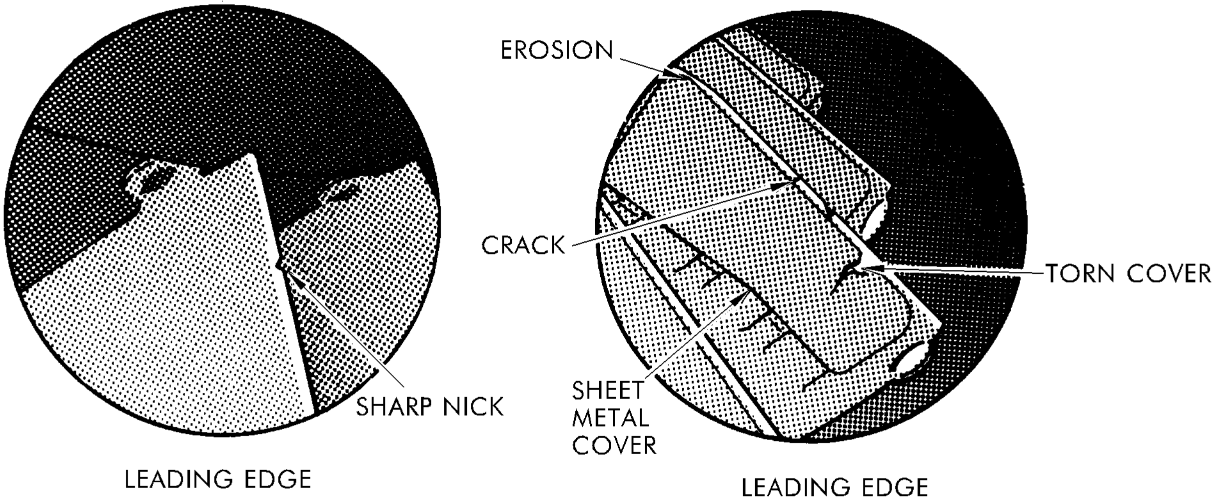


Figure 1-97. Compressor Forward Area (Port No. 2); Borescope Inspection



A = INNER 25% OF AIRFOIL LEADING EDGE
B = MIDDLE 25% OF AIRFOIL LEADING EDGE
C = OUTER 50% OF AIRFOIL LEADING EDGE

STAGE 1 BLADES
VIEW A



INLET GUIDE VANES
VIEW B

1156992-00-A2A

Figure 1-98. Compressor Rotor Stage 1 Blades and Inlet Guide Vanes (Main Frame Port); Borescope Inspection

c. Borescope-inspect compressor aft area as follows:

(1) For engines that have caps at borescope port no. 3 or no. 5 (fig. 1-95), remove cap from port using a 5/8-inch wrench. For engines that have borescope plugs at borescope port no. 3 or no. 5, remove plug from port using a 1/4-inch ratchet and extension. Inspect cap or plug (para 1-191).

CAUTION

- Allow internal components of engine to cool at 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(2) Move ON/OFF switch (7, fig. 1-89) to either L1 or L2 and adjust light intensity control (6) for best viewing. Insert borescope into port no. 3 or no. 5 (fig. 1-95).

(3) Position borescope probe so that stage 5 blades and compressor flowpath coating can be seen through space between stage 5 vanes (fig. 1-99, view A). Light carrier (2, fig. 1-89) should be pointing to aft end of engine.

(4) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect all 32 stage 5 blades and compressor flowpath coating. Move borescope probe in and out of port to view entire length of blade and flowpath coating.

(5) Inspect all visible stage 5 vanes and compressor flowpath coating. Move borescope in and out of port to inspect as many vanes as possible.

(6) Position borescope probe so that impeller vanes can be seen (fig. 1-99, view B). Light carrier should be pointing toward front of engine.

(7) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect all impeller vanes for damage.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (6, fig. 1-89) counterclockwise, and place ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope caps or plugs with antiseize thread compound (MIL-T-5544) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D).

(10) For engines that have caps, install cap in port no. 3 or no. 5 (fig. 1-95). Torque cap to 100-125 inch-pounds. For engines that have borescope plugs, install plug in port no. 3 or no. 5. Torque plug to 55-70 inch-pounds.

d. If borescope inspection of engine is completed, do the following:

(1) Disconnect light carrier (2, fig. 1-89) from light supply port (8) and borescope (3). Place borescope (3) and carrier (2) in insert cover (1).

(2) Unplug power cord (9) from light supply (5) and from either aircraft utility power receptacle, or from alternate power source.

(3) Disconnect adapter cable (4) from power cord (9). Place cable (4) in insert cover (1) and place cord (9) in bottom half of borescope kit.

1-178. (T700) Borescope Inspection of Combustion Section Area Using Borescope 21C7190P01. The instructions in this paragraph require the use of right-angle rigid borescope (3, fig. 1-89) and retrospective rigid borescope (10). Use both right-angle rigid and retrospective rigid borescopes (3, 10), as necessary, to inspect all areas named. Borescope inspection of combustion liner and stage 1 turbine nozzle vanes is done through inspection port no. 1, no. 4, or no. 7 (fig. 1-95), located on the midframe. See paragraph 1-195 for inspection limits.

a. Set up light supply (para 1-176).

b. Connect one end of light carrier (2, fig. 1-89) to borescope (3 or 10), as necessary. Connect the other end of carrier (2) to light supply port (8).

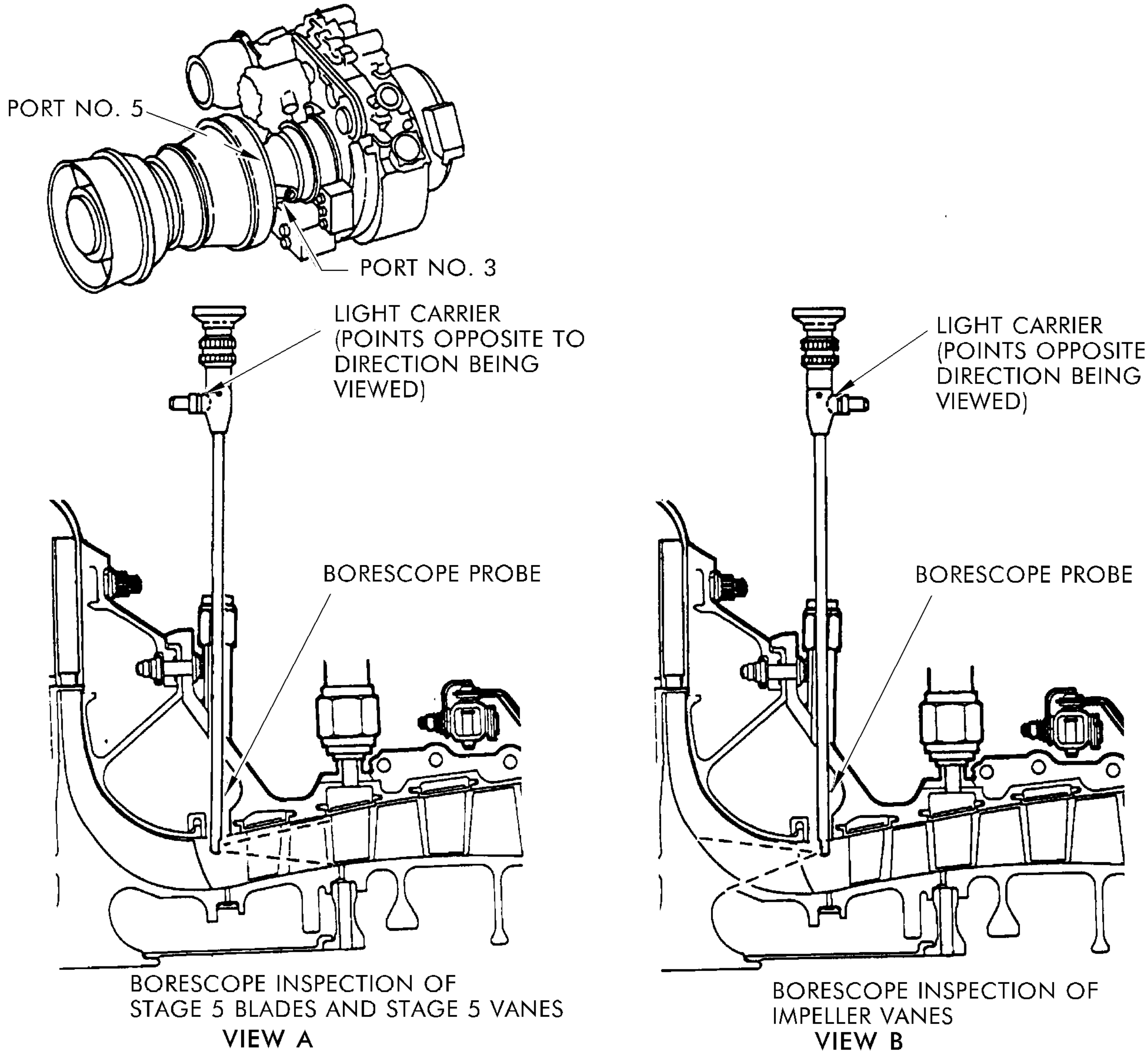


Figure 1-99. Compressor Aft Area (Port No. 3 or Port No. 5); Borescope Inspection

WARNING

Fluorescent Dye Penetrant

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged inhalation of vapor can result in dizziness, drowsiness, headache, and nausea.
- After any prolonged contact with skin, wash contacted area with soap and water. Remove oil-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When applying liquid by brush or aerosol spray at unexhausted workbench, wear approved respirator and goggles.

c. Remove borescope plug from port no. 1. If plug is too tight, apply Zyglo penetrant (item 91, Appendix D) to plug to avoid possible damage to midframe casing. Inspect borescope plug (para 1-196).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

d. Place ON/OFF switch (7) to either L1 or L2, and adjust light intensity control (6) to give best viewing.

e. Insert borescope probe carefully into port no. 1 (fig. 1-95). Insert probe through hole in combustion liner so that stage 1 nozzle can be seen. Light carrier should be pointing to front of engine (fig. 1-100). Rotate and move probe in and out to inspect as many nozzle vanes as possible (para 1-195).

f. Adjust depth of probe, and inspect areas around igniter and primer nozzles.

g. Adjust depth of probe until outer shell can be seen.

h. Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

i. Adjust depths of probe until inner shell can be seen.

j. Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

k. When inspection is completed, carefully remove borescope probe from port no. 1.

l. Apply antiseize thread compound (MIL-T-5544) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) to threads and contacting surfaces of borescope plug and casing.

m. Install borescope plug in port no. 1. Tighten (15° wrench arc) plug.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

n. Disconnect ignition lead from igniter plug at port no. 4 or port no. 7. Remove nut and igniter plug (para 7-5).

o. Insert probe into port no. 4 or no. 7 (fig. 1-95). Light carrier should be pointing to front of engine (fig. 1-101, view A). Rotate and move probe in and out to permit inspection of as many nozzle vanes as possible.

p. Rotate probe and inspect combustion liner. Light carrier should be pointing to rear of engine (view B). Adjust depth of probe, and inspect areas around dome, swirlers, and fuel injectors.

q. Repeat steps f thru j.

r. When inspection is completed, carefully remove borescope probe. Then turn light intensity control (6, fig. 1-89) counterclockwise, and place ON/OFF switch (7) to OFF.

s. Install igniter plug (para 7-9) at port no. 4 or no. 7 (fig. 1-95).

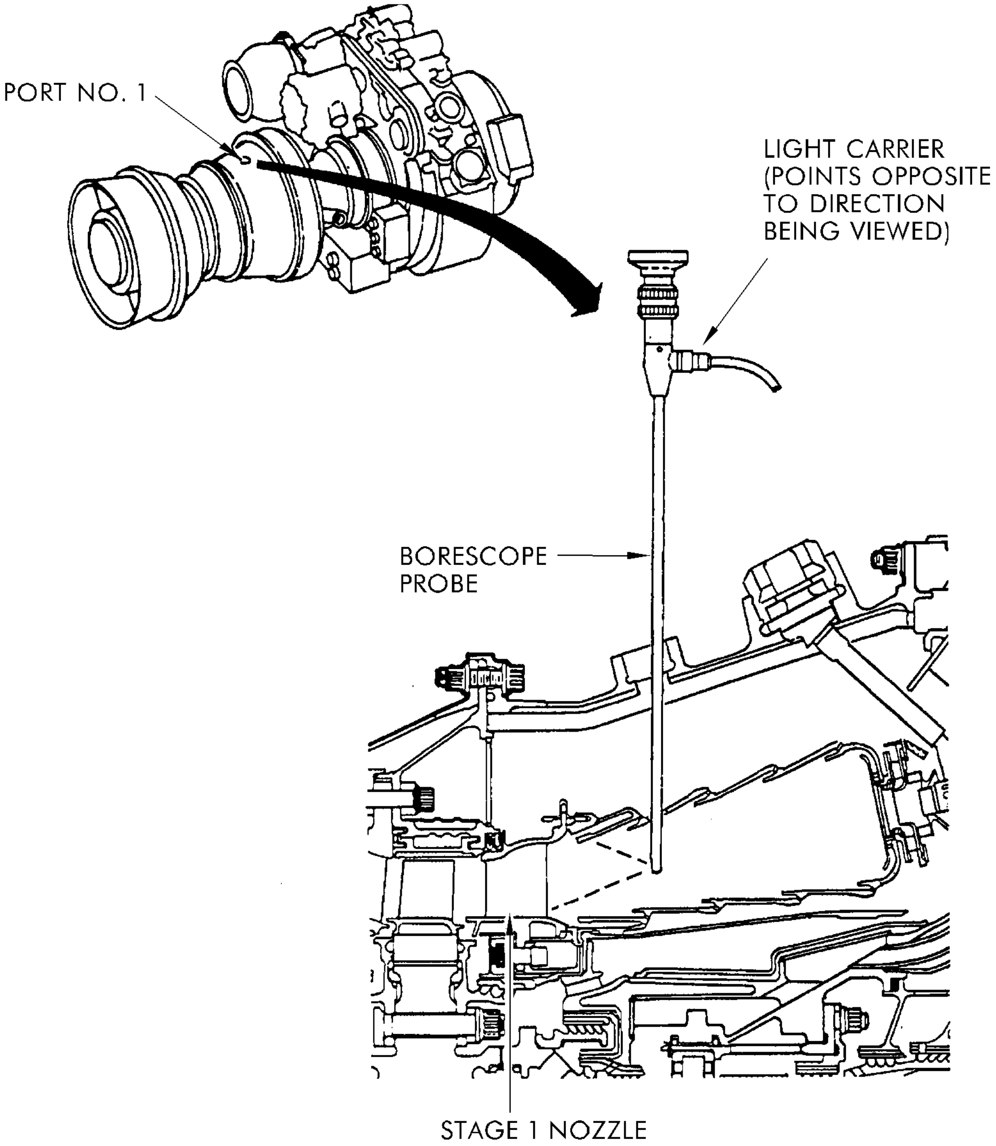


Figure 1-100. (T700) ***Combustion Section (Port No. 1); Borescope Inspection***

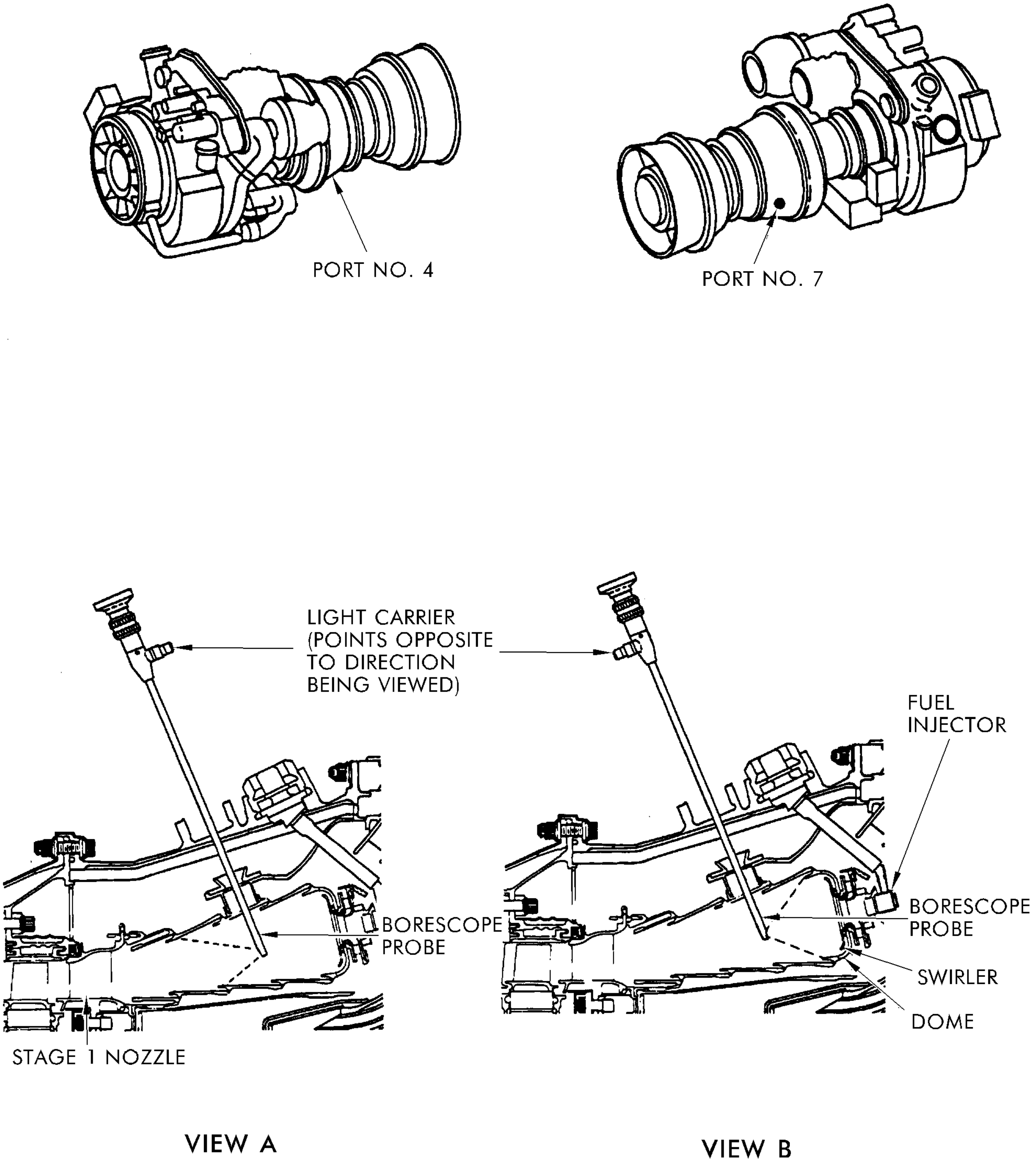


Figure 1-101. Combustion Section (Port No. 4 or Port No. 7); Borescope Inspection

t. Disconnect carrier (2, fig. 1-89) from light supply port (8) and borescope (3 or 10). Place borescope (3 or 10) and carrier (2) in insert cover (1).

u. Unplug power cord (9) from light supply (5) and from either aircraft utility receptacle, or from alternate power source.

v. Disconnect adapter cable (4) from power cord (9). Place cable (4) in insert cover (1) and place cord (9) in bottom half of borescope kit.

1-179. (T701, T701C, T701D) Light Source Supply Setup (21C7190P02).

a. Open borescope kit 21C7190P02 and pull down insert cover (1, fig. 1-90) with stored borescopes.

b. Turn light intensity control (8) completely counterclockwise.

CAUTION

> Be sure that ON/OFF switch (7) is at OFF before connecting light supply (10) to power cord (6); otherwise, light supply (10) will be damaged.

NOTE

> Adapter cable (2) is used to adapt the light supply power cord (6) to the aircraft 115-volt, 400 Hz utility power receptacle (J14E).

c. Connect one end of power cord (6) to light supply (10). Connect the other end of power cord (6) to either of the following:

- Aircraft 115 volt, 400 Hz utility power receptacle (J14E), using adapter cable (2).
- 115 volt, 60 to 400 Hz power source.

1-180. (T701, T701C, T701D) Borescope Inspection of Compressor Forward and Aft Areas Using Borescope 21C7190P02. The instructions in this paragraph require the use of the right-angle rigid borescopes (11, 12, fig. 1-90). Use the right-angle borescopes and the retrospective rigid borescope (5), as necessary, to inspect all areas named.

At the compressor forward area, borescope inspection of compressor flowpath coating, compressor rotor, stage 1 blades and inlet vanes is done through port no. 2 (fig. 1-97). See paragraphs 1-182 and 2-53 for inspection limits. At the compressor aft area, borescope inspection of compressor flowpath coating, compressor rotor, stage 5 blades and vanes is done through port no. 3 (fig. 1-99) for right-hand engine installation where the inboard port no. 5 is not accessible. For left-hand engine installation, use port no. 5. See paragraph 1-190 and 2-53 for inspection limits.

a. Set up light supply (para 1-179).

b. Borescope-inspect compressor forward area as follows:

(1) Open the inlet guide vanes using an open-end wrench on flat of actuating shaft. Inlet guide vanes are open when hydromechanical unit (HMU) actuator rod is fully retracted.

(2) Connect one end of light carrier (3, fig. 1-90) to borescope (5, 11, or 12). Connect the other end of carrier (3) to light supply port (9).

(3) Remove borescope plug from port no. 2 (fig. 1-96) using a 1/4 inch ratchet and extension. Inspect borescope plug (para 1-183).

CAUTION

> - Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
> - Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(4) Place ON/OFF switch (7, fig. 1-90) to either L1 or L2, and adjust light intensity control (8) to give best viewing. Insert borescope into port no. 2 (fig. 1-97).

(5) Position probe so that stage 1 blades can be seen through inlet guide vanes (fig. 1-97). Light carrier should be pointing towards front of engine.

(6) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect all stage 1 blades (there are 20 of them) and compressor flowpath coating. Move probe in and out, so that entire length of blade can be seen. Look closely at leading edge and tips of blades. To provide a reference for determining size of tears or nicks in blades, compare depth of crack or tear to distance from the forward edge of stage 1

disk to the edge of fillet radius of leading edge of blade (which is 1/16 inch or 2/32 inch) (fig. 1-98).

(7) Rotate probe and inspect all visible inlet guide vanes and compressor flowpath coating. Move probe in and out to inspect as many inlet guide vanes as possible.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (8, fig. 1-90) counterclockwise, and place ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) and reinstall plug in port no. 2 (fig. 1-96) using a 1/4 inch ratchet and extension. Torque plug to 90-110 inch-pounds.

(10) Reinstall radial drive shaft cover assembly, retaining ring, and cover boot (para 5-36).

c. Borescope-inspect compressor aft area as follows:

(1) Remove borescope plug from port no. 3 or no. 5 using a 1/4 inch ratchet and extension. Inspect plug (para 1-191).

CAUTION

- Allow internal components of engine to cool to 100° (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(2) Place ON/OFF switch (7, fig. 1-90) to either L1 or L2 and adjust light intensity control (8) for best viewing. Insert borescope into port no. 3 or no. 5 (fig. 1-96).

(3) Position borescope probe so that stage 5 blades and compressor flowpath coating can be seen through space between stage 5 vanes (fig. 1-99, view A). Light carrier (3, fig. 1-90) should be pointing to aft end of engine.

(4) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect all 32 stage 5 blades and compressor flowpath coating. Move borescope probe in and out of port to view entire length of blade and flowpath coating.

(5) Inspect all visible stage 5 vanes and compressor flowpath coating. Move borescope in and out of port to inspect as many of the vanes as possible.

(6) Position borescope probe so that impeller vanes can be seen (fig. 1-99, view B). Light carrier should be pointing toward front of engine.

(7) Slowly rotate by hand-cranking engine (para 1-98). Inspect all impeller vanes for damage.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (8, fig. 1-90) counterclockwise, and place ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D).

(10) Install borescope plug in port no. 3 or no. 5. Torque plug to 55-70 inch-pounds.

d. If borescope inspection of engine is completed, do the following:

(1) Disconnect light carrier from borescope (5, 11, or 12) and from light supply port (9). Place borescope (5, 11, or 12) and carrier in insert cover (1).

(2) Unplug power cord (6) from light supply (10) and from either aircraft utility power receptacle, or from alternate power source.

(3) Disconnect adapter cable (2) from power cord (6). Place cable (2) in insert cover (1) and place cord (6) in bottom half of borescope kit.

1-181. (T701, T701C, T701D) Borescope Inspection of Combustion Section Area Using Borescope 21C7190P02. The instructions in this paragraph require the use of right-angle borescopes (11, 12, fig. 1-90) and retrospective rigid borescope (5). Use right-angle rigid and retrospective rigid borescopes (5, 11, 12), as well as right-angle extension (4) as necessary, to inspect all areas named. Borescope inspection of combustion liner and stage 1 turbine nozzle vanes is done through the following inspection ports no. 4 and no. 7 (fig. 1-96), located on midframe. See paragraph 1-195 for inspection limits.

a. Set up light supply (para 1-179).

NOTE

Installed engines may require the use of the right-angle extension (4, fig. 1-90) and short right-angle rigid borescope (12) to permit proper viewing.

b. Connect one end of light carrier (3) to borescope (5, 11, or 12), as necessary. Connect the other end of carrier (3) to light supply port (9). For engines installed on aircraft, connect right-angle extension (4) to borescope (12).

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

c. Disconnect ignition lead from igniter plug at port no. 4 or port no. 7. Remove nut and igniter plug.

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

d. Place ON/OFF switch (7) to either L1 or L2, and adjust light intensity control (8) to give best viewing.

e. Insert probe into port no. 4 or no. 7 (fig. 1-96). Light carrier should be pointing to front of engine (fig. 1-101, view A). Rotate and move probe in and out to inspect as many nozzle vanes as possible (para 1-195).

f. Rotate probe and inspect combustion liner. Light carrier should be pointing to rear of engine (view B). Adjust depth of probe, and inspect areas around dome, swirlers, and fuel injectors.

g. Adjust depth of probe, and inspect area around igniter.

h. Adjust depth of probe until outer shell can be seen.

i. Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

j. Adjust depth of probe until inner shell can be seen.

k. Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

l. When inspection is completed, carefully remove borescope probe. Then turn light intensity control (8, fig. 1-90) counterclockwise, and place ON/OFF switch (7) to OFF.

m. Install igniter plug (para 7-10) at port no. 4 or no. 7 (fig. 1-96).

n. Disconnect carrier (3, fig. 1-90) from light supply port (9) and borescope (5, 11, or 12). If extension (4) was used, disconnect it from borescope (12). Place borescope (5, 11, or 12), extension (4), and carrier (3) in insert cover (1).

o. Unplug power cord (6) from light supply (10) and from either aircraft utility receptacle, or from alternate power source.

p. Disconnect adapter cable (2) from power cord (6). Place cable (2) in insert cover (1) and place cord (6) in bottom half of borescope kit.

1-182. Inspection of Compressor Rotor, Stage 1 Blades, Inlet Guide Vanes, and Areas Forward of Compressor.

See table 1-29.

Table 1-29. Inspection of Compressor Rotor, Stage 1 Blades, Inlet Guide Vanes, and Areas Forward of Compressor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
NOTE Blended blades and vanes are common in engines returned to service from overhaul.			
a. Blades (fig. 1-98) for:			
(1) Dents and bends.	Smooth minor deformation allowed.	AVUM: Not repairable. AVIM: Replace cold section module.	AVUM: Replace engine.
(2) Cracks.	None allowed.	AVUM: Not repairable. AVIM: Replace cold section module.	AVUM: Replace engine.
(3) Erosion and associated tears and nicks.	Any amount, unless there is an unacceptable loss in engine performance. Refer to maximum power check (para 1-145 **(T700)**, 1-146 **(T701, T701C, T701D AH-64A)**, or 1-147 **(T701C, T701D UH-60L)**).	AVUM: Not repairable. AVIM: Any amount as long as engine passes the maximum power check (para 1-145 **(T700)**, 1-146 **(T701, T701C, T701D AH-64A)**, or 1-147 **(T701C, T701D UH-60L)**), or performance evaluation test (para 1-238 **(T700)**, 1-241 **(T701, T701C, T701D)**) after blending.	AVUM: Replace engine. AVIM: Blend and recontour leading edges of stage 1 blades (para 2-5) or replace cold section module.
(4) Tears and nicks not associated with erosion.	None allowed on inner 25% of airfoil leading edge (area A, (fig. 1-98). Any number, 1/16-inch deep over the middle 25%-50% of airfoil leading edge (area B). Any number, 1/8-inch deep on outer 50% of airfoil leading edge (area C).	AVUM: Not repairable. AVIM: Any amount as long as minimum chord lengths are maintained after blending. See paragraph 2-5.	AVUM: Replace engine. AVIM: Blend and recontour leading edges of stage 1 blades (para 2-5) or replace cold section module.
(5) Curled leading edges resulting from FOD.	Up to 25% of airfoil leading edge at tip may be curled (fig. 1-98, view A).	AVUM: Not repairable. AVIM: Damage to four damaged blades and four blades that are directly 180° opposite them, whether they are damaged or not damaged. A total of eight blades can be repaired.	AVUM: Replace engine. AVIM: Repair leading edge of stage 1 blade (para 2-6) or replace cold section module.
b. Inlet guide vane airfoils for:			

Table 1-29. Inspection of Compressor Rotor, Stage 1 Blades, Inlet Guide Vanes, and Areas Forward of Compressor (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(1) Cracks and torn metal except in sheet metal cover.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Cracks in sheet metal cover.	Any number, any length, with no pieces in danger of breaking out.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(3) Torn or missing metal in sheet metal cover.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(4) Nicks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(5) Dents and bends.	Smooth minor deformation allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(6) Erosion.	Any amount, unless there is an unacceptable loss in engine performance.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
c. Mainframe flowpath and IGV support for rubs or scrapes caused by movement of IGV.	Any amount without high metal, provided engine performance is acceptable.	Same as usable limits with high metal.	AVUM: Replace engine. AVIM: Remove case half (para 2-5) and blend high metal or replace cold section module.
d. Compressor rotor flowpath coating for:			
(1) Rub marks and grooves.	Any amount, provided engine performance is acceptable, and grooves or wear do not penetrate into parent metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Delamination, flaking, or loose material.	Any amount, provided engine performance is acceptable.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

NOTE

When removing coating material from blades or vanes, be careful not to round out or damage the edges of blade or vane tips.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
e. Blades and vanes for coating material.	Any amount, provided engine performance is acceptable.	Same as usable limits, provided engine performance can be restored to acceptable limits.	AVUM: Replace engine. AVIM: Remove case half (para 2-5) and blend high metal or replace cold section module.

1-183. Inspection of Main Frame Borescope Plug. See table 1-30.

Table 1-30. Inspection of Main Frame Borescope Plug

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Plug (fig. 1-102) for:			
a. Cracks.	None allowed.	Not repairable.	Replace plug.
b. Missing or damaged threads.	Not allowed.	Not repairable.	Replace plug.
c. Wrench damage in each corner of square drive sockets.	Any amount, without high metal, if plug can be installed properly.	Not repairable.	Replace plug.
d. Discoloration.	Any amount.	Not applicable.	Not applicable.
e. Nicks and scratches, except on threads.	Any number.	Not applicable.	Not applicable.

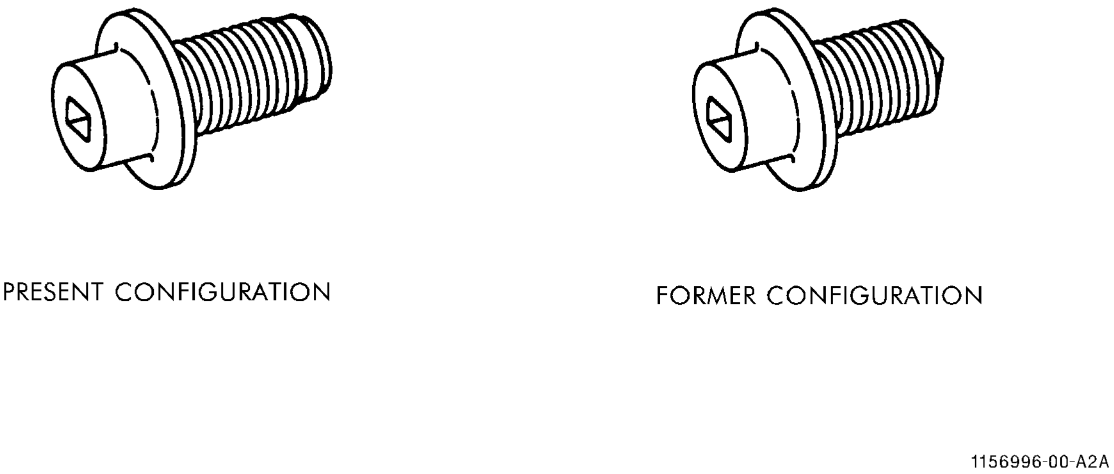


Figure 1-102. Main Frame Borescope Plug; Inspection

1-184. (T700) Light Source Setup (21C7744P01).

a. Open borescope kit 21C7744P01 and pull down insert cover (1, fig. 1-91) containing stored borescopes.

b. Be sure that power switch (11) is at “0” position and that light intensity control (12) is completely counterclockwise.

NOTE

Power cable assembly adapter (2) is used to adapt the power cable (9) to the aircraft 115-volt, 400 Hz utility power receptacle (J257).

c. Connect power cable (9) to either of the following:

- Aircraft 115-volt, 400 Hz utility power receptacle (J257), using power cable assembly adapter (2).
- 115 or 230-volt, 50 to 400 Hz power source.

1-185. (T700) Borescope Inspection of Compressor Forward and Aft Areas Using Borescope 21C7744P01. The instructions in this paragraph require the use of right-angle rigid borescope (6, fig. 1-91). At the compressor forward area, borescope inspection of compressor flowpath coating, compressor rotor, stage 1 blades and inlet guide vanes is done through port no. 2 (fig. 1-95). See paragraph 1-182 and 2-53 for inspection limits. At the compressor aft area, borescope inspection of compressor flowpath coating, compressor rotor, stage 5 blades, stage 5 vanes, and impeller vanes is done through port no. 3 (fig. 1-95) for right-hand engine installation where inboard port no. 5 is not accessible. For left-hand engine installation, use port no. 5. See paragraphs 1-190 and 2-53 for inspection limits.

a. Set up light source (para 1-184).

b. Borescope-inspect compressor forward area as follows:

(1) For a better view of stage 1 blades, open the inlet guide vanes using an open-end wrench on flats of actuating shaft. Inlet guide vanes are open when hydromechanical control unit (HMU) actuator rod is fully retracted.

(2) Connect metal clad light carrier (4, fig. 1-91) to light source (7) and to right-angle rigid borescope (6) as follows:

(a) Plug connector (3) of carrier (4) into light input guide (8) L1 or L2.

(b) Place light guide selector switch (10) to L1 if connector is inserted into input L1, or place light guide selector switch to L2 if connector is inserted into input L2.

(c) Connect other end of light carrier (4) to right-angle rigid borescope (6).

(3) Remove borescope plug from port no. 2 (fig. 1-95), using a 1/4-inch ratchet and extension. Inspect borescope plug (para 1-183).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(4) Push power switch (11, fig. 1-91) to “1” position, and adjust light intensity control (12) to give best viewing. Insert borescope into port no. 2 (fig. 1-97).

(5) Position borescope probe so that stage 1 blades can be seen through space between inlet guide vanes (fig. 1-97). Light carrier should be pointing opposite direction being viewed.

(6) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). One turn of the radial drive shaft assembly will rotate compressor rotor about 1-1/4 turns. Inspect all stage 1 blades (there are 20 of them) and compressor flowpath coating. Move probe in and out, so that entire length of blade can be seen. Look closely at leading edge and tips of blades. To provide a reference for determining size of tears or nicks in blades, compare depth of tear or nick to distance from forward edge of stage 1 disk to the edge of fillet radius of leading edge of blade (which is 1/16 inch) (fig. 1-98).

(7) Inspect all visible inlet guide vanes and compressor flowpath coating. Move probe in and out to inspect as many inlet guide vanes as possible.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (12, fig. 1-91) counterclockwise, and push power switch (11) to “0” position.

(9) Lightly coat threads of borescope plug with antiseize thread compound (MIL-T-5544) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) and reinstall plug in port no. 2 (fig. 1-95), using a 1/4 inch ratchet and extension. Torque plug to 90-110 inch pounds.

(10) Reinstall radial drive shaft cover assembly, retaining ring, and cover boot (para 5-36).

c. Borescope-inspect compressor aft area as follows:

(1) For engines that have caps at borescope port no. 3 or no. 5 (fig. 1-95), remove cap from port using a 5/8-inch wrench. For engines that have borescope plugs at borescope port no. 3 or no. 5, remove plug from port using a 1/4 inch ratchet and extension. Inspect cap or plug (para 1-191).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(2) Push power switch (11, fig. 1-91) to “1” position, and adjust light intensity control (12) to give best viewing. Insert borescope into port no. 3 or port no. 5 (fig. 1-95).

(3) Position borescope probe so that stage 5 blades and compressor flowpath coating can be seen through space between stage 5 vanes (fig. 1-99, view A). Light carrier should be pointing opposite direction being viewed.

(4) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). One turn of the radial drive shaft assembly will rotate compressor rotor about 1-1/4 turns. Inspect all 32 stage 5 blades and compressor flowpath coating. Move probe in and out of port to view entire length of blade.

(5) Inspect all visible stage 5 vanes and compressor flowpath coating. Move probe in or out of port to inspect as many vanes as possible.

(6) Position borescope probe so that impeller vanes can be seen (view B). Light carrier should be pointing opposite direction being viewed.

(7) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). Inspect all impeller vanes for damage.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (12, fig. 1-91) counterclockwise, and push power switch (11) to “0” position.

(9) Lightly coat threads of borescope plug with antiseize thread compound (MIL-T-5544) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D).

(10) For engines that have caps, install cap in port no. 3 or no. 5 (fig. 1-95). Torque cap to 100-125 inch-pounds. For engines that have borescope plugs, install plug in port no. 3 or no. 5. Torque plug to 55-70 inch-pounds.

d. If borescope inspection of engine is completed, do the following:

(1) Disconnect light carrier (4, fig. 1-91) from light source (7) and from borescope (6). Place borescope (6) and carrier (4) in insert cover (1).

(2) Unplug power cable (9) from either aircraft utility power receptacle or from alternate power source.

(3) Disconnect adapter (2) from power cable (9). Place adapter (2) in insert cover (1) and place cable (9) in bottom half of borescope kit.

1-186. (T700) Borescope Inspection of Combustion Section Area Using Borescope 21C7744P01. The instructions in this paragraph require the use of right-angle rigid borescope (6, fig. 1-91) or retrospective rigid borescope (5). Borescope inspection of combustion liner and stage 1 turbine nozzle vanes is done through port no. 1, no. 4, or no. 7 located on midframe (fig. 1-95). See paragraph 1-195 for inspection limits.

a. Set up light source (para 1-184).

b. Connect light carrier (4, fig. 1-91) to light source (9) and to borescope (5 or 6) as follows:

(1) Plug connector (3) into light input guide (8) L1 or L2.

(2) Place light guide selector switch (10) to L1 if connector is inserted into input L1, or place light guide selector switch to L2 if connector is inserted into input L2.

(3) Connect other end of light carrier (4) to borescope.

WARNING

Fluorescent Dye Penetrant

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged inhalation of vapor can result in dizziness, drowsiness, headache, and nausea.
- After any prolonged contact with skin, wash contacted area with soap and water. Remove oil-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When applying liquid by brush or aerosol spray at unexhausted workbench, wear approved respirator and goggles.

c. Remove borescope plug from port no. 1. If plug is too tight, apply Zyglo penetrant (item 91, Appendix D) to plug to avoid possible damage to midframe casing. Inspect borescope plug (para 1-196).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

d. Push power switch (11) to “1” position, and adjust light intensity control (12) to give best viewing.

e. Insert borescope probe carefully into port no. 1 (fig. 1-95). Insert probe through hole in combustion liner so that stage 1 nozzle can be seen. Light carrier should be pointing opposite direction being viewed (fig. 1-100). Rotate and move probe in and out to inspect as many nozzle vanes as possible.

f. Adjust depth of probe, and inspect areas around igniter-plug.

g. Adjust depth of probe until outer shell of combustion liner can be seen.

h. Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

i. Adjust depth of probe until inner shell of combustion liner can be seen.

j. Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

k. When inspection is completed, carefully remove borescope probe from port no. 1.

l. Apply antiseize thread compound MIL-T-5544 or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) to threads and contacting surfaces of borescope plug and casing.

m. Install borescope plug in port no. 1. Tighten (15° wrench arc) plug.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

n. Disconnect ignition lead from igniter plug at port no. 4 or port no. 7. Remove nut and igniter plug (para 7-5).

o. Insert probe into port no. 4 or no. 7 (fig. 1-95). Light carrier should be pointing to front of engine (fig. 1-101, view A). Rotate and move probe in and out to inspect as many nozzle vanes as possible.

p. Rotate probe and inspect combustion liner. Light carrier should be pointing opposite direction being viewed (view B). Adjust depth of probe, and inspect areas around dome, swirlers, and fuel injectors.

q. Repeat steps f thru j.

r. When inspection is complete, carefully remove borescope probe. Then turn light intensity control (12, fig. 1-91) counterclockwise, and push power switch (11) to “0” position.

s. Reinstall igniter plug (para 7-9) at port no. 4 or port no. 7 (fig. 1-95).

t. Disconnect carrier (4, fig. 1-91) from borescope (5 or 6) and from light source (7). Place borescope (5 or 6) and carrier (4) in insert cover (1).

u. Unplug power cable (9) from either aircraft utility power receptacle or from alternate power source.

v. Disconnect adapter (2) from cable (9). Place cable (9) in bottom half of borescope kit.

1-187. Light Source Setup (21C7744P02 (T700) or 21C7744P03).

a. Open borescope kit 21C7744P02 or 21C7744P03 and pull down insert cover (1, fig. 1-92) containing stored borescopes.

b. Be sure that power switch (14) is at “0” position and that light intensity control (15) is completely counterclockwise.

NOTE

Power cable assembly adapter (2) **(T700)** or (19) **(T701, T701C, T701D)** is used to adapt the power cable (12) to the aircraft 115-volt, 400 Hz utility power receptacle J257 **(T700)** or J14E **(T701, T701C, T701D)**.

c. Connect power cable (12) to either of the following:

- Aircraft 115-volt, 400 Hz utility power receptacle J257 **(T700)** or J14E **(T701, T701C, T701D)**, using power cable assembly adapter (2) **(T700)** or (19) **(T701, T701C, T701D)**.
- 115 or 230-volt, 50 to 400 Hz power source.

1-188. Borescope Inspection of Compressor Forward and Aft Areas Using Borescope 21C7744P02 (T700) or 21C7744P03.

The instructions in this paragraph require the use of right-angle rigid borescope (11, fig. 1-92). At the compressor forward area, borescope inspection of compressor flowpath coating, compressor rotor stage 1 blades and inlet guide vanes is done through port no. 2 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**). See paragraphs 1-182 and 2-53 for inspection limits. At the compressor aft area, borescope inspection of compressor flowpath coating, compressor rotor, stage 5 blades, stage 5 vanes, and impeller vanes is done through port no. 3 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**) for right-hand engine installation where inboard port no. 5 is not accessible. For left-hand engine installation, use port no. 5. See paragraphs 1-190 and 2-53 for inspection limits.

a. Set up light source (para 1-187).

b. Borescope-inspect compressor forward area as follows:

(1) For a better view of stage 1 blades, open the inlet guide vanes using an open-end wrench on flats of actuating shaft. Inlet guide vanes are open when hydromechanical control unit (HMU) variable geometry shaft is fully retracted.

(2) Connect light carrier (9, fig. 1-92) to light source (16) and to right-angle borescope (11) as follows:

(a) Plug connector (5) of carrier into light input guide (17) L1 or L2.

(b) Place light guide selector switch (13) to L1 if connector is inserted into input L1, or place light guide selector switch to L2 if connector is inserted into input L2.

(c) Connect other end of light carrier (9) onto right-angle rigid borescope.

(3) Remove borescope plug from port no. 2 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**), using a 1/4-inch ratchet and extension. Inspect borescope plug (para 1-183).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(4) Push power switch (14, fig. 1-92) to “1” position, and adjust light intensity control (15) to give best viewing. Insert borescope into port no. 2 (fig. 1-97).

(5) Position borescope probe so that stage 1 blades can be seen through space between inlet guide vanes (fig. 1-97). Light carrier should be pointing towards front of engine.

(6) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). One turn of the radial drive shaft assembly will rotate compressor rotor about 1-1/4 turns. Inspect all stage 1 blades (there are 20 of them) and compressor flowpath coating. Move probe in and out, so that entire length of blade can be seen. Look closely at leading edge of tips of blades. To provide a reference for determining size of tears or nicks in blades, compare depth of tear or nick to distance from forward edge of stage 1 disk to the edge of fillet radius of leading edge of blade (which is 1/16 inch) (fig. 1-98).

(7) Inspect all visible inlet guide vanes and compressor flowpath coating. Move probe in and out to inspect as many inlet guide vanes as possible.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (15, fig. 1-92) counterclockwise, and push power switch (14) to “0” position.

(9) Lightly coat threads of borescope plug with antiseize thread compounds (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) and reinstall plug in port no. 2 (fig. 1-95), using a 1/4 inch ratchet and extension. Torque plug to 90-110 inch pounds.

(10) Reinstall radial drive shaft cover assembly, retaining ring, and cover boot (para 5-36).

c. Borescope-inspect compressor aft area as follows:

(1) For engines that have caps at borescope port no. 3 or no. 5 (fig. 1-95), remove cap from port using a 5/8-inch wrench. For engines that have borescope plugs at borescope port no. 3 or no. 5, remove plug from port using a 1/4 inch ratchet and extension. Inspect cap or plug (para 1-191).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(2) Push power switch (14, fig. 1-92) to “1” position, and adjust light intensity control (15) to give best viewing. Insert borescope into port no. 3 or port no. 5 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**).

(3) Position borescope probe so that stage 5 blades and compressor flowpath coating can be seen through space between stage 5 vanes (fig. 1-99, view A). Light carrier should be pointing opposite direction being viewed.

(4) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). One turn of the radial drive shaft assembly will rotate compressor rotor about 1-1/4 turns. Inspect all 32 stage 5 blades and compressor flowpath coating. Move probe in and out of port to view entire length of blades.

(5) Inspect all visible stage 5 vanes and compressor flowpath coating. Move probe in or out of port to inspect as many vanes as possible.

(6) Position borescope probe so that impeller vanes can be seen (fig. 1-99, view B). Light carrier should be pointing opposite direction being viewed.

(7) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). Inspect all impeller vanes for damage.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (15, fig. 1-92) counterclockwise, and push power switch (14) to “0” position.

(9) Lightly coat threads of borescope plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D).

(10) Install borescope plug in port no. 3 or no. 5. Torque plug to 55-70 inch-pounds.

d. If borescope inspection of engine is completed, do the following:

(1) Disconnect light carrier (9, fig. 1-92) from borescope (11) and from light source (16). Place borescope (11) and carrier (9) in insert cover (1).

(2) Unplug power cable (12) from either aircraft utility power receptacle or from alternate power source.

(3) Disconnect adapter (2) **(T700)** or (19) **(T701, T701C, T701D)** from power cable (12). Place adapter (2 or 19) in insert cover (1) and place cable (12) in bottom half of borescope kit.

1-189. Borescope Inspection of Combustion Section Area Using Borescope (21C7744P02 (T700) or 21C7744P03). The instructions in this paragraph require the use of right-angle rigid borescope (short) (18, fig. 1-92), right-angle rigid borescope (11), or retrospective rigid borescope (10). Use right-angle extension (4), as necessary, to inspect the combustion section. Borescope inspection of combustion liner and stage 1 turbine nozzle vanes is done through port no. 1 **(T700)**, no. 4, or no. 7 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**). See paragraph 1-195 for inspection limits.

a. Set up light source (para 1-187).

NOTE

Installed engines require the use of right-angle rigid borescope (short) (18, fig. 1-92) and right-angle extension (4).

b. For engines installed on aircraft, connect right-angle extension (4) to right-angle rigid borescope (short) (18) as follows:

(1) Remove eyepiece (3) from borescope (18).

(2) Remove protective covers from right-angle extension (4).

(3) Rotate borescope attachment ring (7) counterclockwise to seat tabs flush against inside wall of right-angle adapter (6).

(4) Insert eyepiece of borescope (18) into right-angle adapter (6).

(5) Rotate borescope attachment ring (7) clockwise to secure borescope (18).

c. Connect one end of light carrier (9) to light source (16) and to borescope (10, 11, or 18) as follows:

(1) Plug connector (5) of carrier (9) into light input guide (17) L1 or L2.

(2) Place light guide selector switch (13) to L1 if connector is inserted into input L1, or place light guide selector switch to L2 if connector is inserted into input L2.

(3) Connect other end of light carrier (9) to borescope (10, 11, or 18).

WARNING

Fluorescent Dye Penetrant

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged inhalation of vapor can result in dizziness, drowsiness, headache, and nausea.
- After any prolonged contact with skin, wash contacted area with soap and water. Remove oil-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When applying liquid by brush or aerosol spray at unexhausted workbench, wear approved respirator and goggles.

d. **(T700)** Remove borescope plug from port no. 1. If plug is too tight, apply Zyglo penetrant (item 91, Appendix D) to plug to avoid possible damage to midframe casing. Inspect borescope plug (para 1-196).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescoping.

e. Push power switch (14) to “1” position. Adjust light intensity control (15) to give best viewing.

f. **(T700)** Insert borescope probe carefully into port no. 1 (fig. 1-95). Insert probe through hole in combustion liner so that stage 1 nozzle can be seen. Light carrier should be pointing opposite direction being viewed. Rotate and move probe in and out to inspect as many nozzle vanes as possible (para 1-195).

g. **(T700)** Adjust depth of probe, and inspect areas around igniter and primer nozzles.

h. **(T700)** Adjust depth of probe until outer shell can be seen.

i. **(T700)** Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

j. **(T700)** Adjust depth of probe until inner shell can be seen.

k. **(T700)** Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

l. **(T700)** When inspection is completed, carefully remove borescope probe from port no. 1.

m. **(T700)** Apply antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) to threads and contacting surfaces of borescope plug and casing.

n. **(T700)** Install borescope plug in port no. 1. tighten (15° wrench arc) plug.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

o. Disconnect ignition lead from igniter plug at port no. 4 or port no. 7. Remove retaining nut **(T700)** and igniter plug (para 7-5 **(T700)** or para 7-6 **(T701, T701C, T701D)**).

CAUTION

- All internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

p. Insert borescope (10, 11, or 18, fig. 1-92) into port no. 4 or port no. 7 (fig. 1-101). Light carrier (9, fig. 1-92) should be pointing towards front of engine (fig. 1-101, view A). Rotate and move probe in and out to permit inspection of as many nozzle vanes as possible.

q. If borescope (short) (18, fig. 1-92) is being used, turn rotation ring (8) by hand, and inspect combustion liner (fig. 1-101, view B). If either borescope (10, fig. 1-92) or borescope (11) is being used, rotate probe so that light carrier (9) is pointing towards aft end of engine (fig. 1-101, view B) and inspect combustion liner.

r. Adjust depth of probe, and inspect areas around dome, swirlers, and fuel injectors.

s. Adjust depth of probe, and inspect areas around igniter plug.

t. Adjust depth of probe until outer shell of combustion liner can be seen.

u. Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

v. Adjust depth of probe until inner shell of combustion liner can be seen.

w. Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

x. When inspection is completed, carefully remove borescope probe. Then turn light intensity control (15, fig. 1-92) counterclockwise, and push power switch (14) to "0" position.

y. Reinstall igniter plug (para 7-9 **(T700)** or para 7-10 **(T701, T701C, T701D)**) at port no. 4 or port no. 7 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**).

z. Disconnect borescope (10, 11, or 18, fig. 1-92) from carrier (9). Place borescope (10, 11, or 18) in insert cover (1).

aa. Remove connector (5) of carrier (9) from light input guide (17). Place light carrier (9) in insert cover (1).

ab. If borescope (short) (18) was used, do the following:

(1) Disconnect right-angle extension (4) from borescope (18) by turning borescope attachment ring (7) counterclockwise.

(2) Remove borescope (18) from adapter (6), and place borescope (18) in insert cover (1).

(3) Install protective covers on each end of right-angle extension, and place extension in insert cover (1).

ac. Unplug power cable (12) from either aircraft utility power receptacle or from alternate power source.

ad. Disconnect adapter (2) from cable (12). Place adapter (2) in insert cover (1) and place cable (12) in bottom half of borescope kit.

1-190. Inspection of Compressor Rotor, Stage 5 Blades, Stage 5 Vanes, and Impeller Vanes. See table 1-31.

Table 1-31. Inspection of Compressor Rotor, Stage 5 Blades, Stage 5 Vanes, and Impeller Vanes

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Blades and vanes (fig. 1-103) for:			
a. Sharp nicks, tears, and cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
b. Erosion.	Allowed, unless there is an unacceptable loss in engine performance.	AVUM: Not repairable. AVIM: Any amount as long as minimum chord lengths are maintained after blending. See paragraph 2-5.	AVUM: Replace engine. AVIM: Blend and recontour leading edges of stage 5 blades (para 2-5) or replace cold section module.
c. Dents and bends.	Smooth or minor deformations allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

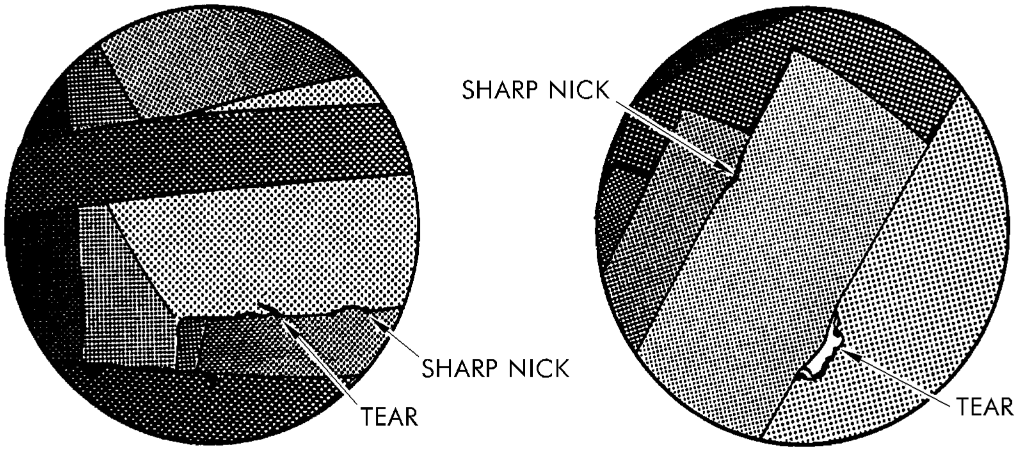
Table 1-31. Inspection of Compressor Rotor, Stage 5 Blades, Stage 5 Vanes, and Impeller Vanes (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. Compressor rotor flowpath coating for:			
(1) Rub marks and grooves.	Any amount, provided engine performance is acceptable, and grooves or wear do not penetrate into parent metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Delamination, flaking, or loose material.	Any amount, provided engine performance is acceptable.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

NOTE

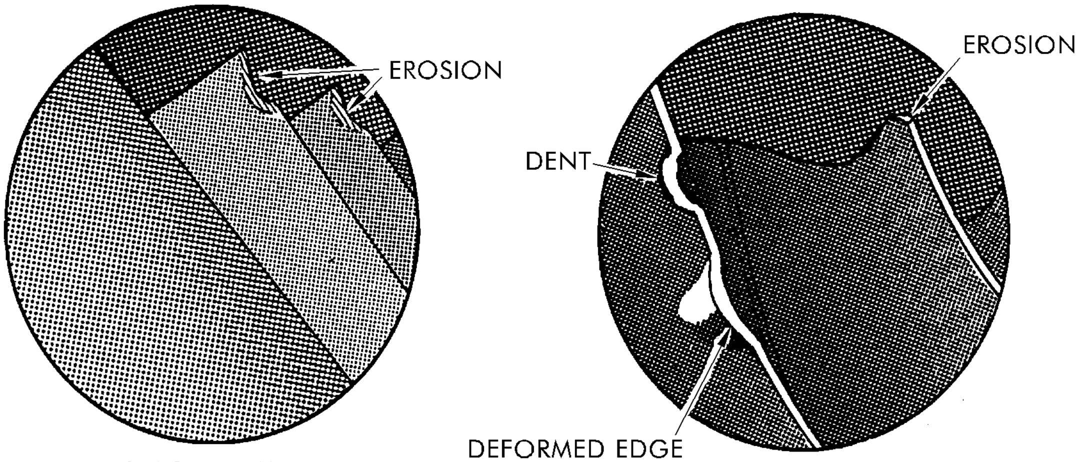
When removing coating material from blades or vanes, be careful not to round out or damage the edges of blade or vane tips.

e. Coating material.	Any amount, provided engine performance is acceptable.	Same as usable limits, provided engine performance can be restored to acceptable limits.	AVUM: Replace engine. AVIM: Remove case half (para 2-5) or replace cold section module.



STAGE 5 BLADE
LEADING EDGE
THROUGH STAGE 5 VANES

STAGE 5 VANE
TRAILING EDGE



STAGE 5 VANE
TRAILING EDGE

LEADING EDGE
OF IMPELLER

1156997-00-A2A

Figure 1-103. Compressor Rotor Stage 5 Blades, Stage 5 Vanes, and Impeller (Typical View); Borescope Inspection

1-191. Inspection of Compressor Case Borescope Port Caps and Plugs.

See table 1-32.

Table 1-32. Inspection of Compressor Case Borescope Port Caps and Plugs

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Caps (fig. 1-104) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace cap.
(2) Missing or damaged threads.	Up to one damaged or missing thread without crossed threads or loose material.	Same as usable limits, with crossed threads or loose material.	AVUM: Replace cap. AVIM: Remove loose materials and chase threads.
(3) Wrench damage on each corner of hex flats.	Any amount, without high metal, if cap can be installed properly.	Any amount that can be reworked to usable limits.	Remove high metal on hex flats.
(4) Discoloration.	Any amount.	Not applicable.	Not applicable.
(5) Nicks and scratches, except on threads.	Any number, 1/64- inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
b. Plugs (fig. 1-104) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace plug.
(2) Missing or damaged threads.	Up to one damaged or missing thread without crossed threads or loose material.	Same as usable limits, with crossed threads or loose material.	AVUM: Replace plug. AVIM: Remove loose material and chase threads.
(3) Wrench damage in each corner of square drive socket.	Any amount, without high metal, if plug can be installed properly.	Not repairable.	Replace plug.
(4) Discoloration.	Any amount.	Not applicable.	Not applicable.
(5) Nicks and scratches, except on threads.	Any number, 1/64-inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.

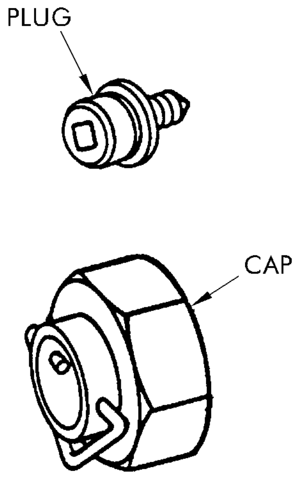


Figure 1-104. Compressor Case Borescope Port Caps and Plugs; Inspection

1-192. Light Source Setup (21C7700P03).

a. Open borescope kit 21C7700P03 (fig. 1-93).

b. Turn light intensity control (6) fully counterclockwise.

CAUTION

Be sure that ON/OFF switch (7) is at OFF before connecting light source (5) to power cord (9); otherwise, light source (5) will be damaged.

NOTE

Cable adapter (10 or 11) is used to adapt the power cord (9) to the aircraft 115-volt, 400Hz utility power receptacle (J257 **(T700)** or J14E **(T701, T701C, T701D)**).

c. Connect one end of power cord (9) to light sourc (5). Connect the other end of power cord (9) to either of the following:

- Aircraft 115-volt, 400Hz utility power receptacle (J257 **(T700)** or J14E **(T701, T701C, T701D)**), using cable adapter (10 or 11).
- 115 or 230-volt, 50 to 400Hz power source.

1-193. Borescope Inspection of Compressor Forward and Aft Areas Using Borescope 21C7700P03. The instructions in this paragraph require the use of the retrospective rigid borescope (12, fig. 1-93). At the compressor forward area, borescope inspection of compressor flowpath coating, compressor rotor, stage 1 blades and inlet guide vanes is done through port no. 2 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**). See paragraphs 1-182 and 2-53 for inspection limits. At the compressor aft area, borescope inspection of compressor flowpath coating, compressor rotor, stage 5 blades and vanes is done through port no. 3 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**) for right-hand engine installations where the inboard port no. 5 is not accessible. For left-hand engine installation, use port no. 5. See paragraphs 1-190 and 2-53 for inspection limits.

a. Set up light source (para 1-192).

b. Borescope-inspect compressor forward area as follows:

(1) For a better view of stage 1 blades, open the inlet guide vanes using an open-end wrench on flats of actuating shaft. Inlet guide vanes are open when hydromechanical control unit (HMU) actuator rod is fully retracted.

(2) Connect one end of light carrier (2, fig. 1-93) to borescope (12). Connect the other end of carrier (2) to light source port (8).

(3) Remove borescope plug from port no. 2 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**), using a 1/4-inch ratchet and extension. Inspect borescope plug (para 1-183).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(4) Move ON/OFF switch (7) to ON. Adjust light intensity control (6) to give best viewing. Insert borescope (12) into port no. 2 (fig. 1-97).

(5) Position borescope probe so that compressor flowpath coating and stage 1 blades can be seen between inlet guide vanes. Light carrier should be pointing opposite direction being viewed.

(6) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). One turn of the radial drive shaft assembly will rotate compressor rotor about 1-1/4 turns. Inspect all stage 1 blades (there are 20 of them) and flowpath coating. Move probe in and out, so that entire length of blade can be seen. Look closely at leading edge and tips of blades. To provide a reference for determining size of tears or nicks in blades, compare depth of tear or nick to distance from forward edge of stage 1 disk to the edge of fillet radius of leading edge of blade (which is 1/16 inch) (fig. 1-98).

(7) Inspect all visible inlet guide vanes and flowpath coating. Move probe in and out to inspect as many inlet guide vanes as possible.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (6, fig. 1-93) counterclockwise and move ON/OFF switch to OFF.

(9) Lightly coat threads of borescope plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) and reinstall plug in port no. 2 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**), using a 1/4-inch ratchet and extension. Torque plug to 90-110 inch pounds.

(10) Reinstall radial drive shaft cover assembly, retaining ring, and cover boot (para 5-36).

c. Borescope-inspect compressor aft area as follows:

(1) For engines that have caps at borescope port no. 3 or no. 5 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**), remove cap from port using a 5/8-inch wrench. For engines that have borescope plugs at borescope port no. 3 or no. 5, remove plug from port using a 1/4-inch ratchet and extension. Inspect cap or plug (para 1-191).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(2) Move ON/OFF switch (7) to ON. Adjust light intensity control (6) to give best viewing. Insert borescope (12) into port no. 3 or no. 5 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**).

(3) Position borescope probe so that stage 5 blades and compressor flowpath coating can be seen between stage 5 vanes (fig. 1-99, view A). Light carrier should be pointing opposite direction being viewed.

(4) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect compressor flowpath coating and all 32 stage 5 blades. Move borescope probe in and out of port to view entire length of blade and flowpath coating.

(5) Rotate borescope and move probe in and out to inspect all visible stage 5 vanes and flowpath coating.

(6) Position borescope probe so that impeller vanes can be seen (fig. 1-99, view B). Light carrier should be pointing opposite direction being viewed.

(7) Slowly rotate rotor by hand-cranking engine (para 1-98) and inspect all impeller vanes for damage.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (6, fig. 1-89) counterclockwise, and move ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope caps or plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D).

(10) For engines that have caps, install cap in port no. 3 or no. 5 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**). Torque cap to 100-125 inch-pounds. For engines that have borescope plugs, install plug in port no. 3 or no. 5. Torque plug to 55-70 inch-pounds

d. If borescope inspection of engine is completed, do the following:

(1) Disconnect borescope (12, fig. 1-93) from light carrier (2). Place borescope (12) in insert cover (13).

(2) Disconnect light carrier (2) from light source port (8). Place carrier (2) in insert cover (13).

(3) Unplug cord (9) from either aircraft utility power receptacle or from alternate power source.

(4) Disconnect adapter (10 or 11) from cord (9). Place adapter (10 or 11) light source (5), and cord (9) in borescope kit.

1-194. Borescope Inspection of Combustion Section Area Using Borescope 21C7700P03. The instructions in this paragraph require the use of right-angle rigid borescopes (3, 4, fig. 1-93) and retrospective rigid borescope (12). Use borescopes (3, 4, 12) as well as right-angle extension (1), as necessary, to inspect all areas named. Borescope inspection of combustion liner and stage 1 turbine nozzle vanes is done through inspection port no. 1 **(T700)**, no. 4 or no. 7 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**), located on the midframe. See paragraph 1-195 for inspection limits.

a. Set up light source (para 1-192).

NOTE

Installed engines may require the use of the right-angle extension (1, fig. 1-93) and short right-angle rigid borescope (3) to permit proper viewing.

b. Connect one end of light carrier (2) to borescope (3, 4, or 12), as necessary. Connect the other end of carrier (2) to light source port (8). For engines installed on aircraft, correct right-angle extension (1) to borescope (3).

WARNING

Fluorescent Dye Penetrant

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged inhalation of vapor can result in dizziness, drowsiness, headache, and nausea.
- After any prolonged contact with skin, wash contacted area with soap and water. Remove oil-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When applying liquid by brush or aerosol spray at unexhausted workbench, wear approved respirator and goggles.

c. **(T700)** Remove borescope plug from port no. 1. If plug is too tight, apply Zyglo penetrant (item 91, Appendix D) to plug to avoid possible damage to midframe casing. Inspect borescope plug (para 1-196).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

d. Move ON/OFF switch (7) to ON. Adjust light intensity control (6) to give best viewing.

e. **(T700)** Insert borescope probe carefully into port no. 1 (fig. 1-95). Insert probe through hole in combustion liner so that stage 1 nozzle can be seen. Light carrier should be pointing opposite direction being viewed. Rotate and move probe in and out to inspect as many nozzle vanes as possible (para 1-195).

f. **(T700)** Adjust depth of probe and inspect areas around igniter and primer nozzles.

g. **(T700)** Adjust depth of probe until outer shell can be seen.

h. **(T700)** Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

i. **(T700)** Adjust depth of probe until inner shell can be seen.

j. **(T700)** Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

k. **(T700)** When inspection is completed, carefully remove borescope probe from port no. 1.

l. **(T700)** Apply antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) to threads and contacting surfaces of borescope plug and casing. Install borescope plug in port no. 1. Tighten (15° wrench arc) plug.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

m. Disconnect ignition lead from igniter plug at port no. 4 or port no. 7. Remove retaining nut **(T700)** and igniter plug (para 7-5 **(T700)** or para 7-6 **(T701, T701C, T701D)**).

n. Insert probe into port no. 4 or no. 7 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**). Light carrier should be pointing opposite direction being viewed. Rotate and move probe in and out to inspect as many stage 1 nozzle vanes as possible (para 1-195). Light carrier should be pointing opposite direction being viewed.

o. Rotate probe and inspect combustion liner (para 1-195).

p. Adjust depth of probe, and inspect areas around dome, swirlers, and fuel injectors.

q. Adjust depth of probe, and inspect areas around igniter and primer nozzles.

r. Adjust depth of probe until outer shell can be seen.

s. Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

t. Adjust depth of probe until inner shell can be seen.

u. Inspect all visible areas of shell, starting as swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

v. When inspection is completed, carefully remove borescope probe. Then turn light intensity control (6, fig. 1-93) counterclockwise, and place ON/OFF switch (7) to OFF.

w. Reinstall igniter plug (para 7-9 **(T700)** or para 7-10 **(T701, T701C, T701D)**) in port no. 4 or port no. 7.

x. Disconnect borescope (3, 4, or 12) from carrier (2). If borescope (short) (3) was used, disconnect extension (1) from borescope (3). Place borescope (3, 4, or 12) and extension (1), if used, in insert cover (13).

y. Disconnect carrier (2) from light source port (8). Place carrier (2) in insert cover (13).

z. Unplug power cord (9) from either aircraft utility power receptacle or from alternate power source. Disconnect adapter (10 or 11) from cord (9). Place cord (9) in bottom half of borescope kit and place adapter (10 or 11) in upper half or borescope kit.

1-195. Inspection of Stage 1 Turbine Nozzle Vanes and Combustion Liner. See table 1-33.

Table 1-33. Inspection of Stage 1 Turbine Nozzle Vanes and Combustion Liner

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Stage 1 turbine nozzle vanes (fig. 1-105 and 1-106) for:			
(1) Cracks in leading edges.	Any amount if no danger of piece falling out.	Not repairable.	AVUM: Replace engine. AVIM: Replace nozzle assembly.
(2) Burn-through.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace nozzle assembly.
(3) Discoloration or surface roughness.	Any amount if no evidence of separation or blistering.	Not applicable.	Not applicable.
(4) Blistering or separation.	Approximately 1/2 inch x 1/4 inch, two places per vane.	Not repairable.	AVUM: Replace engine. AVIM: Replace nozzle assembly.
(5) Plugged cooling holes.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace nozzle assembly.
b. Combustion liner for:			
(1) Excessive carbon buildup that blocks air holes and completely resists air flow passages, or that is built up enough to hold flame, or that accumulates on tips of fuel injectors.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace liner.
(2) Cracks.	Any number if they do not form a network that would allow a piece of liner to fall out if crack got longer.	Not repairable.	AVUM: Replace engine. AVIM: Replace liner.
(3) Burn-through or missing pieces.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace liner.

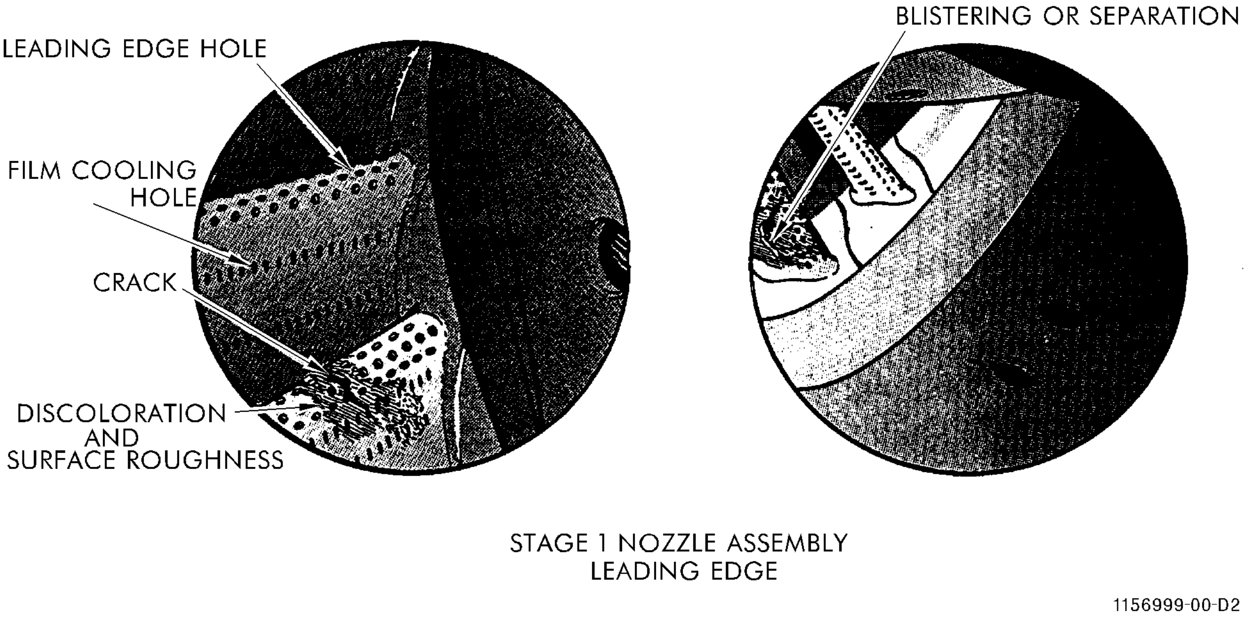
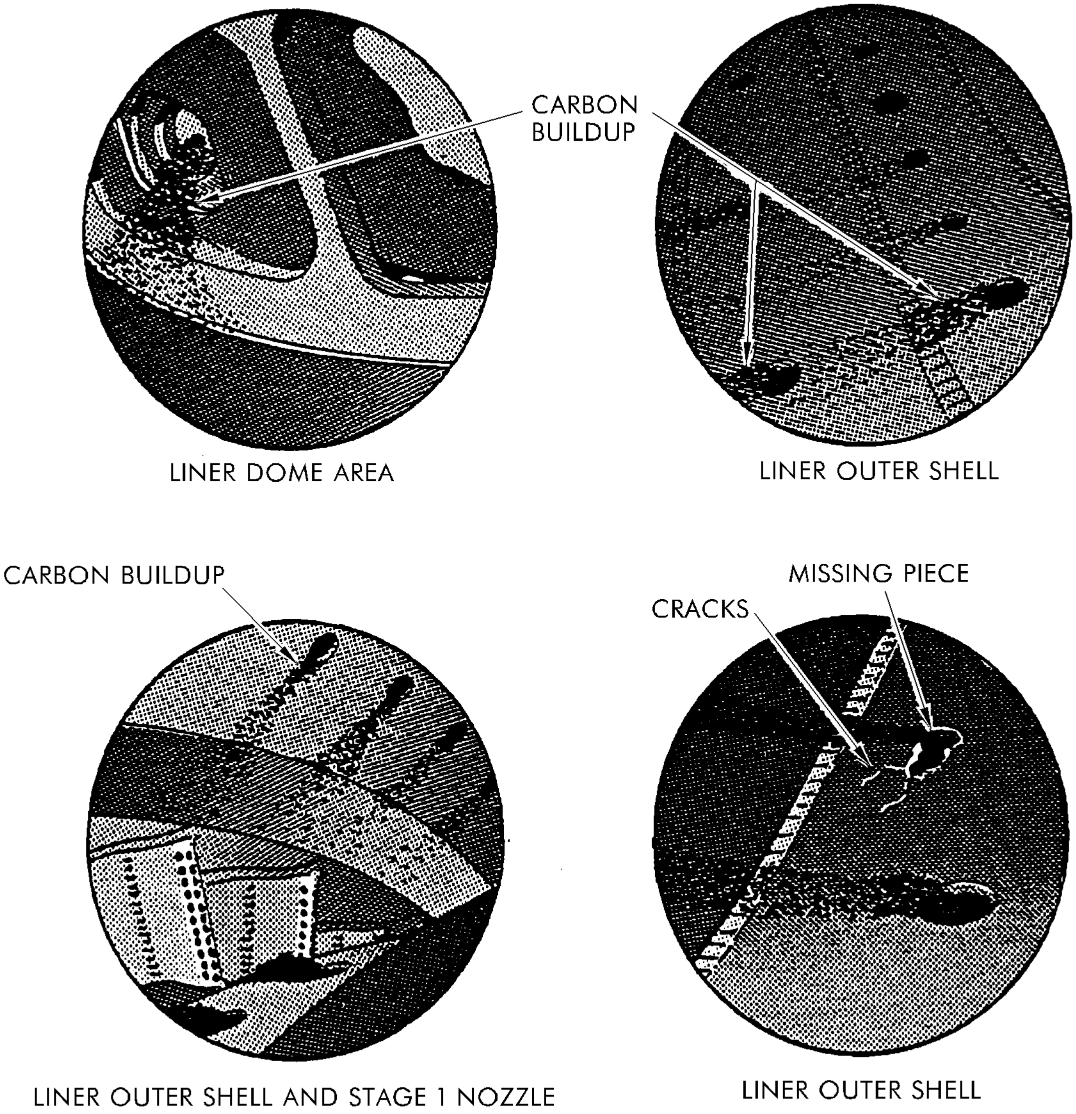


Figure 1-105. Stage 1 Nozzle; Borescope Inspection



LINER DOME AREA

LINER OUTER SHELL

LINER OUTER SHELL AND STAGE 1 NOZZLE

LINER OUTER SHELL

Figure 1-106. Combustion Liner and Stage 1 Nozzle; Borescope Inspection

1-196. (T700) Inspection of Midframe Borescope Port Plug.

See table 1-34.

Table 1-34. *(T700)* ***Inspection of Midframe Borescope Port Plug***

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Plug (fig. 1-107) for:			
a. Cracks.	None allowed.	Not repairable.	Replace plug.
b. Missing or damaged threads.	None allowed.	Not repairable.	Replace plug.
c. Wrench damage on each corner of hex flats.	Any amount, without high metal, if plug can be installed properly.	Any amount that can be reworked to usable limits.	Remove high metal on hex flats.
d. Distortion.	Any amount if plug can be torqued properly.	Not repairable.	Replace plug.
e. Discoloration.	Any amount.	Not applicable.	Not applicable.
f. Nicks and scratches, except on threads.	Any number.	Not applicable.	Not applicable.

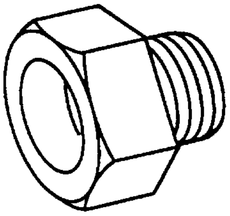


Figure 1-107. *(T700)* ***Midframe Borescope Port Plug; Inspection***

1-197. Light Source Setup (21C7779P03).

a. Open borescope kit 21C7779P03 (fig. 1-94).

b. Turn light intensity control (5) fully counterclockwise.

CAUTION

Be sure that ON/OFF switch (7) is at OFF before connecting light source (8) to power cord (6); otherwise, light source (8) will be damaged.

NOTE

Cable assembly (1 or 2) is used to adapt the power cord (6) to the aircraft 115-volt, 400Hz utility power receptacle (J257 **(T700)** or J14E **(T701, T701C, T701D)**), as applicable.

c. Connect one end of power cord (6) to light source (8). Connect the other end of power cord (6) to either of the following:

- Aircraft 115-volt, 400Hz utility power receptacle (J257 **(T700)** or J14E **(T701, T701C, T701D)**), using cable assembly (1 or 2).
- 115 or 230-volt, 50 to 400 Hz power source.

1-198. Borescope Inspection of Compressor Forward and Aft Areas Using Borescope 21C7779P03. The instructions in this paragraph require the use of the retrospective rigid borescope (11, fig. 1-94). At the compressor forward area, borescope inspection of compressor flowpath coating, compressor rotor, stage 1 blades and inlet guide vanes is done through port no. 2 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**). See paragraph 1-182 and 2-53 for inspection limits. Inspection of compressor flowpath coating, compressor rotor, stage 5 blades and vanes is done through port no. 3 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**) for right-hand engine installation where the inboard port no. 5 is not accessible. For left-hand engine installation, use port no. 5. See paragraphs 1-190 and 2-53 for inspection limits.

a. Set up light source (para 1-197).

b. Borescope-inspect compressor forward area as follows:

(1) For a better view of stage 1 blades, open the inlet guide vanes using an open-end wrench on flats of actuating shaft. Inlet guide vanes are open when hydromechanical control unit (HMU) actuator rod is fully retracted.

(2) Connect one end of light carrier (3, fig. 1-94) to borescope (11). Connect the other end of carrier (3) to light source port (4).

(3) Remove borescope plug from port no. 2 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**), using a 1/4-inch ratchet and extension. Inspect borescope plug (para 1-183).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(4) Move ON/OFF switch (7) to ON. Adjust light intensity control (5) to give best viewing. Insert borescope (11) into port no. 2 (fig. 1-97).

(5) Position borescope probe so that compressor flowpath coating and stage 1 blades can be seen between inlet guide vanes. Light carrier should be pointing opposite direction being viewed.

(6) Slowly rotate compressor rotor by hand-cranking the engine (para 1-98). One turn of the radial drive shaft assembly will rotate compressor rotor about 1-1/4 turns. Inspect all stage 1 blades (there are 20 of them) and flowpath coating. Move probe in and out, so that entire length of blade can be seen. Look closely at leading edge and tips of blades. To provide a reference for determining size of tears or nicks in blades, compare depth of tear or nick to distance from forward edge of stage 1 disk to the edge of fillet radius of leading edge of blade (which is 1/16 inch) (fig. 1-98).

(7) Inspect all visible inlet guide vanes and flowpath coating. Move probe in and out to inspect as many inlet guide vanes as possible.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (5, fig. 1-94) counterclockwise and move ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) and reinstall plug in port no. 2 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**), using a 1/4-inch ratchet and extension. Torque plug to 90-110 inch pounds.

(10) Reinstall radial drive shaft cover assembly, retaining ring, and cover boot (para 5-36).

c. Borescope-inspect compressor aft area as follows:

(1) For engines that have caps at borescope port no. 3 or no. 5 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**), remove cap from port using a 5/8-inch wrench. For engines that have borescope plugs at borescope port no. 3 or no. 5, remove plug from port using a 1/4-inch ratchet and extension. Inspect cap or plug (para 1-191).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

(2) Move ON/OFF switch (7) to ON. Adjust light intensity control (5) to give best viewing. Insert borescope (11) into port no. 3 or no. 5 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**).

(3) Position borescope probe so that stage 5 blades and compressor flowpath coating can be seen between stage 5 vanes (fig. 1-99, view A). Light carrier should be pointing opposite direction being viewed.

(4) Slowly rotate rotor by hand-cranking engine (para 1-98). Inspect compressor flowpath coating and all 32 stage 5 blades. Move borescope probe in and out of port to view entire length of blade and flowpath coating.

(5) Rotate borescope and move probe in and out to inspect all visible stage 5 vanes and flowpath coating.

(6) Position borescope probe so that impeller vanes can be seen (fig. 1-99, view B). Light carrier should be pointing opposite direction being viewed.

(7) Slowly rotate rotor by hand-cranking engine (para 1-98), and inspect all impeller vanes for damage.

(8) When inspection is completed, carefully remove borescope probe. Then turn light intensity control (5, fig. 1-94) counterclockwise, and move ON/OFF switch (7) to OFF.

(9) Lightly coat threads of borescope cap or plug with antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D).

(10) For engines that have caps, install cap in port no. 3 or no. 5 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**). Torque cap to 100-125 inch-pounds. For engines that have borescope plugs, install plug in port no. 3 or no. 5. Torque plug to 55-70 inch-pounds.

d. If borescope inspection of engine is completed, do the following:

(1) Disconnect borescope (11, fig. 1-94) from light carrier (3). Place borescope (11) in transit case (13).

(2) Disconnect light carrier (3) from light source port (8). Place carrier (3) in transit case (13).

(3) Unplug cord (6) from either aircraft utility power receptacle or from alternate power source.

(4) Disconnect assembly (1 or 2) from cord (6). Place assembly (1 or 2), light source (8), in borescope kit.

1-199. Borescope Inspection of Combustion Section Area Using Borescope 21C7779P03. The instructions in this paragraph require the use of right-angle rigid borescopes (10, 12, fig. 1-94) and retrospective rigid borescope (11). Use borescopes (10, 11, 12) as well as viewing adapter (9), as necessary, to inspect all areas named. Borescope inspection of combustion liner and stage 1 turbine nozzle vanes is done through inspection ports no. 1 **(T700)**, no. 4 or no. 7 (fig. 1-95 **(T700)** or fig. 1-96 **(T701, T701C, T701D)**), located on the midframe. See paragraph 1-195 for inspection limits.

a. Set up light source (para 1-197).

NOTE

Installed engines may require the use of the viewing adapter (9, fig. 1-94) and short right-angle rigid borescope (12) to permit proper viewing.

b. Connect one end of light carrier (3) to borescope (10, 11, or 12), as necessary. Connect the other end of carrier (3) to light source port (4). For engines installed on aircraft, connect viewing adapter (9) to borescope (12).

WARNING

Fluorescent Dye Penetrant

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged inhalation of vapor can result in dizziness, drowsiness, headache, and nausea.
- After any prolonged contact with skin, wash contacted area with soap and water. Remove oil-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When applying liquid by brush or aerosol spray at unexhausted workbench, wear approved respirator and goggles.

c. **(T700)** Remove borescope plug from port no. 1. If plug is too tight, apply Zyglo penetrant (item 91, Appendix D) to plug to avoid possible damage to midframe casing. Inspect borescope plug (para 1-196).

CAUTION

- Allow internal components of engine to cool to 100°F (38°C) or less (or to ambient temperature) before borescoping. Borescope probe can be damaged if it is used near parts hotter than 150°F (66°C).
- Be extremely careful when inserting borescope into engine port to avoid damaging borescope.

d. Move ON/OFF switch (7) to ON. Adjust light intensity control (5) to give best viewing.

e. **(T700)** Insert borescope probe carefully into port no. 1 (fig. 1-95). Insert probe through hole in combustion liner so that stage 1 nozzle can be seen. Light carrier should be pointing opposite direction being viewed. Rotate and move probe in and out to inspect as many nozzle vanes as possible (para 1-195).

f. **(T700)** Adjust depth of probe, and inspect areas around igniter and primer nozzles.

g. **(T700)** Adjust depth of probe until outer shell can be seen.

h. **(T700)** Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

i. **(T700)** Adjust depth of probe until inner shell can be seen.

j. **(T700)** Inspect all visible areas of inner shell, starting at swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

k. **(T700)** When inspection is completed, carefully remove borescope probe from port no. 1.

l. **(T700)** Apply antiseize thread compound (AMS 2518) or synthetic graphite grease GP460 (antiseize) (item 56, Appendix D) to threads and contacting surfaces of borescope plug and casing. Install borescope plug in port no. 1. Tighten (15° wrench arc) plug.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

m. Disconnect ignition lead from igniter plug at port no. 4 or no. 7. Remove retaining nut **(T700)** and igniter plug (para 7-5 **(T700)** or para 7-6 **(T701, T701C, T701D)**).

n. Insert probe into port no. 4 or no. 7 (fig. 1-95 **(T700)** or 1-96 **(T701, T701C, T701D)**). Light carrier should be pointing opposite direction being viewed. Rotate and move probe in and out to inspect as many stage 1 nozzle vanes as possible (para 1-195). Light carrier should be pointing opposite direction being viewed.

o. Rotate probe and inspect combustion liner (para 1-195).

p. Adjust depth of probe, and inspect areas around dome, swirlers, and fuel injectors.

q. Adjust depth of probe, and inspect areas around igniter and primer nozzles.

r. Adjust depth of probe until outer shell can be seen.

s. Starting at swirlers, inspect all visible areas of outer shell until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

t. Adjust depth of probe until inner shell can be seen.

u. Inspect all visible areas of inner shell, starting as swirlers, until stage 1 nozzle comes into view. Make several viewing sweeps, changing depth of probe each time, until all areas have been thoroughly inspected.

v. When inspection is completed, carefully remove borescope probe. Then turn light intensity control (5, fig. 1-94) counterclockwise, and move ON/OFF switch (7) to OFF.

w. Reinstall igniter plug (para 7-9 **(T700)** or para 7-10 **(T701, T701C, T701D)**) in port no. 4 or port no. 7.

x. Disconnect borescope (10, 11, or 12) from carrier (3). If borescope (short) (12) was used, disconnect viewing adapter (9) from borescope (12). Place borescope (10, 11, or 12) and adapter (9) if used in transit case (13).

y. Disconnect carrier (3) from light source port (4). Place carrier (3) in transit case (13).

z. Unplug power cord (6) from either aircraft utility power receptacle or from alternate power source. Disconnect assembly (1 or 2) from cord (6). Place cord (6), light source (8) , and assembly (1 or 2) in transit case (13).

1-200. PREINSTALLATION BUILDUP.

NOTE

- If HMU PN 4046T52G28 or 4046T52G29 (6068T97P07 or 6068T97P08) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU, the opposite engine must be configured with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU. Additionally, both engines must be configured with 5078T29G02 (6080T56P03) or higher DECs.
- If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with 4046T52G30 (6068T97P09) or 4046T52G38 (6068T97P13) HMU.

Preliminary Information. **(T701)** All Apache aircraft **(AH-64A)** serial number 84-24273 and subsequent have been manufactured to accept a Transient Droop Improvement (TDI) consisting of the hardware listed below as well as certain airframe changes. The TDI improves the engines acceleration capability under transient maneuvers. Apache aircraft manufactured before serial number 84-24273 may or may not incorporate TDI improvements and therefore, when replacing engines it will be necessary to determine the aircraft configuration and to restore the aircraft to that same configuration at time of engine change. For example:

Spare engines removed from shipping containers require the following preinstallation buildup:

	Part Number	
Nomenclature	Non-TDI Configuration	TDI Configuration
Digital Electronic Control (DEC)	N/A	6068T81
Electrical control unit (ECU)	4076T60G04	4082T99 and subsequent
Hydromechanical unit (HMU)	4046T52G12	4046T52G14 and subsequent
Amplifier support bracket	6039T75G01	6058T52 and subsequent
Electrical unit bracket	5044T77G01	5056T75G02 and subsequent
Ignition exciter bracket assembly	6043T42G01	6058T12 and subsequent
Yellow cable bracket	N/A	4082T14 and subsequent
Loop type cushioned clamp	N/A	4053T91P16 and subsequent
Machine bolt	N/A	J643P04A and subsequent

a. **(T701)** Determine if spare engine and engine to be replaced is of TDI or non-TDI configuration by checking the part numbers on the installed parts against the part numbers listed in matrix above.

NOTE

- **(T701)** TDI Configured Aircraft. It will be necessary to remove TDI hardware from an engine to be replaced with TDI configuration, and install the TDI hardware on a spare engine if that spare engine has non-TDI hardware. The non-TDI hardware from the spare engine will be installed on the engine to be replace.
- **(T701)** (Non-TDI Configured Aircraft. It will also be necessary to remove non-TDI hardware from an engine (to be replaced) with non-TDI configuration, and install the non-TDI hardware on a spare engine if that spare engine has TDI hardware. The TDI hardware will be installed on the engine to be replaced.

b. **(T701)** If the engine to be replaced and the spare engine are of different configuration, replace the applicable parts on both engines as follows:

(1) Remove two bolts that secure amplifier support bracket (4, fig. 10-13) to forward flange of compressor case.

(2) Remove two bolts (1) and two nuts (3) that secure support bracket (4) to tabs (2) on compressor case.

(3) Remove bracket (4) and electrical unit bracket (7) assembled to each other.

(4) Position bracket (4) on tabs (2) of compressor case and on forward flange of compressor case.

(5) Install two bolts (1) (boltheads aft) and two nuts (3). Secure bracket (4) onto tabs (2) of compressor case. Torque nuts (3) to 45-50 inch-pounds.

(6) Install two bolts to secure bracket (4) to forward flange of compressor case. Torque bolts to 45-50 inch-pounds.

(7) Remove ignition exciter bracket assembly (para 2-5) step a(2)) from boltholes 4, 5, and 6.

(8) Install three bolts (4, fig. 2-1) and ignition exciter bracket assembly (3) in boltholes 4, 5, and 6.

(9) Remove yellow electrical cable (3, fig. 10-16) from yellow cable bracket (9).

(10) Loosen bolt (11) that secures loop type cushioned clamp (10) to sensing tube (2). Remove clamp (10), bracket (9), and bolt (11) from tube (2).

(11) Install clamp (10) around tube (2), and secure bracket (9), using bolt (11). Do not tighten bolt (11).

(12) Install cable (3) in bracket (9) so that cable (3) is on the outside of tube (2).

(13) Torque bolt (11) to 45-50 inch-pounds.

c. If the engine to be replaced and the spare engine are of the same configuration, do steps d thru h.

d. Install **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-16).

e. Install HMU (para 6-44).

f. Install fuel pressure sensor (para 6-65).

g. Install oil pressure sensor (para 8-151 **(T700)** or 8-152 **(T701, T701C, T701D)**).

h. **(T700, T701C, T701D)** Install oil temperature sensor (para 8-145).

1-201. PREPARATION FOR STORAGE AND SHIPMENT.

1-202. General Information.

a. The following procedures provide instructions for preservation and storage of the complete engine assembly. Weight and dimensional data for the shipping and storage container 8145CON004-1 are included in paragraph 1-48.

b. Storage procedures for an installed engine are divided into two categories: Short-Term Storage (para 1-204) and Intermediate Storage (para 1-205). Storage procedures for removed engines are included in paragraph 1-206, Long-Term Storage.

c. If engine is being returned to Depot, remove HMU (para 6-40), **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-12), fuel pressure sensor (para 6-63), oil pressure sensor (para 8-147 **(T700)** or 8-148 **(T701, T701C, T701D)**) and **(T700, T701C, T701D)** oil temperature sensor (para 8-142).

1-203. Storage Categories.

a. Short-Term Storage (1 to 45 Days). Short-term storage is used to preserve an installed engine up to 45 days, during which time the engine requires very little attention.

b. Intermediate Storage (46 to 180 Days). An installed engine that will be inactive for more than 45 days, but not exceeding 180 days, will be prepared and maintained in intermediate storage.

c. Long-Term Storage. This type of storage is used to preserve an uninstalled engine for storage and/or shipment.

1-204. Short-Term Storage.

a. Engine Preservation.

(1) Perform a 10-hour/fourteen-day inspection (para 1-61). Inspect engine for removed or disconnected parts. Be sure that all discrepancies are entered in aircraft logbook.

(2) Be sure that engine accessories and inlet area are clean and free from corrosion and foreign material.

(3) Clean the engine (para 1-157).

(4) Install protective covers on engine inlet and exhaust. If covers are not available, seal openings with barrier material (item 12, Appendix D), and secure with adhesive tape (item 107, Appendix D).

(5) Record date and extent of engine preservation in engine records and aircraft logbook.

b. Maintenance During Short-Term Storage.

(1) No maintenance is required during short-term storage.

(2) If engine remains in storage for more than 45 days, the engine will be prepared for intermediate storage as directed in paragraph 1-205.

1-205. Intermediate Storage.

a. Engine Preservation.

(1) Perform a 10-hour/fourteen-day inspection (para 1-61). Inspect engine for removed or disconnected part. Be sure that all discrepancies are entered in aircraft logbook.

(2) Be sure that engine, accessories, and inlet area are clean and free from corrosion and foreign material.

(3) Clean the engine (para 1-157).

(4) Allow engine to cool enough to prevent auto-ignition; then preserve fuel system as follows:

CAUTION

- **(UH-60)** To avoid accidental starting of engine, be sure that key-lock ignition switch is at OFF position.
- **(AH-64)** Ignition key must be in the ON position to motor engine. Caution must be taken not to inadvertently move the engine start switch to the START position. If the engine start switch is moved to the START position, the engine will begin a start sequence and may start.

(a) **(UH-60)** Place key-lock ignition switch at OFF position.

(b) Disconnect fuel supply inlet line. Connect a line between a clean, vented 5-gallon container and fuel boost pump inlet. Fill container with lubricating oil (item 86, Appendix D). Place container above engine fuel inlet. Cap disconnected fuel line using cap (item 38, Appendix D).

(c) Remove fuel filter bowl (para 6-52), but do not discard fuel filter element or packings.

(d) Drain all fuel from filter bowl, and fill bowl with lubricating oil (item 86, Appendix D).

(e) Reinstall fuel filter bowl with original fuel filter element and packings. Hand-tighten fuel filter bowl.

(f) Place power control lever at GROUND IDLE.

CAUTION

- Do not exceed starter duty cycle.
- Motoring time can be broken up into shorter periods.
- Observe required starter cool-down times between operating cycles.
- **(AH-64)** Ignition key must be in the ON position to motor engine. Caution must be taken not to inadvertently move the engine start switch to the START position. If the engine start switch is moved to the START position, the engine will begin a start sequence and may start.

(g) **(AH-64)** Place engine starter switch in the ignition override position. Place key-lock ignition switch at ON position.

NOTE

As engine is motored, fuel and oil will be discharged from engine overboard drain.

(h) Motor engine at maximum starter speed for 4 minutes.

(i) Return power control lever to OFF.

(j) Disconnect line from pump inlet, and connect fuel line.

(k) Remove and discard fuel filter element (para 6-52). Install new fuel filter element (para 6-55).

(l) Tag engine and cyclic stick with following information: ENGINE FUEL SYSTEM HAS BEEN PRESERVED WITH LUBRICATING OIL, MIL-L-6081, GRADE 1010. FLUSHING IS REQUIRED PRIOR TO OPERATION.

CAUTION

Protective covers for inlet and exhaust will be seated securely to keep moisture out of engine.

(5) Install engine inlet and exhaust protective covers. If covers are not available, seal openings with barrier material (item 12, Appendix D), and secure them with adhesive tape (item 107, Appendix D).

(6) Record date and extent of engine preservation in engine records and aircraft logbook.

b. Maintenance During Intermediate Storage. None.

1-206. Long-Term Storage.

a. Inspection Prior to Storage.

(1) Inspect engine for general condition and for removal or discarded parts.

(2) Record discrepancies in engine records.

b. Engine Preservation.

(1) Before removing engine from aircraft, clean engine and preserve engine fuel system with lubricating oil as outlined for intermediate storage. See paragraph 1-205, steps a(3) and a(4).

(2) Cover all openings, electrical connectors, and parts.

(3) Drain oil tank (para 1-113).

(4) Attach tag to fuel inlet shipping plug, marked with following information: ENGINE FUEL SYSTEM HAS BEEN PRESERVED WITH LUBRICATING OIL, MIL-L-6081, GRADE 1010. FLUSHING IS REQUIRED PRIOR TO OPERATION.

(5) Install engine into shipping and storage container (para 1-58).

c. Maintenance During Long-Term Storage.

(1) Maintenance during long-term storage consists of periodic inspection of the relative humidity in the shipping and storage container 8145CONOO4-1 (para 1-60).

(2) Humidity indicator (13, fig. 1-40) for the container can be seen through a transparent cover (window) from outside the container.

(3) The indicator has three sections marked 30, 40, and 50, representing percent humidity.

(4) As relative humidity in container increases, sections change from a blue color in numerical sequence to a lavender color. For example, if air in a container has 45% relative humidity, the 30 and 40 sections will be lavender-colored.

(5) If indicator card is all white, it has lost its sensitivity and will be replaced (para 1-58, step n).

1-207. PRESERVATION OF ENGINES INVOLVED IN ACCIDENTS.

CAUTION

If an engine has been involved in an accident in which engine failure or malfunction is suspected to have been a factor, it must not be treated for corrosion protection and the fuel system must not be preserved.

a. Without disconnecting lines or fittings, make every effort to prevent the remaining fuel and oil in the engine from leaking out.

b. Seal all openings with covers. If covers are not available, seal with barrier material (item 12, Appendix D).

c. Plug all ports and cap all fittings.

d. Install engine into shipping and storage container (para 1-58).

1-208. Damaged, Cannibalized, or Failed Engine Preservation. Inoperable engines that are removed because they require parts or maintenance will be preserved as required (depending on storage time). Store preserved engine in a shipping container or in a clean, dry area, adequately protected from dirt, corrosion, and physical damage.

1-209. Preservation of Fuel System LRU's. Fuel system LRU's which are removed from engine for more than 48 hours for maintenance, or for return to Depot, or for storage will be preserved as follows:

a. Hydromechanical Control Unit (HMU).

CAUTION

Before removing HMU from engine, protective cap must be installed over electrical connector of HMU. Otherwise, jet fuel will damage electrical connector.

(1) Install a cap or plug in P3 fitting (located at 8 o'clock position on rear face of HMU) and a clean, dry protective cap over electrical connector (caps and plugs, items 22, 23, 20, 46, 93, Appendix D).

CAUTION

Do not use a tool to turn power available spindle (PAS). Rotate by hand only.

(2) Set PAS to full increase position (full clockwise rotation).

CAUTION

Do not allow lubricating oil to enter P3 port.

(3) Hold HMU over a suitable container and drain fuel from fuel discharge fitting, fitting on one side of HMU, and fuel inlet port. Move the VG actuator rod in and out several times and rotate HMU as fuel drains.

(4) Place HMU in a clean drip pan so that forward flange is up.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

NOTE

Oil will flow into HMU slowly.

(5) **(Hamilton Standard)** Pour lubricating oil (item 86, Appendix D) from a new can into fuel inlet port. Rotate drive shaft and move VG actuator rod in and out several times as oil is poured into HMU.

(6) **(Woodward Governor)** Pour lubricating oil (item 86, Appendix D) from a new can into fuel inlet port. Move VG actuator rod in and out several times as oil is poured into HMU.

(7) Hold finger over inlet port and slosh oil around in HMU so that all internal areas are coated.

(8) Drain oil from HMU. Move VG actuator rod in and out several times while oil is draining.

(9) Hold HMU so that fuel outlet port is up and pour oil from a new can into the outlet port. When full, turn HMU over and drain oil.

(10) Cap or plug (items 22, 23, 20, 46, 93, Appendix D) inlet and outlet openings.

(11) Coat external bare-metal surfaces, including splines, with oil (item 86, Appendix D).

(12) Attach a tag to HMU stating: THIS PART PRESERVED WITH LUBRICATING OIL, MIL-L-6081, Grade 1010.

(13) Attach a properly filled out materiel condition tag.

(14) Prepare forms according to DA PAM 738-751 or T.O. 00-20-1 as applicable, and place them in a plastic bag (item 11, Appendix D) (to be stowed with the HMU in shipping container).

(15) Package HMU for shipment and/or storage (para 1-210).

b. **(T700)** Pressurizing and Overspeed Unit (POU).

(1) Install a clean, dry protective cap (item 25, Appendix D) over electrical connector.

(2) Hold POU over a suitable container, and drain all fuel

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(3) Place POU in a clean drip pan, and pour lubricating oil (item 86, Appendix D) into the inlet and outlet ports.

(4) Drain oil from POU, and install plugs in inlet and outlet ports.

(5) Coat external bare-metal surfaces with lubricating oil (item 86, Appendix D).

(6) Attach a tag to POU stating: THIS PART PRESERVED WITH LUBRICATING OIL, MIL-L- 6081, Grade 1010.

(7) Attach a properly filled-out materiel condition tag.

(8) Prepare forms according to DA PAM 738-751 or T.O. 00-20-1 as applicable, and place them in a plastic bag (item 11, Appendix D) (to be stowed with the POU in shipping container).

(9) Package POU for shipment and/or storage (para 1-210).

c. **(T701, T701C, T701D)** Overspeed and Drain Valve (ODV).

(1) Install a cap or plug (item 48, Appendix D) on P3 fitting and a clean, dry protective cap (item 25, Appendix D) over electrical connector.

(2) Hold ODV over a suitable container and drain all fuel.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(3) Place ODV in a clean drip pan and pour lubricating oil (item 86, Appendix D) into inlet and outlet ports.

(4) Drain oil from ODV and install plugs in inlet and outlet ports.

(5) Coat external bare-metal surfaces with lubricating oil (item 86, Appendix D).

(6) Attach a tag to ODV stating: THIS PART PRESERVED WITH LUBRICATING OIL, MIL-PRF-6081, Grade 1010.

(7) Attach a properly filled out materiel condition tag.

(8) Prepare forms according to DA PAM 738-751 or T.O. 00-20-1 as applicable, and place them in a plastic bag (item 11, Appendix D) (to be stowed with the ODV in shipping container).

(9) Package ODV for shipment and/or storage (para 1-210).

d. Fuel Boost Pump.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(1) Place fuel boost pump in a clean drip pan and pour lubricating oil (item 86, Appendix D) into inlet port. Turn pump drive shaft and continue pouring until oil runs from discharge port.

(2) Drain oil from pump and cap or plug inlet, outlet, oil, and drain ports.

(3) Coat external bare-metal surfaces including splines with lubricating oil (item 86, Appendix D).

(4) Attach a tag to fuel boost pump stating: THIS PART PRESERVED WITH LUBRICATING OIL, MIL-PRF-6081, Grade 1010.

(5) Attach a properly filled out materiel condition tag.

(6) Prepare forms according to DA PAM 738-751 or T.O. 00-20-1 as applicable, and place in a plastic bag (item 11, Appendix D) (to be stowed with the fuel boost pump in shipping container).

(7) Package fuel pump for shipment and/or storage (para 1-210).

e. Oil Cooler.

(1) Hold oil cooler over a suitable container and drain all fuel.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(2) Fill oil cooler fuel passages with lubricating oil (item 86, Appendix D).

(3) Slosh oil around in cooler so that all internal fuel passages are coated.

(4) Drain oil from cooler, and cap or plug inlet and outlet ports.

(5) Coat external bare-metal surfaces with lubricating oil (item 86, Appendix D).

(6) Attach a tag to oil cooler stating: THIS PART PRESERVED WITH LUBRICATING OIL, MIL-PRF-6081, Grade 1010.

(7) Attach a properly filled out materiel condition tag.

(8) Prepare forms according to DA PAM 738-751 or T.O. 00-20-1 as applicable and place in a plastic bag (item 11, Appendix D) (to be stowed with the oil cooler in shipping container).

(9) Package oil cooler for shipment and/or storage (para 1-210).

1-210. Packaging LRU's for Shipment or Storage.

LRU's that are removed for more than 48 hours for maintenance, for return to Depot, or for storage, will be packaged. Shipping and storage case 21C7303P01 will hold the electrical control unit, digital electronic control, or the anti-icing bleed and start valve. Shipping and storage case 21C7302P01 will hold any one or all of the following:

- fuel boost pump
- oil and scavenge pump
- **(T700, T701)** history recorder
- **(T701C, T701D)** history counter
- **(T700)** pressurizing and overspeed unit, or **(T701, T701C, T701D)** overspeed and drain valve

Package LRU's as follows:

a. Electrical Control Unit (ECU), Digital Electronic Control (DEC) or Anti-Icing Bleed and Start Valve.

(1) Attach envelope, containing forms to the LRU being shipped or stored, and wrap them in barrier material (item 12, Appendix D). Secure the wrap with tape (item 107, Appendix D).

(2) When packaging electrical control unit or digital electronic control (2, fig. 1-108, sheet 1), install unit into shipping and storage case 21C7303P01 (1), so that electrical connectors face aft.

(3) Prior to packaging the anti-ice bleed and start valve (3), do the following:

(a) Remove all protective caps, shipping closures, paper tags, and packaging material.

(b) Shake/tilt valve until standing water is removed through ports.

(c) Dry/clean external surface of valve.

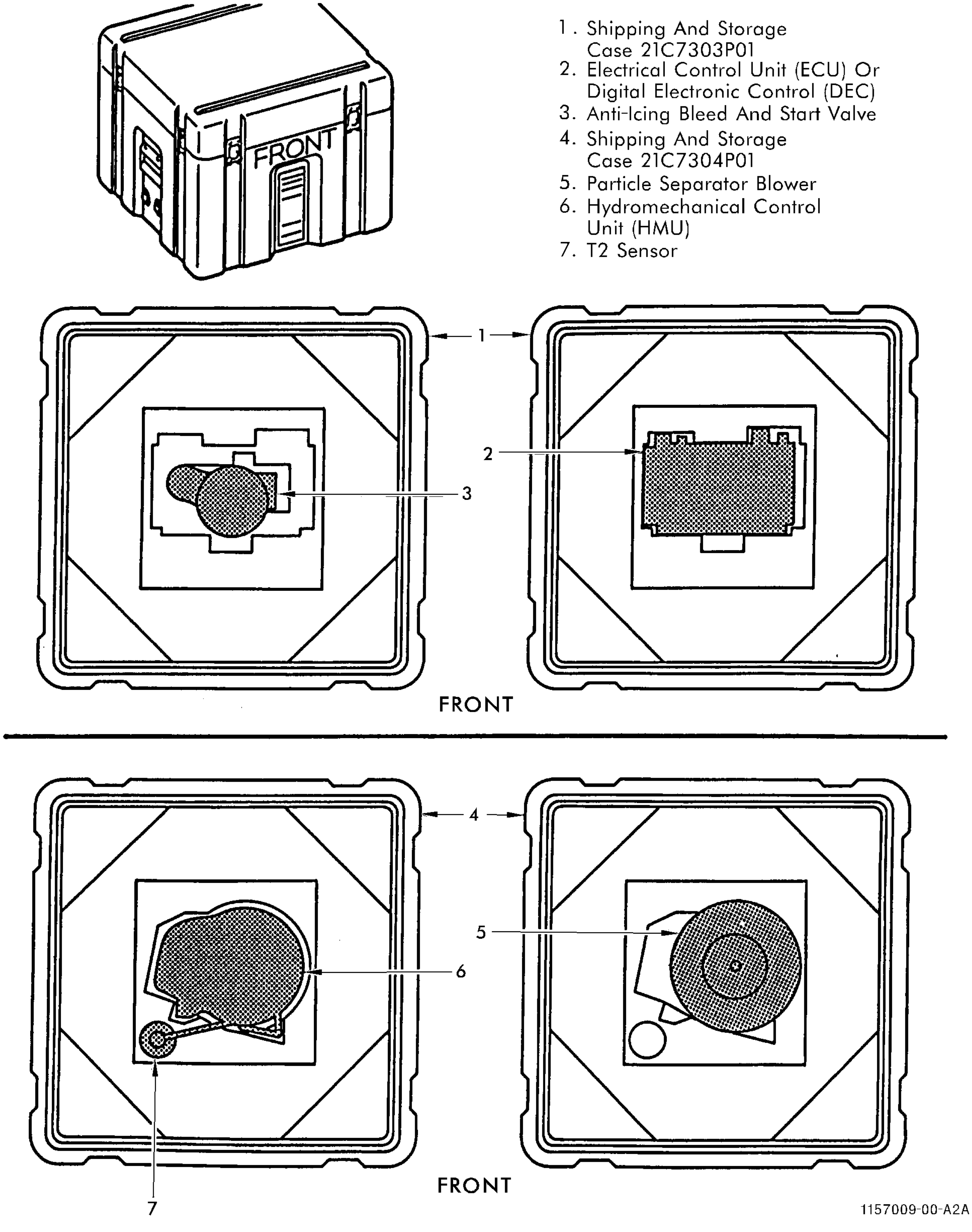
(d) Reapply protective caps, shipping closure, paper tags, and packaging materials.

(e) Place valve in a plastic bag and add desiccant.

(f) Seal plastic bag.

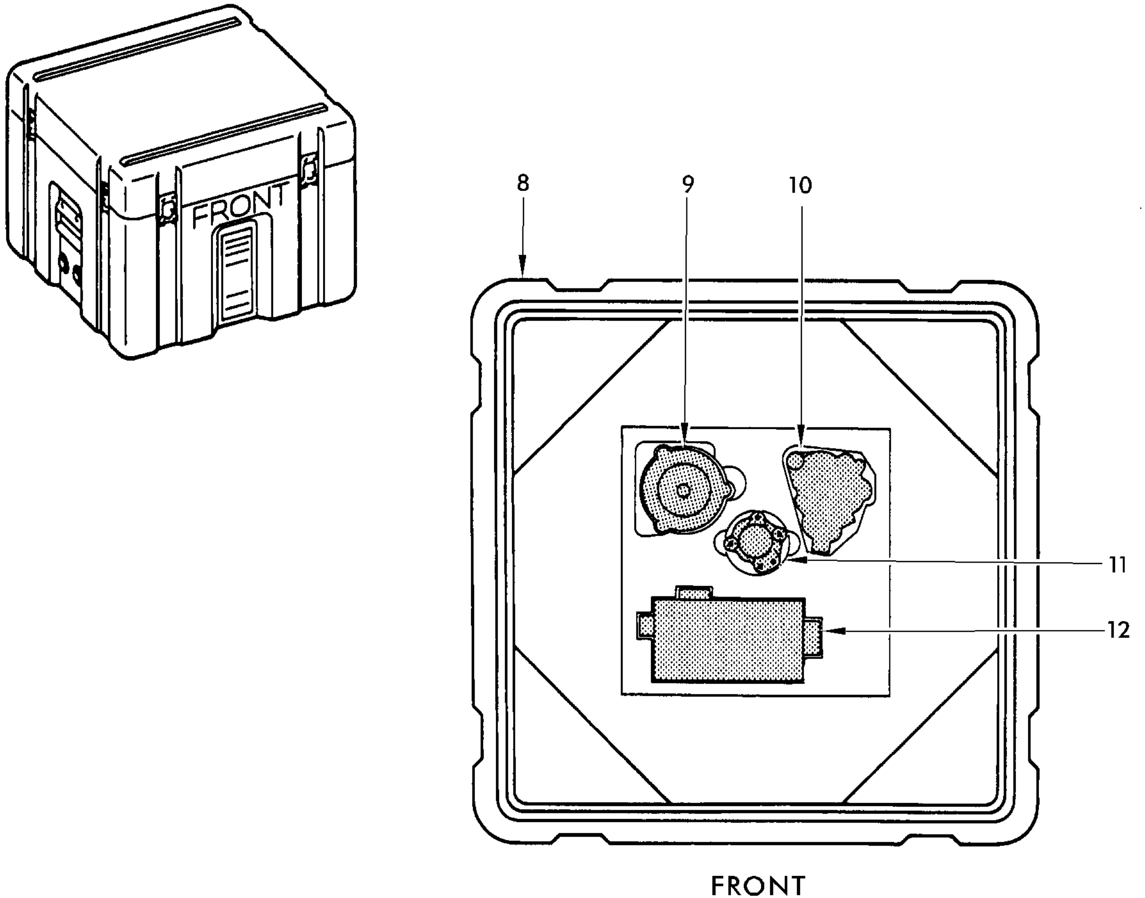
(4) When packaging anti-icing bleed and start valve (3), install valve into case (1), so that electrical connector faces down.

(5) Secure lid onto case.



1. Shipping And Storage Case 21C7303P01
2. Electrical Control Unit (ECU) Or Digital Electronic Control (DEC)
3. Anti-Icing Bleed And Start Valve
4. Shipping And Storage Case 21C7304P01
5. Particle Separator Blower
6. Hydromechanical Control Unit (HMU)
7. T2 Sensor

Figure 1-108. Packaging LRU's for Shipment or Storage (Sheet 1 of 2)



8. Shipping And Storage Case
9. Fuel Boost Pump
10. **(T700)** Pressurizing And Overspeed Unit (POU), Or **(T701, T701C, T701D)** Overspeed And Drain Valve (ODV)
11. Lube And Scavenge Pump
12. **(T700, T701)** History Recorder Or **(T701C, T701D)** History Counter

1157010-01

Figure 1-108. Packaging LRU's for Shipment or Storage (Sheet 2 of 2)

(6) Cross out old markings on case that do not apply to LRU inside. Using stencil marking ink (item 81, Appendix D), mark the following on top half of container:

- Form control number
- Serial number
- Date packed
- Reinspection date (6 months after date packed)

b. Hydromechanical Control Unit (HMU) or Particle Separator Blower.

(1) Attach envelope, containing forms to the LRU being shipped or stored, and wrap them in barrier material (item 12, Appendix D). Secure the wrap with tape (item 107, Appendix D).

(2) When packaging the hydromechanical control unit (6), install unit into shipping and storage case 21C7304P01 (4), shaft end up. Insert T2 sensor (7) into slot as shown.

(3) When packaging particle separator blower (5), install blower into case (4), shaft end up.

(4) Secure lid onto case.

(5) Cross out old markings on case that do not apply to LRU inside. Using stencil marking ink (item 81, Appendix D), mark the following on top half of container:

- Form control number
- Serial number
- Date packed
- Reinspection date (6 months after date packed)

c. Fuel Boost Pump; **(T700)** Pressurizing and Overspeed Unit (POU), or **(T701, T701C, T701D)** Overspeed and Drain Valve (ODV); Oil and Scavenge Pump; or **(T700, T701)** History Recorder or **(T701C, T701D)** History Counter.

(1) Attach envelope, containing forms to the LRU being shipped or stored, and wrap them in barrier material (item 12, Appendix D). Secure the wrap with tape (item 107, Appendix D).

(2) When packaging fuel boost pump (9, fig. 1-108, sheet 2), install pump into shipping and storage case (8), shaft end up.

(3) When packaging either **(T700)** POU (10), or **(T701, T701C, T701D)** ODV (10), install POU, or ODV into case 21C7302P01 (8), so that electrical connector end is facing down.

(4) When packaging oil and scavenge pump (11), install pump into case (8), shaft end down.

(5) When packing history recorder (12), install recorder into case (8) so that electrical connector is located to the left.

(6) Secure lid onto case.

(7) Cross out old markings on case that do not apply to LRU inside. Using stencil marking ink (item 81, Appendix D), mark the following on top half of container:

- Form control number
- Serial number
- Date packed
- Reinspection date (6 months after date packed)

d. Oil Cooler.

(1) Attach envelope, containing forms to oil cooler, and wrap them in barrier material (item 12, Appendix D). Secure wrap with tape (item 107, Appendix D).

(2) Package oil cooler as follows:

(a) Line a metal, cardboard, fiberboard, or wood shipping container with a minimum of 2 inches of dry cushioning material (item 68, Appendix D).

(b) Place 16 units (one bag) of desiccant (item 70, Appendix D) and wrapped oil cooler into container.

(c) Cover oil cooler with a minimum of 2 inches of cushioning material (item 68, Appendix D).

(d) Secure lid on container.

(3) Cross out old markings on container that do not apply to oil cooler inside. Using stencil marking ink (item 81, Appendix D), mark the following on top half of container:

- Form control number
- Serial number
- Date packed
- Reinspection date (6 months after date packed)

Section VIII. ENGINE TEST IN MOBILE OR FIXED FACILITIES

1-211. ENGINE TESTING IN THE MODULAR ENGINE TEST SYSTEM (METS), FLEXIBLE ENGINE DIAGNOSTIC SYSTEM (FEDS), OR COMPACT ENGINE TEST SYSTEM (CETS).

1-212. Preliminary Instructions.

NOTE

- Testing the engine in the METS/FEDS/CETS is the preferred method of engine test. Testing in the aircraft is an alternate method.
- If the METS/FEDS/CETS is unavailable, engine testing may be done on aircraft according to engine checks listed in table 1-39.

a. The following instructions define the requirements for operating the **T700, T701, T701C** or **T701D** engine when installed in the Modular Engine Test System (METS), Flexible Engine Diagnostic System (FEDS), or Compact Engine Test System (CETS). All pre-run inspection (para 1-217) will be done before running engine in METS/FEDS/CETS. Manuals (METS) TM 55-4920-328-13-1/-2, (FEDS) no number, and (CETS) SE-876-03-1006 contain descriptions and tables for the system. It will provide test technicians and maintenance personnel with the necessary information for proper operation and maintenance of the METS/FEDS/CETS.

b. Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

c. Table 1-39 lists the checks and tests that must be made after engine parts have been replaced. Parts removed to gain access to other parts or other areas are also subject to checks and tests.

d. See paragraph 1-213 for engine operating parameters.

e. When troubleshooting the engine, see paragraphs 1-254 and 1-255.

f. Fuel will conform to specification MIL-DTL-5624 grade JP4 (NATO Code F40)/Jet B, MIL-DTL-5624 grade JP5 (NATO Code F44)/Jet A, and MIL-DTL-83133 grade JP8 (NATO Code F34)/Jet A-1.

NOTE

Commercial fuels are commonly made to conform to American Society for Testing and Materials (ASTM) Specification D 1655. The ASTM fuel specification does not contain anti-icing additives unless specified. Foreign military fuels also may not contain an anti-icing inhibitor. Icing inhibitor conforming to MIL-DTL-27686 (Commercial name PRIST) will be added to commercial and foreign fuels, not containing an icing inhibitor, during refueling operations, regardless of ambient temperatures. Refueling operations will be done using accepted commercial procedures. The additive provides anti-icing protection and also functions as a biocide to kill microbial growths in aircraft fuel systems.

g. Lubricating oil will conform to specification MIL-PRF-7808 (NATO Code 0-148)/TYPE I, or MIL-PRF-23699 (NATO Code 0-156)/TYPE II.

h. Record the time at each scheduled reading.

i. Record the history recorder or history counter events, before and after each engine run, on the log sheet.

j. Preserve the engine (para 1-252) before removing it from the METS/FEDS/CETS.

k. When engine has to be cleaned for performance recovery, see paragraph 1-157.

l. Use table 1-35 for converting temperature in Centigrade to temperature in Fahrenheit.

Table 1-35. Temperature Conversions

–459.4 to –220			–210 to 0			1 to 25			26 to 50			51 to 75			76 to 100			101 to 340			341 to 490			491 to 750		
C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F
–273	–459.4		–134	–210	–346	–17.2	1	33.8	–3.33	26	78.8	10.6	51	123.8	24.4	76	168.8	43	110	230	177	350	662	260	500	932
–268	–450		–129	–200	–328	–16.7	2	35.6	–2.78	27	80.6	11.1	52	125.6	25.0	77	170.6	49	120	248	182	360	680	266	510	950
–262	–440		–123	–190	–310	–16.1	3	37.4	–2.22	28	82.4	11.7	53	127.4	25.6	78	172.4	54	130	266	188	370	698	271	520	968
–257	–430		–118	–180	–292	–15.6	4	39.2	–1.67	29	84.2	12.2	54	129.2	26.1	79	174.2	60	140	284	193	380	716	277	530	986
–251	–420		–112	–170	–274	–15.0	5	41.0	–1.11	30	86.0	12.8	55	131.0	26.7	80	176.0	66	150	302	199	390	734	282	540	1004
–246	–410		–107	–160	–256	–14.4	6	42.8	–0.56	31	87.8	13.3	56	132.8	27.2	81	177.8	71	160	320	204	400	752	288	550	1022
–240	–400		–101	–150	–238	–13.9	7	44.6	0	32	89.6	13.9	57	134.6	27.8	82	179.6	77	170	338	210	410	770	293	560	1040
–234	–390		–95.6	–140	–220	–13.3	8	46.4	0.56	33	91.4	14.4	58	136.4	28.3	83	181.4	82	180	356	216	420	788	299	570	1058
–229	–380		–90.0	–130	–202	–12.8	9	48.2	1.11	34	93.2	15.0	59	138.2	28.9	84	183.2	88	190	374	221	430	806	304	580	1076
–223	–370		–84.4	–120	–184	–12.2	10	50.0	1.67	35	95.0	15.6	60	140.0	29.4	85	185.0	93	200	392	227	440	824	310	590	1094
–218	–360		–78.9	–110	–166	–11.7	11	51.8	2.22	36	96.8	16.1	61	141.8	30.0	86	186.8	99	210	410	232	450	842	316	400	1112
–212	–350		–73.3	–100	–148	–11.1	12	53.6	2.78	37	98.6	16.7	62	143.6	30.6	87	188.6	100	212	413	238	460	860	321	610	1130
–207	–340		–67.8	–90	–130	–10.6	13	55.4	3.33	38	100.4	17.2	63	145.4	31.1	88	190.4	104	220	428	243	470	878	327	620	1148
–201	–330		–62.2	–80	–112	–10.0	14	57.2	3.89	39	102.2	17.8	64	147.2	31.7	89	192.2	110	230	446	249	480	896	332	630	1166
–196	–320		–56.7	–70	–94	–9.44	15	59.0	4.44	40	104.0	18.3	65	149.0	32.2	90	194.0	116	240	464	254	490	914	338	640	1184
–190	–310		–51.1	–60	–76	–8.89	16	60.8	5.00	41	105.8	18.9	66	150.8	32.8	91	195.8	121	250	482				343	650	1202
–184	–300		–45.6	–50	–58	–8.33	17	62.6	5.56	42	107.6	19.4	67	152.6	33.3	92	197.6	127	260	500				349	660	1220
–179	–290		–40.0	–40	–40	–7.78	18	64.4	6.11	43	109.4	20.0	68	154.4	33.9	93	199.4	132	270	518				354	670	1238
–173	–280		–34.4	–30	–22	–7.22	19	66.2	6.67	44	111.2	20.6	69	156.2	34.4	94	201.2	138	280	536				360	680	1256
–169	–273	–459.4	–28.9	–20	–4	–6.67	20	68.0	7.22	45	113.0	21.1	70	158.0	35.0	95	203.0	143	290	554				366	690	1274
–168	–270	–454	–23.3	–10	14	–6.11	21	69.8	7.78	46	114.8	21.7	71	159.8	35.6	96	204.8	149	300	572				371	700	1292
–162	–260	–436	–17.8	0	32	–5.56	22	71.6	8.33	47	116.6	22.2	72	161.6	36.1	97	206.6	154	310	590				377	710	1310
–157	–250	–418				–5.00	23	73.4	8.89	48	118.4	22.8	73	163.4	36.7	98	208.4	160	320	608				382	720	1328
–151	–240	–400				–4.44	24	75.2	9.44	49	120.2	23.3	74	165.2	37.2	99	210.2	166	330	626				388	730	1346
–146	–230	–382				–3.89	25	77.0	10.0	50	122.0	23.9	75	167.0	37.8	100	212.0	171	340	644				393	740	1364
–140	–220	–364																						399	750	1382

NOTE—The numbers in bold face type refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale. If converting from Fahrenheit degrees to Centigrade degrees the equivalent temperature will be found in the left column, while if converting from degrees Centigrade to degrees Fahrenheit, the answer will be found in the column on the right.

$$^\circ F = \frac{9}{5}\,(^\circ C) + 32$$

$$^\circ C = \frac{5}{9}\,(^\circ F) - 32$$

INTERPOLATION FACTORS

C		F	C		F
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

Table 1-35. Temperature Conversions (Cont)

751 to 1000			1001 to 1250			1251 to 1490			1491 to 1750			1751 to 2000			2001 to 2250			2251 to 2490			2491 to 2750			2751 to 3000		
C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F	C	C or F	F
404	760	1400	543	1010	1850	682	1260	2300	816	1500	2732	960	1760	3200	1099	2010	3650	1238	2260	4100	1371	2500	4532	1516	2760	5000
410	770	1418	549	1020	1863	688	1270	2318	821	1510	2750	966	1770	3218	1104	2020	3668	1243	2270	4118	1377	2510	4550	1521	2770	5018
416	780	1436	554	1030	1886	693	1280	2336	827	1520	2768	971	1780	3236	1110	2030	3686	1249	2280	4136	1382	2520	4568	1527	2780	5036
421	790	1454	560	1040	1904	699	1290	2354	832	1530	2786	977	1790	3254	1116	2040	3704	1254	2290	4154	1388	2530	4586	1532	2790	5054
427	800	1472	566	1050	1922	704	1300	2372	838	1540	2804	982	1800	3272	1121	2050	3722	1260	2300	4172	1393	2540	4604	1538	2800	5072
432	810	1490	571	1060	1940	710	1310	2390	843	1550	2822	988	1810	3290	1127	2060	3740	1266	2310	4190	1399	2550	4622	1543	2810	5090
438	820	1508	577	1070	1958	716	1320	2408	849	1560	2840	993	1820	3308	1132	2070	3758	1271	2320	4208	1404	2560	4640	1549	2820	5108
443	830	1526	582	1080	1976	721	1330	2426	854	1570	2858	999	1830	3326	1138	2080	3776	1277	2330	4226	1410	2570	4658	1554	2830	5126
449	840	1544	588	1090	1994	727	1340	2444	860	1580	2876	1004	1840	3344	1143	2090	3794	1282	2340	4244	1416	2580	4676	1560	2840	5144
454	850	1562	593	1100	2012	732	1350	2462	866	1590	2894	1010	1850	3362	1149	2100	3812	1288	2350	4262	1421	2590	4694	1566	2850	5162
460	860	1580	599	1110	2030	738	1360	2480	871	1600	2912	1016	1860	3380	1154	2110	3830	1293	2360	4280	1427	2600	4712	1571	2860	5180
466	870	1598	604	1120	2048	743	1370	2498	877	1610	2930	1021	1870	3398	1160	2120	3848	1299	2370	4298	1432	2610	4730	1577	2870	5198
471	880	1616	610	1130	2066	749	1380	2516	882	1620	2948	1027	1880	3416	1166	2130	3866	1304	2380	4316	1438	2620	4748	1582	2880	5216
477	890	1634	616	1140	2084	754	1390	2534	888	1630	2966	1032	1890	3434	1171	2140	3884	1310	2390	4334	1443	2630	4766	1588	2890	5234
482	900	1652	621	1150	2102	760	1400	2552	893	1640	2984	1038	1900	3452	1177	2150	3902	1316	2400	4352	1449	2640	4784	1593	2900	5252
488	910	1670	627	1160	2120	766	1410	2570	899	1650	3002	1043	1910	3470	1182	2160	3920	1321	2410	4370	1454	2650	4802	1599	2910	5270
493	920	1688	632	1170	2138	771	1420	2588	904	1660	3020	1049	1920	3488	1188	2170	3938	1327	2420	4388	1460	2660	4820	1604	2920	5288
499	930	1706	638	1180	2156	777	1430	2606	910	1670	3038	1054	1930	3506	1193	2180	3956	1332	2430	4406	1466	2670	4838	1610	2930	5306
504	940	1724	648	1190	2174	782	1440	2624	916	1680	3056	1060	1940	3524	1199	2190	3974	1338	2440	4424	1471	2680	4856	1616	2940	5324
510	950	1742	649	1200	2192	788	1450	2642	921	1690	3074	1066	1950	3542	1204	2200	3992	1343	2450	4442	1477	2690	4874	1621	2950	5342
516	960	1760	654	1210	2210	793	1460	2660	927	1700	3092	1071	1960	3560	1210	2210	4010	1349	2460	4460	1482	2700	4892	1627	2960	5360
521	970	1778	660	1220	2228	799	1470	2678	932	1710	3110	1077	1970	3578	1216	2220	4028	1354	2470	4478	1488	2710	4910	1632	2970	5378
527	980	1796	666	1230	2246	804	1480	2696	938	1720	3128	1082	1980	3596	1221	2230	4046	1360	2480	4496	1493	2720	4928	1638	2980	5396
532	990	1814	671	1240	2264	810	1490	2714	943	1730	3146	1088	1990	3614	1227	2240	4064	1366	2490	4514	1499	2730	4946	1643	2990	5414
538	1000	1832	677	1250	2282				949	1740	3164	1093	2000	3632	1232	2250	4082				1504	2740	4964	1649	3000	5432
									954	1750	3182										1510	2750	4982			

NOTE—The numbers in bold face type refer to the temperature either in degrees Centigrade or Fahrenheit which it is desired to convert into the other scale. If converting from Fahrenheit degrees to Centigrade degrees the equivalent temperature will be found in the left column, while if converting from degrees Centigrade to degrees Fahrenheit, the answer will be found in the column on the right.

$$°F = \frac{9}{5}(°C) + 32$$

$$°C = \frac{5}{9}(°F) - 32$$

INTERPOLATION FACTORS

C		F	C		F
0.56	1	1.8	3.33	6	10.8
1.11	2	3.6	3.89	7	12.6
1.67	3	5.4	4.44	8	14.4
2.22	4	7.2	5.00	9	16.2
2.78	5	9.0	5.56	10	18.0

1-213. Engine Operating Parameters. Observe engine operating limits in table 1-36 **(T700)**, 1-37 **(T701, T701C, T701D)**.

*Table 1-36. **(T700)** Engine Operating Limits (In METS/FEDS/CETS)*

NOTE

- 100% Ng = 44,700 rpm
- (METS) 100% Np = 20,000 rpm
- (FEDS/CETS) 100% Np = 20,000 rpm
- (METS) Overspeed trips at 111 ± 1% Np (22,200 rpm)
- (FEDS/CETS) Overspeed trips at 111 ± 1% Np (22,200 rpm)
- (METS) Overspeed test position trips at 103 ± 1% Np (20,600 rpm)
- (FEDS/CETS) Overspeed test position trips at 103 ± 1% Np (20,600 rpm)

Item	Limits	Remarks
Ng:		
a. Max continuous	99% (44,152 rpm)	Ng overspeed replacement limits are; Ng exceeds 47,000 rpm (105%) for 12 seconds or longer or exceeds 46,000 rpm (103%) for 2 1/2 minutes or longer, refer to paragraph 1-278.
b. Intermediate	102% (45,652 rpm)	
c. Transient (12 seconds)	105% (47,000 rpm)	
d. Ground idle	63% (28,161 rpm) (minimum)	
Np:		
a. No time limit	(METS) 110% (22,000 rpm) (FEDS/CETS) 110% (22,000 rpm)	For power turbine overspeed replacement limits, see figure 1-148.
b. Transient (12 seconds)	(METS) 127% (25,300 rpm) (FEDS/CETS) 127% (25,300 rpm)	
TGT:		
a. Max continuous	1427°F (775°C)	
b. Max steady-state (red line)	1562°F (850°C)	
c. Transient (12 seconds)	1627°F (886°C)	
Time limits at temperature:		
a. No time limit	1427°F (775°C)	For engine overtemperature maintenance limits, see figures 1-151 and 1-154.
b. 30 minutes	1562°F (850°C)	
c. Transient (12 seconds)	1627°F (886°C)	
d. No operation allowed	Above 1627°F (886°C)	

*Table 1-36. **(T700)** Engine Operating Limits (In METS/FEDS/CETS) (Cont)*

Item	Limits	Remarks
Output shaft torque:		
a. Max continuous	410 foot-pounds	For engine torque limits, see figure 1-150.
b. Intermediate (30 minutes)	500 foot-pounds	
c. Transient (12 seconds)	700 foot-pounds	
Free air temperature (FAT).	–65° to 131°F (–54° to 55°C)	
Fuel and oil leakage.	2 cc/min. maximum (approximately 10 drops per minute)	Leakage from all drains with engine running.
HMU Vent drain leakage:		
a. Running	50 cc/hr	
b. Static (excluding leakage during priming of HMU)	50 cc/hr (about 4 drops per minute)	
Oil Cooler (PNs 6044T95P01 or 6044T95P02) weephole.	No leakage allowed	
POU drain (at shutdown).	75 cc maximum 20 cc minimum	
Swirl frame drain (running).	5 cc/hr maximum	
All drains after a false start.	200 cc maximum	
Ignition exciter duty cycle.	2 minutes ON 3 minutes OFF 2 minutes ON 23 minutes OFF	

CAUTION

At any time during engine operation, if PAS is reduced below ground idle and there is a decreasing indication of Ng, Np, T4.5, torque, Wf, P3, or oil pressure, immediately chop PAS to stopcock/shutoff and shut down engine. Advancing PAS from below ground idle during engine deceleration may result in a stall or engine overtemperature. See emergency shutdown procedure.

Item	Limits	Remarks
Starting:		
a. Time between ground starts	30 seconds minimum	If engine does not light off, abort start. Motor engine on starter (ignition OFF, PAS lever at 0°, water-in and water-out levers closed) for 30 seconds to purge system of fuel.
b. Time-to-idle	See figure 1-109	
c. Time-to-lightoff	10 seconds (30 seconds on first start)	

*Table 1-36. **(T700)** Engine Operating Limits (In METS/FEDS/CETS) (Cont)*

Item	Limits	Remarks
Electric starter duty cycle.	*30 seconds ON 2 minutes OFF *30 seconds ON 2 minutes OFF 30 seconds ON 1 hour OFF	* Either one of the first two times on starter may be for 45 seconds, but a 5-minute cooling period must follow before using starter again.
Oil pressure:	**CAUTION** Do not use lubricating oil MIL-L-23699 (TYPE II) when operating engine in FAT below –30°F (–34°C); otherwise, engine may be damaged.	• It is normal for oil pressure to be high during first start when oil is cold. Oil pressure should return to normal after 5 minutes operation at idle speed. • Normal oil pressure is defined as that pressure reading obtained during stabilized power settings with a clean lubrication system and with normal operating oil temperatures.
a. Oil and scavenge pump PN 5043T73P02	See figure 1-110 for oil pressure versus Ng	For oil pressure that is out-of-limits, use EODP temperature correction (para 1-247).
b. Oil and scavenge pump PN 5034T11P04	See figure 1-111 or 1-112 for oil pressure versus Ng	For oil pressure that does not fall within the dash lines of figure 1-111 or 1-112, use EODP temperature correction (para 1-247).
Oil pressure fluctuation.	±5 psi maximum	
Oil consumption.	133 cc/hr (1 quart per 6.5 hours of engine running)	See paragraph 1-249 for example of calculating oil consumption in cc/hr.

*Table 1-36. **(T700)** Engine Operating Limits (In METS/FEDS/CETS) (Cont)*

Item	Limits	Remarks
Oil temperature (at pump discharge) at all engine power settings.	Normal Temp Range: 95°-275°F (35°-135°C) Min Temp: None Max Temp: 300°F (149°C)	• Oil temperature limits • Apply to both MIL-L-7808 (TYPE I) and MIL-L-23699 (TYPE II). • If oil temperature is out-of-limits, troubleshoot problem as directed in troubleshooting procedures (para 1-254). • Do not run engine when oil is above maximum temperature.
Vibrations:		
a. Engine		
(1) Starting vibrations	2.8 inch/sec	
(2) Transient vibrations less than 5 seconds duration	2.8 inch/sec	
(3) Steady-state vibrations	1.5 inch/sec	
b. Water Brake		
(1) All power settings	2.0 inch/sec	
Anti-icing bleed and start valve closing limits.	See figure 1-118	

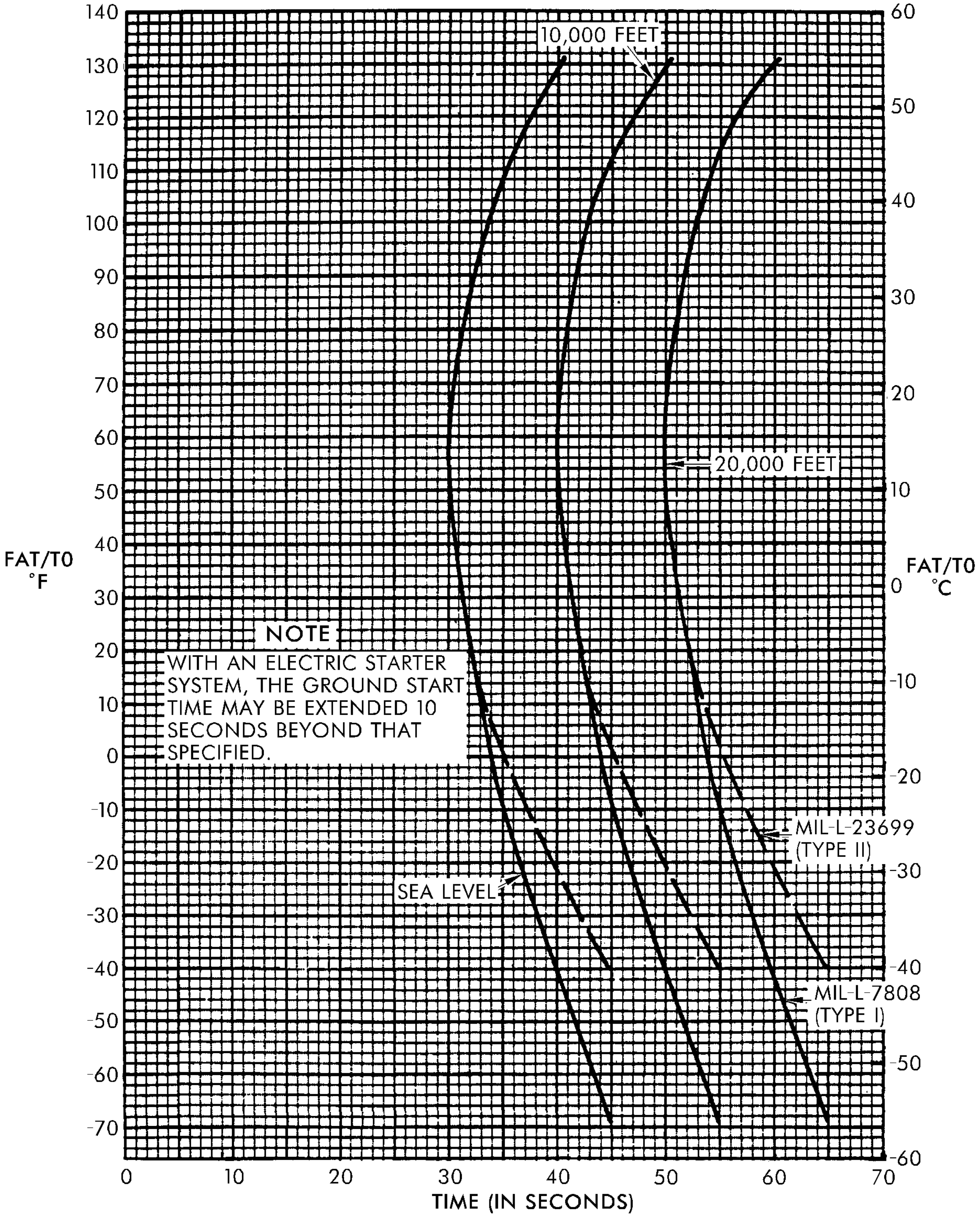


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Figure 1-109. Time-to-Idle Limits

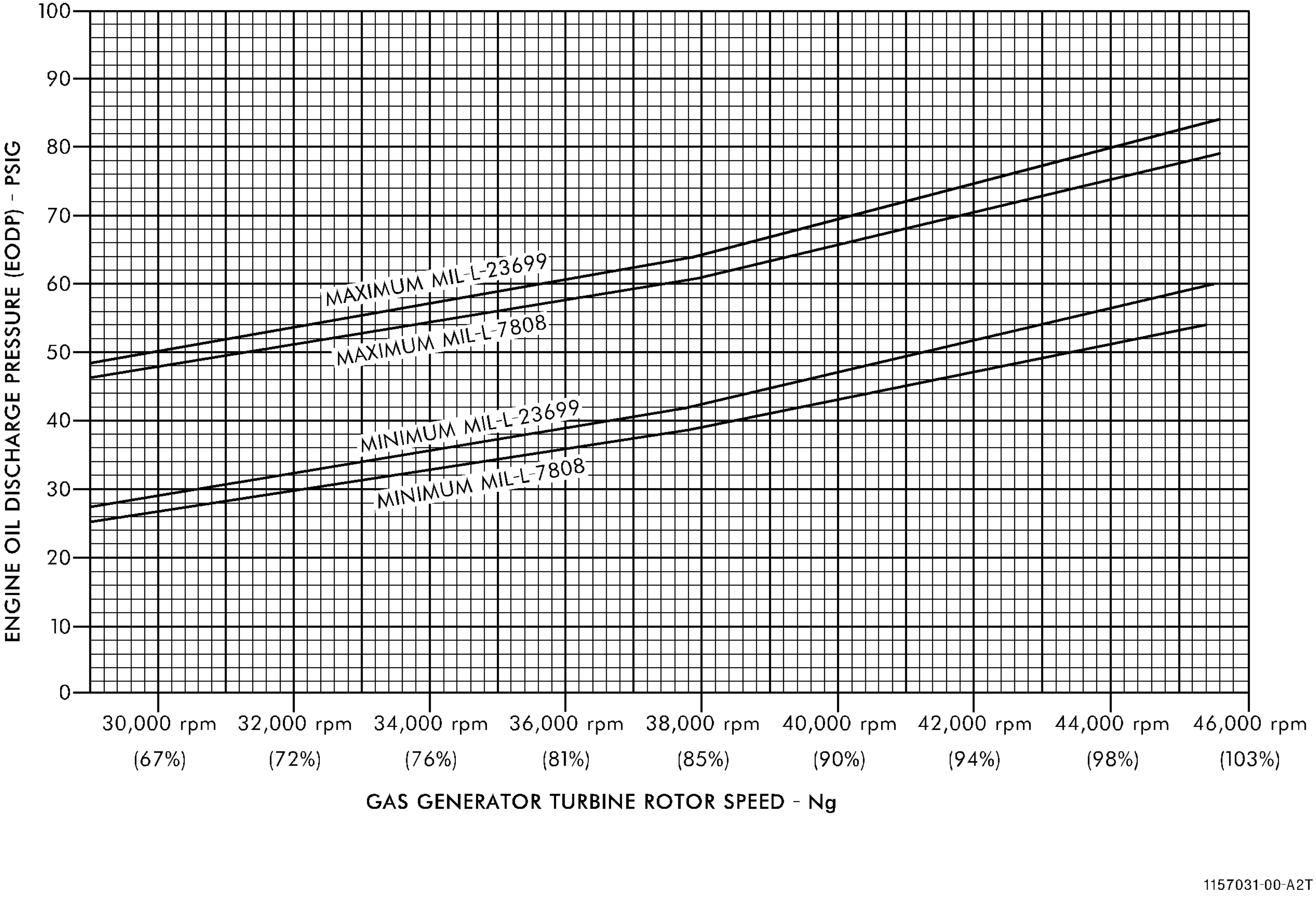


Figure 1-110. *(T700)* **Oil Pressure Limits for Pump PN 5043T73P02**

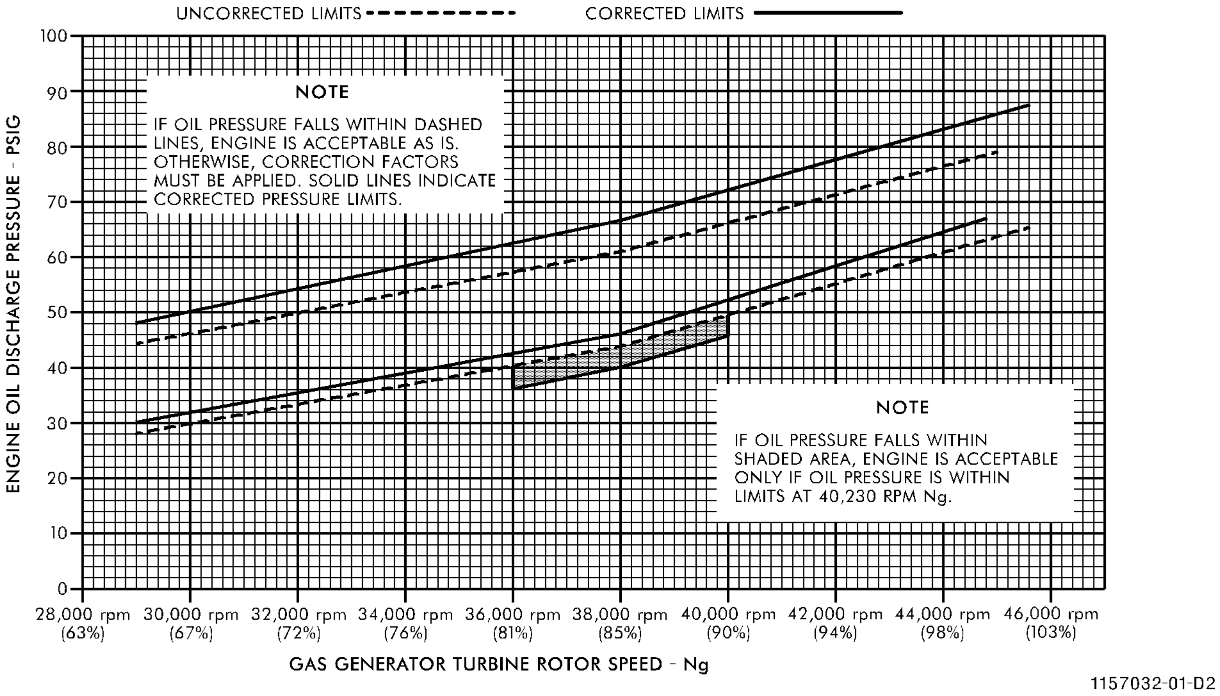


*Figure 1-111. **(T700)** Oil Pressure Limits for Pump PN 5034T11P04 and Oil MIL-L-23699*

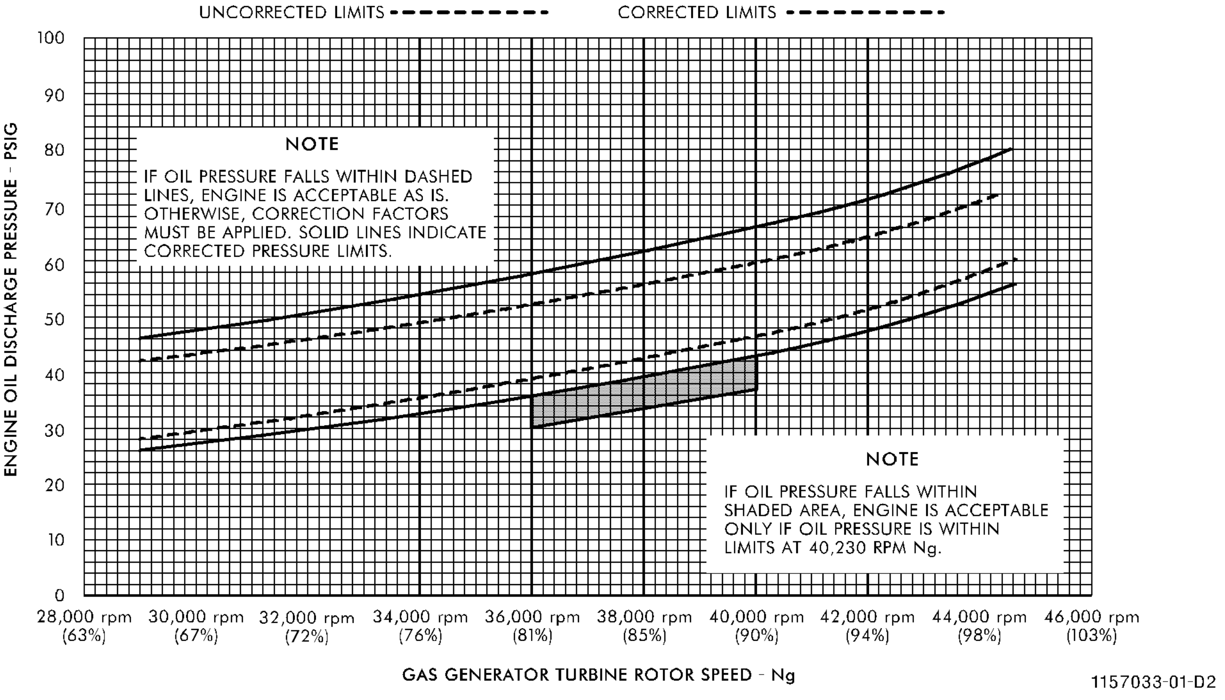


*Figure 1-112. **(T700)** Oil Pressure Limits for Pump PN 5034T11P04 and Oil MIL-L-7808*

Table 1-37. ***(T701, T701C, T701D)*** *Engine Operating Limits (In METS/FEDS/CETS)*

Item	Limits	Remarks
	NOTE • 100% Ng = 44,700 rpm • (METS) 100% Np = 20,000 rpm • (FEDS/CETS) 100% Np = 20,000 rpm • (METS) Overspeed trips at 125 ± 1% Np (25,000 rpm) • (FEDS/CETS) Overspeed trips at 125 ± 1% Np (25,000 rpm) • (METS) Overspeed test position trips at 100 ± 1% Np (20,000 rpm) • (FEDS/CETS) Overspeed test position trips at 100 ± 1% Np (20,000 rpm)	
Ng:		
a. Max continuous	99% (44,152 rpm) (30 minutes)	Ng overspeed replacement limits are; Ng exceeds 47,000 rpm (105%) for 12 seconds or longer or exceeds 46,000 rpm (103%) for 2 1/2 minutes or longer, refer to paragraph 1-278.
b. Intermediate	102% (45,652 rpm)	
c. Transient (12 seconds)	105% (47,000 rpm)	
d. Ground idle	63% (28,161 rpm) (minimum)	
Np:		
a. No time limit	(METS) 110% (22,000 rpm) (FEDS/CETS) 110% (22,000 rpm)	For power turbine overspeed replacement limits, see figure 1-149.
b. Transient (12 seconds)	(METS) 127% (25,300 rpm) (FEDS/CETS) 127% (25,300 rpm)	
TGT:		
a. Max continuous	**(T701)** 1485°F (807°C) **(T701C, T701D)** 1490°F (810°C)	
b. Intermediate (30 minutes)	**(T701)** 1596°F (869°C) **(T701C, T701D)** 1564°F (851°C)	
c. Maximum (10 minutes)	**(T701C, T701D)** 1612°F (878°C)	
d. Contingency (2.5 minutes)	**(T701)** 1683°F (917°C) **(T701C, T701D)** 1657°F (903°C)	
e. Transient (12 seconds)	**(T701)** 1769°F (965°C) **(T701C, T701D)** 1740°F (949°C)	
f. Starting	**(T701)** 1596°F (869°C) **(T701C, T701D)** 1564°F (851°C)	

Table 1-37. ***(T701, T701C, T701D)*** *Engine Operating Limits (In METS/FEDS/CETS) (Cont)*

Item	Limits		Remarks
Time limits at temperature:			
a. No time limit	**(T701)** Up to 1484°F (Up to 807°C) **(T701C, T701D)** Up to 1490°F (810°C)		For engine overtemperature maintenance limits, see figures **(T701)** 1-152 or **(T701C, T701D)** 1-153 and **(T701)** 1-155 or **(T701C, T701D)** 1-156.
b. 30 minutes	**(T701)** 1596°F (869°C) **(T701C, T701D)** 1564°F (851°C)		
c. 10 minutes	**(T701C, T701D)** 1612°F (878°C)		
d. 2.5 minutes	**(T701)** 1683°F (917°C) **(T701C, T701D)** 1657°F (903°C)		
e. Transient (12 seconds)	**(T701)** 1769°F (965°C) **(T701C, T701D)** 1740°F (949°C)		
f. No operation allowed	**(T701)** Above 1769°F (965°C) **(T701C, T701D)** Above 1740°F (949°C)		
Output shaft torque (foot-pounds):			
	(T701)	**(T701C, T701D)**	
a. Max continuous	410	500	For engine torque limits, see figure 1-150.
b. Intermediate (30 minutes)	500	543	
c. Transient (12 seconds)	700	700	
Free air temperature (FAT).	–65° to 135°F(–54° to 57°C)		
Fuel and oil leakage.	2 cc/min maximum (approximately 10 drops per minute)		Leakage from all drains with engine running.
HMU vent drain leakage:			
a. Running	50 cc/hr		
b. Static (excluding leakage during priming of HMU)	50 cc/hr (about 4 drops per minute)		
Oil cooler PNs 6044T95P01 or 6044T95P02) weephole	No leakage allowed		

Table 1-37. ***(T701, T701C, T701D)*** *Engine Operating Limits (In METS/FEDS/CETS) (Cont)*

Item	Limits	Remarks
ODV drain at shutdown	100 cc maximum 15 cc minimum	
All drains after a false start	200 cc maximum	
Ignition exciter duty cycle	2 minutes ON 3 minutes OFF 2 minutes ON 3 minutes OFF 2 minutes ON 48 minutes OFF	

CAUTION

At any time during engine operation, if PAS is reduced below ground idle and there is a decreasing indication of Ng, Np, T4.5, torque, Wf, P3, or oil pressure, immediately chop PAS to stopcock/shutoff and shut down engine. Advancing PAS from below ground idle during engine deceleration may result in a stall or engine overtemperature. See emergency shutdown procedure.

Item	Limits	Remarks
Starting:		
a. Time between ground starts	30 seconds minimum	If engine does not light off, abort start. Motor engine on starter (ignition OFF, PAS lever at 0°, water-in and water-out levers closed) for 30 seconds to purge system of fuel.
b. Time-to-idle	See figure 1-109	
c. Time-to-lightoff	10 seconds (30 seconds on first start)	
Electric starter duty cycle.	*30 seconds ON 2 minutes OFF *30 seconds ON 2 minutes OFF 30 seconds ON 1 hour OFF	* Either one of the first two times on starter may be for 45 seconds, but a 5-minute cooling period must follow before using starter again.
Oil pressure:		

CAUTION

To avoid engine damage do not use lubricating oil MIL-PRF-23699 (TYPE II) when operating engine in FAT below –30°F (–34°C).

NOTE

- It is normal for oil pressure to be high during first start when oil is cold. Oil pressure should return to normal after 5 minutes operation at idle speed.
- Normal oil pressure is defined as that pressure reading obtained during stabilized power settings with a clean lubrication system and with normal operating oil temperatures.

Table 1-37. ***(T701, T701C, T701D)*** *Engine Operating Limits (In METS/FEDS/CETS) (Cont)*

<table>
<tr><th>Item</th><th>Limits</th><th>Remarks</th></tr>
<tr><td>B-sump Δ oil pressure.</td><td>See figure 1-113</td><td>During the first 5 minutes of operation, do not accelerate above ground idle speed until oil pressure can be held to maximum limit throughout acceleration.</td></tr>
<tr><td>Oil pressure fluctuation.</td><td>±5 psi maximum</td><td></td></tr>
<tr><td>Oil consumption.</td><td>133 cc/hr (1 quart per 6.5 hours of engine running)</td><td>See paragraph 1-249 for example of calculating oil consumption in cc/hr.</td></tr>
<tr><td>Oil temperature (at pump discharge) at all engine power settings.</td><td><table><tr><th>Normal Temp Range</th><th>Min Temp</th><th>Max Temp</th></tr><tr><td>95°-275°F (35°-135°C)</td><td>None</td><td>300°F (149°C)</td></tr></table></td><td>• Oil temperature limits apply to both MIL-PRF-7808 (TYPE I) and MIL-PRF-23699 (TYPE II).
• If oil temperature is out-of-limits, troubleshoot problem as directed in troubleshooting procedures (para 1-254).
• Do not run engine when oil is above maximum temperature.</td></tr>
<tr><td>Vibrations:</td><td></td><td></td></tr>
<tr><td>a. Engine</td><td></td><td></td></tr>
<tr><td>(1) Starting vibrations</td><td>2.8 inch/sec</td><td></td></tr>
<tr><td>(2) Transient vibrations less than 5 seconds duration</td><td>2.8 inch/sec</td><td></td></tr>
<tr><td>(3) Steady-state vibrations</td><td>1.5 inch/sec</td><td></td></tr>
<tr><td>b. Water Brake</td><td></td><td></td></tr>
<tr><td>(1) All power settings</td><td>2.0 inch/sec</td><td></td></tr>
<tr><td>Anti-icing bleed and start valve closing limits.</td><td>See figure 1-118</td><td></td></tr>
</table>

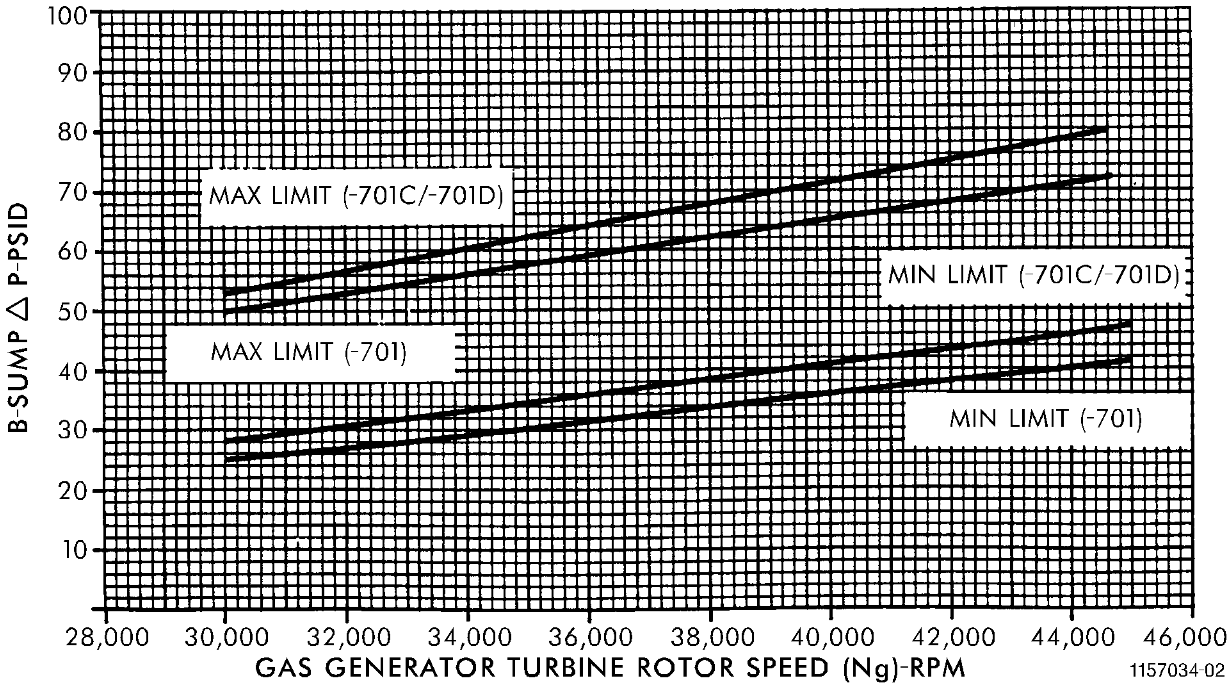


Figure 1-113. ***(T701, T701C, T701D)*** *B-Sump Delta (△) Pressure Oil Limits*

1-214. Warnings and Cautions. The following warning and caution will be observed during engine testing:

WARNING

Engine Testing (Enclosed)

- Before starting engine, be sure that personnel are clear of engine inlet and exhaust, and that the test stand is properly secured.
- All test areas shall be adequately ventilated to avoid buildup of toxic fuel vapors or exhaust gases.
- Do not stand opposite turbine section when engine is operating above idle speed.
- All personnel in the immediate area shall wear ear muffs and ear plugs whenever engine is running.
- Fuel vapors are heavier than air. When they settle and collect in confined areas, they are highly flammable. When air temperature is above 80°F (27°C), jet fuel will ignite more readily than gasoline when exposed to a hot object.
- Clothing subjected to splashed or sprayed fuel creates a potential fire hazard. Persons wearing wet clothing should go to a fire-safe area and change clothing immediately; this action will prevent fire and will prevent irritation to skin. Clothing should be dried in open air (outside of building) as soon as removal and should be washed thoroughly before wearing again.
- Fuels shall be kept in approved safety containers when not in use.

CAUTION

- Avoid operating in Np ranges of 25-40% and 55-75%.
- Engine will be operated within limits (para 1-213) at all times.
- Make sure that engine test area is clean. Dirt and other foreign objects drawn into the engine can seriously damage the compressor and other critical parts.
- Air supply to water brake should be turned on before operating engine in METS/FEDS/CETS.
- Make sure arrow on check valve in water brake air line is installed properly (arrow pointing to water brake).

1-215. Cold Weather Operation.

a. General Information. Engine will perform correctly in cold weather; however, the operator should observe precautions and advice given in this paragraph. Engine inlet and exhaust covers should be installed when engine is not operating, to prevent water and snow from entering and accumulating in the engine.

CAUTION

- Do not use JP5 or JP8 fuel when operating engine in ambient air temperatures below –30°F (–34°C).
- Do not use lubricating oil (item 85, Appendix D) when operating in ambient air temperatures below –30°F (–34°C). When operating below this temperature, lubricating oil will be flushed from engine by following procedure in paragraph 1-114 when replacing contaminated oil. Refill engine oil tank with lubricating oil (item 87, Appendix D).

b. Engine Anti-Icing System Operation.

CAUTION

- Anti-icing system will be turned on to prevent engine damage due to icing.
- The engine anti-icing system is not designed to de-ice the engine. Therefore, it will be turned on before reaching probable icing conditions.

(1) The anti-icing system will be turned on when ambient temperature is 41°F (5°C) or colder and when icing conditions (humidity is greater than or equal to 80%, or if there is visible moisture) are present.

(2) When operating in areas where icing conditions may be encountered, check operation of engine anti-icing system (para 1-237).

(3) Water and snow may have entered engine inlet during operation or during periods when engine was unsheltered. During pre-test inspection, specifically check

engine for accumulation of ice or snow. If present, accumulation will be removed before engine start. Ice will be thawed, not chipped away.

c. Engine Oil System Characteristics.

(1) It is normal to observe high engine oil pressure during initial starts when oil is cold. Run engine at idle speed until oil pressure is within limits. Oil pressure should return to normal range after operating five minutes. However, time required for warmup will depend on temperature of engine and oil system before start.

(2) During starts in extremely cold weather, –54°C (–65°F) or below, the following oil pressure characteristics are typical:

(a) Oil pressure may remain at zero for the first 20 to 30 seconds after initiating start. Abort start if oil pressure does not register within one minute after initiating start.

(b) Once oil pressure begins to indicate on gage, it will increase rapidly and will exceed 100 psig. Oil pressure will decrease as oil temperature rises and will return to within operating limits given in table 1-36 **(T700)** or 1-37 **(T701, T701C, T701D)** . This condition is normal. The time it takes for oil pressure to decrease to 100 psig or below will depend on the ambient temperature, but oil pressure should be within operating limits within 4 to 5 minutes after starting the engine.

(c) Oil pressure may increase above 100 psig if engine is accelerated above idle while oil temperature is below normal operating range. Oil pressure will decrease to within normal operating range as oil temperature increases.

(3) It is normal for the oil filter bypass light to come on when starting and when oil temperatures are below normal operating temperatures. This is due to high oil viscosity and contamination buildup in the oil filter. When the engine oil temperature reaches approximately 38°C (100°F) during warmup, the light should go out.

d. Engine Operation Below –40°C (–40°F).

(1) If engine does not light off within 10 seconds after Ng begins to increase, de-energize ignition and retard PAS lever to 0° and then advance to 26° (ground idle) three times, ending at 26°.

(2) If engine still does not light off within 40 seconds, de-energize ignition, retard PAS lever to 0°, prime the fuel system (para 1-219), and repeat engine start (para 1-224).

1-216. Emergency Shutdown Procedure. (See paragraph 1-248 for normal shutdown procedures.)

a. An emergency shutdown is one in which the engine is shut down from high power (over 90% Ng) without first running the engine for 2 minutes at idle speed.

b. Before testing an engine, the operator will read and observe the following instructions:

(1) After an emergency shutdown, do not try to restart engine until fault has been found and corrected.

(2) If an abnormal engine condition such as a compressor stall, flameout, or overtemperature occurs, shut down the engine immediately. During compressor rotor coastdown, listen for any unusual noises or for signs of a mechanical failure.

(3) Before attempting restart after emergency shutdown, do the following:

CAUTION

- Do not exceed starter operating limits.
- TGT must be brought below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F) before attempting engine restart.
- Attempted restart must be made within 5 minutes of emergency shutdown.

(a) With PAS lever at 0° and with ignition OFF, motor engine until TGT decreases below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F).

(b) Make restart attempt within 5 minutes of emergency shutdown.

(c) If restart attempt cannot be made within 5 minutes of emergency shutdown, wait 4 hours minimum before attempting engine restart.

(d) Hand-crank engine (para 1-98) to verify that the gas generator rotor is not seized.

(4) If there is evidence of combustion after shutdown, if TGT rises rapidly, or if TGT is greater than 538°C (1000°F), make sure that PAS lever is at 0° and that ignition is OFF. Motor engine until TGT indicates combustion has stopped or until TGT is below 538°C

(1000°F). Continue to monitor TGT to be sure combustion or temperature greater than 538°C (1000°F) does not occur. If it does, continue motoring the engine even if starter limitations must be exceeded.

(5) If there is evidence of fire inside the engine, extinguish fire with CO_2 by spraying it into engine air inlet while motoring engine. Starter limitations may be exceeded. Refer to table 1-16 (item 2) for required maintenance action.

(6) If engine is equipped with a DEC, record the fault code displayed 30 seconds after engine shutdown. If no fault is detected, the torque reading will be 0.00. If fault is detected, refer to table 1-45 and troubleshoot DEC.

1-217. Pre-Run Inspection. Perform the following inspections before engine start:

a. Check oil level indicator. If necessary, add oil (para 1-112).

b. Be sure that oil tank filler cap is properly installed.

c. Check electrical cables for chafing and for broken or missing brackets or clamps. Be sure that electrical connectors are secure.

d. Be sure that fuel, oil, air tubes, and hoses are secure. Check for chafing, leaks, and for broken or missing clamps.

e. Be sure that PAS and LDS actuation controls are secure and rigged according to METS/FEDS/CETS manual.

f. Be sure that V-band clamps on HMU, particle separator blower, and compressor blankoff plates are secure.

g. Check outside of engine for oil or fuel leaks, and for missing or broken bolts and nuts. If oil or fuel is noted in engine bay area, check weephole on oil cooler PNs 6044T95P01 or 6044T95P02 for leakage during idle speed leakage check (para 1-226).

h. Check engine inlet and exhaust for foreign objects or foreign object damage (FOD).

i. On oil filter, be sure that impending bypass button has not popped.

j. On fuel filter, be sure that impending bypass button has not popped.

k. Be sure that engine mounts are secure.

l. Be sure that variable geometry (VG) linkage is secure. Quick-release pins must be properly engaged.

m. Be sure that bellmouth and inlet screen are properly alined and are securely mounted.

n. Be sure that all drain containers are empty and that the following engine drain lines are properly installed (see figure FO-3 for drain locations):

- Combustor (D1)
- Common (D3)
- Swirl frame (D6)
- **(T700)** POU (D4)
- **(T701, T701C, T701D)** ODV (D4)
- HMU vent (D5)

o. Be sure that all accelerometers, brackets, and leads are correctly positioned and are secure.

p. Move PAS and LDS levers through full range of travel. When PAS lever goes through 127° to 130°, check ECU or DEC lockout operation by listening for a click from the Hamilton Standard HMU or aligning the white scribe line on the PAS spindle with the stop boss on the Woodward Governor HMU housing. If click is not heard or the white line is not completely visible, check PAS rigging according to METS/FEDS/CETS manual.

WARNING

Electrical Test Leads

To prevent possible fire, do not allow electrical test leads to contact fuel lines.

q. Be sure that test electrical leads are not touching fuel lines, so they cannot be shorted.

WARNING

Testing Chip Detector

To prevent injury from electrical shock, do not hold detector in bare hands when doing the following test.

r. Remove electrical chip detector (para 8-52) with green cable attached. With power on, short an insulated screwdriver across contacts to see if electrical chip detector light works.

s. Reinstall electrical chip detector (para 8-55).

t. Be sure anti-icing panel light shows that the anti-icing bleed and start valve is open.

1-218. Preparation for Engine Start. Perform the following before starting engine:

- Engine Fuel System Priming (para 1-219)
- Engine Rollover (Dry Motoring) (para 1-220)
- Fuel Flow Verification Check (para 1-221)

1-219. Engine Fuel System Priming.

a. Be sure that all test panel warning lights are off. Turn fuel pump on, and record fuel inlet pressure; pressure will be 20-50 psig.

b. Set WATER-IN lever to closed position and WATER-OUT lever to open position.

c. Advance PAS lever slowly to 130°. Record PAS lever angle at first sign of fuel flow from common drain. PAS lever angle must be within 125°-130°. If angle is out of limit, check PAS rigging according to applicable aircraft maintenance manual.

d. Allow fuel to drain (vent) for 30 to 60 seconds from HMU vent or until a steady stream of fuel, free of air and preserving oil, is draining from the vent. Fuel flow will go to zero when PAS lever is retarded to 122° - 124°. If not, PAS is misrigged or HMU is not functioning properly. Check PAS rigging to determine source of problem.

e. Set PAS lever to 0°.

f. Empty HMU vent drain container in accordance with local safety regulations.

1-220. Engine Rollover (Dry Motoring). If fuel system has not been primed, go back to paragraph 1-219 before continuing.

a. Turn on water to water brake. Make sure that water pressure for water brake bearing is 80-100 psig in order to provide sufficient flow to lubricate the bearing.

b. Make sure that ignition switch is OFF, that LDS and PAS levers are at 0°, that WATER-IN lever is in closed position, and that WATER-OUT lever is in open position.

c. Turn on air to water brake. Make sure air supply is 40-80 psig.

d. With PAS lever at 0°, there will be no fuel flow from **(T700)** POU drain, or **(T701, T701C, T701D)** ODV drain.

CAUTION

Do not exceed starter duty cycle.

NOTE

The starting system should motor the engine to at least 24% Ng (10,281 rpm).

e. With PAS lever at 0° and ignition OFF, energize starter until maximum rollover speed is indicated.

f. Record stabilized Ng speed. (24% (10,281 rpm) minimum).

g. Check for the following:

(1) No fuel or oil leaks. With PAS lever at 0°, there should be no fuel flow from **(T700)** POU, or **(T701, T701C, T701D)** ODV drain.

(2) Positive engine oil discharge pressure.

(3) Anti-icing panel light shows that anti-icing bleed and start valve is open.

h. De-energize starter and check for unusual noise during coastdown.

1-221. Fuel Flow Verification Check.

WARNING

If the engine is run in the aircraft instead of the METS/FEDS/CETS, pull the ignition circuit breaker before attempting FUEL FLOW VERIFICATION CHECK to prevent the engine from starting.

a. Manually position actuating system linkage assembly to FULL OPEN (actuator rod retracted into HMU). Using an open-end wrench on flats of actuating shaft, extend and retract HMU actuator rod. Check for full HMU actuator rod travel of 1.6 - 1.8 inches.

CAUTION

Ignition must be OFF when setting PAS lever to 26° (ground idle).

b. Motor engine to at least 24% (10,281 rpm) starter motoring speed. With ignition OFF, set PAS lever to 26° (ground idle) for 30 seconds; then record Wf, P3, and Ng. Wf should be 60 ±5 lb/hr. Look for fuel mist coming from tailpipe.

c. Check to be sure that the VG stator vanes are in a full-closed position (HMU actuator rod fully extended).

d. Return PAS lever to 0°. Continue to motor engine on the starter for 15 seconds more.

e. De-energize starter and allow engine to coast down. Make the following checks:

(1) Check for leaks in fuel system. With the exception of approximately 1 ounce (30cc) of fuel found in the **(T700)** POU manifold assembly, or **(T701, T701C, T701D)** ODV manifold assembly drain container, there should be no fuel leaks.

(2) Check engine oil level. If necessary, add oil (para 1-112).

1-222. Mechanical Check.

NOTE

Mechanical check is not required if break-in is required.

a. The following readings will be taken during test unless procedures indicate certain parameters: Ng, Np, TGT, Wf, engine torque, water brake torque, T0, P3, oil pressure, oil temperatures, vibration levels, VG tracking angle, and PAS and LDS lever positions.

b. Following normal engine start (para 1-224) and after performing idle speed check (para 1-227), if required, do the following mechanical check:

(1) Position LDS lever to 0° and PAS lever to 26°. When at ground idle speed, position WATER-IN lever to set Np at 45-50%.

CAUTION

Do not exceed 3 seconds in the Np range of 55-75%.

(2) Turn Np DEMAND knob for minimum Np speed.

(3) Position WATER-IN lever to CLOSED and position WATER-OUT lever to OPEN. With LDS lever at 0°, slowly advance PAS lever to 117°. Adjust Np DEMAND knob to set Np at (METS) 104.5% (20,900 rpm) (FEDS/CETS) 104.5% (20,900 rpm). Be sure stage 1 VG tracking is within limits (fig. 1-114 and 1-115).

CAUTION

- Do not allow TGT to exceed the maximum limit setting.
- Do not allow Ng to exceed 102%.

(4) With Np set for (METS) 104.5% (20,900 rpm) (FEDS/CETS) 104.5% (20,900 rpm) speed, set LDS lever to 50°.

(5) Use WATER-IN lever to vary Ng as shown in table 1-38.

Table 1-38. Mechanical Check Settings

Np Demand Dial For Np	Ng	Time of Change In Seconds	Position Held
(METS) 104.5% (20,900 rpm) (FEDS/CETS) 104.5% (20,900 rpm)	92%	10	30 seconds (see step (7))
(METS) 104.5% (20,900 rpm) (FEDS/CETS) 104.5% (20,900 rpm)	96%	10	30 seconds (see step (7))
(METS) 104.5% (20,900 rpm) (FEDS/CETS) 104.5% (20,900 rpm)	TGT limiter: **(T700)** 1539°-1560°F (837°-849°C) **(T701)** 1569°-1591°F (854°-866°C) **(T701C, T701D)** 1580°-1602°F (860°-872°C)		30 seconds (see step (7))

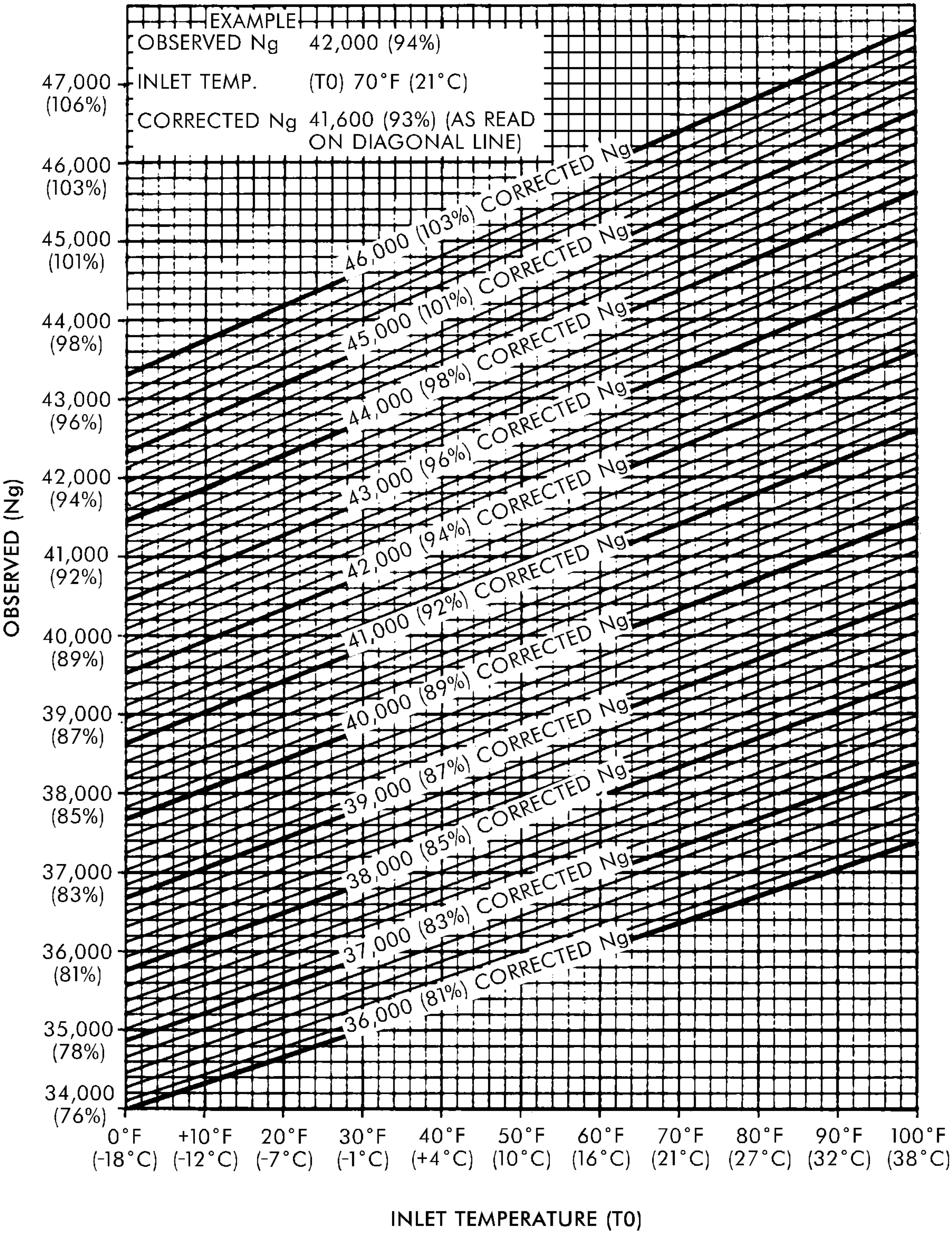
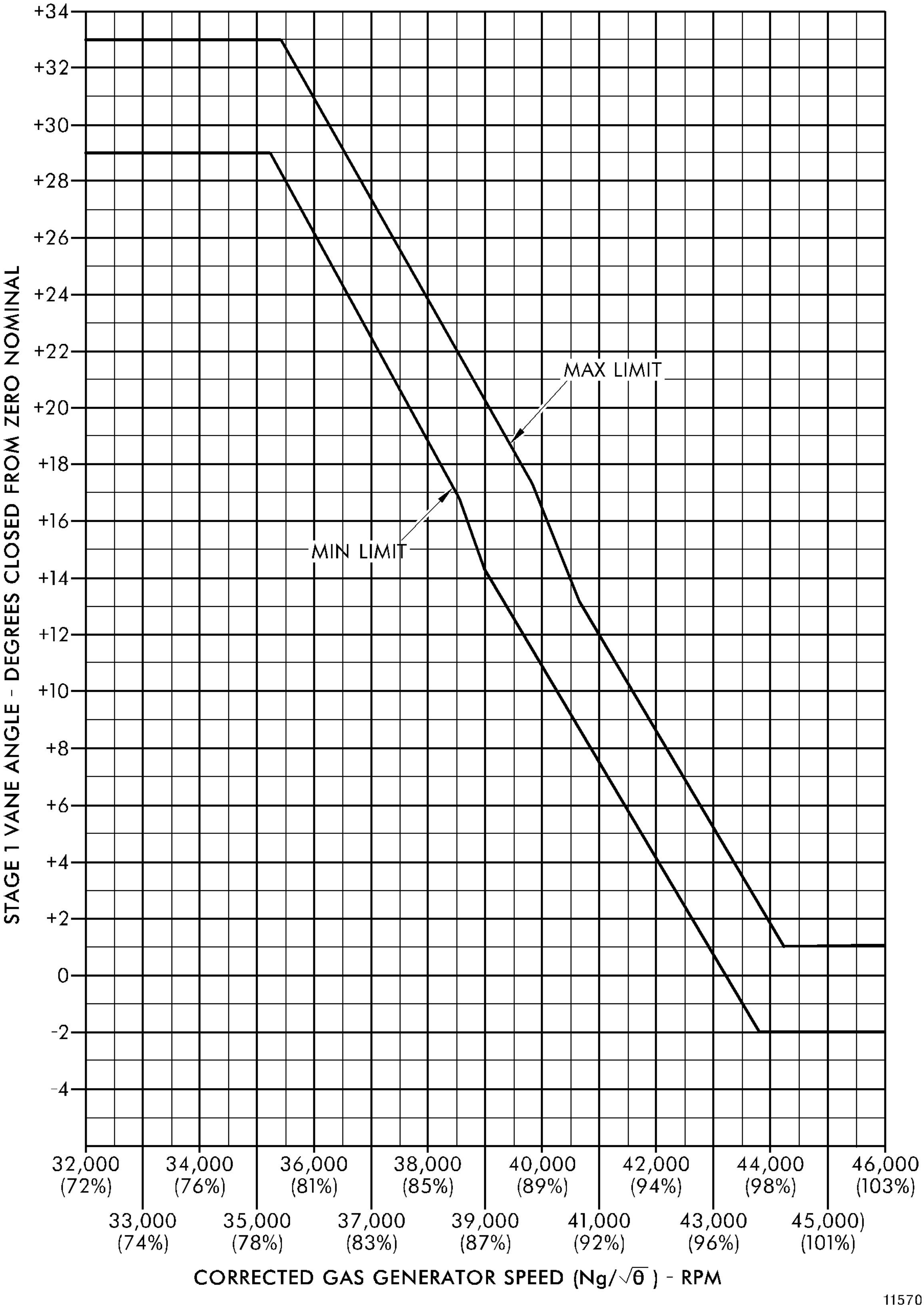


Figure 1-114. Temperature Corrections for Stage 1 VG Tracking



1157036-00-A2A

Figure 1-115. Stage 1 VG Tracking

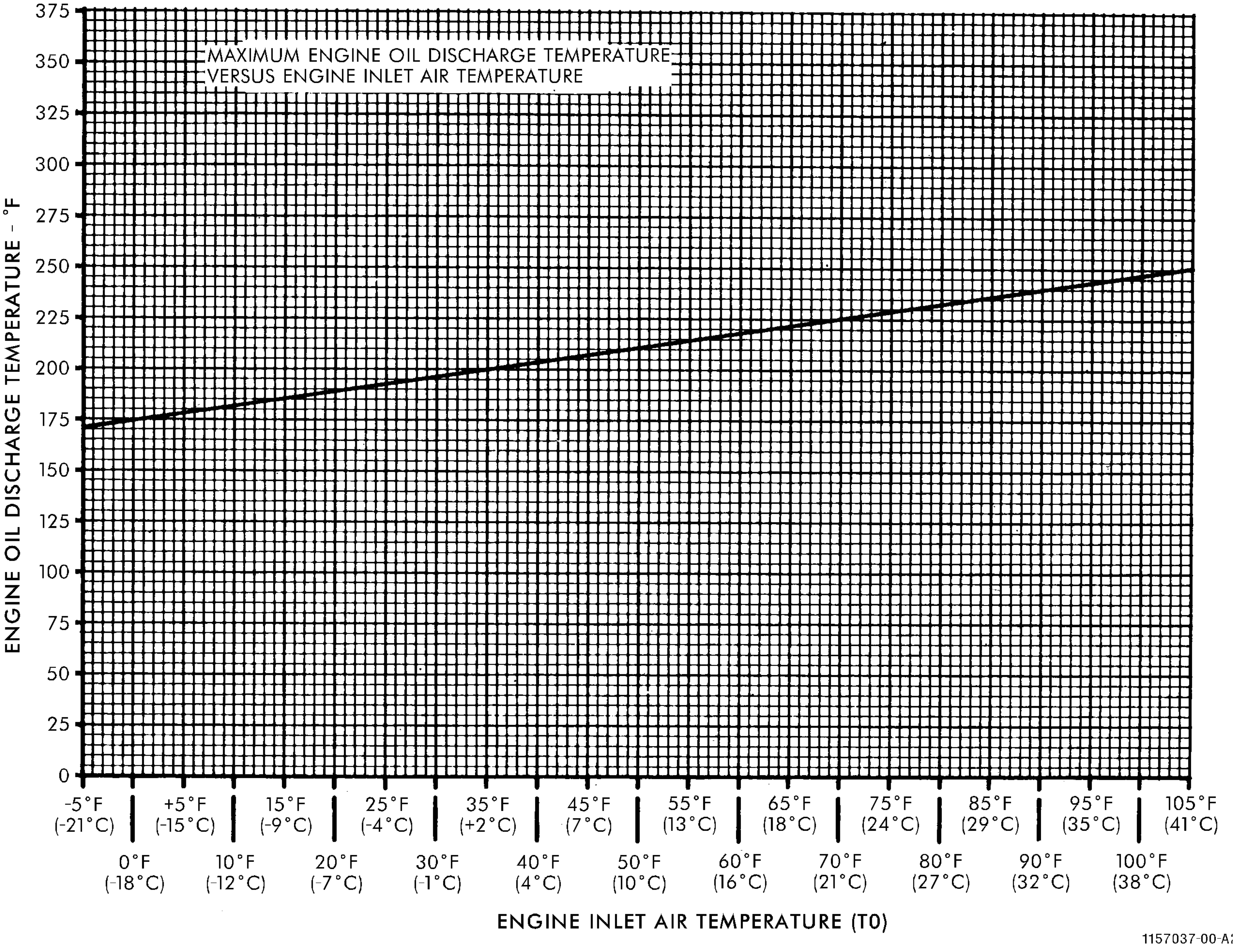


Figure 1-116. Oil Discharge Temperature

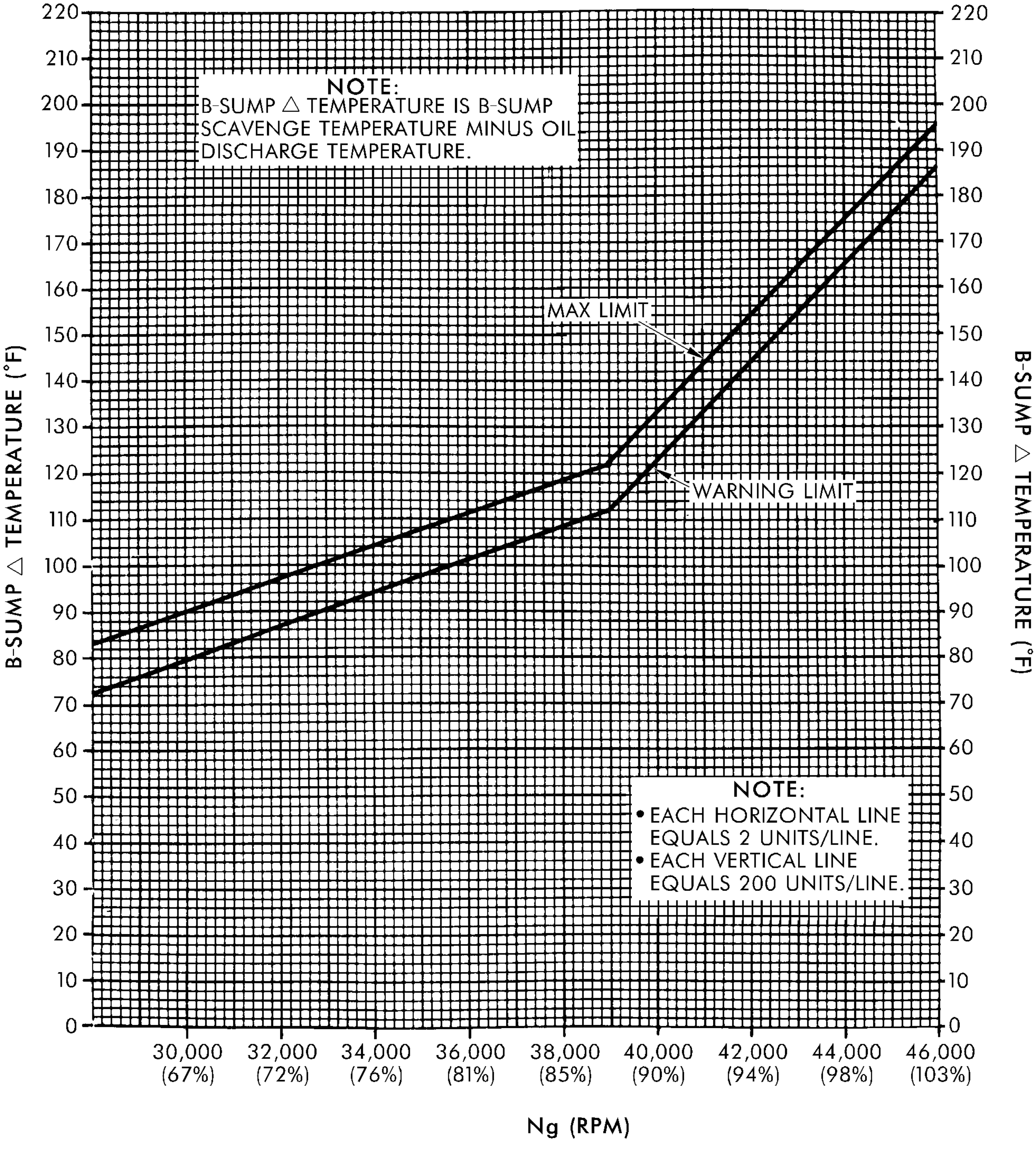


Figure 1-117. Oil Scavenge Temperature for B-Sump

(6) Record Ng and T0 at the exact time the anti-ice panel light goes on.

(7) After each 30-second position held (see table 1-38), check and record the following before continuing:

(a) Ng, Np, TGT, engine torque, water brake torque, T0, VG tracking, and engine vibration levels.

(b) Oil pressure (see table 1-36 **(T700)** or 1-37 **(T701, T701C, T701D)** for limits).

(c) Oil discharge and scavenge temperature (fig. 1-116 and 1-117).

CAUTION

When decelerating, retard PAS lever before reducing the WATER-IN lever to avoid Np speed increase to the overspeed trip point.

(8) Return engine to ground idle by reducing PAS lever to 26°. Reposition the WATER-IN lever setting to hold Np at 45-50% with the gas generator at ground idle. Reduce LDS lever to 0°.

1-223. Engine Checks and Tests Required Following Replacement of Parts (AVIM).

a. Table 1-39 lists the checks and tests that must be made after engine parts have been replaced. Parts removed to gain access to other parts or other areas are also subject to the checks and tests.

b. If more than one check or test is required, they can be done during the same run.

NOTE

The HMU is designed to be adjusted at depot only. Adjustments to the HMU are safety wired to prevent adjustment at AVUM and AVIM.

c. When fuel system components are replaced or when fuel system lines are disconnected for any reason, check table 1-39 to see if an overspeed check is required.

d. The engine fuel system will be primed in accordance with table 1-39 when METS/FEDS/CETS fuel lines have been disconnected and when engine is first installed. Prime engine fuel system (para 1-219) and perform idle speed leakage check (para 1-226).

e. After all tests are completed, preserve engine parts (para 1-252), purge oil system (para 1-253), and store parts (para 1-201).

1-224. Engine Start.

CAUTION

- A water pressure of 80-100 pounds per square inch gage (psig) must be maintained to prevent water brake bearing failure.
- At any time during engine operation, if PAS is reduced below ground idle and there is a decreasing indication of Ng, Np, T4.5, torque, Wf, P3, or oil pressure, immediately chop PAS to stopcock/shutoff and shut down engine. Advancing PAS from below ground idle during engine deceleration may result in a stall or engine overtemperature. See emergency shutdown procedure.

NOTE

- The starting system should be able to motor the engine to at least 10,728 rpm (24%) Ng. The starter must not be cut out below 23,244 rpm (52%) Ng.
- After depreserving engine or after replacing any one of the following:
  - **(T700)** POU
  - **(T701, T701C, T701D)** ODV
  - Oil cooler
  - HMU

  The first engine start may be delayed (delayed lightoff) or may take longer than normal to reach idle speed (ground idle). Some smoke may be noticed, but visible smoke should disappear after preservation oil is burned off.

a. Be sure ECU/DEC ground switch on test panel is at the T700 position, as instructed in manual (METS) TM 55-4920-328-13-1, (FEDS) no number, or (CETS) SE-876-03-1006. Turn on water to water brake. Make sure that water pressure for water brake bearing is 80-100 psig in order to provide sufficient flow to lubricate the bearing.

b. Turn on air to water brake. Make sure air supply is 40-80 psig.

c. Abort start by returning PAS lever to 0° if the following requirements are not met:

(1) If TGT reaches the normal TGT limiter temperature before ground idle speed is reached, de-energize ignition, and continue to motor the engine until TGT decreases below 538°C (1000°F).

Table 1-39. Checks Required Following Replacement of Parts at AVIM

NOTE:
Engine designation is as follows:

(A) = **(T700)**
(B) = **(T701)**
(C) = **(T701C, T701D)**
(D) = **(T701, T701C, T701D)**
(E) = **(T700, T701)**
(F) = **(T700, T701C, T701D)**

Item	Part Replaced	Priming METS/FEDS/CETS Para 1-219 A/C Para 1-137	Engine Start METS/FEDS/CETS Para 1-224 A/C Para 1-123	Idle Speed Leakage METS/FEDS/CETS Para 1-226 A/C Para 1-139	Idle Speed METS/FEDS/CETS Para 1-227 A/C Para 1-140	Break-In METS/FEDS/CETS Para 1-228 A/C Para 1-148	Overspeed METS/FEDS/CETS (A) Para 1-229 (D) Para 1-230 A/C (A) Para 1-132 (D) Para 1-133	Np Governing METS/FEDS/CETS Para 1-231 A/C Para 1-141	TGT Limiter Setting/Contingency Power Check A/C (D) Para 1-130	TGT Limiter Setting METS/FEDS/CETS (A) Para 1-232 (D) Para 1-233 A/C (A) Para 1-129	Torque Matching METS/FEDS/CETS Para 1-234 A/C Para 1-141	(E) ECU or (C) DEC LOCKOUT METS/FEDS/CETS Para 1-235 A/C Para 1-134	Torque Repeatability METS/FEDS/CETS Para 1-236 A/C Para 1-88	Anti-Icing Bleed and Start Valve METS/FEDS/CETS Para 1-237 A/C Para 1-143	Maximum Power Check METS/FEDS/CETS (A) Para 1-238, 1-239; (D) Para 1-241, 1-242 A/C (A) Para 1-145, (D) Para 1-146, (C) Para 1-147	Oil Consumption METS/FEDS/CETS Para 1-249 A/C Para 1-144	Mechanical METS/FEDS/CETS Para 1-222
1.	Accessory Gearbox											•					
2.	COLD SECTION MODULE	•	•	•	•		•	•	•	•	•	•		•	•	•	•
3.	A-Sump Output Shaft Assembly		•	•									•			•	•
4.	Compressor Case Half, Right-Hand Removal and Reinstallation	•	•	•	•		•	•	•	•	•		•	•	•		
5.	Inlet Separator Boot		•	•													
6.	No. 1 Carbon Seal		•	•												•	
7.	Power Takeoff Drive Assembly		•	•									•			•	
8.	Swirl Frame		•	•												•	
9.	HOT SECTION MODULE	•	•	•		•	•	•	•	•	•		•		•	•	
10.	Combustion Liner	•	•	•			•	•	•	•	•		•		•	•	
11.	Face-Type Seal		•	•			•	•	•	•	•		•		•	•	
12.	Gas Generator Rotor and Stator		•	•		•	•	•	•	•	•		•		•	•	
13.	Stage 1 Nozzle Assembly		•	•			•	•	•	•	•		•		•	•	
14.	POWER TURBINE MODULE		•	•			•	•	•	•	•		•		•	•	•
15.	C-Sump Cover and C-Sump Heat Shield		•	•												•	
16.	ACCESSORY SECTION MODULE	•	•	•	•		•	•	•	•		•		•		•	•
17.	Accessory Drive Gearbox Carbon Seals	•	•	•												•	
18.	Particle Separator Blower		•	•	•											•	
19.	Particle Separator Inlet Duct		•	•	•												
20.	Radial Drive Shaft Assembly		•	•	•												
21.	Radial Drive Shaft Cover Assembly		•	•													
22.	Radial Drive Shaft Cover Boot		•	•													
23.	FUEL SYSTEM																
24.	Carbon Seal	•	•	•												•	
25.	Fuel Boost Pump	•	•	•													
26.	Fuel Filter	•	•	•													

Table 1-39. Checks Required Following Replacement of Parts at AVIM (Cont)

NOTE:
Engine designation is as follows:

(A) = **(T700)**
(B) = **(T701)**
(C) = **(T701C, T701D)**
(D) = **(T701, T701C, T701D)**
(E) = **(T700, T701)**
(F) = **(T700, T701C, T701D)**

Item	Part Replaced	Priming METS/FEDS/CETS Para 1-219 A/C Para 1-137	Engine Start METS/FEDS/CETS Para 1-224 A/C Para 1-123	Idle Speed Leakage METS/FEDS/CETS Para 1-226 A/C Para 1-139	Idle Speed METS/FEDS/CETS Para 1-227 A/C Para 1-140	Break-In METS/FEDS/CETS Para 1-228 A/C Para 1-148	Overspeed METS/FEDS/CETS (A) Para 1-229 (D) Para 1-230 A/C (A) Para 1-132 (D) Para 1-133	Np Governing METS/FEDS/CETS Para 1-231 A/C Para 1-141	TGT Limiter Setting/Contingency Power Check A/C (D) Para 1-130	TGT Limiter Setting METS/FEDS/CETS (A) Para 1-232 (D) Para 1-233 A/C (A) Para 1-129	Torque Matching METS/FEDS/CETS Para 1-234 A/C Para 1-141	(E) ECU or (C) DEC LOCKOUT METS/FEDS/CETS Para 1-235 A/C Para 1-134	Torque Repeatability METS/FEDS/CETS Para 1-236 A/C Para 1-88	Anti-Icing Bleed and Start Valve METS/FEDS/CETS Para 1-237 A/C Para 1-143	Maximum Power Check METS/FEDS/CETS (A) Para 1-238, 1-239; (D) Para 1-241, 1-242 A/C (A) Para 1-145, (D) Para 1-146, (C) Para 1-147	Oil Consumption METS/FEDS/CETS Para 1-249 A/C Para 1-144	Mechanical METS/FEDS/CETS Para 1-222
27.	Fuel Filter Element and Bowl	•	•	•													
28.	Fuel Injectors	•	•	•													
29.	Fuel Pressure Sensor	•	•	•													
30.	(A) Fuel Start Feed Tube	•	•	•													
31.	(A) Fuel Start Manifold Tube	•	•	•													
32.	Gearbox-to-HMU Hose Assembly	•	•	•													
33.	HMU	•	•	•	•		•	•				•		•			•
34.	Main Fuel Manifold	•	•	•													
35.	(A) Primer Nozzles	•	•	•													
36.	(A) POU Manifold or (D) ODV Manifold Assembly	•	•	•													
37.	(A) POU or (D) ODV	•	•	•			•										
38.	ELECTRICAL SYSTEM																
39.	Alternator Rotor		•	•	•		•	•									
40.	Alternator Stator		•	•	•		•	•									
41.	Blue Electrical Cable (W5)		•				•				•						
42.	(E) ECU or (C) DEC		•	•			•	•	•	•	•						
43.	Electrical Ignition Leads		•														
44.	Green Electrical Cable (W3)		•		•									•			
45.	(E) History Recorder or (C) History Counter		•														
46.	Ignition Exciter Assembly		•														
47.	Igniter Plugs		•														
48.	Np Sensor		•	•				•									
49.	Thermocouple Assembly		•	•					•	•					•		
50.	Torque and Overspeed Sensor		•	•			•				•		•				
51.	Yellow Electrical Cable (W4)		•				•	•	•	•							
52.	OIL SYSTEM																

Table 1-39. Checks Required Following Replacement of Parts at AVIM (Cont)

NOTE:
Engine designation is as follows:

(A) = **(T700)**
(B) = **(T701)**
(C) = **(T701C, T701D)**
(D) = **(T701, T701C, T701D)**
(E) = **(T700, T701)**
(F) = **(T700, T701C, T701D)**

Item	Part Replaced	Priming METS/FEDS/CETS Para 1-219 A/C Para 1-137	Engine Start METS/FEDS/CETS Para 1-224 A/C Para 1-123	Idle Speed Leakage METS/FEDS/CETS Para 1-226 A/C Para 1-139	Idle Speed METS/FEDS/CETS Para 1-227 A/C Para 1-140	Break-In METS/FEDS/CETS Para 1-228 A/C Para 1-148	Overspeed METS/FEDS/CETS (A) Para 1-229 (D) Para 1-230 A/C (A) Para 1-132 (D) Para 1-133	Np Governing METS/FEDS/CETS Para 1-231 A/C Para 1-141	TGT Limiter Setting/Contingency Power Check A/C (D) Para 1-130	TGT Limiter Setting METS/FEDS/CETS (A) Para 1-232 (D) Para 1-233 A/C (A) Para 1-129	Torque Matching METS/FEDS/CETS Para 1-234 A/C Para 1-141	(E) ECU or (C) DEC LOCKOUT METS/FEDS/CETS Para 1-235 A/C Para 1-134	Torque Repeatability METS/FEDS/CETS Para 1-236 A/C Para 1-88	Anti-Icing Bleed and Start Valve METS/FEDS/CETS Para 1-237 A/C Para 1-143	Maximum Power Check METS/FEDS/CETS (A) Para 1-238, 1-239; (D) Para 1-241, 1-242 A/C (A) Para 1-145, (D) Para 1-146, (C) Para 1-147	Oil Consumption METS/FEDS/CETS Para 1-249 A/C Para 1-144	Mechanical METS/FEDS/CETS Para 1-222
53.	B-Sump Drain Tube		•	•													
54.	B-Sump Oil Inlet Check Valve		•	•													
55.	(D) B-Sump Delta Pressure Tube		•	•													
56.	Bypass Valve Assembly		•	•													
57.	C-Sump Aft Scavenge Tube		•	•													
58.	C-Sump Forward Oil Scavenge Tube		•	•													
59.	C-Sump Forward Scavenge Tube		•	•													
60.	C-Sump Oil Supply Tube		•	•													
61.	Cold Oil Relief Valve		•	•													
62.	Electrical Chip Detector		•	•													
63.	Main Frame Oil Strainer		•	•													
64.	Mid C-Sump Scavenge Tube		•	•													
65.	Oil and Scavenge Pump		•	•												•	
66.	Oil Cooler		•	•												•	
67.	Oil Cooler Bypass Relief Valve		•	•													
68.	Oil Drain Insert		•	•													
69.	Oil Drain Plug		•	•													
70.	Oil Filter Bowl and Indicator Assembly		•	•													
71.	Oil Filter Bypass Sensor		•	•													
72.	Oil Filter Element		•	•													
73.	Oil Level Indicator		•	•													
74.	Oil Manifold Assembly		•	•												•	
75.	Oil Pressure Sensor		•	•													
76.	Oil Supply Tubes (Left-Hand and Right-Hand)		•	•													
77.	Oil Tank Cap and Adapter		•	•													
78.	(F) Oil Temperature Sensor		•	•													

Table 1-39. Checks Required Following Replacement of Parts at AVIM (Cont)

NOTE:
Engine designation is as follows:

(A) = **(T700)**
(B) = **(T701)**
(C) = **(T701C, T701D)**
(D) = **(T701, T701C, T701D)**
(E) = **(T700, T701)**
(F) = **(T700, T701C, T701D)**

Item	Part Replaced	Priming METS/FEDS/CETS Para 1-219 A/C Para 1-137	Engine Start METS/FEDS/CETS Para 1-224 A/C Para 1-123	Idle Speed Leakage METS/FEDS/CETS Para 1-226 A/C Para 1-139	Idle Speed METS/FEDS/CETS Para 1-227 A/C Para 1-140	Break-In METS/FEDS/CETS Para 1-228 A/C Para 1-148	Overspeed METS/FEDS/CETS (A) Para 1-229 (D) Para 1-230 A/C (A) Para 1-132 (D) Para 1-133	Np Governing METS/FEDS/CETS Para 1-231 A/C Para 1-141	TGT Limiter Setting/Contingency Power Check A/C (D) Para 1-130	TGT Limiter Setting METS/FEDS/CETS (A) Para 1-232 (D) Para 1-233 A/C (A) Para 1-129	Torque Matching METS/FEDS/CETS Para 1-234 A/C Para 1-141	(E) ECU or (C) DEC LOCKOUT METS/FEDS/CETS Para 1-235 A/C Para 1-134	Torque Repeatability METS/FEDS/CETS Para 1-236 A/C Para 1-88	Anti-Icing Bleed and Start Valve METS/FEDS/CETS Para 1-237 A/C Para 1-143	Maximum Power Check METS/FEDS/CETS (A) Para 1-238, 1-239; (D) Para 1-241, 1-242 A/C (A) Para 1-145, (D) Para 1-146, (C) Para 1-147	Oil Consumption METS/FEDS/CETS Para 1-249 A/C Para 1-144	Mechanical METS/FEDS/CETS Para 1-222
79.	Oil Transfer Sleeve		•	•												•	
80.	Scavenge Screens		•	•													
81.	AIR SYSTEM																
82.	Anti-Icing Bleed and Start Valve		•	•										•			
83.	Anti-Icing Bleed Duct		•	•													
84.	Anti-Icing IGV Duct		•	•													
85.	Anti-Icing IGV Feed Tube		•	•													
86.	Anti-Icing Seal Housing		•	•													
87.	Anti-Icing Seal Retainer, Lanyard and Clip Assembly		•	•													
88.	Compressor Leakage Air Tube		•	•													
89.	Forward Seal Pressure Tube		•	•	•												
90.	(A) P3 Hose and Tube Assembly (D) P3 Tube		•	•	•												
91.	Seal Pressure and Scavenge Tube Assembly		•	•	•												
92.	Sensing Tube		•	•													

(2) If no sign of positive oil pressure within 30 seconds after engine starter is energized, de-energize ignition and starter.

(3) If engine does not light off within 30 seconds after Ng begins to increase, de-energize ignition and retard PAS lever to 0°. Motor engine for at least 15 seconds to purge fuel.

(4) If power turbine does not rotate within 30 seconds after reaching ground idle speed, abort start.

d. During engine starting, observe the following precautions:

(1) If Ng hangs up in 54-58% range, chop PAS lever to 0°. Do not operate engine for more than 10 seconds in this range.

(2) Maximum time allowed for Np to remain in 25-40% range is 10 seconds.

(3) If Np approaches 55% during start with LDS lever at 0°, open WATER-IN lever.

(4) If start is discontinued, monitor TGT after shutdown. If TGT increases above 538°C (1000°F) or if there is evidence of combustion after shutdown (indicated by a rapid increase in TGT), motor engine until temperature decreases below 538°C (1000°F). Wait 5 minutes or until TGT decreases below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F) before attempting an engine start.

(5) For starting vibration limits, see table 1-36 **(T700)** or 1-37 **(T701, T701C, T701D)**.

e. Start engine as follows:

NOTE

- During engine starting, a combustor rumbling may be heard before reaching ground idle. This rumbling sound is acceptable as long as it stops before reaching ground idle.
- The Woodward Governor HMU gear pump has a unique sound described as: clanking, rubbing, screeching, and clicking. These sounds may be heard during engine startup and coastdown.

(1) Make sure ignition switch and TORQUE MATCH switch is OFF. Set LDS and PAS levers to 0°. Set WATER-IN lever to CLOSED position.

(2) Set WATER-OUT lever to maximum open position.

CAUTION

Avoid operating in an Np range of 55-75%.

(3) If steady-state break-in is required, adjust Np demand to 85% (17,000 rpm). If steady-state break-in is not required, adjust Np demand to 100% (20,000 rpm). Record Np demand dial setting on test log.

(4) Record engine inlet air temperature (T0).

CAUTION

Do not allow fuel to enter engine before energizing ignition. If PAS lever is not at 0°, fuel will enter the engine.

(5) At the same time, press and hold starter and ignition and start the timer. Advance PAS lever to 26° (ground idle) after a positive Ng indication.

(6) De-energize starter and ignition at 52% Ng. If combustor rumbling persists at or above ground idle, shut down engine and refer to troubleshooting procedure 24 (table 1-45).

(7) Record the following:

(a) Time to reach ground idle speed (timed to 63%).

(b) Maximum TGT during acceleration to ground idle.

(c) Engine inlet air temperature (T0).

(d) Engine oil discharge pressure.

(e) Maximum vibration at each accelerometer during acceleration to ground idle.

(8) At ground idle speed, set WATER-IN lever at 45-50% Np. Record WATER-IN lever position. It will be used for future starts and ground idle positions.

CAUTION

- Lack of torque reading could mean that Np overspeed protection system is not working.
- If engine torque indicator is not working, engine must be shut down and fault fixed.

(9) Record all instrument readings after engine has stabilized for one minute. See table 1-36 **(T700)** or 1-37 **(T701, T701C, T701D)** for operating limits.

1-225. HMU P3 Fitting Check.

a. Prepare aircraft for safe ground maintenance in accordance with applicable aircraft maintenance manual.

b. Position the firewall fuel shutoff switch to ON (open).

c. Read fuel system preliminary instructions (para 6-3).

d. Remove **(T700)** P3 hose and tube assembly or **(T701, T701C, T701D)** P3 tube from HMU (para 6-40).

e. **(T701, T701C, T701D AH-64A)** Fuel selector shall be in cross feed position.

f. Pressurize aircraft fuel system in accordance with applicable aircraft maintenance manual.

g. With fuel system pressurized, inspect the P3 fitting on the HMU for leakage for 3 minutes. No leakage allowed.

h. If leakage is observed, replace HMU (para 6-40).

i. If leakage is not observed, install **(T700)** P3 hose and tube assembly or **(T701, T701C, T701D)** P3 tube onto HMU (para 6-40).

j. Inspect for FOD and secure work area.

k. Repeat steps a through j for other engine.

1-226. Idle Speed Leakage Check. While engine is running at idle speed, visually inspect the engine for leaks as follows:

a. Check for air leakage using either of the following methods:

WARNING

Working Near Hot Sections

Keep hands away from hot sections.

(1) The preferred method is to apply Leak Test Oxygen System Solution (item 98, Appendix D) on surfaces where air leaks are suspected. Solution will bubble if there is leakage.

(2) An alternate method is to place hand approximately 6 - 12 inches away from air system components, connections, compressor case splitline flanges, and other engine mating flange.

(3) The following inspection criteria shall be utilized:

(a) No air leakage is allowed around the P3 line/connections or around other threaded fitting torqued connections.

(b) Air leakage around the anti-icing bleed and start valve and attaching fittings is acceptable if bare hand can be held within 6 inches of the air leak.

(c) Air leakage around the engine compressor case splitline flanges, other engine mating flanges, slip joint connections, or metal to metal sealing surfaces is acceptable if bare hand can be held within 12 inches of the air leak.

b. Check for air leaks in the following areas:

- **(T700)** primer nozzles retaining nuts (3, fig. 6-1)
- fuel injector retaining nuts (7, fig. 6-5)
- **(T700)** igniter plug retaining nuts (4, fig. 7-1)
- **(T701, T701C, T701D)** igniter plug (1, fig. 7-2)

CAUTION

Retaining nuts and **(T701, T701C, T701D)** igniter plugs are installed with a torque of 15° wrench-arc. When applying additional wrench-arc, do not exceed a total torque of 30° wrench-arc; otherwise, midframe ports may crack.

(1) If air leaks are found, apply an additional 15° wrench-arc to retaining nut or **(T701, T701C, T701D)** igniter plug and recheck for air leaks (step a).

If air continues to leak around fuel injector retaining nut (7, fig. 6-5), do the following:

(a) Shut down engine and remove fuel injector from midframe port (para 6-24).

(b) Inspect mating surface of fuel injector mounting flange (4, fig. 6-6) (para 6-25).

(c) Inspect fuel injector seating surface (15, fig. 2-40) (para 2-62).

c. Visually check for fuel and oil leaks, paying particular attention to the following:

(1) Hose and tube connections that were disconnected and reinstalled during troubleshooting.

(2) Mating flange joints between accessory drive gearbox assembly and its components, specifically between the AGB and the mainframe.

(3) Total surface area of the mainframe.

(4) Area between fuel filter bowl and filter housing.

(5) Overboard drain for excessive oil or fuel leakage.

(6) Weephole at 12 o'clock position on oil cooler PN 6044T95P01 or PN 6044T95P02.

d. If any leaks are found, shut down engine by moving PAS lever to 0°.

e. Correct all leaks.

f. Check oil level indicator. If necessary, add oil (para 1-112).

g. Restart engine (para 1-224, step e).

1-227. Idle Speed Check.

a. Maintain Np at 45-50% by adjusting the WATER-IN lever. Set idle speed PAS to 26° (Ng speed should be at min value).

b. Slowly move PAS lever until Ng reaches 85% ±2% reading. Immediately after reaching speed, slowly reduce PAS lever to 26°. Minimum ground idle speed limit shall be 63% (28,161 rpm).

1-228. Break-In Run. A break-in run is required whenever the gas generator stator and rotor are replaced. If a break-in run is required, proceed as follows:

CAUTION

- Avoid operating in Np range of 55-75%.
- Maximum acceleration and deceleration rate is 2500 rpm (Ng) per minute until break-in run is completed; otherwise, gas generator stator and rotor may be damaged.

a. With WATER-IN lever set to hold Np at 45-50%, advance PAS lever to set Ng at 85 ±2%.

b. Set LDS lever to 0° and use PAS lever to accelerate to 85% Np.

c. Set Np DEMAND dial to 85%, set PAS lever to 117° and set LDS to 50°. With Np at 85%, or as low as possible, use WATER-IN lever to vary Ng, as directed in table 1-40.

Table 1-40. Break-In Run

a. Vary Ng as follows:

Ng From	Ng To	Time of Change (in seconds)	Ng To	Time of Change (in seconds)	Position Held (in seconds)
84%	88%	10	87%	10	30
87%	91%	10	89%	10	30
89%	93%	10	92%	10	30
92%	88%	10	92%	10	30
92%	95%	10	94%	10	30

(Before proceeding, take a full set of readings after 30 seconds. VG tracking must be within limits of figures 1-114 and 1-115).

b. Slowly decelerate to 89% Ng.

NOTE

(**T701C, T701D Apache** engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.

c. Use Np DEMAND to rapidly increase and decrease Np as follows:

Np From	Np To	Np To	Position Held (in seconds)
85%	95%	90%	30
90%	100%	95%	30
95%	105%	100%	30

d. **(T700)** Advance LDS lever to 70°. With Np DEMAND set for 104.5%, vary Ng as follows:

CAUTION

Do not exceed TGT of 1535°F (835°C); otherwise, engine overtemperature damage may result. If TGT limit is reached, consider it Max Limiting Temperature for last two readings in step d.

Ng From	Ng To	Time of Change (in seconds)	Ng To	Time of Change (in seconds)	Position Held (in seconds)
94%	97%	10	96%	10	30
96%	TGT=1380°F (749°C)	20	TGT=1409°F (765°C)	20	30

(Before proceeding, take a full set of readings after 30 seconds. VG tracking must be within limits of figures 1-114 and 1-115).

Ng From	Ng To	Time of Change (in seconds)	Ng To	Time of Change (in seconds)	Position Held (in seconds)
TGT = 1409°F (765°C)	98%	10	96%	10	30
96%	100%	10	98%	10	30
98%	Max Limiting	10	1,500 RPM less	10	30
1,500	Max Limiting	10	Max Limiting	10	30

Table 1-40. Break-In Run (Cont)

<table>
<tr><th>Ng
From</th><th>Ng
To</th><th>Time of
Change
(in seconds)</th><th>Ng
To</th><th>Time of
Change
(in seconds)</th><th>Position
Held
(in seconds)</th></tr>
<tr><td colspan="6">e. Take a full set of readings after 30 seconds.</td></tr>
<tr><td colspan="6">NOTE
(T701C, T701D Apache engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.</td></tr>
<tr><td colspan="6">f. (T701, T701C, T701D) Advance LDS lever to 70° with NP demand set for 104.5%, and vary Ng as follows:</td></tr>
<tr><td colspan="6">CAUTION
Do not exceed TGT limit of (T701) 1562°F (850°C) (T701C, T701D) 1584° (862°C); otherwise, engine overtemperature damage may result. If TGT limit is reached, consider it Max Limiting for last reading in this step.</td></tr>
<tr><td>94%</td><td>89%</td><td>20</td><td>75% Max Con (figure 1-126 (T701), or figure 1-127 (T701C, T701D))</td><td>20</td><td>30</td></tr>
<tr><td colspan="6">(Before proceeding, take a full set of readings after 30 seconds. VG tracking must be within limits of figures 1-114 and 1-115).</td></tr>
<tr><td>75% Max Con</td><td>97%</td><td>10</td><td>96%</td><td>10</td><td>30</td></tr>
<tr><td>96%</td><td>TGT = (T701) 1450°F (788°C) (T701C, T701D) 1470°F (799°C)</td><td>20</td><td>TGT = (T701) 1482°F (805°C) (T701C, T701D) 1508°F (820°C)</td><td>20</td><td>30</td></tr>
<tr><td colspan="6">(Before proceeding, take a full set of readings after 30 seconds. VG tracking must be within limits of figures 1-114 and 1-115).</td></tr>
<tr><td>TGT = 1482°F (805°C)</td><td>98%</td><td>10</td><td>97%</td><td>10</td><td>30</td></tr>
<tr><td>97%</td><td>99%</td><td>10</td><td>98%</td><td>10</td><td>30</td></tr>
<tr><td>98%</td><td>102%</td><td>10</td><td>99%</td><td>10</td><td>30</td></tr>
<tr><td>99%</td><td>101%</td><td>10</td><td>100%</td><td>10</td><td>30</td></tr>
<tr><td>1,500 RPM Less Max Limiting</td><td>—</td><td>—</td><td>Max Limiting</td><td>10</td><td>30</td></tr>
<tr><td colspan="6">g. Take a full set of readings after 30 seconds.</td></tr>
</table>

NOTE

During cold weather operation (para 1-215), low ambient temperatures may prevent completion of steady-state break-in. At least 90% Ng must be reached to complete cold day break-in requirements. If 90% Ng cannot be reached, completion of break-in will be postponed until ambient temperature increases.

d. Complete break-in run as follows:

(1) Slowly set TGT to 1430°-1450°F (777°-788°C).

NOTE

(**T701C**, **T701D** **Apache** engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.

(2) Rapidly (10 seconds or less) decrease Np to 96%.

1-229. (T700) Overspeed Check.

a. Position LDS lever to 0° and PAS lever to 26°. When at ground idle speed, position WATER-IN lever to set Np at 45-50%.

CAUTION

To avoid engine damage, do not operate in an Np range of 55%-75%.

b. Slowly move PAS lever to 117° and LDS to 50°.

c. Use Np dial set up to (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm).

d. Press and hold in both Np overspeed test buttons A and B at the same time.

e. With both Np overspeed button A and B depressed, slowly increase Np demand until you see a sharp drop in Ng (this should occur when Np reaches (METS) 103 ± 1% (20,600 rpm) or (FEDS/CETS) 103 ± 1% (20,600 rpm)). Wait for Ng to cycle three times.

f. Release button B while holding button A depressed. Ng should stabilize.

g. Release button A.

h. Depress button B. Ng should remain stable.

i. Release button B. Continue test.

1-230. (T701, T701C, T701D) Overspeed Check.

a. Position LDS lever to 0° and PAS lever to 26°. When at ground idle speed, position WATER-IN lever to set Np at 45-50%.

CAUTION

To avoid engine damage, do not operate in an Np range of 55%-75%.

b. Slowly move PAS lever to 117° and LDS lever to 50°.

c. Set Np DEMAND dial for (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm) Np speed.

CAUTION

To avoid damage to ignition exciter, do not exceed ignition exciter duty cycle (refer to table 1-37).

d. Press and hold in ignition button.

CAUTION

To avoid engine damage, TGT must be monitored during overspeed test.

e. If TGT exceeds (ECU) 1593°F (867°C) or (DEC) 1598°F (870°C), shutdown immediately. Motor engine on starter until TGT decreases below 1000°F (538°C). Wait 5 minutes or until TGT decreases below 302°F (150°C) before attempting an engine start.

f. Press overspeed button A. Ng should not decrease. If it does, release button A, shut engine down, and troubleshoot Np overspeed system (table 1-45).

g. Press overspeed button B. Ng should not decrease. If it does, release button B, shut engine down and troubleshoot Np overspeed system (table 1-45).

CAUTION

Delay in release of both buttons A and B may result in Ng recycling below IDLE, subsequent engine stall, and TGT increase.

h. With both buttons A and B depressed, wait for a drop in Ng. Immediately release buttons A and B.

i. After five seconds has elapsed release ignition button.

1-231. Np Governing Check. The engine control system is designed to maintain a constant Np speed, usually (METS) 104.5 ± 1% (20,900 rpm) or (FEDS/CETS) 104.5 ± 1% (20,900 rpm). If Np cannot be held at this speed, then the Np governing system is not governing.

NOTE

- LDS lever and WATER-IN lever should be moved slowly and at the same time to avoid hitting NP overspeed trip setting.
- (**T701C**, **T701D Apache** engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.

a. Move PAS lever to 117°, move LDS lever to 35°, and adjust WATER-IN lever to get an engine torque reading of 175 ft-lbs. Set Np speed to (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm). Record Np, torque, and LDS.

b. Using the WATER-IN lever, increase torque to 225 ft-lbs. Do not change LDS, PAS, or Np speed setting. Np speed must remain at (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm). Record Np, torque, and LDS.

c. Using the WATER-IN lever, decrease torque to 125 ft-lbs. Do not change LDS, PAS, or Np speed setting. Np speed must remain at (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm). Record Np, torque, and LDS.

NOTE

During torque changes, Np speed may vary slightly, but should settle out at (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm) quickly.

d. If Np remains at 104.5% in steps a thru c, then Np governing is operating properly.

1-232. (T700) TGT Limiter Setting Check (METS/FEDS/CETS). If T0 is below 40°F (4°C), TGT limiter setting check may not be possible. Note this fact on test log sheet, and continue with next required test.

a. Set Np DEMAND dial for 104.5% Np; set PAS lever to 117° and LDS lever to 70°. Be sure ECU ground switch or test panel is at the **T700** position, as instructed in manual (METS) TM 55-4920-328-13-1, (FEDS) no number, or (CETS) SE-876-03-1006.

b. Slowly open WATER-IN lever until TGT indicator peaks between 837°-849°C (1538° - 1561°F) Do not exceed 849°C (1561°F).

c. Allow TGT to stabilize, then slowly open WATER-IN lever until Np decreases to 98%.

d. Wait 5 seconds and record TGT, Np, T0, Wf, Ng, engine torque, and water brake torque.

e. TGT must be 837° - 849°C (1538° - 1561°F).

f. Close WATER-IN lever until TGT is 1390° - 1410°F (754° - 766°C).

1-233. (T701, T701C, T701D) TGT Limiter Setting Check (METS/FEDS/CETS). If T0 is below (ECU) 40°F (4°C) or (DEC) 7°F (–14°C) TGT limiter setting check may not be possible. Note this fact on test log sheet and continue with next required test.

NOTE

(**T701C**, **T701D Apache** engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.

a. Set TORQUE MATCH switch to RUN, and set Np DEMAND dial for (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm) Np; set PAS lever to 117° and LDS lever to 70°. Be sure ECU or DEC ground switch on test panel is at the **T700** position, as instructed in manual (METS) TM 55-4920-328-13-1, (FEDS) no number, or (CETS) SE-876-03-1006.

b. Slowly open WATER-IN lever until TGT indicator peaks between **(T701)** 854°-866°C (1569°-1591°F) or **(T701C, T701D)** 860°-872°C (1580°-1602°F). Do not exceed **(T701)** 866°C (1591°F) or **(T701C, T701D)** 872°C (1602°F).

c. Allow TGT to stabilize, then slowly open WATER-IN lever until Np decreases to (METS) 102.5% (FEDS/CETS) 102.5%.

d. Wait 5 seconds and record TGT, Np, T0, Wf, Ng, engine torque, and water brake torque.

e. TGT must be **(T701)** 854°-866°C (1569°-1591°F) or **(T701C, T701D)** 860°-872°C (1580°-1602°F).

f. Close WATER-IN lever until TGT is (ECU) 754°-766°C (1390°-1410°F).

1-234. Torque Matching Check.

a. Set TORQUE MATCH switch to OFF.

b. Move LDS lever to 70°. Open WATER-IN lever so that Ng is 97% maximum or so that engine torque is 140-160 ft-lbs. Np should be about (METS) 100% (20,000 rpm) or (FEDS/CETS) 100% (20,000 rpm). Record Np, engine torque, water brake torque, and Ng.

c. Set TORQUE MATCH switch to RUN. For engines equipped with a DEC, a momentary rise in Np (approximately 300 rpm) may be observed. Np should return to (METS) 100% (20,000 rpm) or (FEDS/CETS) 100% (20,000 rpm) and remain steady. Record Np reading.

d. Set TORQUE MATCH switch to T/S. Np should increase 3-8% above speed in step b.

e. Set TORQUE MATCH switch to OFF. Np should return to original speed in step b. Record Np speed.

1-235. ECU or DEC Lock-Out System Check.

CAUTION

TGT limiter and Np governor are bypassed when engine is operated with ECU or DEC locked out. Retard PAS lever to avoid exceeding the normal TGT limiter setting and maintain Np speed within desired range.

NOTE

Perform this check only if the ECU and/or HMU are to be shipped/installed on the engine or cold section module.

a. Set Np DEMAND dial for 93-97% Np.

b. Set PAS lever to 117°, LDS lever to 50°, and set WATER-IN lever so that TGT is 1390°-1410°F (754°-766°C).

CAUTION

Uncommanded % NG increasing will result from an engine control failing high side, and uncommanded % NG decreasing will result from an engine control failing low side.

NOTE

Advancing the PAS lever to maximum (130°) locks out the signal from the ECU or DEC to the HMU. The engine must be controlled manually, using PAS and LDS levers, to make sure that it does not exceed operating limits.

c. Anytime an HMU or AGB is removed and it or a replacement is installed, perform a minimum of 5 cycles of DEC or ECU lockout. Lockout without an uncommanded acceleration or deceleration should occur. If an uncommanded acceleration or deceleration occurs, see troubleshooting procedure 8 or 30 as appropriate.

d. Momentarily advance PAS lever to 130° and then retard lever back to 50°.

e. ECU or DEC is now locked out. Np should be 95% or lower. If Np increases beyond 95%, Np must be decreased either by opening setting on WATER-IN lever or decreasing setting on PAS lever.

f. Slowly advance PAS lever until Np reaches (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm). This will indicate that ECU or DEC is locked out.

CAUTION

To avoid engine damage, do not operate engine steady-state between 24%-38% Np (5,000-8,000 rpm) or 57%-72% Np (11,900-15,000 rpm) range.

g. Move PAS lever to 26° (ground idle) to reset ECU or DEC.

CAUTION

While advancing PAS lever, observe Np. Make sure Np reference is not exceeded. If Np exceeds 95% setting, ECU or DEC reset was not done and the PAS lever must be retarded to 26°.

h. Slowly advance PAS lever to 117°. Np should not exceed 95%. This indicates ECU or DEC has been reset.

NOTE

(**T701C**, **T701D** **Apache** engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.

i. Set Np DEMAND dial for (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm) Np speed; Np will increase to (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm). This indicates the system is operating normally. Record results of ECU or DEC Lock-Out System Check on log sheet.

1-236. Torque Repeatability Check.

NOTE

(**T701C**, **T701D** **Apache** engines equipped with DEC PN 6080T56P03) Do not exceed maximum Np demand setting while increasing Np demand during check. Otherwise, the DEC fault (Np demand signal) will appear at engine shutdown.

a. Set PAS to 117°, LDS to 50° and Np DEMAND dial for (METS) 104.5% (20,900 rpm) or (FEDS/CETS) 104.5% (20,900 rpm) Np speed. Using the WATER-IN lever, set the following points in steps a(1) through a(4) in an acceleration direction. If any of one of the points are overshot, reduce load by 500 inch-pounds. Reset the point by increasing load.

NOTE

When setting points in the acceleration direction, be careful not to overshoot the torque setting.

(1) Water brake torque of 1500 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

(2) Water brake torque of 2000 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

(3) Water brake torque of 2800 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

(4) Water brake torque of 3500 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

b. Set the following points in steps b(1) through b(3) in a deceleration direction. When setting points in the deceleration direction, be careful not to undershoot the torque setting. If the point is undershot, increase load by 500 inch-pounds. Reset the point by decreasing the load.

(1) Water brake torque of 2800 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

(2) Water brake torque of 2000 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

(3) Water brake torque of 1500 ±50 inch-pounds. Record TGT, water brake torque, engine torque, and Np.

c. Deceleration engine torque recorded in step b must be within ±6 foot-pounds of each corresponding engine torque recorded in step a.

1-237. Anti-Icing Bleed and Start Valve Check.

a. With Np DEMAND dial still set for 104.5% speed, slowly move WATER-IN lever to set 92-94% Ng. Move LDS lever to 50°.

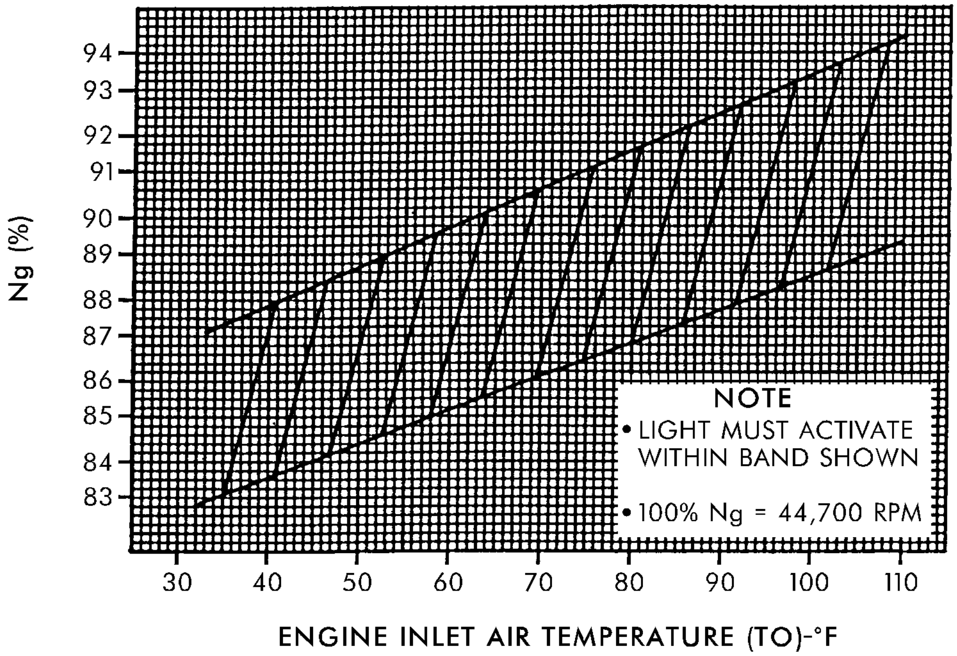
b. Record Ng, static pressure at compressor discharge (P3), TGT, and Wf.

c. Turn anti-ice switch to ON. Anti-ice light must come on and TGT must rise. Record Ng, TGT, Wf, P3, and T0.

d. Turn anti-ice switch to OFF. Anti-ice light will go off and TGT will decrease. Record TGT, T0, Ng, and P3.

e. Decel to ground idle (PAS lever to 26°).

f. Determine the point of anti-icing bleed and start valve closing speed vs% Ng (fig. 1-118). Troubleshoot any valve falling outside the limits in figure 1-118 and replace any valve failing to meet these limits after troubleshooting.



NOTE
- LIGHT MUST ACTIVATE WITHIN BAND SHOWN
- 100% Ng = 44,700 RPM

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Figure 1-118. Anti-Icing Bleed and Start Valve Closing Speeds vs Ng

1-238. (T700) Performance Evaluation Test.

NOTE

(T701, T701C, T701D) performance evaluation test is described in paragraph 1-241.

a. Review the following requirements before starting the performance evaluation test:

(1) Barometer reading must be taken before and after the test run. At each test point, record barometer reading.

(2) Fuel will conform to JP-4, JP-5, or JP-8. Measure and record specific gravity of fuel before the performance test.

(3) A complete set of zero readings will be taken prior to the start of the performance evaluation test and after shutdown. Record all history recorder readings before and after test.

(4) Ng, Np, Wf, engine torque, and water brake torque must be recorded as close to the same time as possible.

(5) The following readings will be taken at each condition (table 1-41) during performance evaluation test: T0, engine torque, TGT, Wf, Np, Ng, water brake torque, P3, oil pressure (see table 1-36 for limits), oil temperature, oil scavenge temperature, vibration levels, VG tracking angle, PAS and LDS lever positions.

(6) Record any engine malfunction on the test log sheet.

(7) Record time at which each schedule test condition is started and completed.

(8) Do not exceed water brake torque limits specified in METS/FEDS/CETS manual.

b. Do the performance evaluation test as follows:

(1) Make sure anti-icing switch is OFF.

(2) Stay at test conditions 2 and 3 (table 1-41), for 5 minutes minimum before recording readings.

(3) Use WATER-IN lever to set water brake torque and TGT.

(4) Set test condition 2, table 1-41 (900 HP) as follows:

(a) Determine barometer pressure (PA).

(b) Enter pressure on figure 1-119 at BAROMETER PRESSURE to get WATER BRAKE TORQUE setting.

(c) Advance WATER-IN lever until water brake torque (from figure 1-119) is set.

(5) Set test condition 3 (IRP), by advancing WATER-IN lever until TGT, Wf, or Ng limit specified in table 1-41 is reached.

(6) After performance evaluation test is completed, compare oil pressure reading at IRP with steady-state break-in (para 1-228) IRP oil pressure reading. Maximum allowable shift between the two readings is 5 psi corrected.

*Table 1-41. **(T700)** Performance Evaluation Test*

Test Condition	PAS Setting	LDS Setting	Np	Time at Test Condition	Minimum Corrected Horsepower/ torque in Foot-pounds	TGT Limit	Flow Limit (Lb/Hr)	Fuel Ng Limit %
1. Ground Idle (G/I)	26 ±2.5°	0°	41-50% (8,000-11,000 rpm)	3 Min				
2. 900 HP (fig. 1-119)	117 ±2°	50°	(METS) 104.5% (20,900 ± 200 rpm) (FEDS/ CETS) 104.5% (20,900 ± 200 rpm)	5 Min			See fig. 1-125	
3. IRP	117 ±2°	70°	(METS) 104.5% (20,900 ± 200 rpm) (FEDS/ CETS) 104.5% (20,900 ± 200 rpm)	5 Min	1497/393 Max	1535 - 1562°F (835-850°C)	Max 800	See fig. 1-120

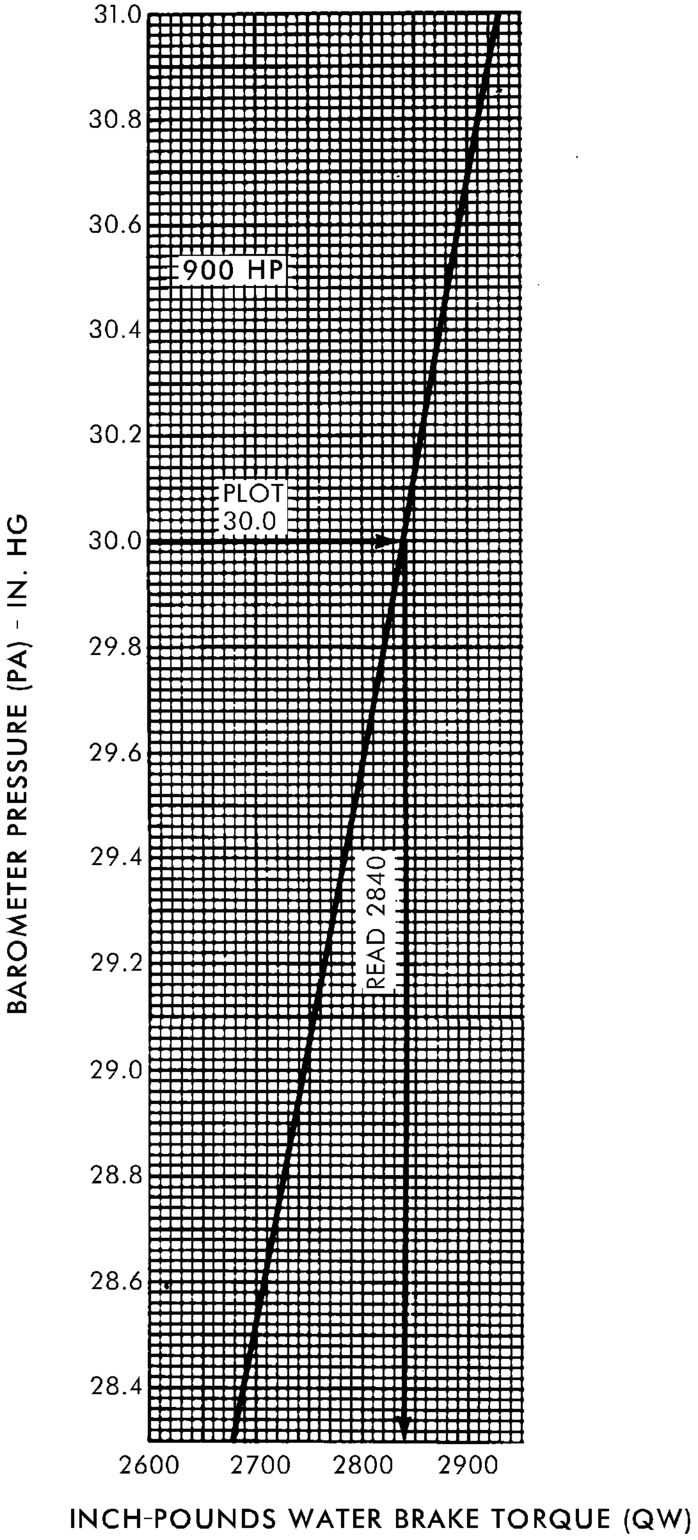

Figure 1-119. (T700) Water Brake Torque 900 HP

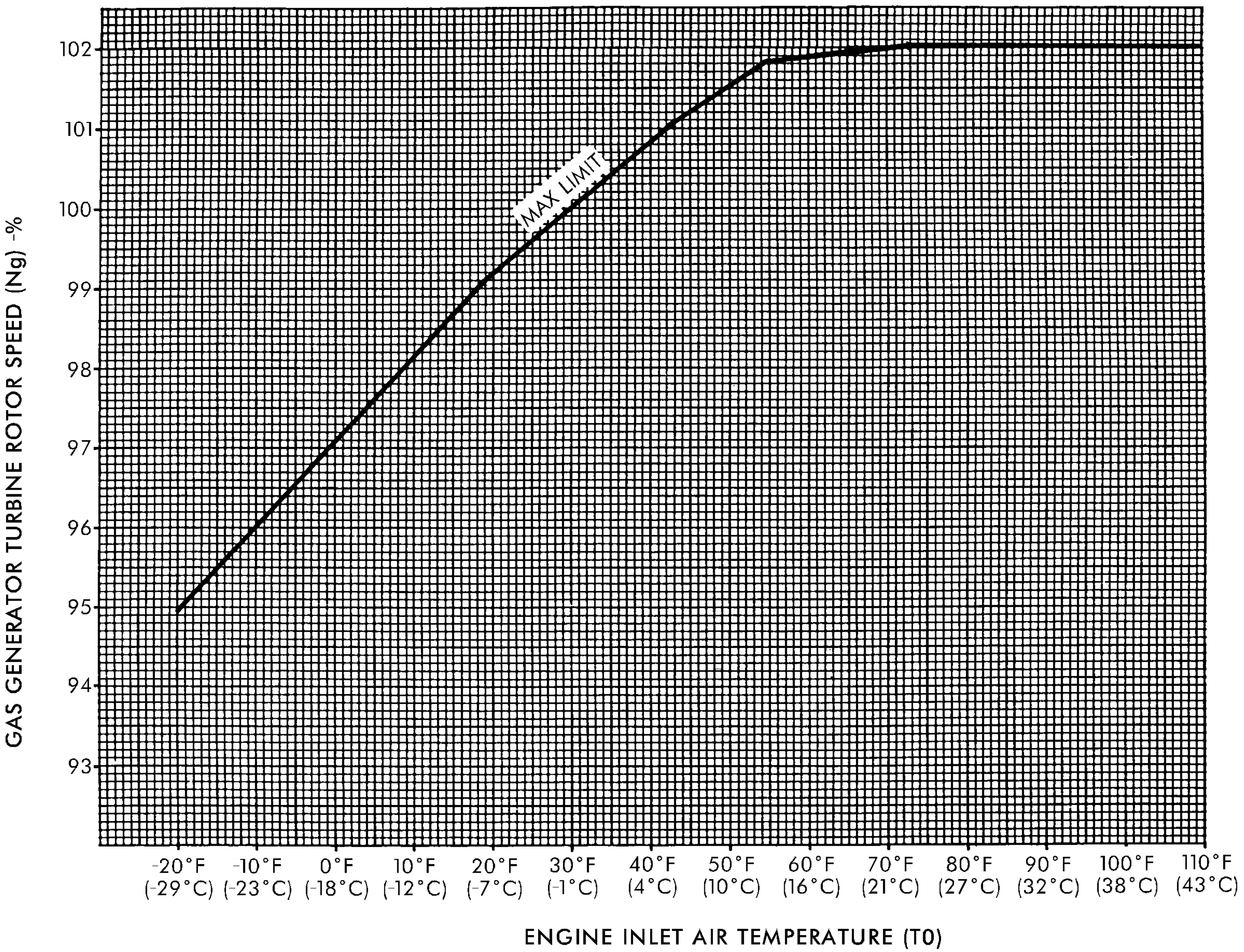

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Figure 1-120. *(T700)* ***Ng Actual Speed Limit***

1-239. (T700) Performance Calculation Procedure. Use the water brake torque-measuring system.

NOTE

- Performance calculation procedure is described in paragraph **(T701)** 1-242 or **(T701C, T701D)** 1-244 .
- TGT limiting is required for engine protection at FAT of 50°F (10°C) and above. No TGT limiting is required if FAT is below 50°F (10°C), because other control limits provide engine protection.

a. Definitions of symbols and parameters used in the performance calculations are in table 1-42.

*Table 1-42. **(T700)** Definitions of Symbols and Parameters*

Symbol	Source	Parameter
EODP	Measured	Engine oil discharge pressure.
EODPK	Calculated	Engine oil discharge pressure corrected for temperature.
EODT	Measured	Engine oil discharge temperature.
ΔEODT	Calculated	Actual EODT minus baseline EODT (from figure 1-143).
FAT	Measured	Free air temperature.
Hg	Measured	Barometric pressure in inches of Mercury.
LHV	Calculated	Lower heating value of fuel based on 18,600 btu/lb. JP-4 (1.005), JP-5 (0.997), and JP-8 (0.999).
Ng	Measured	Gas generator speed in % of 44,700 rpm.
Np	Measured	Power turbine rotor speed, in rpm.
PA	Measured	Pressure altitude in feet above mean sea level.
P3	Measured	Compressor discharge air pressure.
δ	Calculated	Correction factor for sea-level standard atmospheric pressure (i.e. ratio of barometric pressure to sea level standard barometric pressure).
Qobs	Measured	Engine torque measured in foot-pounds.
QW	Measured	Water brake torque in inch-pounds.
SHP	Calculated	Uncorrected shaft horsepower calculated from engine torque output and output shaft rpm.
SHPA	Calculated	SHPK adjusted to the TGT Rated.
SHPK	Calculated	Engine shaft horsepower corrected for sea level standard atmospheric pressure.
ΔSHP/ΔTGT	Figure 1-121	Rate of change of SHPK with changes in TGT.

Table 1-42. ***(T700)*** *Definitions of Symbols and Parameters (Cont)*

Symbol	Source	Parameter
ΔSHP	Calculated	Difference between 900 horsepower and the test SHPK.
TGT	Measured	Gas temperature measured by TGT harness °F.
TGT RATED	Defined	Gas temperature rating in °F. (Intermediate rated power = 1535°F).
TGT TARGET	Figure 1-122	Target TGT for testing.
ΔTGT	Calculated	Difference between TGT TARGET and TGT.
T0	Measured	Engine inlet air temperature.
Wf	Measured	Fuel flow in pounds per hour (lb/hr).
Wfa	Calculated	Wfk adjusted to rating horsepower.
Wfa (Maximum)	Figure 1-125	Maximum Wfa at 900 SHPK.
ΔWf/ΔSHP	Figure 1-124	Rate of change of Wfk with changes in SHPK.
Wfk	Calculated	Fuel flow corrected for sea-level standard atmospheric pressure δ, and fuel LHV.

b. Engine performance test data, recorded during the performance evaluation test, will be corrected to standard day sea-level conditions to determine if the engine meets performance requirements.

c. Calculate the correction factor for sea-level standard atmospheric pressure as follows:

$$\delta = \frac{\text{PA (inches of mercury)}}{29.92}$$

d. Calculate corrected shaft horsepower as follows:

(1) **Warm day** (at or above 50°F (10°C)).

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024}$$

$$\text{SHPK} = \frac{\text{SHP}}{\delta}$$

$$\Delta\text{TGT} = \text{TGT TARGET} - \text{TGT}$$
(See figure 1-122 for TGT TARGET)

ΔSHPΔTGT = See figure 1-121
Enter curve at measured T0

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT})(\Delta\text{SHP}/\Delta\text{TGT})$$

(2) **Cold day** (below 50°F (10°C)). If TGT is below TGT TARGET (fig. 1-122), then ΔTGT and ΔSHP/ΔTGT adjustments are not necessary. Adjust only if TGT is above TGT TARGET.

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024}$$

$$\text{SHPK} = \frac{\text{SHP}}{\delta}$$

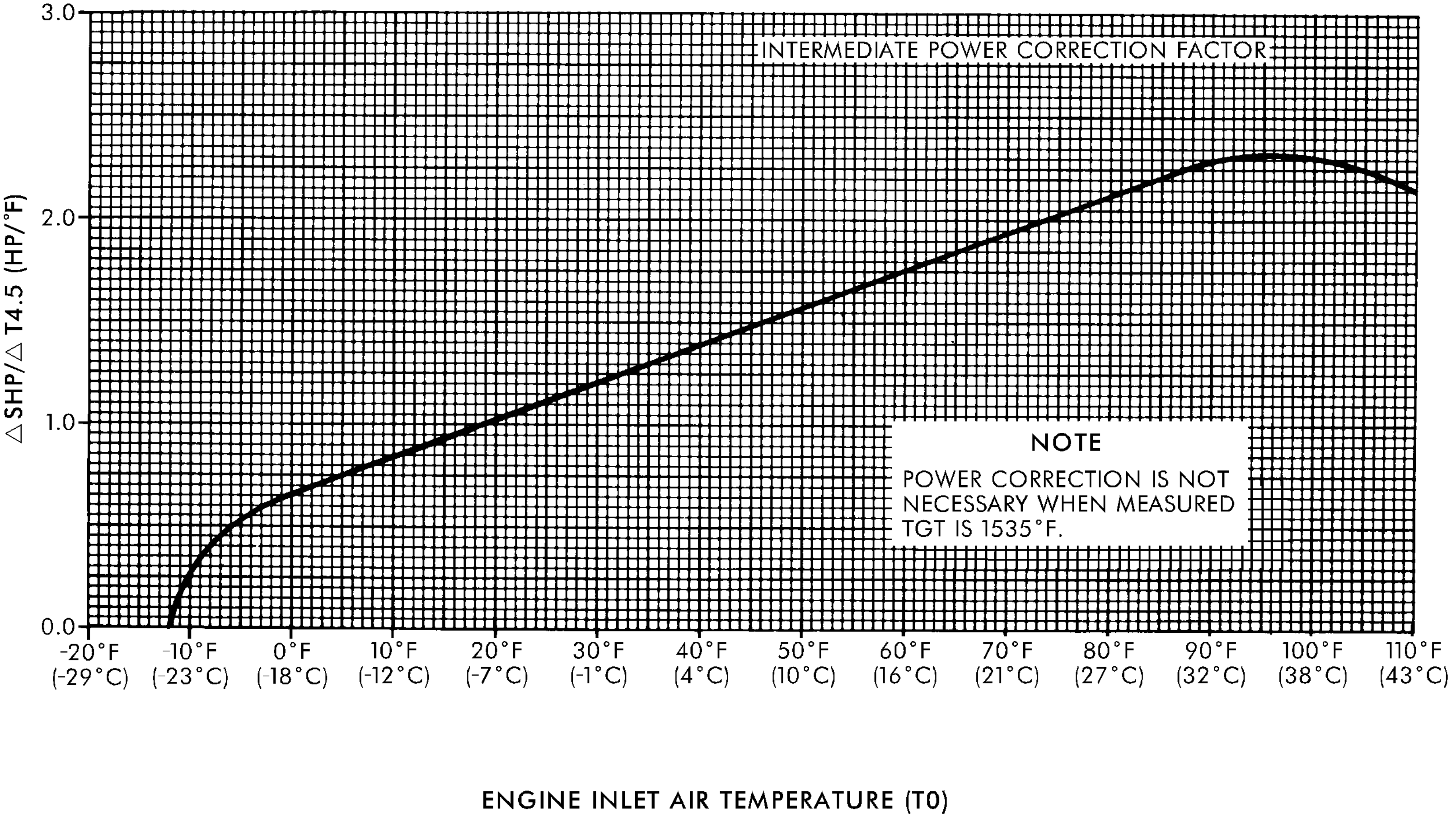
TGT TARGET = See figure 1-122

$$\Delta\text{TGT} = \text{TGT TARGET - TGT}$$

ΔSHPΔTGT = See figure 1-121
Enter curve at measured T0

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT})(\Delta\text{SHP}/\Delta\text{TGT})$$

e. After calculating SHPA for intermediate rated power, determine whether engine passes or fails rated performance from figure 1-123. Enter curve at measured T0.



NOTE

POWER CORRECTION IS NOT NECESSARY WHEN MEASURED TGT IS 1535°F.

Figure 1-121. ***(T700)*** *Power Correction Factor*

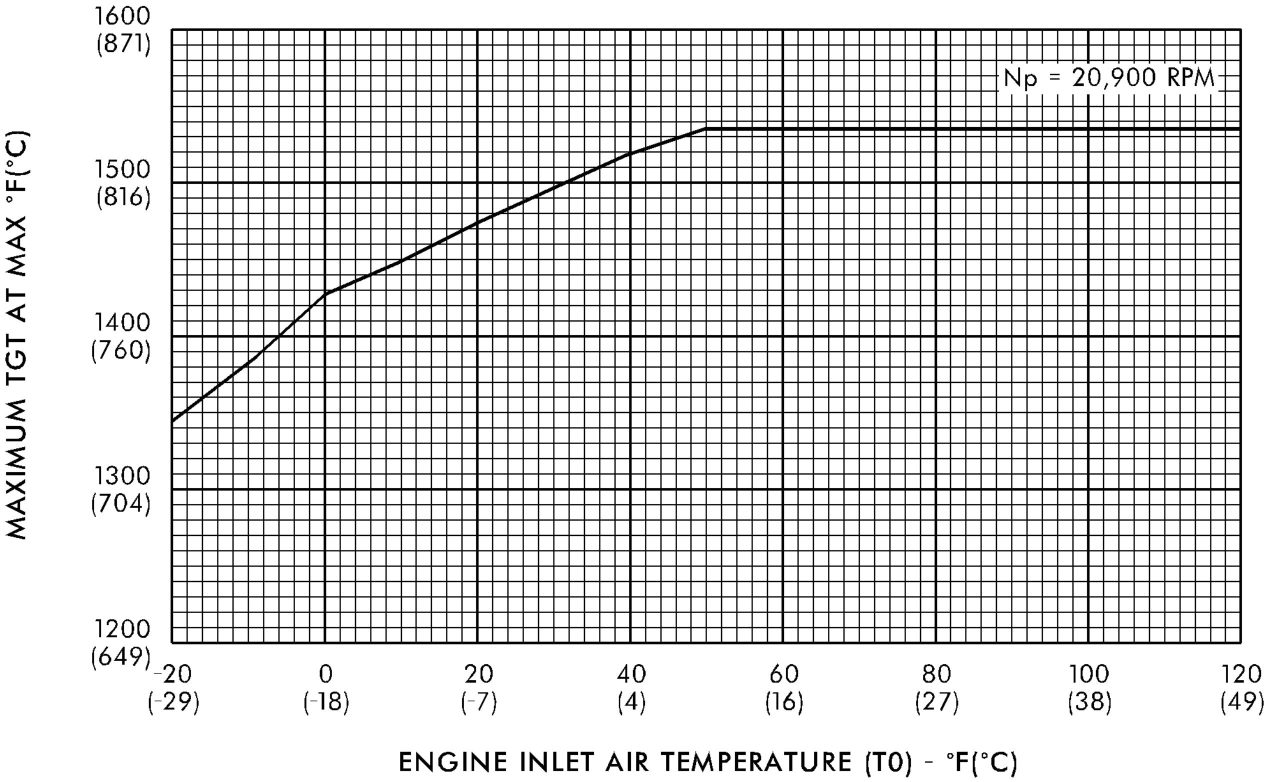


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Figure 1-122. ***(T700)*** *TGT Target Correction Factor*

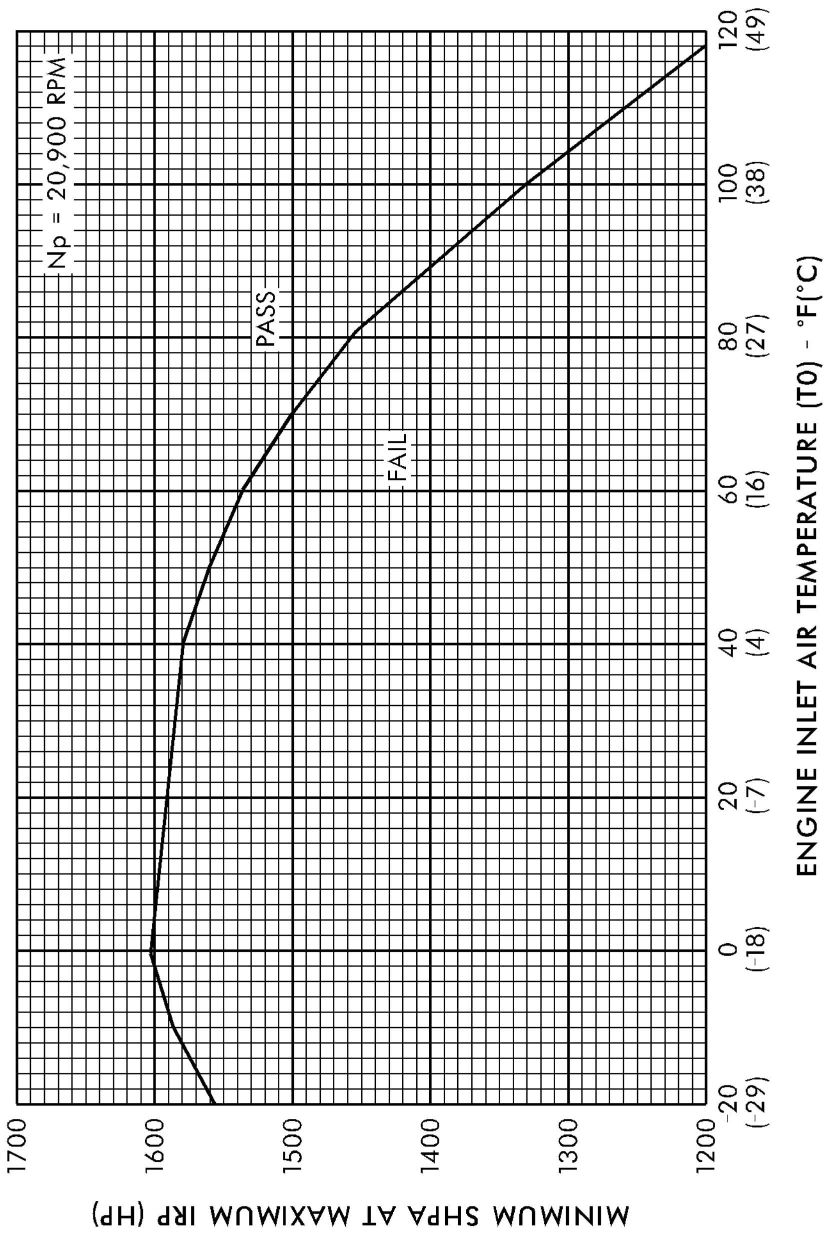

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Figure 1-123. **(T700)** Intermediate Rated Power Minimum Limit - 95% Specification

NOTE

- Examples 1 and 2 are used to rate performance when T0 is above 50°F (10°C).
- Examples 3 and 4 are used to rate performance when T0 is below 50°F (10°C).

EXAMPLE 1: Calculating intermediate rated power (IRP) (TGT TARGET = 1535°F) with TGT measured at 1530°F (below TGT TARGET), with T0 50°F (10°C) and above.

Where:

$\mathrm{T0} = 77°\mathrm{F}$
$\mathrm{TGT} = 1530°\mathrm{F}$
$\mathrm{QW} = 4740$ inch-pounds
$\mathrm{PA} = 28.80$ in. Hg
$\mathrm{Np} = 20{,}900$ rpm

Calculation of Correction Factor:

$$\delta = \frac{\mathrm{PA}}{29.92}$$
$$\delta = \frac{28.80}{29.93}$$
$$\delta = 0.963$$
$$\mathrm{SHP} = \frac{\mathrm{QW} \times \mathrm{Np}}{63{,}024}$$
$$\mathrm{SHP} = \frac{4740 \times 20{,}900}{63{,}024}$$
$$\mathrm{SHP} = 1571.9$$
$$\mathrm{SHPK} = \frac{\mathrm{SHP}}{\delta}$$
$$\mathrm{SHPK} = \frac{1571.9}{0.963}$$
$$\mathrm{SHPK} = 1632.3$$
$$\Delta\mathrm{TGT} = \mathrm{TGT\ TARGET - TGT}$$
$$\Delta\mathrm{TGT} = 1535°\mathrm{F} - 1530°\mathrm{F}$$
$$\Delta\mathrm{TGT} = 5°\mathrm{F}$$
$$\Delta\mathrm{SHP}/\Delta\mathrm{TGT} = \text{from figure 1-121 at T0 of } 77°\mathrm{F}$$
$$\Delta\mathrm{SHP}/\Delta\mathrm{TGT} = 2.05$$
$$\mathrm{SHPA} = \mathrm{SHPK} + (\Delta\mathrm{TGT} \times \Delta\mathrm{SHP}/\Delta\mathrm{TGT})$$
$$\mathrm{SHPA} = 1632.3 + (5 \times 2.05)$$
$$\mathrm{SHPA} = 1632.3 + 10.25$$
$$\mathrm{SHPA} = 1642.6$$

Entering figure 1-123 at T0 = 77°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1470 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

EXAMPLE 2: Calculating intermediate rated power (IRP) (TGT TARGET = 1535°F) with TGT measured at 1540°F (above TGT TARGET), with T0 50°F (10°C) and above.

Where:

$\mathrm{T0} = 77°\mathrm{F}$
$\mathrm{TGT} = 1540°\mathrm{F}$
$\mathrm{QW} = 4800$ inch-pounds
$\mathrm{PA} = 28.80$ in. Hg
$\mathrm{Np} = 20{,}900$ rpm

Calculation of Correction Factor:

$$\delta = \frac{\mathrm{PA}}{29.92}$$
$$\delta = \frac{28.80}{29.92}$$
$$\delta = 0.963$$
$$\mathrm{SHP} = \frac{\mathrm{QW} \times \mathrm{Np}}{63{,}024}$$
$$\mathrm{SHP} = 1591.8$$
$$\mathrm{SHPK} = \frac{1591.8}{0.963}$$
$$\mathrm{SHPK} = 1653.0$$
$$\Delta\mathrm{TGT} = \mathrm{TGT\ TARGET - TGT}$$
$$\Delta\mathrm{TGT} = 1535°\mathrm{F} - 1540°\mathrm{F}$$
$$\Delta\mathrm{TGT} = -5°\mathrm{F}$$
$$\Delta\mathrm{SHP}/\Delta\mathrm{TGT} = \text{from figure 1-121 at T0 of } 77°\mathrm{F}$$
$$\Delta\mathrm{SHP}/\Delta\mathrm{TGT} = 2.05$$
$$\mathrm{SHPA} = \mathrm{SHPK} + (\Delta\mathrm{TGT} \times \Delta\mathrm{SHP}/\Delta\mathrm{TGT})$$
$$\mathrm{SHPA} = 1653.0 + (-5 \times 2.05)$$
$$\mathrm{SHPA} = 1653.0 - 10.25$$
$$\mathrm{SHPA} = 1642.8$$

Entering figure 1-123 at T0 = 77°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1470 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

EXAMPLE 3: Calculating intermediate rated power (IRP) (below TGT TARGET) with TGT measured at 1423°F, with T0 below 50°F (10°C).

Where:

$T0 = +5°F$
$TGT = 1423°F$
$QW = 5185$ inch-pounds
$PA = 28.80$ in. Hg
$Np = 20{,}900$ rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5185 \times 20{,}900}{63{,}024}$$

$$SHP = 1719.4$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHPK = \frac{1719.4}{0.963}$$

$$SHPK = 1785.5$$

$\Delta TGT =$ TGT TARGET (From fig. 1-122 at T0 of +5°F) – TGT

$$\Delta TGT = 1440°F - 1423°F$$

$$\Delta TGT = 17°F$$

Since TGT is below TGT TARGET, no adjustment is necessary.

$$SHPA = SHPK = 1785.5$$

Entering figure 1-123 at T0 = 5°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1600 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

EXAMPLE 4: Calculating intermediate rated power (IRP) (TGT TARGET = 1535°F) with TGT measured at 1455°F (above TGT TARGET), with T0 below 50°F (10°C)

Where:

$T0 = +5°F$
$TGT = 1455°F$
$QW = 5190$ inch-pounds
$PA = 28.80$ in. Hg
$Np = 20{,}900$ rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5190 \times 20{,}900}{63{,}024}$$

$$SHP = 1721.1$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHP = \frac{1721.1}{0.963}$$

$$SHPK = 1787.2$$

$\Delta TGT =$ TGT TARGET (From fig. 1-122 at T0 of +5°F) – TGT

$$\Delta TGT = 1440°F - 1455°F$$

$$\Delta TGT = -15°F$$

$\Delta SHP/\Delta TGT =$ from figure 1-121 at T0 of 5°F

$$\Delta SHP/\Delta TGT = 0.75$$

$$SHPA = SHPK + (\Delta TGT \times \Delta SHP/\Delta TGT)$$

$$SHPA = 1787.2 + (-15 \times 0.75)$$

$$SHPA = 1787.2 - 11.25$$

$$SHPA = 1776.0$$

Entering figure 1-123 at T0 = 5°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1600 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

1-240. (T700) Partial Power Fuel Consumption Calculation at 900 HP (test condition 2, table 1-41).

NOTE

(T701, T701C, T701D) Partial power fuel consumption calculation at 1132 HP is described in paragraph **(701)** 1-243 or **(T701C, T701D)** paragraph 1-245.

a. Calculate the correction factor for sea-level standard day barometric pressure as follows:

$$\delta = \frac{\text{PA (inches of mercury)}}{29.92}$$

b. Determine shaft horsepower as follows:

$$\text{SHPK} = \frac{\text{QW} \times \text{Np}}{63,024 \times \delta}$$

c. Determine ΔSHP as follows:

$$\Delta\text{SHP} = 900\ \text{HP} - \text{SHPK}$$

d. Determine Wfk as follows:

$$\text{Wfk} = \frac{\text{Wf} \times \text{LHV}}{\delta}$$

Where:

LHV = 1.005 for JP-4 Fuel
LHV = 0.997 for JP-5 Fuel
LHV = 0.999 for JP-8 Fuel

e. Determine Wfa as follows: Using figure 1-124, enter curve at measured at T0 to determine ΔWf/ΔSHP.

$$\text{Wfa} = \text{Wfk} + (\Delta\text{SHP})(\Delta\text{Wf}/\Delta\text{SHP})$$

f. After calculating Wfa for 900 shaft horsepower, enter figure 1-125 at measured T0. If Wfa is below the maximum curve for the T0 measured, the engine passes fuel flow performance check.

g. Example of calculating for 900 HP condition:

Where:

PA = 30.00 inches of mercury
T0 = 59°F measured
Wf = 460 lbs/hr measured and corrected for instruments

(1) Determine QW from figure 1-119 to set 900 HP (test point, 2, table 1-41).

(2) From curve on figure 1-119 at PA = 30.00, QW = 2840 inch-pounds.

$$\delta = \frac{\text{PA}}{29.92} = \frac{30.00}{29.92} = 1.003$$

$$\text{SHPK} = \frac{\text{QW} \times \text{Np}}{63,024 \times \delta}$$

$$\text{SHPK} = \frac{2840 \times 20,900}{63,024 \times 1.003} = 939.0$$

$$\Delta\text{SHP} = 900\ \text{HP} - \text{SHPK}$$

$$\Delta\text{SHP} = 900 - 939.0 = -39.0\ \text{HP}$$

$$\text{Wfk} = \frac{\text{Wf} \times \text{LHV*}}{\delta}$$

*Assume JP-4 fuel where LHV= 1.005

$$\text{Wfk} = \frac{460 \times 1.005}{1.003}$$

$$\text{Wfk} = 460.9\ \text{lbs/hr}$$

$$\Delta\text{WF}/\Delta\text{SHP from figure 1-124 at T0 of } 59°\text{F} = 0.352$$

$$\text{Wfa} = \text{Wfk} + (\Delta\text{SHP})(\Delta\text{Wf}/\Delta\text{SHP})$$

$$\text{Wfa} = 460.9 + (-39.0)(0.352)$$

$$\text{Wfa} = 460.9 - 13.7$$

$$\text{Wfa} = 447.2\ \text{lbs/hr}$$

From figure 1-125 at T0 of 59°F Wfa of 447.2 lbs/hr is below the maximum curve value and is acceptable.

1-241. (T701, T701C, T701D) Performance Evaluation Test.

NOTE

(T700) performance evaluation test is described in paragraph 1-238.

a. Review the following requirements before starting the performance evaluation test:

(1) Barometer reading must be taken before and after the test run. At each test point, record barometer reading.

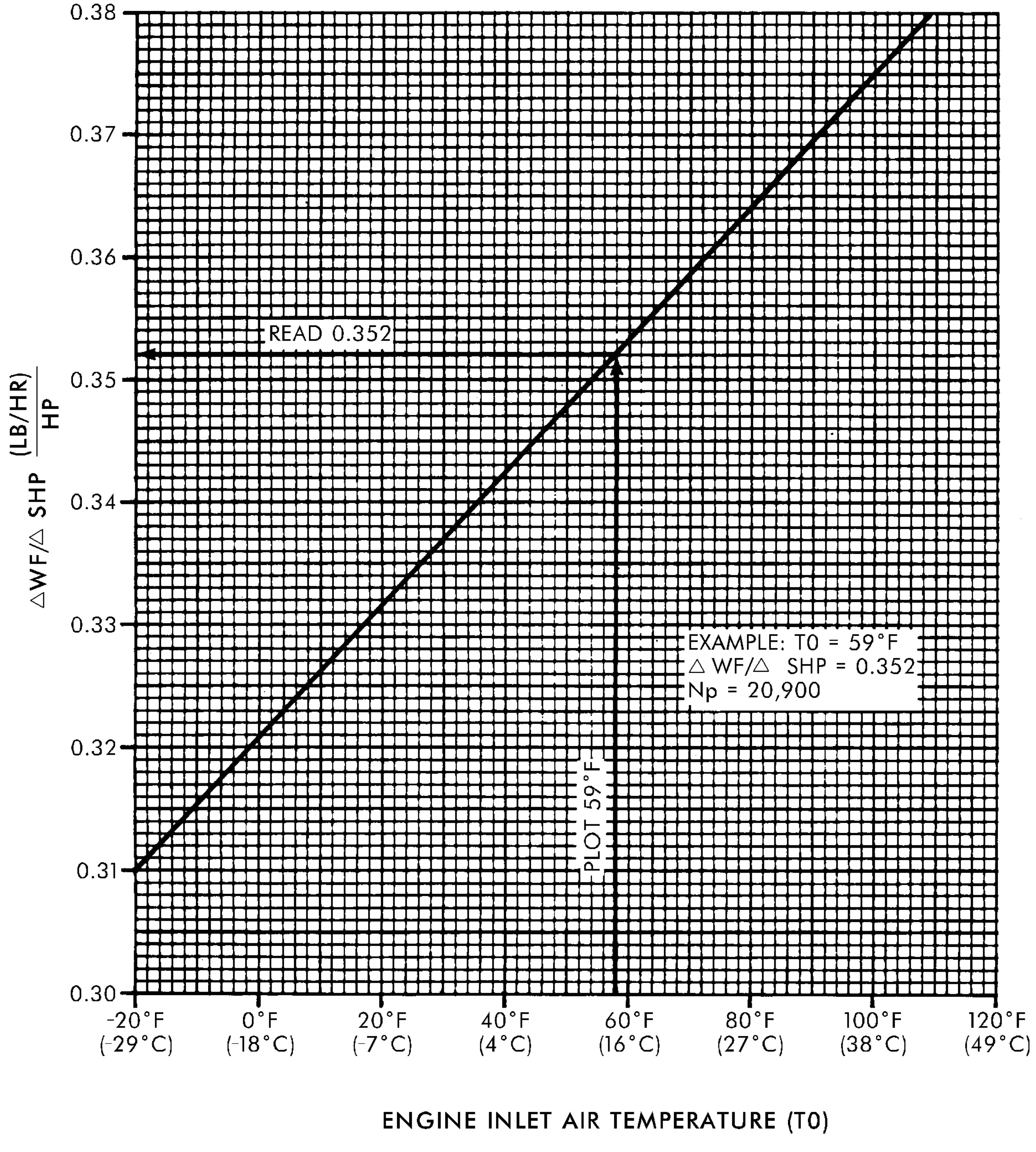

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Figure 1-124. ***(T700)*** *Fuel Flow Correction Factor for 900 SHPK*

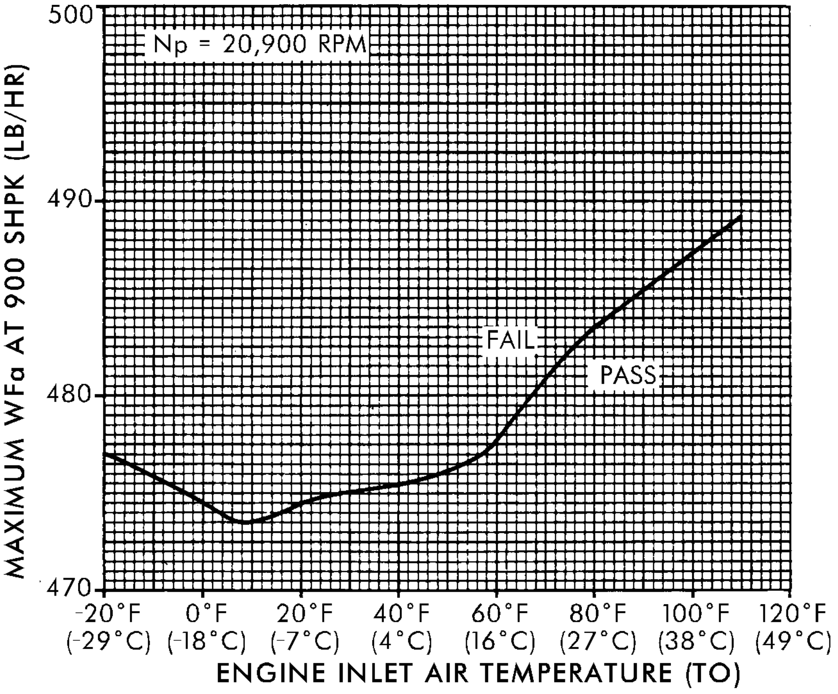

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*Figure 1-125. **(T700)** Maximum Fuel Flow at 900 SHPK*

(2) Fuel will conform to JP-4, JP-5, or JP-8. Measure and record specific gravity of fuel before the performance test.

(3) A complete set of zero readings will be taken prior to the start of the performance evaluation test and after shutdown. Record all **(T701)** history recorder or **(T701C, T701D)** history counter readings before and after test.

(4) Ng, Np, Wf, engine torque, and water brake torque must be recorded as close to the same time as possible.

(5) The following readings will be taken at each condition (table 1-43) during performance evaluation test: T0, engine torque, TGT, Wf, Np, Ng, water brake torque, oil pressure (see table 1-37 for limits), oil temperature, oil scavenge temperature, vibration levels, VG tracking angle, PAS and LDS lever positions.

(6) Record any engine malfunction on the test log sheet.

(7) Record time at which each schedule test condition is started and completed.

(8) Do not exceed water brake torque limits specified in METS/FEDS/CETS manual.

b. **(T701, ECU)** Do the performance evaluation test as follows:

(1) Make sure anti-icing switch is OFF.

(2) Stay at test conditions 2 and 4 (table 1-43), for 5 minutes minimum before recording readings.

(3) Use WATER-IN lever to set water brake torque and TGT.

(4) Set test condition 2, table 1-43 (1132 HP) as follows:

(a) Determine barometer pressure (PA).

(b) Enter pressure on figure 1-126 at BAROMETER PRESSURE to get WATER BRAKE TORQUE setting.

(c) Advance WATER-IN lever until water brake torque (from figure 1-126) is set.

(5) Set test condition 4 (IRP), by advancing WATER-IN lever until TGT, Wf, or Ng limit specified in table 1-43 is reached.

*Table 1-43. **(T701, T701C, T701D)** Performance Evaluation Test*

Ng Test Condition	PAS Setting	LDS Setting	Np	Time at Test Conditions	TGT Limit	Fuel Flow Limit (Lb/Hr)	Limit %
1. Ground Idle (G/I)	26 ±2.5°	0°	41-50% (8,000- 11,000 rpm)	3 Min			
2. (ECU) 1132 HP (fig. 1-126)	117 ±2°	50°	(METS) 104.5% (20,900 ±200 rpm) (FEDS/CETS) 104.5% (20,900 ±200 rpm)	5 Min		See fig. 1-133	
3. (DEC) 75% MC (fig. 1-127)	117 ±2°	50°	(METS) 104.5% (20,900 ±200 rpm) (FEDS/CETS) 104.5% (20,900 ±200 rpm)	5 Min		See fig. 1-139	
4.**(T701 ECU)** IRP	117 ±2°	70°	(METS) 104.5% (20,900 ±200 rpm) (FEDS/CETS) 104.5% (20,900 ±200 rpm)	5 Min	**(ECU)** 1565°-1596°F (852°-869°C)	**(ECU)** 850 Max	(See fig. 1-128)
5.**(T701C, T701D DEC)** Max			(METS) 104.5% (20,900 ±200 rpm) (FEDS/CETS) 104.5% (20,900 ±200 rpm)		**(DEC)** 1573°-1609°F (856°-876°C)	**(DEC)** 969 Max	(See fig. 1-129)

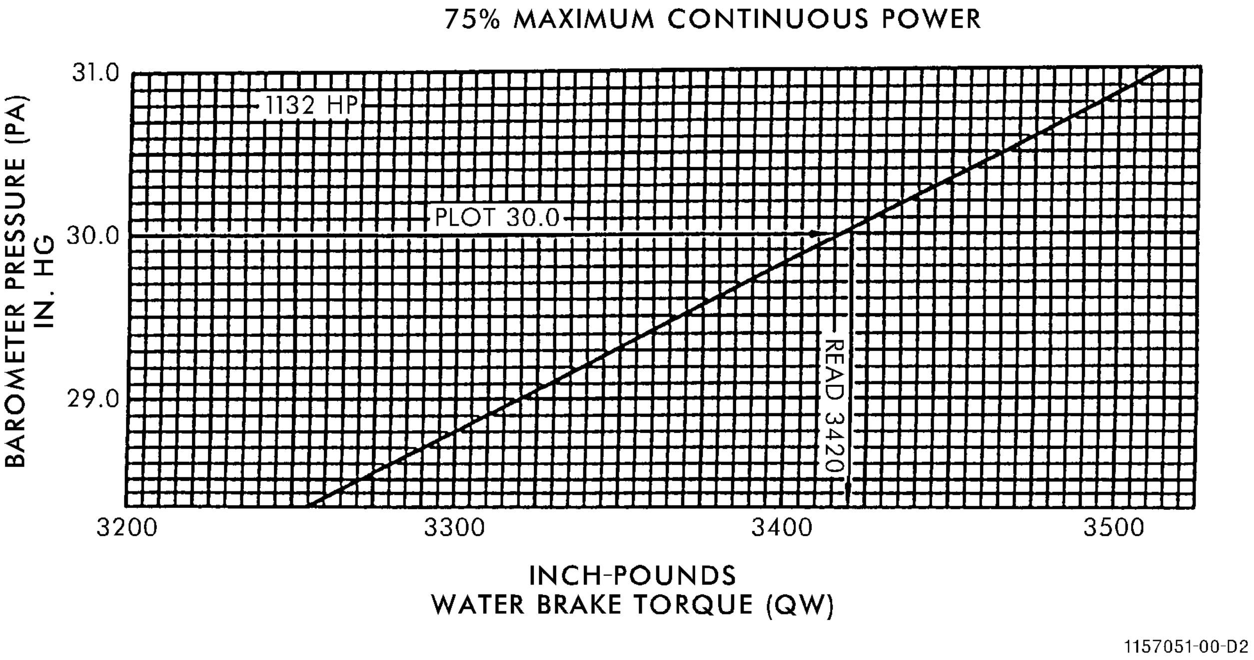

*Figure 1-126. **(T701)** Water Brake Torque at 1132 HP*

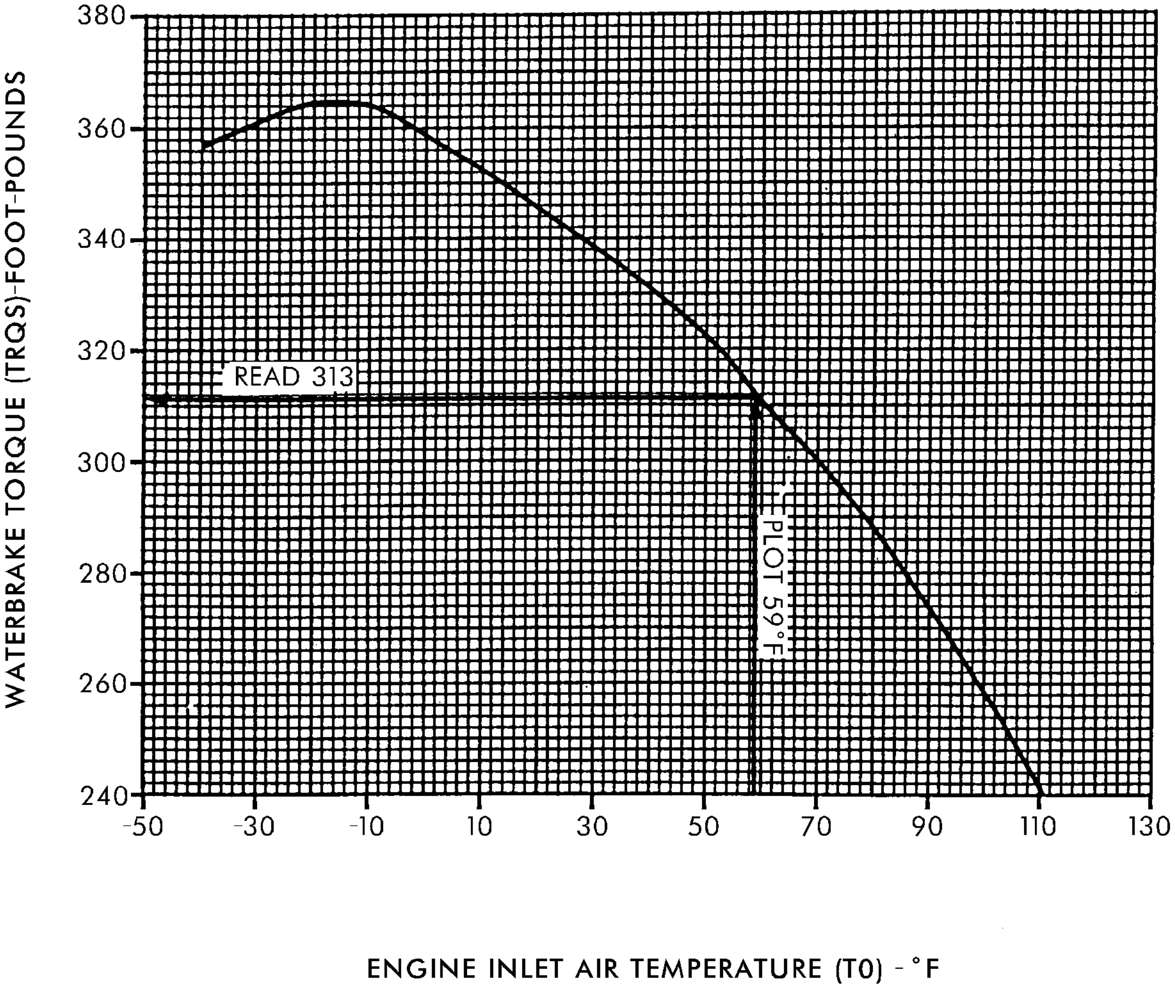

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Figure 1-127. ***(T701C, T701D)*** *Waterbrake Torque at 75% Maximum Continuous*

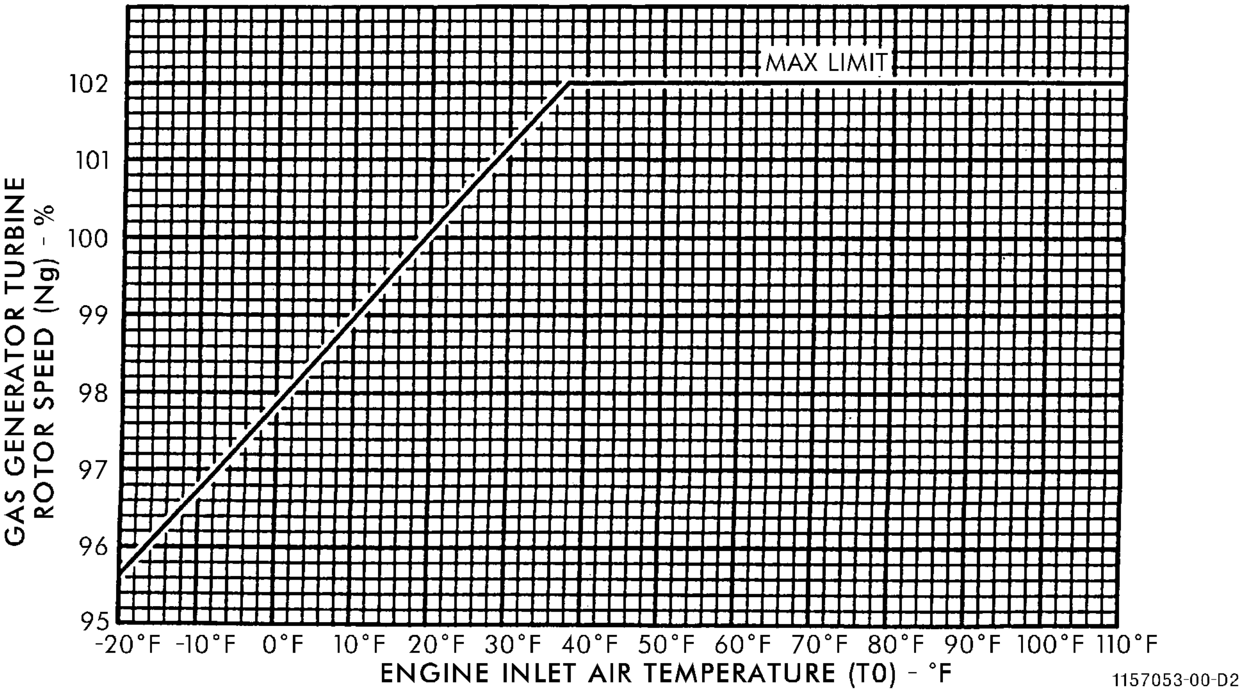

*Figure 1-128. **(T701)** Ng Physical Speed Limit*

c. **(T701C, T701D DEC)** Do the performance evaluation test as follows:

(1) Make sure anti-icing switch is OFF.

(2) Stay at test conditions 3 and 5 (table 1-43), for 5 minutes minimum before recording readings.

(3) Use WATER-IN lever to set water brake torque and TGT.

(4) Set test condition 3, table 1-43 (75% MC) as follows:

(a) Determine T0 (°F).

(b) Enter T0 on figure 1-129 at ENGINE INLET AIR TEMP to get WATER BRAKE TORQUE setting.

(c) Advance WATER-IN lever until water brake torque (from fig. 1-129) is set.

(5) Set test condition 5 (MAXIMUM), by advancing WATER-IN lever until TGT, Wf, or Ng limit specified in table 1-43 is reached.

1-242. (T701 ECU) Performance Calculation Procedure. Use the water brake torque-measuring system.

NOTE

- **(T700)** performance calculation procedure is described in paragraph 1-239.
- TGT limiting is required for engine protection at FAT of 59°F (15°C) and above. No TGT limiting is required if FAT is below 59°F (15°C), as other control limits provide engine protection.

a. Definitions of symbols and parameters used in the performance calculations are in table 1-44.

b. Engine performance test data, recorded during the performance evaluation test, will be corrected to standard day sea-level conditions to determine if the engine meets performance requirements.

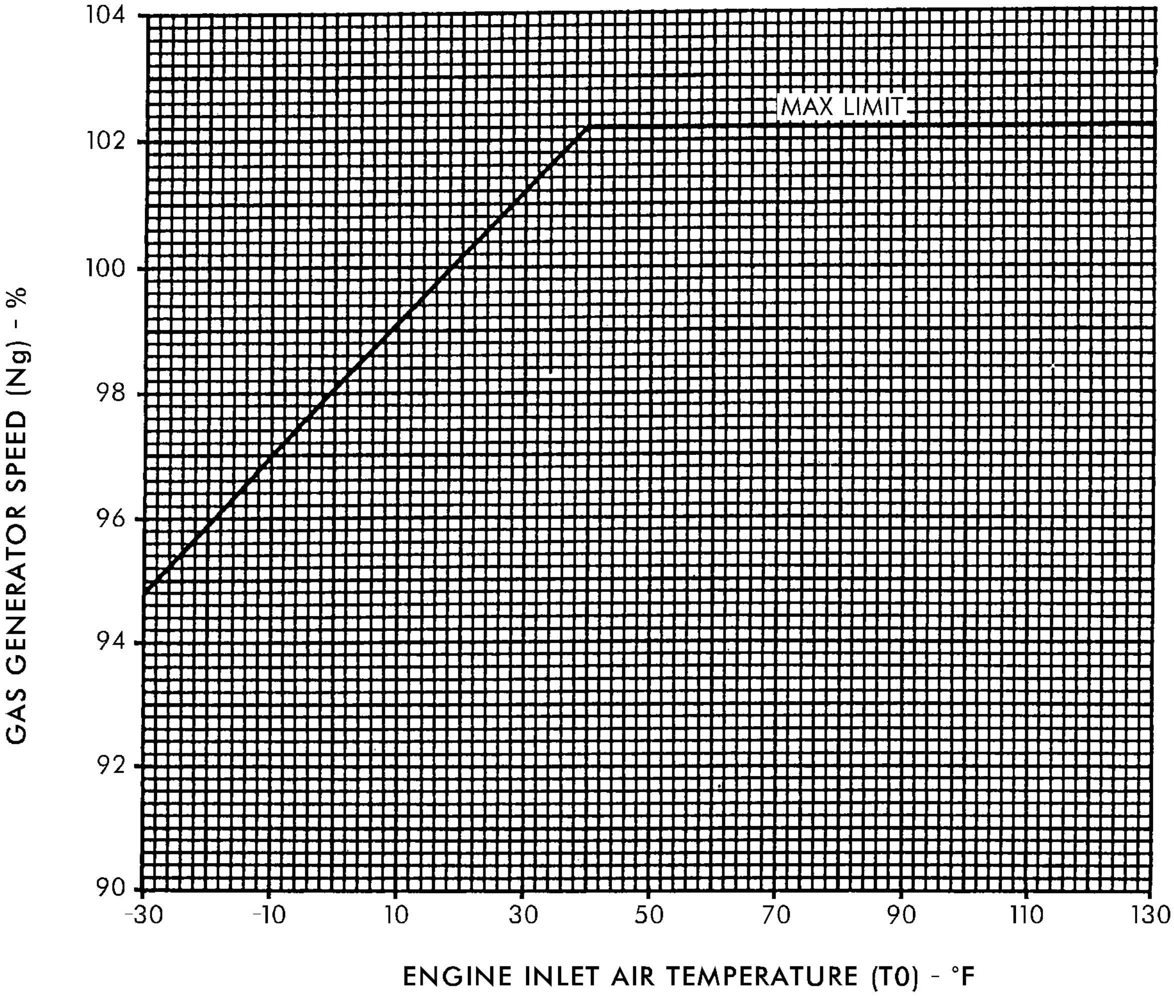

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Figure 1-129. ***(T701C, T701D)*** *Ng Physical Speed Limit*

Table 1-44. (T701, T701C, T701D) Definitions of Symbols and Parameters

Symbol/Parameter	Source	Definition
Hg	Measured	Barometric pressure in inches of Mercury.
LHV	Calculated	Lower heating value of fuel based on 18,600 btu/lb JP-4 (1.005), JP-5 (0.997), and JP-8 (0.999).
Ng	Measured	Gas generator speed in% of 44,700 rpm.
Np	Measured	Power turbine rotor speed, in rpm.
PA	Measured	Barometric pressure at test site is measured in inches of Mercury.
δ	Calculated	Correction factor for sea-level standard atmospheric pressure.
Qobs	Measured	Engine torque measured in foot-pounds.
QW	Measured	Water brake torque in inch-pounds.
SHP	Calculated	Uncorrected shaft horsepower calculated from engine torque output and output shaft rpm.
SHPA	Calculated	SHPK adjusted to the TGT Rated.
SHPK	Calculated	Engine shaft horsepower corrected for sea-level standard atmospheric pressure.
(T701 ECU) ΔSHP/ΔTGT	Figure 1-131	Rate of change of SHPK with changes in TGT.
(DEC) ΔSHP/ΔTGT	Figure 1-136	Rate of change of SHPK with changes in TGT.
(T701 ECU) ΔSHP	Calculated	Difference between 1132 horsepower and the test SHPK.
(DEC) ΔSHP	Calculated	Difference between 75% Maximum Continuous and the test SHPK.
TGT	Measured	Gas temperature measured by TGT harness in °F.
TGT RATED	Defined	Gas temperature at rated point in °F. (Intermediate rated power = 1535°F)
TGT TARGET	Figure 1-130	Target TGT for testing.

Table 1-44. (T701, T701C, T701D) Definitions of Symbols and Parameters (Cont)

Symbol/Parameter	Source	Definition
ΔTGT	Calculated	Difference between TGT TARGET and TGT.
T0	Measured	Engine inlet air temperature in °F.
TRQK	Calculated	Waterbrake torque corrected for sea level standard atmospheric pressure.
ΔTRQ	Calculated	Difference between rating torque (TRQS) and corrected test torque (TRQK).
TRQS	Figure 1-127	Rating torque (foot-pounds) for 75% Maximum Continuous.
ΔWF/ΔTRQ	Figure 1-138	Rate of change of Wfk with changes in TRQK.
Wf	Measured	Fuel flow in pounds per hour (lb/hr).
Wfa	Calculated	Wfk adjusted to rating horsepower.
(T701) Wfa (Maximum)	Figure 1-134	Maximum Wfa at 1132 SHPK.
(DEC) Wfa (Maximum)	Figure 1-139	Maximum Wfa at 75% Maximum Continuous.
ΔWf/ΔSHP	Figure 1-133	Rate of change of Wfk with changes in SHPK.
Wfk	Calculated	Fuel flow corrected for sea-level standard atmospheric pressure δ and LHV.

c. Calculate the correction factor for sea-level standard atmospheric pressure as follows:

$$\delta = \frac{\text{PA (inches of mercury)}}{29.92}$$

d. Calculate corrected shaft horsepower as follows:

(1) **Warm day** (at or above 59°F (15°C)).

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024}$$

$$\text{SHPK} = \frac{\text{SHP}}{\delta}$$

$\Delta\text{TGT} = \text{TGT TARGET} - \text{TGT}$ (See figure 1-130 for TGT TARGET.)

$\Delta\text{SHP}/\Delta\text{TGT}$ See figure 1-131. Enter curve at measured T0.

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT})(\Delta\text{SHP}/\Delta\text{TGT})$$

(2) **Cold day** (below 59°F (15°C)).

If TGT is below TGT TARGET (fig. 1-130), then ΔTGT and ΔSHP/ΔTGT adjustments are not necessary (see example 3). Adjust only if TGT is above TGT TARGET.

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024}$$

$$\text{SHPK} = \frac{\text{SHP}}{\delta}$$

TGT TARGET = See figure 1-130

$\Delta\text{TGT} = \text{TGT TARGET} - \text{TGT}$

$\Delta\text{SHP}/\Delta\text{TGT}$ See figure 1-131. Enter curve at measured T0.

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT})(\Delta\text{SHP}/\Delta\text{TGT})$$

e. After calculating SHPA for intermediate rated power, determine whether engine passes or fails rated performance from figure 1-132. Enter curve at measured T0.

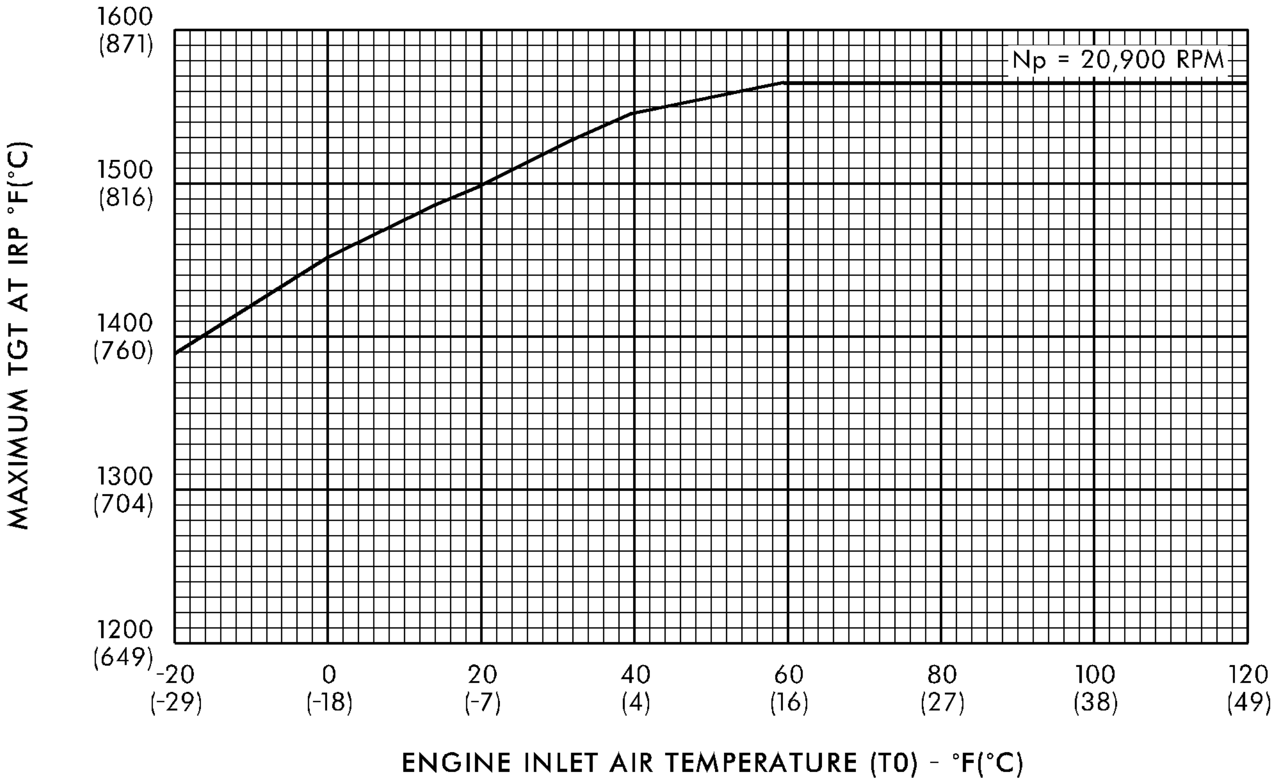

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Figure 1-130. ***(T701)*** *TGT TARGET Correction Factor*

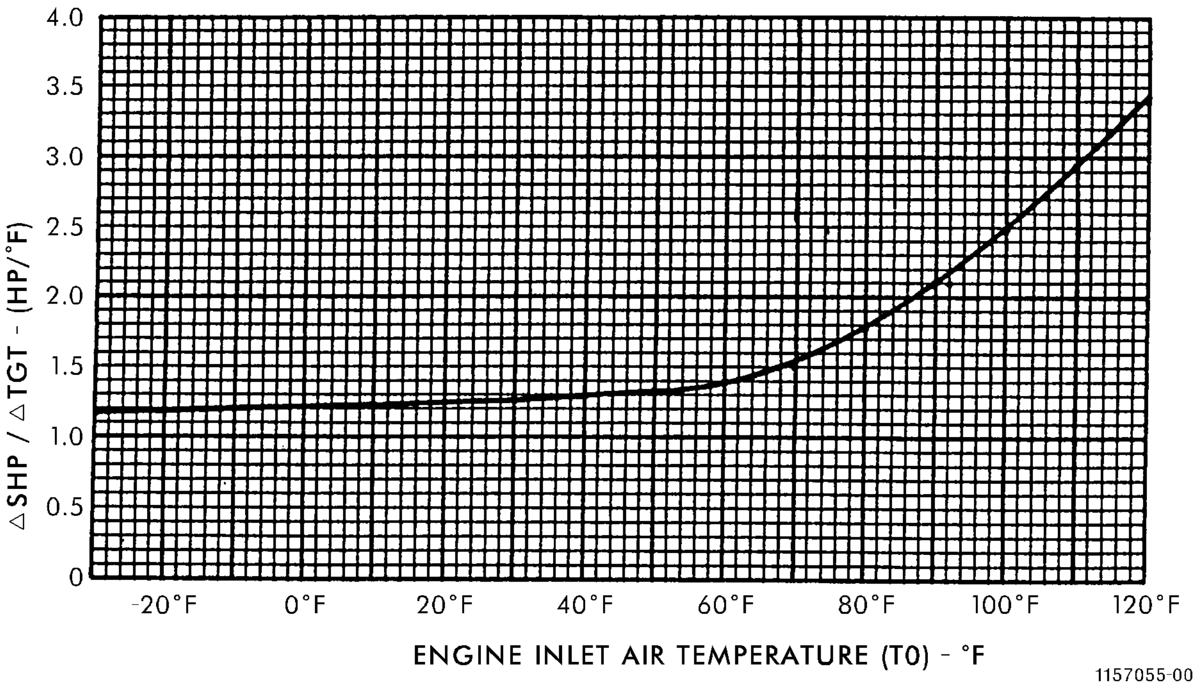

Figure 1-131. ***(T701)*** *Intermediate Rated Power Correction Factor*

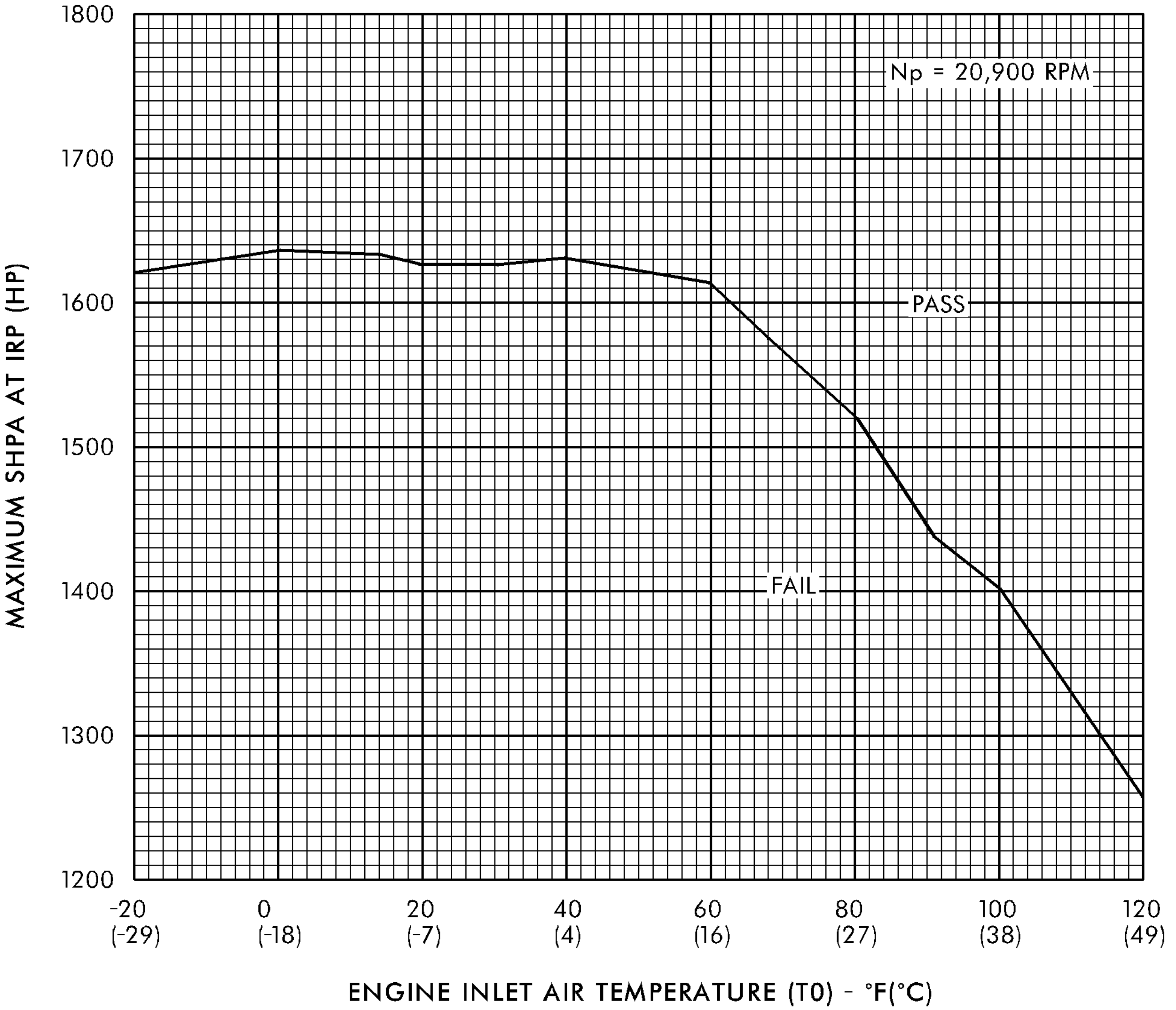

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Figure 1-132. **(T701)** Intermediate Rated Power Limit - 95% Specification

NOTE

- Examples 1 and 2 are used to rate performance when T0 is above 59°F (15°C).
- Examples 3 and 4 are used to rate performance when T0 is below 59°F (15°C).

f. **EXAMPLE 1:** Calculating intermediate rated power (IRP) (TGT TARGET = 1565°F) with TGT measured at 1560°F (below TGT TARGET), with T0 59°F (15°C) and above.

Where:

$T0 = 77°F$
$TGT = 1560°F$
$QW = 4750$ inch-pounds
$PA = 28.80$ in. Hg
$Np = 20{,}900$ rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$
$$\delta = \frac{28.80}{29.92}$$
$$\delta = 0.963$$
$$SHP = \frac{QW \times Np}{63{,}024}$$
$$SHP = \frac{4750 \times 20{,}900}{63{,}024}$$
$$SHP = 1575.2$$
$$SHPK = \frac{1575.2}{0.963}$$
$$SHPK = 1637$$
$$\Delta TGT = \text{TGT TARGET (from fig. 1-130 at T0 of 77°F)} - TGT$$
$$\Delta TGT = 1565°F - 1560°F$$
$$\Delta TGT = 5°F$$
$$\Delta SHP/\Delta TGT = \text{from figure 1-131 at T0 of 77°F}$$
$$\Delta SHP/\Delta TGT = 1.70$$
$$SHPA = SHPK + (\Delta TGT \times \Delta SHP/\Delta TGT)$$
$$SHPA = 1637 + (5 \times 1.70)$$
$$SHPA = 1637 + 8.5$$
$$SHPA = 1645.5$$

Entering figure 1-132 at T0 = 77°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1535 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

EXAMPLE 2: Calculating intermediate rated power (IRP) (TGT TARGET = 1565°F) with TGT measured at 1570°F (above TGT TARGET), with T0 59°F (15°C) and above.

Where:

$T0 = 77°F$
$TGT = 1570°F$
$QW = 4810$ inch-pounds
$PA = 28.80$ in. Hg
$Np = 20{,}900$ rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$
$$\delta = \frac{28.80}{29.92}$$
$$\delta = 0.963$$
$$SHP = \frac{QW \times Np}{63{,}024}$$
$$SHP = \frac{4810 \times 20{,}900}{63{,}024}$$
$$SHP = 1595$$
$$SHPK = \frac{SHP}{\delta}$$
$$SHP = \frac{1595}{0.963}$$
$$SHPK = 1656$$
$$\Delta TGT = \text{TGT TARGET (from fig. 1-130 at T0 of 77°F)} - TGT$$
$$\Delta TGT = 1565°F - 1570°F$$
$$\Delta TDT = -5°F$$
$$\Delta SHP/\Delta TGT = \text{from figure 1-131 at T0 of 77°F}$$
$$\Delta SHP/\Delta TGT = 1.70$$
$$SHPA = SHPK + (\Delta TGT \times \Delta SHP/\Delta TGT)$$
$$SHPA = 1656 + (-5 \times 1.70)$$
$$SHPA = 1656 - 8.5$$
$$SHPA = 1647.5$$

Entering figure 1-132 at T0 = 77°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1535 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

EXAMPLE 3: Calculating intermediate rated power (IRP) (below TGT TARGET) with TGT measured at 1449°F, with T0 below 59°F (15°C).

Where:

T0 = +5°F
TGT = 1449°F
QW = 5185 inch-pounds
PA = 28.80 in. Hg
Np = 20,900 rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5185 \times 20{,}900}{63{,}024}$$

$$SHP = 1719.4$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHPK = \frac{1719.4}{0.963}$$

$$SHPK = 1785.5$$

$$\Delta TGT = \text{TGT TARGET (from fig. 1-130 at T0 of 5°F)} - TGT$$

$$\Delta TGT = 1465°F - 1449°F$$

$$\Delta TGT = 16°F$$

Since TGT is below TGT TARGET, no adjustment is necessary.

$$SHPA = 1785.5$$

Entering figure 1-132 at T0 = 5°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1625 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

EXAMPLE 4: Calculating intermediate rated power (IRP) (TGT TARGET = 1465°F) with TGT measured at 1481°F (above TGT TARGET) with T0 below 59°F (15°C).

Where:

T0 = +5°F
TGT = 1481°F
QW = 5190 inch-pounds
PA = 28.80 in. Hg
Np = 20,900 rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5190 \times 20{,}900}{63{,}024}$$

$$SHP = 1721.1$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHPK = \frac{1721.1}{0.963}$$

$$SHPK = 1787.2$$

$$\Delta TGT = \text{TGT TARGET (from fig. 1-130 at T0 of 5°F)} - TGT$$

$$\Delta TGT = 1465°F - 1481°F$$

$$\Delta TGT = -16°F$$

$$\Delta SHP/\Delta TGT = \text{from figure 1-131 at T0 of 5°F}$$

$$\Delta SHP/\Delta TGT = 1.20$$

$$SHPA = SHPK + (\Delta TGT \times \Delta SHP/\Delta TGT)$$

$$SHPA = 1787.2 + (-16 \times 1.20)$$

$$SHPA = 1787.2 - 19.2$$

$$SHPA = 1768$$

Entering figure 1-125 at T0 5°F, we find that the minimum SHPA at intermediate rated power (IRP) is 1625 HP. Therefore, the intermediate rated power (IRP) point is above the recommended engine limit.

1-243. (T701) Partial Power Fuel Consumption Calculation at 1132 HP Test Condition (2, table 1-43).

a. Calculate the correction factor for sea-level standard day barometric pressure as follows:

$$\delta = \frac{\text{PA (inches of mercury)}}{29.92}$$

b. Determine shaft horsepower as follows:

$$\text{SHPK} = \frac{\text{QW} \times \text{Np}}{63{,}024 \times \delta}$$

c. Determine ΔSHP as follows:

$$\Delta\text{SHP} = 1132\text{HP} - \text{SHPK}$$

d. Determine Wfk as follows:

$$\text{Wfk} = \frac{\text{Wf} \times \text{LHV}}{\delta}$$

Where:

LHV = 1.005 for JP-4 Fuel
LHV = 0.997 for JP-5 Fuel
LHV = 0.999 for JP-8 Fuel

e. Determine Wfa as follows: Using figure 1-133, enter curve at measured T0 to determine ΔWf/ΔSHP.

$$\text{Wfa} = \text{Wfk} + (\Delta\text{SHP})(\Delta\text{Wf}/\Delta\text{SHP})$$

f. After calculating Wfa for 1132 shaft horsepower, enter figure 1-134 at measured T0. If Wfa is below the maximum curve for the T0 measured, the engine passes fuel flow performance check.

g. Example of calculating for 1132 HP condition:

(1) Where:

PA = 30.00 inches of mercury
T0 = 59°F measured
Wf = 520 lbs/hr measured and corrected for instruments

(2) Determine QW from figure 1-126 to set 1132 HP (test condition, 2, table 1-43).

(3) From curve on figure 1-126 at PA 30.00, QW = 3420 inch-pounds.

$$\delta = \frac{\text{PA}}{29.92} = \frac{30.00}{29.92} = 1.003$$

$$\text{SHPK} = \frac{\text{QW} \times \text{Np}}{63{,}024 \times \delta}$$

$$\text{SHPK} = \frac{3420 \times 20{,}900}{63{,}024 \times 1.003} = 1130.75$$

$$\Delta\text{SHP} = 1132\text{ HP} - \text{SHPK}$$

$$\Delta\text{SHP} = 1132 - 1130.75 = +1.25\text{ HP}$$

$$\text{Wfk} = \frac{\text{Wf} \times \text{LHV}^*}{\delta}$$

*Assume JP-4 fuel where LHV = 1.005

$$\text{Wfk} = \frac{520 \times 1.005}{1.003}$$

$$\text{Wfk} = 521\text{ lbs/hr}$$

$\Delta\text{Wf}/\Delta\text{SHP}$ from figure 1-133 at T0 of 59°F = 0.354

$$\text{Wfa} = \text{Wfk} + (\Delta\text{SHP})(\Delta\text{Wf}/\Delta\text{SHP})$$

$$\text{Wfa} = 521 + (-1.25) \times (0.3555)$$

$$\text{Wfa} = 521 + 0.44$$

$$\text{Wfa} = 521.44\text{ lbs/hr}$$

(4) From figure 1-134 at T0 of 59°F Wfa of 575.8 lbs/hr is below the maximum curve value and is acceptable.

1-244. (DEC) Performance Calculation Procedure.

Use the water brake torque-measuring system.

NOTE

- **(T700)** performance calculation procedure is described in paragraph 1-239.
- TGT limiting is required for engine protection at FAT of 19°F (–7.2°C) and above. No TGT limiting is required if FAT is below 19°F (–7.2°C), as other control limits provide engine protection.

a. Definitions of symbols and parameters used in the performance calculations are in table 1-44.

b. Engine performance test data, recorded during the performance evaluation test, will be corrected to sea-level standard atmospheric conditions to determine if the engine meets performance requirements.

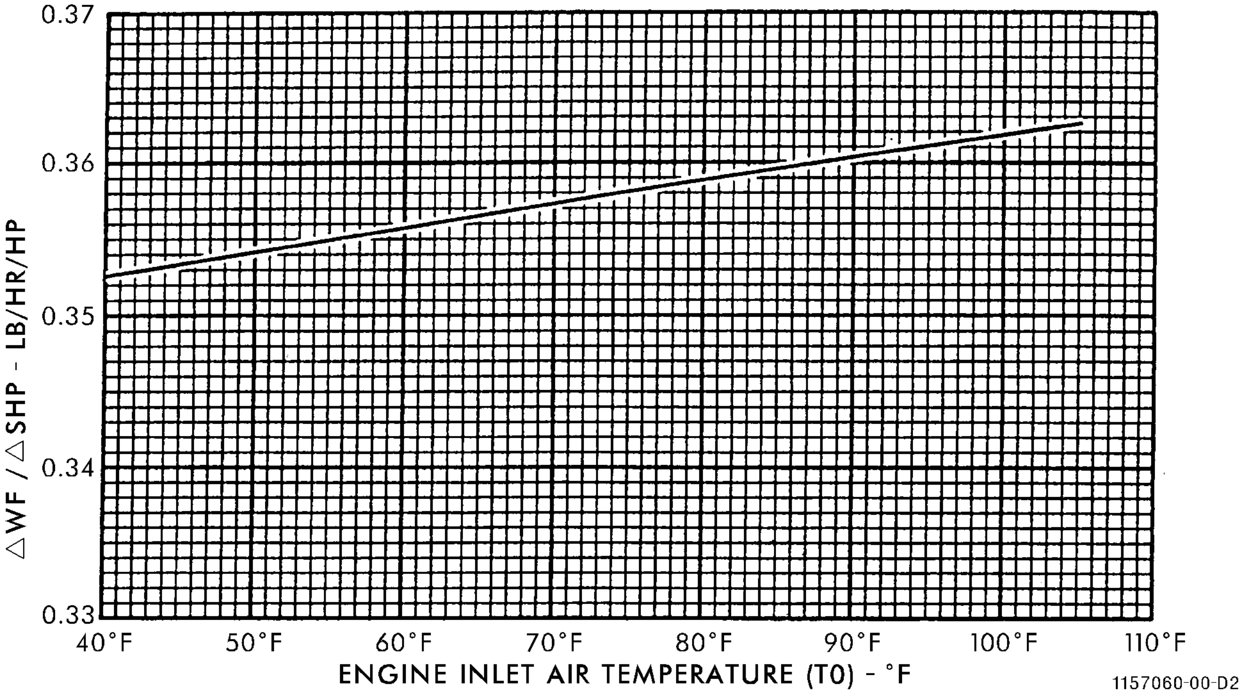

Figure 1-133. **(T701)** Fuel Flow Correction Factor for 1132 SHPK

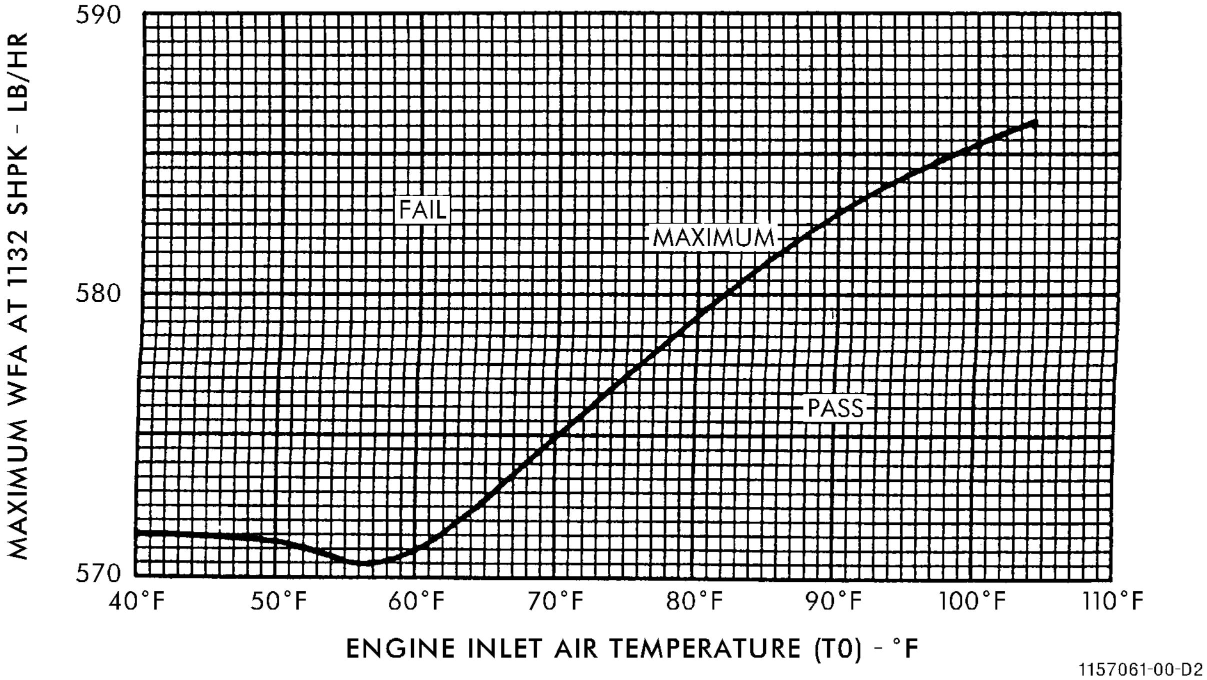

Figure 1-134. **(T700, T701)** Maximum Fuel Flow at 1132 SHPK

c. Calculate the correction factor for sea-level standard atmospheric pressure as follows:

$$\delta = \frac{\text{PA (inches of mercury)}}{29.92}$$

d. Calculate corrected shaft horsepower as follows:

(1) **Warm day** (at or above 19°F).

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024}$$

$$\text{SHPK} = \frac{\text{SHP}}{\delta}$$

ΔTGT = TGT TARGET – TGT (See figure 1-135 for TGT TARGET.)

ΔSHP/ΔTGT = See figure 1-136. Enter curve at measured T0.

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT})(\Delta\text{SHP}/\Delta\text{TGT})$$

(2) **Cold day** (below 19°F).

If TGT is below TGT Rated (fig. 1-135), then ΔTGT and ΔSHP/ΔTGT adjustments are not necessary (see example 3). Adjust only if TGT is above TGT TARGET.

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024 \times \delta}$$

$$\text{SHPK} = \frac{\text{SHP}}{\delta}$$

TGT TARGET = See figure 1-135.

ΔTGT = TGT TARGET – TGT

ΔSHP/ΔTGT = See figure 1-136. Enter curve at measured T0.

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT})(\Delta\text{SHP}/\Delta\text{TGT})$$

e. After calculating SHPA for Maximum, determine whether engine passes or fails rated performance from figure 1-137. Enter curve at measured T0.

NOTE

- Examples 1 and 2 are used to rate performance when T0 is above 19°F.
- Examples 3 and 4 are used to rate performance when T0 is below 19°F.

EXAMPLE 1: Calculating maximum (MAX) (TGT TARGET = 1573°F) with TGT measured at 1570°F (below TGT TARGET), with T0 19°F and above.

Where:

T0 = 77°F
TGT = 1570°F
QW = 5500 inch-pounds
PA = 28.80 in. Hg
Np = 20,900 rpm

Calculation for Correction Factor:

$$\delta = \frac{\text{PA}}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$\text{SHP} = \frac{\text{QW} \times \text{Np}}{63{,}024}$$

$$\text{SHP} = \frac{5500 \times 20{,}900}{63{,}024}$$

$$\text{SHP} = 1823.9$$

$$\text{SHPK} = \frac{1823.9}{0.963}$$

$$\text{SHPK} = 1894$$

ΔTGT = TGT TARGET (from fig. 1-130 at T0 of 77°F) – TGT

$$\Delta\text{TGT} = 1573°\text{F} - 1570°\text{F}$$

$$\Delta\text{TGT} = 3°\text{F}$$

ΔSHP/ΔTGT = (from fig. 1-136 at T0 of 77°F)

$$\Delta\text{SHP}/\Delta\text{TGT} = 1.8$$

$$\text{SHPA} = \text{SHPK} + (\Delta\text{TGT} \times \Delta\text{SHP}/\Delta\text{TGT})$$

$$\text{SHPA} = 1894 + (3 \times 1.8)$$

$$\text{SHPA} = 1894 + 5.4$$

$$\text{SHPA} = 1899.4$$

Entering figure 1-137 at T0 = 77°F, we find that the minimum SHPA at Maximum (MAX) is 1745 HP. Therefore, the Maximum (MAX) point is above the recommended engine limit.

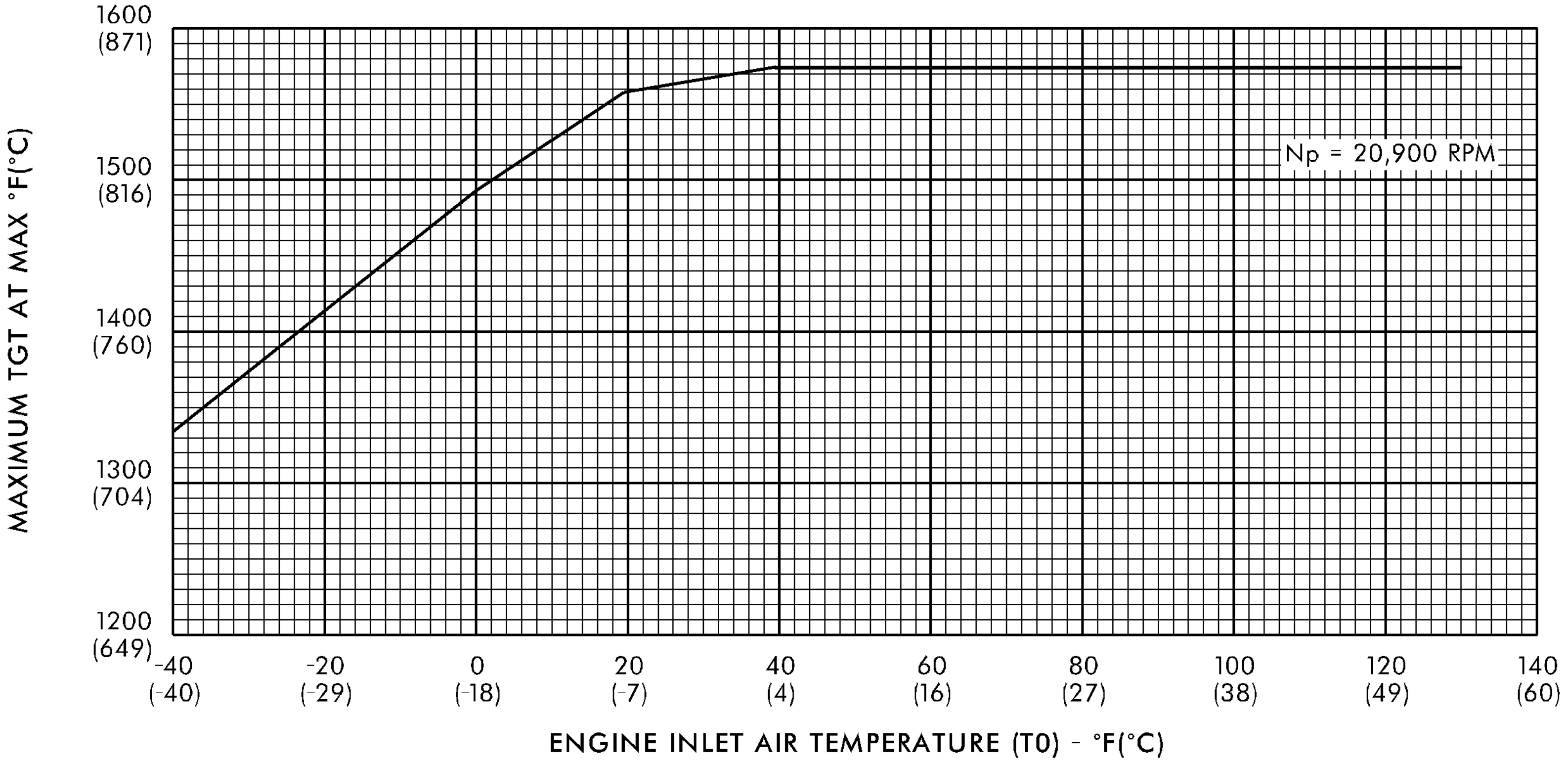

Figure 1-135. ***(T701C, T701D)*** *TGT TARGET Correction Factor*

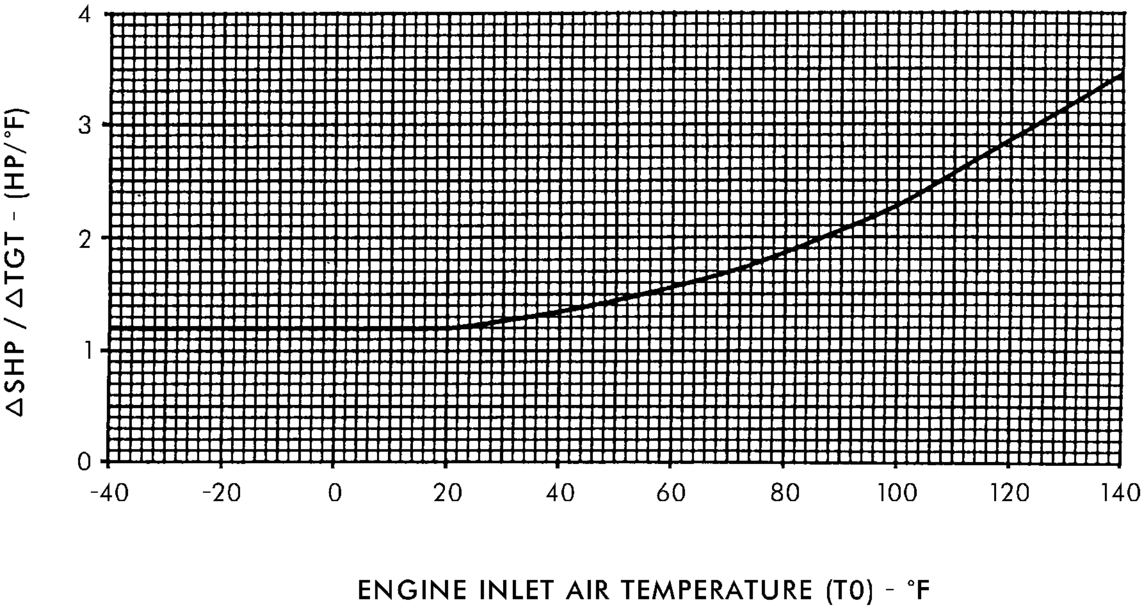

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Figure 1-136. ***(T701C, T701D)*** *Maximum Power Corrections Factor*

EXAMPLE 2: Calculating Maximum (MAX) (TGT TARGET = 1573°F) with TGT measured at 1580°F (above TGT TARGET), with T0 19°F and above.

Where:

$T0 = 77°F$
$TGT = 1580°F$
$QW = 5560$ inch-pounds
$PA = 28.80$ in. Hg
$Np = 20{,}900$ rpm

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5560 \times 20{,}900}{63{,}024}$$

$$SHP = 1843.8$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHPK = \frac{1843.8}{0.963}$$

$$SHPK = 1914.6$$

$\Delta TGT = $ TGT TARGET (see fig. 1-135 at T0 of 77°F) – TGT

$$\Delta TGT = 1573°F - 1580°F$$

$$\Delta TGT = -7°F$$

$\Delta SHP/\Delta TGT = $ from figure 1-136 at T0 of 77°F

$$\Delta SHP/\Delta TGT = 1.8$$

$$SHPA = SHPK + (\Delta TGT \times \Delta SHP/\Delta TGT)$$

$$SHPA = 1914.6 + (-7 \times 1.8)$$

$$SHPA = 1914.6 - 12.6$$

$$SHPA = 1902.0$$

Entering figure 1-137 at T0 = 77°F, we find that the minimum SHPA at Maximum (MAX) is 1745 HP. Therefore, the Maximum (MAX) point is above the recommended engine limit.

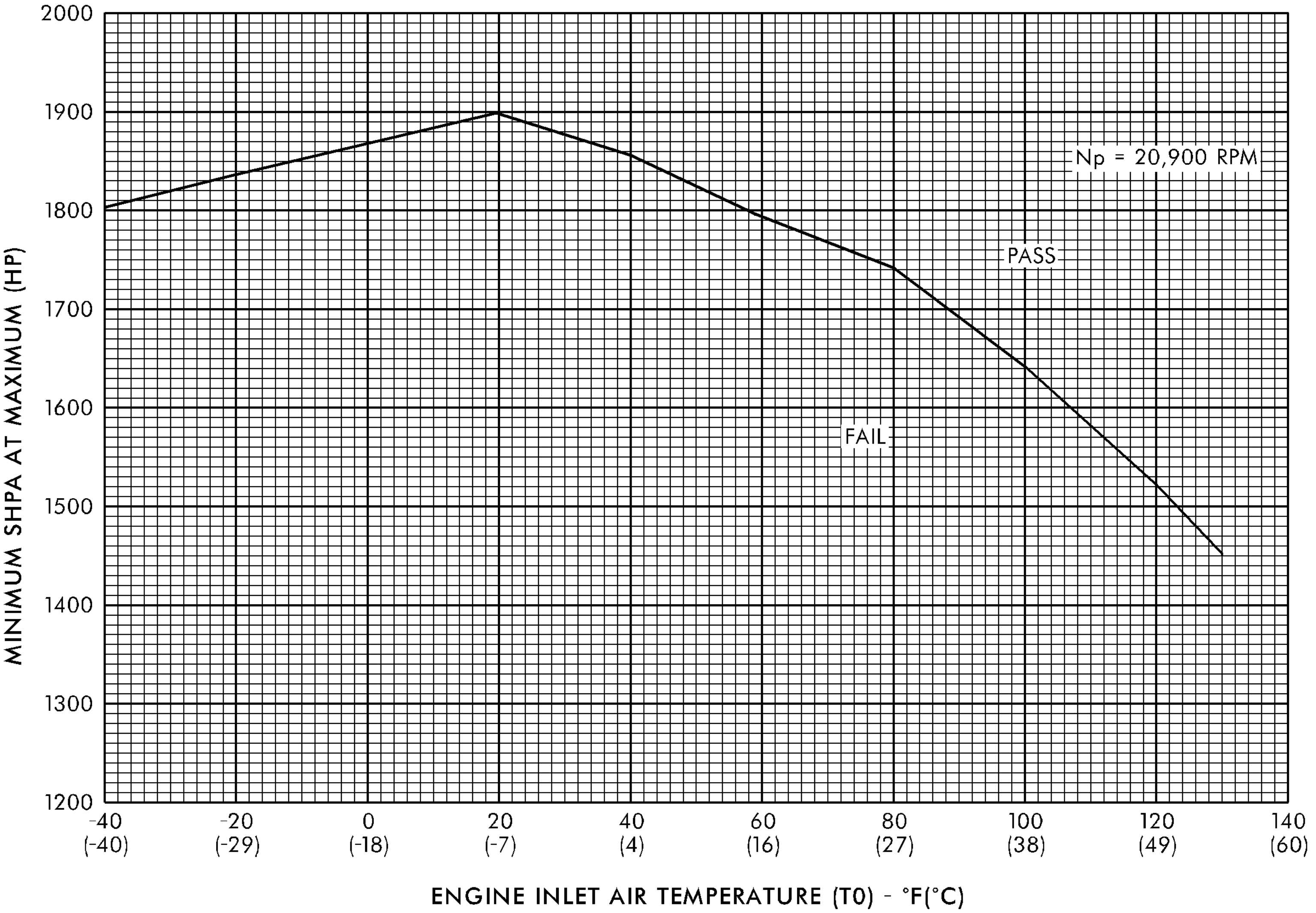

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Figure 1-137. ***(T701C, T701D)*** *Maximum Power Limit - 95% Specification*

EXAMPLE 3: Calculating Maximum (MAX) (below TGT TARGET) with TGT measured at 1505°F, with T0 below 19°F.

Where:

$$\begin{aligned} T0 &= +5°F \\ TGT &= 1505°F \\ QW &= 5580 \text{ inch-pounds} \\ PA &= 28.80 \text{ in. Hg} \\ Np &= 20{,}900 \text{ rpm} \end{aligned}$$

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5880 \times 20{,}900}{63{,}024}$$

$$SHP = 1949.9$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHPK = \frac{1949.9}{0.963}$$

$$SHPK = 2024.8$$

$$\Delta TGT = \text{TGT TARGET (from fig. 1-135 at T0 of 5°F)} - TGT$$

$$\Delta TGT = 1510°F - 1505°F$$

$$\Delta TGT = 5°F$$

Since TGT is below TGT TARGET, no adjustment is necessary.

$$SHPA = 2024.8$$

Entering figure 1-137 at T0 = 5°F, we find that the minimum SHPA at Maximum (MAX) is 1885 HP. Therefore, the Maximum (MAX) point is above the recommended engine limit.

EXAMPLE 4: Calculating Maximum (MAX) (TGT TARGET = 1510°F) with TGT measured at 1517°F (above TGT TARGET) with T0 below 19°F.

Where:

$$\begin{aligned} T0 &= +5°F \\ TGT &= 1517°F \\ QW &= 5850 \text{ inch-pounds} \\ PA &= 28.80 \text{ in. Hg} \\ Np &= 20{,}900 \text{ rpm} \end{aligned}$$

Calculation for Correction Factor:

$$\delta = \frac{PA}{29.92}$$

$$\delta = \frac{28.80}{29.92}$$

$$\delta = 0.963$$

$$SHP = \frac{QW \times Np}{63{,}024}$$

$$SHP = \frac{5850 \times 20{,}900}{63{,}024}$$

$$SHP = 1940$$

$$SHPK = \frac{SHP}{\delta}$$

$$SHPK = \frac{1940}{0.963}$$

$$SHPK = 2014.5$$

$$\Delta TGT = \text{TGT TARGET (from fig. 1-135 at T0 of 5°F)} - TGT$$

$$\Delta TGT = 1510°F - 1517°F$$

$$\Delta TGT = -7°F$$

$$\Delta SHP/\Delta TGT = \text{from figure 1-136 at T0 of 5°F}$$

$$\Delta SHP/\Delta TGT = 1.20$$

$$SHPA = SHPK + (\Delta TGT \times \Delta SHP/\Delta TGT)$$

$$SHPA = 2014.5 + (-7 \times 1.20)$$

$$SHPA = 2014.5 - 8.4$$

$$SHPA = 2006.1$$

Entering figure 1-137 at T0 5°F, we find that the minimum SHPA at Maximum (MAX) is 1885 HP. Therefore, the Maximum (MAX) point is above the recommended engine limit.

1-245. (T701C, T701D) Partial Power Fuel Consumption Calculation at 75% MC Test Condition (3, table 1-43).

a. Calculate the correction factor for sea-level standard day barometric pressure as follows:

$$\delta = \frac{\text{PA (inches of mercury)}}{29.92}$$

b. Determine corrected waterbrake torque as follows:

$$\text{TRQK} = \frac{\text{QW}}{\delta \times 12}$$

c. Determine ΔTRQ as follows:

$$\Delta\text{TRQ} = \text{TRQS (from fig. 1-127)} - \text{TRQK}$$

d. Determine Wfk as follows:

$$\text{Wfk} = \frac{\text{Wf} \times \text{LHV}}{\delta}$$

Where:

LHV = 1.005 for JP-4 Fuel
LHV = 0.997 for JP-5 Fuel
LHV = 0.999 for JP-8 Fuel

e. Determine Wfa as follows: Using figure 1-138, enter curve at measured T0 to determine ΔWf/ΔSHP.

$$\text{Wfa} = \text{Wfk} + (\Delta\text{TRQ})(\Delta\text{Wf}/\Delta\text{TRQ})$$

f. After calculating Wfa for 75% MC, enter figure 1-139 at measured T0. If Wfa is below the maximum curve for the T0 measured, the engine passes fuel flow performance check.

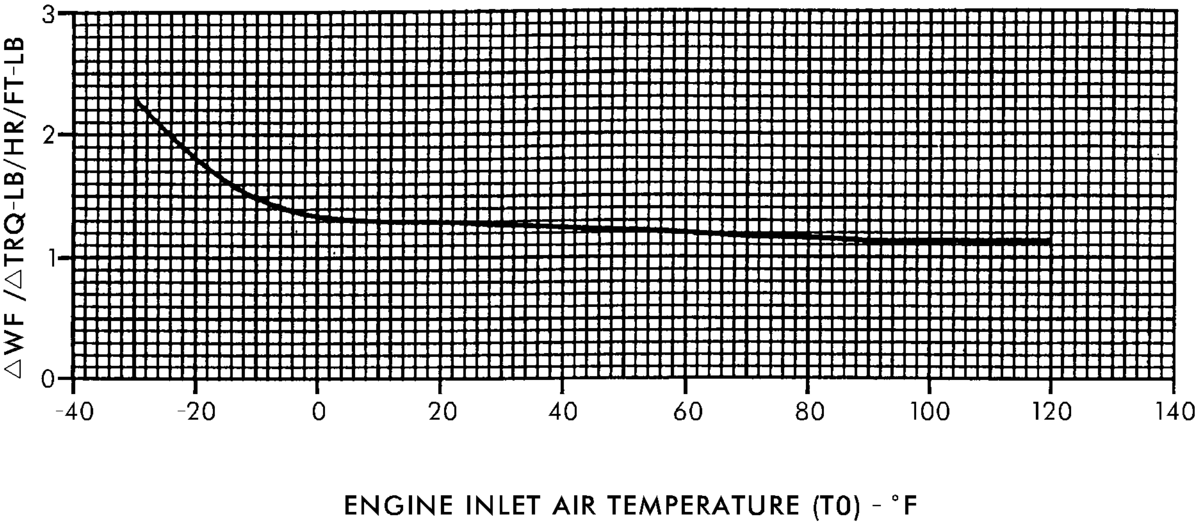

*Figure 1-138. **(T701C, T701D)** Fuel Flow Correction Factor for 75% Maximum Correction*

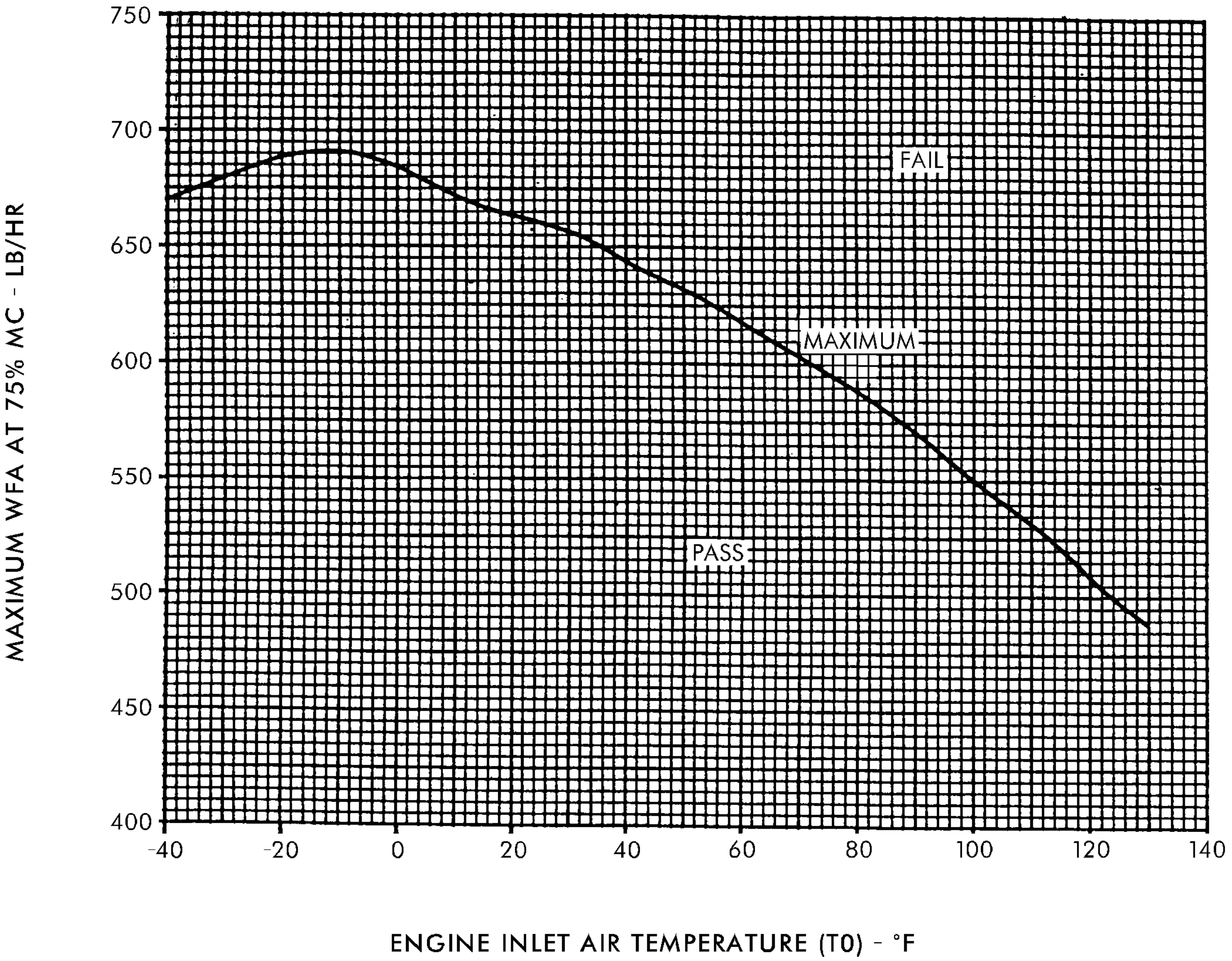

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Figure 1-139. ***(T701C, T701D)*** *Maximum Fuel Flow at 75% Maximum Correction*

g. Example of calculating for 75% MC condition:

(1) Where:

$$\begin{aligned} PA &= 30.00 \text{ inches of mercury} \\ T0 &= 59°\text{F measured} \\ Wf &= 605 \text{ lbs/hr measured and corrected for instruments} \end{aligned}$$

(2) Determine QW from figure 1-127 to set 75% MC (test condition, 3, table 1-43). Entering the curve at T0 = 59° F, required torque to set (TRQs) is 313 ft-lbs (3756 inch-pounds).

(3) Measured waterbrake torque (QW) is 3775 inch-pounds. Calculate corrections as follows:

$$\begin{aligned} \delta &= \frac{PA}{29.92} = \frac{30.00}{29.92} = 1.003 \\ TRQK &= \frac{QW}{8 \times 12} \\ SHPK &= \frac{3775}{12 \times 1.003} = 313.6 \\ \Delta TRQ &= TRQS - TRQK \\ \Delta TRQ &= 313 - 313.6 = -0.6 \\ Wfk &= \frac{Wf \times LHV^*}{\delta} \end{aligned}$$

$$\text{*Assume JP-4 fuel where LHV} = 1.005$$

$$\begin{aligned} Wfk &= \frac{605 \times 1.005}{1.003} \\ Wfk &= 606.2 \text{ lbs/hr} \end{aligned}$$

$$\Delta Wf/\Delta TRQ \text{ from figure 1-138 at T0 of } 59°\text{F} = 1.2$$

$$\begin{aligned} Wfa &= Wfk + (\Delta TRQ)(\Delta Wf/\Delta TRQ) \\ Wfa &= 606.2 + (-0.6) \times (1.2) \\ Wfa &= 606.2 - 0.7 \\ Wfa &= 605.5 \text{ lbs/hr} \end{aligned}$$

From figure 1-139 at T0 of 59°F Wfa of 605.5 lbs/hr is below the maximum curve value and is acceptable.

1-246. Engine Torque Accuracy Check. Engine torque error may be calculated from test data taken at test conditions 2 and 3 of table 1-41 **(T700)** or test conditions 3 and 5 of table 1-43 **(T701, T701C, T701D)**, as follows:

a. Torque error = Engine torque observed (Qobs) minus QW.

b. Water brake torque corrected for instrument error.

$$\text{Torque Error} = \frac{\text{Qobs} -}{} \left(\frac{\text{QW corrected}}{12}\right)$$

c. Example (IRP or Max test condition)

(1) Qobs = 400 ft-lbs

(2) QW = 4764 inch-pounds

(3)
$$\text{Torque error} = 400 - \frac{(4764)}{12} = +3 \text{ ft-lbs}$$

d. Compare calculated torque error with graph in figure 1-140 **(T700)**, 1-141 **(T701)**, or 1-142 **(T701C, T701D)**. At Qobs of 400 ft-lbs, a torque error of +3 ft-lbs is within limits.

1-247. (T700) Engine Oil Discharge Pressure (EODP) Temperature Corrections. Engine oil discharge temperature and pressure (EODT/EODP) must be stabilized for 10 minutes minimum before taking a reading at G/I point, and for 5 minutes minimum at higher power conditions.

a. EODP correction (EODPK) for EODT above baseline EODT (typical example).

Where:

$$\begin{aligned} Ng &= 42{,}800 \text{ rpm} \\ T0 &= 90°\text{F} \\ EODT &= 253°\text{F} \\ \text{Baseline EODT} &= 191°\text{F (from fig. 1-143)} \\ EODP &= 52.5 \text{ psig} \\ \Delta EODT &= EODT - \text{Baseline EODT} \\ \Delta EODT &= 253°\text{F} - 191°\text{F} \\ \Delta EODT &= 62°\text{F} \\ EODPK &= EODP + (\Delta EODT \times \\ &\qquad \text{correction factor from curve} \\ &\qquad \text{1, fig. 1-144)} \\ EODPK &= 52.5 + (62 \times .216) \\ EODPK &= 65.9 \text{ psig} \end{aligned}$$

Limits:

Using oil MIL-PRF-23699, at an Ng of 42,800 rpm, and oil and scavenge pump PN 5043T73P02, oil pressure limits are 54 to 77 psig (fig. 1-110). With oil and scavenge pump PN 5034T11P04, oil pressure limits are 57 to 80 psig (fig. 1-111). In both cases, EODPK of 65.9 psig is within limits.

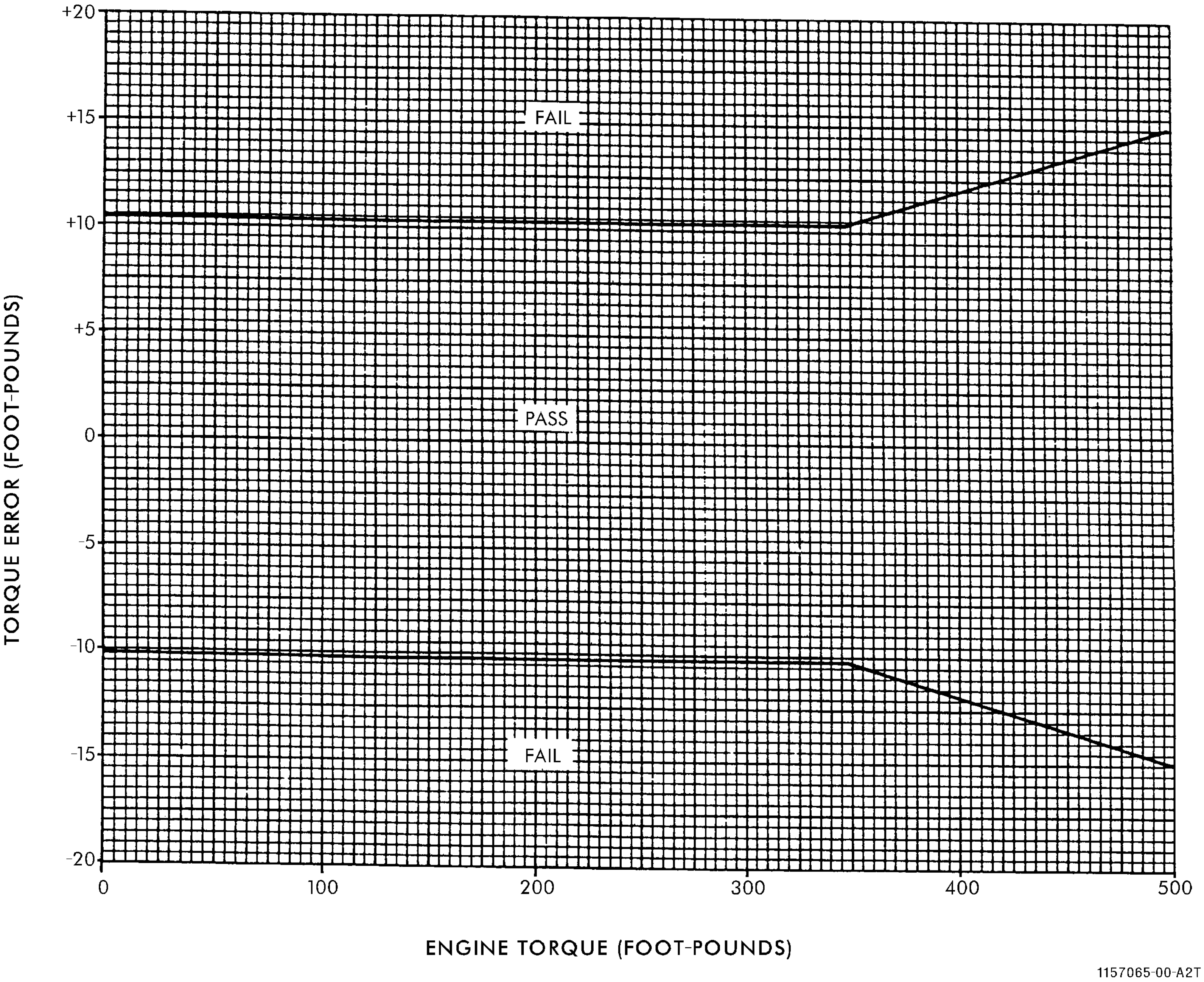

Figure 1-140. ***(T700)*** *Engine Torque vs Water Brake Torque*

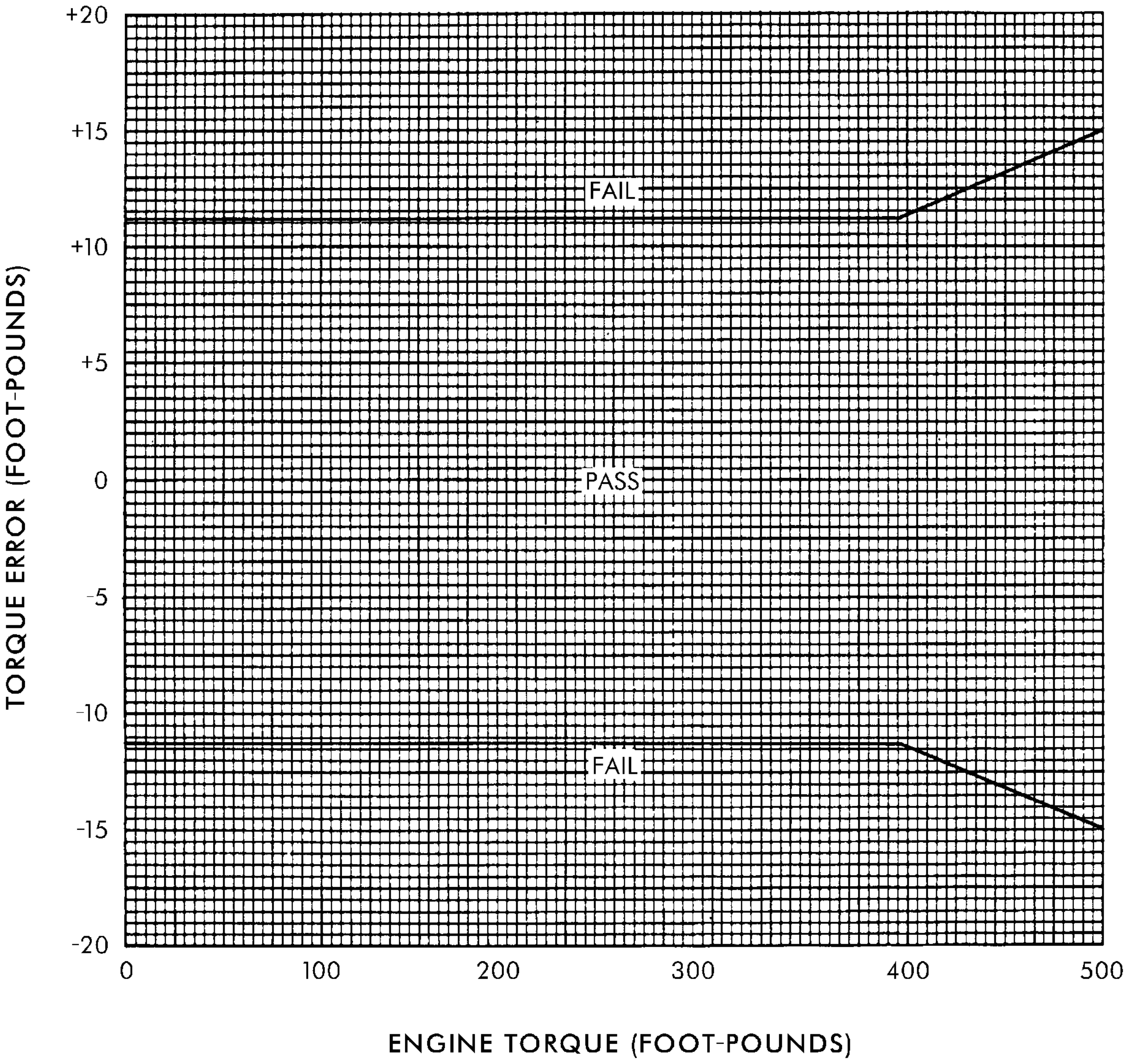

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Figure 1-141. ***(T701)*** *Engine Torque vs Water Brake Torque*

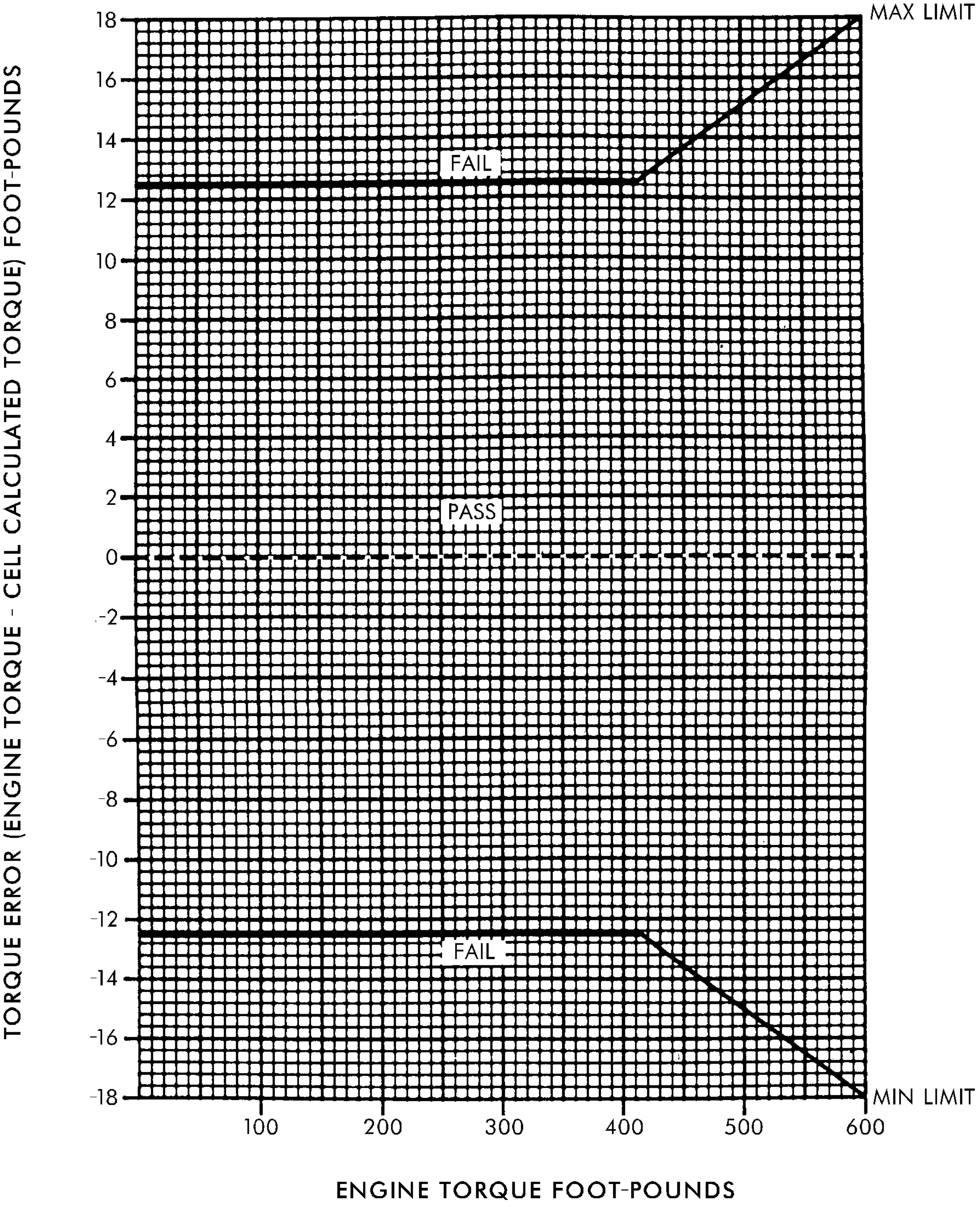

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Figure 1-142. ***(T701C, T701D)*** *Engine Torque vs Water Brake Torque*

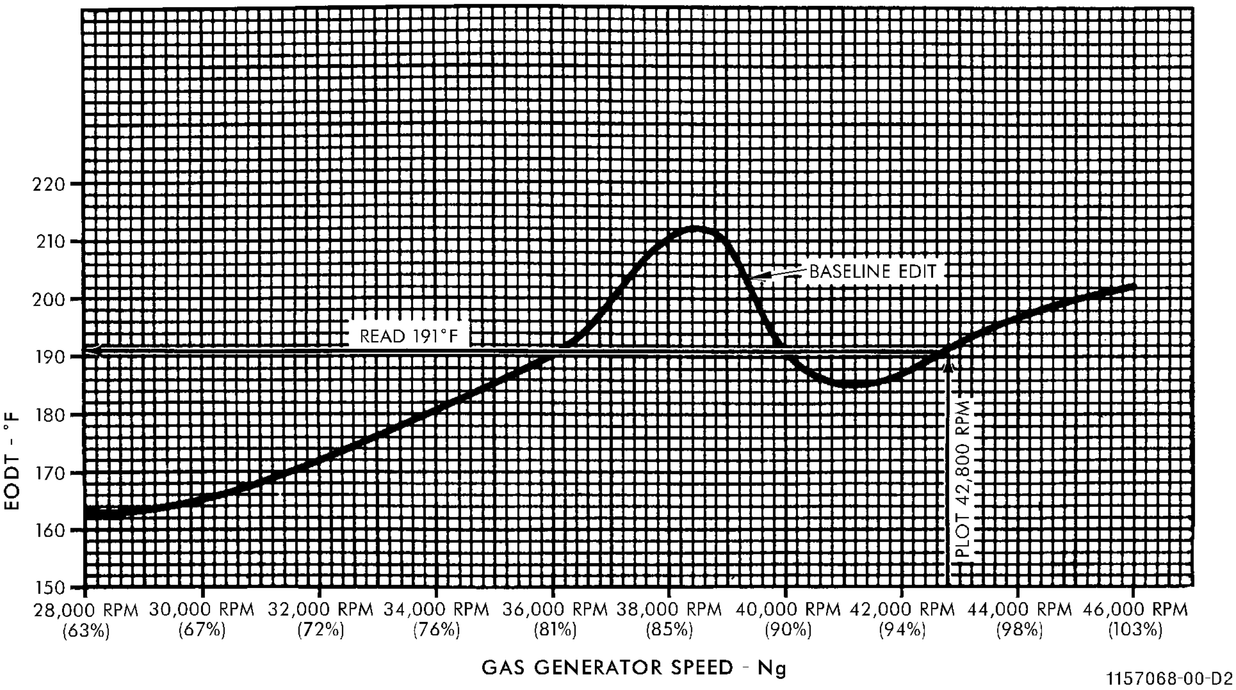

Figure 1-143. ***(T700)*** *Engine Oil Discharge Temperature (EODT) vs Ng*

b. EODPK for EODT below baseline EODT (typical example).

Where:

Ng = 41,300 rpm
T0 = 32°F
EODT = 132°F
Baseline EODT = 187°F (from fig. 1-143)
EODP = 67.4 psig
ΔEODT = EODT – Baseline EODT
ΔEODT = 132 – 187
ΔEODT = –55
EODPK = EODP + (ΔEODT × correction factor from curve 2, fig. 1-144)
EODPK = 67.4 + (–55 × .184)
EODPK = 57.3 psig

Limits:

Using oil MIL-PRF-7808, at an Ng of 41,300 rpm, and oil and scavenge pump PN 5043T73P02, oil pressure limits are 46 to 69 psig (fig. 1-110). With oil and scavenge pump PN 5034T11P04, oil pressure limits are 48 to 71 psig (fig. 1-112). In both cases, EODP of 57.3 psig is within limits.

c. If EODP is still out-of-limits after correction, see troubleshooting procedure 49 or 53.

1-248. Engine Shutdown.

a. Remain at ground idle (PAS lever at 26°) for a minimum of 2 minutes.

b. Move PAS lever to 0°.

c. Move WATER-IN and WATER-OUT levers to CLOSED. Make sure PAS is at 0° and that ignition is OFF.

d. Monitor TGT after shutdown. If the temperature rises above 538°C (1000°F) or if there is evidence of combustion after shutdown, (indicated by a rapidly increasing TGT), motor the engine until the temperature decreases below 538°C (1000°F). Wait 5 minutes or until TGT decreases below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F) before attempting an engine start.

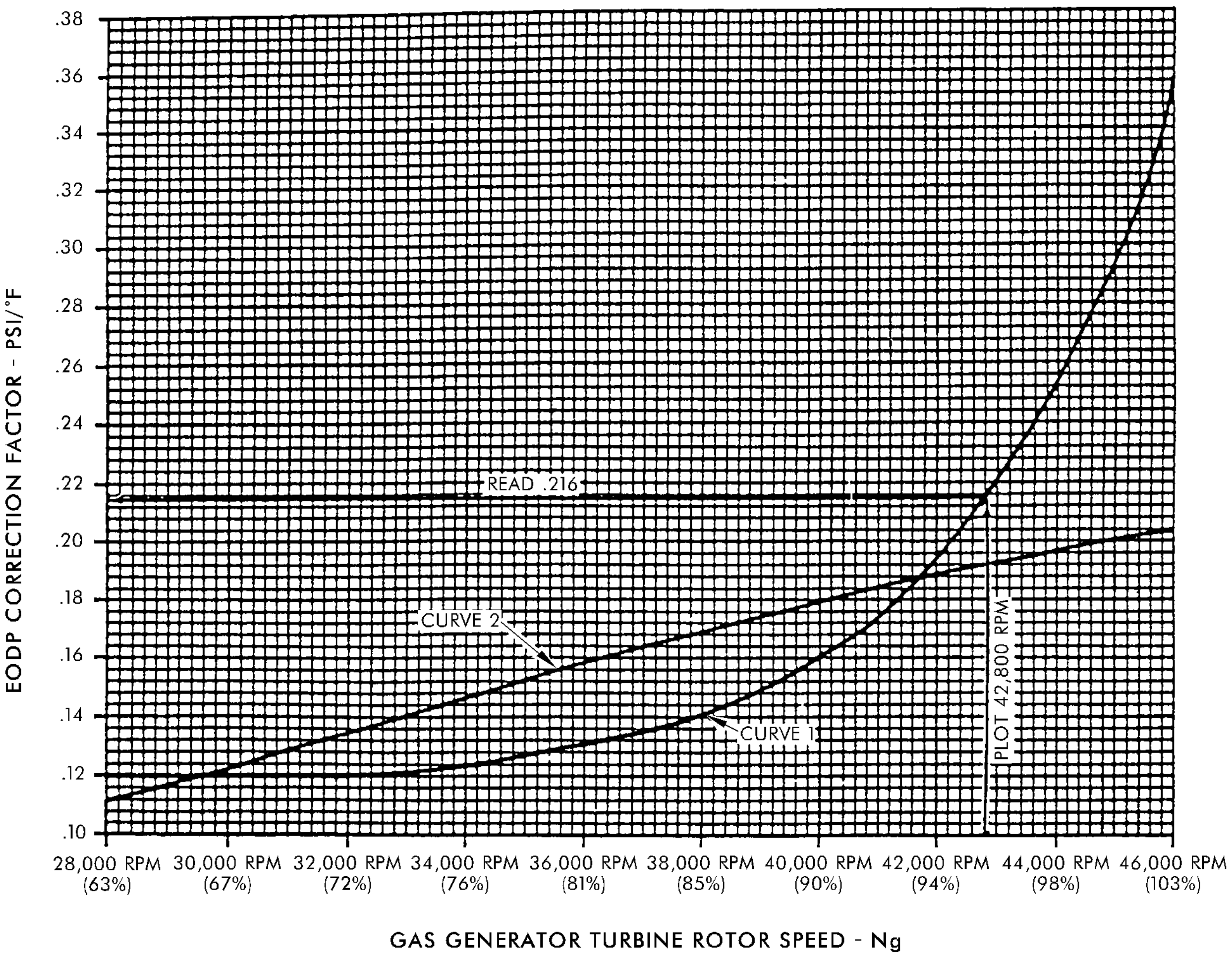

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Figure 1-144. (T700) *Engine Oil Discharge Pressure (EODP) vs Ng*

e. If engine is equipped with a DEC, record the fault code displayed 30 seconds after engine shutdown. If no fault is detected, the torque reading will be 0.00. If fault is detected, refer to table 1-13 and troubleshoot DEC.

1-249. Oil Consumption Check.

a. Review engine records and maintenance request to determine if an oil consumption check is required. Table 1-39 lists checks required.

b. If a check is required, it may be combined with other engine tests to reduce engine operating time.

c. Start engine and operate it until oil temperature has stabilized. Shut down engine, wait 20 minutes, then check oil level. If necessary, add oil to bring level to full (para 1-112).

d. Start engine and operate it for a minimum of 60 minutes to complete whatever operational checks are required.

e. Shut down engine and record operating time. After 20 minutes, check oil level. If necessary, add oil to bring level to full. Record the number of cubic centimeters (cc) added.

f. Calculate oil consumption in cc/hr. using the following formula:

$$\text{Oil consumption in cc/hr} = \frac{\text{cc of oil added} \times 60 \text{ min}}{\text{Recorded operating} \times 1 \text{ hr time in minutes}}$$

EXAMPLE:

During test, the engine was run for one hour and ten minutes, and 48 cc of oil was added to bring oil level in tank to FULL.

$$\text{Recorded operating time (step e)} = 70 \text{ min}$$

$$\text{cc of oil added (step e)} = 48 \text{ cc}$$

$$\text{Oil consumption} = \frac{48 \text{ cc}}{70 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}}$$

$$= \frac{2880}{70} = 41.1 \text{ cc/hr}$$

1-250. Post-Engine Test Requirements. Correct all test faults. Perform check run as required and record results of test. Record **(ECU)** history recorder or **(DEC)** history counter events after all running is complete; then perform the procedures in the following paragraphs:

- Engine Preservation (para 1-252)
- Oil System Purging (para 1-253)
- Preparation For Storage (para 1-201)
- Seal (waterproof) the torque and overspeed sensor and Np sensor hex connectors (para H-9)

1-251. Post-Engine Test Oil Leakage Check.

a. Visually check for oil leaks, paying particular attention to the following locations:

(1) All tube connections, specifically those that were disconnected and reinstalled during test or troubleshooting.

(2) Mating flange joints between accessory drive gearbox assembly and its components, specifically between the AGB and the mainframe.

(3) All other surface areas of mainframe.

b. Check all locations called out in step a for the following:

- Leakage (see Glossary for definition)
- Seepage (see Glossary for definition)
- Weepage (see Glossary for definition)

c. If discoloration or wetness is not found, go to para 1-252, otherwise do the following:

NOTE

The following steps must be performed to determine if wetness found is due to leaks or excess oil/fluid.

(1) Using a clean lint-free wiper, rub surface having discolored stains. If wiper remains dry and does not absorb oil, component is acceptable. If oil is absorbed on wiper, component is not acceptable and the cause must be determined and corrected.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

WARNING

Trichlorotrifluoroethane
MIL-C-81302

- Repeated or prolonged contact with liquid or inhalation of vapor can cause skin and eye irritation, dermatitis, drowsiness, and heart damage.
- After prolonged skin contact, wash contacted area with soap and water. Remove contaminated clothing. If vapors cause irritation, go to fresh air; get medical attention.
- When handling liquid in vapor-degreasing tank with hinged cover and air-exhaust, or at air-exhausted workbench, wear approved gloves and goggles.
- When handling liquid at open, unexhausted workbench, wear approved respirator, gloves, and goggles.
- Dispose of liquid-soaked rags in approved metal container.

CAUTION

Cleaning solvent will damage electrical connectors by causing swelling of the insert.

(2) Using a soft-bristle brush (item 16, Appendix D) moistened in cleaning solvent (item 99 or 115, Appendix D) or equivalent, clean outside of mainframe or AGB where leakage, seepage, or weepage is present.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(3) Brush part with water to remove solvent and blow-dry part with compressed air.

(4) If oil staining/wetness reappears (within 30 minutes), determine the cause and repair or replace part.

1-252. Engine Preservation. If engine storage is required, preserve engine fuel system with lubrication oil as follows (before removing engine from METS/FEDS/CETS):

NOTE

Oil system purging (para 1-253) and engine preservation (para 1-252) may be done at the same time.

a. Allow engine to cool sufficiently to prevent auto-ignition.

b. Be sure ignition is switched to OFF.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

c. Disconnect fuel supply inlet hose and cap it. Use a clean, vented 5-gallon container and connect a hose between it and fuel boost pump inlet. Fill can with oil (item 86, Appendix D). Place container above engine inlet.

d. Turn on water to water brake. Make sure that water pressure for water brake bearing is 80-100 psig in order to provide sufficient flow to lubricate the bearing.

e. Turn on air to water brake. Make sure air supply is 40 - 80 psig.

f. Set PAS lever to LOCKOUT (130°).

CAUTION

Do not exceed starter duty cycle. See table 1-36 **(T700)** or table 1-37 **(T701, T701C, T701D)** for limits. Motoring time can be broken up into shorter periods. Observe required starter cool down times between operating cycles.

g. Motor engine at maximum starter speed for 2 minutes. Disengage starter and return PAS lever to OFF.

h. Disconnect hose from pump inlet.

i. Tag the engine with the following information: Engine system has been preserved with lubricating oil, MIL-PRF-6081, Grade 1010.

1-253. Oil System Purging. Oil system purging is not required if engine is being shipped to another location or if further engine maintenance is required. Purge system as follows:

WARNING

Draining of Oil Tank

To prevent being burned by hot oil, wear protective gloves when draining oil.

NOTE

Oil system purging (para 1-253) and engine preservation (para 1-252) may be done at the same time.

a. With bucket placed under oil drain plug at 6 o'clock position on main frame, remove oil drain plug. Allow oil to drain for at least 10 minutes.

b. Remove engine oil discharge pressure hose from accessory gearbox. Connect filtered, compressed air line (90 psig) to discharge pressure fitting on accessory gearbox. Do not turn on air.

c. Turn on water to water brake. Make sure that water pressure for water brake bearing is 80-100 psig in order to provide enough flow to lubricate the bearing.

d. Turn on air to water brake. Make sure air supply is 40-80 psig.

e. With LDS and PAS levers at 0°, and with WATER-IN and WATER-OUT levers CLOSED, motor engine on starter to maximum motoring speed for 2 minutes. When Ng stabilizes, fully turn on air pressure (90 psig) to hose connector on discharge pressure fitting.

f. Shut off starter. Continue air pressure for 5 more minutes. Shut off air.

g. Install new packing on oil drain plug, and thread plug into oil drain fitting.

h. Tighten (15° wrench arc) plug.

i. Prepare engine for storage (para 1-201).

1-254. TROUBLESHOOTING (METS/FEDS/CETS).

a. Troubleshooting procedures are used to locate and correct faults. Use of these procedures will reduce delays and maintenance down-time. It will also reduce unnecessary replacement of engine parts.

NOTE

Two basic things have been assumed in these procedures:

NOTE

- The correct operating procedures have been followed.
- The fault is caused by a single failure.

b. Troubleshooting procedures are in logic-diagram format and ask a question which is answered by a yes or a no. The answer will lead to another question or to a final solution.

c. Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

d. When reference is made to METS/FEDS/CETS manual, refer to Modular Engine Test System (METS) manual TM 55-4920-328-13-1 and -13-2, Flexible Engine Diagnostic System (FEDS) manual no number, or Compact Engine Test System (CETS) manual SE-876-03-1006.

e. The logic diagram lists the parts which might cause the fault. The METS/FEDS/CETS readings can often reveal which of these parts are causing the fault.

f. Use caution to avoid problems caused by false METS/FEDS/CETS readings. In most cases, you can find a false reading by checking it against other readings.

g. The troubleshooting procedures lists the action to be taken to correct the fault.

h. Preserve the engine (para 1-252) before removing it from the METS/FEDS/CETS.

i. See figure FO-2 for a schematic diagram of the engine electrical system and for locations of electrical connectors.

j. Any fluctuation or spiking of engine related parameters, such as Ng speed, Np speed, Torque, or TGT may be due to dirty or inadequately secured electrical connectors. Such connectors will be disconnected, inspected, and cleaned prior to the next engine test and prior to any LRU component removal.

k. The following is an outline of procedures to follow when troubleshooting:

(1) If possible, confirm the reported fault with a test run.

(2) Troubleshoot according to the symptoms.

(3) Do a test run to confirm that the fault has been fixed.

1-255. Symptom Index (METS/FEDS/CETS). See table 1-45 for a listing of troubleshooting symptoms.

Table 1-45. Symptom Index (METS/FEDS/CETS)

Symptom	Troubleshooting Procedure
ANTI-ICING SYSTEM	
Engine Anti-Icing System Malfunction	1
ENGINE	
Engine Flames Out During Normal Operation (combustion stops, indicated by a drop in TGT, Wf, P3, Ng, Np, torque and oil pressure)	2
(T700) Engine Flames Out During Np Overspeed Check (Combustion stops, indicated by a drop in TGT, Wf, P3, Ng, Np, torque, and oil pressure)	3
Gas Generator Speed (Ng)	
Ng Does Not Accelerate Above Ground Idle Speed	4
Ng High at Ground Idle Speed	5
*Ng Instrument Fluctuating or Not Indicating (all other instruments normal)	6
Ng Low at Ground Idle Speed	7
Uncontrolled Deceleration (Ng) (Ng and TGT decreases without retarding PAS lever)	8
History Recorder or History Counter	
(T700, T701) History Recorder Malfunction (engine time function inoperative)	9
(T701C, T701D) History Counter Malfunction (engine time function inoperative)	10
(T700, T701) History Recorder Malfunction (LCF function inoperative)	11
(T701C , T701D) History Counter Malfunction (LCF 1 function inoperative)	12
(T701C, T701D) History Counter Malfunction (LCF 2 function inoperative)	13
(T700, T701) History Recorder Malfunction (one or more functions inoperative)	14
(T701C, T701D) History Counter Malfunction (more than one function inoperative)	15
(T700, T701) History Recorder Malfunction (time-temperature function inoperative)	16
(T701C, T701D) History Counter Malfunction (time-temperature function inoperative)	17
Power Turbine Speed (Np)	
No Np Governing when Advancing PAS Lever to FLY (Np may increase to: **(T700)** (METS) 111 ± 1% (22,200 rpm) or (FEDS/CETS) 111 ± 1% (22,200 rpm) **(T701, T701C, T701D)** (METS) 125 ± 1% (25,000 rpm) or (FEDS/CETS) 125 ± 1% (25,000 rpm) tripping Np overspeed system)	18
Np Does Not Respond to Np Demand Trim (with torque matching normal, Np does not respond to normal Np trim)	19
*Np Instrument Fluctuating or Not Indicating (all other instruments normal)	20
Stalls	
Stall Above Ground Idle Speed	21

* - Refer to paragraph 1-254, step j before starting troubleshooting procedure.

Table 1-45. Symptom Index (METS/FEDS/CETS) (Cont)

Symptom	Troubleshooting Procedure
Starting Stalls (audible popping or whining during Ng acceleration to ground idle)	22
Starting	
Abnormally High TGT During Start	23
Combustor Rumble During Start	24
No Start (fuel mist seen coming from tailpipe; no rise in TGT)	25
No Start (no compressor rotor rotation)	26
(T700) No Start (no fuel mist seen coming from tailpipe; no rise in TGT)	27
(T701, T701C, T701D) No Start (no fuel mist seen coming from tailpipe; no rise in TGT)	28
Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and ground idle speed.)	29
Uncontrolled Accleration (Ng) (gas generator speed continues to accelerate beyond ground idle speed)	30
Engine Exceeds TGT Operating Limits and is in “Overtemperature Maintenance Required” Area of Figure: **(T700)** Figure 1-151 or 1-154, **(T701)** Figure 1-152 or 1-155, or **(T701C, T701D)** Figure 1-153 or 1-156	31
Engine Exceeds TGT Operating Limits in “Troubleshoot” Area of Figure: **(T700)** Figure 1-151 or 1-154, **(T701)** Figure 1-152 or 1-155, or **(T701C, T701D)** Figure 1-153 or 1-156	32
Engine Overtemperature (exceeds TGT operating limits)	33
TGT Exceeds Limiter Setting (TGT exceeds **(T700, T701)** ECU or **(T701C, T701D)** DEC limiter setting at T0 above **(T700, T701)** 40°F (4°C) or **(T701C, T701D)** 7°F (–14°C))	34
*TGT Fluctuates at Ground Idle Speed (idle speed or TGT drifts above and below limits)	35
*TGT Instrument Fluctuating or Not Indicating (all other instruments normal)	36
FUEL SYSTEM	
Excessive Fuel Leaking from Overboard Drain While Engine is Operating at Ground Idle Speed	37
No Fuel Mist Seen Coming from the Common Drain During Engine Prime or Vapor Vent	38
Fuel Filter Bypass Light ON	39
Low Fuel Pressure Caution Light ON Below Flight Idle Speed	40
Low Fuel Pressure Caution Light ON At or Above Flight Idle Speed	41
OIL SYSTEM	
Limited Power Due to Control System Problems (torque, % Ng, and TGT are abnormally low)	42
Electrical Chip Detector Light ON During Operation	43
Electrical Chip Detector Light ON (no debris found)	44
Excessive Oil Leakage at Service Port Scupper	45
Excessive Oil Leakage from Overboard Drain (out-of-limits)	46
High Oil Consumption (over limits)	47

* - Refer to paragraph 1-254, step j before starting troubleshooting procedure.

Table 1-45. Symptom Index (METS/FEDS/CETS) (Cont)

Symptom	Troubleshooting Procedure
High Oil Level (oil level above full mark in sight glass)	48
High Oil Pressure	49
No Oil Pressure	50
(T700, T701C, T701D) No Oil Temperature	51
Oil Filter Bypass Light Comes ON	52
Oil Pressure Below Limits	53
Oil Pressure Fluctuates	54
(T700, T701C, T701D) Oil Temperature Exceeds Limits (exceeds normal operating temperature)	55
Smoke in Exhaust	56
OVERSPEED TEST SYSTEM	
Overspeed (Engine Flames Out) (See Troubleshooting Procedure 3)	
Overspeed Cuts in with One Test Button Depressed	57
Overspeed Test System Will Not Operate (overspeed test system fails to cutback Ng and Np)	58
STEADY-STATE OPERATION - FLIGHT POWER RANGE	
ECU or DEC Lockout Mode Inoperative (engine will not respond to ECU or DEC lockout when PAS lever is advanced to maximum position or engine will not reset from lockout)	59
Low Engine Performance (torque low for given TGT)	60
Stable Operation With ECU or DEC Locked Out (Ng, TGT, and Np fluctuated above and below limits when ECU or DEC was not locked out)	61
Torque Instrument Fluctuating or Not Indicating (all other instruments normal)	62
Torque Matching Inoperative (Np does not respond during torque matching check (para 1-234))	63
Uncontrolled Acceleration above Ground Idle Speed while Advancing PAS Lever to FLY (all engine parameters indicating)	64
*Unstable Operation	65
*Unstable Operation with **(T700, T701)** ECU or **(T701C, T701D)** DEC Locked Out (Ng, T0, Torque, and Np fluctuate greater than 5% with **(T700, T701)** ECU or **(T701C, T701D)** DEC locked out)	66
VIBRATION	
Accessory Section Module Vibration and Exhaust Frame Vibration Exceed Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second)	67
Accessory Section Module Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second)	68
Exhaust Frame Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second)	69
Steady-State Vibration Limit (1.5 Inches/Second) or Transient Vibration Limit (2.8 Inches/Second) is Exceeded	70

* - Refer to paragraph 1-254, step j before starting troubleshooting procedure.

Table 1-45. Symptom Index (METS/FEDS/CETS) (Cont)

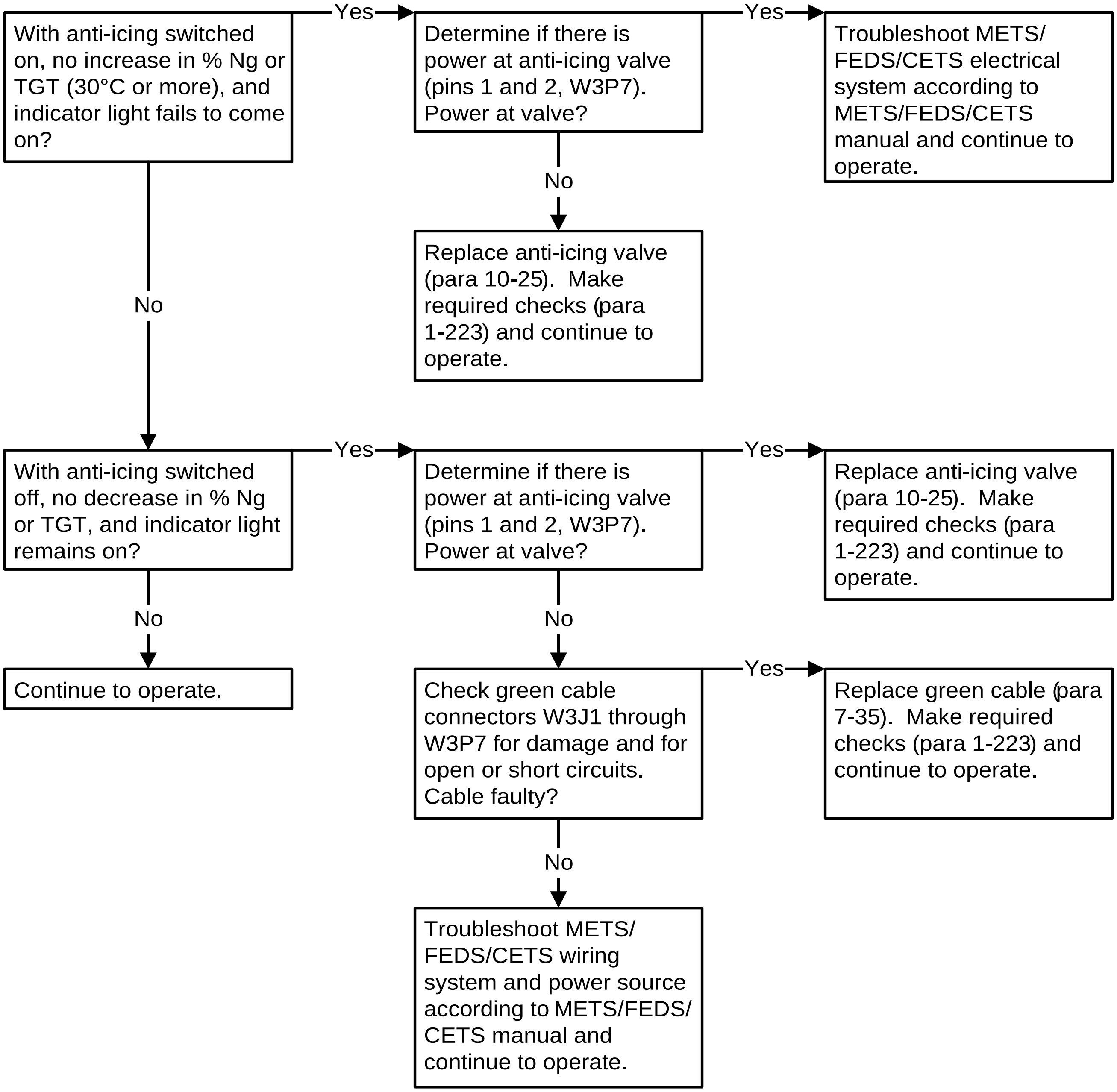
Symptom	Troubleshooting Procedure
DEC - ENGINE TORQUE INDICATOR FAULT CODES	
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 15% (±3%) (check DEC)	71
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 25% (±3%) (Np demand channel)	72
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 35% (±3%) (load share channel)	73
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 45% (±3%) (TGT channel)	74
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 55% (±3%) (check DEC)	75
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 65% (±3%) (Ng channel)	76
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 75% (±3%) (Np channel)	77
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 85% (±3%) (torque and overspeed channel)	78
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 95% (±3%) (hot start prevention channel)	79
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 105% (±3%) (115V 400 Hz power)	80
(T701C, T701D) DEC - Engine Torque Indicator Fault Code - 115% (±3%) (collective channel)	81
(T701C, 701D Black Hawk) DEC - Engine Torque Indicator Fault Code - 125% (±3%) (Nr channel)	82

* - Refer to paragraph 1-254, step j before starting troubleshooting procedure.

Troubleshooting Procedure 1. Engine Anti-Icing System Malfunction

NOTE

- If anti-icing system is switched on with engine operating at high power, engine may be limited by the ECU or DEC TGT limiter or HMU acceleration schedule.
- When anti-icing is turned on, the panel anti-icing light will come on. Also, the TGT will increase.
- Anti-icing system is off when 28 vdc power is applied to valve.



With anti-icing switched on, no increase in % Ng or TGT (30°C or more), and indicator light fails to come on?

Determine if there is power at anti-icing valve (pins 1 and 2, W3P7). Power at valve?

Troubleshoot METS/FEDS/CETS electrical system according to METS/FEDS/CETS manual and continue to operate.

Replace anti-icing valve (para 10-25). Make required checks (para 1-223) and continue to operate.

With anti-icing switched off, no decrease in % Ng or TGT, and indicator light remains on?

Determine if there is power at anti-icing valve (pins 1 and 2, W3P7). Power at valve?

Replace anti-icing valve (para 10-25). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Check green cable connectors W3J1 through W3P7 for damage and for open or short circuits. Cable faulty?

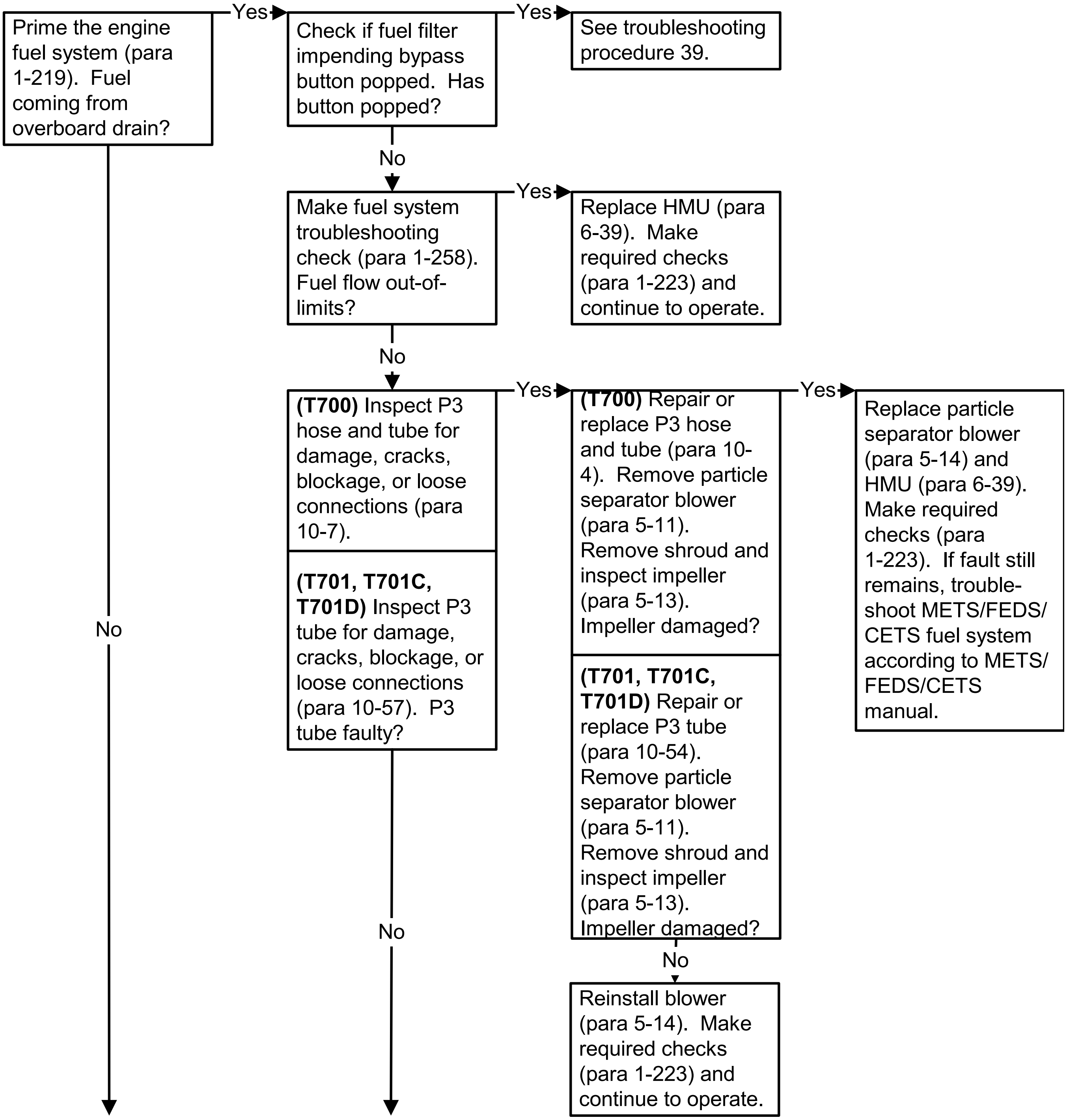
Replace green cable (para 7-35). Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS wiring system and power source according to METS/FEDS/CETS manual and continue to operate.

Troubleshooting Procedure 2. ***Engine Flames Out During Normal Operation (combustion stops, indicated by a drop in TGT, Wf, P3, Ng, Np, torque and oil pressure)***

NOTE

Flameout can be caused by a compressor stall. Before troubleshooting, check METS/FEDS/CETS and engine as instructed in engine flameout check (para 1-286).



Prime the engine fuel system (para 1-219). Fuel coming from overboard drain?

Check if fuel filter impending bypass button popped. Has button popped?

See troubleshooting procedure 39.

Make fuel system troubleshooting check (para 1-258). Fuel flow out-of-limits?

Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

(T700) Inspect P3 hose and tube for damage, cracks, blockage, or loose connections (para 10-7).

(T701, T701C, T701D) Inspect P3 tube for damage, cracks, blockage, or loose connections (para 10-57). P3 tube faulty?

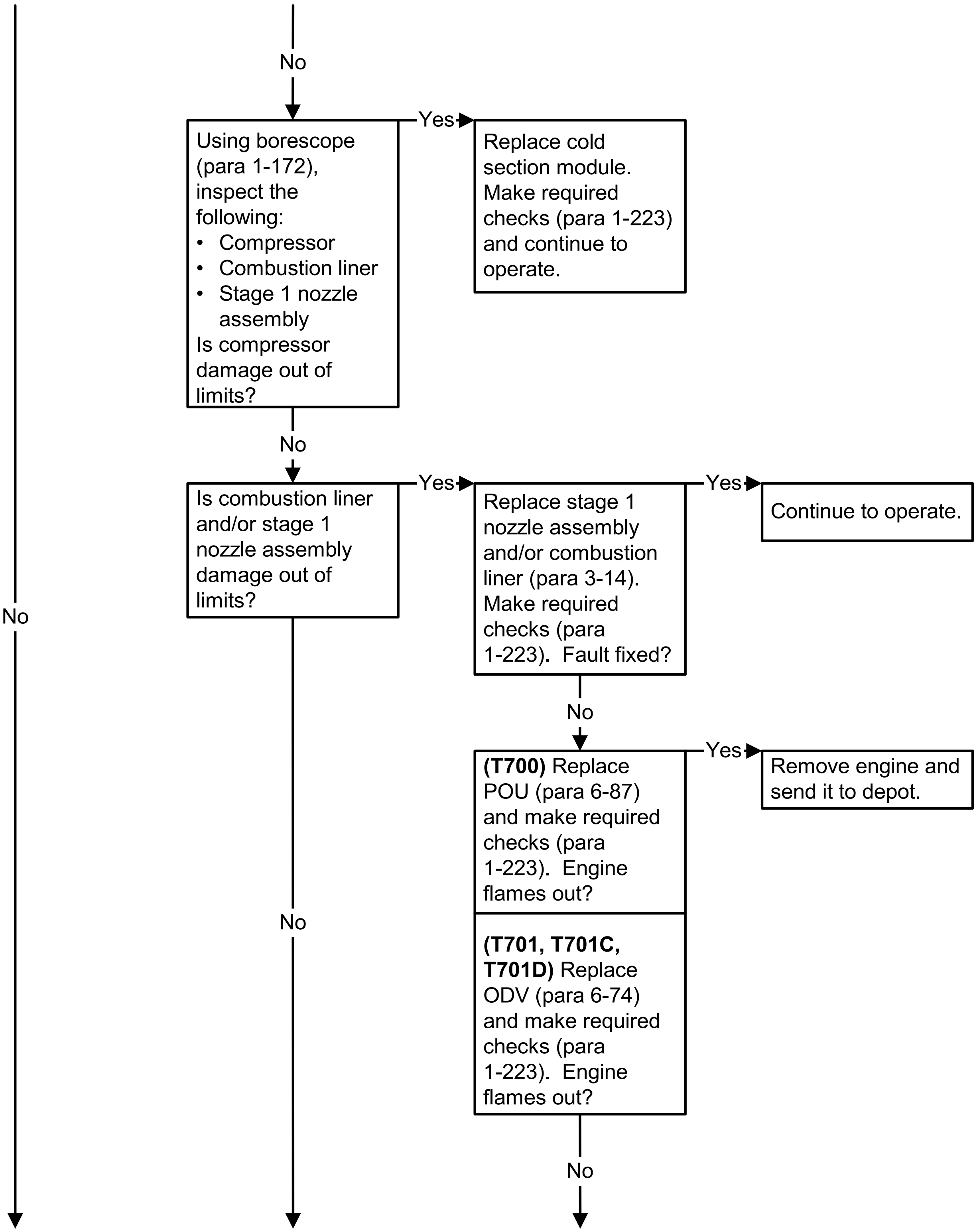
(T700) Repair or replace P3 hose and tube (para 10-4). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

Replace particle separator blower (para 5-14) and HMU (para 6-39). Make required checks (para 1-223). If fault still remains, trouble-shoot METS/FEDS/CETS fuel system according to METS/FEDS/CETS manual.

Reinstall blower (para 5-14). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 2. Engine Flames Out During Normal Operation (combustion stops, indicated by a drop in TGT, Wf, P3, Ng, Np, torque and oil pressure) (Cont)



Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion liner
- Stage 1 nozzle assembly

Is compressor damage out of limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Is combustion liner and/or stage 1 nozzle assembly damage out of limits?

Replace stage 1 nozzle assembly and/or combustion liner (para 3-14). Make required checks (para 1-223). Fault fixed?

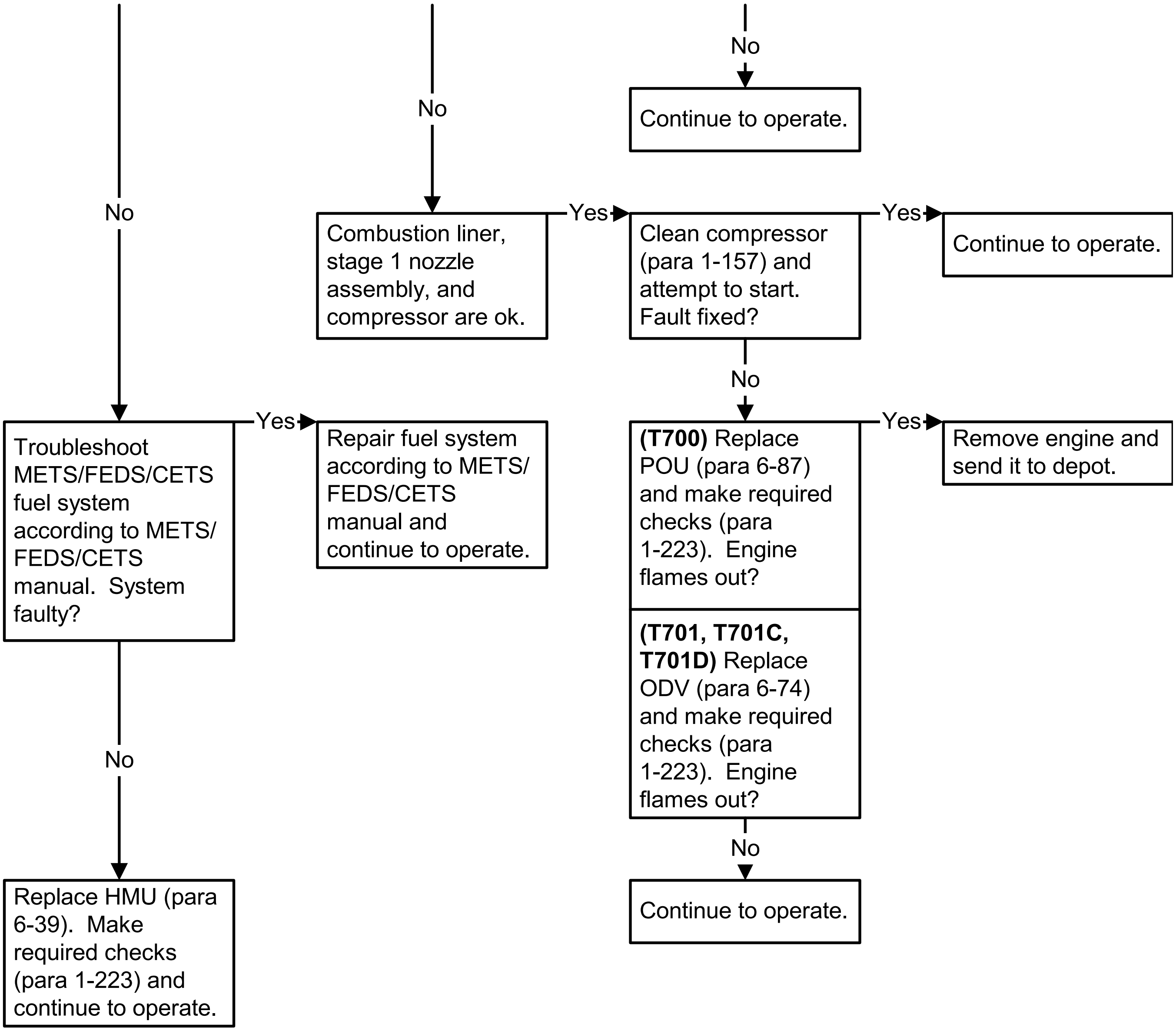
Continue to operate.

(T700) Replace POU (para 6-87) and make required checks (para 1-223). Engine flames out?

(T701, T701C, T701D) Replace ODV (para 6-74) and make required checks (para 1-223). Engine flames out?

Remove engine and send it to depot.

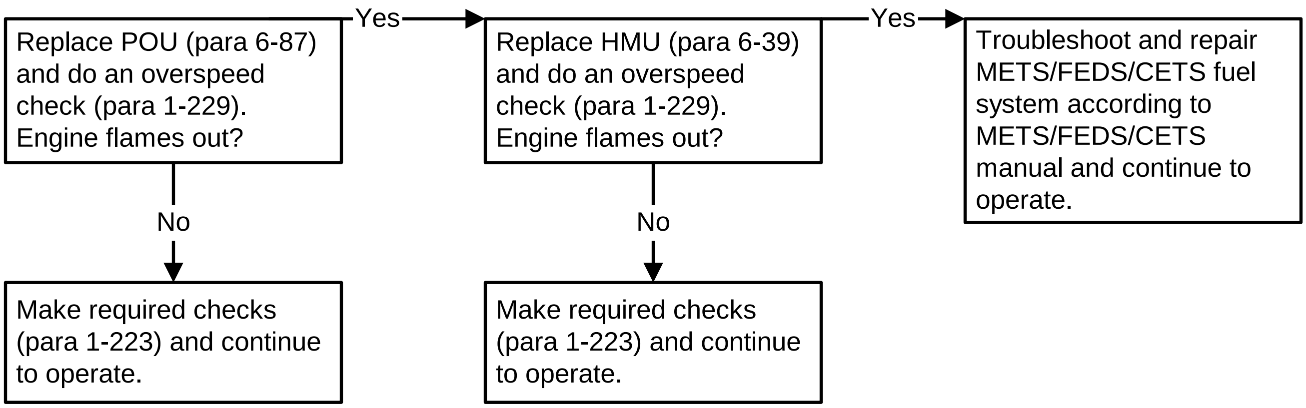
Troubleshooting Procedure 2. Engine Flames Out During Normal Operation (combustion stops, indicated by a drop in TGT, Wf, P3, Ng, Np, torque and oil pressure) (Cont)



Troubleshooting Procedure 3. *(T700)* ***Engine Flames Out During Np Overspeed Check (Combustion stops, indicated by a drop in TGT, Wf, P3, Ng, Np, torque, and oil pressure)***

NOTE

Flameout can be caused by a compressor stall. Before troubleshooting, check METS/FEDS/CETS and engine as instructed in engine flameout check (para 1-286).



Replace POU (para 6-87) and do an overspeed check (para 1-229). Engine flames out?

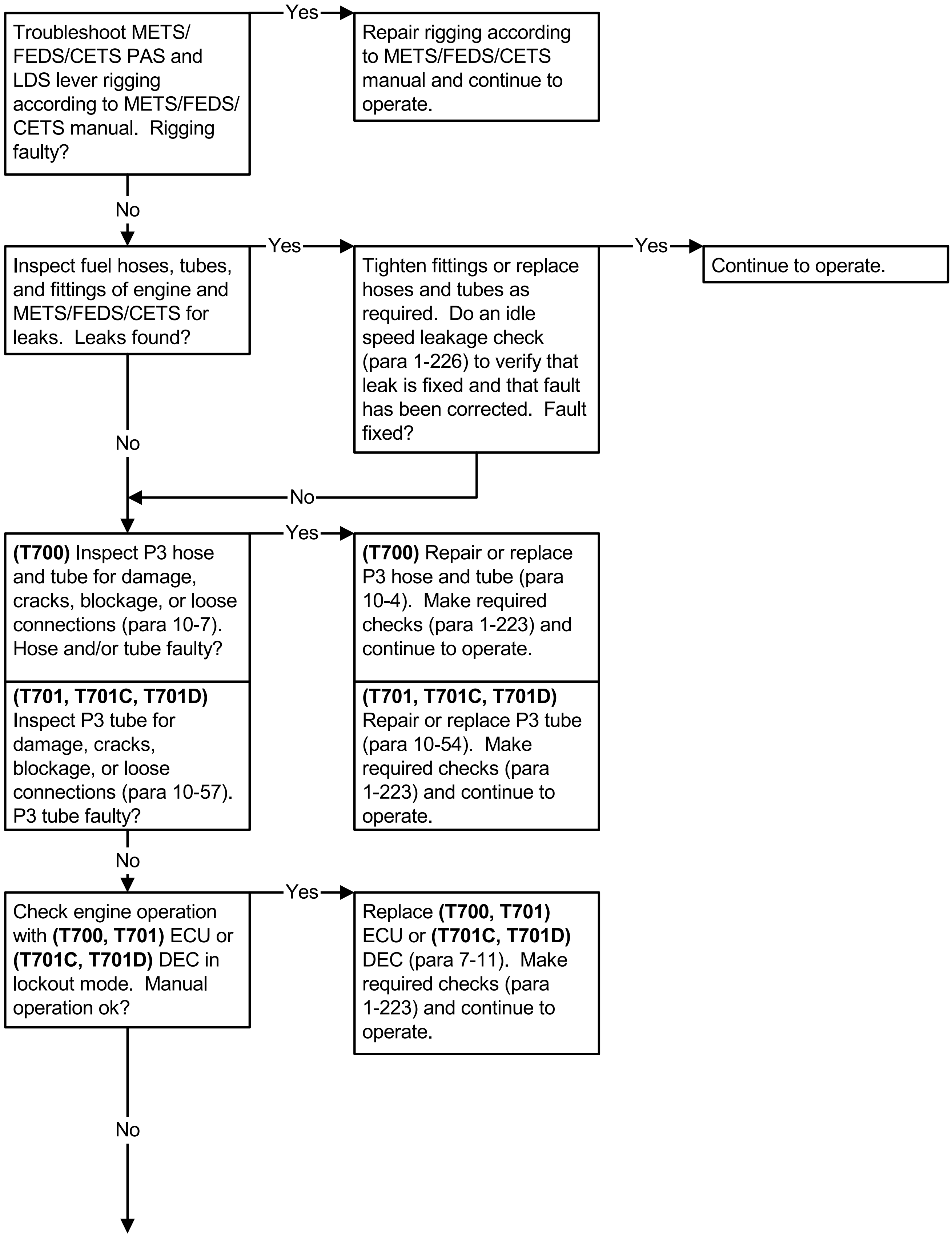
Replace HMU (para 6-39) and do an overspeed check (para 1-229). Engine flames out?

Troubleshoot and repair METS/FEDS/CETS fuel system according to METS/FEDS/CETS manual and continue to operate.

Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 4. Ng Does Not Accelerate Above Ground Idle Speed



Troubleshoot METS/FEDS/CETS PAS and LDS lever rigging according to METS/FEDS/CETS manual. Rigging faulty?

Repair rigging according to METS/FEDS/CETS manual and continue to operate.

Inspect fuel hoses, tubes, and fittings of engine and METS/FEDS/CETS for leaks. Leaks found?

Tighten fittings or replace hoses and tubes as required. Do an idle speed leakage check (para 1-226) to verify that leak is fixed and that fault has been corrected. Fault fixed?

Continue to operate.

(T700) Inspect P3 hose and tube for damage, cracks, blockage, or loose connections (para 10-7). Hose and/or tube faulty?

(T700) Repair or replace P3 hose and tube (para 10-4). Make required checks (para 1-223) and continue to operate.

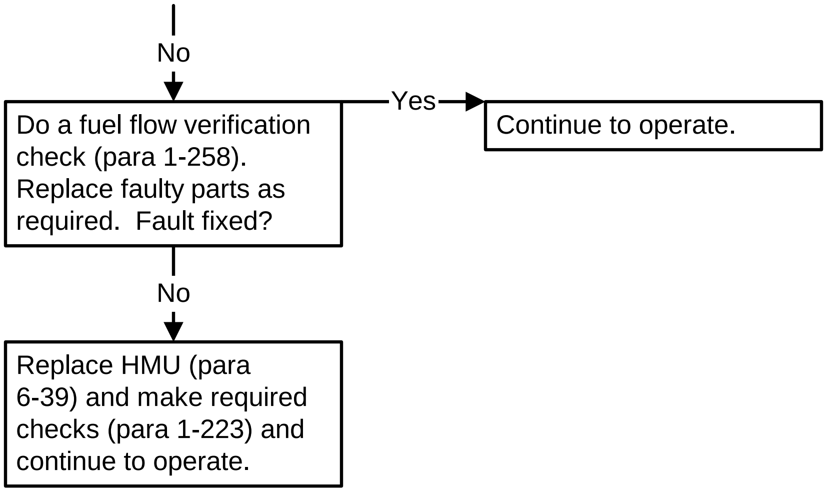
(T701, T701C, T701D) Inspect P3 tube for damage, cracks, blockage, or loose connections (para 10-57). P3 tube faulty?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Make required checks (para 1-223) and continue to operate.

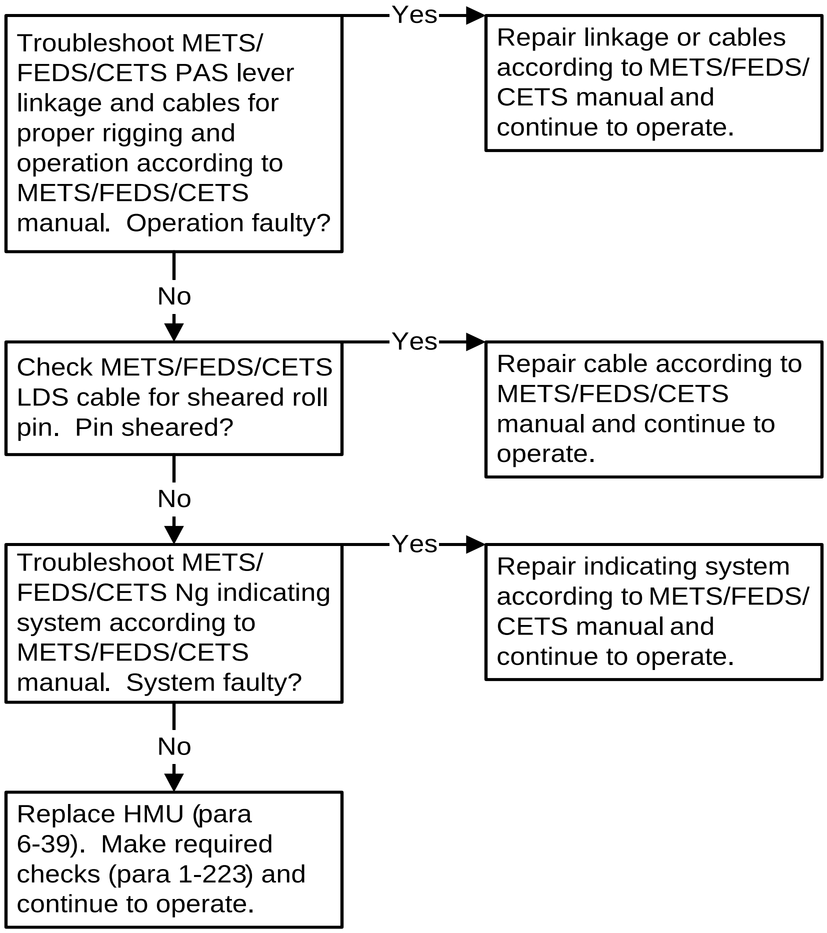
Check engine operation with **(T700, T701)** ECU or **(T701C, T701D)** DEC in lockout mode. Manual operation ok?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 4. Ng Does Not Accelerate Above Ground Idle Speed (Cont)



Troubleshooting Procedure 5. Ng High at Ground Idle Speed



Troubleshoot METS/FEDS/CETS PAS lever linkage and cables for proper rigging and operation according to METS/FEDS/CETS manual. Operation faulty?

Repair linkage or cables according to METS/FEDS/CETS manual and continue to operate.

Check METS/FEDS/CETS LDS cable for sheared roll pin. Pin sheared?

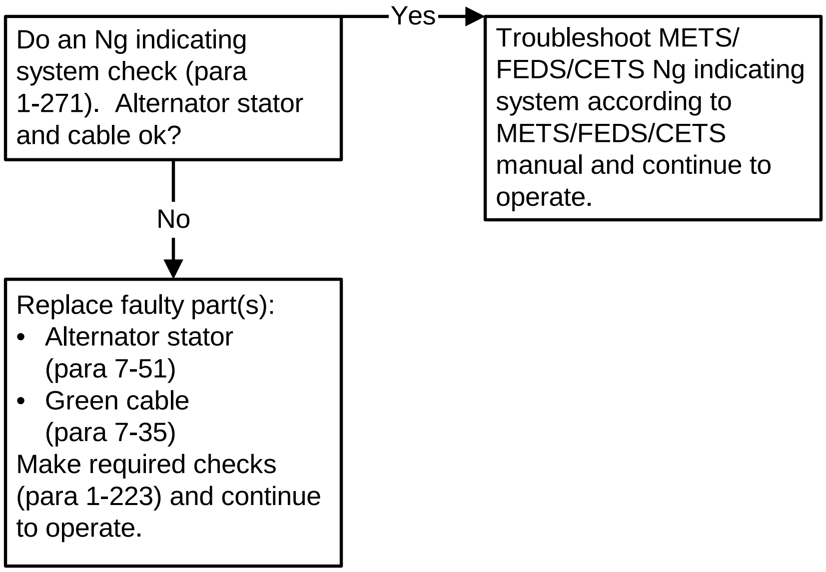
Repair cable according to METS/FEDS/CETS manual and continue to operate.

Troubleshoot METS/FEDS/CETS Ng indicating system according to METS/FEDS/CETS manual. System faulty?

Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 6. Ng Instrument Fluctuating or Not Indicating (all other instruments normal)



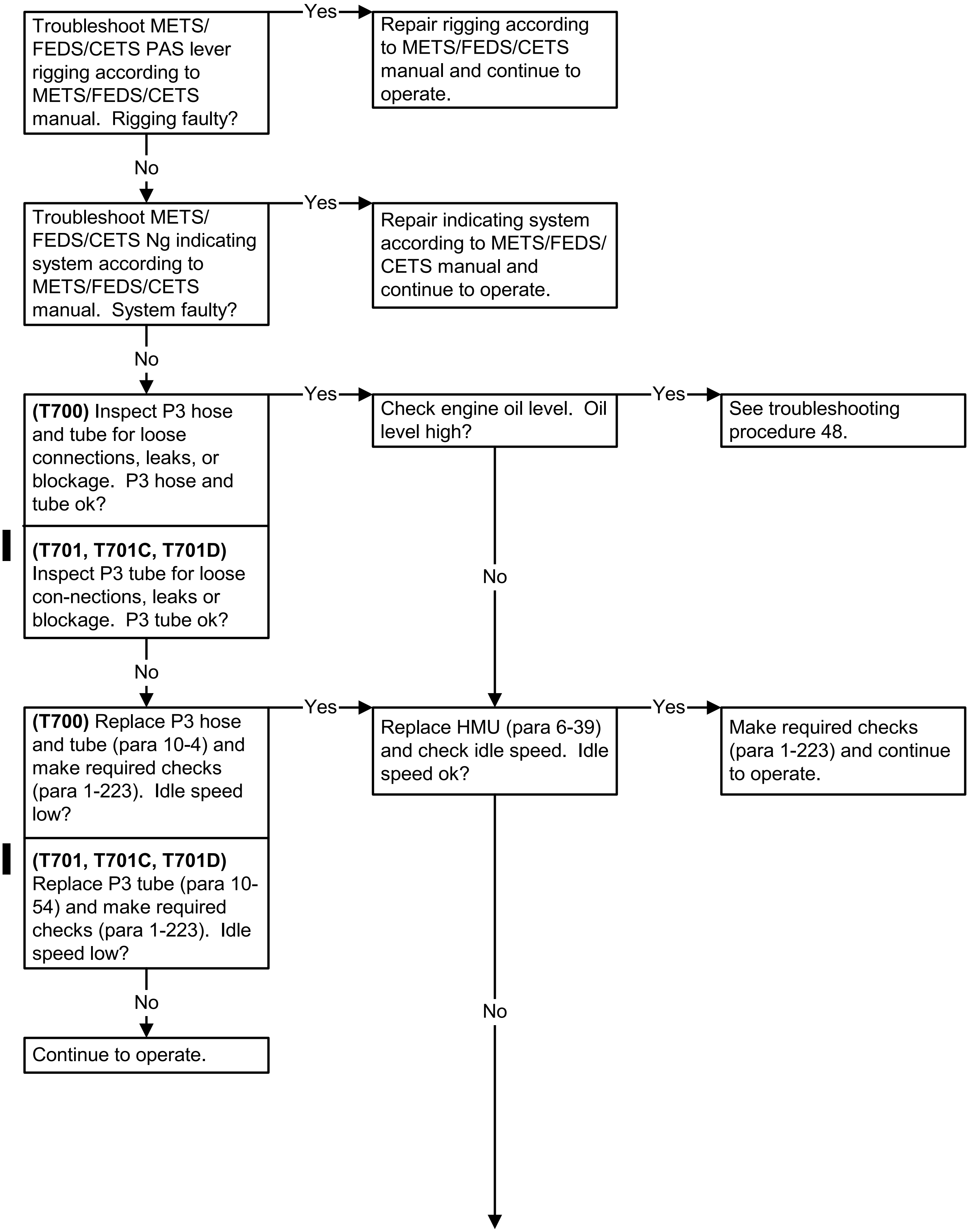
Do an Ng indicating system check (para 1-271). Alternator stator and cable ok?

Troubleshoot METS/FEDS/CETS Ng indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace faulty part(s):
- Alternator stator (para 7-51)
- Green cable (para 7-35)

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 7. Ng Low at Ground Idle Speed



Troubleshoot METS/FEDS/CETS PAS lever rigging according to METS/FEDS/CETS manual. Rigging faulty?

Repair rigging according to METS/FEDS/CETS manual and continue to operate.

Troubleshoot METS/FEDS/CETS Ng indicating system according to METS/FEDS/CETS manual. System faulty?

Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

(T700) Inspect P3 hose and tube for loose connections, leaks, or blockage. P3 hose and tube ok?

(T701, T701C, T701D) Inspect P3 tube for loose con-nections, leaks or blockage. P3 tube ok?

Check engine oil level. Oil level high?

See troubleshooting procedure 48.

(T700) Replace P3 hose and tube (para 10-4) and make required checks (para 1-223). Idle speed low?

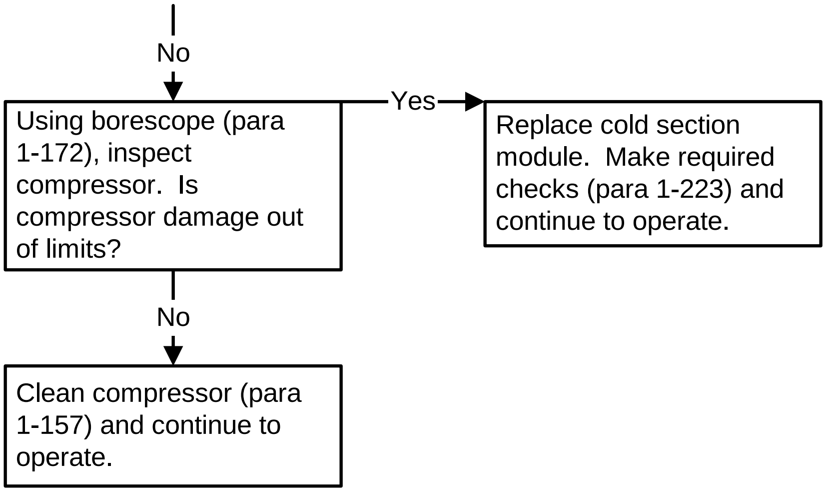
(T701, T701C, T701D) Replace P3 tube (para 10-54) and make required checks (para 1-223). Idle speed low?

Replace HMU (para 6-39) and check idle speed. Idle speed ok?

Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 7. Ng Low at Ground Idle Speed (Cont)

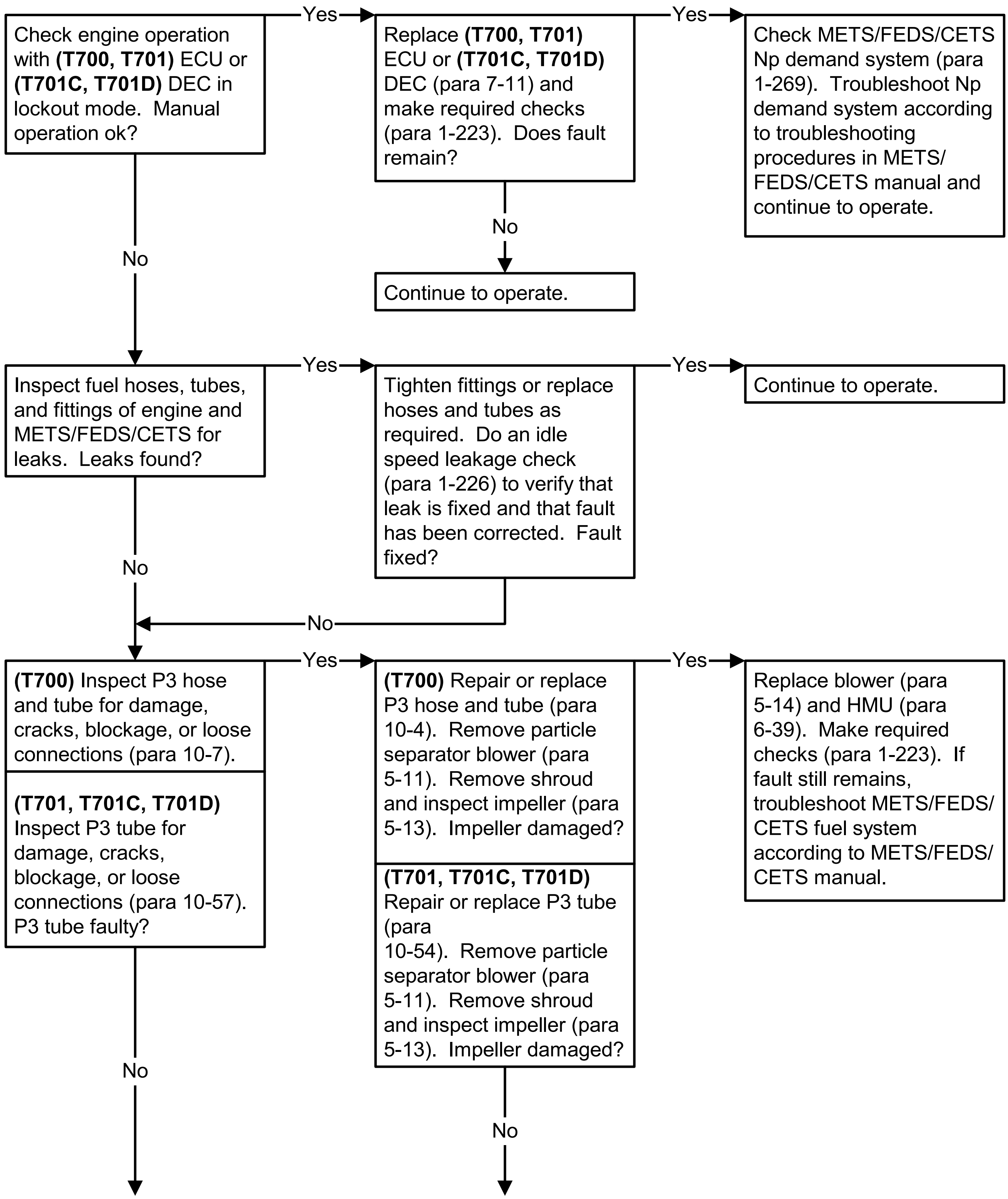


Using borescope (para 1-172), inspect compressor. Is compressor damage out of limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Clean compressor (para 1-157) and continue to operate.

Troubleshooting Procedure 8. Uncontrolled Deceleration (Ng)
(Ng and TGT decreases without retarding PAS lever)



Check engine operation with **(T700, T701)** ECU or **(T701C, T701D)** DEC in lockout mode. Manual operation ok?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11) and make required checks (para 1-223). Does fault remain?

Check METS/FEDS/CETS Np demand system (para 1-269). Troubleshoot Np demand system according to troubleshooting procedures in METS/FEDS/CETS manual and continue to operate.

Continue to operate.

Inspect fuel hoses, tubes, and fittings of engine and METS/FEDS/CETS for leaks. Leaks found?

Tighten fittings or replace hoses and tubes as required. Do an idle speed leakage check (para 1-226) to verify that leak is fixed and that fault has been corrected. Fault fixed?

Continue to operate.

(T700) Inspect P3 hose and tube for damage, cracks, blockage, or loose connections (para 10-7).

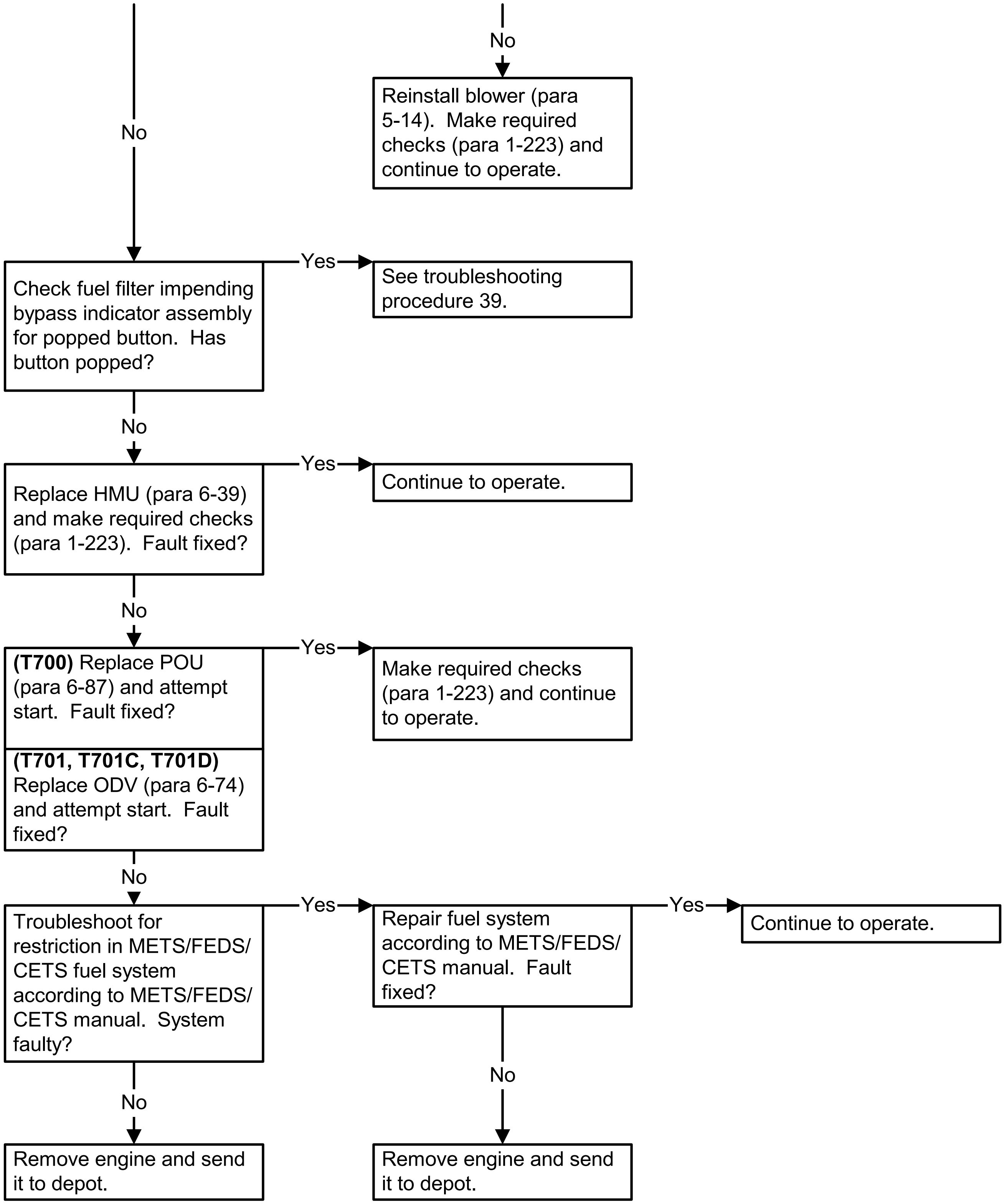
(T701, T701C, T701D) Inspect P3 tube for damage, cracks, blockage, or loose connections (para 10-57). P3 tube faulty?

(T700) Repair or replace P3 hose and tube (para 10-4). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

Replace blower (para 5-14) and HMU (para 6-39). Make required checks (para 1-223). If fault still remains, troubleshoot METS/FEDS/CETS fuel system according to METS/FEDS/CETS manual.

Troubleshooting Procedure 8. Uncontrolled Deceleration (Ng) (Ng and TGT decreases without retarding PAS lever) (Cont)



Reinstall blower (para 5-14). Make required checks (para 1-223) and continue to operate.

Check fuel filter impending bypass indicator assembly for popped button. Has button popped?

See troubleshooting procedure 39.

Replace HMU (para 6-39) and make required checks (para 1-223). Fault fixed?

Continue to operate.

(T700) Replace POU (para 6-87) and attempt start. Fault fixed?

(T701, T701C, T701D) Replace ODV (para 6-74) and attempt start. Fault fixed?

Make required checks (para 1-223) and continue to operate.

Troubleshoot for restriction in METS/FEDS/CETS fuel system according to METS/FEDS/CETS manual. System faulty?

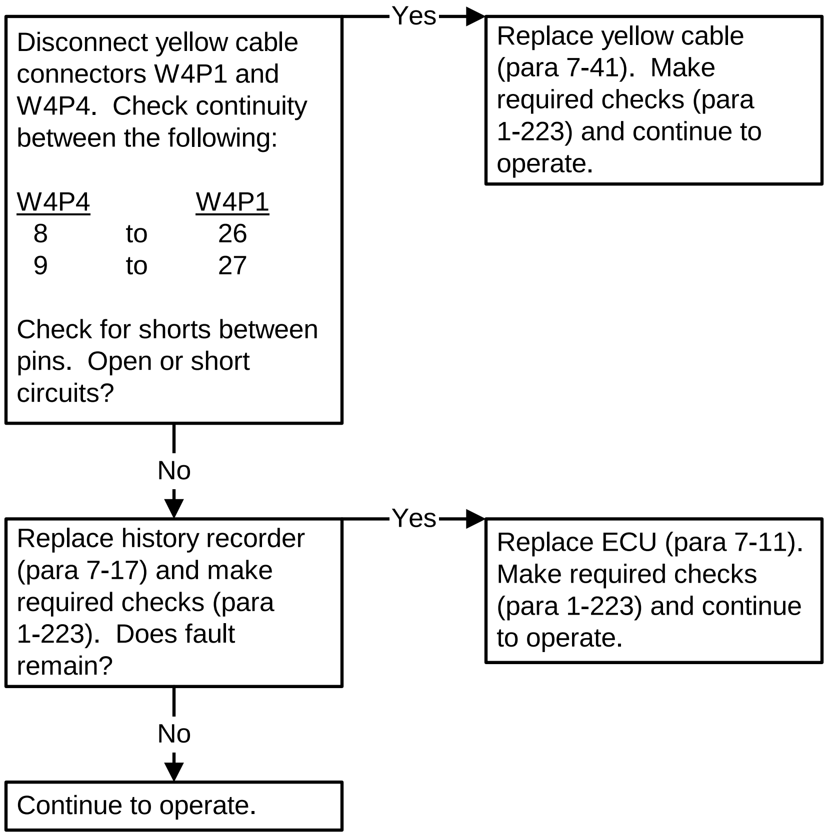
Repair fuel system according to METS/FEDS/CETS manual. Fault fixed?

Continue to operate.

Remove engine and send it to depot.

Remove engine and send it to depot.

Troubleshooting Procedure 9. *(T700, T701)* ***History Recorder Malfunction (engine time function inoperative)***



Disconnect yellow cable connectors W4P1 and W4P4. Check continuity between the following:

W4P4		W4P1
8	to	26
9	to	27

Check for shorts between pins. Open or short circuits?

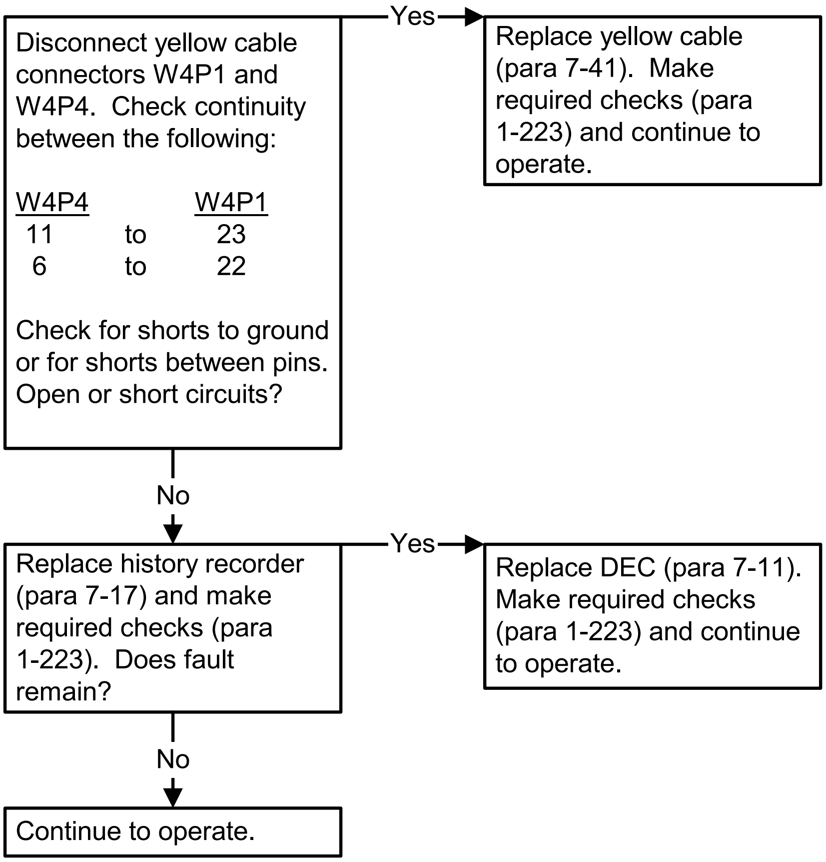
Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace history recorder (para 7-17) and make required checks (para 1-223). Does fault remain?

Replace ECU (para 7-11). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 10. (T701C, T701D) History Counter Malfunction (engine time function inoperative)



Disconnect yellow cable connectors W4P1 and W4P4. Check continuity between the following:

W4P4		W4P1
11	to	23
6	to	22

Check for shorts to ground or for shorts between pins. Open or short circuits?

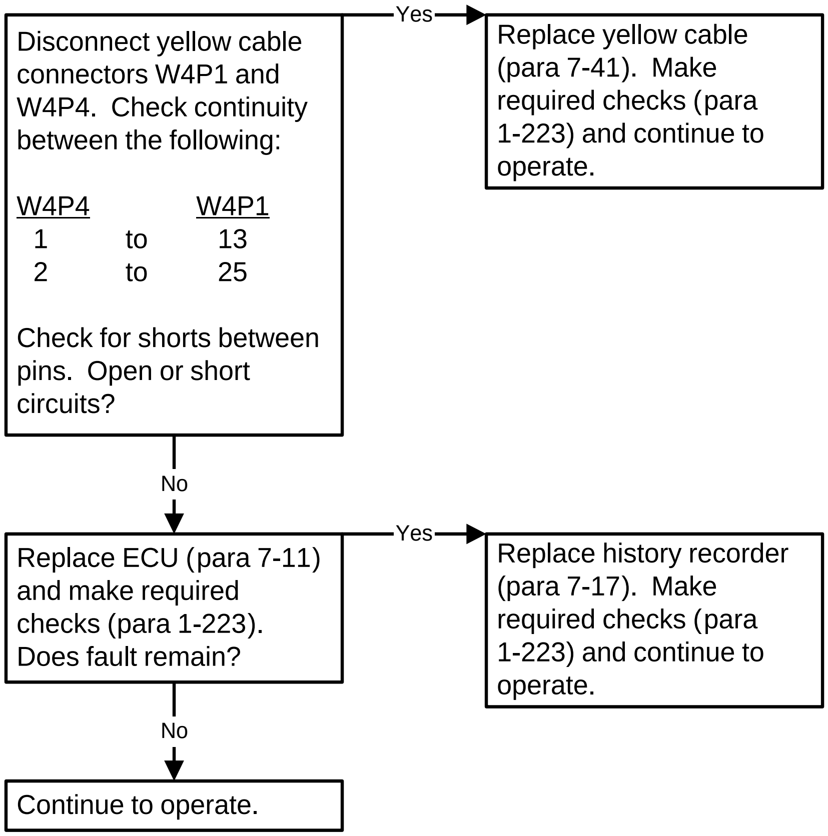
Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace history recorder (para 7-17) and make required checks (para 1-223). Does fault remain?

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 11. *(T700, T701)* ***History Recorder Malfunction (LCF function inoperative)***



Disconnect yellow cable connectors W4P1 and W4P4. Check continuity between the following:

W4P4		W4P1
1	to	13
2	to	25

Check for shorts between pins. Open or short circuits?

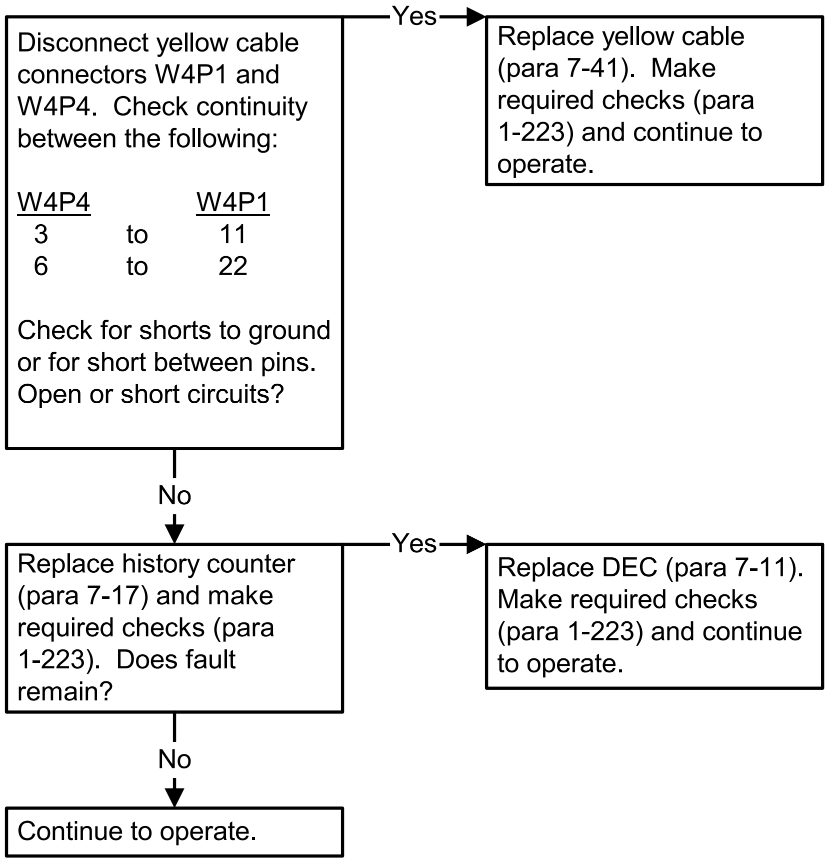
Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace ECU (para 7-11) and make required checks (para 1-223). Does fault remain?

Replace history recorder (para 7-17). Make required checks (para 1-223) and continue to operate.

Continue to operate.

*Troubleshooting Procedure 12. **(T701C , T701D)** History Counter Malfunction (LCF 1 function inoperative)*



Disconnect yellow cable connectors W4P1 and W4P4. Check continuity between the following:

W4P4		W4P1
3	to	11
6	to	22

Check for shorts to ground or for short between pins. Open or short circuits?

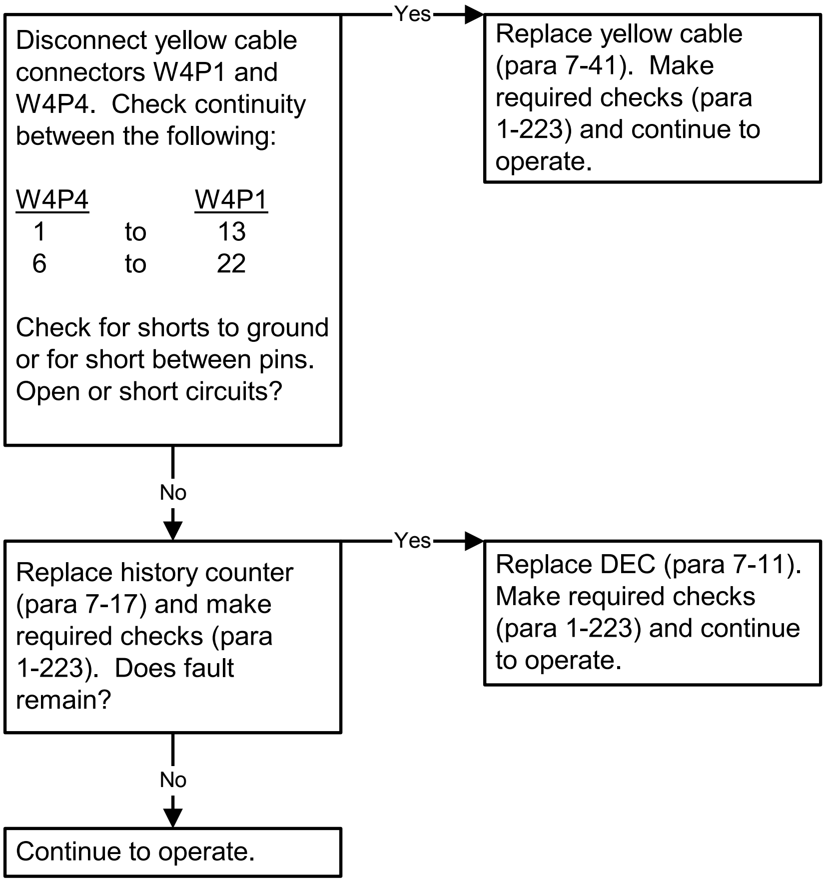
Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace history counter (para 7-17) and make required checks (para 1-223). Does fault remain?

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 13. (T701C, T701D) History Counter Malfunction (LCF 2 function inoperative)



Disconnect yellow cable connectors W4P1 and W4P4. Check continuity between the following:

W4P4		W4P1
1	to	13
6	to	22

Check for shorts to ground or for short between pins. Open or short circuits?

Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace history counter (para 7-17) and make required checks (para 1-223). Does fault remain?

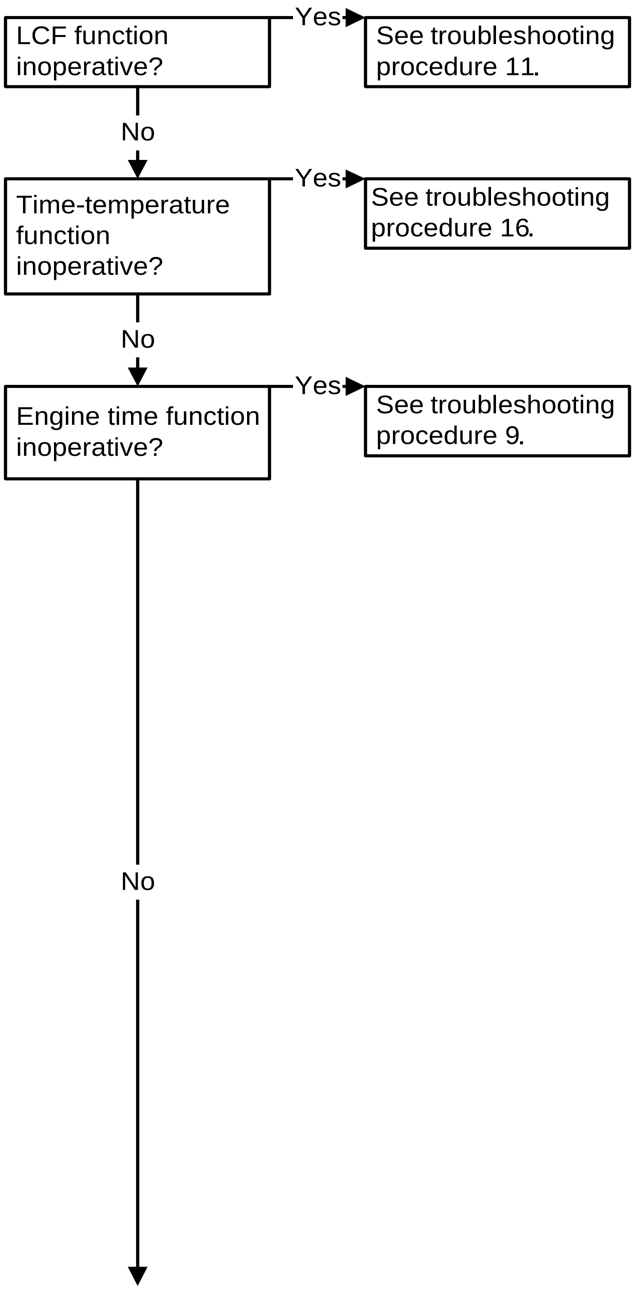
Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 14. *(T700, T701) History Recorder Malfunction (one or more functions inoperative)*

NOTE 1

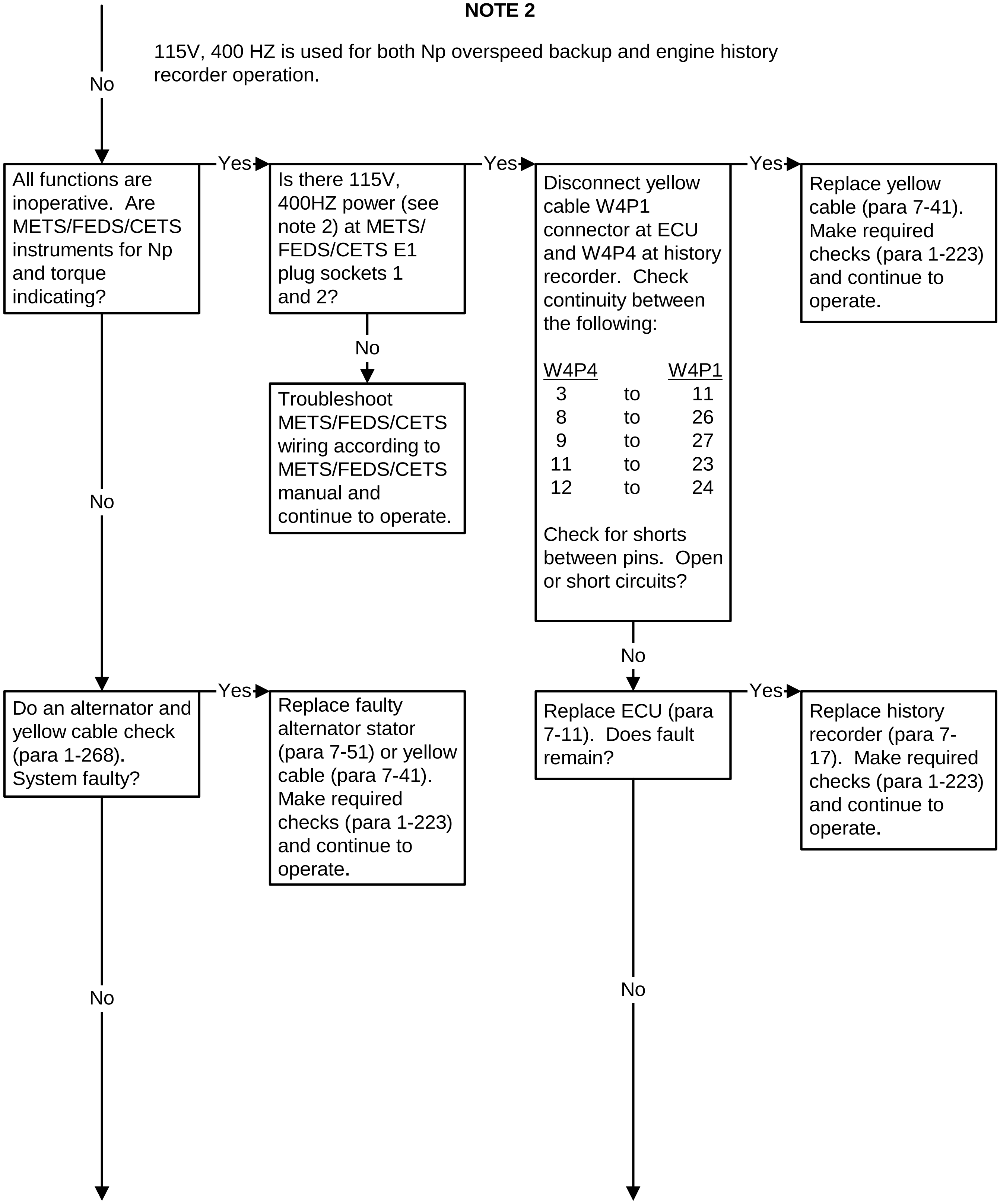
- During ground idle operations, check history recorder hours indicator window to verify that there is 115V, 400 HZ power at history recorder.
- Check yellow cable connectors at the ECU, at alternator, and at history recorder for tightness. When removing connectors, check pins and sockets for damage.



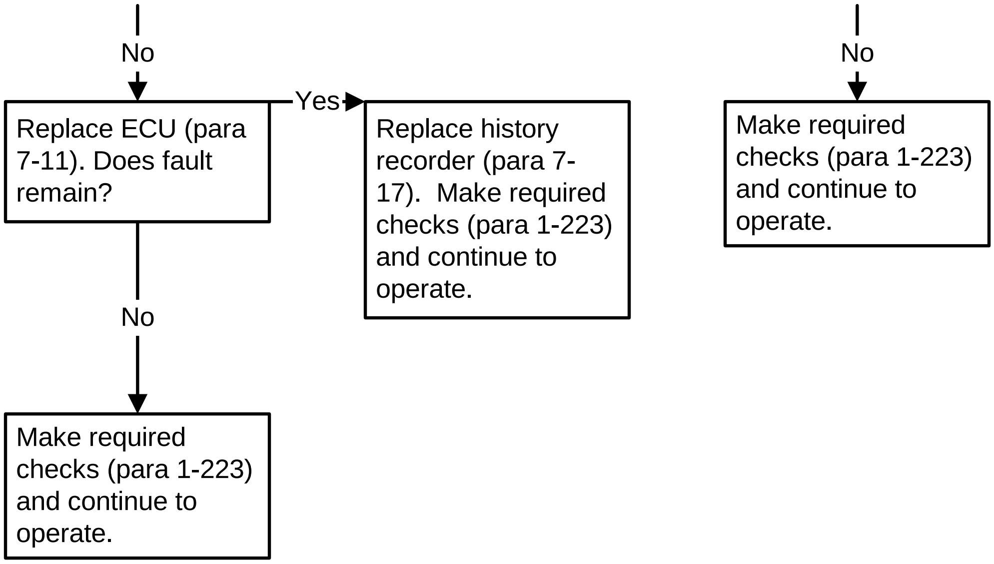
Troubleshooting Procedure 14. (T700, T701) ***History Recorder Malfunction (one or more functions inoperative) (Cont)***

NOTE 2

115V, 400 HZ is used for both Np overspeed backup and engine history recorder operation.



Troubleshooting Procedure 14. ***(T700, T701) History Recorder Malfunction (one or more functions inoperative) (Cont)***


Replace ECU (para 7-11). Does fault remain?

Replace history recorder (para 7-17). Make required checks (para 1-223) and continue to operate.

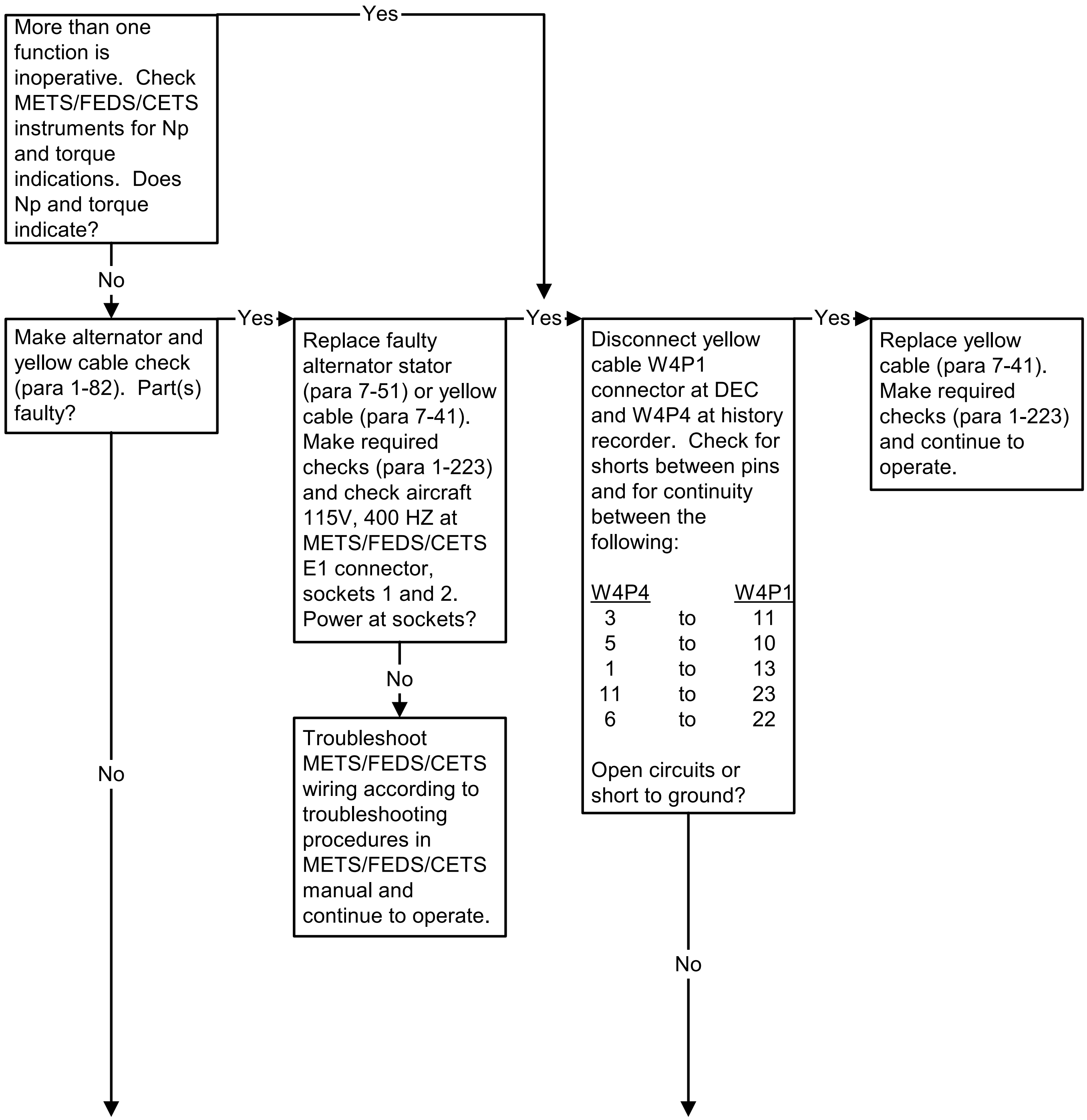
Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 15. (T701C, T701D) History Counter Malfunction (more than one function inoperative)

NOTE

Check yellow cable connectors at DEC, alternator stator, and history counter for tightness. When removing connectors, check pins and sockets for damage.



More than one function is inoperative. Check METS/FEDS/CETS instruments for Np and torque indications. Does Np and torque indicate?

Make alternator and yellow cable check (para 1-82). Part(s) faulty?

Replace faulty alternator stator (para 7-51) or yellow cable (para 7-41). Make required checks (para 1-223) and check aircraft 115V, 400 HZ at METS/FEDS/CETS E1 connector, sockets 1 and 2. Power at sockets?

Troubleshoot METS/FEDS/CETS wiring according to troubleshooting procedures in METS/FEDS/CETS manual and continue to operate.

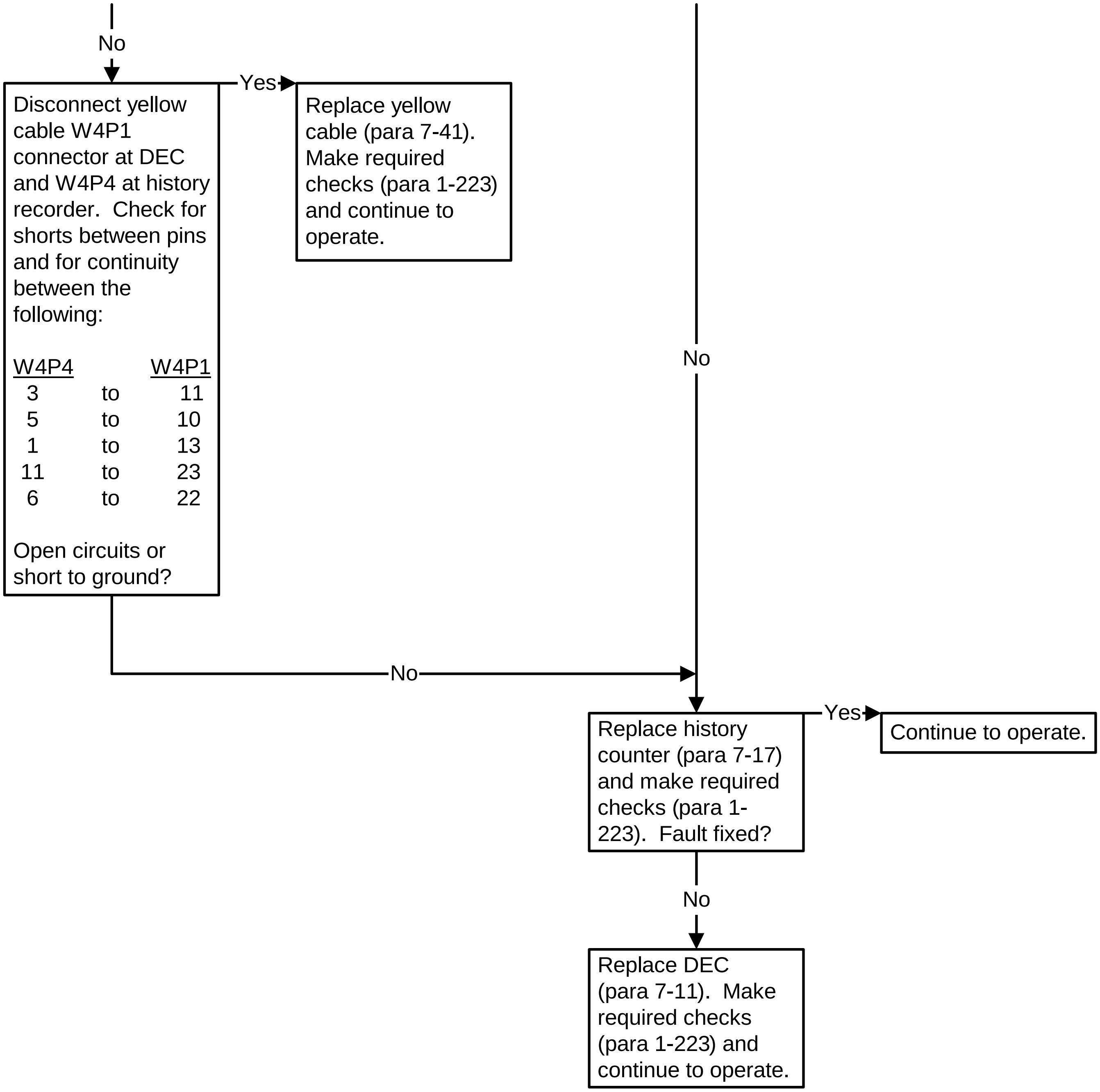
Disconnect yellow cable W4P1 connector at DEC and W4P4 at history recorder. Check for shorts between pins and for continuity between the following:

W4P4		W4P1
3	to	11
5	to	10
1	to	13
11	to	23
6	to	22

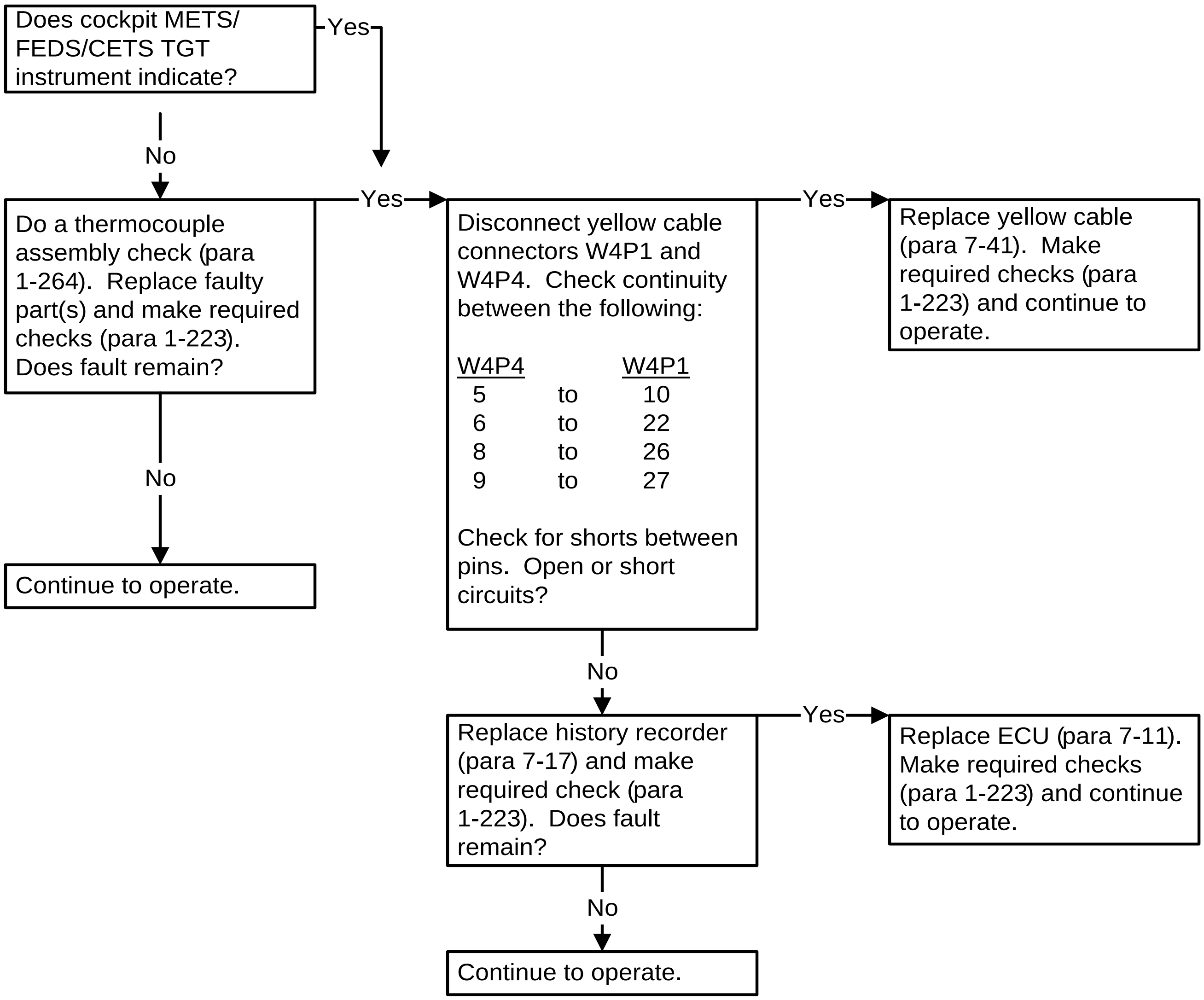
Open circuits or short to ground?

Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 15. *(T701C)* ***History Counter Malfunction (more than one function inoperative) (Cont)***



Troubleshooting Procedure 16. *(T700, T701)* ***History Recorder Malfunction (time-temperature function inoperative)***



Does cockpit METS/FEDS/CETS TGT instrument indicate?

Do a thermocouple assembly check (para 1-264). Replace faulty part(s) and make required checks (para 1-223). Does fault remain?

Continue to operate.

Disconnect yellow cable connectors W4P1 and W4P4. Check continuity between the following:

W4P4		W4P1
5	to	10
6	to	22
8	to	26
9	to	27

Check for shorts between pins. Open or short circuits?

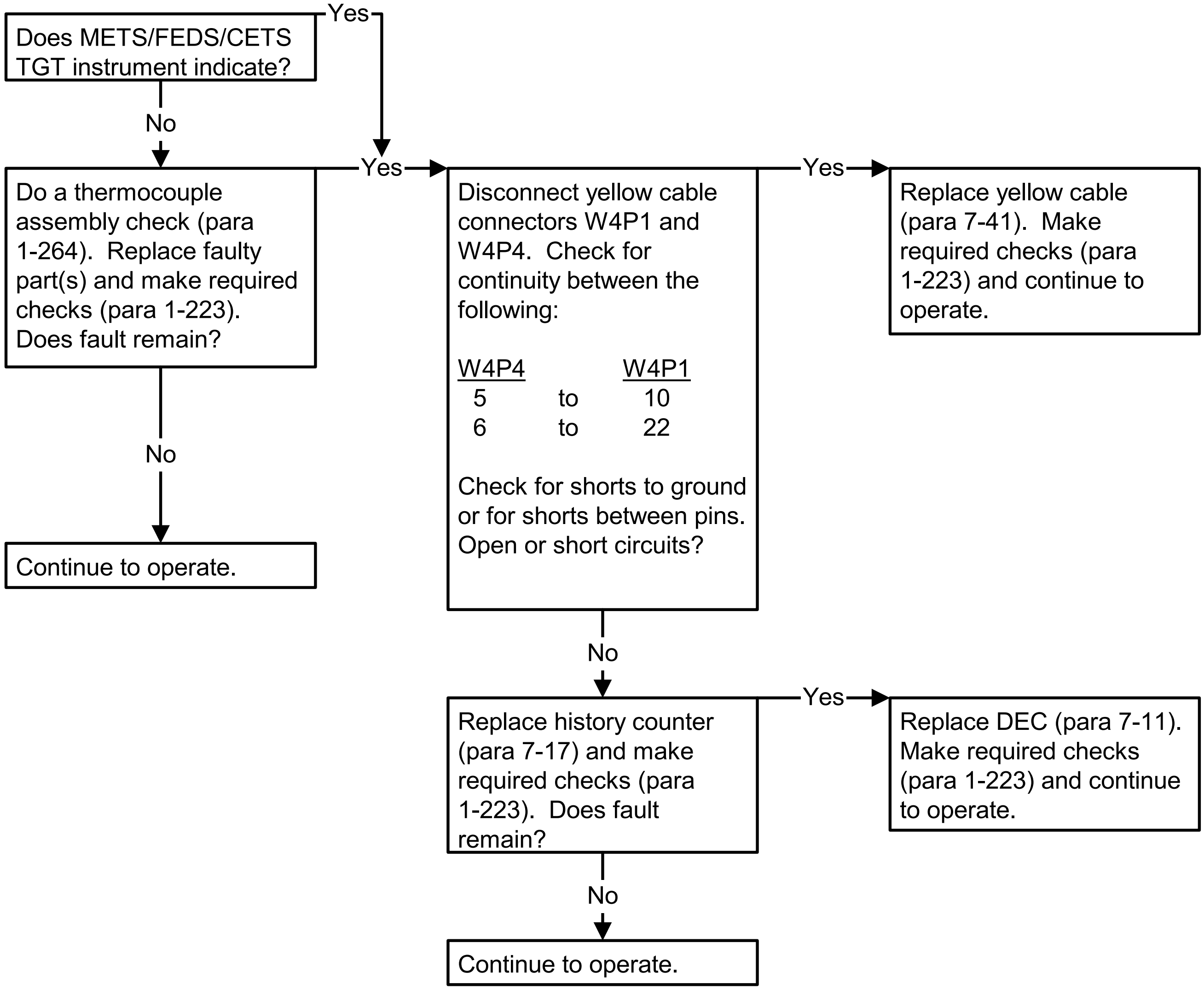
Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace history recorder (para 7-17) and make required check (para 1-223). Does fault remain?

Replace ECU (para 7-11). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 17. (T701C, T701D) History Counter Malfunction (time-temperature function inoperative)



Does METS/FEDS/CETS TGT instrument indicate?

Do a thermocouple assembly check (para 1-264). Replace faulty part(s) and make required checks (para 1-223). Does fault remain?

Continue to operate.

Disconnect yellow cable connectors W4P1 and W4P4. Check for continuity between the following:

W4P4		W4P1
5	to	10
6	to	22

Check for shorts to ground or for shorts between pins. Open or short circuits?

Replace yellow cable (para 7-41). Make required checks (para 1-223) and continue to operate.

Replace history counter (para 7-17) and make required checks (para 1-223). Does fault remain?

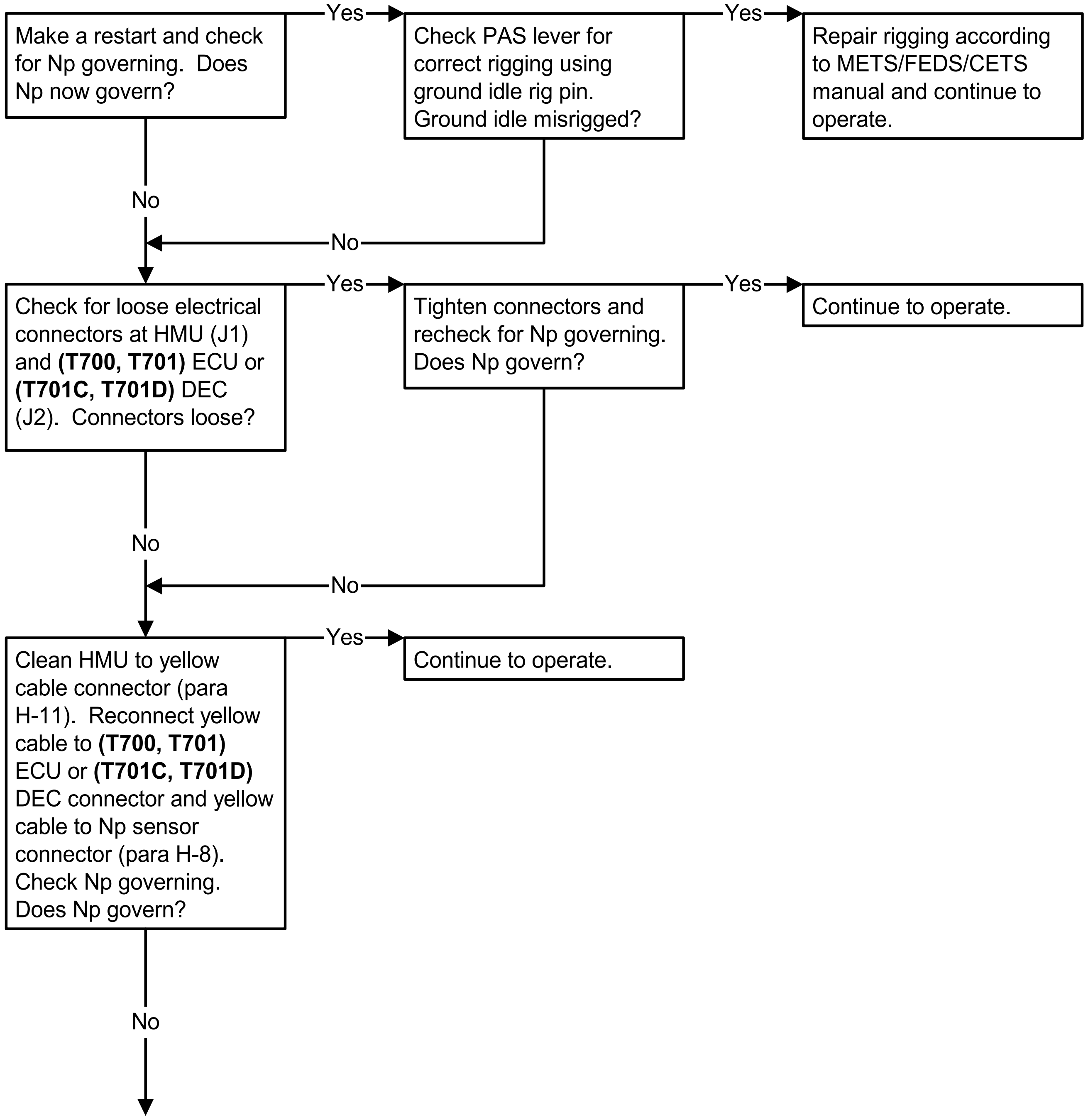
Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 18. No Np Governing when Advancing PAS Lever to FLY (Np may increase to: (T700) (METS) 111 ± 1% (22,200 rpm) or (FEDS/CETS) 111 ± 1% (22,200 rpm) (T701, T701C, T701D) (METS) 125 ± 1% (25,000 rpm) or (FEDS/CETS) 125 ± 1% (25,000 rpm) tripping Np overspeed system)

NOTE

(T700, T701) ECU or **(T701C, T701D)** DEC is reset from lockout when PAS lever is slightly forward of ground idle detent. Be sure that lack of Np governing is not just failure to retard PAS lever far enough to reset normal **(T700, T701)** ECU or **(T701C, T701D)** DEC operation.



Make a restart and check for Np governing. Does Np now govern?

Check PAS lever for correct rigging using ground idle rig pin. Ground idle misrigged?

Repair rigging according to METS/FEDS/CETS manual and continue to operate.

Check for loose electrical connectors at HMU (J1) and **(T700, T701)** ECU or **(T701C, T701D)** DEC (J2). Connectors loose?

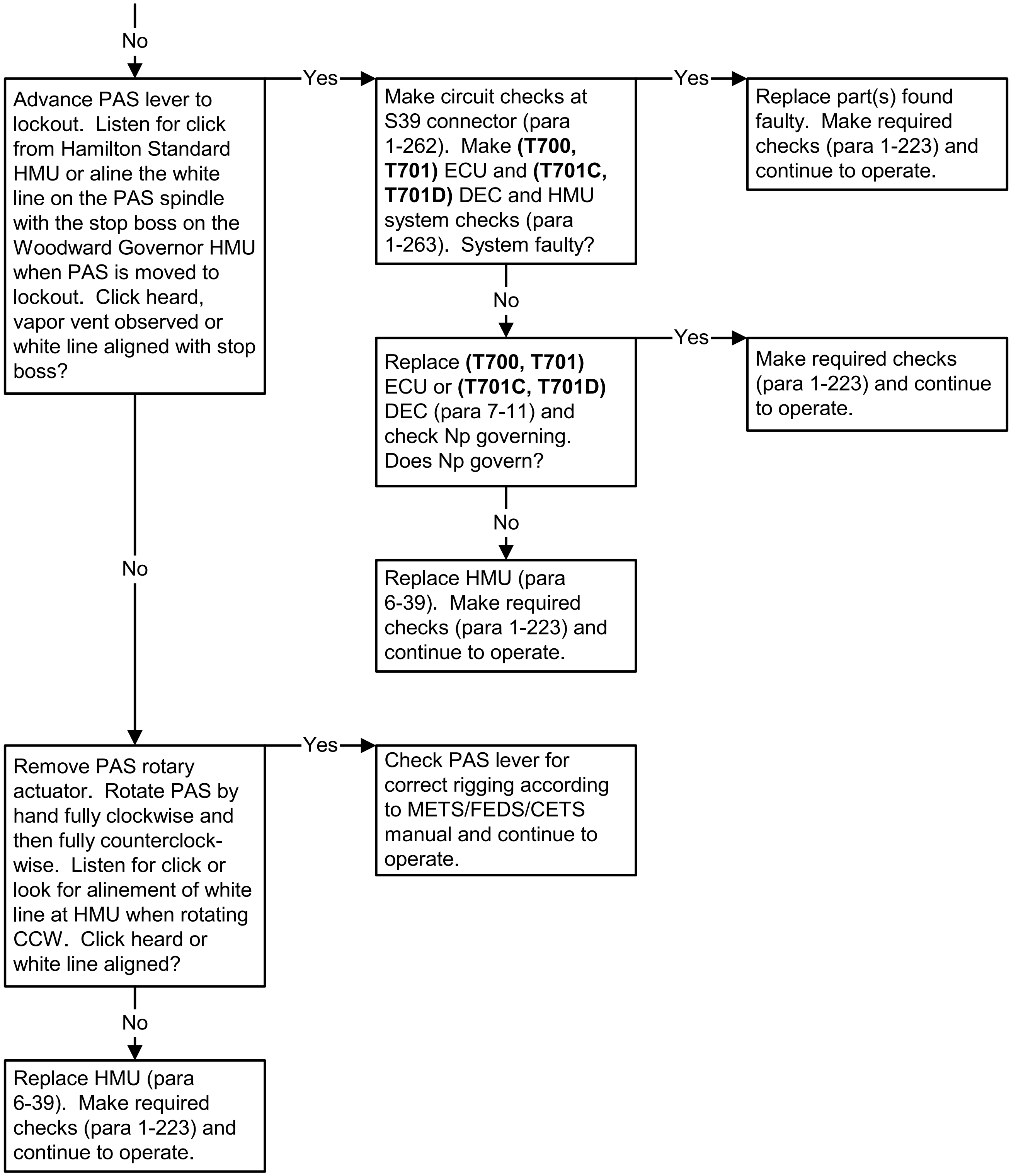
Tighten connectors and recheck for Np governing. Does Np govern?

Continue to operate.

Clean HMU to yellow cable connector (para H-11). Reconnect yellow cable to **(T700, T701)** ECU or **(T701C, T701D)** DEC connector and yellow cable to Np sensor connector (para H-8). Check Np governing. Does Np govern?

Continue to operate.

Troubleshooting Procedure 18. ***No Np Governing when Advancing PAS Lever to FLY (Np may increase to: (T700) (METS) 111 ± 1% (22,200 rpm) or (FEDS/CETS) 111 ± 1% (22,200 rpm) (T701, T701C, T701D) (METS) 125 ± 1% (25,000 rpm) or (FEDS/CETS) 125 ± 1% (25,000 rpm) tripping Np overspeed system)***



Advance PAS lever to lockout. Listen for click from Hamilton Standard HMU or aline the white line on the PAS spindle with the stop boss on the Woodward Governor HMU when PAS is moved to lockout. Click heard, vapor vent observed or white line aligned with stop boss?

Make circuit checks at S39 connector (para 1-262). Make **(T700, T701)** ECU and **(T701C, T701D)** DEC and HMU system checks (para 1-263). System faulty?

Replace part(s) found faulty. Make required checks (para 1-223) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11) and check Np governing. Does Np govern?

Make required checks (para 1-223) and continue to operate.

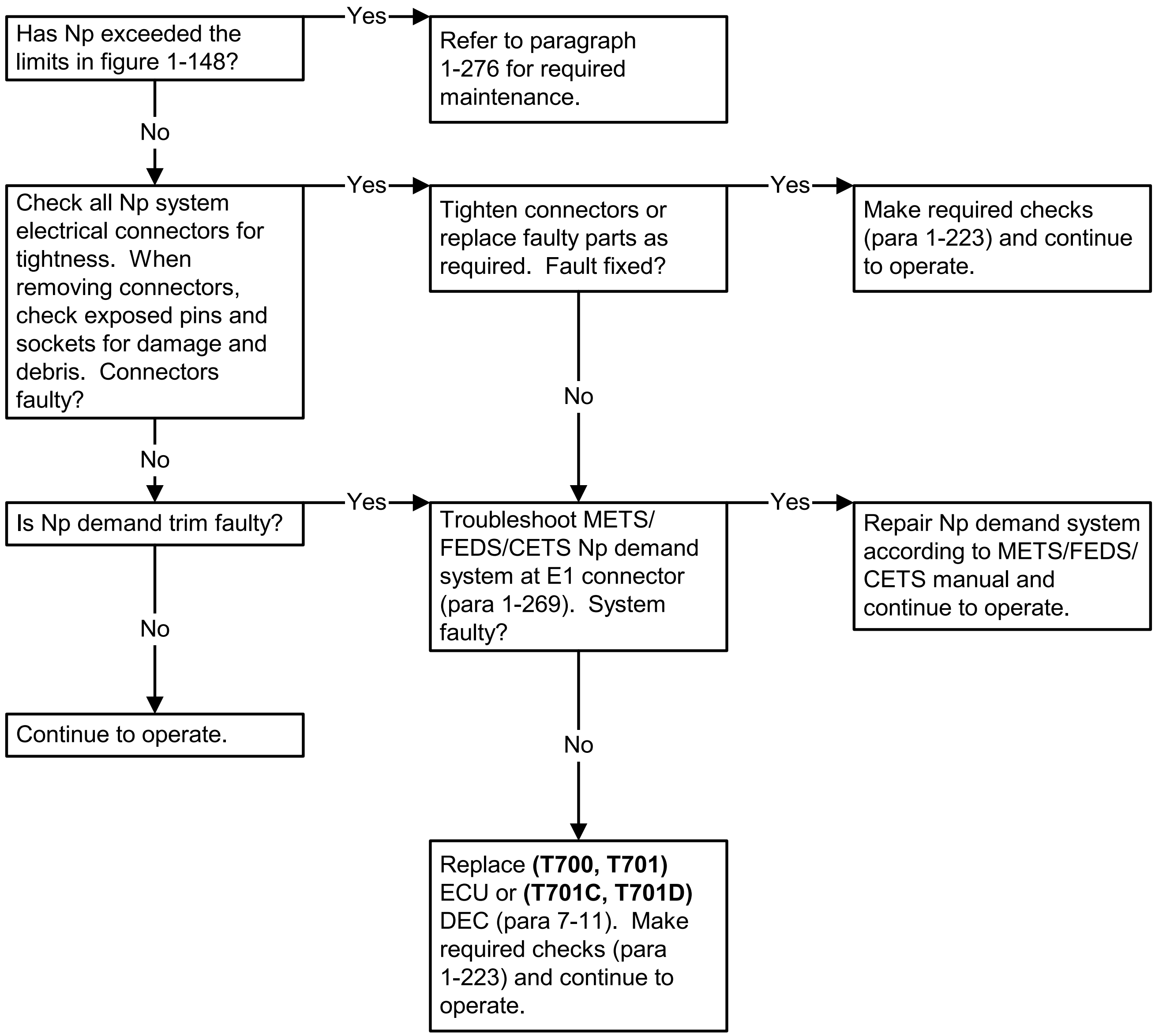
Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

Remove PAS rotary actuator. Rotate PAS by hand fully clockwise and then fully counterclockwise. Listen for click or look for alinement of white line at HMU when rotating CCW. Click heard or white line aligned?

Check PAS lever for correct rigging according to METS/FEDS/CETS manual and continue to operate.

Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

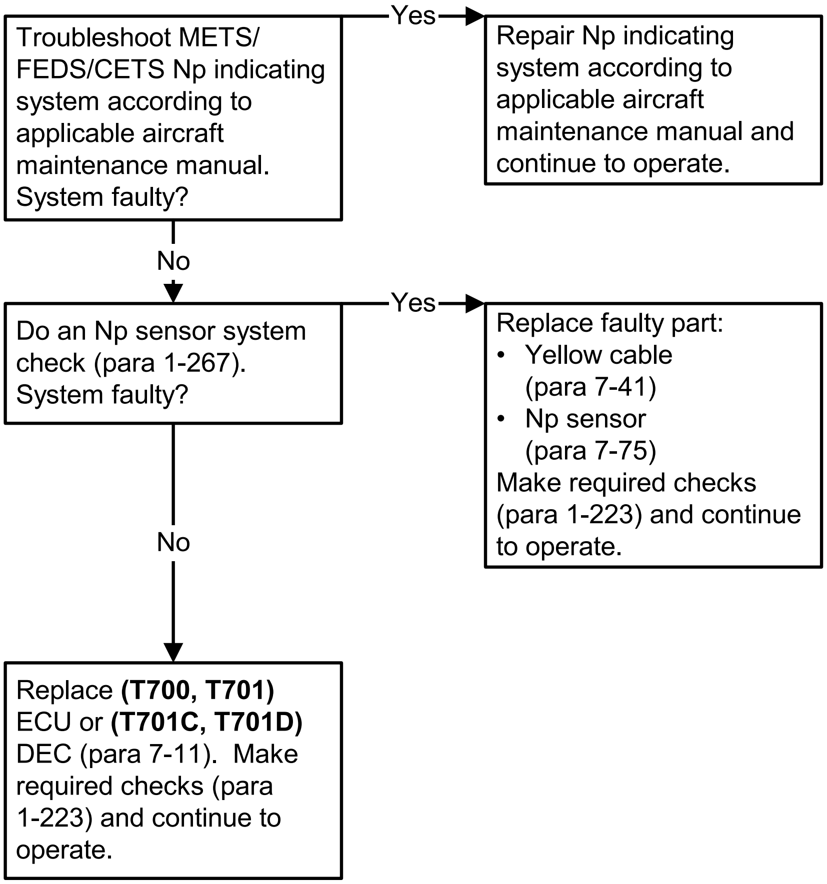
Troubleshooting Procedure 19. Np Does Not Respond to Np Demand Trim (with torque matching normal, Np does not respond to normal Np trim)



Troubleshooting Procedure 20. Np Instrument Fluctuating or Not Indicating (all other instruments normal)

NOTE

A slight audible metal-to-metal rubbing noise coming from within the power turbine module after extended operation at high power is normal.



Troubleshoot METS/FEDS/CETS Np indicating system according to applicable aircraft maintenance manual. System faulty?

Repair Np indicating system according to applicable aircraft maintenance manual and continue to operate.

Do an Np sensor system check (para 1-267). System faulty?

Replace faulty part:
- Yellow cable (para 7-41)
- Np sensor (para 7-75)

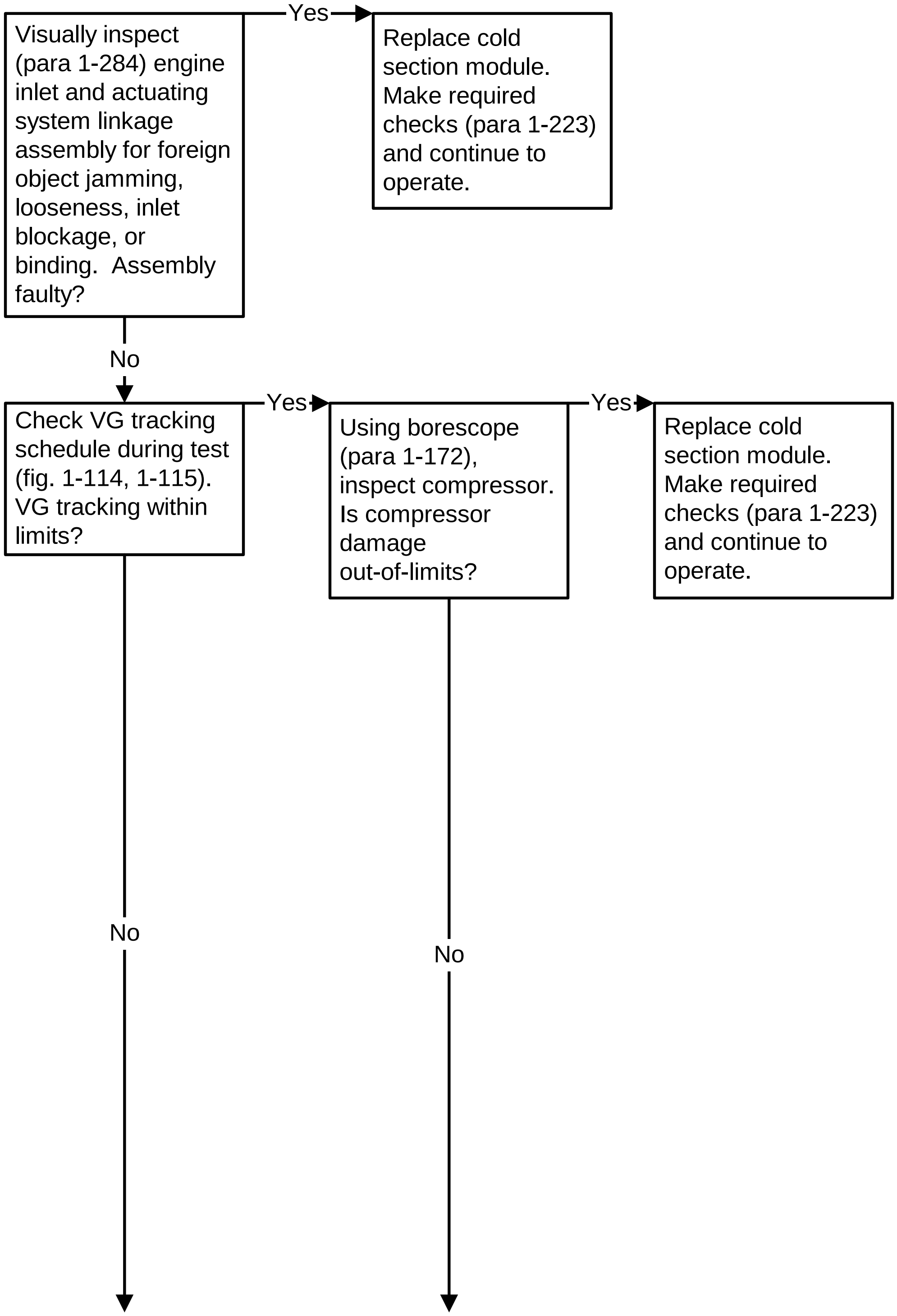
Make required checks (para 1-223) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 21. Stall Above Ground Idle Speed

NOTE

- A stall is indicated by a rumble or bang and may not cause a rise in TGT.
- If an unusually high-pitched whining sound is heard, see paragraph 1-273.



Visually inspect (para 1-284) engine inlet and actuating system linkage assembly for foreign object jamming, looseness, inlet blockage, or binding. Assembly faulty?

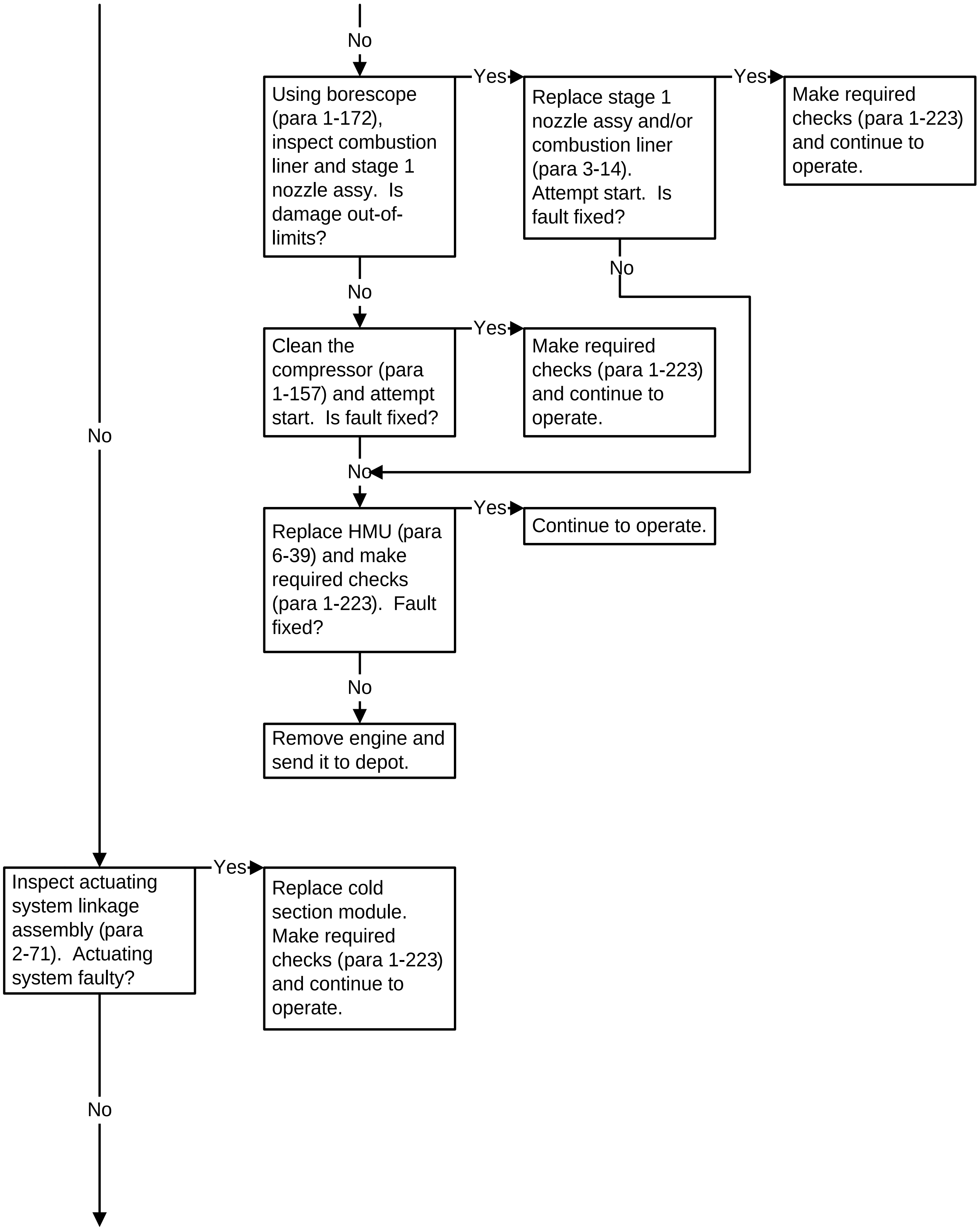
Replace cold section module. Make required checks (para 1-223) and continue to operate.

Check VG tracking schedule during test (fig. 1-114, 1-115). VG tracking within limits?

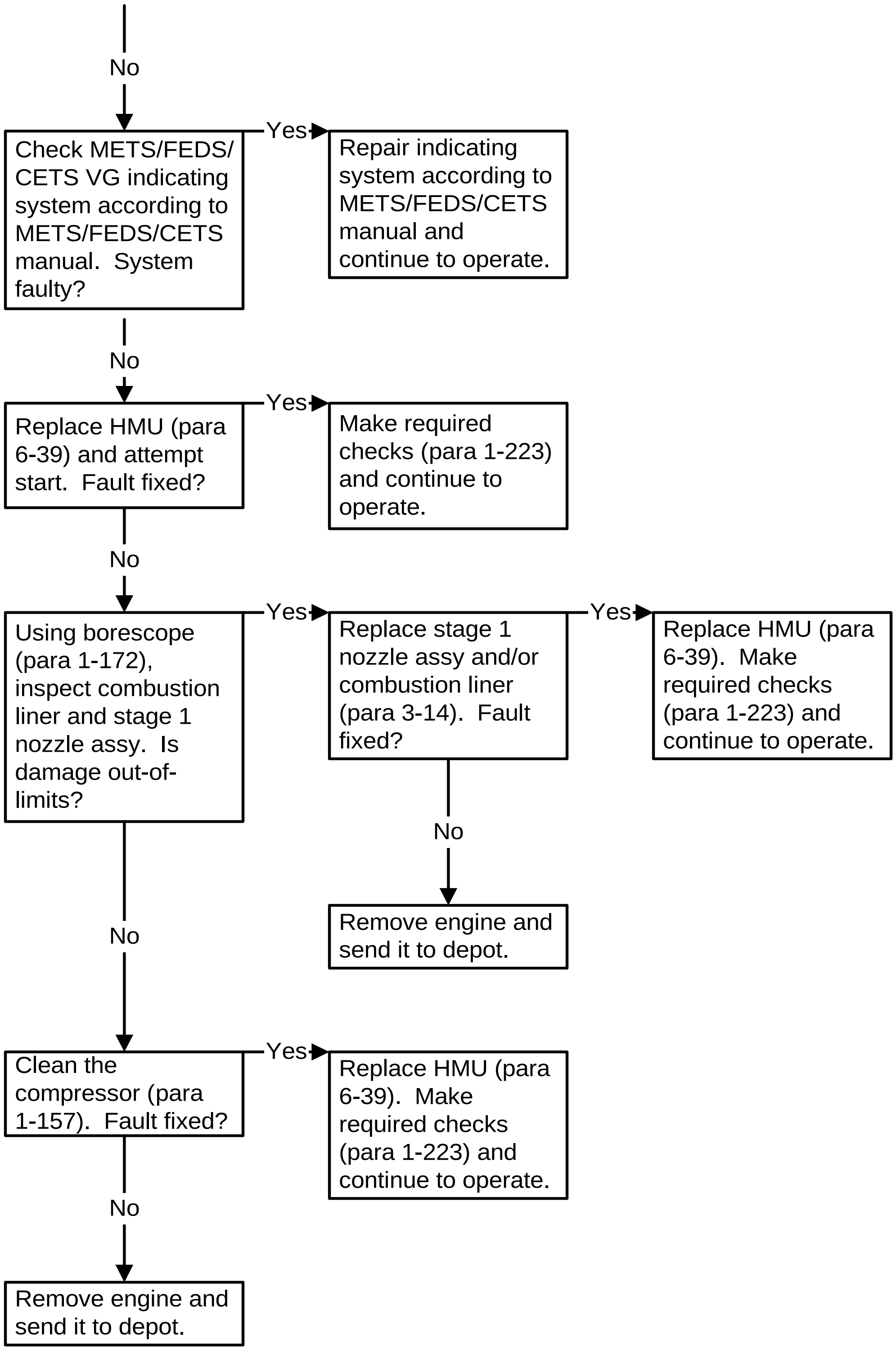
Using borescope (para 1-172), inspect compressor. Is compressor damage out-of-limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 21. Stall Above Ground Idle Speed (Cont)



Troubleshooting Procedure 21. Stall Above Ground Idle Speed (Cont)



Troubleshooting Procedure 22. Starting Stalls (audible popping or whining during Ng acceleration to ground idle)

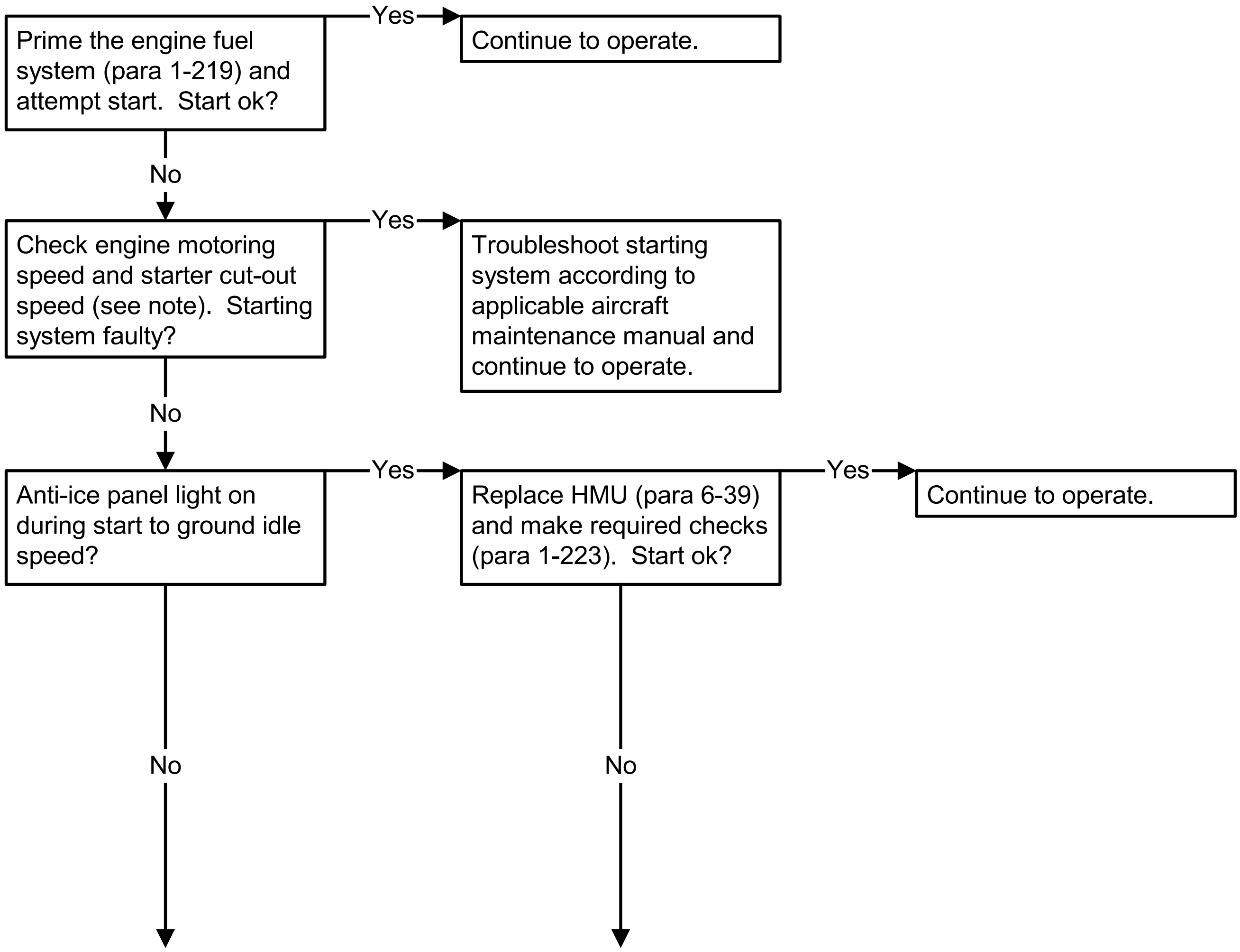
CAUTION

If TGT exceeds the following,
- **(T700)** 850°C (1562°F)
- **(T701)** 869°C (1596°F)
- **(T701C, T701D)** 851°C (1564°F)

before idle speed is reached, retard PAS lever to 0°. Deactivate ignition and motor engine until TGT decreases below 1000°F (538°C).

NOTE

Starting system should be able to motor the engine to at least 24% Ng (10,728 RPM). Starter must cut out below 52% Ng (23,244 RPM). This can be checked by using test panel instruments.



Prime the engine fuel system (para 1-219) and attempt start. Start ok?

Continue to operate.

Check engine motoring speed and starter cut-out speed (see note). Starting system faulty?

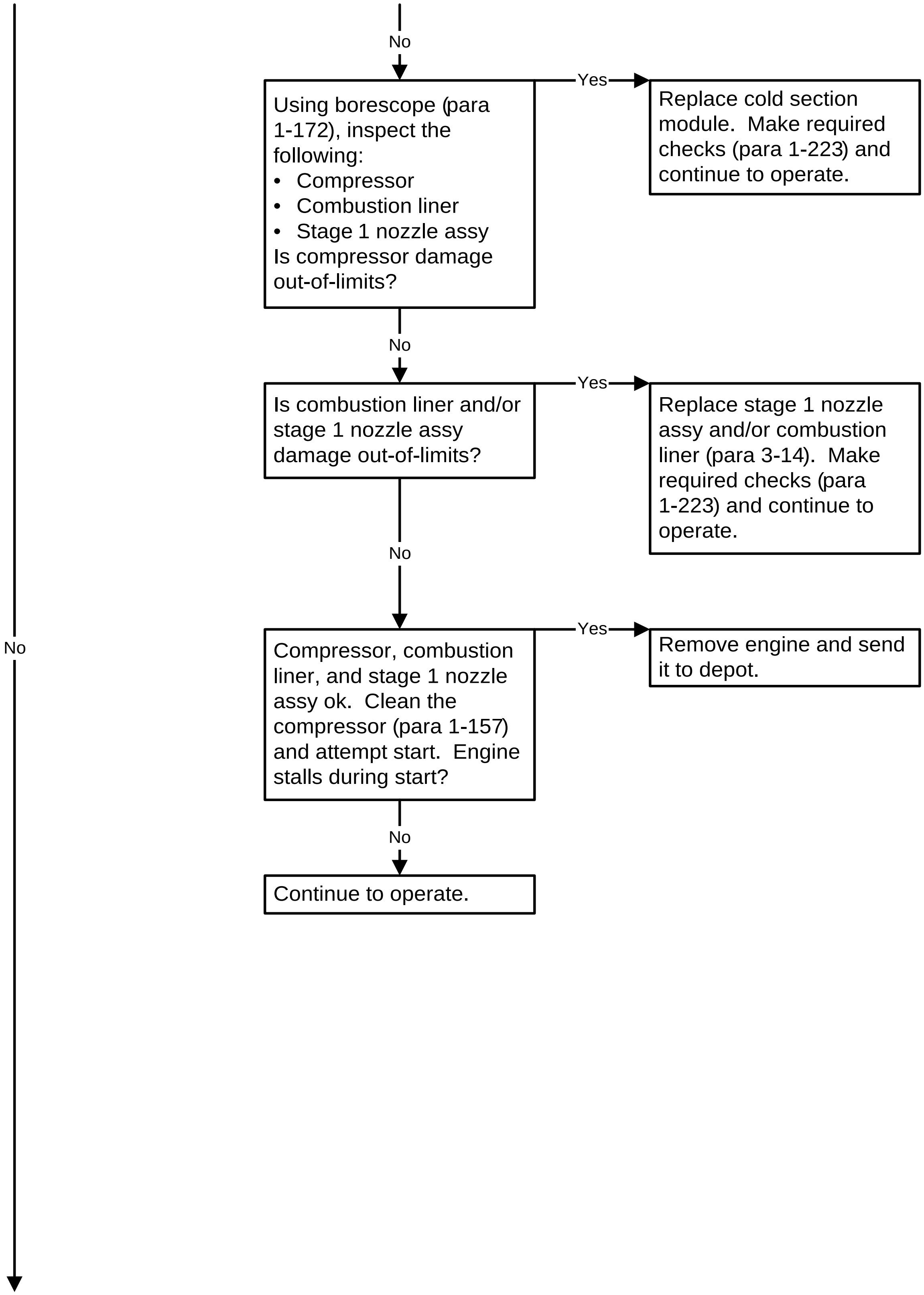
Troubleshoot starting system according to applicable aircraft maintenance manual and continue to operate.

Anti-ice panel light on during start to ground idle speed?

Replace HMU (para 6-39) and make required checks (para 1-223). Start ok?

Continue to operate.

Troubleshooting Procedure 22. Starting Stalls (audible popping or whining during Ng acceleration to ground idle) (Cont)



Using borescope (para 1-172), inspect the following:

- Compressor
- Combustion liner
- Stage 1 nozzle assy

Is compressor damage out-of-limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Is combustion liner and/or stage 1 nozzle assy damage out-of-limits?

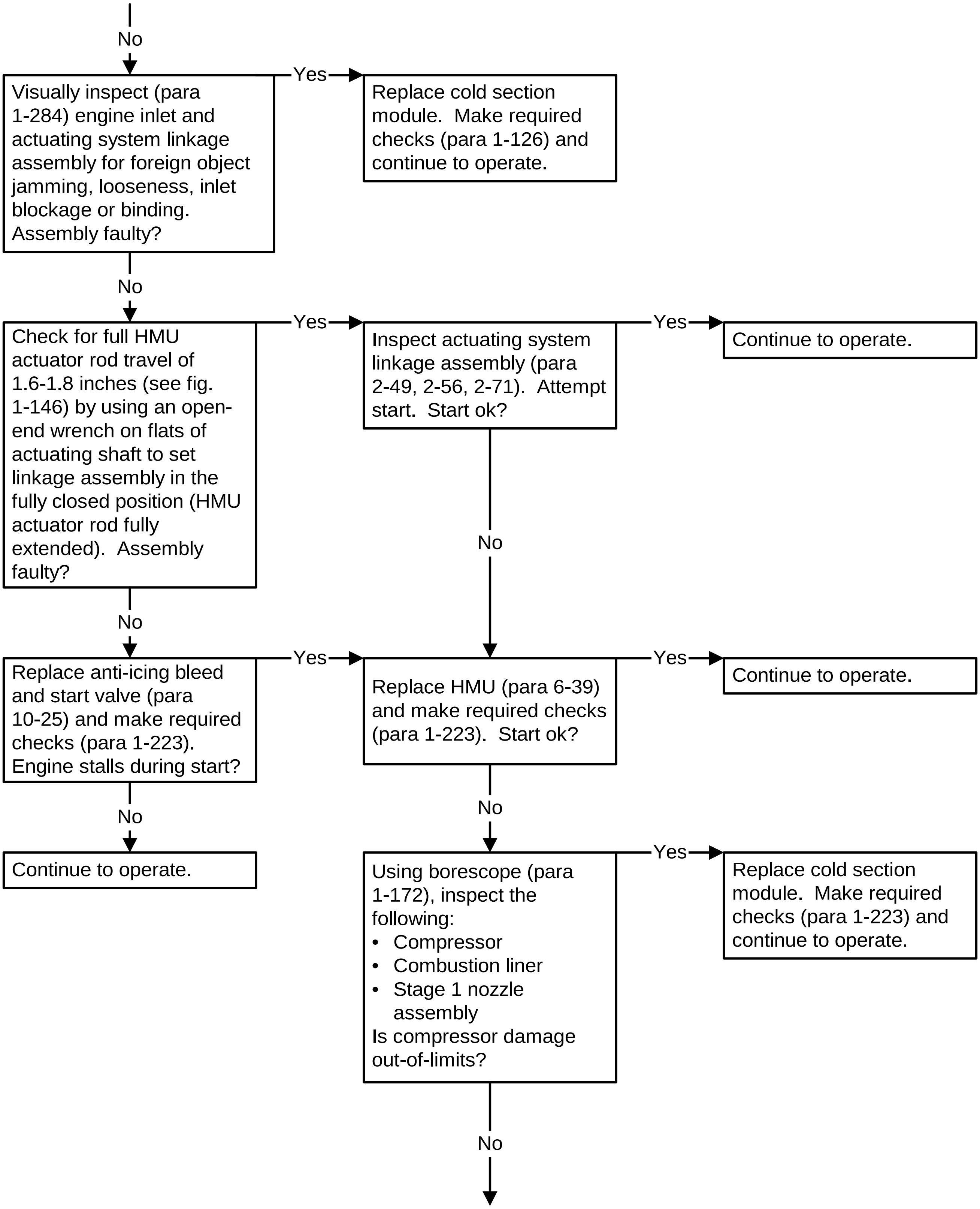
Replace stage 1 nozzle assy and/or combustion liner (para 3-14). Make required checks (para 1-223) and continue to operate.

Compressor, combustion liner, and stage 1 nozzle assy ok. Clean the compressor (para 1-157) and attempt start. Engine stalls during start?

Remove engine and send it to depot.

Continue to operate.

Troubleshooting Procedure 22. Starting Stalls (audible popping or whining during Ng acceleration to ground idle) (Cont)



Visually inspect (para 1-284) engine inlet and actuating system linkage assembly for foreign object jamming, looseness, inlet blockage or binding. Assembly faulty?

Replace cold section module. Make required checks (para 1-126) and continue to operate.

Check for full HMU actuator rod travel of 1.6-1.8 inches (see fig. 1-146) by using an open-end wrench on flats of actuating shaft to set linkage assembly in the fully closed position (HMU actuator rod fully extended). Assembly faulty?

Inspect actuating system linkage assembly (para 2-49, 2-56, 2-71). Attempt start. Start ok?

Continue to operate.

Replace anti-icing bleed and start valve (para 10-25) and make required checks (para 1-223). Engine stalls during start?

Replace HMU (para 6-39) and make required checks (para 1-223). Start ok?

Continue to operate.

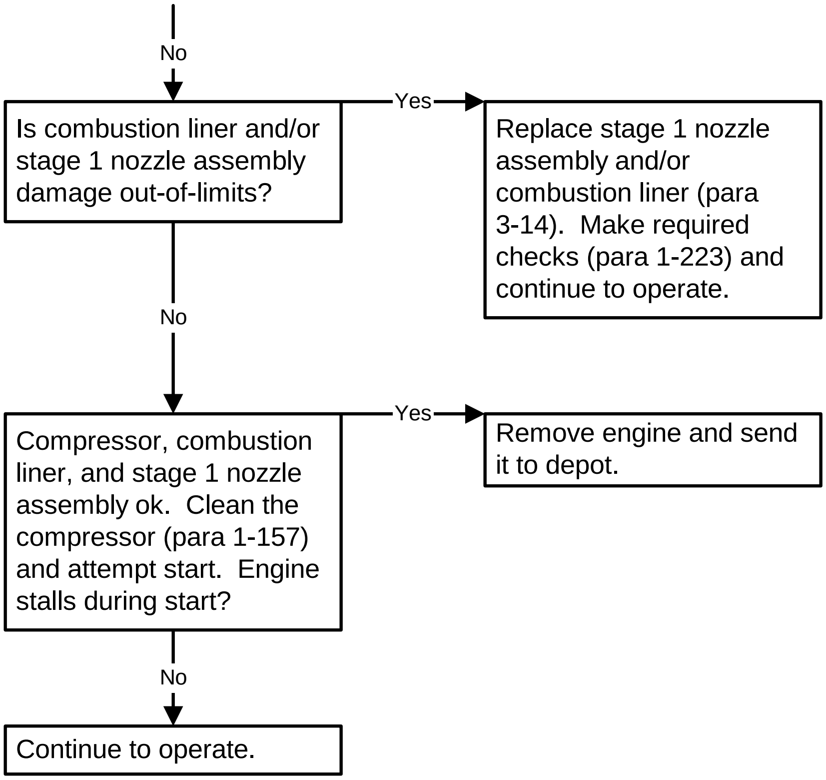
Continue to operate.

Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion liner
- Stage 1 nozzle assembly

Is compressor damage out-of-limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 22. Starting Stalls (audible popping or whining during Ng acceleration to ground idle) (Cont)



Is combustion liner and/or stage 1 nozzle assembly damage out-of-limits?

Replace stage 1 nozzle assembly and/or combustion liner (para 3-14). Make required checks (para 1-223) and continue to operate.

Compressor, combustion liner, and stage 1 nozzle assembly ok. Clean the compressor (para 1-157) and attempt start. Engine stalls during start?

Remove engine and send it to depot.

Continue to operate.

Troubleshooting Procedure 23. Abnormally High TGT During Start

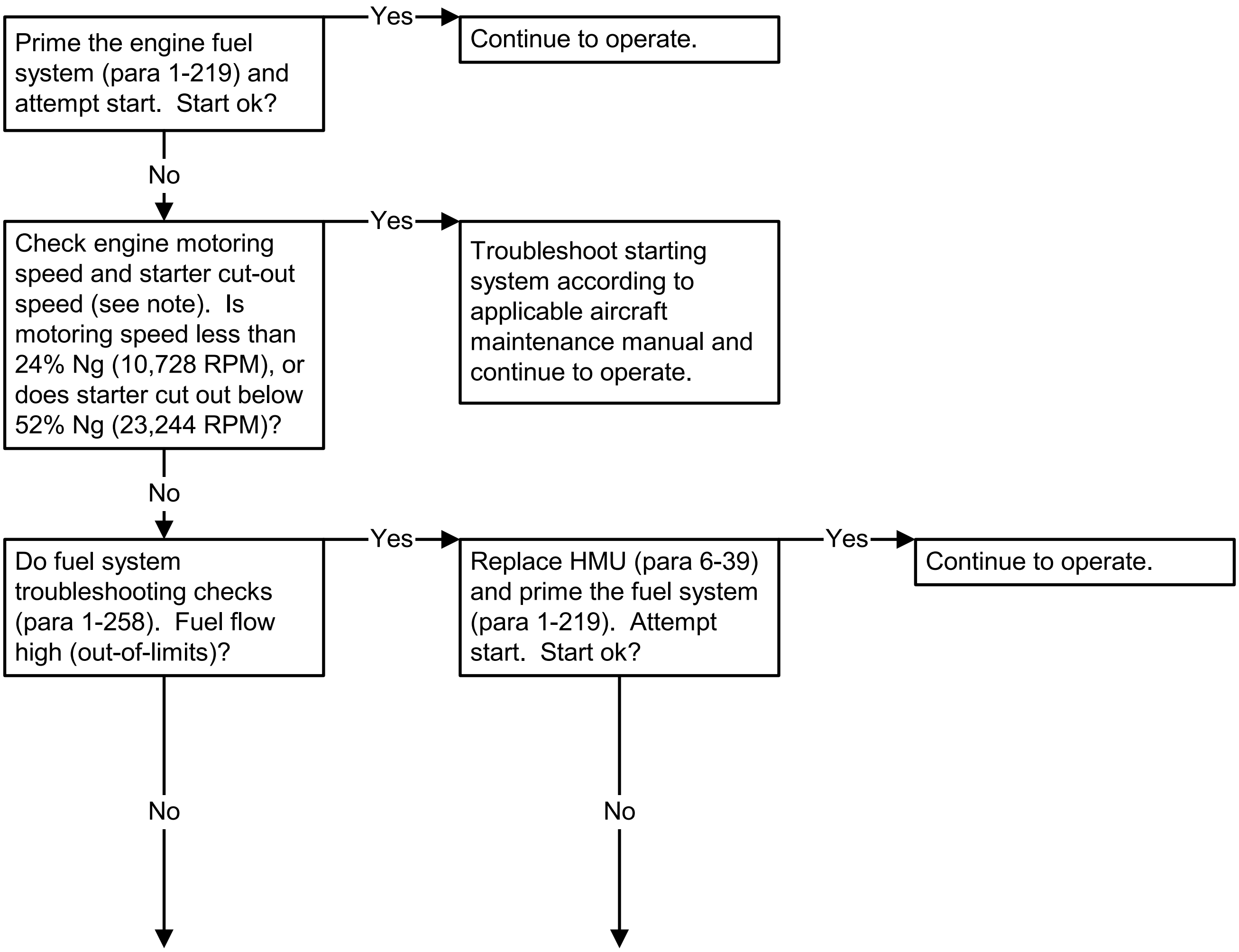
CAUTION

If TGT exceeds the following:
- **(T700)** 850°C (1562°F)
- **(T701)** 869°C (1596°F)
- **(T701C, T701D)** 851°C (1564°F)

before idle speed is reached, retard PAS lever to 0°. Deactivate ignition and motor engine until TGT decreases below 1000°F (538°C).

NOTE

Starting system should be able to motor the engine to at least 24% Ng (10,728 RPM). Starter must cut out below 52% Ng (23,244 RPM). This can be checked by using test panel instruments.



Prime the engine fuel system (para 1-219) and attempt start. Start ok?

Continue to operate.

Check engine motoring speed and starter cut-out speed (see note). Is motoring speed less than 24% Ng (10,728 RPM), or does starter cut out below 52% Ng (23,244 RPM)?

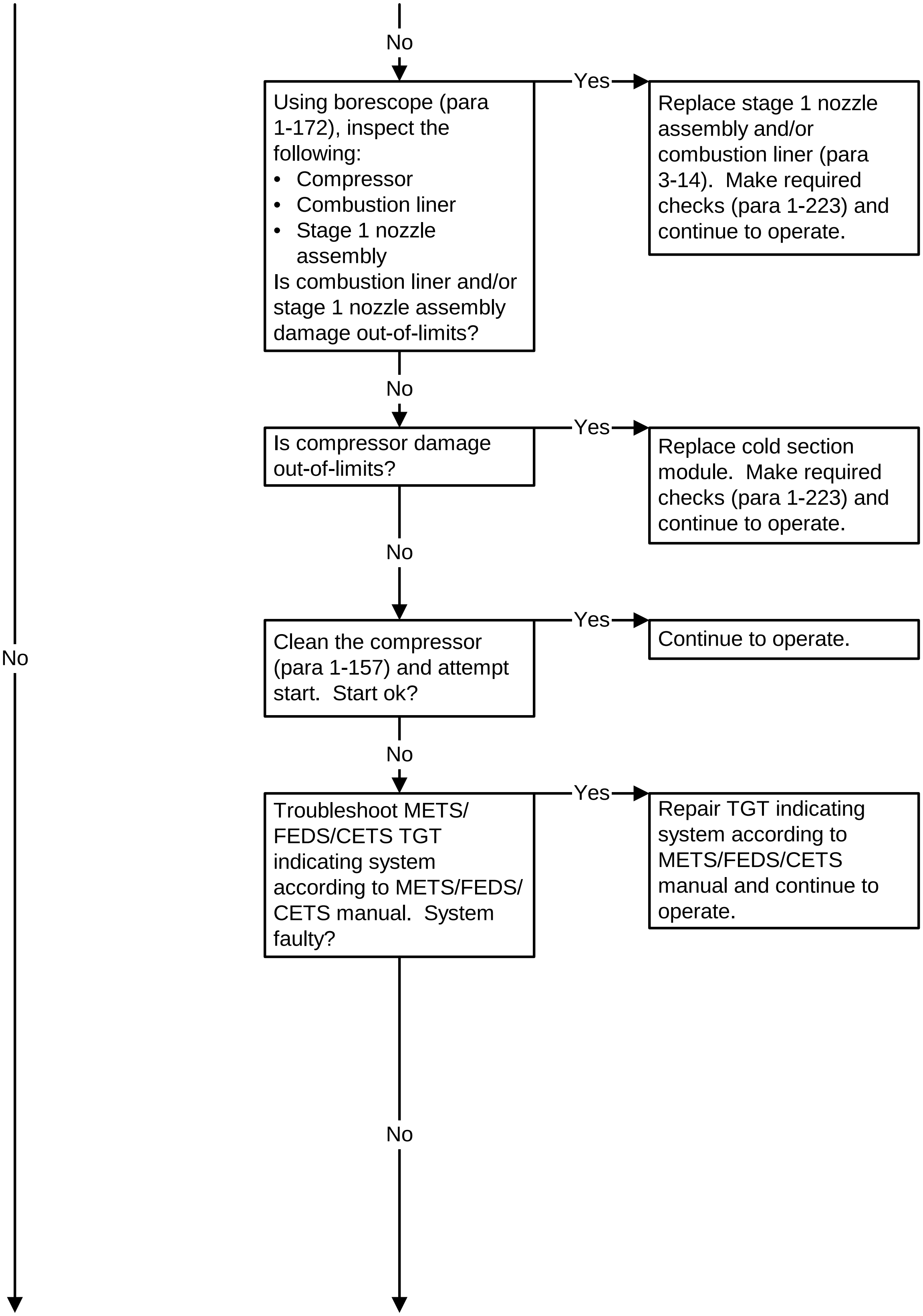
Troubleshoot starting system according to applicable aircraft maintenance manual and continue to operate.

Do fuel system troubleshooting checks (para 1-258). Fuel flow high (out-of-limits)?

Replace HMU (para 6-39) and prime the fuel system (para 1-219). Attempt start. Start ok?

Continue to operate.

Troubleshooting Procedure 23. Abnormally High TGT During Start (Cont)



Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion liner
- Stage 1 nozzle assembly

Is combustion liner and/or stage 1 nozzle assembly damage out-of-limits?

Replace stage 1 nozzle assembly and/or combustion liner (para 3-14). Make required checks (para 1-223) and continue to operate.

Is compressor damage out-of-limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

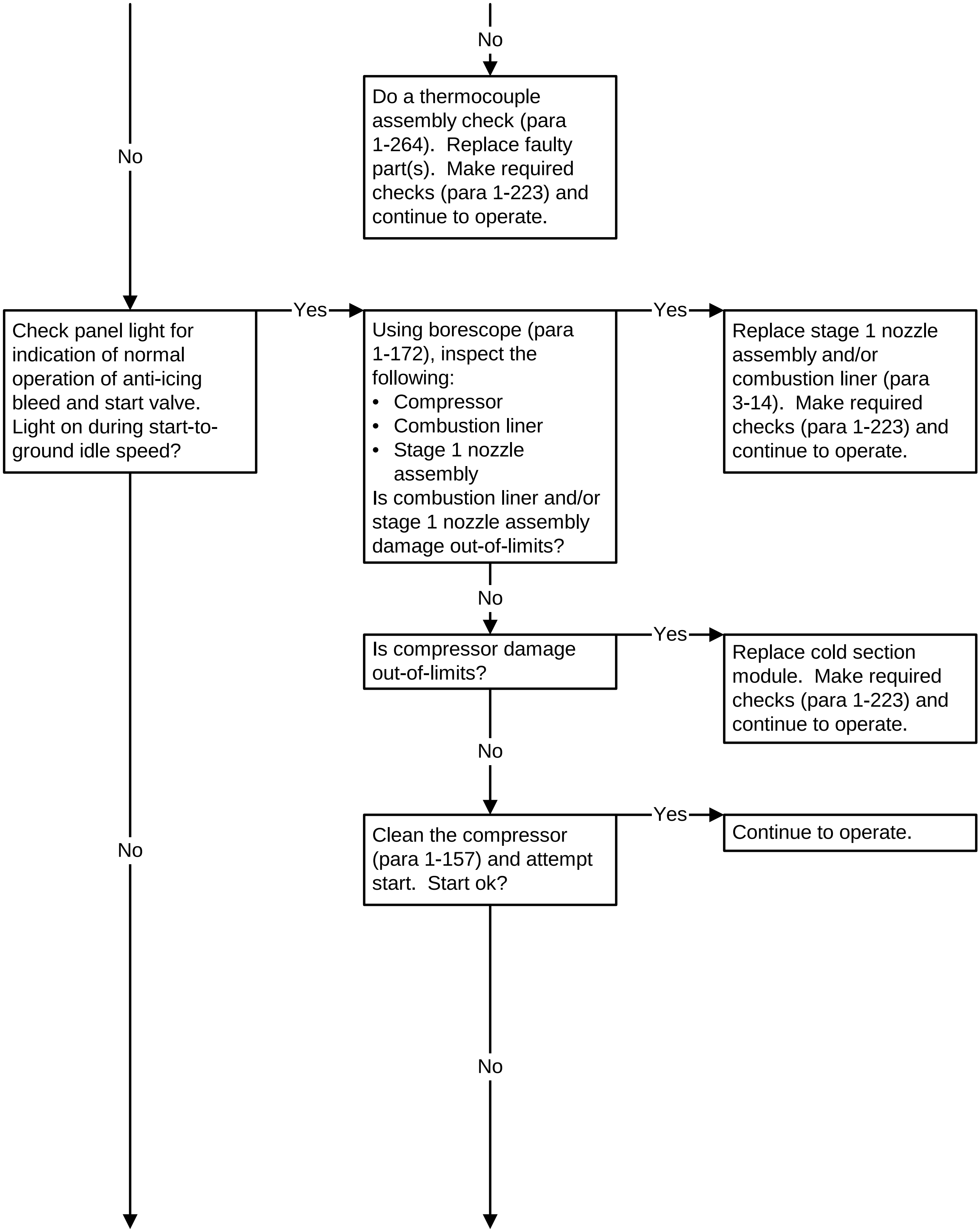
Clean the compressor (para 1-157) and attempt start. Start ok?

Continue to operate.

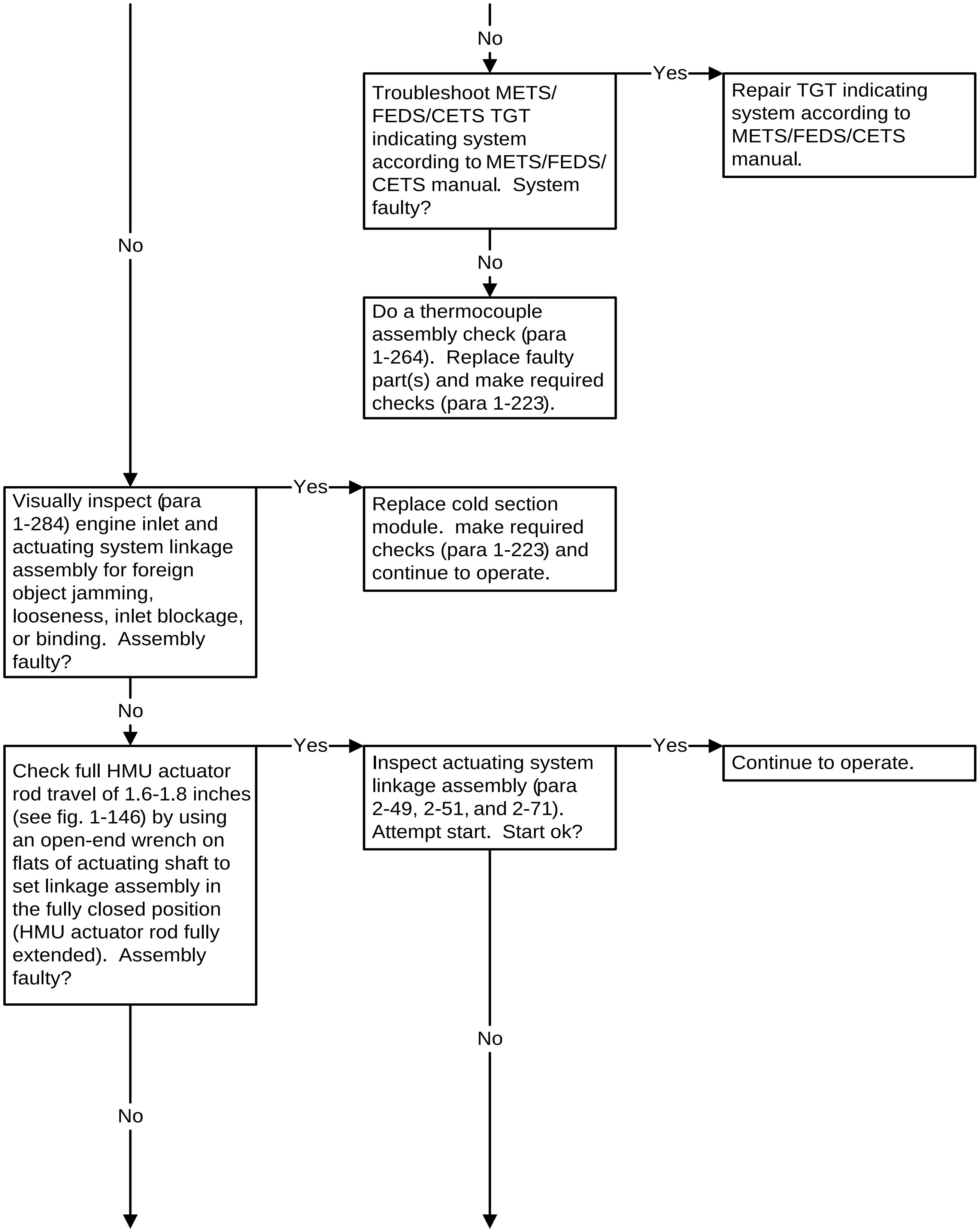
Troubleshoot METS/FEDS/CETS TGT indicating system according to METS/FEDS/CETS manual. System faulty?

Repair TGT indicating system according to METS/FEDS/CETS manual and continue to operate.

Troubleshooting Procedure 23. Abnormally High TGT During Start (Cont)



Troubleshooting Procedure 23. Abnormally High TGT During Start (Cont)



Troubleshoot METS/FEDS/CETS TGT indicating system according to METS/FEDS/CETS manual. System faulty?

Repair TGT indicating system according to METS/FEDS/CETS manual.

Do a thermocouple assembly check (para 1-264). Replace faulty part(s) and make required checks (para 1-223).

Visually inspect (para 1-284) engine inlet and actuating system linkage assembly for foreign object jamming, looseness, inlet blockage, or binding. Assembly faulty?

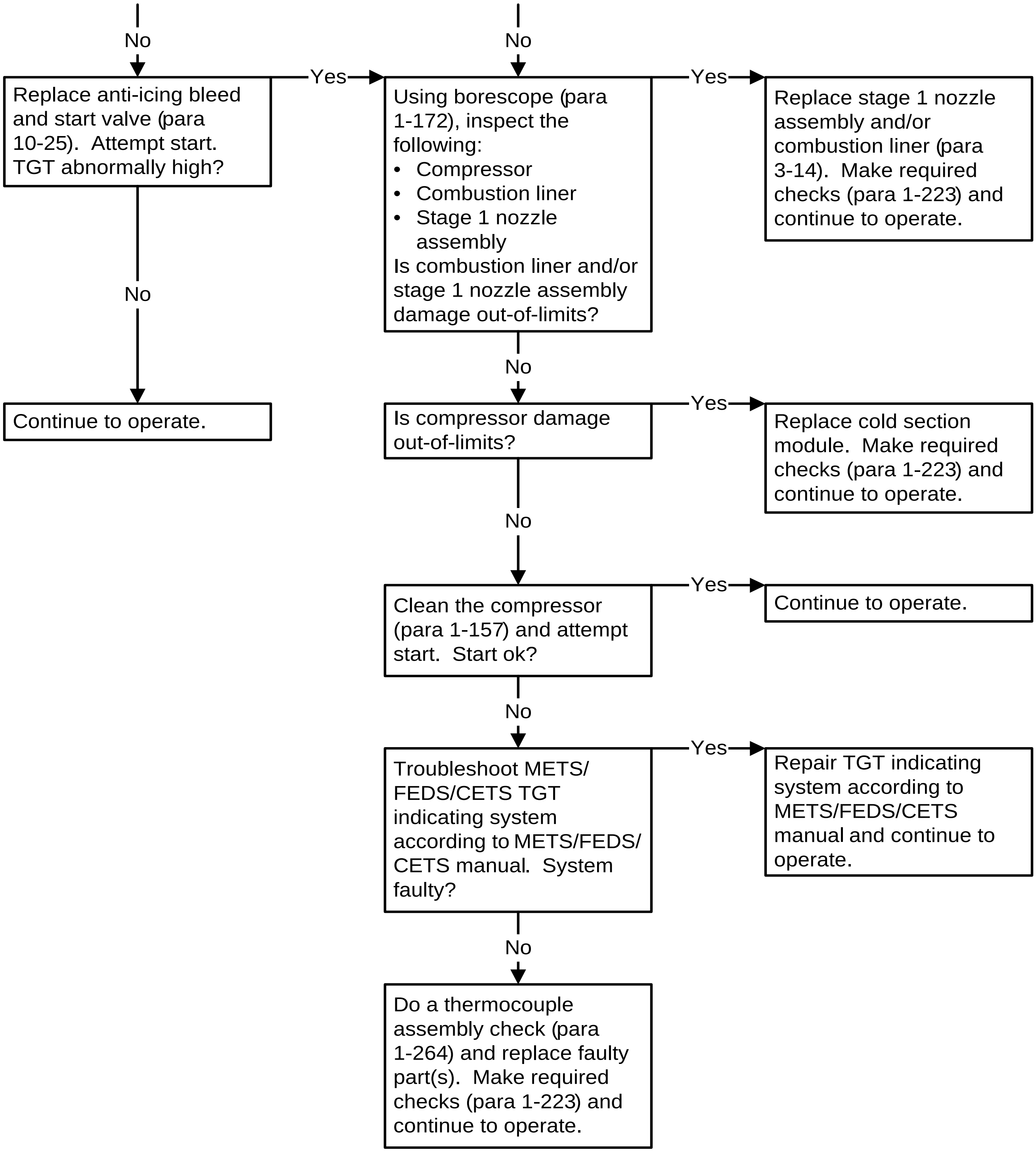
Replace cold section module. make required checks (para 1-223) and continue to operate.

Check full HMU actuator rod travel of 1.6-1.8 inches (see fig. 1-146) by using an open-end wrench on flats of actuating shaft to set linkage assembly in the fully closed position (HMU actuator rod fully extended). Assembly faulty?

Inspect actuating system linkage assembly (para 2-49, 2-51, and 2-71). Attempt start. Start ok?

Continue to operate.

Troubleshooting Procedure 23. Abnormally High TGT During Start (Cont)



Replace anti-icing bleed and start valve (para 10-25). Attempt start. TGT abnormally high?

Continue to operate.

Using borescope (para 1-172), inspect the following:

- Compressor
- Combustion liner
- Stage 1 nozzle assembly

Is combustion liner and/or stage 1 nozzle assembly damage out-of-limits?

Replace stage 1 nozzle assembly and/or combustion liner (para 3-14). Make required checks (para 1-223) and continue to operate.

Is compressor damage out-of-limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Clean the compressor (para 1-157) and attempt start. Start ok?

Continue to operate.

Troubleshoot METS/FEDS/CETS TGT indicating system according to METS/FEDS/CETS manual. System faulty?

Repair TGT indicating system according to METS/FEDS/CETS manual and continue to operate.

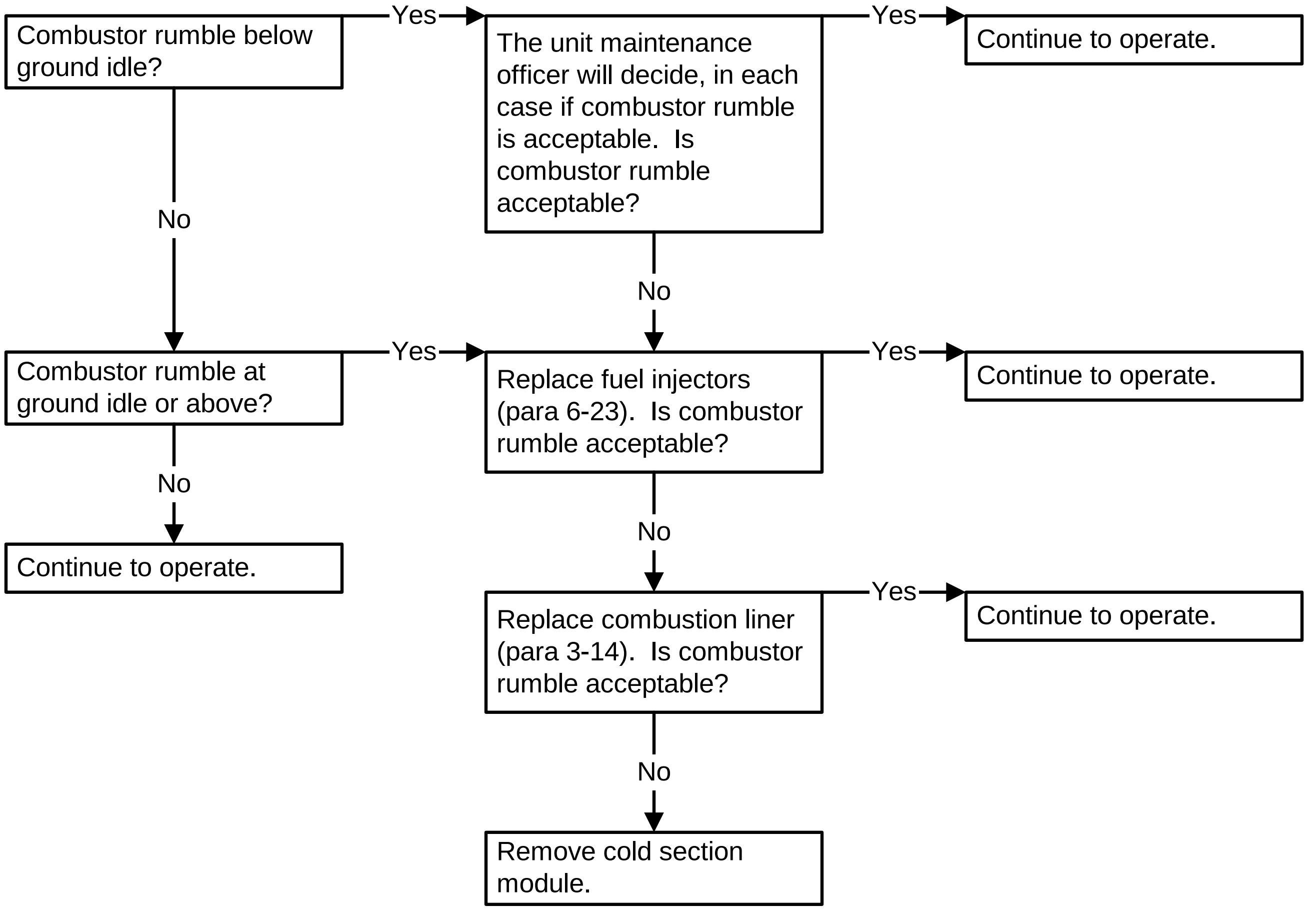
Do a thermocouple assembly check (para 1-264) and replace faulty part(s). Make required checks (para 1-223) and continue to operate.

]

Troubleshooting Procedure 24. Combustor Rumble During Start

NOTE

- Combustor rumble is a low frequency noise often described as a howl that may be heard intermittently during engine start.
- Combustor rumble may be more pronounced during cold weather and/or during engine acceleration to ground idle.

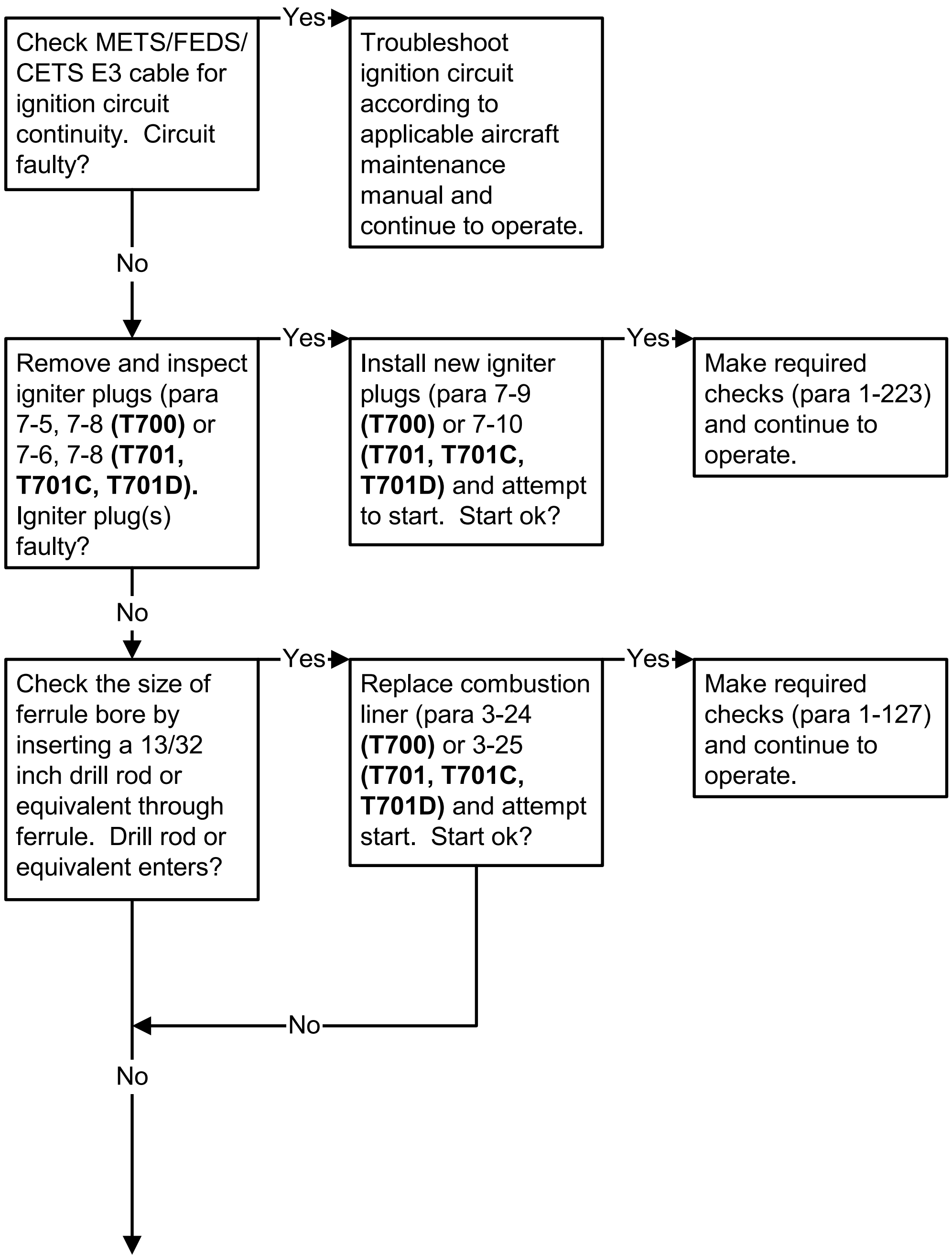


Troubleshooting Procedure 25.   No Start (fuel mist seen coming from tailpipe; no rise in TGT)

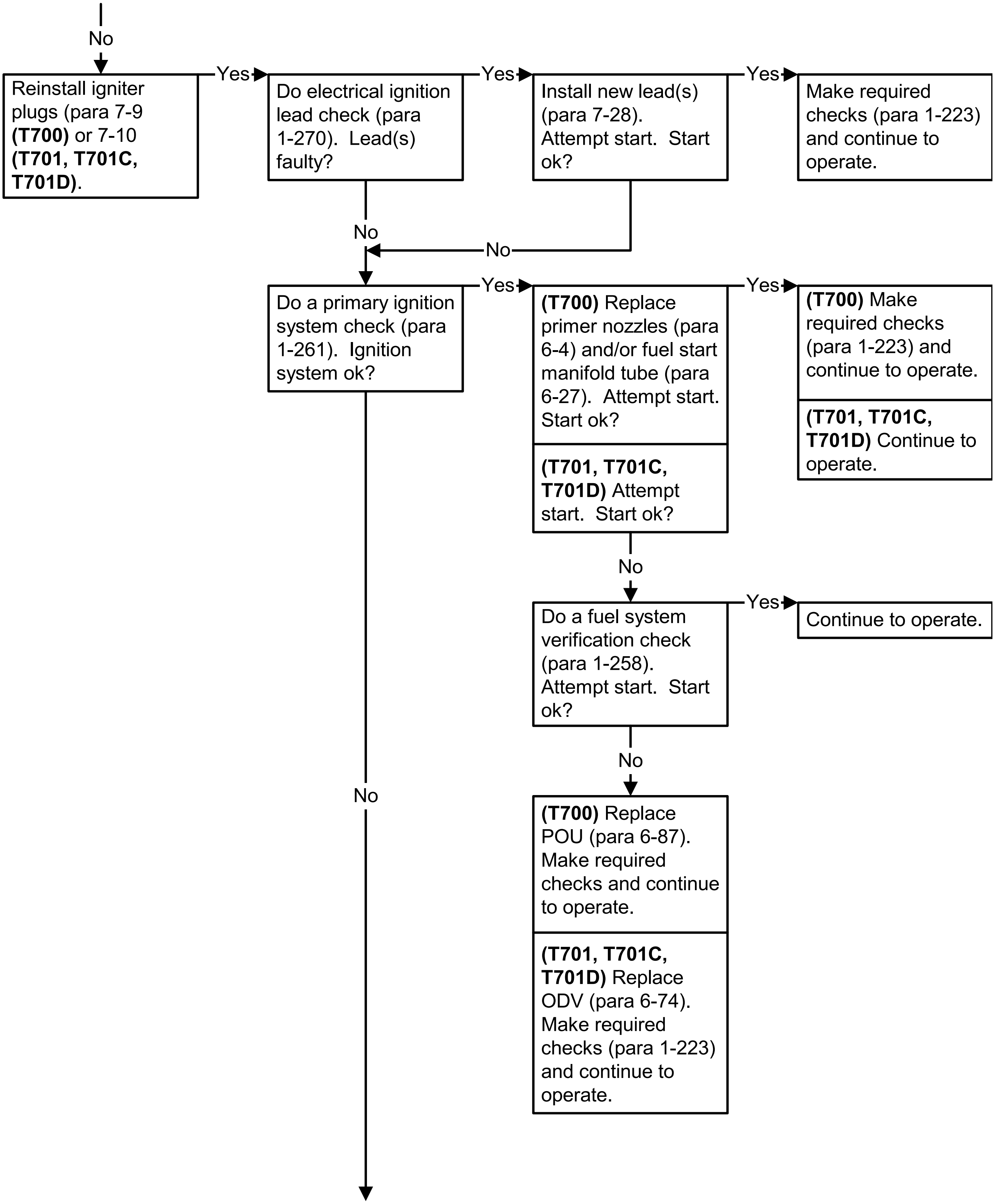
WARNING

Igniter Plugs

- High voltage may be present.
- Do not touch electrical output connector when operating any ignition component.
- Be sure ignition unit and plugs are grounded before energizing the circuit.
- Never hold or touch igniter plug when energizing the ignition circuit.



Troubleshooting Procedure 25. No Start (fuel mist seen coming from tailpipe; no rise in TGT) (Cont)



Reinstall igniter plugs (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**.

Do electrical ignition lead check (para 1-270). Lead(s) faulty?

Install new lead(s) (para 7-28). Attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

Do a primary ignition system check (para 1-261). Ignition system ok?

(T700) Replace primer nozzles (para 6-4) and/or fuel start manifold tube (para 6-27). Attempt start. Start ok?

(T701, T701C, T701D) Attempt start. Start ok?

(T700) Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Continue to operate.

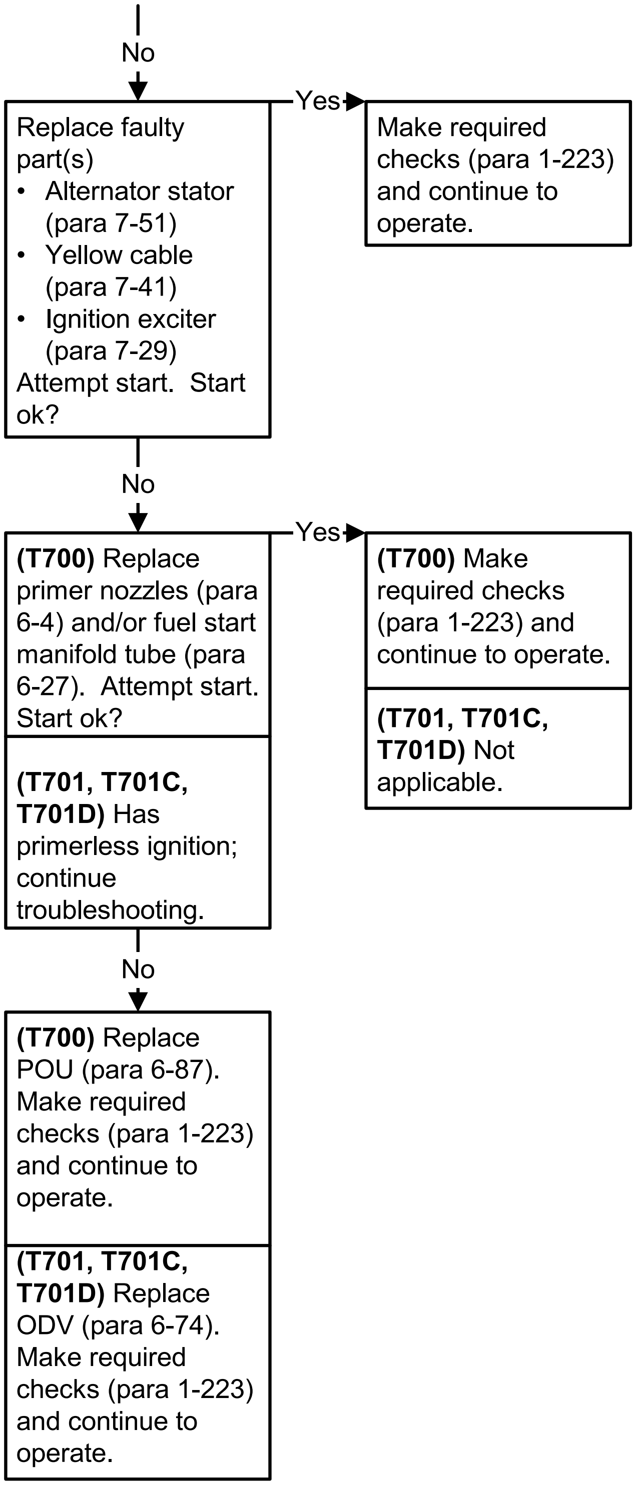
Do a fuel system verification check (para 1-258). Attempt start. Start ok?

Continue to operate.

(T700) Replace POU (para 6-87). Make required checks and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 25. No Start (fuel mist seen coming from tailpipe; no rise in TGT) (Cont)



Replace faulty part(s)

- Alternator stator (para 7-51)
- Yellow cable (para 7-41)
- Ignition exciter (para 7-29)

Attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

(T700) Replace primer nozzles (para 6-4) and/or fuel start manifold tube (para 6-27). Attempt start. Start ok?

(T701, T701C, T701D) Has primerless ignition; continue troubleshooting.

(T700) Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Not applicable.

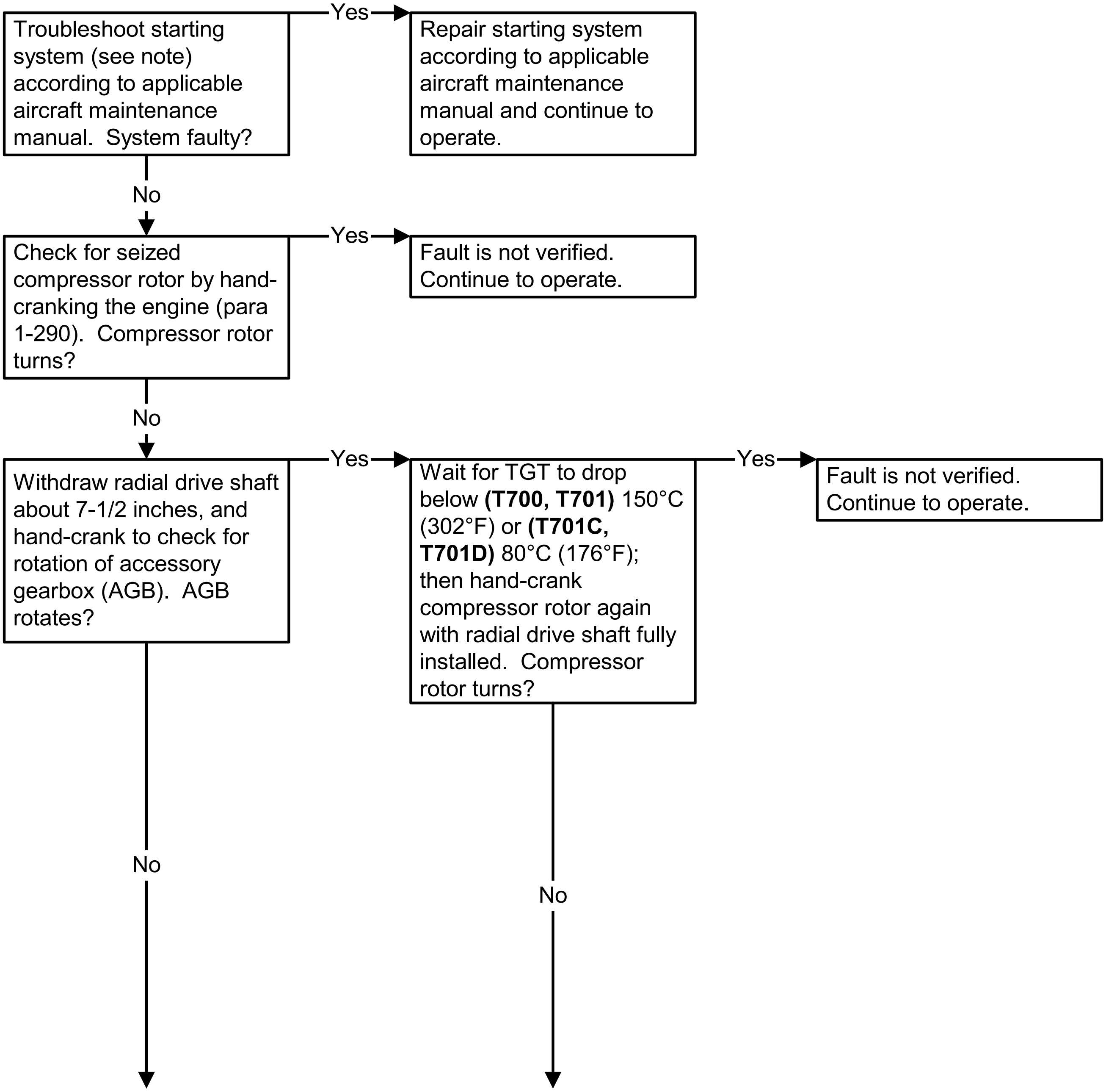
(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 26. *No Start (no compressor rotor rotation)*

NOTE

Starting system should be able to motor the engine to at least 24% Ng (10,728 RPM). Starter must not cut out below 52% Ng (23,244 RPM). This can be checked by using test panel instruments.



Troubleshoot starting system (see note) according to applicable aircraft maintenance manual. System faulty?

Repair starting system according to applicable aircraft maintenance manual and continue to operate.

Check for seized compressor rotor by hand-cranking the engine (para 1-290). Compressor rotor turns?

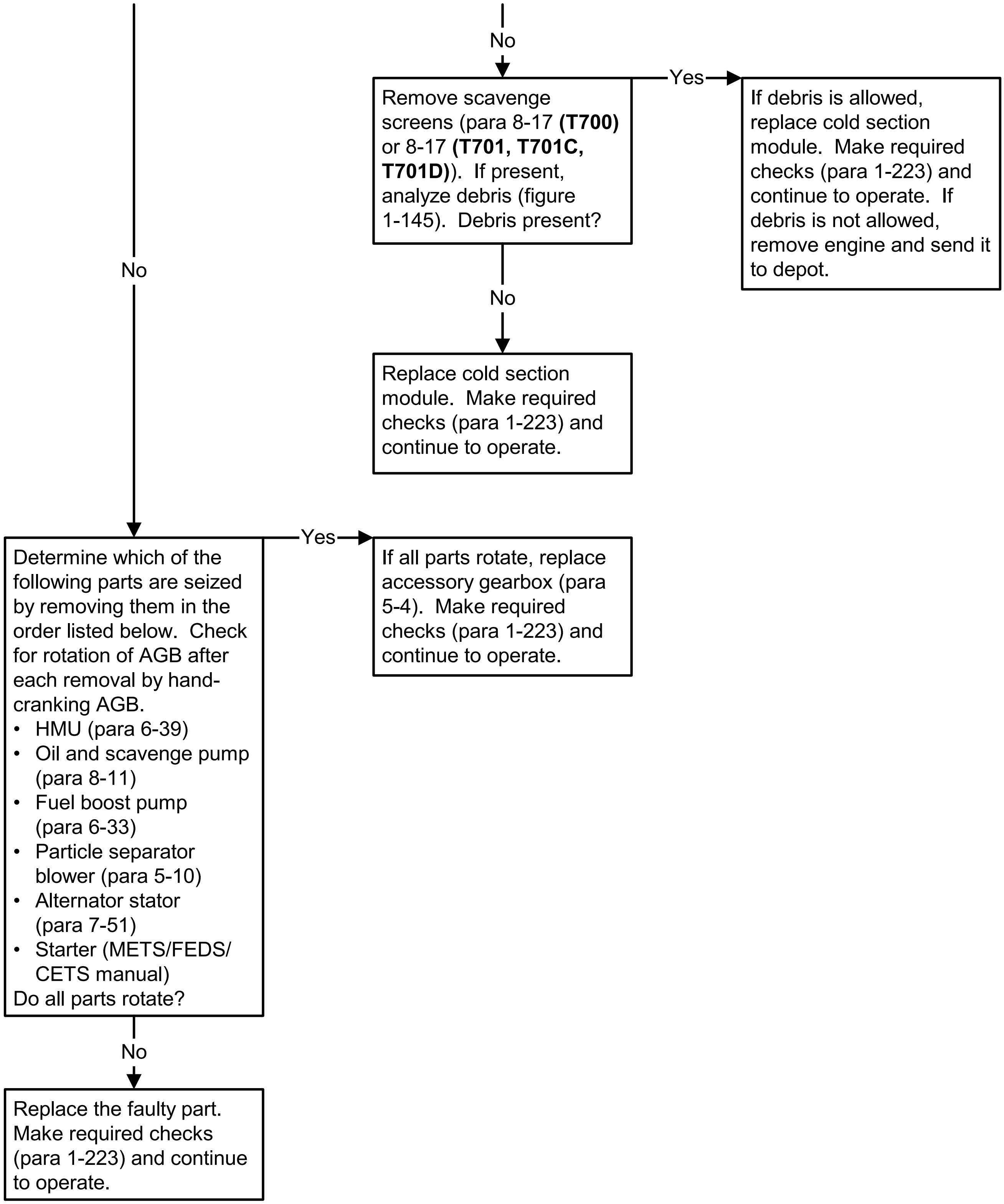
Fault is not verified. Continue to operate.

Withdraw radial drive shaft about 7-1/2 inches, and hand-crank to check for rotation of accessory gearbox (AGB). AGB rotates?

Wait for TGT to drop below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F); then hand-crank compressor rotor again with radial drive shaft fully installed. Compressor rotor turns?

Fault is not verified. Continue to operate.

Troubleshooting Procedure 26. No Start (no compressor rotor rotation) (Cont)



Remove scavenge screens (para 8-17 **(T700)** or 8-17 **(T701, T701C, T701D)**). If present, analyze debris (figure 1-145). Debris present?

If debris is allowed, replace cold section module. Make required checks (para 1-223) and continue to operate. If debris is not allowed, remove engine and send it to depot.

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Determine which of the following parts are seized by removing them in the order listed below. Check for rotation of AGB after each removal by hand-cranking AGB.

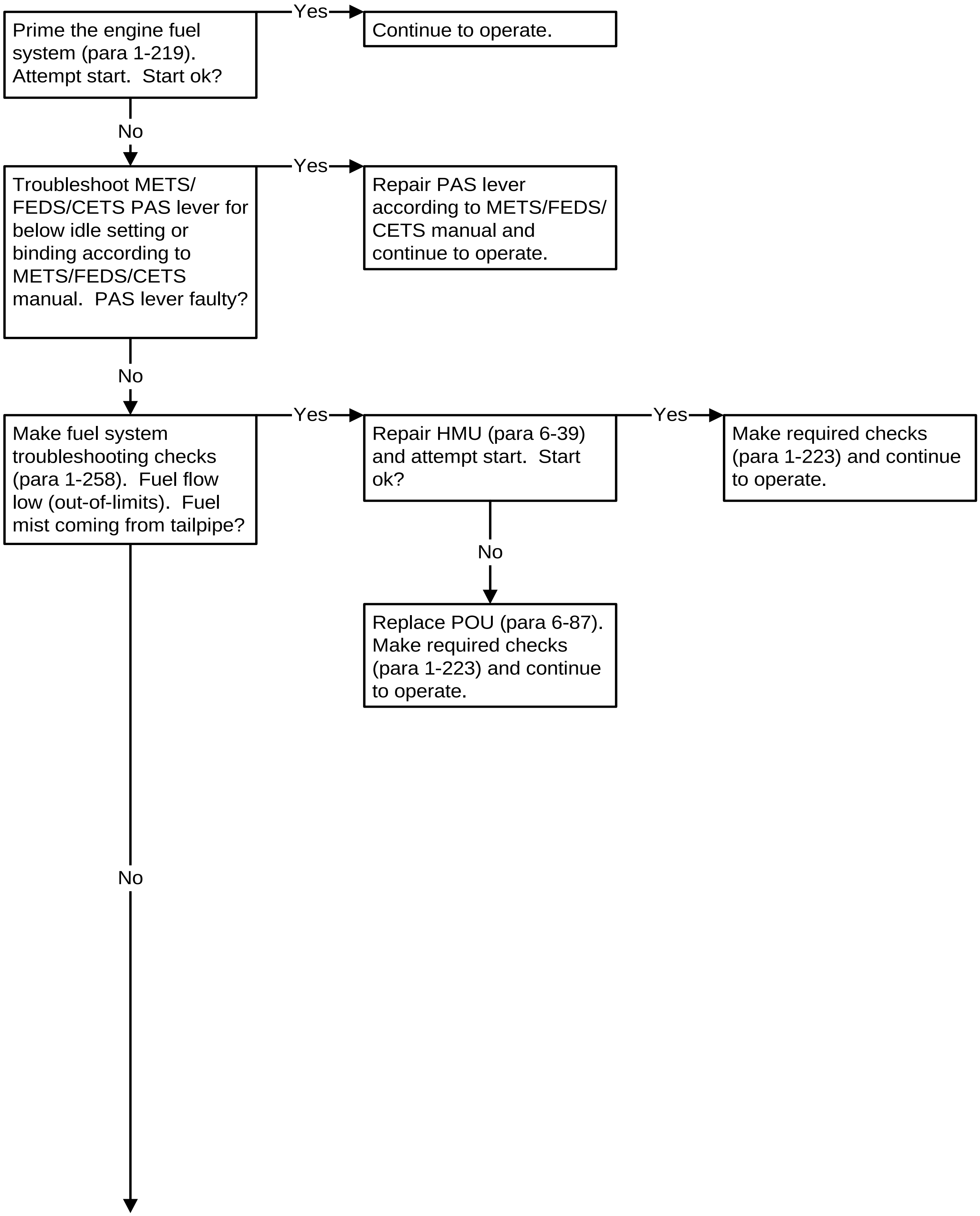
- HMU (para 6-39)
- Oil and scavenge pump (para 8-11)
- Fuel boost pump (para 6-33)
- Particle separator blower (para 5-10)
- Alternator stator (para 7-51)
- Starter (METS/FEDS/CETS manual)

Do all parts rotate?

If all parts rotate, replace accessory gearbox (para 5-4). Make required checks (para 1-223) and continue to operate.

Replace the faulty part. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 27. *(T700)* ***No Start (no fuel mist seen coming from tailpipe; no rise in TGT)***



Prime the engine fuel system (para 1-219). Attempt start. Start ok?

Continue to operate.

Troubleshoot METS/FEDS/CETS PAS lever for below idle setting or binding according to METS/FEDS/CETS manual. PAS lever faulty?

Repair PAS lever according to METS/FEDS/CETS manual and continue to operate.

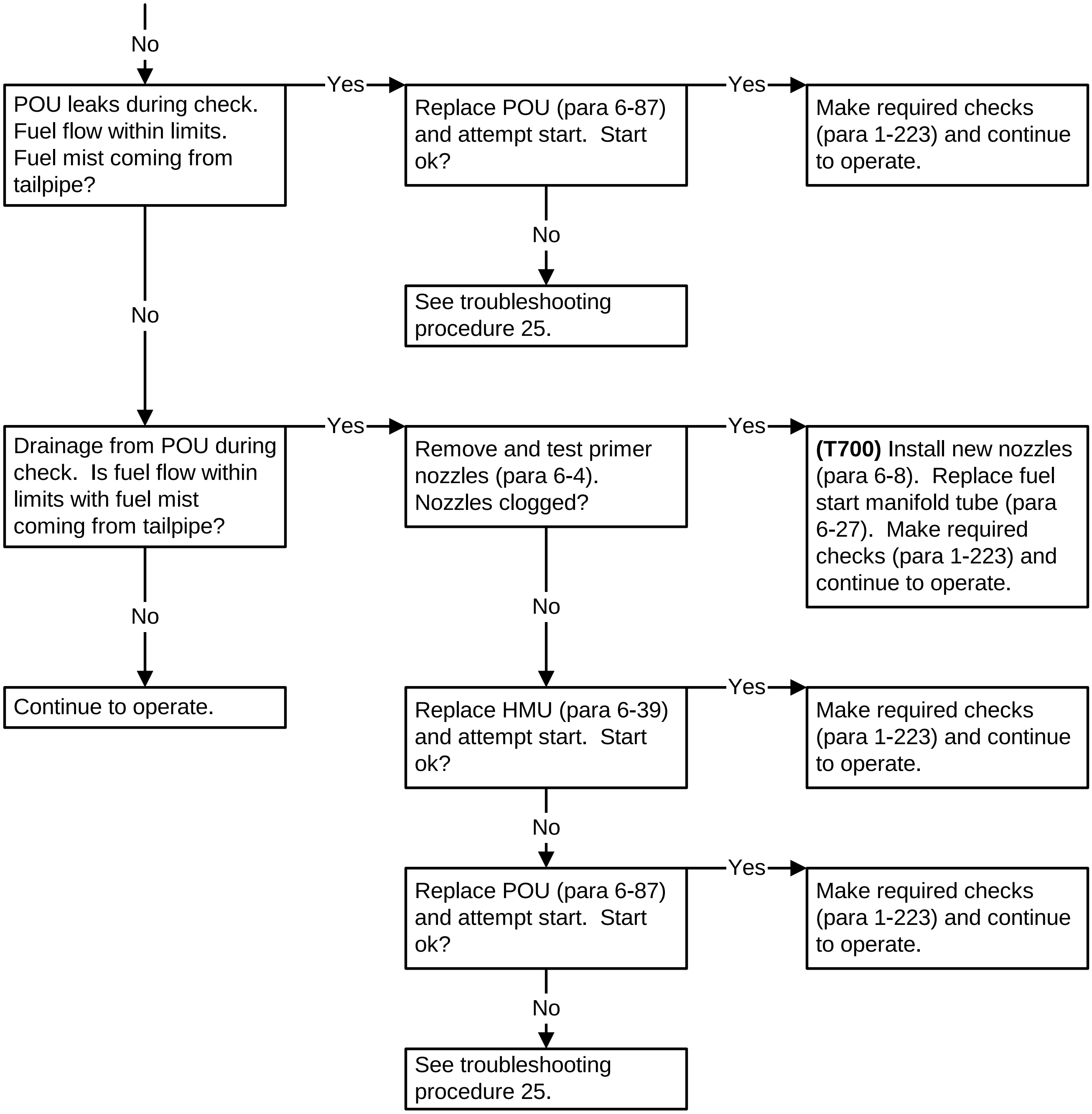
Make fuel system troubleshooting checks (para 1-258). Fuel flow low (out-of-limits). Fuel mist coming from tailpipe?

Repair HMU (para 6-39) and attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 27. (T700) No Start (no fuel mist seen coming from tailpipe; no rise in TGT) (Cont)



POU leaks during check. Fuel flow within limits. Fuel mist coming from tailpipe?

Replace POU (para 6-87) and attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

See troubleshooting procedure 25.

Drainage from POU during check. Is fuel flow within limits with fuel mist coming from tailpipe?

Remove and test primer nozzles (para 6-4). Nozzles clogged?

(T700) Install new nozzles (para 6-8). Replace fuel start manifold tube (para 6-27). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Replace HMU (para 6-39) and attempt start. Start ok?

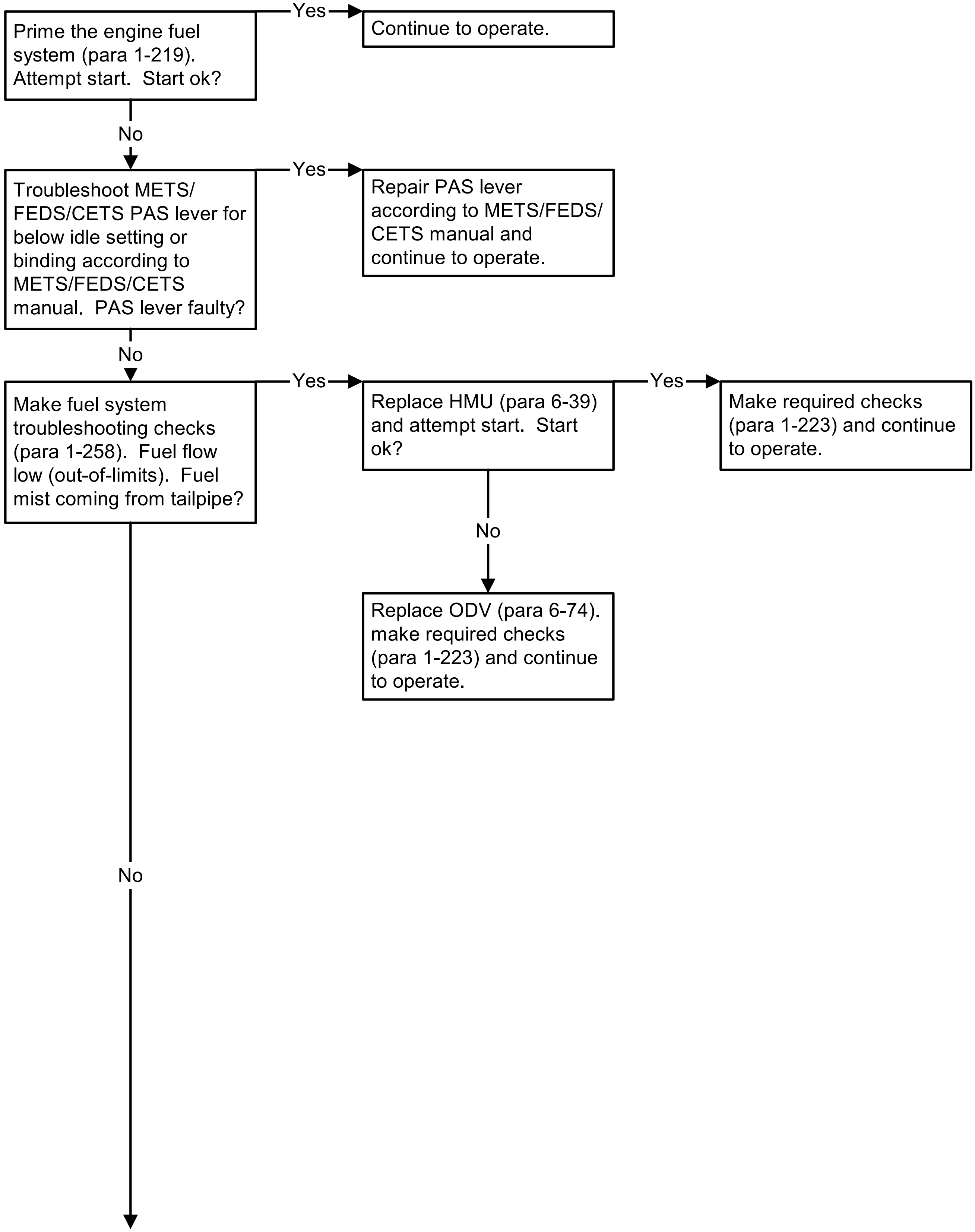
Make required checks (para 1-223) and continue to operate.

Replace POU (para 6-87) and attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

See troubleshooting procedure 25.

Troubleshooting Procedure 28. (T701, T701C, T701D) No Start (no fuel mist seen coming from tailpipe; no rise in TGT)



Prime the engine fuel system (para 1-219). Attempt start. Start ok?

Continue to operate.

Troubleshoot METS/FEDS/CETS PAS lever for below idle setting or binding according to METS/FEDS/CETS manual. PAS lever faulty?

Repair PAS lever according to METS/FEDS/CETS manual and continue to operate.

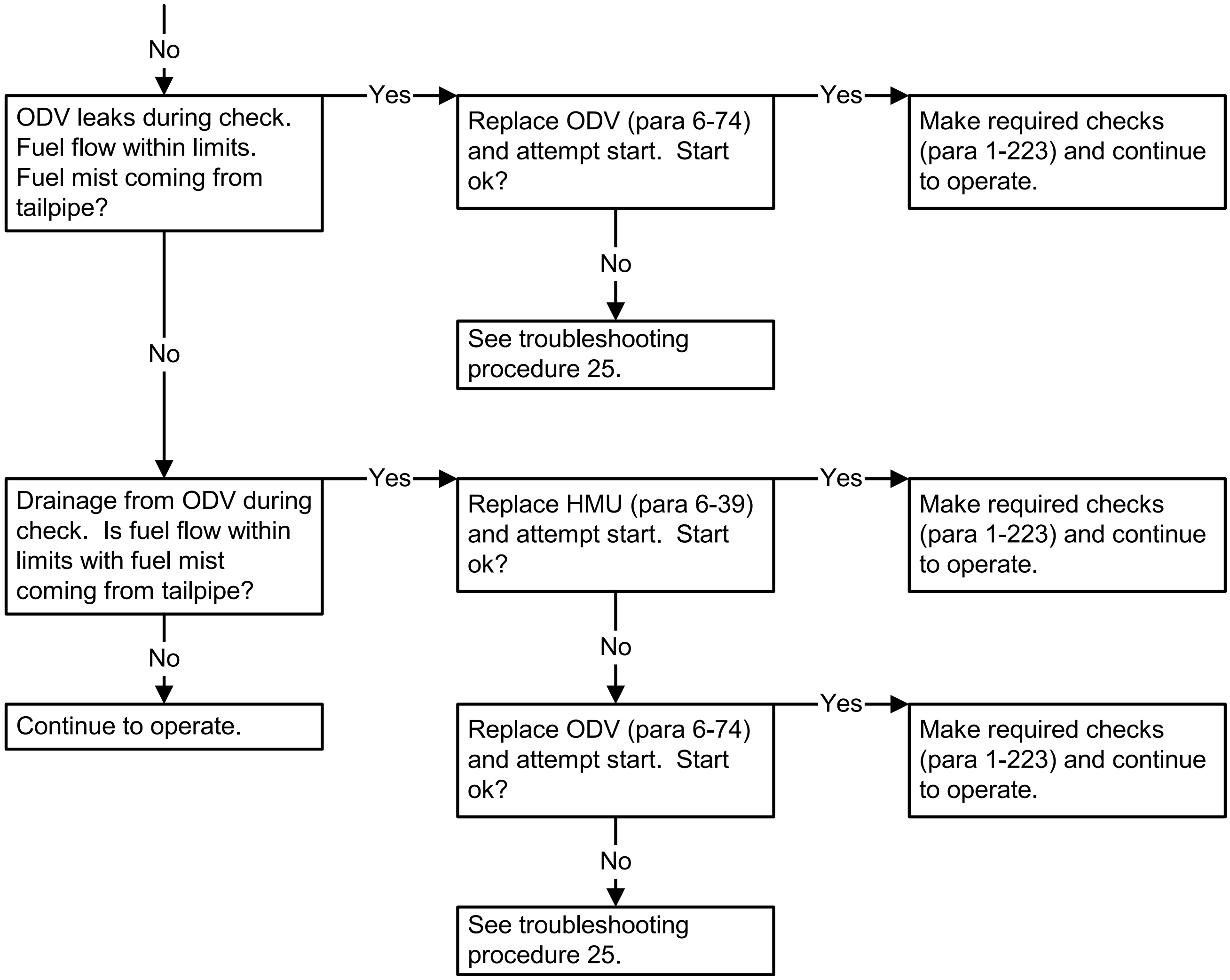
Make fuel system troubleshooting checks (para 1-258). Fuel flow low (out-of-limits). Fuel mist coming from tailpipe?

Replace HMU (para 6-39) and attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

Replace ODV (para 6-74). make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 28. (T701, T701C, T701D) No Start (no fuel mist seen coming from tailpipe; no rise in TGT) (Cont)



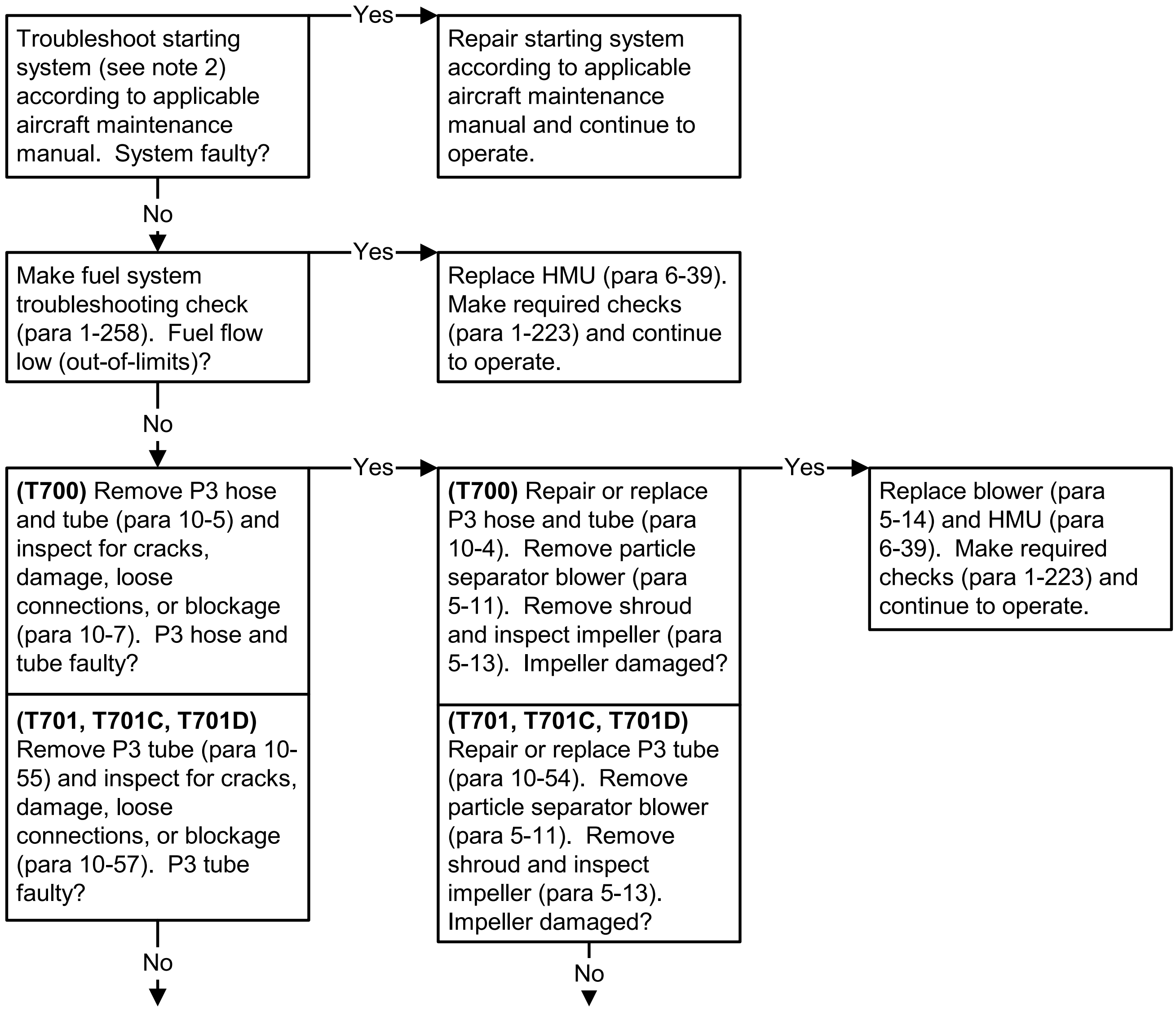
Troubleshooting Procedure 29. Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and ground idle speed.)

NOTE 1

- If anti-icing bleed and start valve does not open, compressor will probably stall at about 40% Ng (17,880 RPM). When compressor stalls, a rumble or bang will be heard, but TGT may not rise.
- If an unusually high-pitched whining sound is heard, see paragraph 1-273.

NOTE 2

Starting system should be able to motor engine to at least 24% Ng (10,728 RPM). Starter must not cut out below 52% Ng (23,244 RPM). This can be checked by using test panel instruments.



Troubleshoot starting system (see note 2) according to applicable aircraft maintenance manual. System faulty?

Yes

Repair starting system according to applicable aircraft maintenance manual and continue to operate.

No

Make fuel system troubleshooting check (para 1-258). Fuel flow low (out-of-limits)?

Yes

Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

No

(T700) Remove P3 hose and tube (para 10-5) and inspect for cracks, damage, loose connections, or blockage (para 10-7). P3 hose and tube faulty?

(T701, T701C, T701D) Remove P3 tube (para 10-55) and inspect for cracks, damage, loose connections, or blockage (para 10-57). P3 tube faulty?

Yes

(T700) Repair or replace P3 hose and tube (para 10-4). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

(T701, T701C, T701D) Repair or replace P3 tube (para 10-54). Remove particle separator blower (para 5-11). Remove shroud and inspect impeller (para 5-13). Impeller damaged?

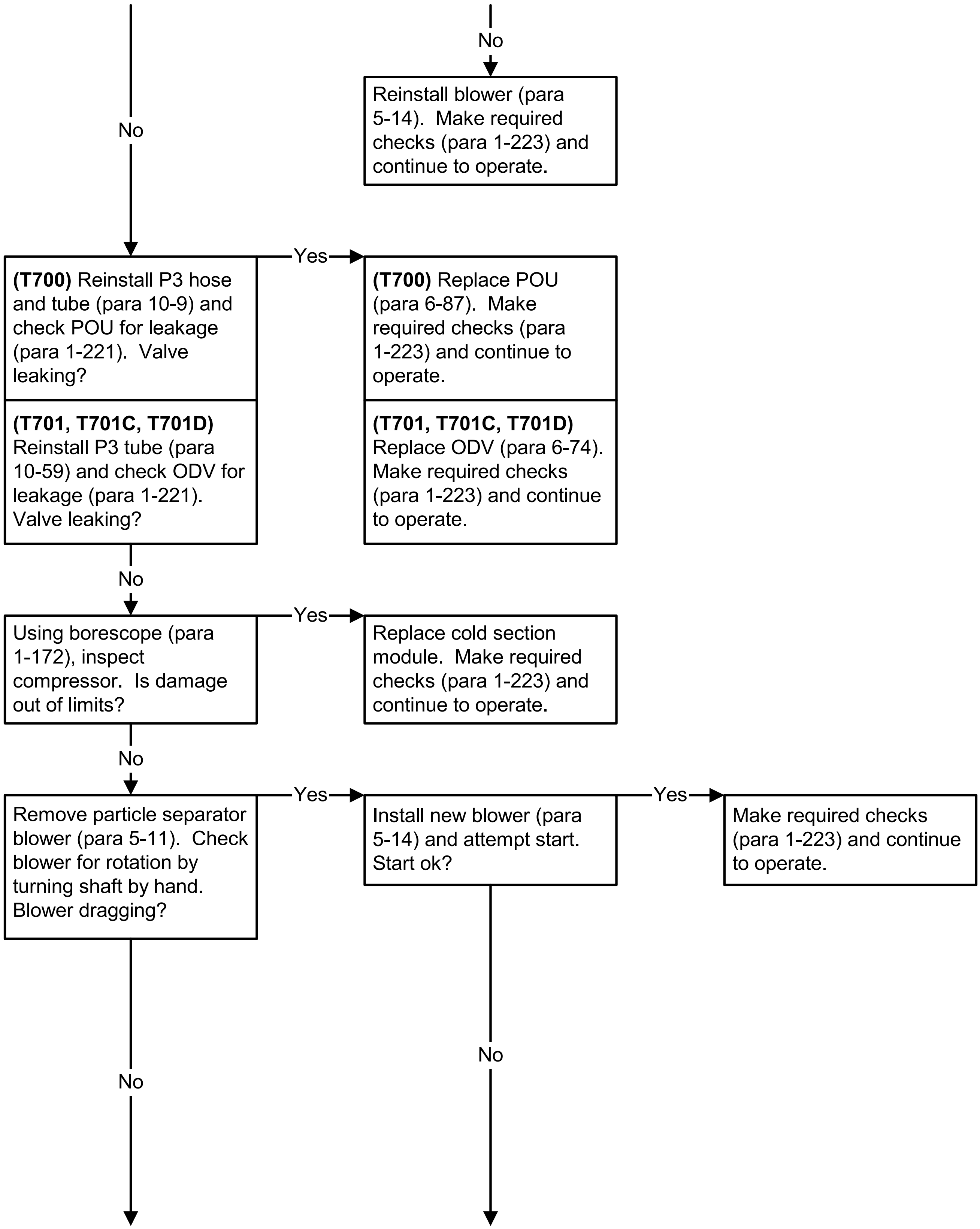
Yes

Replace blower (para 5-14) and HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

No

No

Troubleshooting Procedure 29. Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and ground idle speed.) (Cont)



Reinstall blower (para 5-14). Make required checks (para 1-223) and continue to operate.

(T700) Reinstall P3 hose and tube (para 10-9) and check POU for leakage (para 1-221). Valve leaking?

(T701, T701C, T701D) Reinstall P3 tube (para 10-59) and check ODV for leakage (para 1-221). Valve leaking?

(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

Using borescope (para 1-172), inspect compressor. Is damage out of limits?

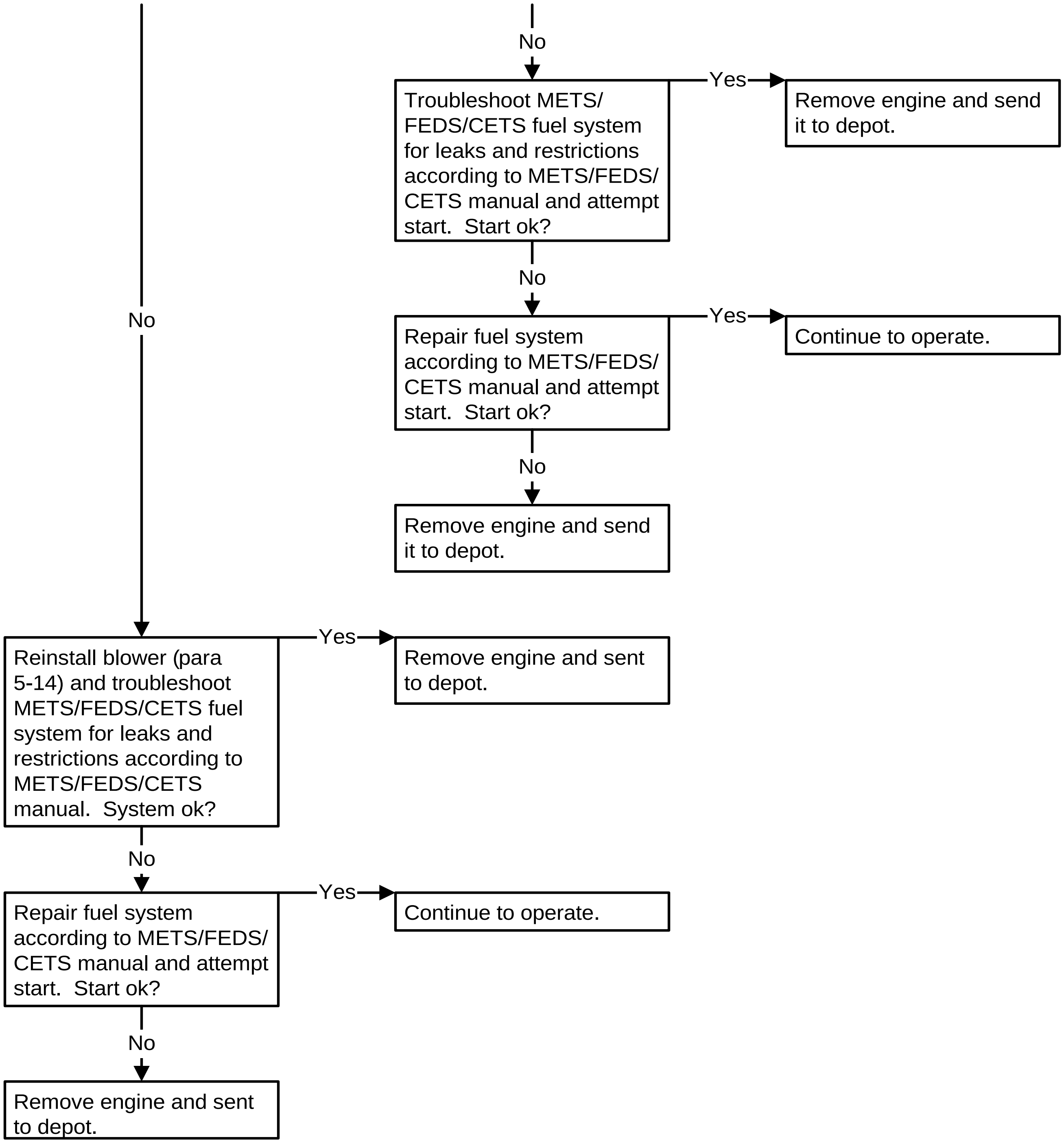
Replace cold section module. Make required checks (para 1-223) and continue to operate.

Remove particle separator blower (para 5-11). Check blower for rotation by turning shaft by hand. Blower dragging?

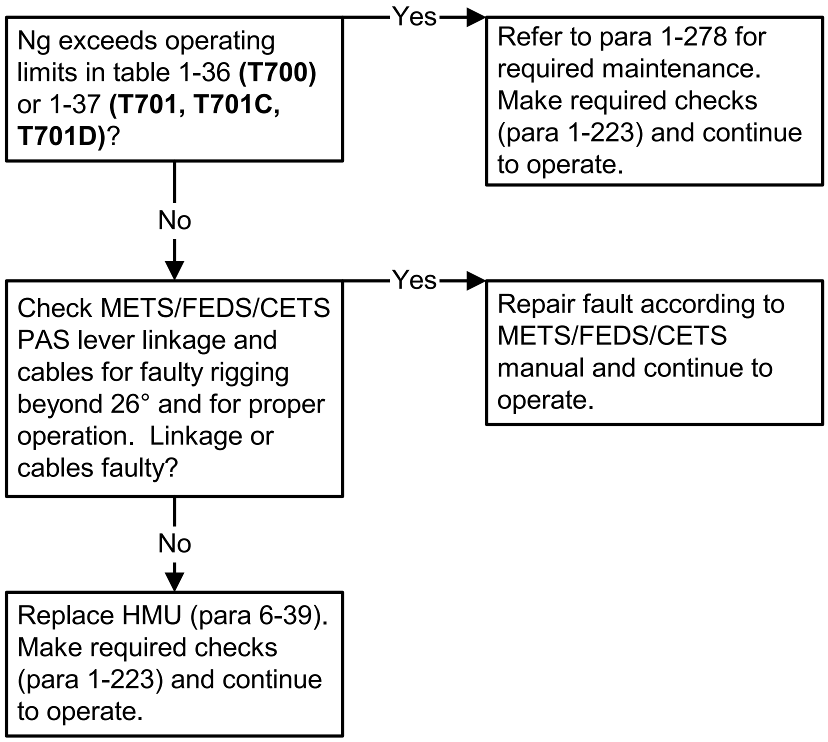
Install new blower (para 5-14) and attempt start. Start ok?

Make required checks (para 1-223) and continue to operate.

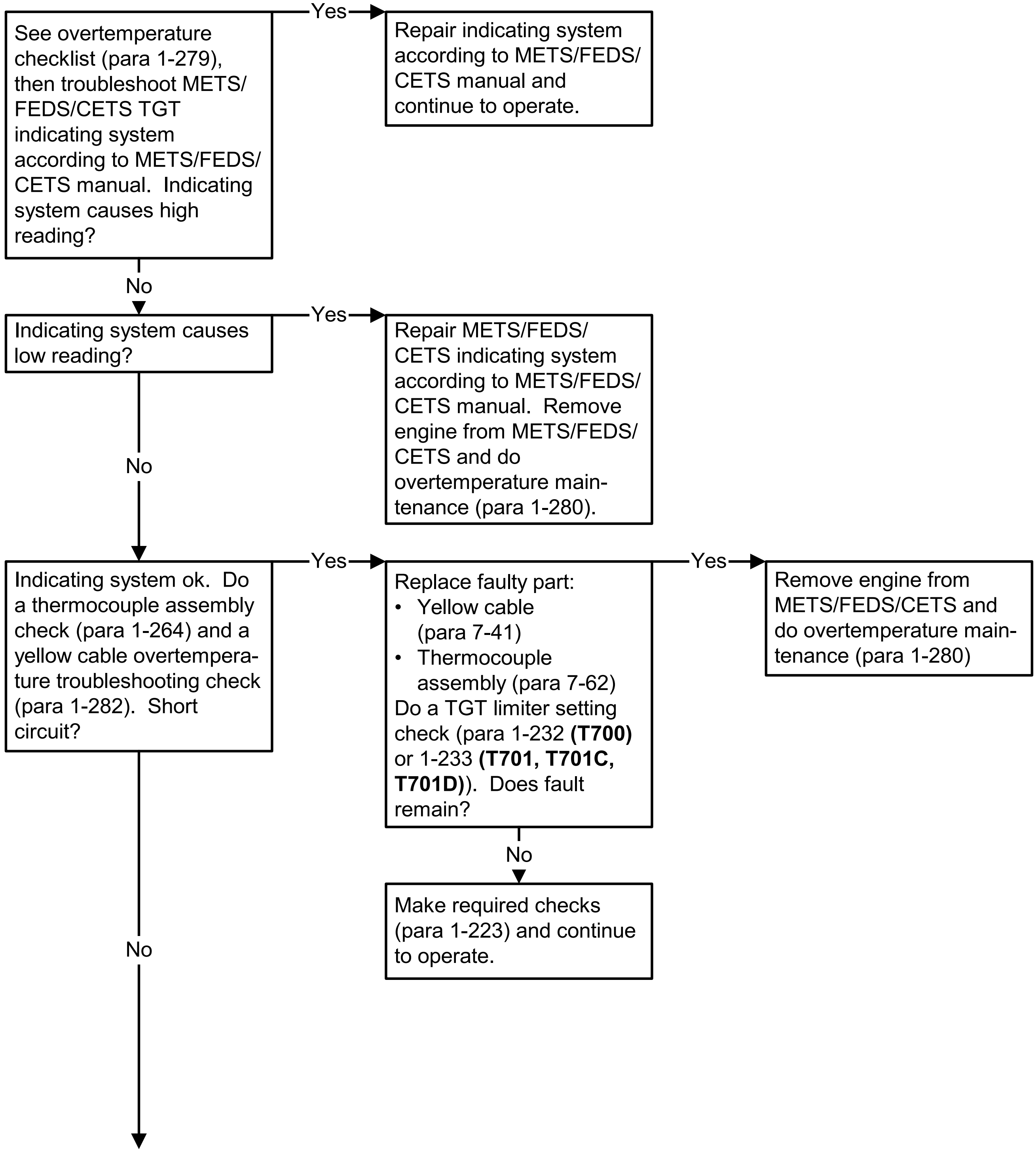
Troubleshooting Procedure 29. Slow or Hung Start (TGT increases but hangs) (On a hung start, engine lights off but does not accelerate to idle speed. Speed hangs up between lightoff and ground idle speed.) (Cont)



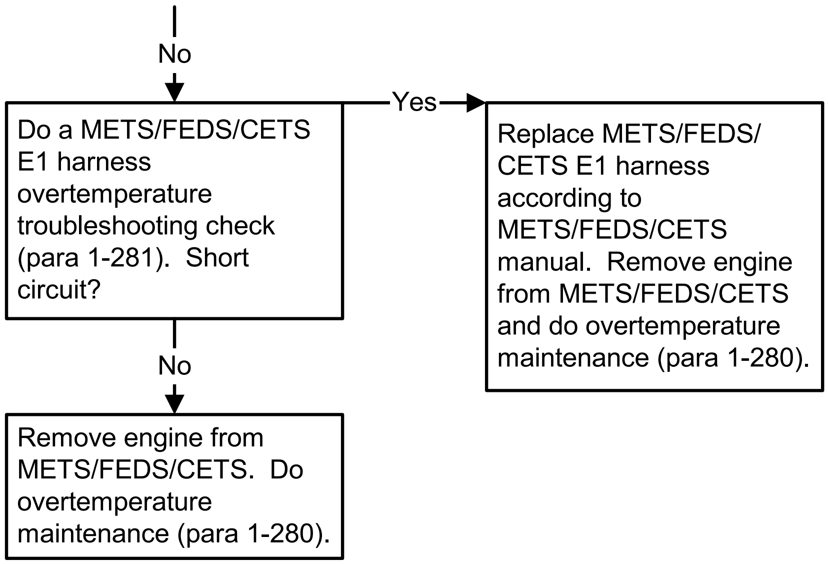
Troubleshooting Procedure 30. Uncontrolled Accleration (Ng) (gas generator speed continues to accelerate beyond ground idle speed)



Troubleshooting Procedure 31. Engine Exceeds TGT Operating Limits and is in “Overtemperature Maintenance Required” Area of Figure: (T700) Figure 1-151 or 1-154, (T701) Figure 1-152 or 1-155, or (T701C, T701D) Figure 1-153 or 1-156



Troubleshooting Procedure 31. Engine Exceeds TGT Operating Limits and is in "Overtemperature Maintenance Required" Area of Figure: (T700) Figure 1-151 or 1-154, (T701) Figure 1-152 or 1-155, or (T701C, T701D) Figure 1-153 or 1-156

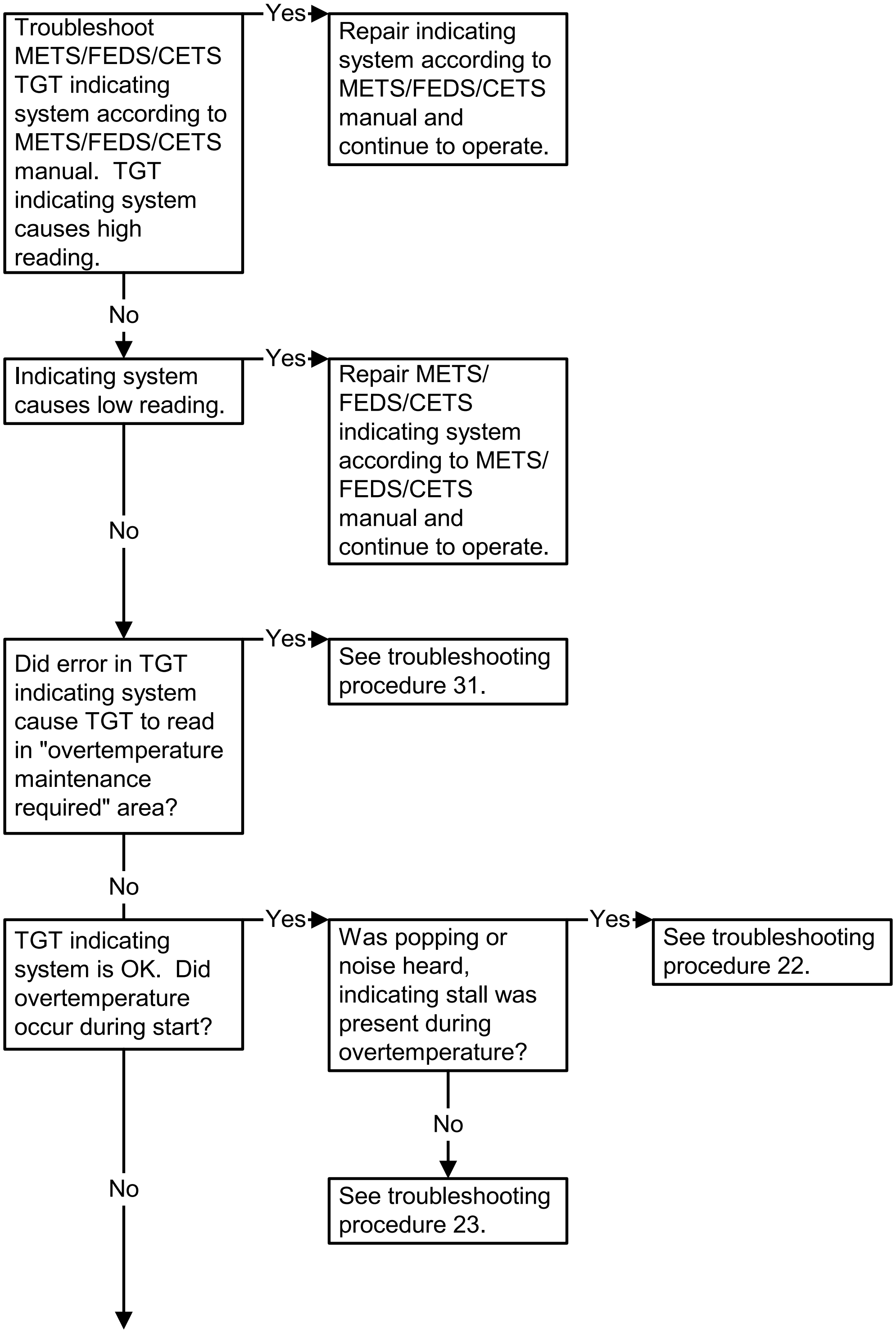


Do a METS/FEDS/CETS E1 harness overtemperature troubleshooting check (para 1-281). Short circuit?

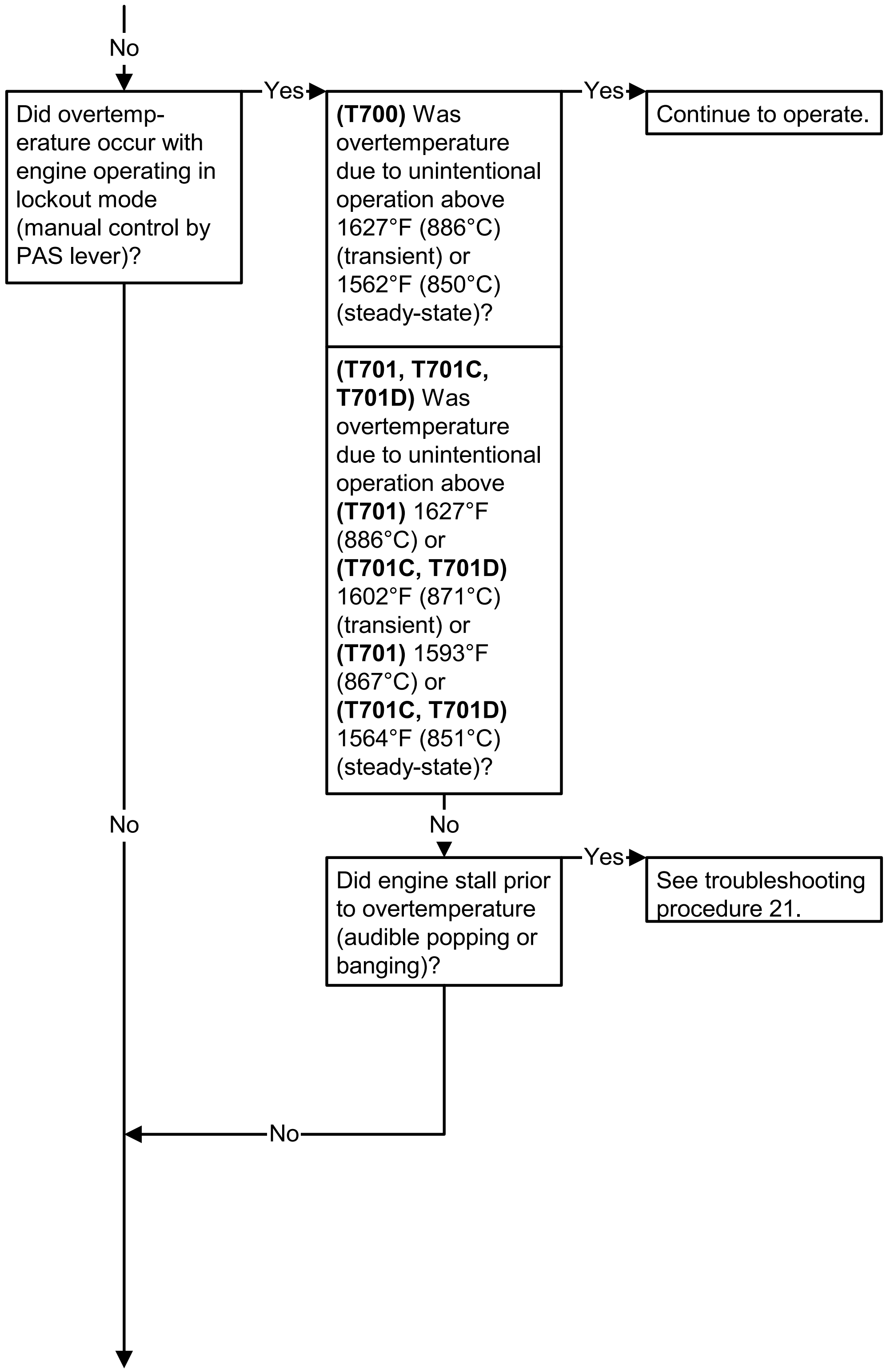
Replace METS/FEDS/CETS E1 harness according to METS/FEDS/CETS manual. Remove engine from METS/FEDS/CETS and do overtemperature maintenance (para 1-280).

Remove engine from METS/FEDS/CETS. Do overtemperature maintenance (para 1-280).

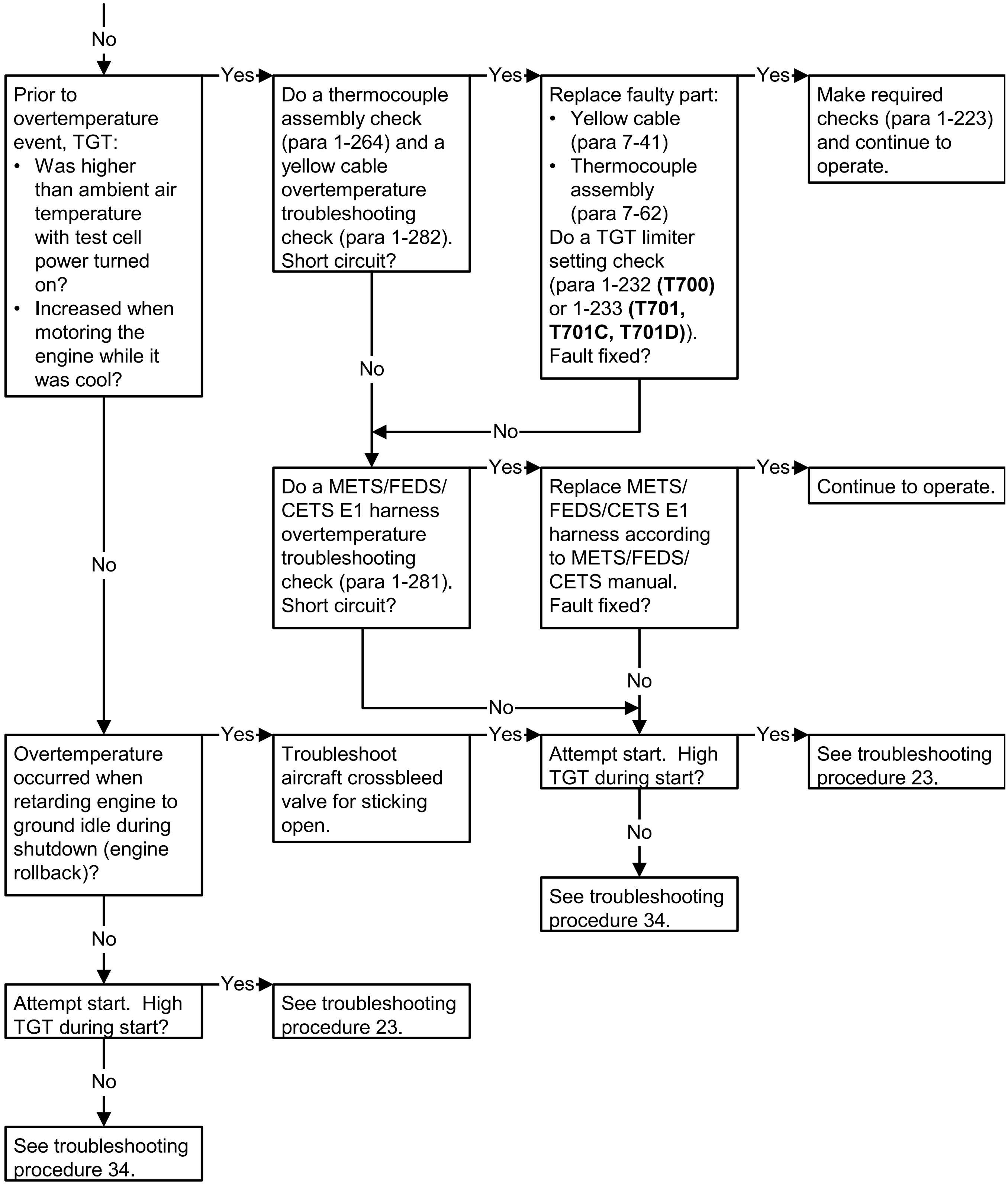
Troubleshooting Procedure 32. Engine Exceeds TGT Operating Limits in “Troubleshoot” Area of Figure: (T700) Figure 1-151 or 1-154, (T701) Figure 1-152 or 1-155, or (T701C, T701D) Figure 1-153 or 1-156



Troubleshooting Procedure 32. Engine Exceeds TGT Operating Limits in "Troubleshoot" Area of Figure: (T700) Figure 1-151 or 1-154, (T701) Figure 1-152 or 1-155, or (T701C, T701D) Figure 1-153 or 1-156



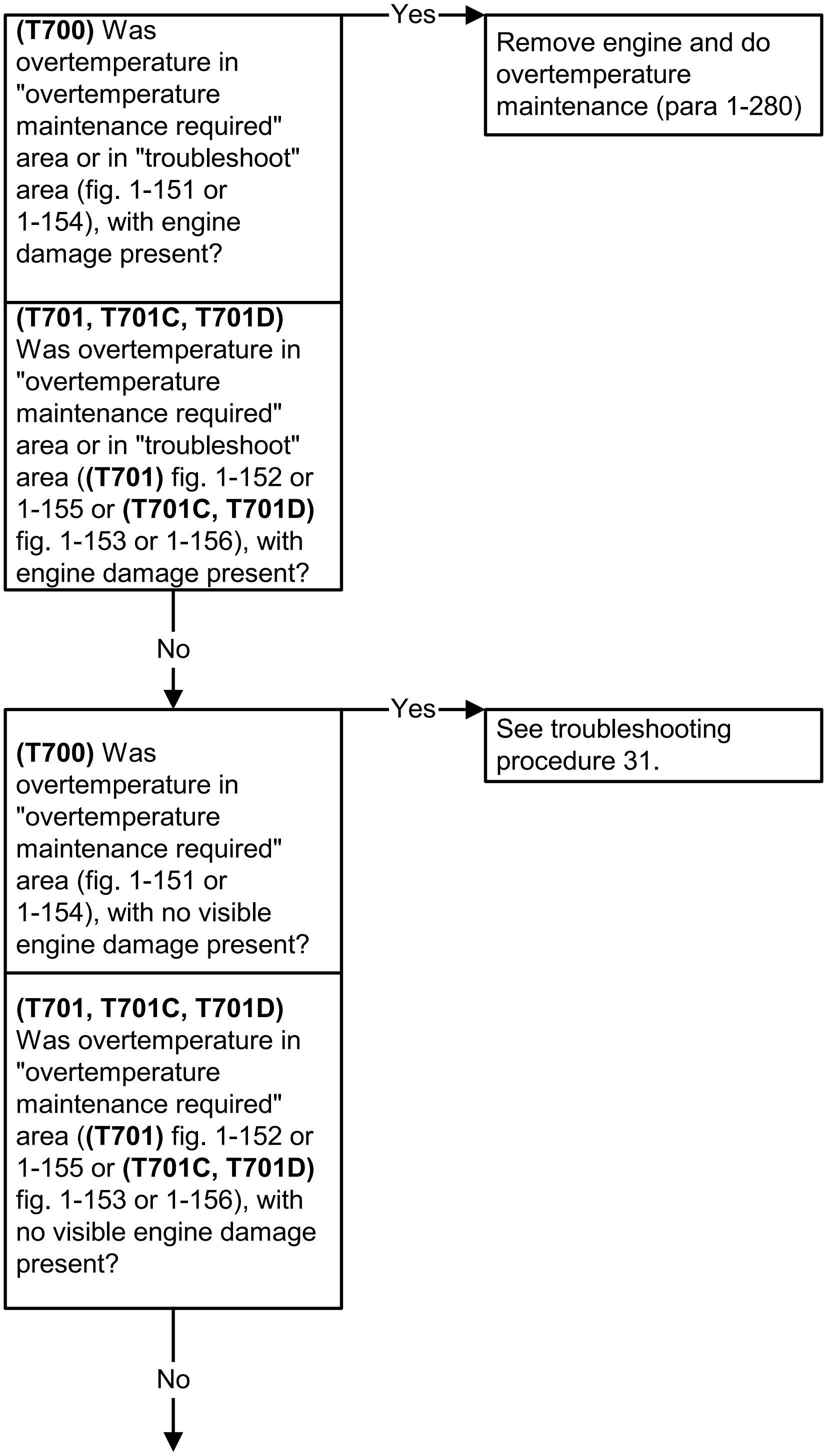
Troubleshooting Procedure 32. Engine Exceeds TGT Operating Limits in "Troubleshoot" Area of Figure: (T700) Figure 1-151 or 1-154, (T701) Figure 1-152 or 1-155, or (T701C, T701D) Figure 1-153 or 1-156



Troubleshooting Procedure 33. Engine Overtemperature (exceeds TGT operating limits)

NOTE

See overtemperature checklist (para 1-279) before troubleshooting.



(T700) Was overtemperature in "overtemperature maintenance required" area or in "troubleshoot" area (fig. 1-151 or 1-154), with engine damage present?

(T701, T701C, T701D) Was overtemperature in "overtemperature maintenance required" area or in "troubleshoot" area (**(T701)** fig. 1-152 or 1-155 or **(T701C, T701D)** fig. 1-153 or 1-156), with engine damage present?

Yes → Remove engine and do overtemperature maintenance (para 1-280)

No ↓

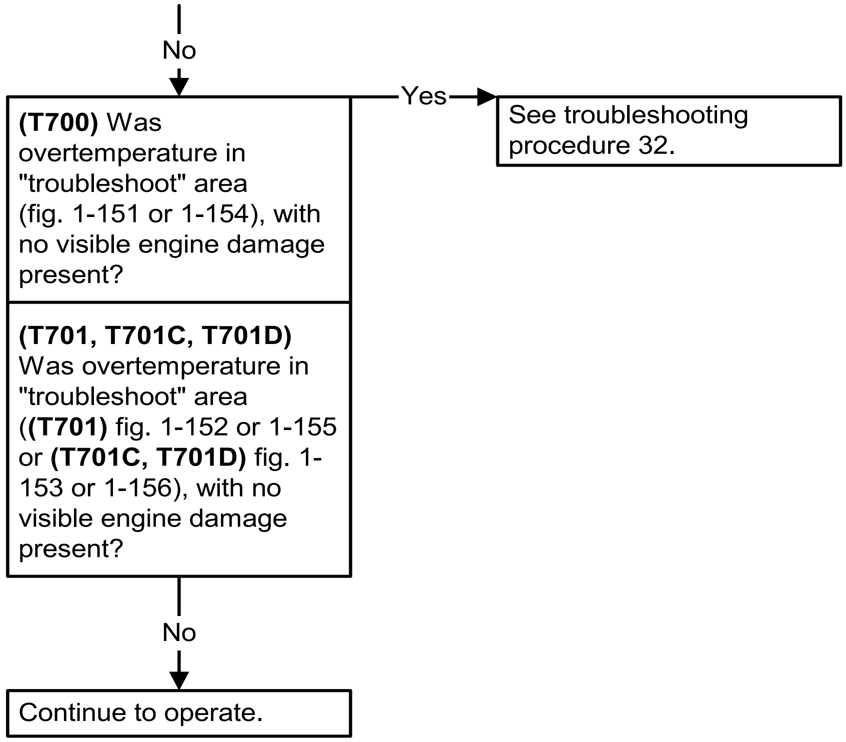
(T700) Was overtemperature in "overtemperature maintenance required" area (fig. 1-151 or 1-154), with no visible engine damage present?

(T701, T701C, T701D) Was overtemperature in "overtemperature maintenance required" area (**(T701)** fig. 1-152 or 1-155 or **(T701C, T701D)** fig. 1-153 or 1-156), with no visible engine damage present?

Yes → See troubleshooting procedure 31.

No ↓

Troubleshooting Procedure 33. Engine Overtemperature (exceeds TGT operating limits) (Cont)



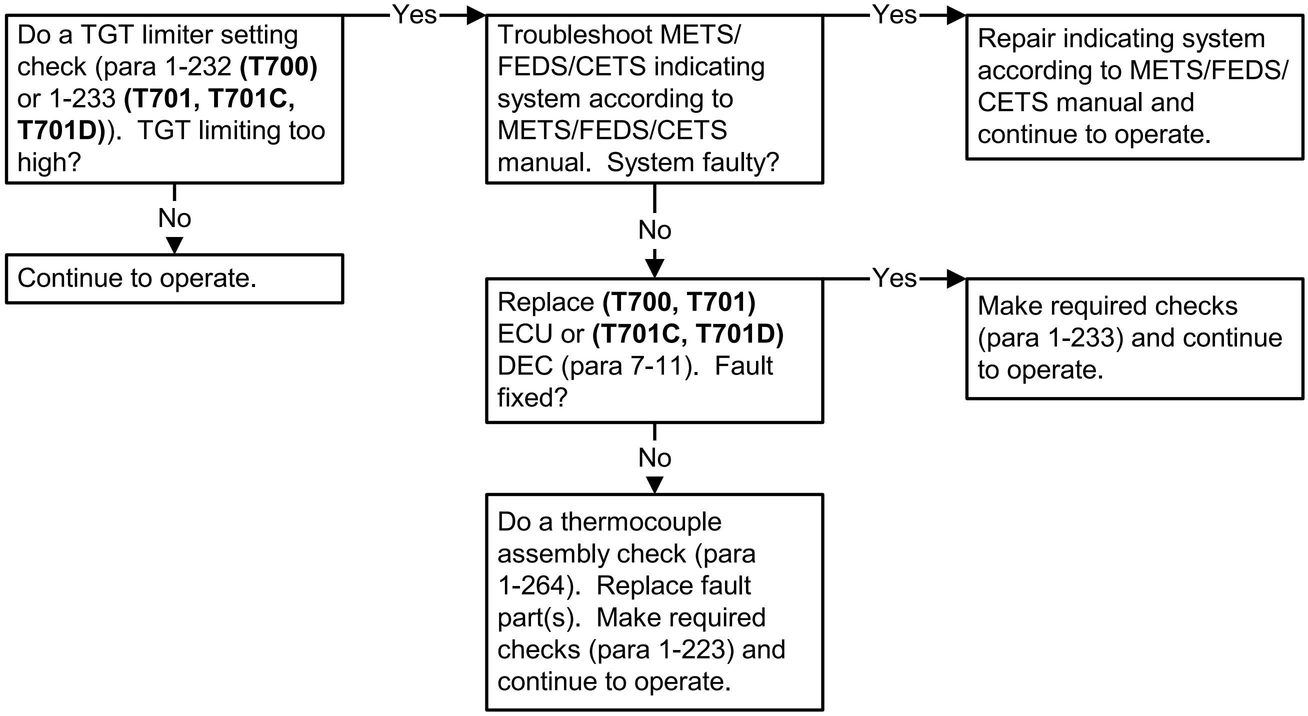
(T700) Was overtemperature in "troubleshoot" area (fig. 1-151 or 1-154), with no visible engine damage present?

(T701, T701C, T701D) Was overtemperature in "troubleshoot" area (**(T701)** fig. 1-152 or 1-155 or **(T701C, T701D)** fig. 1-153 or 1-156), with no visible engine damage present?

See troubleshooting procedure 32.

Continue to operate.

Troubleshooting Procedure 34. TGT Exceeds Limiter Setting (TGT exceeds (T700, T701) ECU or (T701C, T701D) DEC limiter setting at T0 above (T700, T701) 40°F (4°C) or (T701C, T701D) 7°F (–14°C))



Do a TGT limiter setting check (para 1-232 **(T700)** or 1-233 **(T701, T701C, T701D)**). TGT limiting too high?

Continue to operate.

Troubleshoot METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual. System faulty?

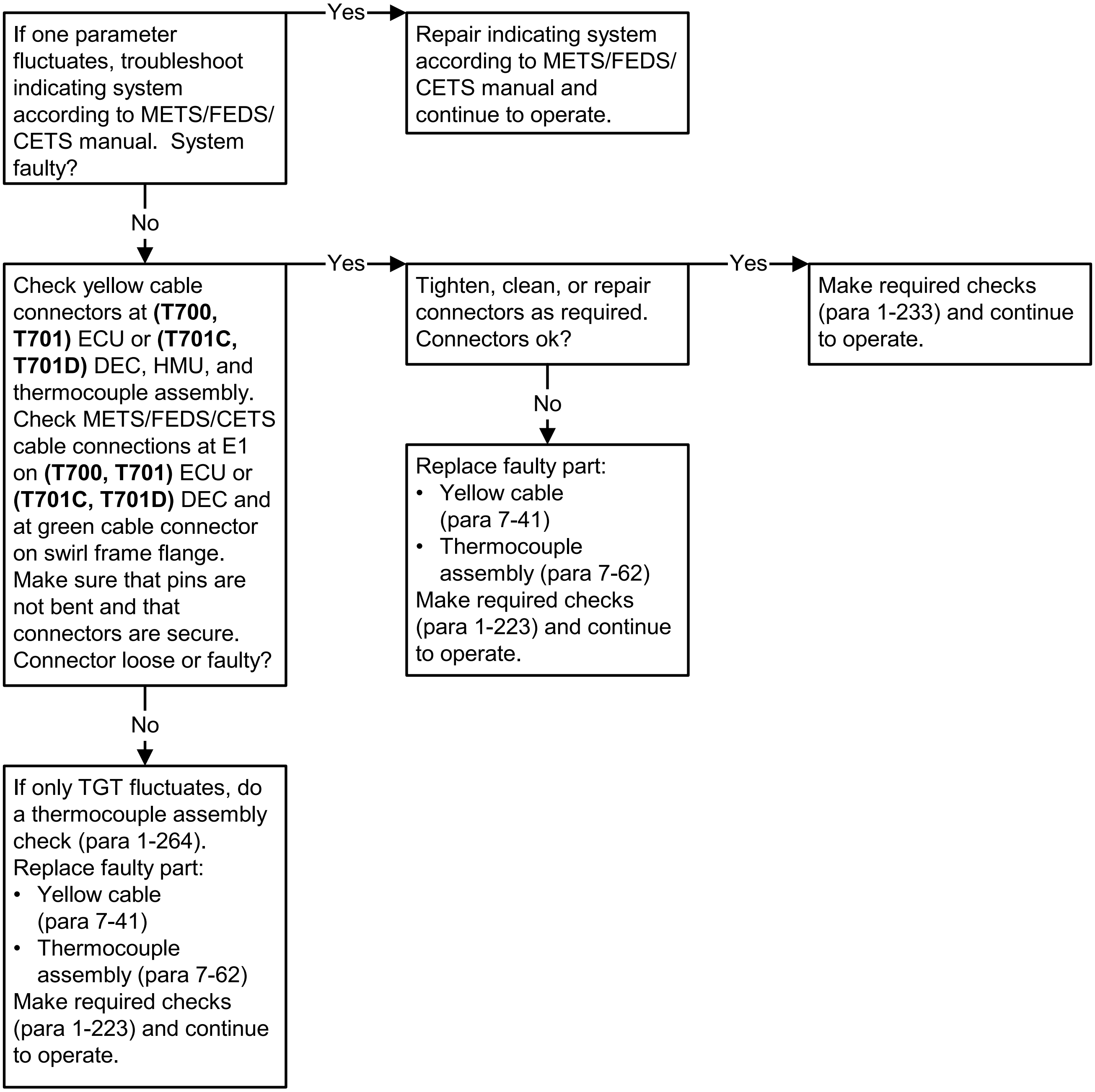
Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Fault fixed?

Make required checks (para 1-233) and continue to operate.

Do a thermocouple assembly check (para 1-264). Replace fault part(s). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 35. TGT Fluctuates at Ground Idle Speed (idle speed or TGT drifts above and below limits)



If one parameter fluctuates, troubleshoot indicating system according to METS/FEDS/CETS manual. System faulty?

Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Check yellow cable connectors at **(T700, T701)** ECU or **(T701C, T701D)** DEC, HMU, and thermocouple assembly. Check METS/FEDS/CETS cable connections at E1 on **(T700, T701)** ECU or **(T701C, T701D)** DEC and at green cable connector on swirl frame flange. Make sure that pins are not bent and that connectors are secure. Connector loose or faulty?

Tighten, clean, or repair connectors as required. Connectors ok?

Make required checks (para 1-233) and continue to operate.

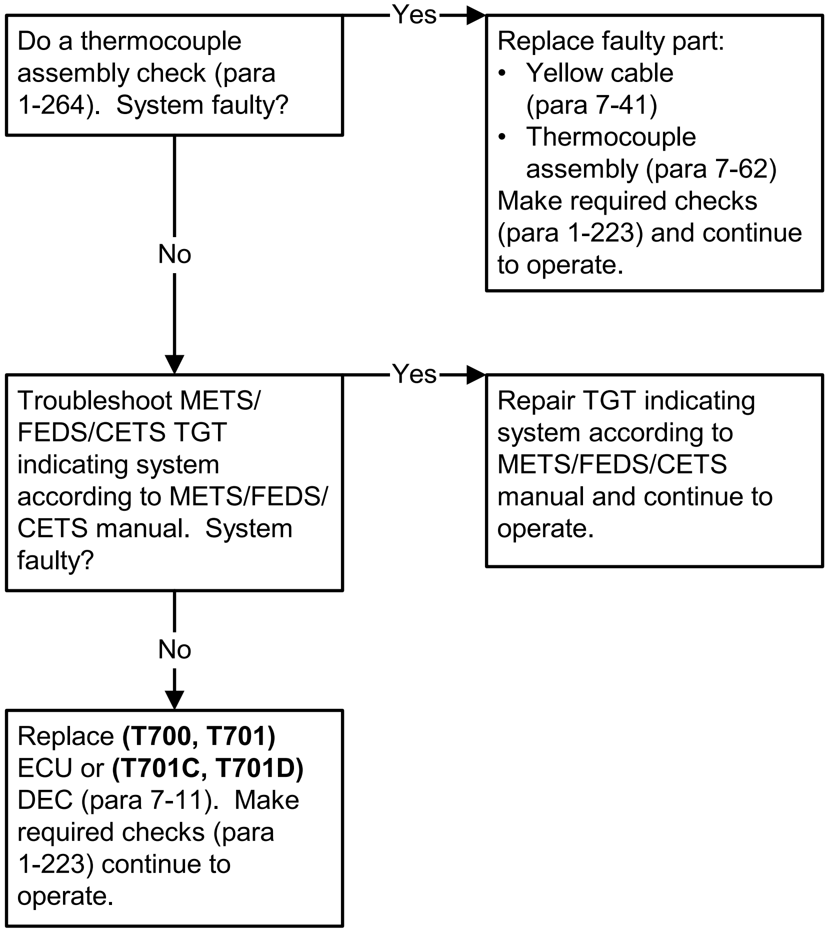
Replace faulty part:
- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Make required checks (para 1-223) and continue to operate.

If only TGT fluctuates, do a thermocouple assembly check (para 1-264). Replace faulty part:
- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 36. TGT Instrument Fluctuating or Not Indicating (all other instruments normal)



Do a thermocouple assembly check (para 1-264). System faulty?

Replace faulty part:

- Yellow cable (para 7-41)
- Thermocouple assembly (para 7-62)

Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS TGT indicating system according to METS/FEDS/CETS manual. System faulty?

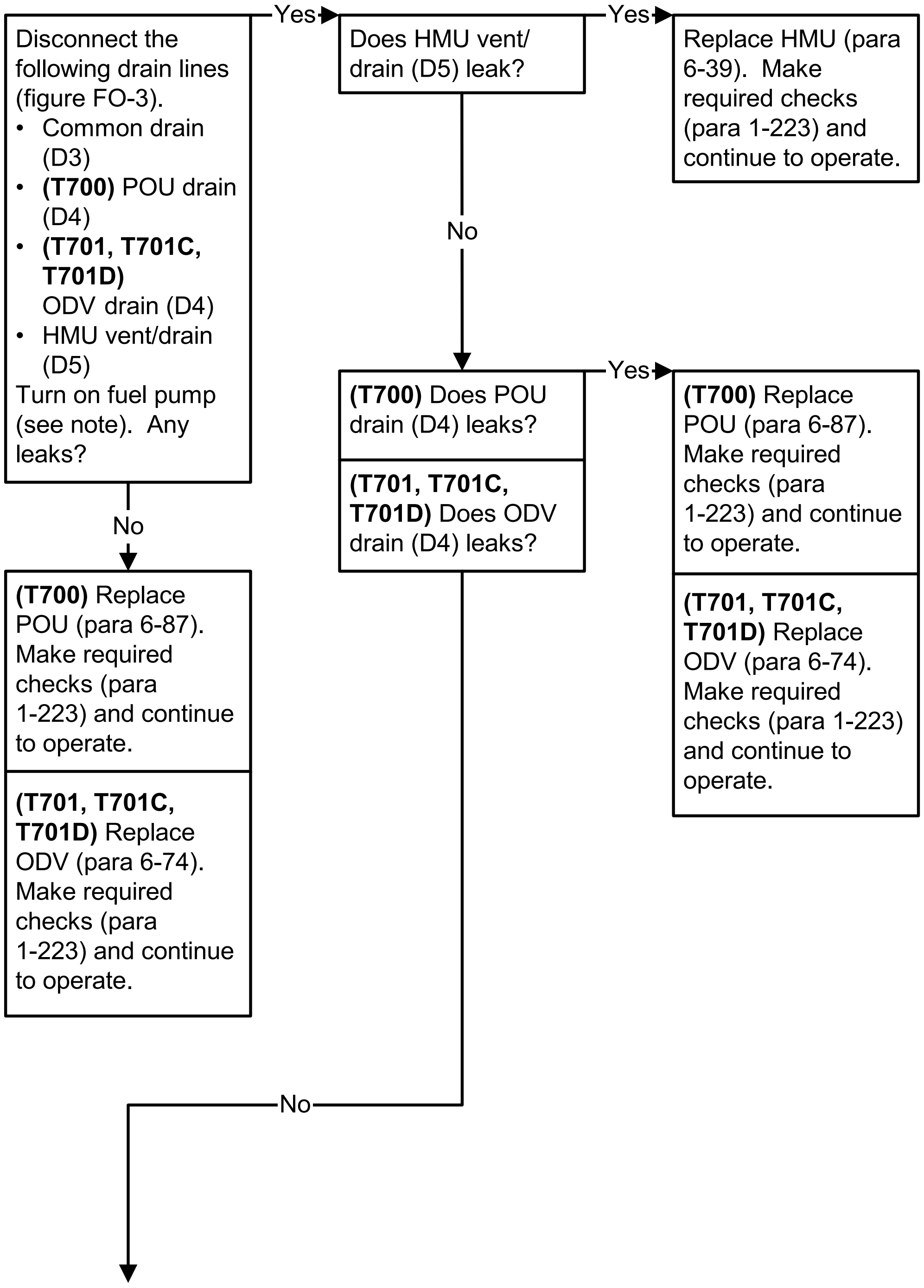
Repair TGT indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) continue to operate.

Troubleshooting Procedure 37. Excessive Fuel Leaking from Overboard Drain While Engine is Operating at Ground Idle Speed

NOTE

Make sure that fuel pump circuit breaker is on an the PAS lever is at off position.



Disconnect the following drain lines (figure FO-3).
- Common drain (D3)
- **(T700)** POU drain (D4)
- **(T701, T701C, T701D)** ODV drain (D4)
- HMU vent/drain (D5)

Turn on fuel pump (see note). Any leaks?

Does HMU vent/ drain (D5) leak?

Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

(T700) Does POU drain (D4) leaks?

(T701, T701C, T701D) Does ODV drain (D4) leaks?

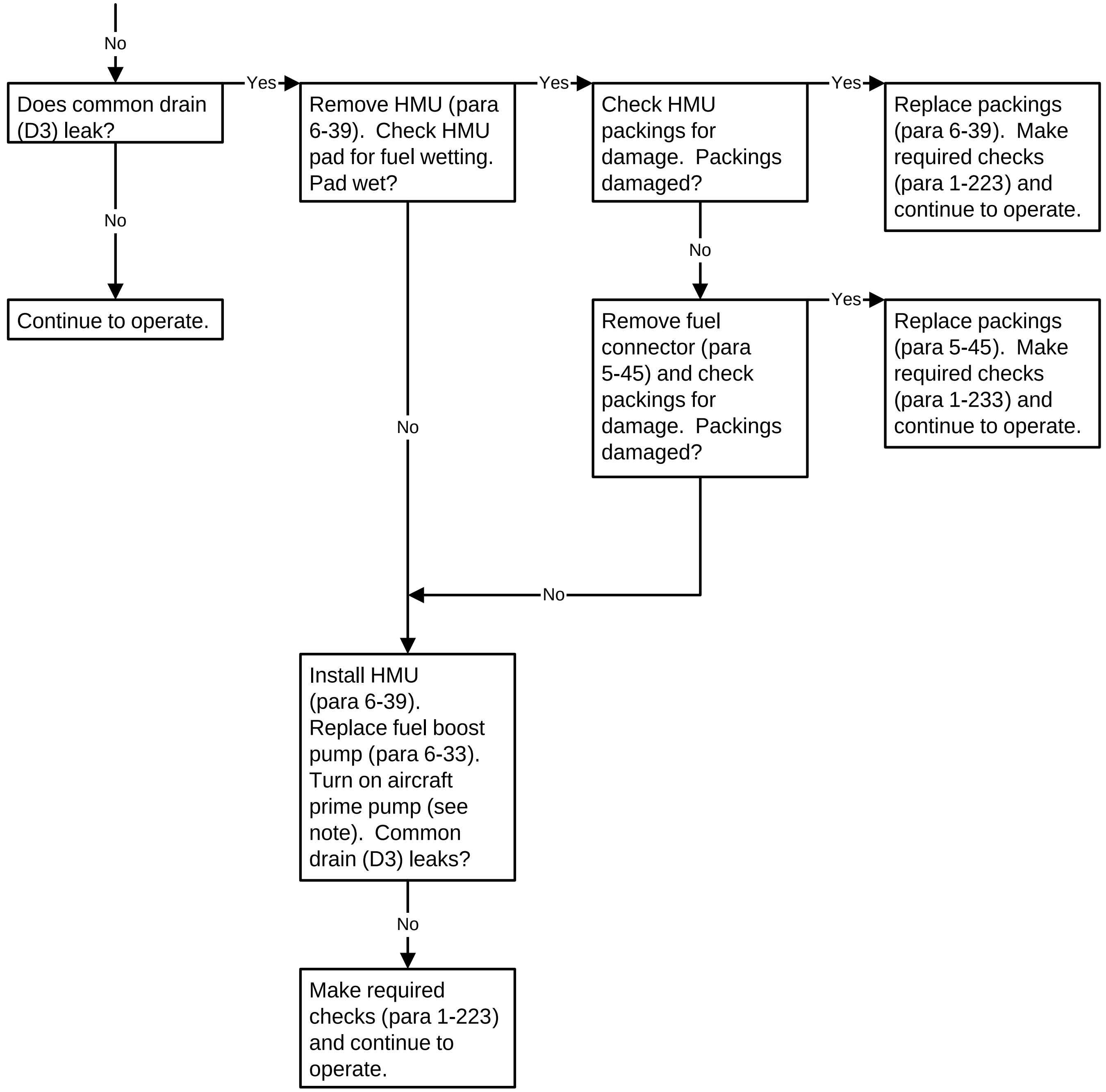
(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

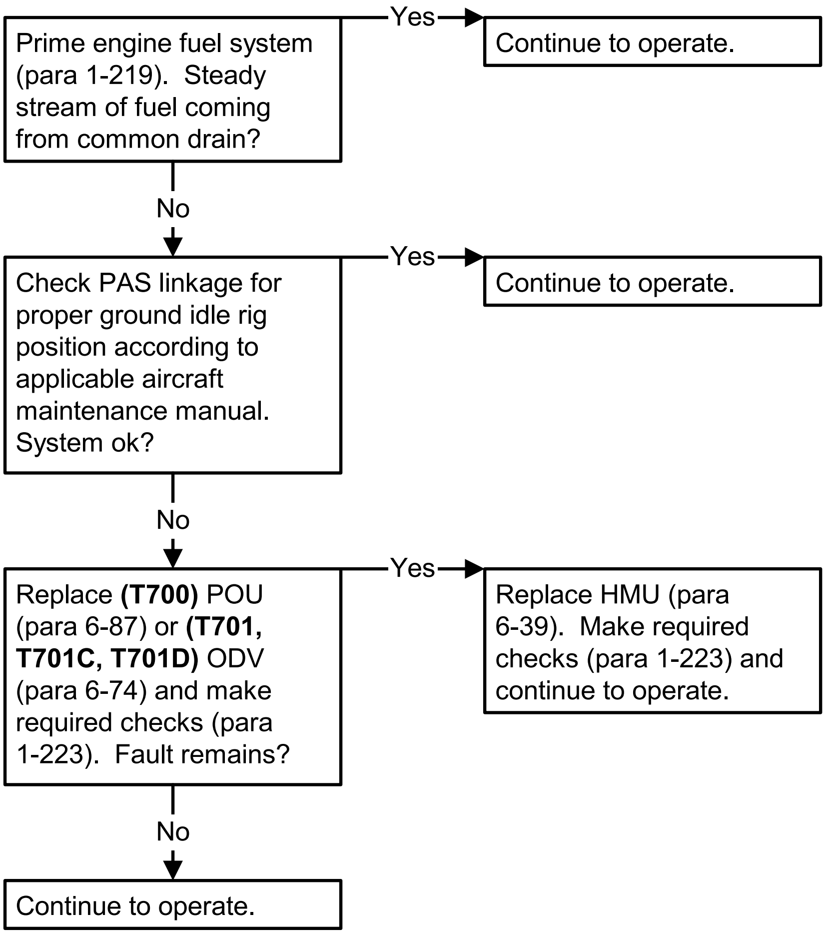
(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 37. Excessive Fuel Leaking from Overboard Drain While Engine is Operating at Ground Idle Speed (Cont)



Troubleshooting Procedure 38. No Fuel Mist Seen Coming from the Common Drain During Engine Prime or Vapor Vent



Prime engine fuel system (para 1-219). Steady stream of fuel coming from common drain?

Continue to operate.

Check PAS linkage for proper ground idle rig position according to applicable aircraft maintenance manual. System ok?

Continue to operate.

Replace **(T700)** POU (para 6-87) or **(T701, T701C, T701D)** ODV (para 6-74) and make required checks (para 1-223). Fault remains?

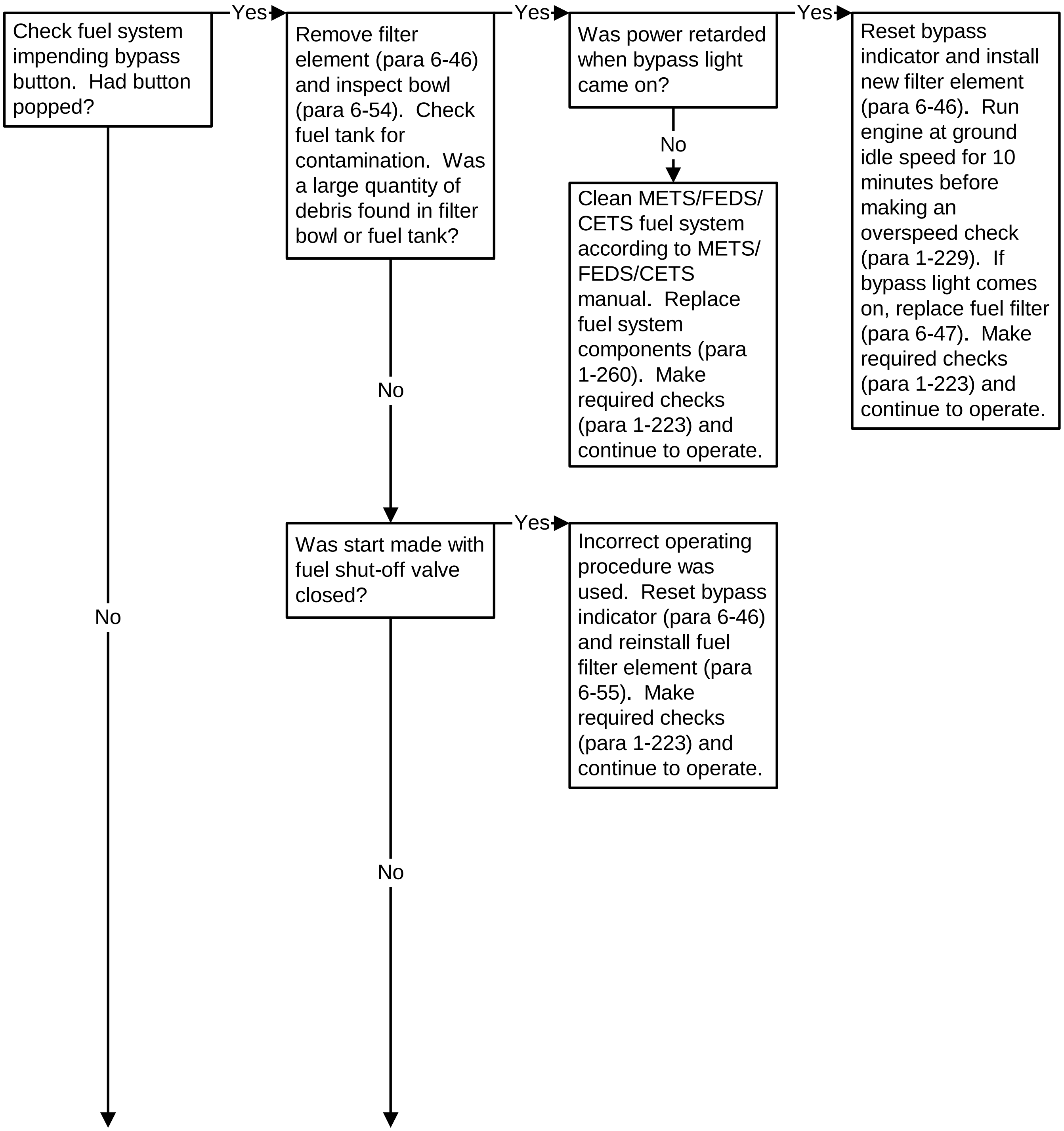
Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

Continue to operate.

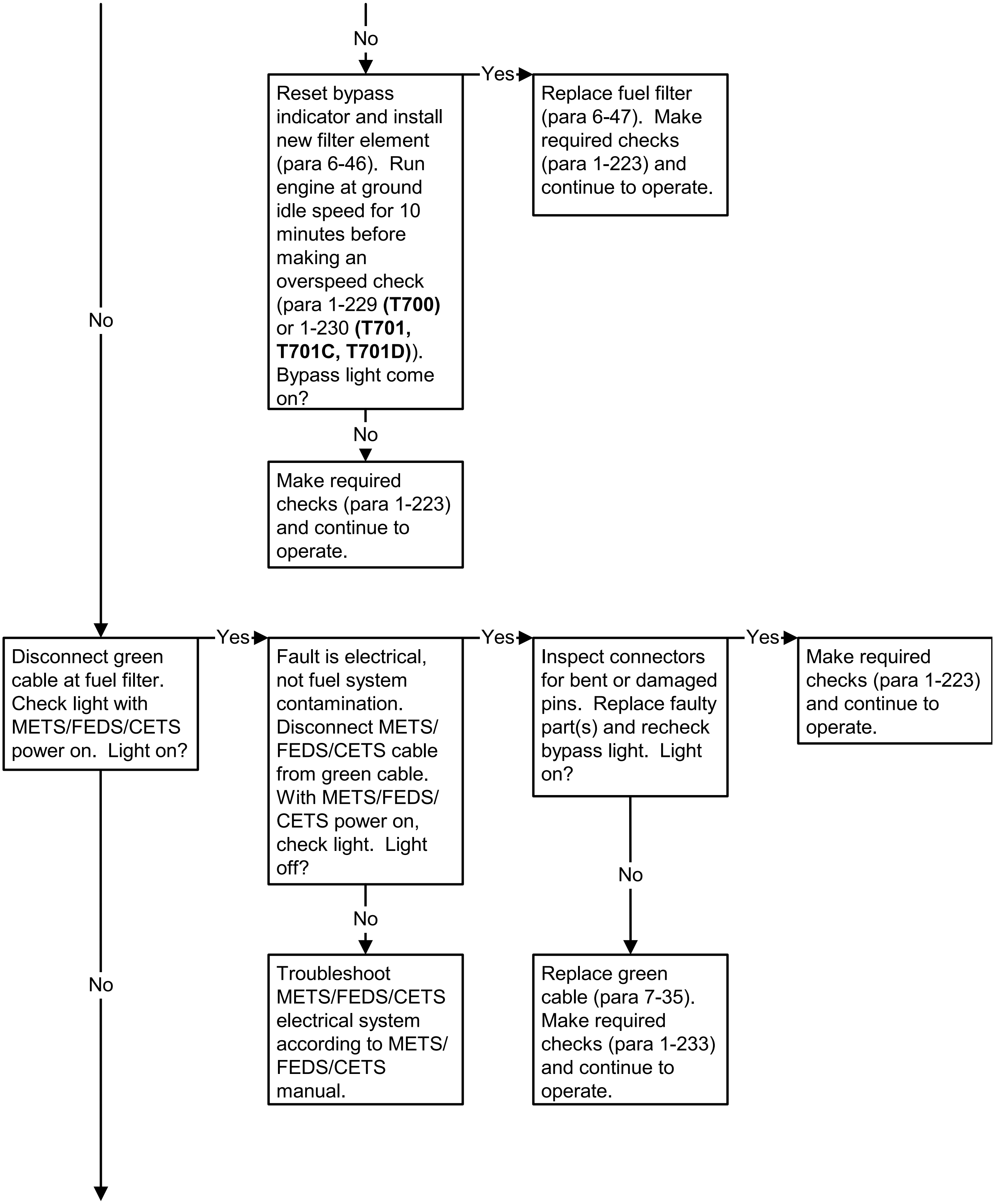
Troubleshooting Procedure 39. Fuel Filter Bypass Light ON

NOTE

If engine start is made improperly, with fuel shutoff valve closed, bypass light will come on.



Troubleshooting Procedure 39. Fuel Filter Bypass Light ON (Cont)



Reset bypass indicator and install new filter element (para 6-46). Run engine at ground idle speed for 10 minutes before making an overspeed check (para 1-229 **(T700)** or 1-230 **(T701, T701C, T701D)**). Bypass light come on?

Replace fuel filter (para 6-47). Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

Disconnect green cable at fuel filter. Check light with METS/FEDS/CETS power on. Light on?

Fault is electrical, not fuel system contamination. Disconnect METS/FEDS/CETS cable from green cable. With METS/FEDS/CETS power on, check light. Light off?

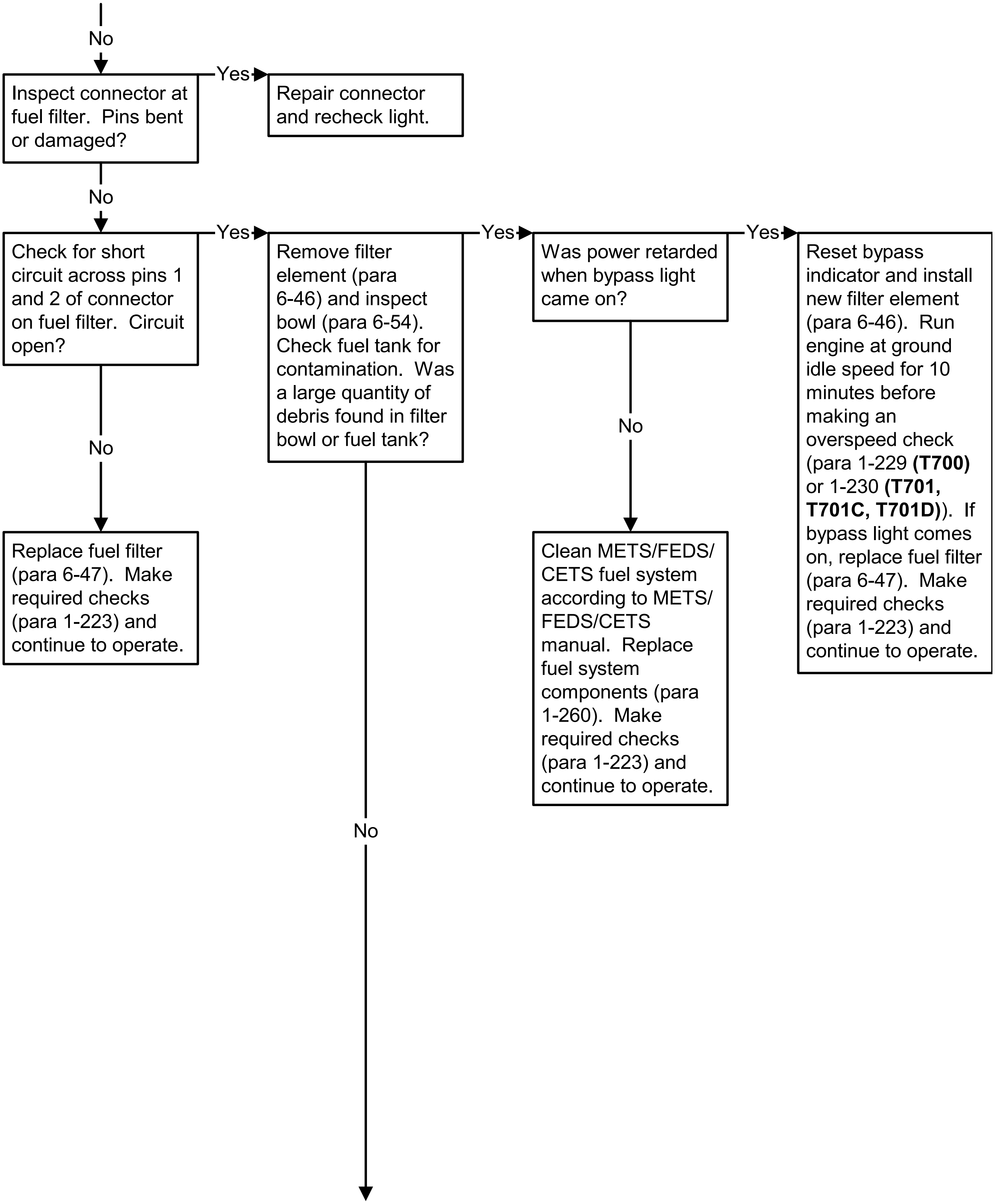
Inspect connectors for bent or damaged pins. Replace faulty part(s) and recheck bypass light. Light on?

Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS electrical system according to METS/FEDS/CETS manual.

Replace green cable (para 7-35). Make required checks (para 1-233) and continue to operate.

Troubleshooting Procedure 39. Fuel Filter Bypass Light ON (Cont)



Inspect connector at fuel filter. Pins bent or damaged?

Repair connector and recheck light.

Check for short circuit across pins 1 and 2 of connector on fuel filter. Circuit open?

Remove filter element (para 6-46) and inspect bowl (para 6-54). Check fuel tank for contamination. Was a large quantity of debris found in filter bowl or fuel tank?

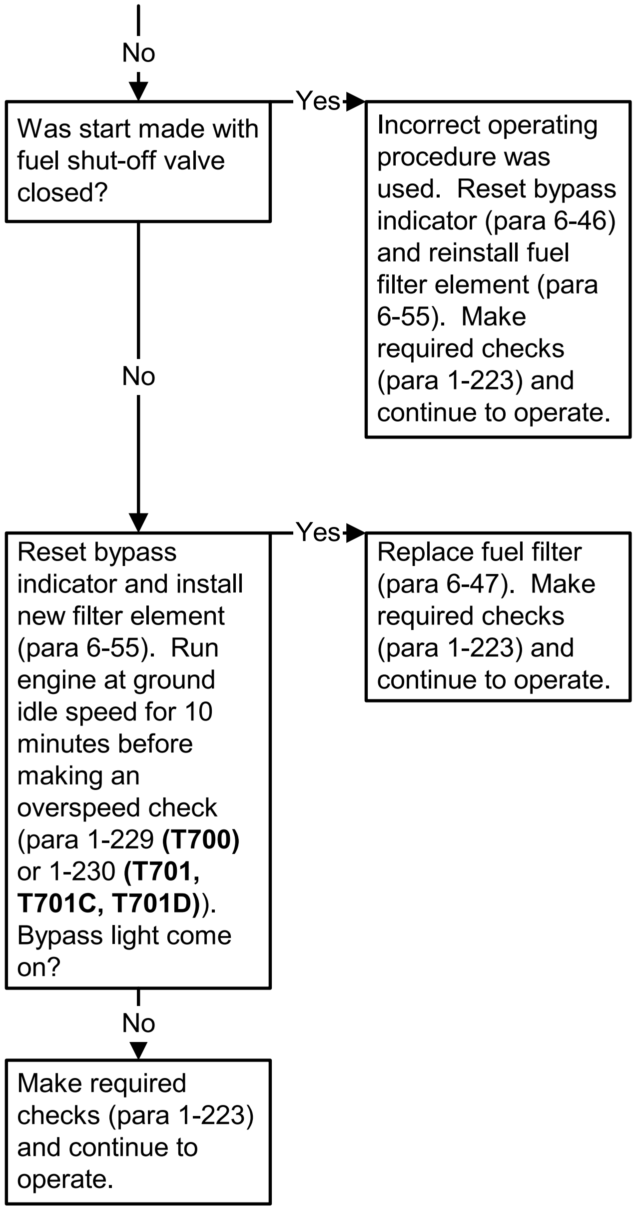
Was power retarded when bypass light came on?

Reset bypass indicator and install new filter element (para 6-46). Run engine at ground idle speed for 10 minutes before making an overspeed check (para 1-229 **(T700)** or 1-230 **(T701, T701C, T701D)**). If bypass light comes on, replace fuel filter (para 6-47). Make required checks (para 1-223) and continue to operate.

Replace fuel filter (para 6-47). Make required checks (para 1-223) and continue to operate.

Clean METS/FEDS/CETS fuel system according to METS/FEDS/CETS manual. Replace fuel system components (para 1-260). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 39. Fuel Filter Bypass Light ON (Cont)



Was start made with fuel shut-off valve closed?

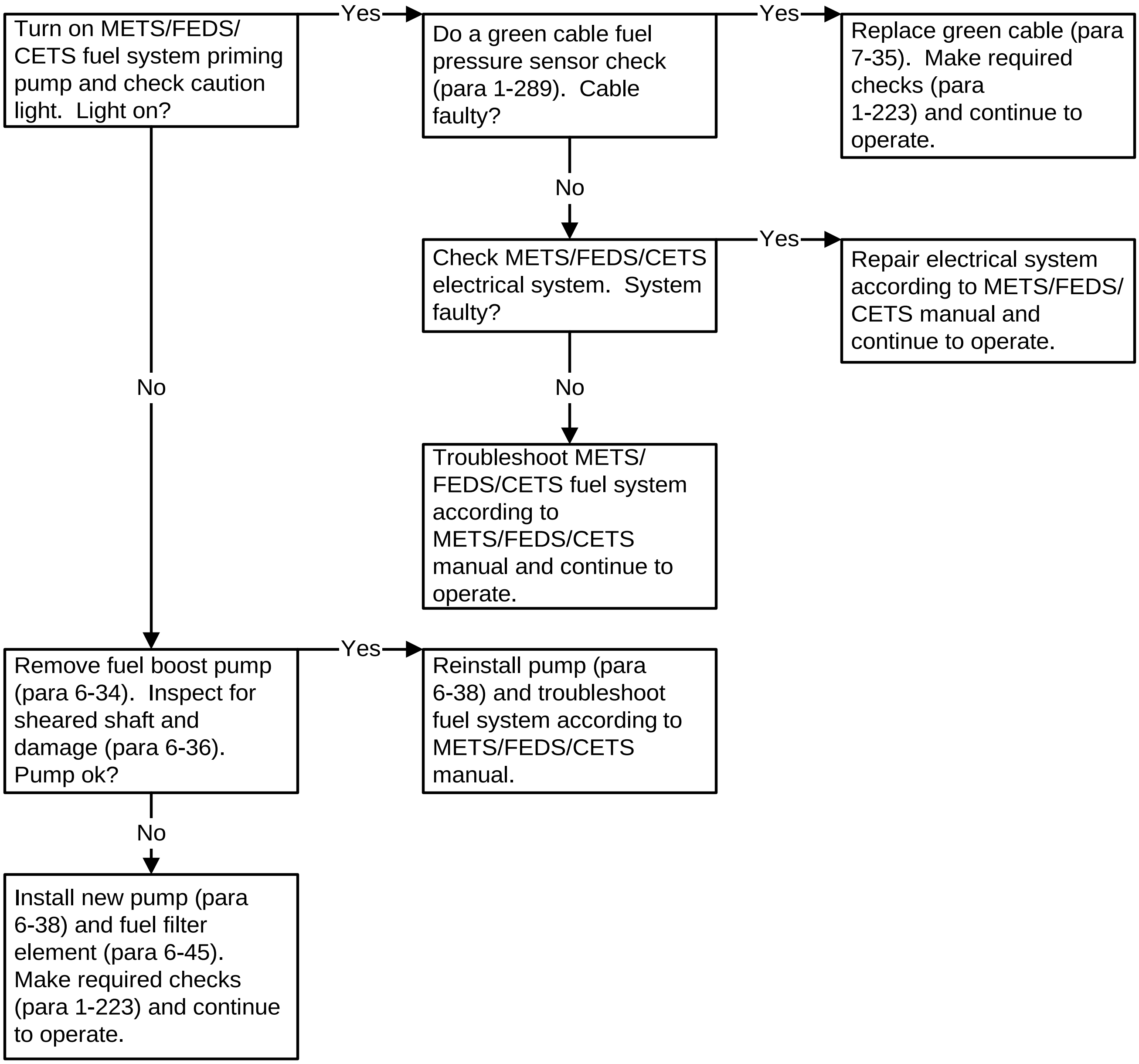
Incorrect operating procedure was used. Reset bypass indicator (para 6-46) and reinstall fuel filter element (para 6-55). Make required checks (para 1-223) and continue to operate.

Reset bypass indicator and install new filter element (para 6-55). Run engine at ground idle speed for 10 minutes before making an overspeed check (para 1-229 **(T700)** or 1-230 **(T701, T701C, T701D)**). Bypass light come on?

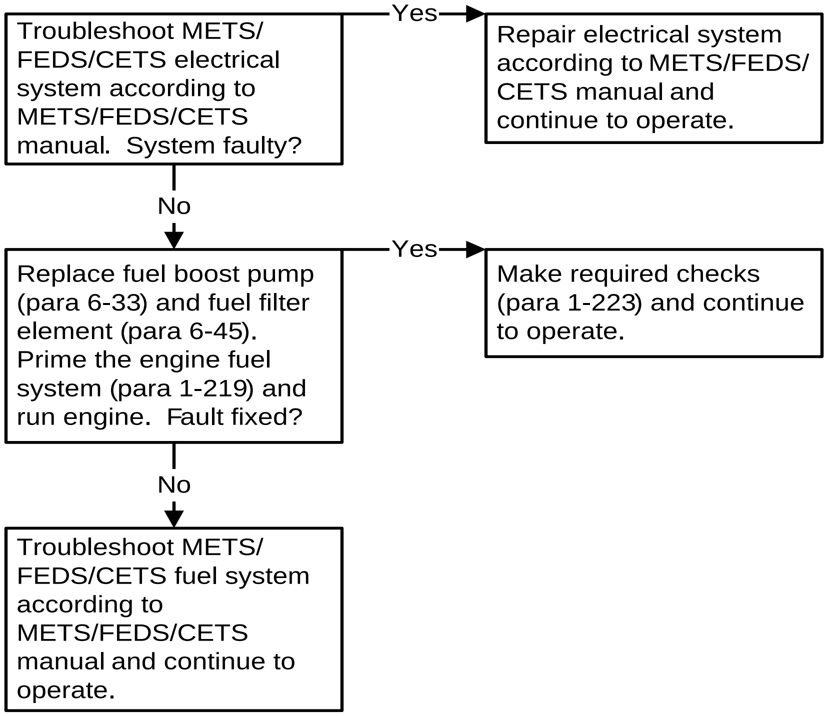
Replace fuel filter (para 6-47). Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

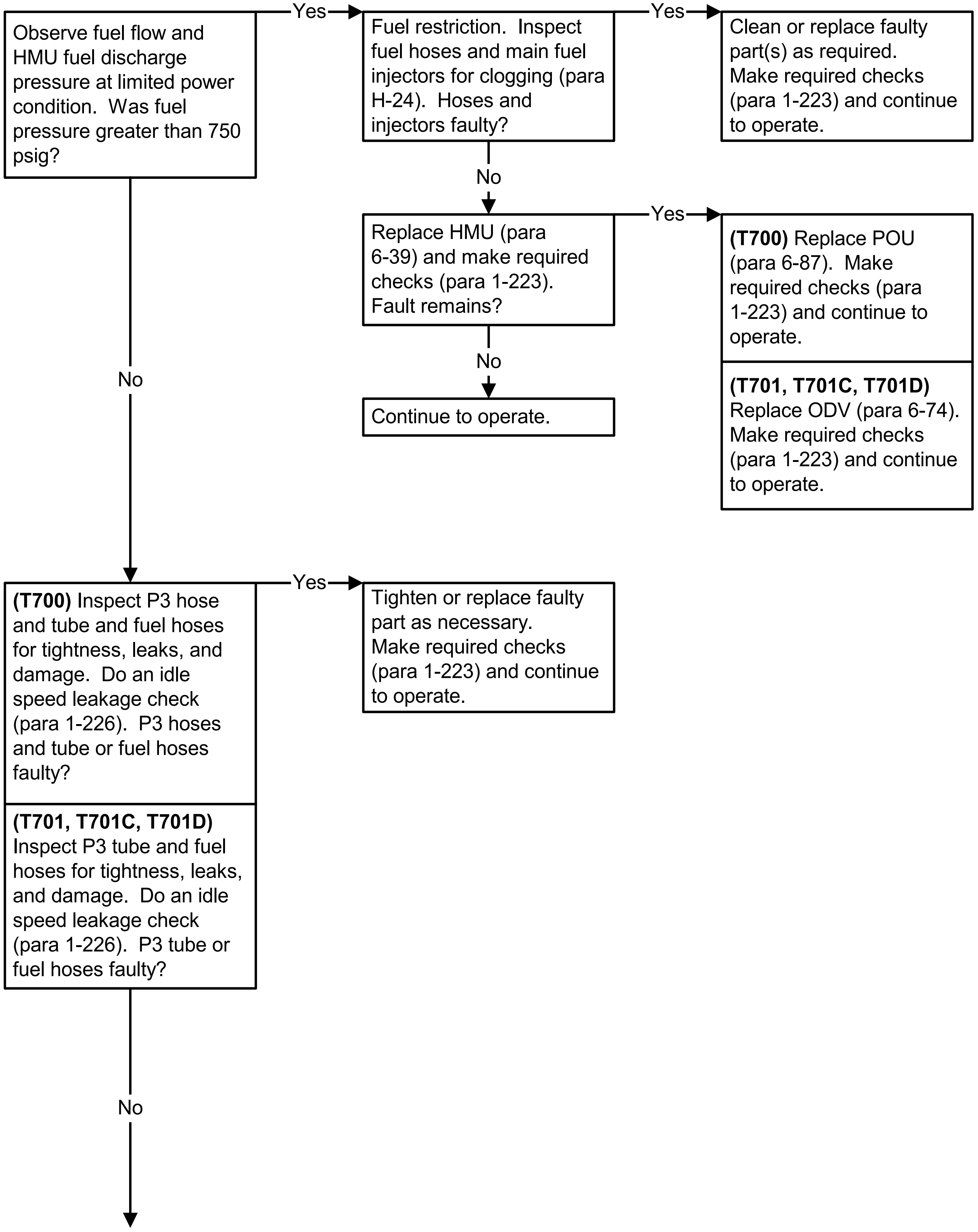
Troubleshooting Procedure 40. Low Fuel Pressure Caution Light ON Below Flight Idle Speed



Troubleshooting Procedure 41. Low Fuel Pressure Caution Light ON At or Above Flight Idle Speed



Troubleshooting Procedure 42. Limited Power Due to Control System Problems (torque, % Ng, and TGT are abnormally low)



Observe fuel flow and HMU fuel discharge pressure at limited power condition. Was fuel pressure greater than 750 psig?

Fuel restriction. Inspect fuel hoses and main fuel injectors for clogging (para H-24). Hoses and injectors faulty?

Clean or replace faulty part(s) as required. Make required checks (para 1-223) and continue to operate.

Replace HMU (para 6-39) and make required checks (para 1-223). Fault remains?

(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

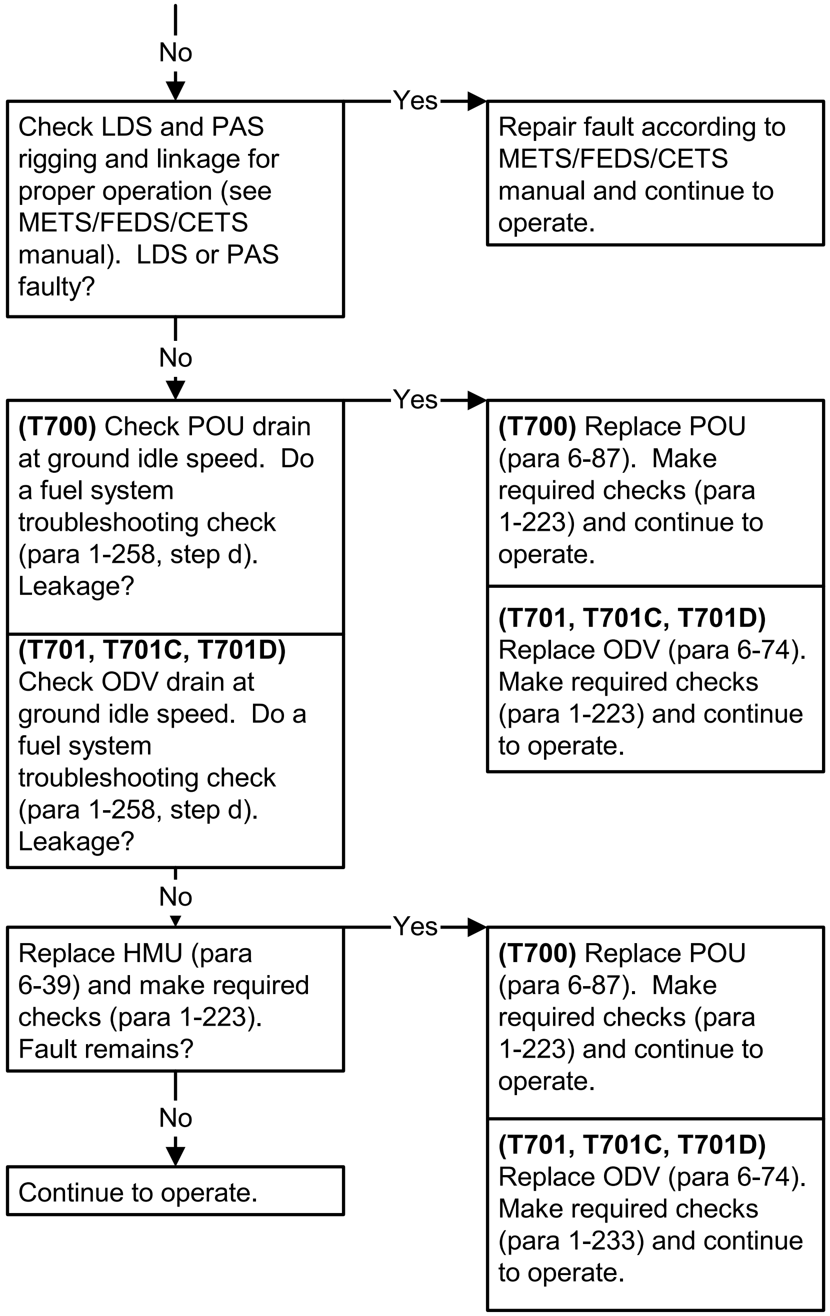
Continue to operate.

(T700) Inspect P3 hose and tube and fuel hoses for tightness, leaks, and damage. Do an idle speed leakage check (para 1-226). P3 hoses and tube or fuel hoses faulty?

(T701, T701C, T701D) Inspect P3 tube and fuel hoses for tightness, leaks, and damage. Do an idle speed leakage check (para 1-226). P3 tube or fuel hoses faulty?

Tighten or replace faulty part as necessary. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 42. Limited Power Due to Control System Problems (torque, % Ng, and TGT are abnormally low) (Cont)



Check LDS and PAS rigging and linkage for proper operation (see METS/FEDS/CETS manual). LDS or PAS faulty?

Repair fault according to METS/FEDS/CETS manual and continue to operate.

(T700) Check POU drain at ground idle speed. Do a fuel system troubleshooting check (para 1-258, step d). Leakage?

(T701, T701C, T701D) Check ODV drain at ground idle speed. Do a fuel system troubleshooting check (para 1-258, step d). Leakage?

(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

Replace HMU (para 6-39) and make required checks (para 1-223). Fault remains?

(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

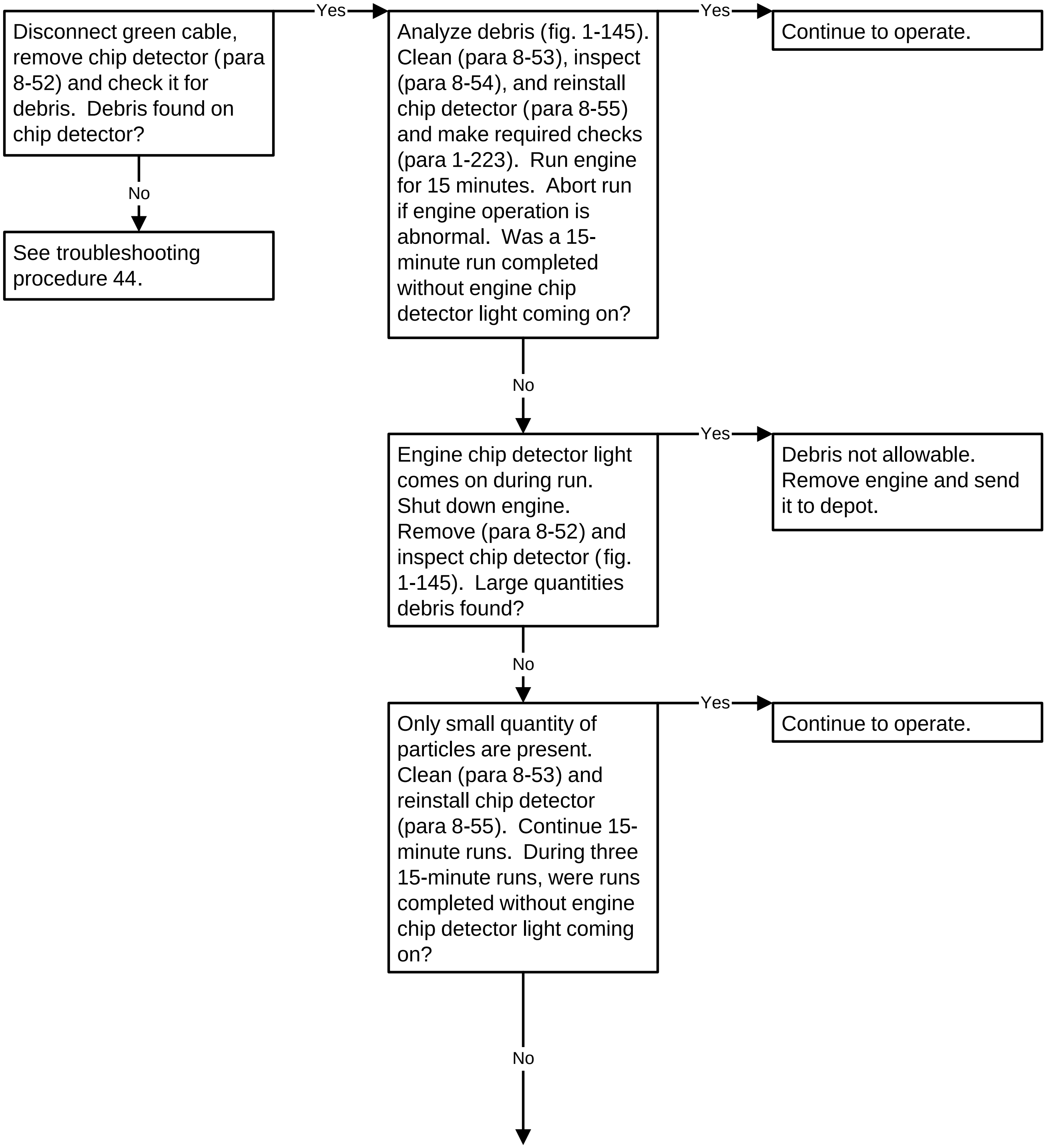
(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-233) and continue to operate.

Continue to operate.

Troubleshooting Procedure 43. Electrical Chip Detector Light ON During Operation

NOTE

Repetitive chip light occurences, after being cleared by 15-minute runs is cause to reject the engine.



Disconnect green cable, remove chip detector (para 8-52) and check it for debris. Debris found on chip detector?

See troubleshooting procedure 44.

Analyze debris (fig. 1-145). Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55) and make required checks (para 1-223). Run engine for 15 minutes. Abort run if engine operation is abnormal. Was a 15-minute run completed without engine chip detector light coming on?

Continue to operate.

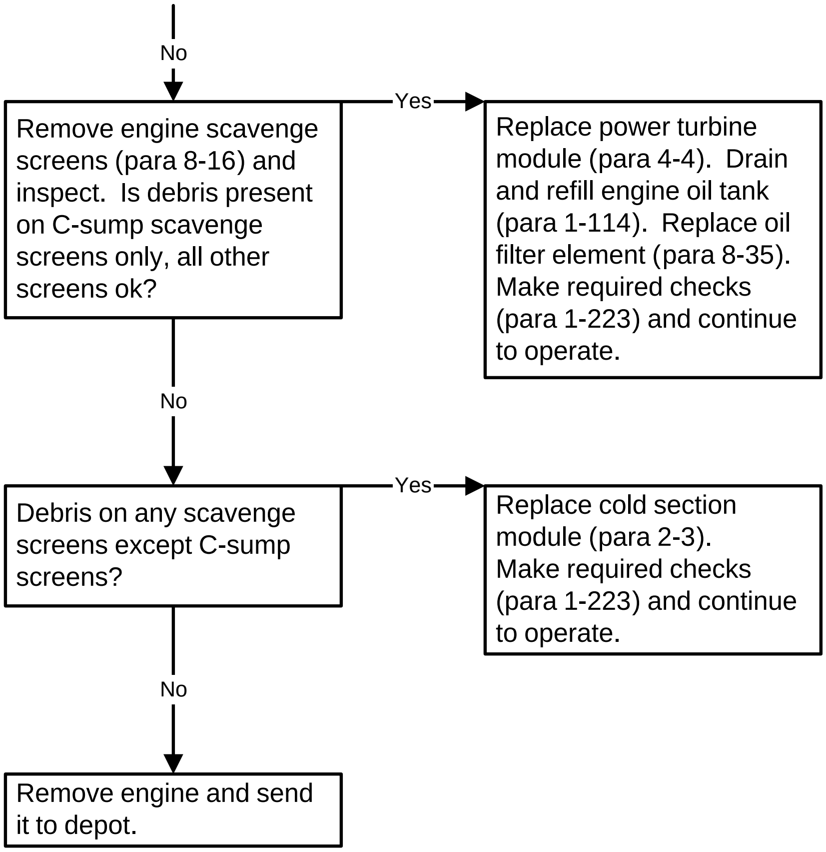
Engine chip detector light comes on during run. Shut down engine. Remove (para 8-52) and inspect chip detector (fig. 1-145). Large quantities debris found?

Debris not allowable. Remove engine and send it to depot.

Only small quantity of particles are present. Clean (para 8-53) and reinstall chip detector (para 8-55). Continue 15-minute runs. During three 15-minute runs, were runs completed without engine chip detector light coming on?

Continue to operate.

Troubleshooting Procedure 43. Electrical Chip Detector Light ON During Operation (Cont)



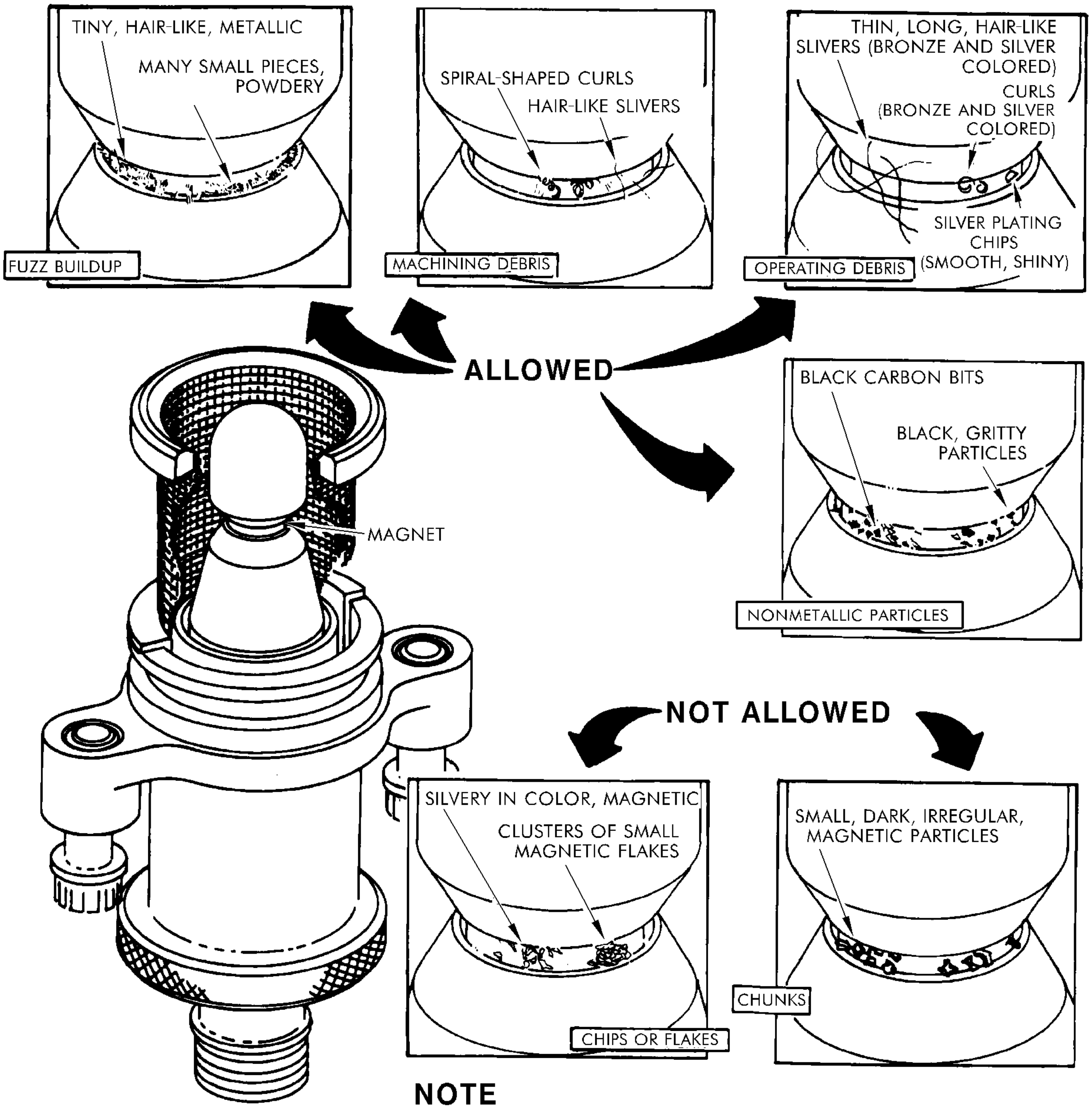
Remove engine scavenge screens (para 8-16) and inspect. Is debris present on C-sump scavenge screens only, all other screens ok?

Replace power turbine module (para 4-4). Drain and refill engine oil tank (para 1-114). Replace oil filter element (para 8-35). Make required checks (para 1-223) and continue to operate.

Debris on any scavenge screens except C-sump screens?

Replace cold section module (para 2-3). Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.



NOTE

1. DURING NORMAL OPERATION, SOME BUILDUP OF MATERIALS THAT ARE "ALLOWED"MAY BE FOUND ON CHIP DETECTOR. THE AMOUNT WILL VARY BUT IS NOT CAUSE FOR ENGINE REMOVAL.

2. CHARACTERISTICS FOR IDENTIFYING TYPES OF CHIPS THAT ARE "NOT ALLOWED" ARE AS FOLLOWS:

   - MAGNETIC MATERIAL. (DETERMINE IF SMALL CHIPS ARE MAGNETIC BY PLACING CHIPS ON THIN PAPER AND BY OBSERVING IF CHIPS MOVE WHEN MAGNET IS MOVED UNDER PAPER.)
   - MANY CHIPS OF SIMILAR SIZE AND SHAPE.
   - SMOOTH AND REFLECTIVE ON ONE SIDE, ROUGH ON THE OTHER SIDE, MAGNETIC.
   - ROUGHLY CIRCULAR OR ELLIPTICAL FLAKES, THINNER AROUND THE EDGES, MAGNETIC.

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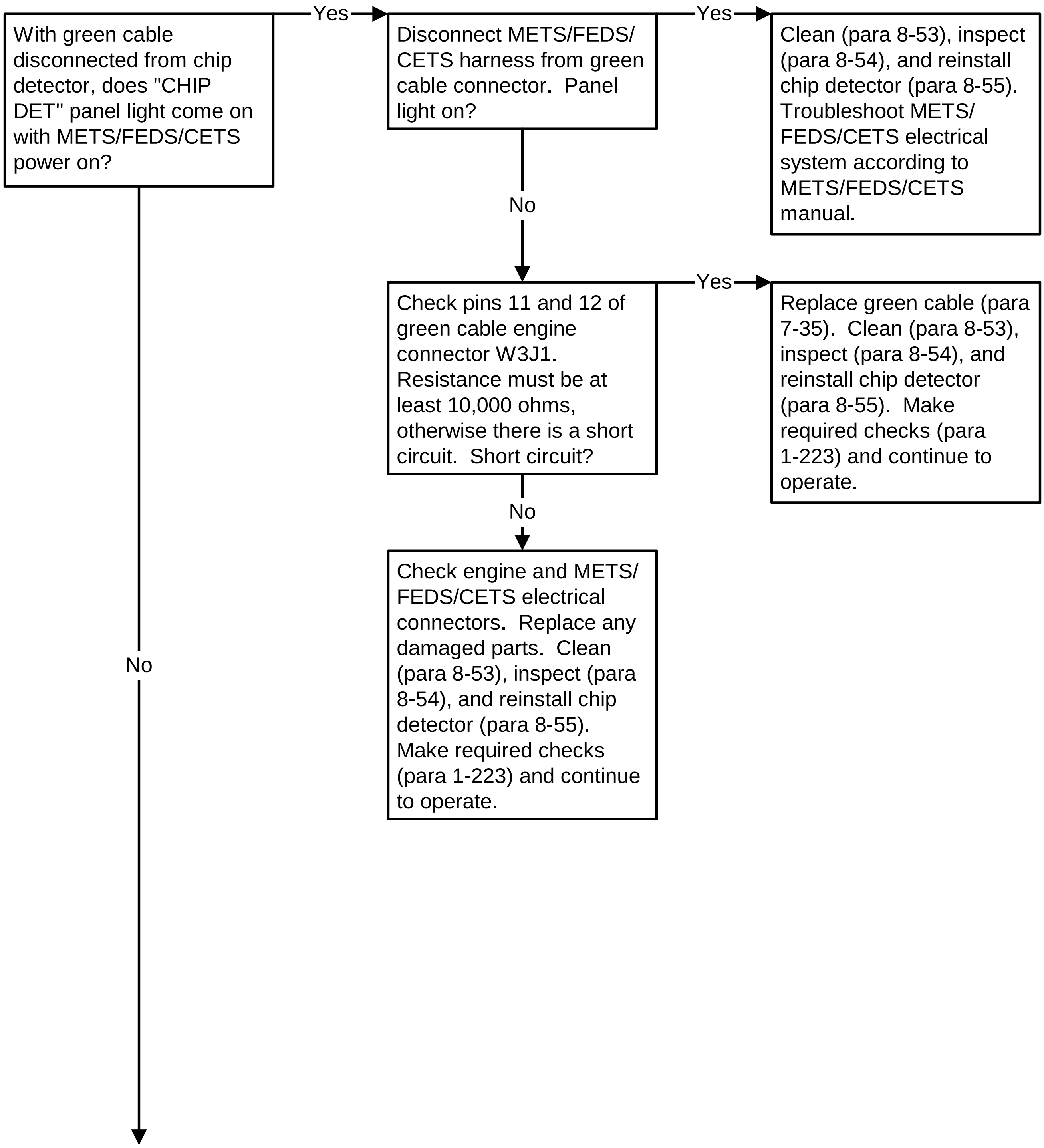
Figure 1-145. Electrical Chip Detector Debris; Analysis

Troubleshooting Procedure 44. Electrical Chip Detector Light ON (no debris found)

NOTE

When detector light comes on and no contamination is found, fault is electrical, not mechanical.



With green cable disconnected from chip detector, does "CHIP DET" panel light come on with METS/FEDS/CETS power on?

Disconnect METS/FEDS/CETS harness from green cable connector. Panel light on?

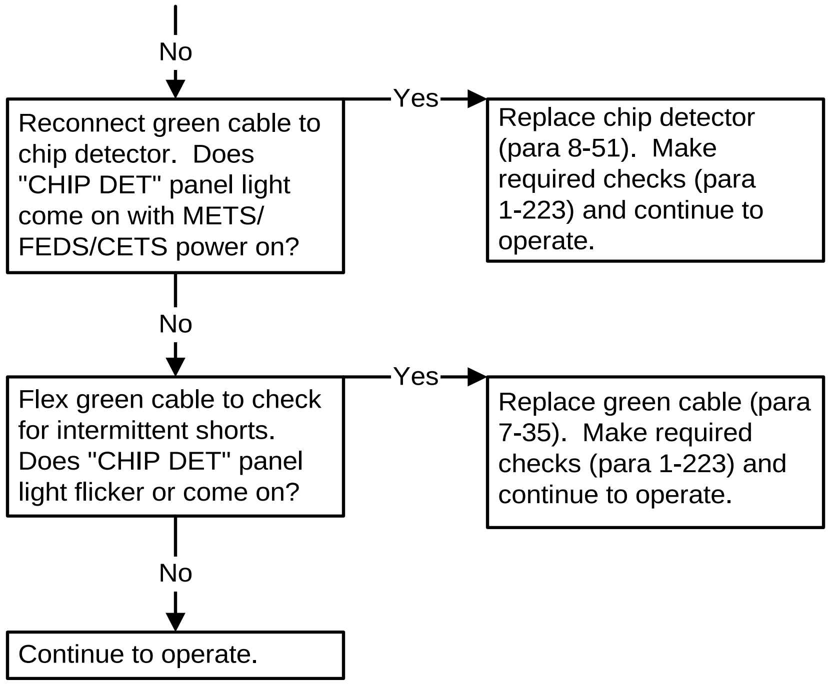
Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55). Troubleshoot METS/FEDS/CETS electrical system according to METS/FEDS/CETS manual.

Check pins 11 and 12 of green cable engine connector W3J1. Resistance must be at least 10,000 ohms, otherwise there is a short circuit. Short circuit?

Replace green cable (para 7-35). Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55). Make required checks (para 1-223) and continue to operate.

Check engine and METS/FEDS/CETS electrical connectors. Replace any damaged parts. Clean (para 8-53), inspect (para 8-54), and reinstall chip detector (para 8-55). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 44. Electrical Chip Detector Light ON (no debris found) (Cont)



Reconnect green cable to chip detector. Does "CHIP DET" panel light come on with METS/FEDS/CETS power on?

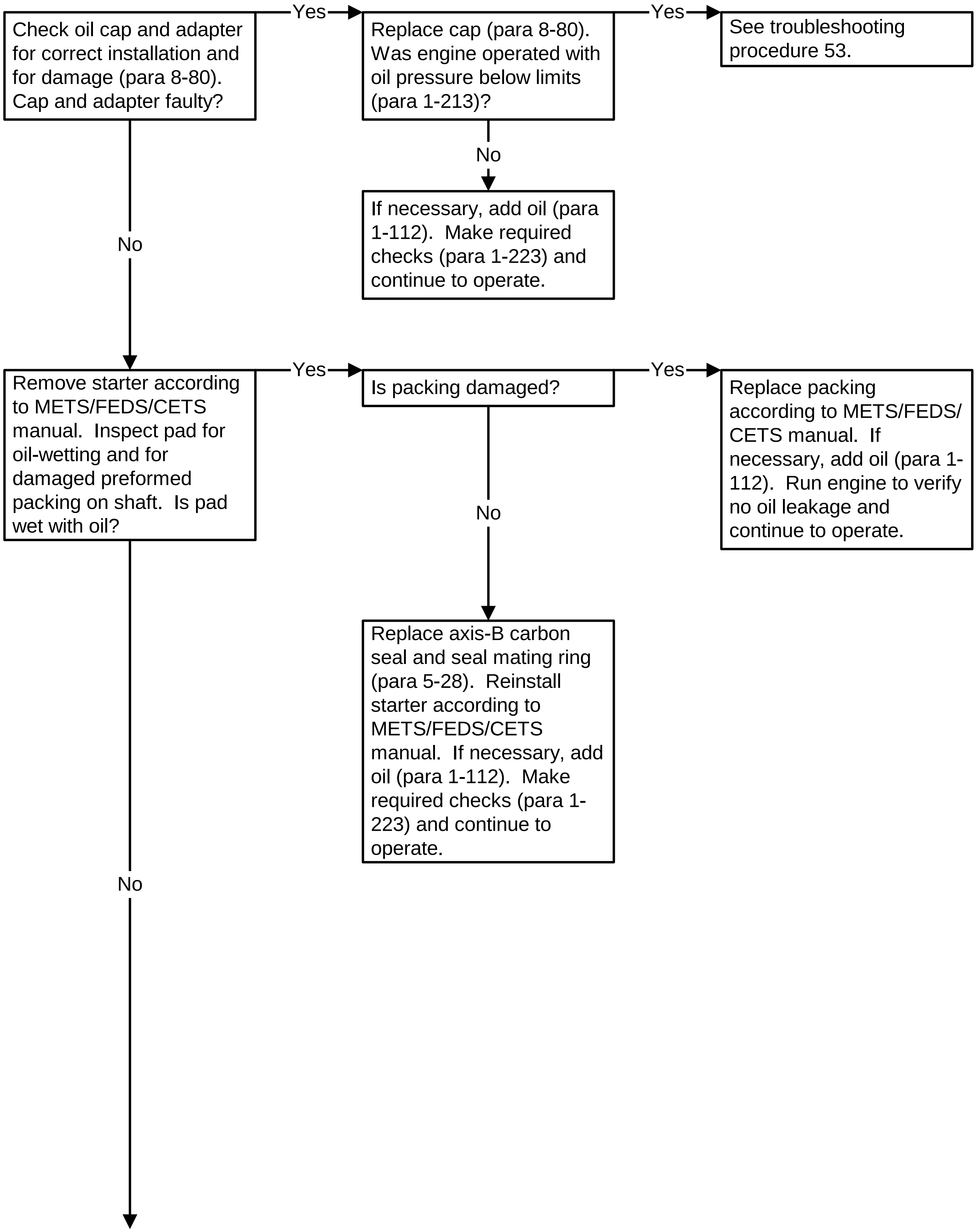
Replace chip detector (para 8-51). Make required checks (para 1-223) and continue to operate.

Flex green cable to check for intermittent shorts. Does "CHIP DET" panel light flicker or come on?

Replace green cable (para 7-35). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Troubleshooting Procedure 45. Excessive Oil Leakage at Service Port Scupper



Check oil cap and adapter for correct installation and for damage (para 8-80). Cap and adapter faulty?

Replace cap (para 8-80). Was engine operated with oil pressure below limits (para 1-213)?

See troubleshooting procedure 53.

If necessary, add oil (para 1-112). Make required checks (para 1-223) and continue to operate.

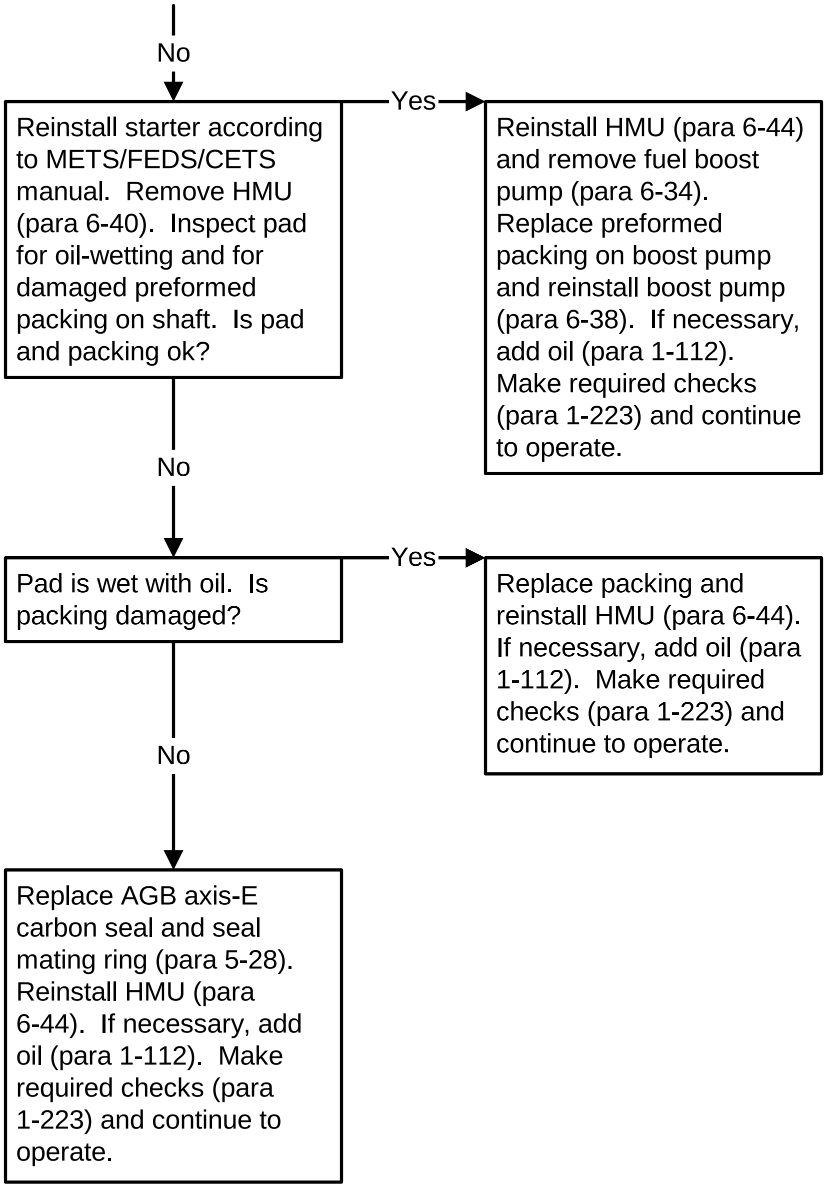
Remove starter according to METS/FEDS/CETS manual. Inspect pad for oil-wetting and for damaged preformed packing on shaft. Is pad wet with oil?

Is packing damaged?

Replace packing according to METS/FEDS/CETS manual. If necessary, add oil (para 1-112). Run engine to verify no oil leakage and continue to operate.

Replace axis-B carbon seal and seal mating ring (para 5-28). Reinstall starter according to METS/FEDS/CETS manual. If necessary, add oil (para 1-112). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 45. Excessive Oil Leakage at Service Port Scupper (Cont)



Reinstall starter according to METS/FEDS/CETS manual. Remove HMU (para 6-40). Inspect pad for oil-wetting and for damaged preformed packing on shaft. Is pad and packing ok?

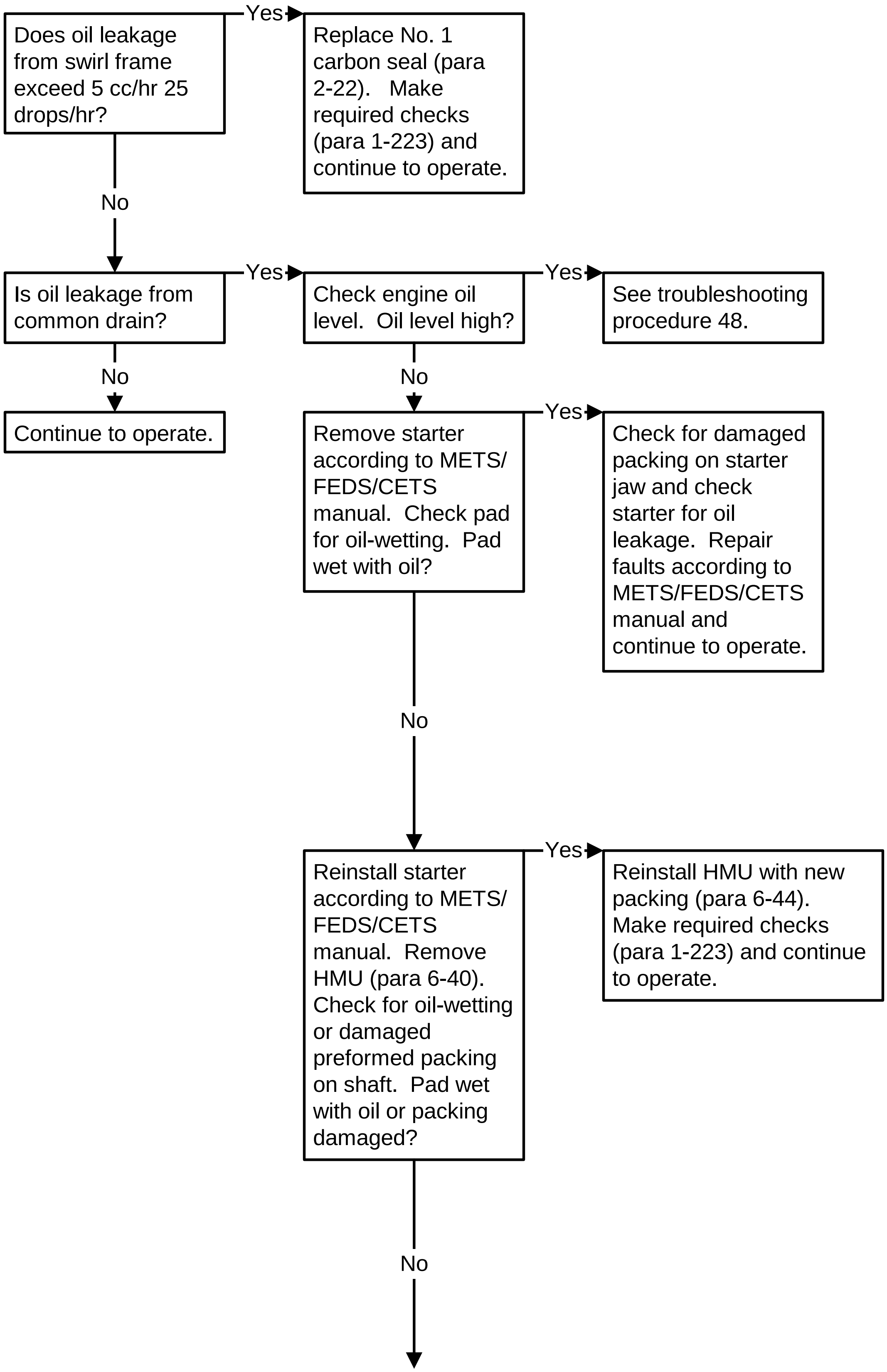
Reinstall HMU (para 6-44) and remove fuel boost pump (para 6-34). Replace preformed packing on boost pump and reinstall boost pump (para 6-38). If necessary, add oil (para 1-112). Make required checks (para 1-223) and continue to operate.

Pad is wet with oil. Is packing damaged?

Replace packing and reinstall HMU (para 6-44). If necessary, add oil (para 1-112). Make required checks (para 1-223) and continue to operate.

Replace AGB axis-E carbon seal and seal mating ring (para 5-28). Reinstall HMU (para 6-44). If necessary, add oil (para 1-112). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 46. Excessive Oil Leakage from Overboard Drain (out-of-limits)



Does oil leakage from swirl frame exceed 5 cc/hr 25 drops/hr?

Replace No. 1 carbon seal (para 2-22). Make required checks (para 1-223) and continue to operate.

Is oil leakage from common drain?

Check engine oil level. Oil level high?

See troubleshooting procedure 48.

Continue to operate.

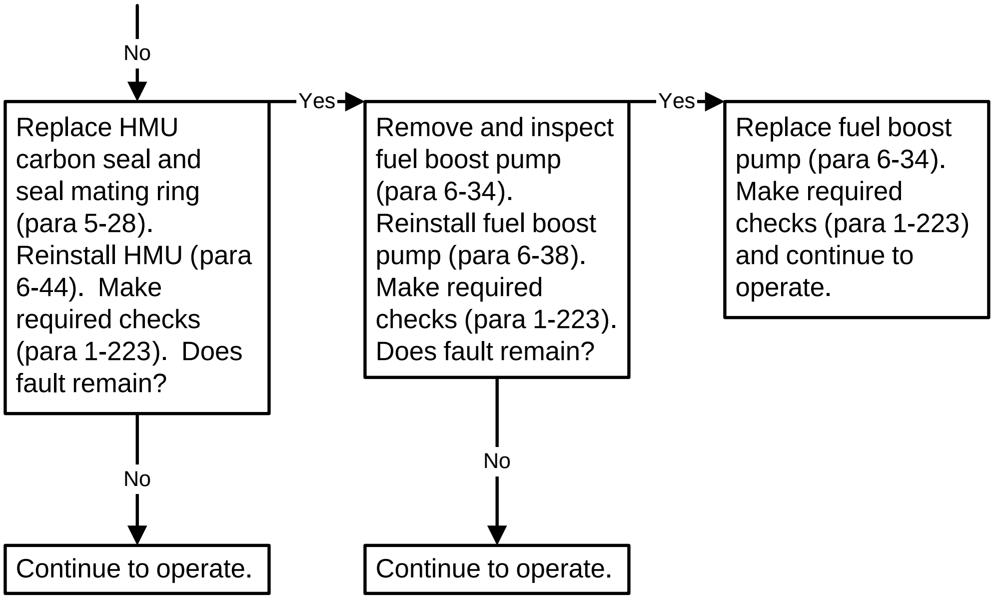
Remove starter according to METS/FEDS/CETS manual. Check pad for oil-wetting. Pad wet with oil?

Check for damaged packing on starter jaw and check starter for oil leakage. Repair faults according to METS/FEDS/CETS manual and continue to operate.

Reinstall starter according to METS/FEDS/CETS manual. Remove HMU (para 6-40). Check for oil-wetting or damaged preformed packing on shaft. Pad wet with oil or packing damaged?

Reinstall HMU with new packing (para 6-44). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 46. Excessive Oil Leakage from Overboard Drain (out-of-limits) (Cont)



Replace HMU carbon seal and seal mating ring (para 5-28). Reinstall HMU (para 6-44). Make required checks (para 1-223). Does fault remain?

Remove and inspect fuel boost pump (para 6-34). Reinstall fuel boost pump (para 6-38). Make required checks (para 1-223). Does fault remain?

Replace fuel boost pump (para 6-34). Make required checks (para 1-223) and continue to operate.

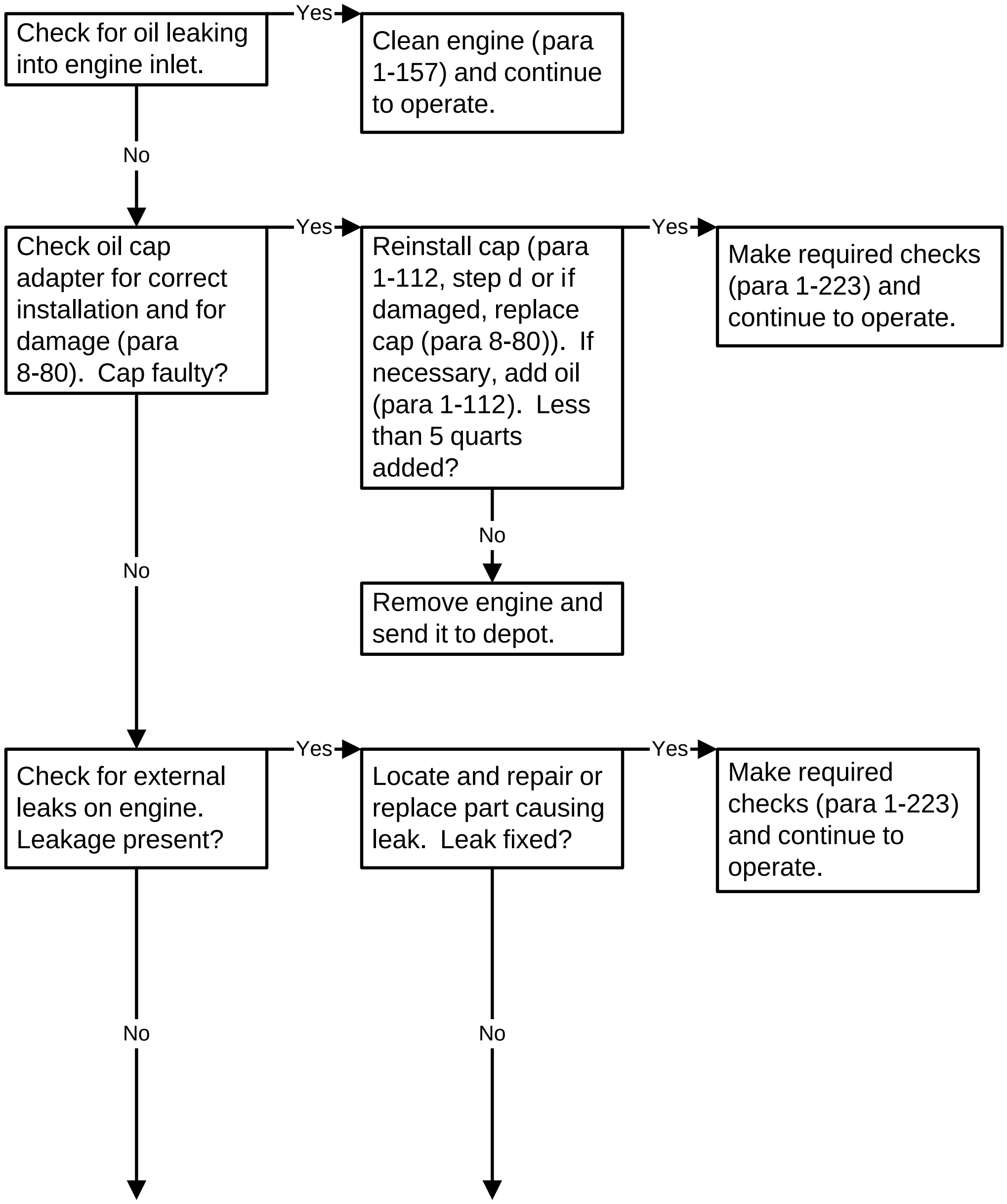
Continue to operate.

Continue to operate.

Troubleshooting Procedure 47. High Oil Consumption (over limits)

NOTE

- According to standard procedure, addition of oil in whole quart quantities may result in apparent high oil consumption. If excessive oil consumption is suspected, maintain a log of quarts of oil used and of engine operating time. See para 1-213 for limits.
- If engine oil system is serviced and engine is tipped during removal or installation, oil will seep (oil forming drops, puddles, or streaks) from A-sump, down stage 1 blades, and into bottom of the main frame. This is no cause to reject the engine.



Check for oil leaking into engine inlet.

Clean engine (para 1-157) and continue to operate.

Check oil cap adapter for correct installation and for damage (para 8-80). Cap faulty?

Reinstall cap (para 1-112, step d or if damaged, replace cap (para 8-80)). If necessary, add oil (para 1-112). Less than 5 quarts added?

Make required checks (para 1-223) and continue to operate.

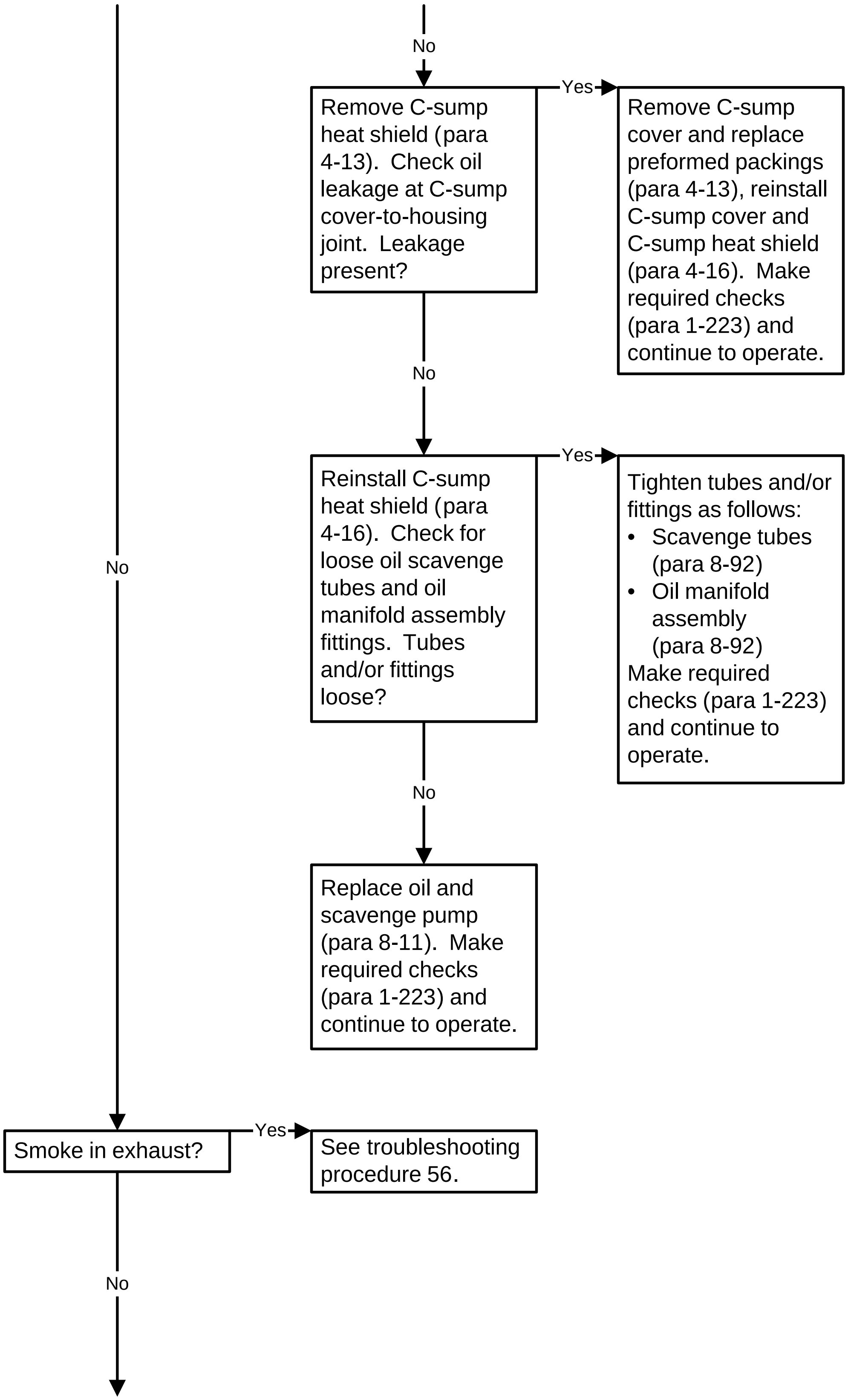
Remove engine and send it to depot.

Check for external leaks on engine. Leakage present?

Locate and repair or replace part causing leak. Leak fixed?

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 47. High Oil Consumption (over limits) (Cont)



Remove C-sump heat shield (para 4-13). Check oil leakage at C-sump cover-to-housing joint. Leakage present?

Remove C-sump cover and replace preformed packings (para 4-13), reinstall C-sump cover and C-sump heat shield (para 4-16). Make required checks (para 1-223) and continue to operate.

Reinstall C-sump heat shield (para 4-16). Check for loose oil scavenge tubes and oil manifold assembly fittings. Tubes and/or fittings loose?

Tighten tubes and/or fittings as follows:

- Scavenge tubes (para 8-92)
- Oil manifold assembly (para 8-92)

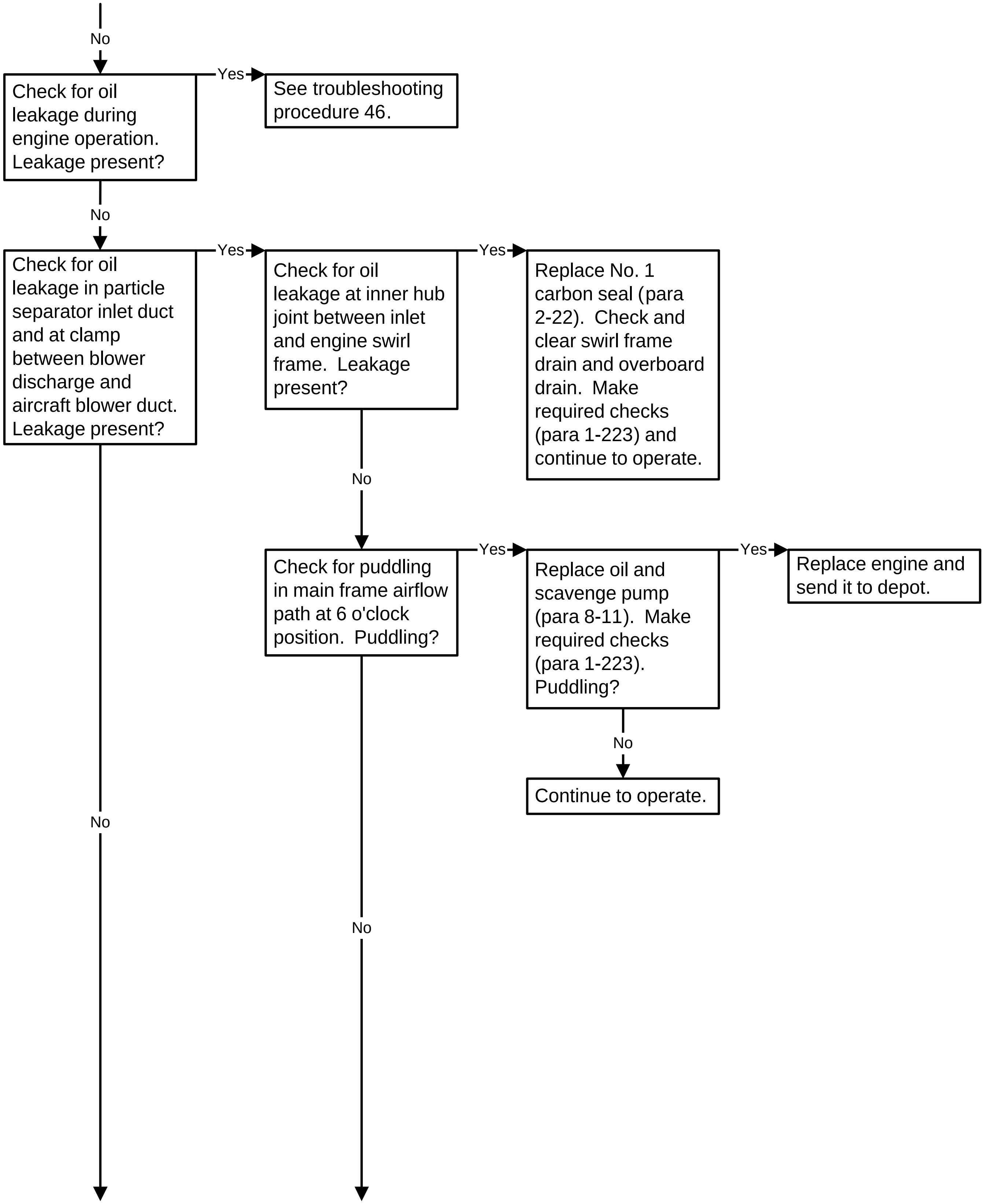
Make required checks (para 1-223) and continue to operate.

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-223) and continue to operate.

Smoke in exhaust?

See troubleshooting procedure 56.

Troubleshooting Procedure 47. High Oil Consumption (over limits) (Cont)



Check for oil leakage during engine operation. Leakage present?

See troubleshooting procedure 46.

Check for oil leakage in particle separator inlet duct and at clamp between blower discharge and aircraft blower duct. Leakage present?

Check for oil leakage at inner hub joint between inlet and engine swirl frame. Leakage present?

Replace No. 1 carbon seal (para 2-22). Check and clear swirl frame drain and overboard drain. Make required checks (para 1-223) and continue to operate.

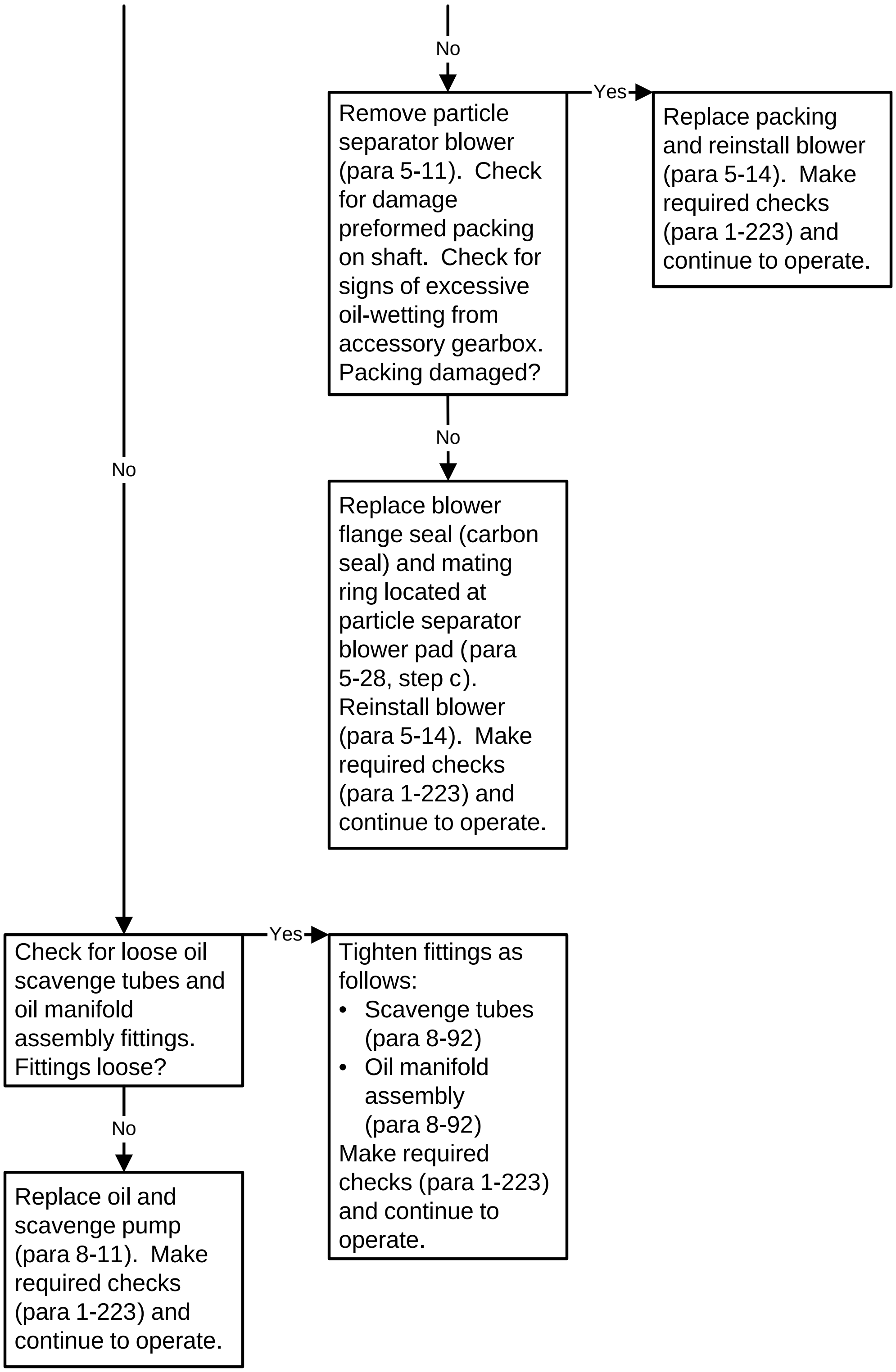
Check for puddling in main frame airflow path at 6 o'clock position. Puddling?

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-223). Puddling?

Replace engine and send it to depot.

Continue to operate.

Troubleshooting Procedure 47. High Oil Consumption (over limits) (Cont)



Remove particle separator blower (para 5-11). Check for damage preformed packing on shaft. Check for signs of excessive oil-wetting from accessory gearbox. Packing damaged?

Replace packing and reinstall blower (para 5-14). Make required checks (para 1-223) and continue to operate.

Replace blower flange seal (carbon seal) and mating ring located at particle separator blower pad (para 5-28, step c). Reinstall blower (para 5-14). Make required checks (para 1-223) and continue to operate.

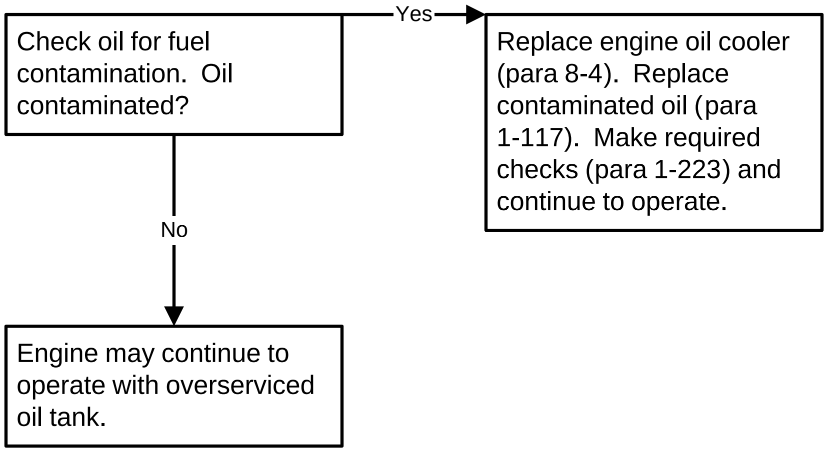
Check for loose oil scavenge tubes and oil manifold assembly fittings. Fittings loose?

Tighten fittings as follows:
- Scavenge tubes (para 8-92)
- Oil manifold assembly (para 8-92)

Make required checks (para 1-223) and continue to operate.

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-223) and continue to operate.

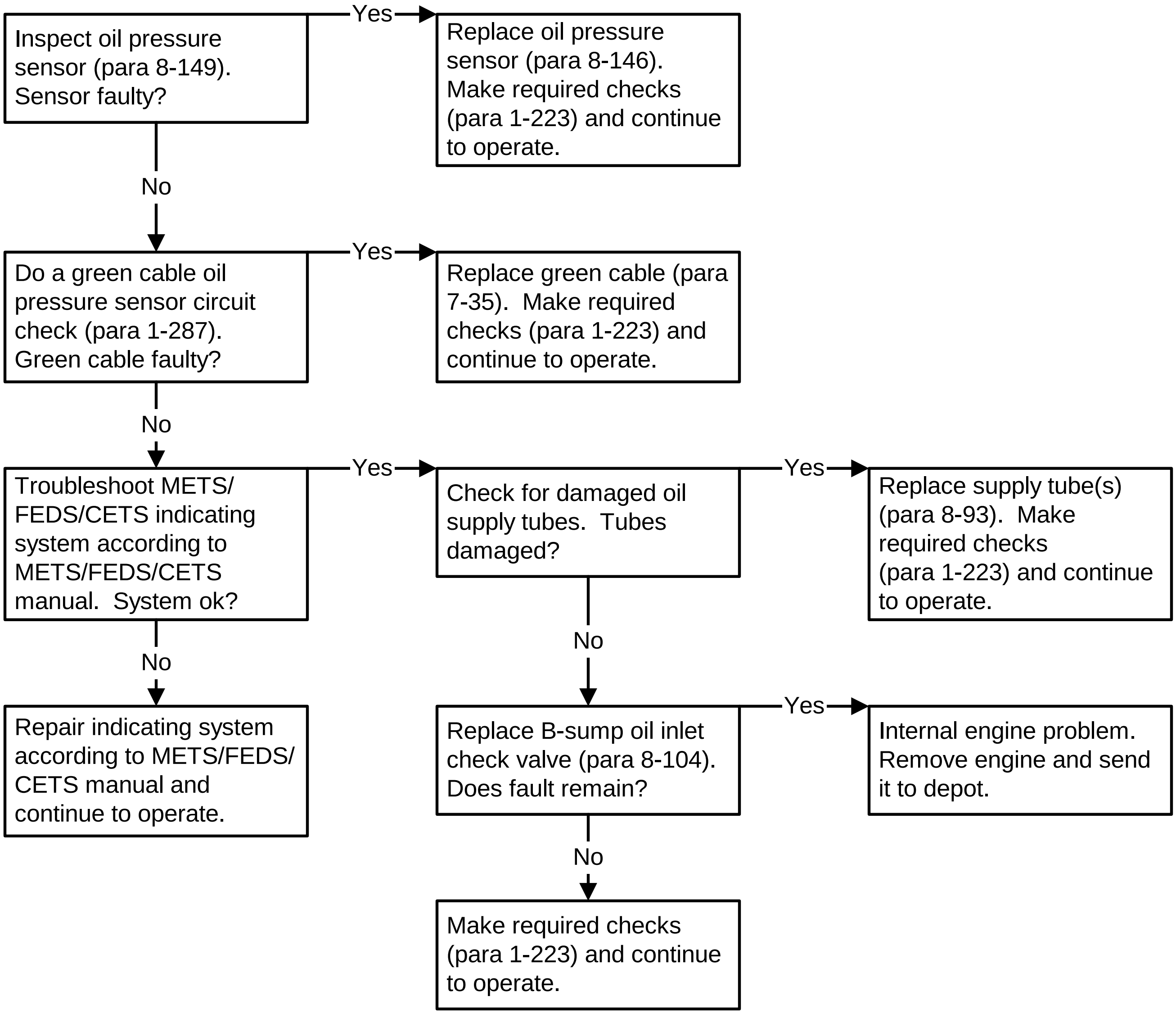
Troubleshooting Procedure 48. High Oil Level (oil level above full mark in sight glass)



Troubleshooting Procedure 49. High Oil Pressure

NOTE

A sudden increase in oil pressure of 10 psi over normal engine pressure is cause for investigation. Do not change oil and scavenge pump, because it cannot cause high oil pressure. Oil pressure during initial start (cold oil) should return to normal after 5 minutes at idle speed.



Inspect oil pressure sensor (para 8-149). Sensor faulty?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-223) and continue to operate.

Do a green cable oil pressure sensor circuit check (para 1-287). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual. System ok?

Check for damaged oil supply tubes. Tubes damaged?

Replace supply tube(s) (para 8-93). Make required checks (para 1-223) and continue to operate.

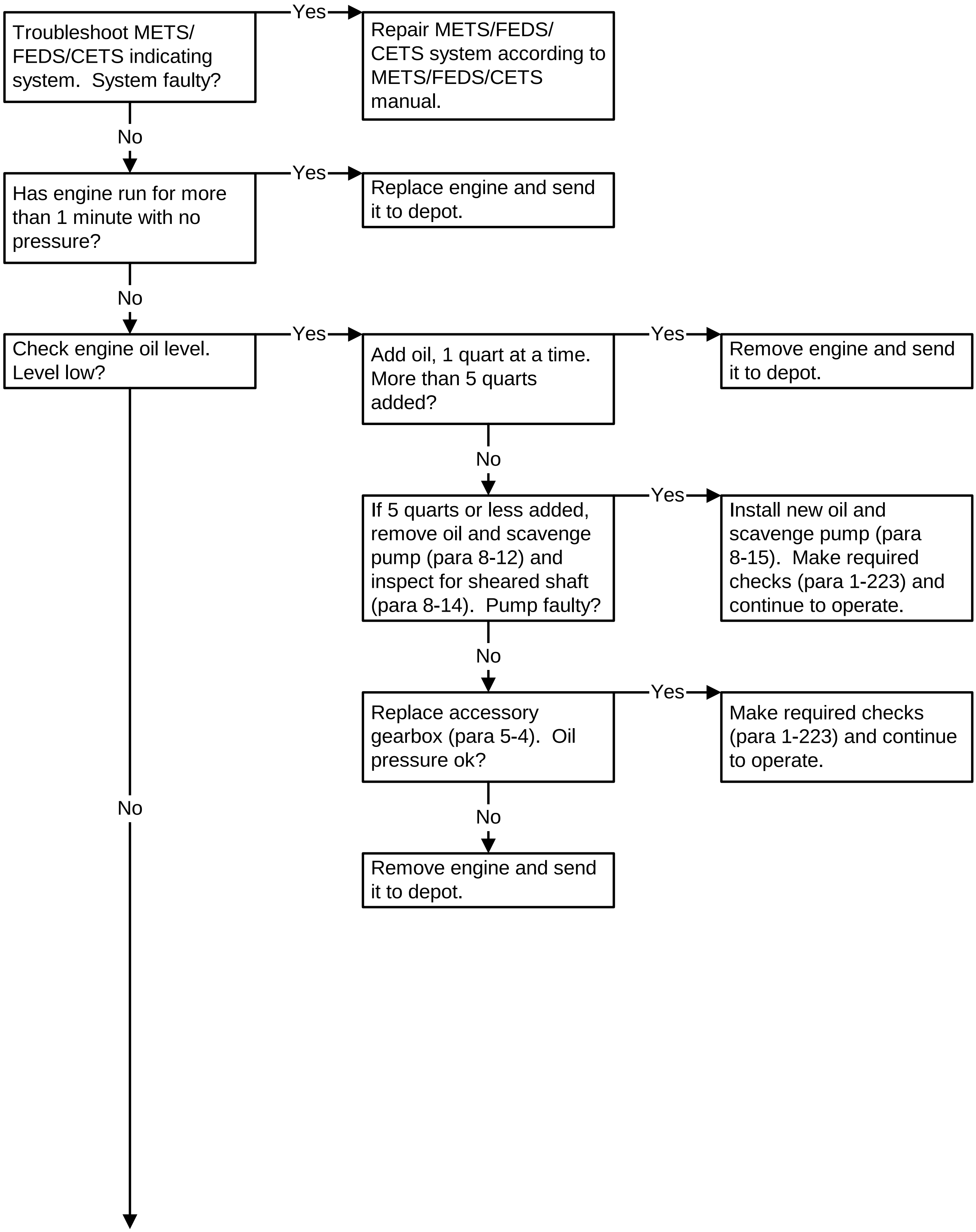
Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace B-sump oil inlet check valve (para 8-104). Does fault remain?

Internal engine problem. Remove engine and send it to depot.

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 50. No Oil Pressure



Troubleshoot METS/FEDS/CETS indicating system. System faulty?

Repair METS/FEDS/CETS system according to METS/FEDS/CETS manual.

Has engine run for more than 1 minute with no pressure?

Replace engine and send it to depot.

Check engine oil level. Level low?

Add oil, 1 quart at a time. More than 5 quarts added?

Remove engine and send it to depot.

If 5 quarts or less added, remove oil and scavenge pump (para 8-12) and inspect for sheared shaft (para 8-14). Pump faulty?

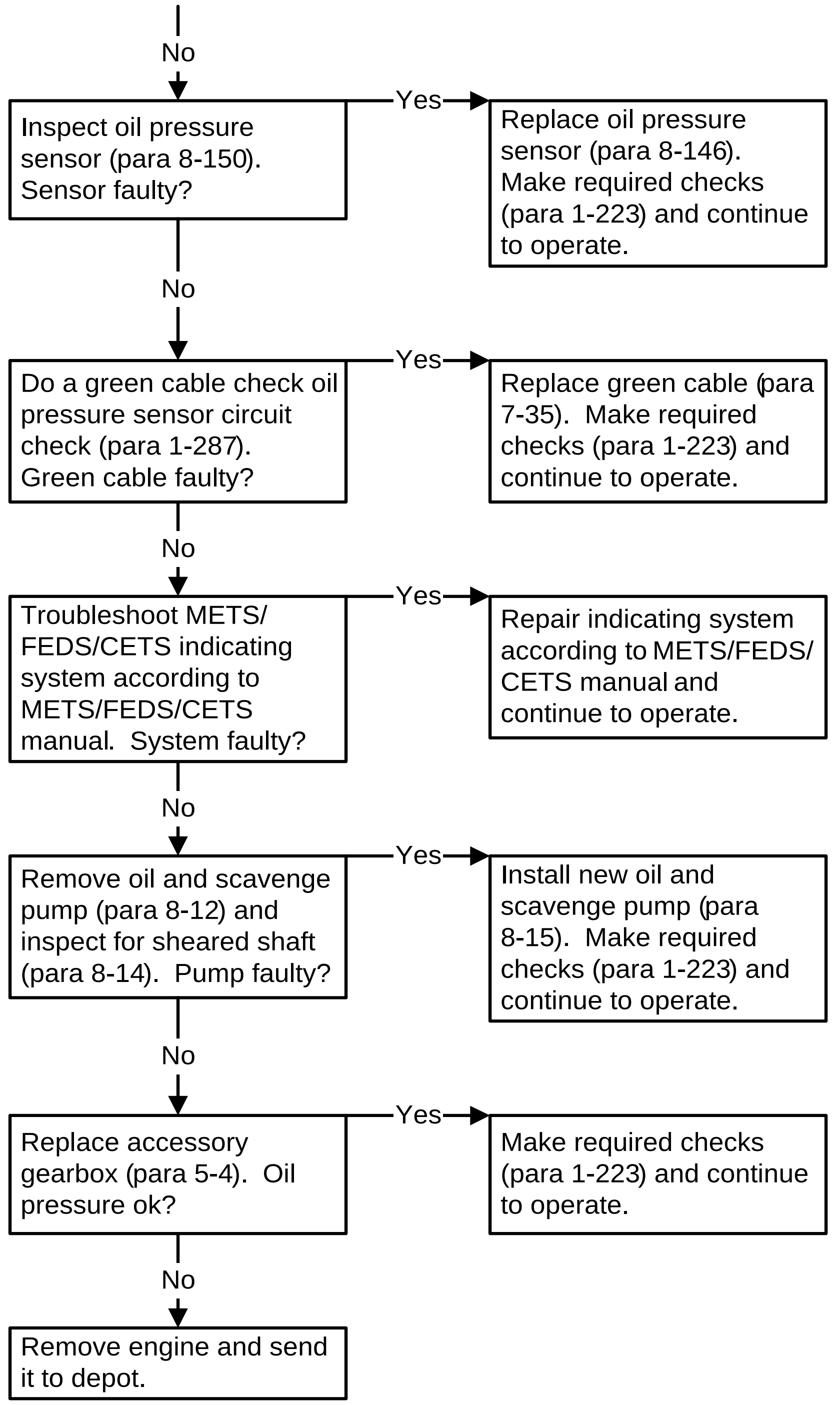
Install new oil and scavenge pump (para 8-15). Make required checks (para 1-223) and continue to operate.

Replace accessory gearbox (para 5-4). Oil pressure ok?

Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.

Troubleshooting Procedure 50. No Oil Pressure (Cont)



Inspect oil pressure sensor (para 8-150). Sensor faulty?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-223) and continue to operate.

Do a green cable check oil pressure sensor circuit check (para 1-287). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual. System faulty?

Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Remove oil and scavenge pump (para 8-12) and inspect for sheared shaft (para 8-14). Pump faulty?

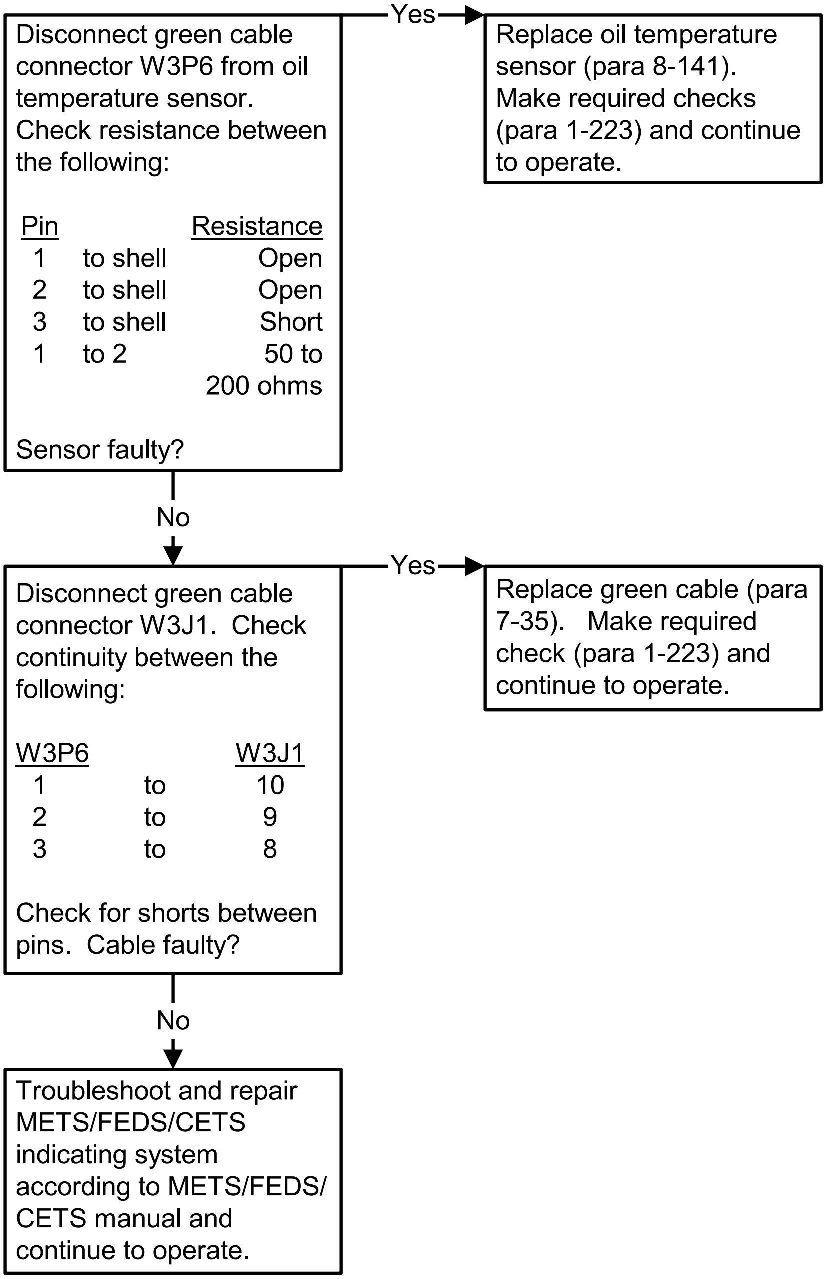
Install new oil and scavenge pump (para 8-15). Make required checks (para 1-223) and continue to operate.

Replace accessory gearbox (para 5-4). Oil pressure ok?

Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.

Troubleshooting Procedure 51. (T700, T701C, T701D) No Oil Temperature



Disconnect green cable connector W3P6 from oil temperature sensor. Check resistance between the following:

Pin		Resistance
1	to shell	Open
2	to shell	Open
3	to shell	Short
1	to 2	50 to 200 ohms

Sensor faulty?

Replace oil temperature sensor (para 8-141). Make required checks (para 1-223) and continue to operate.

Disconnect green cable connector W3J1. Check continuity between the following:

W3P6		W3J1
1	to	10
2	to	9
3	to	8

Check for shorts between pins. Cable faulty?

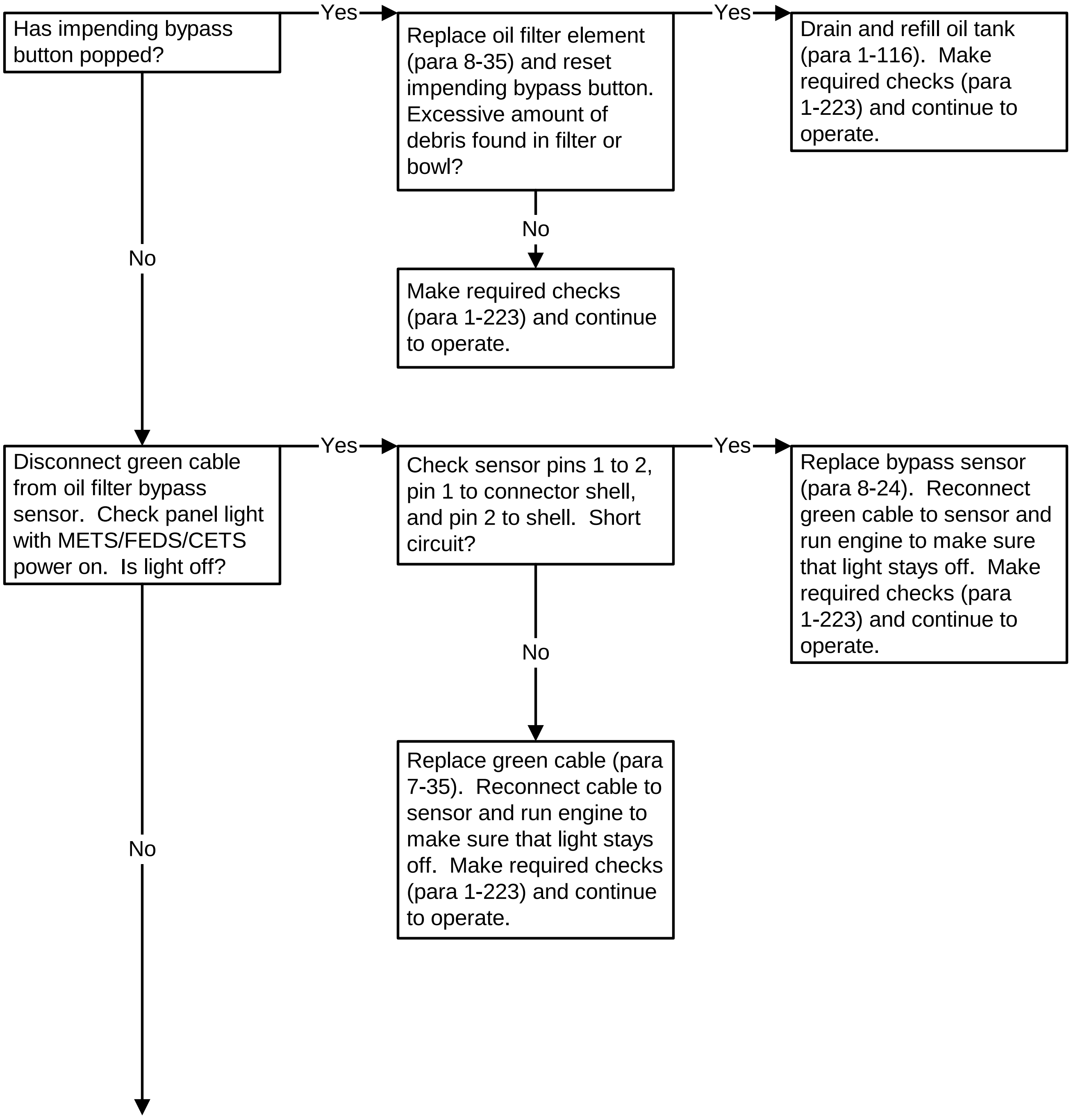
Replace green cable (para 7-35). Make required check (para 1-223) and continue to operate.

Troubleshoot and repair METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual and continue to operate.

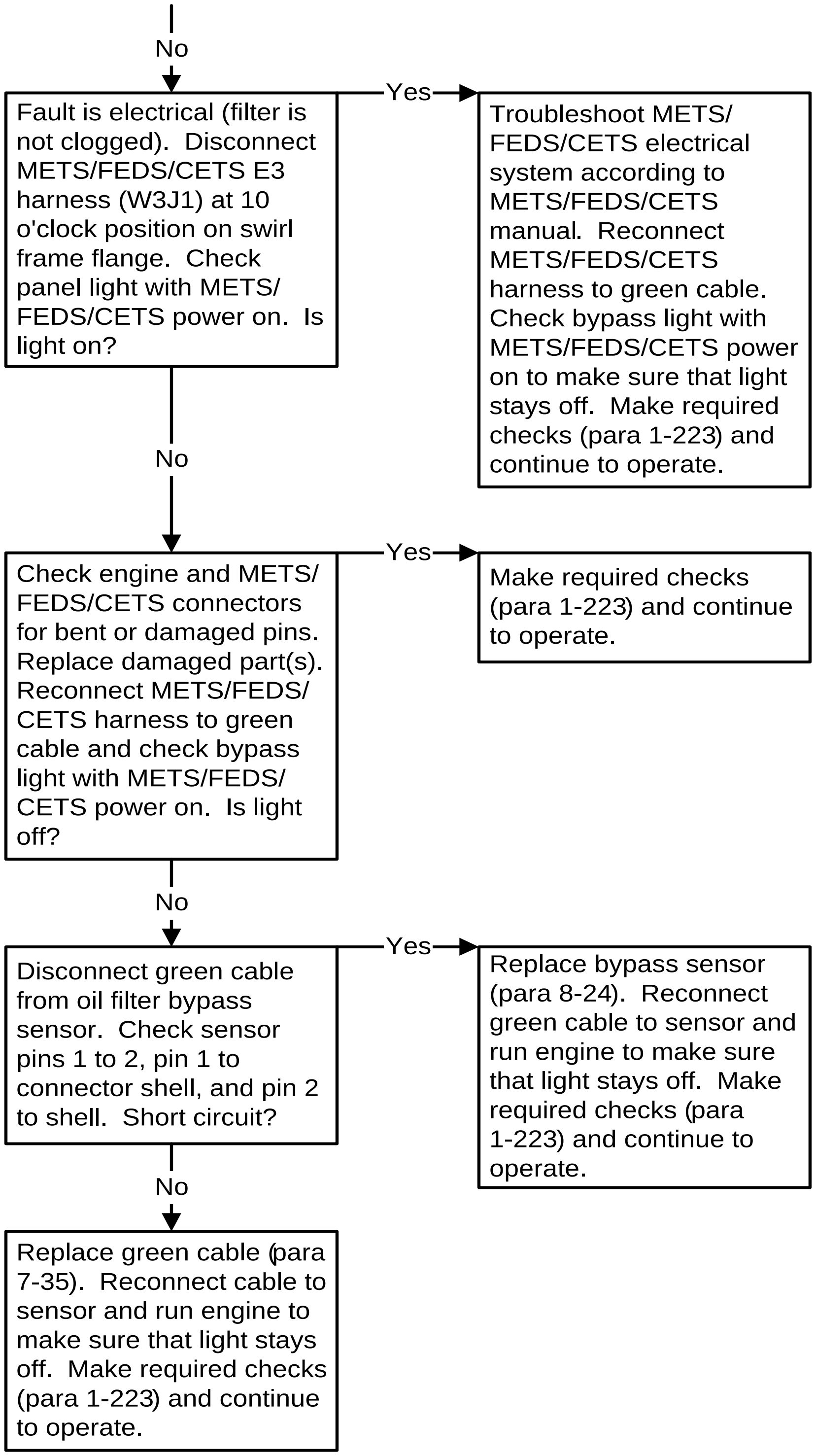
Troubleshooting Procedure 52. Oil Filter Bypass Light Comes ON

NOTE

During engine starting, when engine oil temperature is below normal operating temperature, the oil filter bypass light on test panel may come on and may stay on until oil reaches 100°F (38°C). If oil filter is too dirty, the light will stay on after oil temperature is stable.



Troubleshooting Procedure 52. Oil Filter Bypass Light Comes ON (Cont)



Fault is electrical (filter is not clogged). Disconnect METS/FEDS/CETS E3 harness (W3J1) at 10 o'clock position on swirl frame flange. Check panel light with METS/FEDS/CETS power on. Is light on?

Troubleshoot METS/FEDS/CETS electrical system according to METS/FEDS/CETS manual. Reconnect METS/FEDS/CETS harness to green cable. Check bypass light with METS/FEDS/CETS power on to make sure that light stays off. Make required checks (para 1-223) and continue to operate.

Check engine and METS/FEDS/CETS connectors for bent or damaged pins. Replace damaged part(s). Reconnect METS/FEDS/CETS harness to green cable and check bypass light with METS/FEDS/CETS power on. Is light off?

Make required checks (para 1-223) and continue to operate.

Disconnect green cable from oil filter bypass sensor. Check sensor pins 1 to 2, pin 1 to connector shell, and pin 2 to shell. Short circuit?

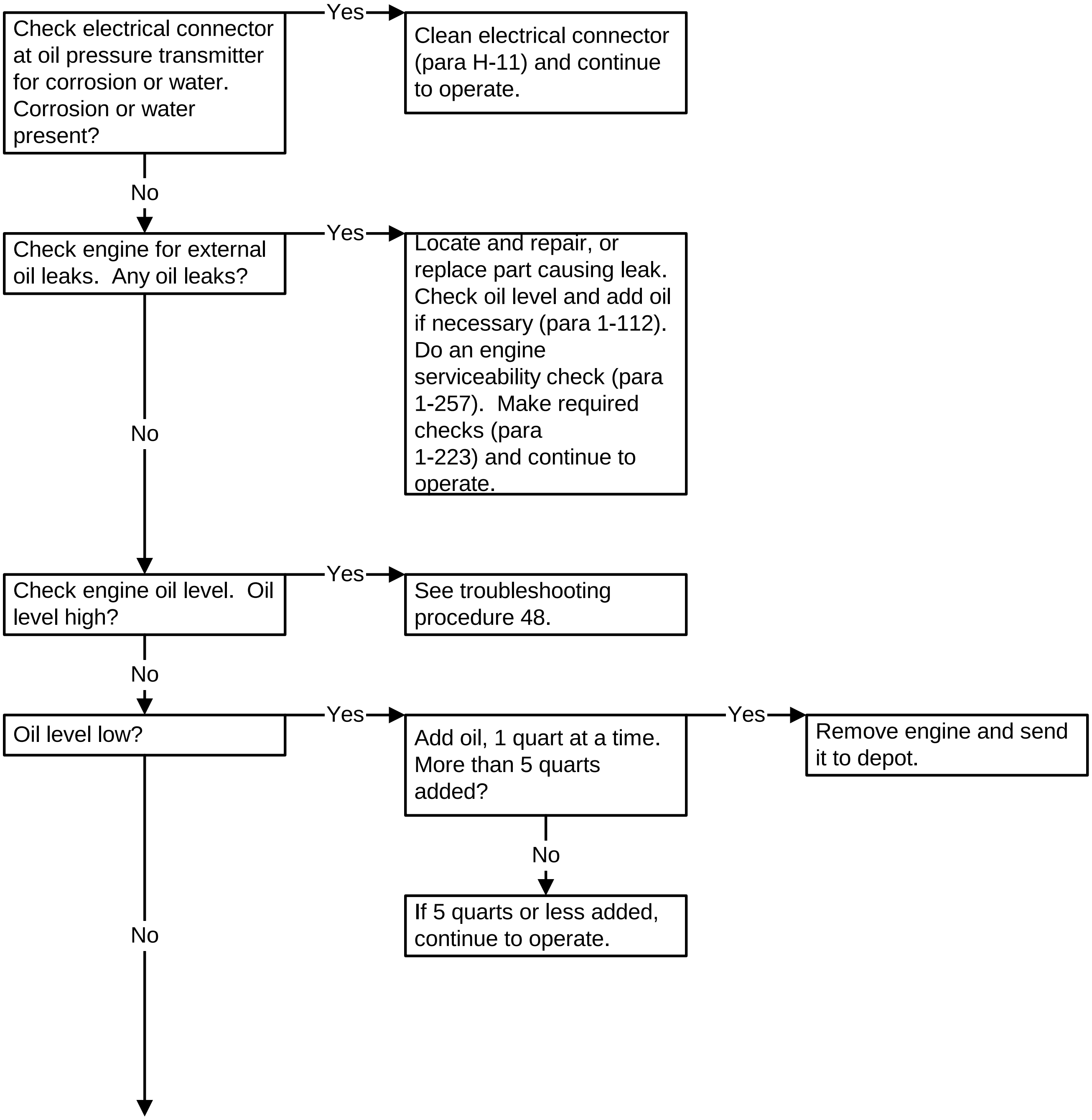
Replace bypass sensor (para 8-24). Reconnect green cable to sensor and run engine to make sure that light stays off. Make required checks (para 1-223) and continue to operate.

Replace green cable (para 7-35). Reconnect cable to sensor and run engine to make sure that light stays off. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 53. Oil Pressure Below Limits

CAUTION

If engine runs for more than 1 minute with oil pressure below minimum limits (para 1-213), and with METS/FEDS/CETS indicating system ok, remove engine and send it to depot.



Check electrical connector at oil pressure transmitter for corrosion or water. Corrosion or water present?

Clean electrical connector (para H-11) and continue to operate.

Check engine for external oil leaks. Any oil leaks?

Locate and repair, or replace part causing leak. Check oil level and add oil if necessary (para 1-112). Do an engine serviceability check (para 1-257). Make required checks (para 1-223) and continue to operate.

Check engine oil level. Oil level high?

See troubleshooting procedure 48.

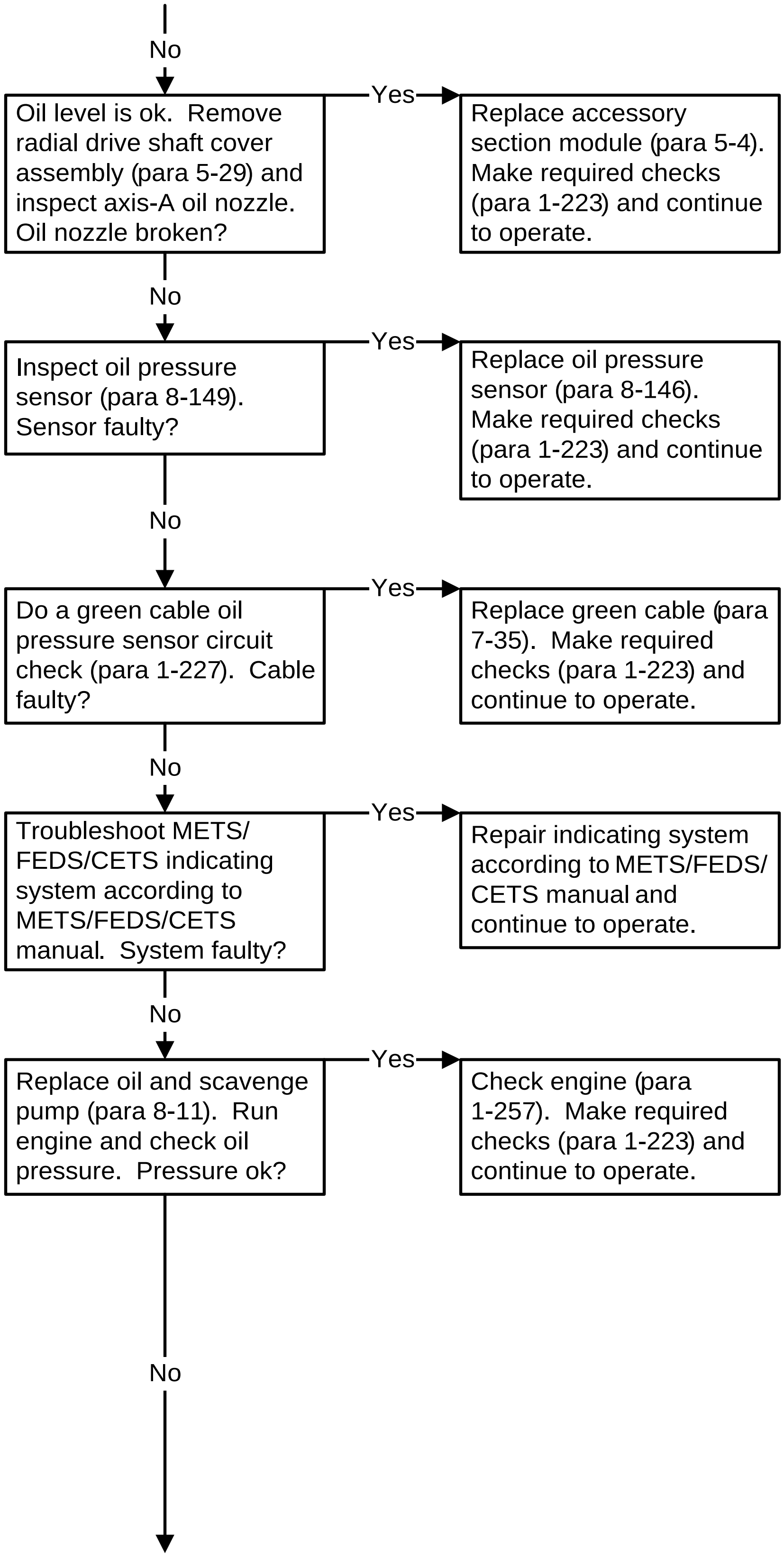
Oil level low?

Add oil, 1 quart at a time. More than 5 quarts added?

Remove engine and send it to depot.

If 5 quarts or less added, continue to operate.

Troubleshooting Procedure 53. Oil Pressure Below Limits (Cont)



Oil level is ok. Remove radial drive shaft cover assembly (para 5-29) and inspect axis-A oil nozzle. Oil nozzle broken?

Replace accessory section module (para 5-4). Make required checks (para 1-223) and continue to operate.

Inspect oil pressure sensor (para 8-149). Sensor faulty?

Replace oil pressure sensor (para 8-146). Make required checks (para 1-223) and continue to operate.

Do a green cable oil pressure sensor circuit check (para 1-227). Cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-223) and continue to operate.

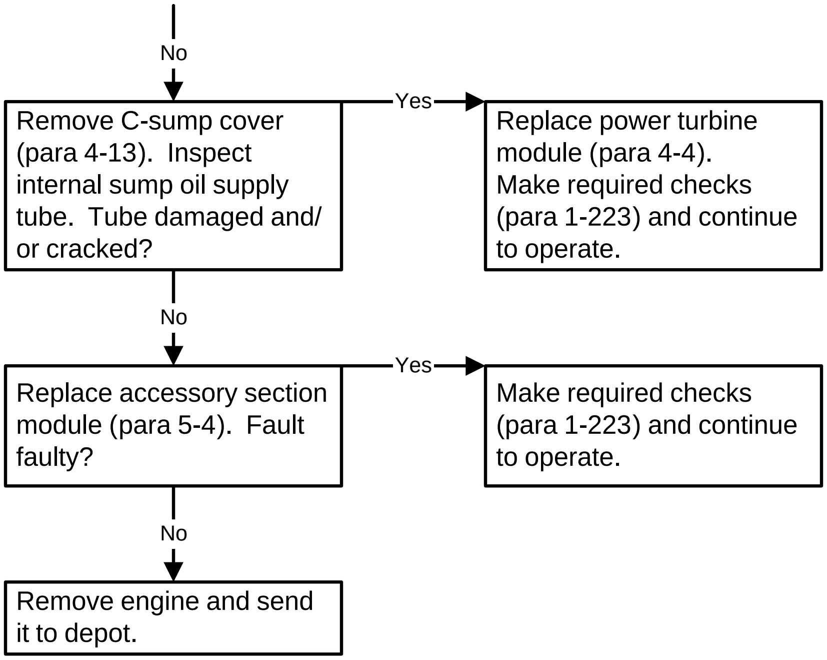
Troubleshoot METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual. System faulty?

Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace oil and scavenge pump (para 8-11). Run engine and check oil pressure. Pressure ok?

Check engine (para 1-257). Make required checks (para 1-223) and continue to operate.

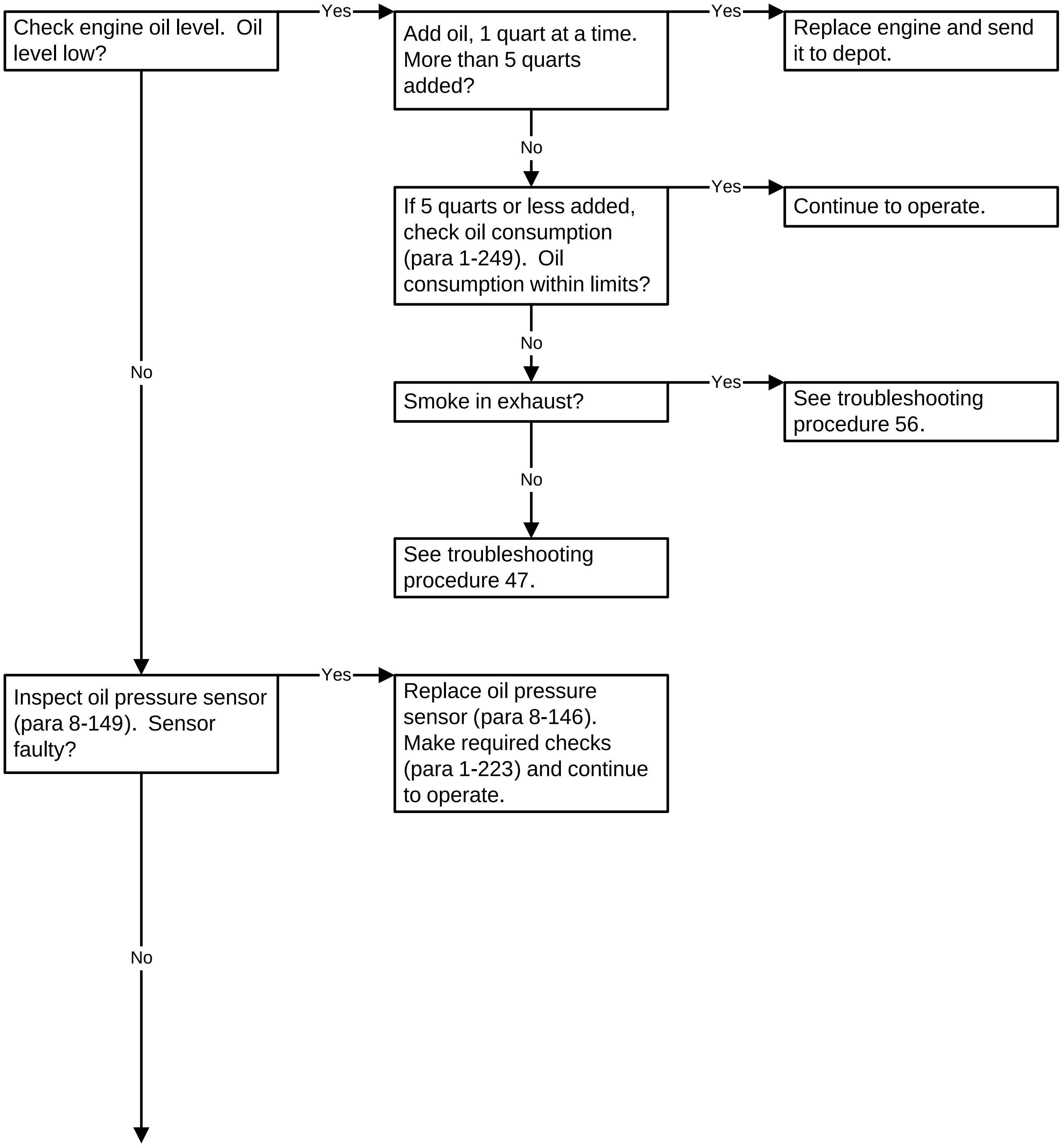
Troubleshooting Procedure 53. Oil Pressure Below Limits (Cont)



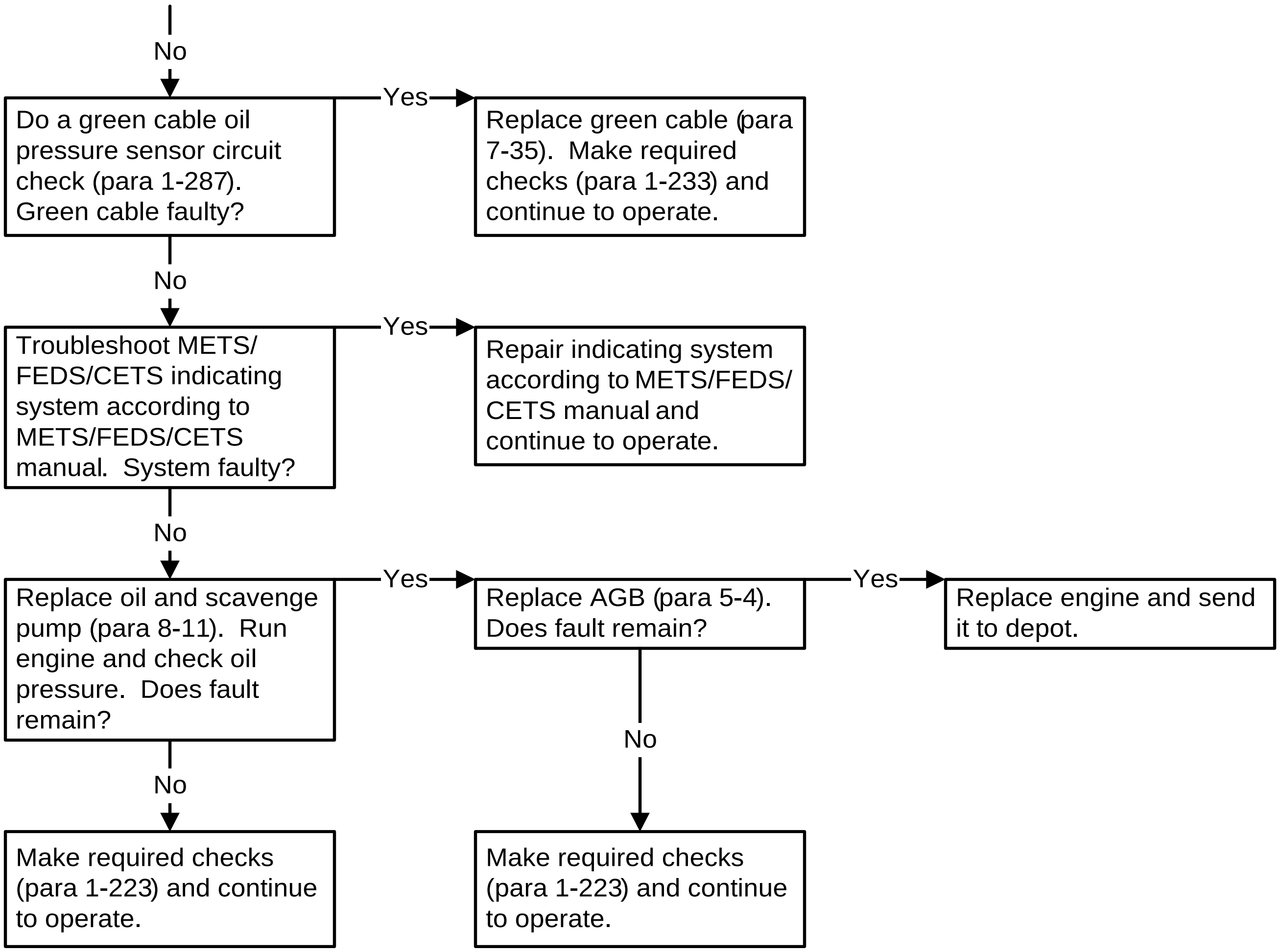
Troubleshooting Procedure 54. Oil Pressure Fluctuates

NOTE

A change of ±5 psi is cause for investigation. Oil pressure will change during transient conditions. These changes should stop about 1 minute after return to steady-state Ng conditions.



Troubleshooting Procedure 54. Oil Pressure Fluctuates (Cont)



Do a green cable oil pressure sensor circuit check (para 1-287). Green cable faulty?

Replace green cable (para 7-35). Make required checks (para 1-233) and continue to operate.

Troubleshoot METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual. System faulty?

Repair indicating system according to METS/FEDS/CETS manual and continue to operate.

Replace oil and scavenge pump (para 8-11). Run engine and check oil pressure. Does fault remain?

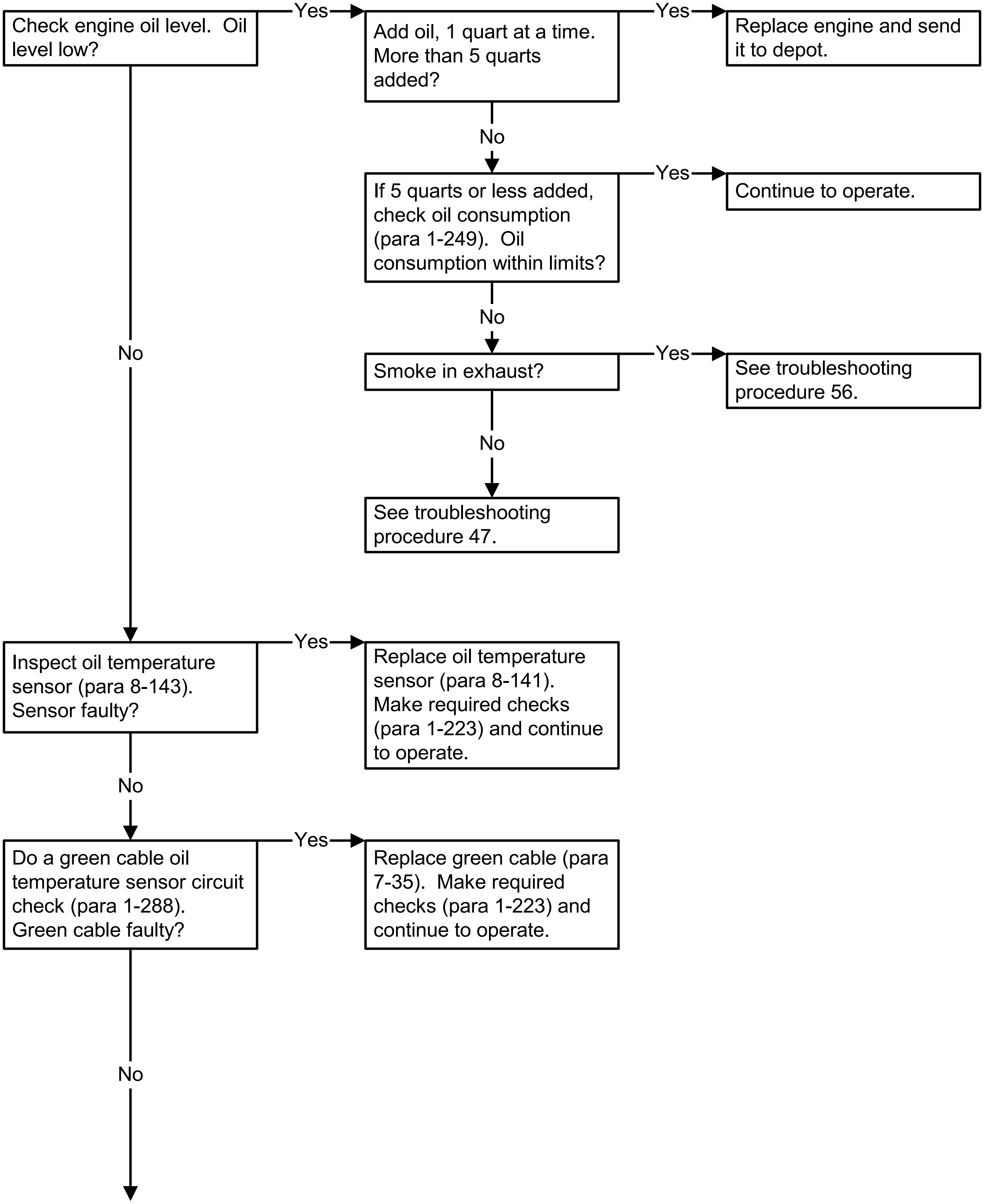
Replace AGB (para 5-4). Does fault remain?

Replace engine and send it to depot.

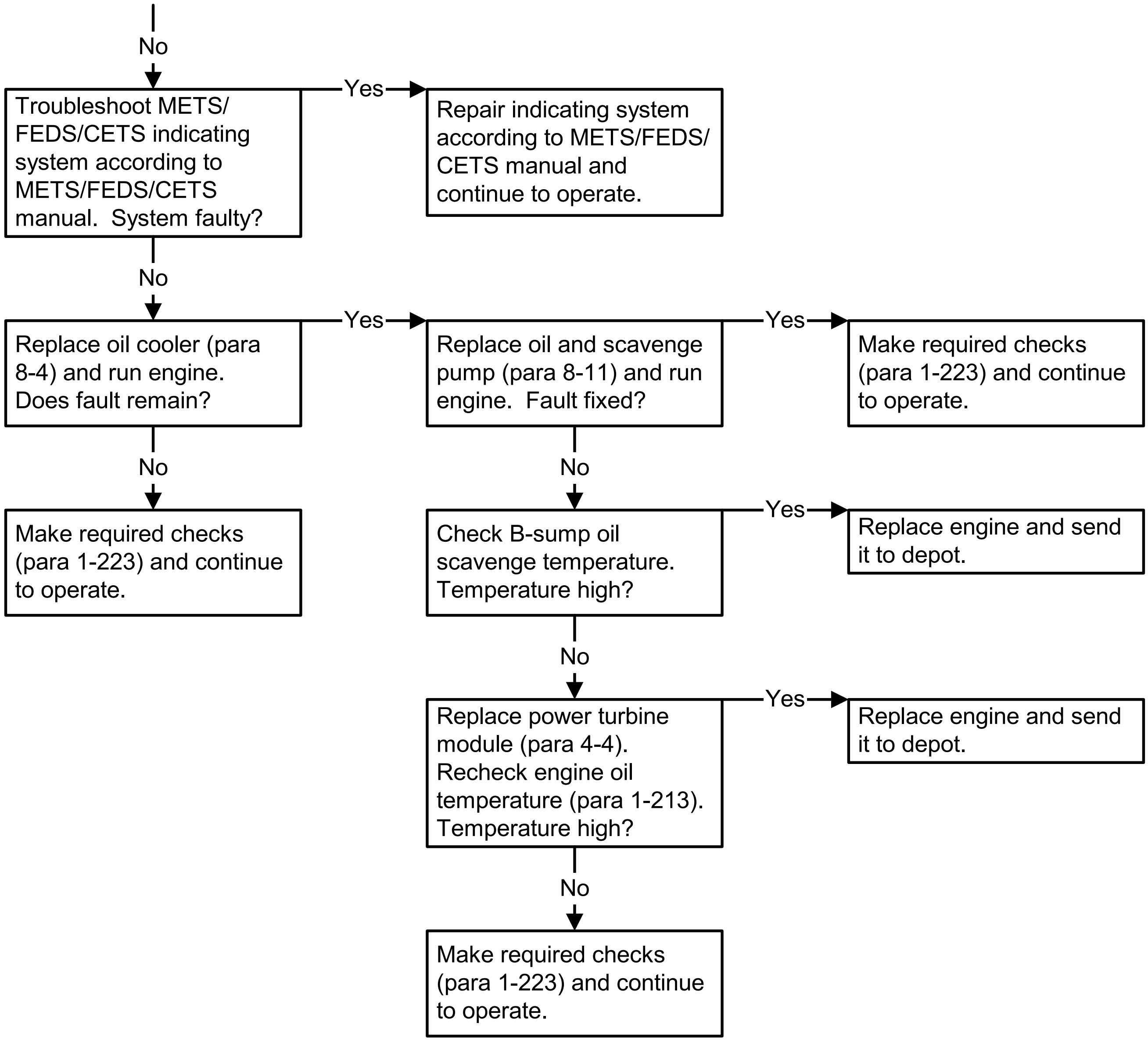
Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 55. (T700, T701C, T701D) Oil Temperature Exceeds Limits (exceeds normal operating temperature)



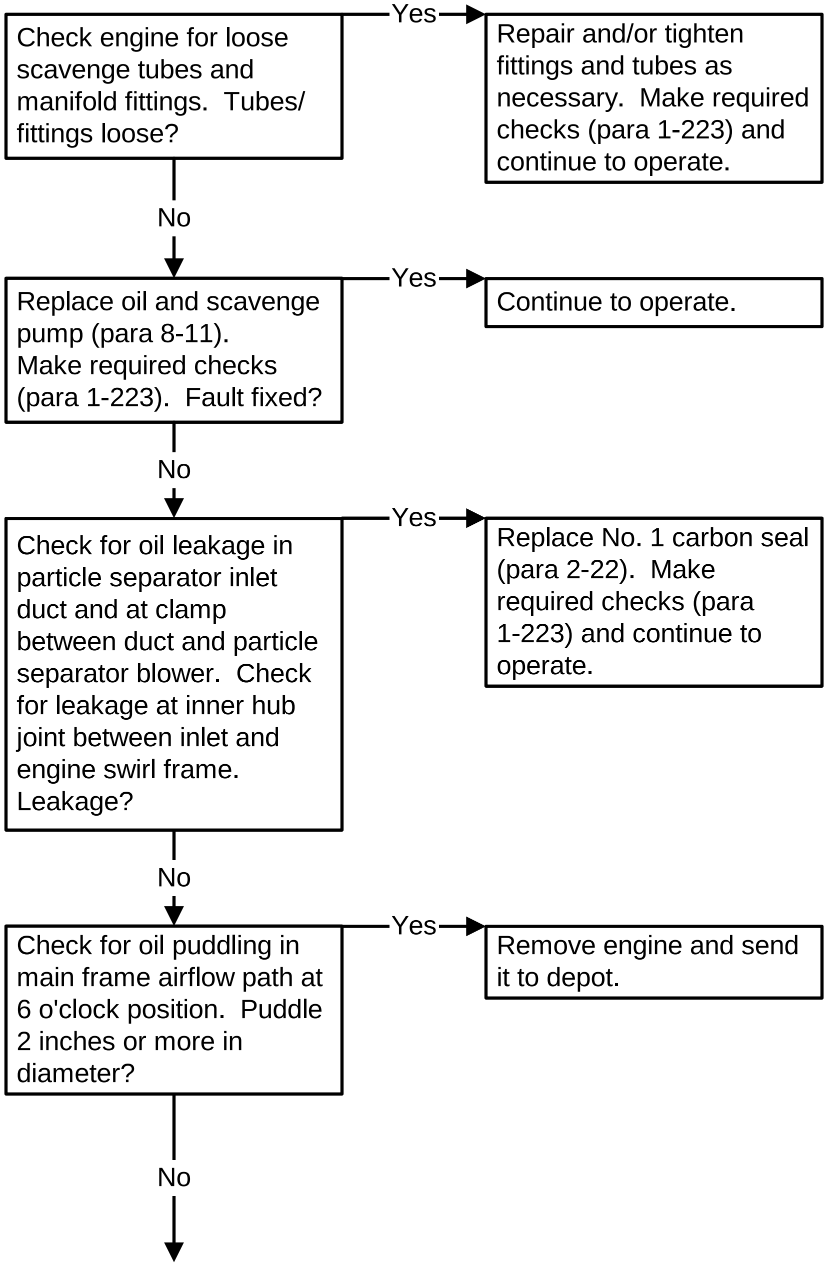
Troubleshooting Procedure 55. (T700, T701C, T701D) Oil Temperature Exceeds Limits (exceeds normal operating temperature) (Cont)



Troubleshooting Procedure 56. Smoke in Exhaust

NOTE

- White mist coming out of tailpipe prior to engine lightoff, is fuel mist. Smoke may be visible on initial start after engine change or depreservation. No visible smoke should appear after preservation oil is burned off.
- If engine oil system is serviced and engine is tipped during removal or installation, oil will seep from A-sump, down stage 1 blades and into bottom of the main frame. This is no cause to reject the engine. However, engine may cleaned (para 1-157) as required.



Check engine for loose scavenge tubes and manifold fittings. Tubes/ fittings loose?

Repair and/or tighten fittings and tubes as necessary. Make required checks (para 1-223) and continue to operate.

Replace oil and scavenge pump (para 8-11). Make required checks (para 1-223). Fault fixed?

Continue to operate.

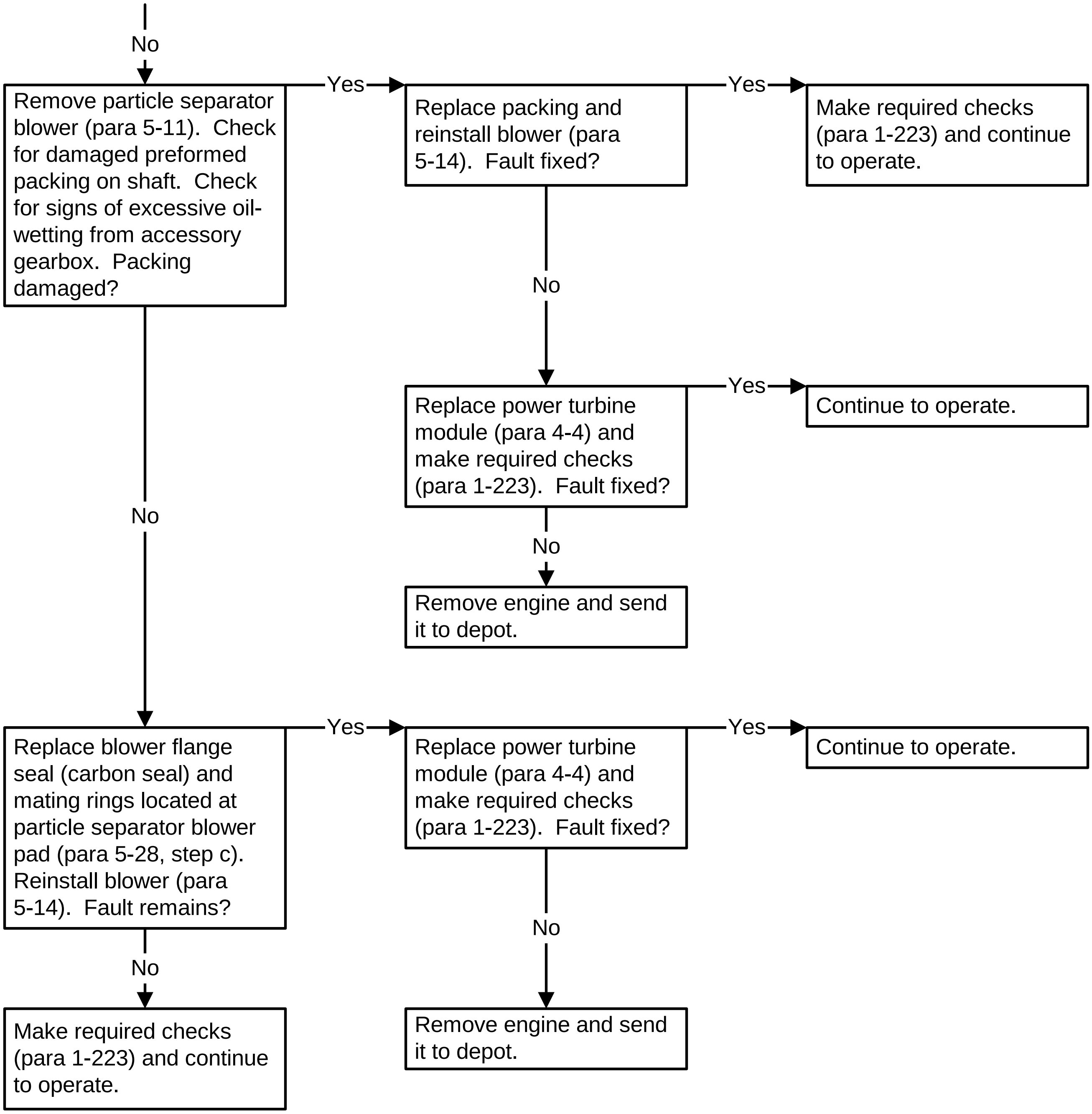
Check for oil leakage in particle separator inlet duct and at clamp between duct and particle separator blower. Check for leakage at inner hub joint between inlet and engine swirl frame. Leakage?

Replace No. 1 carbon seal (para 2-22). Make required checks (para 1-223) and continue to operate.

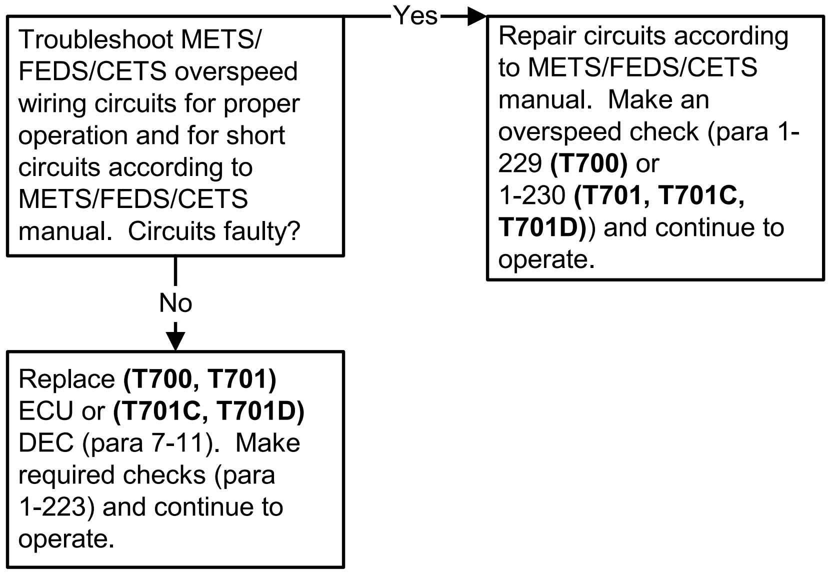
Check for oil puddling in main frame airflow path at 6 o'clock position. Puddle 2 inches or more in diameter?

Remove engine and send it to depot.

Troubleshooting Procedure 56. Smoke in Exhaust (Cont)



Troubleshooting Procedure 57. Overspeed Cuts in with One Test Button Depressed

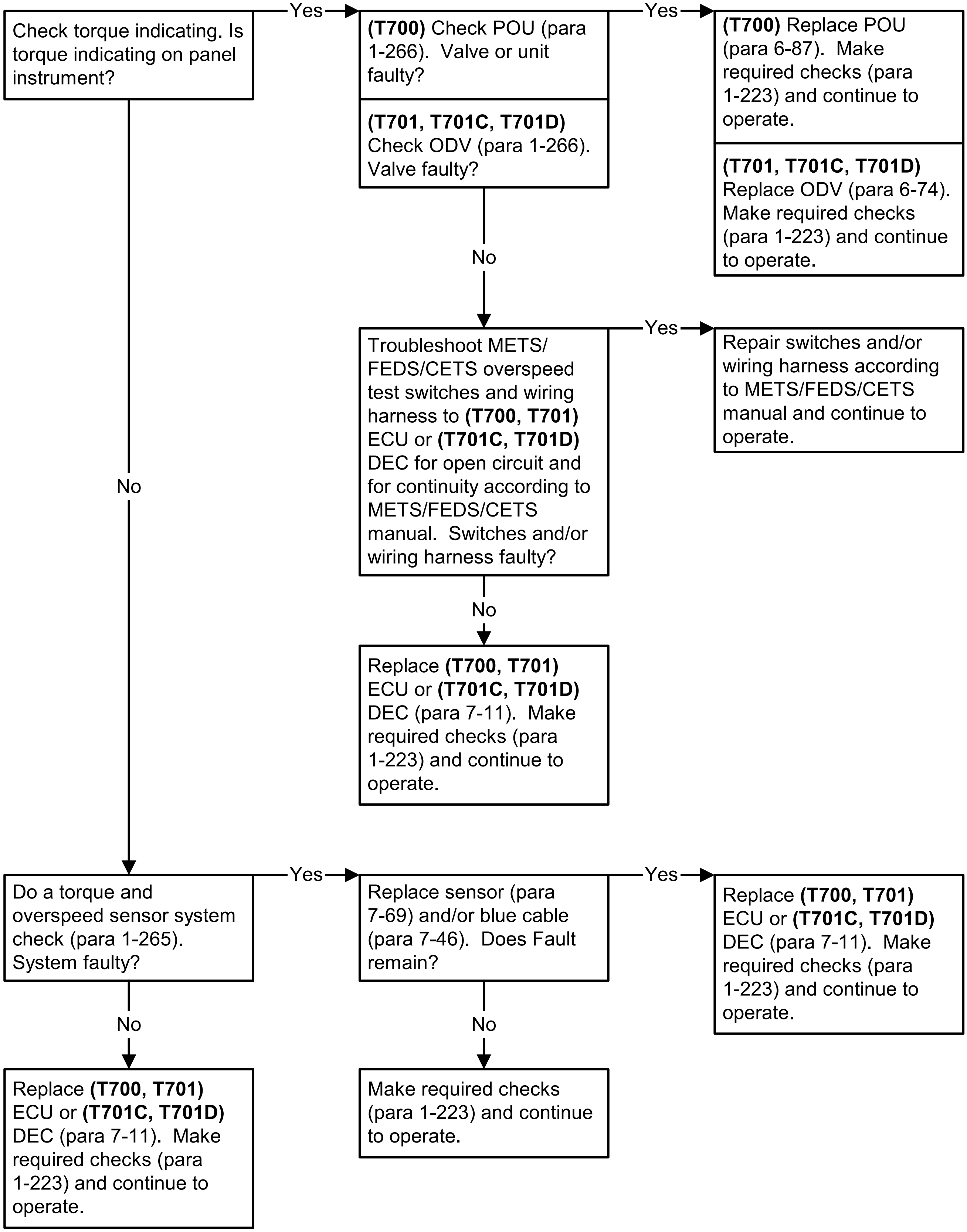


Troubleshoot METS/FEDS/CETS overspeed wiring circuits for proper operation and for short circuits according to METS/FEDS/CETS manual. Circuits faulty?

Repair circuits according to METS/FEDS/CETS manual. Make an overspeed check (para 1-229 **(T700)** or 1-230 **(T701, T701C, T701D)**) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 58. Overspeed Test System Will Not Operate (overspeed test system fails to cutback Ng and Np)



Check torque indicating. Is torque indicating on panel instrument?

(T700) Check POU (para 1-266). Valve or unit faulty?

(T701, T701C, T701D) Check ODV (para 1-266). Valve faulty?

(T700) Replace POU (para 6-87). Make required checks (para 1-223) and continue to operate.

(T701, T701C, T701D) Replace ODV (para 6-74). Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS overspeed test switches and wiring harness to **(T700, T701)** ECU or **(T701C, T701D)** DEC for open circuit and for continuity according to METS/FEDS/CETS manual. Switches and/or wiring harness faulty?

Repair switches and/or wiring harness according to METS/FEDS/CETS manual and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Do a torque and overspeed sensor system check (para 1-265). System faulty?

Replace sensor (para 7-69) and/or blue cable (para 7-46). Does Fault remain?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

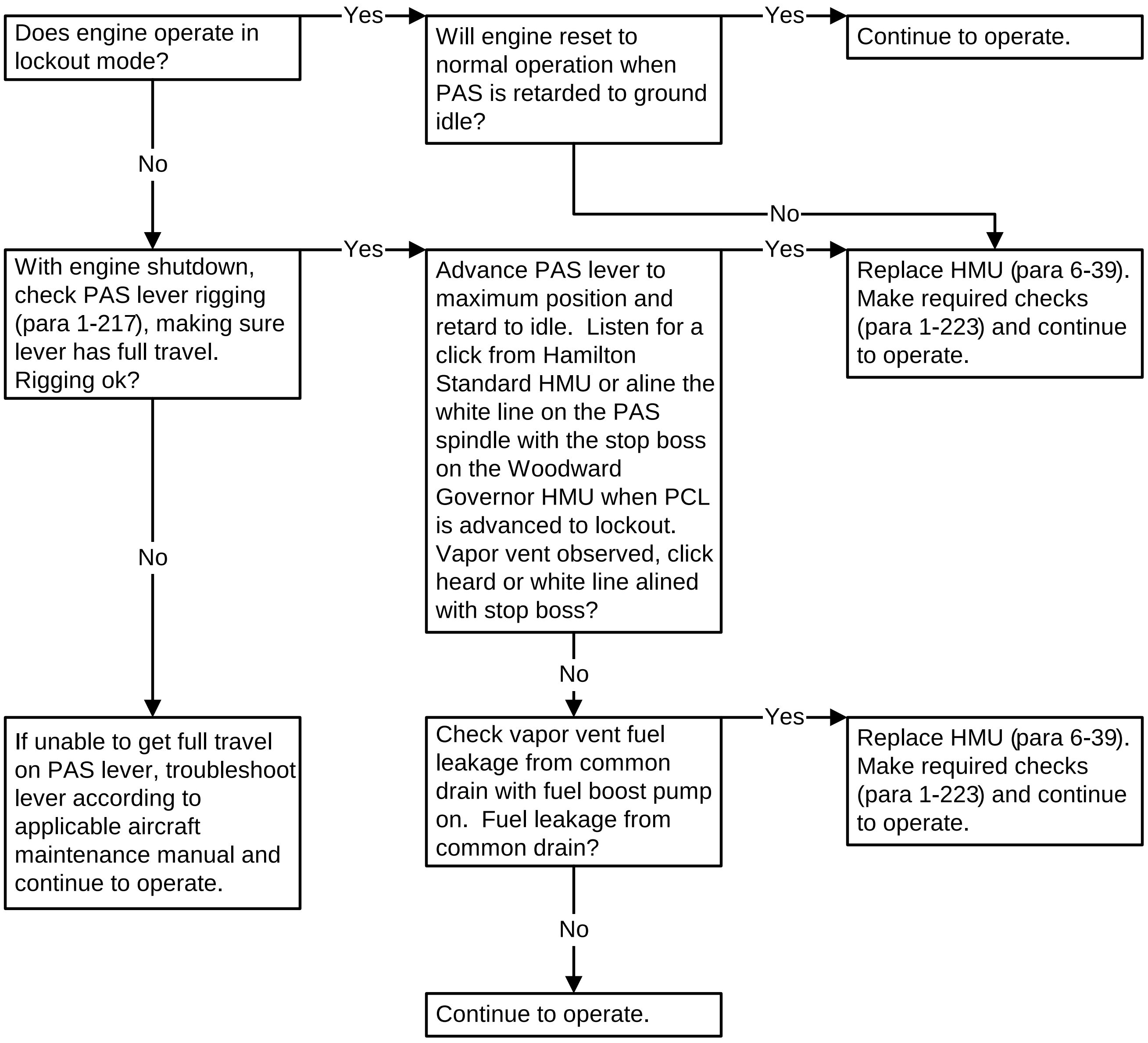
Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 59. *ECU or DEC Lockout Mode Inoperative (engine will not respond to ECU or DEC lockout when PAS lever is advanced to maximum position or engine will not reset from lockout)*

NOTE

During normal operation, when PAS lever is advanced to maximum position, a rapid increase in % Ng will occur. Manual control of PAS lever is required to maintain (METS) 104.5% Np (20,900 RPM) (FEDS/CETS) 100% Np (20,900 RPM).



Does engine operate in lockout mode?

Will engine reset to normal operation when PAS is retarded to ground idle?

Continue to operate.

With engine shutdown, check PAS lever rigging (para 1-217), making sure lever has full travel. Rigging ok?

Advance PAS lever to maximum position and retard to idle. Listen for a click from Hamilton Standard HMU or aline the white line on the PAS spindle with the stop boss on the Woodward Governor HMU when PCL is advanced to lockout. Vapor vent observed, click heard or white line alined with stop boss?

Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

If unable to get full travel on PAS lever, troubleshoot lever according to applicable aircraft maintenance manual and continue to operate.

Check vapor vent fuel leakage from common drain with fuel boost pump on. Fuel leakage from common drain?

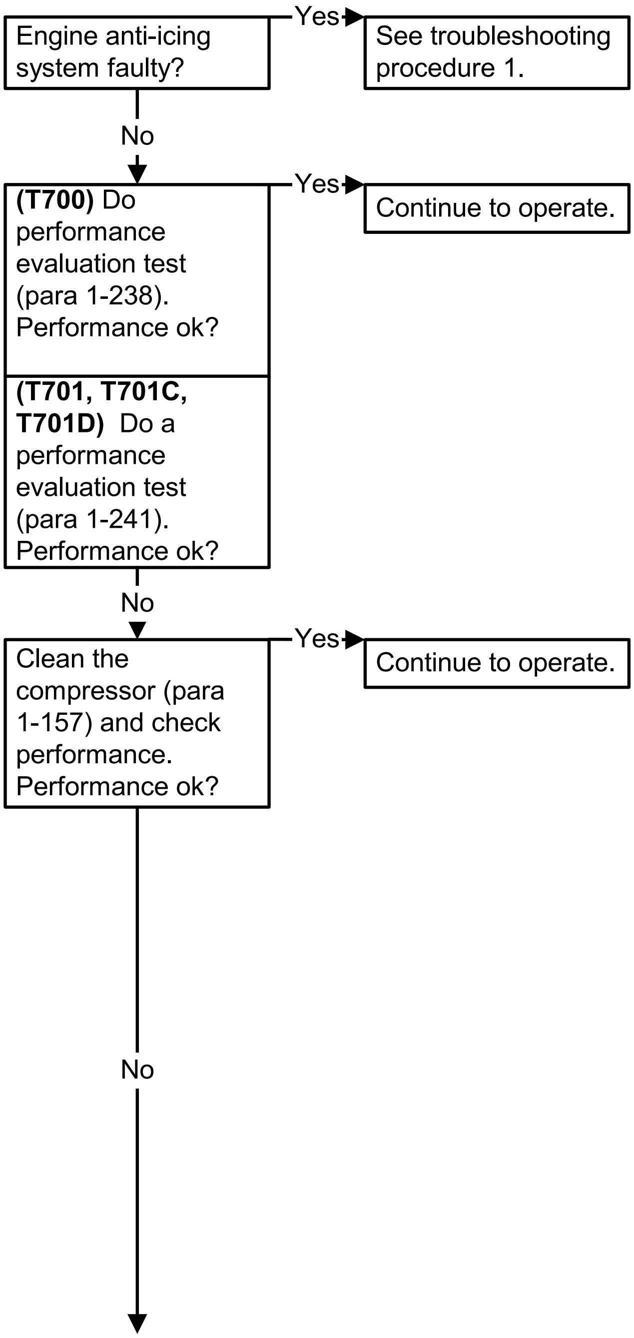
Replace HMU (para 6-39). Make required checks (para 1-223) and continue to operate.

Continue to operate.

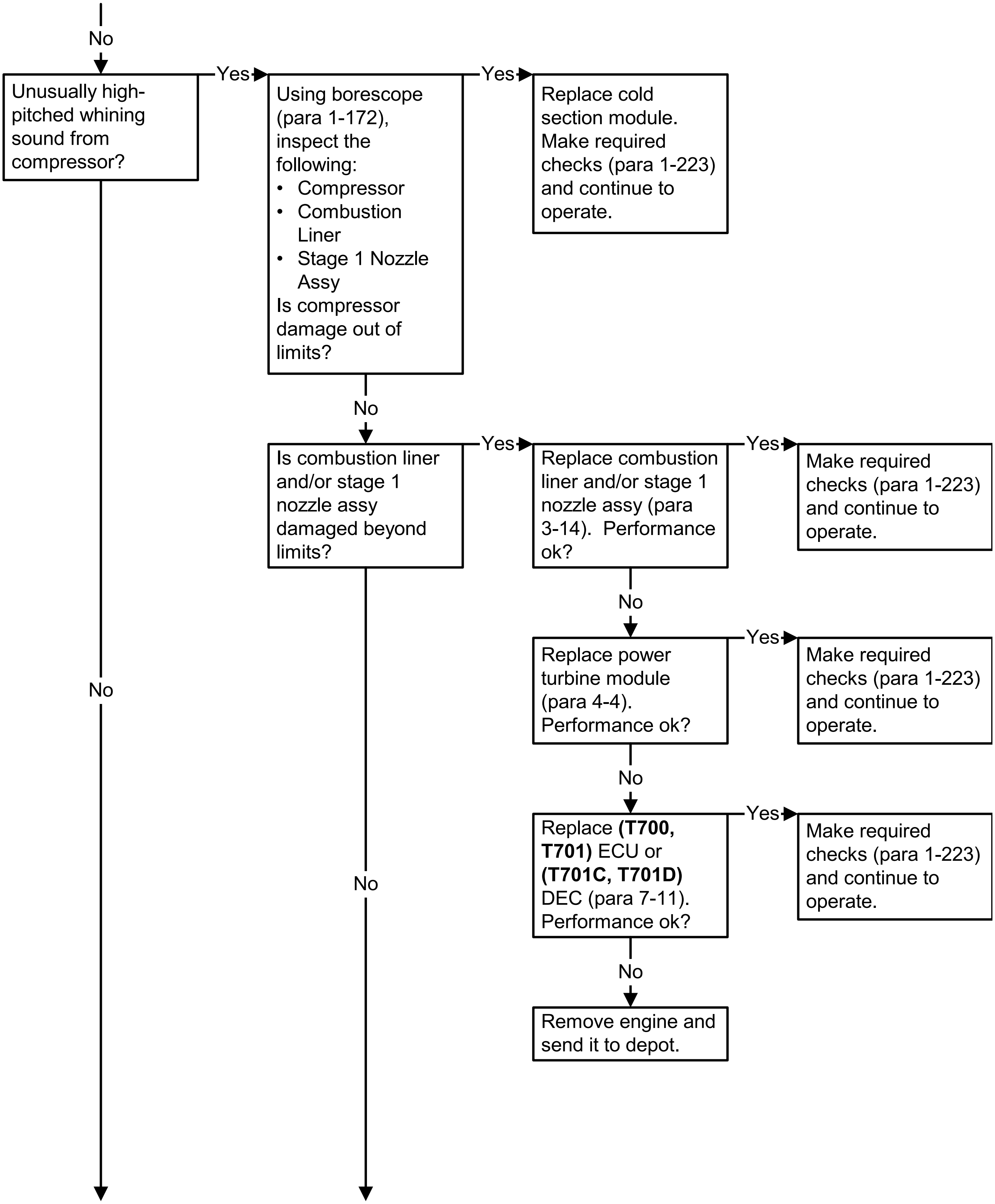
Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT)

NOTE

- Make sure METS/FEDS/CETS instrumentation is calibrated.
- Before taking performance data, check the anti-icing system for proper operation (para 1-237). All performance data must be taken with anti-ice off.
- **(T700)** for engines not already equipped, install ECU PN 4046T29G08, G09, or G10 when ECU replacement is required.



Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT) (Cont)



Unusually high-pitched whining sound from compressor?

Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion Liner
- Stage 1 Nozzle Assy

Is compressor damage out of limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Is combustion liner and/or stage 1 nozzle assy damaged beyond limits?

Replace combustion liner and/or stage 1 nozzle assy (para 3-14). Performance ok?

Make required checks (para 1-223) and continue to operate.

Replace power turbine module (para 4-4). Performance ok?

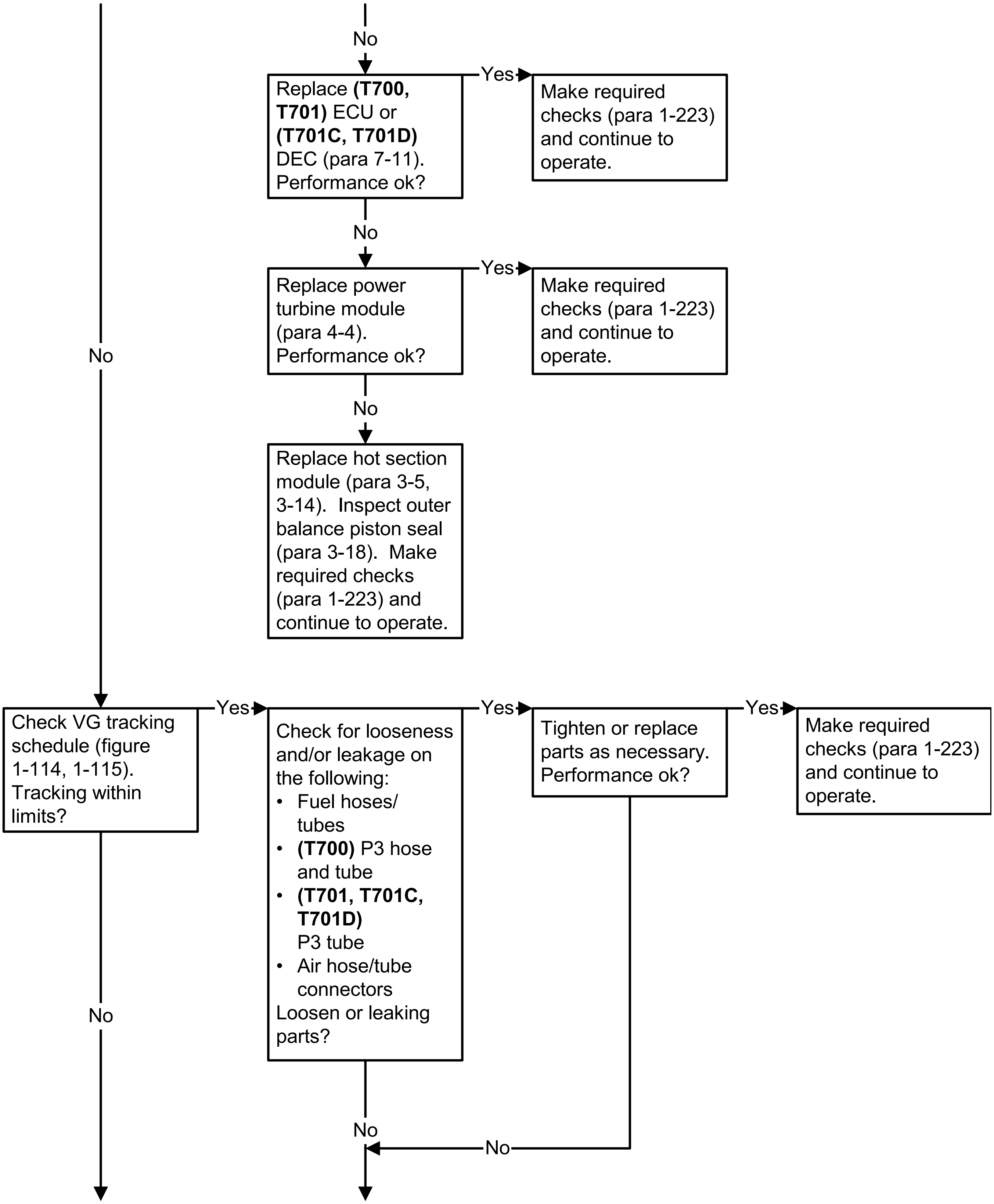
Make required checks (para 1-223) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Performance ok?

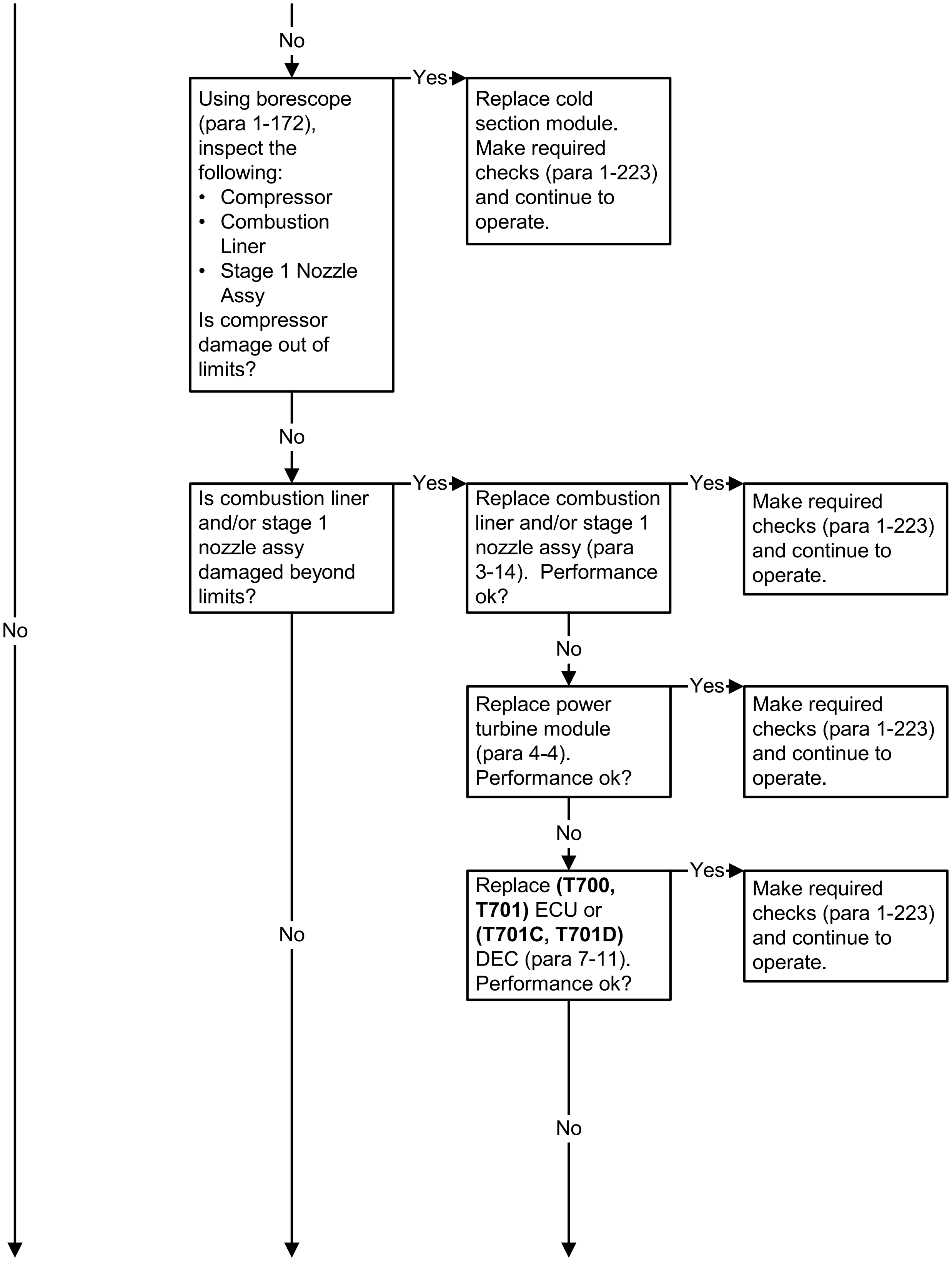
Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.

Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT) (Cont)



Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT) (Cont)



Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion Liner
- Stage 1 Nozzle Assy

Is compressor damage out of limits?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Is combustion liner and/or stage 1 nozzle assy damaged beyond limits?

Replace combustion liner and/or stage 1 nozzle assy (para 3-14). Performance ok?

Make required checks (para 1-223) and continue to operate.

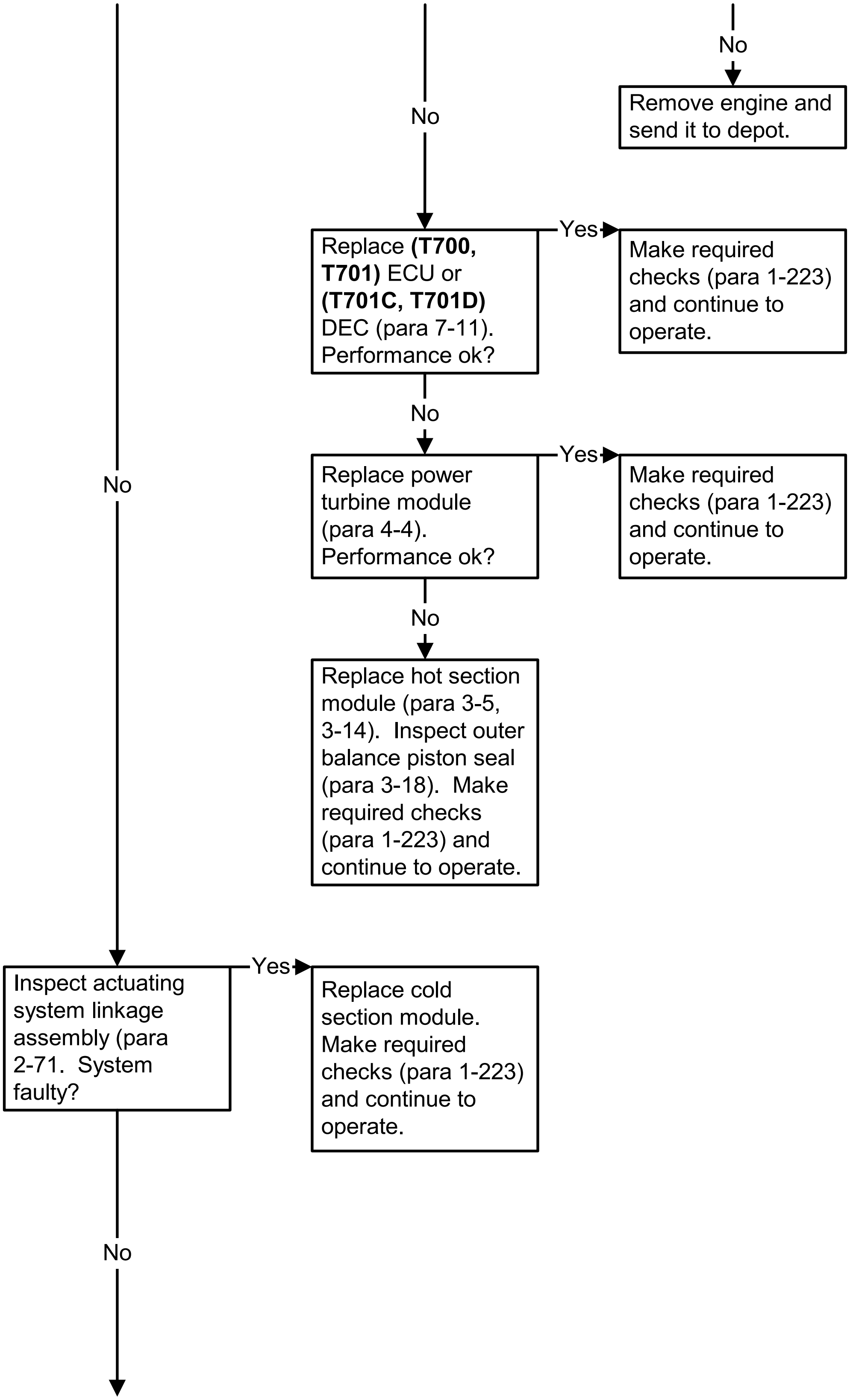
Replace power turbine module (para 4-4). Performance ok?

Make required checks (para 1-223) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Performance ok?

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT) (Cont)



Remove engine and send it to depot.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Performance ok?

Make required checks (para 1-223) and continue to operate.

Replace power turbine module (para 4-4). Performance ok?

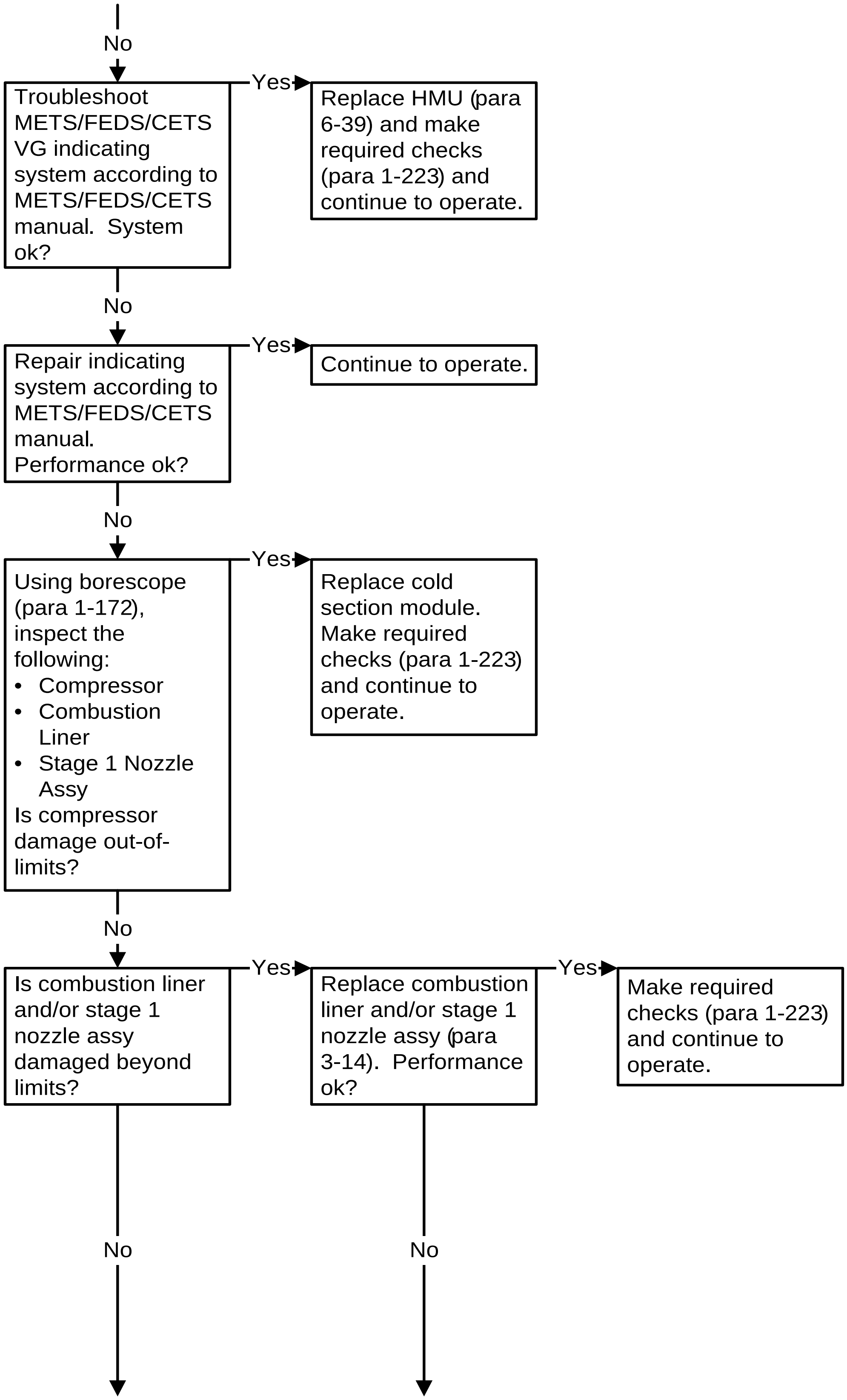
Make required checks (para 1-223) and continue to operate.

Replace hot section module (para 3-5, 3-14). Inspect outer balance piston seal (para 3-18). Make required checks (para 1-223) and continue to operate.

Inspect actuating system linkage assembly (para 2-71. System faulty?

Replace cold section module. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT) (Cont)



Troubleshoot METS/FEDS/CETS VG indicating system according to METS/FEDS/CETS manual. System ok?

Replace HMU (para 6-39) and make required checks (para 1-223) and continue to operate.

Repair indicating system according to METS/FEDS/CETS manual. Performance ok?

Continue to operate.

Using borescope (para 1-172), inspect the following:
- Compressor
- Combustion Liner
- Stage 1 Nozzle Assy

Is compressor damage out-of-limits?

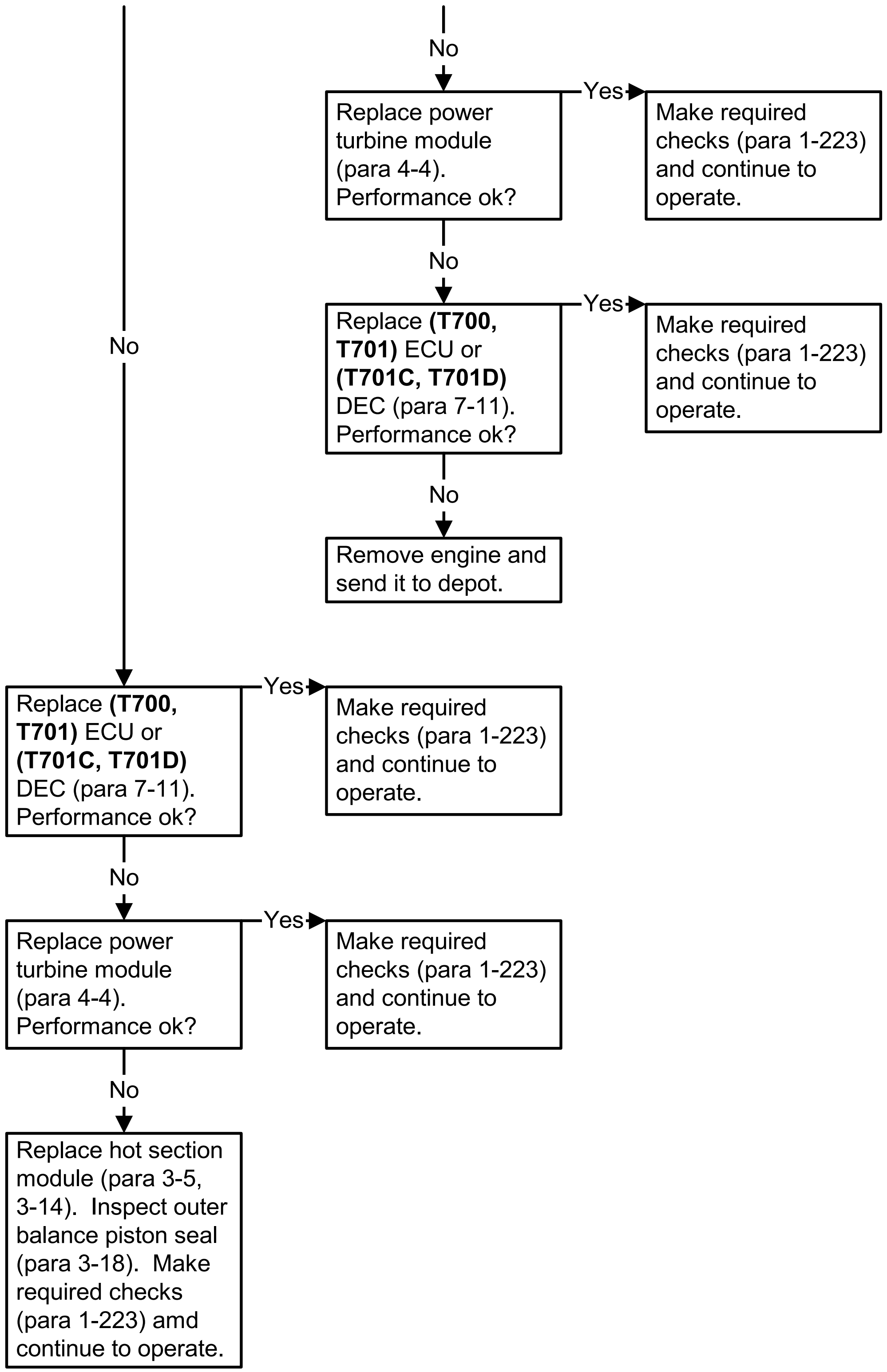
Replace cold section module. Make required checks (para 1-223) and continue to operate.

Is combustion liner and/or stage 1 nozzle assy damaged beyond limits?

Replace combustion liner and/or stage 1 nozzle assy (para 3-14). Performance ok?

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 60. Low Engine Performance (torque low for given TGT) (Cont)



Replace power turbine module (para 4-4). Performance ok?

Make required checks (para 1-223) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Performance ok?

Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Performance ok?

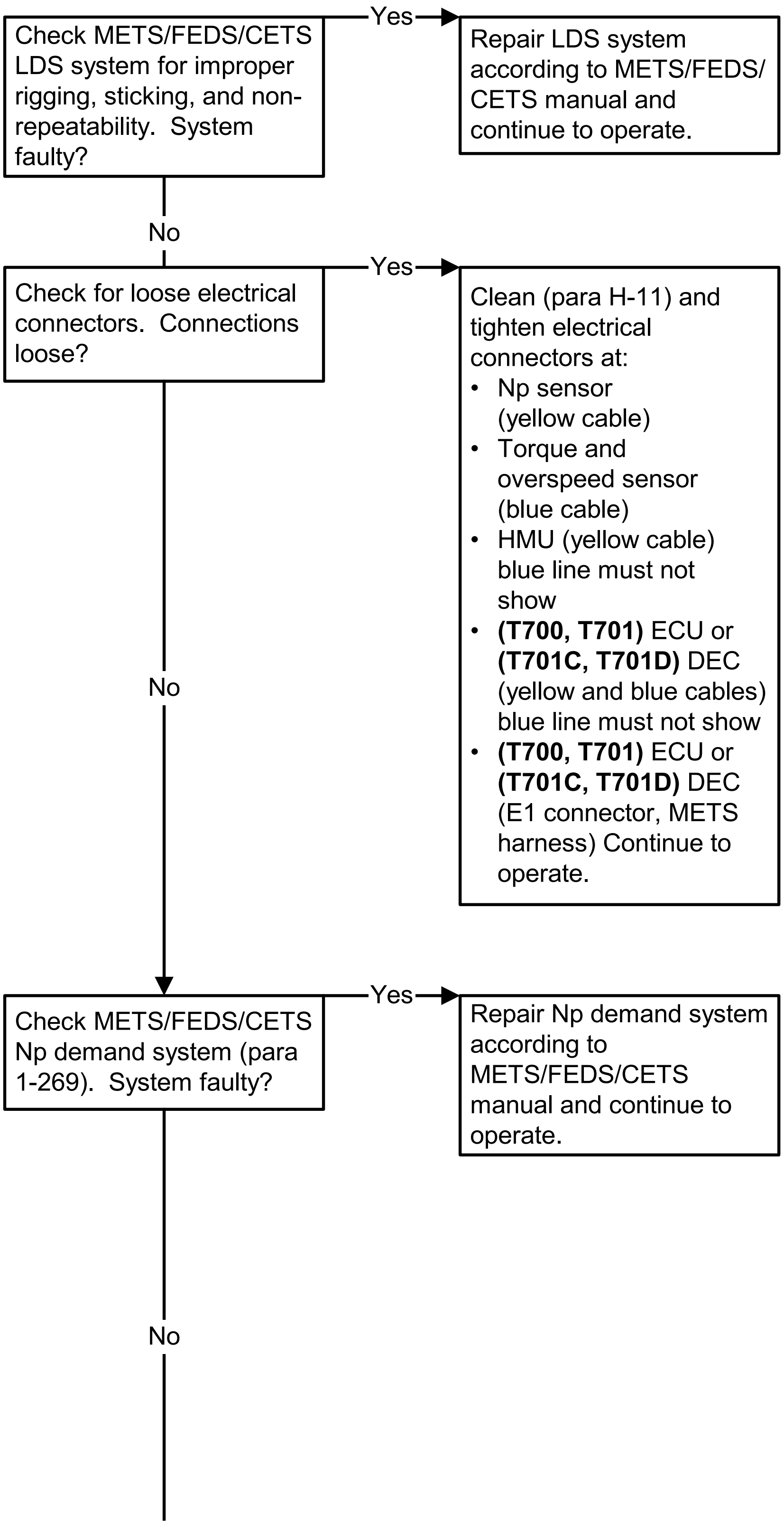
Make required checks (para 1-223) and continue to operate.

Replace power turbine module (para 4-4). Performance ok?

Make required checks (para 1-223) and continue to operate.

Replace hot section module (para 3-5, 3-14). Inspect outer balance piston seal (para 3-18). Make required checks (para 1-223) amd continue to operate.

Troubleshooting Procedure 61. Stable Operation With ECU or DEC Locked Out (Ng, TGT, and Np fluctuated above and below limits when ECU or DEC was not locked out)



Check METS/FEDS/CETS LDS system for improper rigging, sticking, and non-repeatability. System faulty?

Repair LDS system according to METS/FEDS/CETS manual and continue to operate.

Check for loose electrical connectors. Connections loose?

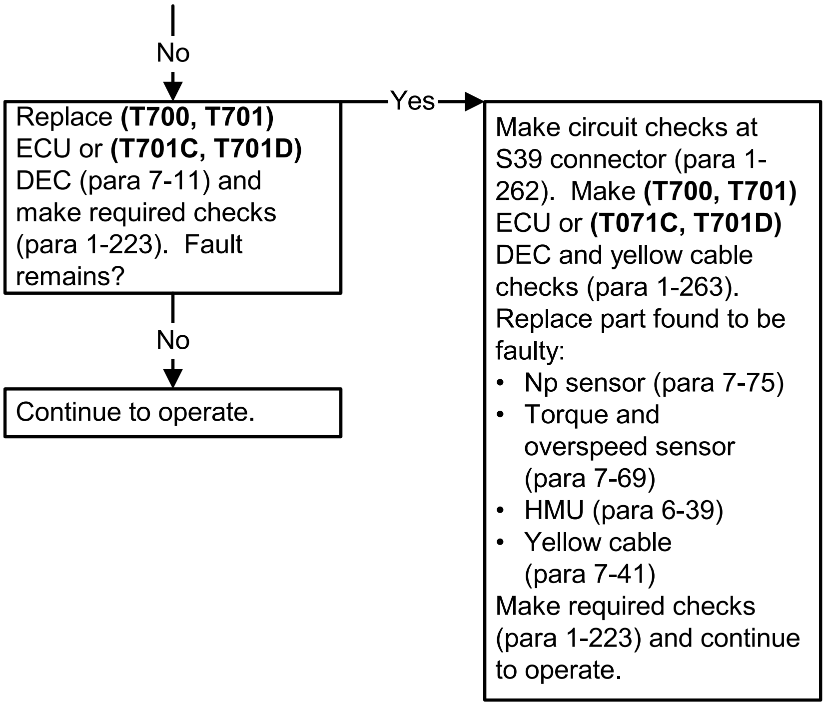
Clean (para H-11) and tighten electrical connectors at:

- Np sensor (yellow cable)
- Torque and overspeed sensor (blue cable)
- HMU (yellow cable) blue line must not show
- **(T700, T701)** ECU or **(T701C, T701D)** DEC (yellow and blue cables) blue line must not show
- **(T700, T701)** ECU or **(T701C, T701D)** DEC (E1 connector, METS harness) Continue to operate.

Check METS/FEDS/CETS Np demand system (para 1-269). System faulty?

Repair Np demand system according to METS/FEDS/CETS manual and continue to operate.

Troubleshooting Procedure 61. Stable Operation With ECU or DEC Locked Out (Ng, TGT, and Np fluctuated above and below limits when ECU or DEC was not locked out) (Cont)



Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11) and make required checks (para 1-223). Fault remains?

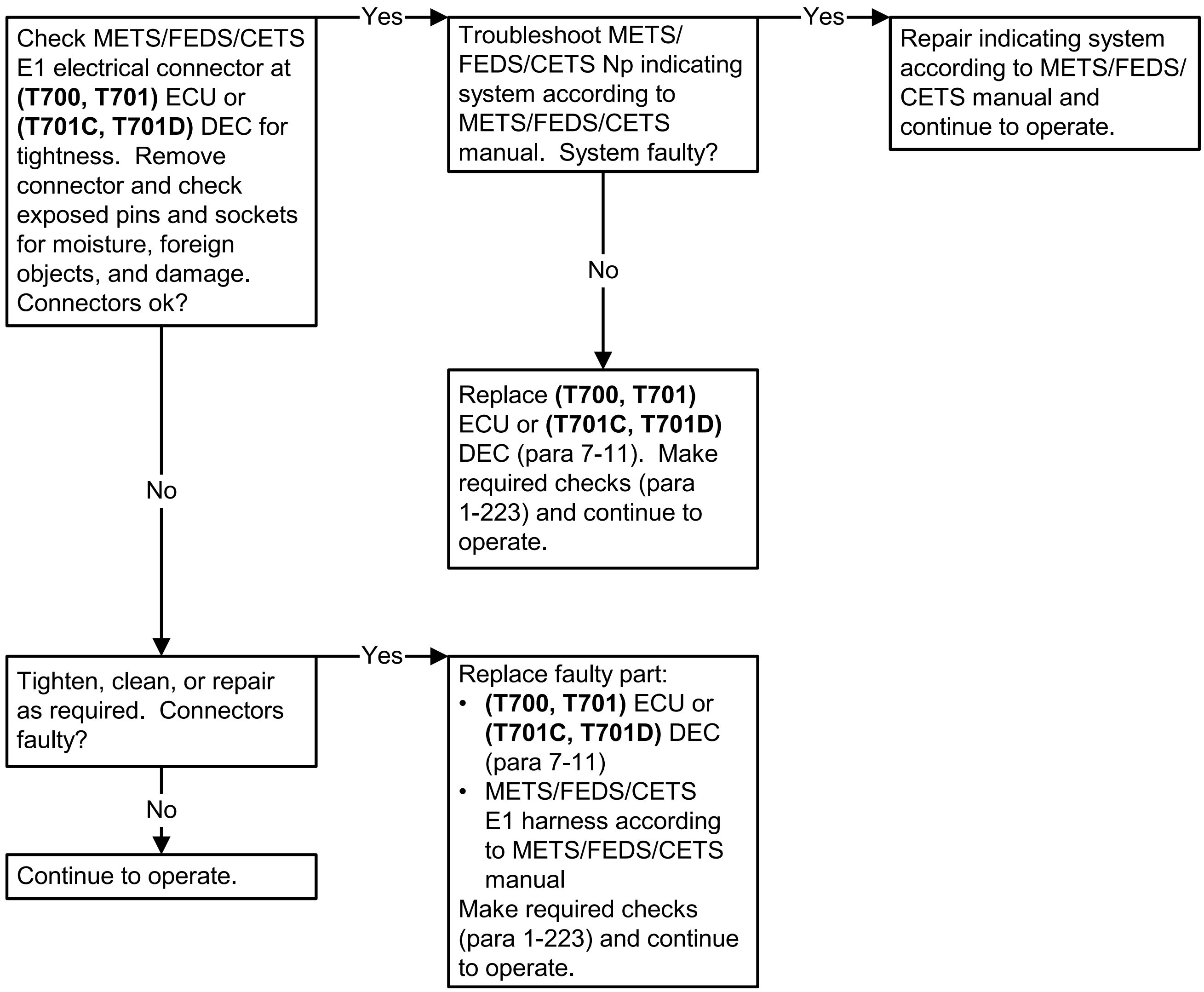
Continue to operate.

Make circuit checks at S39 connector (para 1-262). Make **(T700, T701)** ECU or **(T071C, T701D)** DEC and yellow cable checks (para 1-263). Replace part found to be faulty:

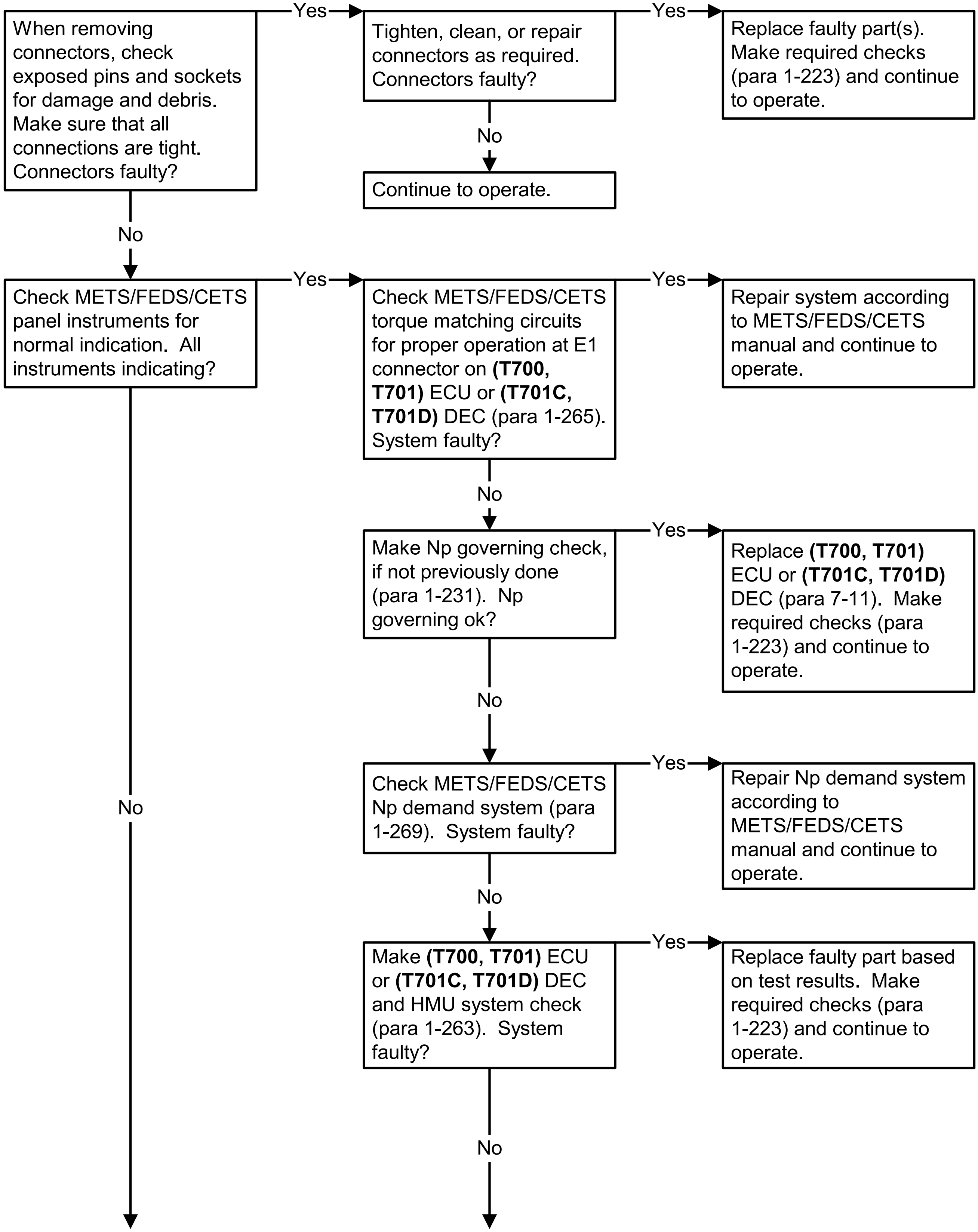
- Np sensor (para 7-75)
- Torque and overspeed sensor (para 7-69)
- HMU (para 6-39)
- Yellow cable (para 7-41)

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 62. Torque Instrument Fluctuating or Not Indicating (all other instruments normal)



Troubleshooting Procedure 63. Torque Matching Inoperative (Np does not respond during torque matching check (para 1-234))



When removing connectors, check exposed pins and sockets for damage and debris. Make sure that all connections are tight. Connectors faulty?

Tighten, clean, or repair connectors as required. Connectors faulty?

Replace faulty part(s). Make required checks (para 1-223) and continue to operate.

Continue to operate.

Check METS/FEDS/CETS panel instruments for normal indication. All instruments indicating?

Check METS/FEDS/CETS torque matching circuits for proper operation at E1 connector on **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 1-265). System faulty?

Repair system according to METS/FEDS/CETS manual and continue to operate.

Make Np governing check, if not previously done (para 1-231). Np governing ok?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

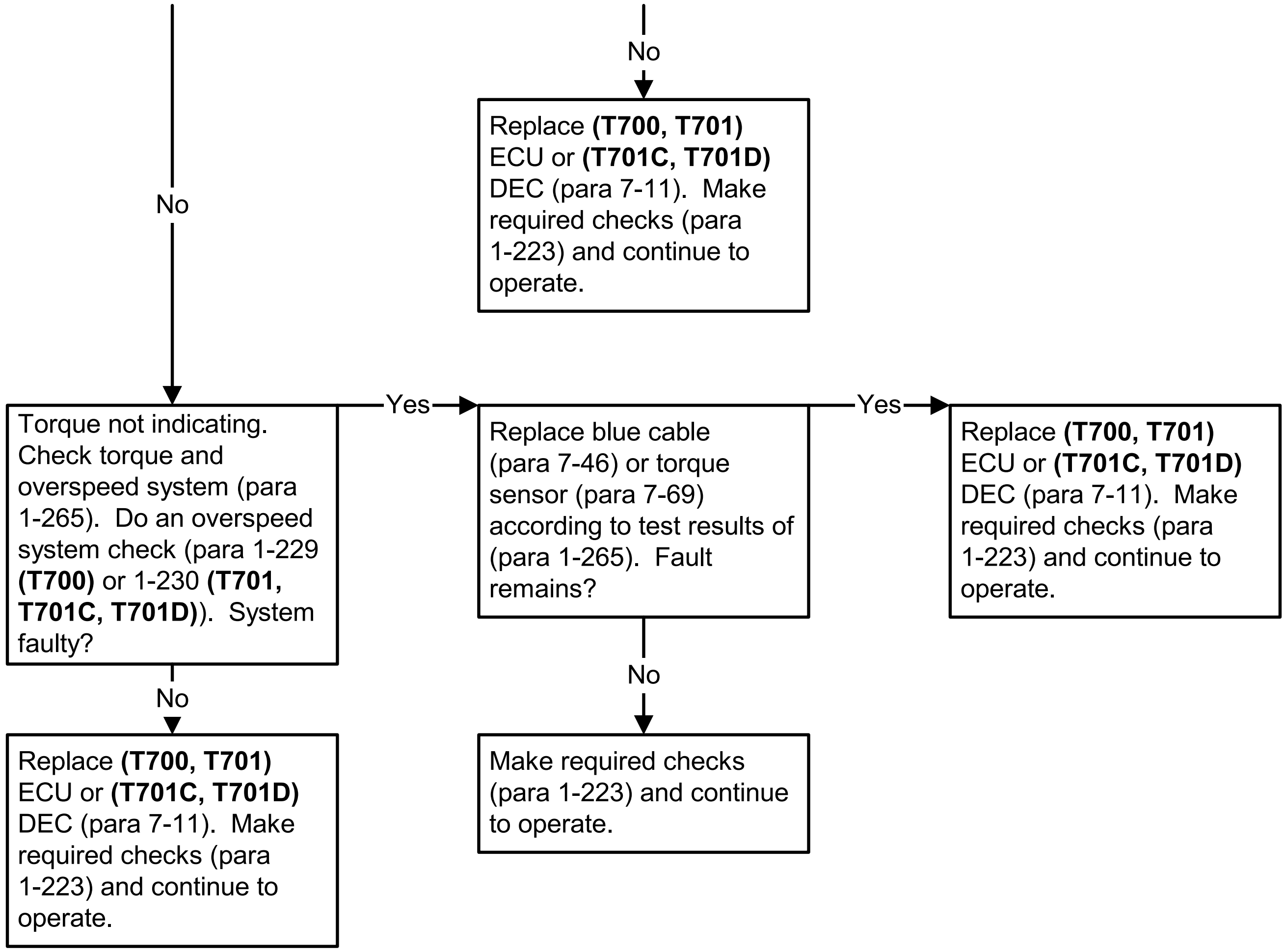
Check METS/FEDS/CETS Np demand system (para 1-269). System faulty?

Repair Np demand system according to METS/FEDS/CETS manual and continue to operate.

Make **(T700, T701)** ECU or **(T701C, T701D)** DEC and HMU system check (para 1-263). System faulty?

Replace faulty part based on test results. Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 63. Torque Matching Inoperative (Np does not respond during torque matching check (para 1-234)) (Cont)



Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Torque not indicating. Check torque and overspeed system (para 1-265). Do an overspeed system check (para 1-229 **(T700)** or 1-230 **(T701, T701C, T701D)**). System faulty?

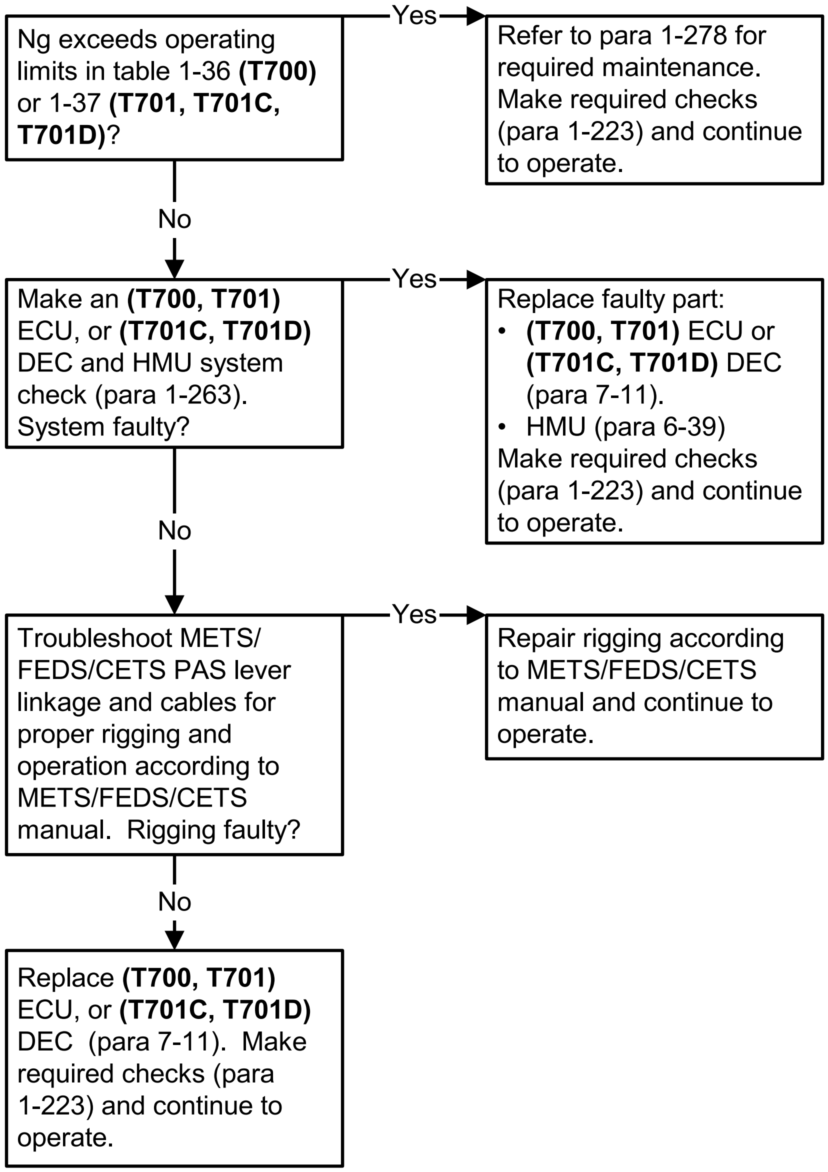
Replace blue cable (para 7-46) or torque sensor (para 7-69) according to test results of (para 1-265). Fault remains?

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Replace **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 64. Uncontrolled Acceleration above Ground Idle Speed while Advancing PAS Lever to FLY (all engine parameters indicating)



Ng exceeds operating limits in table 1-36 **(T700)** or 1-37 **(T701, T701C, T701D)**?

Refer to para 1-278 for required maintenance. Make required checks (para 1-223) and continue to operate.

Make an **(T700, T701)** ECU, or **(T701C, T701D)** DEC and HMU system check (para 1-263). System faulty?

Replace faulty part:
- **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-11).
- HMU (para 6-39)

Make required checks (para 1-223) and continue to operate.

Troubleshoot METS/FEDS/CETS PAS lever linkage and cables for proper rigging and operation according to METS/FEDS/CETS manual. Rigging faulty?

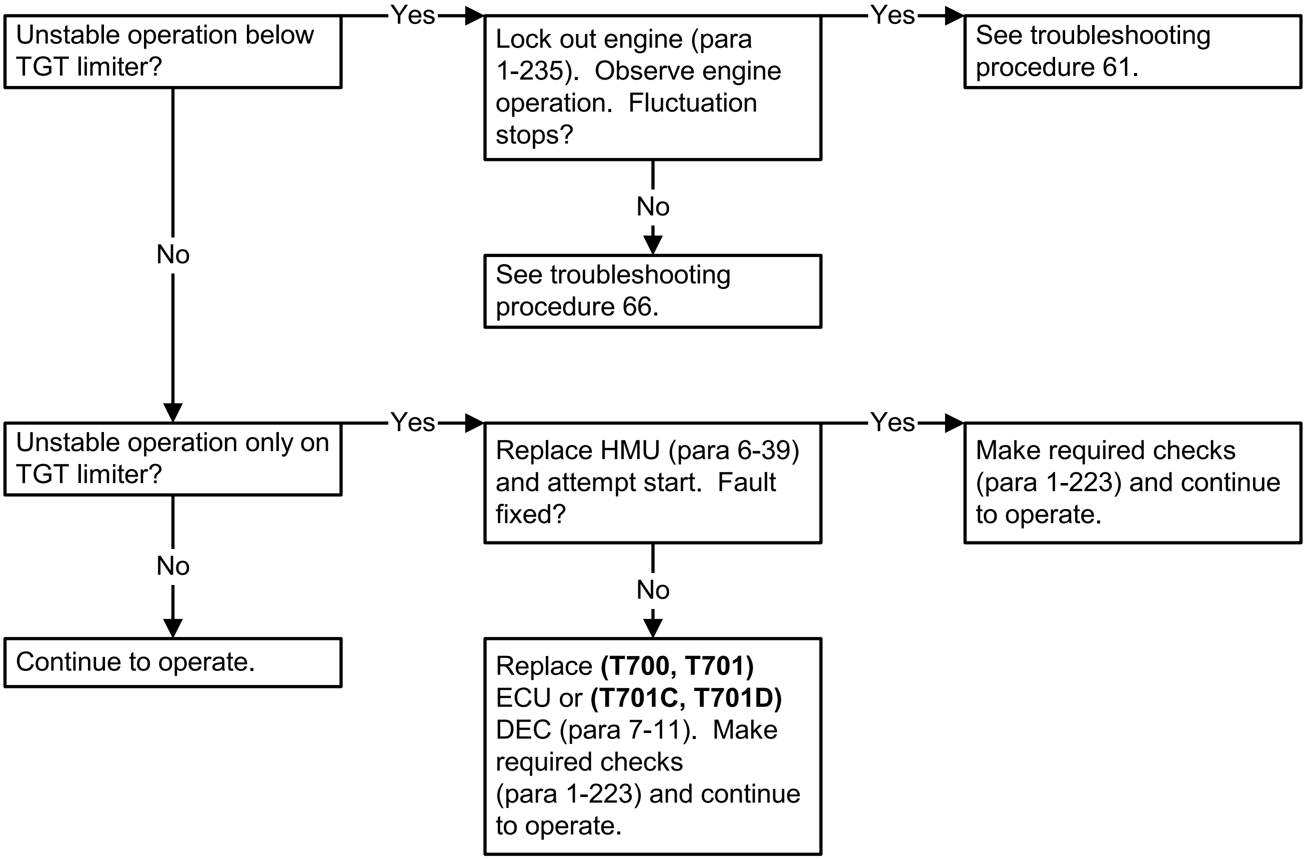
Repair rigging according to METS/FEDS/CETS manual and continue to operate.

Replace **(T700, T701)** ECU, or **(T701C, T701D)** DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 65. Unstable Operation

NOTE

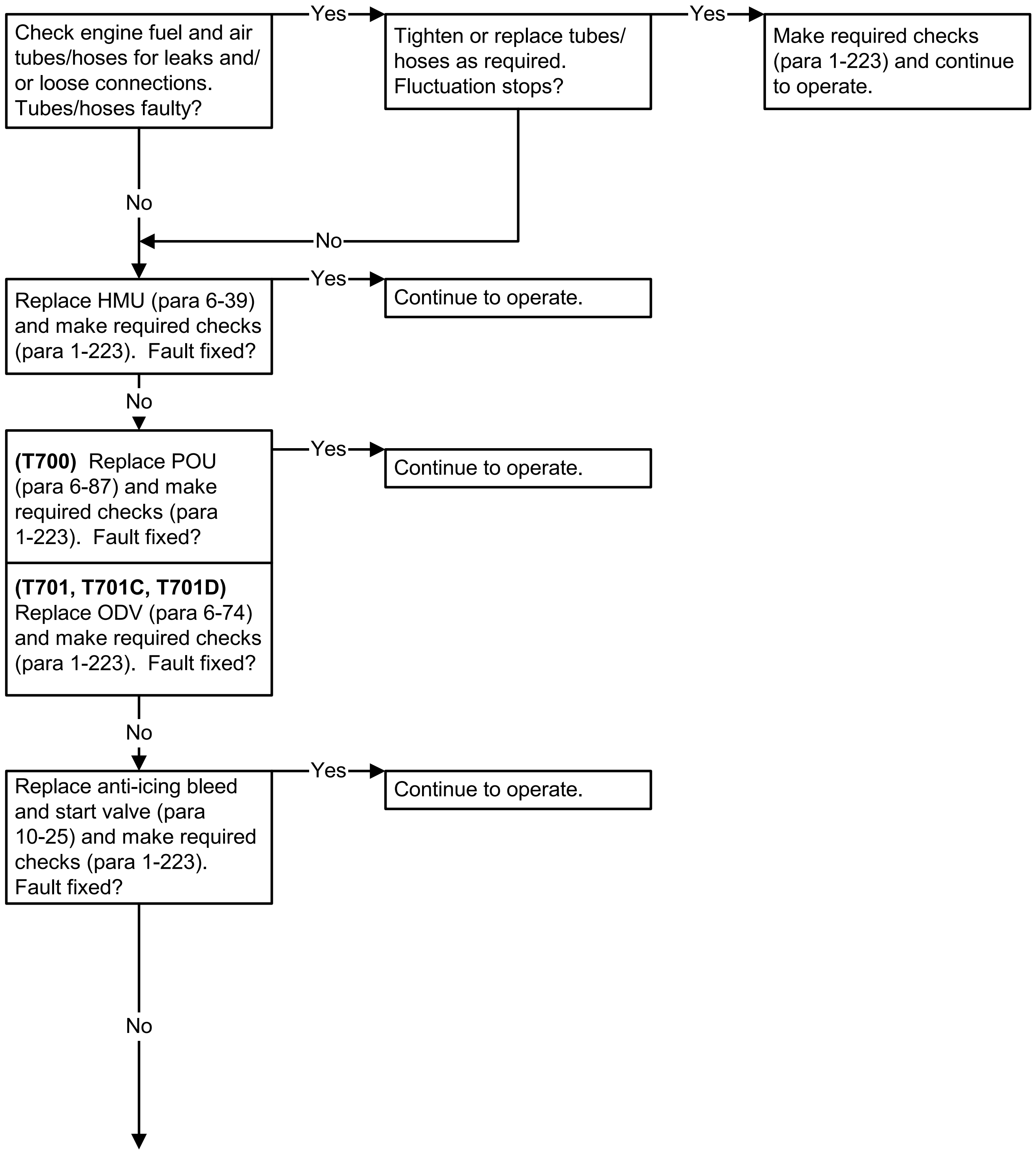
- If a problem of fluctuation occurs on one instrument only (either Ng, Np, or torque), the most likely cause is the indicating system. Troubleshoot METS/FEDS/CETS indicating system according to METS/FEDS/CETS manual.
- Make sure water brake load system is operating normally.



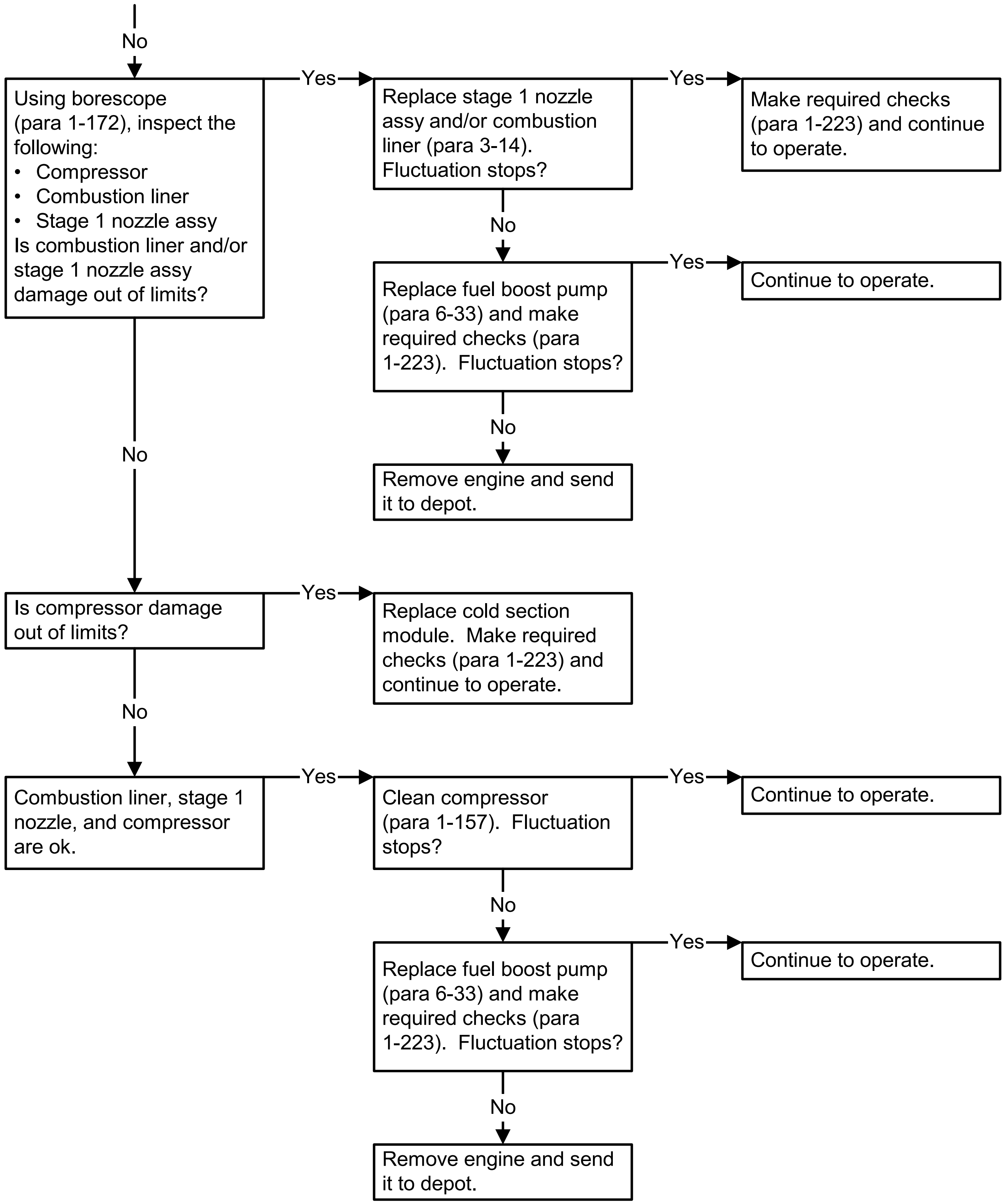
Troubleshooting Procedure 66. *Unstable Operation with (T700, T701) ECU or (T701C, T701D) DEC Locked Out (Ng, T0, Torque, and Np fluctuate greater than 5% with (T700, T701) ECU or (T701C, T701D) DEC locked out)*

NOTE

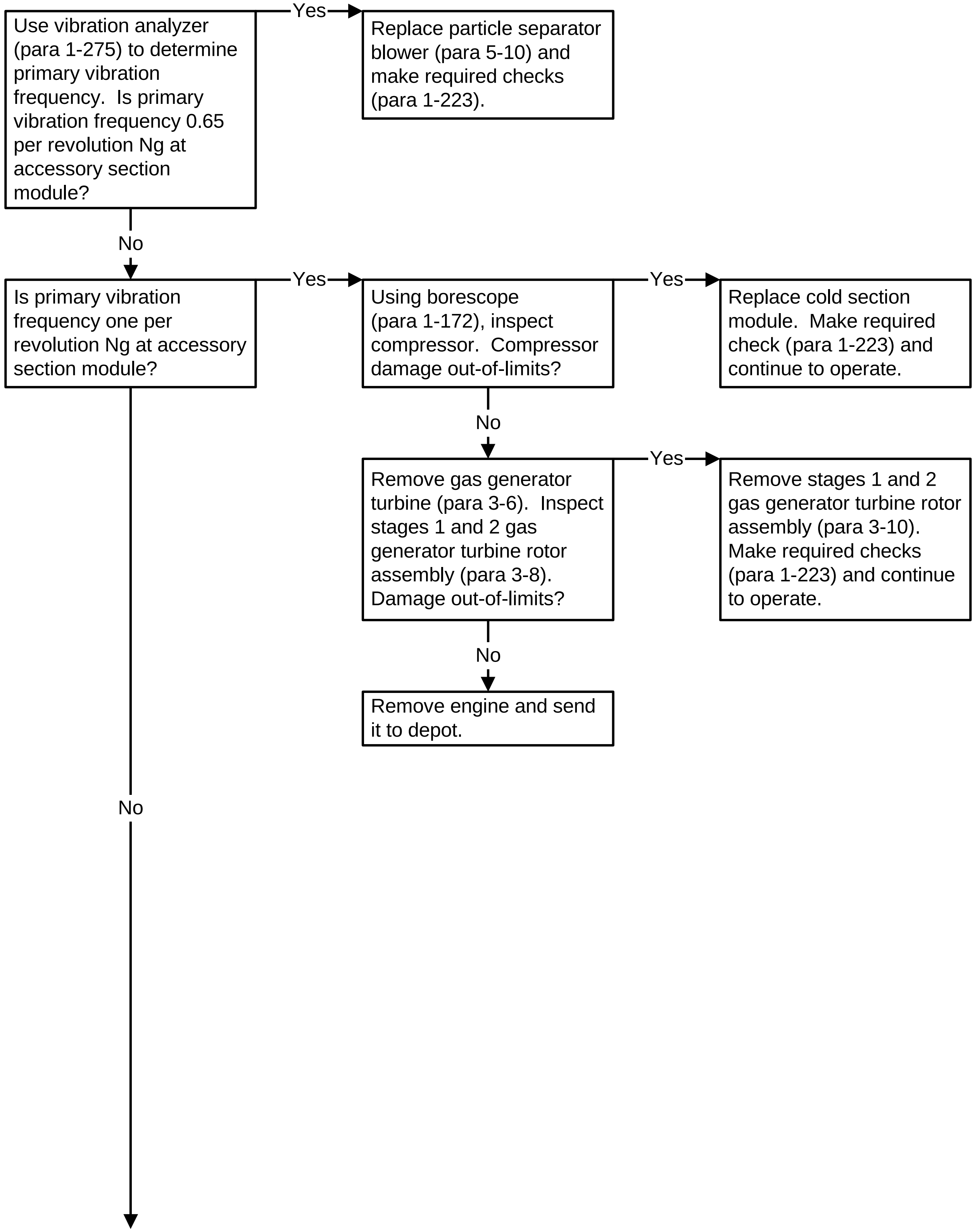
If fuel filter bypass light is on, refer to troubleshooting procedure 37.



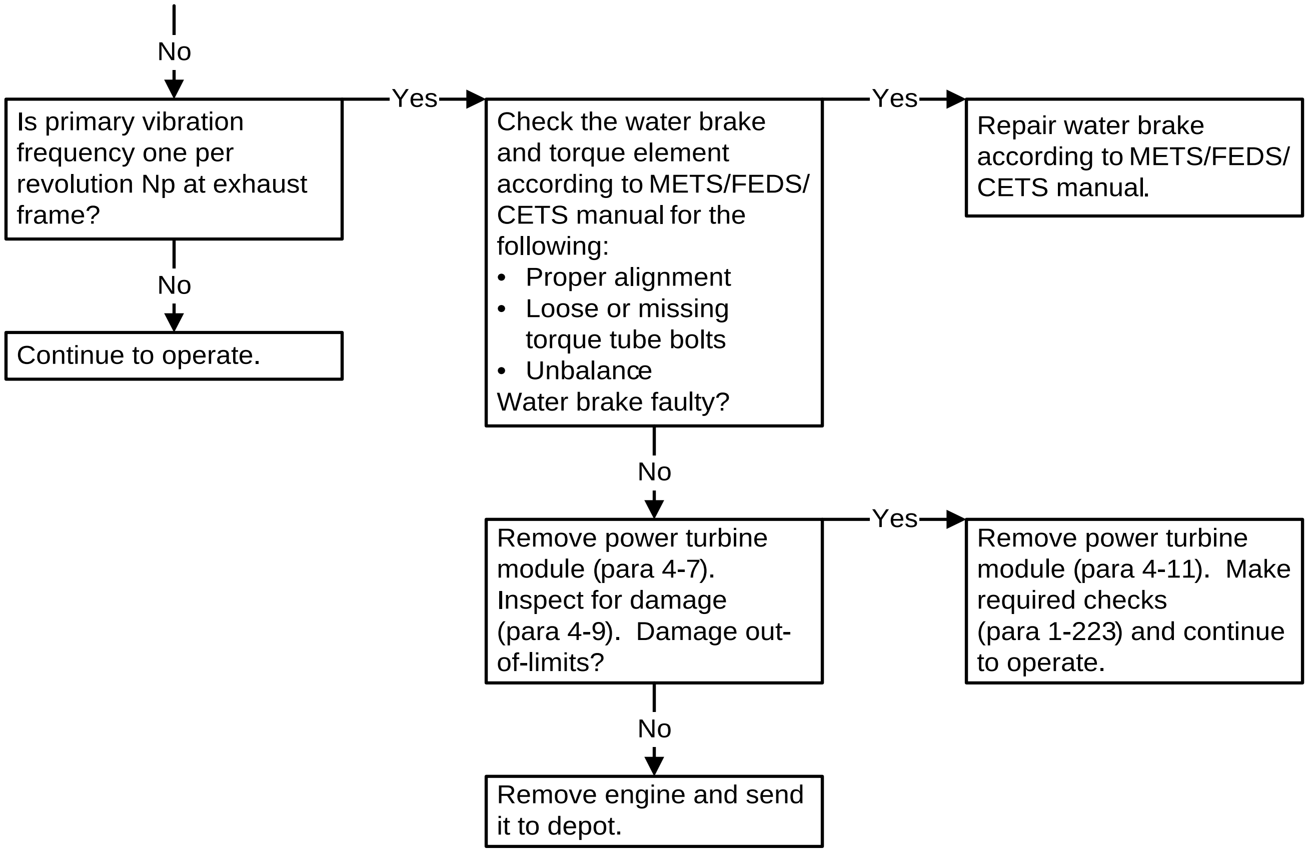
Troubleshooting Procedure 66. Unstable Operation with (T700, T701) ECU or (T701C, T701D) DEC Locked Out (Ng, T0, Torque, and Np fluctuate greater than 5% with (T700, T701) ECU or (T701C, T701D) DEC locked out) (Cont)



Troubleshooting Procedure 67. Accessory Section Module Vibration and Exhaust Frame Vibration Exceed Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second)



Troubleshooting Procedure 67. Accessory Section Module Vibration and Exhaust Frame Vibration Exceed Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second) (Cont)



Is primary vibration frequency one per revolution Np at exhaust frame?

Continue to operate.

Check the water brake and torque element according to METS/FEDS/CETS manual for the following:

- Proper alignment
- Loose or missing torque tube bolts
- Unbalance

Water brake faulty?

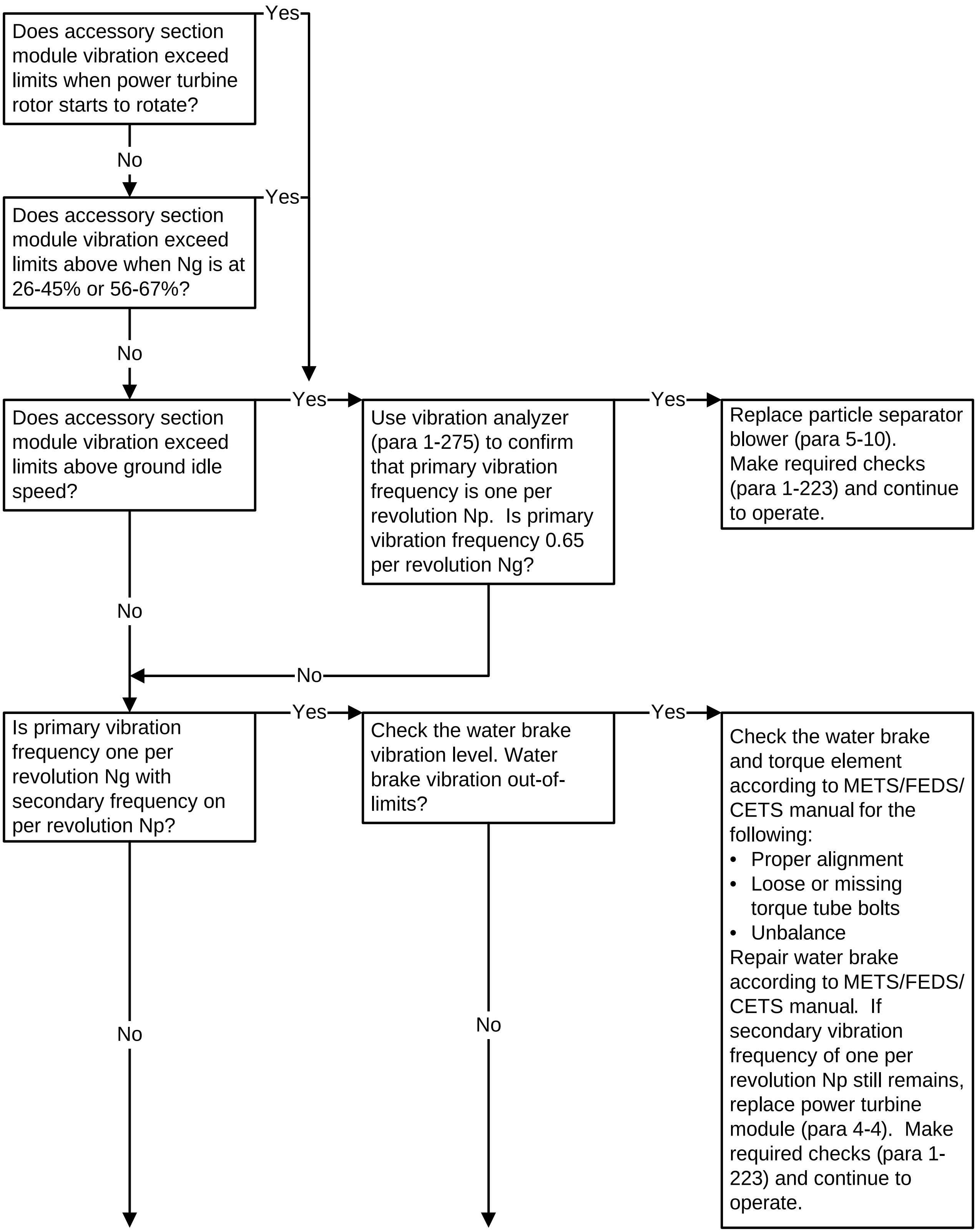
Repair water brake according to METS/FEDS/CETS manual.

Remove power turbine module (para 4-7). Inspect for damage (para 4-9). Damage out-of-limits?

Remove power turbine module (para 4-11). Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.

Troubleshooting Procedure 68. Accessory Section Module Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second)



Does accessory section module vibration exceed limits when power turbine rotor starts to rotate?

Does accessory section module vibration exceed limits above when Ng is at 26-45% or 56-67%?

Does accessory section module vibration exceed limits above ground idle speed?

Use vibration analyzer (para 1-275) to confirm that primary vibration frequency is one per revolution Np. Is primary vibration frequency 0.65 per revolution Ng?

Replace particle separator blower (para 5-10). Make required checks (para 1-223) and continue to operate.

Is primary vibration frequency one per revolution Ng with secondary frequency on per revolution Np?

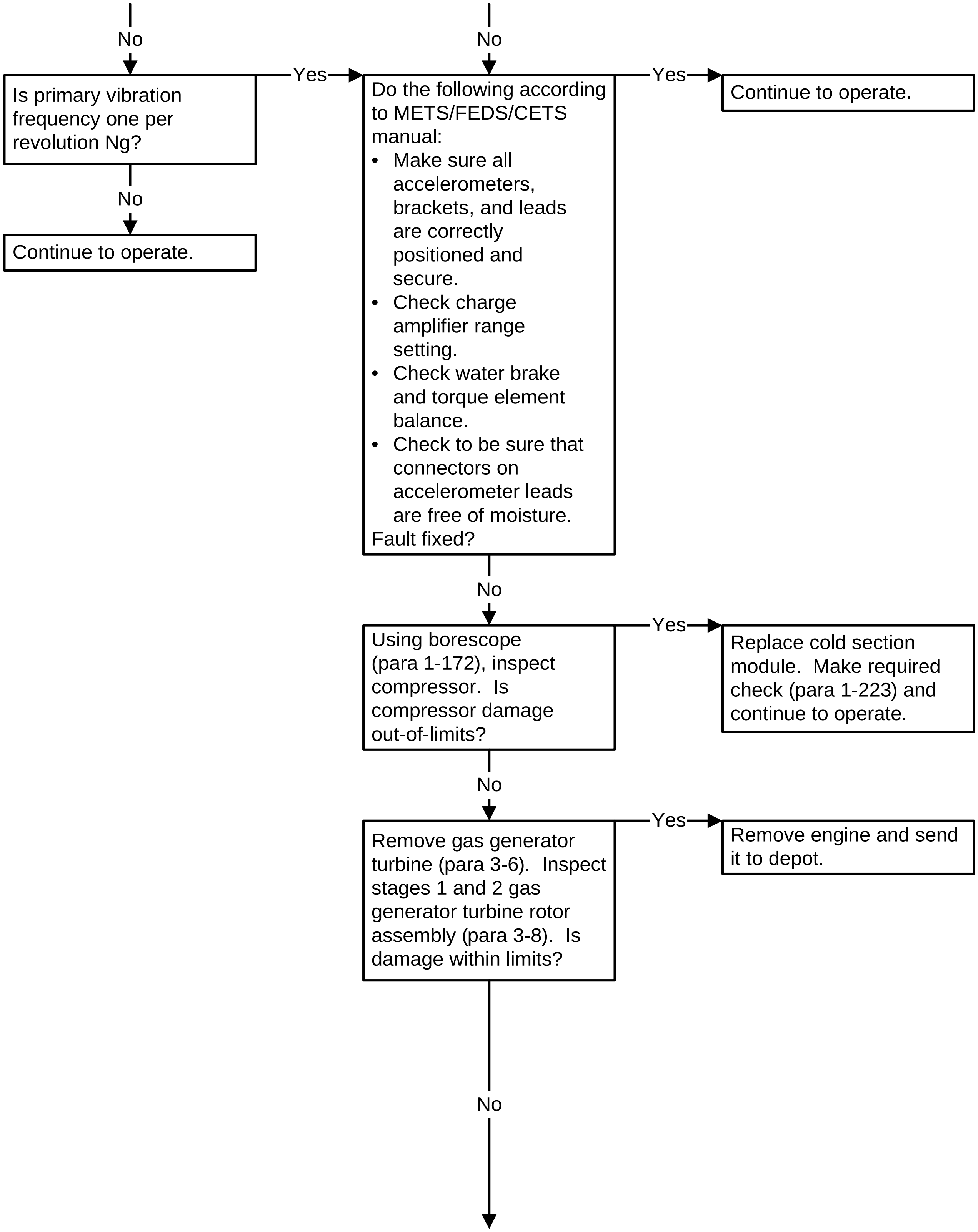
Check the water brake vibration level. Water brake vibration out-of-limits?

Check the water brake and torque element according to METS/FEDS/CETS manual for the following:

- Proper alignment
- Loose or missing torque tube bolts
- Unbalance

Repair water brake according to METS/FEDS/CETS manual. If secondary vibration frequency of one per revolution Np still remains, replace power turbine module (para 4-4). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 68. Accessory Section Module Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second) (Cont)



Is primary vibration frequency one per revolution Ng?

Continue to operate.

Do the following according to METS/FEDS/CETS manual:

- Make sure all accelerometers, brackets, and leads are correctly positioned and secure.
- Check charge amplifier range setting.
- Check water brake and torque element balance.
- Check to be sure that connectors on accelerometer leads are free of moisture.

Fault fixed?

Continue to operate.

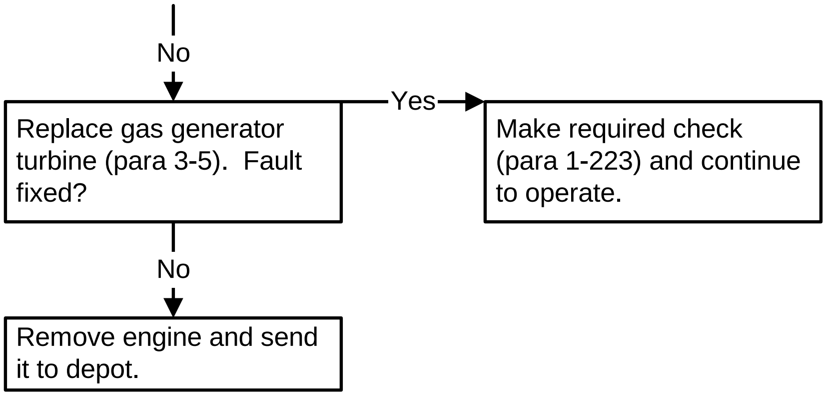
Using borescope (para 1-172), inspect compressor. Is compressor damage out-of-limits?

Replace cold section module. Make required check (para 1-223) and continue to operate.

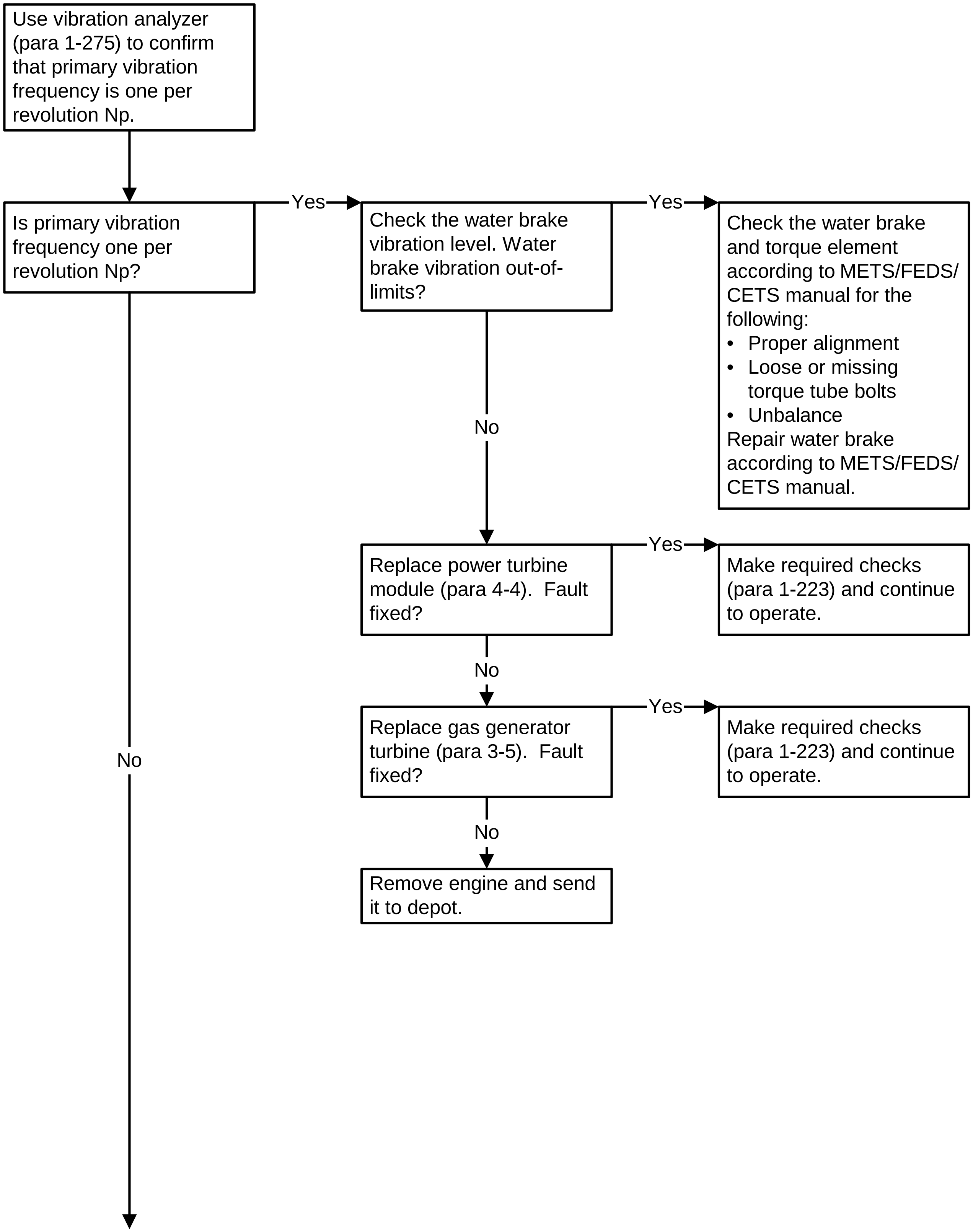
Remove gas generator turbine (para 3-6). Inspect stages 1 and 2 gas generator turbine rotor assembly (para 3-8). Is damage within limits?

Remove engine and send it to depot.

Troubleshooting Procedure 68. Accessory Section Module Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second) (Cont)



Troubleshooting Procedure 69. Exhaust Frame Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second)



Use vibration analyzer (para 1-275) to confirm that primary vibration frequency is one per revolution Np.

Is primary vibration frequency one per revolution Np?

Check the water brake vibration level. Water brake vibration out-of-limits?

Check the water brake and torque element according to METS/FEDS/CETS manual for the following:

- Proper alignment
- Loose or missing torque tube bolts
- Unbalance

Repair water brake according to METS/FEDS/CETS manual.

Replace power turbine module (para 4-4). Fault fixed?

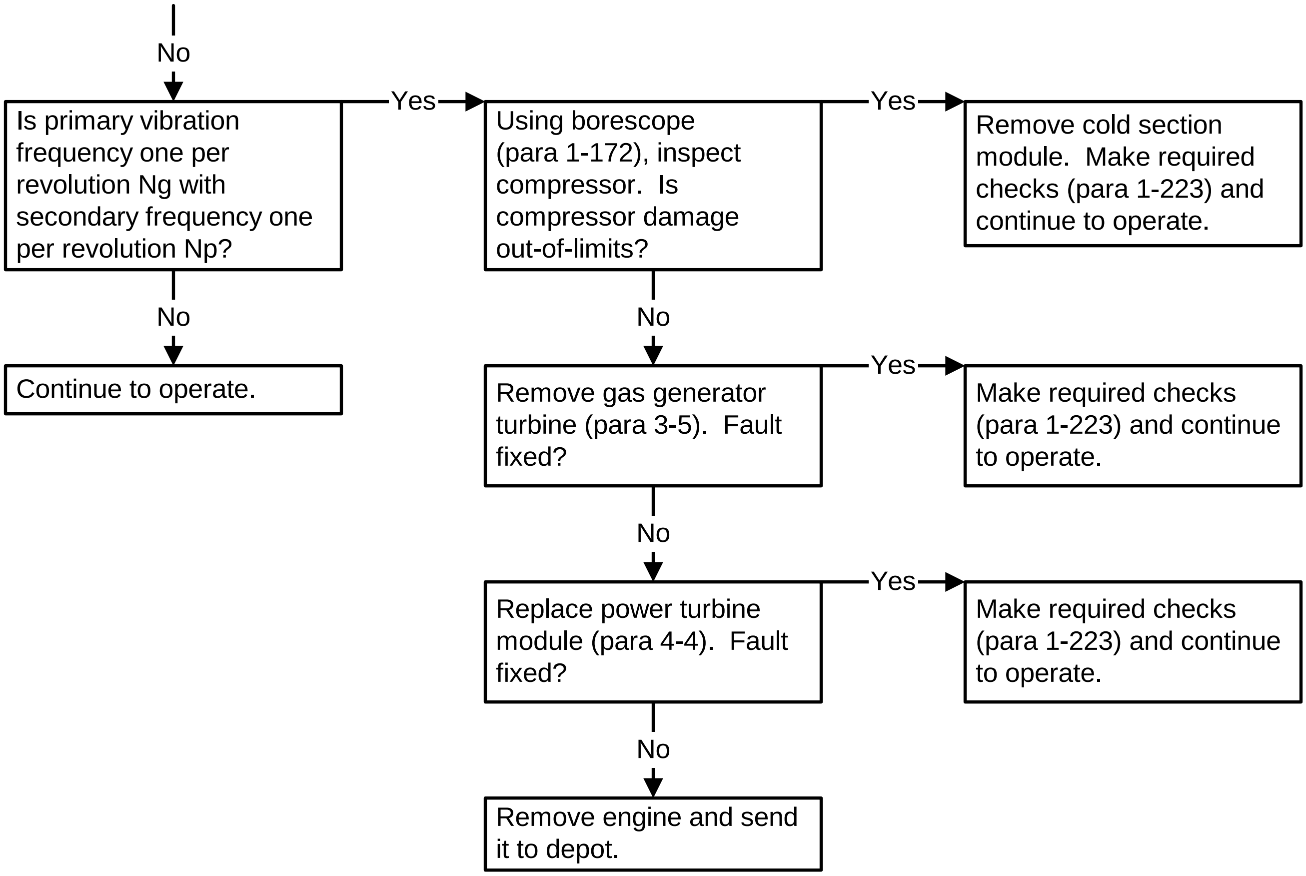
Make required checks (para 1-223) and continue to operate.

Replace gas generator turbine (para 3-5). Fault fixed?

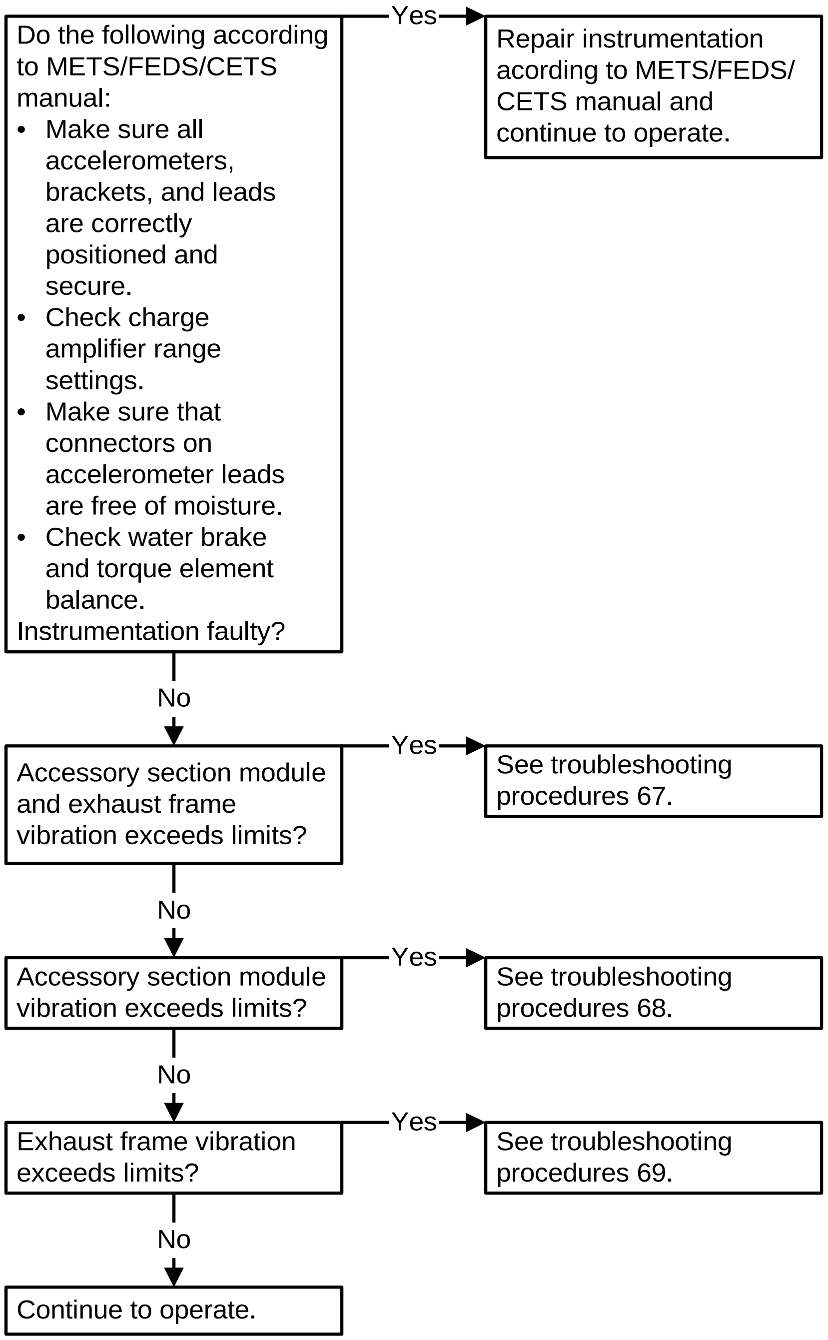
Make required checks (para 1-223) and continue to operate.

Remove engine and send it to depot.

Troubleshooting Procedure 69. Exhaust Frame Vibration Exceeds Steady-State Limit (1.5 Inches/Second) or Transient Limit (2.8 Inches/Second) (Cont)



Troubleshooting Procedure 70. Steady-State Vibration Limit (1.5 Inches/Second) or Transient Vibration Limit (2.8 Inches/Second) is Exceeded



Do the following according to METS/FEDS/CETS manual:

- Make sure all accelerometers, brackets, and leads are correctly positioned and secure.
- Check charge amplifier range settings.
- Make sure that connectors on accelerometer leads are free of moisture.
- Check water brake and torque element balance.

Instrumentation faulty?

Yes → Repair instrumentation acording to METS/FEDS/CETS manual and continue to operate.

No ↓

Accessory section module and exhaust frame vibration exceeds limits?

Yes → See troubleshooting procedures 67.

No ↓

Accessory section module vibration exceeds limits?

Yes → See troubleshooting procedures 68.

No ↓

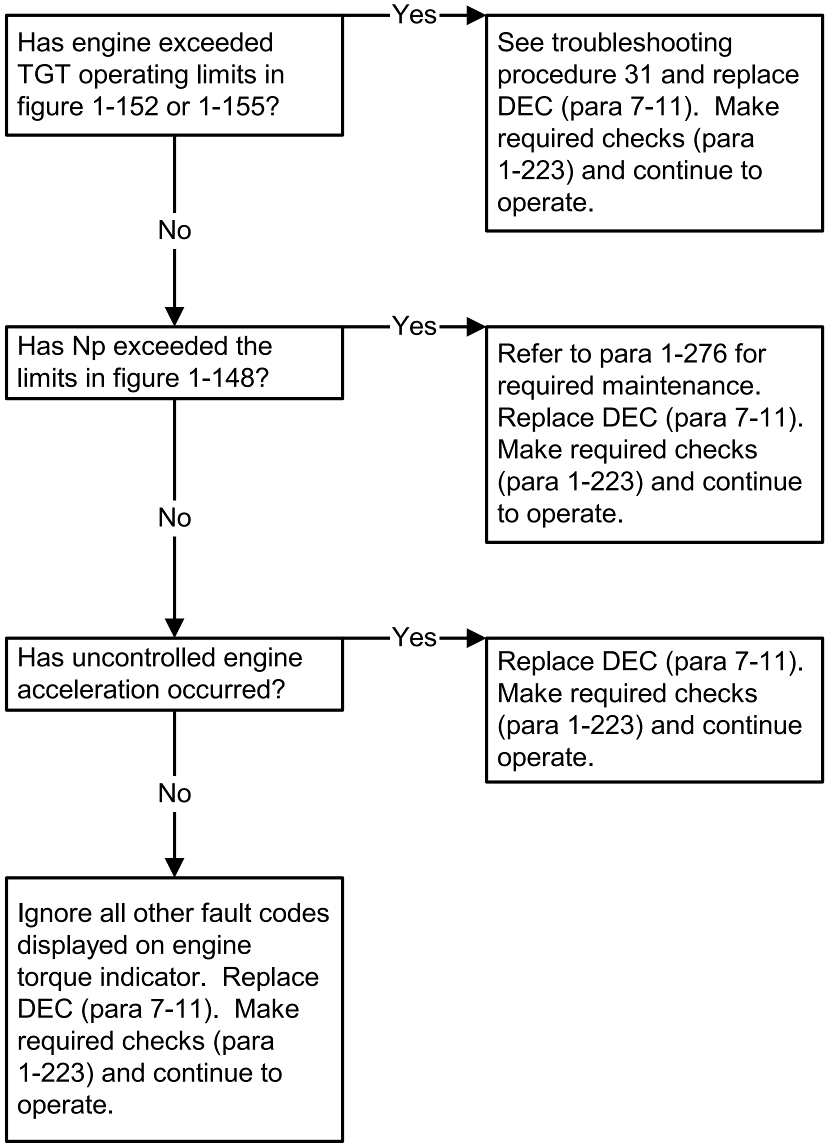
Exhaust frame vibration exceeds limits?

Yes → See troubleshooting procedures 69.

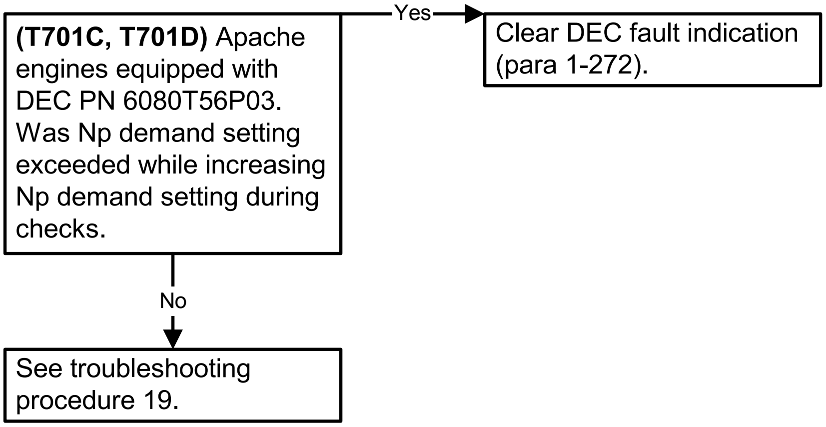
No ↓

Continue to operate.

Troubleshooting Procedure 71. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 15% (±3%) (check DEC)



Troubleshooting Procedure 72. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 25% (±3%) (Np demand channel)



(T701C, T701D) Apache engines equipped with DEC PN 6080T56P03. Was Np demand setting exceeded while increasing Np demand setting during checks.

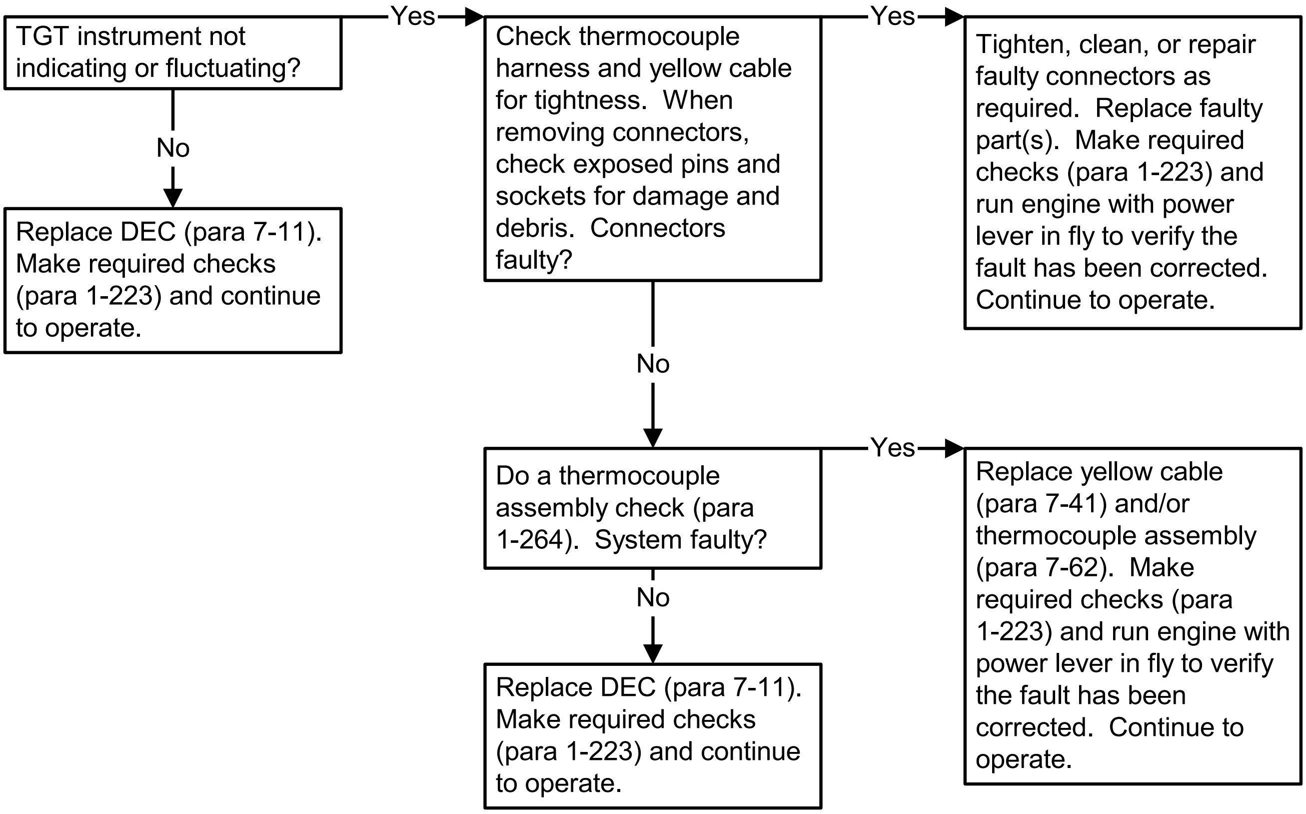
Clear DEC fault indication (para 1-272).

See troubleshooting procedure 19.

Troubleshooting Procedure 73. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 35% (±3%) (load share channel)

See troubleshooting procedure 63.

Troubleshooting Procedure 74. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 45% (±3%) (TGT channel)



TGT instrument not indicating or fluctuating?

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Check thermocouple harness and yellow cable for tightness. When removing connectors, check exposed pins and sockets for damage and debris. Connectors faulty?

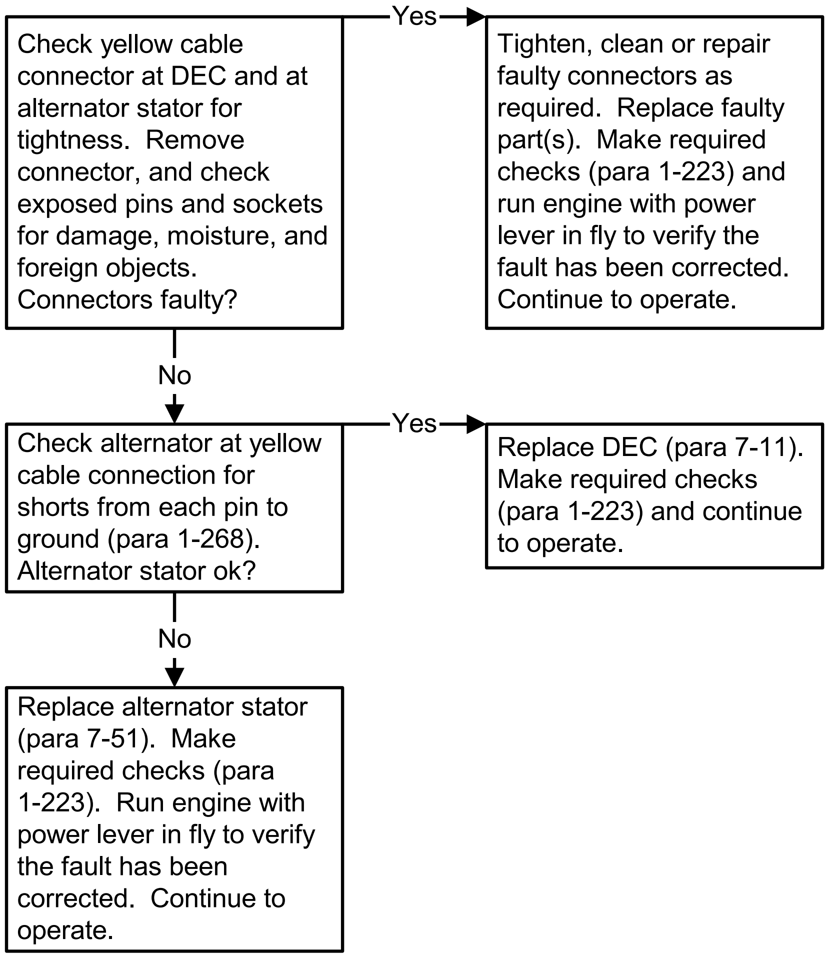
Tighten, clean, or repair faulty connectors as required. Replace faulty part(s). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Do a thermocouple assembly check (para 1-264). System faulty?

Replace yellow cable (para 7-41) and/or thermocouple assembly (para 7-62). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 75. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 55% (±3%) (check DEC)



Check yellow cable connector at DEC and at alternator stator for tightness. Remove connector, and check exposed pins and sockets for damage, moisture, and foreign objects. Connectors faulty?

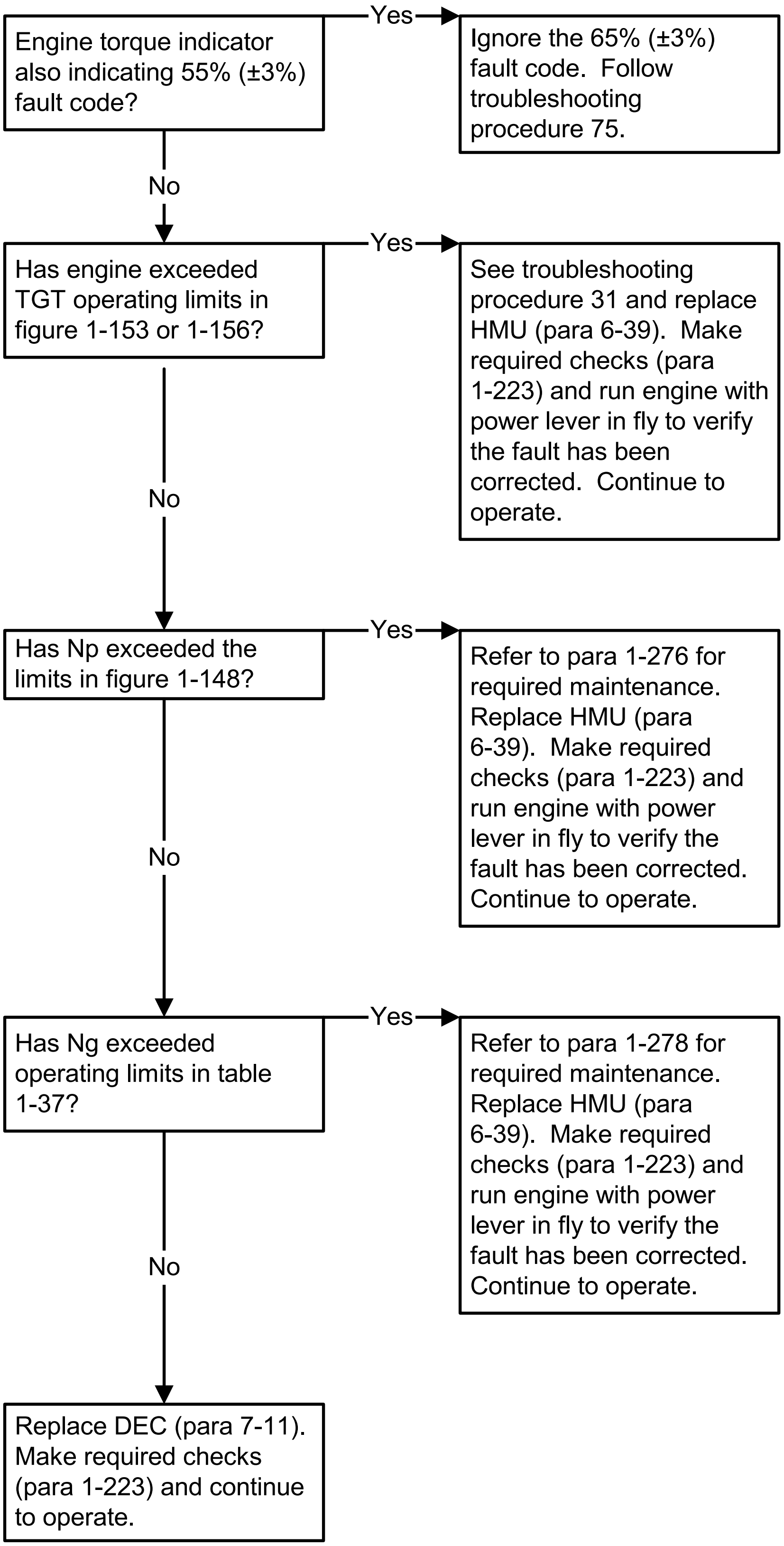
Tighten, clean or repair faulty connectors as required. Replace faulty part(s). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Check alternator at yellow cable connection for shorts from each pin to ground (para 1-268). Alternator stator ok?

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Replace alternator stator (para 7-51). Make required checks (para 1-223). Run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Troubleshooting Procedure 76. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 65% (±3%) (Ng channel)



Engine torque indicator also indicating 55% (±3%) fault code?

Ignore the 65% (±3%) fault code. Follow troubleshooting procedure 75.

Has engine exceeded TGT operating limits in figure 1-153 or 1-156?

See troubleshooting procedure 31 and replace HMU (para 6-39). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Has Np exceeded the limits in figure 1-148?

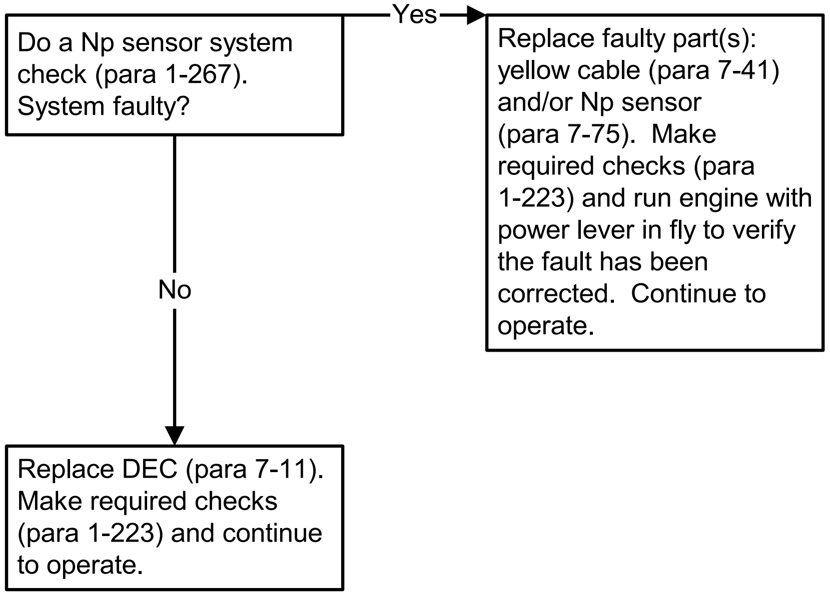
Refer to para 1-276 for required maintenance. Replace HMU (para 6-39). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Has Ng exceeded operating limits in table 1-37?

Refer to para 1-278 for required maintenance. Replace HMU (para 6-39). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

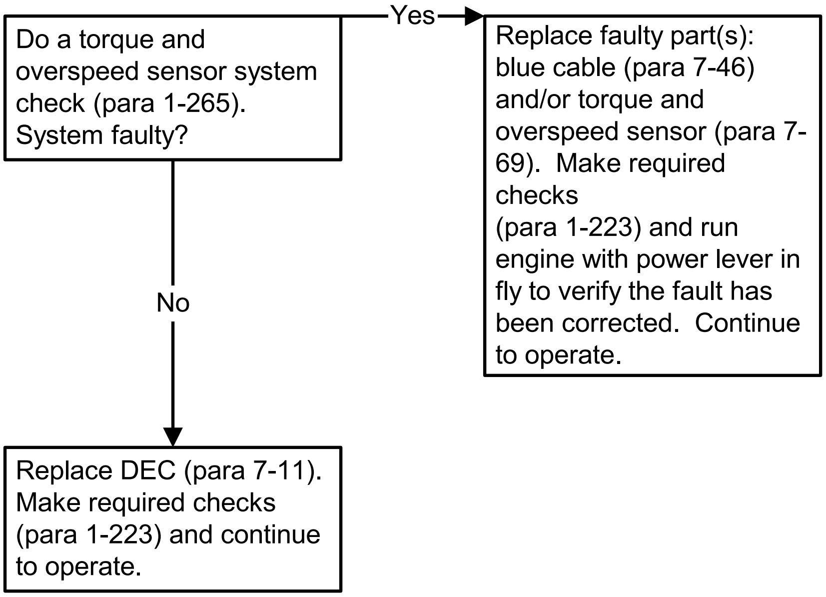
Troubleshooting Procedure 77. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 75% (±3%) (Np channel)


Do a Np sensor system check (para 1-267). System faulty?

Replace faulty part(s): yellow cable (para 7-41) and/or Np sensor (para 7-75). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 78. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 85% (±3%) (torque and overspeed channel)

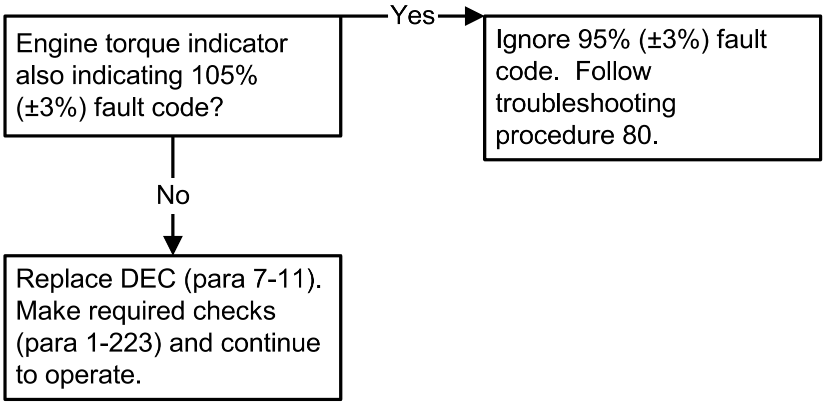


Do a torque and overspeed sensor system check (para 1-265). System faulty?

Replace faulty part(s): blue cable (para 7-46) and/or torque and overspeed sensor (para 7-69). Make required checks (para 1-223) and run engine with power lever in fly to verify the fault has been corrected. Continue to operate.

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

Troubleshooting Procedure 79. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 95% (±3%) (hot start prevention channel)

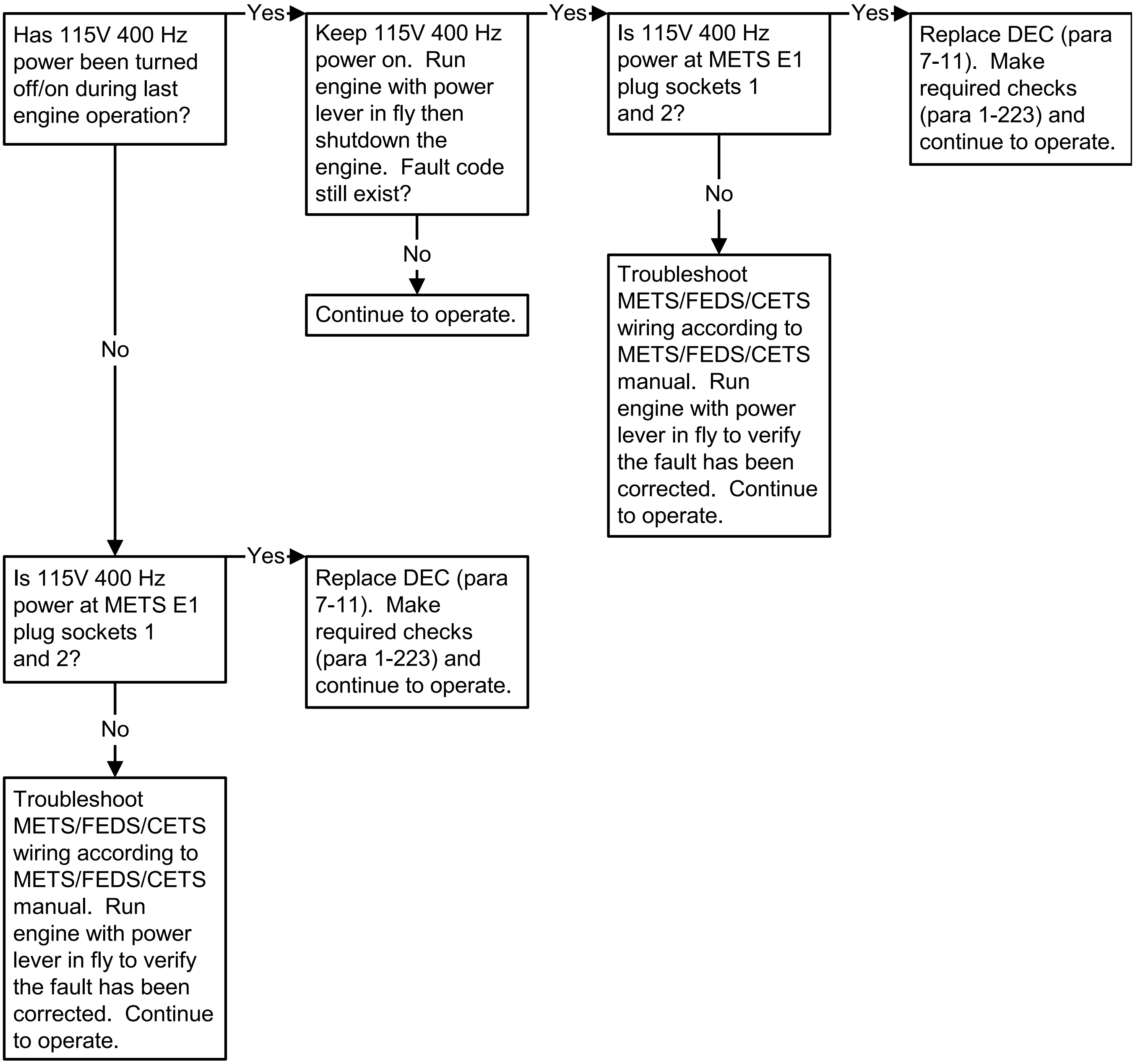


Engine torque indicator also indicating 105% (±3%) fault code?

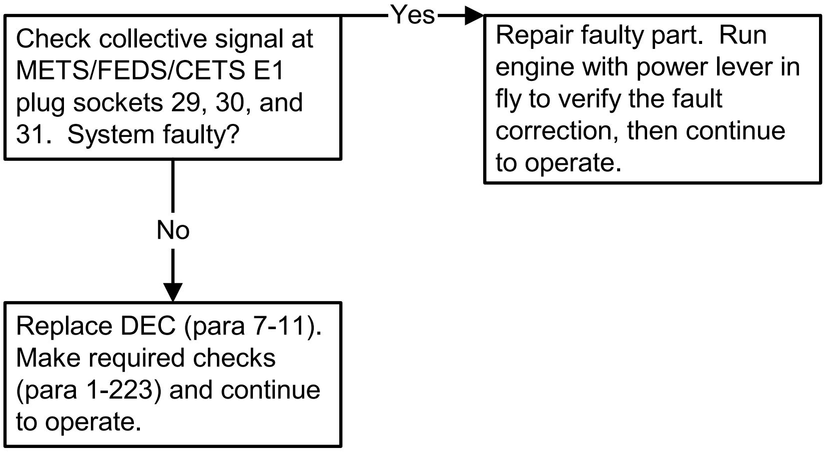
Ignore 95% (±3%) fault code. Follow troubleshooting procedure 80.

Replace DEC (para 7-11). Make required checks (para 1-223) and continue to operate.

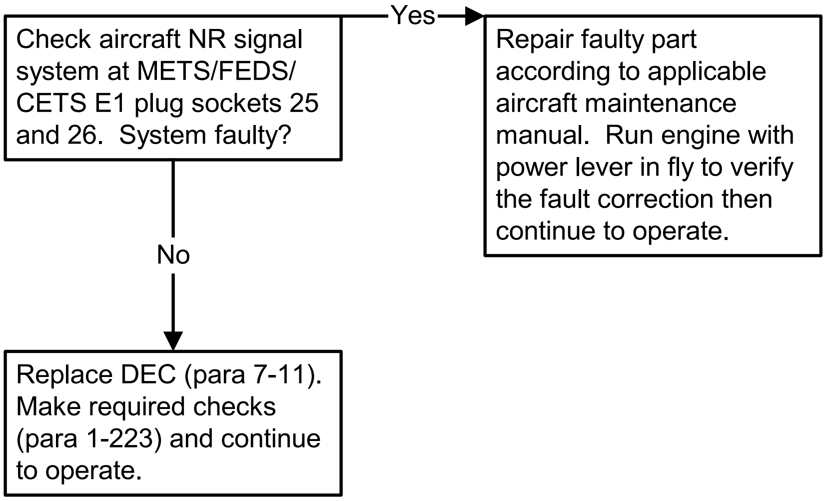
Troubleshooting Procedure 80. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 105% (±3%) (115V 400 Hz power)



Troubleshooting Procedure 81. (T701C, T701D) DEC - Engine Torque Indicator Fault Code - 115% (±3%) (collective channel)



Troubleshooting Procedure 82. (T701C, 701D Black Hawk) DEC - Engine Torque Indicator Fault Code - 125% (±3%) (Nr channel)



1-256. TROUBLESHOOTING CHECKS (METS/FEDS/CETS).

1-257. Engine Serviceability Test for No or Low (Below Minimum Limits) Oil Pressure.

a. Remove oil scavenge thermocouple according to METS/FEDS/CETS manual. Remove scavenge screens (para 8-17 **(T700)**, 8-18 **(T701)**, or 8-19 **(T701C, T701D)**). Inspect them for contamination. Place any debris found, in a container. Attach tag to container; reinstall oil scavenge thermocouple according to METS/FEDS/CETS manual. Reinstall scavenge screens (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).

b. Remove electrical chip detector (para 8-52). Inspect it for contamination. Place any allowable contamination (fig. 1-145) in container. Attach tag to container. Reinstall electrical chip detector (para 8-55).

c. If impending bypass indicator button has popped, remove oil filter bowl and indicator assembly (para 8-31). Inspect it for debris. Place any debris found in a suitable container. Attach tag identifying where debris was found to container. Reinstall oil filter bowl assembly (para 8-34).

d. During engine run, watch for:

(1) CHIP DET light coming on.

(2) Oil filter bypass light coming on.

(3) Changes in engine vibration levels.

(4) An uncommanded deceleration in Ng or increase in scavenge temperature, indicating a possible bearing seizure.

e. Record oil pressures and oil temperatures versus Ng for lever positions used and check them against engine history.

f. Start engine and run at ground idle speed (WATER-OUT lever at maximum open position, PAS lever at 26° ±2.5°) for 5 minutes.

g. Advance PAS lever to 117° ±2°. With LDS lever at 70°, use WATER-IN lever to set TGT at 1320°-1340°F (716°-727°C). Note torque level and run at this condition for 10 minutes.

h. Return PAS lever to ground idle speed (PAS lever at 26° ±2.5°). Run at this condition for 5 minutes.

i. Advance PAS lever to 117° ±2°. With LDS lever at 70°, use WATER-IN lever to set TGT at 1320°-1340°F (716° -727°C). Set torque level noted in step g. Run at this condition for 10 minutes.

j. Return PAS lever to ground idle speed (PAS lever at 26° ±2.5°). Run at this condition for 2 minutes.

k. Repeat steps i and j three more times to complete engine run.

l. Shut down engine.

m. Remove electrical chip detector (para 8-52). Remove oil scavenge thermocouple according to METS/FEDS/CETS manual. Remove scavenge screens (para 8-17 **(T700)**, 8-18 **(T701)**, or 8-19 **(T701C, T701D)**). If impending bypass button has popped, remove oil filter bowl and indicator assembly (para 8-31). Inspect them for allowable contamination (fig. 1-145). If only allowable contamination is found and engine has run for 60 minutes with all conditions normal, clean (para 8-53) and reinstall (para 8-55) electrical chip detector. Clean and reinstall oil scavenge thermocouple according to METS/FEDS/CETS manual and scavenge screens (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**). Make checks required in paragraph 1-223. Return engine to service.

n. Discard allowable particles found in oil scavenge thermocouple, scavenge screens, and chip detector or filter bowl (steps a, b, and c).

o. If contamination is present in large quantities, remove engine according to METS/FEDS/CETS manual. Send engine and particles found on chip detector and scavenge screens to Depot.

1-258. Fuel Flow Verification Troubleshooting Checks.

a. Preliminary Information. Procedures in steps b, c, and d can be used to:

(1) Verify fuel flow to engine.

(2) Check the following for faulty operation:

(a) **(T700)** pressurizing and overspeed unit (POU).

(b) **(T701, T701C, T701D)** overspeed and drain valve (ODV).

(3) It is important to understand the following before doing this check:

(a) Step b is a check for faulty operation of the actuating system linkage assembly, HMU actuator rod, and anti-icing bleed and start valve. The VG system should close (HMU actuator rod extended) and anti-icing panel light should be on when PAS lever is at idle and engine is motoring.

(b) Step c verifies that fuel is flowing to engine. Fuel should drain from **(T700)** POU, or from **(T701, T701C, T701D)** ODV after PAS lever is retarded to 0°.

(c) Step d is a check for faulty operation of **(T700)** POU, or for faulty operation of **(T701, T701C, T701D)** ODV. Fuel should not drain from the **(T700)** POU, or **(T701, T701C, T701D)** ODV when PAS lever is at ground idle position and when the engine is motoring at maximum motoring speed.

(d) Do steps in steps b, c, and d at the same time.

b. Actuating System and Anti-Icing Bleed and Start Valve Check.

(1) Visually inspect actuating system linkage assembly for:

- Foreign object jamming (para 1-284)
- Loose variable vane actuator levers at vane spindles and actuating rings (para 1-284)
- Loose actuating ring bearing buttons (para 1-284)
- Improper engagement of lever arms to vanes and actuating rings of inlet guide vanes and stages 1 and 2 variable vanes (para 1-284)

CAUTION

Do not torque the actuating linkage assembly beyond the normal operating range. Otherwise, the anti-icing bleed and start valve (AIBSV) or the variable geometry may be damaged.

(2) Do an AIBSV swing check as follows:

(a) Using a 7/16-inch open-end wrench as a lever, disengage the quick-disconnect pin (4, fig. 1-146).

(b) Using an open-end torque wrench on flat (5), rotate the assembly through the entire range of travel. Torque shall not exceed 20 foot-pounds.

(c) If torque exceeds 20 foot-pounds, disconnect quick-disconnect pin (6) from link assembly (7).

(d) Using an open-end torque wrench on flat (5), slowly rotate the assembly through the entire range of travel. Torque shall not exceed 12 foot-pounds.

(e) If torque exceeds 12 foot-pounds, disconnect link assemblies (1) from IGV actuating ring (8), stage 1 actuating ring (9), and stage 2 actuating ring (2).

(f) The actuating rings shall be moved by hand through the entire range of travel.

(g) Locate and repair the source of binding.

(h) Connect three link assemblies (1) to the rings (2, 8, 9), using bolts and self-locking nuts. Torque nuts to 32-35 inch-pounds.

(i) Aline link assembly (7) with AIBSV shaft and engage quick-disconnect pin (6).

(j) Repeat steps (b) thru (g) until the source of binding is found.

(k) Using pin (4), reconnect link assembly (3).

(3) Using an open-end wrench on flats of actuating shaft, extend and retract HMU actuator rod. Check for full HMU actuator rod travel of 1.6 - 1.8 inches, for loose variable vane levers at vane spindles and actuating rings, and for loose actuating ring bearings.

(4) Position actuating shaft so that HMU actuator rod is fully retracted.

(5) When motoring engine in step c, check the following:

(a) Be sure that anti-ice valve panel light goes on. If anti-ice panel light does not light, troubleshoot METS/FEDS/CETS A/I ON indication circuit according to METS/FEDS/CETS manual. If circuit is not faulty, replace anti-icing bleed and start valve (para 10-25).

(b) During engine rollover, check HMU actuator rod; it should extend fully. If it is not fully extended, replace HMU (para 6-39).

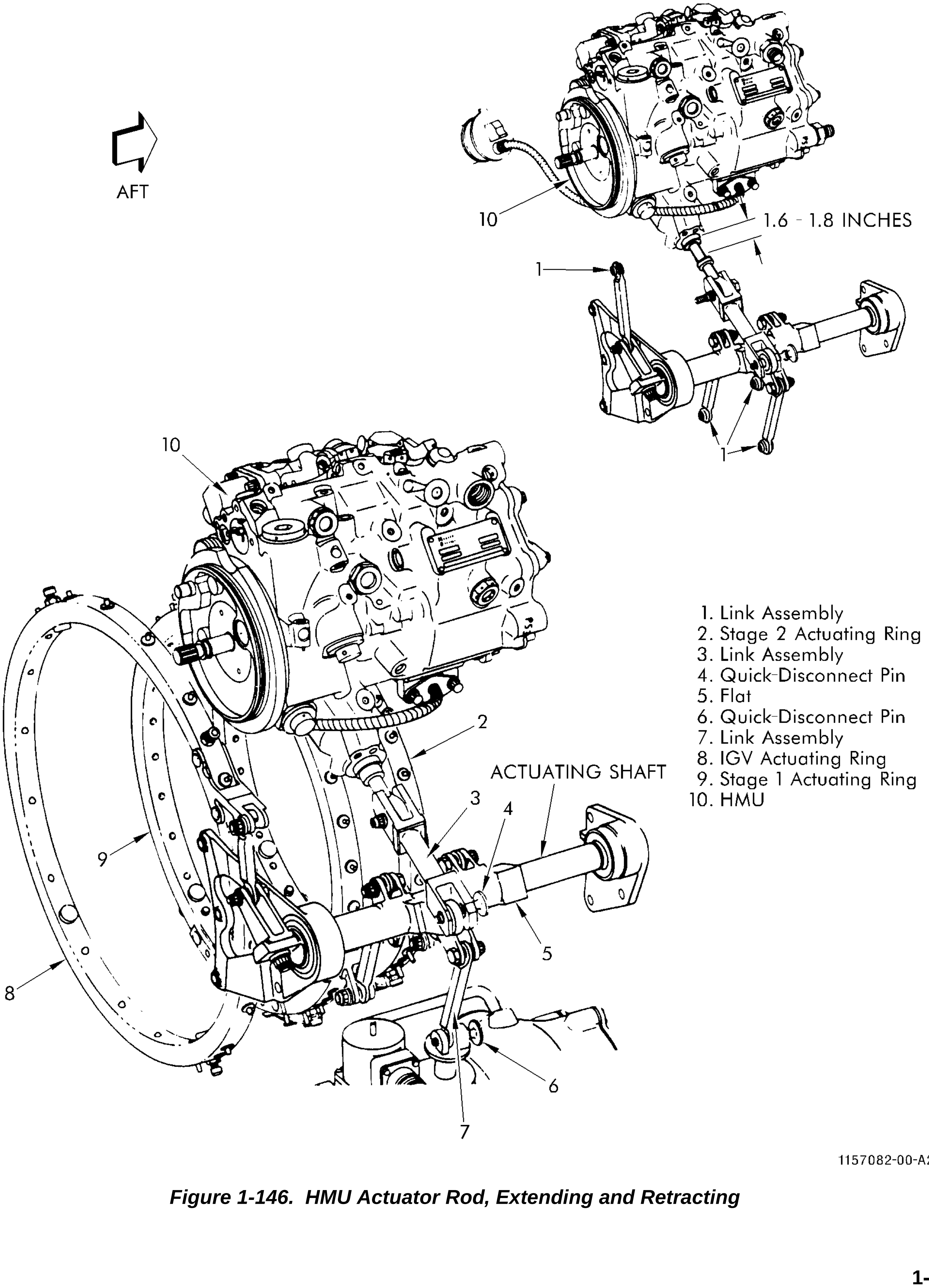


Figure 1-146. HMU Actuator Rod, Extending and Retracting

c. Fuel Flow Verification. Fuel is flowing to the engine if a reading can be seen on METS/FEDS/CETS FUEL FLOW indicator and a mist can be seen coming from tailpipe during wet rollover, or if fuel drains from **(T700)** POU manifold assembly, or from **(T701, T701C, T701D)** ODV manifold assembly, after PAS lever is retarded to 0°.

(1) De-energize ignition system (ignition OFF).

(2) Place PAS lever at ground idle (26° ±2.5°).

(3) Motor engine to maximum motoring speed (at least 23% Ng, but not more than 25% Ng) for 30 seconds. Indicated fuel flow will be 55-65 lb/hr. Record Wf, P3, and Ng.

(4) Look for fuel mist coming from tailpipe.

(5) After 30 seconds with engine motoring at maximum speed, retard PAS lever to 0°.

(6) Within 10 seconds after PAS lever is retarded to 0°, about 1 ounce (30cc) of fuel should drain from POU manifold assembly, or ODV manifold assembly. This indicates that main fuel manifold is being purged.

(7) De-energize starter after a total of 40 seconds.

(8) If fuel does not drain as specified in step (6), replace the following:

- **(T700)** POU (para 6-87)
- **(T701, T701C, T701D)** ODV (para 6-74)

d. **(T700)** POU, or **(T701, T701C, T701D)** ODV Checks.

(1) If fuel system has been recently primed, do this check two times. Residual fuel from fuel system priming may flow from overboard drain giving false indication of a defective POU, or ODV. The second check will be a more reliable indicator of valve operation.

(2) Check for a faulty POU, or ODV valve while doing the test in step b. If a steady stream of fuel comes from the drain during motoring with PAS lever at ground idle or with engine operating at ground idle speed, replace the following:

- **(T700)** POU (para 6-87).
- **(T701, T701C, T701D)** ODV (para 6-74).

It is normal to observe some leakage, but not a steady stream of fuel from the overboard drain, during initial rollover.

1-259. Fuel Filter Bypass Valve Check.

a. Remove fuel filter element and bowl (para 6-46).

b. Push on the bypass valve poppet (socket head screw) inside fuel filter housing. If it does not move freely, replace fuel filter (para 6-45).

1-260. Checkout of Engine Fuel System. When METS/FEDS/CETS FUEL FILTER BYPASS light comes on and a lot of debris is found in filter bowl (showing that engine fuel system is dirty), do the following after METS/FEDS/CETS fuel system has been flushed:

a. If impending bypass button did not pop out, impending bypass sensor failed. Replace fuel filter (para 6-45).

b. If impending bypass button has popped, clean out filter bowl (para 6-53) and install new filter element (para 6-46). Reset bypass indicator.

c. With external power on, vapor-vent fuel system for 2 minutes to flush any debris from fuel passages. Then repeat procedure for 2 more minutes.

d. Because flushing may not remove all debris from internal parts of HMU, replace HMU (para 6-39).

e. Disconnect manifold assembly as follows:

(1) **(T700)** Disconnect POU manifold assembly (para 6-82) from main fuel manifold and fuel start feed tube. Connect drain hoses to coupling nut and fittings of manifold assembly.

(2) **(T701, T701C, T701D)** Disconnect ODV manifold assembly (para 6-69) from main fuel manifold. Connect drain hoses to coupling nut and fitting of ODV manifold assembly.

f. Deactivate ignition system by disconnecting yellow cable from ignition exciter assembly.

CAUTION

To avoid damage to starter, do not exceed starter duty cycle. Refer to table 1-36 **(T700)** or table 1-37 **(T701, T701C, T701D)** for duty cycle limits.

g. To flush out debris, place ends of drain hoses in container and make two 2-minute rollovers with PAS lever in ground idle position.

h. **(T700)** Reconnect POU manifold assembly to main fuel manifold and to fuel start feed tube. Tighten (60° wrench arc) coupling nuts. **(T701, T701C, T701D)** Reconnect ODV manifold assembly to main fuel manifold. Tighten (60° wrench arc) coupling nut.

i. Replace the following:

- **(T700)** POU (para 6-87)
- **(T701, T701C, T701D)** ODV (para 6-74)
- Oil cooler (para 8-4)

j. Reactivate ignition system.

k. Run engine for 10 minutes at ground idle speed. Make sure that there are no problems. Make checks required (para 1-223).

l. Shut down engine. Check impending bypass button.

m. If FUEL FILTER BYPASS light did not come on during the 10-minute run and if impending bypass button did not pop, engine can continue in operation.

1-261. Primary Ignition System Check. The following checks test the circuits in the alternator stator, yellow cable, and ignition exciter assembly. These checks determine which of these components should be replaced.

a. Use a multimeter for this check. Make sure all electrical connectors are tight.

b. Disconnect the METS/FEDS/CETS cable from electrical connector (W3J1-green cable) on flange of swirl frame. Measure resistance between the following pins in electrical connector (W3J1-green cable).

(1) Resistance between pins 17 and 18 will be as follows:

- **(T700)** 10-15 ohms
- **(T701, T701C, T701D)** 1-3 ohms

If readings are out-of-limits, circuit is open or shorted. Remove electrical connector (W3P1-green cable) and check cable for pin-to-pin continuity and pin-to-ground for shorts; pins 1 to 17, 2 to 18, 3 to 19, 4 to 20, and 5 to 21. No open or shorted circuits allowed. If cable is not faulty, measure resistance between pins 1 and 2 at J1 connector on alternator stator. Resistance between pins will be as follows:

- **(T700)** 10-15 ohms
- **(T701, T701, T701D)** 1.5-3.0 ohms

If resistance is out-of-limits, replace alternator stator (para 7-51).

(2) Resistance between pins 2 and 3 at J1 connector on alternator stator will be as follows:

- **(T700)** 1.5-3.0 ohms
- **(T701, T701C, T701D)** 1.0-3.0 ohms

If readings are out-of-limits, the circuit is open or shorted. Do step c.

c. Isolate fault to either yellow cable or ignition exciter assembly as follows:

(1) Disconnect yellow cable at alternator stator and ignition exciter assembly.

(2) Check continuity between the two connectors, pins 1 to 1 and 2 to 2. Check connectors for shorts between pins 1 and 2.

(3) No open or shorted circuits allowed. If open or short circuits exist, replace yellow cable (para 7-41).

(4) If cable checks are within limits, replace ignition exciter assembly (para 7-29).

1-262. Circuit Checks at S39 Connector on ECU/DEC. ECU/DEC circuit continuity switch boxes (fig. 1-147) are provided so that circuits can be checked through the S39 connector on the ECU/DEC.

(T701) - Use switch box 21C7085G02. **(T700)** and **(T701C, T701D)** - Use switch box 21C7085G01. Refer to Preinstallation Buildup (para 1-200) to determine aircraft configuration.

The following steps outline the general procedure and provide limits. All limits are sufficient when circuit checks are done at moderate temperatures. However, readings may vary if checks are performed when temperatures are more extreme.

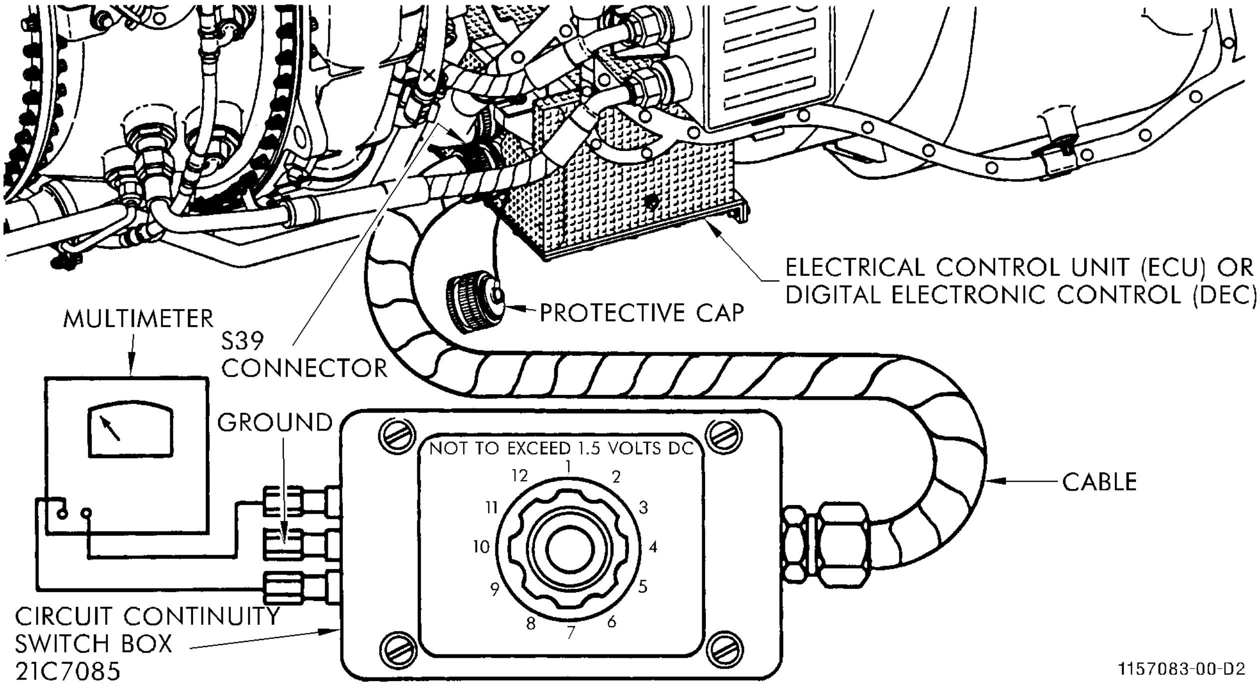


Figure 1-147. ECU or DEC Circuit Continuity Switch Box for S39 Connector

a. Use a multimeter for this check.

b. Connect switch box to S39 connector and check circuits as follows:

(1) Remove protective cap from S39 connector.

(2) Connect cable to S39 connector.

CAUTION

Do not exceed 1.5 volts dc on multimeter, because the ECU/DEC will be damaged.

(3) Connect multimeter to red and black terminals on switch box.

(4) Position selector switch to select circuit to be tested. Table 1-46 identifies circuits and provides limits.

(5) Check each circuit for resistance limits. If resistance is out-of-limits, troubleshoot fault according to the following individual circuit checks as outlined in paragraphs listed below:

Circuit Checks:	Paragraph:
Np Sensor	1-267
HMU	1-263
Alternator	1-268
Thermocouple Assembly	1-264
Torque and Overspeed Sensor	1-265
Overspeed System:	
• **(T700)** POU	1-266
• **(T701, T701C, T701D)** ODV	1-266

c. Check each circuit for shorts-to-ground as follows:

(1) Remove test lead connected to red terminal and connect to green terminal.

(2) Check each circuit listed in step b(5) at the corresponding switch position; no short circuits allowed. Minimum allowable resistance to ground is 1 megohm. If a short circuit is found, disconnect E1 connector from ECU/DEC to isolate fault to METS/FEDS/CETS wiring system or to engine.

Table 1-46. Resistance Limits for Circuit Checks at S39 Connector

Resistance Switch Position		Limits in Ohms	
		Min	Max
1	Alternator ECU/DEC power winding:		
	• **(T700)**	2.0	4.0
	• **(T701, T701C, T701D)**	1.5	4.0
2	Thermocouple assembly	1.0	5.0
3	HMU linear variable displacement transducer (LVDT)	3	35
4	Np Sensor	13	21
5	Torque and overspeed sensor	13	21
6	Overspeed solenoid valve:		
	• **(T700)** POU	18	24
	• **(T701, T701C, T701D)** ODV	18	24
7	HMU torque motor	45	90
8	Do not use	—	—
9	Do not use	—	—

NOTE

Np demand must be checked at the minimum and maximum trim positions. The E1 harness must also be connected.

10	Np demand to common ground (Trim limits: 1920 ohms at maximum position; 5750 ohms at minimum position)	—	—
11	Load share to ground	—	—
12	Do not use	—	—

(3) If short circuit remains with E1 harness disconnected, isolate fault by disconnecting electrical connector (W4P1-yellow cable) from ECU/DEC. If short circuit remains, problem is in the blue cable system and must be isolated to the following:

- blue cable or torque and overspeed sensor (para 1-265)
- **(T700)** POU overspeed solenoid (para 1-266)
- **(T701, T701C, T701D)** ODV overspeed solenoid (para 1-266)

(4) If short circuit is no longer present, problem is in yellow cable system and must be isolated to either yellow cable or connecting sensors. Troubleshoot fault according to the following individual circuit checks in paragraphs listed below:

Circuit Checks:	Paragraph:
ECU/DEC	1-263
Np Sensor	1-267
HMU	1-263
Alternator	1-268
Thermocouple Assembly	1-264

(5) Remove test lead connected to red terminal and connect to black terminal. Repeat steps (2) thru (4).

1-263. ECU/DEC and HMU System Check. The following checks test the circuits for the torque motor and LVDT in the HMU, and also check the circuits in the yellow cable that connect the ECU/DEC to the HMU. These checks determine whether the ECU/ DEC, HMU or the yellow cable should be replaced.

a. Make circuit resistance and short circuit checks through S39 connector on ECU/DEC, using switch box. See paragraph 1-262 for instructions and limits. Set selector switch at position numbers 3 and 7. If readings are out-of-limits or if an open or short circuit is found, do steps b and c to isolate fault to either HMU or yellow cable.

b. Check HMU as follows:

(1) Disconnect yellow cable from HMU.

CAUTION

If HMU is installed on engine, pins could be bent when measuring resistance between them, and when checking each one for short circuit-to-ground. Therefore, a mating plug should be used to prevent damage to pins.

(2) Measure resistance between pins in connector (J1) on HMU. The resistance will be as follows:

Pins on HMU	Resistance (ohms)	
	Hamilton Standard	Woodward Governor
Pins 1 and 2 (toque motor)	105-165	135-155
Pins 3 and 4 (torque motor)	105-165	135-155
Pins 6 and 7 (LVDT secondary)	10-25	5-35
Pins 7 and 8 (LVDT secondary)	10-25	15-25
Pins 6 and 8 (LVDT secondary)	20-50	30-50
Pins 9 and 10 (LVDT secondary)	20-45	30-50
Pins 11 and 12 (LVDT secondary)	20-45	30-50

(3) Check each pin for short circuit-to- ground. No short circuits allowed.

(4) If readings are out-of-limits, circuit is faulty. Replace HMU (para 6-39). If readings are within limits, continue to step c.

c. Check yellow cable as follows:

(1) Disconnect yellow cable at **(T700, T701)** ECU or **(T701C, T701D)** and HMU.

(2) Check socket-to-socket continuity between electrical connector (W4P1-yellow cable) and electrical connector (W4P3-yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P3 Sockets
1	to	1
2	to	2
3	to	3
4	to	4
5	to	6
6	to	7
7	to	8
15	to	9
16	to	10
17	to	11
18	to	12

(3) Check for short circuits between sockets 1, 2, 3, 4, 5, 6, 7, 15, 16, 17, and 18 in electrical connector (W4P1-yellow cable). No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If yellow cable is faulty, replace it (para 7-41).

(6) If yellow cable is not faulty, connect it to ECU/DEC and HMU.

d. If neither HMU nor yellow cable is faulty, replace ECU/DEC.

1-264. Thermocouple Assembly Check. The following checks test the circuits in thermocouple assembly and test the circuits in yellow cable that connect the thermocouple assembly to the ECU/DEC. These checks determine whether the thermocouple assembly or the yellow cable should be replaced.

a. Make circuit resistance and short circuit checks through S39 connector on ECU/DEC, using switch box. See paragraph 1-262 for instructions and limits. Set selector switch at position number 2. If reading is out-of-limits or if an open or short circuit is found, do the following steps to isolate fault to either thermocouple assembly or yellow cable.

b. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/DEC and at thermocouple assembly.

(2) Check socket-to-socket continuity between electrical connector (W4P1-yellow cable) and electrical connector (W4P7-yellow cable) (see following list). No open circuits allowed.

W4P7 Sockets		W4P1 Sockets
A or D	to	28
B or C	to	29

(3) Check for short circuit between sockets 28 and 29 in electrical connector (W4P1-yellow cable). No short circuits allowed.

(4) Check sockets 28 and 29 for short circuit to outer metal braid of cable. No short circuit allowed. Minimum resistance will be 1 megohm.

(5) If yellow cable is faulty, replace it (para 7-41).

c. Check thermocouple assembly as follows:

(1) Check pins C and D for short circuit to outer metal braid of cable. No short circuits allowed.

(2) If thermocouple assembly is faulty, replace it (para 7-62).

1-265. Torque and Overspeed Sensor System Check. The following checks test the circuits in the torque and overspeed sensor and the circuits in the blue cable that connect the sensor to the ECU/DEC. These checks determine whether the sensor or the blue cable should be replaced.

a. Make circuit resistance and short circuit checks through S39 connector on ECU/DEC, using switch box. See paragraph 1-262 for instructions and limits. Set selector switch at position number 5. If reading is outside-of-limits or if an open or short circuit is found, do the following steps to isolate fault to either torque and overspeed sensor or blue cable.

b. Check torque and overspeed sensor as follows:

(1) Disconnect blue cable from sensor.

(2) Measure resistance between pins A and C and between pins B and D in connector (11) on sensor. Normal resistance for both readings is 13 to 21 ohms.

(3) Check each pin for short circuit to ground. No short circuits allowed.

(4) If readings are out-of-limits, circuit is faulty. Replace torque and overspeed sensor (para 7-69).

c. Check blue cable as follows:

(1) Disconnect blue cable at ECU/DEC.

(2) Check socket-to-socket continuity between electrical connector (W5P1-blue cable) and electrical connector (W5P3-blue cable) (see following list). No open circuits allowed.

W5P1 Sockets		W5P3 Sockets
3	to	D
10	to	C
11	to	B
12	to	A

(3) Check for short circuits between sockets 3, 10, 11, and 12 or A, B, C, and D. No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum allowable resistance is 1 megohm.

(5) If blue cable is faulty, replace it (para 7-46).

(6) If blue cable is not faulty, reconnect it to ECU and torque and overspeed sensor.

1-266. Overspeed System Checks for (T700) Pressurizing and Overspeed Unit (POU), and (T701, T701C, T701D) Overspeed and Drain Valve (ODV). The following checks test the circuits in the following:

- **(T700)** POU.
- **(T701, T701C, T701D)** ODV.
- blue cable that connects ECU/ DEC to POU, or ODV.

These checks determine whether the valve or the blue cable should be replaced.

a. Make circuit resistance and short circuit checks through S39 connector on ECU, using switch box. See paragraph 1-262 for instructions and limits.

Set selector switch at position number 6. If reading is out-of-limits, the circuit is open or shorted. Do the following to isolate fault to the valve or the blue cable.

b. Check **(T700)** POU, or **(T701, T701C, T701D)** ODV as follows:

(1) Disconnect blue cable from the valve.

(2) Measure resistance between pins 1 and 3 and between pins 2 and 4 in connector (J1) on valve. Normal resistance for both readings is 18 to 24 ohms.

(3) Check each pin for short circuit to ground. No short circuit allowed.

(4) If readings are out-of-limits, circuit is faulty. Replace the following:

- **(T700)** POU (para 6-87).
- **(T701, T701C, T701D)** ODV (para 6-74).

c. Check blue cable as follows:

(1) Disconnect blue cable at ECU/DEC.

(2) Check socket-to-socket continuity between electrical connector (W5P1-blue cable) and electrical connector (W5P2-blue cable) (see following list). No open circuits allowed.

W5P1 Sockets		W5P2 Sockets
5	to	1
6	to	2
7	to	3
8	to	4

(3) Check for short circuits between sockets 1, 2, 3, and 4 in electrical connector (W5P2-blue cable). No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum allowable resistance is 1 megohm.

(5) If blue cable is faulty, replace it (para 7-46).

(6) If blue cable is not faulty, reconnect it to ECU/DEC and to **(T700)** POU, or **(T701, T701C, T701D)** ODV.

1-267. Np Sensor System Check. The following checks will determine whether the Np sensor or the yellow cable is faulty.

a. Make circuit resistance and short circuit checks through S39 connector on ECU/DEC, using switch box. See paragraph 1-262 for instructions and limits. Set selector switch at position number 4. If reading is out-of-limits, circuit is open or shorted. Do the following to isolate fault to either Np sensor or yellow cable.

b. Check Np sensor as follows:

(1) Disconnect yellow cable from Np sensor.

(2) Measure resistance between pins A and C and between pins B and D in connector (J1) on Np sensor. Normal resistance for both readings is 13 to 21 ohms.

(3) Check each pin for short circuit-to-ground. No short circuits allowed.

(4) If readings are out-of-limits, circuit is faulty. Replace Np sensor (para 7-75).

c. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/DEC and Np sensor.

(2) Check socket-to-socket continuity between electrical connector (W4P1-yellow cable) and electrical

connector (W4P2-yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P2 Sockets
9	to	A
8	to	B
20	to	C
21	to	D

(3) Check for short circuits between sockets A, B, C, and D or 9, 8, 20, and 21. No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed.

(5) If yellow cable is faulty, replace it (para 7-41).

(6) If yellow cable is not faulty, reconnect it to ECU/DEC and Np sensor.

1-268. Alternator and Yellow Cable Check. The following checks test the alternator windings and the circuits in yellow cable that connect the ECU/ DEC to the alternator. These checks determine whether the alternator stator or the yellow cable should be replaced.

a. Make circuit resistance and short circuit checks through S39 connector on ECU, using switch box. See paragraph 1-262 for instructions and limits. Set selector switch at position number 1. If reading is out-of-limits or if an open or short circuit is found, do the following to isolate fault to either alternator or yellow cable.

b. Check the alternator as follows:

(1) Disconnect yellow cable from alternator.

CAUTION

When measuring pin-to-pin resistance, use care to prevent bending of individual pins.

(2) Measure resistance between pins 3 and 5 in connector (J2) on alternator. Resistance must be:

- **(T700)** 2.0 - 4.0 ohms
- **(T701, T701C, T701D)** 1.0 - 2.5 ohms

(3) Check each pin for short circuit-to-ground. Minimum resistance shall be 20 megohms.

(4) Measure pin-to-pin resistance of the J2 connector between pins 1 and 2, 3, 4, 5, respectively, and between pins 2 and 3, 4, 5, respectively. Minimum resistance shall be 20 megohms.

(5) If reading is out-of-limits, circuit is faulty. Replace alternator stator (para 7-51). If reading is within limits, continue to step c.

c. Check yellow cable as follows:

(1) Disconnect yellow cable at ECU/DEC and alternator.

(2) Check socket-to-socket continuity between electrical connector (W4P1-yellow cable) and electrical connector (W4P5-yellow cable) (see following list). No open circuits allowed.

W4P1 Sockets		W4P5 Sockets
30	to	3
31	to	4
19	to	5

(3) Check for short circuits between sockets 3, 4, and 5 in electrical connector (W4P5-yellow cable). No short circuits allowed.

(4) Check each socket for short circuit to outer metal braid of cable. No short circuits allowed. Minimum resistance will be 1 megohm.

(5) If yellow cable is faulty, replace it (para 7-41).

(6) If yellow cable is not faulty, reconnect it to **(T700, T701)** ECU or **(T701C, T701D)** DEC and alternator.

1-269. METS/FEDS/CETS Np Demand System and Instrument Indicating Cables Check.

WARNING

To avoid possible electrical shock or damage to test equipment, all power to test panel must be de-energized.

a. Use a multimeter for these checks.

b. Check METS/FEDS/CETS cables and harnesses for loose connectors and for damaged pins or sockets. See METS/FEDS/CETS manual.

c. Disconnect METS/FEDS/CETS harness from **(T700, T701)** ECU or **(T701C, T701D)** DEC connector and check METS/FEDS/CETS circuits for:

(1) Resistance between sockets 18 and 20; 19 and 20; 21 and 20. See METS/FEDS/CETS manual for limits and circuitry. If an open circuit is found during these checks, check continuity in harness between sockets 18, 19, 20, 21, and corresponding pin at other end of circuit. Check for shorts as instructed in steps (2) through (5).

(2) Short circuits between sockets 18 and 20; 19 and 21. No short circuits allowed. Check each socket for shorts to ground. Minimum resistance will be 1 megohm.

(3) Short circuits between METS/FEDS/CETS ground and sockets 3, 18, 19, 20, 21, and 22. No short circuits allowed.

(4) With E1 connector removed, check for short circuit between METS/FEDS/CETS ground and sockets 3, 6, 8, 9, 10, 11, 12, 14, 16, 17, and 22 on connector. No short circuits allowed. Minimum resistance will be 1 megohm, with exception as indicated in following note.

NOTE

Sockets 9 and 11 may indicate continuity to METS/FEDS/CETS ground if METS/FEDS/CETS instrumentation is grounded (designed that way). See METS/FEDS/CETS manual for circuit details and resistance values.

(5) Check for short circuits between each connector socket and each socket within connector (socket 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 18, 19, 20, 21, 22, 23, and 24). Short circuits are not allowed, except sockets 3 and 22 which are load share circuits commons and which will show continuity.

1-270. Electrical Ignition Lead Check.

a. Use a multimeter for these checks.

b. Remove electrical ignition leads (para 7-24).

c. Check socket on one end of ignition lead to socket on other end of ignition lead for continuity. If continuity is not indicated, replace ignition lead (para 7-28).

d. Check ignition lead for short-to-ground by testing socket of one end of ignition lead to metal braid. If ignition lead is shorted, replace it (para 7-28).

e. Repeat steps c and d for other electrical ignition lead.

1-271. Ng Indicating System Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for these checks.

b. Disconnect METS/FEDS/CETS harness from electrical connector (W3J1-green cable) on swirl frame.

c. Measure resistance between pins 20 and 21 in electrical connector (W3J1). Resistance will be 2.0 to 3.5 ohms. If reading is out-of-limits, check for short or open circuit as follows:

(1) Remove green cable from alternator connector.

(2) Measure resistance between pins 4 and 5 on alternator connector (J1). Resistance will be as follows:

- **(T700)** 2.0 - 3.5 ohms
- **(T701, T701C, T701D)** 2.5 - 4.0 ohms

(3) If reading is within limits, replace green cable (para 7-35). If reading is out-of-limits, replace alternator stator (para 7-51).

1-272. DEC Fault Code Reset Verification.

NOTE

If the problem has been corrected the DEC will reset itself. To verify corrective action, it is required to operate engine at ground idle.

a. Start engine and run at ground idle speed (WATER-OUT lever to maximum open position, PAS lever at 26° ±2.5°).

b. Shut down engine (PAS lever to 0°). If no fault is detected the torque reading will be 0.00, fault is cleared. If fault is detected, refer to table 1-13 and troubleshoot DEC.

1-273. Unusual Engine Noise.

a. If an unusual high-pitched whining sound is heard, do the following:

NOTE

- Certain compressor damage can cause a high-pitched whining sound. The noise will vary with gas generator speed and should be much higher than usual engine noise level.
- Compressor rotors with repaired stage 1 blades produce a higher pitched noise than is present on undamaged compressor rotors. This higher pitched noise is not harmful to personnel or material, and should not be cause for engine removal from METS/FEDS/CETS.

(1) Reduce power and stop running engine as soon as practical to avoid damaging compressor.

(2) Review engine records to determine if stage 1 compressor rotor blades have been repaired (para 2-6).

(3) If stage 1 blades have not been repaired, borescope the compressor (para 1-172).

b. The Woodward Governor HMU emits a louder noise (than Hamilton Standard) during all levels of engine operation.

c. A new (before break-in) gas generator rotor and stator could emit a rubbing sound, from the outer balance piston seal, this is normal.

1-274. Maintenance Required Following Sudden Engine Stoppage. Engine removal is required if sudden engine stoppage is suspected. Sudden stoppage involves stopping or significantly decelerating the engine’s core or power turbine (PT) shaft via external mechanical forces such as air vehicle drive train failure/lock-up or forces from a crash or hard landing that stops or abnormally decelerates the airframe’s main rotor, potentially causing engine damage. Sudden stoppage does not result from termination of fuel flow nor does it result from emergency stopping where restart and reuse of the engine is allowable. The following events are cause for engine sudden stoppage removal and inspection of the engine:

a. A high deceleration rotor incident resulting in removal of the main transmission, input modules, and/or nose gearboxes.

b. The event caused damage to engine mounts or attaching hardware.

c. The event caused unusual noise or rubs.

NOTE

The following actions/inspections shall be performed to determine which portions of the engine must be returned to Depot.

d. Remove the A-sump output shaft assembly and the power turbine module (para 2-19 and 4-7 respectively).

e. Inspect the following components. If rubs and/or cracks are detected, return the entire engine to Depot. If no rubs and/or cracks are detected, the PT module and A-sump output shaft assembly must be returned to Depot, the remainder of the engine may remain in service:

- Power Turbine Shaft Assembly for circumferential rubs (para 4-30).
- Compressor Tie Rod for circumferential rubs on the inside diameter near the compressor tie rod round nut bushing, see figure 2-39.
- Diffuser Midframe Casing Assembly mount lugs for cracks (para 2-62).
- Swirl Frame flanges for cracks (para 2-12).

f. Engines that are subjected to a compressor/gas generator sudden stoppage such as the seizure of the engine air starter, require the replacement of the radial drive shaft assembly.

1-275. Vibration Analyzer Check. Vibration analyzer is used to measure engine vibration levels. It receives vibration input signals from accelerometers attached to the engine during test.

a. Connect analyzer to 115V ac outlet.

b. Disconnect METS/FEDS/CETS accelerometer leads from engine accelerometers.

c. Connect analyzer leads to engine accelerometers.

d. Set analyzer dial to correct readout range.

e. Set analyzer to correct scale.

f. Turn analyzer ON.

g. Make checks required.

h. When check is completed, turn analyzer OFF. Remove analyzer leads from engine accelerometers. Reconnect METS/FEDS/CETS accelerometer leads to engine accelerometers. Disconnect analyzer from 115 V ac outlet.

1-276. Maintenance Required Following Np Overspeed. If engine Np speed exceeded the limits shown in figure 1-148 **(T700)** or figure 1-149 **(T701, T701C, T701D)** do the following:

a. Replace power turbine module (para 4-4).

b. Replace A-sump output shaft assembly (para 2-18).

c. Return both power turbine module and A-sump output shaft assembly to Depot.

1-277. Maintenance Required Following Engine Overtorque. If engine exceeded the torque limits shown in figure 1-150, do the following:

a. Replace power turbine module (para 4-4).

b. Return power turbine module to Depot.

1-278. Maintenance Required Following Gas Generator (Ng) Overspeed. If gas generator speed exceeds 47,000 rpm (105%) for 12 seconds or longer or exceeds 46,000 rpm (103%) for 2 1/2 minutes or longer return cold section module and gas generator rotor/stator assembly or engine to depot. Mark for: Ng OVERSPEED INVESTIGATION.

1-279. Overtemperature Checklist.

CAUTION

If an emergency start is conducted without the aid of cockpit engine parameter display and a hung start or hot start occurs, do not attempt any further starts. Continued operation of engine will result in further engine damage. Remove and mark engine components as outlined in paragraph 1-280.

a. When reviewing reported overtemperature problems, check for the following to verify that an overtemperature problem exists:

(1) Stall (audible popping and banging).

(2) High TGT at shutdown requiring cooling rollover.

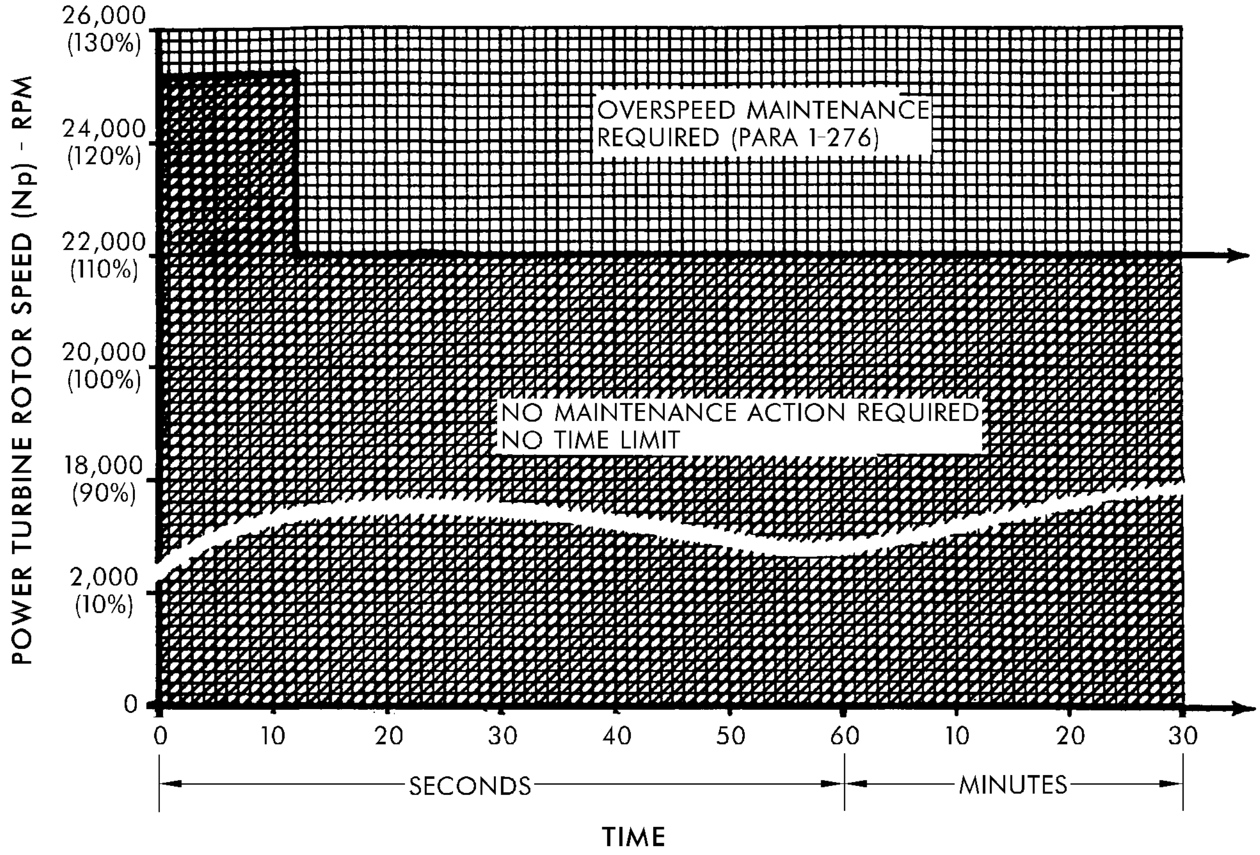


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Figure 1-148. (T700) ***Maintenance Requirements following Np Overspeed (Above 22,000 rpm)***

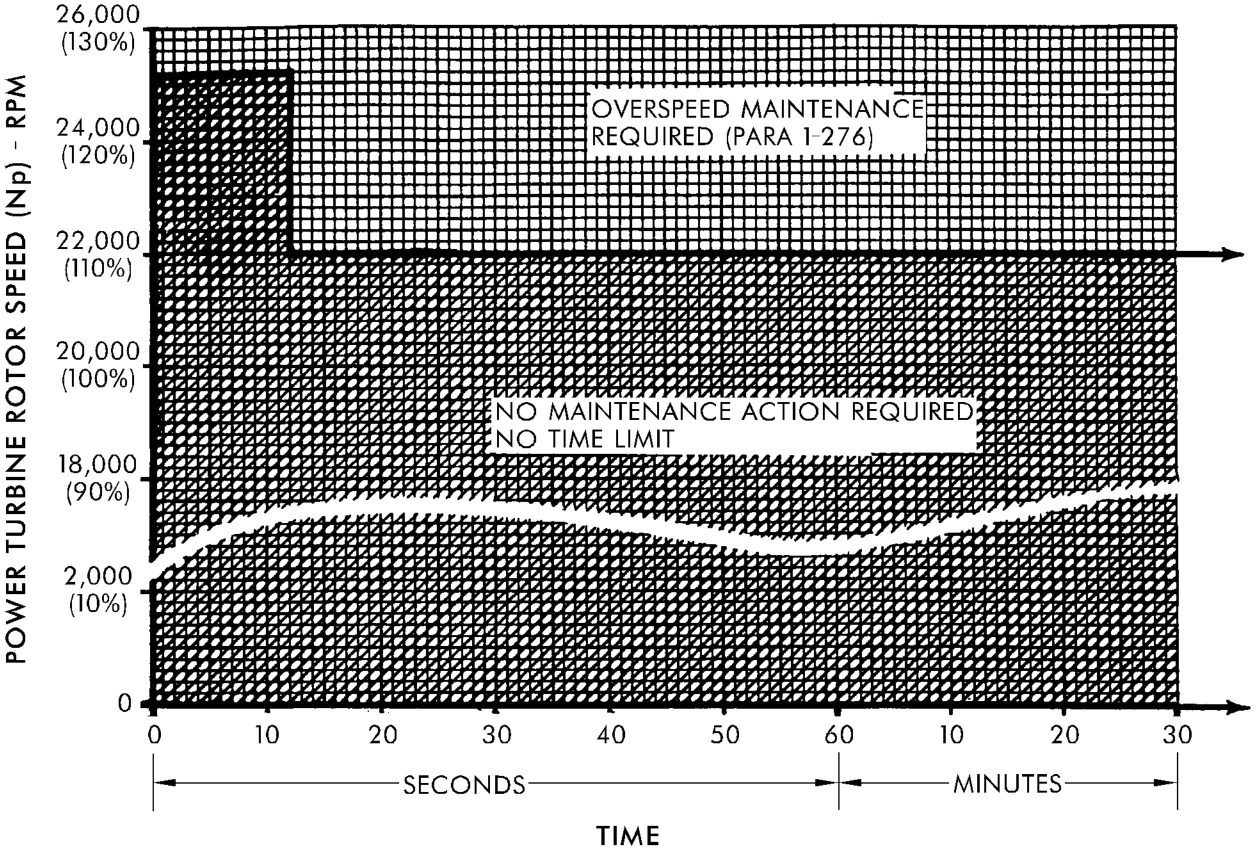

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Figure 1-149. ***(T701, T701C, T701D)*** *Maintenance Requirements Following Np Overspeed (Above 22,000 rpm)*

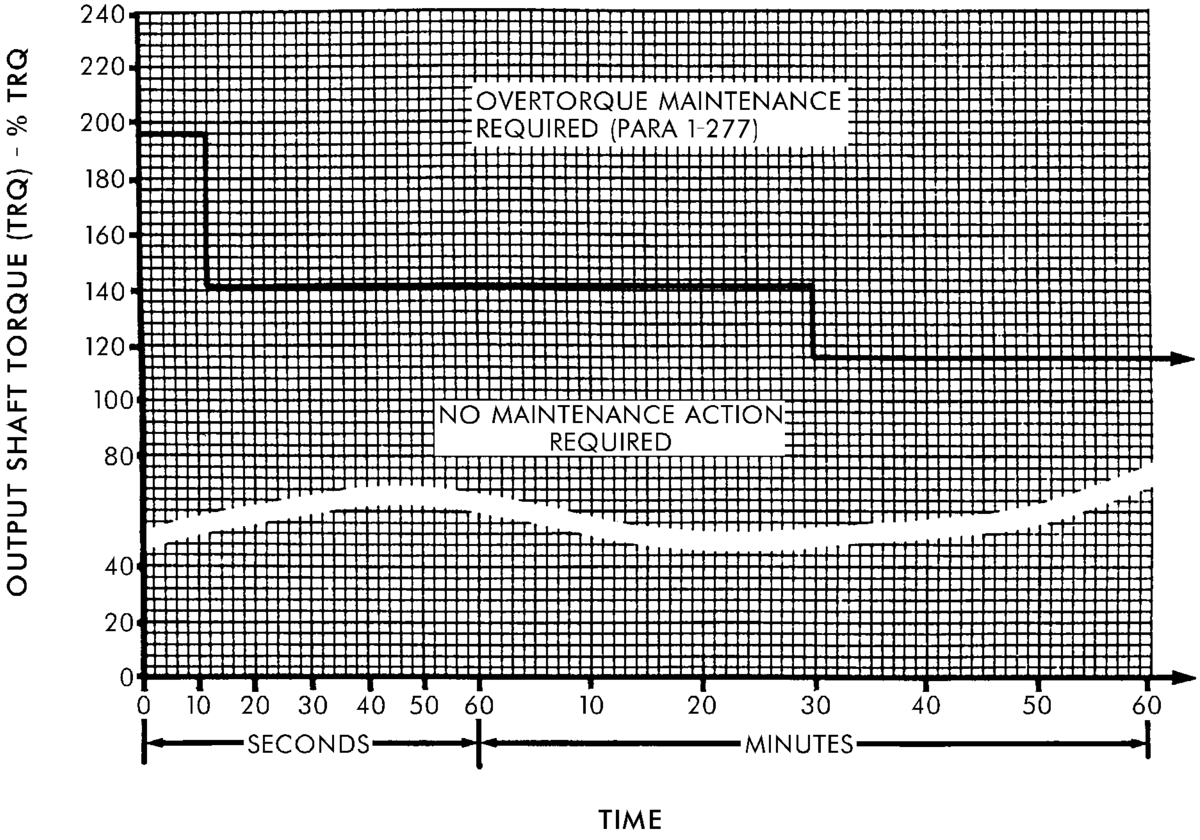

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Figure 1-150. Maintenance Requirements Following Engine Overtorque (Above 116%)

(3) Engine rollback and warning light activation if at ground idle speed.

(4) Engine was being operated in lockout mode.

(5) Engine inlet blockage (airflow disruption).

b. Determine extent of overtemperature as follows:

(1) Determine maximum TGT reached.

(2) **(T700)** Determine time spent at 1742°F (950°C) or below if overtemperature occurred above ground idle; on start-to-ground idle, or ground idle-to-shutdown.

(3) **(T701, T701C, T701D)** If overtemperature occurred above ground idle, determine time spent at **(T701)** 1769°F (965°C) or **(T701C, T701D)** 1713°F (934°C) or below. If overtemperature occurred on start or shutdown, determine time spent at **(T701)** 1742°F (950°C) or **(T701C, T701D)** 1738°F (948°C) or below.

c. Inspect engine for visual signs of overtemperature damage as follows:

(1) Indications that molten metal has passed through and has adhered to the vanes.

(2) Seized power turbine rotor or gas generator rotor. If seized, allow TGT to cool below **(T700, T701)** 150°C (302°F) or **(T701C, T701D)** 80°C (176°F) and then recheck rotors for seizure.

(3) Borescope engine (para 1-172) as follows:

(a) Check for compressor rotor damage (para 1-182).

(b) Check for burned or missing stage 1 gas generator turbine rotor blade tips. (View through stage 1 turbine nozzle.)

(c) Check for presence of burning on stage 1 turbine nozzle.

(d) Check combustion liner for signs of overtemperature damage.

d. Compare maximum TGT reached and time spent at maximum TGT with the engine overtemperature limits in figure 1-151 and 1-154 **(T700)** or figures 1-152 and 1-155 **(T701)** or figures 1-153 and 1-156 **(T701C, T701D)** to determine if maintenance action is required.

e. If visual evidence of overtemperature is found during inspection (step c), perform overtemperature maintenance (paragraph 1-280).

1-280. Maintenance Required Following Engine Overtemperature. If engine was operated with TGT outside the limits of figure 1-151 or 1-154 **(T700)** or figure 1-152 or 1-155 **(T701)** or figures 1-153 and 1-156 **(T701C, T701D)**, or if borescope inspection shows evidence of thermal distress due to overtemperature, do the following:

a. Remove the following components, mark them FOR OVERTEMPERATURE INVESTIGATION, and return them to Depot.

- HMU (para 6-40)
- Power turbine module (para 4-7)
- Gas generator turbine rotor and stator (para 3-6)
- Stage 1 nozzle assembly (para 3-15)

b. Remove the combustion liner (para 3-15) and inspect it (para 3-21). If inspection shows liner to be in serviceable condition, reinstall it (para 3-24). If combustion liner is out-of-limits, mark it FOR OVERTEMPERATURE INVESTIGATION, return it to Depot, and install a replacement liner (para 3-24).

c. Install the following replacement components:

- Stage 1 nozzle assembly (para 3-24)
- Gas generator turbine rotor and stator (para 3-13)
- Power turbine module (para 4-11)
- HMU (para 6-44)

d. After installation, make required checks (para 1-223).

1-281. E1 Harness (METS/FEDS/CETS) Overtemperature Troubleshooting Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect the E1 harness from the **(T700, T701)** ECU or **(T701C, T701D)** DEC.

c. Check for a short circuit between sockets 24 to 16 and 23 to 16. No short circuits allowed.

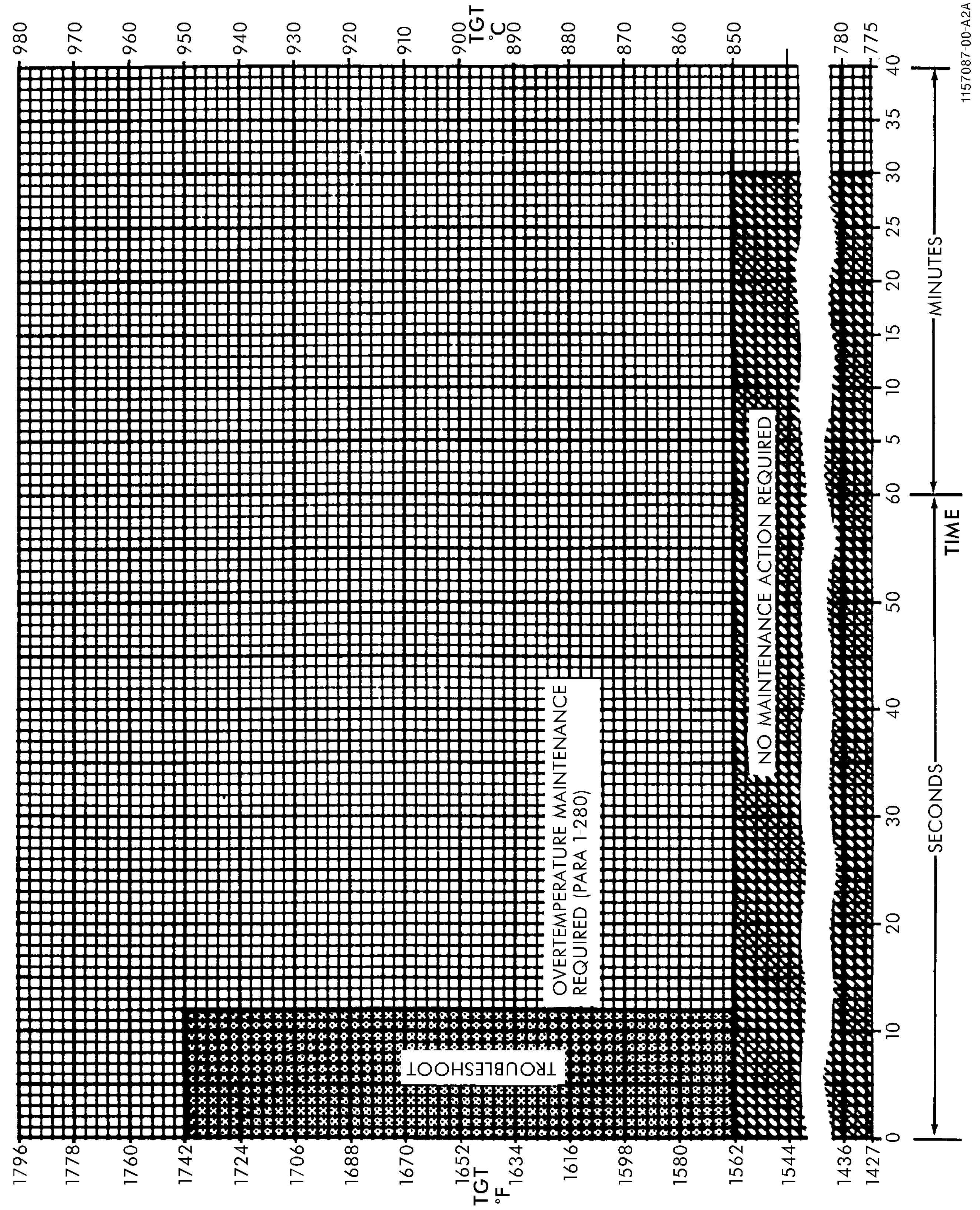

Figure 1-151. (T700) ***Engine Maintenance Requirements for Overtemperature Operation from Start-to-Ground Idle and from Ground Idle-to-Shutdown***

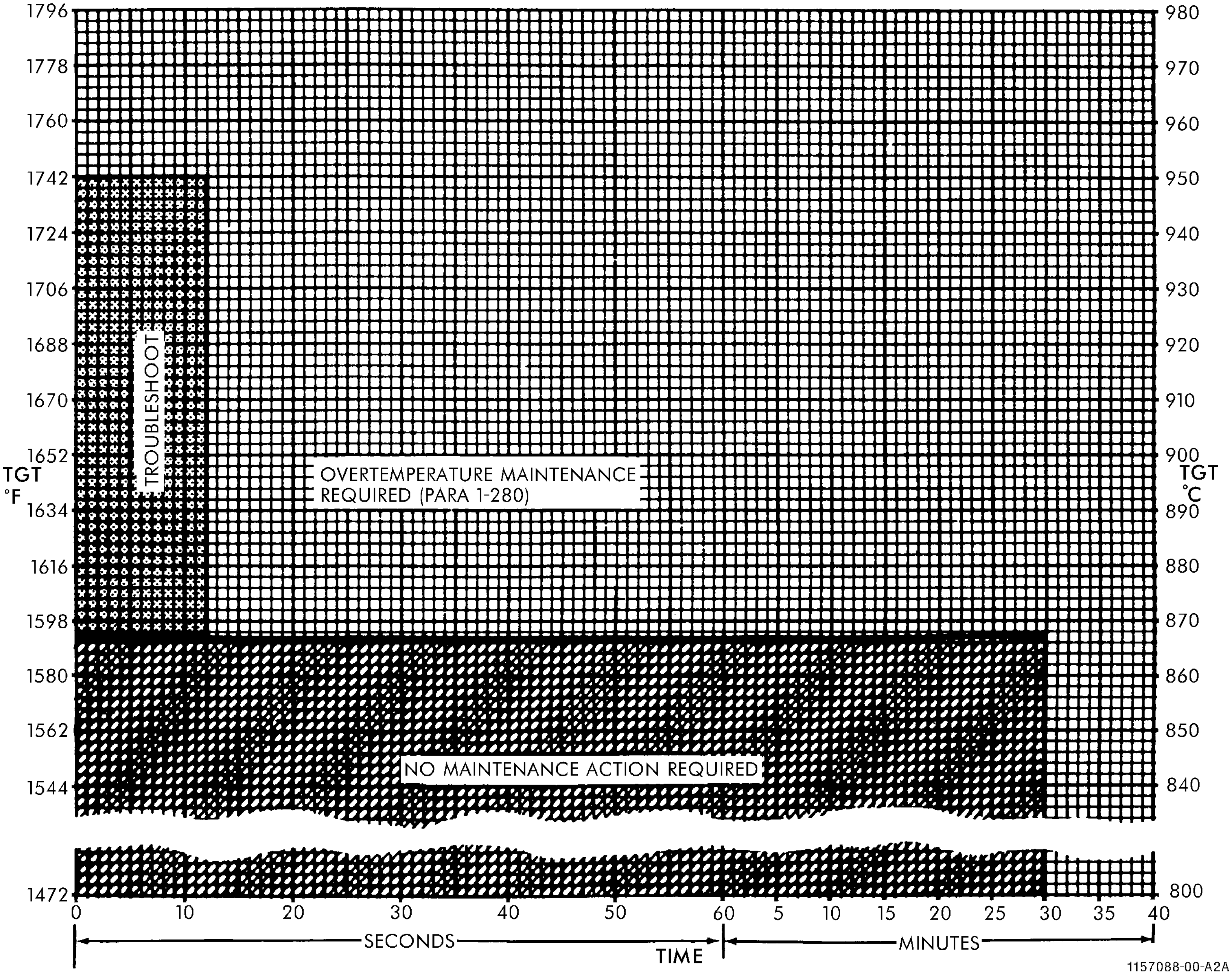

Figure 1-152.** (T701) **Engine Maintenance Requirements for Overtemperature Operation from Start-to-Ground Idle and from Ground Idle-to-Shutdown

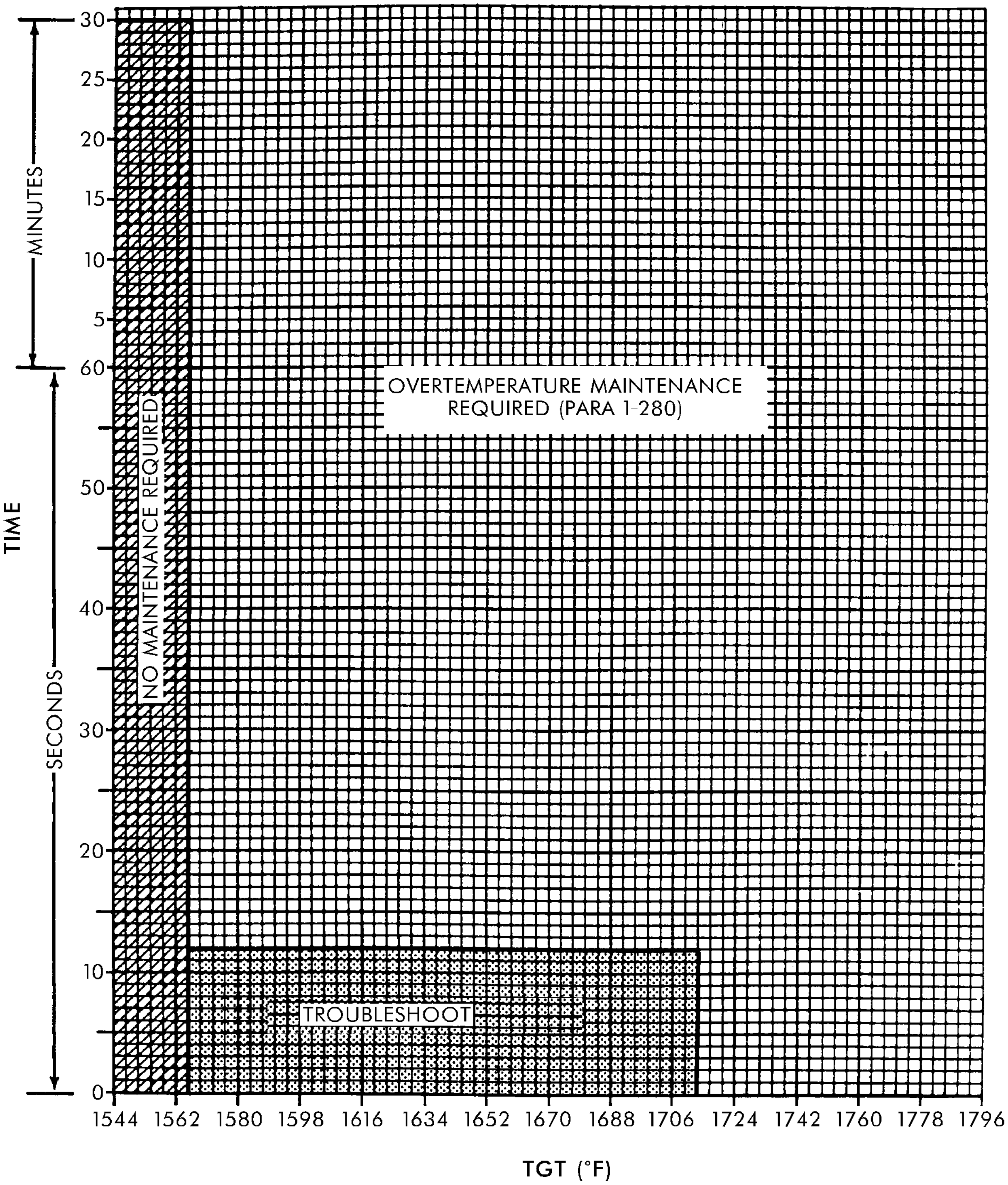

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Figure 1-153. ***(T701C, T701D)*** ***Engine Maintenance Requirements for Overtemperature Operation from Start-to-Ground Idle and Ground Idle-to-Shutdown***

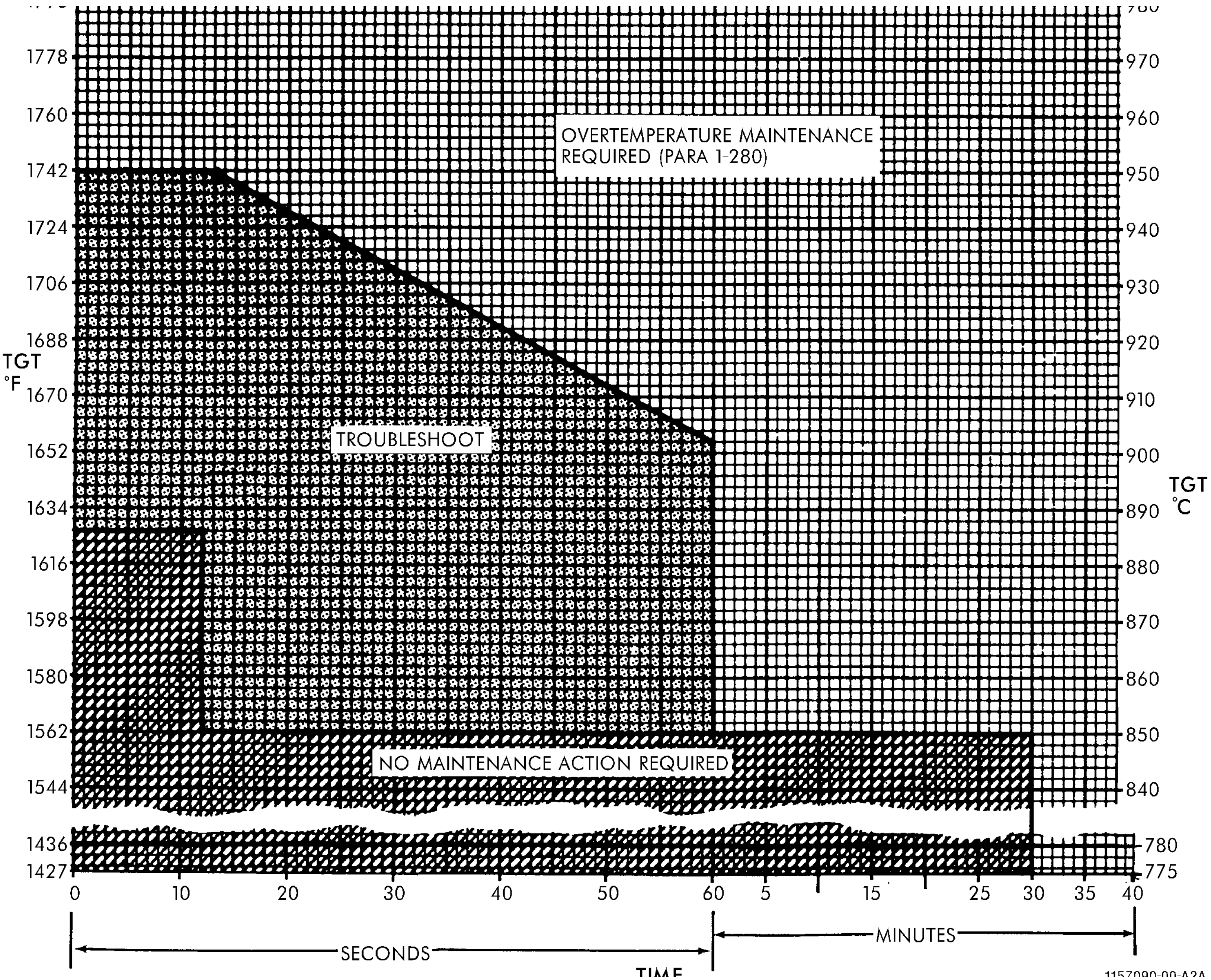

Figure 1-154. (T700) Engine Maintenance Requirements for Overtemperature Operation Above Ground Idle

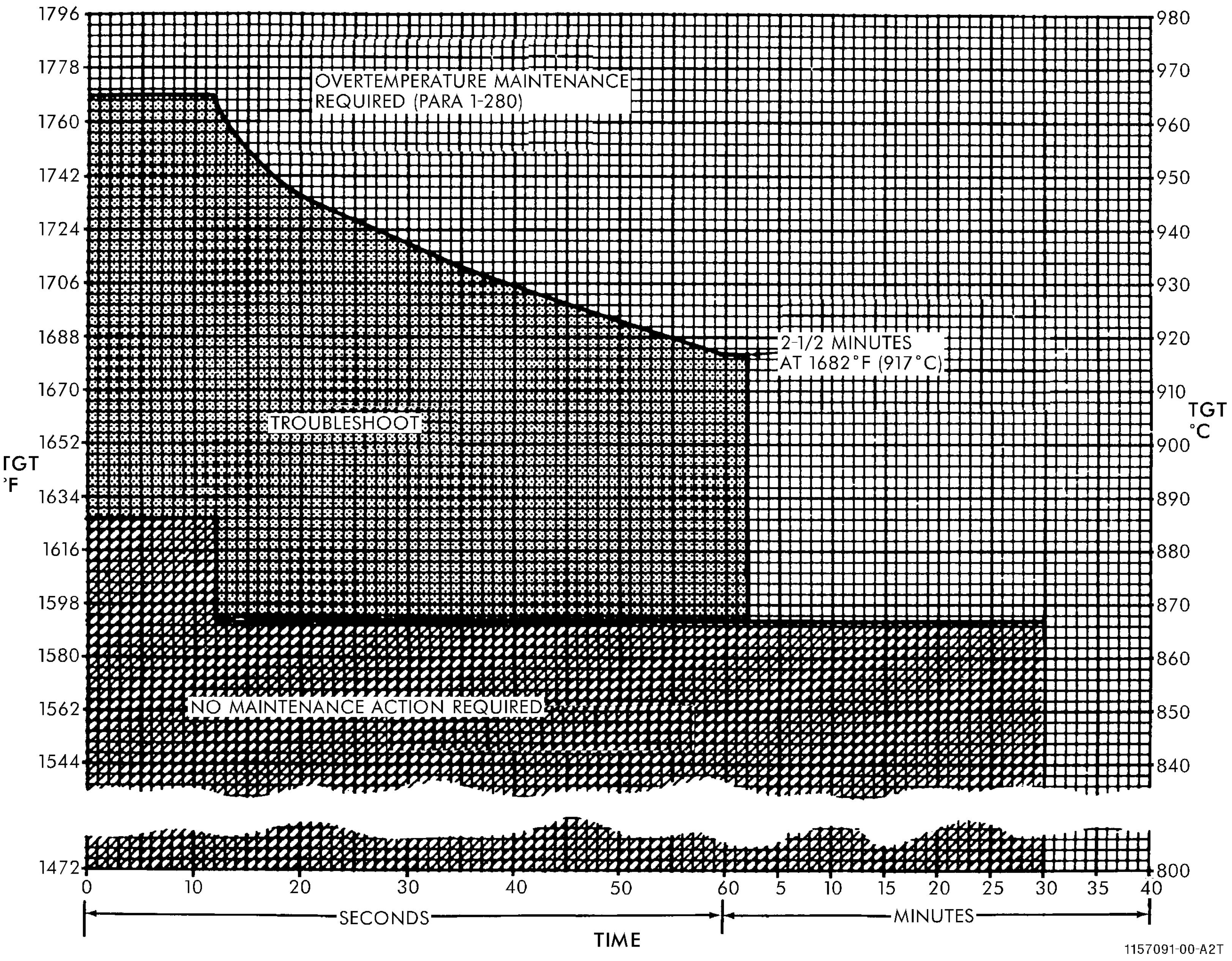

Figure 1-155. (T701) Engine Maintenance Requirements for Overtemperature Operation Above Ground Idle

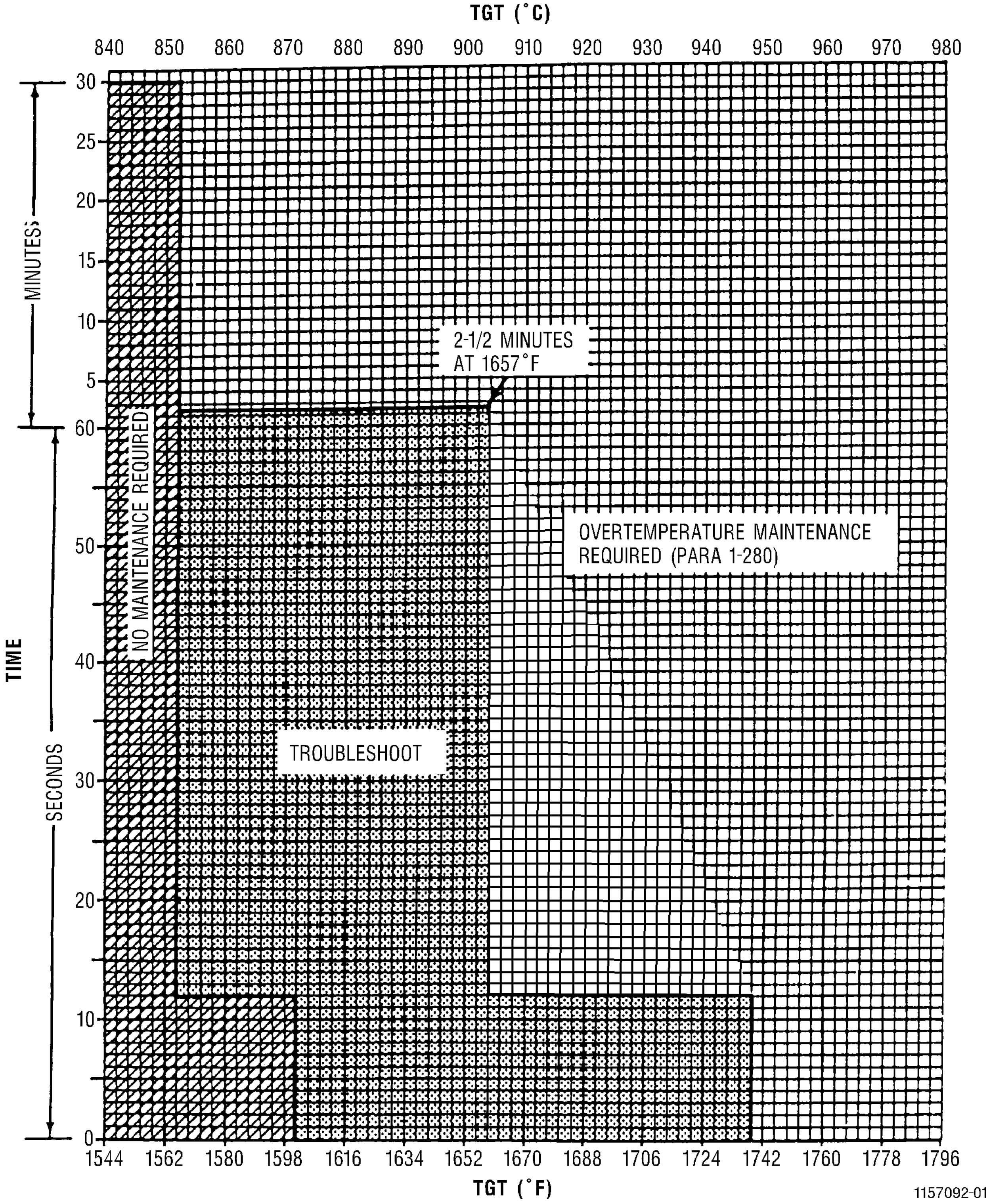

*Figure 1-156. **(T701C, T701D)** Engine Maintenance Requirements for Overtemperature Operation Above Ground Idle*

d. Check for shorts to METS/FEDS/CETS ground or for socket-to-socket short in METS/FEDS/CETS E1 connector (para 1-269, step c(4)).

1-282. Yellow Cable Overtemperature Troubleshooting Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect the following yellow cable connectors at the:

- **(T700, T701)** ECU or **(T701C, T701D)** DEC (W4P1)
- **(T700, T701)** History recorder or
- **(T701C, T701D)** History counterNp sensor
- Thermocouple assembly
- HMU
- Ignition exciter

c. Check electrical connector (W4P1-yellow cable) for short circuits between all sockets to the outer metal braid of yellow cable. No short circuits allowed.

d. Check for shorts between all sockets. None allowed.

e. If yellow cable is faulty, replace it (para 7-41).

1-283. Maintenance Required Following Failure of Aircraft High Speed Output Driveshaft. If engine was operated with a failed aircraft high speed output driveshaft, do the following:

a. Remove engine A-sump output shaft assembly (para 2-19). Send A-Sump output shaft assembly to Depot.

b. Remove power turbine module (para 4-7). Inspect power turbine driveshaft assembly (para 4-30). In addition, inspect splines of power turbine driveshaft for visual damage. If visual damage is evident, return power turbine module to Depot.

c. Using borescope (para 1-172), inspect compressor for damage.

d. Remove radial drive shaft assembly (para 5-38) and inspect assembly (para 5-40).

e. Check power takeoff drive assembly for looseness; then remove it (para 2-27) and inspect assembly (para 2-28).

f. Using borescope, inspect carbon seal sleeve (fig. 1-157) on inside of stage 1 compressor rotor blade-disk. Cracks, breaks, or missing pieces are not allowed. If cracks, breaks, or missing pieces are observed, remove and replace cold section module.

g. Replace A-sump output shaft assembly (para 2-21).

h. Reinstall engine parts that passed inspections in steps b through f; replace those engine parts that did not pass inspections in steps b through f.

- Cold section module
- Power takeoff drive assembly (para 2-29)
- Radial drive shaft assembly (para 5-41)
- No. 1 carbon seal (para 2-25)
- Power turbine module (para 4-11)

i. Make required engine checks listed in table 1-39.

1-284. Maintenance Required Following Compressor Airflow Disruption or Engine Inlet Blockage. If engine was suspected of having inlet blockage or airflow disruption, do the following:

CAUTION

Compressor airflow disruption could cause fatigue failure to compressor rotor blades and stator vanes.

a. Inspect inlet guide vanes, stage 1 and stage 2 guide vanes, and actuating levers. If vanes or levers are disconnected, broken, loose, or missing, replace (AVUM) engine or (AVIM) cold section module (para 2-1). Tag engine or cold section module stating: THIS PART REPLACED BECAUSE OF AIRFLOW DISRUPTION OR INLET BLOCKAGE.

b. Open IGV's to full open position for maximum viewing.

c. Inspect front frame vanes, scavenge passages, and vanes in swirl frame for foreign material (para 2-1).

d. Borescope-inspect (para 1-171) the compressor section.

e. If foreign material is wrapped around leading edge (full height) of any number of nonadjacent single inlet guide vanes (fig. 1-158, view A) or two adjacent single inlet guide vanes, remove foreign material and borescope-inspect (para 1-171) the compressor section.

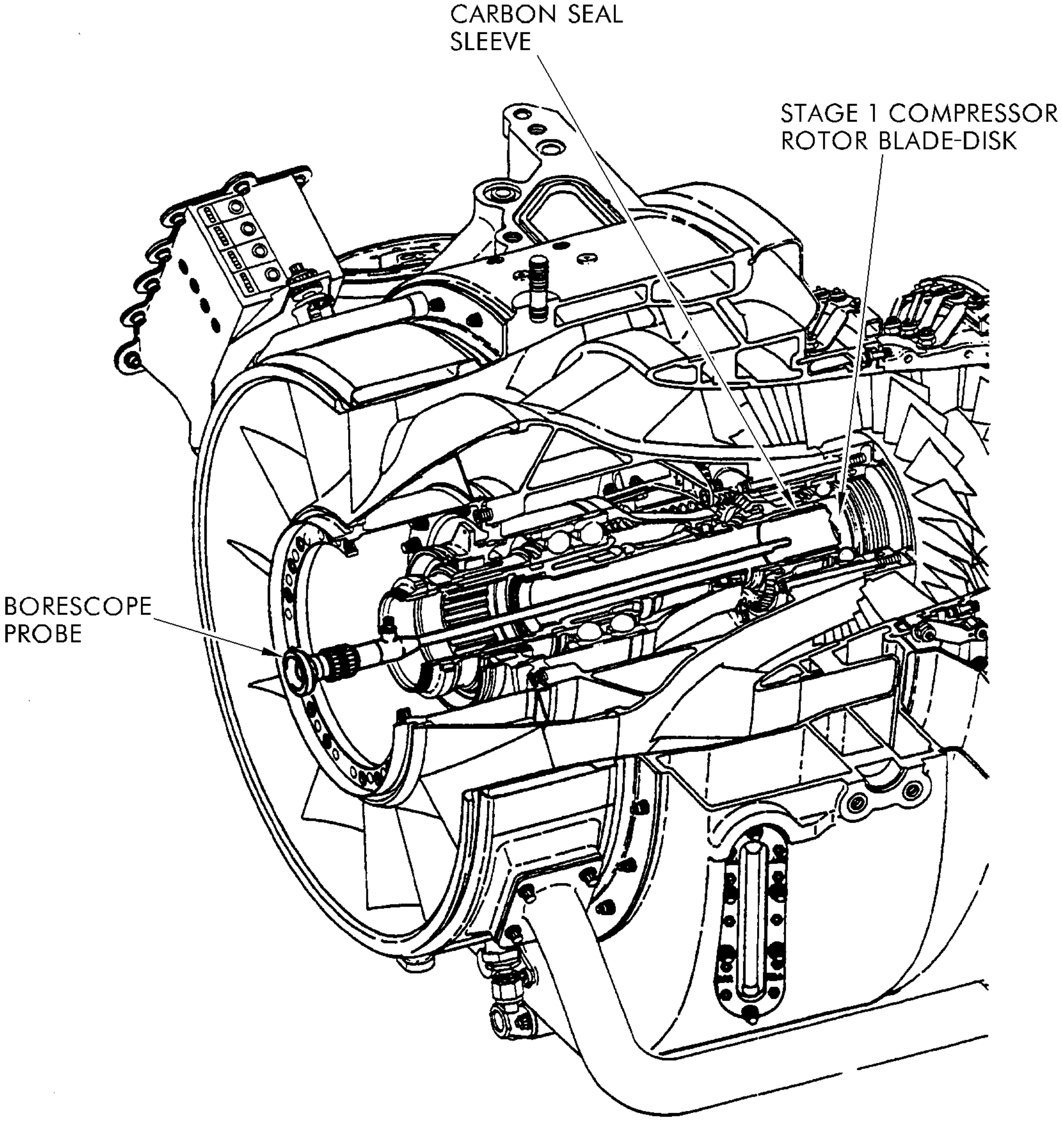

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Figure 1-157. Stage 1 Compressor Rotor Blade-Disk; Borescope Inspection of Carbon Seal Sleeve

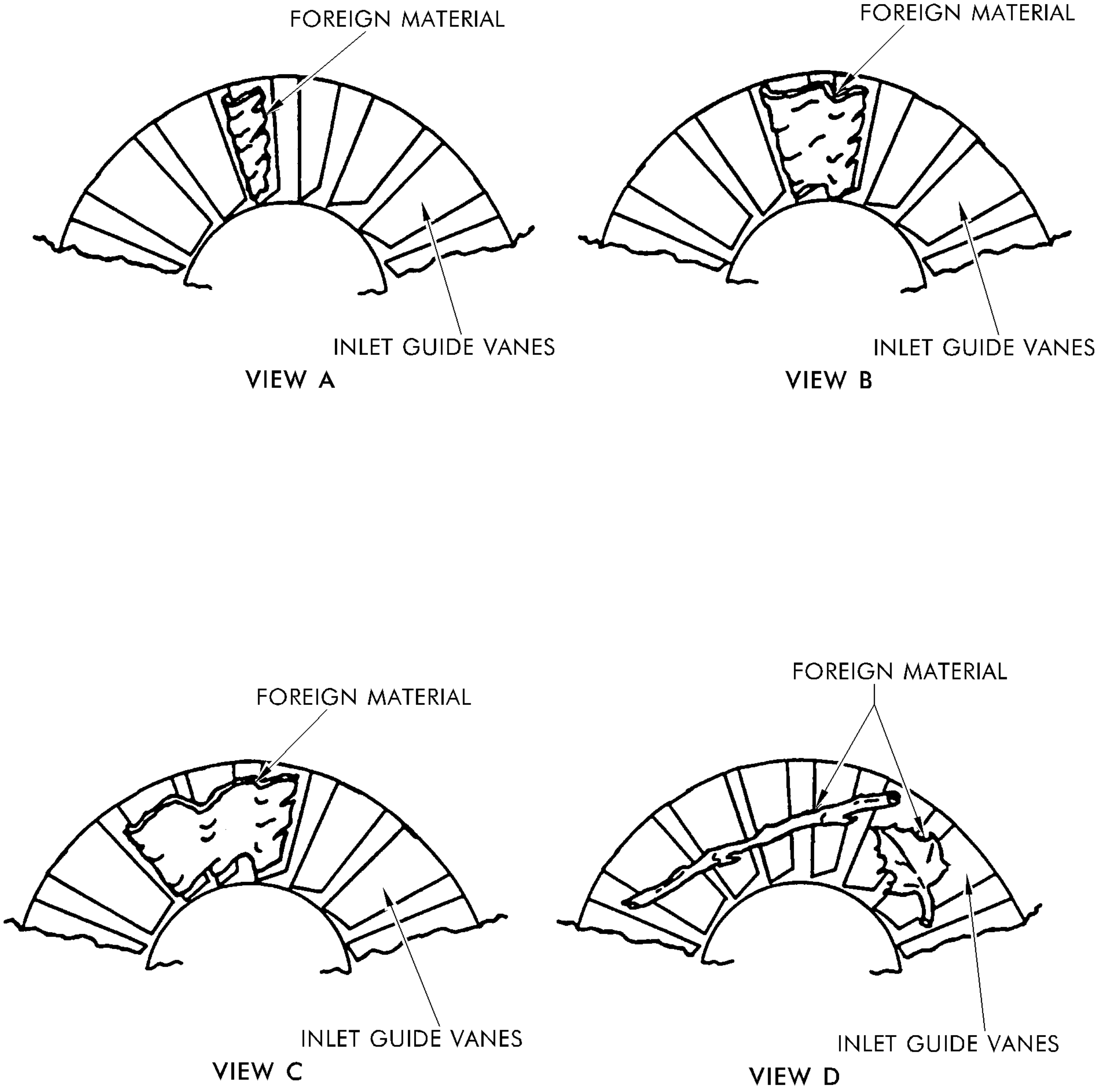


Figure 1-158. Inlet Guide Vanes; Inspection

f. If foreign material is wrapped around leading edge of more than two adjacent single inlet guide vanes, replace (AVUM) engine or (AVIM) cold section module (para 2-1). Tag engine or cold section module stating: THIS PART REPLACED BECAUSE OF AIRFLOW DISRUPTION OR INLET BLOCKAGE.

g. If foreign material is spanning two vanes (full height) (view B), remove foreign material and borescope-inspect (para 1-171) the compressor section.

h. If foreign material is spanning more than two vanes (full height), replace (AVUM) engine or (AVIM) cold section module (para 2-1). Tag engine or cold section module stating: THIS PART REPLACED BECAUSE OF AIRFLOW DISRUPTION OR INLET BLOCKAGE.

i. If foreign material is more than 1/2 inch wide, and is spanning three vanes (two passages) (or more) (view C), replace (AVUM) engine or (AVIM) cold section module (para 2-1). Tag engine or cold section module stating: THIS PART REPLACED BECAUSE OF AIRFLOW DISRUPTION OR INLET BLOCKAGE.

j. If debris is light (view D), remove debris and borescope-inspect (para 1-171) stage 1 compressor rotor blades.

k. If debris is nested and will create blockage similar to steps f, h, or i, replace (AVUM) engine or (AVIM) cold section module (para 2-1). Tag engine or cold section module stating: THIS PART REPLACED BECAUSE OF AIRFLOW DISRUPTION OR INLET BLOCKAGE.

l. Make required checks listed in table 1-39.

1-285. Inspection of Engines Involved in Accidents or Incidents.

CAUTION

The maintenance manual provides the actions necessary to keep an engine in proper serviceable condition for operation in normal operating exposure conditions. An accident, incident, or equivalent mishap may result in concealed damage to an engine and will be considered abnormal operation. Any engine exposed to abnormal conditions requires special inspection and part dispositions in excess of normal manual requirements and limits. Some of the abnormal conditions to which an engine may be exposed are:

- Shock loading, collision impact, crash damage, separation from the aircraft, or handling or transportation mishap.
- Structural overstress; the engine structure supporting the weight of the aircraft as in failure or separation of the landing gear.
- Sudden seizure or stoppage of the engine rotor or rotors.
- G-loading during operation in excess of airframe manual limits.
- Extreme ingestion events.
- Fire exposure:
  - Fire consuming aircraft, all or portion thereof.
  - Post crash engine exterior fire, engine only.
  - Engine undercowl fire.
  - Fire in storage or transport.
- Thermal quench by submersion into water while operating.
- Exposure to corrosives:
  - Chemicals, saltwater, or sewage.
  - Post mishap.
  - Unprotected storage.
- Impact or explosion from bomb, rocket, or missle attack.
- Exposure to fire-fighting materials.

These events are highly variable and the conditions, to which engines involved are exposed, are unpredictable. This prevents establishing a single, all inclusive procedure. Before proceeding with a post-mishap salvage action to reinstate airworthiness, contact AMCOM: AMSAM-AR-E-P-E Commerical Phone (256) 313-4983; DSN 897-4983 for special inspection requirements.

Depending upon the circumstances of the event, instances of localized, limited damage can be dispositioned by normal channels. For major events such as an accident, incident, or equivalent mishap, execution of a special inspection workscope is required for disposition of each of the engines involved.

Assurance of a part's airworthiness is derived from control of material processing and manufacturing, operation within defined limits, and maintenance within defined limits and processes, as well as by inspection. Parts exposed to abnormal conditions, such as accidents or incidents, may appear to be good, when in fact the actual state of material cannot be ascertained even by the most advanced non-destructive testing and inspection methods. For ongoing airworthiness, records of the component operating history must be unbroken, continuous, and known to be within normal controlled conditions. Parts which have been involved in a mishap must be formally reviewed for severity of operation beyond the normal working environment, and dispositioned as to the necessity for a special inspection workscope. The operator, therefore, should verify that service history of major used replacement parts is known, and that, when applicable, required special inspections and part dispostions, following exposure to abnormal conditions, have been completed and the part is airworthy.

An engine involved in an accident or incident should be processed through depot facility as soon as it has been released by the Accident Investigation Board. For clarification, contact AMCOM: AMSAM-AR-E-P-E Commerical Phone (256) 313-4983; DSN 897-4983.

1-286. Engine Flameout Check. When troubleshooting engine flameouts, inspect METS/FEDS/CETS fuel system and engine as follows:

a. METS/FEDS/CETS fuel system for:

- Leaks and blockage
- Faulty valves

- Plugged filters
- Loose fittings (including fuel boost pump inlet)
- Lit METS/FEDS/CETS bypass indicator light. If lit, go to troubleshooting procedure 2.

b. Engine for:

- Loose electrical connectors
- Loose fuel connections
- Damaged fuel lines
- Contaminated fuel system
- Popped fuel filter impending bypass button
- **(T700)** Damaged or clogged P3 hose and tube assembly
- **(T701, T701C, T701D)** Damaged or clogged P3 tube
- Variable vane actuating system binding, foreign object jamming, and proper rigging of PAS
- Visible evidence of foreign object damage (i.e., nicked swirl frame vanes, missing test probes, etc.)

1-287. Oil Pressure Sensor Green Cable Circuit Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connector (W3P2-green cable) at oil pressure sensor and disconnect METS/FEDS/CETS harness at electrical connector (W3J1-green cable) on swirl frame.

c. Check continuity of green cable from connectors W3P2 to W3J1 as follows (no open circuits allowed):

W3P2 Sockets		W3J1 Pins
1	to	7
2	to	6
3	to	5

d. Check electrical connector (W3P2) for short circuits between sockets 1, 2, and 3. No short circuits allowed.

e. Check electrical connector (W3P2) for short circuits to ground from sockets 1, 2, and 3. No short circuits allowed.

f. If green cable is faulty, replace it (para 7-35).

g. If green cable is not faulty, reconnect it to oil pressure sensor and reconnect METS/FEDS/CETS harness to electrical connector (W3J1) on swirl frame.

1-288. (T700, T701C, T701D) Oil Temperature Sensor Green Cable Circuit Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connector (W3P6 - green cable) at oil temperature sensor and disconnect aircraft METS/FEDS/CETS harness (E3) at electrical connector (W3J1 - green cable) on swirl frame.

c. Check continuity of green cable from connectors W3P6 to W3J1 as follows (no open circuits allowed):

W3P6 Sockets		W3J1 Pins
1	to	10
2	to	9
3	to	8

d. Check electrical connector (W3P6) for short circuits between sockets 1, 2, and 3. No short circuits allowed.

e. Check electrical connector (W3P6) for short circuits to METS/FEDS/CETS ground from sockets 1, 2, and 3. No short circuits allowed.

f. If green cable is faulty, replace it (para 7-35).

g. If green cable is not faulty, reconnect it to oil temperature sensor, and reconnect METS/FEDS/CETS harness (E3) to electrical connector (W3J1-green cable) on swirl frame.

1-289. Fuel Pressure Sensor Green Cable Circuit Check. Electrical connector locations are shown in figure FO-2.

a. Use a multimeter for this check.

b. Disconnect electrical connector (W3P8-green cable) at fuel pressure sensor and disconnect METS/FEDS/CETS harness at electrical connector (W3J1-green cable) on swirl frame.

c. Check continuity of green cable from connectors W3P8 to W3J1 as follows (no open circuits allowed):

W3P8 Sockets		W3J1 Pins
1	to	22
2	to	23
3	to	24

d. Check electrical connector (W3P8) for short circuits between sockets 1, 2, and 3. No short circuits allowed.

e. Check electrical connector (W3P8) for short circuits to ground from sockets 1, 2, and 3. No short circuits allowed.

f. If green cable is faulty, replace it (para 7-35).

g. If green cable is not faulty, reconnect it to fuel pressure sensor, and reconnect METS/FEDS/CETS harness to electrical connector (W3J1-green cable) on swirl frame.

1-290. HAND-CRANKING THE ENGINE.

CAUTION

> When removing or installing components, use extreme care to prevent damage to axis-A oil nozzle.

a. Remove radial drive shaft cover boot (fig. 1-159), retaining ring, and radial drive shaft cover assembly.

b. Inspect packing for nicks, cuts, or looseness. Replace defective packing.

c. Crank radial drive shaft assembly as shown in figure 1-159, using a 5/16-inch socket, an extension, and a ratchet.

CAUTION

> To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

d. Install cover assembly, retaining ring, and boot.

1-291. HAND-CRANKING THE ACCESSORY GEARBOX.

CAUTION

> When removing or installing components, use extreme care to prevent damage to axis-A oil nozzle.

a. Remove radial drive shaft cover boot (fig. 1-159), retaining ring, and radial drive shaft cover assembly.

b. Inspect packing for nicks, cuts, or looseness. Replace defective packing.

c. Withdraw radial drive shaft assembly about 7-1/2 inches so that power takeoff drive spline (lower spline) on radial drive shaft engages spline within accessory gearbox.

d. Crank radial drive shaft assembly, using a 5/16-inch socket and ratchet. Gearbox drive train will turn without turning the compressor rotor.

CAUTION

> To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

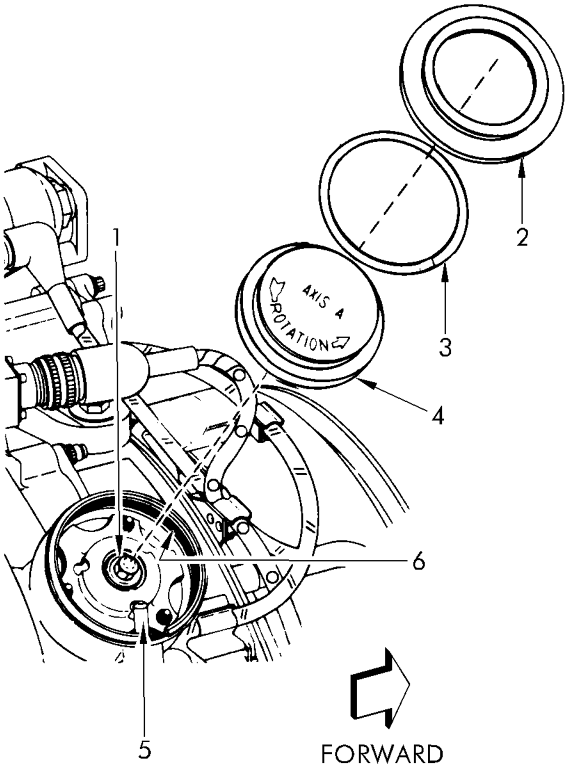
e. Install cover assembly, retaining ring, and boot.

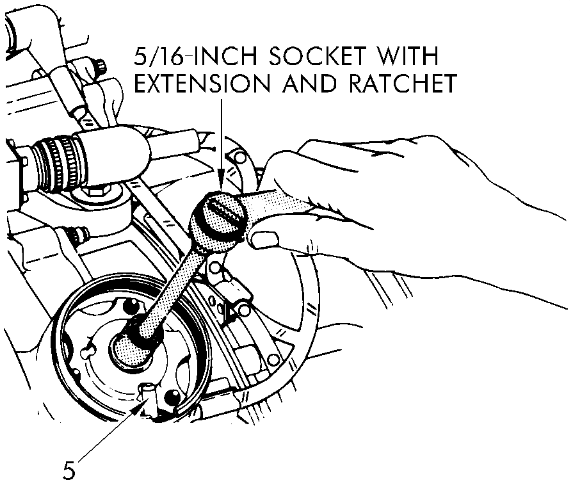
CAUTION

- WHEN HANDCRANKING ENGINE THROUGH AXIS-A RADIAL DRIVE SHAFT, USE EXTREME CARE TO AVOID CONTACT AND DAMAGE TO AXIS-A OIL JET.
- DO NOT USE BOX OR OPEN END WRENCH TO HANDCRANK ENGINE.
- WHEN REMOVING AND INSTALLING AXIS-A COVER ASSEMBLY, USE EXTREME CARE TO AVOID CONTACT AND DAMAGE TO THE AXIS-A OIL NOZZLE.
- TO PREVENT ANY OIL LOSS AND POSSIBLE IN-FLIGHT SHUTDOWN BE SURE AXIS-A COVER IS REINSTALLED PROPERLY.

NOTE

- TURNING WRENCH COUNTERCLOCKWISE WILL TURN ROTOR CLOCKWISE (AFT LOOKING FORWARD).
- ONE TURN OF THE RADIAL DRIVE SHAFT ASSEMBLY WILL ROTATE THE COMPRESSOR ROTOR APPROXIMATELY 1-1/4 TURNS.





1. Radial Drive Shaft Assembly
2. Radial Drive Shaft Cover Boot
3. Retaining Ring
4. Radial Drive Shaft Cover Assembly
5. Axis-A Oil Nozzle
6. Packing

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Figure 1-159. Hand-Cranking the Engine or the Accessory Gearbox

CHAPTER 2

COMPRESSOR SECTION

COLD SECTION MODULE

2-1. CHAPTER OVERVIEW.

This chapter contains instructions for removing, cleaning, inspecting, repairing, and installing components contained in the cold section module to the extent allowed by the Maintenance Allocation Chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

2-2. CHAPTER INDEX.

Maintenance procedures in this chapter are arranged as follows:

2-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. When removing or installing parts, prevent entry of foreign objects into air and oil passages.

b. Do not use tape to cover oil passages or openings. Tape adhesive can dissolve in oil and can cause contamination.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

c. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

d. Inspect replacement parts for serviceability before installation.

e. Always use a backup wrench on fittings when removing or installing hoses or tubes.

f. When connecting hoses or tubes, use wrench-arc tightening method (para H-14, Appendix H).

g. Before connecting electrical connectors, refer to paragraph H-7, Appendix H for proper procedure.

h. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

i. If cold section module is going to be returned to Depot, prepare cold section module for shipment (para 2-82).

2-4. COMPRESSOR ROTOR ASSEMBLY.

Refer to paragraph 1-172 for borescope inspection procedures for the forward and aft areas of the compressor.

2-5. Blending of Compressor Rotor Blades to Recover Engine Performance (AVIM). This is an effective procedure to significantly restore engine performance by blending compressor rotor blades that have eroded or that have experienced foreign object damage. The extent of engine performance recovery will depend on the results of the maximum power check (para 1-145 **(T700)**, 1-146 **(T701, T701C, T701D AH-64A)** or 1-147 **(T701C, T701D)**) or the results of the performance evaluation test (para 1-238 **(T700)** or 1-241 **(T701, T701C, T701D UH-60L)**) . This procedure is provided for use in situations that warrant extending the useful life of the engine before replacing the cold section module. The unit maintenance officer will decide, in each case, if blending should be done.

a. Removal of Right-Hand Compressor Case.

CAUTION

Do not remove or install a Power Turbine Module with a compressor case half removed. Otherwise, stage 1 blisk, PT shaft seal teeth or carbon seal may be damaged.

NOTE

Before removing right-hand compressor case, engine must be installed in transportation adapter 21C7082G02 (para 1-54).

(1) Remove the following external parts:

- Yellow electrical cable (para 7-42)
- HMU (para 6-40)
- Ignition exciter assembly (para 7-30)
- Anti-icing IGV feed tube (para 10-21)
- Forward seal pressure tube (para 10-33)
- Mid C-sump scavenge tube (para 8-130)
- Electrical control unit (ECU) bracket or digital electronic control (DEC) bracket (para 7-12).

(2) Remove anti-icing feed tube bracket assembly (2, fig. 2-1), ignition exciter bracket assembly (3), and amplifier support bracket (5) as follows:

CAUTION

If any bolt on compressor case forward or aft flanges seizes or becomes difficult to unthread, do not use excessive force to remove it; otherwise, bolt may break.

(a) Try to remove bolts (1) at boltholes 2, 3, 7, and 9 and bolts (4) at boltholes 4 thru 6 on forward flange of right-hand compressor case. If bolts (1, 4) are hard to remove, go to step (b); otherwise, go to step (f). For broken bolt, go to paragraph 2-39, and inspect main frame (for broken bolt) table 2-8.

WARNING

Penetrating Oil

- Do not use near open flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

(b) If any bolts (1, 4) are hard to remove, apply penetrating oil (item 88, Appendix D). Allow oil to soak for 10 minutes.

(c) Using dial torque wrench, try to remove bolt (1) again. Do not exceed 150 inch-pounds.

(d) If bolts (1, 4) still cannot be removed, do the following:

1 Using hammer and a plastic drift, tap on head of seized bolts (1, 4).

2 Using dial torque wrench, tighten bolts (1, 4) until bolts turn. Do not exceed 160 inch-pounds.

WARNING

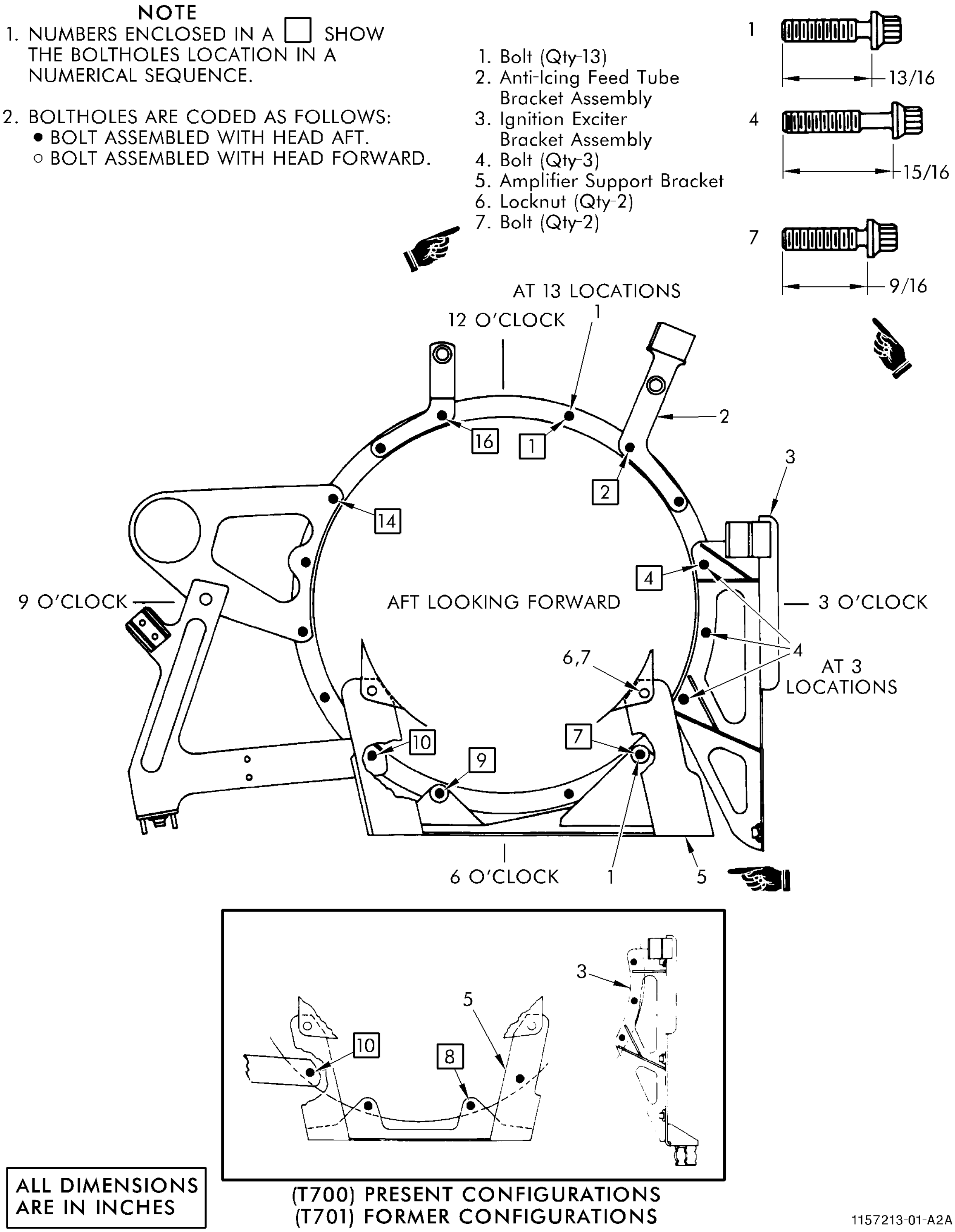
Penetrating Oil

Observe warning in step (b).

3 Apply penetrating oil (item 88, Appendix D), as required. Using torque wrench, alternately loosen and tighten bolts (1, 4) until bolts can be removed.

(e) Repeat steps (c) and (d) for remaining bolts that are hard to remove.

(f) Remove anti-icing feed tube bracket assembly (2) and ignition exciter bracket assembly (3).



NOTE

1. NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLES LOCATION IN A NUMERICAL SEQUENCE.
2. BOLTHOLES ARE CODED AS FOLLOWS:
   - ● BOLT ASSEMBLED WITH HEAD AFT.
   - ○ BOLT ASSEMBLED WITH HEAD FORWARD.

1. Bolt (Qty-13)
2. Anti-Icing Feed Tube Bracket Assembly
3. Ignition Exciter Bracket Assembly
4. Bolt (Qty-3)
5. Amplifier Support Bracket
6. Locknut (Qty-2)
7. Bolt (Qty-2)

ALL DIMENSIONS ARE IN INCHES

(T700) PRESENT CONFIGURATIONS
(T701) FORMER CONFIGURATIONS

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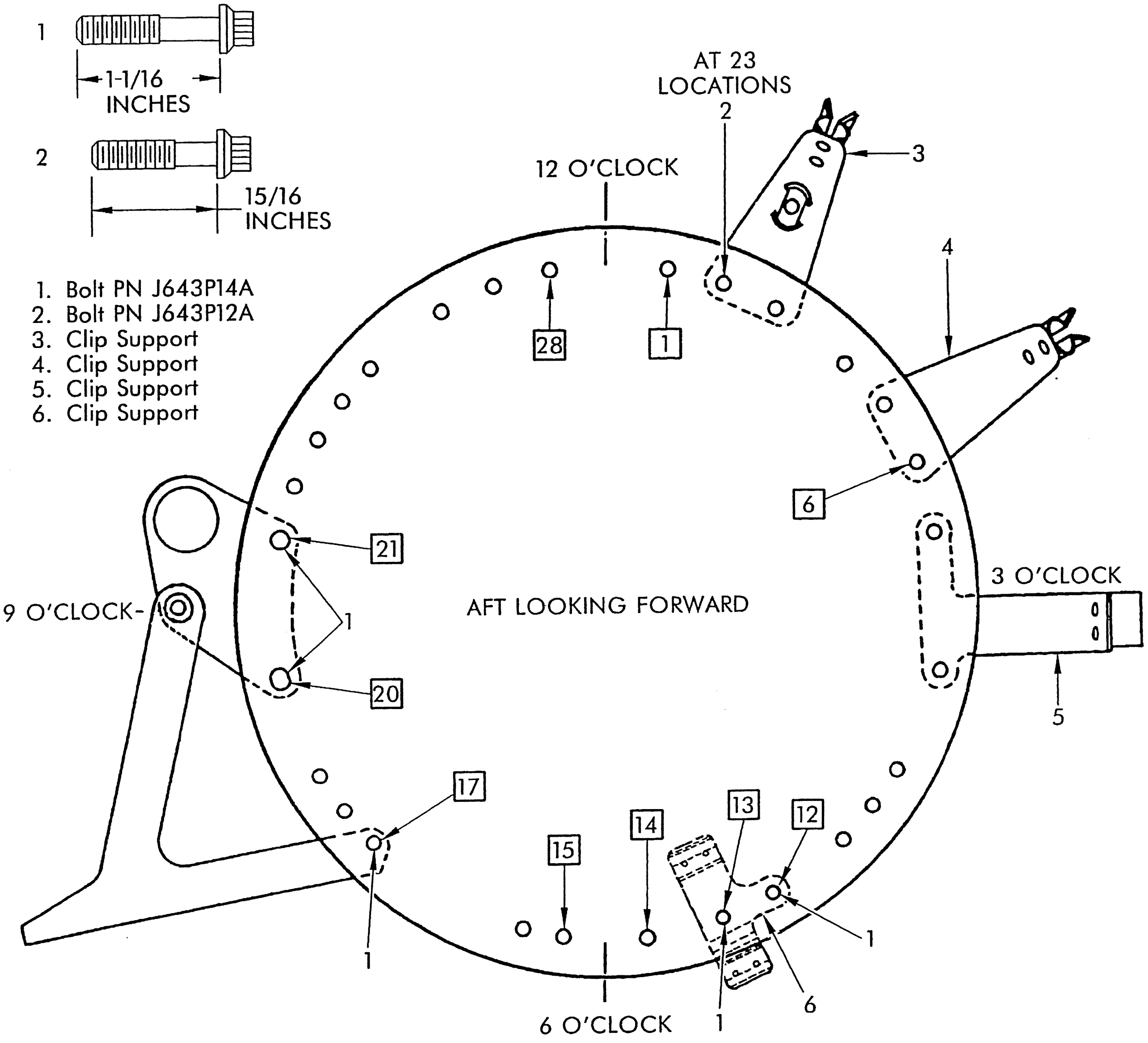
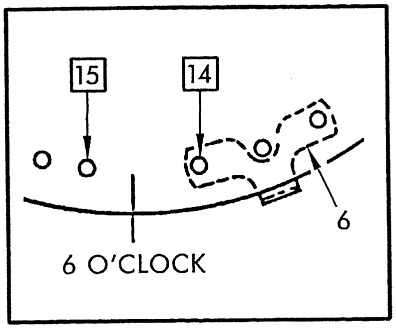
Figure 2-1. Main Frame-to-Compressor Case; Bolting Diagram



1. Bolt PN J643P14A
2. Bolt PN J643P12A
3. Clip Support
4. Clip Support
5. Clip Support
6. Clip Support



(T700) FORMER CONFIGURATION

NOTE

1. NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLE LOCATION IN A NUMERICAL SEQUENCE.
2. BOLTHOLES ARE CODED AS FOLLOWS:
   ○ BOLT INSTALLED WITH HEAD FORWARD.
3. (T700 FORMER CONFIGURATION) USE PN J643P14A BOLTS FOR BOLTHOLES 12, 14, 17, 20, 21 AND PN J643P12A BOLTS FOR ALL OTHERS.
4. USE PN J643P14A BOLTS FOR BOLTHOLES 12, 13, 17, 20, 21 AND PN J643P12A BOLTS FOR ALL OTHERS.

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Figure 2-2. Compressor-to-Diffuser Case Flange; Bolting Diagram

(g) Remove amplifier support bracket (5) as follows:

1 Remove two bolts (1) that secure bracket (5) to forward flange of compressor case at boltholes 7 and 9 as specified in steps (a) through (e).

2 Remove two bolts (7) and two locknuts (6) that secure bracket (5) to rib of compressor case.

3 Remove amplifier support bracket (5).

(3) Remove clip supports (3, 4, 5, 6, fig. 2-2) as follows:

CAUTION

If any bolt on compressor case forward or aft flanges seizes or becomes difficult to unthread, do not use excessive force to remove it; otherwise, bolt may break.

(a) Try to remove bolts (1) at boltholes 1 thru 15 and 28 on rear flange of compressor case. If bolts (1) are hard to remove, go to step (b); otherwise, go to step (f). For broken bolt go to paragraph 2-62, and inspect diffuser case (for broken bolt) table 2-18.

WARNING

Penetrating Oil

- Do not use near open flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

(b) If any bolt (1) is hard to remove, apply penetrating oil (item 88, Appendix D). Allow oil to soak for 10 minutes.

(c) Using dial torque wrench, try to remove bolt (1) again. Do not exceed 150 inch-pounds.

(d) If bolt (1) still cannot be removed, do the following:

1 Using hammer and a plastic drift, tap on head of seized bolt (1).

2 Using dial torque wrench, tighten bolt (1) until it turns. Do not exceed 160 inch-pounds.

WARNING

Penetrating Oil

Observe warning in step (b).

3 Apply penetrating oil (item 88, Appendix D), as required, and using torque wrench, alternately loosen and tighten bolt (1) until it can be removed.

(e) Repeat steps (c) and (d) for remaining bolts that are hard to remove.

(f) Remove clip supports (3, 4, 5, 6).

CAUTION

Antirotation plates, inner sectors, and pin retainers have been line-drilled to the actuating rings and cannot be interchanged with one another or with those on other rings.

(4) Remove pin retainers, antirotation plates, and inner sectors from vane actuating rings as follows:

(a) Remove eight outermost self-locking nuts (1, fig. 2-3, sheet 1) that secure pin retainers (2) to stages 1 and 2 vane actuating rings (6, 7). Remove pin retainers (2).

(b) Using white ink (item 81, Appendix D), mark pin retainers (2) TOP, BOTTOM, and STAGE NO., as applicable, so they will not become intermixed.

(c) Remove 24 pins (8) from 6 and 12 o'clock positions on actuating rings.

(d) Rotate vane actuator levers (9, 10) to gain access to shearbolts (3), inner sectors (4), and antirotation plates (5).

(e) Remove remaining eight self-locking nuts (1).

(f) Remove shearbolts, inner sectors, and antirotation plates.

(g) Using white ink (item 81, Appendix D), mark antirotation plates and inner sectors TOP, BOTTOM,

1. Self-Locking Nuts (Qty-16)
2. Pin Retainers (Qty-4)
3. Shearbolts (Qty-16)
4. Inner Sectors (Qty-4)
5. Antirotation Plates (Qty-4)
6. Stage 1 Actuating Ring
7. Stage 2 Actuating Ring
8. Pins (Qty-24)
9. Stage 1 Vane Actuator Levers
10. Stage 2 Vane Actuator Levers

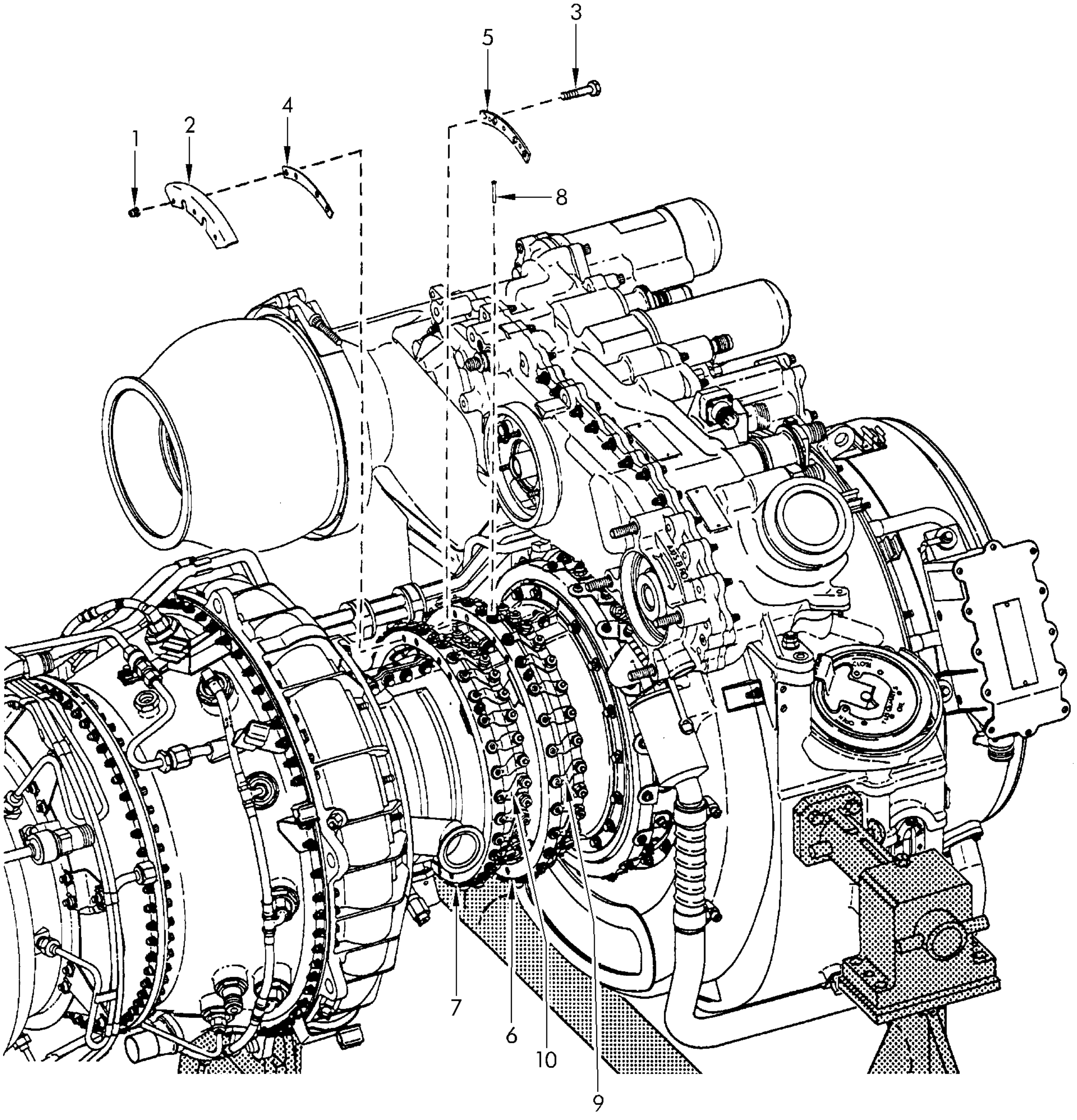

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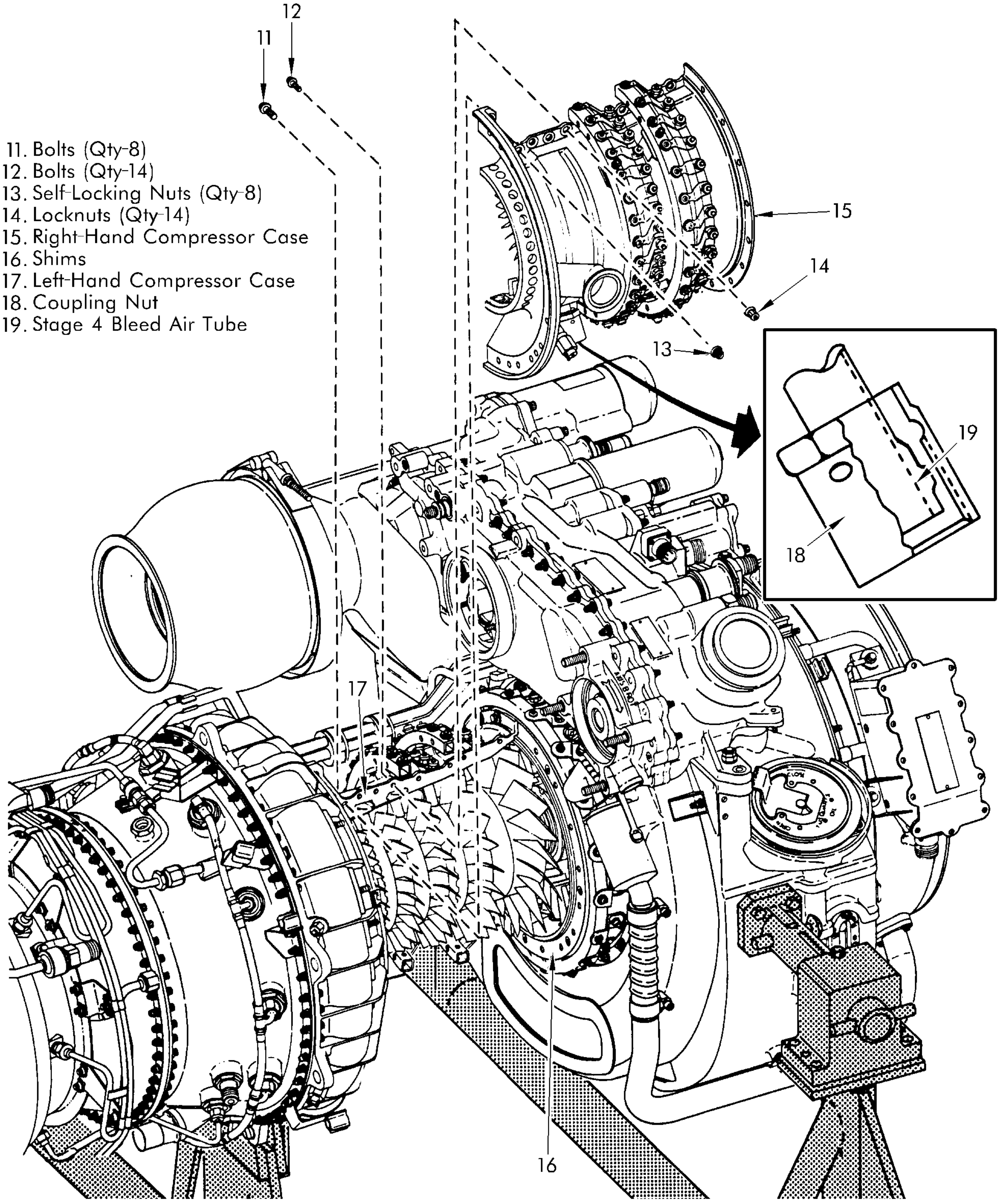
Figure 2-3. Right-Hand Compressor Case; Removal, Inspection, and Installation (Sheet 1 of 2)



11. Bolts (Qty-8)
12. Bolts (Qty-14)
13. Self-Locking Nuts (Qty-8)
14. Locknuts (Qty-14)
15. Right-Hand Compressor Case
16. Shims
17. Left-Hand Compressor Case
18. Coupling Nut
19. Stage 4 Bleed Air Tube

Figure 2-3. Right-Hand Compressor Case; Removal, Inspection, and Installation (Sheet 2 of 2) and STAGE NO., as applicable, so they will not become intermixed.

(5) Position inlet guide vane ring (as required) by moving actuating shaft for access to compressor splitline nuts and bolts.

(6) Remove bolts (11, 12, fig. 2-3, sheet 2), self-locking nuts (13), and locknuts (14), from splitlines of compressor case at 6 o'clock and 12 o'clock positions.

(7) Rotate 24 vane actuator levers back to their positions on actuating rings; and reinstall 24 pins removed in step (4)(c).

(8) Reposition inlet guide vane ring (as required) by moving actuating shaft to allow clearance for compressor case half removal.

CAUTION

Do not move transportation adapter once right-hand compressor case is removed; otherwise, engine may be damaged.

(9) While second mechanic applies slight pressure from right-to-left on aft edge of exhaust frame, remove right-hand compressor case (15) from engine.

(10) To hold shims (16) in place, install bolts (1, 4, fig. 2-1) into holes in main frame.

(11) If transportation adapter must be moved, install dummy compressor casing bar support 21C7112G01 between the diffuser and midframe casing assembly and the particle separator main frame assembly. Install bolts through ends of bar to secure bar to flanges. Snug the bolts.

b. Inspection of Compressor Rotor and Compressor Rotor Blades. See table 2-1.

Table 2-1. Inspection of Compressor Rotor and Compressor Rotor Blades

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
NOTE Blended blades and vanes are common in engines returned to service from overhaul.			
a. Stage 1 blades for:			
(1) Dents and bends.	Smooth minor deformation allowed.	Any number that can be blended to within limits of figure 2-4.	Blend blades (para 2-5, step e) or replace cold section module.
(2) Cracks.	None allowed.	Not repairable.	Replace cold section module.
(3) Erosion and associated tears and nicks.	Any amount, unless there is an unacceptable loss in engine performance.	Any amount if engine passes the maximum power check (para 1-145 **(T700)**, 1-146 **(T701, T701C, T701D AH-64A)**, or 1-147 **(T701C, T701D UH-60L)**) or the performance evaluation test (para 1-238 **(T700)**, 1-241 **(T701, T701C, T701D)**) or after blending.	Blend blades (para 2-5, step e) or replace cold section module.

Table 2-1. Inspection of Compressor Rotor and Compressor Rotor Blades (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Tears and nicks not associated with erosion.	None allowed on inner 25% of airfoil leading edge (area A, (fig. 1-98)). Any number, 1/32-inch deep, over the middle 25% of airfoil leading edge (area B). Any number, 1/8-inch deep, on outer 50% of airfoil leading edge (area C).	Any amount that can be blended to within limits of figure 2-4.	Blend blades (para 2-5, step e) or replace cold section module.
(5) Damaged tip corners.	Not allowed.	(a) Any amount that can be blended to within limits of figure 2-4.	(a) Blend tip corners (para 2-5, step e) or replace cold section module.
		(b) Any amount that can be chamfered within limits of figure 2-16.	(b) Chamfer tip corners (para 2-7) or replace cold section module.
(6) Curled leading edges resulting from FOD.	Not allowed.	(a) Four damaged blades and the four blades that are directly 180° opposite, whether or not they are damaged. A total of eight blades may be repaired.	(a) Repair leading edge of stage 1 blade (para 2-6) or replace cold section module.
		(b) Any amount that can be chamfered within limits of figure 2-16.	(b) Repair leading edge of stage 1 blade (para 2-7) or replace cold section module.
b. Stages 2 thru 5 blades for:			
(1) Cracks.	None allowed.	Not repairable.	Replace cold section module.
(2) Critical areas of blades for nicks, dents, pits, and scratches.	Any number 0.005 inch maximum depth.	Not repairable.	Replace cold section module.
(3) Noncritical areas of blades for:			
(a) Nicks, pits, and scratches in leading and trailing edges.	Any number, up to 0.010 inch deep, without high metal.	Any number that can be blended to within limits of figure 2-4.	Blend blades (para 2-5, step e) or replace cold section module.

Table 2-1. Inspection of Compressor Rotor and Compressor Rotor Blades (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) Nicks, pits, and scratches in other noncritical areas.	Any number up to 0.010 inch deep.	Not repairable.	Replace cold section module.
(c) Dents and bends in leading and trailing edge.	Any number up to 0.015 inch deep.	Any number that can be blended to within limits of figure 2-4.	Blend blades (para 2-5, step e) or replace cold section module.
(d) Dents and bends in other noncritical areas.	Any number up to 0.015 inch deep.	Not repairable.	Replace cold section module.
(e) Damaged tip corners.	Not allowed.	(a) Any amount that can be blended to within limits of figure 2-4.	(a) Blend tip corners (para 2-5, step e) or replace cold section module.
		(b) Any amount that can be chamfered within limits of figure 2-16.	(b) Chamfer tip corners (para 2-7) or replace cold section module.
(f) Erosion and associated tears and nicks.	Any amount, unless there is an unacceptable loss in engine performance.	Any amount if engine passes the maximum power check (para 1-145 **(T700)**, para 1-146 **(T701, T701C, T701D AH-64A)** or para 1-147 **(T701C, T701D UH-60L)**) or the performance evaluation test (para 1-238 **(T700)** or 1-241 **(T701, T701C, T701D)**) after blending.	Blend blades (para 2-5, step e) or replace cold section module.
c. Compressor rotor flowpath coating for:			
(1) Rub marks and grooves.	Any amount, provided performance is acceptable, and grooves or wear do not penetrate into parent metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Delamination, flaking, or loose material.	Any amount, provided engine performance is acceptable.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

Table 2-1. Inspection of Compressor Rotor and Compressor Rotor Blades (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Reddish, greenish, or whitish material.	Any amount, provided engine performance is acceptable and the compressor has been cleaned (para 1-157).	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

NOTE

When removing coating material from blade tips, be careful not to round out or damage the edges of blade tips.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. Blades for coating material.	Any amount, provided engine performance is acceptable.	Same as usable limit, provided engine performance can be restored to acceptable limits.	AVUM: Replace engine. AVIM: Replace cold section module.

c. When inspecting rotor assembly, damage to compressor rotor blades that requires blending, polishing, or clipping are grouped in the following categories:

Erosion	Characterized as rough leading edges on blades as would be the case following sand ingestion. This type of damage is worse at stage 1 with a significant decrease in severity in the stages farther aft.
Ice FOD	Confined to the stage 1 blades, this type of damage is evident by large leading edge curls and is commonly repaired by blade clipping.
Minor FOD	This type of damage can be associated with small stone or gravel ingestion or may be the result of blade fragments separated from blade rows upstream. Results are usually small nicks, tears or dents in either the leading or trailing edges of the blades.
Handling damage	Usually seen as small to moderate, smooth tip corner curls. This type of damage is often the result of dropped or impacted hardware.

d. Evaluation of Chord Length Requirements.

(1) To determine if sufficient blade material will remain after blending, use compressor rotor blade-disk leading edge gage set 21C7784P01 for **T700** engines or 21C7785P01 for **T701/T701C/T701D** engines to check damage due to erosion or foreign object damage. If gages are not available, use dimensional limits shown in figure 2-4. See figure 2-5, views A and B for leading edge contour. Use gage sets as follows:

NOTE

Use leading edge gage when no trailing edge irregularities exist. Use leading edge/trailing edge gage when leading edge and/or trailing edge irregularities exist.

(a) Select correct gage, depending on which blade-disk is being examined and whether leading edge or leading edge/trailing edge damage is present.

(b) Position gage on the convex side of the blade.

(c) When using the leading edge gages, position gage over trailing edge and tip of blade. The blade area between the leading edge of blade and leading edge of gage is the allowable blade removal area. If gage covers any damaged areas, blade cannot be blended.

(d) When using the leading edge/trailing edge gages, position gage over blade tip. Proceed as follows:

1 If no leading edge damage is present, position leading edge of gage even with leading edge of

blade. The blade area between the trailing edge of blade and trailing edge of gage is the allowable blade removal area. If gage covers any damaged areas, blade cannot be blended.

2 If leading edge and trailing edge damage is present, position gage between damaged areas. The blade areas between the edges of blade and edges of gage are the allowable blade removal areas. If gage covers any damaged areas, blade cannot be blended.

(e) Visually inspect blade to determine if nicks and/or irregularities reduce chordal length of blade to unacceptable limits by extending into area covered by gage.

(2) If gages or dimensional measurements indicate that minimum chord length of damaged blades will be acceptable after blending, go to step e.

(3) If it is obvious that chord length of any blade will be out of limits, the blending procedure cannot be used.

(a) For stage 1 blades, see paragraph 2-6 to determine if blades can be repaired. If blades cannot be repaired, replace cold section module.

(b) For stage 2 thru stage 5 blades, replace cold section module.

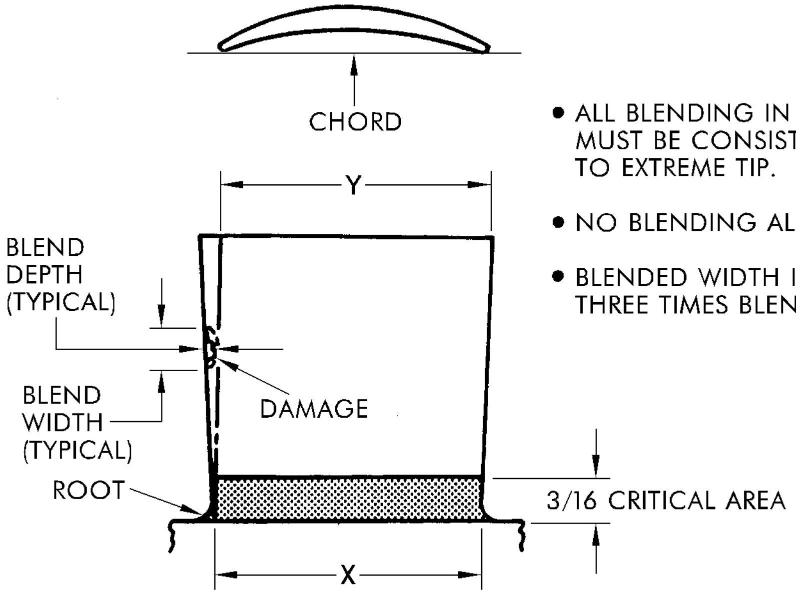
(4) If sufficient chord length will remain after blending, proceed to step e.

e. Blending of Compressor Rotor Blades.

(1) Using tape (item 107, Appendix D), cover shims and exposed curvic couplings between blade-disks.

(2) Grind smooth three cutting surfaces of a four-inch flat file (fig. 2-6). Round off all edges.

(3) Position blade to be blended at 5 o'clock position. File the leading edge (3, fig. 2-5, view A) tangent to the convex surface (2). Remove any leading edge rollover or other defects. Use machinist scribe or similar tool to determine when the rollover or other defect has been removed.

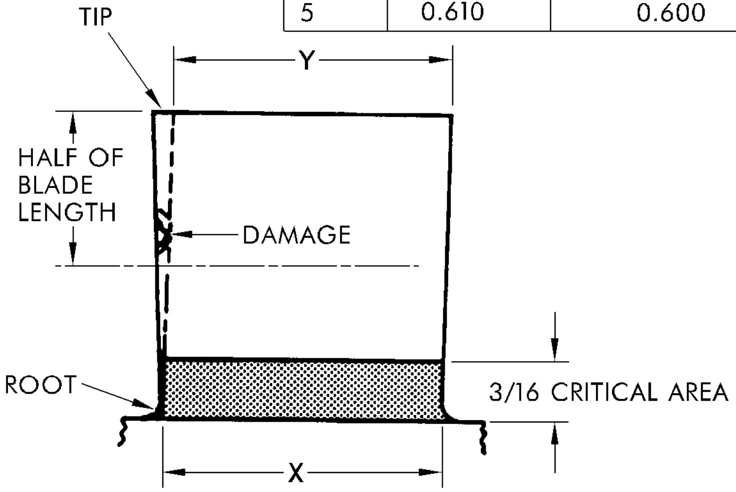


NOTE

- ALL BLENDING IN TOP HALF OF STAGE 4 BLADES MUST BE CONSISTENT FROM DAMAGED AREA TO EXTREME TIP.
- NO BLENDING ALLOWED IN CRITICAL AREAS.
- BLENDED WIDTH IN ROOT HALF SHALL BE AT LEAST THREE TIMES BLENDED DEPTH.

STAGES 1, 2, 3, AND 5 BLADES WITH LEADING EDGE DAMAGE

	DIM X MINIMUM ROOT CHORD ☛		DIM Y MINIMUM TIP CHORD ☛	
STAGE	T700 21C7784P01	T701/T701C/T701D 21C7785P01	T700 21C7784P01	T701/T701C/T701D 21C7785P01
1	1.360	1.350	1.510	1.430
2	1.090	1.080	1.140	1.060
3	0.810	0.790	0.840	0.780
4	0.750	0.740	0.780	0.730
5	0.610	0.600	0.640	0.600

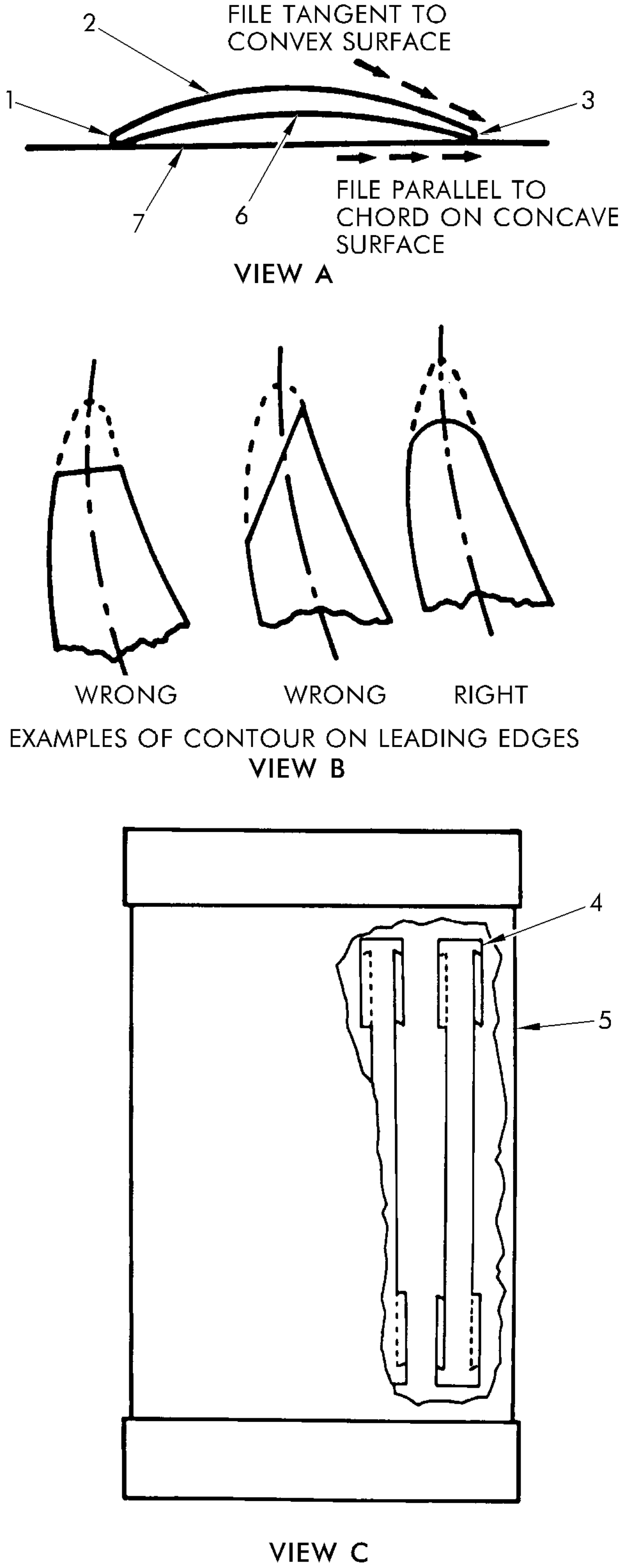


STAGE 4 BLADES WITH LEADING EDGE DAMAGE

ALL DIMENSIONS ARE IN INCHES

1157223-03

Figure 2-4. Compressor Rotor Blades; Usable Limits after Blending



1. Trailing Edge
2. Convex Surface
3. Leading Edge
4. Medium Grade Stone
5. Blade-Disk Leading Edge Dresser Set
6. Concave Surface
7. Chord

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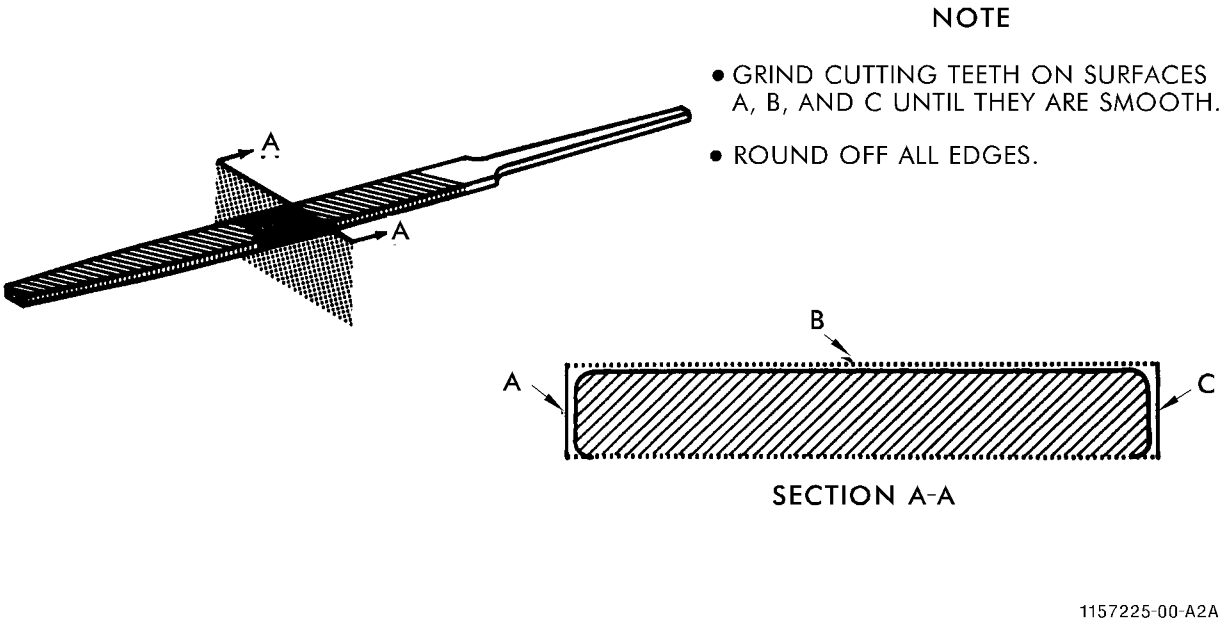
Figure 2-5. Compressor Rotor Blades; Contour



NOTE

- GRIND CUTTING TEETH ON SURFACES A, B, AND C UNTIL THEY ARE SMOOTH.
- ROUND OFF ALL EDGES.

Figure 2-6. Four-Inch Flat File; Reworking of

(4) Repeat steps (1) and (3) for each blade until convex surface of all blades have been filed.

(5) To blend concave surface of blade, position blade at 3 o'clock position; replace any tape (item 107, Appendix D) that has been removed.

CAUTION

Do not allow the file or stone to contact the front frame or trailing edges of the inlet guide vanes.

(6) Using a small, fine file or abrasive stone (item 104, Appendix D), blend the leading edge parallel to the concave surface (fig. 2-5, view A) to remove any surface roughness.

(7) Repeat steps (5) and (6) for each blade until concave surface of all blades have been filed or stoned.

NOTE

- There are two methods for restoring the leading edge contour of stage 1 compressor rotor blades. The preferred method (step (9)) is to use the stage 1 blade-disk leading edge dresser set 21C7478G01. The alternate method (step (10)) is to use abrasive cloth.
- The method (step (10)) for restoring the leading edge contour of stages 2 thru 5 compressor rotor blades is to use abrasive cloth.

(8) If stage 1 blade-disk leading edge dresser set 21C7478G01 is available, go to step (9); otherwise, go to step (10).

(9) Using dresser set (5), restore leading edge contour of stage 1 blades as follows:

(a) Using medium grade stone (4), round leading edge (3) of blade using a "back and forth" motion.

(b) Round leading edge until a uniform radius is obtained (view B).

(10) Restore leading edge contour of stages 1 thru 5 blades, using abrasive cloth (item 53, Appendix D) as follows:

(a) Cut abrasive cloth into narrow strips.

(b) Using cloth strips, round leading edge (3), using a "shoe-shining" motion (view B).

(11) Repeat step (5) and step (9) or (10) for each blade until all blades are properly contoured (fig. 2-5, view B).

(12) Hold a piece of crocus cloth (item 55, Appendix D) against the blade surface. Using a thin piece of wood, such as a tongue depressor, apply light pressure to the cloth and polish the concave and convex surfaces of the blade. With a piece of crocus cloth that has been cut in a narrow strip, polish the leading edge of the blade. Polish all blade surfaces until the finish is as close as practical to the original finish of the part.

(13) Repeat steps (1) and (12) for each blade, until all blades have been polished.

(14) Using a machinery towel or paper towel (item 112 or 113, Appendix D), clean the compressor rotor and case. Remove all tape.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(15) Using dry, filtered, compressed air, remove debris from internal and external areas of engine.

(16) Check blended blades as follows:

(a) If blades have been blended to repair tears or nicks not associated with erosion, check chord length (fig. 2-4). If out-of-limits, replace cold section module. If within limits, reinstall right-hand compressor case (para 2-5, step e).

(b) If blades have been blended to repair erosion, do not check chord length. Reinstall right-hand compressor case (para 2-5, step e). Do a maximum power check (para 1-145 **(T700)**, para 1-146 **(T701, T701C, T701D AH-64A)** or para 1-147 **(T701C, T701D UH-60L)**) or do a performance evaluation test (para 1-238 **(T700)** or 1-241 **(T701, T701C, T701D)**) to determine engine serviceability.

f. Installation of Right-Hand Compressor Case.

CAUTION

Do not remove or install a Power Turbine Module with a compressor case half removed. Otherwise, stage 1 blisk, PT shaft seal teeth or carbon seal may be damaged.

(1) Remove dummy compressor casing bar support 21C7112G01, if it was installed.

(2) Install seal strips as follows:

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

(a) Clean seal strip grooves (fig. 2-7) on flanges of both case halves, using a paper towel (item 113, Appendix D) soaked with isopropyl alcohol (item 3, Appendix D).

(b) If necessary, trim length of seal strips so that there is a 0.040-0.080 inch gap at both ends of seal when it is installed in groove.

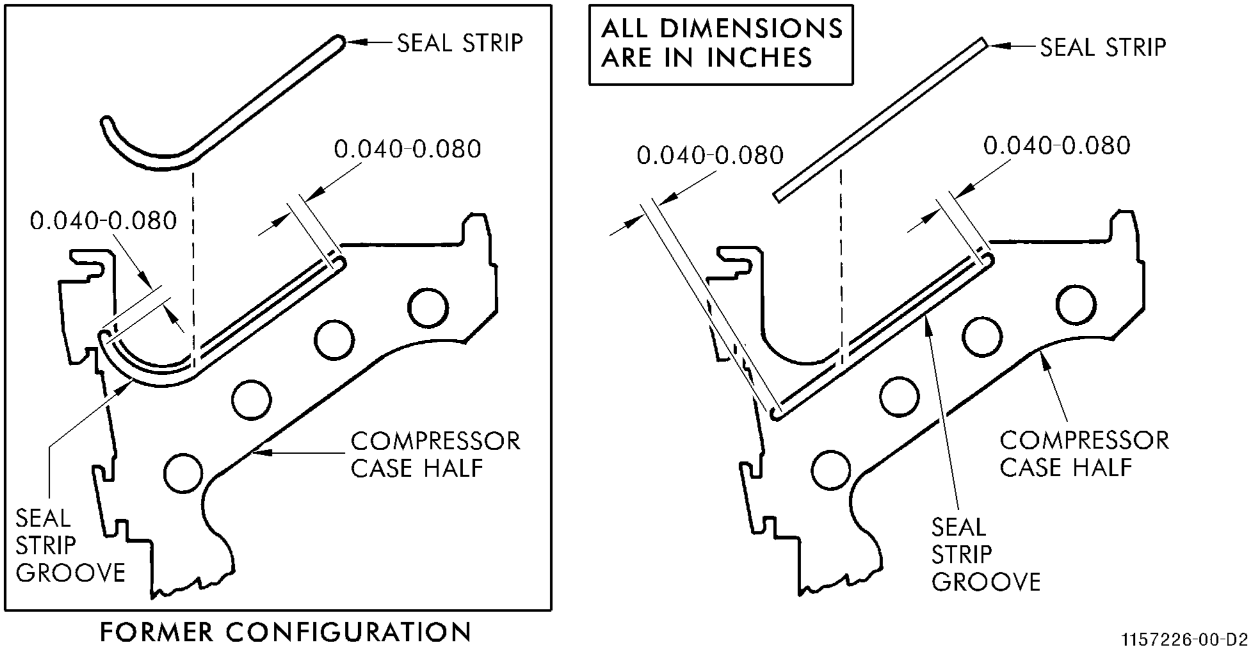


Figure 2-7. Seal Strip Groove in Compressor Case Splitline Flange

WARNING

RTV-162 Silicone Rubber
Adhesive/Sealant
MIL-A-46146A

- Wear approved gloves and goggles/face shield.
- Vapors released during curing are combustible. Do not use near open flames, near welding areas, or on hot surfaces.
- Do not breathe vapors. Use in a well-ventilated area.
- Repeated inhalation of vapor can cause mild respiratory irritation.
- If any vapor contacts eyes, immediately flush affected area thoroughly with water for at least 15 minutes and get medical attention if irritation persists.
- Do not ingest. May be harmful if swallowed.
- In case of ingestion, do not induce vomiting. Slowly dilute using 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
- In case of skin contact, remove material completely with dry cloth or paper towel before washing with detergent and water. After contact, hands and skin should be washed before eating, drinking, or smoking. Skin irritation is not expected, but may occur in certain sensitive individuals.

WARNING

RTV-3145 Adhesive/Sealant
Potting Compound

- In case of skin contact, flush contacted area with water. After contact, hands and skin should be washed before eating, drinking, or smoking.
- Eye protection should be worn when working with this material. If liquid contacts eyes, flush eyes thoroughly with water for 15 minutes.
- If prolonged contact with vapor is likely, wear approved respirator.

CAUTION

- Do not allow any RTV sealant to come in contact with any other hardware, particularly at the sensor located at the ten o'clock position.
- Do not exceed 0.250 inch maximum thickness of sealant, as it may not cure properly.

NOTE

Use of RTV-3145 (gray) is optional.

(c) Apply a thin coat of RTV-162 or RTV-3145 (gray) sealant (item 96 or item 97, Appendix D) to grooves and install seal strips. Remove excess sealant with a paper towel (item 113, Appendix D) soaked with isopropyl alcohol (item 3, Appendix D).

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(3) Remove bolts used to hold shims (16, fig. 2-3, sheet 2) in place. Lubricate shims and compressor flanges with lubricating oil (item 85 or 87, Appendix D).

CAUTION

If shims are damaged during installation of compressor case, engine must be sent to Depot.

(4) Be sure shims, located between forward flange of compressor case and main frame, remain in place during positioning of the right-hand compressor case.

(5) Be sure to check compressor section for FOD before installing right-hand compressor case.

(6) Be sure antirotation keys are installed in key slots on case halves.

(7) While second mechanic applies slight pressure from right-to-left on aft edge of exhaust frame, position right-hand compressor case (15) onto engine. Seat 12 o'clock splitline of compressor case first; rotate case down while checking to be sure that shims between forward flange of compressor case and aft flange of main frame remain in place.

(8) Remove 24 pins (8, fig. 2-3, sheet 1), and rotate 24 vane actuator levers (9, 10) to ease installation of bolts (11, 12, fig. 2-3, sheet 2) on flange of compressor splitline.

(9) Position inlet guide vane ring, as required, by moving actuating shaft for access to compressor splitline bolts and nuts.

NOTE

To torque shoulder bolt no. 9 at the 6 o'clock position, it must be installed from the right side, aft looking forward.

(10) Secure flanges of compressor case splitline with the following hardware:

- 14 shoulder bolts (4, fig. 2-8)
- 14 locknuts (1)
- 8 shoulder bolts (3)
- 8 self-locking nuts (2)

(11) Torque bolts (3, 4) as directed in figure 2-8.

(12) Install antirotation plates (5, fig. 2-3, sheet 1), inner sectors (4), and pin retainers (2) on stage 1 actuating ring (6) as follows:

(a) Be sure antirotation plates (5), inner sectors (4), and pin retainers (2) are installed at positions for which they were marked.

(b) Position antirotation plates (5) over bushings on forward side of stage 1 actuating ring (6) at 12 o'clock position.

(c) Position inner sector (4) over bushings on aft side of actuating ring (6).

(d) Install two shearbolts (3) through two innermost holes, so that heads fit into hex recesses in antirotation plate (5).

CAUTION

Do not overtorque self-locking nuts (1). Otherwise, actuating ring will be damaged.

(e) Install two nuts (1) onto shearbolts (3). Torque nuts (1) to 16-19 inch-pounds.

(f) Install two shearbolts (3) through two outermost holes, so that heads fit into hex recesses in antirotation plate (5).

(g) Position actuator levers (9 or 10) over bushings on actuating rings and install pins (8).

(h) Slide pin retainers (2) over ends of outermost bolts and install self-locking nuts (1). Torque nuts to 16-19 inch-pounds.

(i) Repeat steps (b) thru (h) at 6 o'clock position.

(13) Refer to step (12) and install antirotation plates, inner sectors, and pin retainers on stage 2 actuating ring (7).

(14) Be sure that actuating rings are free to move.

(15) Secure forward flange of right-hand compressor case as follows:

(a) Install two bolts (1, fig. 2-1) and anti-icing feed tube bracket assembly (2) in boltholes 2 and 3.

(b) Install three bolts (4) and ignition exciter bracket assembly (3) in boltholes 4, 5, and 6.

(c) Install two bolts (1) and amplifier support bracket (5) in boltholes 7 and 9. Install two bolts (7) and two locknuts (6) to secure bracket (5) to compressor case rib.

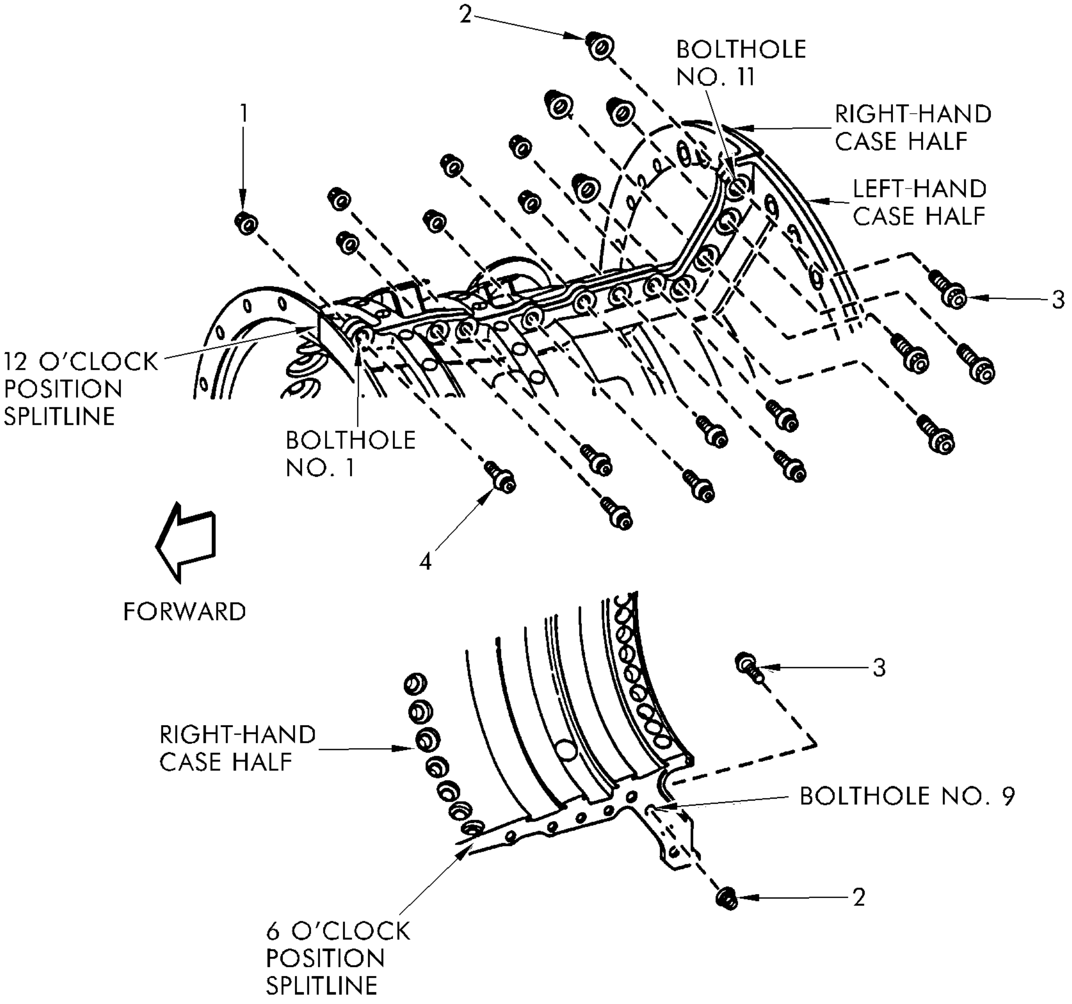
(d) Install remaining bolts (1) in remaining boltholes.

(e) Torque all bolts to 45-50 inch-pounds.

CAUTION

Do not overtorque compressor case aft flange bolts. Bolts overtorqued may seize at next disassembly.

(16) Secure aft flange of right-hand compressor case as follows:



VIEW A

CROSS-TORQUE NUTS ALTERNATELY ON BOTH FLANGES TO VALUES GIVEN AND IN SEQUENCE SHOWN. FOR EXAMPLE: TOP SIDE NUT 1; BOTTOM SIDE NUT 1; TOP SIDE NUT 7; BOTTOM SIDE NUT 7; TOP SIDE NUT 11; BOTTOM SIDE NUT 11; ETC.

BOLT TORQUING SEQUENCE BY BOLTHOLE NUMBER										
BOLTHOLE NUMBER	1	7	11	2	3	4	5	6	8	9	10
TORQUE (INCH-POUNDS)	70-75	70-75	145-150	70-75	70-75	70-75	70-75	70-75	145-150	145-150	145-150

1. Locknut (Qty-14)
2. Self-Locking Nut (Qty-8)
3. Shoulder Bolt (Qty-8)
4. Shoulder Bolt (Qty-14)

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Figure 2-8. Compressor Case Splitline Flange; Bolting and Torquing Sequence

(a) **(T700)** For engines with former configuration clip support (5, fig. 2-2), install eight bolts (1) in boltholes 1, 4, 9, 10, 11, 13, 15, and 28.

(b) For engines with present configuration clip support (5, fig. 2-2), install eight bolts (1) in boltholes 1, 4, 9, 10, 11, 14, 15, and 28.

(c) Install two bolts (1) and clip support (2) in boltholes 2 and 3.

(d) Install two bolts (1) and clip support (3) in boltholes 5 and 6.

(e) Install two bolts (1) and clip support (4) in boltholes 7 and 8.

(f) **(T700)** For engines with former configuration clip support (5), install two bolts (1) and clip support (5) in boltholes 12 and 14.

(g) For engines with present configuration clip support (5), install two bolts (1) and clip support (5) in boltholes 12 and 13.

(h) Install two bolts (1) and clip support (5) in boltholes 12 and 14.

(i) Cross-torque all bolts to 45-50 inch-pounds.

(17) If not already installed, install power turbine module (para 4-11).

(18) Install the following external parts:

- Electrical control unit or digital electronic control (para 7-16)
- Mid C-sump scavenge tube (para 8-134)
- Forward seal pressure tube (para 10-37)
- Anti-icing IGV feed tube (para 10-24)
- Ignition exciter assembly (para 7-34)
- HMU (para 6-44)
- Yellow electrical cable (para 7-45)

(19) Make required engine checks listed in table 1-39.

2-6. Repair of Compressor Rotor Stage 1 Blades to Recover Engine Performance (AVIM). This is an effective procedure to significantly restore engine performance by repairing stage 1 blades damaged by foreign objects. Use this blade clipping procedure only if blade damage could not be repaired by blending (para 2-5) or chamfering (para 2-7). The extent of engine performance recovery will depend on the results of the maximum power check (para 1-145 **(T700)**, 1-146 **(T701, T701C, T701D AH-64A)** or 1-147 **(T701C, T701D, UH-60L)**) or the results of the performance evaluation test (para 1-238 **(T700)** or 1-241 **(T701, T701C, T701D)**). This procedure will extend use of the cold section module. This procedure will be used to repair four damaged stage 1 compressor rotor blades and the four stage 1 compressor rotor blades directly 180° opposite, whether or not damaged. Therefore, a total of eight blades may be repaired.

NOTE

This repair procedure produces a higher pitched noise than is present on an undamaged compressor. This higher pitch noise has been determined to have no harmful effects to personnel or material and should not be cause for removal of engine from an aircraft.

a. Remove right-hand compressor case-half (para 2-5, step a).

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

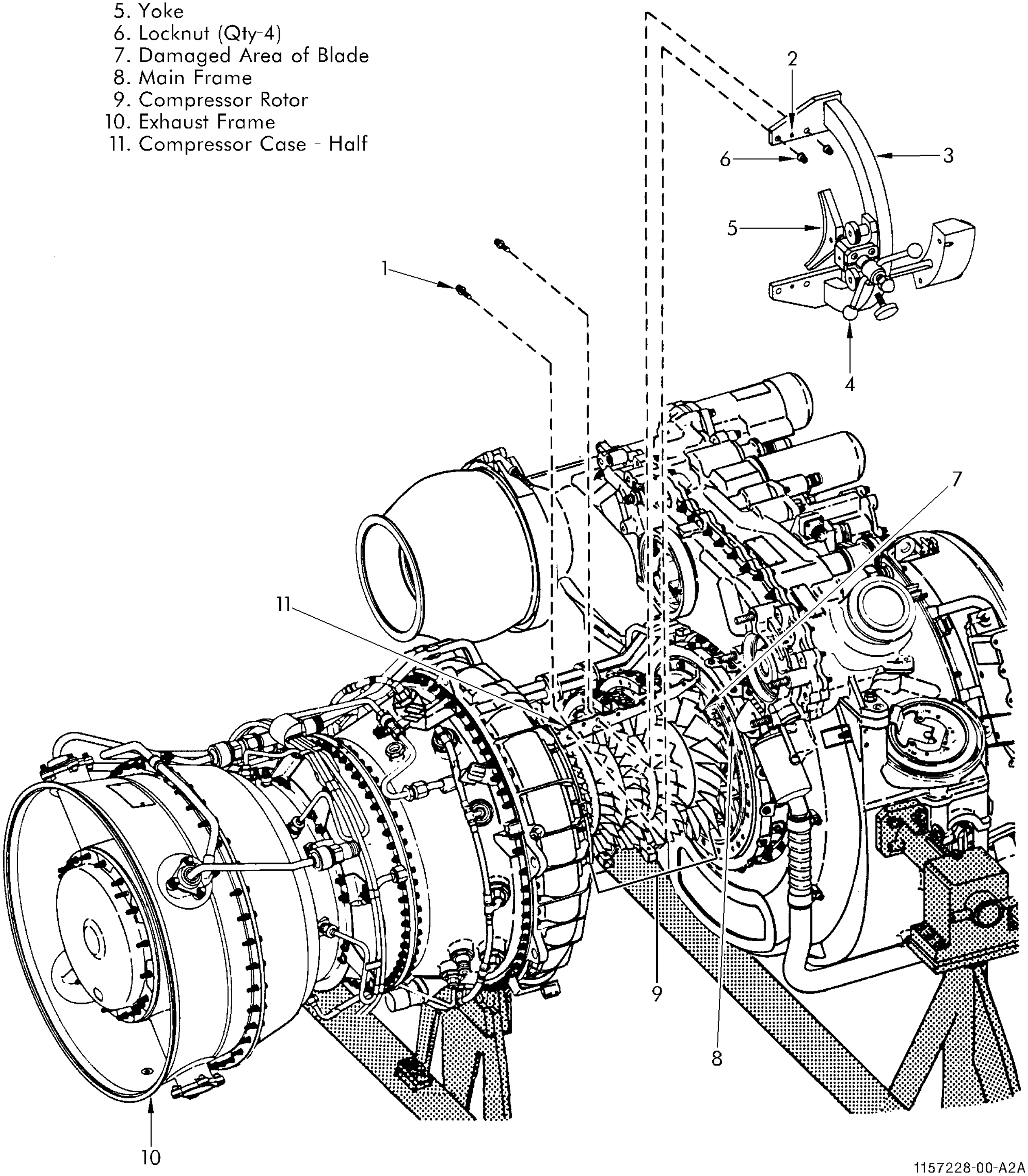
CAUTION

Do not force compressor rotor to rotate. Forcing rotor to rotate may cause additional damage to blades.

b. Rotate compressor rotor (9, fig. 2-9) by hand, and inspect all stage 1 blades (table 2-1), for foreign object damage. If rotor does not rotate freely, have a second mechanic lift up on lower section of exhaust frame (10). If lifting force is necessary to allow rotor to rotate, it must be used every time the rotor is rotated.

c. Replace cold section module if inspection (step b) show either of the following:

- Foreign object damage to any number of blades in stage 2, 3, 4, or 5 that cannot be chamfered within limits in paragraph 2-7.
- Foreign object damage to more than four diagonally opposite pairs of stage 1 compressor rotor blades (eight total).



1. Bolt (Qty-4)
2. Dowel Pin (Qty-2)
3. Bridge
4. Clamping Handle
5. Yoke
6. Locknut (Qty-4)
7. Damaged Area of Blade
8. Main Frame
9. Compressor Rotor
10. Exhaust Frame
11. Compressor Case - Half

1157228-00-A2A

Figure 2-9. Bridge 17A8744P04; Installation

d. Inspect damaged stage 1 blade (fig. 2-10) to determine if damaged area can be repaired to usable limits. Determine if half clip will remove damaged portion of blade or if full clip is required.

e. Cut off damaged area of blade (7, fig. 2-9) as follows:

(1) Install template 21C7419P14/P15 or 21C7419P18/P19 over marked blade as shown in figure 2-11.

(2) Using a felt-tip marker (item 83, Appendix D) or similar marking device, trace the leading edge of the template on marked blade. Remove template.

NOTE

Use of tape will prevent damaged area of blade from entering engine when damaged area is cut off.

(3) Attach a piece of tape (item 107, Appendix D), from damaged area of blade (7, fig. 2-9) to the main frame (8).

CAUTION

- Do not use sheetmetal cutting shears that have red or yellow identification handles; otherwise, additional blade damage may result.
- To avoid removing too much blade material, position shears slightly forward of marked line.

(4) Using sheetmetal cutting shears (6, fig. 2-12) with green identification handles (5), position lower cutting blade (4) and upper cutting blade (2) between the damaged area of blade (3). Be sure that shears are positioned slightly forward of marked line.

WARNING

Clipping Stage 1 Blades

Clippings from clipped blade can cause injury to eyes or face. When clipping blade, wear approved gloves and face shield.

CAUTION

Do not apply excessive side force while cutting blade; otherwise, blade edge may be bent or curled.

(5) Cut off damaged area of blade, slightly forward of marked line.

(6) Remove tape, with damaged area attached, from main frame.

NOTE

Compressor rotor lock 21C7422G01 (1, fig. 2-13) does not come with blade clipping kit 21C7419G01/G02.

f. Install compressor rotor lock 21C7422G01 (1, fig. 2-13) onto bridge 17A8744P04 (4) as follows:

(1) Aline hole in rotor lock (1) with dowel pin (11) on bridge (4).

(2) Secure rotor lock by threading two knobs (2) into bridge. Tighten knobs handtight.

(3) Turn clamping handle (3) fully clockwise.

g. Install holding adapter 17A8744P03 (6) into bridge (4) as follows:

(1) Aline rod (5) with hole in bridge.

(2) Install holding adapter (6) into bridge and slide it as close to bridge (4) as possible. Be sure that flat area of rod is facing hex head screw (10).

(3) Secure adapter by tightening hex head screw (10) handtight.

h. Install bridge (3, fig. 2-9) onto compressor case-half (11) as follows:

(1) Locate bolthole no. six on top and bottom flanges of compressor case-half, by counting boltholes from forward to aft. Aline two dowel pins (2) with bolthole no. six on top and bottom flanges of compressor case. Rotate compressor VG actuating shaft until dowel pins can be installed in boltholes.

(2) Secure bridge (3) to compressor case, using four bolts (1) and four locknuts (6). Torque locknuts to 70-75 inch-pounds.

NOTE

The following step requires 2 people.

i. Install filing fixture 17A8744P05 (8, fig. 2-13) so that damaged area of blade is straddled by filing guide (9). Loosen hex head screw (10). Slide holding adapter (6) forward, against filing fixture (8), until four pins (7) are compressed. With pins compressed, have a second mechanic tighten hex head screw handtight.

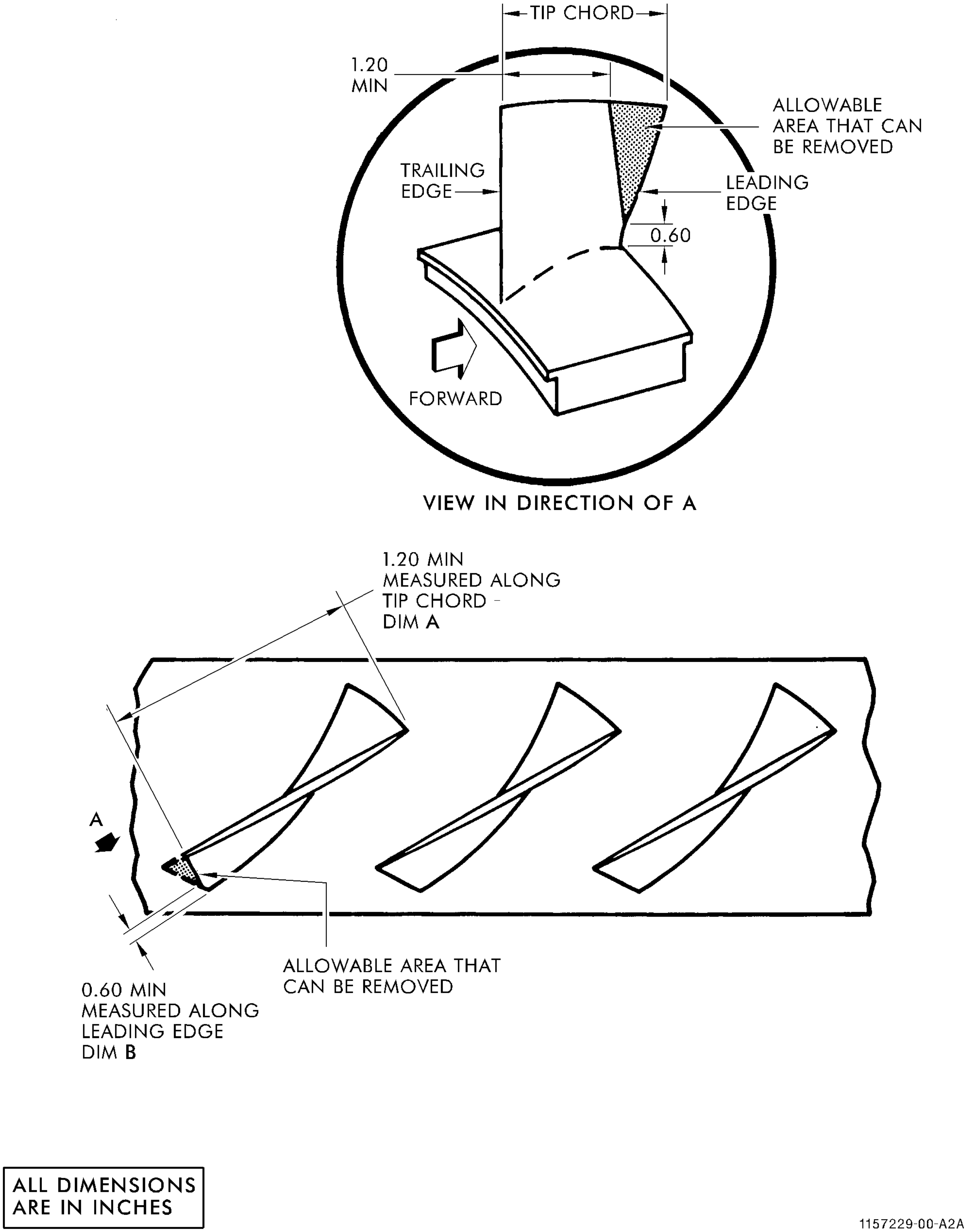
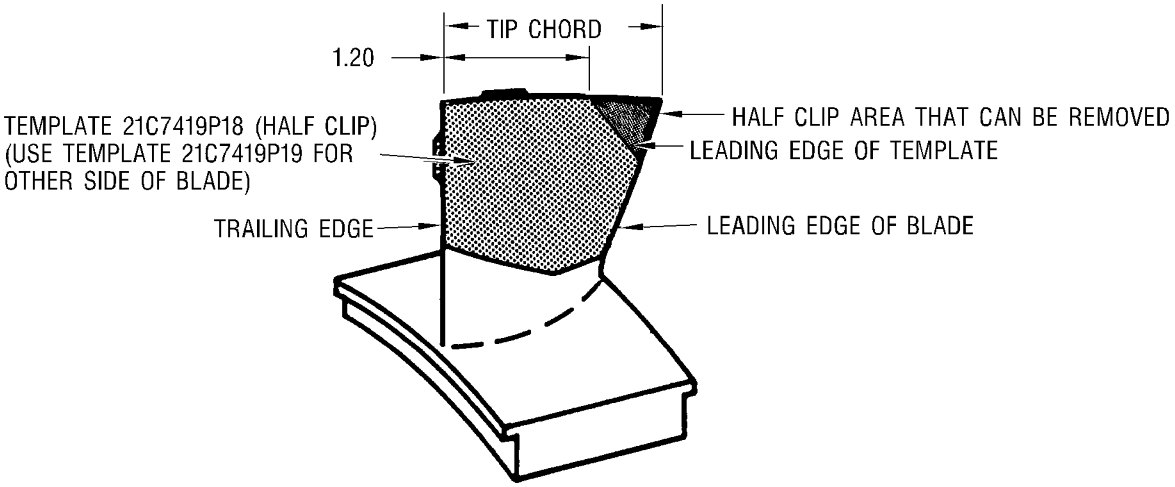
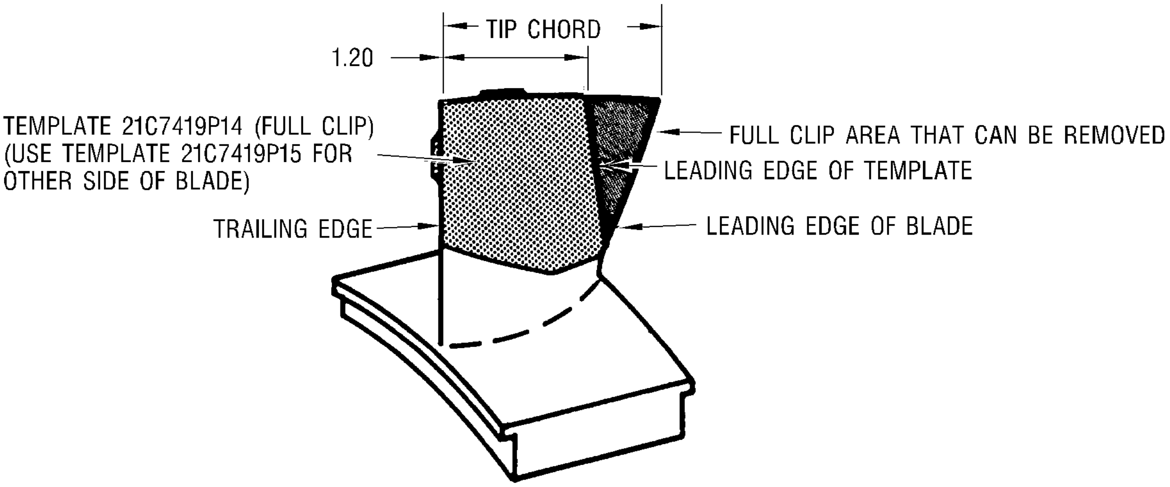


Figure 2-10. Removing Material from Leading Edge of Stage 1 Compressor Blade; Usable Limits



HALF CLIP



FULL CLIP

**ALL DIMENSIONS
ARE IN INCHES**

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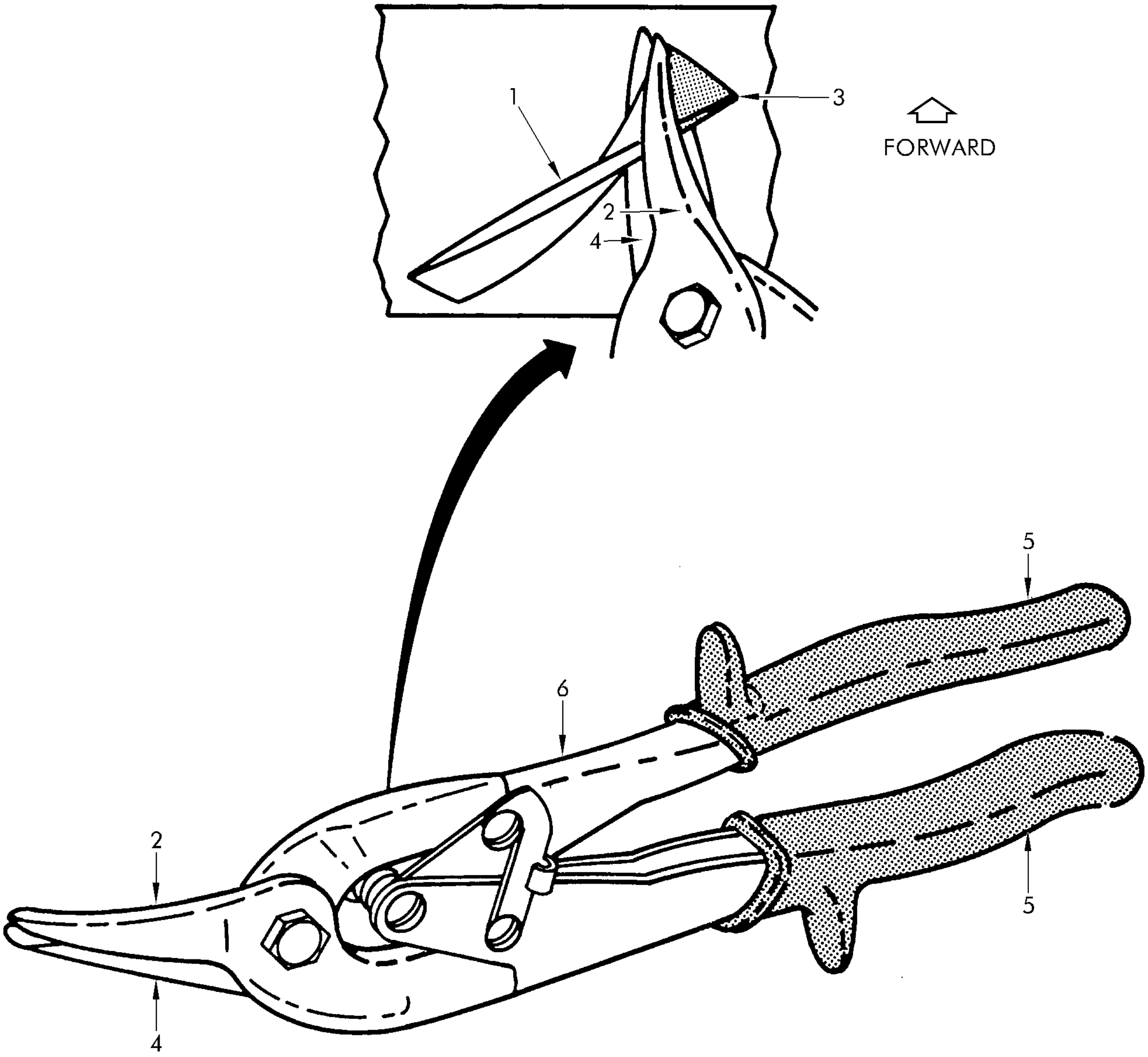
Figure 2-11. Blade Clipping Template; Installation



1. Stage 1 Blade
2. Upper Cutting Blade
3. Damaged Area of Blade
4. Lower Cutting Blade
5. Green Identification Handles
6. Sheetmetal Cutting Shears

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Figure 2-12. Cutting Off Damaged Area of Stage 1 Blade; Correct Method

j. Lock compressor rotor (9, fig. 2-9) by turning clamping handle (4) counterclockwise until yoke (5) prevents rotor from turning.

k. Check filing fixture (3, fig. 2-14) for looseness. If loose, loosen hex head screw (1), and squeeze holding adapter (2) and filing fixture (3) together while second mechanic tightens screw (1).

l. Assemble coarse file (fig. 2-15) as follows:

(1) Insert small end of file (2) into file handle (1).

(2) Install safety stop (4) onto file so that two capscrews (3) are on safe side of file (5). Tighten capscrews.

(3) Repeat steps (1) and (2) and assemble fine file.

NOTE

Use of tape will prevent metal filings from lodging between shim and rear flange of main frame.

m. Using tape (item 107, Appendix D), cover shim at rear flange of main frame (8, fig. 2-9).

NOTE

Only file what is required to remove damaged area. Filing of blade completely flat with guide results in maximum material removal.

n. Insert coarse file into filing guide (9, fig. 2-13), and file damaged area; then insert fine file and remove surface roughness.

o. Loosen hex head screw (10), slide holding adapter (6) aft, and remove filing fixture (8).

NOTE

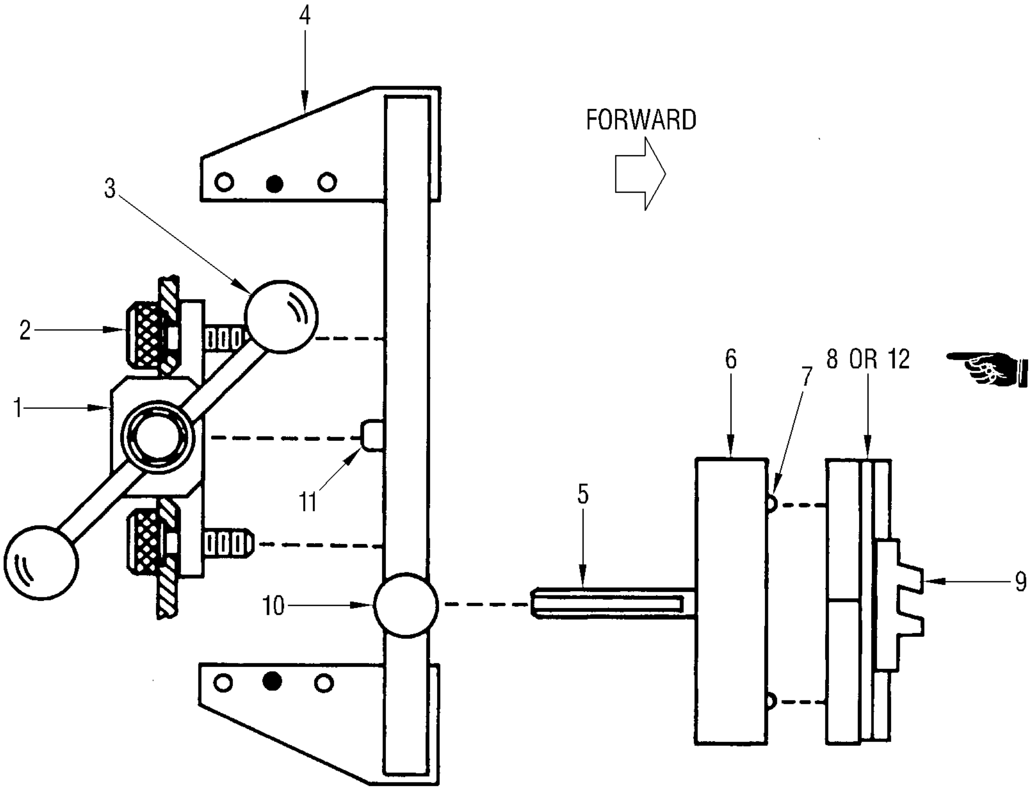
There are two methods of restoring the leading edge contour of stage 1 compressor rotor blades. The preferred method (para p.(1)) is to use the stage 1 blade-disk leading edge dresser set 21C7478G01. The alternate method (para p.(2)) is to use abrasive cloth.

p. Using a small, fine file, blend the leading edge parallel to the concave surface (fig. 2-5, view A). If stage 1 blade-disk leading edge dresser set 21C7478G01 is available, go to step (1), otherwise go to step (2).

(1) Using dresser set 21C7478G01, restore leading edge contour of stage 1 blades. Using medium grade stone, round leading edge of blade using a “back and forth” motion until a uniform radius is obtained (fig. 2-5, view B). Go to step (3).

(2) Using abrasive cloth of 220 grit or finer (item 53, Appendix D), cut cloth into narrow strips, and round the leading edges of blades using a “shoeshining” motion until blades are properly contoured (fig. 2-5, view B).

(3) Hold a piece of crocus cloth (item 55, Appendix D) against the blade surface. Using a thin piece of wood, such as a tongue depressor, apply light pressure to the cloth and polish the concave and convex surfaces of the blades. With a piece of crocus cloth that has been cut in narrow strip, polish the leading edge of the blade. Polish all blade surfaces until the finish is as close as practical to the original finish of the part.



LEGEND

1. Compressor Rotor Lock 21C7422G01
2. Knob (Qty-2)
3. Clamping Handle
4. Bridge 17A8744P04 (Part of 21C7419G02)
5. Rod
6. Holding Adapter 17A8744P03 (Part of 21C7419G02)
7. Pin (Qty-4)
8. Full Clip Filing Fixture 17A8744P05 (Part of 21C7419G02)
9. Filing Guide
10. Hex Head Screw
11. Dowel Pin
12. Half Clip Filing Fixture 17A8744P18 (Part of 21C7419G02)

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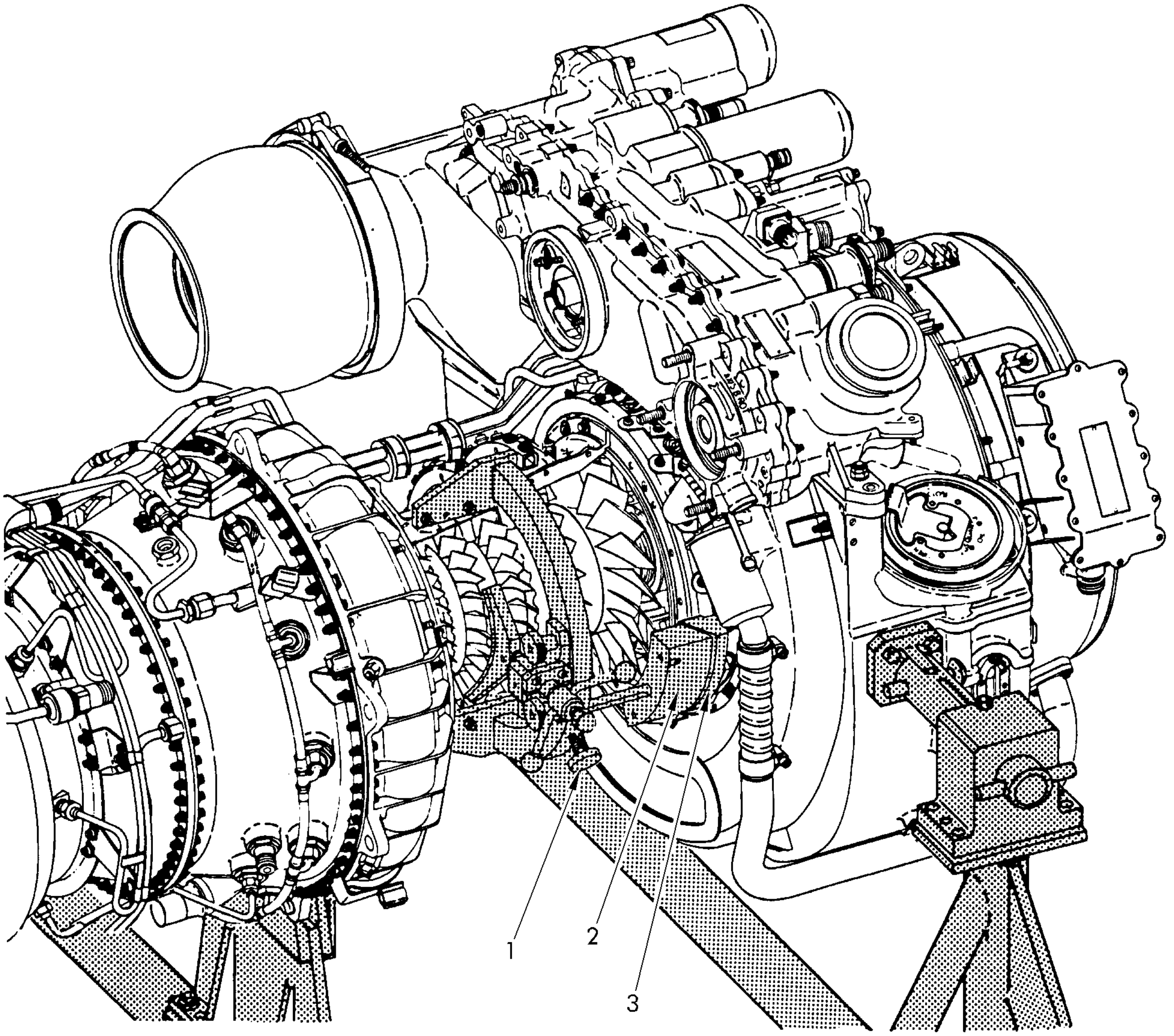
Figure 2-13. Compressor Rotor Lock 21C7422G01 and Holding Adapter 17A8744P03 to Bridge 17A8744P04; Assembly and Installation



1. Hex Head Screw
2. Holding Adapter
3. Filing Fixture

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Figure 2-14. Compressor Rotor Lock 21C7422G01 and Holding Adapter 17A8744P03 to Bridge 17A8744P04; Installed

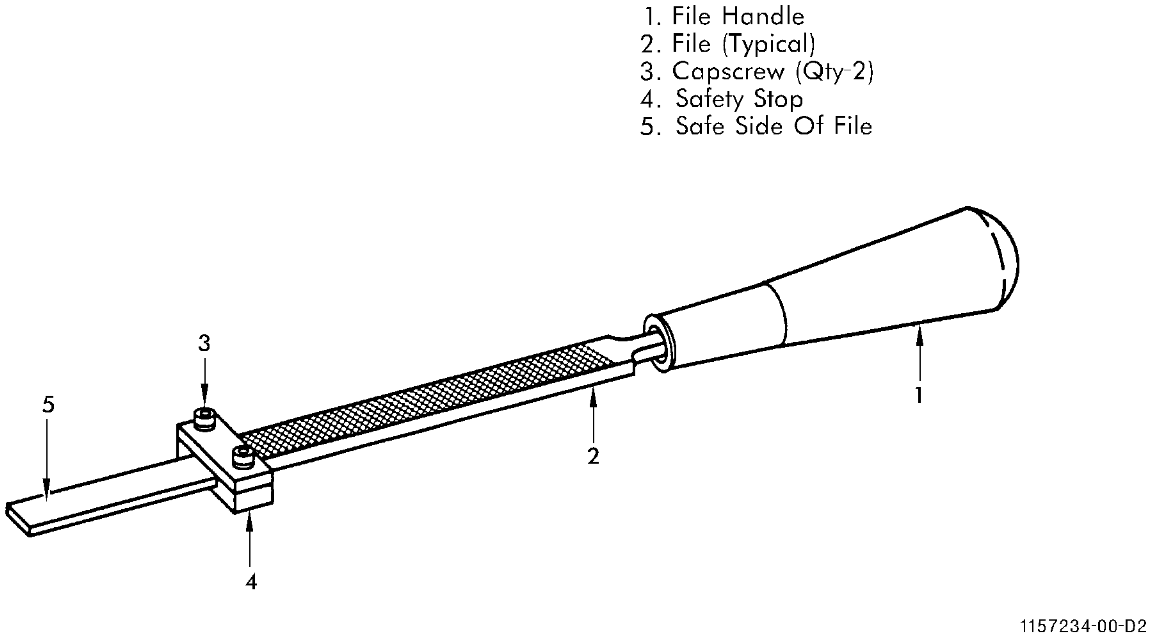


Figure 2-15. Course File and Fine File; Assembly

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

q. Using dry, filtered, compressed air, remove filing debris from internal and external areas of engine.

r. Inspect damaged blade. After removing the maximum amount of material permitted by the filing guide, if there is still a damaged area on blade (fig. 2-10), replace cold section module. Otherwise, go to step s.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

NOTE

To maintain correct compressor rotor balance, an equal amount of material must be removed from blade that is 180° from damaged blade.

s. Locate blade 180° from damaged blade as follows:

(1) Unlock compressor rotor (9, fig. 2-9) by turning clamping handle (4) clockwise.

(2) Starting with blade next to damaged blade, count ten blades.

(3) Identify tenth blade by marking it with blue Dykem Marker (item 82, Appendix D).

(4) Rotate compressor rotor so that damaged blade is exposed. Repeat blade counting procedure in step (2) in opposite direction to verify location of marked blade.

t. Cut off blade tip as follows:

(1) Install same template used for prior blade clip (21C7419P14/P15 or 21C7419P18/P19) over marked blade as shown in figure 2-11.

(2) Using a felt-tip marker (item 83, Appendix D) or similar marking device, trace the leading edge of the template on marked blade. Remove template.

(3) Attach a piece of tape (item 107, Appendix D), from main frame to tip of blade being cut off.

CAUTION

- Do not use sheet metal cutting shears that have red or yellow identification handles; otherwise, additional blade damage could result.
- To avoid removing too much blade material, position shears slightly forward of marked line.

(4) Using sheet metal cutting shears (6, fig. 2-12) with green identification handles (5), position lower cutting blade (4) and upper cutting blade (2) between the damaged area of blade (3). Be sure that shears are positioned slightly forward of marked blade.

WARNING

Clipping Stage 1 Blades

Clippings from clipped blade can cause injury to eyes or face. When clipping blade, wear approved gloves and face shield.

CAUTION

- Do not apply excessive side force while cutting blade; otherwise, blade edge may be bent or curled.
- To avoid removing too much blade material, position shears slightly forward of marked line.

(5) Cut blade tip off, slightly forward of marked line.

(6) Remove tape, with blade tip attached, from main frame.

u. Install filing fixture (steps i thru k) over marked blade. Remove material from marked blade (steps n thru q).

CAUTION

Do not allow bridge to drop onto compressor rotor; otherwise, blades may be damaged.

v. With another mechanic holding bridge (3, fig. 2-9), remove four locknuts (6) and four bolts (1). Remove bridge (3).

w. Loosen hex head screw (10, fig. 2-13), and remove holding adapter (6) from bridge (4).

x. Remove tape from rear flange of main frame.

CAUTION

Before installing right-hand compressor case-half, be sure power turbine module is installed. Failure to install power turbine module before installing right-hand case-half could cause serious damage to shims.

y. Install right-hand compressor case-half (para 2-5, step e).

2-7. Chamfering of Compressor Rotor Blades to Recover Engine Performance (AVIM). This is an effective procedure to significantly restore engine performance by chamfering compressor rotor blades damaged by foreign objects. The extent of engine performance recovery will depend on the results of the maximum power check (para 1-145 **(T700)**, para 1-146 **(T701, T701C, T701D AH-64A)** or para 1-147 **(T701C, T701D UH-60L)**) or the results of the performance evaluation test (para 1-238 **(T700)**, 1-241 **(T701, T701C, T701D)**). This procedure will extend use of the cold section module. This procedure will be used to chamfer any number of damaged compressor rotor blades and the compressor rotor blades directly 180° opposite, whether or not they are damaged.

a. Remove right-hand compressor case-half (para 2-5, step a).

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

CAUTION

Do not force compressor rotor to rotate. Forcing rotor to rotate may cause additional damage to blades.

b. Rotate compressor rotor (9, fig. 2-9) by hand, and inspect all blades (table 2-1) for foreign object damage. If rotor does not rotate freely, have a second mechanic lift up on lower section of exhaust frame (10). If lifting force is necessary to allow rotor to rotate, it must be used every time the rotor is rotated.

NOTE

- Use of tape will prevent metal filings from lodging between shim and rear flange of main frame and between exposed curvic teeth of blade-disks.
- It may be necessary to use green-handled, sheet metal cutting shears to remove curled ends on blade tips.

c. Using tape (item 107, Appendix D), cover shim at rear flange of main frame (8) and exposed curvic teeth of blade-disks.

d. Rework a four-inch flat file (fig. 2-6).

e. Using marker (item 82, Appendix D), mark damaged area of blade tip corner(s) in each stage (fig. 2-16).

f. Using scriber, scribe angle of chamfer at tip corner(s) of leading or trailing edge of damaged blade(s) or of both edges in each stage. Chamfer length must not exceed usable limits (fig. 2-16).

g. In stage 1, locate the blade(s) opposite the damaged blade(s) as follows:

(1) In a clockwise direction, count 10 blades (half the total of 20 blades) from the damaged blade. Mark this blade using marker (item 82, Appendix D).

(2) To check that this blade is 180° opposite the damaged blade, count 10 blades in a counterclockwise direction from the damaged one, and mark using marker. Both marks should be on the same blade.

h. Using marker, mark blade tip corner(s) of the blade(s) 180° opposite the damaged blade(s).

i. In stages 2 thru 5, locate the blade(s) 180° opposite the damaged blade(s) and mark blade tip corner(s). Stages 2 thru 5 have 22, 28, 28, and 32 blades respectively.

j. Measure dimensions D, E, F, G, or H, on damaged blade(s) in each stage, as applicable.

k. Transfer these measurements to the blade(s) 180° opposite the damaged blade(s).

l. Using scriber, scribe angle of chamfer at tip corner(s) of leading or trailing edge of blade(s) or both in each stage. Chamfer length must not exceed usable limits (fig. 2-16).

NOTE

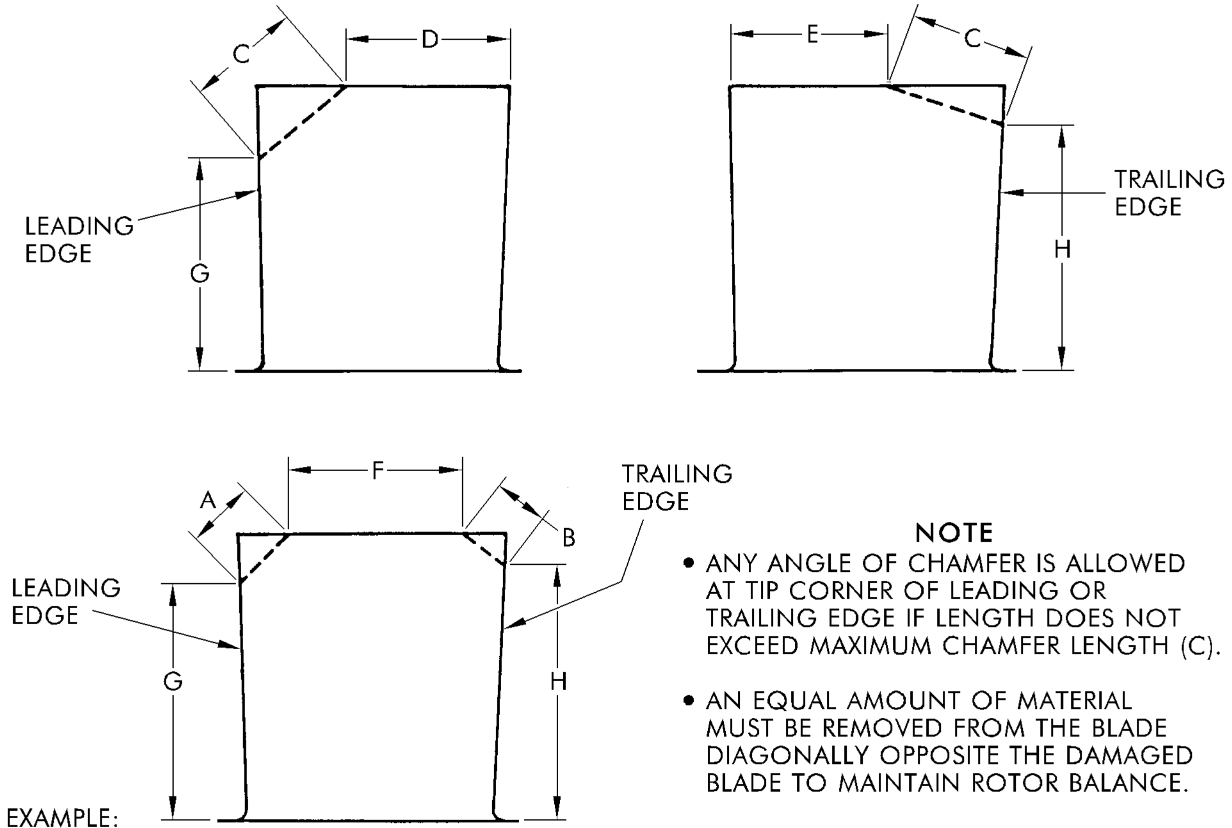
- Chamfering of an equal amount of material from the blade(s) 180° opposite the damaged blade(s) is required to maintain rotor balance.
- Blade chamfering shall be completed, even if an existing chamfer is located on the 180° opposite blade. If the existing chamfer is equal to or larger in size, no further chamfering is required. If the existing chamfer is smaller, do steps j, k, l, m, or n.

m. Chamfer stage 1 blade tip corner(s) as follows:

(1) If stage 1 blade tip corner(s) is slightly damaged, do the following; otherwise, go to step m(2):

(a) Using reworked file (fig. 2-6), file blade tip corner(s) to scribed chamfer line.

(b) Break all sharp edges using fine file and restore contour along chamfer (fig. 2-5).



EXAMPLE:
STAGE 3 BLADE:

A = 1/8
+B = 1/4
C = 3/8

NOTE

- ANY ANGLE OF CHAMFER IS ALLOWED AT TIP CORNER OF LEADING OR TRAILING EDGE IF LENGTH DOES NOT EXCEED MAXIMUM CHAMFER LENGTH (C).
- AN EQUAL AMOUNT OF MATERIAL MUST BE REMOVED FROM THE BLADE DIAGONALLY OPPOSITE THE DAMAGED BLADE TO MAINTAIN ROTOR BALANCE.
- DURING COMPRESSOR BLADE INSPECTION, IF A BLADE WITH AN EXISTING CHAMFER IS OBSERVED, NO ADDITIONAL CHAMFER IS REQUIRED ON 180° OPPOSITE BLADE.

NOTE

WHEN BOTH LEADING AND TRAILING EDGE TIP CORNERS ARE CHAMFERED, THE SUM OF A AND B MUST NOT EXCEED MAXIMUM CHAMFER LENGTH (C).

BLADES	
STAGE	MAX CHAMFER LENGTH (C)
1	3/4
2	5/8
3	3/8
4	11/32
5	9/32

ALL DIMENSIONS ARE IN INCHES

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Figure 2-16. Compressor Rotor Blades; Usable Limits after Chamfering

(c) Hold a piece of crocus cloth (item 55, Appendix D) against the blade surface. Using a thin piece of wood such as a tongue depressor, apply light pressure to the cloth and polish the concave and convex surfaces of the blade and restore contour along chamfer (fig. 2-5). Cut narrow strips of crocus cloth (item 55, Appendix D), and polish the leading edge of the blade. Polish all blade surfaces until the finish is as close as practical to the original finish of the part.

(d) Locate blade(s) 180° opposite chamfered blade(s) and repeat steps (a) thru (c).

(2) If stage 1 blade tip corner(s) is heavily damaged but is within usable limits, do the following:

(a) Clip damaged area(s) close to the scribed chamfer line, using green-handled, sheet metal cutting shears (fig. 2-12).

(b) Using rework file (fig. 2-6), file blade tip corner(s) to scribed chamfer line.

(c) Using fine file, break all sharp edges.

(d) Hold a piece of crocus cloth (item 55, Appendix D) against the blade surface. Using a thin piece of wood such as a tongue depressor, apply light pressure to the cloth and polish the concave and convex surfaces of the blade. With a piece of crocus cloth (item 55, Appendix D) that has been cut in a narrow strip, polish the leading edge of the blade and restore edge contour along chamfer (fig. 2-5). Polish all blade surfaces until the finish is as close as practical to the original finish of the part.

(e) Locate the blade(s) opposite the damaged one(s) and repeat steps (a) thru (d).

n. Chamfer stages 2 thru 5 tip corner(s) as follows:

(1) Using rework file, file blade tip corner(s) to scribed chamfer line.

(2) Using fine file, break all sharp edges.

(3) Hold a piece of crocus cloth (item 55, Appendix D) against the blade surface. Using a thin piece of wood such as a tongue depressor, apply light pressure to the cloth and polish the concave and convex surfaces of the blade. With a piece of crocus cloth (item 55, Appendix D) that has been cut in a narrow strip, polish the leading edge of the blade and restore edge contour along chamfer (fig. 2-5). Polish all blade surfaces until the finish is as close as practical to the original finish of the part.

(4) Locate blade(s) 180° opposite chamfered blade(s) and repeat steps (1) thru (3).

o. Remove tape from rear flange of main frame and curvic teeth of blade-disks.

CAUTION

Do not remove or install the power turbine module with the right-hand compressor case-half removed. If both the right-hand compressor case-half and power turbine module are removed, the compressor case-half should be installed first, with care taken not to damage the shims at the forward flange of the compressor case and the main frame.

p. Install right-hand compressor case-half (para 2-5, step f).

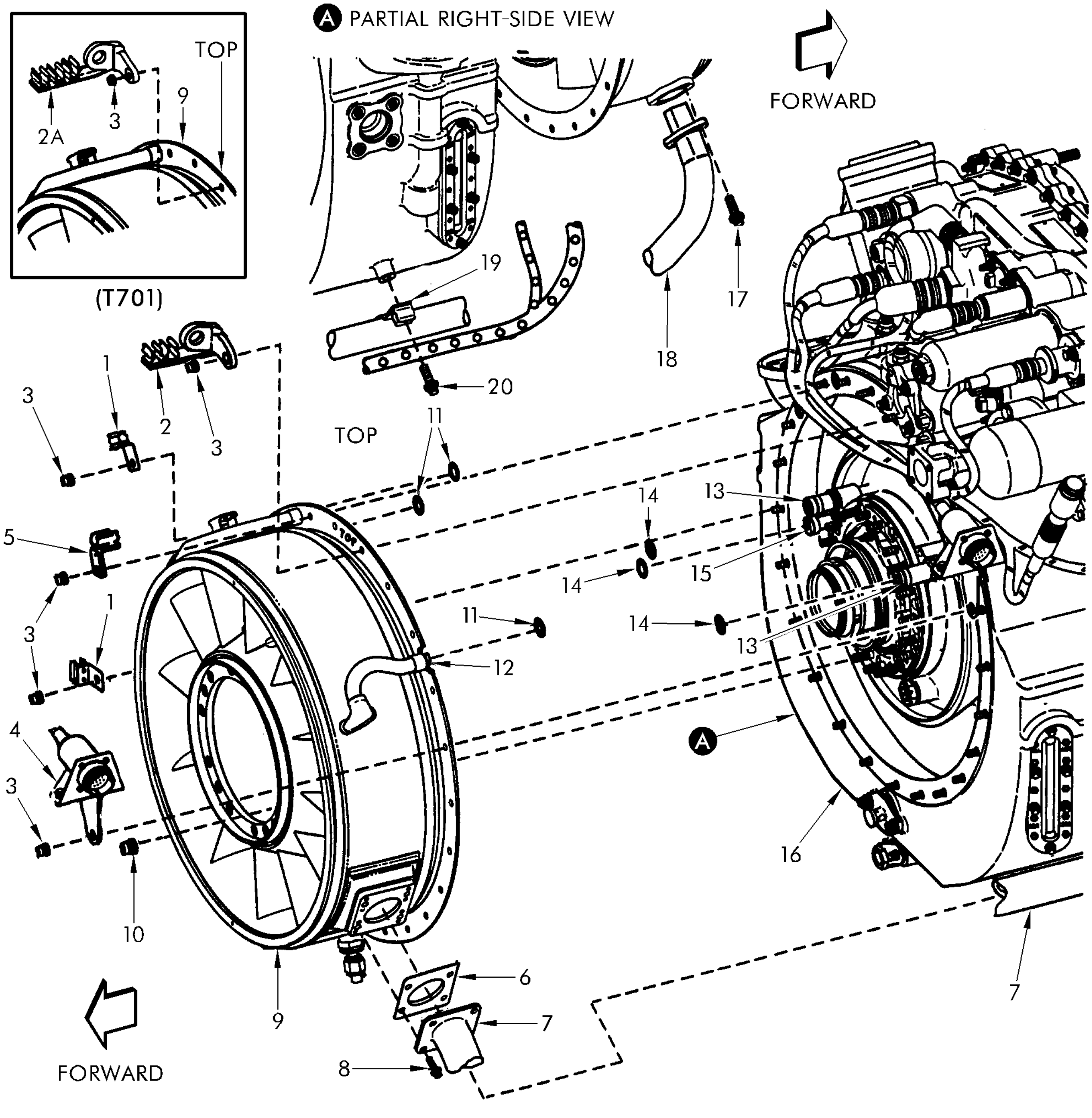
2-8. SWIRL FRAME.

2-9. (T700, T701) Removal of Swirl Frame (AVIM).

a. Remove history recorder (para 7-18).

b. **(T700)** Pull green electrical cable and yellow electrical cable from clip supports (1, 5, fig. 2-17, from forward suspension lug (2) on swirl frame (9), and from clip support on bracket (19).

c. **(T701)** Pull green electrical cable and yellow electrical cable from clip supports (1, 5, fig. 2-17), from forward suspension lug (2A) on swirl frame (9), and from clip support on bracket (19). Pull B-sump delta pressure tube from lug (2A).



1. Clip Support (Qty-2)
2. **(T700)** Forward Susupension Lug
2A. **(T701)** Forward Suspension Lug
3. Locknut (Qty-24)
4. E3 (Green Cable) Connector Bracket
5. Clip Support
6. Anti-Ice Line Gasket
7. Anti-Icing Bleed Duct
8. Bolt (Qty-4)
9. Swirl Frame
10. Self-Locking Nut (Qty-20)
11. Preformed Packing (Qty-3)
12. Sleeve (Qty-3)
13. Oil-Discharged Scavenge Tube (Qty-2)
14. Preformed Packing (Qty-3)
15. Oil Inlet Tube
16. Main Frame
17. Bolt (Qty-2)
18. Sensing Tube
19. Bracket
20. Bolt

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Figure 2-17. *(T700, T701)* ***Swirl Frame; Removal and Installation***

d. Remove the following:

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

NOTE

Gasket might stick to pad on swirl frame. If it does, it can be inspected after removing swirl frame.

(1) Four bolts (8) and anti-ice line gasket (PN 3032T42P01 only) (6). Inspect gasket for splits. Splits are not allowed. Save gasket for use at installation.

(2) Two bolts (17).

(3) Twenty-four locknuts (3), lug (2 **(T700)** or 2A **(T701)**), three clip supports (1, 5), and E3 (green cable) connector bracket (4).

(4) Twenty self-locking nuts (10) from swirl frame-to-front frame mating flange.

(5) Bolt (20) from bracket (19).

NOTE

When swirl frame is removed, packings for sleeves might stay on sleeves or in packing grooves on the main frame forward flange. In either case, be sure they are removed and discarded.

e. Pull sensing tube (18) out and remove swirl frame.

f. Remove and discard three packings (11) from sleeves (12) or from forward flange of main frame (16).

g. Remove and discard three packings (14) from oil inlet tube (15) and oil-discharge scavenge tubes (13).

h. If inspection of oil inlet and scavenge tubes is necessary, see table 2-6.

2-10. (T701C, T701D) Removal of Swirl Frame (AVIM).

a. Remove history counter (para 7-18).

b. Remove green electrical cable and yellow electrical cable from clip supports (20, 22, 27, fig. 2-18).

c. Remove green electrical cable from forward suspension lug (21).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

NOTE

Anti-ice line gasket (7) might stick to pad on swirl frame (17).

d. Remove four bolts (9) and gasket (PN 3032T42P01 only) (7). Inspect gasket for damage. If it is damaged, dispose of it; if it is not damaged, save it for installation.

e. Remove drain lower tube (10) as follows:

(1) Loosen top clamp (15) on non-metallic oil drain hose (16).

(2) Remove and discard packings (14).

(3) Remove fitting drain (13).

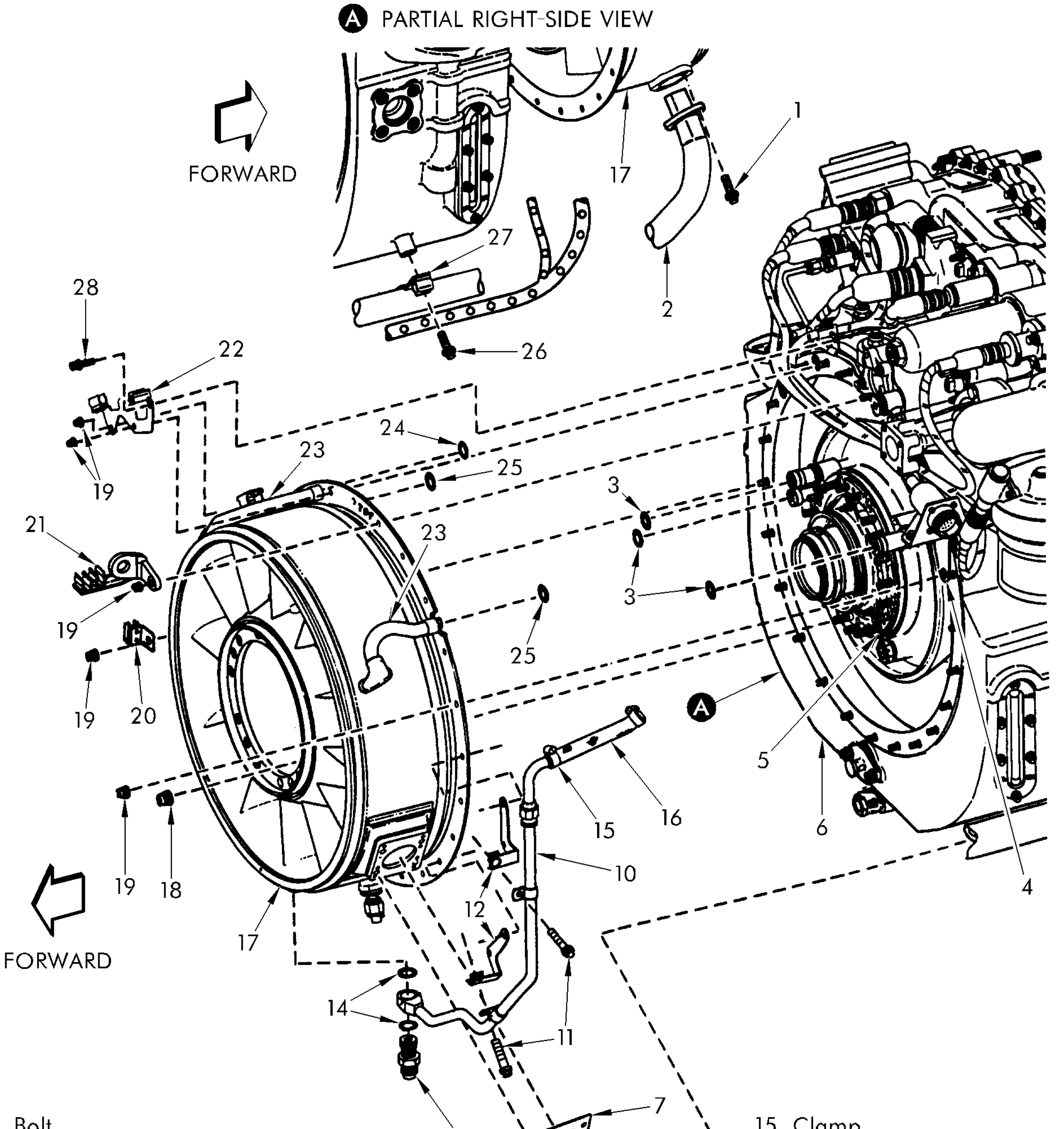
(4) Remove bolts (11) from brackets (12).

(5) Remove drain lower tube (10).

(6) Remove four locknuts (19) from two brackets (12). Remove brackets.

f. Remove two bolts (1) from sensing tube (2).

g. Remove bolt (28) from clamp on B-sump delta pressure tube.



1. Bolt
2. Sensing Tube
3. Packings
4. E3 Connector Bracket
5. Front Frame
6. Main Frame
7. Anti-Ice Line Gasket
8. Anti-Icing Bleed Duct
9. Bolt
10. Drain Lower Tube
11. Bolts
12. Brackets
13. Drain Fitting
14. Packings
15. Clamp
16. Nonmetallic Oil Drain Hose
17. Swirl Frame
18. Self-Locking Nut
19. Locknut
20. Clip Support
21. Forward Suspension Lug
22. Clip Supports
23. Oil Scavenge Tube
24. Packing
25. Packing
26. Bolt
27. Clip Support
28. Bolt

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Figure 2-18. ***(T701C, T701D)*** *Swirl Frame; Removal and Installation*

h. Remove 24 locknuts (19) that secure swirl frame (17) to main frame (6).

i. Remove lug (21) and clip supports (20, 22). Remove E3 connector bracket (4) from studs.

j. Remove 20 self-locking nuts (18) that secure swirl frame (17) to front frame (5).

k. Remove bolt (26). Pull sensing tube (2) out from swirl frame (17).

NOTE

Packings (24, 25) might remain on aft flange of swirl frame (17) or in packing grooves on forward flange of main frame (6).

l. Remove swirl frame (17). Remove and dispose of two packings (25) from oil scavenge tubes (23) and packing (24) from oil inlet tube.

m. Remove and dispose of three packings (3) from oil tubes on front frame (5).

2-11. Cleaning of Swirl Frame (AVIM).

a. Plug or cover all openings before cleaning.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the swirl frame using dry, filtered, compressed air.

2-12. Inspection of Swirl Frame. See table 2-2. At AVIM, inspection of the swirl frame and the front frame (table 2-7) is done at the same time.

Table 2-2. Inspection of Swirl Frame

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Swirl frame (fig. 2-19) for:			
a. Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).

NOTE

Swirl frames that have been repaired may have a combination of gray, gold, green, and brown touchup paint. Regardless of the colors, do not reject the swirl frame.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Flaking or missing coating.	Any amount without any loose pieces.	Any amount.	Remove loose pieces, using cloth (item 52 or 53, Appendix D). Touchup frame (para 2-15).
c. Nicks, dents, and scratches in flanges (1, 10).	Any number, 0.030 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
d. Nicks and scratches in:			
(1) Casing walls (15).	Any number, 0.030 inch deep, without high metal.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(2) Vanes (8).	Any number, 0.030 inch deep, without high metal.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(3) Sealing surfaces (9).	Any number, 0.003 inch deep, without high metal.	Not repairable.	Replace swirl frame (para 2-16).
e. AVIM: Loose or damaged inserts.	See Inspection of Studs and Threaded Inserts (para H-27, Appendix H).		
f. AVIM: Missing inserts.	None allowed.	Not repairable.	Replace insert (para H-29, Appendix H).
g. AVIM: Self-locking feature of inserts.	Mating bolt should not be able to be threaded completely through insert, using fingers.	Not repairable.	Replace insert (para H-29, Appendix H).

Table 2-2. Inspection of Swirl Frame (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
h. Cracks or voids in brazed joints of:			
(1) Circumferential joints except joints A and B (fig. 2-19).	Five per joint up to 0.250 inch long separated by a minimum of 1/2 inch.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(2) Circumferential joint A.	Any number located within 0.135 inch from surface C.	Any number.	Not applicable.
(3) Circumferential joint B.	Any number up to 0.120 inch radial and 0.060 inch deep.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(4) Vane joint (13) and braze joint of swirl frame PN 6038T05G02.	One per joint up to 0.375 inch long.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(5) Axial joints on outer casing, except at tubes (11) and wash manifold boss (12).	Two per joint, cumulative length not to exceed 2.500 inches, and within 1/4 inch of overlap joint.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(6) Axial joints at tubes (11).	Three cracks, 0.100 inch long separated by a minimum of 1/2 inch.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(7) Axial joints at wash manifold boss (12).	None allowed.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(8) Outer panel (16).	Five per joint, 0.250 inch long separated by a minimum of 1 inch.	Any number.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(9) **(T700)** Air shute (4) (on swirl frame PN 6038T05).	One per cover up to 0.250 inch long.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
i. AVIM: Damaged sleeves (3).	None allowed.	Any amount.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
j. Dents in:			
(1) Casing walls (15).	Any number, 0.030 inch deep, without high metal.	(a) Same as usable limits, with high metal.	(a) Remove high metal.

Table 2-2. Inspection of Swirl Frame (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
		(b) Any number.	(b) AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(2) Vanes (8).	Any number, 0.060 inch deep, without high metal.	(a) Any number, 0.060 inch deep, with high metal.	(a) Remove high metal.
		(b) Any number.	(b) AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).

NOTE

The forward inner flange of swirl frame PN 6038T05 is fitted with inserts. All other swirl frames are fitted with shank nuts.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
k. Loose, damaged, distorted, or missing shank nuts (14).	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
l. Damaged or missing threads of inserts (6, 14) or shank nuts (14).	Up to one damaged or missing thread, without crossed threads or loose material.	Not repairable.	Replace insert (para H-29, Appendix H).
m. Oil supply tube (7) and oil scavenge tubes (2, 11) for:			
(1) Leaks.	Not allowed.	Any amount.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(2) Cracks in tack weld of tube bosses.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
n. Vanes (8) for tears.	None allowed.	Any amount if no more than 10% of area of vane is affected. Up to four vanes maximum, with no more than two adjacent vanes affected. No repairs allowed within 1/4 inch of hub section.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).

Table 2-2. Inspection of Swirl Frame (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
o. Nut plates (5) for:			
(1) Damaged or missing threads.	Up to one thread damaged or missing, without high metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(2) Run-on torque.	Usable if bolt cannot be run on completely by hand.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(3) Looseness.	Usable if nut cannot turn 360°.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
p. Corrosion pitting on outer flange and inner flange.	Any amount, up to 0.060 inch deep, over not more than 50% of flange area.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
q. Outer casing surface for:			
(1) Surface ripples or irregularities on casing outer surface.	Any number, within 0.150 inch of normal contour provided there are no sharp creases or high metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace swirl frame (para 2-16).
(2) Discoloration (whitish blotchy condition which will leave a greenish trace on a cloth when wiped).	Any amount.	Not applicable.	Not applicable.

2-13. Repair of Swirl Frame (AVIM). Repair of swirl frame is limited to that specified in Corrective Action column of table 2-2.

2-14. Replacement of Swirl Frame Sleeve (AVIM).

a. Apply several layers of tape (item 107, Appendix D) on aft flange surface around damaged sleeve.

b. Using pliers, remove sleeve (fig. 2-20, view A) as follows:

(1) Place jaws of pliers on sleeve and squeeze in direction of arrows as shown in view A.

(2) Continue to squeeze sleeve until it collapses (view B).

(3) Place pliers 90° opposite (view C) and apply force.

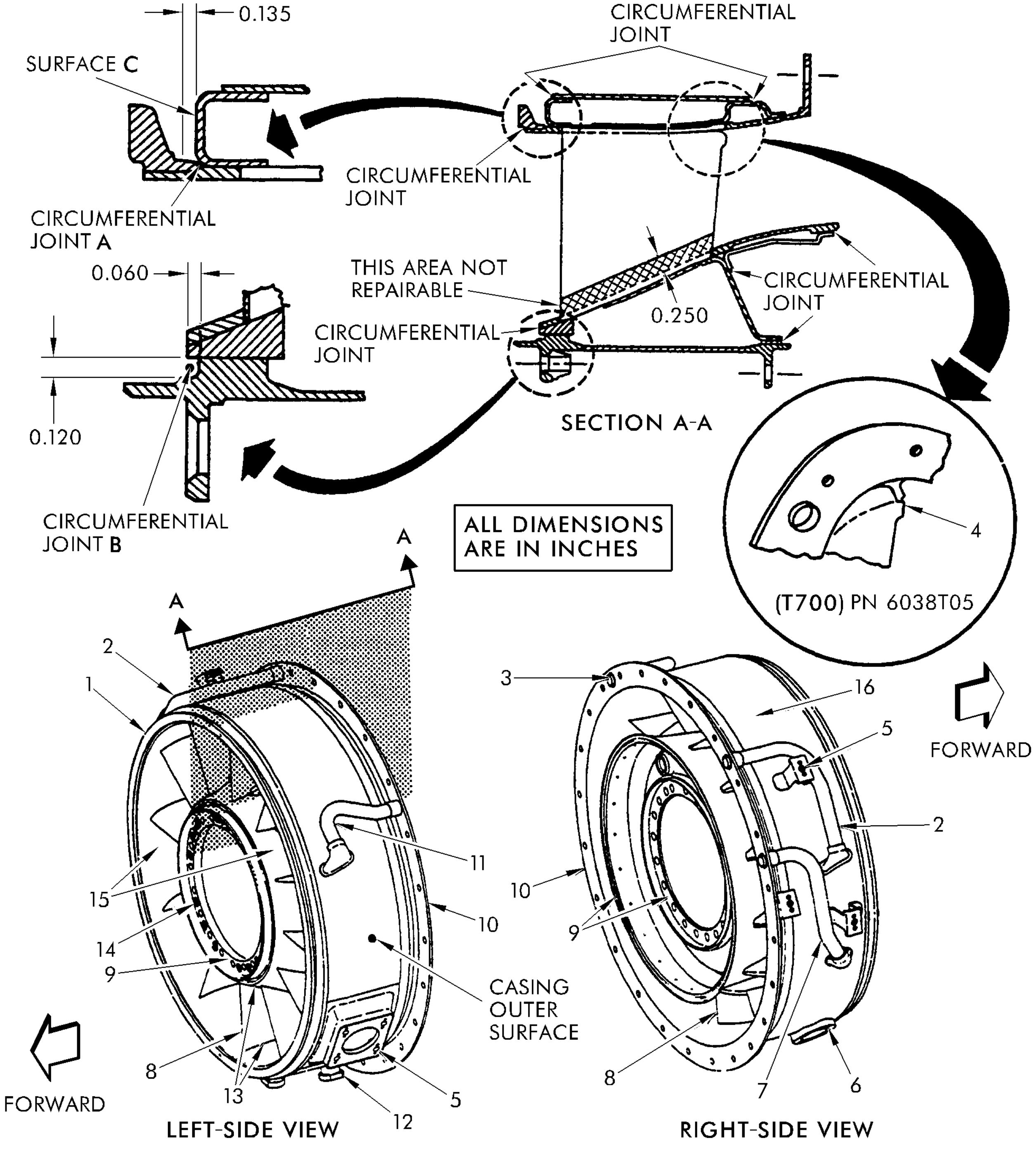
(4) Continue to squeeze sleeve until it collapses (view D). Remove sleeve when it is fully collapsed and is no longer being held by interference fit.

c. Using a fine stone (item 104, Appendix D), remove any burrs from around tube opening.

d. Using magnet, make sure replacement sleeve is attracted to magnet. If it is not, replace with magnetic sleeve.

e. Using swirl frame sleeve pusher LMT 749 (fig. 2-21), install replacement sleeve PN 3904T06P01 as follows:

(1) Place flat end of sleeve over small end of pusher.



1. Forward Flange
2. Aft Scavenge Tube
3. Sleeve (Qty-3)
4. **(T700)** Air Shute (on Swirl Frame PN 6038T05)
5. Nut Plate (Qty-7)
6. Insert (Qty-2)
7. Oil Supply Tube
8. Vane
9. Sealing Surface
10. Aft Flange
11. Forward Scavenge Tube
12. Water-Wash Boss
13. Vane Joint
14. Shank Nut (Qty-15)
    (T700) Insert (Qty-15) (on Swirl Frame PN 6038T05)
15. Casing Wall
16. Outer Panel

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Figure 2-19. Swirl Frame; Inspection

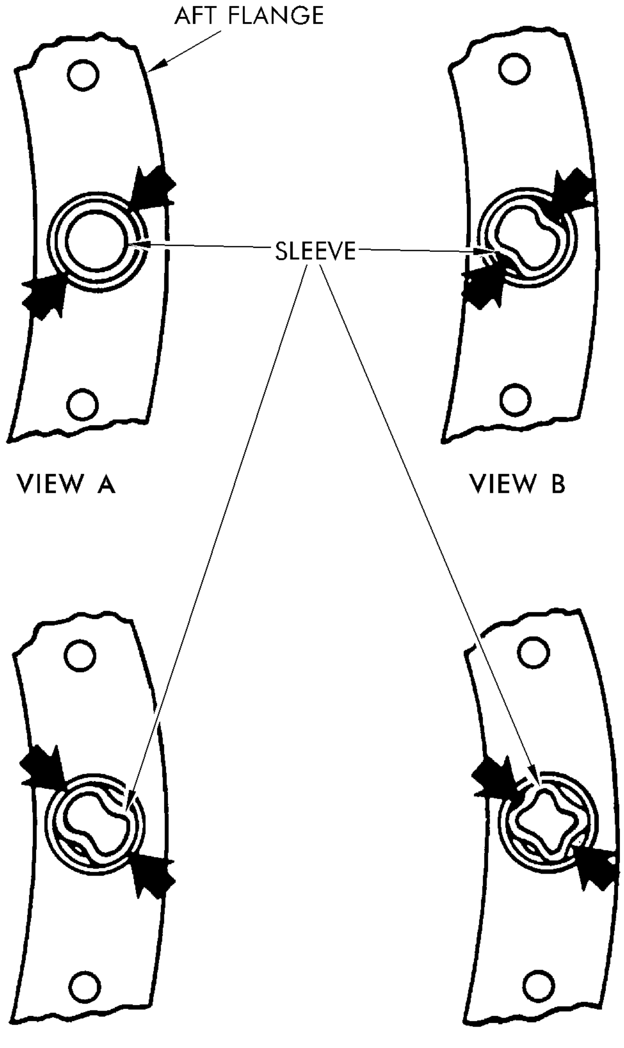

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Figure 2-20. Swirl Frame Sleeve; Removal

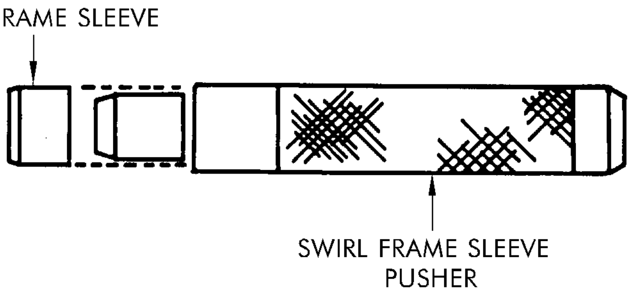

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Figure 2-21. Swirl Frame Sleeve Pusher LMT 749

WARNING

Dry Ice
BB-C-104

- Contact of skin with solid will cause severe burns or frostbite or both. Prolonged inhalation of vapor may cause increased heart rate, shortness of breath, sweating, and headache.
- If any solid contacts the skin, immediately flush affected area with water. Do not rub affected area. Immediately get medical help.
- If vapors cause headache or sweating, go to fresh air.
- When handling solid (or when handling parts chilled by dry ice), wear approved protective gloves.

(2) Place sleeve and pusher into a pack of dry ice (item 80, Appendix D), and allow them to chill for approximately ten minutes.

(3) Place swirl frame on workbench, aft end down, and with area to be repaired overhanging edge of workbench.

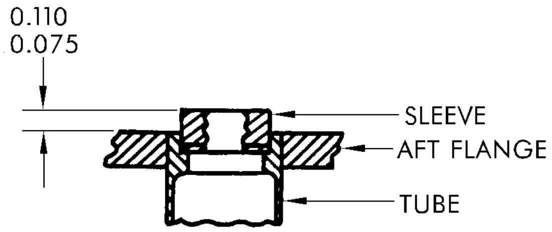
(4) Wearing protective gloves (item 77, Appendix D), remove sleeve and pusher from dry ice.

(5) Carefully insert sleeve into tube opening.

(6) Turn swirl frame, forward end down, and using pusher and plastic mallet, gently tap sleeve until it is seated.

(7) Remove pusher and allow sleeve to warm to room temperature.

(8) Check seating dimension of sleeve (fig. 2-22).



ALL DIMENSIONS ARE IN INCHES

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Figure 2-22. Swirl Frame Sleeve; Installation

2-15. Touchup of Coated Areas of Swirl Frame Using SermeTel 196 (AVIM).

WARNING

Trichloroethane
O-T-620

- Do not use near open flames, welding areas, or on very hot surfaces. Do not smoke when using it. Heat and flames can cause the formation of phosgene gas which is injurious to the lungs.
- Repeated or prolonged contact with liquid or inhalation of vapor can cause skin and eye irritation, dermatitis, narcotic effects, and heart damage.
- After prolonged skin contact, wash contacted area with soap and water. Remove contaminated clothing. If vapors cause irritation, go to fresh air. Get medical attention for overexposure of skin and eyes.
- When handling liquid in vapor-degreasing tank with hinged cover and air exhaust, or at air-exhausted workbench, wear approved gloves and goggles.
- When handling liquid at open, unexhausted workbench, wear approved respirator, gloves, and goggles.
- Dispose of liquid-soaked rags in approved metal container.

a. Using solvent (item 114, Appendix D), remove grease from unpainted areas.

CAUTION

After clean metal has been exposed, do not handle parts with bare hands. Handling parts with bare hands could contaminate surface before painting.

b. Lightly buff unpainted areas, using abrasive cloth (item 53, Appendix D). Buff only enough to expose clean metal.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

WARNING

Trichloroethane
O-T-620

- Do not use near open flames, welding areas, or on very hot surfaces. Do not smoke when using it. Heat and flames can cause the formation of phosgene gas which is injurious to the lungs.
- Repeated or prolonged contact with liquid or inhalation of vapor can cause skin and eye irritation, dermatitis, narcotic effects, and heart damage.
- After prolonged skin contact, wash contacted area with soap and water. Remove contaminated clothing. If vapors cause irritation, go to fresh air. Get medical attention for overexposure of skin and eyes.
- When handling liquid in vapor-degreasing tank with hinged cover and air exhaust, or at air-exhausted workbench, wear approved gloves and goggles.
- When handling liquid at open, unexhausted workbench, wear approved respirator, gloves, and goggles.
- Dispose of liquid-soaked rags in approved metal container.

c. Clean any dust from buffered surfaces, using dry, filtered, compressed air or solvent (item 114, Appendix D). Be sure all organic solvents are removed from buffed surfaces. Wipe the buffed area with a lint-free towel (item 113, Appendix D).

d. Protect adjacent surfaces from overspray, using tape (item 106, Appendix D).

WARNING

SermeTel W, 196, and 250 Coatings

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Liquid and mist are acidic and contact can cause burns and irritation of skin and eyes.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. In severe cases, get medical help. Remove paint-saturated clothing.
- Do not let paint overspray accumulate where it can be dispersed in air (shakedown of a duct, for example) or where it can become mixed with alkalines or certain acids.
- Apply paint only in dry, air-exhausted spray booth. Wear approved gloves, goggles or face shield, and long-sleeved clothing.
- Do not dry-sweep powder. Wet down and remove spillage according to disposal procedures.
- Do not eat, smoke, or carry smoking materials in areas where liquid is handled.

e. Shake paint container thoroughly before use. Brush or spray three light coats of paint (item 90, Appendix D). Wait at least 10 minutes between coats.

f. Let the touched up part stand for 8 hours, at room temperature to cure fully. The bonded coating should be uniform, and free of cracks, bubbles, runs, and other imperfections.

NOTE

Color of SermeTel 196 is not an exact match for color of SermeTel W; however, after curing, the color is very close to that of the original material.

g. Check the adherence and curing of the touched-up coating as follows:

(1) Flush the touched-up surface for 1 minute by immersing it in water at room temperature or by flowing water over it. If coating is not removed or softened, it is acceptable.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(2) Rub touched-up surface using a rag soaked with oil (item 85 or 87, Appendix D). If touched-up surface is not removed or softened, it is acceptable.

2-16. (T700, T701) Installation of Swirl Frame (AVIM).

a. Install the following:

(1) Preformed packing (14, fig. 2-17) on each of the two oil-discharge scavenge tubes (13).

(2) Packing (14) on oil inlet tube (15).

(3) Preformed packings (11) on three sleeves (12).

CAUTION

Packings on inlet and scavenge tubes can be damaged if swirl frame is not properly alined with main frame.

b. Carefully install swirl frame (9) (with the word TOP at 12 o'clock position) onto main frame (16).

c. Install 20 self-locking nuts (10) on swirl frame-to-front frame mating flange. Hand-tighten nuts.

d. Install 24 locknuts (3), forward suspension lug (2 **(T700)** or 2A **(T701)**), clip supports (1, 5), and E3 (green cable) connector bracket (4) on swirl frame-to-main frame mating flange. See figure 2-23 for location of clip supports, lug, and bracket. Hand-tighten locknuts.

e. Tighten self-locking nuts (10, fig. 2-17) in crisscross fashion; for example: 12 o'clock, then 6 o'clock; 3 o'clock, then 9 o'clock. Torque nuts (10) to 145-150 inch-pounds in crisscross fashion.

f. Tighten locknuts (3) in crisscross fashion; for example: 12 o'clock, then 6 o'clock; 3 o'clock, then 9 o'clock. Torque locknuts (3) to 45-50 inch-pounds in crisscross fashion.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

g. Install anti-ice line gasket (PN 3032T42P01 only) (6), and four bolts (8) to secure anti-icing bleed duct (7). Torque bolts (8) to 45-50 inch-pounds.

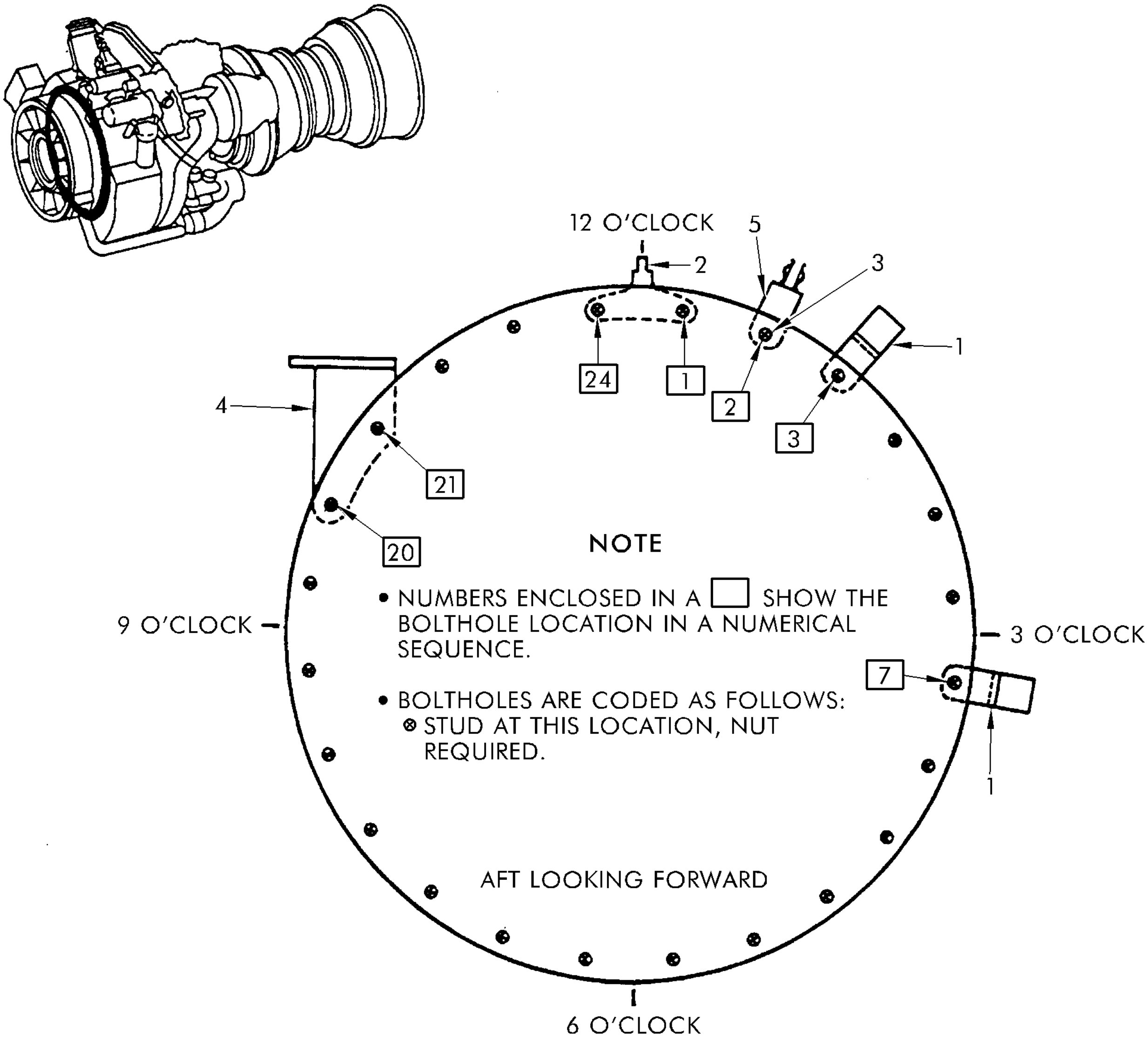
h. Attach sensing tube (18) and secure it with two bolts (17) and bolt (20). Torque bolts to 45-50 inch-pounds.

i. **(T700)** Push green electrical cable and yellow electrical cable into clip supports (1, 5), into forward suspension lug (2), and into clip support on bracket (19).

j. **(T701)** Push green electrical cable and yellow electrical cable into clip supports (1, 5), into forward suspension lug (2A), and into clip support on bracket (19). Push B-sump delta pressure tube into lug (2A).

k. Install history recorder (para 7-22).

l. Make required engine checks listed in table 1-39.



NOTE

- NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLE LOCATION IN A NUMERICAL SEQUENCE.
- BOLTHOLES ARE CODED AS FOLLOWS:
  ⊗ STUD AT THIS LOCATION, NUT REQUIRED.

SWIRL FRAME-TO-MAIN FRAME FLANGE BOLTING DIAGRAM

1. Clip Support (Qty-2)
2. Forward Suspension Lug
3. Locknut (Qty-24)
4. E3 (Green Cable) Connector Bracket
5. Clip Support

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Figure 2-23. *(T700, T701)* ***Swirl Frame; Installation Bolting Diagram***

2-17. (T701C, T701D) Installation of Swirl Frame (AVIM).

a. Install three packings (3, fig. 2-18) on three oil tubes on front frame (5).

b. Install two packings (25) and packing (24) on aft flange of swirl frame (17).

CAUTION

> Packings (3) on front frame (5) can be damaged if swirl frame (17) is not aligned properly with front frame.

c. Aline TOP matchmarks on swirl frame (17) and main frame (6). Install swirl frame onto studs of main frame. Be sure that E3 connector bracket (4) does not interfere with installation of swirl frame.

d. Install 20 self-locking nuts (18) on swirl frame-to-front frame flange. Hand-tighten nuts.

e. Install 13 locknuts (19) on studs of main frame, omitting studs no. 1, 4, 5, 6, 7, 9, 10, 18, 22, 23, and 24 (refer to figure 2-24 for location). Hand-tighten locknuts.

f. Install clip support on studs no. 22 and 23.

g. Install forward suspension lug (21, fig. 2-18) on studs no. 1 and 24.

h. Install E3 connector bracket on studs no. 4 and 5.

i. Install clip support on stud no. 18.

j. Install brackets (12) on studs no. 6, 7, 9, and 10. Hand-tighten locknuts.

k. Install remaining locknuts (19, fig. 2-18) to secure clip supports (20, 22), forward suspension lug (21), and E3 connector bracket (4). Hand-tighten locknuts.

l. Cross-torque 20 self-locking nuts (18) to 145-150 inch-pounds.

m. Cross-torque 24 locknuts (19) to 45-50 inch-pounds.

WARNING

Asbestos

> The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

n. If anti-ice line gasket (PN 3032T42P01 only) (7) is damaged, replace it; if gasket is not damaged, reuse it. Install gasket onto pad of swirl frame (17). Attach anti-icing bleed duct (8), and secure it with four bolts (9).

o. Torque bolts (9) to 45-50 inch-pounds.

p. Insert sensing tube (2) into swirl frame (17). Secure tube with two bolts (1) and bolt (26). Torque bolts (1, 19) to 45-50 inch-pounds.

q. Install green electrical cable, and yellow electrical cable into clip supports (20, 22, 27).

r. Install green electrical cable into clips of forward suspension lug (21).

s. Secure drain lower tube (10) to brackets (12) with bolts (11). Torque bolts to 45-50 inch-pounds.

t. Install two packings (14) onto fitting drain (13) and drain lower tube (10).

u. Install drain lower tube (10) into fitting drain (13). Tighten (15° wrench arc) the fitting in the drain hole of swirl frame (17).

v. Install history counter (para 7-22).

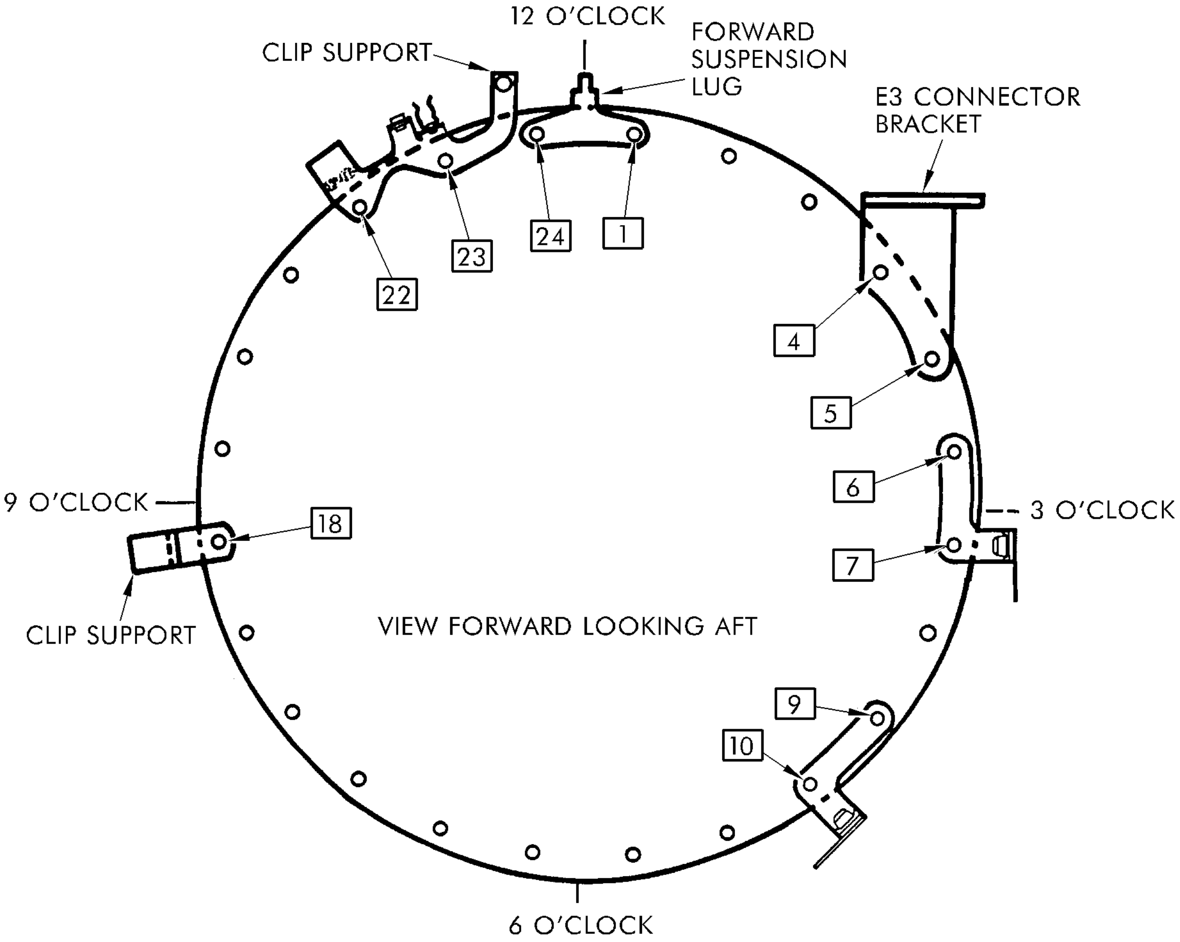
w. Make required engine checks listed in table 1-39.

2-18. A-SUMP OUTPUT SHAFT ASSEMBLY.

2-19. Removal of A-Sump Output Shaft Assembly (AVIM).

a. Remove swirl frame (para 2-8).

b. Remove two screws (1, fig. 2-25).



NOTE
NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLE LOCATION IN A NUMERICAL SEQUENCE.

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Figure 2-24. ***(T701C, T701D)*** ***Swirl Frame; Installation Bolting Diagram***

1. Screw (Qty-2)
2. A-Sump Output Shaft Assembly
3. Jacking Screw Holes (4, 8, and 12 O'clock)
4. Preformed Packing (Qty-3)
5. Preformed Packing
6. Main Frame Flange
7. Front Frame
8. Power Turbine Drive Shaft
9. Preformed Packing

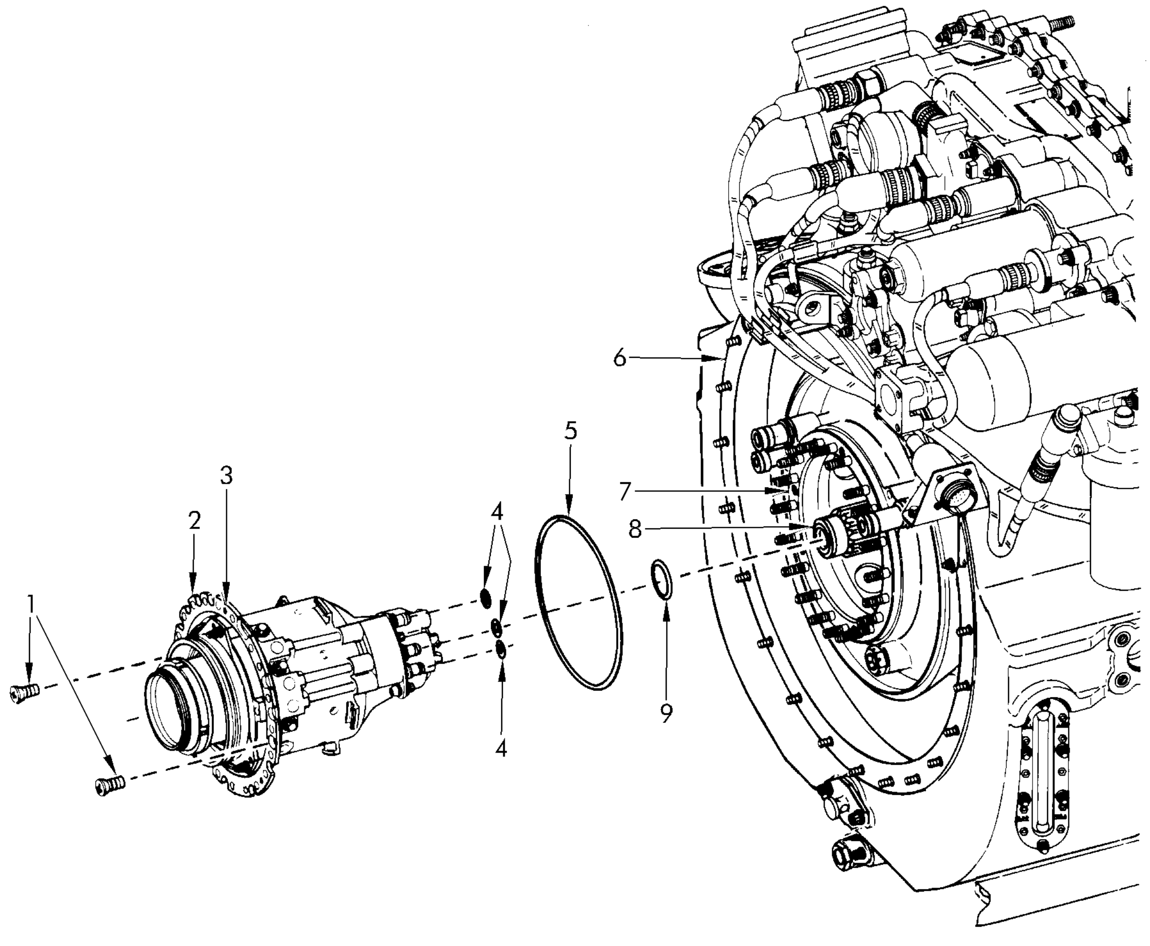

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Figure 2-25. A-Sump Output Shaft Assembly; Removal and Installation

CAUTION

Jacking screws will be installed in output shaft jacking screw holes, not in carbon seal mounting flange.

c. Obtain three bolts (PN J643) (to be used for jacking). Manually thread bolts into jacking screw holes (3) in output shaft until they bottom.

d. Alternately turn each bolt clockwise, 1/4-turn at a time, until assembly can be freely removed.

e. Remove A-sump output shaft assembly (2); then remove bolts used for jacking.

NOTE

Disassembly of the output shaft assembly is not allowed. Therefore, only external packings can be replaced.

f. Remove and discard packings (4, 5) from output shaft assembly.

g. Remove and discard packing (9) from power turbine drive shaft (8).

2-20. Inspection of A-Sump Output Shaft Assembly (AVIM).

See table 2-3.

Table 2-3. Inspection of A-Sump Output Shaft Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. A-sump output shaft assembly (1, fig. 2-26) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace output shaft assembly (para 2-21).
(2) Missing silver plate on splines.	Any amount.	Not applicable.	Not applicable.
(3) Nicks, dents, and scratches (except on spline teeth).	Up to 1/64 inch deep (except 0.005 inch deep maximum on beams), if no more than 1/5 of area is affected. No high metal allowed.	Same as usable limits, with high metal.	Remove high metal and blend to smooth contour.
(4) Loss of black oxide.	Any amount.	Not applicable.	Not applicable.
b. Studs (5) for:			
(1) Damaged threads.	Up to one damaged or missing thread, with no crossed threads or loose material.	Not repairable.	Replace output shaft assembly (para 2-21).
(2) Looseness.	Radial looseness is allowed if there is no axial looseness. Make sure that retainer (Kee) is not loose or missing.	Not repairable.	Replace output shaft assembly (para 2-21).
c. Loose or missing expansion plugs and tapered pins (4).	Not allowed.	Not repairable.	Replace output shaft assembly (para 2-21).

Table 2-3. Inspection of A-Sump Output Shaft Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. A-sump transfer tubes (2) for:			
(1) Nicks, scratches, gouges, chafing, and fretting (except packing groove (3)).	Any amount, up to 0.010 inch deep, without high metal.	Same as usable limits with high metal.	Remove high metal and blend to smooth contour.
(2) Nicks and scratches on floor of packing groove (3).	Any amount, up to 0.003 inch deep, without high metal or sharp edges. Defect must not extend across floor of packing groove (3).	Same as usable limits with high metal or sharp edges.	Carefully store and blend to smooth contour.
(3) Nicks and scratches on walls of packing groove (3).	Any amount, up to 0.010 inch deep, without high metal or sharp edges.	Same as usable limits with high metal or sharp edges.	Carefully stone and blend to smooth contour.

2-21. Installation of A-Sump Output Shaft Assembly (AVIM).

a. Install three packings (4, fig. 2-25) and packing (5) onto A-sump output shaft assembly (2). Install packing (9) onto power turbine drive shaft (8).

b. Aline oil transfer tubes and install output shaft assembly onto front frame (7).

CAUTION

Output shaft assembly will be installed by hand-pressure only. Do not use screws to force output shaft assembly into place. Doing so will damage packings.

c. Be sure that flanges are flush; then install and hand-tighten two screws (1).

d. Install swirl frame (para 2-16).

e. Make required engine checks listed in table 1-39.

2-22. NO. 1 CARBON SEAL.

2-23. Removal of No. 1 Carbon Seal (AVIM).

a. Install no. 1 carbon seal assembly guide 21C7109G01/G02 (7, fig. 2-27) over A-sump output shaft assembly (6).

b. Remove three nuts (1, fig. 2-27).

c. Obtain three bolts (PN J643) (to be used for jacking). Manually thread bolts into mounting flange of no. 1 carbon seal (2).

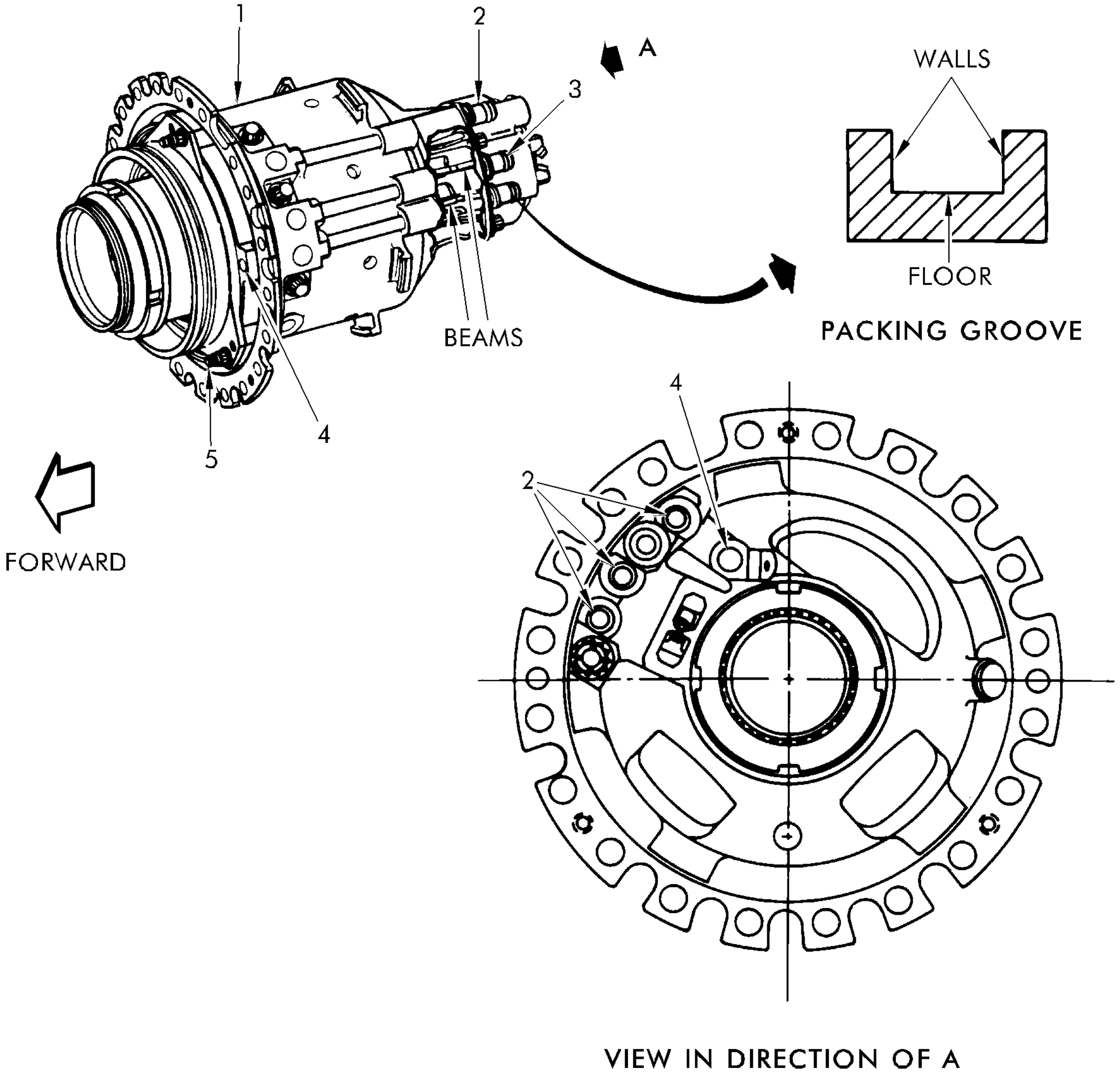
CAUTION

- Do not touch inner surface of carbon seal with your fingers. Skin oil will corrode carbon segments.
- Use care when removing carbon seal so that carbon segments do not contact output shaft locknut. Contact will cause scratches or nicks on carbon segments.

d. Alternately turn each bolt clockwise, one-quarter turn at a time, until seal can be freely removed.

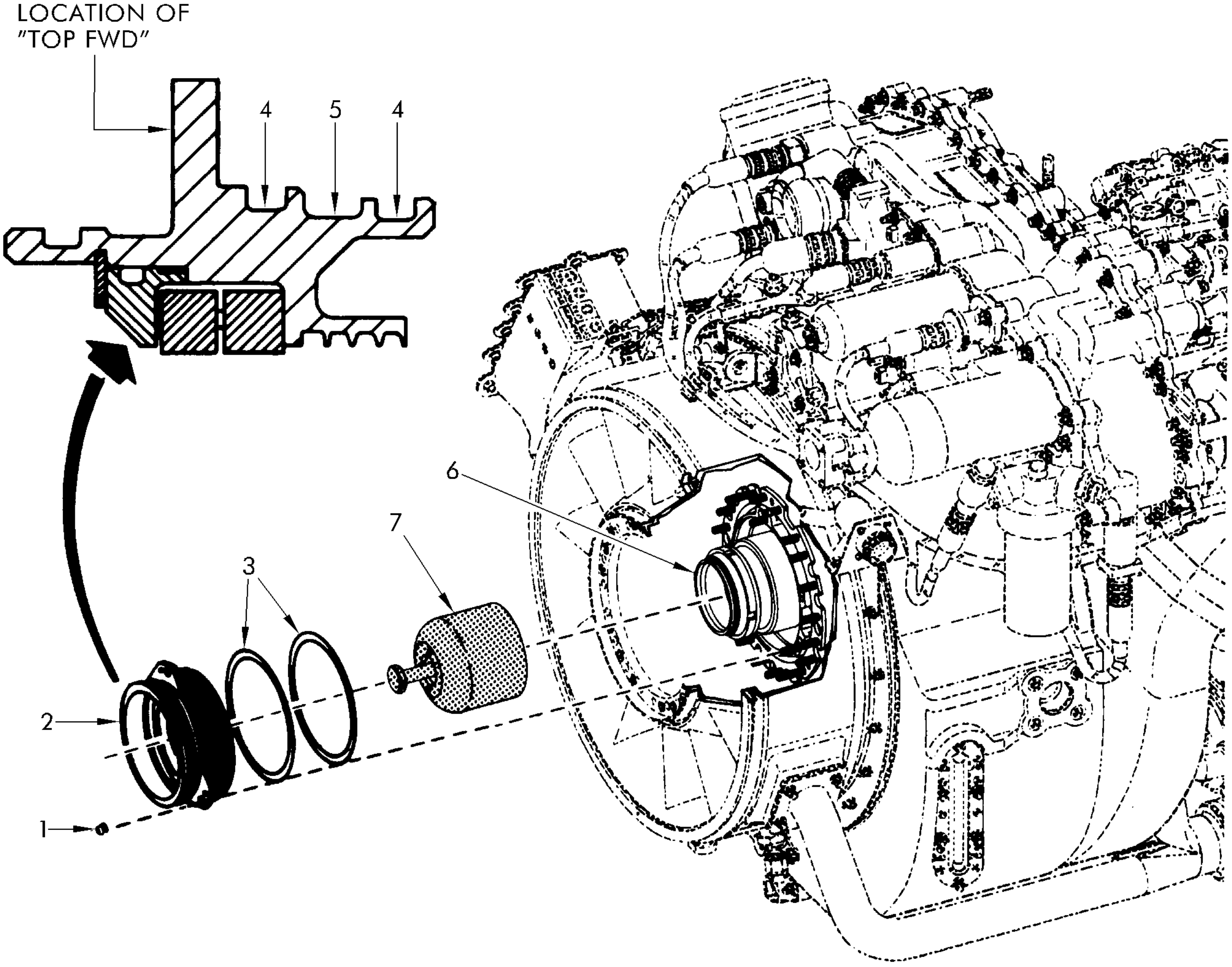
e. Remove seal (2) and then remove bolts used for jacking. Remove and discard two packings (3).

f. Remove guide (7) from output shaft assembly (6).



1. A-Sump Output Shaft Assembly
2. A-Sump Transfer Tube (Qty-3)
3. Packing Groove (3 Places)
4. Expansion Plug and Pin (2 Places)
5. Stud (Qty-3)

Figure 2-26. A-Sump Output Shaft Assembly; Inspection



1. Nut (Qty-3)
2. No. 1 Carbon Seal
3. Preformed Packing (Qty-2)
4. Preformed Packing Groove
5. Seal Pressurization Air Groove
6. A-Sump Output Shaft Assembly
7. No. 1 Carbon Seal Assembly Guide

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Figure 2-27. No. 1 Carbon Seal; Removal and Installation

2-24. Inspection of No. 1 Carbon Seal (AVIM). See table 2-4.

Table 2-4. Inspection of No. 1 Carbon Seal

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
CAUTION The carbon segments of the seal are extremely brittle and are easily damaged.			
a. Carbon seal for:			
(1) Chipped sealing dam (4, fig. 2-28).	Not allowed.	Not repairable.	Replace seal (para 2-25).
(2) Cracks in carbon segments (3).	None allowed.	Not repairable.	Replace seal (para 2-25).
(3) Foreign material imbedded in carbon segments (3).	Not allowed.	Not repairable.	Replace seal (para 2-25).
(4) Chips, other than on sealing dam (4) or axial gaps (7).	Any amount, not over 1/16 inch.	Not repairable.	Replace seal (para 2-25).
(5) Ragged corners.	Any amount.	Not applicable.	Not applicable.
(6) Surface pitting (sandblasted appearance).	Any amount.	Not applicable.	Not applicable.
(7) Scratches in carbon segments (3).	Any number, not over 1/8 inch long.	Not repairable.	Replace seal (para 2-25).
(8) Buildup of coked oil or hard material in:			
(a) Axial grooves (2).	Groove will be at least 0.010 inch deep.	Not repairable.	Replace seal (para 2-25).
(b) Axial gaps (7).	Not allowed.	Not repairable.	Replace seal (para 2-25).
(9) Excessive wear of carbon segments (3).	Dimension from bottom of axial groove (2) to working surface will be at least 0.010 inch.	Not repairable.	Replace seal (para 2-25).
(10) Damage to windback seal threads (4A).	Up to 3 separate dents (0.010 inch deep); chips or missing pieces not allowed.	Not repairable.	Replace seal (para 2-25).

Table 2-4. Inspection of No. 1 Carbon Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Housing (1), retainer (5), and snapring (6) for:			
(1) Nicks, dents, burrs, and scratches.	Any number, 1/64 inch deep on any surface, with no high metal.	Same as usable limits, with high metal.	Remove high metal.
(2) Discoloration, carbon, and varnish deposits.	Any amount.	Not applicable.	Not applicable.
(3) Cracks.	None allowed.	Not repairable.	Replace seal (para 2-25).

2-25. Installation of No. 1 Carbon Seal (AVIM).

CAUTION

- Do not touch inner surface of carbon seal with your fingers. Skin oil will corrode carbon segments.
- Use care when installing carbon seal so that carbon segments do not contact output shaft locknut. Contact will cause scratches or nicks on carbon segments.
- Make sure packings are installed in packing grooves (4, fig. 2-27), not in middle groove.

a. Install no. 1 carbon seal assembly guide 21C7109G01/G02 (7, fig. 2-27) over output shaft assembly (6).

b. Install two packings (3) in grooves (4).

c. Install no. 1 carbon seal (2) with the words TOP FWD at 12 o'clock position.

d. Slide carbon seal (2) over assembly guide (7). Push seal until it engages studs.

e. Install three nuts (1). Tighten nuts equally, 1/4-turn at a time, until carbon seal is seated. Torque nuts to 45-50 inch-pounds.

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

2-26. POWER TAKEOFF DRIVE ASSEMBLY.

2-27. Removal of Power Takeoff Drive Assembly (AVIM).

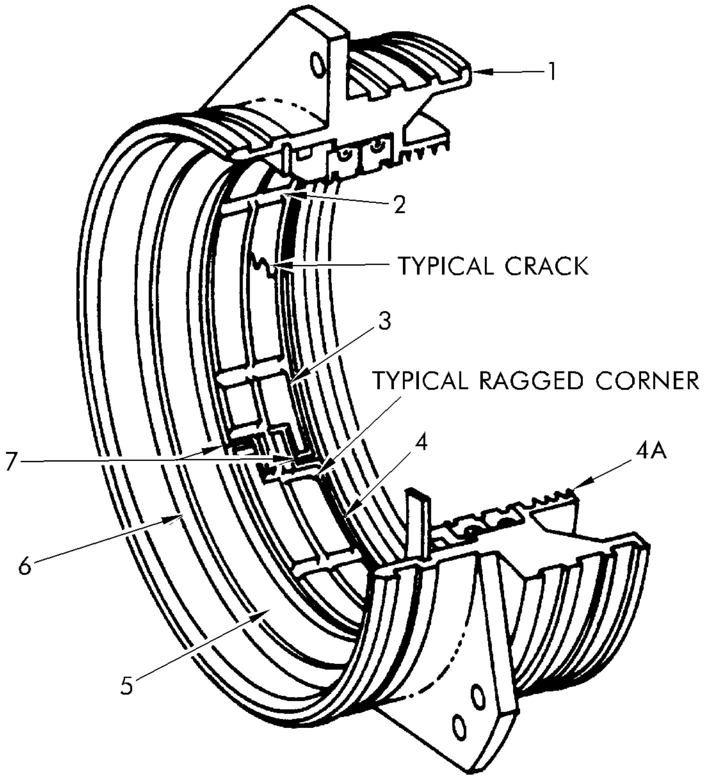
a. Remove swirl frame (para 2-8).

b. Remove A-sump output shaft assembly (para 2-19).

c. Remove radial drive shaft assembly (para 5-38).

d. Remove four nuts (fig. 2-29).

e. Remove power takeoff drive assembly and place it in a clean container.



1. Housing
2. Axial Groove
3. Carbon Segment
4. Sealing Dam
4A. Windback Seal Threads
5. Retainer
6. Snapring
7. Axial Gaps

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Figure 2-28. No. 1 Carbon Seal; Inspection

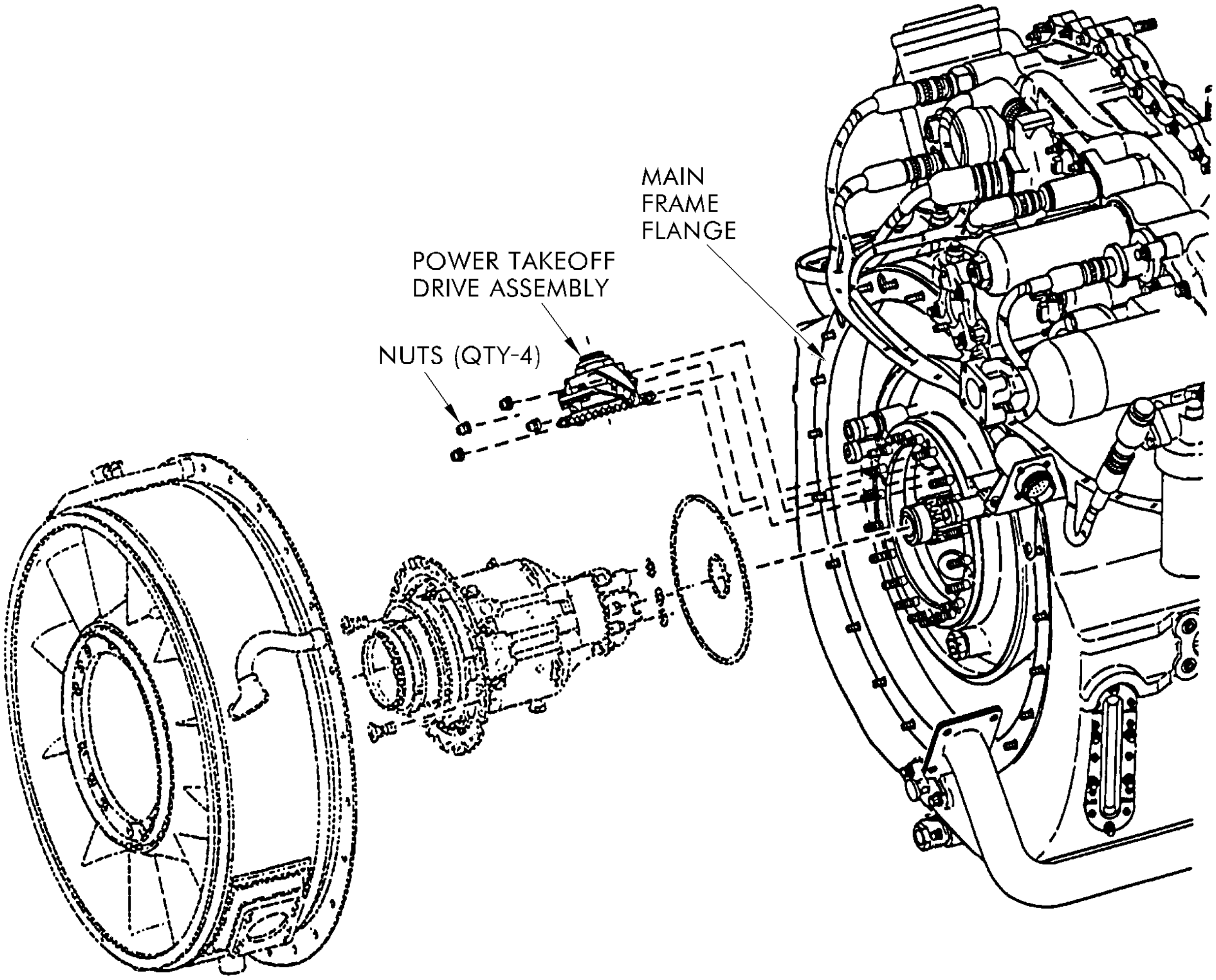


Figure 2-29. Power Takeoff Drive Assembly; Removal and Installation

2-28. Inspection of Power Takeoff Drive Assembly (AVIM). See table 2-5.

Table 2-5. Inspection of Power Takeoff Drive Assembly

WARNING

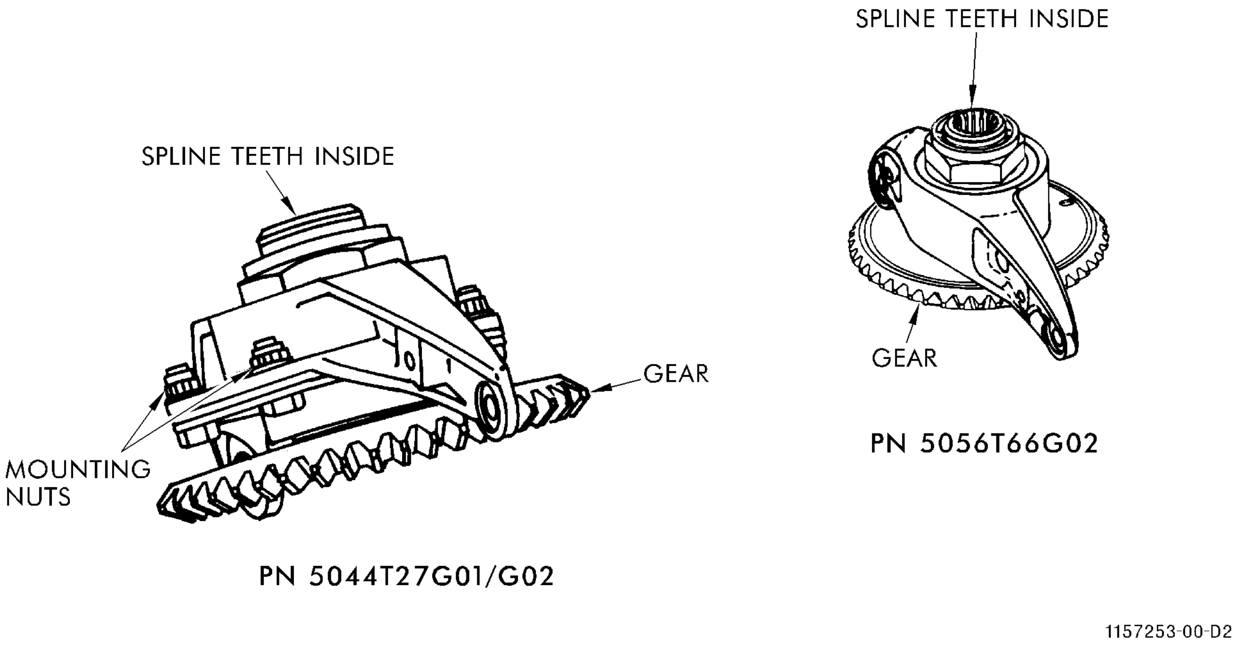
Flight Safety Critical Aircraft Part (Critical Characteristic(s))

Installation of damping ring on bevel gear is a critical characteristic. Refer to step e, in table 2-5.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Power takeoff drive assembly (fig. 2-30) for cracks.	None allowed.	Not repairable.	Replace drive assembly (para 2-29).
b. Body for nicks, dents, and scratches.	Any number, 1/64 inch deep, without sharp edges or high metal.	Same as usable limits, with sharp edges and high metal.	Blend smooth.
c. Gear and spline teeth for:			
(1) Missing silver (on gear teeth).	Any amount.	Not applicable.	Not applicable.
(2) Nicks, burrs, and scratches on:			
(a) Face of teeth.	None allowed.	Not repairable.	Replace drive assembly (para 2-29).
(b) Other areas.	Any number, 1/64 inch deep, without high metal.	Same as usable limits with high metal.	Blend high metal by hand, using a fine stone (item 104, Appendix D).
(3) Wear.	Smooth finish without evidence of scoring.	Same as usable limits, with evidence of scoring.	Blend high metal by hand, using a fine stone (item 104, Appendix D).
(4) Spalling or flaking.	Not allowed.	Not repairable.	Replace drive assembly (para 2-29).
d. Gear for loss of black oxide.	Any amount.	Not applicable.	Not applicable.
e. Gear for installation of damping ring.	Not applicable.	Not repairable.	Replace drive assembly (para 2-29).

Table 2-5. Inspection of Power Takeoff Drive Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
CAUTION Mounting nuts must not be loosened.			
f. If power takeoff drive assembly has three mounting nuts present, inspect the mounting nuts for tightness.	60 inch-pounds minimum.	Any amount of looseness.	Torque nuts to 60-65 inch-pounds in tightening direction only. Do not loosen nuts.



PN 5044T27G01/G02

PN 5056T66G02

Figure 2-30. Power Takeoff Drive Assembly; Inspection

2-29. Installation of Power Takeoff Drive Assembly (AVIM).

WARNING

Flight Safety Critical Aircraft Part (Critical Characteristic(s))

Installation of damping ring on bevel gear is a critical characteristic. Refer to step e, in table 2-5.

CAUTION

Be sure alinement pins on front frame mounting flange are engaged with holes in power takeoff drive assembly.

a. Install power takeoff drive assembly (fig. 2-29). Check alinement of pins. Be sure they have engaged and that gears are meshed with compressor rotor bevel gear.

CAUTION

Follow this procedure to be sure that drive assembly is seated properly.

b. Install and torque nuts as follows:

(1) Install four nuts and note run-on torque.

(2) Torque nuts to 70-75 inch-pounds.

(3) Loosen nut and retighten them, checking run-on torque. Run-on torque should be 4-18 inch-pounds. If run-on torque is not met, replace nut with a new locknut.

(4) Retorque nuts to 55-60 inch-pounds.

c. Install radial drive shaft assembly (para 5-41).

d. Install A-sump output shaft assembly (para 2-21).

e. Install swirl frame (para 2-16).

f. Make required engine checks listed in table 1-39.

2-30. OIL INLET AND SCAVENGE TUBES.

2-31. Removal of Oil Inlet and Scavenge Tubes (AVIM). Removal of oil inlet and scavenge tubes is not required unless max repairable limits of table 2-6 are exceeded.

a. Remove swirl frame (para 2-9).

b. Remove two locknuts (1, fig. 2-31).

c. Remove retainers (2, 7).

d. Pull out two scavenge tubes (4) and oil inlet tube (6).

e. Remove and discard packings (3, 5).

2-32. Inspection of Oil Inlet and Scavenge Tubes (AVIM). See table 2-6.

Table 2-6. Inspection of Oil Inlet and Scavenge Tubes

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil inlet and scavenge tubes (6, 4, fig. 2-31) for:			

NOTE

Normal inspection of the inlet and scavenge tubes is made with the tubes installed.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Burrs on corners of packing groove.	None allowed.	Any amount.	Blend to adjacent contour.
b. Nicks and scratches.	Any number, 0.002 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.

1. Locknut (Qty-2)
2. Retainer
3. Preformed Packing
4. Scavenge Tube (Qty-2)
5. Preformed Packing (Qty-2)
6. Oil Inlet Tube
7. Retainer
8. Front Frame

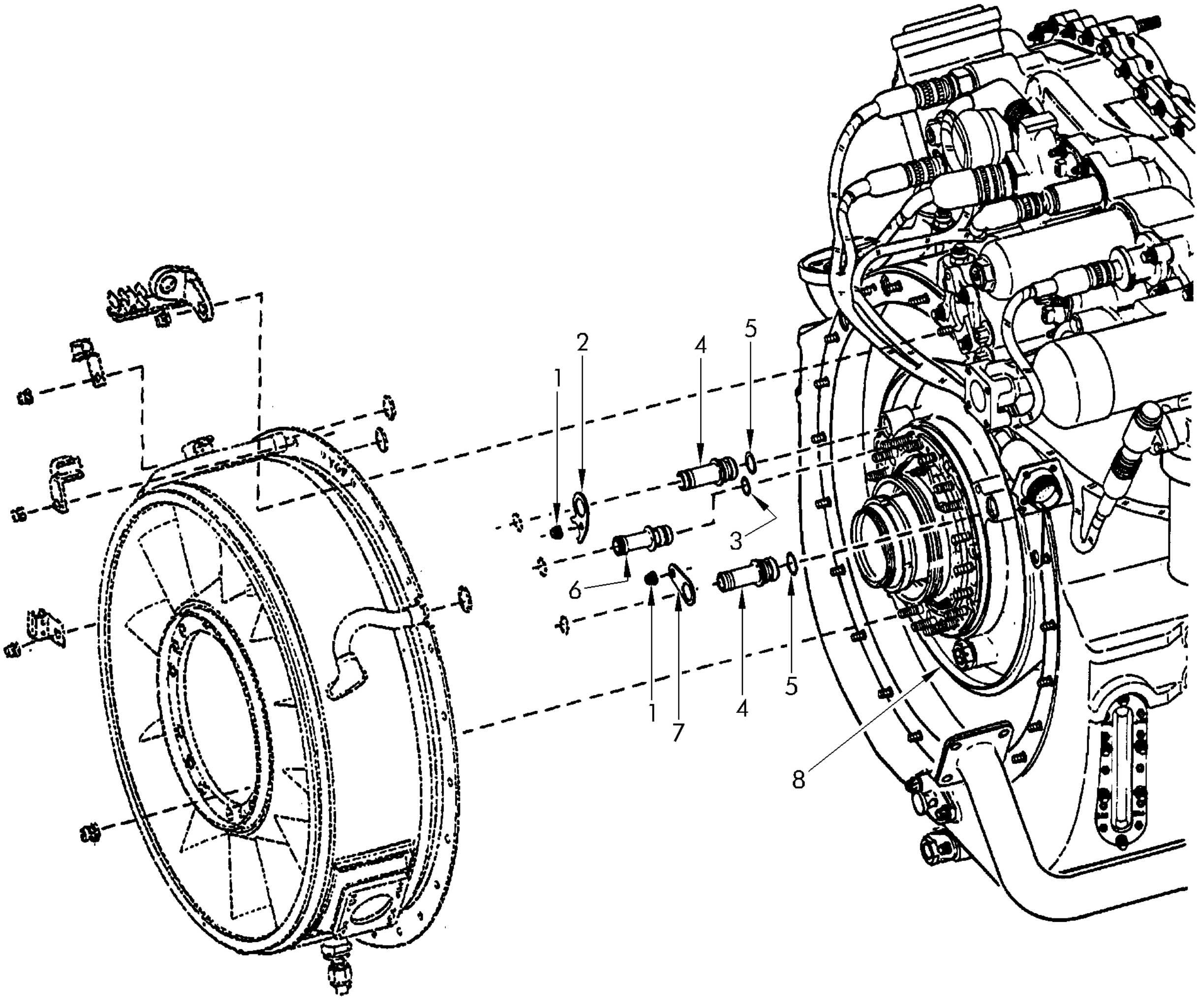


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Figure 2-31. Oil Inlet and Scavenge Tubes; Removal, Inspection, and Installation

2-33. Installation of Oil Inlet and Scavenge Tubes (AVIM).

a. Install packing (5, fig. 2-31) onto aft end of each scavenge tube (4). Install packing (3) onto aft end of oil inlet tube (6).

b. Push tubes into front frame (8).

c. Install retainers (2, 7).

d. Install two locknuts (1). Torque nuts to 45-50 inch-pounds.

e. Install swirl frame (para 2-16).

f. Make required engine checks listed in table 1-39.

2-34. FRONT FRAME.

2-35. Inspection of Front Frame (AVIM). See table 2-7. Inspection of the swirl frame (table 2-2) and the front frame is done at the same time.

2-36. Repair of Front Frame (AVIM). Repair of front frame is limited to that described in Corrective Action column of table 2-7.

Table 2-7. Inspection of Front Frame

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
All visible areas of front frame (fig. 2-32) for:			
a. Cracks.	None allowed.	Not repairable.	Replace cold section module.
	CAUTION If all oil ports are not covered before blending front frame, chips and debris will enter and contaminate oil system passages.		
b. Corrosion pits.	Not allowed.	Up to 1/64 inch deep, over 10% of area, with no more than 2% in any one location.	Blend pits. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
c. Nicks, dents, and scratches.	Any number, 1/32 inch deep, without high metal.	Same as usable limit, with high metal.	Blend high metal. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
d. Damaged studs and inserts.	See Inspection of Studs and Threaded Inserts (para H-27, Appendix H).		

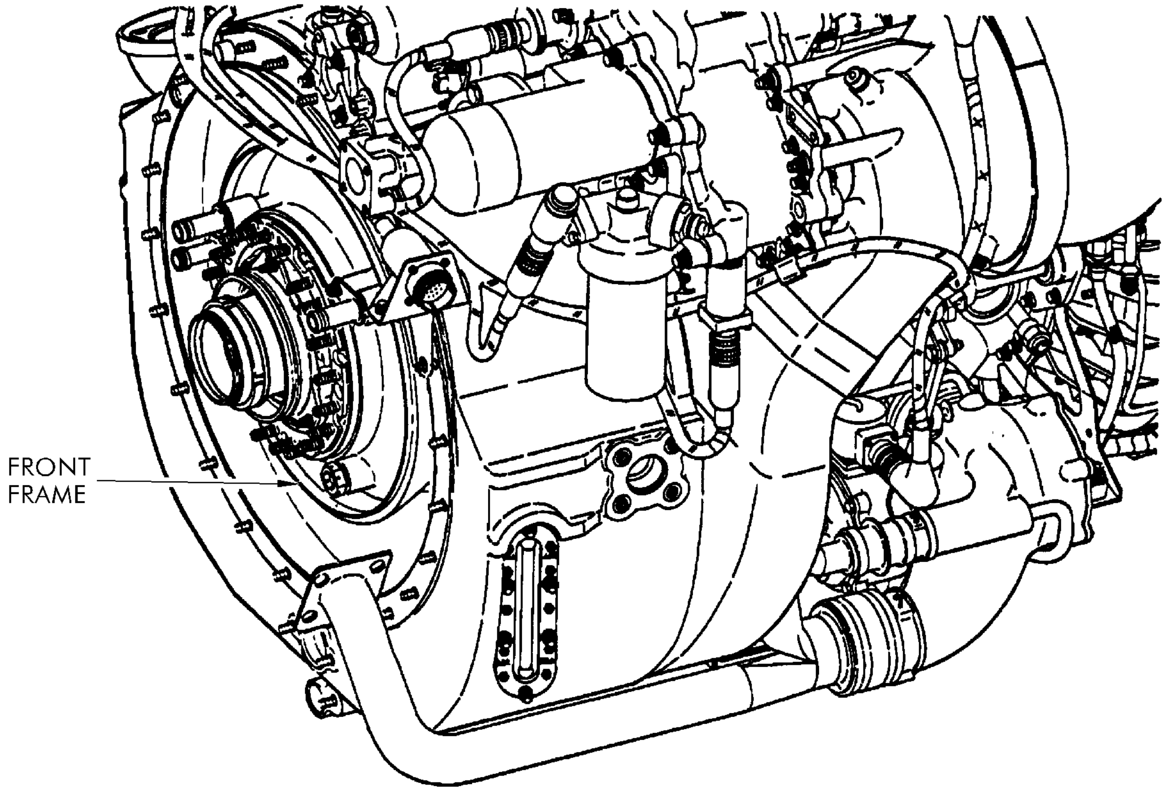

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Figure 2-32. Front Frame; Inspection

2-37. MAIN FRAME.

2-38. Inspection of Main Frame - Preliminary Instructions.

a. Some areas of the main frame will not be accessible except when swirl frame and accessory gearbox are removed. See Chapter 8 for inspection data for the following parts attached to the main frame.

- Oil tank cap and adapter (para 2-83)
- Oil drain plug (para 8-123)
- Oil level indicator (para 8-115)
- Main frame oil strainer (para 8-111)
- Oil transfer sleeves (para 8-119)
- Oil drain insert (para 8-127)

b. See table 2-6 for inspection data for oil inlet and scavenge tubes.

2-39. Inspection of Main Frame. See table 2-8.

Table 2-8. Inspection of Main Frame

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Casing (3, fig. 2-33) for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

CAUTION

If all oil ports are not covered before blending main frame parts, chips and debris will enter and contaminate oil system passages.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Corrosion pits.	Not allowed.	Any number, up to 1/32 inch deep, with no more than 25% of surface area affected.	Blend defect to adjacent contour. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
(3) Nicks, dents, scratches, and gouges.	Any number, up to 0.035 inch deep x 1.00 inch long x 0.100 inch wide, without high metal or sharp corners.	Same as usable limits, with high metal and sharp corners.	Blend high metal to adjacent contour. Blend sharp corners no smaller than 1/16 inch. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).

NOTE

It is acceptable if the channel nut is broken and has fallen into the cavity inside the flange.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Broken bolt on front frame/main frame aft flange.	None allowed.	Two bolts provided they are separated by at least one intact bolt.	Repair broken bolt (para 2-40).
(5) Chafing.	Any number, up to 1/32 inch deep.	Same as usable limits	Blend metal to adjacent contour. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).

Table 2-8. Inspection of Main Frame (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Right-hand oil level indicator pad/sight glass web (11) for:			
(1) Cracks.	None allowed.	Any amount.	Blend defect to adjacent contour. (Web may be entirely removed until adjacent contour is met.)
(2) Dents or bends.	Any amount that does not interfere with assembly of common drain or oil level indicator (12).	Any amount.	Blend defect to adjacent contour. (Web may be entirely removed until adjacent contour is met.) Touch up area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
c. AVIM: Accessory gearbox mounting pad (1, 5) for:			
(1) Defective studs.	See Inspection of Studs and Threaded Inserts (para H-27, Appendix H).		
(2) Nicks, scratches, and burrs in packing grooves (10).	Any number of nicks and scratches, up to 0.005 inch deep, without high metal. Burrs are not allowed.	Any number that can be reworked to usable limits.	Blend burrs and high metal to adjacent contour. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
(3) Nicks and scratches in other areas.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
d. AVIM: Locating pin (2):			
(1) For nicks.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour without making a flat on the pin. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).
(2) Bent or missing.	Not allowed.	Not repairable.	Replace pin.

Table 2-8. Inspection of Main Frame (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
e. AVIM: Studs and inserts for damage.	See Inspection of Studs and Threaded Inserts (para H-27, Appendix H).		
f. AVIM: Oil drain pad (6) and oil strainer pad (7) for nicks, burrs, and scratches.	Any number, up to 1/32 inch deep with high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour. Touch up blended area with Alodine 1200S (item 4, Appendix D) (para H-30, Appendix H).

2-40. Repair of Main Frame (AVIM).

NOTE

It is acceptable if the channel nut is broken and has fallen into the cavity inside the flange.

a. This repair seals the broken bolthole in the front frame/main frame aft flange (IGV case).

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

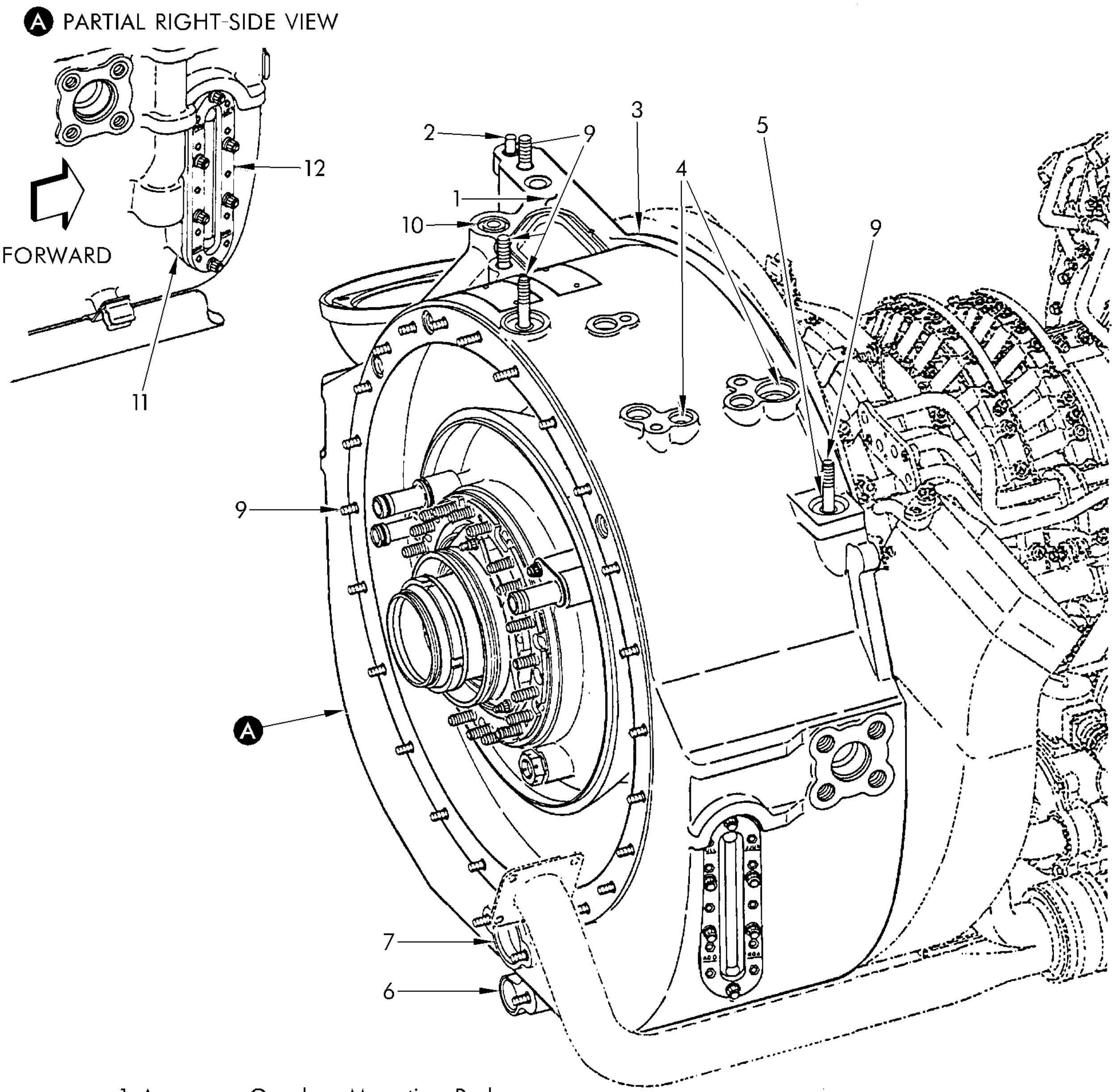
b. Using dry, filtered, compressed air, blow out any debris from bolthole.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

c. Using a towel (item 112, Appendix D) soaked with isopropyl alcohol (item 3, Appendix D), clean broken bolthole and surrounding area.



1. Accessory Gearbox Mounting Pad
2. Locating Pin
3. Casing
4. Oil Supply and Scavenge Ports
5. Accessory Gearbox Mounting Pad
6. Oil Drain Pad
7. Oil Strainer Pad
8. (Deleted)
9. Studs
10. Packing Groove
11. RH Oil Level Indicator Pad/Sight Glass Web
12. RH Oil Level Indicator
13. (Deleted)

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Figure 2-33. Main Frame; Inspection

WARNING

RTV-162 Silicone Rubber
Adhesive/Sealant
MIL-A-46146A

- Wear approved gloves and goggles/face shield.
- Vapors released during curing are combustible. Do not use near open flames, near welding areas, or on hot surfaces.
- Do not breathe vapors. Use in a well-ventilated area.
- Repeated inhalation of vapor can cause mild respiratory irritation.
- If any vapor contacts eyes, immediately flush affected area thoroughly with water for at least 15 minutes and get medical attention if irritation persists.
- Do not ingest. May be harmful if swallowed.
- In case of ingestion, do not induce vomiting. Slowly dilute using 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
- In case of skin contact, remove material completely with dry cloth or paper towel before washing with detergent and water. After contact, hands and skin should be washed before eating, drinking, or smoking. Skin irritation is not expected, but may occur in certain sensitive individuals.

WARNING

RTV-3145 Adhesive/Sealant
Potting Compound

- In case of skin contact, flush contacted area with water. After contact, hands and skin should be washed before eating, drinking, or smoking.
- Eye protection should be worn when working with this material. If liquid contacts eyes, flush eyes thoroughly with water for 15 minutes.
- If prolonged contact with vapor is likely, wear approved respirator.

NOTE

Use of RTV-3145 (gray) is optional.

d. If compressor case half is removed, use RTV-162 or RTV-3145 (gray) (item 96 or item 97, Appendix D), and fill broken bolthole. Be sure RTV is below the surface of the flange to allow proper seating of compressor stator.

e. Install case half, or if case half was not removed, clean (steps b and c) then, fill broken bolthole with RTV-162 or RTV-3145 (gray) (item 96 or item 97, Appendix D). Make sure RTV is flush with compressor case flange.

f. Allow RTV to cure for a minimum of 30 minutes.

g. If shrinkage occurs, apply additional RTV and allow to dry for 30 minutes.

2-41. MAIN FRAME BORESCOPE PLUG.

a. **(T700)** See appropriate steps in paragraph 1-177 or 1-185 for removal and installation instructions.

b. **(T701, T701C, T701D)** See appropriate steps in paragraph 1-180 for removal and installation instructions.

c. See appropriate steps in paragraph 1-188, 1-193, or 1-198 for removal and installation instructions.

d. See paragraph 1-183 for inspection requirements.

2-42. SCROLL CASE.

2-43. Inspection of Scroll Case. See table 2-9.

Table 2-9. Inspection of Scroll Case

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Scroll case (fig. 2-34) for:			
a. Cracks (visible breaks or holes in case).	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
b. Dents.	Up to 1/4 inch from original contour.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
c. Discoloration.	Any amount.	Not applicable.	Not applicable.
d. Missing rivets or brackets.	Not allowed.	Not applicable.	AVUM: Replace engine. AVIM: Replace cold section module.
e. Damaged threads on studs.	Up to two threads damaged, without high metal or crossed threads.	Same as usable limits, with high metal.	Remove high metal.
f. Scratches and nicks.	Any number, up to 1/32 inch deep.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
g. Debris inside scroll.	Not allowed.	Any amount.	Remove ECU or DEC (para 7-12) and clean out debris.
h. Tears on scroll:			
(1) Between boltholes.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Extending from boltholes to inside edge of scroll.	Any amount if there is no danger of a piece falling out.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
i. Delaminations on:			
(1) Scroll body and saddle.	Less than 3/8 inch diameter, not closer than 1/2 inch from any edge, not closer than 1 inch from another delamination, not more than 2 square inches total.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) T2 sensor holster.	For fiberglass surrounding intake tube, not to exceed 30% of total area of fiberglass around tube. For remainder of holster assembly, same as scroll body.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

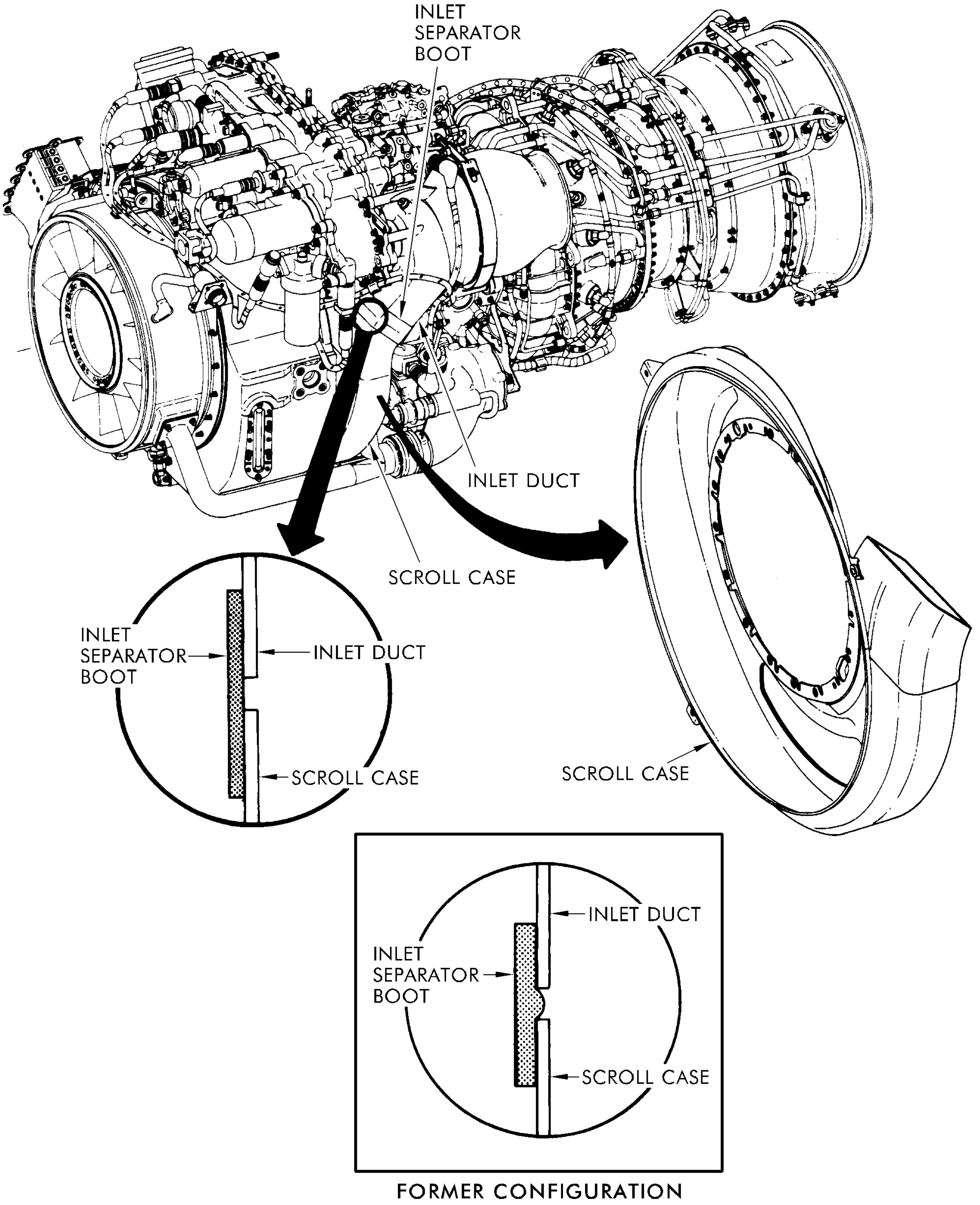

Figure 2-34. Scroll Case; Inspection

2-44. INLET SEPARATOR BOOT.

2-45. Removal of Inlet Separator Boot. If inlet separator boot (fig. 2-34) is being replaced, tear old boot to remove it.

2-46. Inspection of Inlet Separator Boot.

CAUTION

Do not use sharp tool to push boot through opening.

See table 2-10. If boot is going to be reused, slide it through opening between inlet duct and scroll case.

Table 2-10. Inspection of Inlet Separator Boot

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Inlet separator boot (fig. 2-35) for:			
a. Tears.	1/4 inch maximum length from one edge or extending from both sides towards center.	Not repairable.	Replace boot.
b. Decay.	Not enough to cause cracks when boot is stretched.	Not repairable.	Replace boot.

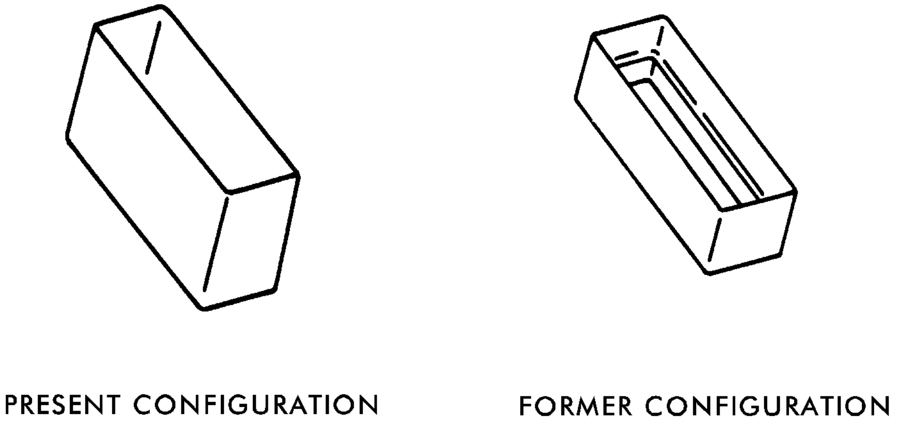

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Figure 2-35. Inlet Separator Boot; Inspection

2-47. Installation of Inlet Separator Boot.

CAUTION

Do not use sharp tool to push boot through opening.

a. Slide boot through opening between inlet duct and scroll case (fig. 2-34).

b. Place boot with enlarged section in opening between inlet duct and scroll case.

c. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

2-48. INLET GUIDE VANE ACTUATING RING.

2-49. Inspection of Inlet Guide Vane (IGV) Actuating Ring. See table 2-11.

Table 2-11. Inspection of Inlet Guide Vane (IGV) Actuating Ring

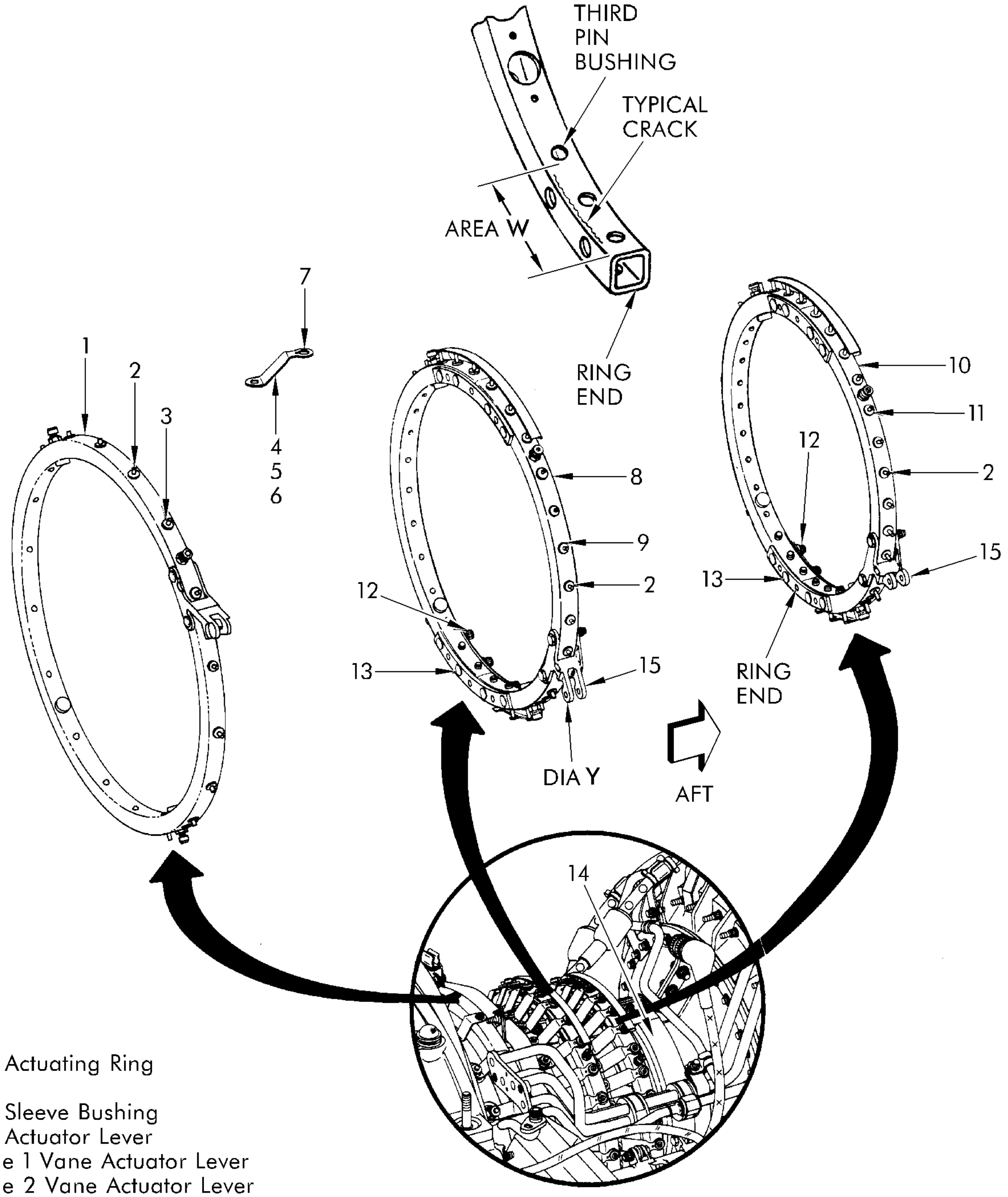
Inspect	Usable Limits	Max Repairable Limits	Corrective Action
IGV actuating ring (1, fig. 2-36) for:			
a. Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
b. Missing pins (2).	Not allowed.	Pins not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
c. Bent parts, noted visually.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

2-50. INLET GUIDE VANE ACTUATOR LEVERS.

2-51. Inspection of Inlet Guide Vane (IGV) Actuator Levers. See table 2-12.

Table 2-12. Inspection of Inlet Guide Vane (IGV) Actuator Levers

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. IGV actuator levers (4, fig. 2-36) for:			
(1) Cracks in metal.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Cracks in race (7).	One crack per lever.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(3) Dents and bends.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
b. IGV sleeve bushing (3) for:			
(1) Axial cracks.	Any number.	Not applicable.	Not applicable.
(2) Missing bushing face segments.	No more than 25% of any face may be missing.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.



1. IGV Actuating Ring
2. Pin
3. IGV Sleeve Bushing
4. IGV Actuator Lever
5. Stage 1 Vane Actuator Lever
6. Stage 2 Vane Actuator Lever
7. Race
8. Stage 1 Vane Actuating Ring
9. Stage 1 Sleeve Bushing
10. Stage 2 Vane Actuating Ring
11. Stage 2 Sleeve Bushing
12. Nut
13. Bolt
14. Compressor Case
15. Clevis

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Figure 2-36. Cold Section Module Parts; Inspection

2-52. COMPRESSOR CASE.

2-53. Inspection of Compressor Case. See table 2-13.

Table 2-13. Inspection of Compressor Case

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Left and right-hand compressor case halves (17, 15, fig. 2-3, sheet 2) for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks, dents, and scratches on:			
(a) Flanges of nonmating surfaces.	Any number, a maximum of 1/16 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
(b) AVIM: Flanges of mating surfaces (case half removed).	Any number, a maximum of 1/16 inch deep, provided less than 25% of flange width is undamaged.	Same as usable limits with high metal.	Blend high metal.
(c) Sealing surface on stage 4 bleed air tube (19).	Any amount, provided there is no leakage or high metal.	Same as usable limits with high metal.	Blend high metal.
(d) Other areas.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
b. Flowpath coating (during borescoping or with case half removed) for:			
(1) Chips, scrapes, scratches, or missing coating at edges, splitlines, flanges or near variable vanes.	Any amount without high metal, provided engine performance is acceptable.	Same as usable limits with high metal.	AVUM: Replace engine. AVIM: Remove right hand case half (para 2-5), and blend high metal, or replace cold section module.
(2) Delamination, flaking, or loose material.	Any amount, provided engine performance is acceptable.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

Table 2-13. Inspection of Compressor Case (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Blade rubs and grooves.	Any amount without high metal, provided engine performance is acceptable and grooves in blade rub path do not penetrate parent metal.	Same as usable limits with high metal.	AVUM: Replace engine. AVIM: Remove right-hand case half (para 2-5), and blend high metal, or replace cold section module.
c. Coupling nut (18) (right-hand case only) for damaged threads.	No high metal or damaged threads that would cause mating to be difficult.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
d. Flange boltholes (fig. 2-37) for damage or wear on:			
(1) Diameter A.	0.1923-0.1928 inch maximum, without high metal.	Same as usable limits with high metal.	Assemble case halves, using bolts in holes that have met usable limits. Ream holes that have high metal. Do not exceed usable limits when reaming.
(2) Diameter B.	0.202-0.208 inch maximum, without high metal.	Same as usable limit with high metal.	Assemble case halves, using bolts in holes that have met usable limits. Ream holes that have high metal. Do not exceed usable limits when reaming.
(3) Diameter C.	0.2523-0.2528 inch maximum, without high metal.	Same as usable limits with high metal.	Assemble case halves, using bolts in holes that have met usable limits. Ream holes that have high metal. Do not exceed usable limits when reaming.
(4) Diameter D.	0.256-0.272 inch maximum, without high metal.	Same as usable limit, with high metal.	Assemble case halves, using bolts in holes that have met usable limits. Ream holes that have high metal. Do not exceed usable limits when reaming.
e. Heat discoloration spots (bluing) on outside surface.	Any amount if bluing can be removed with abrasive cloth P-C-451.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
f. Stator assembly vanes (fig. 2-37) for:			
(1) Cracks not due to FOD.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

Table 2-13. Inspection of Compressor Case (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Erosion:			
(a) Leading edge.	Leading edge may be roughened but not peened over. Chord reduction shall be within limits specified on sheet 1 for stage 1 or sheet 2 for stages 3, 4, or 5.	Any amount of peened-over material which can be removed within limits specified on sheets 1 and 2.	Remove peened-over edges only, using abrasive cloth P-C-451, or a fine stone SSS-S-736. Do not attempt to completely smooth leading edge.
(b) Trailing edge.	Any amount. Chord reduction must be within limits given in sheet 1 for stage 1 or sheet 2 for stages 3, 4, or 5.	Not repairable.	Replace sector.
(3) All other areas for cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(4) Critical areas for nicks, dents, pits, and scratches on concave and convex surfaces.	Any number, 0.005 inch maximum depth.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(5) Noncritical areas of vanes for:			
(a) Nicks, pits, and scratches on concave and convex surfaces.	Any number, 0.010 inch deep, without high metal.	Any number in leading and trailing edges that can be blended to limits specified on sheets 1, 2, and 3.	Blend high metal.

NOTE

Blending is allowed in critical areas of trailing edge only.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) Nicks, pits, and scratches in leading and trailing edges.	Any number, 0.010 inch deep, without high metal.	Any number in leading and trailing edges that can be blended within limits given in sheets 1 or 2.	Replace sector.

NOTE

Blending is allowed in critical areas of trailing edge only.

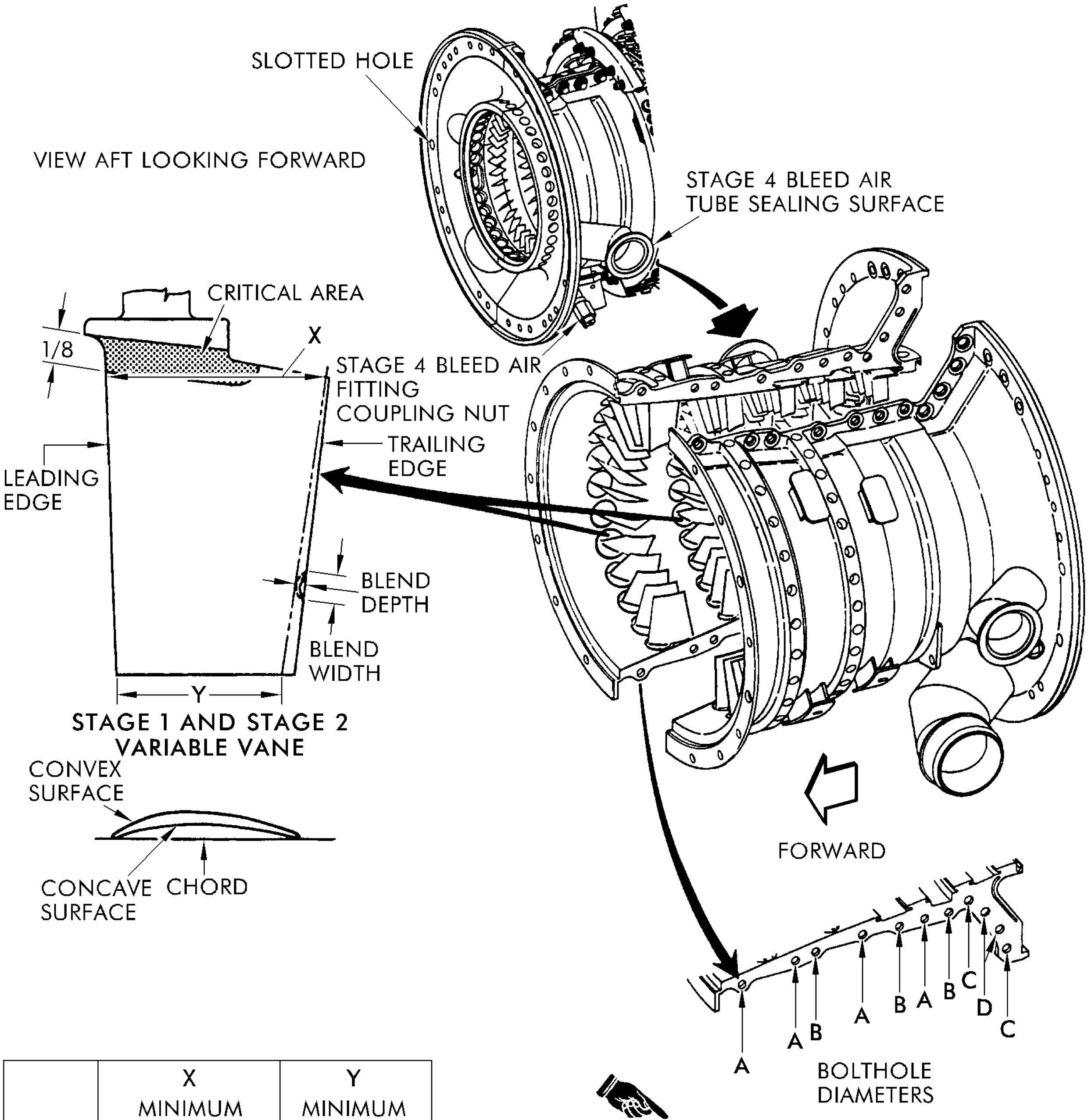
Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(c) Dents and bends in leading and trailing edges.	Any number, 0.020 inch deep.	Any number that can be blended to limits specified on sheets 1, 2, and 3.	Blend high metal.

Table 2-13. Inspection of Compressor Case (Cont)

NOTE

Blending is allowed in critical areas of trailing edge only.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(d) Dents and bends in other noncritical areas.	Any number, 0.020 inch deep.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(e) Damaged tip corners.	Not allowed.	Any amount that can be repaired within limits specified on sheet 3.	Blend tip corners within limits specified on sheet 3.
(6) Dents and bends on concave and convex surfaces.	Any number, 0.020 inch deep.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(7) Cracks, gaps and porosity in brazed joints.	Any amount, any size; maximum cumulative length, 25% of joint length.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.



STAGE	X MINIMUM ROOT CHORD	Y MINIMUM TIP CHORD
1	1.020	0.760
2	0.750	0.580

NOTE

- DO NOT BLEND IN CRITICAL (SHADED) AREA EXCEPT AT TRAILING EDGE.
- BLENDED WIDTH IN ROOT HALF SHALL BE AT LEAST THREE TIMES BLENDED DEPTH.

ALL DIMENSIONS ARE IN INCHES

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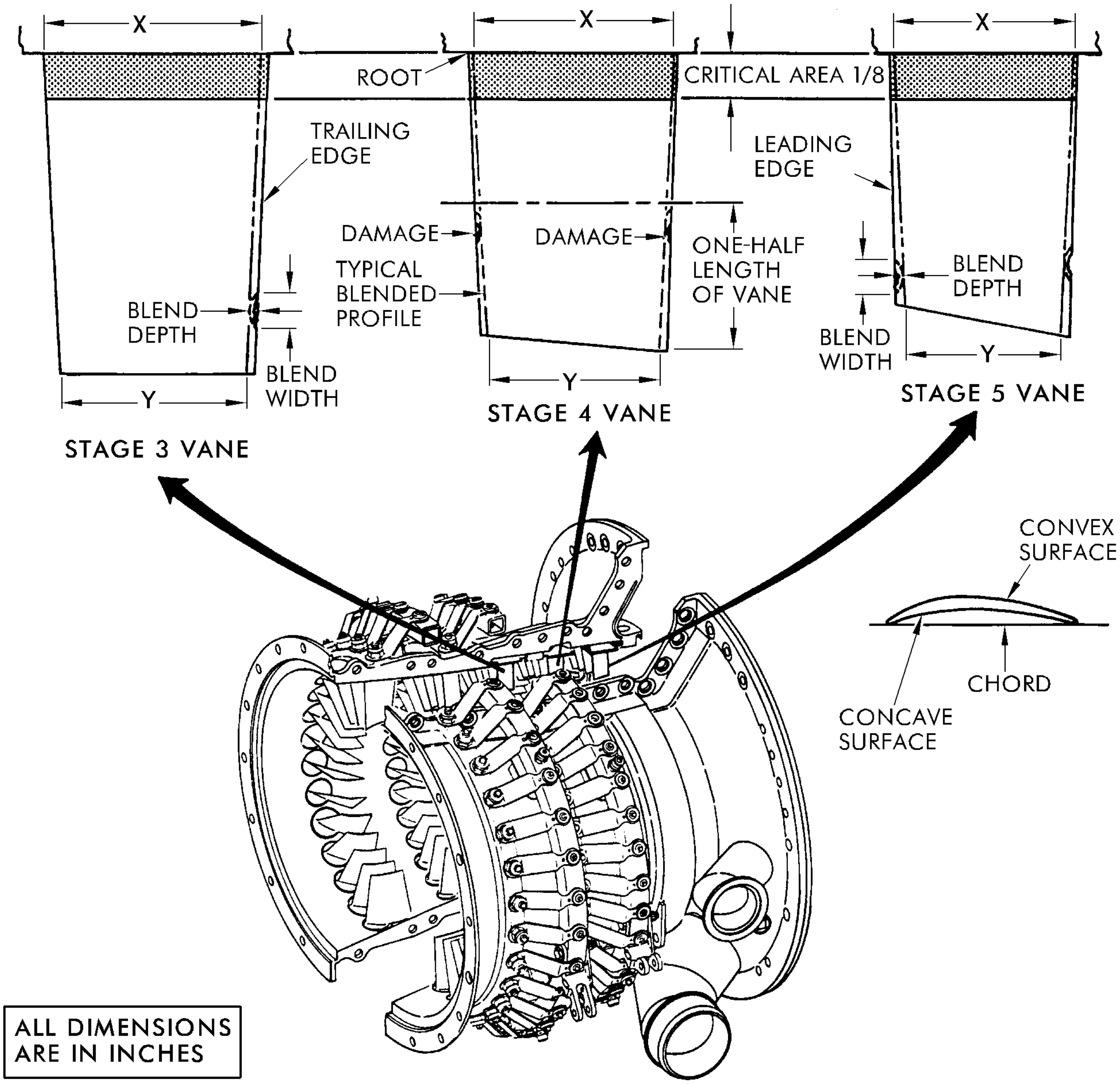
Figure 2-37. Compressor Stator Assembly; Inspection (Sheet 1 of 3)



ALL DIMENSIONS ARE IN INCHES

STAGE	X MINIMUM ROOT CHORD	Y MINIMUM TIP CHORD
3	0.600	0.480
4	0.560	0.480
5	0.510	0.430

NOTE

- DO NOT BLEND IN CRITICAL (SHADED) AREAS EXCEPT AT TRAILING EDGE.
- BLENDED WIDTH IN ROOT HALF SHALL BE AT LEAST THREE TIMES BLENDED DEPTH.
- CRITICAL AREA NOT APPLICABLE TO TRAILING EDGE.

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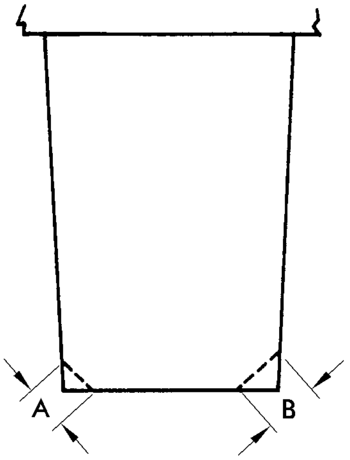
Figure 2-37. Compressor Stator Assembly; Inspection (Sheet 2 of 3)

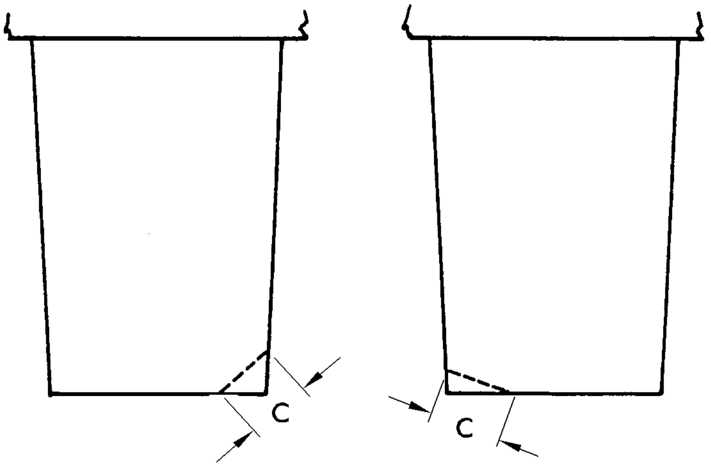


EXAMPLE 1

IF STAGE 3 VANE LEADING AND TRAILING EDGE TIP CORNERS ARE CHAMFERED, SUCH AS A = 5/32 AND B = 3/32, THE SUM IS 8/32; THEREFORE, STAGE 3 VANE EXCEEDS STAGE 3 VANE LIMIT GIVEN IN TABLE.

NOTE

WHEN BOTH LEADING AND TRAILING EDGE TIP CORNERS ARE CHAMFERED, THE SUM OF A AND B SHALL NOT EXCEED LENGTH GIVEN IN TABLE.



EXAMPLE 2

IF STAGE 3 VANE LEADING OR TRAILING EDGE TIP CORNER IS CHAMFERED SUCH AS C = 5/32; STAGE 3 VANE IS WITHIN LIMIT GIVEN IN TABLE.

NOTE

ANY ANGLE OF TIP CHAMFER IS ALLOWED IF LENGTH GIVEN IN TABLE IS NOT EXCEEDED.

STAGE	MAXIMUM VANE TIP CHAMFER
1	11/32
2	9/32
3	7/32
4	7/32
5	7/32

ALL DIMENSIONS ARE IN INCHES

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Figure 2-37. Compressor Stator Assembly; Inspection (Sheet 3 of 3)

2-54. Inspection of Compressor Stator Splitline Shoulder Bolts.

See table 2-14.

Table 2-14. Inspection of Compressor Stator Splitline Shoulder Bolts

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Shoulder bolts (fig. 2-38) for:			
a. Cracks.	None allowed.	Not repairable.	Replace bolt.
b. Nicks, dents, and scratches on shoulder.	Any number that cannot be detected by feel.	Not repairable.	Replace bolt.
c. Nicks, burrs, dents, and high metal on threads.	Up to one thread cumulative damaged, without high metal or crossed threads.	Up to one thread cumulative damaged, with high metal or crossed threads.	Blend high metal. Chase threads to usable limits.
d. Worn shoulder.	Shoulder diameter must not be less than limits in figure 2-38.	Not repairable.	Replace bolt.
e. Wear or damage to head.	Any amount if bolt can be properly torqued.	Not repairable.	Replace bolt.

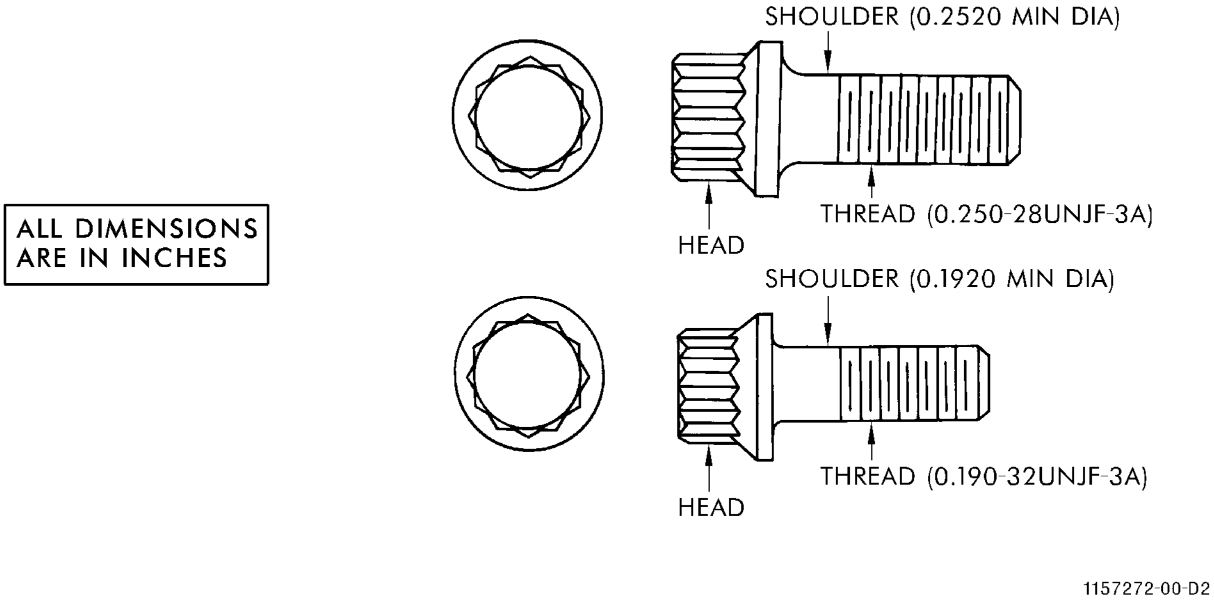


Figure 2-38. Compressor Stator Splitline Shoulder Bolts; Inspection

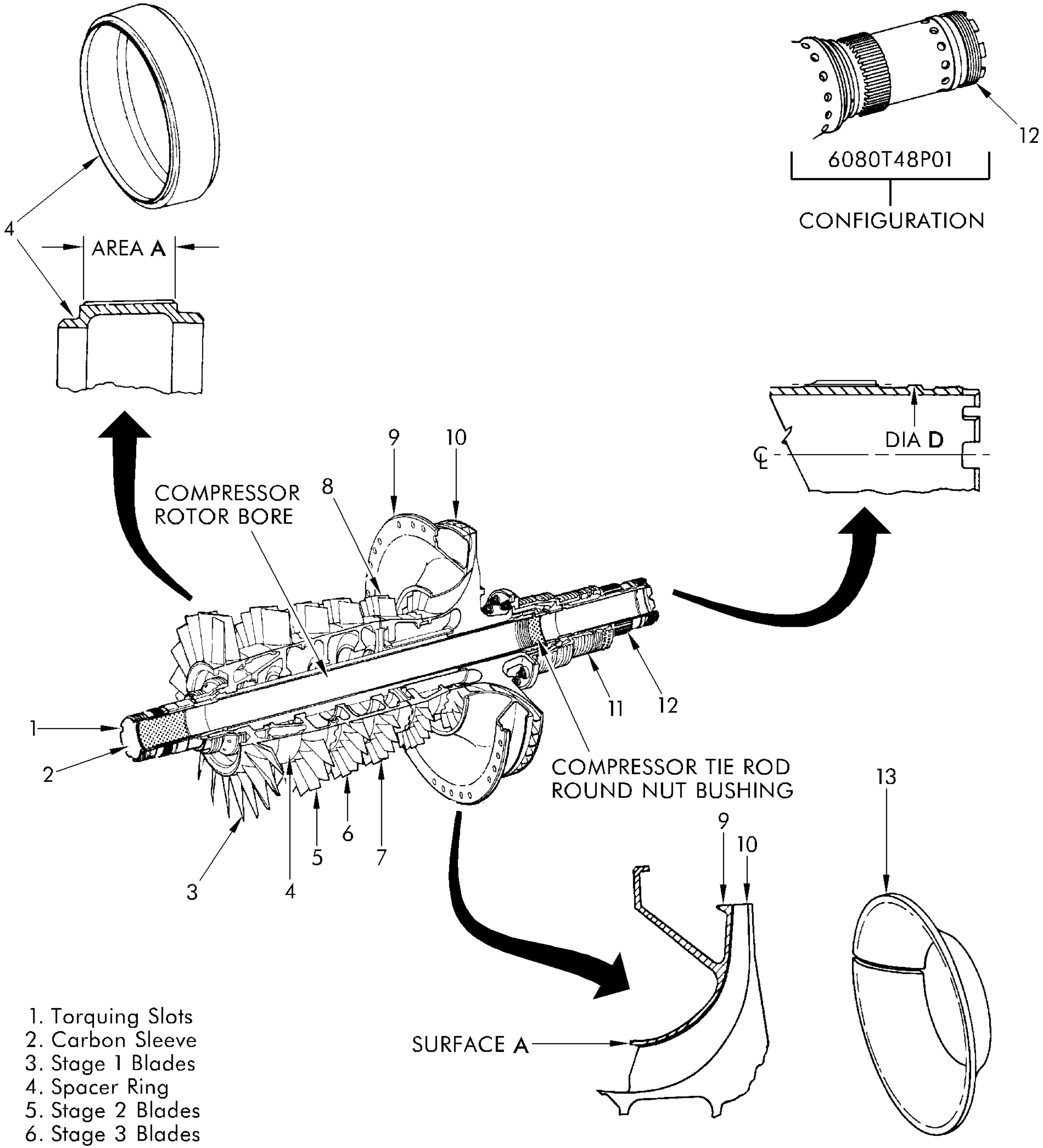
2-55. Inspection of Compressor Rotor Tie Rod Round Nut Bushing and Compressor Bore. See table 2-15.

Table 2-15. Inspection of Compressor Rotor Tie Rod Round Nut Bushing and Compressor Bore

NOTE

In order to inspect compressor rotor tie rod round nut bushing and compressor rotor bore, the power turbine module must be removed as instructed in paragraphs 4-7 and 3-5, respectively.

Inspect		Usable Limits	Max Repairable Limits	Corrective Action
a.	Compressor tie rod round nut bushing (fig. 2-39) (part of tie rod round nut) for broken pieces, cracks, or missing pieces.	Any amount without loose pieces.	Any amount with loose pieces.	Using a vacuum cleaner with tube extension, remove loose particles from compressor rotor bore. Using a right-angle pick or a screwdriver, remove remaining portions of damaged tie rod nut bushing which would be dislodged when power turbine module is installed. Do not scratch ID of compressor rotor bore. Using a vacuum cleaner with tube extension, clean compressor rotor bore again.
b.	Compressor rotor bore for presence of small pieces of black plastic material and carbon debris.	Any amount without black plastic or carbon debris.	Any amount.	Same as corrective action used in previous step a.



1. Torquing Slots
2. Carbon Sleeve
3. Stage 1 Blades
4. Spacer Ring
5. Stage 2 Blades
6. Stage 3 Blades
7. Stage 4 Blades
8. Stage 5 Blades
9. Impeller Shroud
10. Centrifugal Impeller
11. Discharge Rotating Seal
12. Rear Shaft
13. Compressor Impeller Shroud Protector

NOTE

INSPECT SHADED AREAS
BETWEEN EACH STAGE
AND SURFACE **A** FOR RUBS.

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Figure 2-39. Compressor Rotor Tie Rod Round Nut Bushing and Compressor Bore; Inspection

2-56. STAGES 1 AND 2 VANE ACTUATING RINGS.

2-57. Inspection of Stages 1 and 2 Vane Actuating Rings. See table 2-16.

Table 2-16. Inspection of Stages 1 and 2 Vane Actuating Rings

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Stages 1 and 2 vane actuating rings (8, 10, fig. 2-36) for:			
a. Cracks, except area W.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
b. Area W for cracks.	Ring is usable if crack length does not extend beyond the third pin bushing (approximately 2 inches from ring end).	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
CAUTION Do not overtorque nuts (12). Otherwise, actuating ring will be damaged.			
c. Loose bolts (13) and nuts (12).	Not allowed.	Any number.	Tighten. Torque bolts to 16-19 inch-pounds.
d. Missing pins (2).	Not applicable.	Not applicable.	AVUM: Replace engine. AVIM: Replace cold section module.
e. Wear on pins/looseness of bushings.	Slight looseness allowed if pin is not in danger of falling out.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
f. Bent, disconnected, loose, or missing parts, noted visually.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
g. Clevis (15) for wear on diameter Y.	0.166 inch max diameter.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

2-58. STAGES 1 AND 2 VANE ACTUATOR LEVERS.

2-59. Inspection of Stages 1 and 2 Vane Actuator Levers. See table 2-17.

2-60. COMPRESSOR CASE BORESCOPE PORT CAPS OR PLUGS.

a. **(T700)** See appropriate steps in paragraph 1-177, 1-185, 1-193 or 1-198 for removal and installation instructions.

b. **(T701, T701C, T701D)** See appropriate steps in paragraph 1-180, 1-193 or 1-198 for removal and installation instructions.

c. See paragraph 1-191 for inspection requirements.

Table 2-17. Inspection of Stages 1 and 2 Vane Actuator Levers

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Stages 1 and 2 vane actuator levers (5, 6, fig. 2-36) for:			
(1) Cracks in metal.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Cracks in race (7).	One crack per lever.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(3) Dents, bends, disconnected, loose or missing levers.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
b. Stages 1 and 2 sleeve bushings (9, 11) for:			
(1) Axial cracks.	Any number.	Not applicable.	Not applicable.
(2) Missing bushing face segments.	No more than 25% of any face may be missing.	Not repairable.	Replace bushing (by hand or if required use an easy out).

2-61. DIFFUSER AND MIDFRAME CASING ASSEMBLY.

2-62. Inspection of Diffuser and Midframe Casing Assembly.

See table 2-18.

Table 2-18. Inspection of Diffuser and Midframe Casing Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Diffuser case (1, fig. 2-40) for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks, dents, pits, and scratches.	Any number, up to 1/32 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.

NOTE

It is acceptable if the channel nut is broken, and has fallen into the cavity inside the flange.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Broken bolt in compressor-to-diffuser case flange.	None allowed.	Two bolts provided they are separated by at least one intact bolt.	Repair broken bolt (para 2-63).
b. Midframe assembly (2) outer casing for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks and scratches.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(3) Dents.	Any number, up to 1/64 inch deep, if defect is more than one inch away from any port. None allowed within 1 inch of any port.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(4) Stripped self-locking clinch nuts on B-sump.	None allowed.	Any amount.	AVUM: Replace engine. AVIM: Replace B-sump housing self-locking clinch nuts (para 2-66).

Table 2-18. Inspection of Diffuser and Midframe Casing Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
c. Rear flange of midframe assembly (2) for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks and scratches.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
d. Present configuration of fuel injector ports (8), igniter plug ports (6), borescope plug port (7), P3 port (3), and **(T700)** primer nozzle ports (5) for:			
(1) Cracks (including brazed joint on midframe boss (1A)).	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks and scratches.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(3) Cracks in tack welds between boss and casing.	Any number.	Not applicable.	Not applicable.
e. Diffuser case-to-midframe flange for:			
(1) Broken locked-in-stud except at an engine bracket.	One broken stud provided engine performance is acceptable.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Broken locked-in-stud located at an engine bracket.	One broken stud, only if local AMCOM approves.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
f. **(T700)** Former configuration of fuel injector ports (8), igniter plug ports (6), borescope plug port (7), P3 port (3), and primer nozzle ports (5) for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.

Table 2-18. Inspection of Diffuser and Midframe Casing Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Nicks and scratches.	Any number, up to 1/64 inch deep without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
g. Fuel injector ports (8) for burrs or high metal on fuel injector seating surface (15).	None allowed.	Any amount.	AVUM: Repair fuel injector seating surface (para 2-72) if fuel injector port is accessible. Otherwise, replace engine. AVIM: Repair fuel injector seating surface (para 2-72).
h. Oil tube (10), scavenge tube (4), and compressor leakage air tube fitting (11) for:			
(1) Cracks (except in braze joints).	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Cracks in braze joints.	One per port, up to 1/16 inch long, not extending through length of joint.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(3) AVIM: Nicks and scratches on sealing surfaces and on ends of scavenge and oil tube.	None allowed.	Not repairable.	Replace cold section module.
(4) Nicks and scratches on remaining surfaces.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
i. Coupling nuts on scavenge tube (4), oil tube (10), and oil drain tube (12) for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks and scratches.	Any number, up to 1/32 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(3) Missing or damaged threads.	One full thread total, damaged or missing, without high metal, if a normal installation with the mating part can be made.	AVUM: Not repairable. AVIM: One full thread total, that can be blended to usable limits.	AVUM: Replace engine. AVIM: Plug end of tube at defective nut. Blend high metal from threads to make threads usable. Blow out all metal filings and then remove plug in tubing.

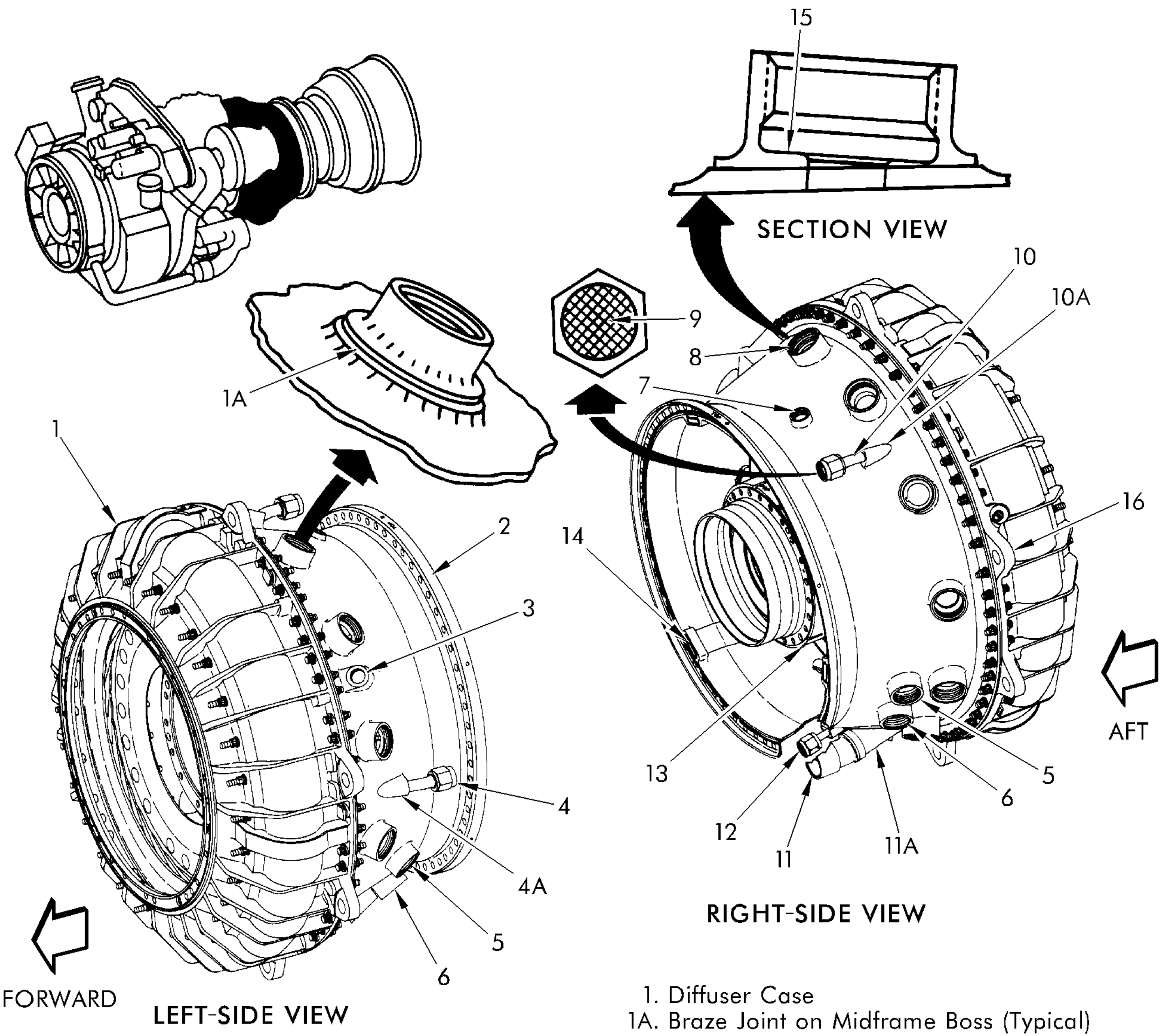
Table 2-18. Inspection of Diffuser and Midframe Casing Assembly (Cont)

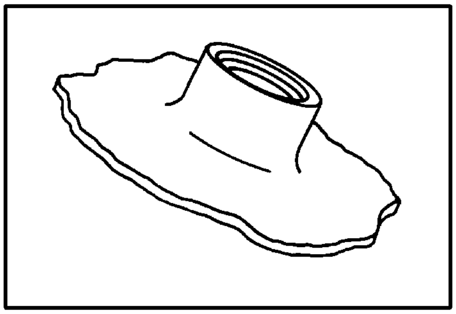
WARNING

Penetrating Oil

- Do not use near open flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Freedom of movement.	Nut must spin freely on tube.	AVUM: Not repairable. AVIM: Any amount that can be repaired to meet usable limits.	AVUM: Replace engine. AVIM: Apply penetrating oil (item 88, Appendix D) to nut and tube, and work nut free.
j. Oil tube (10) for missing screen (9).	Not allowed.	Not applicable.	Replace screen.
k. Scavenge tube boss (4A), oil tube boss (10A), and air tube boss (11A) for:			
(1) Cracks in parent metal and tube welds.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Nicks and scratches.	Any number, up to 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
l. AVIM: Cooling air tube (14) for cracks in brazed joint.	One per tube, up to 0.064 inch long, not extending through length of joint.	Not repairable.	Replace cold section module.
m. Mounting lugs for:			
(1) Cracks, broken or missing pieces.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(2) Worn flange.	0.395-0.401 inch.	Not repairable.	AVUM: Replace engine. AVIM: Replace cold section module.
(3) Worn hole diameter.	0.5022 inch maximum.	Any amount.	AVUM: Replace engine. AVIM: Repair mount lug hole (para 2-64).





(T700) FORMER CONFIGURATION

1. Diffuser Case
1A. Braze Joint on Midframe Boss (Typical)
2. Midframe Assembly
3. P3 Port
4. Scavenge Tube
4A. Scavenge Tube Boss
5. **(T700)** Primer Nozzle Port (Qty-2)
6. Igniter Plug Port (Qty-2)
7. Borescope Plug Port
8. Fuel Injector Port (Qty-12)
9. Screen
10. Oil Tube
10A. Oil Tube Boss
11. Compressor Leakage Air Tube Fitting
11A. Air Tube Boss
12. Oil Drain Tube
13. Combustor Inner Shroud
14. Cooling Air Tube (Qty-3)
15. Fuel Injector Seating Surface
16. Mounting Lugs

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Figure 2-40. Diffuser and Midframe Casing Assembly and Combustor Inner Shroud; Inspection

2-63. Repair Diffuser and Midframe Casing Assembly.

NOTE

It is acceptable if the channel nut is broken and has fallen into the cavity inside the flange.

a. This repair seals the broken bolthole in the compressor case-to-diffuser case flange.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Using dry, filtered, compressed air, blow out any debris from bolthole.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

c. Using a towel (item 112, Appendix D) soaked with isopropyl alcohol (item 3, Appendix D), clean broken bolthole and surrounding area.

WARNING

RTV-162 Silicone Rubber
Adhesive/Sealant
MIL-A-46146A

- Wear approved gloves and goggles/face shield.
- Vapors released during curing are combustible. Do not use near open flames, near welding areas, or on hot surfaces.
- Do not breathe vapors. Use in a well-ventilated area.
- Repeated inhalation of vapor can cause mild respiratory irritation.
- If any vapor contacts eyes, immediately flush affected area thoroughly with water for at least 15 minutes and get medical attention if irritation persists.
- Do not ingest. May be harmful if swallowed.
- In case of ingestion, do not induce vomiting. Slowly dilute using 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
- In case of skin contact, remove material completely with dry cloth or paper towel before washing with detergent and water. After contact, hands and skin should be washed before eating, drinking, or smoking. Skin irritation is not expected, but may occur in certain sensitive individuals.

WARNING

RTV-3145 Adhesive/Sealant
Potting Compound

- In case of skin contact, flush contacted area with water. After contact, hands and skin should be washed before eating, drinking, or smoking.
- Eye protection should be worn when working with this material. If liquid contacts eyes, flush eyes thoroughly with water for 15 minutes.
- If prolonged contact with vapor is likely, wear approved respirator.

NOTE

Use of RTV-3145 (gray) is optional.

d. If compressor case half is removed, use RTV-162 or RTV-3145 (gray) (item 96 or 97, Appendix D), and fill broken bolthole. Be sure RTV is below the surface of the flange to allow proper seating of compressor stator.

e. Install case half, or if case half was not removed, clean (steps b and c) then, fill broken bolthole with RTV-162 or RTV-3145 (gray) (item 96 or 97, Appendix D). Make sure RTV is flush with compressor case flange.

f. Allow RTV to cure for a minimum of 30 minutes.

g. If shrinkage occurs, apply additional RTV and allow to dry for 30 minutes.

h. Fabricate a strap, figure 2-41, view A or if broken bolt is adjacent to compressor case splitline flange, view B.

i. Using fabricated strap (view A or view B), cover hole and secure with adjacent bolts (view C).

2-64. Repair of Diffuser Mount Lug Hole (AVIM).

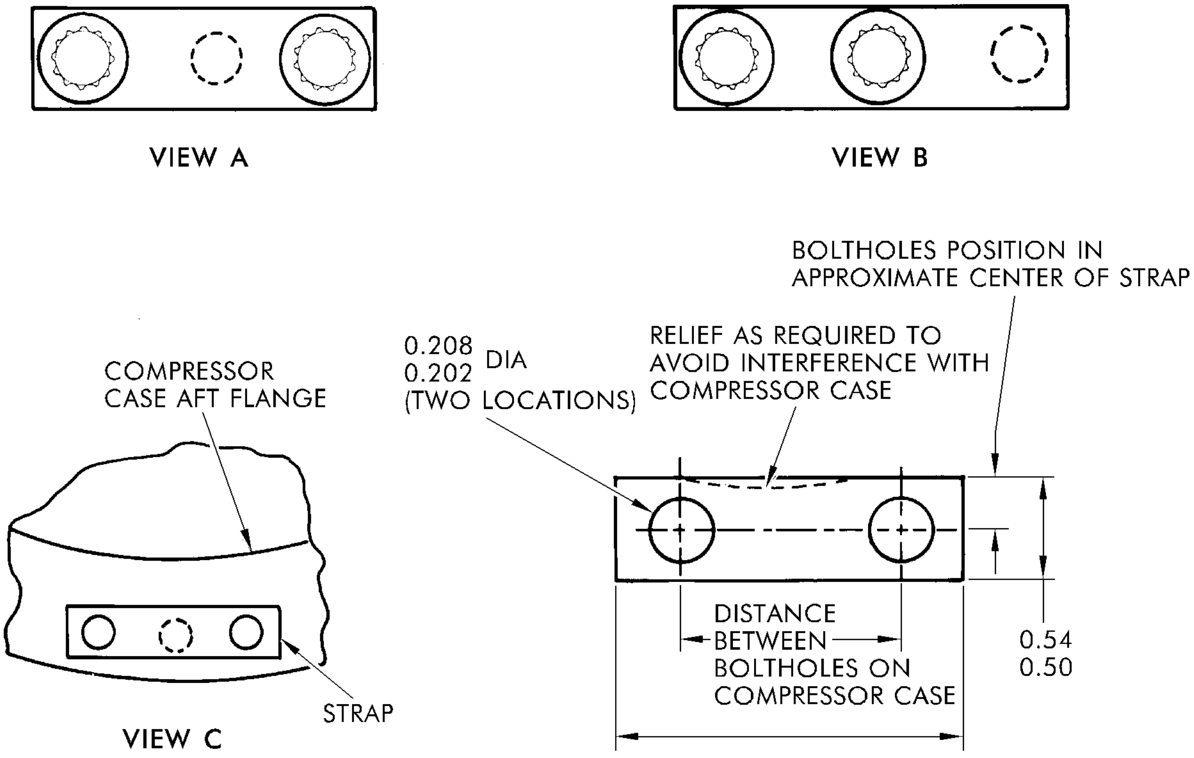
a. If not already done, make the following LMTs (Appendix F):

- 3 o'clock lug drill fixture LMT 893
- 6 o'clock lug drill fixture LMT 894
- 9 o'clock lug drill fixture LMT 895
- Bushing pusher LMT 896

b. Prepare the surrounding area of mounting lug for machining as follows:

(1) If repairing lug(s) at 3 o'clock position, aft looking forward, remove:

- Main Fuel Manifold (para 6-9)
- No. 3 and 4 position Fuel Injectors (para 6-23)
- Thermocouple Assembly (para 7-62)
- 1:30 o'clock position Torque and Overspeed Sensor to Blue Harness Electrical Connector (para 7-46)
- 4 o'clock Ignitor Plug (para 7-4)



LENGTH OF STRAP MUST BE THE DISTANCE BETWEEN BOLTHOLE CENTERS ON COMPRESSOR CASE PLUS 0.50-0.54.

NOTE

- FOR BROKEN BOLT AT THE 3:30 O'CLOCK POSITION, THE STRAP MUST BE CURVED IN ORDER TO COVER BOLTHOLE COMPLETELY.
- DEBURR ALL HOLES AND EDGES SO THAT STRAP LAYS FLAT.

MATERIAL: STAINLESS STEEL
(300 SERIES)
0.180-0.200 THICK

ALL DIMENSIONS
ARE IN INCHES

1157274-00-A2A

Figure 2-41. Broken Bolts on Compressor Case Aft Flange and on Diffuser Case Flange; Repair

(2) If repairing lug(s) at 6 o'clock position, aft looking forward, remove:

- Main Fuel Manifold (para 6-9)
- No. 6 and 7 position Fuel Injectors (para 6-23)
- Compressor Leakage Air Tube (para 10-43)
- Seal Pressure and Scavenge Tube Assembly (para 10-48)
- B-Sump Drain Tube (para 8-74)

(3) If repairing lug(s) at 9 o'clock position, aft looking forward, remove:

- Main Fuel Manifold (para 6-9)
- No. 9 and 10 position Fuel Injectors (para 6-23)
- Thermocouple Assembly (para 7-62)

c. Install LMT fixtures onto diffuser/midframe matched assembly as follows:

(1) If repairing 3 o'clock position lug holes, install LMT 893 on aft side of diffuser case-to-midframe casing assembly bolt circle (fig. 2-42) as follows:

(a) Remove nuts from bolts at bolthole locations 12, 13, 14, 19 and 20. Remove bracket (4). Do not remove bolts.

(b) Install drill fixture LMT 893 (3, fig. 2-43) onto lug holes (1) at 3 o'clock position so that bushing holes in drill fixture (3) aline with lug holes (1). Secure with two capnuts (4).

(2) If repairing 6 o'clock position lug holes, install LMT 894 on aft side of diffuser case-to-midframe casing assembly bolt circle (fig. 2-42) as follows:

(a) Remove nuts from bolts at bolthole locations 28, 29, 34 and 35. Do not remove bolts.

(b) Install drill fixture LMT 894 (3, fig. 2-43) onto lug holes (1) at 6 o'clock position so that bushing holes in drill fixture (3) aline with lug holes (1). Secure with two capnuts (4).

(3) If repairing 9 o'clock position lug holes, install LMT 895 on aft side of diffuser case-to-midframe casing assembly bolt circle (fig. 2-42) as follows:

(a) Remove nuts from bolts at bolthole locations 43, 44, 49 and 50. Do not remove bolts.

(b) Install drill fixture LMT 895 (3, fig. 2-43) onto lug holes (1) at 9 o'clock position so that bushing holes in drill fixture (3) aline with lug holes (1). Secure with two capnuts (4).

d. Install 17/32 inch slip-fit bushing (5) into drill fixture boss.

e. Using shoulder screw (2), secure bushing (5).

f. Do the following while machining the diffuser mount lug:

WARNING

Penetrating Oil

- Do not use near open flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

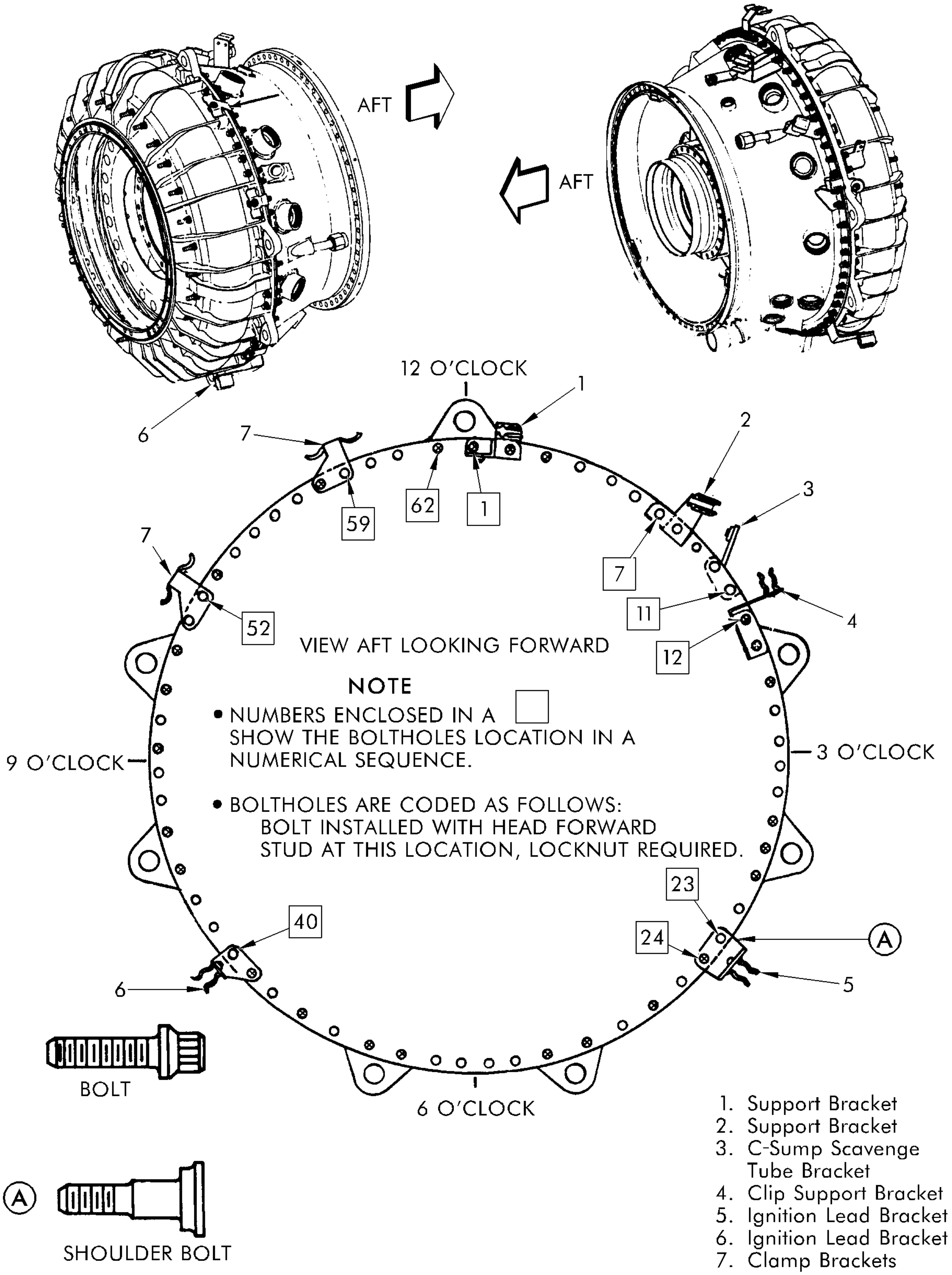
(1) Apply penetrating oil (item 88, Appendix D) to parts to keep from overheating.

(2) Hold drill and end mill as level as possible.

(3) Machining speed of end mill is approximately 150 RPM.

(4) Use a steady even pressure in the direction of machining.

g. Using a 17/32 inch four-fluted end mill, with 45 degree chamfered corners (lightly dressed), machine out the diffuser mount lug hole (1).



1. Support Bracket
2. Support Bracket
3. C-Sump Scavenge Tube Bracket
4. Clip Support Bracket
5. Ignition Lead Bracket
6. Ignition Lead Bracket
7. Clamp Brackets

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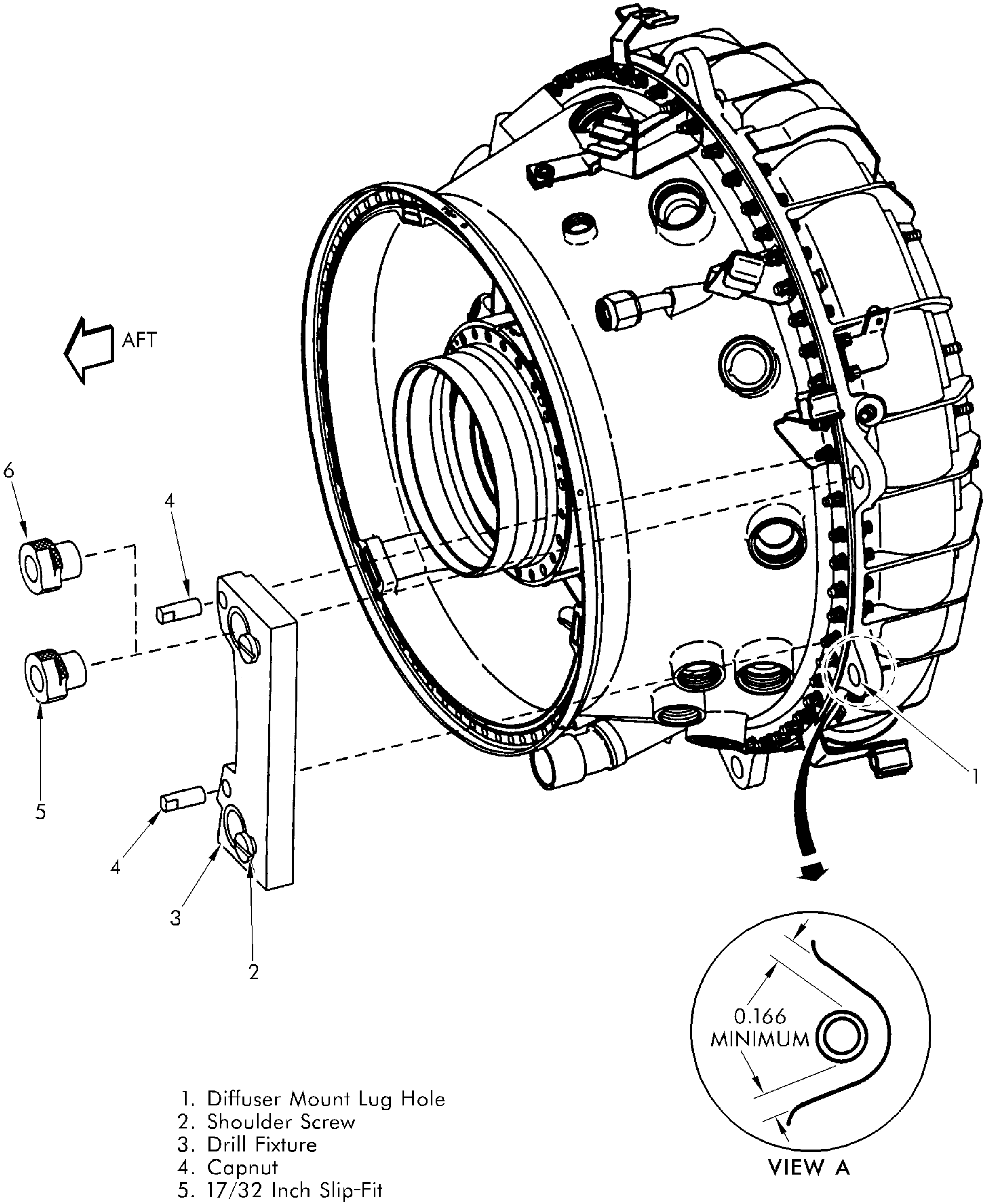
Figure 2-42. Diffuser Case-to-Midframe Casing Assembly; Bolt Diagram



1. Diffuser Mount Lug Hole
2. Shoulder Screw
3. Drill Fixture
4. Capnut
5. 17/32 Inch Slip-Fit Bushing
6. 9/16 Inch Slip-Fit Bushing

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Figure 2-43. Lug Hole Drill Fixture (Typical); Installation and Removal

h. Remove shoulder screw (2) and bushing (5) from drill fixture (3).

i. Install 9/16 inch slip-fit bushing (6) into drill fixture (3).

j. Using shoulder screw (2), secure bushing (6).

k. Do the following while reaming the diffuser mount lug:

WARNING

Penetrating Oil

Observe warning following step f.

(1) Apply penetrating oil (item 88, Appendix D) to parts to keep from overheating.

(2) Hold drill and reamer as level as possible.

(3) Machining speed of reamer is approximately 150 RPM.

(4) Use a steady even pressure in the direction of machining.

l. Install 0.5621- 0.5623 inch reamer into drill fixture and ream out diffuser mount lug hole (1).

m. Repeat steps d through l until all lug holes requiring repair are reamed.

n. Remove drill fixtures from midframe assembly.

o. Remove high metal from both sides of lug holes.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

p. Using isopropyl alcohol (item 3, Appendix D) clean diffuser mount lug and hole. Be sure mount hole and surrounding area is clean and free from oil and grease.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

q. Allow area to dry. Using dry, filtered, compressed air, blow out any debris.

r. Measure thickness of lug being repaired (view A, fig. 2-43); wall thickness must be at least 0.166 inch. If minimum is exceeded, replace diffuser/midframe matched assembly.

s. Using white light and 10X magnifier, inspect reworked hole for cracks (para 2-62).

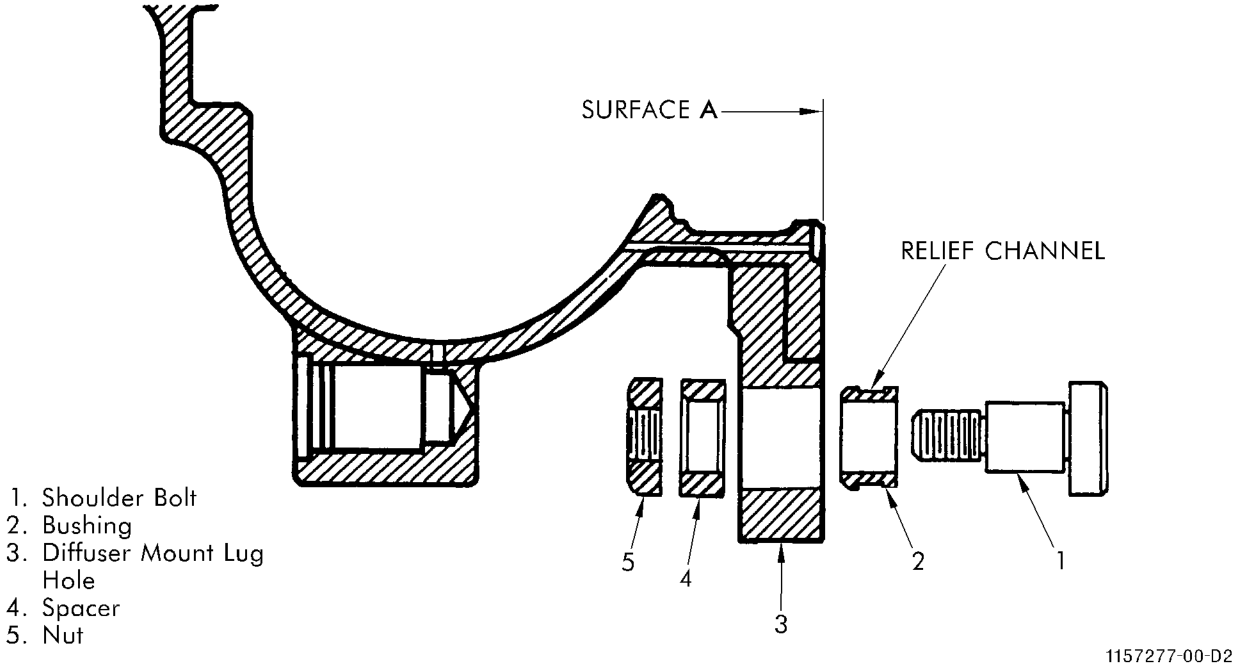


Figure 2-44. Bushing; Installation and Removal

t. Install bushing (2, fig. 2-44) as follows:

(1) Install, from aft side, replacement bushing (2) with lead chamfer end into hole as follows:

(a) Install shoulder bolt (1) through bushing (2), diffuser mount lug hole (3) and spacer (4). Secure with nut (5). Do not draw bushing (2) into lug hole (3).

NOTE

Relief channel should be fully exposed to allow application of loctite.

(b) Draw bushing into hole approximately 0.100 inch by tightening nut (5).

WARNING

Loctite Retaining Compounds

- Prolonged or repeated contact with material can cause dermatitis or skin irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove saturated clothing.
- If vapors cause irritation, go to fresh air. If symptoms persist, obtain medical attention.
- If liquid is ingested, do not induce vomiting. Obtain immediate medical attention.
- When handling liquid at air-exhausted workbench, wear approved gloves, and goggles or face shield
- When handling liquid at unexhausted workbench, wear approved respirator and gloves, and wear goggles or face shield.
- Dispose of liquid-soaked rags in approved metal container.

(2) Using a toothpick or equivalent applicator, apply loctite retaining compound (item 66, Appendix D) completely around bushing relief channel.

(3) Draw bushing into mount lug hole by tightening nut (5) until end of bushing (2) is flush with surface A.

(4) Remove pusher.

(5) Using a clean, dry, lint-free towel, clean residual loctite from mount hole lug.

(6) Allow loctite to set up for 15-20 minutes.

(7) Cure loctite using a heat lamp or heat gun by warming mount lug for 30-45 minutes at 250°F or cure for 24 hours at room temperature.

u. Reinstall engine hardware removed in steps b and c.

v. Make required checks (para 1-223).

2-65. Repair of Broken Bolts on Compressor Case Aft Flange (On-Wing).

NOTE

- The following procedure provides instructions for repair of broken bolts on the compressor case aft flange (compressor case-to-diffuser case flange).
- This on-wing repair allows the use of a press fit pin, and a strap to prevent leakage.

a. Locally fabricate seven LMT Go-NoGo pins as detailed in figure 2-45 or use small hole gauge to measure hole size in flange to within 0.001 inch.

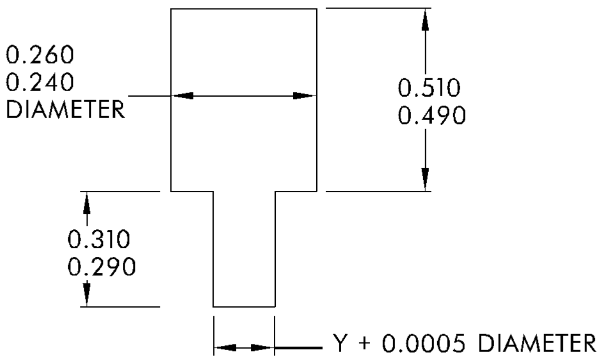
b. Try inserting Go-NoGo pins or small hole gauge in broken bolt hole as follows:

(1) Start with LMT 954 pin (0.208 in. dia) and work down (in increments of 0.001 inch) to 0.202 inch diameter pin.

(2) Determine the largest diameter pin that fits in the hole. The top of each pin has a number that indicates pin diameter. Record diameter of pin.

(3) Using Go-NoGo pin diameter recorded in step (2), fabricate a press fit pin that is 0.0005 inch larger than Go-NoGo pin diameter X (see figure 2-46).

VIBROPEEN A NUMBER ON PIN THAT REPRESENTS DIAMETER
EXAMPLE 2 (REPRESENTS 0.202)
EXAMPLE 3 (REPRESENTS 0.203)



PIN NUMBER	SIZE
LMT 954 PIN 8	(0.208 IN. DIA)
LMT 955 PIN 7	(0.207 IN. DIA)
LMT 956 PIN 6	(0.206 IN. DIA)
LMT 957 PIN 5	(0.205 IN. DIA)
LMT 958 PIN 4	(0.204 IN. DIA)
LMT 959 PIN 3	(0.203 IN. DIA)
LMT 960 PIN 2	(0.202 IN. DIA)

MATERIAL
STAINLESS STEEL
(300 SERIES)

ALL DIMENSIONS
ARE IN INCHES

FABRICATE 7 PINS WITH THE ABOVE SHOWN DIMENSIONS EXCEPT DIAMETER Y TO BE AS FOLLOWS: PIN 2=0.202, PIN 3=0.203, PIN 4=0.204, PIN 5=0.205, PIN 6=0.206, PIN 7=0.207, PIN 8=0.208

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Figure 2-45. (Typical) Go-NoGo Pins, Fabrication

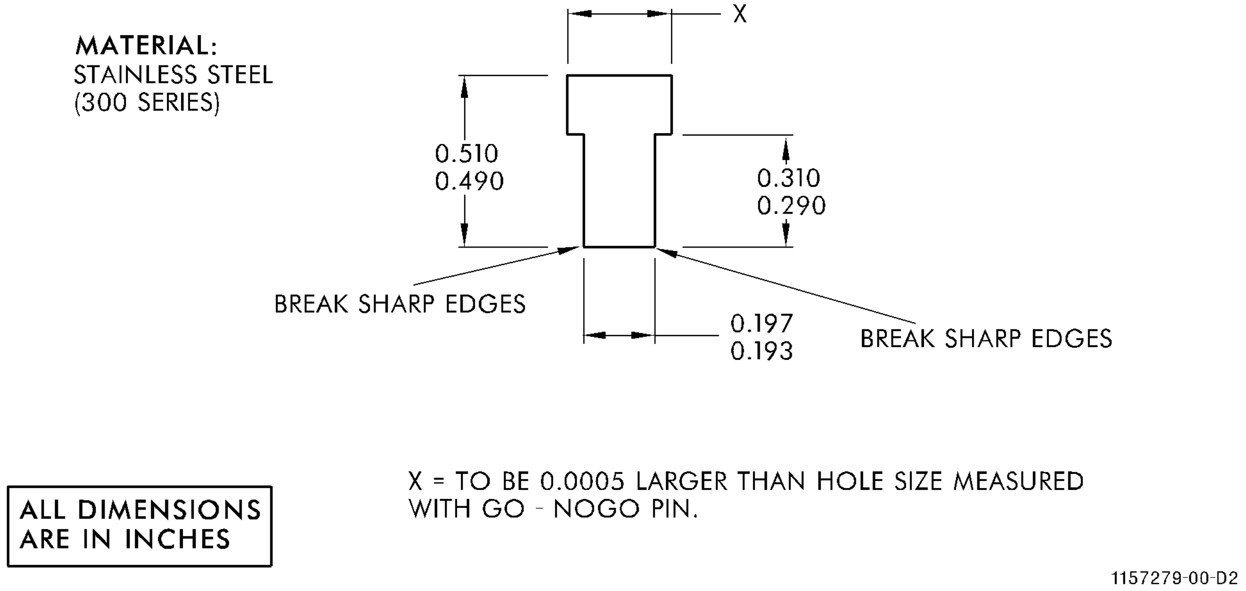


Figure 2-46. Press Fit Pins; Fabrication

(4) Locally fabricate a strap (figure 2-47) to span the hole with broken bolt.

(5) If hole with broken bolt is adjacent to the compressor case splitline flange, strap as shown in view B. Otherwise, secure strap as shown in view A.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

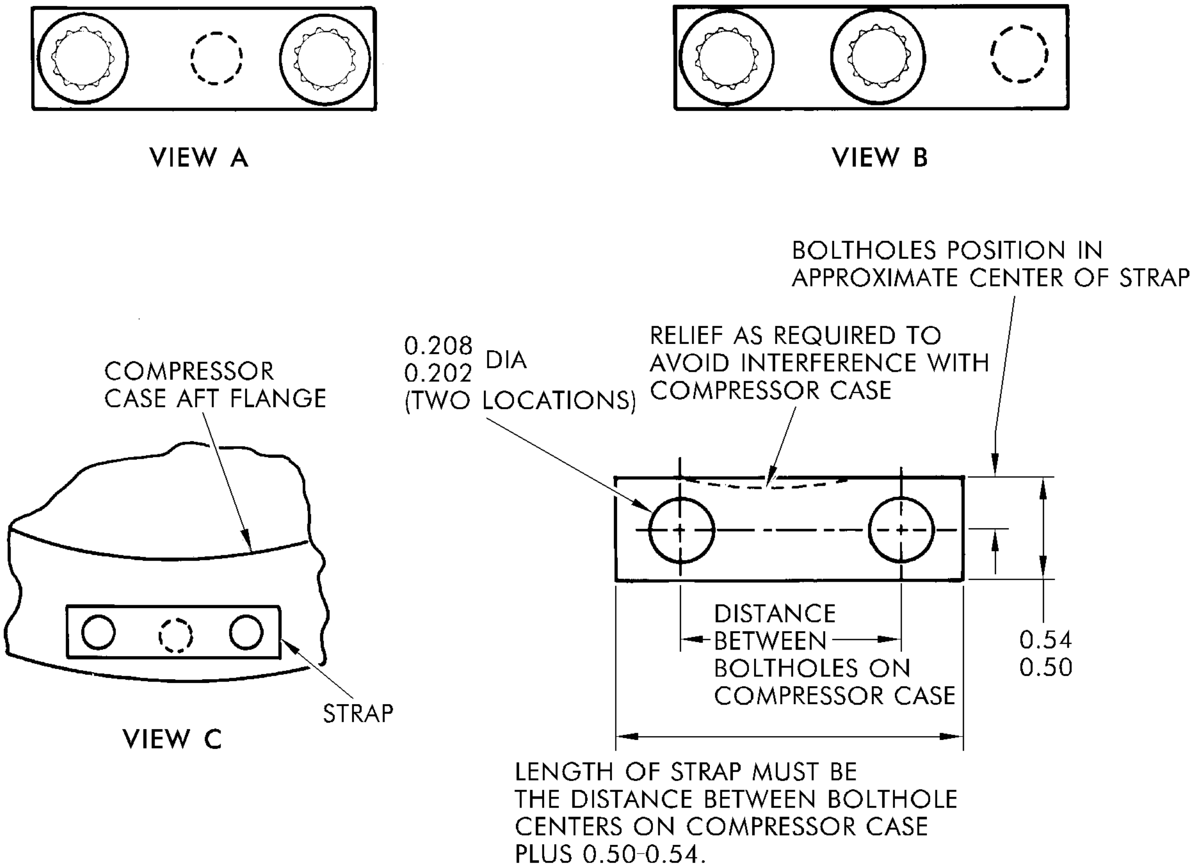
(6) Using lubricating oil or equivalent, lubricate press fit pin and install into hole (small diameter first), finger pressure only.

NOTE

Fastening strap will force the press fit pin to be seated against compressor case flange.

(7) Cover hole with selected strap, and secure with adjacent bolts.

(8) Alternately tighten bolts to pull pin in straight.



NOTE

- FOR BROKEN BOLT AT THE 3:30 O'CLOCK POSITION, THE STRAP MUST BE CURVED IN ORDER TO COVER BOLTHOLE COMPLETELY.
- DEBURR ALL HOLES AND EDGES SO THAT STRAP LAYS FLAT.

MATERIAL: STAINLESS STEEL
(300 SERIES)
0.180-0.200 THICK

ALL DIMENSIONS ARE IN INCHES

1157281-00-A2A

Figure 2-47. Broken Bolts on Compressor Case Aft Flange and on Diffuser Case Flange; Repair

2-66. Replacement of B-Sump Housing Self-Locking Clinch Nuts.

CAUTION

Exercise extreme care when striking bolt to avoid damaging adjacent components.

NOTE

When replacing B-sump clinch nuts, the combustor inner shroud and the outer balance piston seal must be removed for clearance in order to replace the defective nuts.

a. Using a 0.190-32 bolt 1.5 inch long, engage at least two full threads of the damaged clinch nut. Strike sharply with a small ball-peen hammer (8 or 12 oz.) to dislodge nut.

b. Remove bolt and loosened nut.

c. Remove burrs and dirt from holes (4, fig. 2-48).

d. Place new self-locking nut (3) into hole of flange (1). Be sure that lug (2) on self-locking nut (3) is correctly located.

NOTE

There are two tools that can be used to replace B-sump clinch nuts. Use of 21C7771G01 is described in step e. Use of LMT 962 is described in step f.

e. Using clinch nut flaring set 21C7771G01, secure self-locking nut (3) as follows:

(1) Install rivet set (6) 21C7771P07 (part of clinch nut flaring set 21C7771G01) into yoke (5).

(2) Install washers (7), as required, to extend rivet set (6) out so that distance from rivet set (6) to pilot hole in yoke (5) is just a little larger than the distance from top of self-locking nut (3) to bottom of flange (1).

(3) Position compression riveter (8) so pilot hole in yoke (5) is over self-locking nut (3).

(4) Flare self-locking nut (3) until axial movement is 0.005 inch or less. A 0.005-inch shim may enter tightly.

(5) If axial movement of clinch nut is more than 0.005 inch, repeat step (4).

(6) Remove clinch nut flaring set.

f. Using clinch nut flaring set LMT 962 (Appendix F), secure self-locking nut (3) as follows:

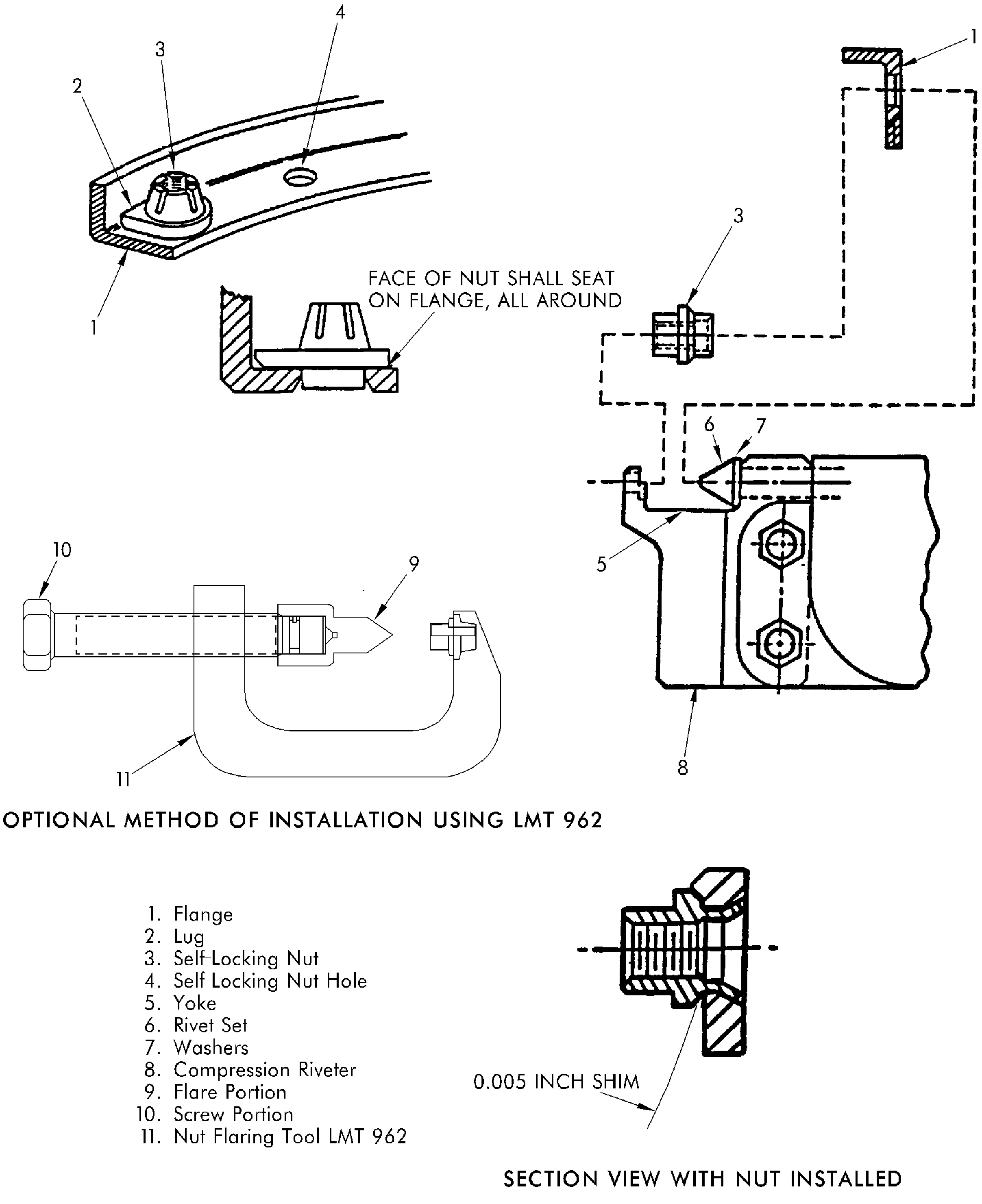
(1) Position LMT 962 so flare portion (9) rests on portion of clinch nut that is to be flared, and so pilot on tool is over self-locking nut (3).

(2) Use appropriate wrench to tighten conical portion of tool into nut. Flare clinch nut until axial movement is 0.005 inch or less. A 0.005-inch shim may enter tightly.

(3) If axial movement of clinch nut is more than 0.005 inch, repeat step (2).

g. Thread a 0.190-32 inch bolt completely through self-locking nut (3). Remove bolt.

h. Inspect self-locking nut (3) (table 2-18).



OPTIONAL METHOD OF INSTALLATION USING LMT 962

SECTION VIEW WITH NUT INSTALLED

1. Flange
2. Lug
3. Self-Locking Nut
4. Self-Locking Nut Hole
5. Yoke
6. Rivet Set
7. Washers
8. Compression Riveter
9. Flare Portion
10. Screw Portion
11. Nut Flaring Tool LMT 962

Figure 2-48. B-Sump Housing Self-Locking Clinch Nut; Installation

2-67. COMBUSTOR INNER SHROUD.

2-68. Inspection of Combustor Inner Shroud (AVIM). See table 2-19.

2-69. (T700) MIDFRAME BORESCOPE PORT PLUG.

a. See appropriate steps in paragraphs 1-178, 1-186, 1-189, 1-194, or 1-199 for removal and installation instructions.

b. See paragraph 1-196 for inspection requirements.

Table 2-19. Inspection of Combustor Inner Shroud

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Combustor inner shroud (13, fig. 2-40) for:			
a. Cracks.	None allowed.	Not repairable.	Replace cold section module.
b. Nicks, dents, and scratches.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
c. Distortion.	Any amount, if there are no drastic changes in contour.	Not repairable.	Replace cold section module.

2-70. ACTUATING SYSTEM LINKAGE ASSEMBLY.

2-71. Inspection of Actuating System Linkage Assembly. See table 2-20.

Table 2-20. Inspection of Actuating System Linkage Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Actuating system linkage assembly (fig. 2-49) for:			
a. Any missing, disconnected, broken, or loose components.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace components per paragraph 2-71.2.
b. Excessive wear or distortion of components, indicated by the assembly being out-of-shape.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace components per paragraph 2-71.2.
c. Spherical bearings as follows:			
(1) Position of spherical bearing (2).	No looseness of bearings in bearing bore.	Not repairable.	AVUM: Inspect per para. 2-71.1. AVIM: Replace components per paragraph 2-71.4.

Table 2-20. Inspection of Actuating System Linkage Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Forward spherical bearing (6) on actuator shaft.	No play in bearing that can be felt with fingers is allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace bearing per paragraph 2-71.4.
(3) Rear spherical bearing (5) on actuator shaft.	Up to 0.0025 inch total radial play allowed.	Not repairable.	AVUM: Inspect per paragraph 2-71.1. AVIM: Replace bearing per paragraph 2-71.4.
d. Measure axial movement of rear bracket as specified in para 2-71.1.	Up to 0.030 inch axial movement.	Not repairable.	AVUM: Inspect per paragraph 2-71.1. AVIM: Replace bearing per paragraph 2-71.4.

2-71.1. Inspection for Axial Movement in Actuating System Linkage Assembly. Inspect rear shaft support bearing and bracket assembly (fig. 2-49) for axial movement as follows:

a. Place a straight edge, or equivalent, across the forward face of bracket.

b. Measure the distance from the forward face of the bracket to the forward face of the spherical bearing as the linkage assembly is moved axially.

c. Maximum axial movement allowed between bearing and bracket is 0.030 inch.

2-71.2. Removal of Actuating System Linkage Assembly.

a. Remove shear bolt (5, fig. 2-49.1) and self-locking nut (6) from each of three actuating ring link assemblies (4) at IGV, stage 1, and stage 2 actuating rings.

b. Remove two bolts (2) from rear shaft support bearing and bracket (9).

c. Remove three bolts (1) from front shaft support bearing and bracket (7).

d. If installed, remove bolt (9, fig. 2-49.2), washer (10), and nut (11) from anti-icing valve bracket (7).

e. Remove shoulder screw (10, fig. 2-49.3) and nut (11) from anti-icing forward bracket (8).

f. Remove actuating system linkage assembly (3, fig. 2-49.1).

2-71.3. Disassembly of Actuating System Linkage System.

a. Remove four shear bolts (5, fig. 2-49.1), four self-locking nuts (6), and link assemblies (4) from IGV rod-end clevis (12) and from clevises on actuating shaft (14).

b. Remove self-locking nut (13) and IGV rod-end clevis (12) from forward end of shaft, and slide front shaft support bearing and bracket (7) off.

c. Remove self-locking nut (11) from aft end of shaft, and slide rear shaft support bearing and bracket (9) off.

2-71.4. Replacement of Link Bearings on Actuating System Linkage Assembly.

a. If front or rear spherical bearing (5, 6, fig. 2-49.4) is being replaced, go to step b. If spherical bearing (10) is being replaced, go to step d.

b. Remove front or rear spherical bearing as follows:

(1) If rear bearing (5) has to be replaced, remove self-locking nut (3) and remove rear shaft support, spherical bearing and bracket.

(2) If front bearing (6) has to be replaced, remove nut (8) from rod-end clevis, and remove rear shaft support, spherical bearing and bracket.

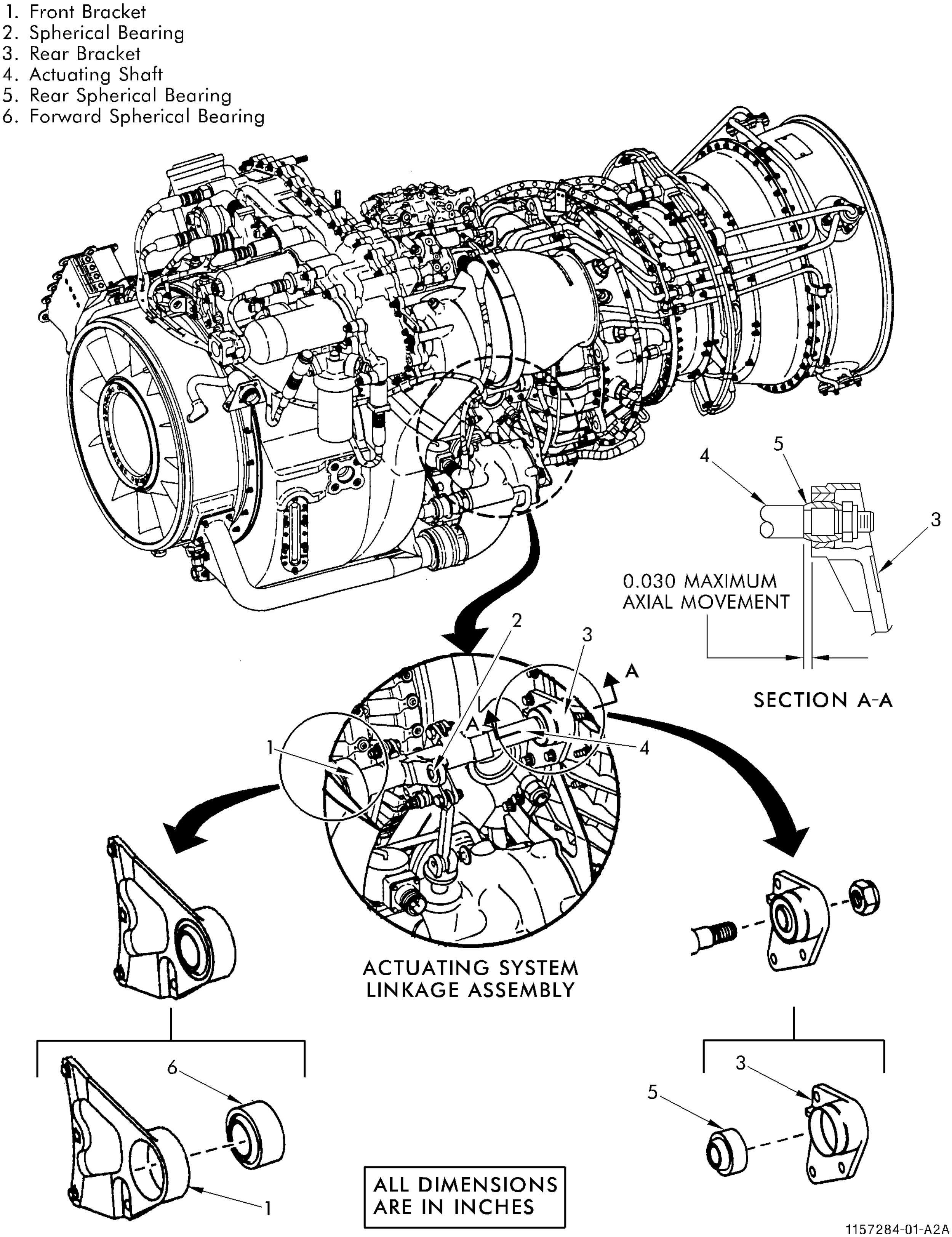


Figure 2-49. Actuating System Linkage Assembly (Typical); Inspection

LEGEND

1. BOLT
2. BOLT
3. ACTUATING SYSTEM LINKAGE ASSEMBLY
4. ACTUATING RING ASSEMBLY
5. SHEAR BOLT
6. SELF-LOCKING NUT
7. FRONT SHAFT SUPPORT BEARING AND BRACKET
8. FRONT SPHERICAL BEARING
9. REAR SHAFT SUPPORT BEARING AND BRACKET
10. AFT SPHERICAL BEARING
11. SELF-LOCKING NUT
12. IGV ROD-END CLEVIS
13. SELF-LOCKING NUT
14. ACTUATING SHAFT
15. SPHERICAL BEARING

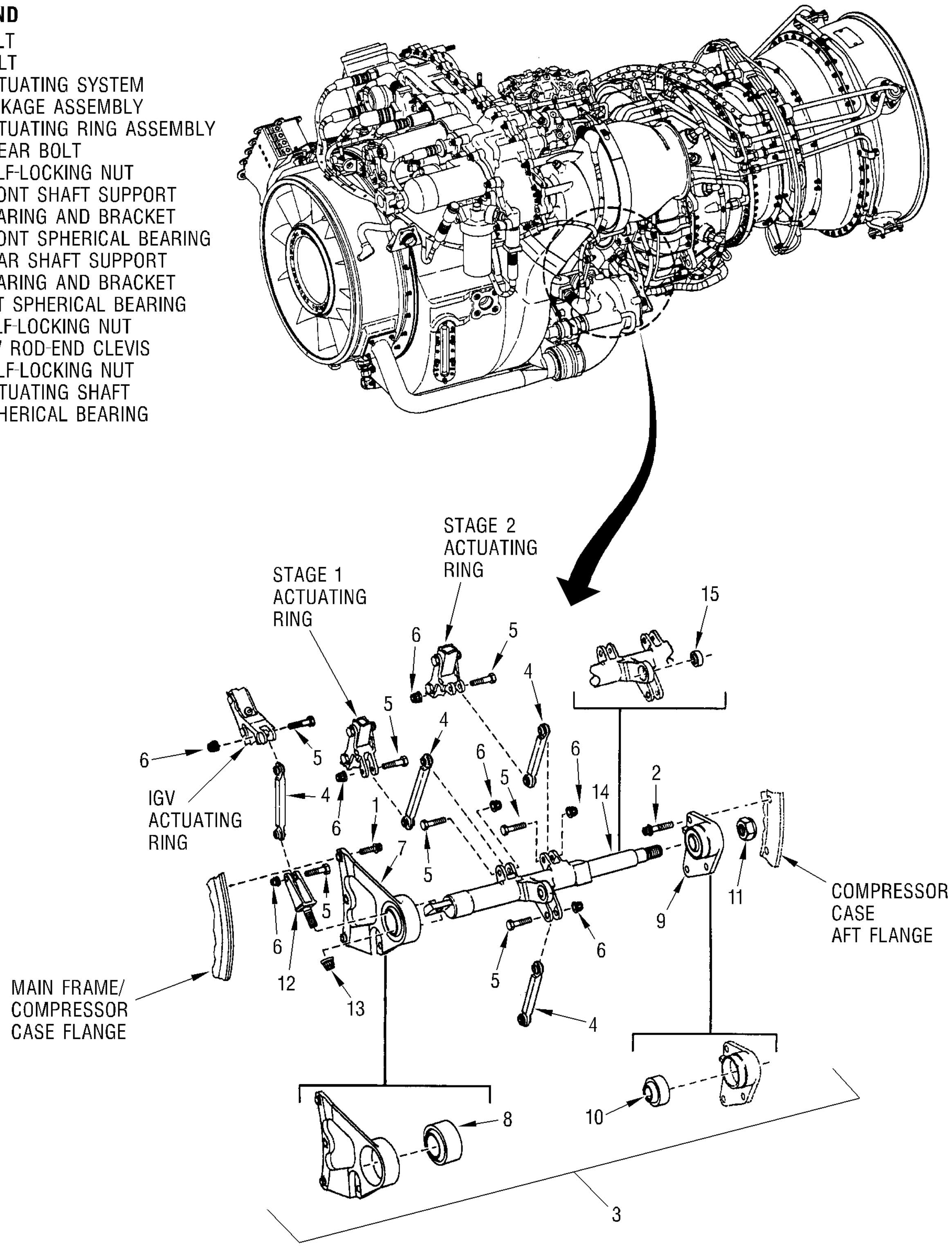
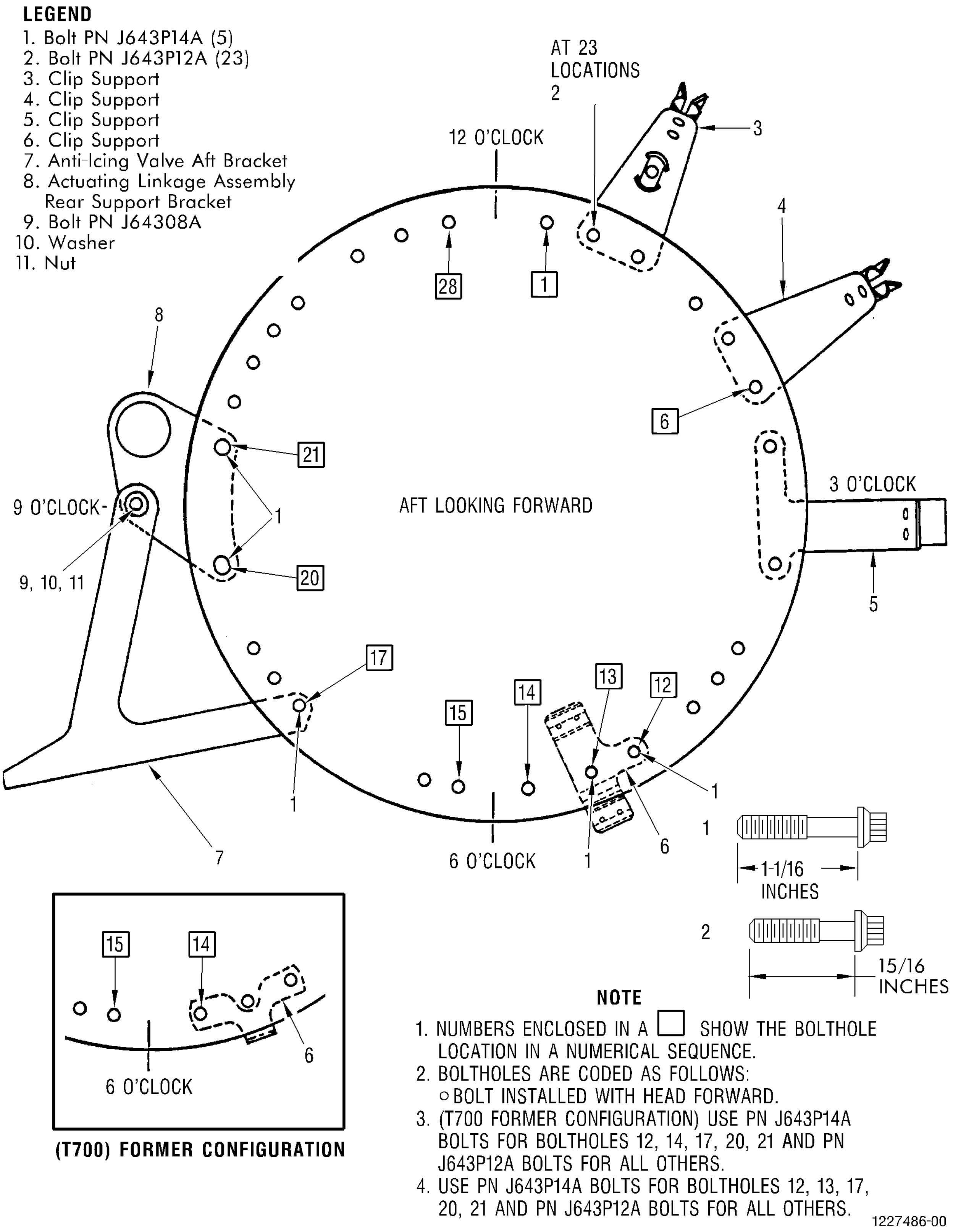


Figure 2-49.1 Actuating System Linkage



LEGEND
1. Bolt PN J643P14A (5)
2. Bolt PN J643P12A (23)
3. Clip Support
4. Clip Support
5. Clip Support
6. Clip Support
7. Anti-Icing Valve Aft Bracket
8. Actuating Linkage Assembly Rear Support Bracket
9. Bolt PN J64308A
10. Washer
11. Nut

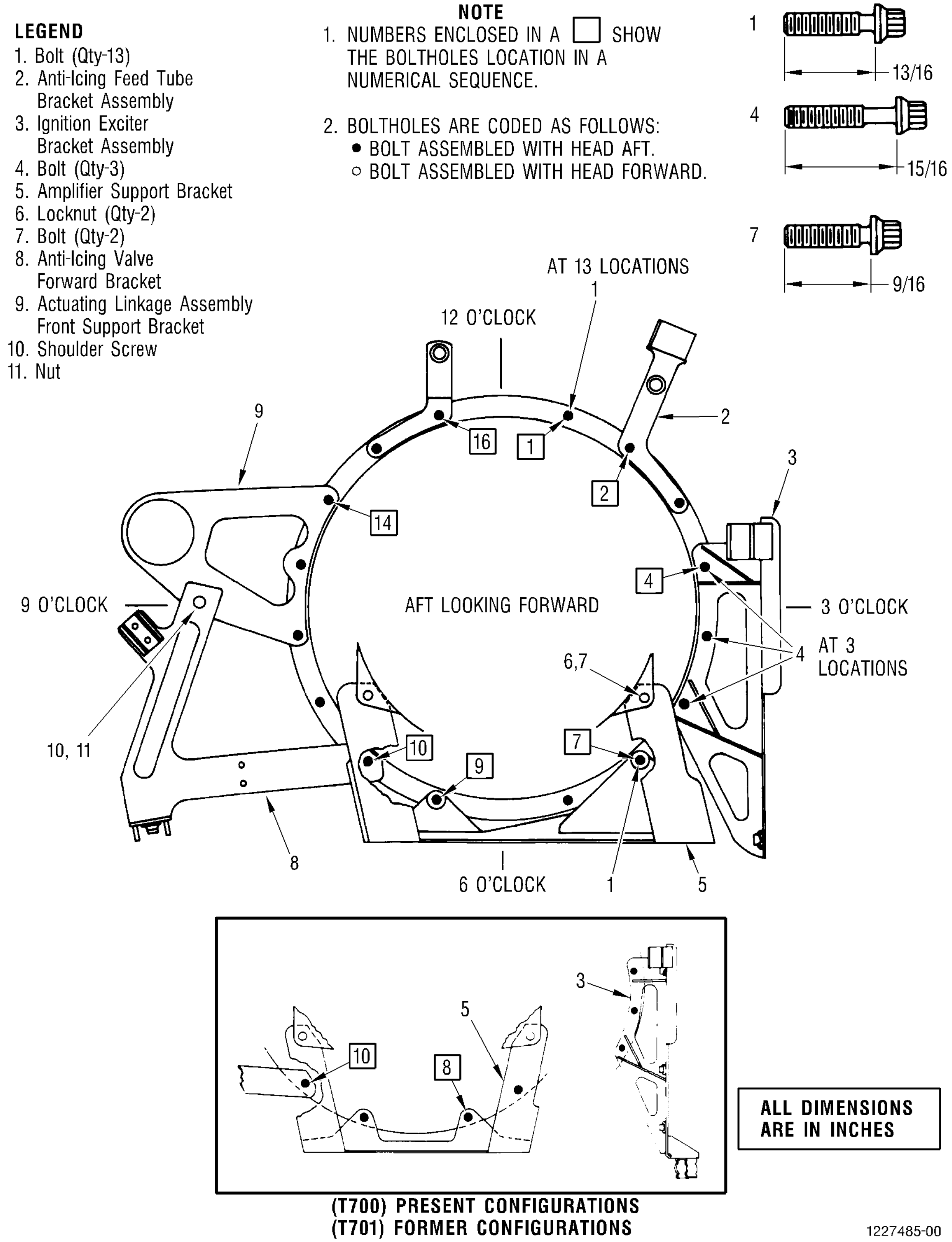
(T700) FORMER CONFIGURATION

NOTE

1. NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLE LOCATION IN A NUMERICAL SEQUENCE.
2. BOLTHOLES ARE CODED AS FOLLOWS:
   ○ BOLT INSTALLED WITH HEAD FORWARD.
3. (T700 FORMER CONFIGURATION) USE PN J643P14A BOLTS FOR BOLTHOLES 12, 14, 17, 20, 21 AND PN J643P12A BOLTS FOR ALL OTHERS.
4. USE PN J643P14A BOLTS FOR BOLTHOLES 12, 13, 17, 20, 21 AND PN J643P12A BOLTS FOR ALL OTHERS.

1227486-00

Figure 2-49.2 Compressor-to-Diffuser Case Flange; Bolting Diagram



LEGEND

1. Bolt (Qty-13)
2. Anti-Icing Feed Tube Bracket Assembly
3. Ignition Exciter Bracket Assembly
4. Bolt (Qty-3)
5. Amplifier Support Bracket
6. Locknut (Qty-2)
7. Bolt (Qty-2)
8. Anti-Icing Valve Forward Bracket
9. Actuating Linkage Assembly Front Support Bracket
10. Shoulder Screw
11. Nut

NOTE

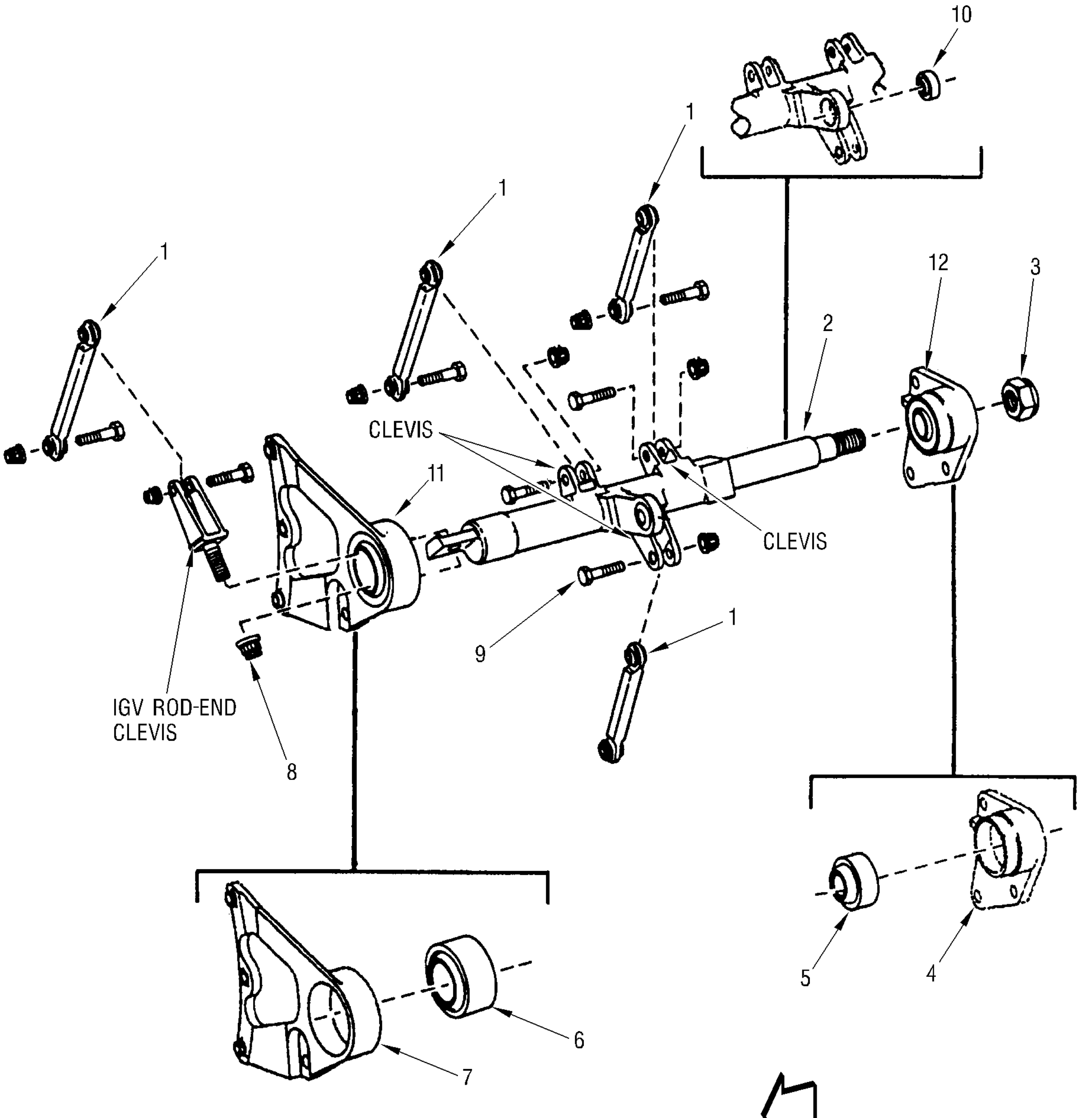
1. NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLES LOCATION IN A NUMERICAL SEQUENCE.
2. BOLTHOLES ARE CODED AS FOLLOWS:
   - ● BOLT ASSEMBLED WITH HEAD AFT.
   - ○ BOLT ASSEMBLED WITH HEAD FORWARD.

ALL DIMENSIONS ARE IN INCHES

(T700) PRESENT CONFIGURATIONS
(T701) FORMER CONFIGURATIONS

1227485-00

Figure 2-49.3 Main Frame-to-Compressor Case; Bolting Diagram



LEGEND

1. LINK ASSEMBLY
2. ACTUATING SHAFT
3. SELF-LOCKING NUT
4. REAR BRACKET
5. REAR SPHERICAL BEARING
6. FRONT SPHERICAL BEARING
7. FRONT BRACKET
8. NUT
9. SHEAR BOLT (QTY-7)
10. SPHERICAL BEARING
11. FRONT BRACKET ASSEMBLY
12. REAR BRACKET ASSEMBLY

1222908-00

Figure 2-49.4 Actuating System Linkage Assembly

NOTE

- To remove front spherical bearing (6), the front bracket assembly (11) must be positioned forward-end-up on arbor press.
- To remove rear spherical bearing (5), the rear bracket assembly (12) must be positioned forward-end-down on arbor press.

(3) Using an arbor press, carefully press bearing from bracket.

(4) Fluorescent penetrant-inspect bracket bore for cracks. No cracks allowed.

c. Using an arbor press, install bearings in bracket as follows:

(1) Using an arbor press and spherical bearing swage tool LMT 806 (Appendix F) for the front spherical bearing (6) or LMT 807 (Appendix F) for the rear spherical bearing (5), swage bearing in place, one side at a time.

(2) Check push-out force of bearing in both forward and aft directions. Bearing must not shift under a load of 300 pounds.

(3) Inspect spherical bearing rotation for freedom of movement. Bearing shall be free to move in all directions.

(4) If spherical bearing (5) was replaced, install support bearing, bracket (4) and self-locking nut (3) onto actuating shaft. Torque self-locking nut to 100-125 inch-pounds.

(5) If spherical bearing (6) was replaced, install support bearing, bracket (7), IGV rod and clevis and self-locking nut (8). Torque self-locking nut to 45-55 inch-pounds.

d. Replace spherical bearing (10) as follows:

NOTE

To remove actuating shaft spherical bearing (10), the actuating shaft (2) must be positioned forward-end-up on arbor press.

(1) Using an arbor press, carefully press spherical bearing (10) from actuating shaft (2).

WARNING

Acetone
ASTM-D329

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke while using it, and do not use it where others are smoking.
- Prolonged inhalation of vapor can irritate eyes and mucous membranes and can cause dizziness and headache. If vapors cause drowsiness, go to fresh air.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Immediately remove solvent-saturated clothing.
- When handling large quantities of liquid (more than a gallon), use at air-exhausted workbench. Wear approved gloves.
- Store solvent and dispose of liquid-soaked rags in approved metal safety container. Metal containers of solvent must be grounded to maintain electrical continuity.

(2) Using lint-free wiper dipped in acetone (item 1A, Appendix D), clean bearing bore in shaft.

(3) Fluorescent penetrant-inspect bearing bore in shaft for cracks. No cracks allowed.

e. Install spherical bearing in shaft as follows:

(1) Using arbor press and spherical bearing swage tool LMT 808 (Appendix F), swage bearing in place, one side at a time.

(2) Check push-out force of bearing in both forward and aft directions. Bearing must not shift under a load of 150 pounds.

(3) Inspect spherical bearing rotation for freedom of movement. Bearing shall be free to move in all directions.

2-71.5. Re-swaging of Spherical Bearing in Actuating System Linkage Assembly.

Re-swage spherical bearing (5, fig. 2-49.4) as follows:

a. Using an arbor press and spherical bearing swage tool LMT 808 (Appendix F), carefully re-swage one or both sides of bearing as required.

b. Check push-out force of bearing in both forward and aft directions. Bearing must not shift under a load of 300 pounds.

c. Inspect spherical bearing for freedom of movement. Bearing shall be free to move in all directions.

2-71.6. Installation of Actuating System Linkage Assembly.

a. Install four shear bolts (5, fig. 2-49.1), four self-locking nuts (6), and link assemblies (4) onto IGV rod-end clevis (12) and onto clevis on actuating shaft (14). Torque nuts (6) to 32-35 inch-pounds.

b. Remove bolts from boltholes 12, 13, 14 (fig. 2-49.3). Position actuating system linkage assembly so that holes in front shaft support bearing and bracket (9) are alined with holes 12, 13, and 14 in main frame-to-compressor flange.

c. Slide bolts from boltholes 12, 13, and 14 through holes in front support bracket and thread them into boltholes on main frame-to-compressor flange. Torque bolts to 45-50 inch-pounds.

d. Secure anti-icing valve forward bracket (8) to actuating linkage assembly front support bracket (9) using shouldered screw (10) and nut (11). Torque nut (11) to 45-50 inch-pounds.

e. Remove bolts from boltholes 20 and 21 (fig. 2-49.2). Position rear support bracket (8) so that holes in support are alined with holes 20 and 21 on compressor-to-diffuser case flange.

f. Slide bolts from boltholes 20 and 21 through holes in rear support bracket and thread them into boltholes on compressor-to-diffuser case flange. Torque bolts to 45-50 inch-pounds.

g. Secure anti-icing valve aft bracket (7) to actuating linkage assembly rear support bracket (8) using bolt (9), washer (10), and nut (11). Torque bolt (9) to 45-50 inch-pounds.

h. Inspect rear shaft support bearing and bracket (fig. 2-49, section A-A) assembly for axial movement as per paragraph 2-71.1.

(1) If axial movement is out of limits, do the following:

(a) Remove actuating system linkage assembly (para 2-71.2, steps b through f).

(b) Replace rear shaft support bearing and bracket (para 2-71.4).

(c) Reinstall actuating system linkage assembly (para 2-71.6).

(d) Perform axial movement inspection (step h).

NOTE

Bolts securing linkage assembly to inlet guide vane, stage 1 and stage 2 actuating rings are installed with boltheads aft.

i. Connect link assemblies (4, fig. 2-49.1) to IGV, stage 1 and stage 2 actuating rings, using bolts (5) and nuts (6). Torque nuts (6) to 32-35 inch-pounds.

2-72. MIDFRAME FUEL INJECTOR PORT.

2-73. Repair of Fuel Injector Seating Surface.

a. Allow engine to cool for at least 1 hour before beginning repair.

NOTE

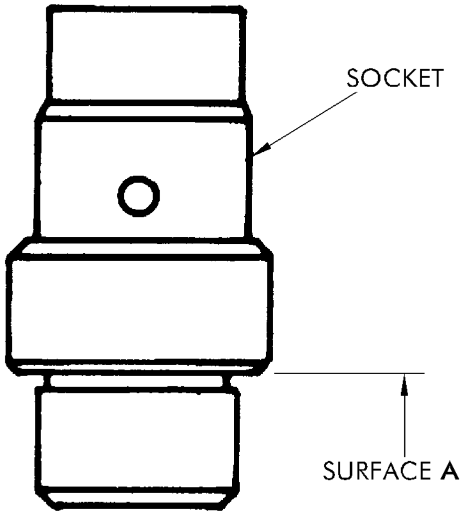
The grit size of lapping compound should be used as a guide in selecting equivalents.

b. Coat surface A of fuel injector boss lapping fixture LMT 754 (fig. 2-50) with compound (item 63, 64, or 65, Appendix D) or equivalent.

c. Insert appropriate drive into socket; then, insert lapping fixture into fuel injector port (8, fig. 2-40).

d. Using a back and forth rotating motion, lap fuel injector seating surface (15) until burrs or high metal are removed.

e. Remove fuel injector boss lapping fixture LMT 754 (fig. 2-50) from fuel injector port (8, fig. 2-40).



1157285-00-D2

Figure 2-50. Fuel Injector Boss Lapping Fixture LMT 754

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

f. Using towel (item 112, Appendix D) soaked in solvent (item 99, Appendix D), remove compound from seating surface (15).

g. Inspect seating surface for burrs and high metal; none allowed.

h. Repeat steps a thru g for remaining defective fuel injector seating surfaces.

i. Install fuel injector into midframe port (para 6-26).

j. Do an idle speed leakage check (table 1-19 or table 1-39 (AVIM)).

2-74. FORWARD SUSPENSION LUG.

2-75. (T700, T701C, T701D) Removal of Forward Suspension Lug.

a. Remove green electrical cables (3, fig. 2-51) from clips (1).

b. Remove only those two nuts (4) that secure forward suspension lug (2) to swirl frame.

c. Remove lug (2).

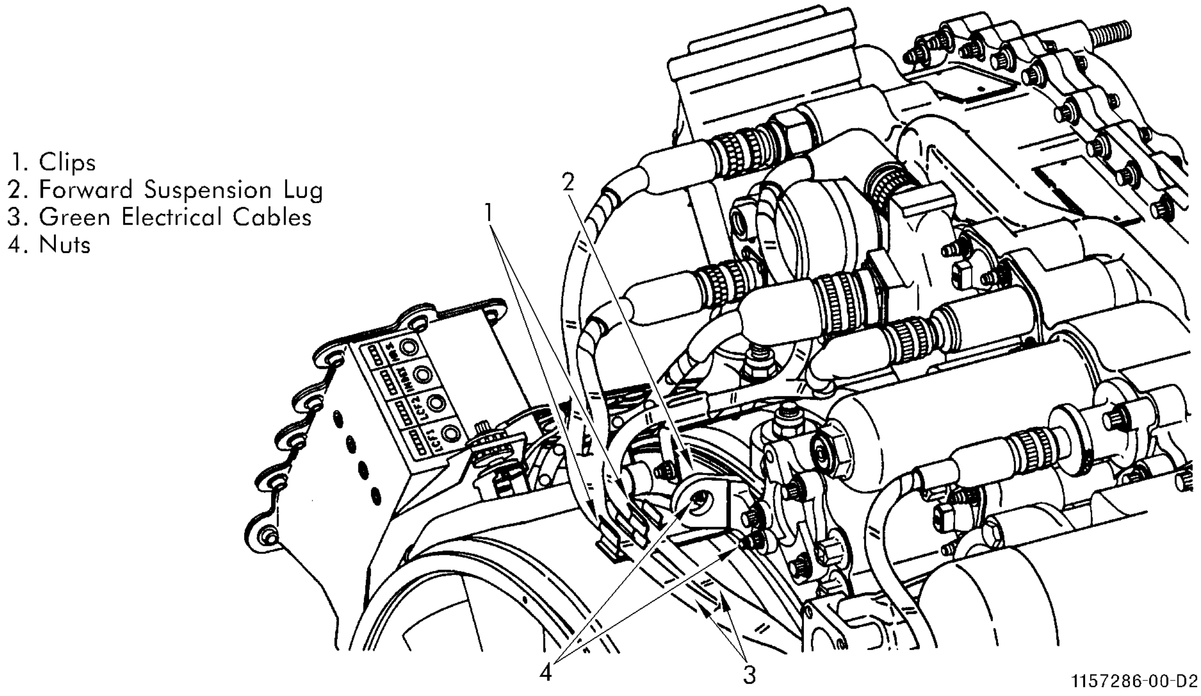


*Figure 2-51. **(T700, T701C, T701D)** Forward Suspension Lug; Removal and Installation*

2-76. (T701) Removal of Forward Suspension Lug.

a. Remove green electrical cables (4, fig. 2-52) and B-sump delta pressure tube (3) from clips (1).

b. Remove only two nuts (5) that secure forward suspension lug (2) to swirl frame.

c. Remove lug (2).

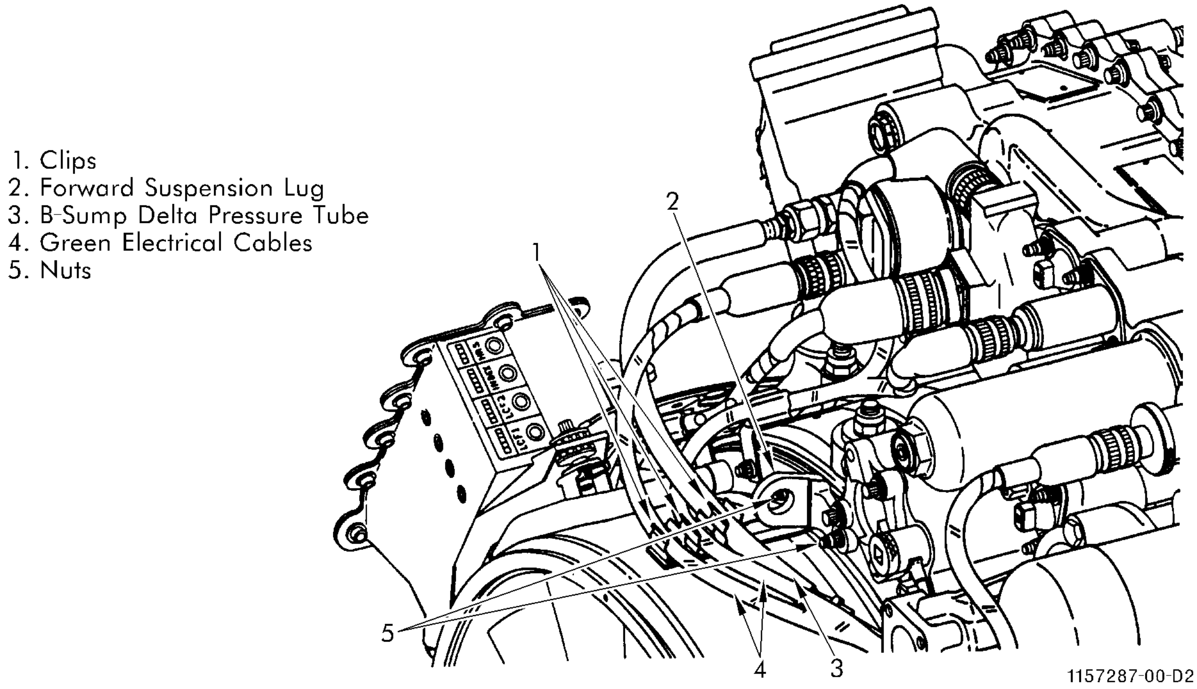


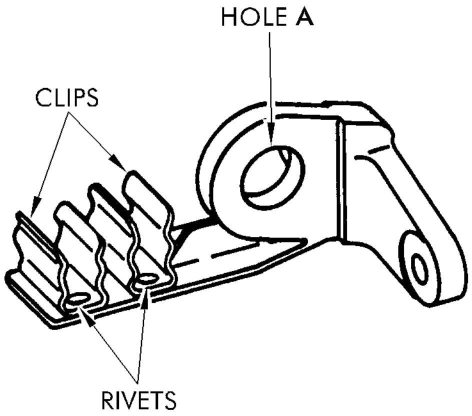
*Figure 2-52. **(T701)** Forward Suspension Lug; Removal and Installation*

2-77. Inspection of Forward Suspension Lug.

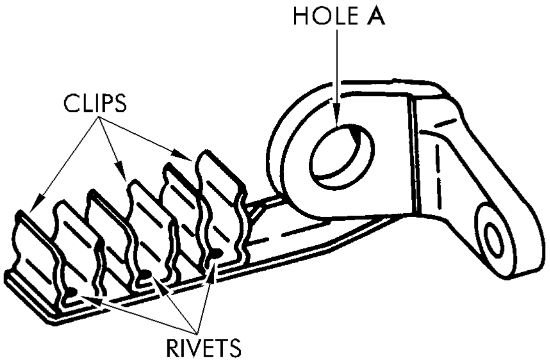
See table 2-21.

Table 2-21. Inspection of Forward Suspension Lug

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Forward suspension lug (fig. 2-53) for:			
a. Cracks.	None allowed.	Not repairable.	Replace lug (para 2-80 **(T700, T701C, T701D)** or 2-81 **(T701)**).
b. Nicks, dents, scratches, and gouges.	Any number, 0.020 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
c. Cracked or broken rivets.	None allowed.	Not repairable.	Replace lug (para 2-80 **(T700, T701C, T701D)** or 2-81 **(T701)**).
d. Worn hole A.	0.510 inch diameter.	Not repairable.	Replace lug (para 2-80 **(T700, T701C, T701D)** or 2-81 **(T701)**).



(T700,T701C, T701D)



(T701)

Figure 2-53. Forward Suspension Lug; Inspection

2-78. (T700, T701C, T701D) Installation of Forward Suspension Lug.

a. Place forward suspension lug (2, fig. 2-51) on swirl frame studs at 12 o'clock position.

b. Install two nuts (4), and torque nuts to 45-50 inch-pounds.

c. Push green electrical cables (3) into clips (1).

2-79. (T701) Installation of Forward Suspension Lug.

a. Place forward suspension lug (2, fig. 2-52) on swirl frame studs at 12 o'clock position.

b. Install two nuts (5), and torque nuts to 45-50 inch-pounds.

c. Push green electrical cables (4) and B-sump delta pressure tube (3) into clips (1).

2-80. PREPARING COLD SECTION MODULE FOR STORAGE OR SHIPMENT.

2-81. Preliminary Information. The cold section module shipping adapter 21C7437G01 and the gas generator shaft tie-bolts restraining adapter 21C7439P01 are used with the shipping and storage container 8145CON004-1. The gas generator shaft tie-bolts restraining adapter is used to hold the gas generator long rotor bolts securely in place while storing or shipping the cold section module. The cold section module shipping adapter is used to maintain proper weight distribution of the cold section module when installed in the shipping and storage container.

2-82. Installation of Gas Generator Shaft Tie-Bolts Restraining Adapter 21C7439P01.

a. Remove the following modules:

- accessory section (para 5-5 **(T700)** or 5-6 **(T701, T701C, T701D)**)
- power turbine (para 4-7)
- hot section (para 3-6) and (para 3-15 **(T700)** or para 3-16 **(T701, T701C, T701D)**)

b. Remove the following components:

- **(T700, T701)** ECU or **(T701C, T701D)** DEC (para 7-12)
- **(T700, T701)** history recorder or **(T701C, T701D)** history counter (para 7-18)
- anti-icing bleed and start valve (para 10-26)

c. Install gas generator shaft tie-bolts restraining adapter 21C7439P01 (2, fig. 2-54) as follows:

(1) Remove five self-locking nuts (1, fig. 2-54) from gas generator long rotor bolts.

(2) Aline boltholes of gas generator shaft tie-bolts restraining adapter (2) with gas generator long rotor bolts (3).

(3) Insert narrow end of restraining adapter (2) into bore of gas generator turbine shaft so that long rotor bolts (3) fit into boltholes of adapter.

(4) Secure long rotor bolts to adapter with five self-locking nuts (1). Hand-tighten self-locking nuts.

2-83. Installation of Cold Section Module Shipping Adapter 21C7437G01.

CAUTION

Lifting lug (1, fig. 2-55) on cold section module shipping adapter 21C7437G01 is for lifting adapter only. Do not use adapter lifting lug to lift or to transport cold section module.

a. Install hook of suitable lifting device into lifting lug (1) of cold section module shipping adapter.

b. Hoist adapter to midframe flange of cold section module.

c. Aline “TOP” markings on adapter and on midframe flange. Be sure that gas generator shaft tie-bolts restraining adapter (2, fig. 2-54) is in place by looking through observation windows (2, fig. 2-55) in adapter.

d. Install 30 bolts (3) and 30 locknuts (4) into every other bolthole location on midframe flange.

e. Torque locknuts to 45-50 inch-pounds.

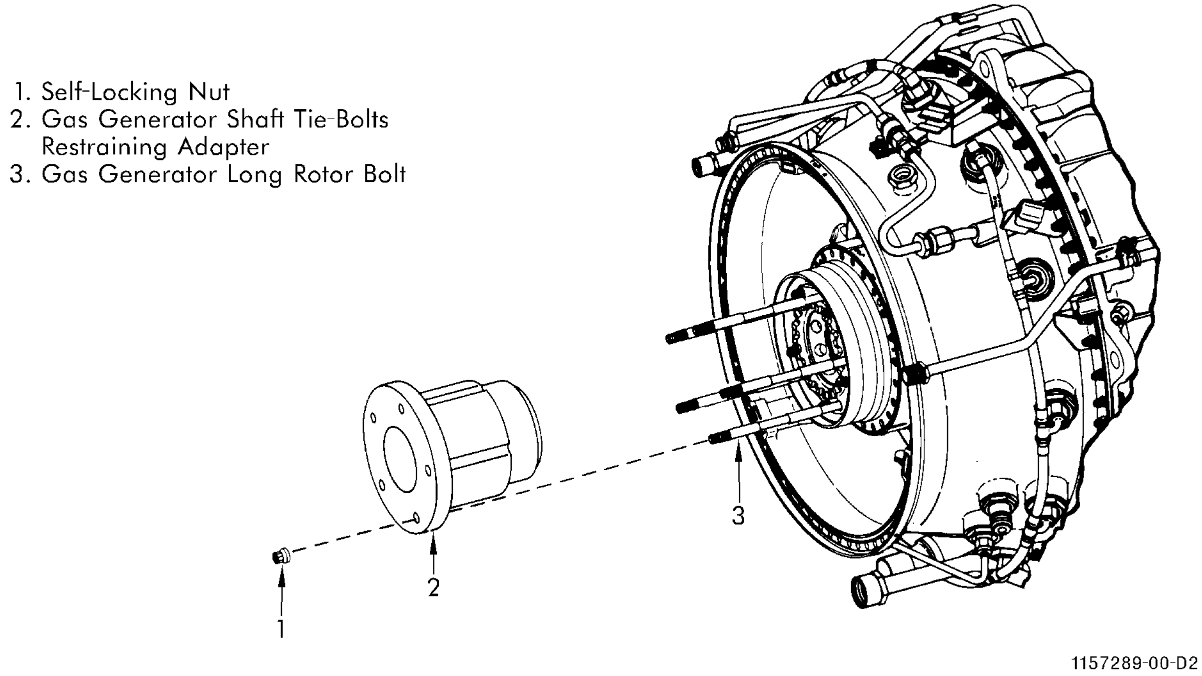


Figure 2-54. Gas Generator Shaft Tie-Bolts Restraining Adapter 21C7439P01; Removal and Installation

2-84. Installation of Cold Section Module into Shipping and Storage Container 8145CON004-1.

After gas generator shaft tie-bolts restraining adapter and cold section module shipping adapter have been installed on cold section module (para. 2-82 or 2-83), refer to paragraph 1-58 for installation of module into shipping and storage container. Install shipping and storage container cover (para 1-59).

2-85. PLACING COLD SECTION MODULE IN SERVICE.

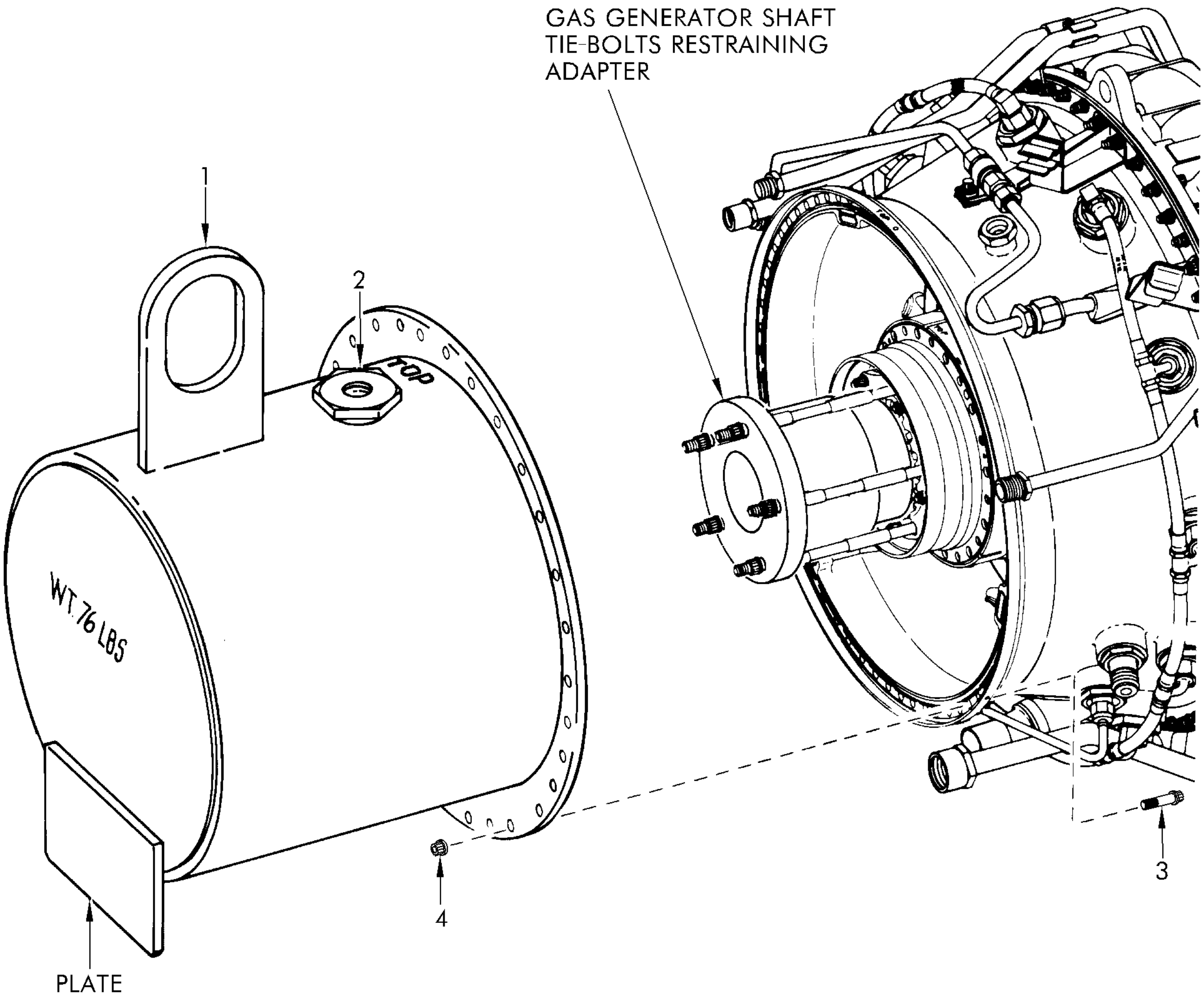
2-86. Preliminary Instructions.

NOTE

Shipping and storage container 8145CON004-1 is used for the cold section module, together with the cold section module shipping adapter 21C7437G01 and with the gas generator turbine shaft tie-bolts restraining adapter 21C7439P01.

a. Be sure that all records and forms are complete.

b. Remove shipping and storage container cover (para 1-49).



1. Lifting Lug
2. Observation Window
3. Bolt (Qty-30)
4. Locknut (Qty-30)

Figure 2-55. Cold Section Module Shipping Adapter 21C7437G01; Removal and Installation

c. Remove cold section module from container (para 1-50).

d. Install module into maintenance stand adapter 21C7071G01 (para 1-56) or into transportation adapter 21C7082G02 (para 1-54).

e. Inspect overall condition of module.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

NOTE

Protective caps should not be removed from cold section module until necessary for buildup.

f. Remove any barrier material and tape from module. Using dry cleaning solvent (item 99, Appendix D), remove tape residue.

g. Clean external module surfaces as necessary.

2-87. Removal of Cold Section Module Shipping Adapter 21C7437G01.

CAUTION

Lifting lug (1, fig. 2-55) on cold section module shipping adapter 21C7437G01 is for lifting shipping adapter only. Do not use adapter lifting lug to lift or to transport cold section module.

a. Install hook of suitable lifting device into lifting lug (1) of shipping adapter. Take up slack to partially support weight of adapter.

b. Remove 30 locknuts (4) and 30 bolts (3) from midframe flange and carefully slide adapter aft.

2-88. Removal of Gas Generator Shaft Tie-Bolts Restraining Adapter 21C7439P01.

a. Remove five self-locking nuts (1, fig. 2-54) from gas generator long rotor bolts (3).

b. Slide adapter aft, and remove it from gas generator turbine shaft.

2-89. Activating Cold Section Module.

a. Replace aircraft gas turbine nameplate (1, fig. 2-56) as follows:

(1) On cold section module being replaced, grasp the drivescrew (2) with end nippers; then, pull upward and turn nippers in a ccw direction. Discard drivescrews.

(2) Pre-bend new nameplate (1), to fit the contour of the main frame (3).

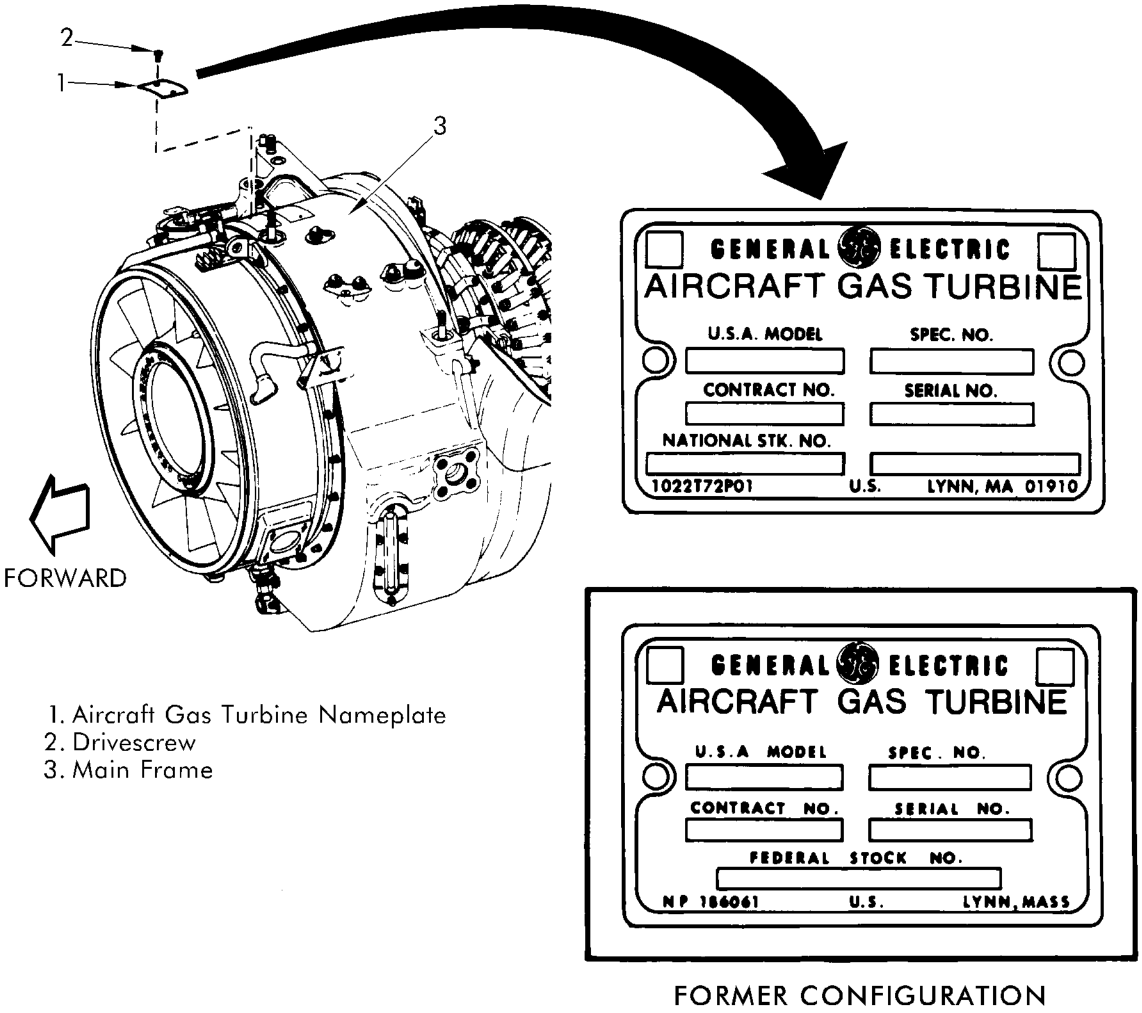


Figure 2-56. Aircraft Gas Turbine Nameplate; Removal and Installation

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

(3) Using a lint-free wiper (item 113, Appendix D) soaked with isopropyl alcohol (item 3, Appendix D), or dry cleaning solvent (item 99, Appendix D), clean mating surfaces of nameplate (1) and main frame (3).

WARNING

Hysol Epoxy EA-934 NA Part A and
EA-934 NA Part B

- Contact with vapor or liquid can cause severe skin and lung irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. If vapors cause irritation, go to fresh air.
- When mixing, heating, or applying solution, wear approved gloves. If prolonged contact with vapor is likely, wear approved respirator.
- Do not eat, smoke, or carry smoking materials in areas where solution is handled.
- Repeated skin exposure to the uncured epoxy resin may cause allergic reactions.

(4) Mix EPON 934 adhesive (item 1, Appendix D) as follows:

(a) Use 100 ±3 parts by weight of EPON 934A.

(b) Use 33 ±1 part by weight of EPON 934B.

(c) Mix EPON 934 in a plastic container, using a spatula or equivalent. Use adhesive within 15 minutes after mixing.

(5) Using EPON 934 adhesive, plug drivescrew holes; then, apply adhesive to main frame and nameplate. Leave about 1/32 inch thick coating of adhesive on both surfaces.

(6) Push nameplate down firmly onto main frame. Remove excess adhesive which is squeezed out from mating area.

(7) Cure adhesive for a minimum of two hours at a room temperature of 60°- 80°F or for a minimum of one hour at 160°-190°F, using a heat lamp or a hot air blower.

b. Remove primer nozzles (para 6-5 **(T700)**) and igniter plugs (para 7-5 **(T700)** or 7-6 **(T701, T701C, T701D)**).

c. Install hot section module (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)** and para 3-13).

d. Reinstall primer nozzles (para 6-8 **(T700)**) and igniter plugs (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).

e. Install the following:

- power turbine module (para 4-11)
- accessory section module (para 5-8 **(T700)** or 5-9 **(T701, T701C, T701D)**)
- ECU or DEC (para 7-16)
- history recorder or history counter (para 7-22)
- anti-icing bleed and start valve (para 10-31)

f. Perform engine checks and tests required for replacement of parts (para 1-223).

CHAPTER 3

COMBUSTION SECTION

HOT SECTION MODULE

3-1. CHAPTER OVERVIEW.

This chapter contains instructions for removing, cleaning, inspecting, repairing, and installing components of the hot section module to the extent allowed by the maintenance allocation chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

3-2. CHAPTER INDEX.

Maintenance procedures in this chapter are arranged as follows:

3-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. The stages 1 and 2 gas generator turbine rotor and gas generator stator are parts of a matched assembly. If either the stage 1 rotor, stage 2 rotor, or gas generator stator is replaced, replace the complete matched assembly.

b. When removing or installing parts, prevent entry of foreign objects into air and oil passages.

c. Do not use tape to cover oil passages or openings. Tape adhesive can dissolve in oil and can cause contamination.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

d. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

e. Inspect replacement parts for serviceability before installation.

f. Always use a backup wrench on fittings when removing or installing hoses or tubes.

g. When connecting hoses or tubes, see wrench-arc tightening method (para H-14, Appendix H).

h. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

3-4. BORESCOPE INSPECTION OF STAGE 1 NOZZLE VANES AND COMBUSTION LINER.

Refer to paragraph 1-192 for borescope inspection procedures for the stage 1 nozzle vanes and the combustion liner.

3-5. STAGES 1 AND 2 GAS GENERATOR TURBINE ROTOR AND GAS GENERATOR STATOR.

3-6. Removal of Stages 1 and 2 Gas Generator Turbine Rotor and Gas Generator Stator (AVIM).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Service life of **(T700)** 6039T54G02 and subsequent, or **(T701)** 6053T40G01 and subsequent is a critical characteristic.

NOTE

The following procedures apply when the engine is installed in maintenance stand adapter 21C7071G01 (para 1-56) Modular Engine Test System (METS), Flexible Engine Diagnostic System (FEDS), or Compact Engine Test System (CETS).

a. Remove power turbine module (para 4-7).

b. If reinstalling gas generator stator, match-mark gas generator stator-to-midframe flange, using blue Dykem marker (item 82, Appendix D).

NOTE

The no. 1 long rotor bolt is the bolt that is closest to the O-matchmark on the stage 2 rotor cooling plate.

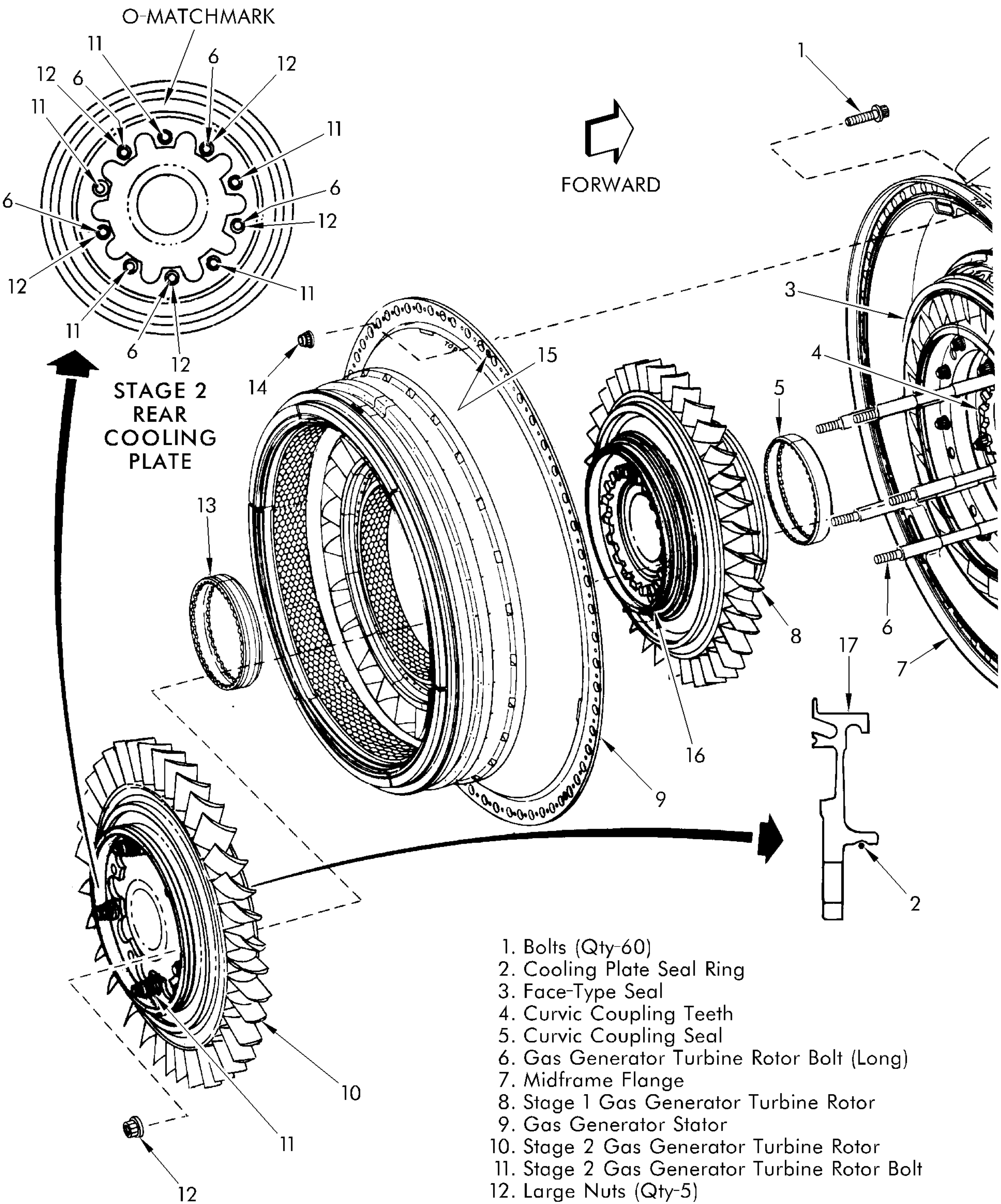
c. If reinstalling the stage 2 gas generator turbine rotor, match-mark the number 1 long rotor bolt and face of stage 2 rear cooling plate, using blue Dykem marker (item 82, Appendix D). **(T701, T701C, T701D)** If installing new stage 2 gas generator turbine rotor, match-mark the number 1 long rotor bolt, using blue Dykem marker (item 82, Appendix D).

CAUTION

Be sure stage 1 nozzle face-type seal (3, fig. 3-1 or 3-2) is installed. If module or engine is found to have been operated without stage 1 nozzle face-type seal installed, the stage 1 and stage 2 turbine blades and dampers may have been subjected to excessive excitation force. Engines operated without stage 1 nozzle face-type seal installed must have the stage 1 and stage 2 turbine blades and dampers replaced.

d. **(T701C, T701D)** Remove face-type seal (17, fig. 3-2).

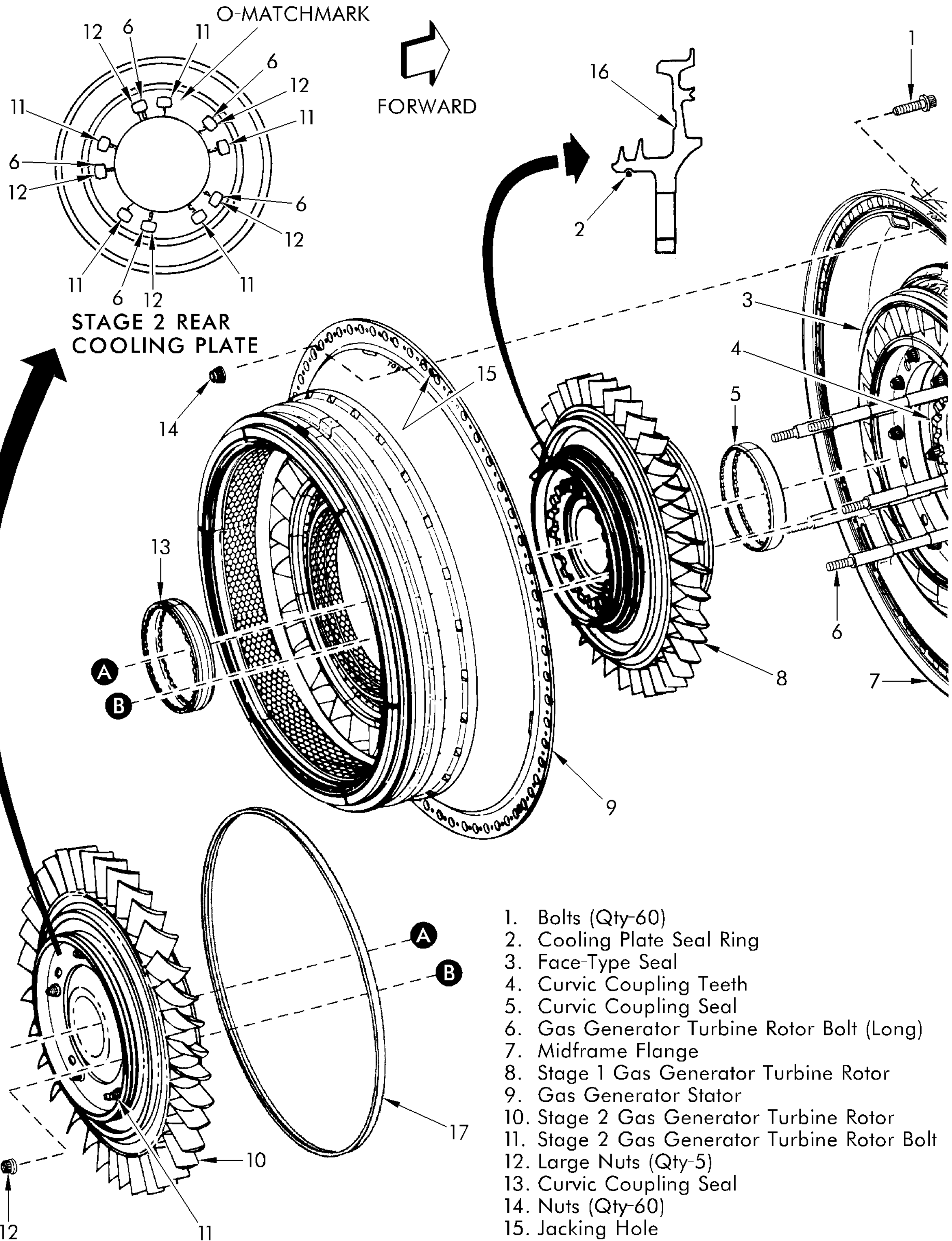
e. There are two methods for removing nuts (12, fig. 3-1 **(T700)** or fig. 3-2 **(T701, T701C, T701D)**) from gas generator rotor bolts (6). If using lock/support adapter (fig. 3-3), see step f. If using gas generator rotor antirotation bar (2, fig. 3-4), see step g.



1. Bolts (Qty-60)
2. Cooling Plate Seal Ring
3. Face-Type Seal
4. Curvic Coupling Teeth
5. Curvic Coupling Seal
6. Gas Generator Turbine Rotor Bolt (Long)
7. Midframe Flange
8. Stage 1 Gas Generator Turbine Rotor
9. Gas Generator Stator
10. Stage 2 Gas Generator Turbine Rotor
11. Stage 2 Gas Generator Turbine Rotor Bolt
12. Large Nuts (Qty-5)
13. Curvic Coupling Seal
14. Nuts (Qty-60)
15. Jacking Hole
16. Stage 1 Aft Cooling Plate
17. Stage 2 Forward Cooling Plate

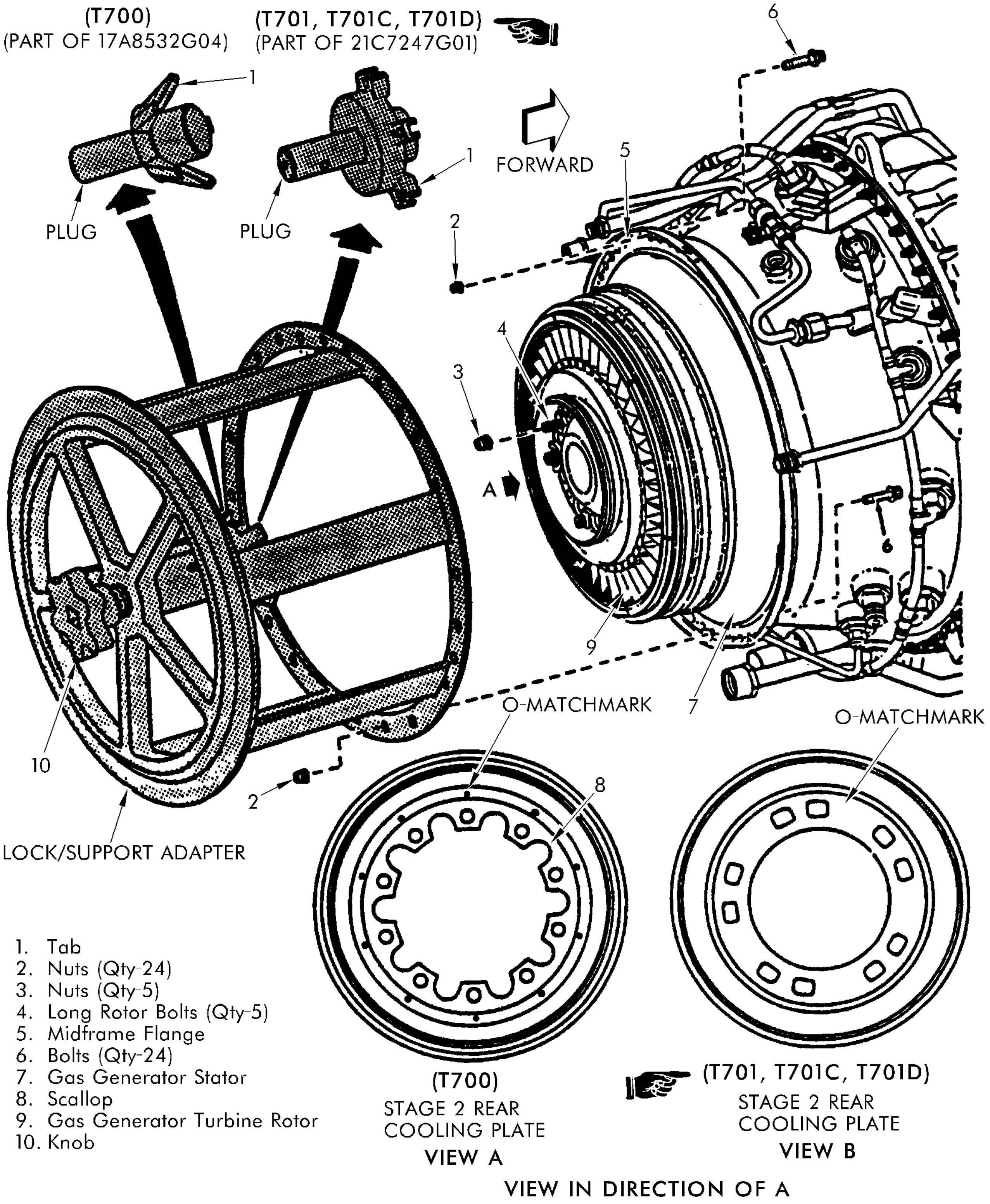
1157313-00-A2A

Figure 3-1. *(T700)* ***Stages 1 and 2 Gas Generator Turbine Rotor and Gas Generator Stator; Removal and Installation***



1. Bolts (Qty-60)
2. Cooling Plate Seal Ring
3. Face-Type Seal
4. Curvic Coupling Teeth
5. Curvic Coupling Seal
6. Gas Generator Turbine Rotor Bolt (Long)
7. Midframe Flange
8. Stage 1 Gas Generator Turbine Rotor
9. Gas Generator Stator
10. Stage 2 Gas Generator Turbine Rotor
11. Stage 2 Gas Generator Turbine Rotor Bolt
12. Large Nuts (Qty-5)
13. Curvic Coupling Seal
14. Nuts (Qty-60)
15. Jacking Hole
16. Stage 1 Aft Cooling Plate
☞ 17. (701C, 701D) Face-Type Seal

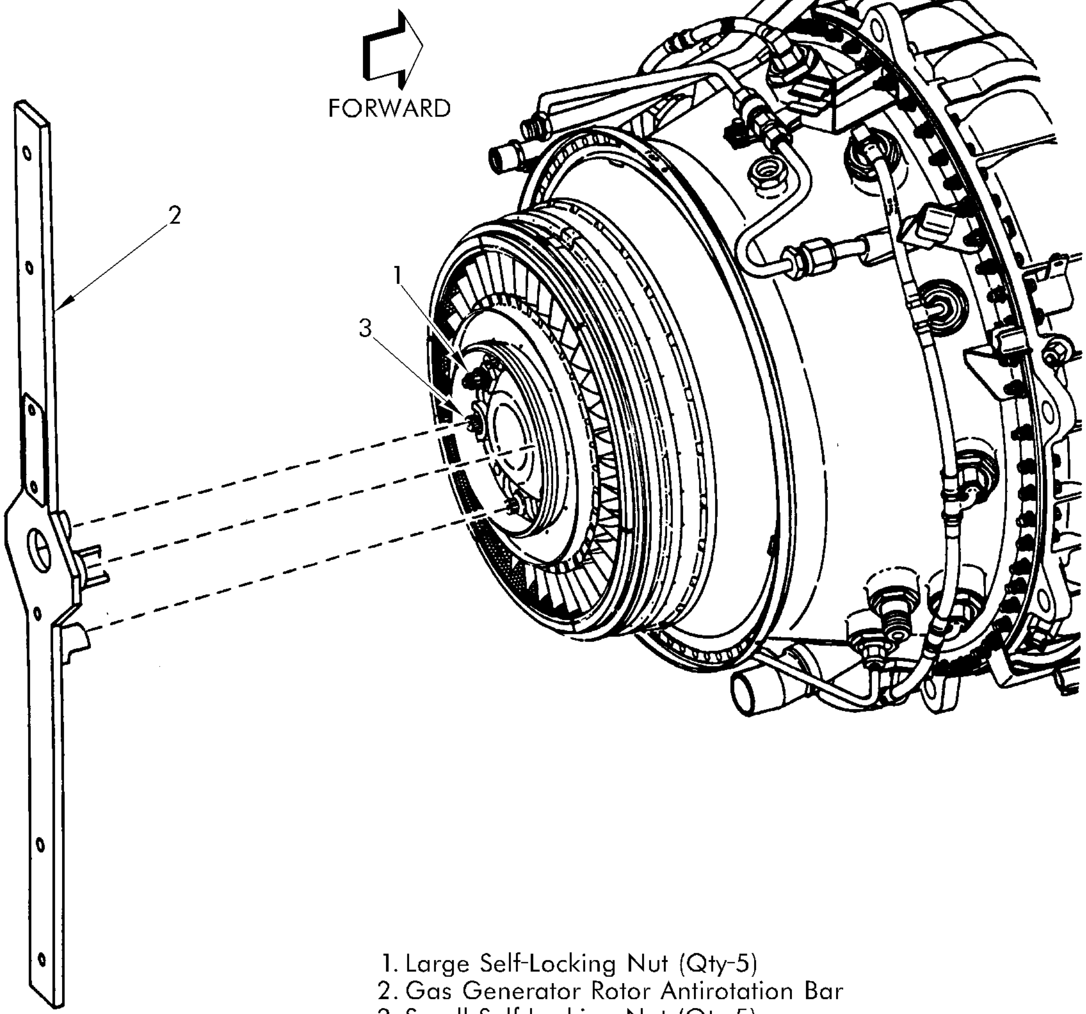
*Figure 3-2. **(T701, T701C, T701D)** Stages 1 and 2 Gas Generator Turbine Rotor and Gas Generator Stator and Face-Type Seal; Removal and Installation*



1. Tab
2. Nuts (Qty-24)
3. Nuts (Qty-5)
4. Long Rotor Bolts (Qty-5)
5. Midframe Flange
6. Bolts (Qty-24)
7. Gas Generator Stator
8. Scallop
9. Gas Generator Turbine Rotor
10. Knob

1157315-01

Figure 3-3. Lock/Support Adapter; Installation and Removal



1. Large Self-Locking Nut (Qty-5)
2. Gas Generator Rotor Antirotation Bar
3. Small Self-Locking Nut (Qty-5)

1157316-00-A2A

Figure 3-4. Gas Generator Rotor Antirotation Bar 21C7399G01; Installation

f. Remove nuts (12, fig. 3-1 **(T700)** or fig. 3-2 **(T701, T701C, T701D)**) as follows:

(1) Remove two bolts (1, fig. 3-1 **(T700)** or 3-2 **(T701, T701C, T701D)**) and nuts (14) from gas generator stator (9) and midframe flange (7).

(2) **(T700)** Install lock/support adapter 17A8532G04 (fig. 3-3) onto midframe flange (5) with 24 nuts (2) and 24 bolts (6) that were removed from power turbine-to-midframe flange. Torque nuts to 70-75 inch-pounds.

(3) **(T701, T701C, T701D)** Install lock/support adapter 21C7247G01 (fig. 3-3) onto midframe flange (5), using 24 nuts (2) and 24 bolts (6) that were removed from power turbine-to-midframe flange. Torque nuts to 70-75 inch-pounds.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(4) **(T700)** Secure lock/support adapter plug as follows:

(a) Turn knob (10) until five tabs (1) of plug are close to scallops (8, view A) of cooling plate.

(b) Rotate gas generator turbine rotor (9) until scallops (8, view A) are alined with five tabs (1). Hand-tighten knob (10).

(5) **(T701, T701C, T701D)** Secure lock/support adapter plug as follows:

(a) Turn knob (10) until five tabs (1) of plug are close to cooling plate (view B).

(b) Rotate gas generator turbine rotor (9) until even numbers stamped on five tabs (1) are positioned directly over small nuts on stage 2 gas generator turbine rotor bolt (11, fig. 3-2). Hand- tighten knob (10).

WARNING

Penetrating Oil

- Do not use near open flames or other heat source including smoking
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritiation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

(6) Apply penetrating oil (item 88, Appendix D) to five large nuts (12, fig. 3-1 **(T700)** and fig. 3-2 **(T701, T701C, T701D)**) on gas generator turbine rotor long bolt (6). Allow penetrating oil to act for 30 minutes before attempting to remove nuts.

CAUTION

Torque shall be released only on the five large nuts (12). Otherwise, rotor imbalance may result.

NOTE

The no. 1 long rotor bolt is the bolt that is the closest to the O-matchmark on the stage 2 rear cooling plate.

(7) Break torque on each of the five large nuts (12) one at a time, without further loosening.

(8) Loosen five large nuts (12) one-quarter turn at a time until all nuts are completely loose.

(9) Remove and discard five large nuts (12).

CAUTION

Stage 2 gas generator turbine rotor (10) and gas generator stator (9) must be held in place by hand during removal of lock/support adapter to prevent rotor and stator from falling off engine.

(10) With another mechanic holding stage 2 turbine rotor (10) and stator (9), remove 24 nuts (2, fig. 3-3) and 24 bolts (6) from lock/support adapter.

(11) Remove lock/support adapter.

(12) Install two bolts (6) and two locknuts (2) (equally spaced) to secure stator to midframe flange.

g. If using gas generator rotor antirotation bar (2, fig. 3-4), remove five large nuts (12, fig. 3-1 **(T700)** or fig. 3-2 **(T701, T701C, T701D)**) as follows:

WARNING

Penetrating Oil

Observe warning in step f(6).

(1) Apply penetrating oil (item 88, Appendix D) to five large self-locking nuts (1, fig. 3-4). Allow penetrating oil to act for 30 minutes before attempting to remove nuts.

(2) Install antirotation bar (2) over three of the five small self-locking nuts (3).

CAUTION

Torque shall be released only on the five large nuts (12, fig. 3-1 **(T700)** and fig. 3-2 **(T701, T701C, T701D)**). Otherwise, rotor imbalance may result.

NOTE

The no. 1 long rotor bolt is the bolt that is closest to the O-matchmark on the stage 2 rear cooling plate.

(3) Break torque on each of the five large nuts (12), one at a time, without further loosening.

(4) Loosen five nuts (12) one-quarter turn at a time until all nuts are completely loose.

(5) Remove and discard five nuts (12).

CAUTION

Stage 2 gas generator turbine rotor (10) must be held in place by hand during removal of antirotation bar to prevent rotor from falling off engine.

(6) With another mechanic holding stage 2 turbine rotor (10), remove antirotation bar.

NOTE

Curvic coupling seal (13, fig. 3-1 **(T700)** or 3-2 **(T701, T701C, T701D)**) might come off with the rotor.

h. Remove stage 2 turbine rotor (10). Remove curvic coupling seal (13) if it did not come off with rotor.

i. Remove two bolts (1) and two locknuts (14) from gas generator stator and midframe flange.

j. Have another mechanic hold stage 1 gas generator turbine rotor (8) so that it will not be pulled aft when stator is removed.

CAUTION

Be sure stage 1 nozzle face-type seal (3, fig. 3-1 or 3-2) is installed. If module or engine is found to have been operated without stage 1 nozzle face-type seal installed, the stage 1 and stage 2 turbine blades and dampers may have been subjected to excessive excitation force. Engines operated without stage 1 nozzle face-type seal installed must have the stage 1 and stage 2 turbine blades and dampers replaced.

k. Remove stator (9). If stator cannot be removed by hand, do the following:

(1) Obtain three bolts PN J643P06A (to be used for jacking). Holding stator by hand, manually thread bolts into jacking holes (15) until bolts bottom.

(2) Turn each bolt clockwise one-quarter turn, one at a time until stator (9) is loose.

CAUTION

Be sure stage 1 nozzle face-type seal (3, fig. 3-1 or 3-2) is installed. If module or engine is found to have been operated without stage 1 nozzle face-type seal installed, the stage 1 and stage 2 turbine blades and dampers may have been subjected to excessive excitation force. Engines operated without stage 1 nozzle face-type seal installed must have the stage 1 and stage 2 turbine blades and dampers replaced.

(3) Remove stator (9); then remove three bolts used for jacking.

l. If reinstalling the stage 1 gas generator turbine rotor, match-mark the face of stage 1 rear cooling plate to the number 1 long rotor bolt, match-marked in step c, using blue Dykem marker (item 82, Appendix D).

m. Remove stage 1 turbine rotor (8) and curvic coupling seal (5).

n. Remove cooling plate seal ring (2) from **(T701, T701C, T701D)** stage 1 aft cooling plate (16, fig. 3-2) or **(T700)** stage 2 forward cooling plate (inner bore) (17, fig. 3-1).

3-7. Cleaning of Stages 1 and 2 Gas Generator Turbine Rotor and Gas Generator Stator and (T701C, T701D) Face-Type Seal (AVIM).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash outside surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and carbon.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Using dry, filtered, compressed air, dry the stages 1 and 2 gas generator turbine rotor, gas generator stator and **(T701C, T701D)** face-type seal.

3-8. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor (AVIM). See table 3-1.

Table 3-1. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
WARNING Flight Safety Critical Aircraft Part (Critical Characteristic(s)) Service life of **(T700)** 6039T54G02 and subsequent, or **(T701)** 6053T40G01 and subsequent is a critical characteristic.			
a. Turbine rotor blades fig. 3-5 **(T700, T701, T701C)** or **(T701D)** fig. 3-5.1 for:			
(1) Cracks:			
(a) Radial, at blade tip (2).	No more than three radial cracks per blade, up to 1/16 inch long, at least 1/8 inch apart.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-1. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) Axial, near blade tip (2).	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) In all other areas of blades.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(2) Tips (2) for:			
(a) Curling.	1/16 inch long at leading and trailing edges.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Burrs.	Any amount.	Not applicable.	Not applicable.
(3) Erosion on leading edge (1).	Any amount, 0.010 inch deep.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(4) Hot gas corrosion (sulfidation).	Any amount of discoloration or surface roughness if there is no blistering, splitting, or separation (delamination) of airfoil surface.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(5) Pits.	Any number, 0.005 inch deep (use a scriber having a 0.030 inch tip radius to detect pits), if airfoil coating is not damaged or cracked without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(6) Trailing edge (4) bowed from straight line.	0.030 inch from straight line.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

NOTE

Pits that are within usable limits have rounded bases and the same texture as the non-pitted coated surface.

Table 3-1. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(7) Plugged cooling air holes (3) at flow check (para 1-166) or if noted visually.	Not more than two on tip surface.	Any amount.	Remove foreign material, using a pin or wire. If a tip cooling hole is blocked or partially blocked by smeared blade material, use a round file or rotary grinder to locally remove the smeared metal. Work the file/grinder across the blade tip, removing the minimum material necessary to remove the smear. Do not attempt to drill through the smear. Drill may break. After smear is removed, remove dirt in hole with pin or wire. Repeat Hot Section cleaning (para 1-157). If plugged holes cannot be cleared, replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(8) **(T701D)** Stage 1 blades for missing TBC coating.	Any amount.	Not applicable.	Not applicable.
(9) Stage 1 turbine rotor blade tip (2) loss at trailing edge.	Not more than a 0.125 × 0.250 inch-size area missing.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(10) Exposed stage 1 and 2 dampers (dampers showing between bottom of turbine blades and cooling plates).	None.	None.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
b. Cooling plates (5, 6):			
(1) All areas except labyrinth seals for:			
(a) Cracks.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Nicks, dents, and scratches.	Any number, 1/64 inch deep, with no high metal.	Same as usable limits, with high metal.	Remove high metal and polish out sharp nicks.
(2) Labyrinth seal (8) for:			
(a) Cracks.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-1. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor (Cont)

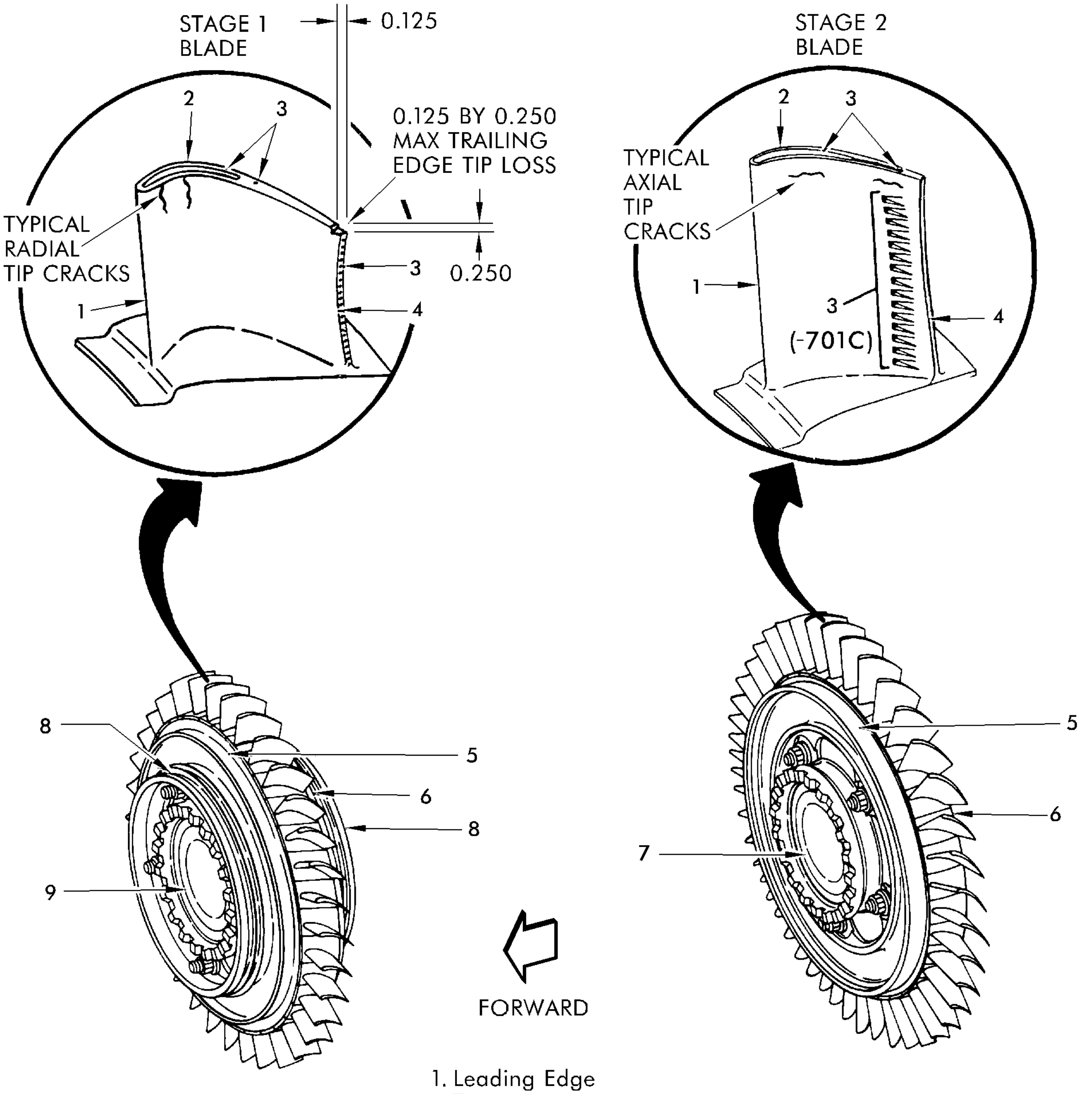
Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) Nicks, dents, and scratches.	Any number, 1/64 inch deep, with no high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(3) Labyrinth seal teeth for:			
(a) Cracks.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Nicks and radial dents.	Any number, 0.015 inch deep; four per tooth not over 0.020 inch deep. Total length of all dents, nicks, and blends (per tooth) not over 30% of circumference. No high metal allowed.	Same as usable limits, with high metal.	Remove high metal and blend.
(c) Axial dents.	Up to 1/32 inch from original contour if no more than one-third of circumference is displaced.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(d) Chipped coating.	Any amount, provided dimensions in steps (4) and (5) are met.	Same as usable limits.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(4) **(T700)** Labyrinth seal teeth for wear on:			
(a) Diameter A of stage 1 turbine forward cooling plate (fig. 3-6, sheet 1).	4.373 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Diameter B of stage 1 turbine forward cooling plate (fig. 3-6, sheet 1).	4.473 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) Diameter A of stage 1 turbine rear cooling plate (fig. 3-6, sheet 1).	4.260 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(d) Diameter B of stage 1 turbine rear cooling plate (fig. 3-6, sheet 1).	4.360 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-1. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(e) Diameter C of stage 1 turbine rear cooling plate (fig. 3-6, sheet 1.	4.460 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(f) Diameter D of stage 1 turbine rear cooling plate (fig. 3-6, sheet 1).	4.560 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(g) Diameter A of stage 2 turbine rear cooling plate (fig. 3-6, sheet 2).	4.407 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(5) **(T701, T701C, T701D)** Labyrinth seal teeth for wear on:			
(a) Diameter A of stage 1 turbine forward cooling plate (fig. 3-7, sheet 1).	4.373 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Diameter B of stage 1 turbine rear cooling plate (fig. 3-7, sheet 1).	4.460 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) Diameter C of stage 1 turbine and gas rear cooling plate (fig. 3-7, sheet 1).	4.560 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(d) Diameter A of stage 2 turbine and gas forward cooling plate (fig. 3-7, sheet 2).	4.360 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(e) Diameter B of stage 2 turbine and gas rear cooling plate (fig. 3-7, sheet 2).	4.407 inches minimum.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

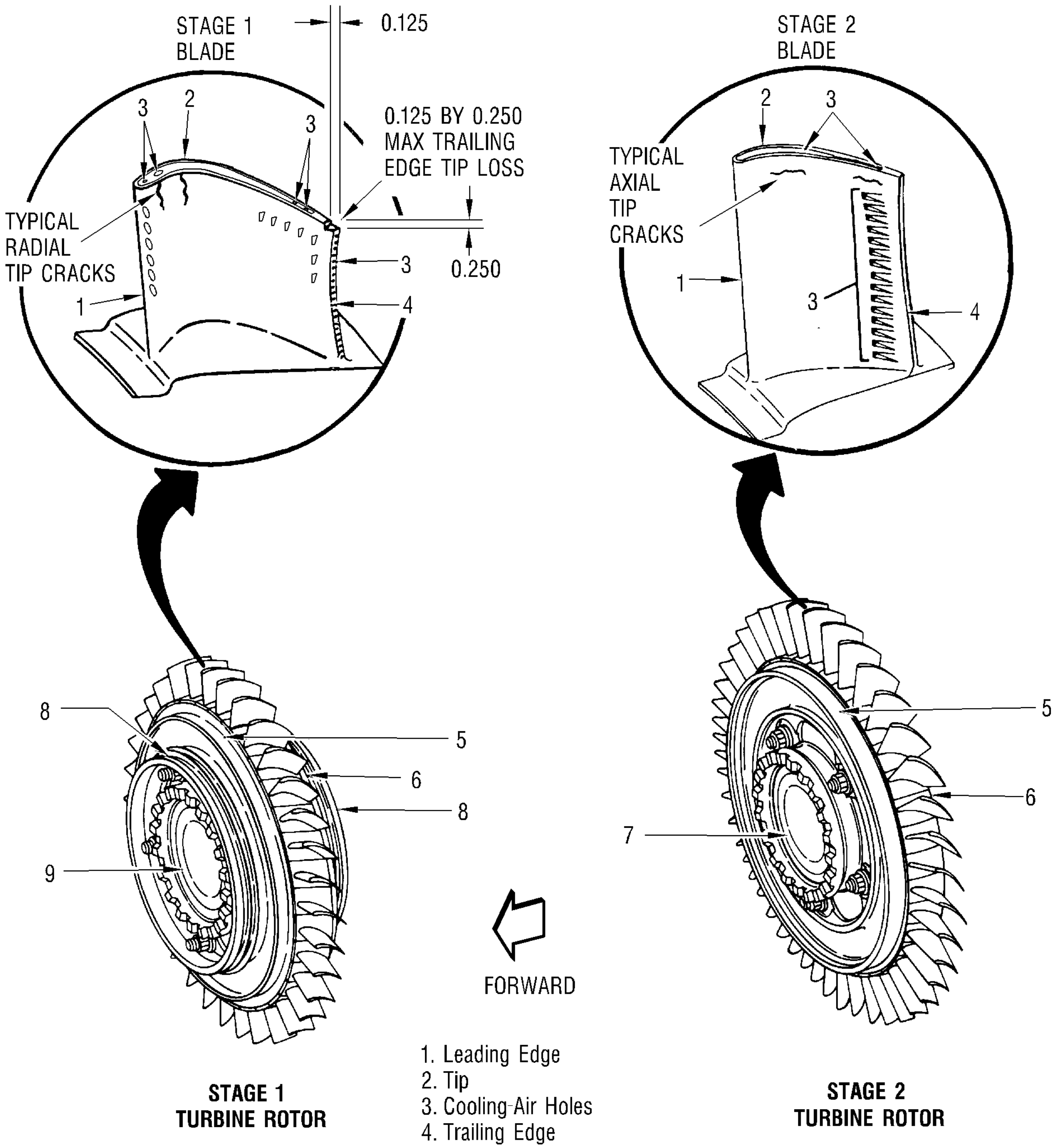
Table 3-1. Inspection of Stages 1 and 2 Gas Generator Turbine Rotor (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
c. Turbine disks (7, 9, fig. 3-5) for:			
WARNING Flight Safety Critical Aircraft Part (Critical Characteristic(s)) Cracks on stage 1 and stage 2 turbine disks are critical characteristic(s).			
(1) Cracks.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(2) Nicks, pits, and scratches.	Any number, 0.005 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.



1. Leading Edge
2. Tip
3. Cooling-Air Holes
4. Trailing Edge
5. Forward Cooling Plate
6. Rear Cooling Plate
7. Stage 2 Turbine Disk
8. Labyrinth Seal
9. Stage 1 Turbine Disk

Figure 3-5. ***(T700, T701, T701C)*** ***Stages 1 and 2 Gas Generator Turbine Rotor; Inspection***



1. Leading Edge
2. Tip
3. Cooling-Air Holes
4. Trailing Edge
5. Forward Cooling Plate
6. Rear Cooling Plate
7. Stage 2 Turbine Disk
8. Labyrinth Seal
9. Stage 1 Turbine Disk

*Figure 3-5.1 **(T701D)** Stages 1 and 2 Gas Generator Turbine Rotor; Inspection*

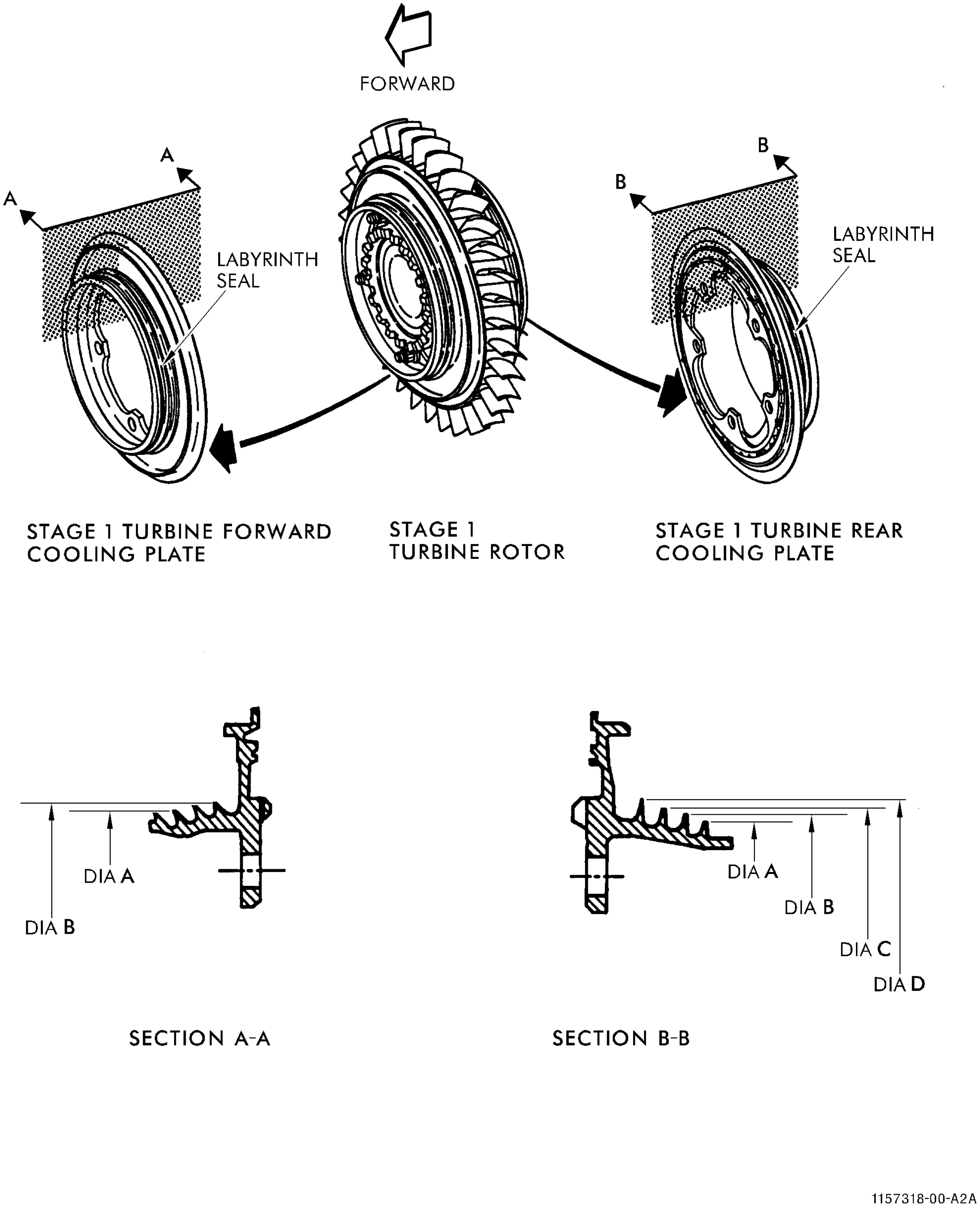


Figure 3-6. ***(T700)*** *Labyrinth Seals for Wear; Inspection (Sheet 1 of 2)*

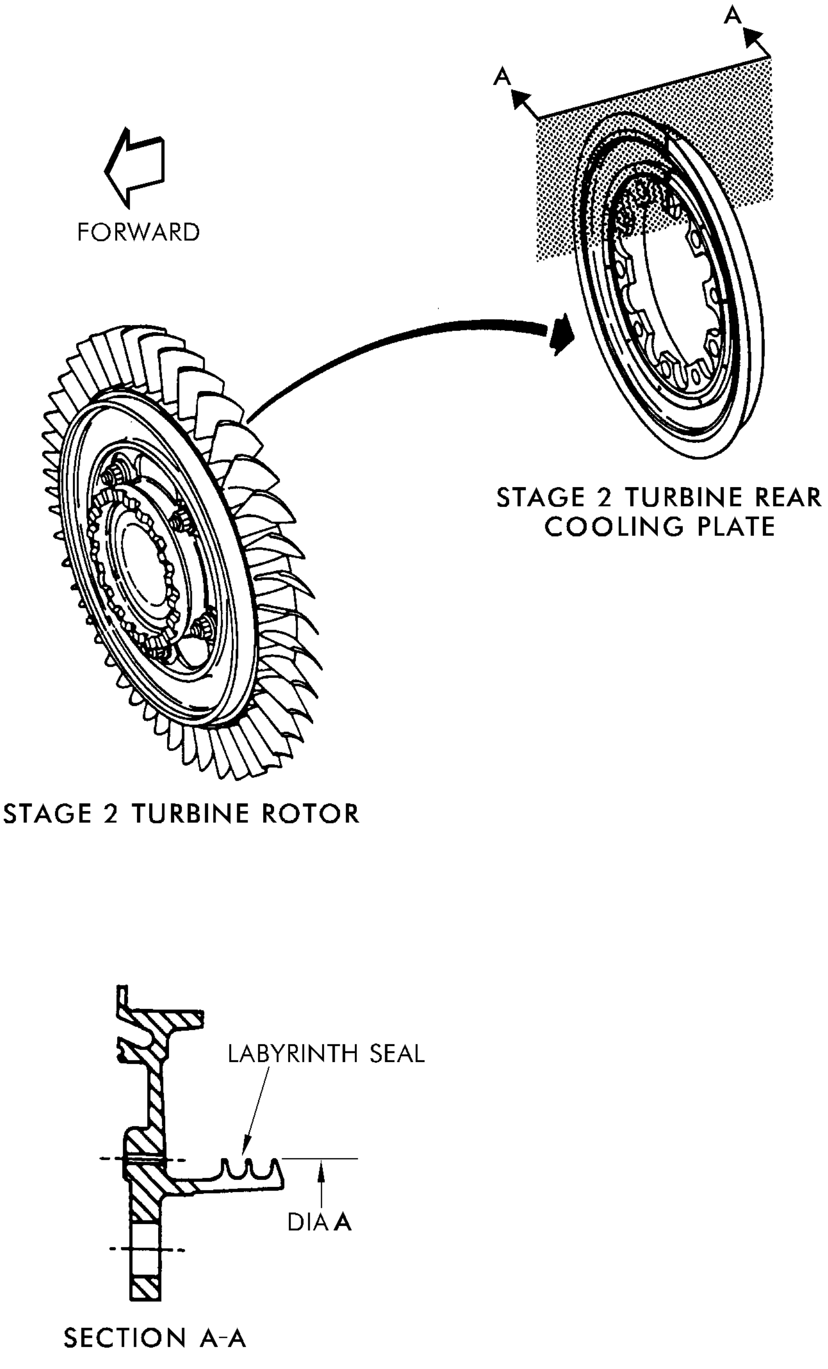


Figure 3-6. ***(T700)*** *Labyrinth Seals for Wear; Inspection (Sheet 2 of 2)*

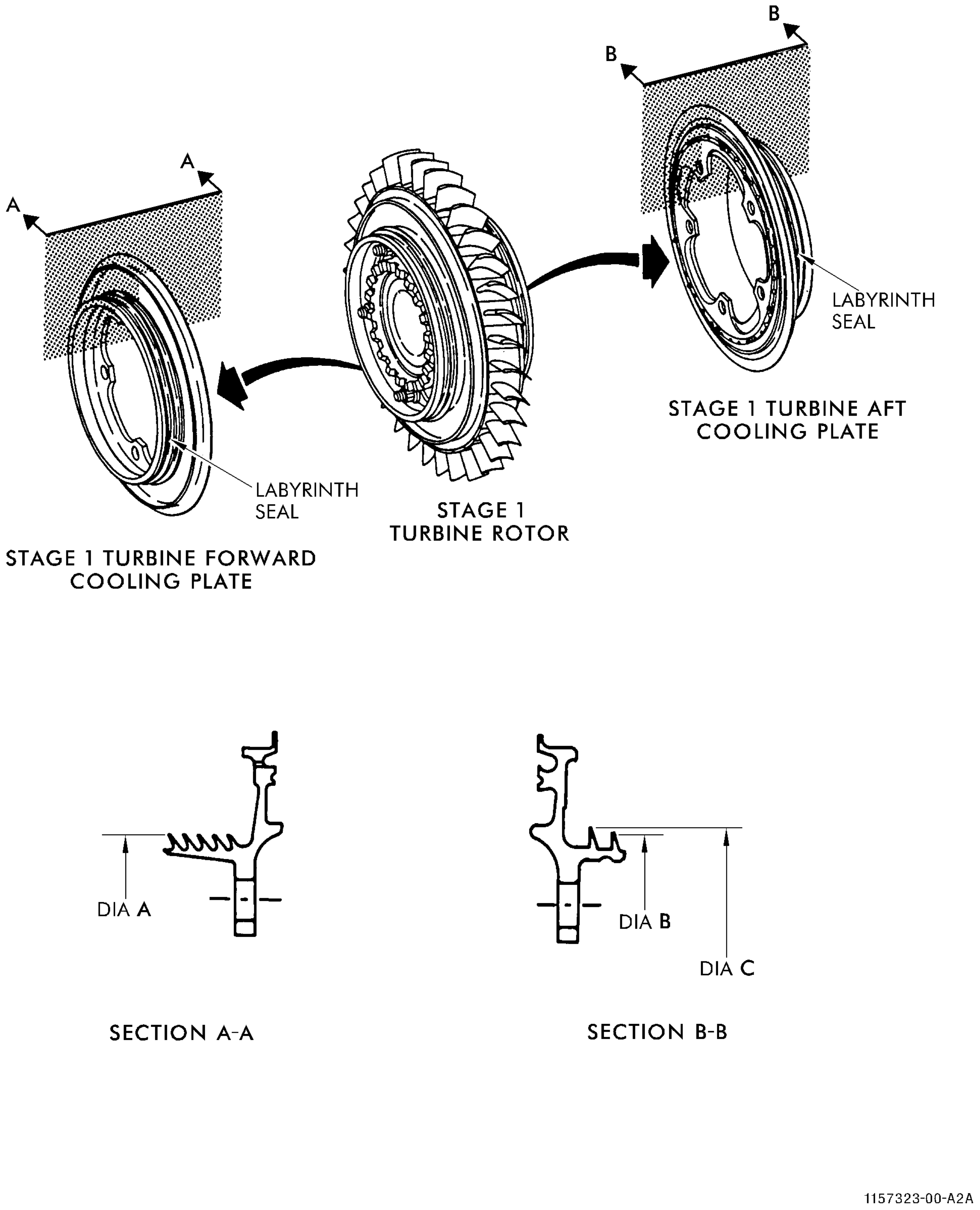


Figure 3-7. ***(T701, T701C, T701D)*** *Labyrinth Seals for Wear; Inspection (Sheet 1 of 2)*

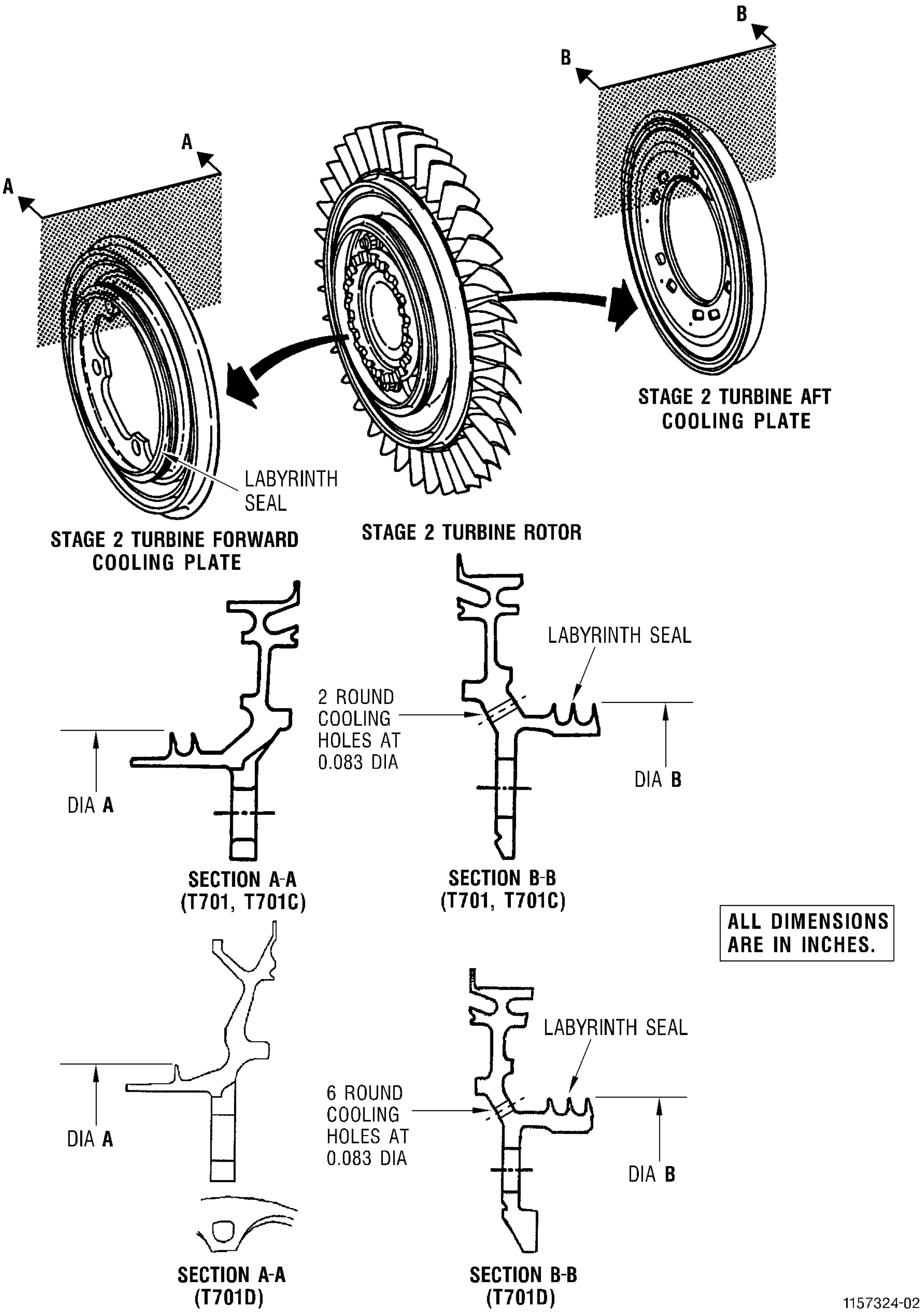


Figure 3-7. ***(T701, T701C, T701D)*** *Labyrinth Seals for Wear; Inspection (Sheet 2 of 2)*

3-9. Inspection of Gas Generator Cooling Plate Seal Ring (AVIM). See table 3-2.

Table 3-2. Inspection of Gas Generator Cooling Plate Seal Ring

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Seal ring (fig. 3-8) for:			
a. Cracks.	None allowed.	Not repairable	Replace seal ring.
b. Nicks, dents, scratches.	Any number, 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
c. Flatness.	With diameter B restrained, ring must be flat within 0.010 inch.	Any amount.	Cold-work seal ring to usable limits.
d. Diameter B for distortion.	In free state, must be round within 0.500 inch.	Any amount.	Cold-work seal ring to usable limits.
e. Discoloration.	Any amount.	Not applicable.	Not applicable.
f. Wear.	Any amount, up to 0.003 inch, as evidenced by flat spots or sections.	Not repairable.	Replace seal ring.

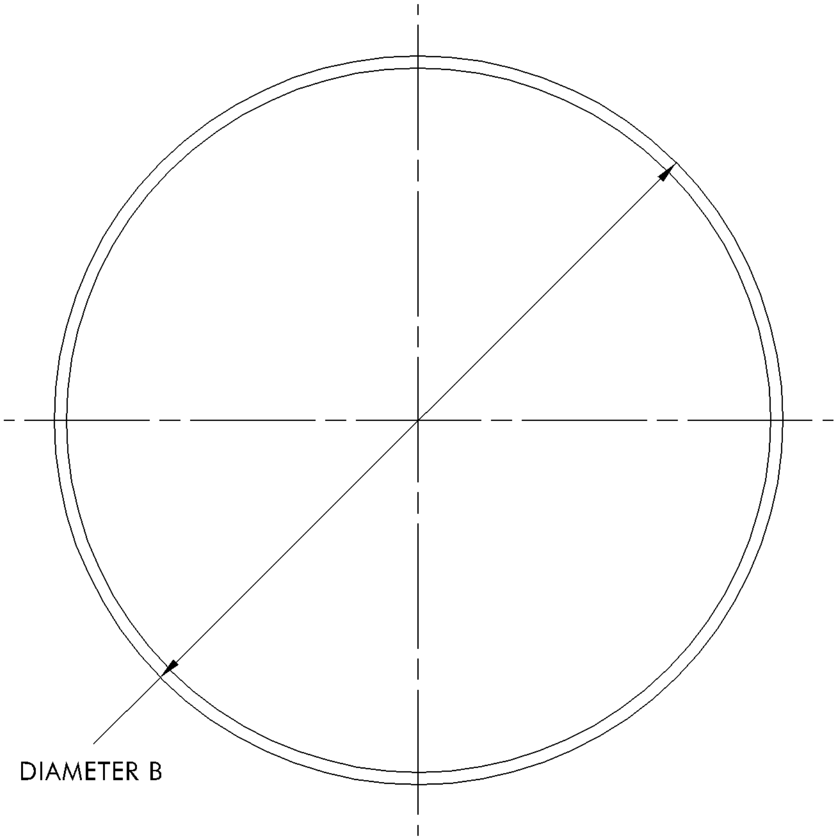


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Figure 3-8. Gas Generator Cooling Plate Seal Ring; Inspection

3-10. Inspection of Curvic Coupling Seals (AVIM).

See table 3-3.

Table 3-3. Inspection of Curvic Coupling Seals

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Curvic coupling seals (fig. 3-9) for:			
a. Cracks.	None allowed.	Not repairable.	Replace seal (para 3-13).
b. Nicks, dents, and scratches.	Any number, 0.005 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
c. Distortion.	No visible distortion allowed.	Not repairable.	Replace seal (para 3-13).
d. Fretting.	25% (max) of working surface on any one tooth. No high metal. Polished or burnished surface is acceptable.	Same as usable limits with high metal.	Blend high metal.

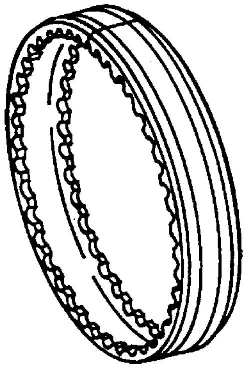


Figure 3-9. Curvic Coupling Seals; Inspection

3-11. Inspection of Gas Generator Stator (AVIM). See table 3-4.

Table 3-4. Inspection of Gas Generator Stator

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Stage 2 turbine nozzle segments (17, fig. 3-10, sheet 1 of sheet 2) for:			
(1) Cracks in the following areas of vanes:			
(a) Trailing edge (3).	Any number less than 1/8 inch long, and three cracks up to 1/4 inch long. Pieces must not be in danger of falling out.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Leading edge (8), and all other areas of vanes.	One crack per segment, up to 5/8 inch long. Two cracks per segment, 1/2 inch long. Any number, up to 1/8 inch long provided there is no danger of pieces falling out.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator.
(2) Cracks in outer bands (16) in:			
(a) Fillet area between vane (4) and outer band.	One crack, up to 3/4 inch long per segment.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Leading edge.	Five cracks, up to 1/2 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) Area between vanes.	One crack, up to 3/4 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(d) All other areas.	Any number if cracks do not cross. Pieces must not be in danger of falling out.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(3) Cracks in inner bands (5).	Four cracks, up to 1/2 inch long; any number, up to 1/8 inch long per segment. Cracks shall not cross each other.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-4. Inspection of Gas Generator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Burns, blistering, and erosion on:			
(a) Vanes (4), except on trailing edge.	1/2 × 1/4 inch, two places per vane.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Trailing edges (3) of vanes.	1/4 inch high × 1/8 inch back from edge of vane.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) Outer and inner bands (16, 5).	1/2 × 1/2 inch, two places each band.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(5) Bumps on vanes (4).	Any number, any size if coating is not wrinkled and bump has a smooth, rounded contour.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(6) Nicks, scratches, and gouges.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(7) Dents in:			
(a) Trailing edges (3).	Any number, up to 1/64 inch deep, within 1/4 inch of edge with smooth deformation and no high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(b) All other areas.	Any number, up to 1/32 inch deep, with smooth deformation and no high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(8) Buckling of trailing edges (3).	Up to 1/32 inch from straight line.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(9) Evidence of hot gas erosion on leading edges (8) and trailing edges (3) or on airfoil surfaces.	Any amount of discoloration or surface roughness if there is no blistering, cracking, or separation of the surface on leading and trailing edges.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(10) Missing pieces on:			
(a) Vane leading edge.	Total area allowed per vane is the equivalent area of a 3/32 inch diameter circle.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-4. Inspection of Gas Generator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) Vane trailing edge.	Total area allowed per vane is 1/2 inch radially by 1/8 inch axially (max four vanes); or 1/4 inch radially by 3/16 inch axially per vane (max four vanes).	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(11) Protruding or missing nozzle segment seals at the inner band (5) at the nozzle assembly.	Up to five segment seals per nozzle assembly, provided engine performance is acceptable.	Not applicable.	Remove protruding segment seal using needle-nose pliers.
b. Stage 2 turbine shroud sectors (2), and stage 1 turbine shroud segments (9) for:			
(1) Cracks in leading and trailing edge flowpath rails (1) and **(T701)** flowpath side rail (10).	Any number if there are no loose or missing pieces.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(2) Cracks in **(T700)** honeycomb or **(T701)** Genaseal filler material:			
(a) Axially.	Two cracks per sector completely across. Four cracks per sector not longer than 1/2 inch. Any number up to 1/8 inch long per sector. Cracks must not intersect each other, and pieces must not be in danger of falling out.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Circumferentially.	Any number, total length not to exceed 2.000 inches.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(3) **(T701, T701C, T701D)** Cracks in solid alloy filler material:			
(a) **(T701, T701C)** Axially.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-4. Inspection of Gas Generator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) **(T701D)** Axially.	One crack up to 1/8 inch long per shroud.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) Circumferentially.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(4) **(T701, T701C, T701D)** Missing solid alloy material.	Not allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

NOTE

As manufactured, any amount of honeycomb filler material may be missing in incomplete cells on all edges of shroud sectors.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(5) **(T700, T701)** Missing honeycomb filler material:			
(a) Partial depth (less than 0.020 inches deep).	Any amount.	Not applicable.	Not applicable.
(b) Partial depth (0.020 inches or greater and not revealing the backing ring).	Not more than 0.25 square inches cumulative for any one shroud sector.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) Full depth (backing ring exposed).	Not more than 0.015 square inches in one location and any one sector.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(6) Nicks, gouges, and dents.	Any number, up to 0.030 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(7) Blade tip wear grooves.	Any amount, up to 0.015 inch deep, if there is a 1/16 inch wide unworn band at forward and aft edges.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-4. Inspection of Gas Generator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
NOTE As manufactured, any amount of honeycomb filler material may be missing in incomplete cells on all edges of shroud sectors.			
(8) **(T700)** Missing honeycomb filler material (without dampers).	Defects in filler material and/or cells are allowed in up to 15% of cells per segment/sector. Defects up to 0.030 inch diameter allowed in no more than 10 adjacent cells. Defects up to 0.030 inch deep are allowed in no more than three adjacent cells.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(9) **(T701)** Missing genaseal filler material.	Not allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(10) Blade material buildup.	Maximum height of 0.005 inch.	Any amount.	Blend to contour of adjacent surface.
NOTE Ceramic shrouds turn yellow after use. A yellow shroud will indicate that the shroud is made of ceramic.			
(11) **(T701C)** Ceramic rub surface material on segments (9):			
(a) Missing or chipped ceramic material.	Any number of areas up to a total of 1/3 of each segment. Exposure of bonding material is allowed (bonding material appears blue-gray color. Color should not be mistaken for black oxidation of backing material).	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Cracks in ceramic coating.	Any number, up to 0.500 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-4. Inspection of Gas Generator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Cracks on stage 2 turbine nozzle static seal (PN 5043T35G02/G03) is (are) critical characteristic(s).

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
c. Stage 2 turbine nozzle static seal (7) for:			
(1) Cracks in honeycomb material.	Any number, if no material is in danger of coming loose.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(2) Cracks (except surfaces X and Y).	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Cracks on (**T700**, **T701**) surfaces X and Y are critical characteristics.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) **(T700, T701)** Cracks on surfaces X and Y.	Splitting/cracking on surface X and Y not to exceed 180 degrees cumulative length for either surface.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(4) Separation of honeycomb from support ring (6).	Not allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(5) Wear grooves or rubs in honeycomb material.	Any amount, up to 0.015 inch deep, compared with unworn portion of seal.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

Table 3-4. Inspection of Gas Generator Stator (Cont)

NOTE

- The **(T700, T701)** GG stator has a two-piece configuration shroud support and is called the stage 1 and 2 shroud supports.
- The **(T701C, T701D)** GG stator has a one-piece configuration shroud support and is called the stage 1 shroud support.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. Stage 1 turbine shroud support (12) for:			
(1) Cracks on:			
(a) Seal mating surface (11).			
1 Circumferential cracks.	No one crack longer than 1/2 inch. Cumulative length of all cracks shall not exceed 3.000 inches.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
2 Radial cracks.	Any number, up to 1/4 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Conical shell (13).	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(c) **(T701C, T701D)** Shield (15).			
1 Circumferential.	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
2 Radial.	Any number, up to 1/4 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(d) Remaining areas.	Any number, up to 1/8 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(2) Nicks, scratches, and gouges.	Any number, up to 0.030 inch deep without high metal.	Same as usable limits, with high metal.	Blend high metal.
(3) **(T701C, T701D)** Plugged cooling holes in shield (15).	Up to five holes, provided they are not adjacent to each other.	Any number.	Using a 0.020 inch (or smaller) diameter wire, remove foreign material.

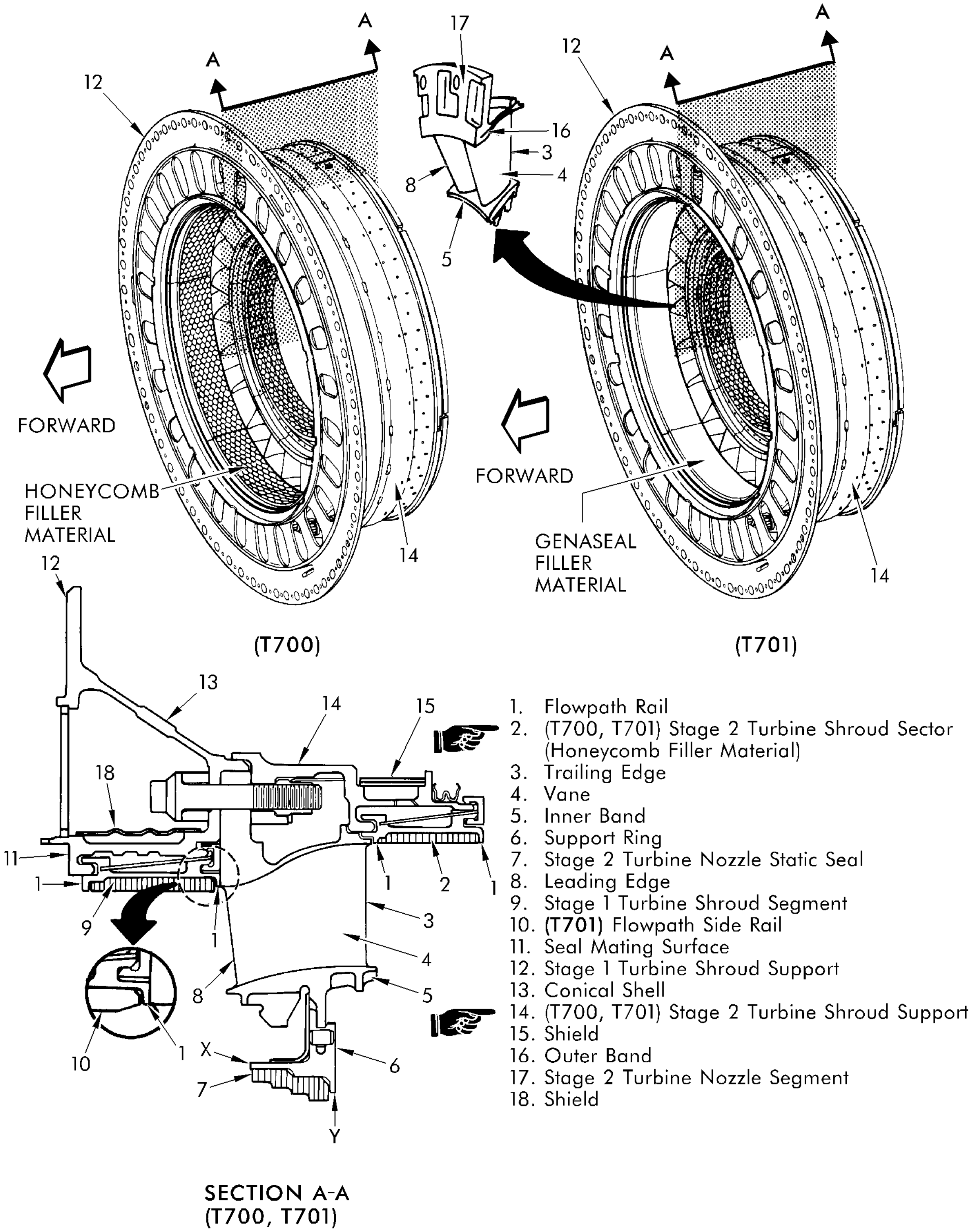
Table 3-4. Inspection of Gas Generator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
e. **(T700, T701)** Shield (18) for:			
(1) Cracks.	Any number, so long as piece is not in danger of falling out.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

NOTE

If missing piece of shield (18) is not found during inspection of hot section then, the broken piece(s) disintegrated and were discharged overboard.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Missing/broken pieces.	Two missing pieces with an area of up to 1.0 square inches per piece.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13); and inspect the hot section (stage 1 nozzle, GG rotor/stator, combustion liner) for missing piece of shield.
f. **(T700, T701)** Stage 2 turbine shroud support (14) for:			
(1) Cracks:			
(a) Circumferential	None allowed.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(b) Radial.	Any number, up to 1/4 inch long.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
(2) Nicks, scratches, and gouges.	Any number, up to 0.030 inch deep without high metal.	Same as usable limits, with high metal.	Blend high metal.
(3) Plugged cooling holes in shield (15).	Up to five holes, provided they are not adjacent to each other.	Any number.	Using a 0.020 inch (or smaller) diameter wire, remove foreign material from holes.



1. Flowpath Rail
2. ☞ (T700, T701) Stage 2 Turbine Shroud Sector (Honeycomb Filler Material)
3. Trailing Edge
4. Vane
5. Inner Band
6. Support Ring
7. Stage 2 Turbine Nozzle Static Seal
8. Leading Edge
9. Stage 1 Turbine Shroud Segment
10. **(T701)** Flowpath Side Rail
11. Seal Mating Surface
12. Stage 1 Turbine Shroud Support
13. Conical Shell
14. ☞ (T700, T701) Stage 2 Turbine Shroud Support
15. Shield
16. Outer Band
17. Stage 2 Turbine Nozzle Segment
18. Shield

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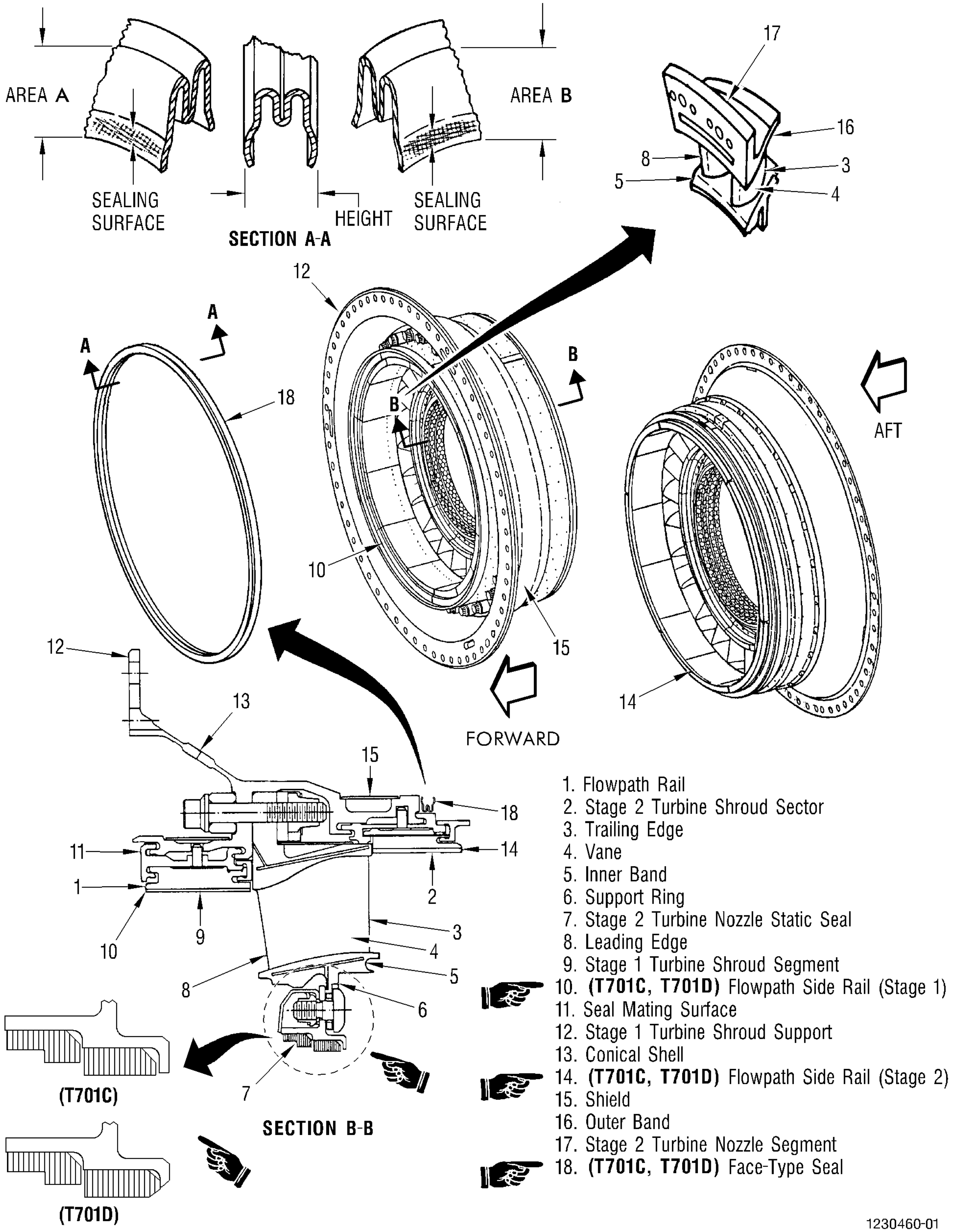
Figure 3-10. Gas Generator Stator; Inspection (Sheet 1 of 2)



1. Flowpath Rail
2. Stage 2 Turbine Shroud Sector
3. Trailing Edge
4. Vane
5. Inner Band
6. Support Ring
7. Stage 2 Turbine Nozzle Static Seal
8. Leading Edge
9. Stage 1 Turbine Shroud Segment
10. ☛ **(T701C, T701D)** Flowpath Side Rail (Stage 1)
11. Seal Mating Surface
12. Stage 1 Turbine Shroud Support
13. Conical Shell
14. ☛ **(T701C, T701D)** Flowpath Side Rail (Stage 2)
15. Shield
16. Outer Band
17. Stage 2 Turbine Nozzle Segment
18. ☛ **(T701C, T701D)** Face-Type Seal

Figure 3-10. Gas Generator Stator; Inspection (Sheet 2 of 2)

3-12. (T701C, T701D) Inspection of Face-Type Seal (AVIM) (Gas Generator Stator).

See table 3-5.

*Table 3-5. **(T701C, T701D)** Inspection of Face-Type Seal (Gas Generator Stator)*

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Face-type seal (18, fig. 3-10) for:			
a. Cracks.	None allowed.	Not repairable.	Replace seal.
b. Height.			
PN 4091T12P01/P02.	0.190 inch minimum.	Not repairable.	Replace seal.
c. Height tolerance variation.	0.010 inch maximum.	Not repairable.	Replace seal.
d. Dents.	None allowed.	Not repairable.	Replace seal.
e. Nicks and scratches on:			
(1) Sealing surfaces.	None allowed.	Not repairable.	Replace seal.
(2) Other areas.	Any number, without high metal.	Any number, with high metal.	Blend high metal.
f. Wear on sealing surfaces.	Up to 0.002 inch reduction of bare parent metal thickness as compared to unworn thickness.	Not repairable.	Replace seal.

3-13. Installation of Stages 1 and 2 Gas Generator Turbine Rotor and Gas Generator Stator and (T701C, T701D) Face-Type Seal (AVIM). (T700)

During installation or replacement of hot section or power turbine modules, maintenance activities will use caution to ensure that gas generator turbine rotors that have wide bore disks are not used with power turbine modules containing drive shafts that have thick balance lands.

CAUTION

- Stages 1 and 2 gas generator turbine rotor PN 6039T54G03 (wide bore configuration) will only be used with power turbine module PN 6043T89G01 (wide bore configuration).
- Stages 1 and 2 gas generator turbine rotor PN 6039T54G02 (narrow bore configuration) may be used with either power turbine module PN 6043T89G01 (wide bore configuration) or PN 6038T61G01 (narrow bore configuration).
- Power turbine module PN 6038T61G01 (narrow bore configuration) will only be used with stages 1 and 2 gas generator turbine rotor PN 6039T54G02 (narrow bore configuration).
- Power turbine module PN 6043T89G01 (wide bore configuration) may be used with either stages 1 and 2 gas generator turbine rotor PN 6039T54G03 (wide bore configuration) or PN 6039T54G02 (narrow bore configuration).

NOTE

Rotor and stator are ordered and replaced as an assembly:

- If stator must be replaced, rotor will also be replaced.
- If rotor must be replaced, stator will also be replaced.

a. **(T700)** Determine whether stages 1 and 2 gas generator turbine rotor is the narrow bore configuration or the wide bore configuration as follows:

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(1) Place U-shaped cutout of gage PN 37D407015P01, shipped with hot section module, into inner bore of stage 2 turbine disk (fig. 3-12). If gage is not available, gage can be fabricated using dimensions in figure 4-3.

(2) Try to slide U-shaped cutout over thickness of disk. If cutout does not fit over disk, turbine rotor has a wide bore and will be used with power turbine module PN 6043T89G01 (wide bore configuration). If cutout does fit over the disk, it is a narrow (non wide) bore disk and may be used with either power turbine module configuration.

NOTE

Rotor and stator are ordered and replaced as an assembly:

- If stator must be replaced, rotor will also be replaced.
- If rotor must be replaced, stator will also be replaced.

b. Install stages 1 and 2 gas generator turbine rotor and gas generator stator as follows:

(1) Clean mating curvic coupling teeth (4, fig. 3-1 **(T700)** or fig. 3-2 **(T701, T701C, T701D)**) with a soft fiber brush.

(2) Install curvic coupling seal (5) inside curvic coupling teeth (4).

CAUTION

- Be sure stage 1 nozzle face-type seal (3, fig. 3-1 or 3-2) is installed. If module or engine is found to have been operated without stage 1 nozzle face-type seal installed, the stage 1 and stage 2 turbine blades and dampers may have been subjected to excessive excitation force. Engines operated without stage 1 nozzle face-type seal installed must have the stage 1 and stage 2 turbine blades and dampers replaced.
- If face-type seal is not properly seated on stage 1 nozzle assembly when gas generator stator is installed, face-type seal will be crushed and damaged.
- Missing or incorrectly seated curvic coupling seals (5, 13) can result in rapid loss of oil from B-sump and lack of lubrication to No. 4 bearing.

(3) Be sure that face-type seal (3) is seated on stage 1 nozzle and that curvic coupling seal (5) is in place inside curvic coupling teeth (4).

CAUTION

If stage 1 turbine rotor is not installed so that nuts on stage 1 bolts and leading edge (thick portion) of turbine blades face forward, components will be damaged.

NOTE

The number 1 long rotor bolt is by design the bolt that is closest to the O-matchmark on the gas generator turbine shaft. In practice, if the long rotor bolt is marked number 1, it takes precedence over the turbine shaft O-matchmark location.

(4) Check for matchmark on no. 1 long rotor bolt. If no. 1 bolt is not marked, using marker (item 82, Appendix D), mark no. 1 bolt on end of bolt.

(5) Reinstall stage 1 turbine rotor (8) by alining matchmark on number 1 long gas generator turbine rotor bolt (6) with matchmark on stage 1 rear cooling plate. Be sure that rotor (8) is installed so that nuts on stage 1 bolts and leading edges (thick portion) of blades face forward. Be sure that face-type seal (3) is seated on stage 1 nozzle.

(6) Be sure cooling plate seal ring (2) is properly seated as follows:

(a) **(T700)** On matched assembly PN 6055T26 seal ring (2) is installed on inner bore of stage 1 aft cooling plate (16).

(b) **(T700)** On matched assembly PN 6055T20 seal ring (2) is installed on inner bore of stage 2 forward cooling plate (17).

(c) **(T701, T701C, T701D)** Seal ring (2) is installed on inner bore of stage 1 aft cooling plate (16).

(d) If seal ring (2) is not installed, insert seal ring into groove and hold in place with beeswax (item 13, Appendix D).

(7) Install new stage 1 gas generator turbine rotor (8) onto long gas generator turbine rotor bolts (6) as follows:

NOTE

Installation of turbine rotor bolts (6) may be made easier with the use of LMT 964 (Appendix F), Tie Bolt Guide. The use of this tool simultaneously supports and holds the correct spacing of all five rotor bolts during installation. Once the bolts have been inserted in the rotor bolt holes, the tool is removed.

(a) **(T700)** Aline number 1 long rotor bolt with the hole closest to O-matchmark on stage 1 rear cooling plate. Insert long rotor bolts (6) into boltholes in rotor. Be sure that rotor (8) is installed so that nuts on stage 1 bolts and leading edges (thick portion) of blades face forward. Be sure that face-type seal (3) is seated on stage 1 nozzle.

(b) **(T701, T701C, T701D)** Aline O-matchmark on gas generator shaft with O-matchmark on stage 1 rear cooling plate. Insert long rotor bolts (6) into boltholes in rotor. Be sure that rotor (8) is installed so that nuts on stage 1 bolts and leading edges (thick portion) of blades face forward. Be sure that face-type seal (3) is seated on stage 1 nozzle.

(8) If a new gas generator stator (9) is being installed, go to step (9). Otherwise, hold stage 1 turbine rotor (8) in position, and reinstall gas generator stator (9) by alining matchmarks on stator flange with matchmark on midframe flange (7).

NOTE

The stator will fit in three orientations. The stator may have to be rotated up to 120° in any direction until the holes and the slots are alined.

(9) Holding stage 1 turbine rotor (8) in position, install new gas generator stator (9) onto midframe flange (7). Be sure that word TOP on stator (9) is alined with word TOP on midframe. If the word TOP is missing on the stator or on the midframe, aline the 60 boltholes and the three cooling slots on the stator. Aline stator with the corresponding holes and slots in the midframe at any of three positions 120° apart.

(10) Holding stator (9), secure it to midframe assembly at top and bottom with two bolts (1) and nuts (14).

(11) Install three equally spaced bolts (1) and nuts (14). Tighten nuts until stator seats in rabbet of midframe flange (7).

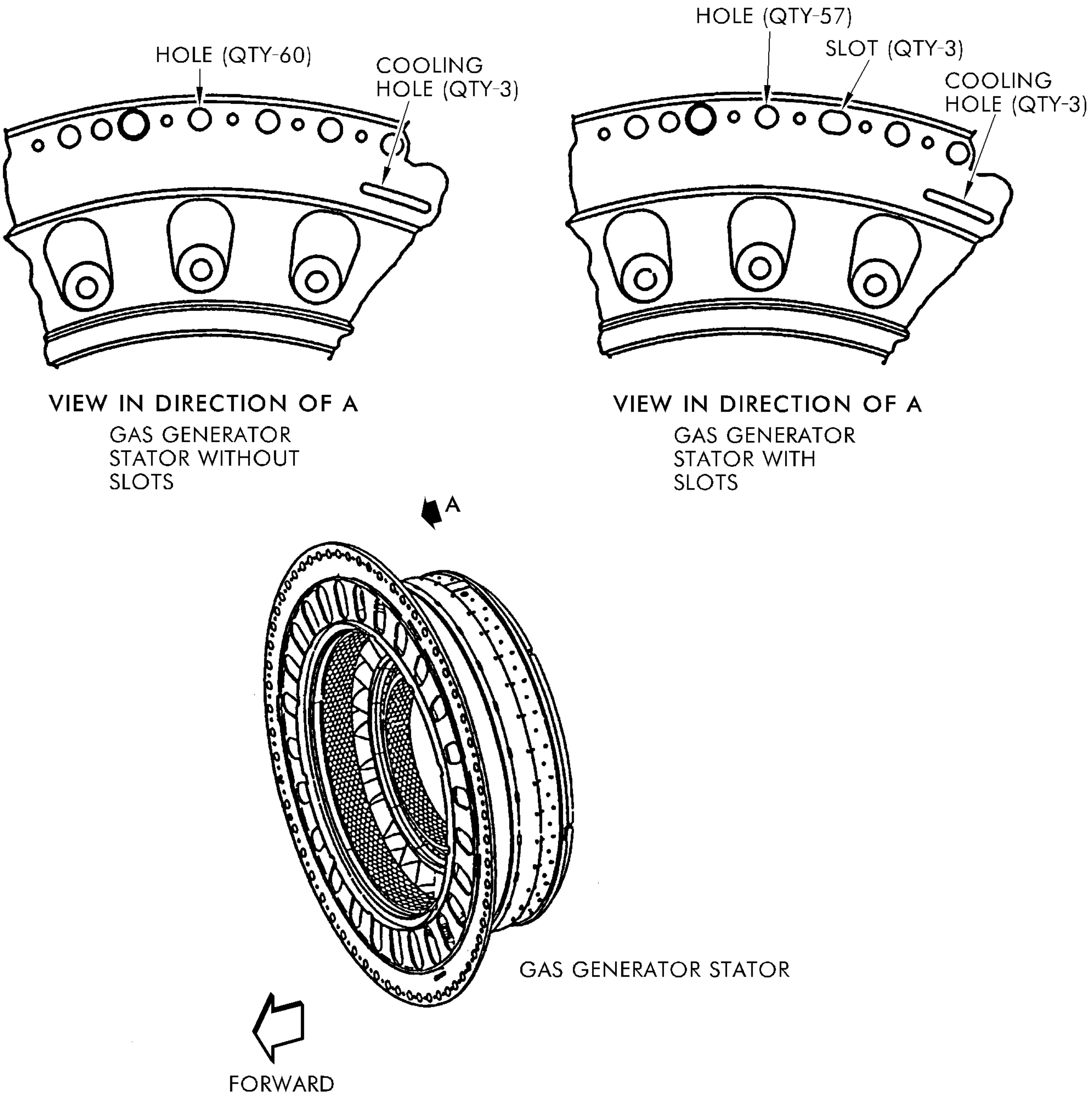


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Figure 3-11. Gas Generator Stator; Alinement

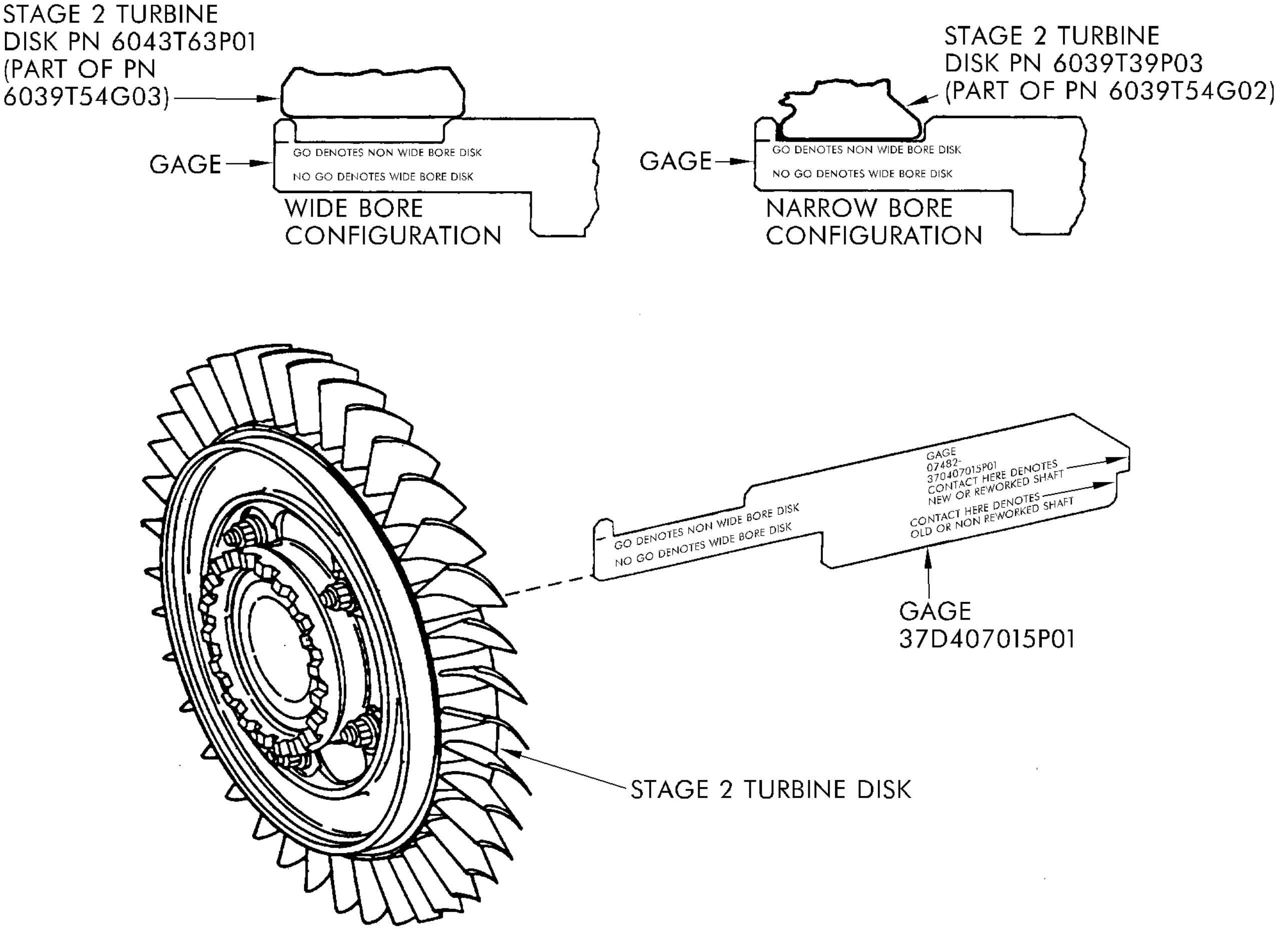

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Figure 3-12. (T700) *Use of Gage 37D407015P01 to Determine Configuration of Stage 2 Turbine Disk*

(12) Put forward pressure on stage 1 turbine rotor to ensure free rotation, and turn rotor at least 360°. No rubs are allowed. If rubs are found and if stator does not have slots (fig. 3-11), remove and reinstall stator and stage 1 turbine rotor.

(13) If rubs are found and if stator has slots (fig. 3-11), remove stator and reinstall it as follows:

(a) Hold stage 1 turbine rotor in position, and install gas generator stator (9, fig. 3-1 **(T700)** or fig. 3-2 **(T701, T701C, T701D)**) onto midframe flange (7). Be sure that word TOP on stator is alined with word TOP on midframe or that matchmark on stator flange is alined with matchmark on midframe flange.

(b) Rotate stator clockwise until cooling holes (fig. 3-11) on stator are alined with cooling holes on midframe.

(c) Hold stator in position, and secure it to midframe assembly at top and bottom with two bolts (1, fig. 3-1 **(T700)** or 3-2 **(T701, T701C, T701D)**) and nuts (14).

(d) Install three equally spaced bolts (1) and nuts (14). Tighten nuts until stator seats in rabbet of midframe flange (7).

(e) Put forward pressure on stage 1 turbine rotor to ensure free rotation, and turn rotor at least 360°. No rubs are allowed. If rubs are found, repeat step (13).

CAUTION

Missing or incorrectly seated curvic coupling seals (5, 13) can result in rapid loss of oil from B-sump and lack of lubrication to No. 4 bearing.

(14) Install curvic coupling seal (13).

CAUTION

Be sure that number 1 long turbine rotor bolt is alined with hole closest to the O-matchmark on stage 2 rear cooling plate during installation. Otherwise, components will be damaged.

(15) If a new stage 2 gas generator turbine rotor (10) is being installed, go to step (16). Otherwise, reinstall stage 2 turbine rotor by alining matchmark on number 1 long turbine rotor bolt with matchmark on stage 2 rear cooling plate. Be sure that curvic teeth on rotor are forward.

(16) Install new stage 2 gas generator turbine rotor (10), curvic teeth forward, onto long turbine rotor bolts (6) as follows:

(a) **(T700)** Aline number 1 rotor bolt with hole closest to O-matchmark on stage 2 rear cooling plate.

(b) **(T701, T701C, T701D)** Aline number 1 rotor bolt with hole closest to O-matchmark on stage 2 rear cooling plate.

(17) Put a light coat of antiseize compound (item 56, Appendix D) on threads of long turbine rotor bolts (6) and on face of each nut (12).

(18) Install five new nuts (12) fingertight.

(19) There are two methods for torquing nuts (12, fig. 3-1 **(T700)** or 3-2 **(T701, T701C, T701D)**). If using lock/support adapter (fig. 3-3), see step (20). If using gas generator rotor antirotation bar (2, fig. 3-4), see step (21).

(20) Install lock/support adapter (fig. 3-1 **(T700)** or 3-2 **(T701, T701C, T701D)**) as follows:

(a) Remove bolts (1), and nuts (14).

(b) **(T700)** Hold stator (9) to midframe flange (7), and install lock/support adapter 17A8532G04 (fig. 3-3) with 24 nuts (2) and 24 bolts (6) that were removed from power turbine-to-midframe flange. Torque nuts to 70-75 inch-pounds.

(c) **(T701, T701C, T701D)** Hold stator (9) against midframe flange (7), and install lock/support adapter 21C7247G01 (fig. 3-3), using 24 nuts (2) and 24 bolts (6) that were removed from power turbine-to-midframe flange. Torque nuts to 70-75 inch-pounds.

(d) **(T700)** Secure lock/support adapter plug as follows:

1 Turn knob (10) until five tabs (1) of plug are close to scallops (8, view A) of cooling plate.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder"s type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

2 Rotate gas generator turbine rotor (9) until scallops (8) are alined with five tabs (1). Hand-tighten knob (10).

(e) **(T701, T701C, T701D)** Secure lock/support adapter plug as follows:

NOTE

Cooling plate (view B) has numbers stamped on its surface. Even numbers identify bolts that secure turbine disk to cooling plate.

1 Turn knob (10) until five tabs (1) of plug are close to cooling plate (view B).

2 Rotate gas generator turbine rotor (9) until even numbers stamped on five tabs (1) are positioned directly over nuts that have an even number stamped on cooling plate (view B), beside the nuts. Hand-tighten knob.

(21) If gas generator rotor antirotation bar 21C7399G01 (2, fig. 3-4) is to be used, install it over three of the five small self-locking nuts (3).

(22) Torque nuts (12, fig. 3-1 **(T700)** or fig. 3-2 **(T701, T701C, T701D)**) as follows:

CAUTION

Gas generator turbine nuts will be torqued in the sequence specified. No change in the procedure is allowed. Binding between blade tips and shrouds, and damage to the gas generator turbine can result if procedure is not followed.

NOTE

If not previously marked, the no. 1 long rotor bolt is the bolt that is closest to the O-matchmark on the stage 2 rear cooling plate.

(a) If no. 1 long rotor bolt is not marked, determine bolt that is closest to the O-matchmark on stage 2 rear cooling plate. Using marker (item 82, Appendix D), mark bolt.

(b) Torque nuts in the following sequence: 1, 5, 9, 3, 7.

NOTE

- If using antirotation bar, a second mechanic is needed to hold bar while other mechanic torques nuts (12).
- Run-on torque is the torque required to screw a self-locking nut onto a thread until threads are fully engaged.

(c) Torque nuts in sequence to 10 inch-pounds above run-on torque.

(d) Torque nuts in sequence to 20 inch-pounds above run-on torque.

(e) Torque nuts in sequence to 30 inch-pounds above run-on torque.

(f) Torque nuts in sequence to 50 inch-pounds above run-on torque.

(g) Torque nuts in sequence to 70 inch-pounds above run-on torque.

(h) Torque nuts in sequence to 90 inch-pounds above run-on torque.

(i) Torque nuts in sequence to 100 inch-pounds above run-on torque.

(j) Torque nuts in sequence to 100-105 inch-pounds above run-on torque.

CAUTION

A minimum of two full threads must be visible after final torquing.

NOTE

Net torque is final torque minus run-on torque.

(k) Repeat step (j) until nuts do not turn when torqued. Do not exceed 100-105 inch-pounds net torque.

(23) If lock/support adapter was used, remove it as follows:

(a) Release clamping on lock/support adapter (fig. 3-3).

(b) Holding lock/support adapter remove nuts (2) and bolts (6).

(c) Remove lock/support adapter.

(24) If antirotation bar was used, remove it.

(25) Check to be sure that stage 2 turbine rotor rotates freely. No rubs are allowed. If rubs are found, remove and reinstall stage 2 turbine rotor.

(26) **(T701C, T701D)** Place beeswax (item 13, Appendix D) on aft end of gas generator stator assembly (7) around entire circumference where face-type seal will be seated. Install face-type seal and be sure that seal seats evenly against shroud support assembly.

(27) Install power turbine module (para 4-11).

(28) Make required engine checks listed in table 1-39.

3-14. STAGE 1 NOZZLE ASSEMBLY, FACE-TYPE SEAL, AND COMBUSTION LINER.

3-15. (T700) Removal of Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner (AVIM).

a. Remove stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-6).

b. Disconnect fuel start manifold tube (1, fig. 3-13) from primer nozzle (3). Install cap (item 46, Appendix D) on manifold coupling nut.

c. Remove nut (2) and primer nozzle (3). Install caps (item 22 and item 48, Appendix D) on ends of nozzle.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that discharge connector is grounded.

d. Disconnect ignition lead (4) from igniter plug (6). Install cap (item 37, Appendix D) on coupling nut of ignition lead.

e. Remove nut (5) and igniter plug (6). Install caps (item 25 and item 48, Appendix D) on ends of plug.

f. Repeat steps b through e for primer nozzle and igniter plug on other side of engine.

g. For engines with former configuration, do the following:

(1) Remove four bolts (12) and discard.

(2) Remove stage 1 turbine nozzle shield (11) and discard.

(3) Remove eight bolts (9).

h. For engines with present configuration, remove twelve bolts (9).

CAUTION

- Combustion liner and stage 1 nozzle assembly will be gently removed together. Otherwise, combustion liner may separate and fall from stage 1 nozzle assembly.
- Do not rest or store combustion liner, forward end down, on primary swirlers (13). Primary swirlers (13) are made from a brittle material and therefore could be easily damaged if liner is rested or stored in such a manner.

NOTE

Any combination of the three combustion liner guides (13, fig. 3-18) may have been removed during prior rework and should be considered acceptable.

i. Gently remove combustion liner (7) and stage 1 nozzle assembly (8) together from midframe.

j. Remove face-type seal (10) from stage 1 nozzle assembly (8).

k. With a small rawhide mallet, tap lightly around edge of stage 1 nozzle assembly to separate it from combustion liner.

3-16. (T701, T701C, T701D) Removal of Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner (AVIM).

a. Remove stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-6).

b. Disconnect ignition lead (5, fig. 3-14) from igniter plug (4). Install cap (item 37, Appendix D) on coupling nut of ignition lead.

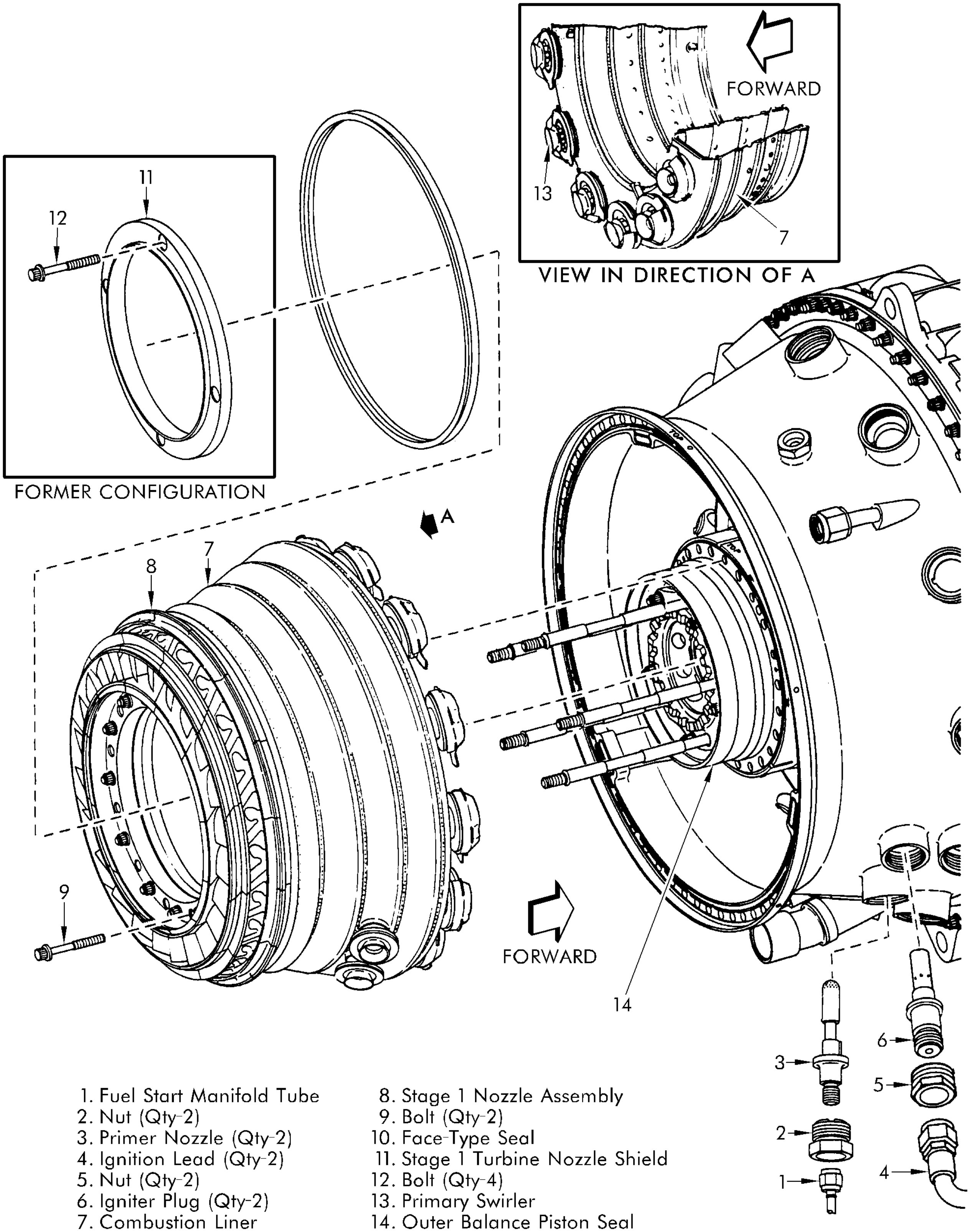
c. Remove plug (4). Install caps (item 25 and item 48, Appendix D) on ends of plug.

d. Repeat steps b and c for igniter plug on other side of engine.

e. Remove four bolts (1).

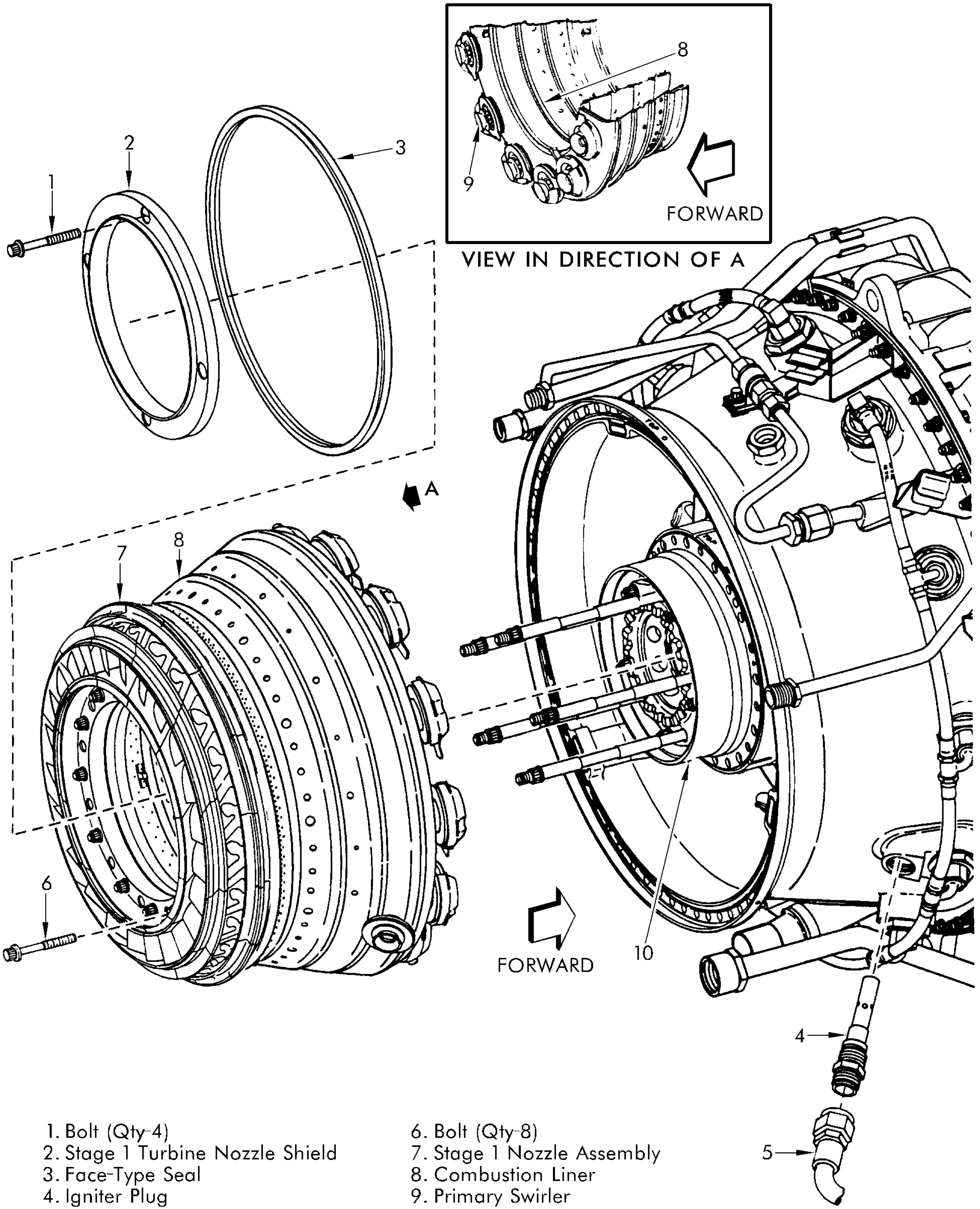
f. Remove stage 1 turbine nozzle shield (2).

g. Remove eight bolts (6).



1. Fuel Start Manifold Tube
2. Nut (Qty-2)
3. Primer Nozzle (Qty-2)
4. Ignition Lead (Qty-2)
5. Nut (Qty-2)
6. Igniter Plug (Qty-2)
7. Combustion Liner
8. Stage 1 Nozzle Assembly
9. Bolt (Qty-2)
10. Face-Type Seal
11. Stage 1 Turbine Nozzle Shield
12. Bolt (Qty-4)
13. Primary Swirler
14. Outer Balance Piston Seal

Figure 3-13. *(T700)* ***Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner; Removal***



1. Bolt (Qty-4)
2. Stage 1 Turbine Nozzle Shield
3. Face-Type Seal
4. Igniter Plug
5. Ignition Lead
6. Bolt (Qty-8)
7. Stage 1 Nozzle Assembly
8. Combustion Liner
9. Primary Swirler
10. Outer Balance Piston Seal

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Figure 3-14. ***(T701, T701C, T701D)*** *Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner; Removal*

CAUTION

- Combustion liner and stage 1 nozzle assembly will be gently removed together. Otherwise, combustion liner may separate and fall from stage 1 nozzle assembly.
- Do not rest or store combustion liner, forward end down, on primary swirlers (9). Primary swirlers are made from a brittle material and therefore could be easily damaged if liner is rested or stored in such a manner.

NOTE

Any combination of the three combustion liner guides (13, fig. 3-19) may have been removed during prior rework and should be considered acceptable.

h. Gently remove combustion liner (8) and stage 1 nozzle assembly (7) together from midframe.

i. Remove face-type seal (3) from stage 1 nozzle assembly (7).

j. With a small rawhide mallet, tap lightly around edge of stage 1 nozzle assembly (7) to separate it from combustion liner (8).

3-17. Removal of Outer Balance Piston Seal (AVIM).

a. The outer balance piston seal (OBP) seal provides a significant contribution to engine performance. To assist in restoration of engine performance, the OBP seal should be inspected when hot section components are replaced for low performance. The OBP seal shall be replaced only if it fails inspection criteria of table 3-6.

b. Using a heat gun, heat OBP seal **(T700)** (14, fig. 3-13) or **(T701, T701C, T701D)** (10, fig. 3-14) evenly around complete outer diameter of seal for approximately 10 minutes.

WARNING

Handling Hot Parts

- When handling hot parts, wear approved gloves.
- Handling of hot parts with bare hands may cause reddening and blistering of skin, or third-degree burns.
- If skin is burned, immerse contacted area in cold water for 10 minutes. If pain or blistering persists, immediately get medical attention.

c. Wearing thermally-insulated gloves (item 77, Appendix D), remove seal.

d. If seal is not loosened after heating, use vise grip plyers LMT 933 (fig. 3-15) to remove seal.

3-18. Inspection of Outer Balance Piston Seal (AVIM).

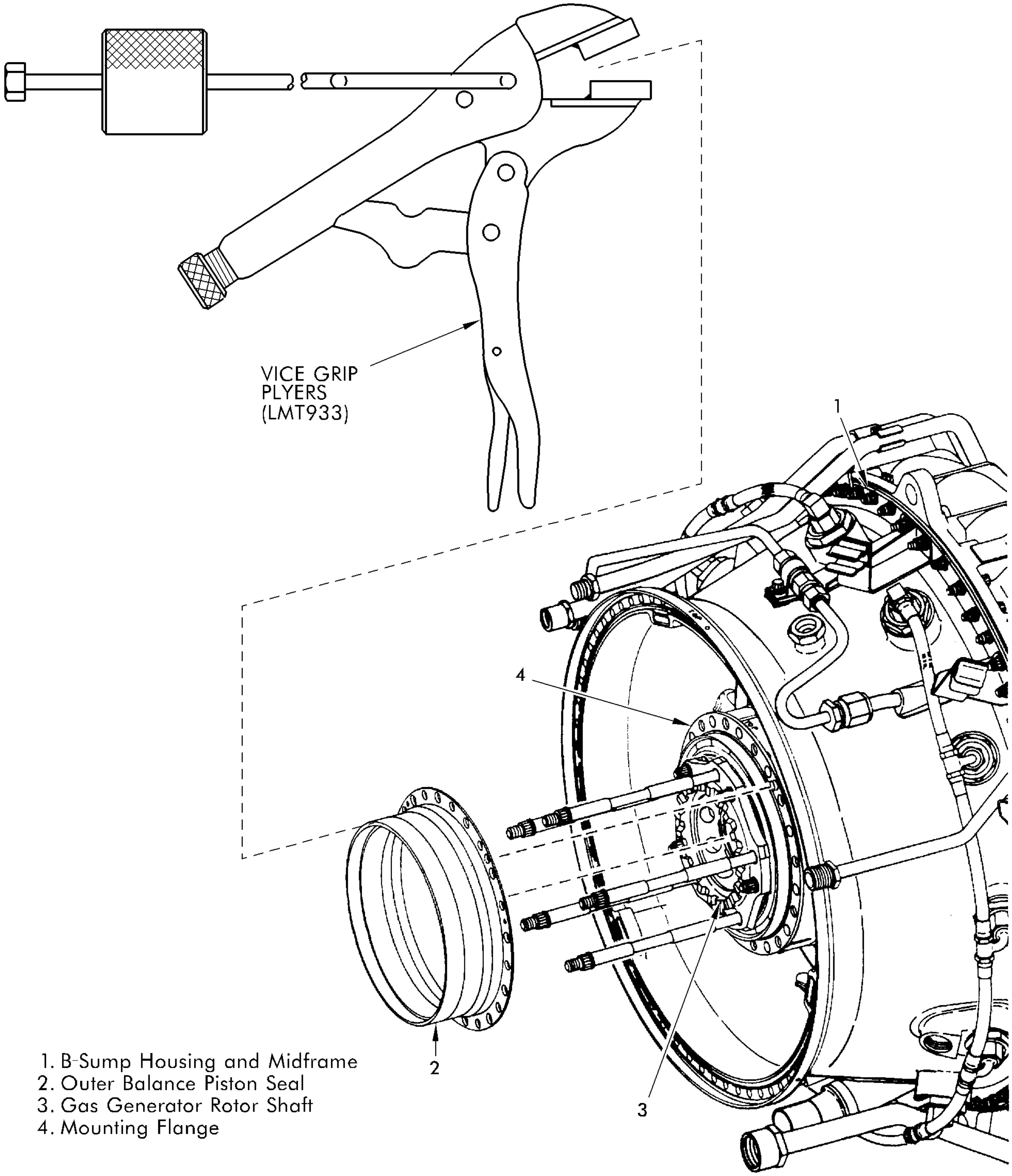
See table 3-6.

Table 3-6. Inspection of Outer Balance Piston Seal

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Overall seal (fig. 3-16) for:			
(1) Cracks except on sealing surfaces of PN 6071T03.	Cracks are allowed on flange from locating pin holes to edge of flange at two locations.	Not repairable.	Replace seal.
(2) Cracks at boltholes.	Four cracks maximum. Cracks must only extend from boltholes toward the OD of flange.	Not repairable.	Replace seal.
(3) Cracks on remaining areas.	None allowed.	Not repairable.	Replace seal.
(4) Nicks, dents, and scratches.	Any number, up to 0.020 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(5) Erosion at surfaces X.	Any amount, 0.005 inch deep maximum.	Not repairable.	Replace seal.
(6) Erosion at area A.	0.041 inch min. wall thickness.	Not repairable.	Replace seal.

Table 3-6. Inspection of Outer Balance Piston Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Sealing surfaces on outer balance piston seal for:			
(1) Rub grooves.	Any number, up to 0.005 inch deep all around seal. Up to 0.010 inch deep if cumulative length does not exceed 30% of circumference.	Not repairable.	Replace seal.
(2) Cracks on PN 6071T03.	Any number, if material is not in danger of coming loose.	Not repairable.	Replace seal.
(3) **(T701, T701C, T701D)** Flaking or delamination.	Not allowed.	Not repairable.	Replace seal.
(4) **(T701, T701C, T701D)** Erosion of material between rub grooves.	Maximum of 0.020 inch above minimum diameter of sealing surfaces.	Not repairable.	Replace seal.
c. **(T700)** Silver alloy seal material of outer balance piston seal for:			
(1) Axial cracks.	Any number, if they are circumferentially at least 1 inch apart.	Not repairable.	Replace seal.
(2) Oxidation or other surface attack.	Up to 30% of surface if no material appears to be in danger of falling out.	Not repairable.	Replace seal.
(3) Separation from backing ring.	No more than four indications at area H; no more than four indications at area G. Max combined length of separations must not exceed 1 inch at area H and 0.75 inch at area G.	Not repairable.	Replace seal.
(4) Craze cracking and surface roughness.	Any amount, any pattern, if alloy material is not lifting, missing or separating from parent material.	Not repairable.	Replace seal.
(5) Pits and voids.	Any number, up to 0.030 inch diameter.	Not repairable.	Replace seal.



1. B-Sump Housing and Midframe
2. Outer Balance Piston Seal
3. Gas Generator Rotor Shaft
4. Mounting Flange

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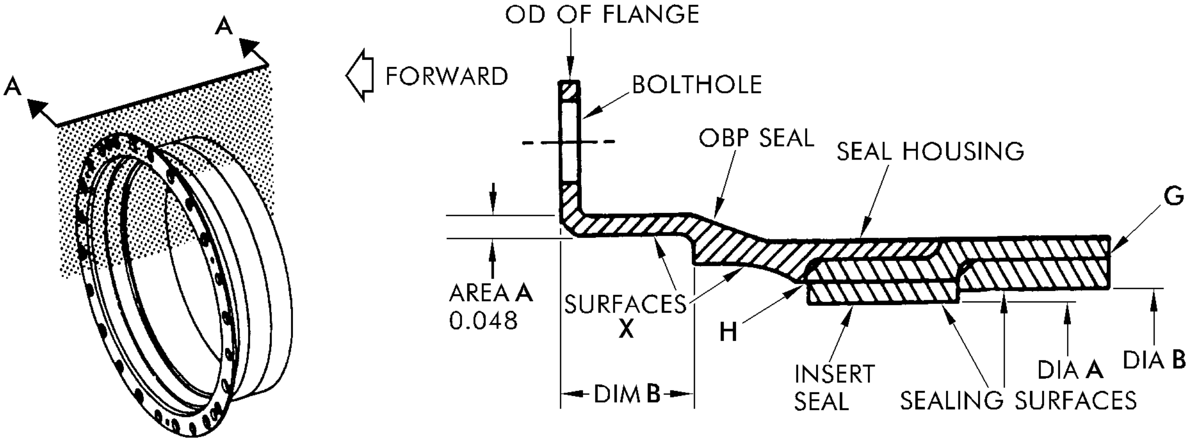
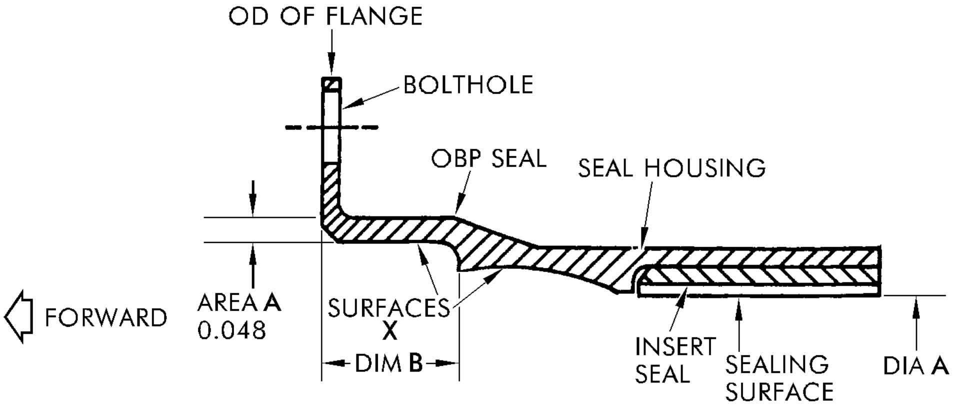
Figure 3-15. Outer Balance Piston Seal; Replacement



(T700) OUTER BALANCE PISTON SEAL
SECTION A-A



(T701,T701C, T701D) OUTER BALANCE PISTON SEAL
SECTION A-A

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Figure 3-16. Outer Balance Piston Seal; Inspection

3-19. Cleaning of Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner (AVIM).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash nozzle assembly, face-type seal, and combustion liner with solvent (item 99, Appendix D) to remove grease, oil, and carbon.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry nozzle assembly, face-type seal, and combustion liner using dry, filtered, compressed air.

3-20. Inspection of Stage 1 Nozzle Assembly and Face-Type Seal (AVIM). See table 3-7.

Table 3-7. Inspection of Stage 1 Nozzle Assembly and Face-Type Seal

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Stage 1 nozzle assembly (fig. 3-17) for:			
(1) Cracks in:			
(a) Vane trailing edge (3).	Any number, less than 1/4 inch long. Up to three cracks 1/2 inch long per nozzle segment (2 vanes per segment). Total cumulative length of all cracks must not exceed 3 inches, if no pieces of metal are in danger of falling out.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) Vane leading edge (2).	Any number, if no pieces are in danger of falling out.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-7. Inspection of Stage 1 Nozzle Assembly and Face-Type Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(c) Outer band (5) and inner band (4).	Four cracks, 1 inch long, if no pieces of metal are in danger of falling out.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Evidence of burning on leading edges of airfoil surfaces.	Any amount of discoloration of surface roughness if there is no blistering, cracking, or separation (delamination) of the surface on leading edges.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Blistering on:			
(a) Vanes (1) except on vane trailing edge (3).	1/2 inch × 1/4 inch, two places per vane.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) Vane trailing edge (3).	Any amount along full radial height if blistering is no more than 1/8 inch back from edge of vane.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(c) Outer band (5) and inner band (4).	1/2 inch × 1/2 inch, two places each band.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(4) **(T701D)** Missing TBC.	Any amount.	Not applicable.	Not applicable.
(5) Nicks, scratches, and gouges.	Any number, 1/64 inch deep, with no high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(6) Pieces missing due to burning or FOD on:			
(a) Vane trailing edge (3).	Nicks not to exceed 1/8 x 1/8 inch maximum of four vanes.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) Other areas of vanes (1).	Not allowed.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(c) Outer band (5) and inner band (4).	1/2 inch long, 3/32 inch from edge (1 per side; any number of vanes).	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-7. Inspection of Stage 1 Nozzle Assembly and Face-Type Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(7) Dents in:			
(a) Vane trailing edge (3).	Any number, 1/64 inch deep, within 1/4 inch of edge with smooth deformation.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) All other areas.	Any number, 1/32 inch deep, with smooth deformation and without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(8) Buckling of vane trailing edge (3).	3/64 inch from straight line.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(9) Ring (6) for:			
(a) Circumferential cracks.	None allowed.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) Radial or axial cracks.	Any number, 1/16 inch long.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(c) Nicks and scratches.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(d) Dents.	Any number, 1/16 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(10) Nozzle support (7) for:			
(a) Cracks.	None allowed.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) Nicks, pits, and scratches.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend.
(11) Plugged cooling holes in vane leading edge (2). (Inspect by holding nozzle assembly up to light source.)	No plugged holes allowed.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-7. Inspection of Stage 1 Nozzle Assembly and Face-Type Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(12) Flaking or missing coating where face-type seal contacts segments.	An area up to 0.050 inch diameter, three places per segment. Does not apply if area is within 0.120 inch of joint between nozzle segments or within 0.060 inch of ID and OD of segment.	Not repairable.	Replace nozzle assembly (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(13) Flaking or missing coating in other areas.	Any amount.	Not applicable.	Not applicable.

CAUTION

Be sure stage 1 nozzle face-type seal (3, fig. 3-1 or 3-2) is installed. If module or engine is found to have been operated without stage 1 nozzle face-type seal installed, the stage 1 and stage 2 turbine blades and dampers may have been subjected to excessive excitation force. Engines operated without stage 1 nozzle face-type seal installed must have the stage 1 and stage 2 turbine blades and dampers replaced.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(14) Presence of face-type seal (8).	Must have been installed during all operation of engine.	Not repairable.	Replace stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).
b. Face-type seal (8) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace seal (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Dents.	None allowed.	Not repairable.	Replace seal (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Nicks and scratches:			
(a) On sealing surfaces.	None allowed.	Not repairable.	Replace seal (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) On other areas.	Any number, without high metal.	Any number, with high metal.	Remove high metal and blend.
(4) Height.	0.205 inch minimum.	Not repairable.	Replace seal (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-7. Inspection of Stage 1 Nozzle Assembly and Face-Type Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(5) Wear on:			
(a) Area A of coated seal.	0.002 inch reduction of coating thickness as compared to unworn thickness.	Not repairable.	Replace seal (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) **(T700)** Sealing surface of uncoated seal.	0.002 inch reduction of bare parent metal thickness as compared to unworn thickness.	Not repairable.	Replace seal (para 3-24).

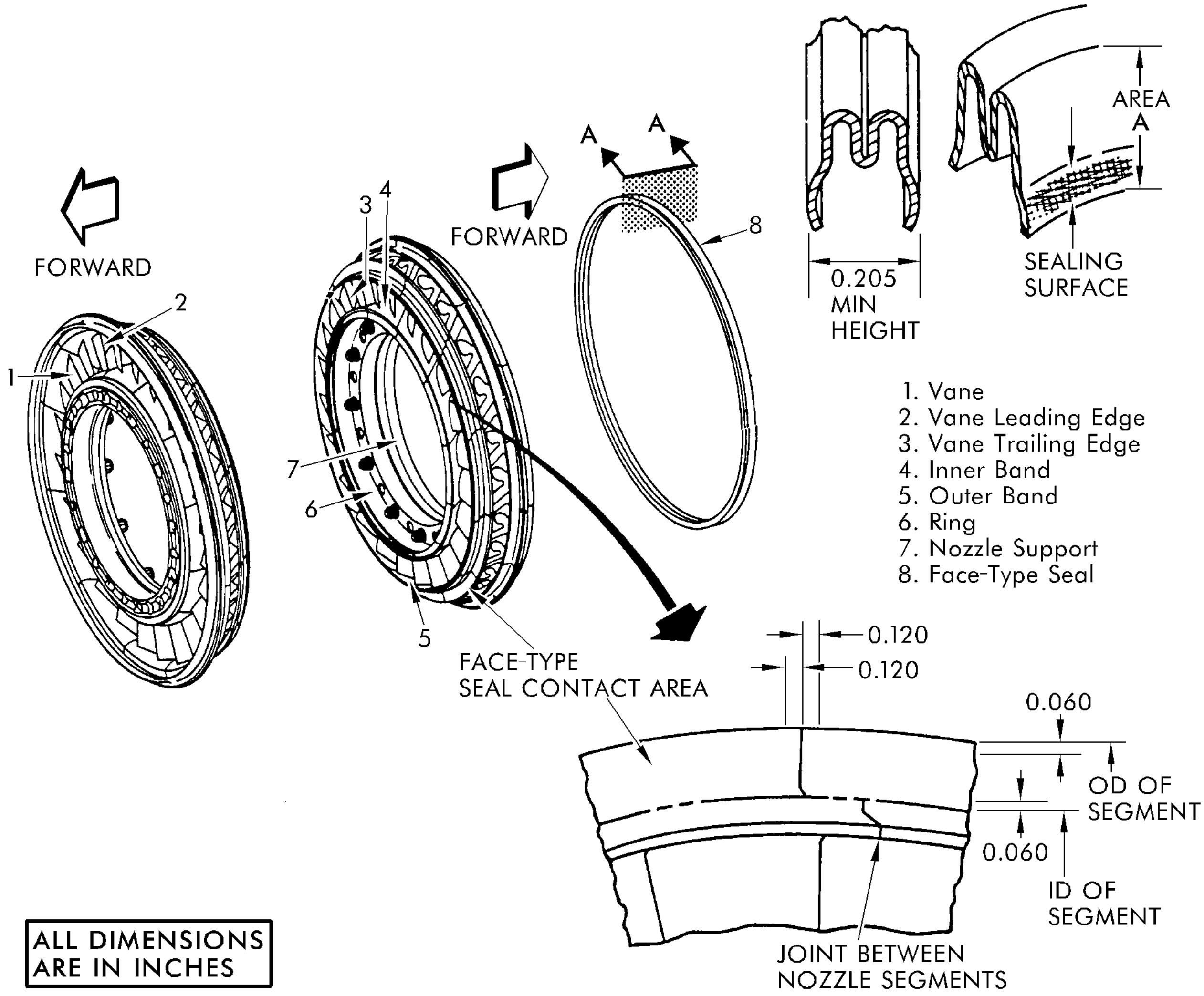

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Figure 3-17. Stage 1 Nozzle Assembly (Typical) and Face-Type Seal; Inspection

3-21. Inspection of Combustion Liner (AVIM). See table 3-8.

Table 3-8. Inspection of Combustion Liner

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Inner and outer shells for:			
(1) Cracks in shell bands (5, 11, fig. 3-18, sheet 1 **(T700)** or fig. 3-19, sheet 1 **(T701, T701C, T701D)**) which run:			
(a) Circumferentially around the band.	Total length of a crack, including burn holes, not to exceed 5/8 inch, if ends in parent metal have been stop-drilled and if total length of circumferential cracks in a band does not exceed 1-1/4 inches.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(b) Other than circumferentially.	Any number, 1/16 inch long; 24 per shell band, 1/8 inch long; six per shell band, 1/4 inch long, if ends in parent metal have been stop drilled and if no piece of metal is in danger of falling out. If connected with a cooling lip crack, total crack length may be up to 7/16 inch long.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Cracks in fusion weld.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Burn holes in shell bands (5, 11).	Six per shell band, if diameter of hole does not exceed 3/16 inch and if cracks extending from defect have been repair welded.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(4) Dents.	Contour of defective area must not be more than 1/8 inch above or below adjacent undistorted contour.	Any amount that can be reworked to usable limits.	Cold-work to adjacent undistorted contour. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No cracks allowed.

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(5) Local distortion due to high temperature.	Contour of defective area must not be more than 1/8 inch above or below adjacent undistorted contour.	Any amount that can be reworked to usable limits.	Cold-work to adjacent undistorted contour. Fluorescent penetrant-inspect (see TM 1-1500-204-23). See step a(1) and a(2).
(6) Distortion of cooling lips (12).	Distortion must be no more than 1/32 inch from adjacent undistorted contour. Gap between lip and shell must not be less than 0.040 inch.	Any amount that can be reworked to usable limits.	Cold-work lip contour until it visually matches adjacent undistorted contour. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No cracks allowed.
(7) Cracks in cooling lips (12) (does not include shell band cracks):			
(a) In the aft band cooling lips.	Any number, 3/16 inch long, if no piece is in danger of falling out.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**)
(b) In the remaining bands of cooling lips.	Any number, any length providing no piece is in danger of falling out. No cracks progressing in the circumferential direction is allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(8) Burnout of cooling lips (12).	Five per lip if depth of defect does not exceed 3/32 inch and if there is no high metal along the edges of the defect which extends into the gas flow or cooling flow.	Five per lip if maximum width of defect does not exceed 3/16 inch.	Blend and coldwork defective area as necessary to eliminate high metal and sharp edges. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No cracks allowed.

NOTE

Depth of defects of this type (nicks, etc.) on any part of the liner may be determined by comparing it with a piece of shim stock or wire whose thickness is equal to that of the limit.

(9) Nicks, scratches, and gouges.	Any number, 0.010 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(10) Plugged cooling holes.	None allowed.	Any number.	Determine size of defective hole using wire gages or various size drill bits. After determining hole size, run the proper size through defective hole, taking care not to damage cooling lip behind hole.
(11) Lack of fusion weld indication at self-fixturing lip (18) of dome/inner shell junction.	Any amount.	Not applicable.	Not applicable.
(12) **(T701D)** Missing TBC.	Any amount.	Not applicable.	Not applicable.
b. Seal (6, fig. 3-18, sheet 1 **(T700)** or fig. 3-19, **(T701, T701C, T701D)**) for nicks, scratches, and gouges.	Any number, 1/64 inch deep, without high metal, and without sharp corners along the edge of the defect.	Same as usable limits, with high metal.	Blend defect to usable limits.
c. Seal support (7) and outer band (8) for:			
(1) Cracks in parent metal.	Any number, 1/4 inch long.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Cracks in fusion welds.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Dents, buckles, and warps.	No visible distortion of annular slot formed by band and seal.	Any amount that can be reworked to usable limits.	Cold-work to usable limits. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No cracks allowed.
(4) Areas of surface erosion due to overtemperature.	Any number if thickness of seal or band at defect is not less than 1/2 the thickness of the adjacent nondefective area.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
d. Seal support (7) for burned out trailing edge.	Not allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
e. Outer band (8) and inner band (9) for burned out trailing edge.	Any number if defect does not extend forward more than 3/16 inch.	Any amount, if width of defect is 1/8 inch or less.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
f. Support (10) for:			
(1) Cracks in parent metal.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Cracks in fusion welds.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Nicks, scratches, and gouges.	Any number, 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(4) Loose or missing headed pin (23).	Not allowed.	Any amount.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T700, T701C, T701D)**).
g. Dome (14) for:			
(1) Cracks.	Any number, up to 3/4 inch long, if cumulative length of all cracks does not exceed 2 1/4 inches and pieces are not in danger of falling out. Parallel cracks must be 3/8 inch minimum apart. Axial and radial cracks may extend through the dome-to-shell weld joint.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Connecting cracks.	Connection of any two cracks is allowed, if length of individual crack does not exceed limits of step g1 and pieces are not in danger of falling out. Limit is exceeded when a third crack connects to the first two.	Not repairable.	Replace combustion liner.
(3) Dents, buckles, and warps.	No visible distortion from normal contour allowed.	Any number that can be reworked to usable limits.	Cold-work defect to usable limits. Fluorescent penetrant-inspect (TM 1-1500-204-23). No cracks allowed.

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Nicks, scratches, and gouges.	Any number, up to 1/32 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(5) Plugged cooling holes and carbon buildup.	Not allowed.	Any number	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
h. Splash plate (15) for:			
(1) Cracks and burnout.	Any number, any length, if pieces are not in danger of falling out.	Any amount, If remaining splash plate area is 50% or more and if pieces are in danger of falling out.	Remove pieces that are in danger of falling out by blending.
(2) Buckling.	Up to 1/32 inch deep; not over 25% of edge can be buckled.	Any amount.	Cold-work defect to usable limits. Reinspect for cracks per step h. 1.
(3) **(T701D)** Missing TBC.	Any amount.	Not applicable.	Not applicable.

NOTE

Carbon deposits must be present. No carbon deposits indicate a plugged fuel injector or a new (less than 20 hours) combustion liner.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Missing carbon deposits.	Carbon deposits must be present (except on a new (less than 20 hours) combustion liner).	Not repairable.	Replace fuel injector (para 6-26).
(5) Carbon buildup.	Not allowed.	Any amount.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
i. Ferrule (4) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
WARNING Penetrating Oil • Combustible near sparks, open flames, welding areas, hot surfaces, other sources of ignition, or while smoking. • Inhalation may cause irritation or burning of respiratory system. • Contact with eyes/face/skin may cause irritation or burning. • Personal protective equipment required when handling or using this material.			
(2) Seizure.	Ferrule must slide freely between retainer and pad.	Any amount.	Work ferrule free using penetrating oil (item 88, Appendix D) to help free seized parts. Check retainer for distortion when ferrule is free. Clean part (para 3-19).
(3) Nicks, scratches, and gouges.	Any number, 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
j. Primary swirler (17) for:			
(1) Cracks.	Up to two cracks in a swirler if cumulative length does not exceed 3/16 inch and if no piece is in danger of falling out.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
WARNING Penetrating Oil Observe warning in step .			
(2) Seizure.	Swirler must slide freely between retainer and pad.	Any amount.	Work swirler free using penetrating oil (item 88, Appendix D) to help free seized parts. Check retainer for distortion when swirler is free. Clean part (para 3-19).
(3) Nicks, scratches, and gouges.	Any number, up to 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(4) Damaged or missing antirotation tab.	Not allowed.	Any amount.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(5) Wear in inside diameter.	Up to 0.338 inch maximum.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
k. Spring (19) for:			
(1) Spring action.	Spring must return primary swirler to its maximum radially outward position.	Any amount.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Missing spring.	Not allowed.	Any amount.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
l. Ferrule retainer (3) and retainer (16) for:			
(1) Cracks in parent metal.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Cracks in fusion welds.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Distortion.	Any amount as long as ferrule moves freely.	Any amount.	Cold-work to usable limits. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No cracks allowed.

NOTE

Any combination of the three combustion liner guides (13, fig. 3-18, 3-19) may have been removed during prior rework and should be considered acceptable.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
m. Guides (13) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Nicks, scratches, and gouges.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(3) Missing guides.	Any number	Any amount.	Not applicable.
n. Combustion liner for aluminum silicon deposits.	None allowed.	Any amount, if parent material is undamaged.	Remove deposits (para 3-23).
o. Eyelet flange (20) for:			
(1) Cracks in attachment weld.	One per weld up to 0.150 inch long.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).

Table 3-8. Inspection of Combustion Liner (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Crack in all other areas.	None allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(3) Distortion.	Contour of defective area will not be more than 1/8 inch above or below adjacent undistorted contour.	Any amount that can be reworked to usable limits.	Cold-work to usable limits. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No crack allowed.
(4) Nick, scratches and gouges.	Any number up to 0.015 inch deep, without high metal.	Same as usable limits with high metal.	Blend metal to adjacent contour.
p. Cowl (21), if applicable for:			
(1) Cracks.	Not allowed.	Not repairable.	Replace combustion liner (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)**).
(2) Dents.	Up to 0.030 inch deep from adjacent contour.	Any amount.	Cold-work to usable limits. Fluorescent penetrant-inspect (see TM 1-1500-204-23). No crack allowed.
(3) Nicks, scratches, and gouges.	Any amount up to 0.010 inch deep without high metal.	Same as usable limits with high metal.	Blend high metal to adjacent contour.

3-22. Installation of Outer Balance Piston Seal (AVIM).

NOTE

The combustor liner shroud can come off when the outer balance piston seal is removed.

a. Ensure combustor inner shroud is installed. Install new preground outer balance piston seal **(T700)** (14, fig. 3-13) or **(T701, T701C, T701D)** (10, fig. 3-14) over combustor inner shroud mounting flange and line up two pin alinement holes on seal over two locating pins on midframe aft inner mounting flange.

b. Using a plastic mallet or a block of wood placed over seal (14 or 10), tap seal into place so it fully seats over pins and onto flange.

3-23. Removal of Aluminum Silicon Deposits (AVIM). The following procedure is for removing aluminum silicon deposits.

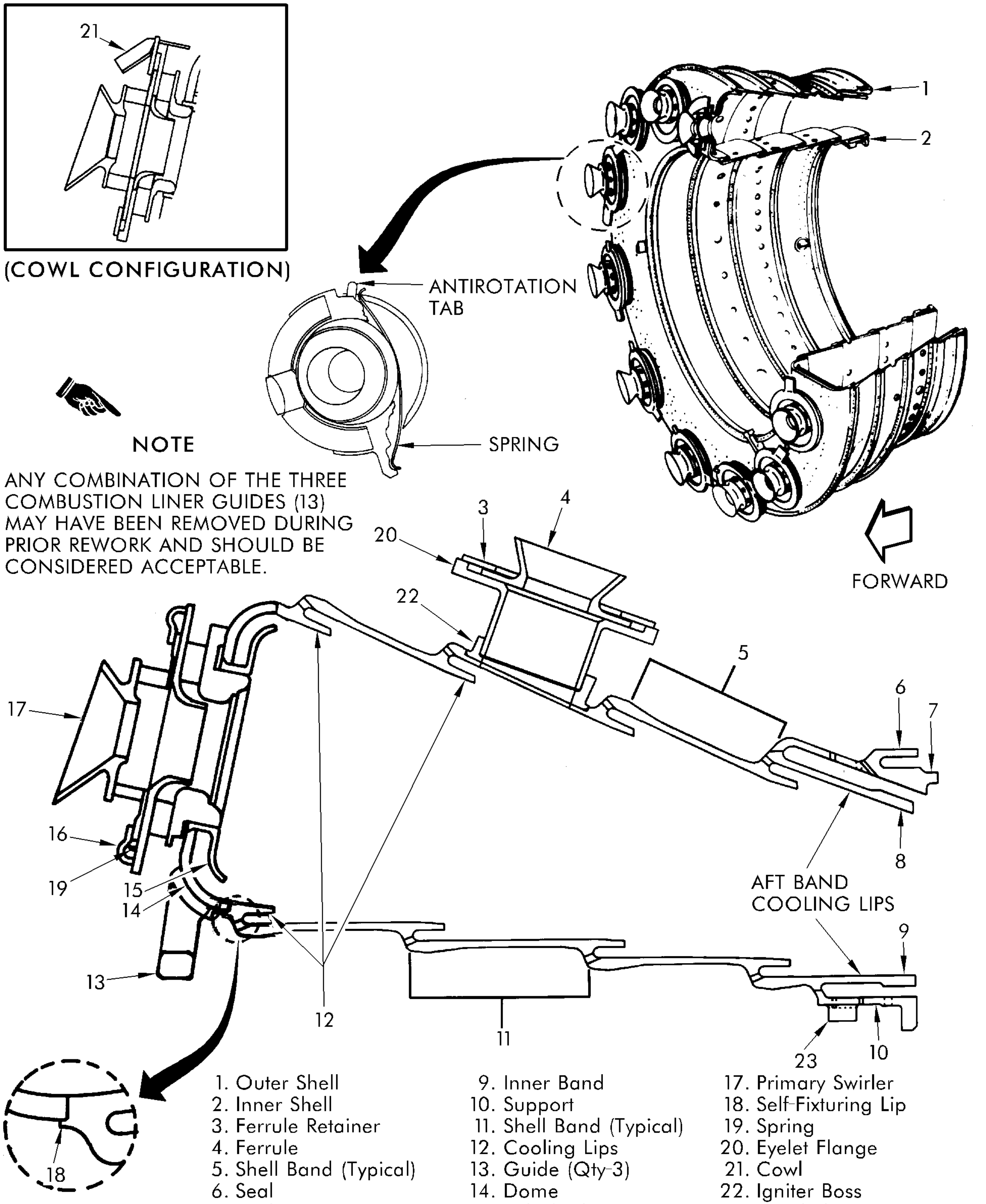
a. Using pad (item 89, Appendix D), remove deposits from assembly.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Using dry, filtered, compressed air, remove deposit dust.



NOTE

ANY COMBINATION OF THE THREE COMBUSTION LINER GUIDES (13) MAY HAVE BEEN REMOVED DURING PRIOR REWORK AND SHOULD BE CONSIDERED ACCEPTABLE.

1. Outer Shell
2. Inner Shell
3. Ferrule Retainer
4. Ferrule
5. Shell Band (Typical)
6. Seal
7. Seal Support
8. Outer Band
9. Inner Band
10. Support
11. Shell Band (Typical)
12. Cooling Lips
13. Guide (Qty-3)
14. Dome
15. Splash Plate
16. Retainer
17. Primary Swirler
18. Self-Fixturing Lip
19. Spring
20. Eyelet Flange
21. Cowl
22. Igniter Boss
23. Headed Pin

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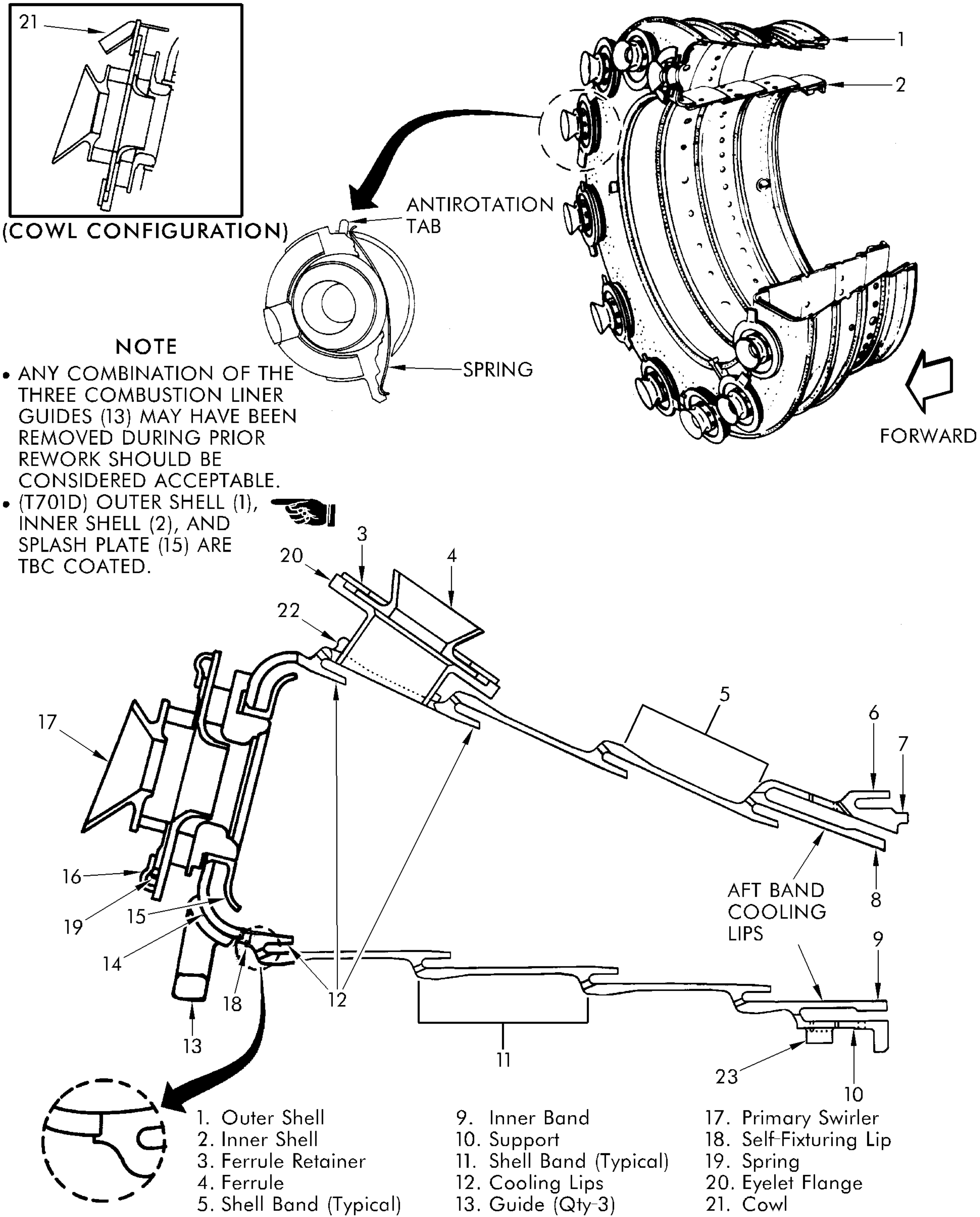
Figure 3-18. (T700) ***Combustion Liner; Inspection***



NOTE

- ANY COMBINATION OF THE THREE COMBUSTION LINER GUIDES (13) MAY HAVE BEEN REMOVED DURING PRIOR REWORK SHOULD BE CONSIDERED ACCEPTABLE.
- (T701D) OUTER SHELL (1), INNER SHELL (2), AND SPLASH PLATE (15) ARE TBC COATED.

1. Outer Shell
2. Inner Shell
3. Ferrule Retainer
4. Ferrule
5. Shell Band (Typical)
6. Seal
7. Seal Support
8. Outer Band
9. Inner Band
10. Support
11. Shell Band (Typical)
12. Cooling Lips
13. Guide (Qty-3)
14. Dome
15. Splash Plate
16. Retainer
17. Primary Swirler
18. Self-Fixturing Lip
19. Spring
20. Eyelet Flange
21. Cowl
22. Igniter Boss
23. Headed Pin

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Figure 3-19. ***(T701, T701C, T701D)*** *Combustion Liner; Inspection*

3-24. (T700) Installation of Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner (AVIM).

a. Assemble combustion liner (8, fig. 3-20) to midframe assembly (1) as follows:

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(1) Check swirlers (10) for freedom of movement. If movement is restricted, apply a thin coat of lubricating oil (item 85 or 87, Appendix D) to swirlers (10).

CAUTION

Installation of combustion liner must be done with care. If liner is jammed into position without a firm rocking motion, damage to fuel injectors could result.

NOTE

Any combination of the three combustion liner guides (13, fig. 3-18) may have been removed during prior rework and should be considered acceptable.

(2) Aline igniter and primer ports on combustion liner (8, fig. 3-20 with those in midframe assembly (1). Aline assembly guides (9) on inside of combustion liner (8) with guide openings inside of midframe. Using a firm rocking motion, install combustion liner (8) so that swirlers (10) slip over fuel injector nozzles.

CAUTION

If combustion liner must be removed, do not rest liner, forward end down, on primary swirlers. Primary swirlers are made from a brittle material which could be easily damaged if liner is rested in such a manner.

(3) Check each swirler (10) to be sure that the fuel injector nozzles have engaged swirlers (10). If not, remove liner and examine fuel injectors and swirlers (10) for damage.

(4) Inspect two nuts (3) for the presence of dry-film lubricant. If threads of nuts are dry, apply a coat of anti-seize compound (item 56, Appendix D).

(5) Install igniter plug (2) and nut (3) (para 7-9).

(6) Connect ignition lead (4) (para 7-9).

(7) Push ignition lead (4) into spring clip bracket on midframe-to-diffuser flange.

(8) Install primer nozzle (5) and nut (6). Tighten (15° wrench arc) nut.

(9) Connect fuel start manifold tube (7). Tighten (60° wrench arc) coupling nut.

(10) Repeat steps (4) thru (9) for primer nozzle and igniter plug on other side of engine.

NOTE

It is possible for the OBP seal to come off with and remain attached to a stage 1 nozzle that is being replaced.

b. Check to be sure that the OBP seal is installed; then install stage 1 nozzle assembly (4, fig. 3-21) onto combustion liner as follows:

(1) Install stage 1 nozzle assembly (4) into groove on combustion liner (5).

(2) Be sure that forward edge of outer combustor seal (6) on outside of stage 1 nozzle assembly (4) fits into groove on combustion liner (5).

(3) Install twelve bolts (7), and torque to 45-50 inch-pounds.

1. Midframe Assembly
2. Igniter Plug
3. Nut
4. Ignition Lead
5. Primer Nozzle
6. Nut
7. Fuel Start Manifold Tube
8. Combustion Liner
9. Assembly Guide
10. Swirlers

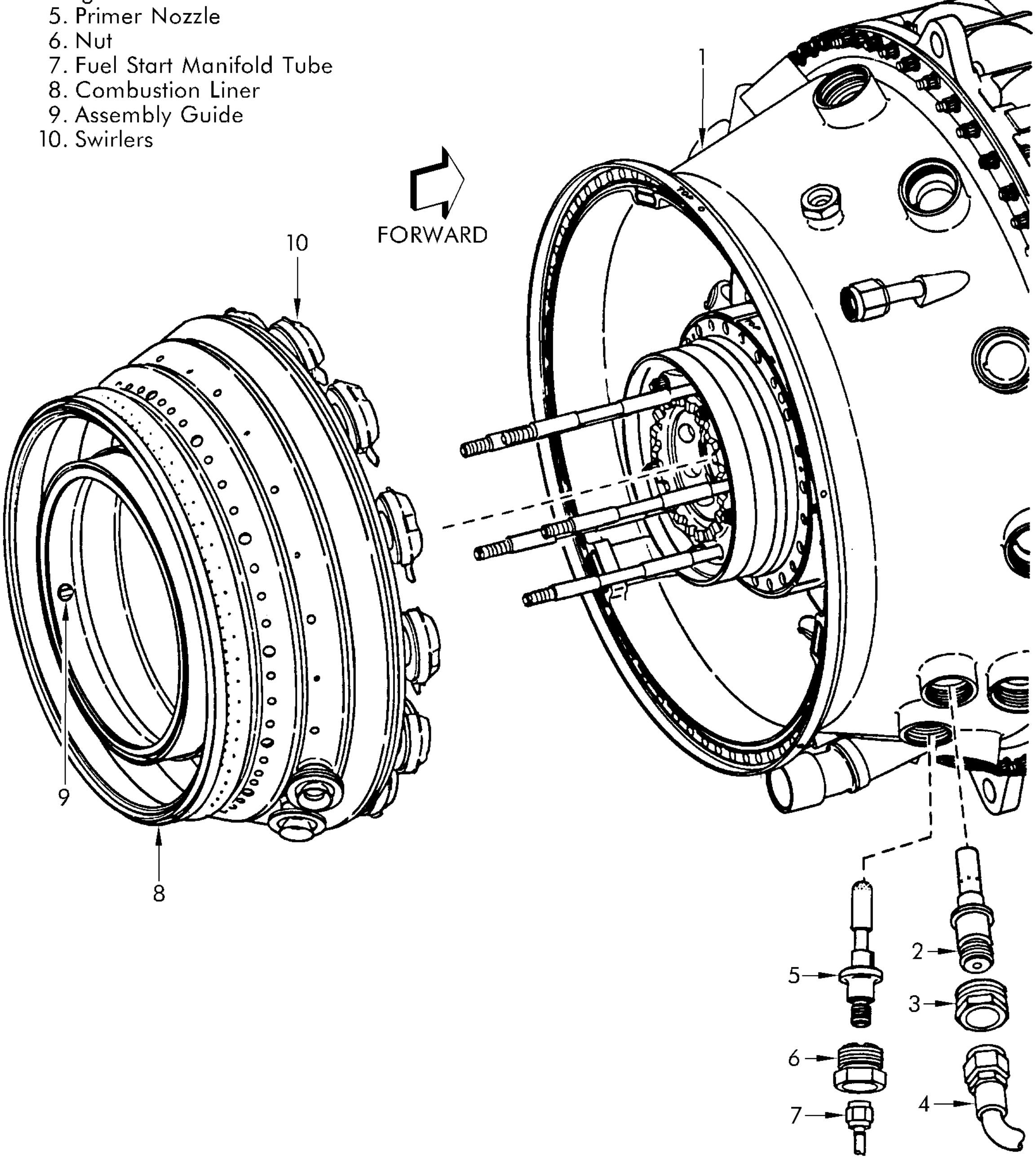

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Figure 3-20. (T700) Combustion Liner; Installation

1. **(T701, T701C, T701D)** Bolt
2. **(T701, T701C, T701D)** Stage 1 Turbine Nozzle Shield
3. Face-Type Seal
4. Stage 1 Nozzle Assembly
5. Groove On Combustion Liner
6. Outer Combustor Seal
7. Bolt

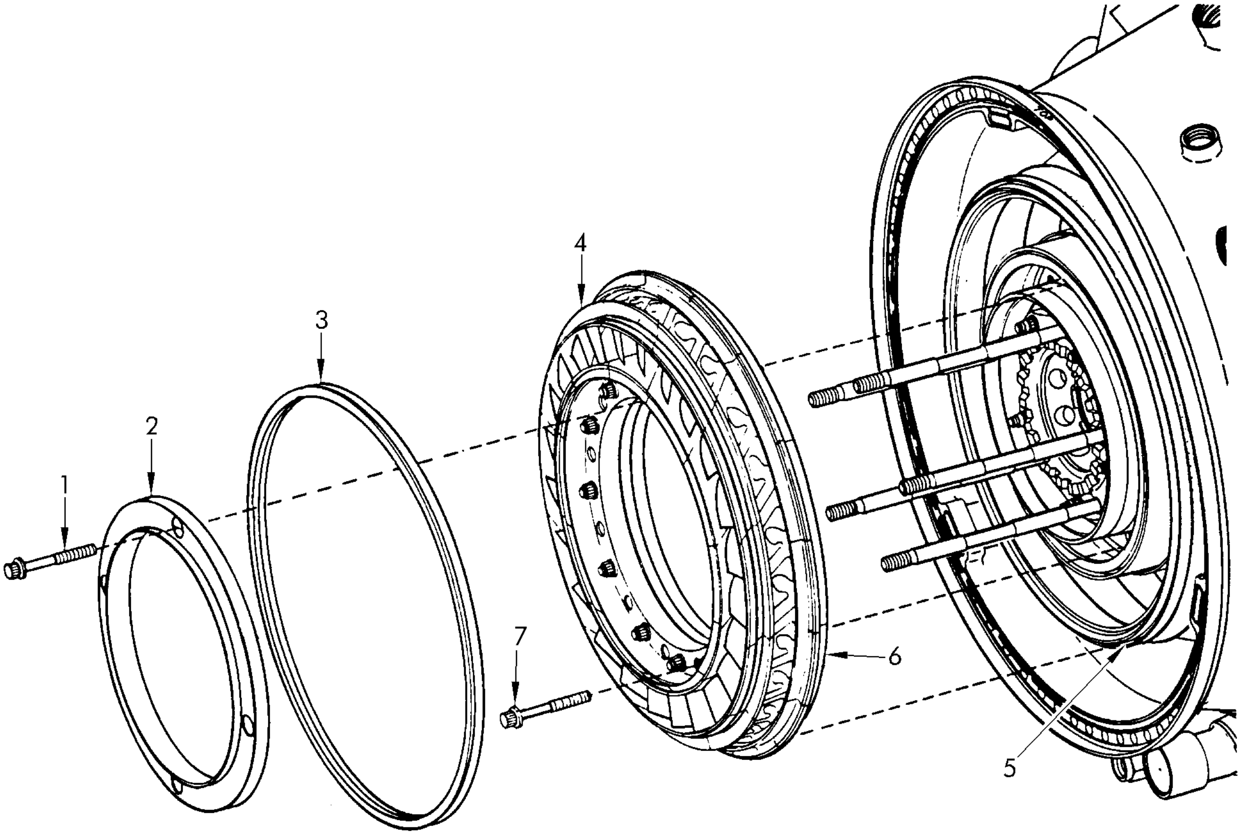


Figure 3-21. Stage 1 Nozzle Assembly and Face-Type Seal; Installation

CAUTION

If face-type seal is not properly installed on stage 1 nozzle assembly when gas generator stator is installed, face-type seal will be crushed and damaged.

c. Install face-type seal (3) onto stage 1 nozzle assembly (4).

d. Install stages 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13).

e. Make required engine checks listed in table 1-39.

3-25. (T701, T701C, T701D) Installation of Stage 1 Nozzle Assembly, Face-Type Seal, and Combustion Liner (AVIM).

a. Assemble combustion liner (4, fig. 3-22) to midframe assembly (1) as follows:

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(1) Check swirlers (6) for freedom of movement. If movement is restricted, apply a thin coat of lubricating oil (item 85 or 87, Appendix D) to swirlers (6).

CAUTION

Installation of combustion liner must be done with care. If liner is jammed into position without a firm rocking motion, damage to fuel injectors could result.

NOTE

Any combination of the three combustion liner guides (13, fig. 3-19) may have been removed during prior rework and should be considered acceptable.

(2) Aline igniter ports on combustion liner (4, fig. 3-22 with those in midframe assembly (1). Aline assembly guides (5) on inside of combustion liner (4) with guide openings inside of midframe. Using a firm rocking motion, install combustion liner (4) so that swirlers (6) slip over fuel injector nozzles.

CAUTION

If combustion liner must be removed, do not rest liner, forward end down, on primary swirlers. Primary swirlers are made from a brittle material which could be easily damaged if liner is rested in such a manner.

(3) Check each swirler (6) to be sure that the fuel injector nozzles have engaged swirlers (6). If not, remove liner (4) and examine fuel injectors and swirlers (6) for damage.

(4) Install igniter plug (2) (para 7-10).

(5) Connect ignition lead (3) (para 7-10).

(6) Push ignition lead (3) into spring clip bracket on midframe-to-diffuser flange.

(7) Repeat steps (4) thru (6) for igniter plug on other side of engine.

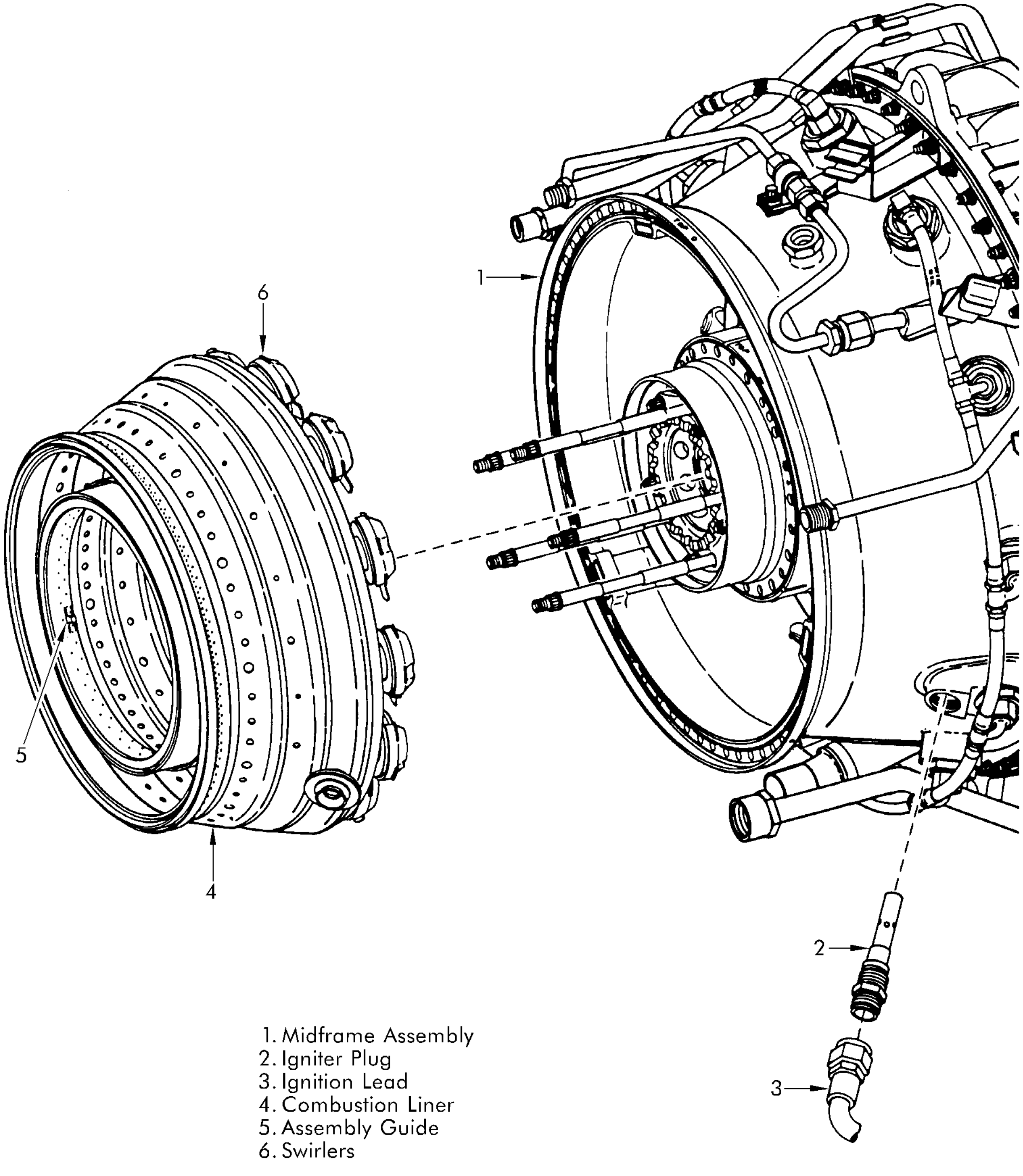
NOTE

It is possible for the OBP seal to come off with and remain attached to a stage 1 nozzle that is being replaced.

b. Check to be sure that the OBP seal is installed; then install stage 1 nozzle assembly (4, fig. 3-21) onto combustion liner as follows:

(1) Install stage 1 nozzle assembly (4) into groove on combustion liner (5).

(2) Be sure that forward edge of outer combustor seal (6) on outside of stage 1 nozzle assembly (4) fits into groove on combustion liner (5).



1. Midframe Assembly
2. Igniter Plug
3. Ignition Lead
4. Combustion Liner
5. Assembly Guide
6. Swirlers

Figure 3-22. ***(T701, T701C, T701D)*** *Combustion Liner; Installation*

NOTE

There are 12 boltholes in the stage 1 nozzle assembly. Bolts are used in eight of these holes to secure the stage 1 nozzle assembly. The four remaining boltholes are used when the shield is installed.

(3) Install eight bolts (7) so that remaining four unused boltholes are 90° apart, at 12, 3, 6, and 9 o'clock positions.

(4) Torque bolts (7) to 45-50 inch-pounds.

(5) Install stage 1 turbine nozzle shield (2) and four bolts (1).

(6) Torque bolts (1) to 45-50 inch-pounds.

CAUTION

If face-type seal is not properly installed on stage 1 nozzle assembly when gas generator stator is installed, face-type seal will be crushed and damaged.

c. Install face-type seal (3) onto stage 1 nozzle assembly (4).

d. Install stage 1 and 2 gas generator turbine rotor and gas generator stator (para 3-13, step b).

e. Make required engine checks listed in table 1-39.

3-26. PREPARING HOT SECTION MODULE FOR STORAGE OR SHIPMENT.

a. Attach envelope containing forms and records to module components.

NOTE

- The hot section module consists of three separate assemblies: stage 1 nozzle assembly, combustion liner, and gas generator turbine (stages 1 and 2 gas generator turbine rotor and gas generator stator). These three assemblies can be replaced independently.
- Be sure the curvic coupling seal and cooling plate seal ring are included assembled or packaged as separate parts.

b. Using container in which new module component was received, place old module component inside and secure lid on container.

c. Cross out old markings on container that do not apply to module component inside.

d. Using stencil marking ink (item 81, Appendix D), mark the following information on top half of container:

- Form control number
- Serial number
- Date packed
- Reinspection date (6 months after date packed)

3-27. PLACING HOT SECTION MODULE IN SERVICE.

NOTE

The hot section module consists of three separate assemblies: stage 1 nozzle assembly, combustion liner, and gas generator turbine (stages 1 and 2 gas generator turbine rotor and gas generator stator). These three assemblies can be replaced independently.

a. Remove module component from container. Save container for future use.

b. Make sure that all records and forms are complete.

c. Inspect overall condition of module component.

d. Install module component onto engine (para 3-24 **(T700)** or 3-25 **(T701, T701C, T701D)** and para 3-13).

CHAPTER 4

POWER TURBINE

POWER TURBINE MODULE

4-1. CHAPTER OVERVIEW.

This chapter contains instructions for removing, cleaning, inspecting, repairing, and installing the power turbine module and its components to the extent allowed by the Maintenance Allocation Chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

4-2. CHAPTER INDEX.

Maintenance procedures in this chapter are arranged as follows:

4-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. When removing or installing parts, prevent entry of foreign objects into air and oil passages and avoid damaging electrical connectors.

b. Do not use tape to cover oil passages or openings. Tape adhesive can dissolve in oil and can cause contamination. Use clean, dry protective caps to cover electrical connectors and other openings.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

c. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

d. Inspect replacement parts for serviceability before installation.

e. Always use a backup wrench on fittings when removing or installing hoses or tubes.

f. When connecting hoses or tubes, see wrench-arc tightening method (para H-14, Appendix H).

g. Before connecting electrical connectors, refer to paragraph H-7, Appendix H for proper procedure.

h. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

4-4. POWER TURBINE (POWER TURBINE MODULE).

4-5. Inspection of Power Turbine Module. For power turbine module inspection, see individual components for inspection requirements.

4-6. Repair of Power Turbine Module. Repair is limited to replacement of external tubing and line replaceable unit (LRU's) to the extent allowed by the Maintenance Allocation Chart (MAC).

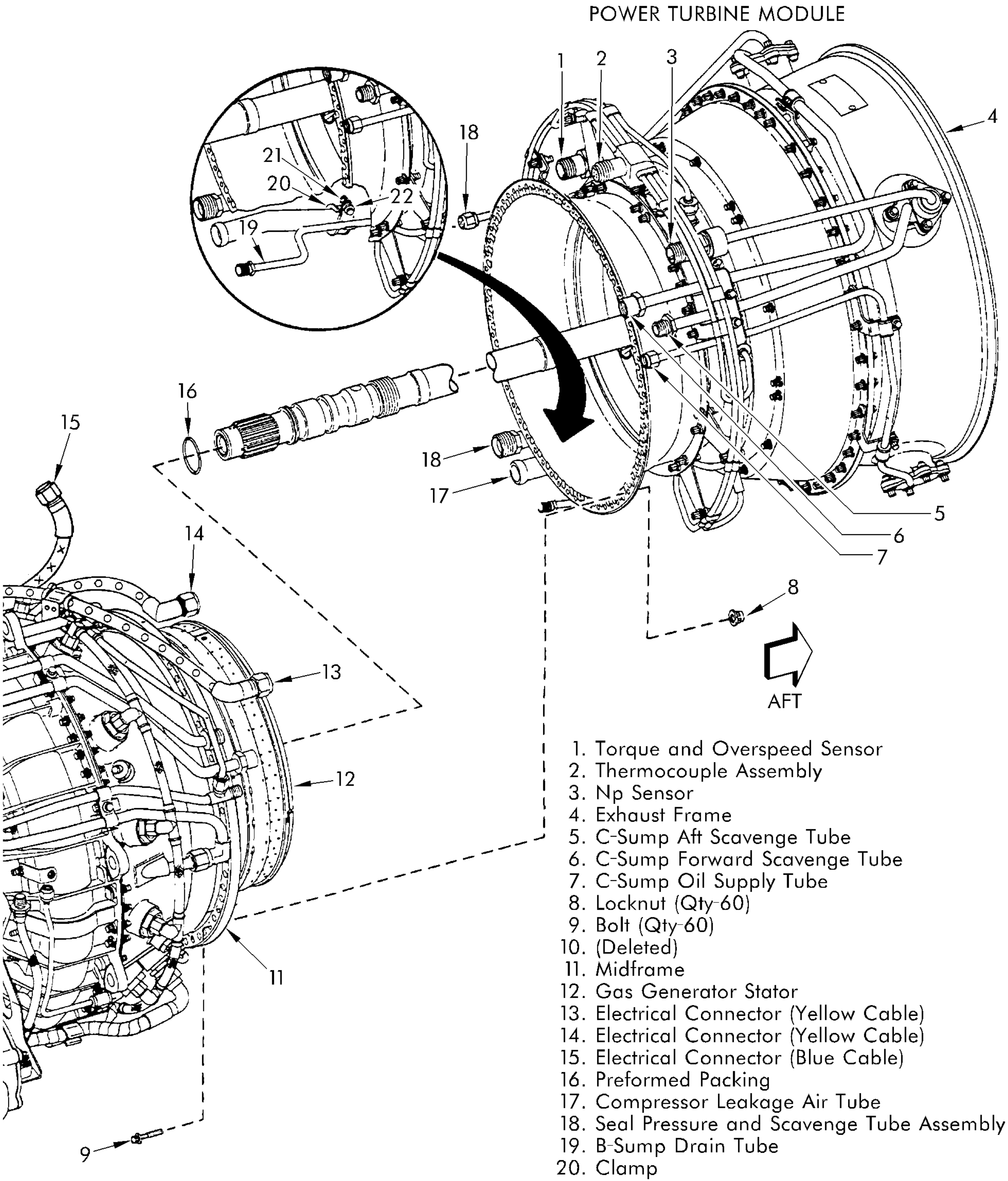
4-7. Removal of Power Turbine Module (AVIM).

CAUTION

Do not remove or install a power turbine module with a compressor case half removed. Otherwise, the stage 1 disk, PT shaft seal teeth, or carbon seal may be damaged.

a. Disconnect electrical connectors (yellow cable 13, 14 and blue cable 15, fig. 4-1) from the following components at forward flange of power turbine module:

- Torque and overspeed sensor (1)
- Thermocouple assembly (2)
- Np sensor (3)



1. Torque and Overspeed Sensor
2. Thermocouple Assembly
3. Np Sensor
4. Exhaust Frame
5. C-Sump Aft Scavenge Tube
6. C-Sump Forward Scavenge Tube
7. C-Sump Oil Supply Tube
8. Locknut (Qty-60)
9. Bolt (Qty-60)
10. (Deleted)
11. Midframe
12. Gas Generator Stator
13. Electrical Connector (Yellow Cable)
14. Electrical Connector (Yellow Cable)
15. Electrical Connector (Blue Cable)
16. Preformed Packing
17. Compressor Leakage Air Tube
18. Seal Pressure and Scavenge Tube Assembly
19. B-Sump Drain Tube
20. Clamp
21. Locknut
22. Bolt

1157351-00-A2A

Figure 4-1. Power Turbine Module (Typical); Removal and Installation

b. Cap electrical connectors with clean, dry, protective caps (item 26, 36, Appendix D).

c. Disconnect the following tubes at forward flange of power turbine module:

- Seal pressure and scavenge tube assembly (18) in two places
- C-sump aft scavenge tube (5)
- C-sump forward scavenge tube (6)
- C-sump oil supply tube (7)

d. **(T700)** On engines serial-numbered 207301 thru 207322, disconnect B-sump drain tube (19) as follows:

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

CAUTION

Follow this procedure to prevent damage to B-sump drain tube.

(1) Loosen locknut (21) and bolt (22) at clamp (PN 299C486P11 only) (20).

(2) Disconnect coupling nut on exhaust frame (4).

(3) Loosen coupling nut on midframe (11), but do not disconnect coupling nut yet.

(4) Separate drain tube from fitting on exhaust frame.

(5) Disconnect coupling nut on midframe from drain tube.

e. **(T700)** On engines serial-numbered 207323 and up, disconnect coupling nut on midframe from B-sump drain tube (19).

f. **(T701, T701C, T701D)** Disconnect coupling nut on midframe from B-sump drain tube (19).

g. If replacing power turbine module, go to next step; otherwise, match-mark power turbine module and midframe flange, using blue Dykem marker (item 82, Appendix D).

NOTE

- Compressor leakage air tube (17) will slide out from compressor leakage air fitting on midframe when module is removed.
- Shoulder bolts (body-bound) on power turbine-to-midframe flange have been superseded by bolts (12-point) (9).

h. Remove 59 bolts (9), and 59 locknuts (8), from flange of midframe (11). Do not remove bolt from bolthole no. 2 (refer to fig. 4-2 for location).

CAUTION

- Do not use external lines or tubing for handling module.
- Be sure that power turbine drive shaft stays alined with bore of cold section module to prevent damage to labyrinth seal.

i. With another mechanic helping, use hands to support power turbine drive shaft. Maintain horizontal and vertical module alinement.

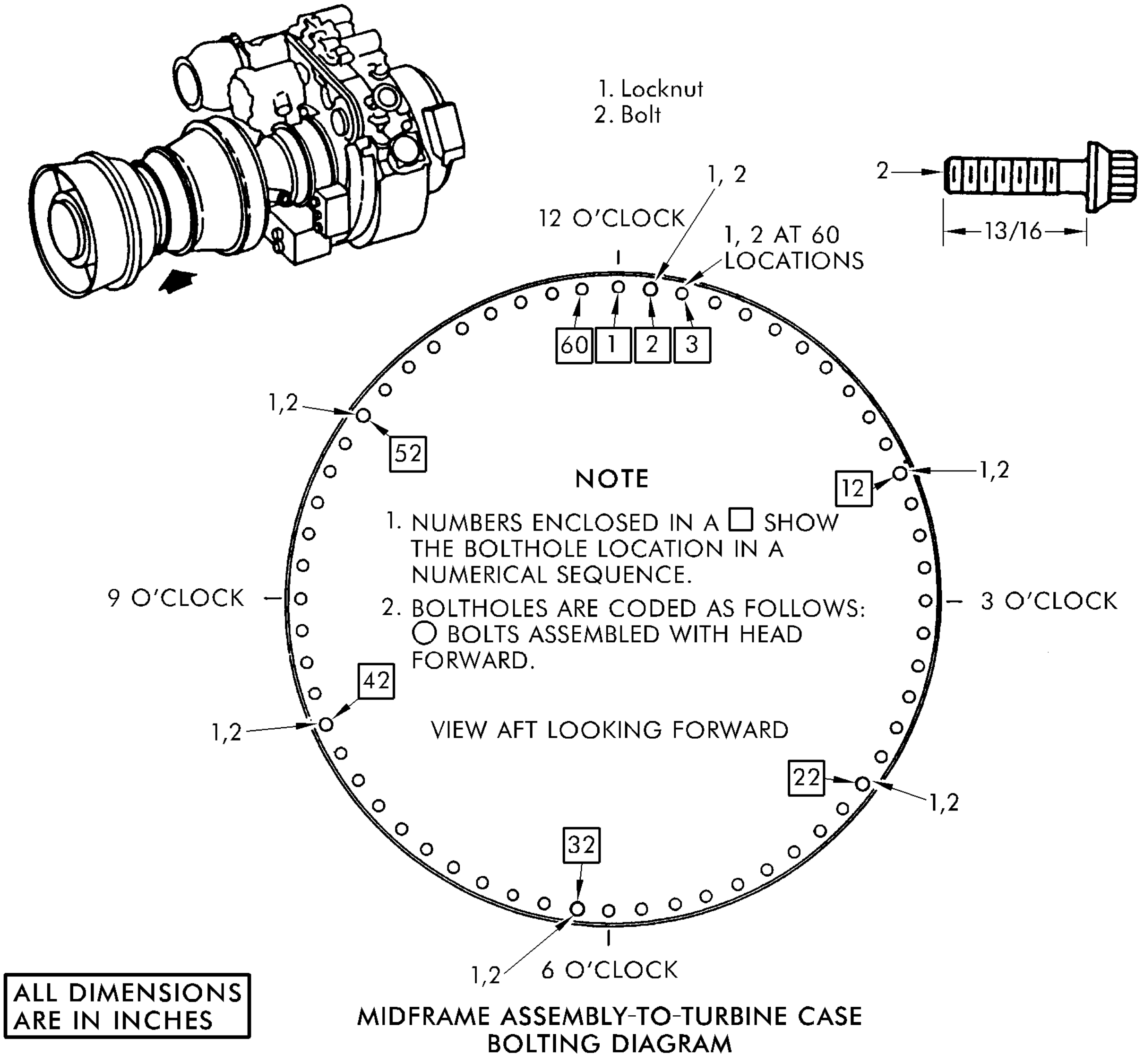
j. Remove remaining locknut (8, fig. 4-1) from remaining bolt (9). Do not remove bolt. Carefully slide module aft until power turbine drive shaft is clear of engine.

k. Place module on bench or on other suitable area, aft end down.

l. Remove packing (16) from power turbine drive shaft.

m. Protect seal teeth on forward end of drive shaft with barrier material (item 12, Appendix D). Wrap material around at least 5 times and tape it with tape (item 107, Appendix D). Cover all exposed tube ends with protective caps (items 17, 18, 19, 24, or 26, Appendix D).

n. Reinstall locknut (8) to secure gas generator stator (12) to midframe (11).



NOTE

1. NUMBERS ENCLOSED IN A ☐ SHOW THE BOLTHOLE LOCATION IN A NUMERICAL SEQUENCE.
2. BOLTHOLES ARE CODED AS FOLLOWS: ○ BOLTS ASSEMBLED WITH HEAD FORWARD.

VIEW AFT LOOKING FORWARD

Figure 4-2. Power Turbine Module; Installation Bolting Diagram

4-8. Cleaning of Power Turbine Module (AVIM).

a. Cover all openings with protective caps (items 17, 18, 19, 24, or 26, Appendix D) as applicable.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Flush or spray-wash outside surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the power turbine module using dry, filtered compressed air.

4-9. Inspection of Power Turbine Module (AVIM). For power turbine module inspection, see individual components for inspection requirements.

4-10. Repair of Power Turbine Module (AVIM). Repair is limited to replacement of external tubing and line replaceable units (LRU's) to the extent allowed by the Maintenance Allocation Chart (MAC).

4-11. Installation of Power Turbine Module (AVIM).

CAUTION

Do not remove or install a power turbine module with a compressor case half removed. Otherwise, the stage 1 disk, PT shaft seal teeth, or carbon seal may be damaged.

(T700) During installation or replacement of hot section or power turbine modules, maintenance activities will use caution to ensure that gas generator turbine rotors that have wide bore disks are not used with power turbine modules containing drive shafts that have thick balance lands.

CAUTION

- Stages 1 and 2 gas generator turbine rotor PN 6039T54G03 (wide bore configuration) will only be used with power turbine module PN 6043T89G01 (wide bore configuration).
- Stages 1 and 2 gas generator turbine rotor PN 6039T54G02 (narrow bore configuration) may be used with either power turbine module PN 6043T89G01 (wide bore configuration) or PN 6038T61G01 (narrow bore configuration).
- Power turbine module PN 6038T61G01 (narrow bore configuration) will only be used with stages 1 and 2 gas generator turbine rotor PN 6039T54G02 (narrow bore configuration).
- Power turbine module PN 6043T89G01 (wide bore configuration) may be used with either stages 1 and 2 gas generator turbine rotor PN 6039T54G03 (wide bore configuration) or PN 6039T54G02 (narrow bore configuration).

a. **(T700)** Determine whether power turbine module is narrow bore configuration or wide bore configuration as follows:

(1) With chamfered end of gage 37D407015P01 (shipped with power turbine module) facing the balance land on the power turbine drive shaft, and with the notch against the drive shaft, slide the gage down onto the balance land (fig. 4-3).

(2) If the gage contacts balance land before it contacts the stage 3 turbine disk, the power turbine module is the narrow bore configuration and will only be used with the narrow bore configuration gas generator turbine rotor.

(3) If the gage contacts the stage 3 turbine disk before it contacts the balance land, the power turbine module is the wide bore configuration and may be used with either gas generator turbine rotor configuration.

b. Install power turbine module as follows:

(1) Remove locknuts (8, fig. 4-1) from all bolts (9) and remove all bolts except the one in the No. 2 position.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(2) Remove protector from seal teeth on power turbine drive shaft. Install packing (16). Apply a light coat of engine oil (item 86 or 87, Appendix D) to spline teeth of power turbine drive shaft. Remove exhaust cover.

NOTE

(T701C, T701D) Prior to assembly of the power turbine module, make sure the face-type seal is present on aft flange of gas generator stator (12, fig. 4-1).

(3) **(T701C, T701D)** If face-type seal is not present, assemble seal to aft end of gas generator assembly. Hold seal in place with beeswax (item 13, Appendix D). Place beeswax around entire circumference where seal will seat.

(4) With another mechanic helping, aline module with engine. Supporting power turbine drive shaft by hand, center it in gas generator bore and insert drive shaft into engine.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

(5) Using leather gloves, hold power turbine rotor and turn output shaft to engage drive shaft splines with output shaft splines.

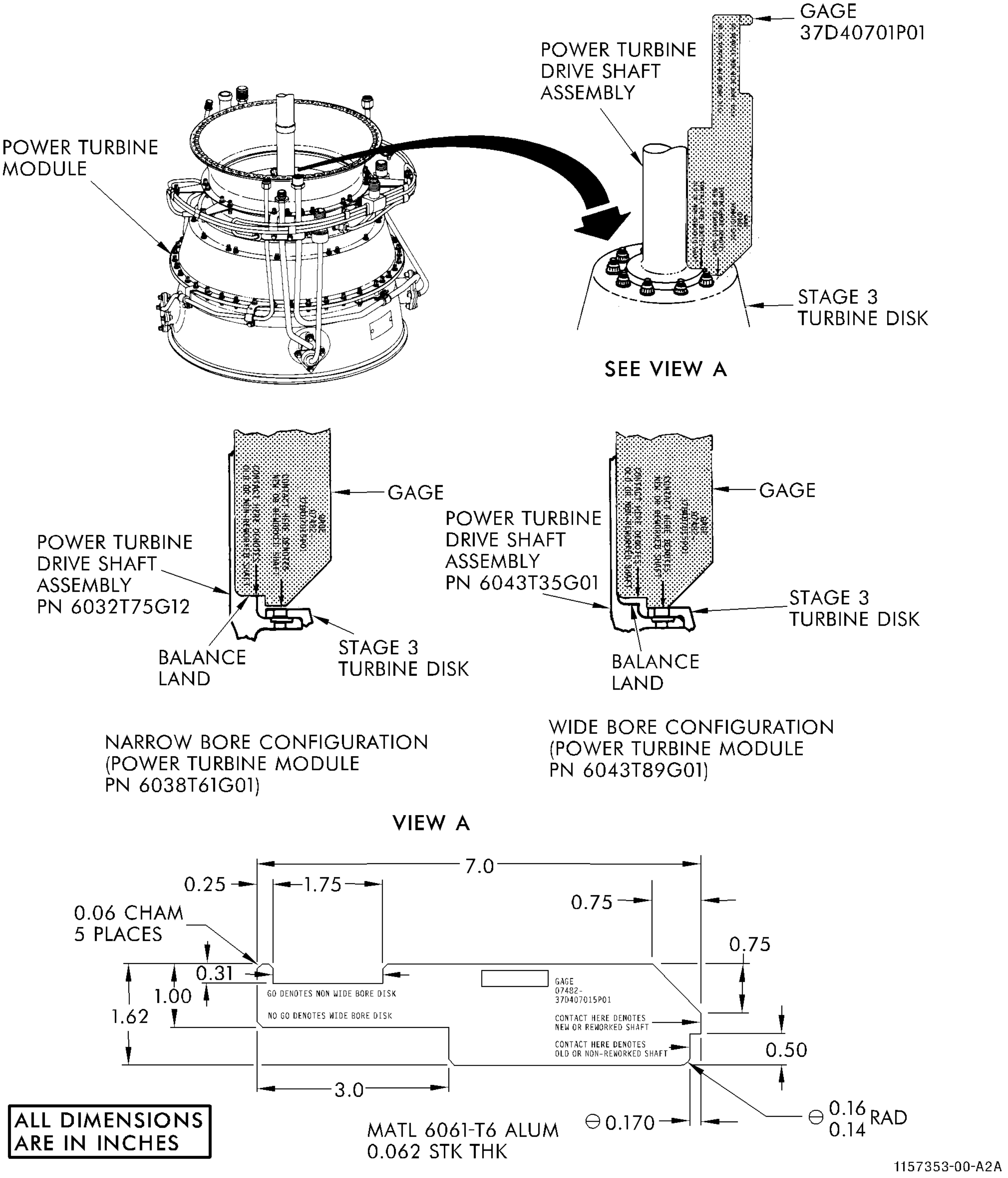


Figure 4-3. (T700) Use of Gage 37D407015P01 to Determine Configuration of Power Turbine Drive Shaft

(6) Aline TOP markings and matchmarks on flanges. Make sure tubes (5, 6, 7, 17, 18, and 19) are alined with mating tubes on cold section module. Check offset bolthole 60 (fig. 4-2) on turbine case and midframe to be sure that they are alined.

CAUTION

Make sure slip-fit connector on compressor leakage air tube (17, fig. 4-1) engages properly.

(7) Push power turbine module onto bolt (9) in bolthole no. 2.

(8) Install locknut (8) onto bolt (9). Tighten locknut until flange rabbet is fully engaged.

WARNING

Handling Bladed Components

Wear leather palm gloves (welder's type with gauntlet) when handling components with assembled blades and vanes. Blades and vanes are sharp and can cause serious injury.

CAUTION

When removing or installing components, use extreme care to prevent damage to axis-A oil nozzle.

(9) Remove radial drive shaft cover assembly (para 5-30). Hold radial drive shaft stationary and rotate power turbine rotor at least 360°. Rotor must rotate freely with no rubs.

NOTE

Shoulder bolts (body-bound) power turbine-to-midframe flange have been superseded by bolts (12-point) (9).

(10) Install bolts (9) in boltholes no. 12, 22, 32, 42, and 52 (refer to fig. 4-2 for location); install locknuts (8, fig.4-1). If shoulder bolts were removed from power turbine-to-midframe flange, discard shoulder bolts and install bolts (9). Tighten nuts in crisscross pattern, for example: 12 o'clock, then 6 o'clock; 2 o'clock, then 8 o'clock; 4 o'clock, then 10 o'clock. Torque nuts to 80-85 inch-pounds in crisscross pattern.

(11) Install remaining 54 bolts (9) and locknuts (8) as follows:

(a) Install six bolts and locknuts, in a crisscross pattern.

(b) Torque locknuts, in a crisscross pattern, to 80-85 inch-pounds.

(c) Repeat steps (a) and (b) until all bolts and locknuts are installed.

(12) Connect the following tubes at forward flange of power turbine module:

(a) C-sump aft scavenge tube (5, fig. 4-1). Tighten (60° wrench-arc) coupling nut.

(b) C-sump forward scavenge tube (6). Tighten (60° wrench-arc) coupling nut.

(c) C-sump oil supply tube (7). Tighten (60° wrench-arc) coupling nut.

(d) Seal pressure and scavenge tube assembly (18) in two places. Tighten (60° wrench-arc) coupling nuts.

(13) **(T700)** On engines serial-numbered 207301 thru 207322, connect B-sump drain tube (19) as follows:

CAUTION

Follow this procedure to prevent damage to B-sump drain tube.

(a) Tighten coupling nut on midframe (11) onto drain tube until nut is seated.

(b) Loosen nut just enough to permit drain tube to move freely.

(c) Tighten coupling nut on exhaust frame (4) onto drain tube until nut is seated.

(d) Loosen nut just enough to permit drain tube to move freely.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

(e) Tighten locknut (21) and bolt (22) at clamp (PN 299C486P11 only) (20). Torque locknut to 45-50 inch-pounds.

(f) Tighten (60° wrench-arc) coupling nuts at both ends of drain tube.

(14) **(T700)** On engines serial-numbered 207323 and up, connect coupling nut on midframe (11) onto B-sump drain tube (19). Tighten (60° wrench-arc) coupling nut.

(15) **(T701, T701C, T701D)** Connect coupling nut on midframe (11) onto B-sump drain tube (19). Tighten (60° wrench-arc) coupling nut.

(16) Connect the following electrical connectors at forward flange of power turbine module:

(a) Electrical connector (blue cable) (15) to torque and overspeed sensor (1). Tighten (15° wrench-arc) connector.

(b) Electrical connector (yellow cable) (13) to Np sensor (3). Tighten (15° wrench-arc) connector.

(c) Electrical connector (yellow cable) (14) to thermocouple assembly (2). Tighten (60° wrench-arc) connector.

(17) Make required engine checks listed in table 1-39.

(18) After completion of final testing, seal connectors (para H-9, Appendix H).

4-12. C-SUMP COVER AND C-SUMP HEAT SHIELD.

4-13. Removal of C-Sump Cover and C-Sump Heat Shield.

a. Remove eight locknuts (1, fig. 4-4) that secure C-sump heat shield (2) to exhaust frame (9).

b. Remove three bolts (3).

c. Using bolts (3) as jacking screws, manually thread into jacking screw holes (4) until they bottom out.

d. Alternately turn screws clockwise, one-quarter turn at a time, until assembly can be freely removed.

e. Remove C-sump cover (5) and jacking screws.

f. Remove and discard packings (7, 8).

4-14. Cleaning of C-Sump Cover.

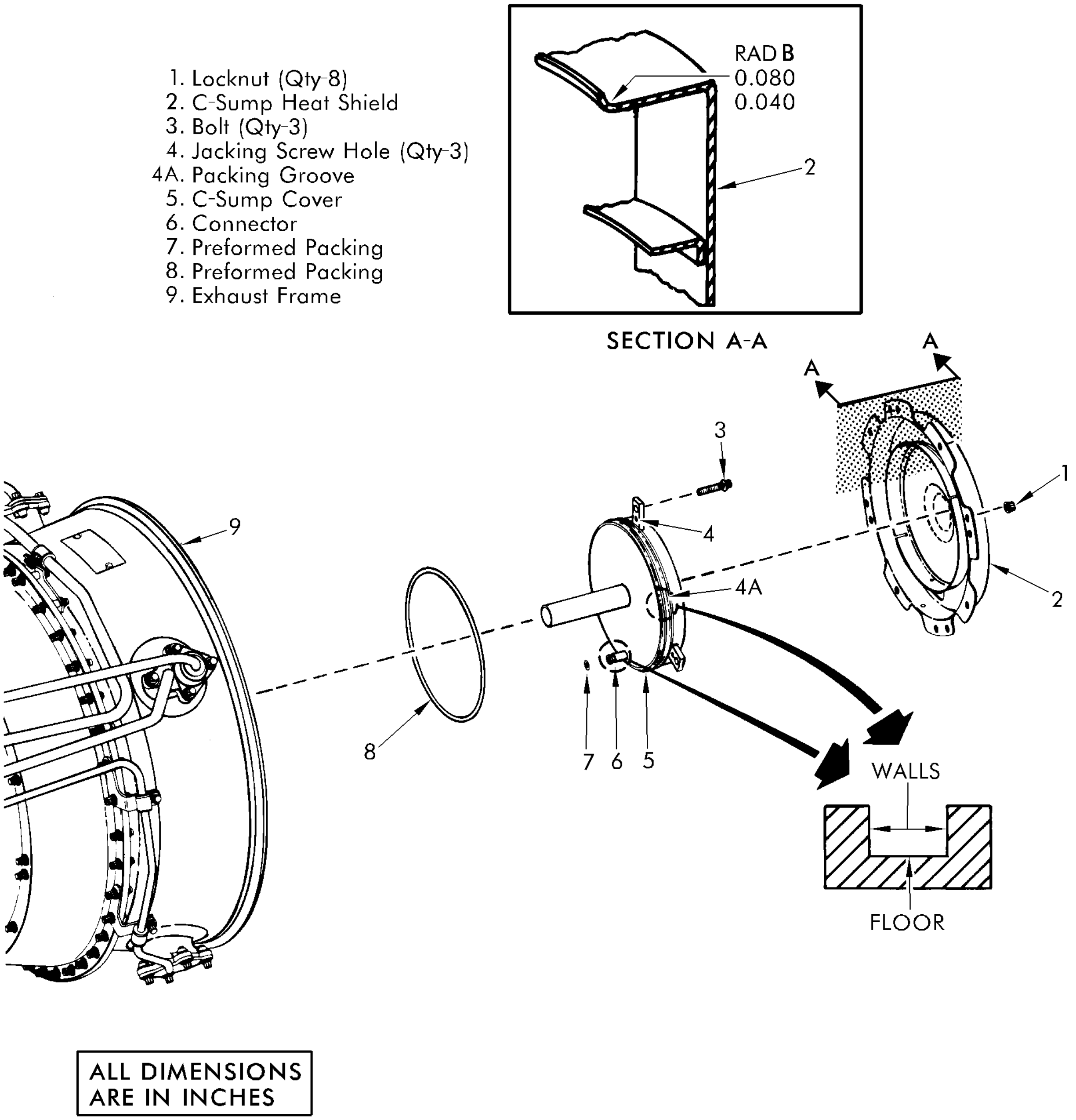
a. Cover all openings with protective caps.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Flush or spray-wash outside surfaces with dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.



1. Locknut (Qty-8)
2. C-Sump Heat Shield
3. Bolt (Qty-3)
4. Jacking Screw Hole (Qty-3)
4A. Packing Groove
5. C-Sump Cover
6. Connector
7. Preformed Packing
8. Preformed Packing
9. Exhaust Frame

Figure 4-4. C-Sump Cover and C-Sump Heat Shield; Removal, Inspection, and Installation

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the C-sump cover using dry, filtered, compressed air.

4-15. Inspection of C-Sump Cover and C-Sump Heat Shield. See table 4-1.

Table 4-1. Inspection of C-Sump Cover and C-Sump Heat Shield

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. C-sump cover (5, fig. 4-4) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace cover (para 4-16).
(2) Nicks and scratches on:			
(a) Floor of packing groove (4A).	Any number, 0.003 inch deep, without sharp edges.	Not repairable.	Replace cover (para 4-16).
(b) Walls of packing groove (4A).	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace cover (para 4-16).
(c) All other areas.	Any number, 1/64 inch deep, without high metal.	Not repairable.	Replace cover (para 4-16).
(3) Dents.	Any amount if function is not affected.	Not repairable.	Replace cover (para 4-16).
b. Missing or damaged threads in threaded jacking screw holes (4).	One full thread cumulative, damaged or missing, without high metal.	One full thread cumulative with high metal.	AVUM: Replace cover (para 4-16). AVIM: Chase threads.
c. C-sump heat shield (2) for:			
(1) Cracks, except in radius B.	None allowed.	Not repairable.	Replace heat shield (para 4-16).
(2) Cracks in radius B.	Eight cracks allowed. Each one not to exceed 1/8 inch, and must not extend outside radius B.	Not repairable.	Replace heat shield (para 4-16).

Table 4-1. Inspection of C-Sump Cover and C-Sump Heat Shield (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Nicks and scratches.	Any amount, up to 1/64 inch deep, without high metal.	Not repairable.	Replace heat shield (para 4-16).
(4) Dents.	Any amount, provided function is not affected.	Not repairable.	Replace heat shield (para 4-16).

4-16. Installation of C-Sump Cover and C-Sump Heat Shield.

a. Install preformed packing (7, fig. 4-4) onto connector (6).

b. Install preformed packing (8) onto C-sump cover (5).

c. Install cover (5) into C-sump housing and secure it with three bolts (3). Torque bolts (3) to 45-50 inch-pounds.

d. Install C-sump heat shield (2) onto exhaust frame (9) so that discharge air slot is at 6 o'clock position.

e. Secure heat shield (2) with eight locknuts (1). Torque locknuts (1) to 70-75 inch-pounds.

f. Make required engine checks listed in table 1-19 or table 1-39 (AVIM).

4-17. EXHAUST FRAME.

4-18. Inspection of Exhaust Frame. See table 4-2.

Table 4-2. Inspection of Exhaust Frame

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Exhaust frame (4, fig. 4-5) for:			
(1) Cracks in parent metal and in welds.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
(2) Dents and buckling.	Any number, 1/8 inch from original contour.	Any number, any depth.	AVUM: Replace engine. AVIM: Cold-work to usable limit. Inspect; cracks are not allowed.
(3) Holes in sheet metal.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
(4) Struts (10) for cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).

Table 4-2. Inspection of Exhaust Frame (Cont)

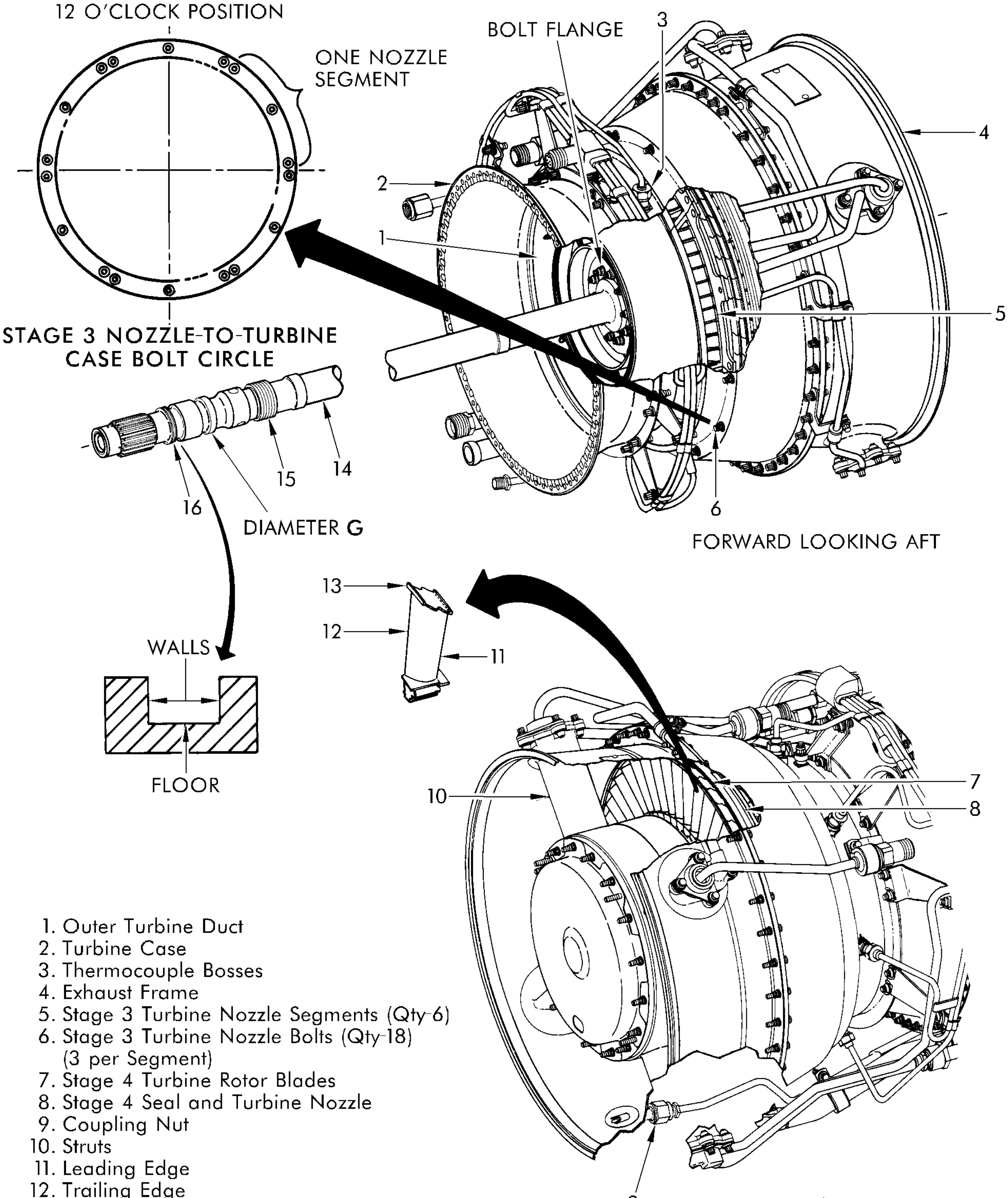
Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Inner casing aft flange (2, fig. 4-6) for:			
(1) Stripped, broken, cracked, or missing studs (5) (long studs), four each.	One damaged or missing stud allowed, if not adjacent to another broken stud.	Any number.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
(2) Stripped, broken, cracked, or missing studs (6) (short studs), 16 each.	One damaged or missing stud allowed, if not adjacent to another broken stud.	Any number.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
c. Coupling nut (9) on oil drain tube for:			
(1) Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
(2) Nicks and scratches.	Any number, 1/32 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(3) Missing or damaged threads.	One full thread total, damaged or missing without high metal, if a normal installation with the mating part can be made.	AVUM: Not repairable. AVIM: One full thread total that can be blended to usable limits.	Replace engine. Plug end of tube at defective nut. Blend high metal. Blow out all metal fillings; then remove plug.

WARNING

Penetrating Oil

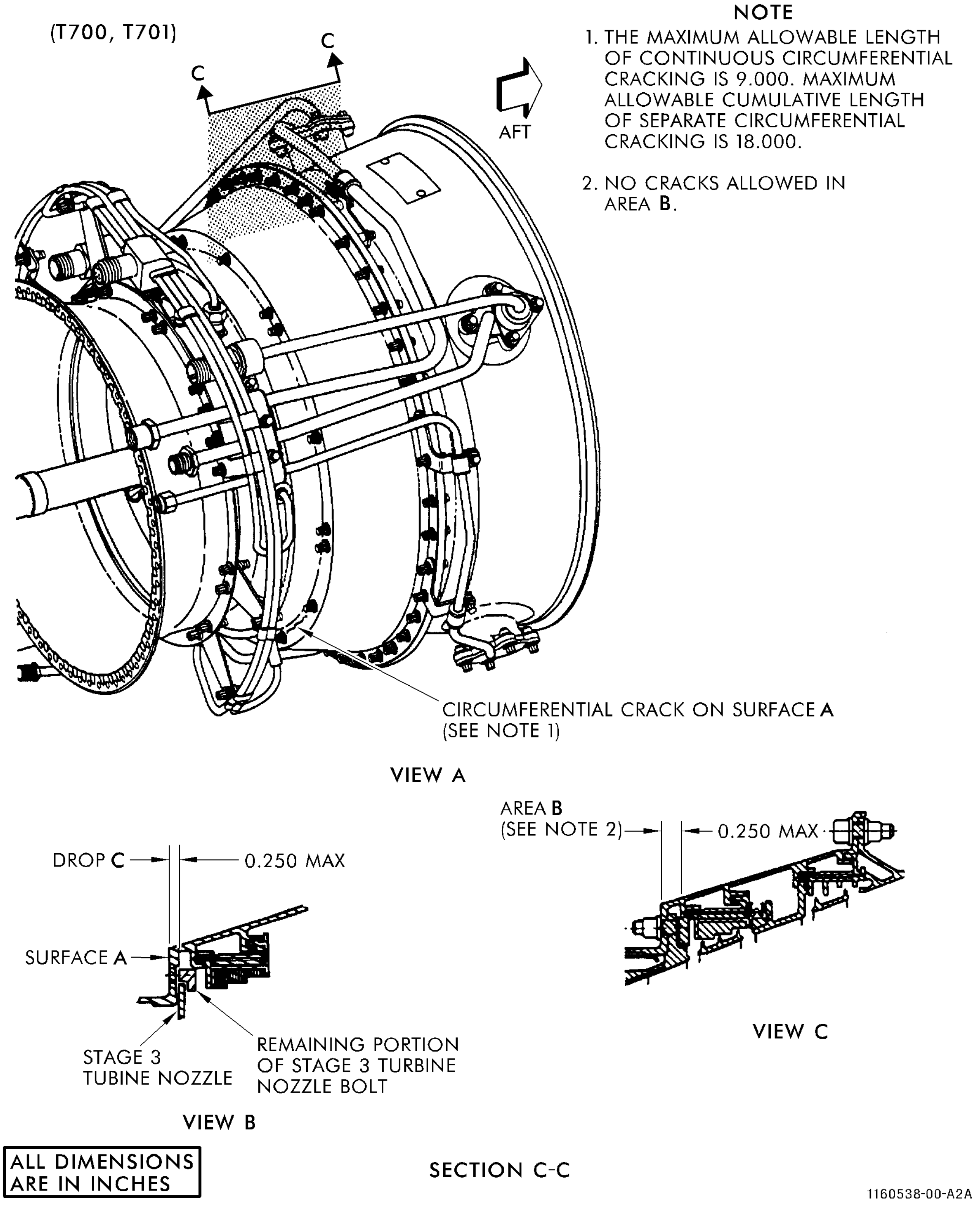
- Do not use near flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolongued skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Freedom of movement.	Nut must spin freely on tube.	AVUM: Not repairable. AVIM: Any amount that can be lubricated to meet usable limits.	Replace engine. Apply penetrating oil (item 88, Appendix D) to nut and tube, and work nut free.



1. Outer Turbine Duct
2. Turbine Case
3. Thermocouple Bosses
4. Exhaust Frame
5. Stage 3 Turbine Nozzle Segments (Qty-6)
6. Stage 3 Turbine Nozzle Bolts (Qty-18) (3 per Segment)
7. Stage 4 Turbine Rotor Blades
8. Stage 4 Seal and Turbine Nozzle
9. Coupling Nut
10. Struts
11. Leading Edge
12. Trailing Edge
13. Tip Shroud
14. Power Turbine Drive Shaft Assembly
15. Seal Teeth
16. Packing Groove

Figure 4-5. Power Turbine Module; Inspection (Sheet 1 of 2)



NOTE

1. THE MAXIMUM ALLOWABLE LENGTH OF CONTINUOUS CIRCUMFERENTIAL CRACKING IS 9.000. MAXIMUM ALLOWABLE CUMULATIVE LENGTH OF SEPARATE CIRCUMFERENTIAL CRACKING IS 18.000.

2. NO CRACKS ALLOWED IN AREA **B**.

Figure 4-5. Power Turbine Module; Inspection (Sheet 2 of 2)

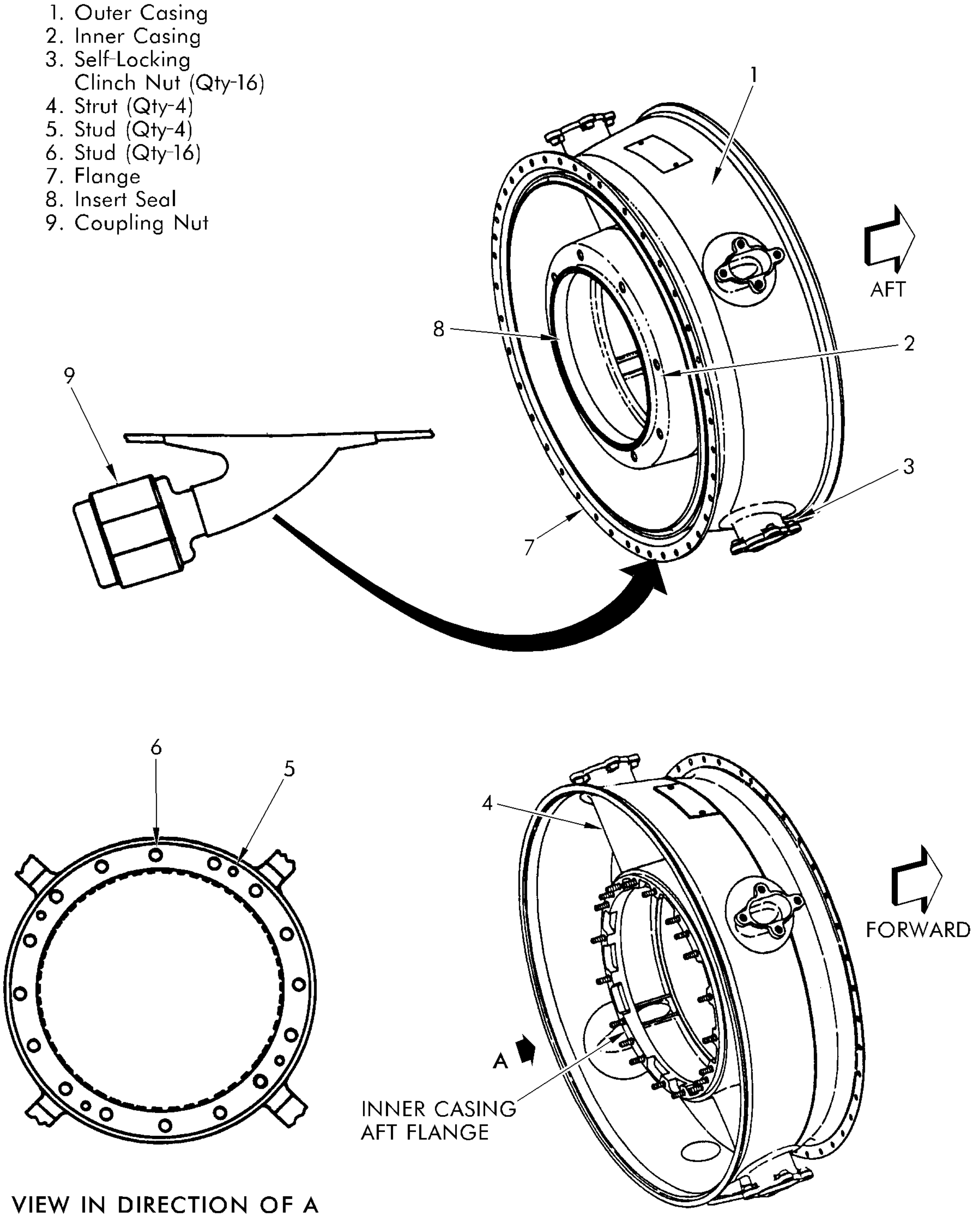


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Figure 4-6. Exhaust Frame; Inspection

4-19. STAGE 4 TURBINE ROTOR BLADES.

4-20. Inspection of Stage 4 Turbine Rotor Blades.

See table 4-3.

Table 4-3. Inspection of Stage 4 Turbine Rotor Blades

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Stage 4 turbine rotor blades (7, fig. 4-5) for:			
a. Cracks.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
b. Nicks, pits, scratches, and dents.	Any number, up to 0.005 inch deep, without high metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
c. Hot gas corrosion.	Any amount of change in color, without surface roughness or separation of airfoil surface.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
d. Eroded leading edge (11).	Up to 1/64 inch deep.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
e. Bending and twisting of trailing edge (12).	Up to 1/32 inch from original contour.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
f. Wear at tip shroud (13).	0.005 inch max.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).

4-21. STAGE 4 SEAL AND TURBINE NOZZLE.

4-22. Inspection of Stage 4 Seal and Turbine Nozzle. See table 4-4.

Table 4-4. Inspection of Stage 4 Seal and Turbine Nozzle

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Stage 4 seal and turbine nozzle (8, fig. 4-5) for:			
a. Cracks in inner and outer bands.	6 radial cracks. 1/8 inch long. No circumferential cracks allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
b. Cracks in trailing edge of vanes.	Any number, 1/8 inch long.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
c. Dents along trailing edge of vanes.	Any number, 1/16 deep, with smooth deformation and without high metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
d. Hot gas corrosion on vanes.	Any amount of change in color or surface roughness if there is no blistering, cracking, or separation (delamination) of vane surface.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
e. Burns or erosion on vanes.	Any amount, 1/8 inch from trailing edge over a distance of 1/2 inch.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
f. Nicks, scratches, and gouges.	Any number, 1/32 inch deep, without high metal.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).

4-23. STAGE 3 TURBINE NOZZLE SEGMENTS.

4-24. Inspection of Stage 3 Turbine Nozzle Segments (AVIM). See table 4-5.

Table 4-5. Inspection of Stage 3 Turbine Nozzle Segments

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Stage 3 turbine nozzle segments (5, fig. 4-5) for:			
a. Cracks in inner and outer bands.	10 radial cracks, up to 1/4 inch long. Circumferential cracks are not allowed.	Not repairable.	Replace module (para 4-11).
b. Cracks in trailing edge of vanes.	Any number, up to 1/8 inch long.	Not repairable.	Replace module (para 4-11).
c. Dents along trailing edge of vanes.	Any number, up to 1/16 inch deep, with smooth deformation and without high metal.	Not repairable.	Replace module (para 4-11).
d. Hot gas corrosion on vanes.	Any amount of change in color or surface roughness if there is no blistering, cracking, or separation of the vane surface.	Not repairable.	Replace module (para 4-11).
e. Burns or erosion.	Any amount, up to 1/8 inch from trailing edge over a distance of up to 1/2 inch.	Not repairable.	Replace module (para 4-11).
f. Nicks, scratches, and gouges.	Any number, up to 1/32 inch deep, without high metal.	Not repairable.	Replace module (para 4-11).
g. **(T700, T701)** Loose or broken stage three turbine nozzle bolts (6). See steps *1 thru *4.	One per segment (6 total) may be missing or broken as long as sufficient broken bolt remains in turbine case to seal the bolthole.	Not repairable.	Replace module (para 4-11).
h. **(T701C, T701D)** Loose or broken stage three turbine nozzle bolts (6).	None allowed.	Not repairable.	Replace module (para 4-11).

*:

(1) Check (by hand only) for broken bolts. If nuts on bolts turn freely, the bolts are broken. Remove nuts and shanks of bolts.

(2) If Power Turbine module PN is 6064T98G01 or 6064T99G01 go to step 4. Otherwise, go to step 3 and step 4.

(3) Using a piece of 1/8 inch diameter drill rod or equivalent, measure from surface A to remaining portion of bolt (drop C, view B, fig. 4-5). Drop must not exceed 0.250 inch.

(4) Do an idle speed leakage check (para 1-226); no leakage allowed.

4-25. OUTER TURBINE DUCT.

4-26. Inspection of Outer Turbine Duct (AVIM).

See table 4-6.

Table 4-6. Inspection of Outer Turbine Duct

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Outer turbine duct (1, fig. 4-5) for:			
a. Cracks.	Any number, up to 1 inch long, without intersecting cracks or no danger of pieces falling out.	Not repairable.	Replace module (para 4-11).
b. Nicks, pits, and scratches.	Up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
c. Dents.	Any number, up to 1/32 inch deep, with smooth deformation.	Not repairable.	Replace module (para 4-11).

4-27. TURBINE CASE.

4-28. Inspection of Turbine Case. See table 4-7.

Table 4-7. Inspection of Turbine Case

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Turbine case (2, fig. 4-5) for:			
a. **(T700, T701)** Cracks in:			
(1) Surface A (view A); circumferential.	Maximum allowable length of continuous circumferential cracking is 9.000 inches. Maximum allowable cumulative length of separate circumferential cracking is 18.000 inches.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
(2) Cone area (area B, view C).	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).
b. Nicks, gouges, and scratches.	Any number, 1/16 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.

Table 4-7. Inspection of Turbine Case (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
c. Dents.	Any number, 1/8 inch deep.	Any number if they can be reached and if they can be cold-worked to usable limits.	AVUM: Replace engine. AVIM: Cold-work to usable limit. Fluorescent penetrant-inspect (see TM 55-1500-204-25/1). No cracks allowed.
d. Damaged threads on thermocouple bosses (3).	Any amount that does not prevent assembly of thermocouple.	Any amount that can be reworked to usable limits by chasing threads.	AVUM: Replace engine. AVIM: Chase threads to allow assembly of thermocouple.
e. Bent flange.	Any amount not more than 1/16 inch from original contour.	Any amount that can be reworked to usable limits by cold-working.	AVUM: Replace engine. AVIM: Cold-work to usable limit and fluorescent penetrant-inspect (see TM 55-1500-204- 25/1). No cracks allowed.
f. **(T700, T701)** Loose or broken stage 3 turbine nozzle bolts (6). See steps *(2) thru *(4).	One per segment (6 total) may be missing or broken as long as sufficient broken bolt remains in turbine case to seal the bolthole.	Not repairable.	AVUM: Replace engine. AVIM: Replace module (para 4-11).

*:

(1) If Power Turbine module PN is 6064T98G01 or 6064T99G01, go to step (4). Otherwise, go to step (3) and step (4).

(2) (AVUM): Except during a Phase Inspection, visually inspect for broken bolts. Inspect (by hand only) for suspected broken bolts. If nuts on bolts turn freely, remove nuts and shanks of broken bolts. (AVIM): Check (by hand only) for broken bolts. If nuts on bolts turn freely, the bolts are broken. Remove nuts and shanks of bolts.

(3) Using a piece of 1/8 inch diameter drill rod or equivalent, check from surface A to remaining portion of bolt (drop C, view B, fig. 4-5). Drop must not exceed 0.250 inch.

(4) Do an idle speed leakage check (para 1-139 or 1-226 (AVIM)); no leakage allowed.

4-29. POWER TURBINE DRIVE SHAFT ASSEMBLY.

4-30. Inspection of Power Turbine Drive Shaft Assembly (AVIM). See table 4-8.

Table 4-8. Inspection of Power Turbine Drive Shaft Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Power turbine drive shaft assembly (14, fig. 4-5) for:			
a. Cracks.	None allowed.	Not repairable.	Replace module (para 4-11).

NOTE

- Machining marks on power turbine drive shaft are not considered circumferential rubs.
- When a PT shaft incurs a rub beyond the usable limit, the associated cold section module must be replaced. Cold section module must be appropriately marked “For PT Shaft Rub Investigation” and forwarded to depot.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Circumferential rubs:			
(1) Lands between aft face of Diameter G and forward face of bolt flange.	Any amount up to 0.005 inch deep without high metal. Deposits and black discoloration are allowed. Obvious burns not allowed.	Not repairable.	Replace module (para 4-11).
(2) Shaft wall between aft face of Diameter G and forward face of bolt flange.	Any amount if the parent metal is not scored. Deposits and black discoloration are allowed. Obvious burns not allowed.	Not repairable.	Replace module (para 4-11).
c. Fretting on Diameter G.	Any amount if diameter G is 1.3830 inches minimum.	Not repairable.	Replace module (para 4-11).
d. Nicks and scratches on:			
(1) Floor of packing groove (16).	Any number, 0.005 inch deep, without sharp edges.	Not repairable.	Replace module (para 4-11).
(2) Walls of packing groove (16).	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace module (para 4-11).
(3) All other areas.	Any number, 0.005 inch deep, without high metal.	Any number, up to 0.005 inch deep, with high metal.	Remove high metal (para H-21, Appendix H).
e. Seal teeth (15) for:			
(1) Radial nicks and dents.	Any number, 0.005 inch deep. 4 per tooth, 0.010 inch deep. 1 per 7 teeth, 0.025 inch deep. Cumulative length of all nicks, dents, and blends per tooth not to exceed 30% of circumference. High metal, sharp edges, or sharp corners are not allowed.	Same as usable limits, with high metal, sharp edges, and sharp corners.	Blend with a fine stone (item 104, Appendix D).

Table 4-8. Inspection of Power Turbine Drive Shaft Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Axial dents.	Up to 0.030 inch from original contour if no more than 30% of circumference is displaced.	Not repairable.	Replace module (para 4-11).
f. Broken pieces of black plastic material and carbon debris on fwd end of shaft.	None allowed.	Any amount.	Remove loose particles from PT shaft fwd end, and clean shaft (para 4-8).

4-31. PREPARING POWER TURBINE MODULE FOR STORAGE OR SHIPMENT.

4-32. Power Turbine Module Shipping and Storage Container 21C7300G01.

a. Preliminary Instructions. Use a forklift when moving the power turbine module shipping and storage container. The entire container, with or without the PT module, must not be moved by pushing or pulling.

b. Dimensions and Weights of Power Turbine Module Shipping and Storage Container 21C7300G01.

Height	58 inches
Width	36 inches
Weight (empty)	437 pounds
Weight (with PT module)	520 pounds
Cubic Displacement	45.8 cubic feet

4-33. Installation of Power Turbine Module into Shipping and Storage Container 21C7300G01.

a. Remove container cover (2, fig. 4-7) as follows:

(1) Remove 12 nuts (23) and 12 bolts (18) from container flanges.

(2) Attach lifting cable (24) to lifting eyes (1) on container cover (2).

WARNING

Hoisting Upper Section
of Shipping Container

- Do not stand under upper section of container while it is suspended from a hoist or while it is being moved from one area to another on a hoist.
- Hoisting of container shall only be performed by designated personnel.
- The load capacity rating shall be clearly marked on hoist. Do not exceed load rating.
- Inspection and testing for cracks or defects in hoist system shall be performed on a regular basis.
- Before lifting, alert personnel in immediate area.

CAUTION

If a PT module (14) is installed in container, use care to avoid damaging power turbine shaft when removing container cover.

(3) Attach hoist to cable (24). Raise cover (2) and place it on the floor.

b. Install PT module (14) into container as follows:

(1) Remove four nuts (5) and four bolts (17) from outer diameter of support mount plate (10).

(2) Remove ten nuts (6) and ten bolts (15) from inner diameter of plate (10).

(3) Loosen two bolts (11) on clamp (7) enough to allow PT shaft to slide through clamp.

(4) Unlock two swivel screws (8) on clamp (7) by loosening two knurled nuts (9).

(5) Turn two swivel screws (8) counterclockwise until clamp (7) rests on plate (10).

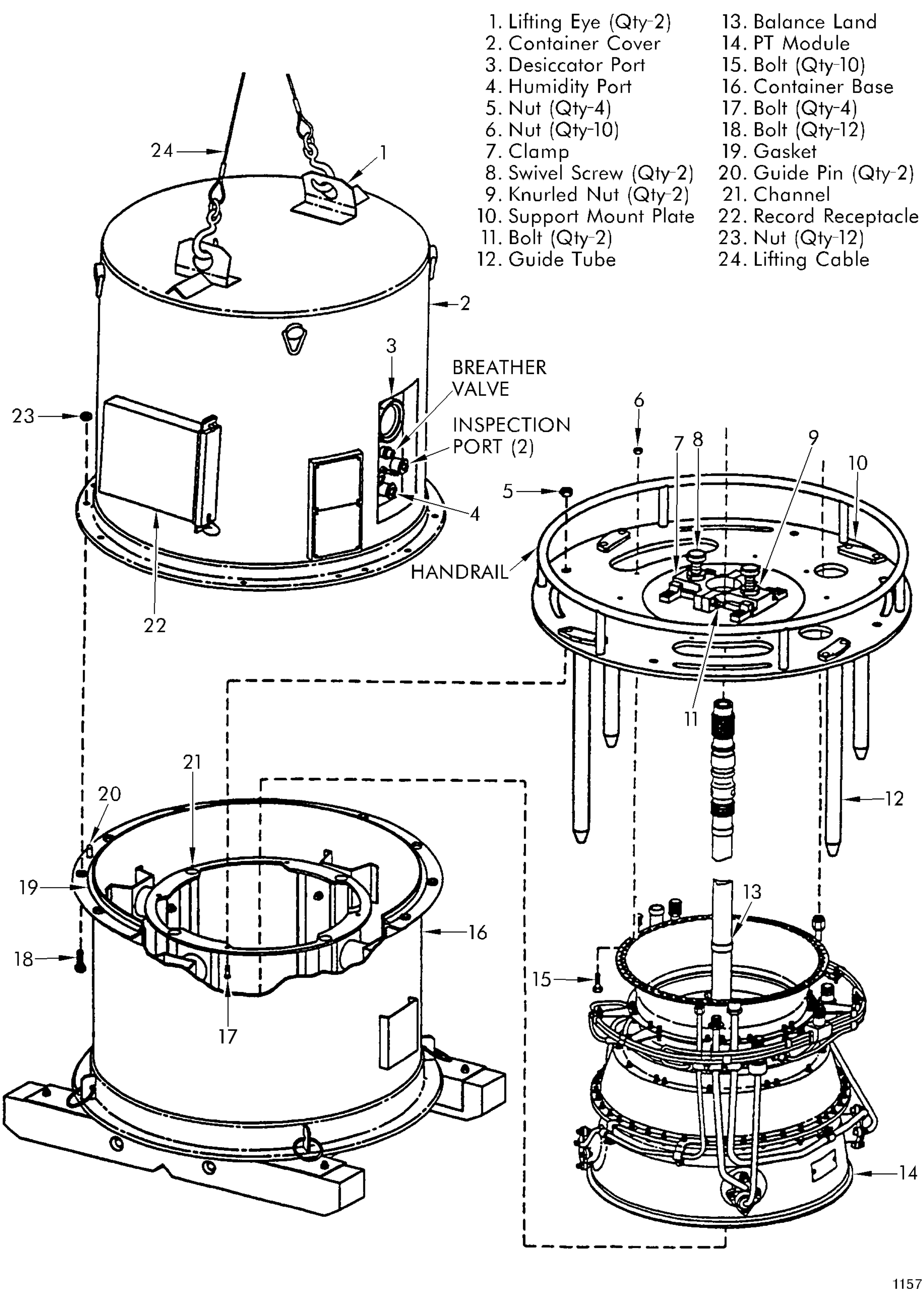

1. Lifting Eye (Qty-2)
2. Container Cover
3. Desiccator Port
4. Humidity Port
5. Nut (Qty-4)
6. Nut (Qty-10)
7. Clamp
8. Swivel Screw (Qty-2)
9. Knurled Nut (Qty-2)
10. Support Mount Plate
11. Bolt (Qty-2)
12. Guide Tube
13. Balance Land
14. PT Module
15. Bolt (Qty-10)
16. Container Base
17. Bolt (Qty-4)
18. Bolt (Qty-12)
19. Gasket
20. Guide Pin (Qty-2)
21. Channel
22. Record Receptacle
23. Nut (Qty-12)
24. Lifting Cable

Figure 4-7. Power Turbine Module Shipping and Storage Container 21C7300G01; Removal and Installation of Module

(6) Protect seal teeth and splines on PT shaft using barrier material (item 12, Appendix D) and tape (item 107, Appendix D).

(7) Lift plate (10) from support frame in container using handrail on support mount plate.

CAUTION

Use care when lowering plate (10) onto power turbine module to avoid damaging power turbine shaft and PT module tubing.

(8) Aline TOP marking on PT module (14) with 12 o'clock marking on plate (10); then carefully lower support mount plate onto flange of PT module.

(9) Attach plate (10) to flange of PT module using ten bolts (15), installed head down, and ten nuts (6), removed in step b(2). Torque bolts (15) to 20-22 inch-pounds.

CAUTION

To avoid damage to PT module tubing, be sure that guide tubes (12) on plate (10) are alined with channels (21) in support frame of container.

(10) Using handrail, lift plate (10), with PT module attached. Alining guide tubes (12) on plate (10) with channels (21) in support frame of container, carefully lower plate and module into container base (16).

(11) Secure module to support frame in container using four bolts (17), installed head down, and four nuts (5), removed in step b(1). Torque bolts (17) to 23-35 foot-pounds.

(12) Verify that clamp (7) is below balance land (13) on PT shaft; then tighten bolts (11) on clamp to secure PT shaft. Torque bolts (11) to 5-7 foot-pounds.

(13) Hand-tighten two swivel screws (8) clockwise; then lock swivel screws by hand-tightening two knurled nuts (9).

c. Install container cover (2) as follows:

WARNING

Hoisting Upper Section
of Shipping Container

- Do not stand under upper section of container while it is suspended from a hoist or while it is being moved from one area to another on a hoist.
- Hoisting of container shall only be performed by designated personnel.
- The load capacity rating shall be clearly marked on hoist. Do not exceed load rating.
- Inspection and testing for cracks or defects in hoist system shall be performed on a regular basis.
- Before lifting, alert personnel in immediate area.

CAUTION

Use care to avoid damaging power turbine shaft when installing container cover.

(1) Attach lifting cable (24) to lifting eyes (1).

(2) Attach hoist to cable and raise cover (2) to a position directly over container base (16).

(3) Wipe gasket (19) and mating flanges of container halves with clean cloth to remove any dirt or particles which could prevent pressure-sealing.

(4) Inspect gasket (19) for nicks, cuts, and gouges. If gasket is damaged, replace it.

(5) Alining holes in flange of cover with guide pins (20) on flange of base (16), carefully lower cover onto base.

(6) Secure container halves using 12 bolts (18), installed head down, and 12 nuts (23), removed in step a(1). Torque bolts (18) to 75-85 foot-pounds.

(7) Release and remove hoist; remove cable (24) from lifting eyes (1).

d. Add desiccant to container as follows:

(1) Remove cover of desiccator port (3) by hand.

(2) Remove old desiccant.

(3) Place 28 units of desiccant (item 70, Appendix D) in basket.

(4) Install cover of desiccator port (3) by seating tabs on port cover into slots in port; then turn cover clockwise, by hand, one-quarter turn.

e. If humidity indicator card, located in humidity port (4), is lavender or pink-colored, replace it as follows:

(1) Remove hex insert of humidity port (4) with an open-end wrench.

(2) Remove retaining clip and card.

(3) Install new card and retaining clip.

(4) Reinstall and hand-tighten hex insert. Be sure that printed sections (i.e. 30, 40, 50) can be read from outside of container.

f. Store power turbine module records in record receptacle (22).

g. Check relative humidity in power turbine module shipping and storage container (step e) not later than 30 days after installation of module into container or as prescribed by the Unit Commander.

(1) If relative humidity is less than 40%, but greater than 30%, record inspection in module records, but change inspection interval to one week.

(2) If relative humidity is 40%, but less than 50%, record inspection in module records, replace desiccant (step d).

(3) If relative humidity is 50% or higher, do the following:

(a) Remove container cover (para 4-33, step a).

(b) Carefully inspect module for signs of corrosion.

(c) If there are no signs of corrosion, change desiccant (step d), replace humidity indicator card (step e), reinstall container cover (step c).

(d) If there are signs of corrosion, change desiccant (step d), reinstall container cover (step c), and send module to Depot for detailed inspection and repair.

4-34. PLACING POWER TURBINE MODULE IN SERVICE.

4-35. Removal of Power Turbine Module from Shipping and Storage Container 21C7300G01.

a. Remove shipping and storage container cover (para 4-33, step a).

b. Remove power turbine module from container as follows:

(1) Remove four nuts (6, fig. 4-7) and four bolts (18) from outer diameter of support mount plate (11).

(2) Lift support mount plate, with PT module attached, from container using handrail on support mount plate.

(3) Remove ten nuts (7) and ten bolts (16) from inner diameter of support mount plate (11).

(4) Unlock two swivel screws (9) on clamp (8) by loosening two knurled nuts (10).

(5) Loosen two bolts (12) on clamp (8) enough to allow PT shaft to slide through clamp.

(6) Turn two swivel screws (9) on clamp (8) counterclockwise until clamp rests on support mount plate.

CAUTION

Use care when lifting support mount plate from power turbine module to avoid damaging power turbine shaft and PT module tubing.

(7) Using handrail, carefully lift support mount plate from PT module.

(8) Reinstall support mount plate into container using hardware removed in steps (1) and (3).

(9) Install container cover (para 4-33, step c).

4-36. Preparing Power Turbine Module for Use.

a. Remove module records from record receptacle (23, fig. 4-7). Be sure that all records and forms are complete.

b. Remove barrier material, and inspect overall condition of module.

c. Install module onto engine (para 4-11).

CHAPTER 5

ACCESSORY GEARBOX

ACCESSORY SECTION MODULE

5-1. CHAPTER OVERVIEW.

This chapter contains instructions for removing, cleaning, inspecting, repairing, and installing the accessory section module and its components to the extent allowed by the Maintenance Allocation Chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-T701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

5-2. CHAPTER INDEX.

Maintenance procedures in this chapter are arranged as follows:

5-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. When removing or installing parts, prevent entry of foreign objects into oil and air passages, and avoid damaging electrical connectors.

b. Do not use tape to cover oil passages or openings. Tape adhesive is soluble in oil and can cause contamination.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

c. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

d. Inspect replacement parts for serviceability before installation.

e. Always use a backup wrench on fittings when removing or installing hoses or tubes.

f. When connecting hoses or tubes, see wrench-arc tightening method (para H-14, Appendix H.

g. Before connecting electrical connectors, refer to paragraph H-7, Appendix H for proper procedure.

h. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

5-4. ACCESSORY GEARBOX, ACCESSORY SECTION MODULE.

5-5. (T700) Removal of Accessory Section Module (AVIM).

CAUTION

- Before removal of accessory section module, areas around main frame-to-gearbox mating flanges must be cleaned to prevent dislodged particles from falling into main frame cavities when gearbox is removed.
- If openings are not capped or plugged, parts may become damaged or contaminated.

a. Clean accessory section module (para 5-7), paying particular attention to areas around main frame-to-gearbox mating flanges.

b. Remove hydromechanical control unit (HMU) (1, fig. 5-1) (para 6-40).

c. Remove P3 hose and tube assembly (2) by disconnecting coupling nuts at POU manifold union if engine is so equipped and at midframe reducer. Install protective caps (item 47, Appendix D) on assembly.

d. Remove POU manifold assembly (3) (para 6-82).

e. Position IGV actuating ring so that vane levers and thrust bearing adjusting screw do not prevent access to bolts (17).

f. Loosen two bolts (17) on oil manifold flange (16). Do not discard adapter gasket (4) unless sealing material is damaged.

g. Disconnect coupling nut on mid C-sump scavenge tube (18).

h. Slide boot (6) down from inlet duct (21).

i. Disconnect electrical connectors from the following parts, and install clean, dry protective caps (items 24, 34, 27, Appendix D):

- Fuel pressure sensor (8)
- Fuel filter bypass sensor (15)
- Electrical chip detector (14)

1. Hydromechanical Control Unit (HMU)
2. P3 Hose and Tube Assembly
3. POU Manifold Assembly
4. Adapter Gasket
5. C-Sump Forward Oil Scavenge Tube
6. Boot
7. Locknut
8. Electrical Connector (Green Cable) to Fuel Pressure Sensor
9. Electrical Connector (Yellow Cable) to Alternator Stator
10. Electrical Connector (Green Cable) to Oil Pressure Sensor
11. Electrical Connector (Green Cable) to Oil Temperature Sensor
12. Electrical Connector (Green Cable) to Alternator Stator
13. Electrical Connector (Green Cable) to Oil Filter Bypass Sensor
14. Electrical Connector (Green Cable) to Electrical Chip Detector
15. Electrical Connector (Green Cable) to Fuel Filter Bypass Sensor
16. Oil Manifold Flange
17. Bolts (Qty-2)
18. Mid C-Sump Scavenge Tube
19. Electrical Connector (Blue Cable) to POU
20. Clip
21. Inlet Duct
22. Clip
23. Washer (Qty-4)
24. Nut (Qty-4)
25. Accessory Section Module

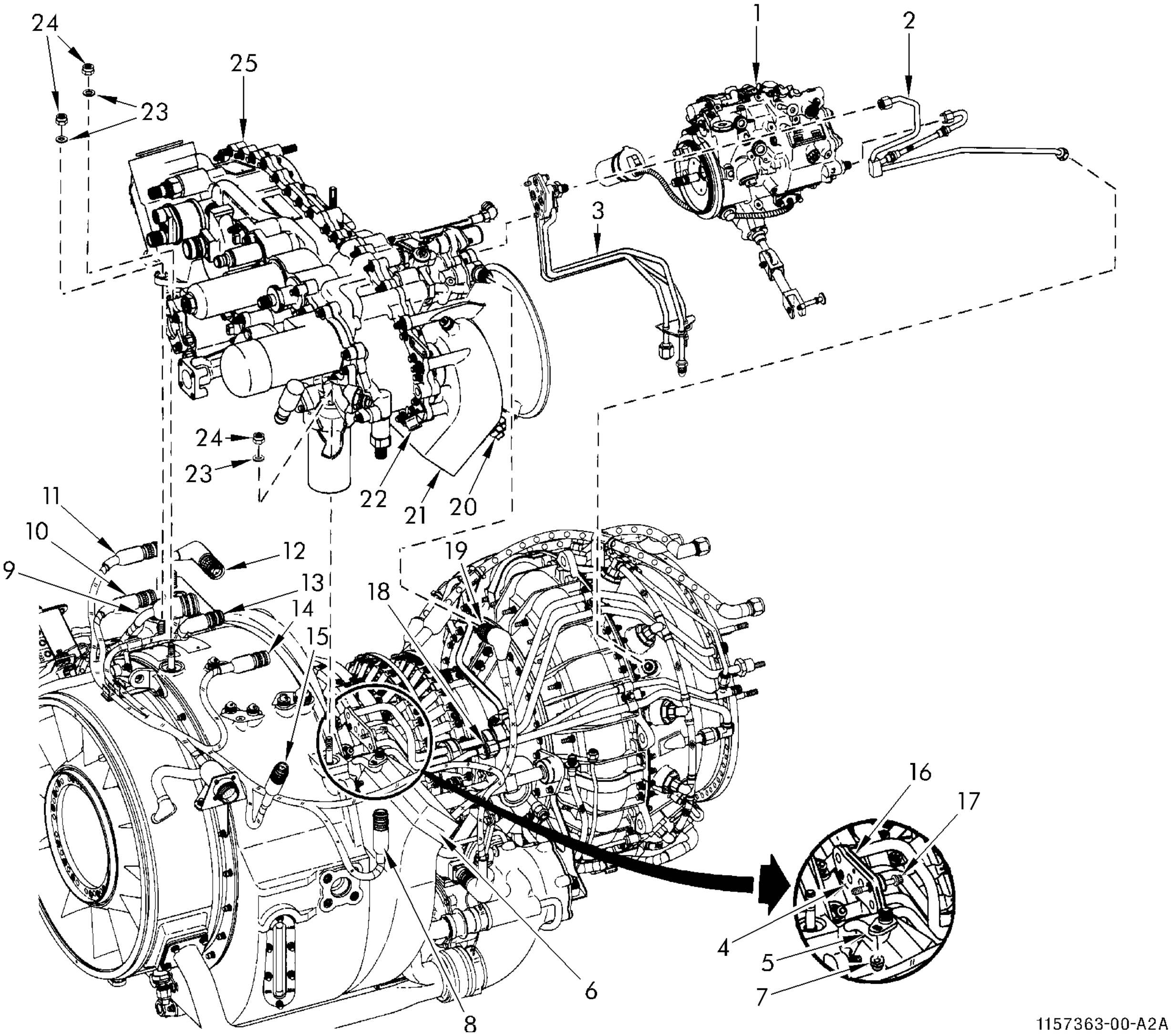


Figure 5-1. *(T700)* ***Accessory Section Module; Removal and Installation***

- Oil filter bypass sensor (13)
- Alternator stator (9)
- Oil pressure sensor (10)
- Oil temperature sensor (11)
- Alternator stator (12)
- POU (19).

j. Remove radial drive shaft assembly (para 5-38).

k. Remove four nuts (24) and washers (23).

l. Remove blue and green cables from clip (20) on inlet duct.

m. Remove green cable from clip (22) on gearbox.

CAUTION

Carefully remove accessory section module to avoid damaging transfer tubes and mounting studs. Be sure that hoses and tubes do not hang up or bind on other parts of engine.

NOTE

The following step requires 2 people.

n. With another mechanic helping, separate accessory section module (25) from main frame by hand, lifting it clear of transfer tubes and mounting studs.

o. Remove and discard preformed packings (1, 2, 3, 4, 5, fig. 5-2).

p. Plug or cap openings in cold section module using caps (items 22, 27, Appendix D), barrier material and adhesive tape (items 12, 107, Appendix D).

q. If replacing accessory section module, remove locknut (7, fig. 5-1) and C-sump forward oil scavenge tube (5). Remove and discard preformed packings (6, fig. 5-2). Return module to Depot.

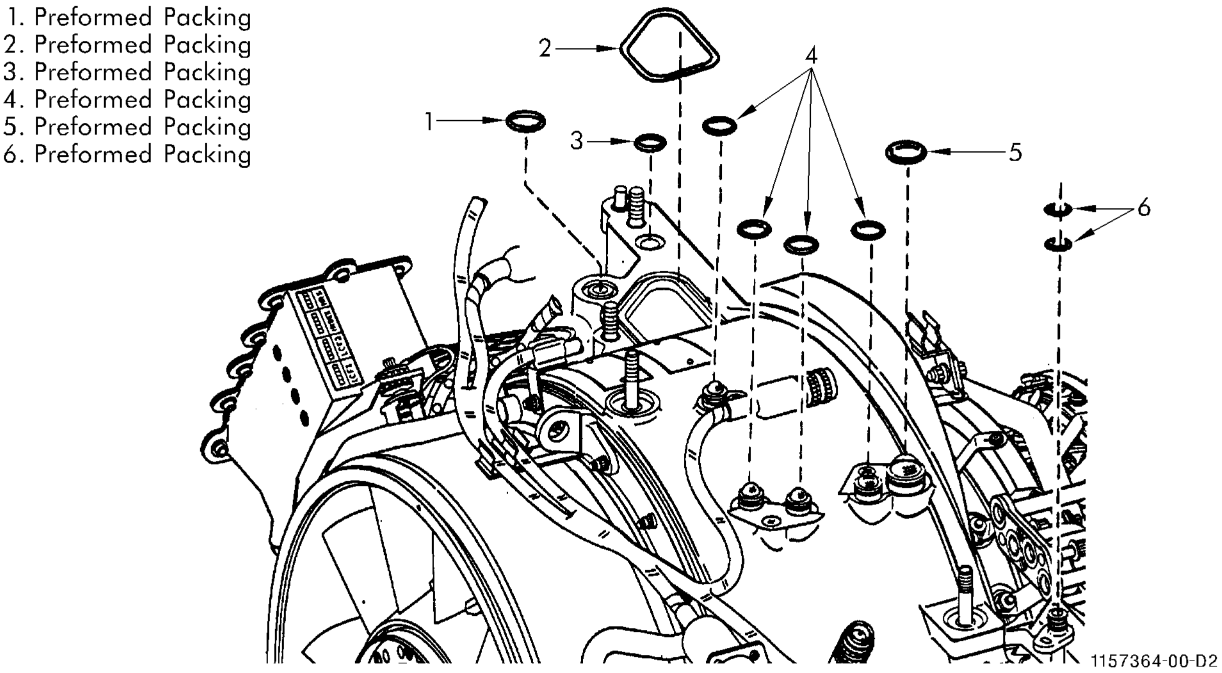


Figure 5-2. Preformed Packings; Removal and Installation

5-6. (T701, T701C, T701D) Removal of Accessory Section Module (AVIM).

CAUTION

- Before removal of accessory section module, areas around main frame-to-gearbox mating flanges must be cleaned to prevent dislodged particles from falling into main frame cavities when gearbox is removed.
- If openings are not capped or plugged, parts may become damaged or contaminated.

a. Clean the accessory section module (para 5-7), paying particular attention to areas around main frame-to-gearbox mating flanges.

b. Remove hydromechanical control unit (HMU) (1, fig. 5-3) (para 6-40).

c. Remove P3 tube (2) by disconnecting coupling nut at midframe reducer. Install protective caps (item 47, Appendix D) on assembly.

d. Remove ODV manifold assembly (3) (para 6-69).

e. Position IGV actuating ring so that vane levers and thrust bearing adjusting screw do not prevent access to bolts (8).

f. Loosen two bolts (8) on oil manifold flange (7). Do not discard adapter gasket (11) unless sealing material is damaged.

g. Disconnect coupling nut on mid C-sump scavenge tube (20).

h. Slide boot (12) down from inlet duct (22).

i. Disconnect electrical connectors from the following parts, and install clean, dry protective caps (items 24, 25, 34, 27, Appendix D):

- Fuel pressure sensor (13)
- Fuel filter bypass sensor (19)
- Electrical chip detector (18)
- Oil filter bypass sensor (17)
- Alternator stator (14)
- Oil pressure sensor (15)
- Alternator stator (16)
- ODV (21)
- **(T701C, T701D)** Oil temperature sensor (11, fig. 5-1)

j. **(T701)** Remove B-sump delta pressure tube (27, fig. 5-3) from forward suspension lug on swirl frame at 12 o'clock position.

k. **(T701C, T701D)** Remove bolt (3, fig 8-40) from clamp on B-sump delta pressure tube (7).

l. Remove radial drive shaft assembly (para 5-38).

m. Remove bolt (5, fig. 5-3) from bracket (6); then, remove cushioned clamp (4) from axis-G seal drain tube.

n. Remove four nuts (26) and washers (25).

o. Remove blue and green cables from clip (23) on inlet duct.

p. Remove green cable from clip (24) on gearbox.

CAUTION

Carefully remove accessory section module to avoid damaging transfer tubes and mounting studs. Be sure that hoses and tubes do not hang up or bind on other parts of engine.

NOTE

The following step requires two people.

q. With another mechanic helping, separate accessory section module (28) from main frame by hand, lifting it clear of transfer tubes and mounting studs.

r. Remove and discard preformed packings (1, 2, 3, 4, 5, fig. 5-2).

s. Plug or cap openings in cold section module, using caps (items 22, 27, Appendix D) and using barrier material and adhesive tape (items 12, 107, Appendix D).

t. If replacing accessory section module, remove locknut (10, figure 5-3), bracket (6), and C-sump forward oil scavenge tube (9). Remove and discard preformed packings (6, fig. 5-2) on forward oil scavenge tube. Return module to Depot.

1. Hydromechanical Control Unit (HMU)
2. P3 Tube
3. ODV Manifold Assembly
4. Cushioned Clamp
5. Bolt
6. Bracket
7. Oil Manifold Flange
8. Bolts (Qty-2)
9. C-Sump Forward Oil Scavenge Tube
10. Locknut
11. Adapter Gasket
12. Boot
13. Electrical Connector (Green Cable) to Fuel Pressure Sensor
14. Electrical Connector (Yellow Cable) to Alternator Stator
15. Electrical Connector (Green Cable) to Oil Pressure Sensor
16. Electrical Connector (Green Cable) to Alternator Stator
17. Electrical Connector (Green Cable) to Oil Filter Bypass Sensor
18. Electrical Connector (Green Cable) to Electrical Chip Detector
19. Electrical Connector (Green Cable) to Fuel Filter Bypass Sensor
20. Mid C-Sump Scavenge Tube
21. Electrical Connector (Blue Cable) to ODV
22. Inlet Duct
23. Clip
24. Clip
25. Washer (Qty-4)
26. Nut (Qty-4)
27. B-Sump Delta Pressure Tube
28. Accessory Section Module

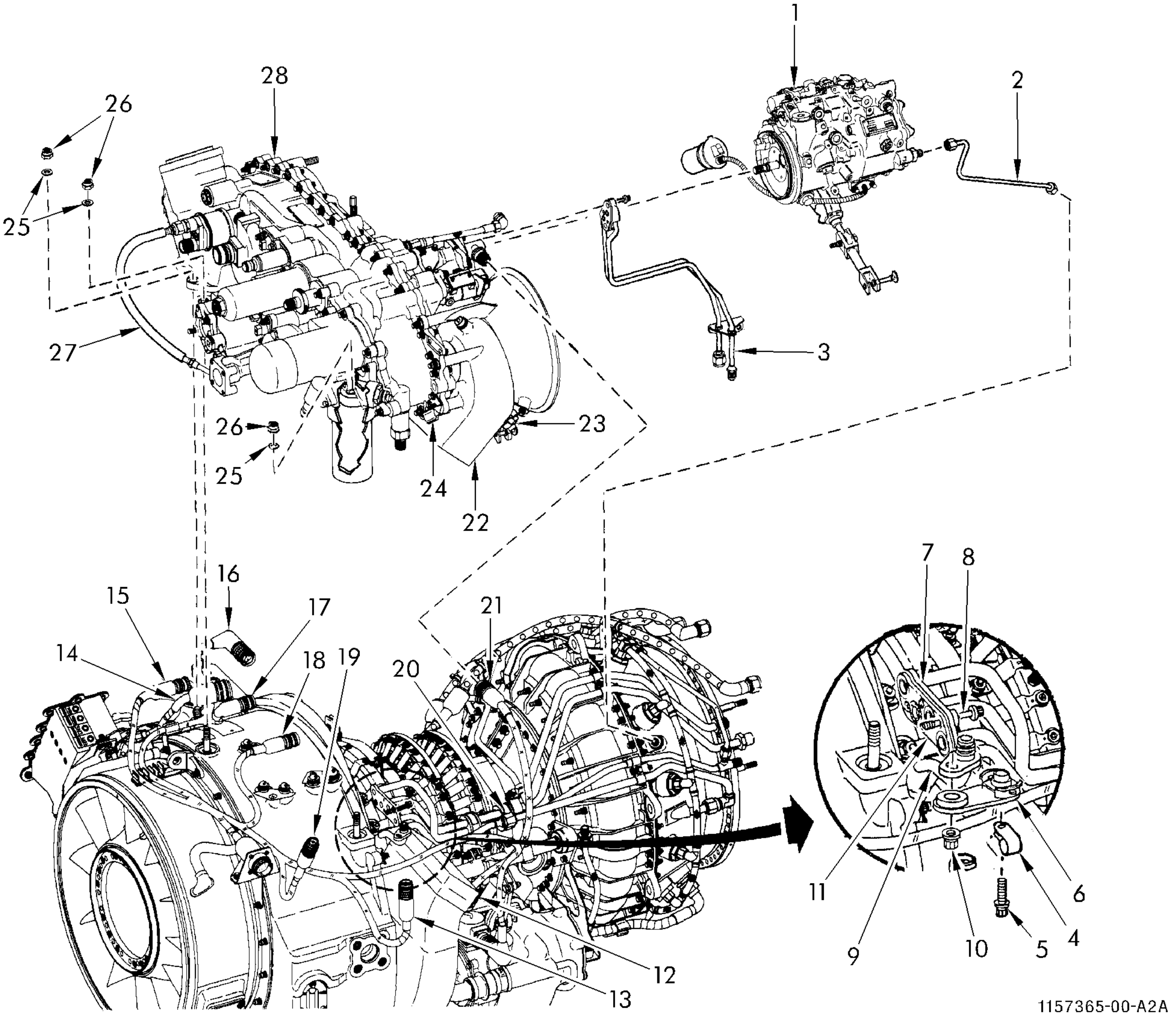


Figure 5-3. (T700, T701C, T701D) Accessory Section Module, Removal and Installation

5-7. Cleaning of Accessory Section Module (AVIM).

a. Be sure that all openings are plugged or covered before cleaning.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D).

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the accessory section module, using dry, filtered, compressed air.

5-8. (T700) Installation of Accessory Section Module (AVIM).

a. If installing new accessory section module, install C-sump forward oil scavenge tube (5, fig. 5-1) as follows:

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(1) Lubricate new preformed packings (6, fig. 5-2) with oil (items 85 or 87, Appendix D) and install packings onto oil scavenge tube (5, fig. 5-1).

(2) Install tube (5) into gearbox and secure with locknut (7). Torque locknut to 24-27 inch-pounds.

CAUTION

Oil manifold assembly (14, fig. 8-23) must be moved aft. Otherwise, adapter gasket (16) may be damaged when installing accessory section module.

b. Disconnect oil manifold assembly as follows:

(1) If power turbine module is installed, disconnect the following:

- C-sump forward scavenge tube (5)
- C-sump aft scavenge tube (6)
- Left-hand oil supply tube (7)
- C-sump oil supply tube (8)
- B-sump scavenge fitting (9)

(2) Loosen two bolts (3, 12) so that upper clamp brackets (1, 13) can be rotated 90° to release oil manifold assembly (14).

(3) Remove bolt (13B) that secures clamp (13A) to support bracket (13C).

(4) Move oil manifold assembly (14) aft.

c. Remove caps or plugs from openings on main frame and accessory section module.

d. Apply a light coat of assembly fluid (item 72, Appendix D) to preformed packing (2, fig. 5-2) and to packing groove in main frame.

e. Install packing (2) into groove on main frame.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

f. Lubricate preformed packings (1, 3, 4, 5) with oil (items 85 or 87, Appendix D) and install on main frame.

CAUTION

During installation, use care to avoid damaging transfer tubes and external hoses or tubes.

NOTE

The following step requires two people.

g. With another mechanic helping, position accessory section module (25, fig. 5-1) over main frame. Carefully lower the module onto main frame.

g.1 If module does not seat, check for clearance between AGB lube pump tower and main frame with a 0.005 inch shim.

(1) If interference/contact is verified, benching of the 6% area of the lube pump tower is allowed (Appendix H-21 and fig. 5-3.1).

(2) If benching is necessary, the locally affected area shall be Alodine protected (Appendix H-30).

h. Install four washers (23) and nuts (24). Tighten (30° wrench-arc) nuts.

i. Install radial drive shaft assembly (para 5-41).

j. Remove caps and connect following electrical connectors:

- Electrical connector (green cable) to electrical chip detector (14)
- Electrical connector (green cable) to fuel filter bypass sensor (15)
- Electrical connector (green cable) to oil filter bypass sensor (13)
- Electrical connector (green cable) to oil temperature sensor (11)
- Electrical connector (green cable) to oil pressure sensor (10)
- Electrical connector (green cable) to fuel pressure sensor (8)
- Electrical connector (green cable) to alternator stator (12)
- Electrical connector (yellow cable) to alternator stator (9)
- Electrical connector (blue cable) to POU (19)

k. Position IGV actuating ring so that vane levers and thrust bearing adjusting screw do not prevent access to bolts (17).

l. Connect C-sump forward oil scavenge tube (5) to mid C-sump scavenge tube (18). Torque (60° wrench-arc) coupling nut on mid C-sump scavenge tube (18).

m. Connect oil manifold assembly (14, fig. 8-23) as follows:

(1) If power turbine module is installed, connect the following, handtight:

- C-sump forward scavenge tube (5)
- C-sump aft scavenge tube (6)
- Left-hand oil supply tube (7)
- C-sump oil supply tube (8)
- B-sump scavenge fitting (9)

(2) With adapter gasket (16) attached, position flange of oil manifold assembly (14) onto gearbox pad. Tighten captive bolts (15) to 45-50 inch-pounds.

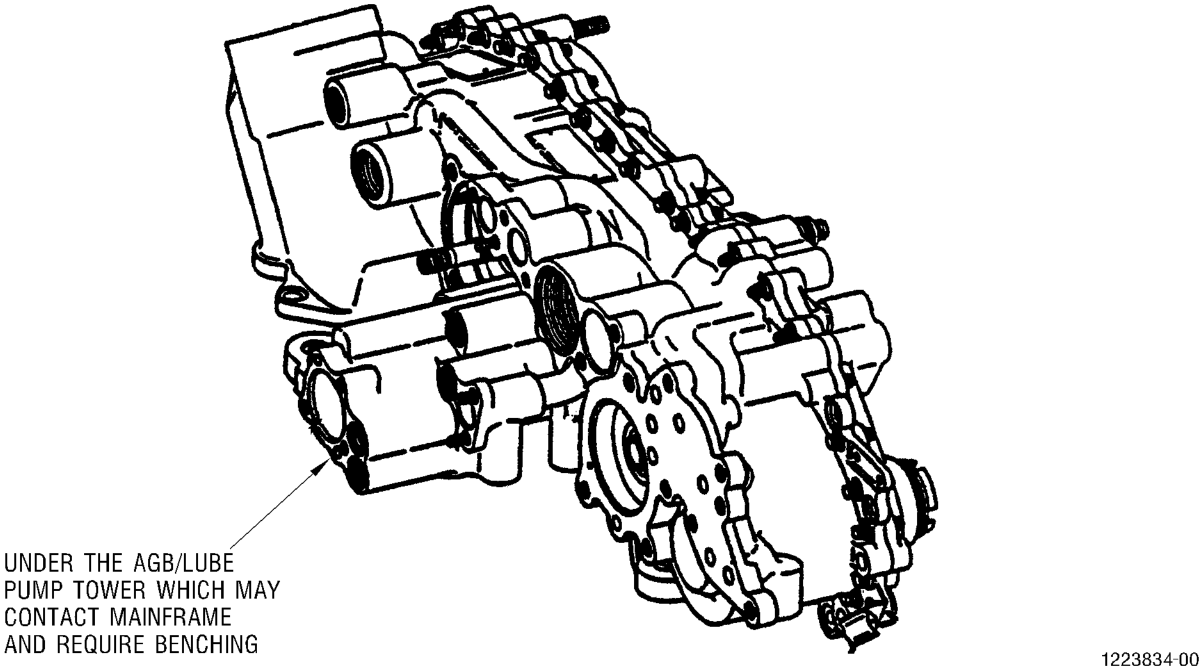


Figure 5-3.1 Accessory Section Module

(3) Tighten (60° wrench-arc) coupling nuts that were hand-tightened in step (1).

(4) Position upper clamp brackets (1, 13), and tighten bolts (3, 12) handtight.

(5) Install bolt (13B) through clamp (13A) and into support bracket (13C).

(6) Torque bolts (3, 12, and 13B) to 45-50 inch-pounds.

n. Slide boot (6, fig. 5-1) up on inlet duct (21).

o. Install POU manifold assembly (3) (para 6-85).

NOTE

P3 hose and tube assembly will not be connected to HMU union until step q.

p. Install hydromechanical control unit (HMU) (1) (para 6-44).

q. Install P3 hose and tube assembly (2, fig. 5-4) as follows:

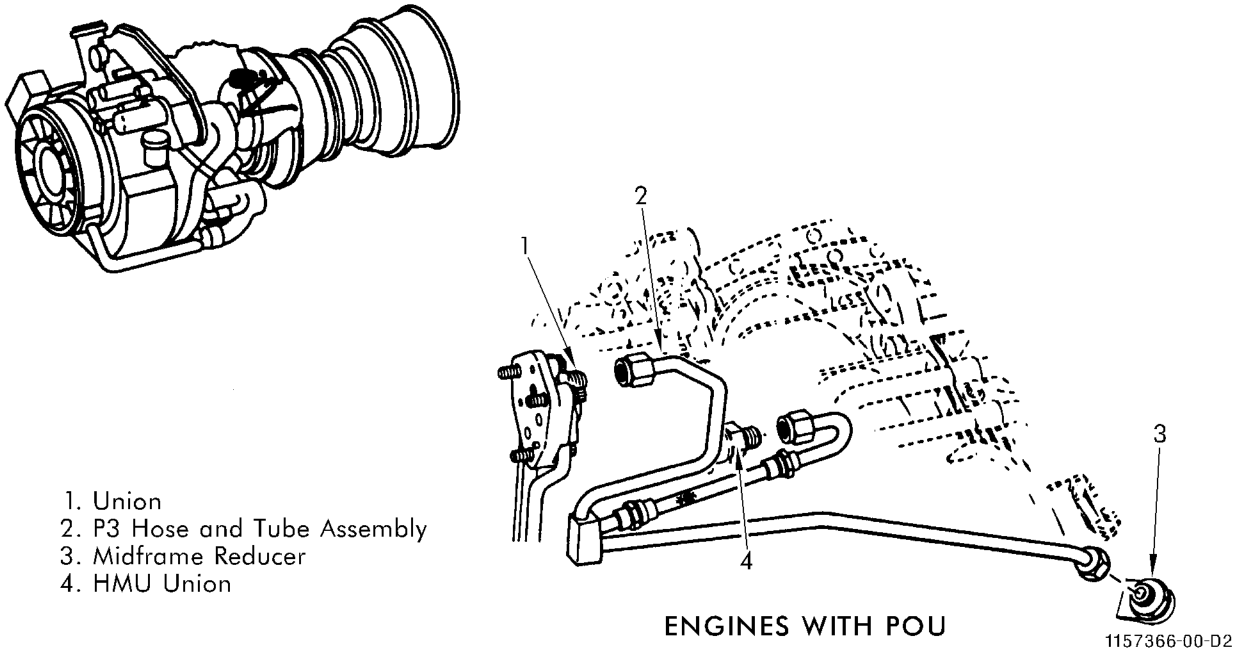
(1) Loosely connect P3 hose and tube assembly (2) to union (1) on POU manifold assembly, to HMU union (4), and to midframe reducer (3).

(2) Hold P3 hose and tube assembly to prevent it from rotating. Tighten (60° wrench-arc) coupling nut at union (1). Tighten (60° wrench-arc) coupling nut at the midframe reducer (3).

(3) Hold U-shaped section of P3 hose and tube assembly at HMU end, and tighten (60° wrench-arc) coupling nut at HMU union (4).

r. Install green cable into clip (22, fig. 5-1) on gearbox and into clip (20) on inlet duct.

s. Install blue cable into clip (20) on inlet duct.



1. Union
2. P3 Hose and Tube Assembly
3. Midframe Reducer
4. HMU Union

Figure 5-4. *(T700)* ***P3 Hose and Tube Assembly; Removal and Installation***

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

t. Make required engine checks in the following order:

Checks	Paragraph
Engine in Aircraft:	
Checkout Procedure for New and Reinstalled Engines	1-126
Engine Checks Required Following Replacement of Parts	1-127
Functional Check	1-131
Maximum Power Check for UH-60A	1-145
Health Indicator Test (HIT) for UH-60A	1-153
Engine in METS/FEDS/CETS:	
Engine Checks and Tests Required Following Replacement of Parts	1-223

5-9. (T701, T701C, T701D) Installation of Accessory Section Module (AVIM).

a. If installing new accessory section module, install C-sump forward oil scavenge tube (9, fig. 5-3) as follows:

(1) Install new preformed packings (6, fig. 5-2) onto oil scavenge tube (9, fig. 5-3).

(2) Install tube (9), and bracket (6) into gearbox and secure with locknut (10). Torque locknut to 24-27 inch-pounds.

CAUTION

Oil manifold assembly (14, fig. 8-23) must be moved aft. Otherwise, adapter gasket (16) may be damaged when installing accessory section module.

b. Disconnect oil manifold assembly as follows:

(1) If power turbine module is installed, disconnect the following:

- C-sump forward scavenge tube (5)
- C-sump aft scavenge tube (6)
- Left-hand oil supply tube (7)
- C-sump oil supply tube (8)
- B-sump scavenge fitting (9)

(2) Loosen two bolts (3, 12) so that upper clamp brackets (1, 13) can be rotated 90° to release oil manifold assembly (14).

(3) Remove bolt (13B) that secures clamp (13A) to support bracket (13C).

(4) Move oil manifold assembly (14) aft.

c. Remove caps or plugs from openings on main frame and accessory section module.

d. Apply a light coat of assembly fluid (item 72, Appendix D) to preformed packing (2, fig. 5-2) and to packing groove in main frame.

e. Install packing (2) into groove on main frame.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

f. Lubricate packings (1, 3, 4, 5) with oil (items 85 or 87, Appendix D), and install them on main frame.

CAUTION

During installation, use care to avoid damaging transfer tubes and external hoses or tubes.

NOTE

The following step requires two people.

g. With another mechanic helping, position accessory section module (28, fig. 5-3) over main frame. Carefully lower the module onto main frame.

h. If module does not seat, check to be sure that transfer tubes in main frame are in their respective ports of accessory section module. Then tap lightly to seat.

i. Install four washers (25) and nuts (26). Tighten (30° wrench arc) nuts.

j. Install radial drive shaft assembly (para 5-41).

k. Remove caps and connect following electrical connectors:

- Electrical connector (green cable) to electrical chip detector (18)
- Electrical connector (green cable) to fuel filter bypass sensor (19)
- Electrical connector (green cable) to oil filter bypass sensor (17)
- Electrical connector (green cable) to oil pressure sensor (15)
- Electrical connector (green cable) to fuel pressure sensor (13)
- Electrical connector (green cable) to alternator stator (16)
- **(T700)** Electrical connector (green cable) to oil temperature sensor (11, fig. 5-1)
- Electrical connector (yellow cable) to alternator stator (14, fig. 5-3)
- Electrical connector (blue cable) to ODV (21)

l. **(T701)** Install B-sump delta pressure tube (6, fig. 8-39) to forward suspension lug at 12 o'clock position on swirl frame.

m. **(T701C, T701D)** Install bolt (3, fig. 8-40) onto clamp (10) on B-sump delta pressure tube (7). Torque bolt to 45-50 inch-pounds.

n. Position IGV actuating ring so that vane levers and thrust bearing adjusting screw do not prevent access to bolts (8, fig. 5-3).

o. Connect C-sump forward oil scavenge tube (9) to mid C-sump scavenge tube (20). Torque (60° wrench-arc) coupling nut on mid C-sump scavenge tube (20).

p. Connect oil manifold assembly (14, fig. 8-23) as follows:

(1) If power turbine module is installed, connect the following, handtight:

- C-sump forward scavenge tube (5)
- C-sump aft scavenge tube (6)
- Left-hand oil supply tube (7)
- C-sump oil supply tube (8)
- B-sump scavenge fitting (9)

(2) With adapter gasket (16) attached, position flange of oil manifold assembly (14) onto gearbox pad. Tighten captive bolts (15) to 45-50 inch-pounds.

(3) Tighten (60° wrench-arc) coupling nuts that were hand-tightened in step (1).

(4) Position upper clamp brackets (1, 13), and tighten bolts (3, 12) handtight.

(5) Install bolt (13B) through clamp (13A) and into support bracket (13C).

(6) Torque bolts (3, 12, and 13B) to 45-50 inch-pounds.

q. Slide boot (12, fig. 5-3) up on inlet duct (22).

r. Install ODV manifold assembly (3) (para 6-72).

NOTE

P3 tube will not be connected to HMU union until step s.

s. Install hydromechanical control unit (HMU) (1) (para 6-44).

t. Install P3 tube (1, fig. 5-5) as follows:

(1) Loosely connect P3 tube (1) to HMU union (3) and to midframe reducer (2).

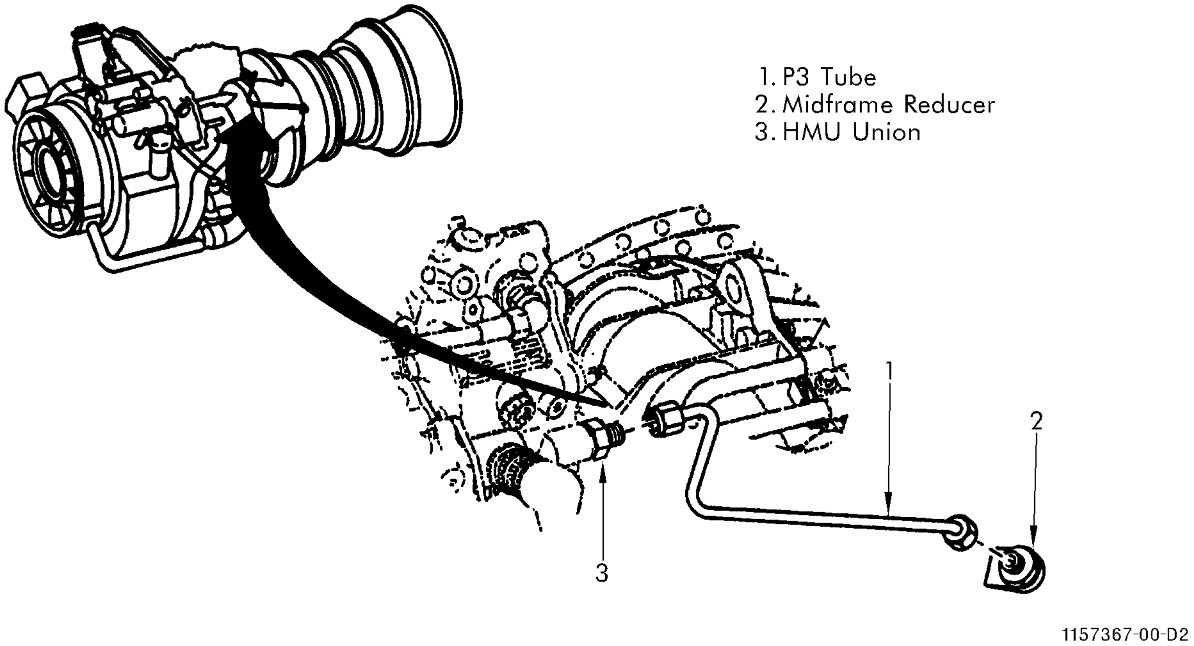


*Figure 5-5. **(T701, T701C, T701D)** P3 Tube; Removal and Installation*

(2) Hold P3 tube to prevent it from rotating into ODV manifold assembly, and tighten (60° wrench-arc) coupling nuts on P3 tube.

u. Install green cable into clip (24, fig. 5-3) on gearbox and into clip (23) on inlet duct.

v. Install blue cable into clip (23) on inlet duct.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

w. Make required engine checks in the following order:

Checks	Paragraph
Engine in aircraft:	
Checkout Procedure for Newly Installed Engines	1-126
Engine Checks Required Following Replacement of Parts	1-127
Functional Check	1-131
(T701) Maximum Power Check for **AH-64A**	1-146
(T701C, T701D) Maximum Power Check for **UH-60L**	1-147
(T701) Health Indicator Test (HIT) for **AH-64A**	1-156
(T701C, T701D) Health Indicator Test (HIT) for **UH-60L**	1-149
Engine in METS/FEDS/CETS:	
Engine Checks and Tests Required Following Replacement of Parts	1-223

5-10. PARTICLE SEPARATOR BLOWER AND V-BAND COUPLING ASSEMBLY.

5-11. Removal of Particle Separator Blower and V-Band Coupling Assembly.

a. If necessary, remove blower exhaust ducting as directed in applicable aircraft maintenance manual.

b. Loosen self-locking nut (2, fig. 5-6) to end of threaded bolt assembly (3). Press down on threaded bolt assembly and release latch.

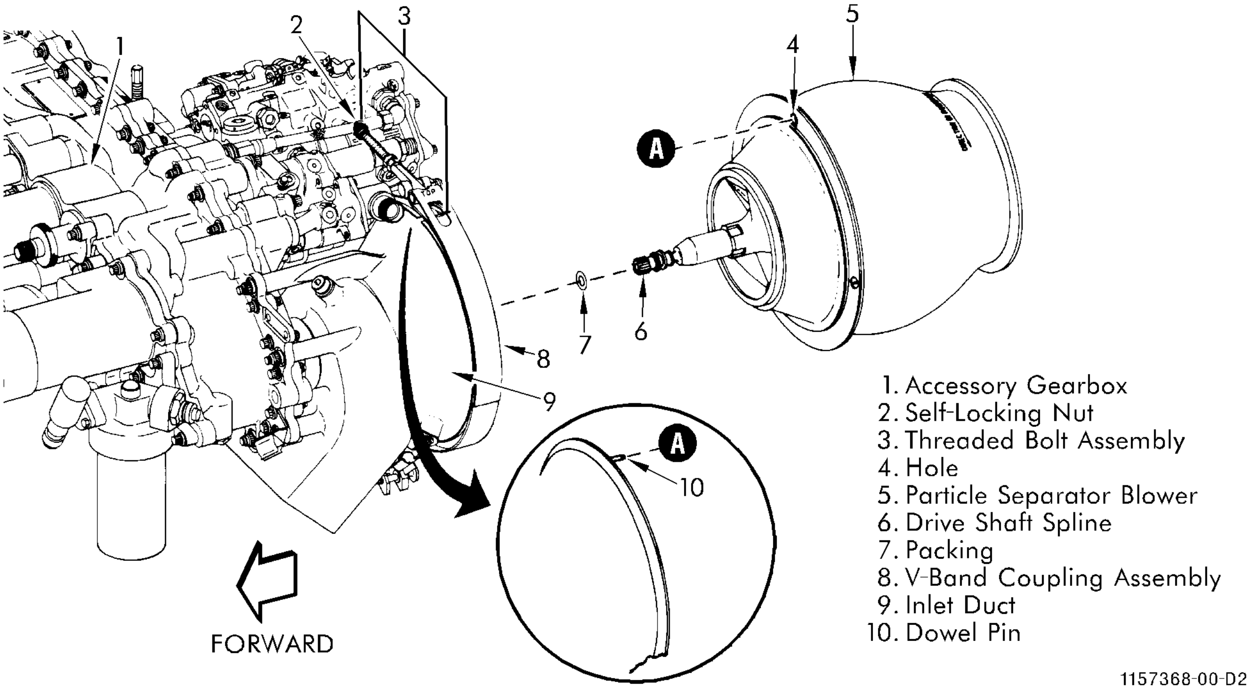


Figure 5-6. Particle Separator Blower and V-Band Coupling Assembly; Removal and Installation

c. Remove particle separator blower (5) and V-band coupling assembly (8) from inlet duct (9).

d. Remove and discard packing (7).

5-12. Cleaning of Particle Separator Blower and V-Band Coupling Assembly.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

CAUTION

Do not immerse particle separator blower in dry cleaning solvent. Otherwise, packed bearing will be damaged.

a. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the blower and V-band coupling assembly (8) using dry, filtered compressed air.

5-13. Inspection of Particle Separator Blower and V-Band Coupling Assembly.

a. With impeller shroud (2, fig. 5-7, view A) installed, inspect impeller vanes (4) for erosion (table 5-1).

Table 5-1. Inspection of Particle Separator Blower and V-Band Coupling Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Impeller vanes (4, fig. 5-7, view A) for erosion.	Erosion hook on full vane is 3/8 inch maximum from forward face of impeller shroud (2).	Not repairable.	Replace blower (para 5-14).
b. Impeller (5, view B) for:			
(1) Nicks, dents, and scratches on:			
(a) Area A (vane to hub fillet area).	None allowed.	Not repairable.	Replace blower (para 5-14).
(b) Area B (hub).	Any number, up to 0.015 inch deep. No more than five defects, 0.020 inch deep.	Not repairable.	Replace blower (para 5-14).
(c) Area C (vane sides).	No more than five defects, 0.020 inch deep.	Not repairable.	Replace blower (para 5-14).
(d) Area D (lower leading edge).	No more than five defects, 0.015 inch deep.	Not repairable.	Replace blower (para 5-14).
(e) Area E (upper leading edge).	Any number, up to 0.030 inch deep.	Not repairable.	Replace blower (para 5-14).

Table 5-1. Inspection of Particle Separator Blower and V-Band Coupling Assembly (Cont)

NOTE

If cracks or missing pieces are found on impeller during inspection, and if HMU is PN 4046T52G08 and below, both blower and HMU shall be replaced. HMU PN 4046T52G08 and below has a P3 bellows that is subject to vibration-caused failure.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Cracks or missing pieces.	None allowed.	Not repairable.	Replace blower (para 5-14) and HMU PN 4046T52G08 and below (para 6-40).
c. Impeller shroud (2) for:			
(1) Erosion damage.	Up to 50% of plating eroded away.	Not repairable.	Replace blower (para 5-14).
(2) Nicks and scratches.	Any number, up to 1/32 inch deep, if plating damage is within a 2-inch circle.	Not repairable.	Replace blower (para 5-14).
(3) Dents.	Any number, up to 1/8 inch in diameter, if plating damage is within a 2-inch circle.	Not repairable.	Replace blower (para 5-14).
(4) Rubs.	None allowed.	Not repairable.	Replace blower (para 5-14).
d. Drive shaft (9) for failure (shearing).	Not allowed.	Not repairable.	Replace blower (para 5-14).
e. V-band coupling assembly (7) for:			
(1) Cracks in:			
(a) Circumferential band.	None allowed.	Not repairable.	Replace coupling assembly (para 5-14).
(b) Spot weld.	None allowed.	Not repairable.	Replace coupling assembly (para 5-14).
(2) Nicks, dents, scratches, and gouges.	Any number, up to 0.010 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
(3) Threads for damage.	Not more than one thread total without crossed threads or high metal.	Same as usable limits, with high metal.	AVUM: Replace coupling assembly (para 5-14). AVIM: Remove high metal and chase threads.

Table 5-1. Inspection of Particle Separator Blower and V-Band Coupling Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Nut hex for rolled edges.	Any amount if wrench fits properly. High metal is not allowed.	Same as usable limits, with high metal.	Remove high metal.

NOTE

- The particle separator blower is a single bearing support item. Axial and radial play in the drive shaft is normal. For proper operation, the drive shaft requires support from a second bearing that is located in the accessory gearbox. Without this second support bearing, the drive shaft may not spin freely if an uninstalled blower is held horizontally.
- The impeller shroud is only removed for access so that a more detailed inspection can be made of the impeller and shroud.

b. If bearing failure is suspected, do the following:

(1) Hold particle separator blower (1) vertically with forward end up. Hold drive shaft (9) and spin blower housing (3).

(2) If housing (3) does not spin freely, or if bearing is noisy, do a more detailed inspection of impeller (5) and shroud (2) as follows:

(a) Remove shroud (2, view B) by removing screws (8).

(b) Repeat step b(1).

(c) If housing (3) still does not spin freely, or if bearing (6) is still noisy, replace blower (para 5-14).

(d) If housing (3) spins freely, and if there is no noise coming from bearing (6), go to step d.

c. Remove impeller shroud (2, view B) as follows:

(1) Remove two screws (8) that secure impeller shroud (2) to particle separator blower (1).

(2) Remove impeller shroud (2).

d. Clean impeller (5), impeller vanes (4), and impeller shroud (2) as follows:

CAUTION

Do not allow dry cleaning solvent on the bearing (6). Otherwise, bearing will be damaged.

(1) Wipe impeller (5), impeller vanes (4), and impeller shroud (2) with towel (item 112, Appendix D) saturated in dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(2) Dry impeller (5), impeller vanes (4), and impeller shroud (2) using dry, filtered, compressed air.

e. Inspect impeller (5), impeller shroud (2), drive shaft (9), and V-band coupling assembly (7). See table 5-1.

f. Reinstall impeller shroud (2) using two screws (8). Torque screws (8) to 7-9 inch-pounds.

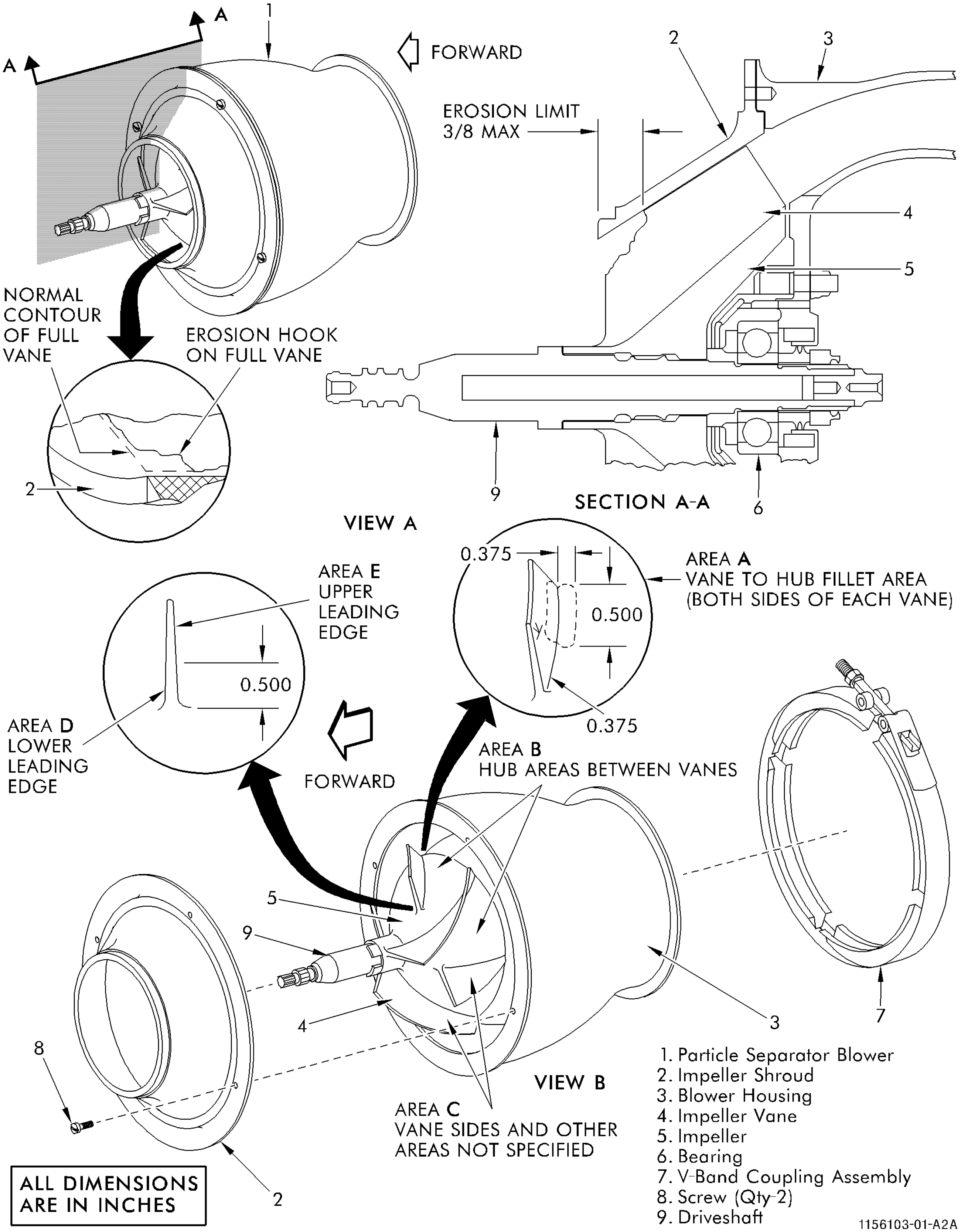


Figure 5-7. Particle Separator Blower and V-Band Coupling Assembly; Inspection

5-14. Installation of Particle Separator Blower and V-Band Coupling Assembly.

CAUTION

V-band coupling assembly will be installed with self-locking nut (2, fig. 5-6) facing toward center of engine; otherwise, aircraft cowling will be damaged.

a. Position V-band coupling assembly (8) toward inlet duct (9) so that threaded bolt assembly (3) is at 12 o'clock position and self-locking nut (2) is facing towards center of engine.

b. Install V-band coupling assembly (8) onto inlet duct (9). Do not tighten nut (2).

c. Install packing (7) on drive shaft spline (6).

d. Aline hole (4) on blower flange with dowel pin (10) on inlet duct (9). AVUM: If dowel pin is missing, aline hole in blower flange within 1/2 inch of hole in inlet duct. Install particle separator blower (5) into inlet duct (9), making sure that drive shaft spline (6) engages spline in accessory gearbox (1).

e. Be sure that threaded bolt assembly (3) is at 12 o'clock position; then secure blower to inlet duct as follows:

(1) Tighten nut (2) until threaded bolt assembly (3) cannot be wiggled by hand. Run-on torque shall be 2-20 inch-pounds.

(2) Torque nut to 30-35 inch-pounds.

(3) Be sure that there are at least 5 threads protruding through the nut.

f. If necessary, reinstall exhaust ducting as directed in applicable aircraft maintenance manual.

g. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

5-15. PARTICLE SEPARATOR INLET DUCT.

5-16. (T700, T701) Removal of Particle Separator Inlet Duct (AVIM).

a. Remove particle separator blower (para 5-11).

b. Using figures 5-8 and 5-9, check configuration of inlet duct (4) to be removed from an assembled engine. If configuration is the same as that in figure 5-8, view A, go to step d. If configuration is the same as that in view B, go to step c. If configuration is the same as that in figure 5-9, go to step e.

c. **(T700)** Remove former configuration inlet duct (4, fig. 5-8, view B) as follows:

(1) Remove locknut (19) and disconnect C-sump forward oil scavenge tube (20) from accessory gearbox.

(2) Remove bolt (16), two washers (17), and nut (18).

(3) Remove clip support (15).

(4) Remove five nuts (3) and bolt (13).

(5) Slide boot (10, view A) down from inlet duct (4).

CAUTION

Do not pry or use excessive force to remove inlet duct; otherwise, it will become damaged.

NOTE

It may be necessary to loosen the POU so that the inlet duct can be easily removed.

(6) Try to remove inlet duct (4). If duct contacts the POU (22), loosen two captive bolts (21) just enough to move the POU out of the way.

(7) Remove inlet duct (4).

(8) Remove and discard preformed packing (12).

d. **(T700)** Remove former configuration inlet duct (4, view A) as follows:

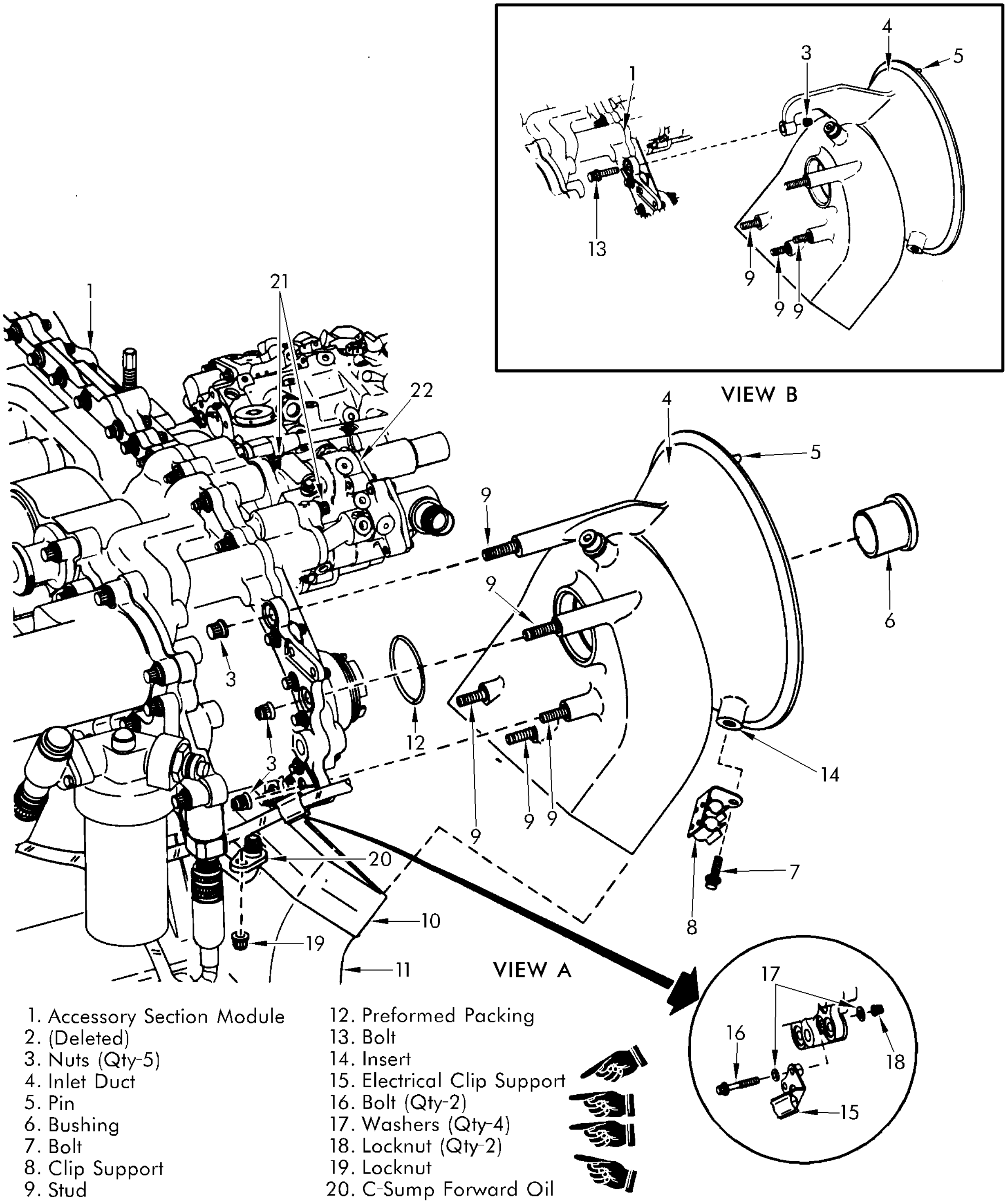
(1) Remove locknut (19) and disconnect C-sump forward oil scavenge tube (20) from accessory gearbox.

(2) Remove bolt (16), two washers (17), and nut (18).

(3) Remove clip support (15).

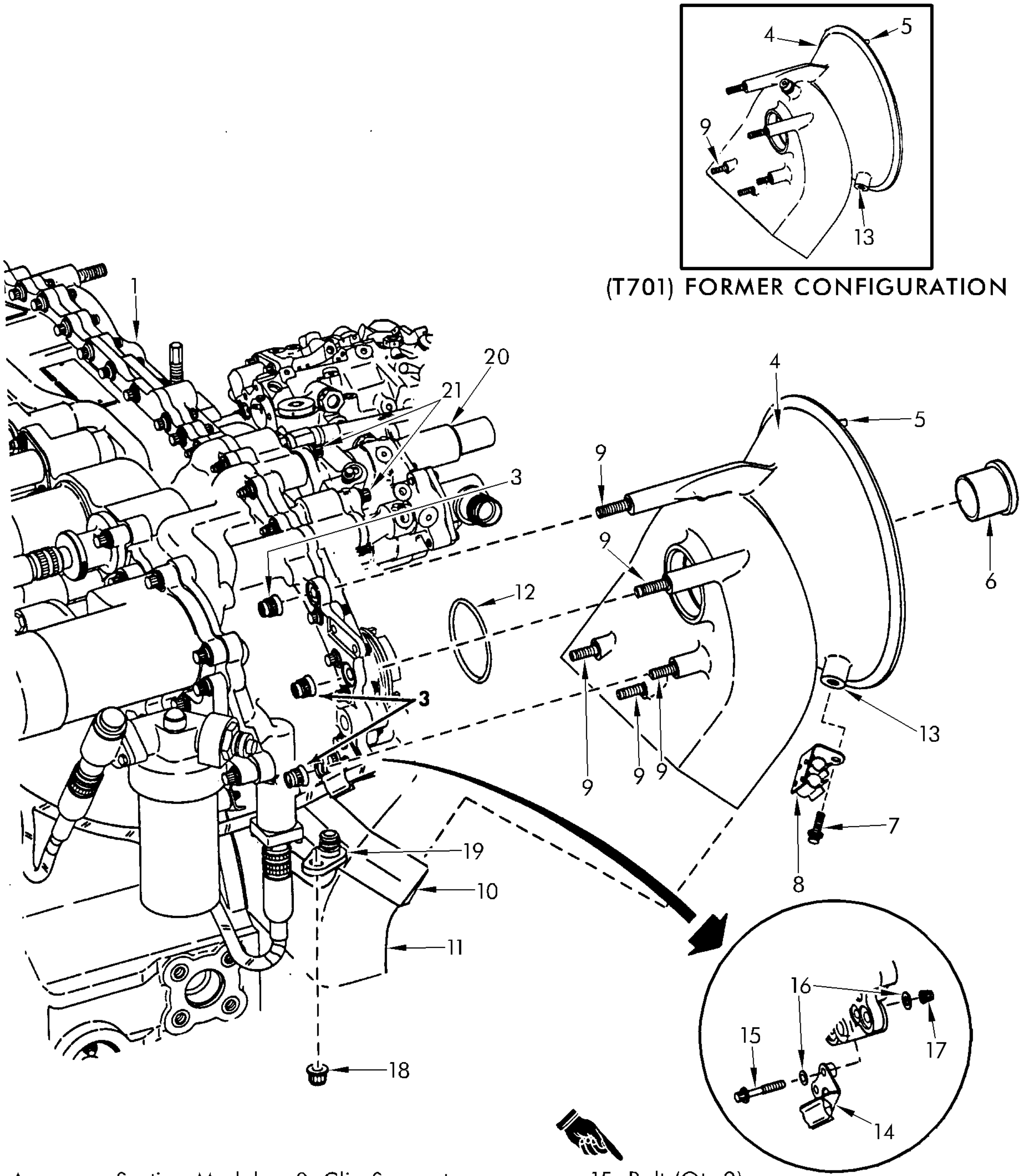
(4) Remove five nuts (3).

(5) Slide boot (10) down from inlet duct (4).



1. Accessory Section Module
2. (Deleted)
3. Nuts (Qty-5)
4. Inlet Duct
5. Pin
6. Bushing
7. Bolt
8. Clip Support
9. Stud
10. Boot
11. Scroll Case
12. Preformed Packing
13. Bolt
14. Insert
15. Electrical Clip Support
16. Bolt (Qty-2)
17. Washers (Qty-4)
18. Locknut (Qty-2)
19. Locknut
20. C-Sump Forward Oil Scavenge Tube
21. Captive Bolt (Qty-2)
22. POU

Figure 5-8. ***(T700)*** *Particle Separator Inlet Duct (Former Configurations); Removal, Inspection, and Installation*


(T701) FORMER CONFIGURATION

1. Accessory Section Module
2. (Deleted)
3. Nuts (Qty-5)
4. Inlet Duct
5. Pin
6. Bushing
7. Bolt
8. Clip Support
9. Studs (Qty-5)
10. Boot
11. Scroll Case
12. Preformed Packing
13. Insert
14. Electrical Clip Support
15. Bolt (Qty-2)
16. Washers (Qty-4)
17. Locknut (Qty-2)
18. Locknut
19. C-Sump Forward Oil Scavenge Tube
20. (T700) POU
21. (T700) Captive Bolts (Qty-2)

Figure 5-9. ***(T700, T701)*** *Particle Separator Inlet Duct; Removal, Inspection and Installation*

CAUTION

Do not pry or use excessive force to remove inlet duct; otherwise, it will become damaged.

NOTE

It may be necessary to loosen the POU so that the inlet duct can be easily removed.

(6) Try to remove inlet duct (4). If duct contacts the POU (22), loosen two captive bolts (21) just enough to move the POU out of the way.

(7) Remove inlet duct (4).

(8) Remove and discard preformed packing (12).

e. Remove inlet duct (4, fig. 5-9) as follows:

(1) Slide boot (10) down from inlet duct (4).

(2) Remove locknut (18), and disconnect C-sump forward oil scavenge tube (19) from accessory gearbox.

(3) Remove bolt (15), two washers (16), and nut (17).

(4) Remove five nuts (3).

(5) Remove clip support (14).

CAUTION

Do not pry or use excessive force to remove inlet duct; otherwise, it will become damaged.

NOTE

(T700) It may be necessary to loosen the POU so that the inlet duct can be easily removed.

(6) **(T700)** Try to remove inlet duct (4). If duct contacts the POU (20), loosen two captive bolts (21) just enough to move the POU out of the way.

(7) Remove inlet duct (4).

(8) Remove and discard preformed packing (12).

f. Do not remove bushing (6) from inlet duct (4). If bushing (6) is loose, tie it to the inlet duct so that it will not get lost.

g. If inlet duct (4) is being replaced, remove bolt (7) and clip support (8). Remove the blue or green electrical cable.

h. Cover scroll case (11) with suitable protective cover.

5-17. (T700, T701C, T701D) Removal of Particle Separator Inlet Duct (AVIM).

a. Remove particle separator blower and V-band coupling assembly (para 5-11).

b. Disconnect the nonmetallic hose from seal cavity drain (2, fig. 5-10).

c. Remove five nuts (3) from studs (21).

d. Slide boot (19) down from inlet duct (4).

CAUTION

Do not pry or use excessive force to remove inlet duct; otherwise, it will become damaged.

e. Remove inlet duct (4) and drain (2) from accessory section module (1).

f. Remove drain (2) from inlet duct (4).

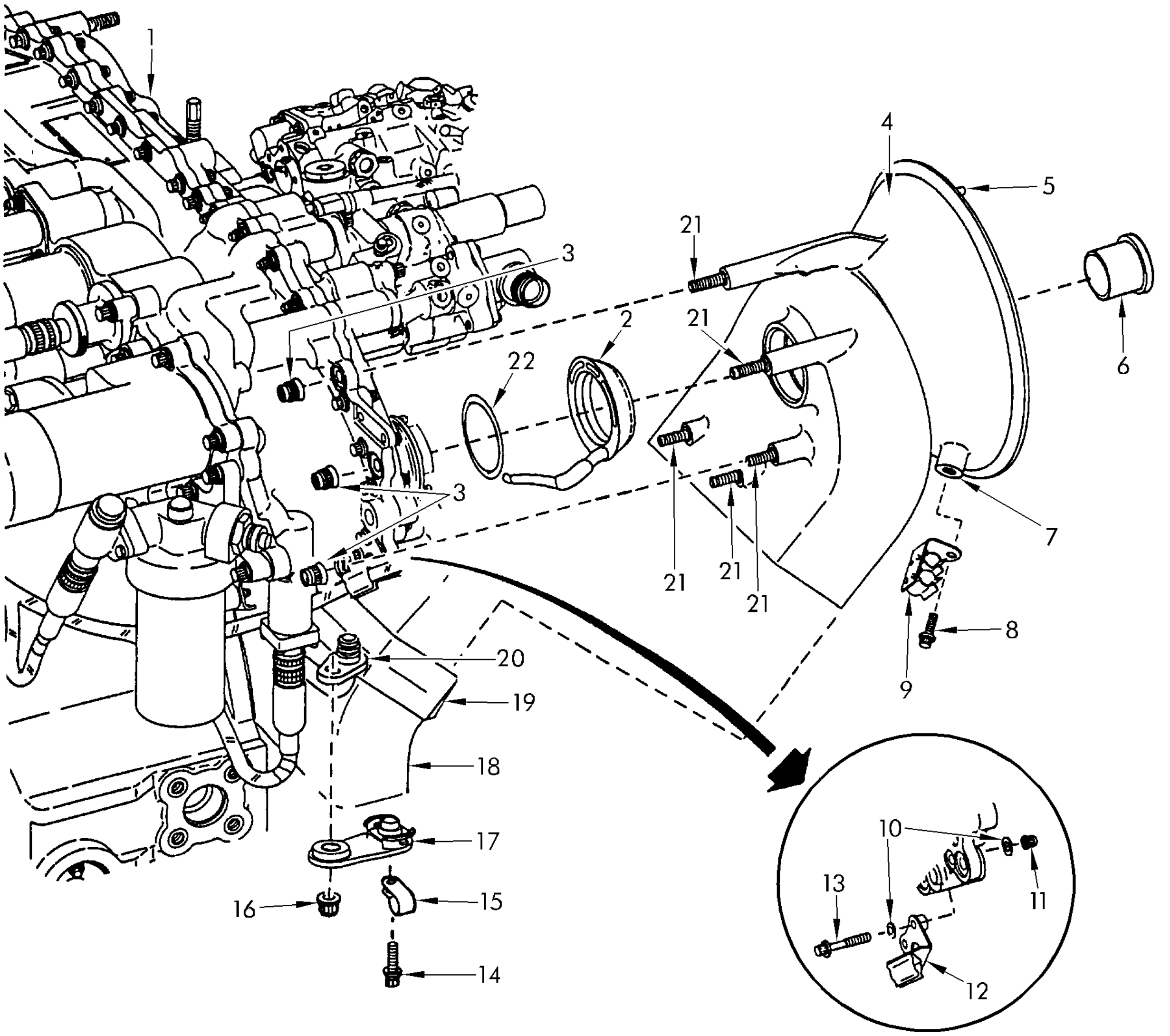
g. Remove and discard preformed packing (22).

h. Do not remove bushing (6) from inlet duct (4).

i. If bushing (6) is loose, tie it to the inlet duct (4) so that it will not get lost.

j. If inlet duct (4) is being replaced, remove bolt (8) and clip support (9). Remove the blue or green electrical cable.

k. Cover scroll case (18) with suitable protective cover.



1. Accessory Section Module
2. Seal Cavity Drain
3. Nuts (Qty-5)
4. Inlet Duct
5. Pin
6. Bushing
7. Insert
8. Bolt
9. Clip Support
10. Washers (Qty-4)
11. Locknut (Qty-2)
12. Electrical Clip Support
13. Bolt (Qty-2)
14. Bolt
15. Cushioned Clamp
16. Locknut
17. Bracket
18. Scroll Case
19. Boot
20. C-Sump Forward Oil Scavenge Tube
21. Studs (Qty-5)
22. Preformed Packing

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Figure 5-10. ***(T700, T701C, 701D)*** *Particle Separator Inlet Duct; Removal, Inspection and Installation*

5-18. Cleaning of Particle Separator Inlet Duct (AVIM).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash surfaces of duct using dry cleaning solvent (item 99, Appendix D).

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the duct using dry, filtered compressed air.

5-19. Inspection of Particle Separator Inlet Duct. See table 5-2.

Table 5-2. Inspection of Particle Separator Inlet Duct

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Inlet duct (4, fig. 5-8, 5-9 or 5-10) for:			
a. Damaged or loose pin (5).	Not allowed.	Not repairable.	AVUM: Remove pin. AVIM: Replace pin (para 5-21, step b).
b. Missing pin (5).	AVUM: Not applicable.	Not applicable.	Duct may be used without pin.
	AVIM: Not allowed.	Not applicable.	Replace pin (para 5-21, step b).
c. AVIM: Studs (9) and inserts (14, fig. 5-8, 13, fig. 5-9 or 7, fig. 5-10).	See Inspection of Studs and Threaded Inserts (para H-27, Appendix H).		

Table 5-2. Inspection of Particle Separator Inlet Duct (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. AVIM: Wear (fig. 5-11) on:			
(1) Diameter A.	4.175 inches maximum.	Not repairable.	Replace duct.
(2) Diameter B.	6.575 inches maximum.	Not repairable.	Replace duct.
(3) Diameter C.	1.762 inches maximum.	Not repairable.	Replace duct.
e. Bushing for:			
(1) Cracks.	None allowed.	Not repairable.	Replace bushing. Press-fit by hand.
(2) Looseness.	Not allowed.	Not repairable.	Replace bushing. Press-fit by hand.
f. AVIM: **(T701C, T701D)** Inlet duct for missing anodize coating.	Not allowed.	Any amount.	Touch up area (para H-30).
g. AVIM: **(T700, T701C, T701D)** Vent tube for:			
(1) Clogging.	None allowed.	Any amount.	Replace duct.
(2) High metal on bushing end.	Must be flush with contour of duct center.	Any amount.	Remove high metal.
(3) Cracked weld.	None allowed.	Not repairable.	Replace duct.

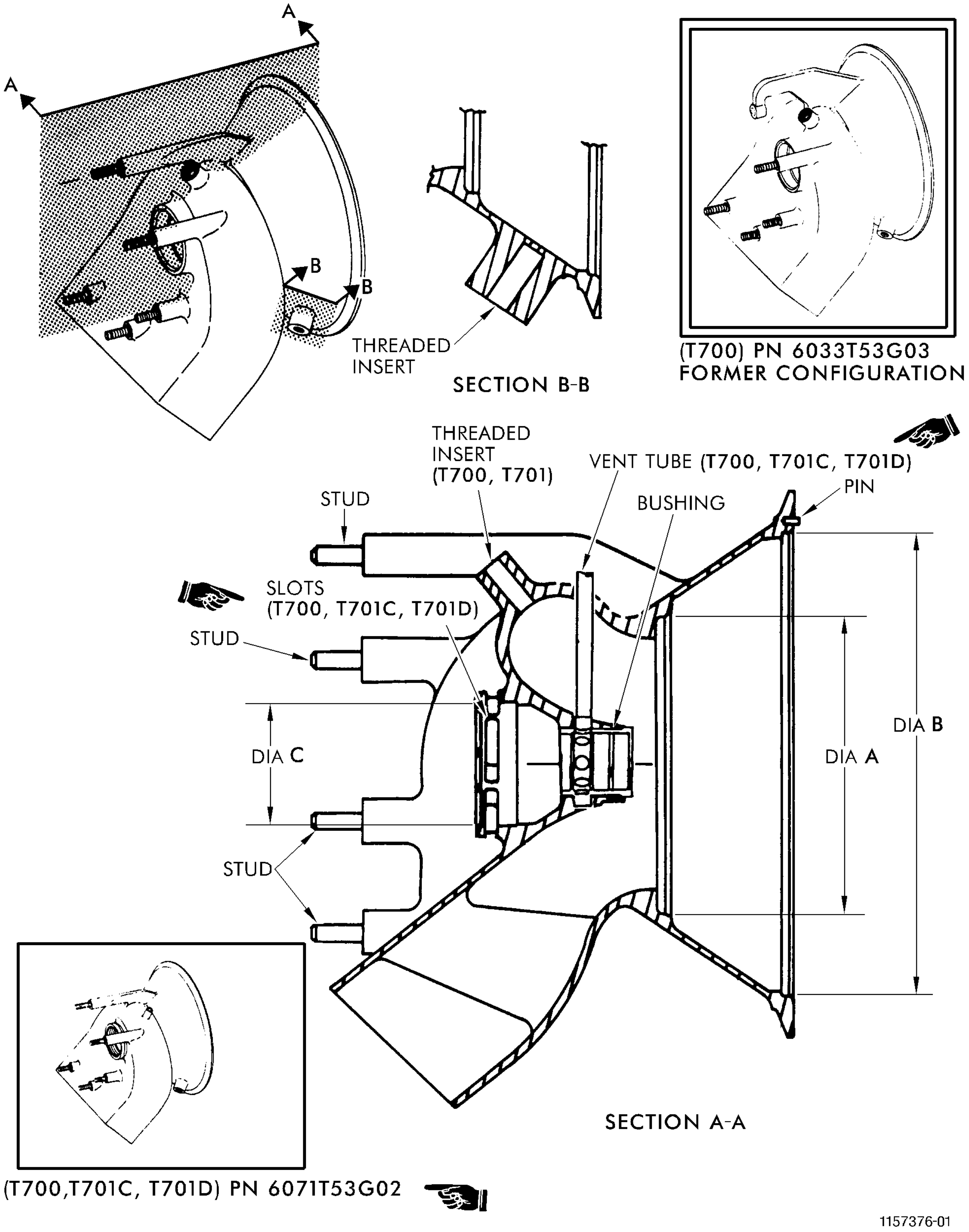


Figure 5-11. Particle Separator Inlet Duct; Inspection

5-20. (T700, T701C, T701D) Inspection of Axis-G Cavity Seal Drain (AVIM). See table 5-3.

Table 5-3. Inspection of Axis-G Cavity Seal Drain

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Boot (fig. 5-12) for:			
(1) Wear.	Up to 0.025 inch deep, over 30% of circumference.	Not repairable.	Replace seal.
(2) Cracks.	None allowed.	Not repairable.	Replace seal.
(3) Separation.	None allowed.	Not repairable.	Replace seal.
b. Ring for:			
(1) Cracks.	None allowed.	Not repairable.	Replace seal.
(2) Nicks, dents, and scratches.	Up to 0.005 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
(3) Clogged slots and hole.	None allowed.	Any amount.	Replace seal.
(4) Tube weld.	No cracks allowed.	Any amount.	Replace seal.
c. Tube for:			
(1) Nicks, dents, and scratches.	Up to 0.005 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
(2) Deformation.	No visible deformation allowed.	Not repairable.	Replace seal.
(3) Clogged end.	Not allowed.	Any amount.	Replace seal.
d. Sleeve for:			
(1) Wear.	Through-wear not allowed.	Not repairable.	Replace sleeve.
(2) Tears and cracks.	Up to 0.250 inch long, not to exceed 30% of surface area.	Not repairable.	Replace sleeve.

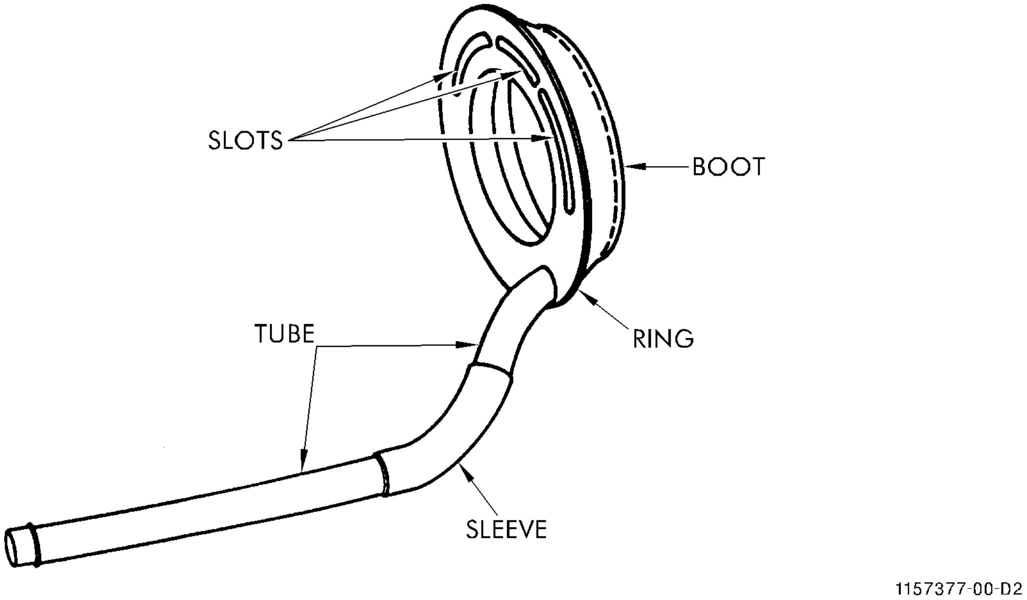


Figure 5-12. (T700, T701C, T701D) Axis-G Cavity Seal Drain; Inspection

5-21. Repair of Particle Separator Inlet Duct (AVIM).

a. If necessary, replace studs (9, fig. 5-8 or 5-9). Refer to paragraph H-28 Appendix H.

b. If pin (5) is missing, damaged, or loose, it must be replaced. Pin is pressed in and held by an interference fit. Use standard pin in following list if hole is not enlarged. If necessary, ream hole in flange of inlet duct (4) to accept required pin, and press in pin. Pin must extend 7/32 ±1/64 inch after installation.

Pin Type	Part Number	Hole Size (inch dia)
Standard	MS9390-170	0.1240-0.1245
0.002-inch, oversize	MS9390-171	0.1260-0.1265
0.005-inch, oversize	MS9390-172	0.1290-0.1295

5-22. (T700, T701) Installation of Particle Separator Inlet Duct (AVIM).

a. Remove protective cover from scroll case (11, fig. 5-8 or 5-9).

b. If inlet duct (4) has been replaced, install clip support (8) with bolt (7).

c. Position clip support (8) as shown and torque bolt (7) to 45-50 inch-pounds.

d. Install packing (12).

e. Be sure that bushing (6) is installed. If it is not, install it.

CAUTION

Do not use force to install inlet duct; otherwise, it will be damaged.

f. **(T700)** If POU was not loosened for the removal of the inlet duct (4), go to step i.

g. **(T700)** If POU was not loosened for the removal of the inlet duct (4), it may be necessary to loosen the POU so that the inlet duct (4) can be easily installed. Go to step h.

h. **(T700)** Try to install inlet duct (4). If duct (4) contacts POU, loosen captive bolts (21) just enough to move POU out of the way.

i. **(T700)** If vent tube (fig. 5-11) has a plug/cover installed, remove it.

j. **(T700)** Move POU out of the way.

k. Install inlet duct (4, fig. 5-8 or 5-9) onto gearbox assembly.

l. Secure inlet duct (4) to gearbox as follows:

(1) **(T700)** If duct (4, view B, fig. 5-8) (former configuration) is being installed, secure it with four nuts (3) and one bolt (13). Torque nuts (3) and bolt (13) to 45-50 inch-pounds.

(2) Insert forward end of C-sump forward oil scavenge tube (20) into boss on accessory gearbox.

(3) Secure C-sump forward oil scavenge tube (20) with locknut (19). Torque locknut (19) to 24-27 inch-pounds.

(4) Install electrical clip support (15) as follows:

(a) Install electrical clip support (15) onto stud (9) and secure with nut (3).

(b) Install electrical clip support (15) using two bolts (16), four washers (17), and two locknuts (18). Torque locknuts (18) to 45-50 inch pounds.

(5) **(T700)** If duct (4, view A) (present configuration) is being installed, secure it with five nuts (3).

(6) Insert forward end of C-sump forward oil scavenge tube (20) into boss on accessory gearbox.

(7) Secure C-sump forward oil scavenge tube (20) with locknut (19). Torque locknut (19) to 24-27 inch-pounds.

(8) Install electrical clip support (15) as follows:

(a) Install electrical clip support (15) onto stud (9) and secure with nut (3). Torque nuts (3) to 45-50 inch-pounds.

(b) Install electrical clip support (15) using two bolts (16), four washers (17), and two locknuts (18). Torque locknuts to 45-50 inch pounds.

(9) If inlet duct (4, fig. 5-9) is being installed, secure it with nuts (3). Torque nuts (3) to 45-50 inch-pounds.

(10) Insert forward end of C-sump forward oil scavenge tube (19) into boss on accessory gearbox.

(11) Secure scavenge tube (19) with locknut (18). Torque locknut (18) to 24-27 inch pounds.

(12) Install electrical clip support (14) as follows:

(a) Install electrical clip support (14) onto stud (9), and secure support (14) with nut (3).

(b) Install electrical clip support (14) using two bolts (15), four washers (16), and two locknuts (17). Torque locknuts to 45-50 inch pounds.

m. If inlet duct (4) is installed on an assembled engine, slide boot (10) up around inlet duct (4).

n. Install particle separator blower (para 5-14).

o. Make required engine checks listed in table 1-39.

5-23. (T700, T701C, T701D) Installation of Particle Separator Inlet Duct (AVIM).

a. Remove protective cover from scroll case (18, fig. 5-10).

b. If inlet duct (4) has been replaced, install clip support (9) with bolt (8). Install the blue or green electrical cable.

c. Position clip support (9) as shown and torque bolt (8) to 45-50 inch-pounds.

d. Install packing (22).

e. Be sure that bushing (6) is installed. If it is not, install it.

f. Install seal cavity drain (2) into inlet duct (4).

CAUTION

Do not use force to install inlet duct; otherwise, it will be damaged.

g. Install inlet duct (4) onto gearbox assembly.

h. Secure inlet duct (4) onto gearbox as follows:

(1) Insert forward end of C-sump forward oil scavenge tube (20) and bracket (17) into boss on accessory gearbox.

(2) Secure scavenge tube (20) and bracket (17) with locknut (16). Torque locknut to 24-27 inch-pounds.

(3) Install cushioned clamp (15) over tube of seal cavity drain (2).

(4) Secure clamp (15) to bracket (17) with bolt (14). Torque bolt (14) to 45-50 inch-pounds.

(5) Install electrical clip support (12) as follows:

(a) Install electrical clip support (12) onto stud (21) and secure electrical clip support (12) with nut (3).

(b) Install electrical clip support (12) using two bolts (13), four washers (10), and two locknuts (11). Torque locknuts (11) to 45-50 inch pounds.

i. If vent tube (fig. 5-11) has a plug/cover installed, remove it.

j. If inlet duct (4, fig. 5-10 is installed on an assembled engine, slide boot (19) up around inlet duct (4).

k. Install particle separator blower (para 5-14).

l. Make required engine checks listed in table 1-39.

5-24. ACCESSORY DRIVE GEARBOX ASSEMBLY.

5-25. Cleaning of Accessory Drive Gearbox Assembly.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Wipe external surfaces with towel (item 112, Appendix D) saturated in dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry accessory drive gearbox assembly using dry, filtered compressed air.

5-26. Inspection of Accessory Drive Gearbox Assembly.

See table 5-4.

Table 5-4. Inspection of Accessory Drive Gearbox Assembly

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Rear and front housings (18, 19, fig. 5-13) for:			
a. Cracks.	None allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace accessory section module (para 5-8).
b. Nicks and scratches in cast surfaces.	Any number, up to 0.030 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal.
c. Damaged studs and inserts.	Not allowed.	Not repairable.	AVUM: Replace engine. AVIM: Replace studs and inserts (para H-28, Appendix H).
d. High metal in oil and scavenge pump bore.	Not allowed.	Any amount within 1/2 inch of front of bore.	Carefully blend high metal. Keep debris out of bore.

5-27. Repair of Accessory Drive Gearbox Assembly (AVIM).

Repair of accessory drive gearbox assembly is limited to that specified in corrective action column of table 5-4 and replacement of carbon seals (para 5-28).

5-28. Replacement of Carbon Seals (AVIM).

a. Replacement of Axis-G Carbon Seal.

(1) If particle separator blower and V-band coupling are installed, remove them (para 5-11).

(2) Remove particle separator inlet duct (para 5-16).

(3) Remove retaining ring (1, fig. 5-13).

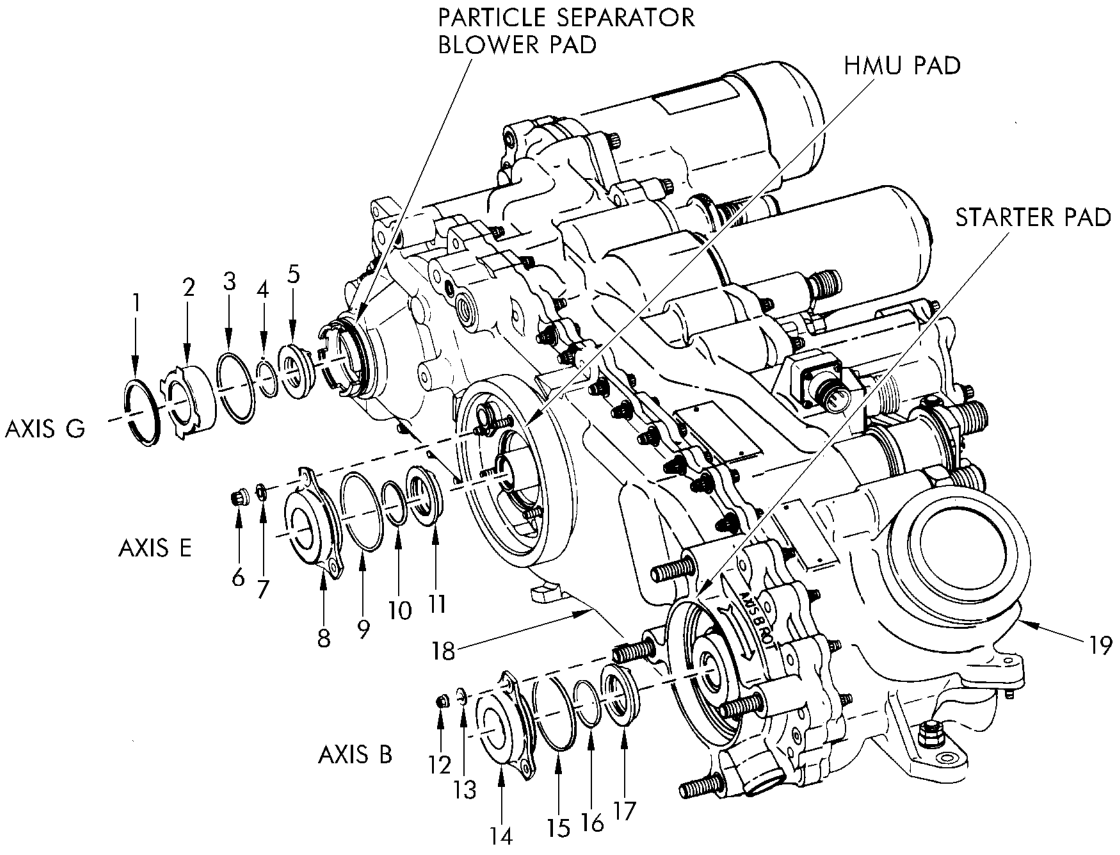
(4) Using axis-G carbon seal puller 21C7239G01/G02 (6, fig. 5-14), remove axis-G carbon seal (2, fig. 5-13) as follows:

(a) Position puller (6, fig. 5-14) over seal (2, fig. 5-13) so that tabs on puller (6, fig. 5-14) begin to engage antirotation lugs of seal (2, fig. 5-13).

(b) Rotate puller body CCW so that tabs are applying pressure to antirotation lugs.

(c) While holding puller (6, fig. 5-14) with one hand, slide hammer with the other hand to remove seal (2, fig. 5-13). Be sure to hold seal (2) so that it will not get damaged.

(5) Remove and discard preformed packing (3) from bore of rear housing (18).



1. Retaining Ring
2. Axis-G Carbon Seal
3. Preformed Packing
4. Preformed Packing
5. Seal Mating Ring
6. Self-Locking Nut (Qty-3)
7. Washer (Qty-3)
8. Axis-E Carbon Seal
9. Preformed Packing
10. Preformed Packing
11. Seal Mating Ring
12. Self-Locking Nut (Qty-3)
13. Washer (Qty-3)
14. Axis-B Carbon Seal
15. Preformed Packing
16. Preformed Packing
17. Seal Mating Ring
18. Rear Housing
19. Front Housing

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Figure 5-13. Accessory Drive Gearbox and Carbon Seals

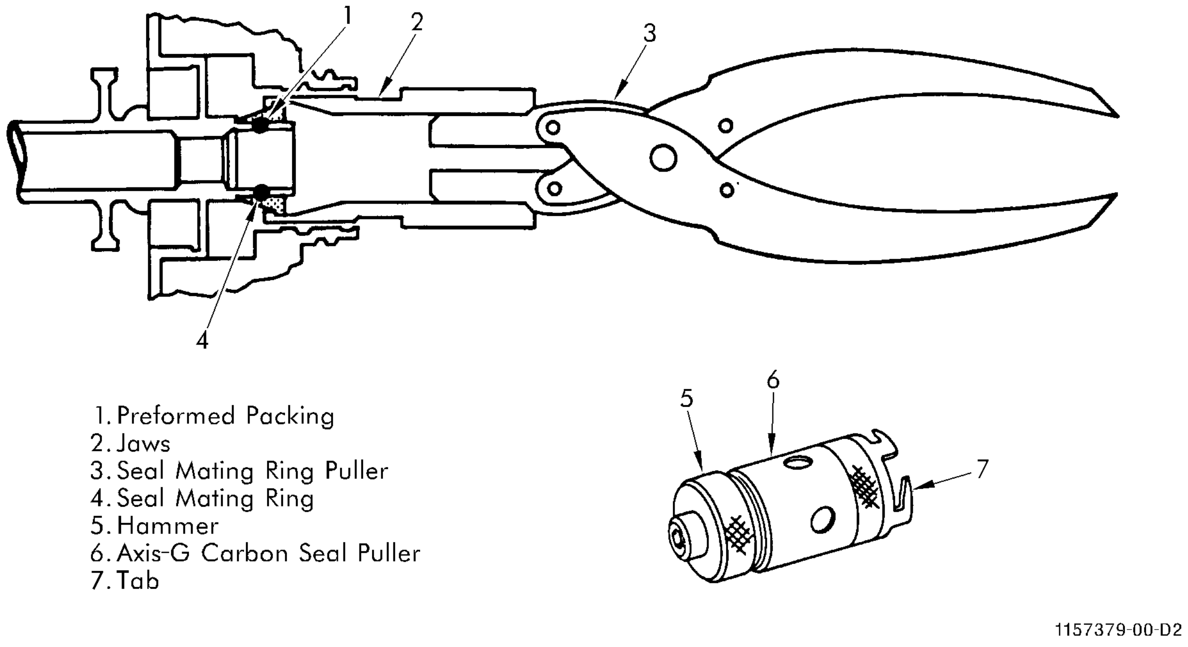


Figure 5-14. Axis-G Carbon Seal Puller 21C7239G01/G02 and Seal Mating Ring Puller 21C7702G01

NOTE

There are two methods for replacing axis-G seal mating ring. The preferred method (step (6)) is to use seal mating ring puller 21C7702G01. The alternate method (step (7)) is to use seal mating ring puller LMT 747 and seal mating ring guide assembly LMT 748.

(6) Replace axis-G seal mating ring (5) using seal mating ring puller 21C7702G01 (3, fig. 5-14) as follows:

(a) Install puller (3) onto seal mating ring (4) so that jaws (2) engage mating ring (4).

(b) Squeeze handles of puller (3) to grasp mating ring (4) and pull mating ring (4) straight out.

(c) Discard mating ring (4) and preformed packing (1) in inner bore of mating ring (4).

(d) Install new preformed packing (4, fig. 5-13) into groove on inner bore of new mating ring (5).

(e) Note position of slots in spur gear relative to inner bore of rear housing (18). Using Blue Dykem marker (item 82, Appendix D) mark location of slots on inner bore of rear housing (18).

CAUTION

Failure to engage tangs on mating ring (5) with slots in spur gear shaft will result in damage to the carbon seal (2).

(f) Using Dykem mark (step (e)) as a guide, aline tangs on mating ring (5) with mating slots in spur gear shaft. Push mating ring (5) forward onto spur gear shaft. Be sure that tangs engage slots. If new mating ring (5) is dropped or scratched, replace it.

(g) Be sure that spur gear shaft protrudes approximately 1/16 inch after mating ring (5) is seated. If gear shaft does not protrude, or if mating ring (5) will not go over spur gear shaft, remove radial drive shaft cover assembly (para 5-30).

(h) Hold shaft extension (3, fig. 5-17) from turning while turning and pushing on mating ring (5, fig. 5-13).

(7) Replace mating ring (5) using seal mating ring puller LMT 747 (fig. F-1, Appendix F) and seal mating ring guide assembly LMT 748 (fig. F-2, Appendix F) as follows:

(a) Loop one piece of 12-inch safety wire, 0.032 inch diameter minimum, behind axis-G seal mating ring (fig. 5-15, view A), so that both ends extend out at the 9 o'clock position of the particle separator blower pad.

(b) Pull safety wire tight so ends are equal. Twist wire two-to-three times (view B).

(c) Repeat steps (a) and (b) for second piece of 12-inch safety wire. The two ends should exit from blower pad at the 3 o'clock position (view B).

(d) Place a 6-inch piece of bar stock, a 6-inch ratchet extension, or equivalent tooling horizontally across blower pad and twist safety wire around bar stock, extension, or equivalent tooling three or four times (view C).

CAUTION

To prevent seal mating ring from falling onto aircraft work platform when it is removed, a screwdriver or similar tool should be inserted into the axis-G spur gear.

(e) Insert screwdriver into axis-G spur gear shaft.

(f) Using bar stock, ratchet extension, or equivalent tooling as a handle, pull seal mating ring (5, fig. 5-13) from rear gearbox housing (18).

(g) Discard mating ring (5) and preformed packing (4) in bore of mating ring (5).

(h) Install new preformed packing (4) into groove in bore of new mating ring (5).

(i) Remove radial drive shaft cover assembly (para 5-30).

(j) With a second mechanic looking into the axis-G opening, turn drive shaft using 5/16-inch socket with extension and ratchet until the two slots on the axis-G spur gear are at the six and twelve o'clock positions.

(k) Inspect surface of seal mating ring (4, fig. 5-16) for burrs, scratches and foreign material. If defects are found, replace the ring (4).

(l) Install seal mating ring (4) onto large diameter of guide (2) (part of LMT 748) with tangs (3) of mating ring (4) at the six and 12 o'clock positions.

(m) Insert small end of guide (2) into bore of spur gear shaft (1) until guide (2) seats against shaft (1).

CAUTION

Failure to engage tangs on seal mating ring with slots in spur gear shaft will result in damage to the carbon seal.

(n) Using slide (5), gently push ring (4) onto spur gear shaft (1). If slide (5) lines up with scribed line (6) and spur gear shaft (1) protrudes ring (4) approximately 1/16 inch, ring (4) is seated. If slide covers scribed line, ring (4) is not seated; repeat steps (a) thru (f) and steps (j) thru (n).

(o) Remove guide assembly from axis-G.

(8) Install radial drive shaft cover assembly (para 5-32).

(9) Install new preformed packing (3, fig. 5-13) in groove in bore of rear housing (18).

CAUTION

- Do not touch carbon surface of carbon seal with your fingers. Skin oil will corrode carbon surface.
- The running surfaces of carbon seals are extremely brittle and can be easily damaged. Be careful when handling them.

(10) Carefully install new axis-G carbon seal (2) into bore of rear housing (18), alining antirotation lugs on seal with slots in gearbox.

(11) Install retaining ring (1).

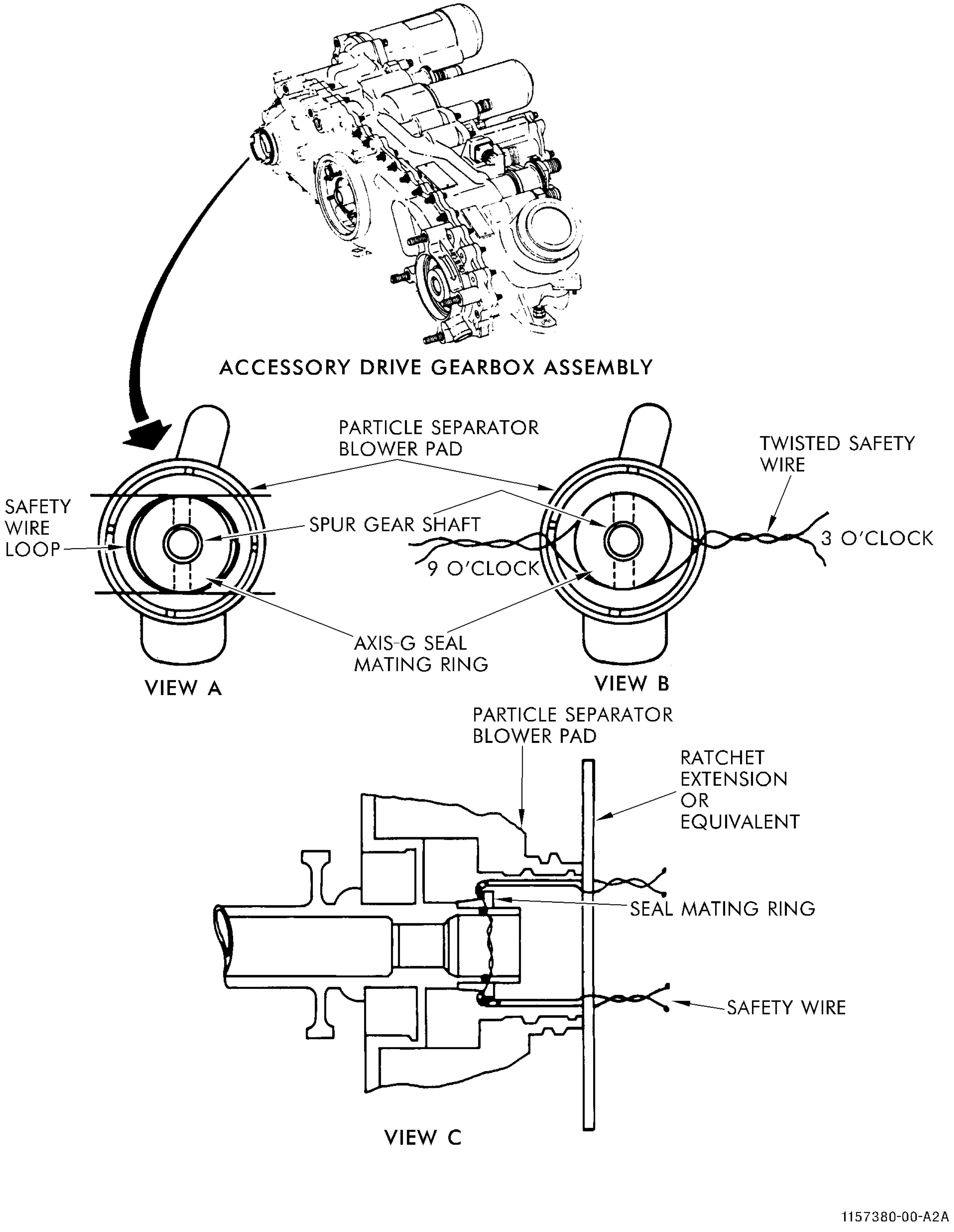
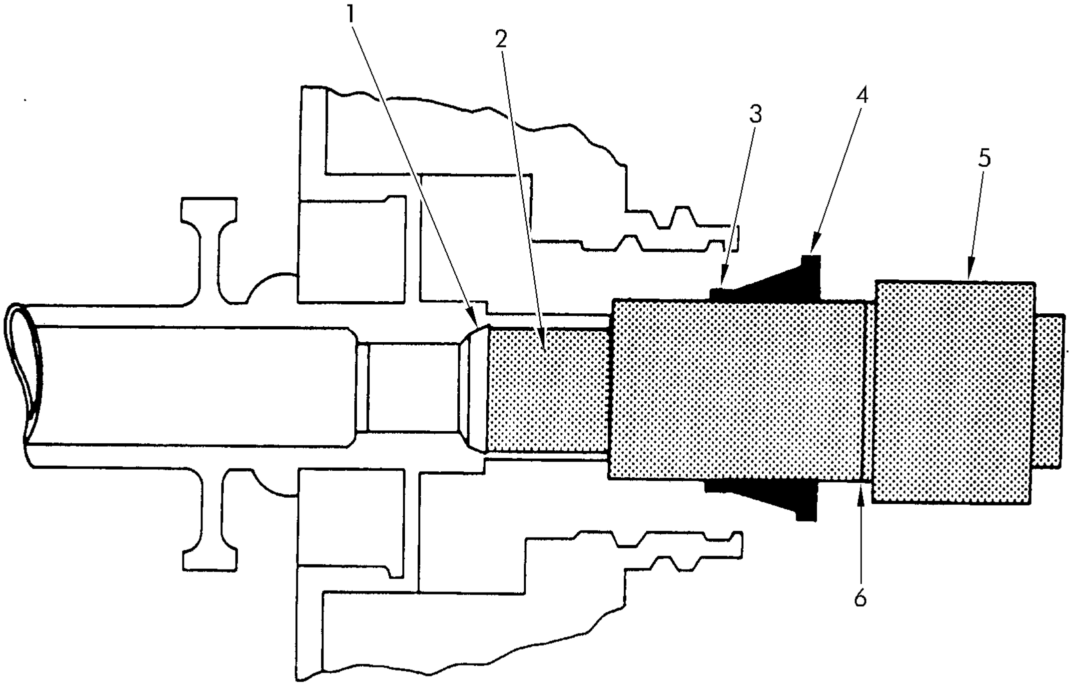


Figure 5-15. Seal Mating Ring Puller LMT 747



1. Spur Gear Shaft
2. Guide
3. Tang
4. Seal Mating Ring
5. Slide
6. Scribed Line

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Figure 5-16. Axis-G Seal Mating Ring Guide Assembly LMT 748

(12) Install particle separator inlet duct (para 5-22).

(13) Install particle separator blower and V-band coupling (para 5-14).

(14) Make required engine checks listed in table 1-39.

b. Replacement of Axis-E Carbon Seal.

(1) If HMU is installed, remove it (para 6-40).

(2) Remove three self-locking nuts (6, fig. 5-13) and three washers (7).

(3) Remove and discard axis-E carbon seal (8).

(4) Remove and discard preformed packing (9).

(5) Remove axis-E seal mating ring (11) as follows:

(a) Install seal mating ring puller 21C7702G01 (3, fig. 5-14) onto seal mating ring (4) so that jaws (2) engage mating ring (4).

(b) Squeeze handles of puller (3) to grasp mating ring (4) and pull mating ring (4) straight out.

(c) Discard mating ring (4) and preformed packing (1) in inner bore of mating ring (4).

(6) Install new packing (10, fig. 5-13) in new mating ring (11).

CAUTION

Failure to engage tangs on seal mating ring with mating slots in bore will result in damage to the carbon seal.

(7) Aline tangs on mating ring (11) with mating slots in bore, and slide mating ring (11) over shaft.

CAUTION

- Do not touch carbon surface of carbon seal with your fingers. Skin oil will corrode carbon surface.
- The running surfaces of carbon seals are extremely brittle and can be easily damaged. Be careful when handling them.

(8) Install new packing (9) onto new axis-E carbon seal (8).

(9) Carefully install carbon seal (8) into bore of rear housing (18).

(10) Install three washers (7) and three nuts (6). Torque nuts to 32-35 inch-pounds.

(11) Install HMU (para 6-44).

(12) Make required engine checks listed in table 1-39.

c. Replacement of Axis-B Carbon Seal.

(1) If starter is installed, remove it as directed in applicable aircraft maintenance manual.

(2) Remove three self-locking nuts (12, fig. 5-13) and three washers (13).

(3) Remove and discard axis-B carbon seal (14).

(4) Remove and discard preformed packing (15).

(5) Remove axis-B seal mating ring (17) as follows:

(a) Install seal mating ring puller 21C7702G01 (3, fig. 5-14) onto seal mating ring (4) so that jaws (2) engage mating ring (4).

(b) Squeeze handles of puller (3) to grasp mating ring (4) and pull mating ring (4) straight out.

(c) Discard mating ring (4) and preformed packing (1) in inner bore of mating ring (4).

(6) Install new packing (16, fig. 5-13) in new mating ring (17).

CAUTION

Failure to engage tangs on seal mating ring with mating slots in bore will result in damage to the carbon seal.

(7) Aline tangs on mating ring (17) with mating slots in bore, and slide mating ring (17) over shaft.

CAUTION

- Do not touch carbon surface of carbon seal with your fingers. Skin oil will corrode carbon surface.
- The running surfaces of carbon seals are extremely brittle and can be easily damaged. Be careful when handling them.

(8) Install new packing (15) onto new axis-B seal (14).

(9) Carefully install carbon seal (14) into bore of rear housing (18).

(10) Install three washers (13) and three nuts (12). Torque nuts to 32-35 inch-pounds.

(11) Install starter as directed in applicable aircraft maintenance manual.

(12) Make required engine checks listed in table 1-39.

5-29. RADIAL DRIVE SHAFT COVER ASSEMBLY.

5-30. Removal of Radial Drive Shaft Cover Assembly.

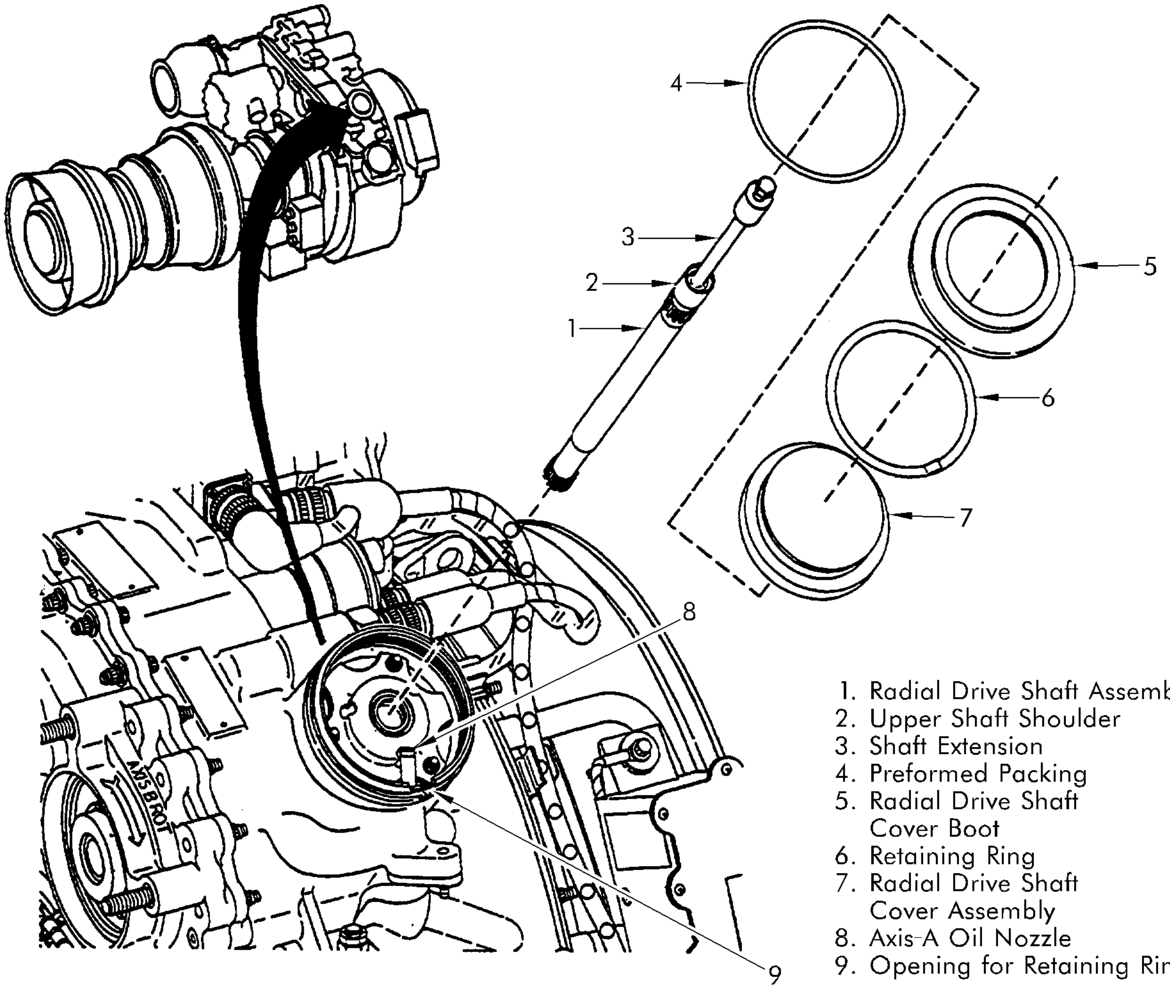
a. Stretch and lift off radial drive shaft cover boot (5, fig. 5-17).

b. Remove retaining ring (6).

CAUTION

When radial drive shaft cover assembly is removed, use extreme care to prevent damage to axis-A oil nozzle (8).

c. Remove radial drive shaft cover assembly (7).



1. Radial Drive Shaft Assembly
2. Upper Shaft Shoulder
3. Shaft Extension
4. Preformed Packing
5. Radial Drive Shaft Cover Boot
6. Retaining Ring
7. Radial Drive Shaft Cover Assembly
8. Axis-A Oil Nozzle
9. Opening for Retaining Ring

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Figure 5-17. Radial Drive Shaft Assembly, Cover Boot, and Cover Assembly; Removal, Inspection, and Installation

5-31. Inspection of Radial Drive Shaft Cover Assembly and Retaining Ring.

See table 5-5.

Table 5-5. Inspection of Radial Drive Shaft Cover Assembly and Retaining Ring

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Radial drive shaft cover assembly (7, fig. 5-17) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace cover assembly (para 5-32).
(2) Nicks and scratches on:			
(a) Sealing surfaces.	None allowed.	Not repairable.	Replace cover assembly (para 5-32).
(b) All other areas.	Any number with no high metal.	Same as usable limits with high metal.	Remove high metal.
(3) Dents.	Any number 1/8 inch deep that do not affect cover assembly.	Not repairable.	Replace cover assembly (para 5-32).
b. Retaining ring (6) for damage.	Not allowed.	Not repairable.	Replace retaining ring (para 5-32).

5-32. Installation of Radial Drive Shaft Cover Assembly.

CAUTION

When installing components, use extreme care to prevent damage to axis-A oil nozzle (8, fig. 5-17).

a. Replace packing (4), if damaged.

CAUTION

To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

b. Install radial drive shaft cover assembly (7) on port.

c. Secure cover assembly, using retaining ring (6). Aline tab on ring with opening (9) in bore.

d. Stretch and press radial drive shaft cover boot (5) all around edge of cover assembly.

e. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

5-33. RADIAL DRIVE SHAFT COVER BOOT.

5-34. Removal of Radial Drive Shaft Cover Boot. Radial drive shaft cover boot (5, fig. 5-17) can be pulled off manually by stretching and lifting it.

5-35. Inspection of Radial Drive Shaft Cover Boot. See table 5-6.

Table 5-6. Inspection of Radial Drive Shaft Cover Boot

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Radial drive shaft cover boot (5, fig. 5-17) for:			
a. Tears.	Minor tears allowed.	Not repairable.	Replace boot (para 5-36).
b. Crazing present when boot is stretched.	None allowed.	Not repairable.	Replace boot (para 5-36).

5-36. Installation of Radial Drive Shaft Cover Boot.

CAUTION

To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

a. Make sure radial drive shaft cover assembly (7, fig. 5-17) is installed (para 5-32).

b. Install boot (5) over cover assembly (7) and over retaining ring (6) by stretching and pressing boot all around edge of cover.

c. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

5-37. RADIAL DRIVE SHAFT ASSEMBLY.

5-38. Removal of Radial Drive Shaft Assembly.

a. Stretch and lift off radial drive shaft cover boot (5, fig. 5-17).

b. Remove retaining ring (6).

CAUTION

When removing components, use extreme care to prevent damage to axis-A oil nozzle (8).

c. Remove radial drive shaft cover assembly (7).

d. Remove radial drive shaft assembly (1).

5-39. Cleaning of Radial Drive Shaft Assembly.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash outside surface with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry radial drive shaft assembly using dry, filtered compressed air.

5-40. Inspection of Radial Drive Shaft Assembly. See table 5-7.

Table 5-7. Inspection of Radial Drive Shaft Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Splines on radial drive shaft assembly (1, fig. 5-17) for visible steps on teeth.	Not allowed.	Not repairable.	Replace radial drive shaft assembly (para 5-41).
b. Backlash between radial drive shaft assembly (1) and shaft extension (3).	Any amount if shaft assembly can be driven with wrench.	Not repairable.	Replace radial drive shaft assembly (para 5-41).
c. Upper shaft shoulder (2) for indentations caused by radial contact with spline teeth.	Any amount up to 0.100 inch long.	Not repairable.	Replace radial drive shaft assembly (para 5-41).

5-41. Installation of Radial Drive Shaft Assembly.

CAUTION

When installing components, use extreme care to prevent damage to axis-A oil nozzle (8, fig. 5-17).

a. Install radial drive shaft assembly (1).

b. Replace packing (4), if damaged.

CAUTION

To prevent any oil loss and any possible in-flight shutdown, be sure Axis-A cover is properly reinstalled.

c. Install radial drive shaft cover assembly (7) on port.

d. Secure cover assembly, using retaining ring (6). Aline tab on ring with opening (9) in bore.

e. Stretch and press radial drive shaft cover boot (5) all around edge of cover assembly.

f. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

5-42. REPLACEMENT OF AXIS-A LUBE NOZZLE.

5-43. Removal of Axis-A Lube Nozzle. Remove axis-A lube nozzle (4, fig. 5-18) as follows:

a. Remove locknut (3) and washer (2) that secure axis-A lube nozzle (4) to front gearbox housing (1).

b. Pull nozzle (4) out of front housing (1).

c. Remove and discard preformed packings (5, 6) from nozzle (4).

5-44. Installation of Axis-A Lube Nozzle. Install axis-A lube nozzle (4, fig. 5-18) as follows:

a. Install two preformed packings (5, 6) onto axis-A lube nozzle (4).

b. Install nozzle (4) into front gearbox housing (1). Using washer (2) and locknut (3), secure nozzle (4).

c. Torque locknut (3) to 32-35 inch-pounds.

5-45. REPLACEMENT OF FUEL CONNECTOR.

5-46. Removal of Fuel Connector. Remove fuel connector (9, fig. 5-18) as follows:

a. Remove locknut (7) and fuel connector retainer (8) from HMU pad in front gearbox housing (1).

b. Remove fuel connector (9).

c. Remove and discard preformed packing (10).

5-47. Cleaning of Fuel Connector.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

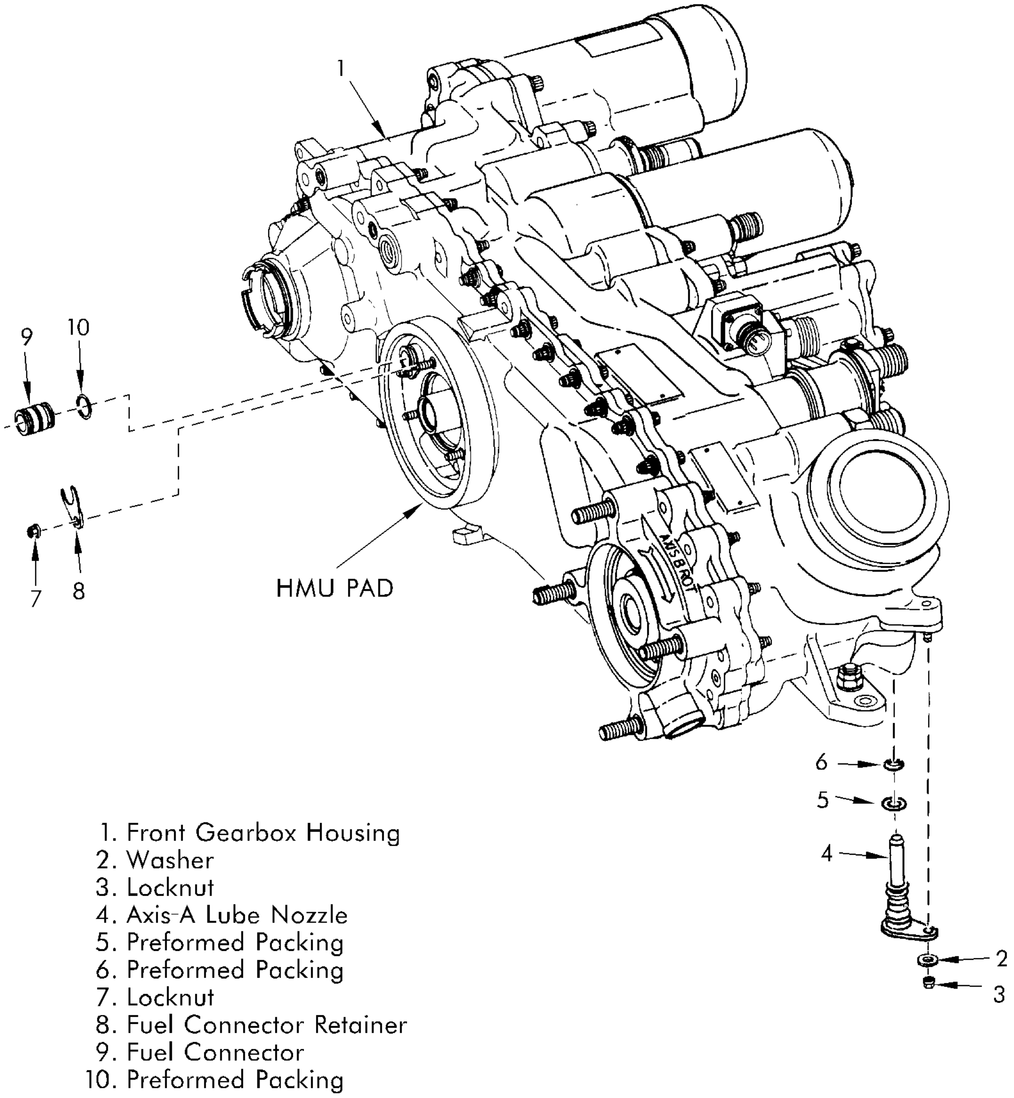
a. Flush or spray wash fuel connector (9, fig. 5-18) with dry cleaning solvent (item 99, Appendix D) to remove grease, oil and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Using dry, filtered compressed air, dry fuel connector.



1. Front Gearbox Housing
2. Washer
3. Locknut
4. Axis-A Lube Nozzle
5. Preformed Packing
6. Preformed Packing
7. Locknut
8. Fuel Connector Retainer
9. Fuel Connector
10. Preformed Packing

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Figure 5-18. Axis-A Lube Nozzle; Replacement

5-48. Inspection of Fuel Connector. See table 5-8.

Table 5-8. Inspection of Fuel Connector

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
WARNING			
Flight Safety Critical Aircraft Part (Critical Characteristic(s))			
Leaks in fuel system components are critical characteristics. No fuel leaks allowed.			
a. Fuel connector (fig. 5-19) for:			
(1) Splits and cracks.	Not allowed.	Not repairable.	Replace fuel connector.
(2) Nicks, gouges, and scratches except in packing groove (3).	None allowed.	Not repairable.	Replace fuel connector.
(3) Dents or flattening.	None allowed.	Not repairable.	Replace fuel connector.
b. Packing grooves for:			
(1) Nicks and scratches on bottom.	Any number, 0.003 inch deep, without high metal.	Not repairable.	Replace fuel connector.
(2) Nicks and scratches on side.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace fuel connector.

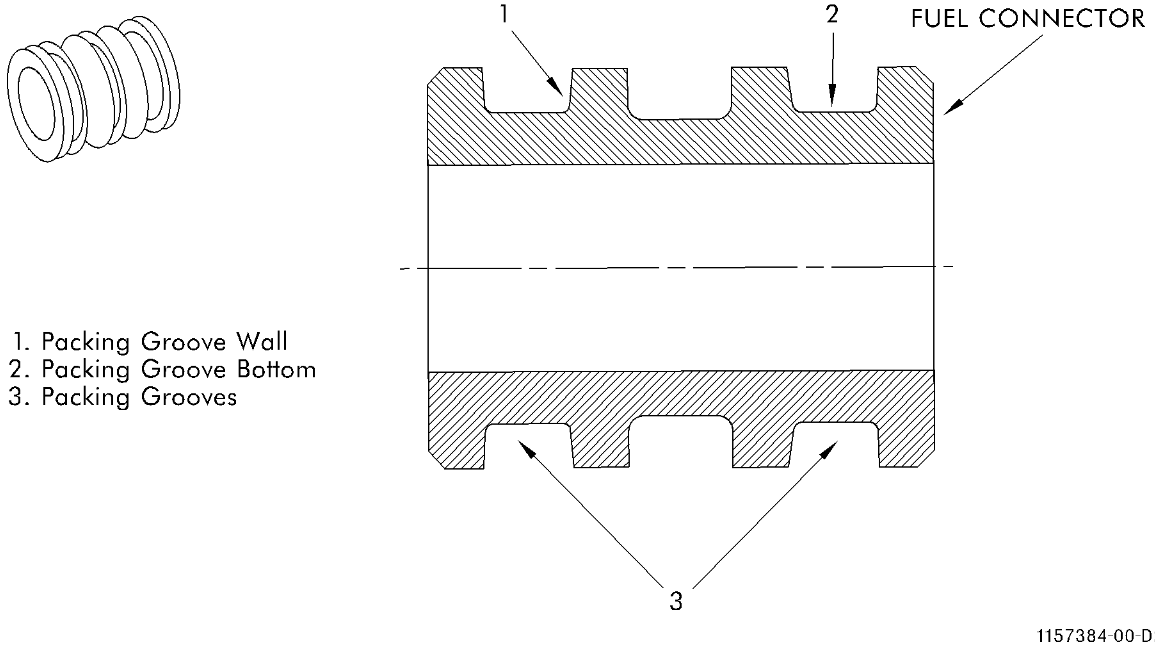


Figure 5-19. Fuel Connector, Inspection

5-49. Installation of Fuel Connector.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

a. Install preformed packing (10, fig. 5-18) onto fuel connector (9).

b. Install fuel connector (9) into HMU pad.

c. Install fuel connector retainer (8) and locknut (7). Torque nut to 32-35 lb in.

5-50. PREPARING ACCESSORY SECTION MODULE FOR STORAGE OR SHIPMENT.

5-51. Accessory Section Module Shipping and Storage Container 21C7301G01.

a. Preliminary Instructions. Use a forklift when moving the accessory section module shipping and storage container. The entire container, with or without the module, must not be moved by pushing or pulling.

b. Dimensions and Weights of Accessory Section Module Shipping and Storage Container 21C7301G01.

Length	44 inches
Width	42 inches
Height	29 inches
Weight (with module)	405 pounds
Weight (empty)	334 pounds
Cubic Displacement	33 cubic feet

5-52. Installation of Accessory Section Module into Accessory Section Module Shipping and Storage Container 21C7301G01.

a. Remove container cover (3, fig. 5-20) as follows:

WARNING

Removing Shipping Container Cover

To prevent personal injury, do not loosen nuts and bolts that secure cover until shipping container has been depressurized.

(1) Depressurize container by pressing center of air filler valve (12) until air can no longer be heard escaping from container; then remove core of air filler valve.

(2) After pressure has been released, reinstall core of air filler valve.

(3) Remove eight nuts (4) and eight bolts (5) from container flanges.

(4) Attach lifting cable (1) to lifting eyes (2) on cover (3).

WARNING

Hoisting Upper Section
of Shipping Container

- Do not stand under upper section of container while it is suspended from a hoist or while it is being moved from one area to another on a hoist.
- Hoisting of container shall only be performed by designated personnel.
- The load capacity rating shall be clearly marked on hoist. Do not exceed load rating.
- Inspection and testing for cracks or defects in hoist system shall be performed on a regular basis.
- Before lifting, alert personnel in immediate area.

(5) Attach hoist to cable (1). Raise cover (3) and place it on the floor.

b. Install accessory section module into accessory section module shipping and storage container 21C7301G01 as follows:

(1) Remove four bolts (3, fig. 5-21) and four nuts (6) that secure accessory module frame (4) to container support (7).

(2) Lift frame (4) from support (7) and place frame on bench, channel side up.

(3) Remove bolts (8, 10, 11), washers (2, 14), and self-locking nuts (1, 15) from frame (4) and plate (12).

(4) Raise gearbox to provide access to axis-A surface. Position plate (12) so that guide pin (13) engages guide pin hole (16) on axis-A surface on gearbox. Secure plate (12) to axis-A surface; snug plate using bolt (11), washer (14), and nut (15).

(5) Insert bolt (8) through opening on frame (4) into channel (5).

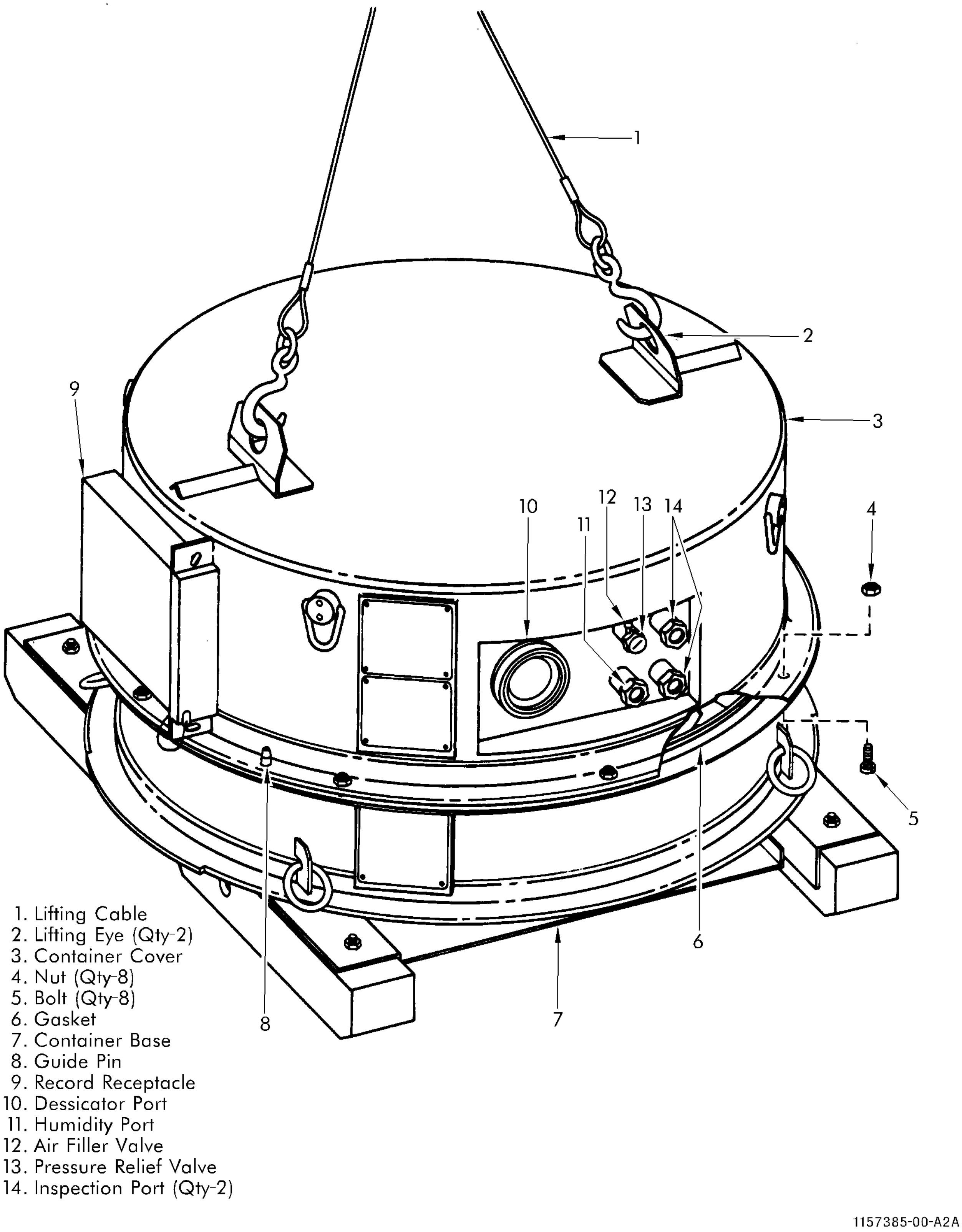
CAUTION

To prevent damage to engine mount lug holes, be sure that plate (12) has been installed between axis-A surface on gearbox and frame (4) before torquing bolts (8) and (10).

(6) With another mechanic helping, carefully lower module onto frame (4), alining channels (5, 9) with mounting holes on gearbox. Secure module onto frame using two bolts (10), bolt (8), (all bolts installed head-down), three washers (2), and three nuts (1). Torque bolts (8, 10, 11) to 120-130 inch-pounds.

(7) Alining holes on frame (4) with those on container support (7), carefully lower frame, with accessory section module attached, onto support. Secure frame to support using four bolts (3) and four nuts (6). Torque bolts to 160-170 inch-pounds.

(8) Place T2 sensor that is attached to HMU, into plastic bag (item 7, Appendix D); then secure T2 sensor onto frame (4) using pressure-sensitive adhesive tape (item 107, Appendix D).



1. Lifting Cable
2. Lifting Eye (Qty-2)
3. Container Cover
4. Nut (Qty-8)
5. Bolt (Qty-8)
6. Gasket
7. Container Base
8. Guide Pin
9. Record Receptacle
10. Dessicator Port
11. Humidity Port
12. Air Filler Valve
13. Pressure Relief Valve
14. Inspection Port (Qty-2)

Figure 5-20. Accessory Section Module Shipping and Storage Container 21C7301G01; Removal and Installation of Cover

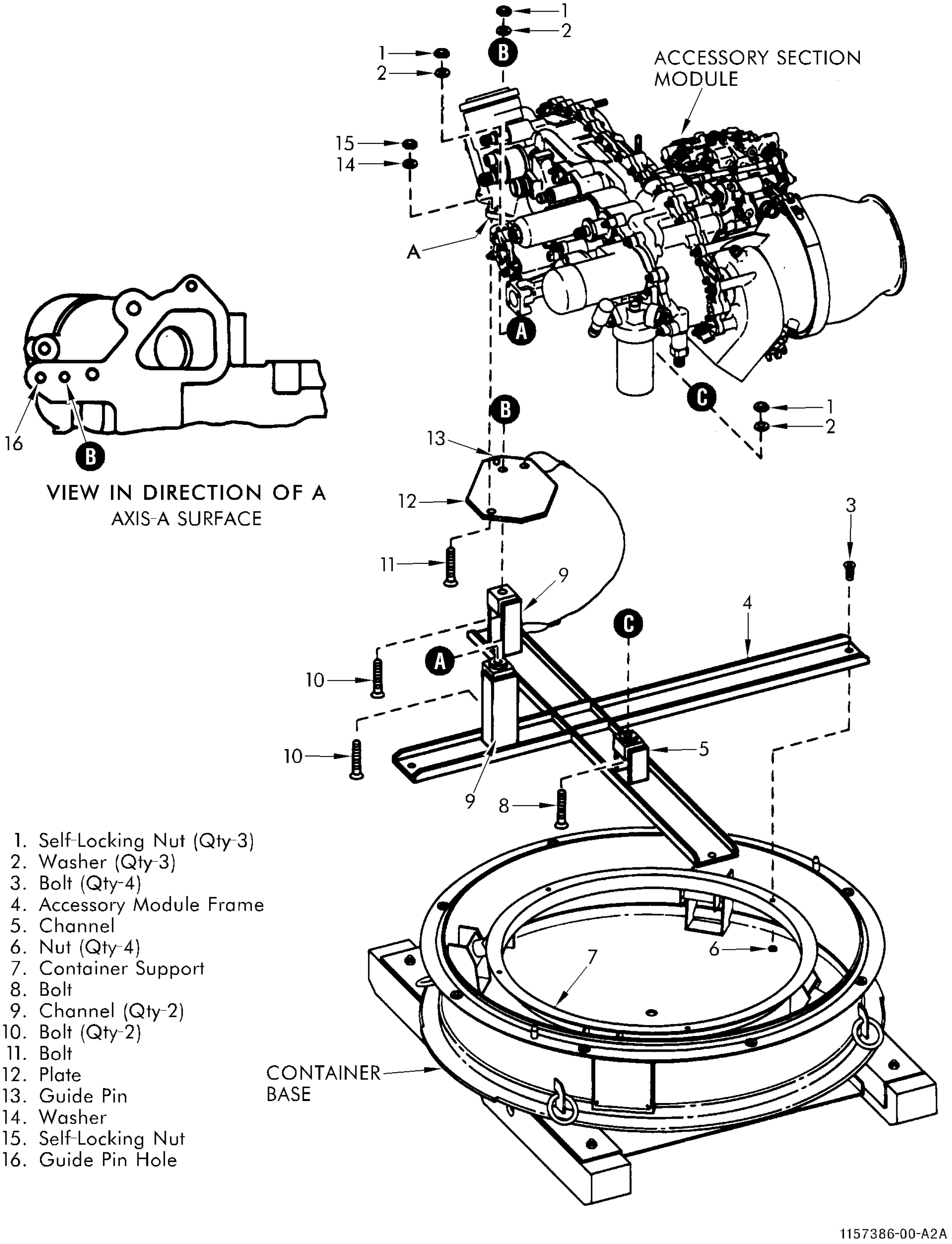


Figure 5-21. Accessory Section Module Shipping and Storage Container 21C7301G01; Removal and Installation of Module

c. Install container cover (3, fig. 5-20) as follows:

WARNING

Hoisting Upper Section
of Shipping Container

- Do not stand under upper section of container while it is suspended from a hoist or while it is being moved from one area to another on a hoist.
- Hoisting of container shall only be performed by designated personnel.
- The load capacity rating shall be clearly marked on hoist. Do not exceed load rating.
- Inspection and testing for cracks or defects in hoist system shall be performed on a regular basis.
- Before lifting, alert personnel in immediate area.

(1) Attach lifting cable (1) to lifting eyes (2).

(2) Attach hoist to cable (1) and raise cover (3) to a position directly over container base (7).

(3) Wipe gasket (6) and mating flanges of container halves with clean cloth to remove any dirt or particles which could prevent pressure-sealing.

(4) Inspect gasket (6) for nicks, cuts, and gouges. If gasket is damaged, replace it.

(5) Alining holes in flange of cover (3) with guide pins (8) on flange of base (7), carefully lower cover onto base.

(6) Secure container halves using eight bolts (5), installed head down, and eight nuts (4). Torque bolts (5) to 75-85 foot-pounds.

(7) Release and remove hoist; remove cable (1) from lifting eyes (2).

d. Add desiccant to container as follows:

(1) Remove cover of desiccator port (10) by hand.

(2) Remove old desiccant.

(3) Place 17 units of desiccant (item 70, Appendix D) in basket.

(4) Install cover of port (10) by seating tabs on port cover into slots in port; then turn cover clockwise, by hand, one-quarter turn.

e. If humidity indicator card, located in humidity port (13), is lavender or pink-colored, replace it as follows:

(1) Remove hex insert of humidity port (11) with an open-end wrench.

(2) Remove retaining clip and card.

(3) Install new card and retaining clip.

(4) Reinstall and hand-tighten hex insert. Be sure that printed sections (i.e. 30, 40, 50) can be read from outside of container.

f. Apply 5 psig of air pressure to air filler valve (12) using a source of dry, filtered, compressed air.

g. Using Leak Test Oxygen System Solution (item 98, Appendix D), inspect container for leaks at the following locations:

- Between container cover (3) and container base (7)
- At desiccator port (10)
- At air filler valve (12)
- At humidity port (11)
- At pressure relief valve (13)
- At inspection port (14)

h. If a leak is seen between cover (3) and base (7), check torque (75-85 foot-pounds) on bolts (5); then repeat leak check. If a leak is still seen, depressurize container (steps a(1) and a(2)), replace gasket (6), and pressurize container (step f). Repeat leak check.

i. If a leak is seen at other inspection locations (step g), depressurize container (steps a(1) and a(2)), replace defective part, and pressurize container (step f). Repeat leak check.

j. Store accessory section module records in record receptacle (9).

k. Check relative humidity in accessory section module shipping and storage container (step e) not later than 30 days after installation of module into container or as prescribed by the Unit Commander.

(1) If relative humidity is less than 40%, but greater than 30%, record inspection in module records, but change inspection interval to one week.

(2) If relative humidity is 40%, but less than 50%, record inspection in module records, depressurize container (steps a(1) and a(2)), replace desiccant (step d), and pressurize container (step f).

(3) Check container for leaks (steps g, h, and i).

(4) If relative humidity is 50% or higher, do the following:

(a) Remove container cover (para 5-52, step a).

(b) Carefully inspect module for signs of corrosion.

(c) If there are no signs of corrosion, change desiccant (step d), replace humidity indicator card (step e), reinstall container cover (step c), and pressurize container (step f).

(d) If there are signs of corrosion, change desiccant (step d), reinstall container cover (step c), and send module to Depot for detailed inspection and repair.

5-53. PLACING ACCESSORY SECTION MODULE IN SERVICE.

5-54. Removal of Accessory Section Module from Accessory Section Module Shipping and Storage Container 21C7301G01.

a. Remove container cover (para 5-52, step a).

b. Remove accessory section module from container as follows:

(1) Remove pressure-sensitive adhesive tape and plastic bag that secure T2 sensor to accessory module frame (4, fig. 5-21).

(2) Remove four bolts (3) and four nuts (6) that secure frame (4) to container support (7).

(3) With another mechanic helping, lift frame (4), with module attached, and place it on bench.

(4) With another mechanic supporting module, remove two bolts (10), bolt (8), bolt (11), three washers (2), washer (14), three self-locking nuts (1), and self-locking nut (15). Remove accessory section module from frame and place it on bench.

(5) Reinstall two bolts (10), bolt (8), three washers (2), and three nuts (1) onto frame (4); reinstall bolt (11), washer (14), and nut (15) onto plate (12).

(6) Alining holes on frame (4) with those on support (7), reinstall frame onto support using four bolts (3) and four nuts (6).

(7) Install container cover (para 5-52, step c).

5-55. Preparing Accessory Section Module for Use.

a. Remove module records from record receptacle (9, fig. 5-20). Be sure that all records and forms are complete.

b. Inspect overall condition of module.

c. Install module onto engine (para 5-8).

CHAPTER 6

FUEL SYSTEM

6-1. CHAPTER OVERVIEW.

This chapter contains instructions for servicing, removing, cleaning, inspecting, repairing, testing, and installing components of the fuel system to the extent allowed by the Maintenance Allocation Chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-701, T700-GE-701C and T700-GE-701D	**(T701, T701C, T701D)**

6-2. CHAPTER INDEX.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

Maintenance procedures in this chapter are arranged as follows:

Subject	Paragraph
Preliminary Instructions	6-3
(T700) Primer Nozzles	6-4
Main Fuel Manifold	6-9
(T700) Fuel Start Feed Tube	6-17
Fuel Injector Assemblies	6-23
(T700) Fuel Start Manifold Tube	6-27
Fuel Boost Pump	6-33
Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling	6-39
Fuel Filter	6-45
Fuel Filter Element and Bowl	6-51
Gearbox-To-HMU Hose Assembly	6-56
Fuel Pressure Sensor	6-62
(T701, T701C, T701D) Overspeed and Drain Valve (ODV) Manifold Assembly	6-66
(T701, T701C, T701D) Overspeed and Drain Valve (ODV)	6-74
(T700) Pressurizing and Overspeed Unit (POU) Manifold Assembly	6-79
(T700) Pressurizing and Overspeed Unit (POU)	6-87

6-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

WARNING

Aviation Turbine Fuel (Jet Fuel)

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Contact of skin with liquid can irritate skin. Contact of eyes with liquid can cause severe irritation and blurred vision. Inhalation of vapor can cause irritation, headache, nausea, and dizziness.
- If liquid contacts eyes, flush them thoroughly with water. Immediately remove fuel-saturated clothing. If vapors cause dizziness, go to fresh air. If liquid is swallowed, do not try to vomit; get medical attention.
- When handling large quantities of liquid (more than one gallon) at an unexhausted workbench, wear approved respirator and goggles or face shield.
- Dispose of liquid-soaked rags in approved metal container.
- Metal containers of fuel must be grounded to maintain electrical continuity.

a. When removing or disconnecting fuel system components, avoid contact with jet fuel.

b. When removing or installing parts, prevent entry of foreign objects into fuel passages, and avoid damaging electrical connectors.

c. Do not use tape to cover fuel passages or openings. Use clean, dry, protective caps to cover electrical connectors and other openings.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

d. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

e. Inspect replacement parts for serviceability before installation.

f. Always use a backup wrench on fittings when removing or installing hoses or tubes.

g. When connecting hoses or tubes, see wrench- arc tightening method (H-14, Appendix H).

h. Before connecting electrical connectors, refer to paragraph H-7, Appendix H for proper procedure.

i. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

6-4. (T700) PRIMER NOZZLES.

6-5. (T700) Removal of Primer Nozzles.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

NOTE

Primer nozzles are located at 4 and 8 o'clock positions on midframe. The removal and installation procedures that follow can be used for both primer nozzles.

a. Disconnect fuel start manifold tube (4, fig. 6-1) from primer nozzle (2).

b. Remove retaining nut (3).

c. Remove primer nozzle (2).

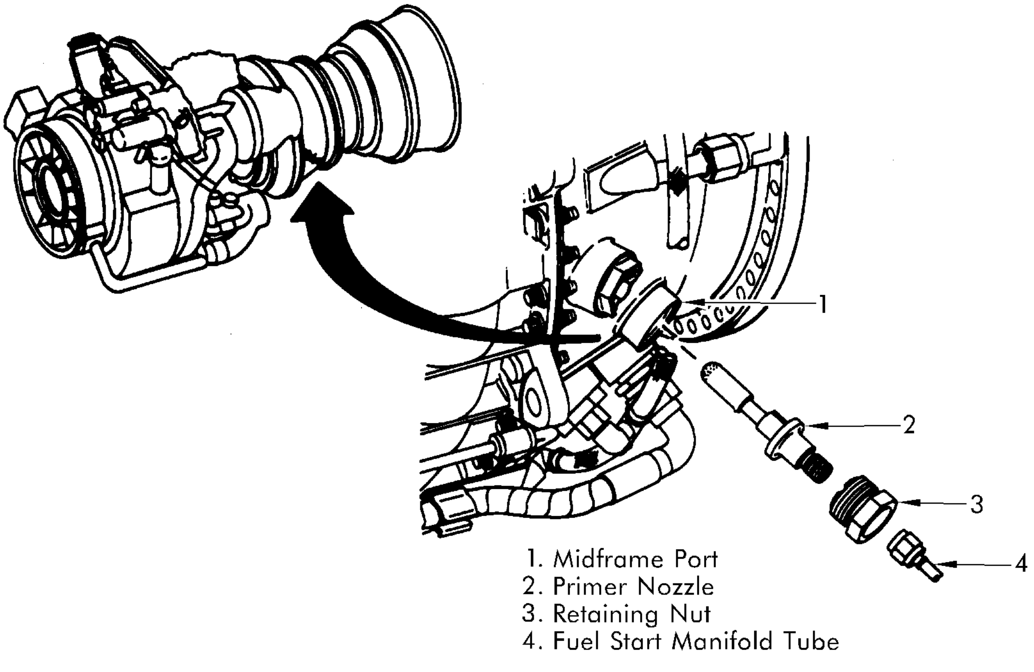


Figure 6-1. *(T700)* ***Primer Nozzle; Removal and Installation***

6-6. (T700) Inspection of Primer Nozzles. See table 6-1.

Table 6-1. *(T700)* **Inspection of Primer Nozzles**

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Primer nozzle tip (4, fig. 6-2) for carbon.	Any amount not clogging orifice. (Use test procedure in paragraph 6-7.)	Not repairable.	Replace nozzle (para 6-8).
b. Inlet fitting (2) for missing or damaged threads.	Two threads total, missing or damaged, without high metal, if threads can be used without cross-threading.	Two threads total, missing or damaged, that can be blended to usable limits.	AVUM: Replace nozzle (para 6-8). AVIM: Chase threads.
c. Retaining nut (1) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace retaining nut (para 6-8).
(2) Missing or damaged threads.	One thread total, missing or damaged, without high metal, if threads can be used without cross-threading.	Not repairable.	Replace retaining nut (para 6-8).
(3) Wrench damage on each corner of hex flats.	Any amount, without high metal, if wrench won't slip on nut.	Not repairable.	Replace retaining nut (para 6-8).
(4) Distortion.	Any amount if wrench will fit on nut.	Not repairable.	Replace retaining nut (para 6-8).
(5) Discoloration.	Any amount.	Not applicable.	Not applicable.
(6) Nicks and scratches, except on threads.	Any number, 1/64 inch deep, without high metal.	Not repairable.	Replace retaining nut (para 6-8).

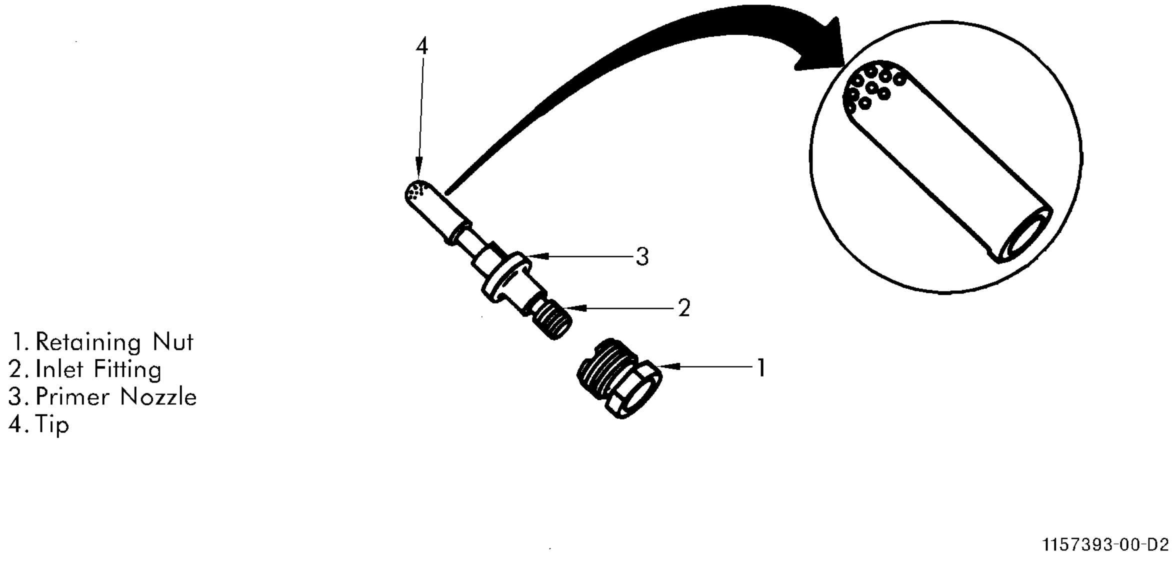


*Figure 6-2. **(T700)** Primer Nozzle; Inspection*

6-7. (T700) Testing of Primer Nozzles.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

Blow filtered, compressed air through primer nozzle. Hold nozzle tip in water, and look for stream of air bubbles coming from orifices. The nozzle is clogged if there is no bubbling. Replace nozzle if clogged.

6-8. (T700) Installation of Primer Nozzles.

a. Insert primer nozzle (2, fig. 6-1) into midframe port (1), and engage key of nozzle (2) into slot of midframe port (1).

b. Holding primer nozzle (2) in place, install retaining nut (3). Torque to 140-150 inch-pounds.

c. Connect fuel start manifold tube (4).

d. If either fuel start manifold tube (4) or primer nozzle (2) is new, tighten coupling nut as follows:

(1) Using open end wrench, seat nut snugly.

(2) Tighten (120° wrench arc) nut.

(3) Loosen nut and reseat it snugly.

(4) Tighten (60° wrench arc) nut.

(5) Repeat steps (3) and (4).

e. If manifold tube (4) and primer nozzles (2) are used, tighten (60° wrench arc) coupling nut.

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-9. MAIN FUEL MANIFOLD.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

6-10. Cleaning of Main Fuel Manifold.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) and remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the main fuel manifold using filtered, compressed air.

6-11. Inspection of Main Fuel Manifold.

See paragraph H-24, Appendix H.

6-12. Removal of Main Fuel Manifold.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

WARNING

Asbestos

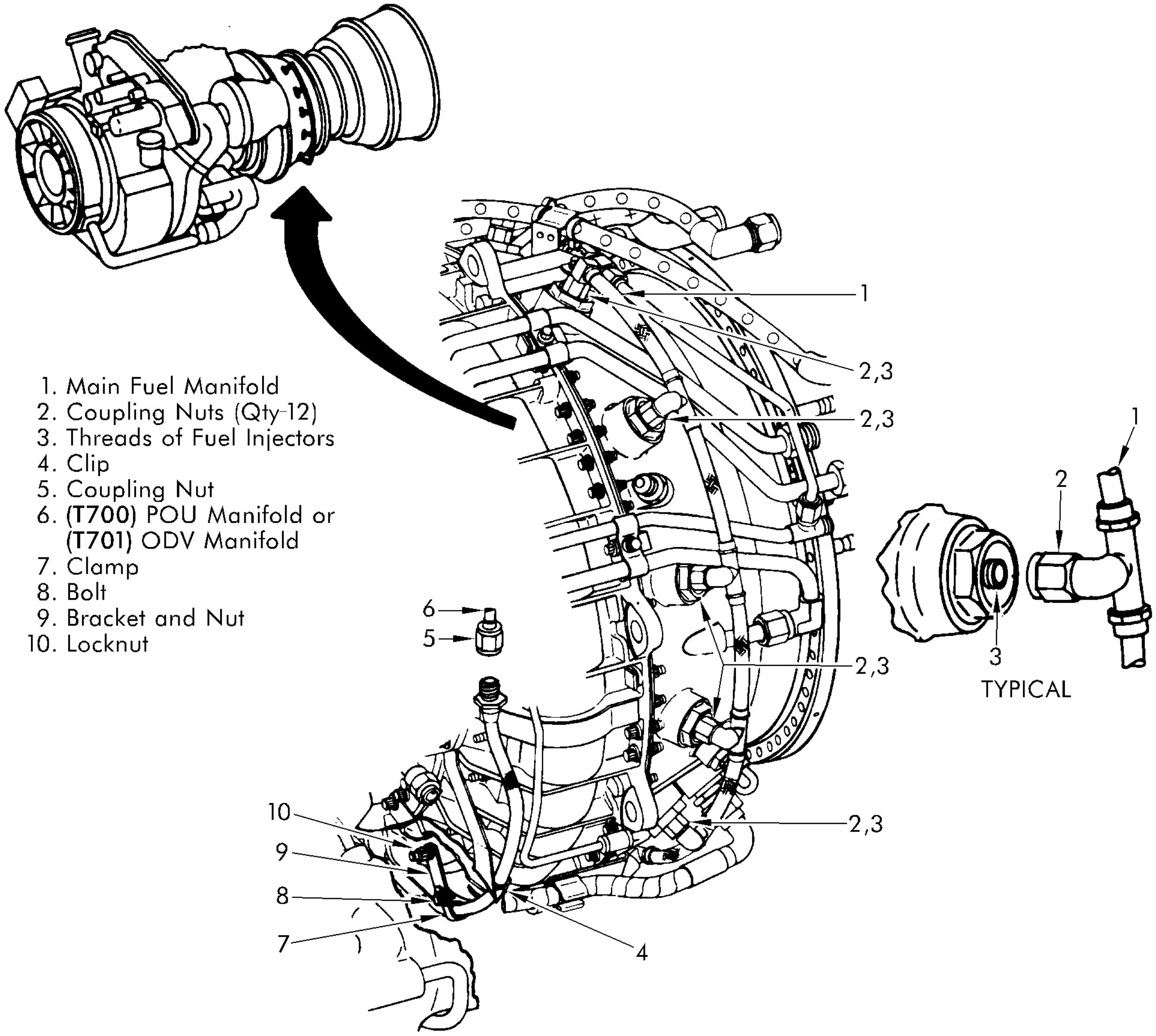
The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

a. Remove bolt (8, fig. 6-3) and clamp (PN 299C486P4/P9 only) (7) from bracket and nut (9). Remove clamp from main fuel manifold (1).

b. **(T700)** Loosen coupling nut (5) on POU manifold (6). Disconnect fuel manifold (1) from POU manifold (6).

c. **(T701, T701C, T701D)** Loosen coupling nut (5) on ODV manifold (6). Disconnect fuel manifold (1) from ODV manifold (6).

d. Remove fuel manifold (1) from clip (4).



1. Main Fuel Manifold
2. Coupling Nuts (Qty-12)
3. Threads of Fuel Injectors
4. Clip
5. Coupling Nut
6. **(T700)** POU Manifold or **(T701)** ODV Manifold
7. Clamp
8. Bolt
9. Bracket and Nut
10. Locknut

Figure 6-3. Main Fuel Manifold; Removal and Installation

CAUTION

- Do not completely disconnect coupling nuts on main fuel manifold from each fuel injector without loosening the adjacent coupling nut. Otherwise, damage to coupling nuts or fuel injector threads will result.
- Be very careful not to damage adjacent tubes and hoses when backing off coupling nuts.

e. Loosen 12 coupling nuts (2) one-half turn each.

f. Starting at one end of fuel manifold (near 12 o'clock position), back off 12 coupling nuts three turns. Use fingers or wrench (turning gently).

g. Disconnect 12 coupling nuts, starting at one end of fuel manifold.

h. Cover all openings with clean, dry protective caps (items 18, 35, Appendix D) to keep out foreign materials.

6-13. Cleaning of Main Fuel Manifold (AVIM). See paragraph H-23, Appendix H.

6-14. Inspection of Main Fuel Manifold (AVIM). See paragraph H-24, Appendix H.

6-15. Testing of Main Fuel Manifold (AVIM). See paragraph H-25, Appendix H.

6-16. Installation of Main Fuel Manifold (AVIM).

a. Position main fuel manifold (1, fig. 6-3) on engine.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

b. Lubricate threads (3) on 12 fuel injectors with lubricating oil (item 85 or 87, Appendix D).

CAUTION

Do not completely connect coupling nuts on main fuel manifold to each fuel injector without partially connecting the adjacent coupling nut. Otherwise, damage to coupling nuts or to fuel injector threads will result.

c. Starting at 6 o'clock position, start 12 coupling nuts (2) onto threads of fuel injectors (3), using fingers. Screw on each coupling nut about three turns, working up from 6 o'clock position on each side of engine. If turns cannot be made, remove fuel manifold and inspect coupling nuts and fuel injectors for dirt or damaged threads.

d. Return to 6 o'clock position and completely screw on each coupling nut using fingers or wrench (turning gently) until each coupling nut is seated.

e. Tighten (60° wrench-arc) coupling nuts (2).

f. **(T700)** Connect fuel manifold (1) to POU manifold (6).

g. **(T701, T701C, T701D)** Connect fuel manifold (1) to ODV manifold (6).

h. If either manifold (6) or fuel manifold (1) is new, tighten nut (5) as follows:

(1) Using open end wrench, seat nut (5) snugly.

(2) Tighten (120° wrench-arc) nut (5).

(3) Loosen nut (5) and reseat it snugly.

(4) Tighten (60° wrench-arc) nut (5).

(5) Repeat steps (3) and (4).

i. If both manifold (6) and fuel manifold (1) are used, tighten (60° wrench-arc) nut (5).

j. Install fuel manifold into clip (4).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

k. Install clamp (7) onto main fuel manifold (1).

l. Aline clamp with bracket and nut (9). Install bolt (8).

m. Loosen locknut (10) that secures bracket and nut (9) to diffuser case.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

n. Position clamp (7) and bracket and nut (9) to be sure fuel manifold (1) does not rub on diffuser case or on other hardware.

o. Torque locknut (10) to 70-75 inch-pounds, and torque bolt (8) to 45-50 inch-pounds.

p. Make required engine checks listed in table 1-39.

6-17. (T700) FUEL START FEED TUBE.

6-18. (T700) Removal of Fuel Start Feed Tube.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Disconnect coupling nut (1, fig. 6-4) from POU manifold assembly.

b. Disconnect coupling nut (8) from fuel start manifold tube (5).

c. Remove bolt (6).

d. Remove fuel start feed tube (11).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

e. If fuel start feed tube (11) is being replaced, remove clamp (PN 299C486P2 only) (10) and put it on the replacement tube in the same position.

6-19. (T700) Cleaning of Fuel Start Feed Tube. See paragraph H-23, Appendix H.

6-20. (T700) Inspection of Fuel Start Feed Tube. See paragraph H-24, Appendix H.

6-21. (T700) Testing of Fuel Start Feed Tube (AVIM). See paragraph H-25, Appendix H.

6-22. (T700) Installation of Fuel Start Feed Tube.

a. Place fuel start feed tube (11, fig. 6-4) under ignition lead (12) as shown.

b. Connect coupling nut (1) to POU manifold assembly. Hand-tighten coupling nut (1).

c. Connect coupling nut (8) to fuel start manifold tube (5). Hand-tighten coupling nut (8).

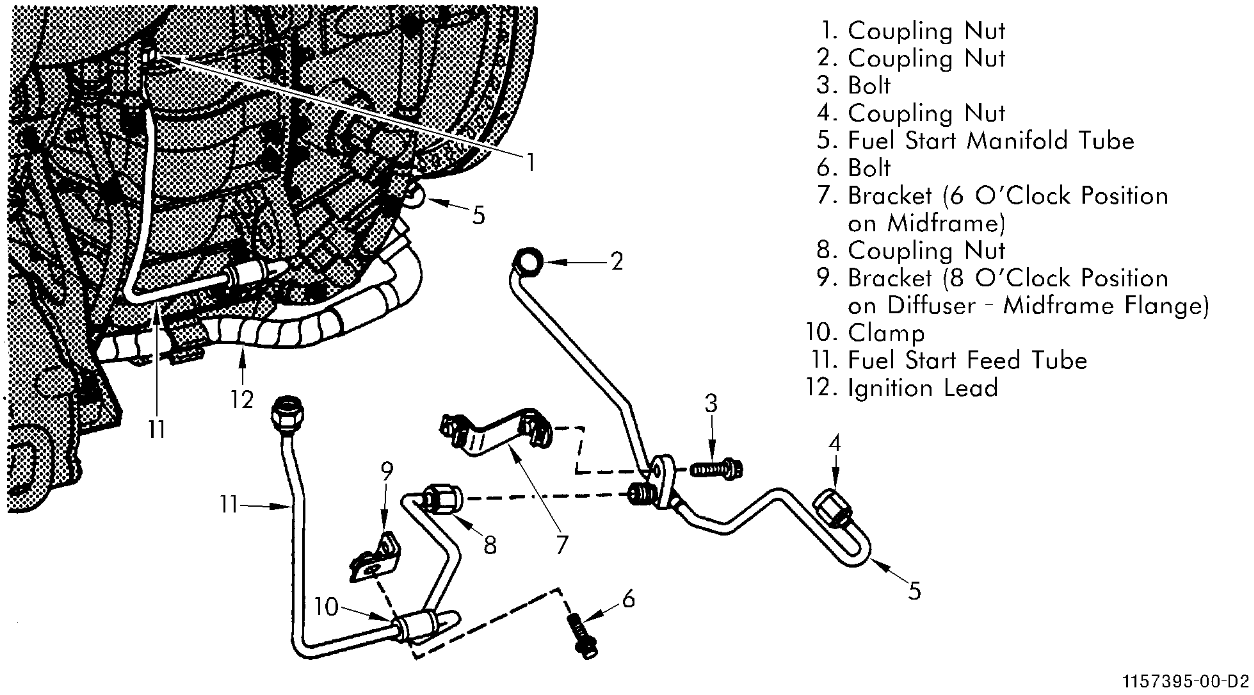


Figure 6-4. (T700) Fuel Start Feed and Fuel Start Manifold Tubes; Removal and Installation

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

d. Position clamp (10) and attach it to bracket (9) with bolt (6). Hand-tighten bolt (6).

e. If either feed tube (11), POU manifold assembly, or manifold tube (5) is new, tighten appropriate coupling nut (1, 8) as follows:

(1) Using open end wcrench, seat nut(s) (1, 8) snug.

(2) Tighten (120° wrench-arc) nut(s) (1, 8).

(3) Loosen nut(s) (1, 8) and reseat snug.

(4) Tighten (60° wrench-arc) nut(s) (1, 8).

(5) Repeat steps (3) and (4).

f. If feed tube (11), POU manifold assembly, and manifold tube (5) are used, tighten (60° wrench- arc) nut(s) (1, 8).

g. Torque bolt (6) to 45-50 inch-pounds.

h. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-23. FUEL INJECTOR ASSEMBLIES.

6-24. Removal of Fuel Injector Assemblies.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

CAUTION

- Do not completely disconnect coupling nuts on main fuel manifold from each fuel injector without loosening the adjacent coupling nut. Otherwise, damage to coupling nuts or fuel injector threads will result.
- Be very careful not to damage adjacent tubes and hoses when backing off coupling nuts.

a. Disconnect main fuel manifold (1, fig. 6-3) from 12 fuel injectors as follows:

WARNING

Abusive Force/Torque on Fuel Injector

- Do not use abusive force/torque when removing a fuel injector.
- Do not hammer wrench-end to shock nut.
- Do not exceed 175 foot-pounds loosening torque.
- Abusive force/torque may result in a broken or damaged midframe.

WARNING

Penetrating Oil

- Do not use near open flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

NOTE

Application of penetrating oil to area around fuel injector boss may help to loosen nut, if required.

(1) Loosen 12 coupling nuts (2) one-half turn each. If loosening of nuts is difficult, apply penetrating oil to area around injector boss, let soak for 10 minutes or until nuts are free to turn.

(2) Starting at one end of fuel manifold (1) (near 12 o'clock position), back off 12 coupling nuts (2) three turns. Use fingers or wrench (turning gently).

(3) Disconnect 12 coupling nuts (2) starting at one end of fuel manifold (1).

b. **(T700)** Loosen coupling nut (5) on POU manifold (6). Disconnect fuel manifold (1) from POU manifold (6).

c. **(T701, T701C, T701D)** Loosen coupling nut (5) on ODV manifold (6). Disconnect fuel manifold (1) from ODV manifold (6).

d. Remove fuel manifold (1) from clip (4).

e. Remove 12 retaining nuts (7, fig. 6-5) and 12 fuel injectors (3).

f. Using a flashlight and a magnifying glass (5× to 10×), inspect midframe boss to casing joint. No cracks allowed. If cracks are found, replace cold section module.

g. Place protective caps (items 23, 49, Appendix D) over fuel injector tip (4) and inlet fitting (1) of each fuel injector (3).

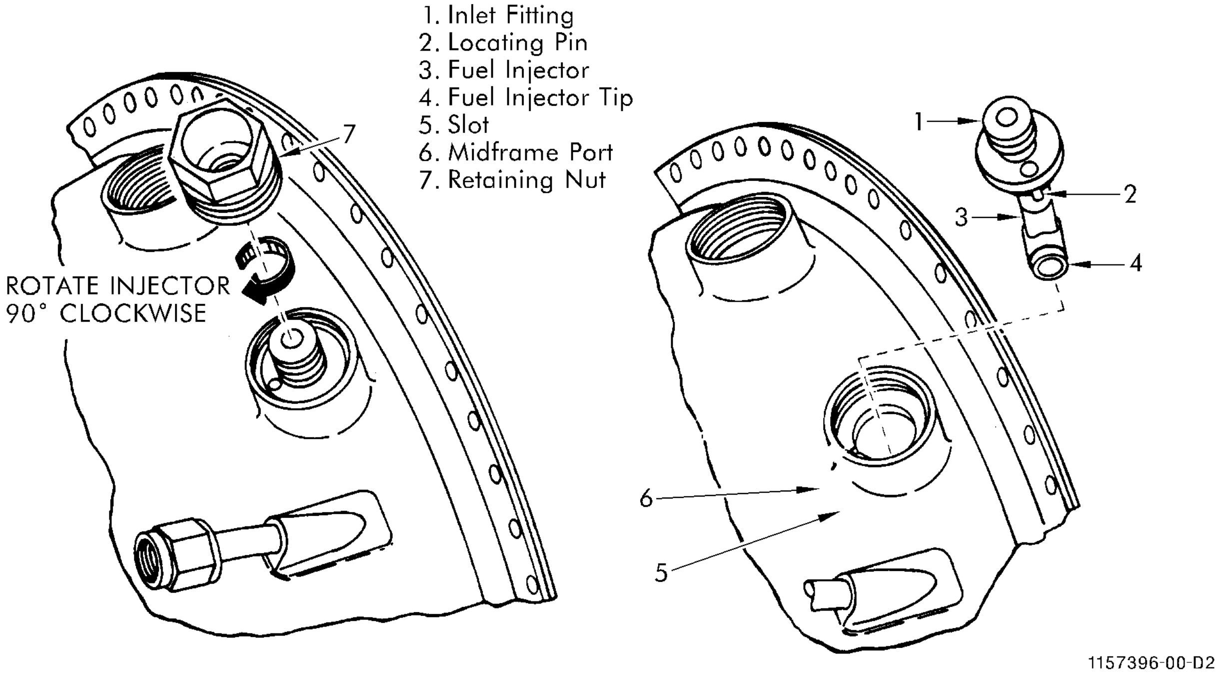


Figure 6-5. Fuel Injector Assembly; Removal and Installation

6-25. Inspection of Fuel Injector Assemblies and Retaining Nuts. See table 6-2.

Table 6-2. Inspection of Fuel Injector Assemblies and Retaining Nuts

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Fuel injector assembly (fig. 6-6) for:			
(1) Discoloration.	Any amount.	Not applicable.	Not applicable.
(2) Tube (3) for:			
(a) Cracks.	None allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(b) Nicks and scratches.	Any number, 0.005 inch deep, with no high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(3) Air shroud (1) for:			
(a) Plugged holes.	Not allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(b) Cracks.	None allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).

Table 6-2. Inspection of Fuel Injector Assemblies and Retaining Nuts (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(c) Nicks and scratches.	None allowed on end of injector tip (2).	Not repairable.	Replace fuel injector assembly (para 6-26).
(d) Wear.	Wear up to 0.005 allowed, any location.	Not repairable.	Replace fuel injector assembly (para 6-26).
(4) Injector tip (2) for:			
(a) Carbon buildup.	Not allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(b) Nicks and scratches on the cone inside end of tip.	None allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(5) Mounting flange (4) for:			
(a) Cracks.	None allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(b) Nicks and scratches.	Any number, up to 0.015 inch deep; without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
(c) Worn locating pin (6).	Pin diameter must not be less than 0.122 inch.	Not repairable.	Replace fuel injector assembly (para 6-26).
(6) Inlet fitting (5) for:			
(a) Missing or damaged threads.	Two threads total, missing or damaged, without high metal, if threads can be used without crossthreading.	Two threads total, missing or damaged that can be blended to usable limits.	AVUM: Replace fuel injector assembly (para 6-26). AVIM: Chase threads.
(b) Cracks.	None allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(c) Broken or missing retaining ring (10).	Not allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
(d) Damaged screen mesh on fuel filter (9).	Not allowed.	Not repairable.	Replace fuel injector assembly (para 6-26).
b. Retaining nut (8) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace retaining nut (para 6-26).
(2) Missing or damaged threads.	One thread missing or damaged, without high metal, if threads can be used without crossthreading.	Not repairable.	Replace retaining nut (para 6-26).

Table 6-2. Inspection of Fuel Injector Assemblies and Retaining Nuts (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Wrench damage on each corner of hex flats.	Any amount, without high metal, if wrench won't slip on nut.	Not repairable.	Replace retaining nut (para 6-26).
(4) Distortion.	Any amount if wrench will fit nut.	Not repairable.	Replace retaining nut (para 6-26).
(5) Discoloration.	Any amount.	Not applicable.	Not applicable.
(6) Nicks and scratches except on threads.	Any number, up to 1/64 inch deep, without high metal.	Not repairable.	Replace retaining nut (para 6-26).
(7) Blockage in bleed hole (7).	Not allowed.	Any amount.	Run a 0.020-inch diameter wire into blocked hole.
(8) Missing silver plating.	None missing on threads. Any amount missing on all other surfaces.	Not repairable.	Replace retaining nut (para 6-26).

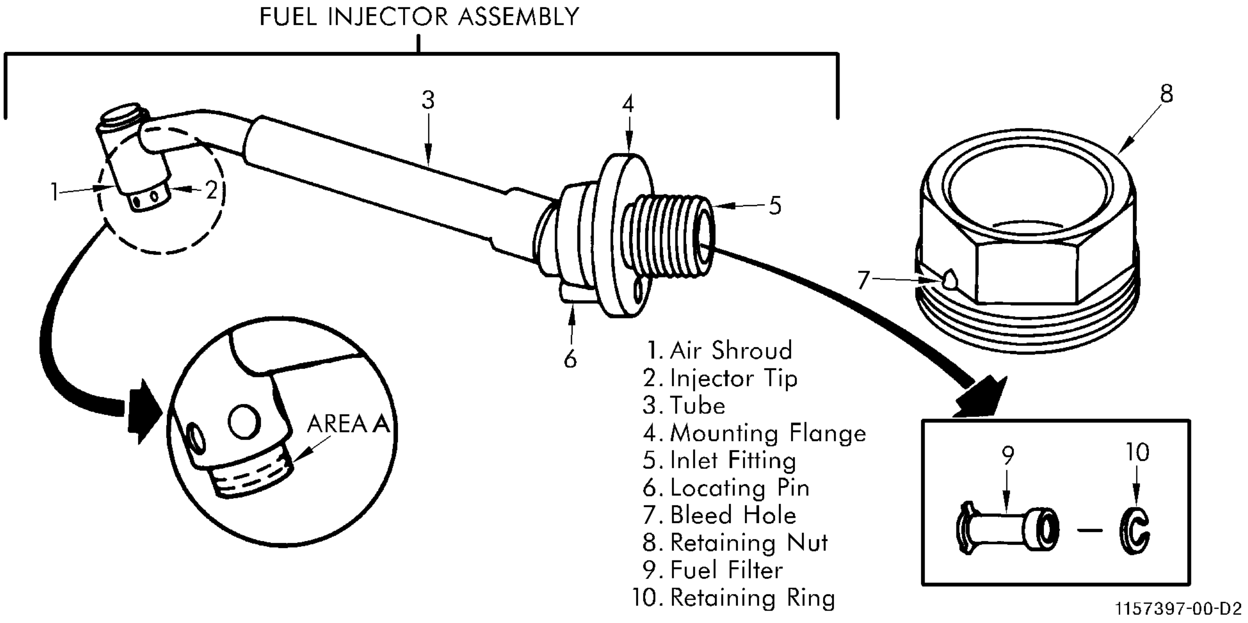


Figure 6-6. Fuel Injector Assembly; Inspection

6-26. Installation of Fuel Injector Assemblies.

a. Install 12 fuel injectors (3, fig. 6-5) in midframe ports (6) as follows:

(1) Place fuel injectors (3) so that fuel injector tip (4) faces 90° away from slot (5) in midframe port (6) as shown.

(2) Insert fuel injector into port as far as it will go.

(3) Turn fuel injector 90° clockwise, as shown, and push it until locating pin (2) enters slot (5). Be sure that fuel injector is seated firmly in midframe port (6).

WARNING

Graphite-Petrolatum
Lubricant A50TF201

- Contact with eyes/face/skin may cause irritation or burning.
- Personal protective equipment required when handling or using this material.
- May lead to allergic sensitivity in some individuals.

WARNING

Thread Compound, Antiseize,
Graphite-Petrolatum
AMS 2518

- Contact with eyes/face/skin may cause irritation or burning.
- Personal protective equipment required when handling or using this material.

(4) Before installing retaining nut (7), inspect threads of nut for presence of antiseize thread compound. If threads are dry, apply a coat of antiseize thread compound (item 56 or 78, Appendix D) to threads and sealing surface of nut (7).

WARNING

Abusive Force/Torque on Fuel Injector

- Do not use abusive force/torque when removing a fuel injector.
- Do not hammer wrench-end to shock nut.
- Do not exceed 175 foot-pounds loosening torque.
- Abusive force/torque may result in a broken or damaged midframe.

(5) Install retaining nuts (7). Torque retaining nuts to 320-340 inch-pounds.

(6) Using a flashlight and a magnifying glass (5× to 10×), inspect midframe boss to casing joint. No cracks allowed. If cracks are found, replace cold section module.

b. Connect main fuel manifold (1, fig. 6-3) to fuel injector(s) as follows:

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(1) Lubricate threads of fuel injectors (3) with lubricating oil (item 85 or 87, Appendix D).

CAUTION

Do not completely connect coupling nuts on main fuel manifold to each fuel injector without partially connecting the adjacent coupling nut. Otherwise, damage to coupling nuts or fuel injector threads will result.

(2) Starting at 6 o'clock position, start coupling nuts (2) onto threads of fuel injectors (3) using fingers. Screw on each coupling nut (2) about three turns, working up from 6 o'clock position on each side of engine. If turns cannot be made, inspect coupling nuts (2) and fuel injectors (3) for dirt or damaged threads.

(3) Return to 6 o'clock position and completely screw on each coupling nut (2) using fingers or wrench (turning gently) until coupling nut (2) is seated.

(4) Tighten (60° wrench-arc) coupling nuts (2).

(5) **(T700)** Connect fuel manifold (1) to POU manifold (6).

(6) **(T701, T701C, T701D)** Connect fuel manifold (1) to ODV manifold (6).

(7) If either manifold (6) or fuel manifold (1) is new, tighten coupling nut (5) as follows:

(a) Using open end wrench, seat nut (5) snugly.

(b) Tighten (120° wrench-arc) nut (5).

(c) Loosen nut (5) and reseat it snugly.

(d) Tighten (60° wrench-arc) nut (5).

(e) Repeat steps (c) and (d).

(8) If both manifold (6) and fuel manifold (1) are used, tighten (60° wrench-arc) nut (5).

(9) Install fuel manifold (1) into clip (4).

c. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-27. (T700) FUEL START MANIFOLD TUBE.

6-28. (T700) Removal of Fuel Start Manifold Tube.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Remove bolt (3, fig. 6-4.)

b. Disconnect coupling nut (8).

c. Disconnect coupling nuts (2, 4) from primer nozzles.

d. Remove fuel start manifold tube (5).

6-29. (T700) Cleaning of Fuel Start Manifold Tube. See paragraph H-23, Appendix H.

6-30. (T700) Inspection of Fuel Start Manifold Tube. See paragraph H-24, Appendix H.

6-31. (T700) Testing of Fuel Start Manifold Tube (AVIM). See paragraph H-25, Appendix H.

6-32. (T700) Installation of Fuel Start Manifold Tube.

a. Position fuel start manifold tube (5, fig. 6-4 and connect coupling nuts (2, 4) onto primer nozzles. Hand-tighten coupling nuts (2, 4).

b. Attach tube (5) to bracket (7) using bolt (3). Hand-tighten bolts (3).

c. Connect coupling nut (8) to tube (5). Hand- tighten coupling nut (8).

d. If either primer nozzles, manifold tube (5), or feed tube (11) is new, tighten coupling nut(s) (2, 4, 8) as follows:

(1) Using open end wrench, seat nut(s) (2, 4, 8) snugly.

(2) Tighten (120° wrench-arc) nut(s) (2, 4, 8).

(3) Loosen nut(s) (2, 4, 8) and reseat snugly.

(4) Tighten (60° wrench-arc) nut(s) (2, 4, 8).

(5) Repeat steps (3) and (4).

e. If primer nozzles, manifold tube (5) and feed tube (11) are used, tighten (60° wrench-arc) nut(s) (2, 4, 8).

f. Torque bolt (3) to 45-50 inch-pounds.

g. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-33. FUEL BOOST PUMP.

6-34. Removal of Fuel Boost Pump.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

CAUTION

Fuel boost pumps which are removed from engine for more than 48 hours for maintenance, for storage, or for return to Depot will be preserved in accordance with paragraph 1-209, step e. This will prevent fuel boost pump from being damaged due to corrosion.

a. Disconnect fuel inlet fitting as directed in applicable aircraft maintenance manual.

b. Loosen three captive bolts (2, fig. 6-7).

c. Remove fuel boost pump (1).

d. Remove and discard four preformed packings (3, 4, 5).

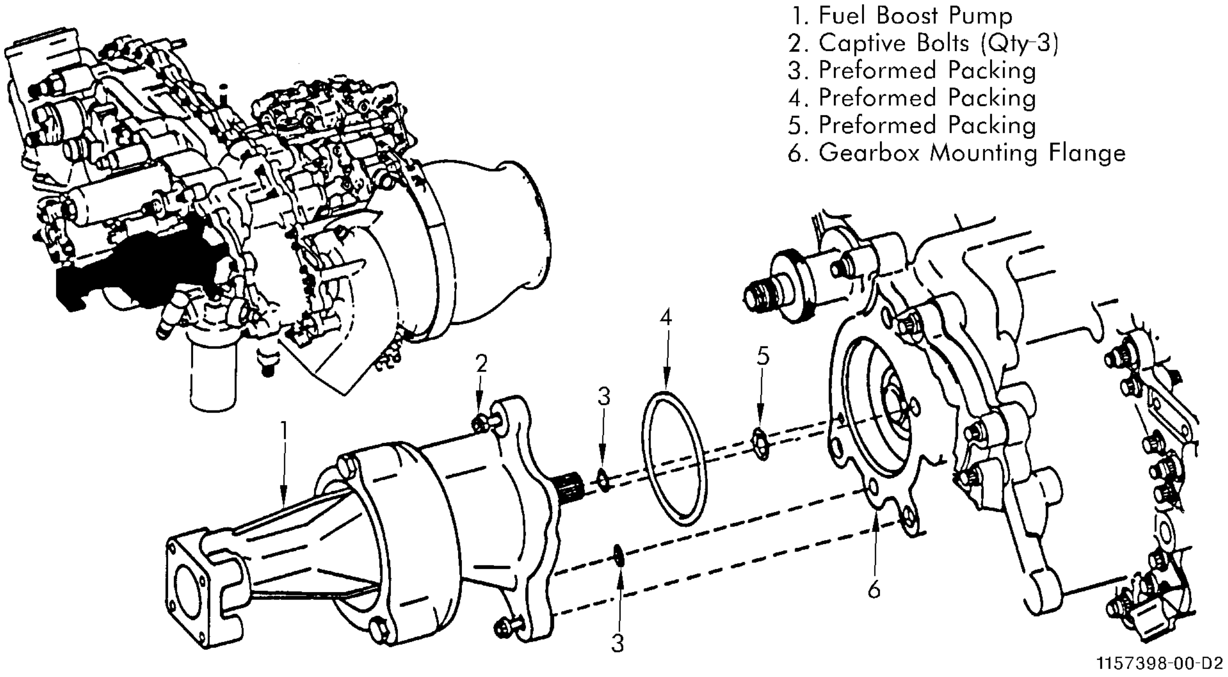


Figure 6-7. Fuel Boost Pump; Removal and Installation

e. Cap/plug all openings with protective caps/plugs (items 34, 30, or 39, Appendix D).

f. If fuel boost pump will not be reinstalled within 48 hours, or if it will be returned to Depot or stored, preserve it (para 1-209, step e).

6-35. Cleaning of Fuel Boost Pump.

a. Before cleaning pump, be sure that all openings are capped with protective caps (items 34, 30, 39, Appendix D).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the fuel boost pump using dry, filtered compressed air.

6-36. Inspection of Fuel Boost Pump.

See table 6-3.

Table 6-3. Inspection of Fuel Boost Pump

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Housing for:			
(1) Visible cracks.	None allowed.	Not repairable.	Replace pump (para 6-38).

WARNING

Flight Safety Critical Aircraft Part (Critical Characteristic(s))

Fuel leaks are critical characteristics for all fuel system components. No fuel leaks allowed.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Leaks.	Not allowed.	Not repairable.	Replace pump (para 6-38).
b. Pilot diameter (5, fig. 6-8) for high metal.	Not allowed.	Any amount.	Remove high metal.

Table 6-3. Inspection of Fuel Boost Pump (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
c. Spline (3) for visible wear steps.	Not allowed.	Not repairable.	Replace pump (para 6-38).
d. Captive bolts (2) for damaged threads.	Not allowed.	Not repairable.	Replace bolts (para H-6, Appendix H).
e. Captive bolt flanges for damaged threads.	Any number of missing threads with no crossed threads or loose material.	Any number with crossed threads or loose material.	AVUM: Replace pump (para 6-38). AVIM: Remove loose material; plug all openings and chase threads to remove crossed threads.
f. Threaded inserts (1) for:			
(1) Damaged threads.	Up to one damaged or missing thread with no crossed threads or loose material.	Same as usable limits with crossed threads or loose material.	AVUM: Replace pump (para 6-38). AVIM: Remove loose material; plug all openings and chase threads to remove crossed threads.
(2) Looseness.	Radial looseness is allowed if inserts do not rotate.	Not repairable.	Replace pump (para 6-38).
g. Packing grooves (4) for nicks and scratches.	None allowed.	Not repairable.	Replace pump (para 6-38).
h. Fuel inlet port (6) for internal nicks and scratches.	Any number, not more than 0.004 inch deep.	Not repairable.	Replace pump (para 6-38).

6-37. Repair of Fuel Boost Pump. Repair is limited to that specified in corrective action column of table 6-3.

6-38. Installation of Fuel Boost Pump.

a. Install four preformed packings (3, 4, 5, fig. 6-7).

b. Position fuel boost pump (1) on gearbox mounting flange (6). Be sure that splines on pump engage with gearbox splines.

c. If splines on pump do not easily engage the gearbox splines, remove pump. Rotate spline on pump by hand, and attempt to install pump again. Repeat this procedure, as necessary, until splines engage easily.

d. Install three captive bolts (2) into gearbox mounting flange (6). Torque bolts to 45-50 inch-pounds.

e. Install fuel inlet fitting as directed in applicable aircraft maintenance manual.

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

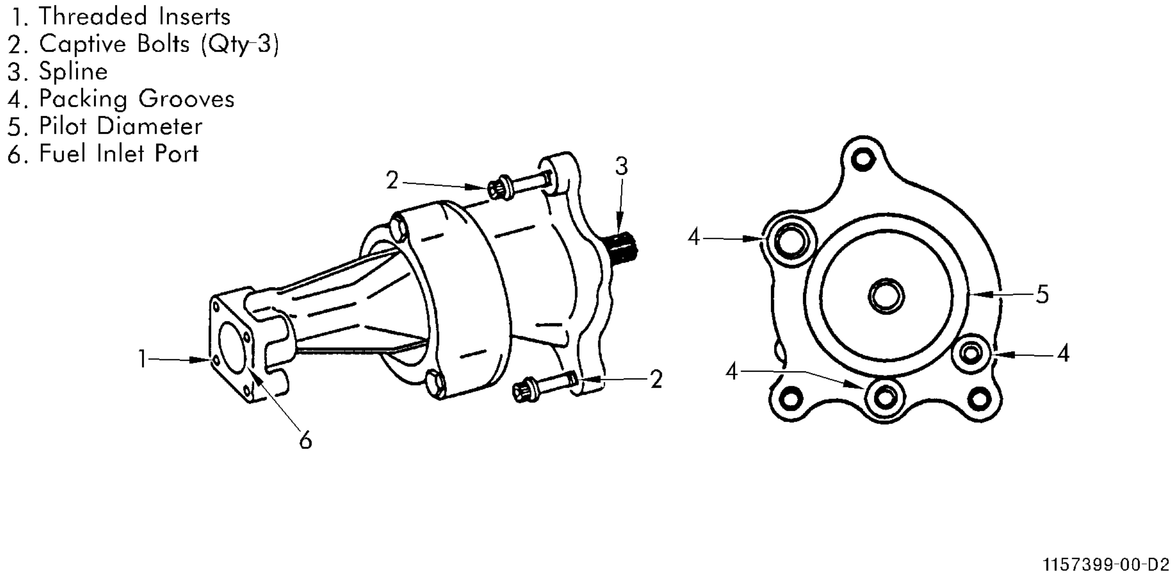


Figure 6-8. Fuel Boost Pump; Inspection

6-39. HYDROMECHANICAL CONTROL UNIT (HMU) AND GROOVED CLAMP COUPLING.

6-40. Removal of Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

CAUTION

- Operation of engine with an improperly seated HMU flange can cause failure of the HMU and loss of engine power. If engine has operated with a mismounted HMU, even if only a start was attempted, replace suspect HMU and return it to Depot.
- Do not force T2 sensor when removing it. Dents in T2 sensor can cause fuel scheduling errors.
- HMU's which are removed from engine for more than 48 hours for maintenance, for storage, or for return to Depot will be preserved in accordance with paragraph 1-209, step a.

NOTE

- If HMU PN 4046T52G28 or 4046T52G29 (6068T97P07 or 6068T97P08) is removed from a T700-GE-701C or from a T700-GE-701D powered **AH-64A** Apache and replaced with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU, the opposite engine must be configured with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU. Additionally, both engines must be configured with 5078T29G02 (6080T56P03) or higher DECs.
- If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with 4046T52G30 (6068T97P09) or 4046T52G38 (6068T97P13) HMU.

a. Do not remove fittings from HMU. If engine is installed, disconnect engine control input assembly according to applicable aircraft maintenance manual.

CAUTION

Before removing HMU from engine, protective cap will be installed over electrical connector of HMU. Otherwise, jet fuel will damage electrical connector.

b. Disconnect electrical connector (yellow cable) (8, fig. 6-9 **(T700)** or 6-10 **(T701, T701C, T701D)**). Cover both electrical connectors with clean, dry, protective caps (item 20 or 28, Appendix D).

c. **(T700)** Disconnect P3 hose and tube assembly (19, fig. 6-9) from HMU (1) only.

d. **(T701, T701C, T701D)** Disconnect P3 tube (19, fig. 6-10) from HMU (1) only.

e. Disconnect gearbox-to-HMU hose assembly (20, fig. 6-9 **(T700)** or 6-10 **(T701, T701C, T701D)**) from HMU.

f. Release latch (15) on holster (16).

g. Remove cable of T2 sensor (9) from clip on compressor case.

h. Using an open-end wrench as a lever, carefully disengage quick-disconnect pin (5) from link assembly (6) and from actuating shaft (7).

i. Loosen locknut (12).

j. Loosen clamp coupling bolt (11) until grooved clamp coupling (13) seats on gearbox lug (14).

k. Carefully slide T2 sensor (9) out of holster (16), and remove HMU (1).

l. Remove grooved clamp coupling (13).

m. Remove and discard packings (2, 3, 10, 17).

n. Reinstall quick disconnect pin onto link assembly.

o. Install clean, dry, protective caps (items 22, 23, 46, Appendix D) as applicable.

CAUTION

Do not use HMU grooved clamp coupling to secure plug adapter 21C7086P01. Adapter may be damaged.

p. Install plug adapter 21C7086P01 (1, fig. 6-11) onto HMU pad (2). Push adapter onto HMU pad until it is secured by the three locking tabs.

6-41. Cleaning of Hydromechanical Control Unit.

a. Be sure that all openings are plugged or covered with appropriate clean, dry, protective caps (items 22, 23, 20, 46, 93, Appendix D).

b. Check electrical connector for moisture or contamination.

c. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap.

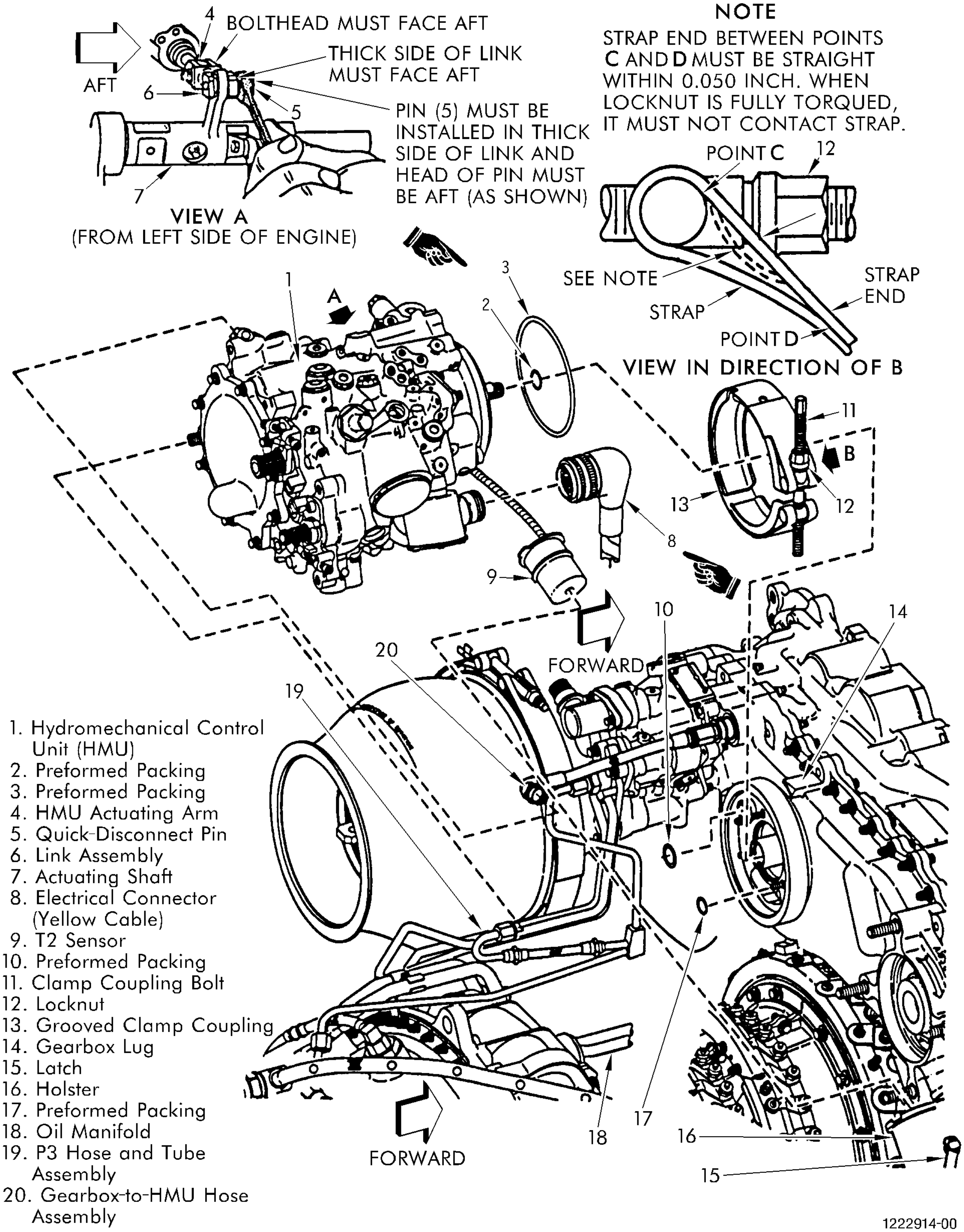
d. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

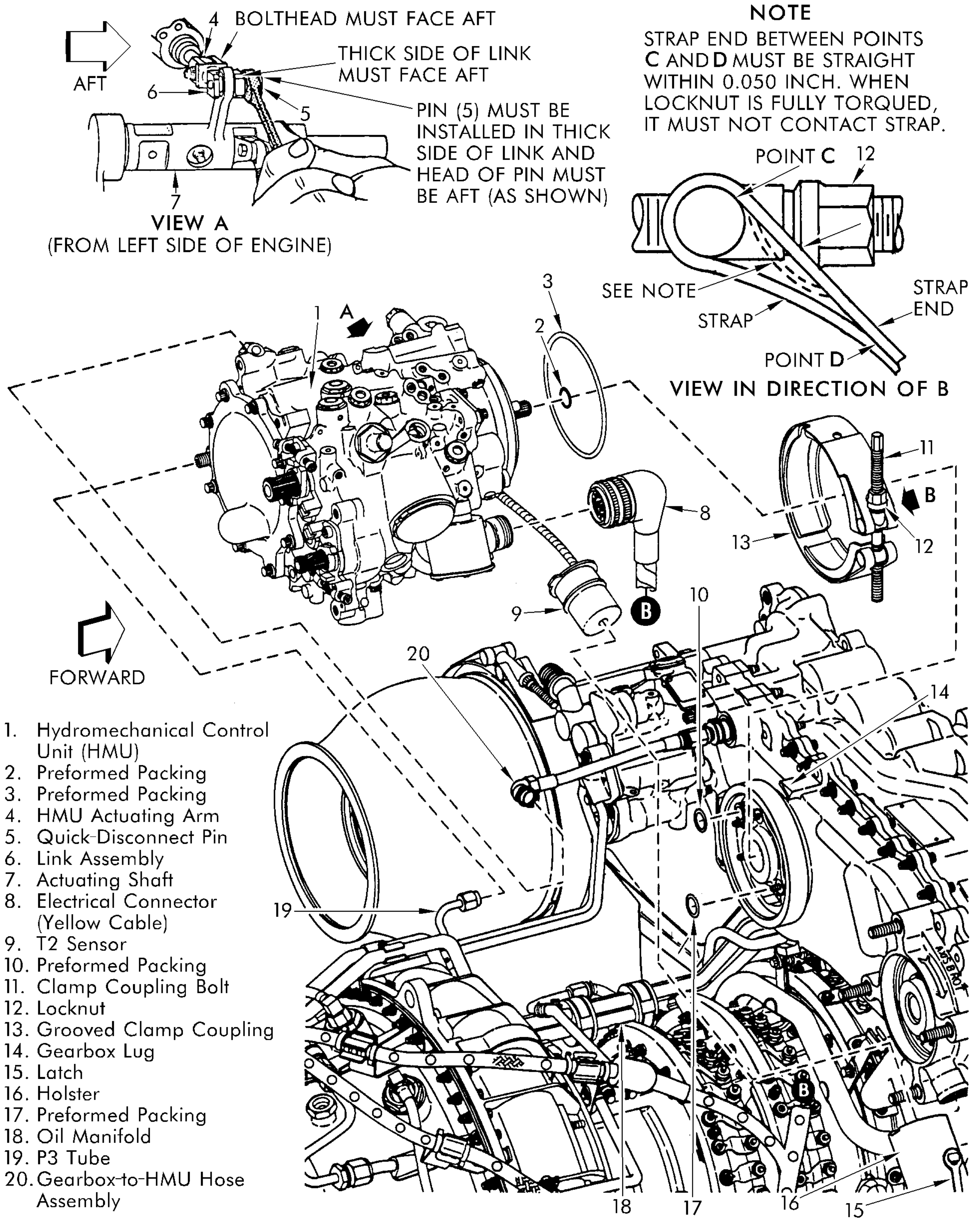
- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

e. Flush or spray-wash outer surface with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.



1. Hydromechanical Control Unit (HMU)
2. Preformed Packing
3. Preformed Packing
4. HMU Actuating Arm
5. Quick-Disconnect Pin
6. Link Assembly
7. Actuating Shaft
8. Electrical Connector (Yellow Cable)
9. T2 Sensor
10. Preformed Packing
11. Clamp Coupling Bolt
12. Locknut
13. Grooved Clamp Coupling
14. Gearbox Lug
15. Latch
16. Holster
17. Preformed Packing
18. Oil Manifold
19. P3 Hose and Tube Assembly
20. Gearbox-to-HMU Hose Assembly

*Figure 6-9. **(T700)** Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling; Removal and Installation*



1. Hydromechanical Control Unit (HMU)
2. Preformed Packing
3. Preformed Packing
4. HMU Actuating Arm
5. Quick-Disconnect Pin
6. Link Assembly
7. Actuating Shaft
8. Electrical Connector (Yellow Cable)
9. T2 Sensor
10. Preformed Packing
11. Clamp Coupling Bolt
12. Locknut
13. Grooved Clamp Coupling
14. Gearbox Lug
15. Latch
16. Holster
17. Preformed Packing
18. Oil Manifold
19. P3 Tube
20. Gearbox-to-HMU Hose Assembly

Figure 6-10. (T701, T701C, T701D) Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling; Removal and Installation

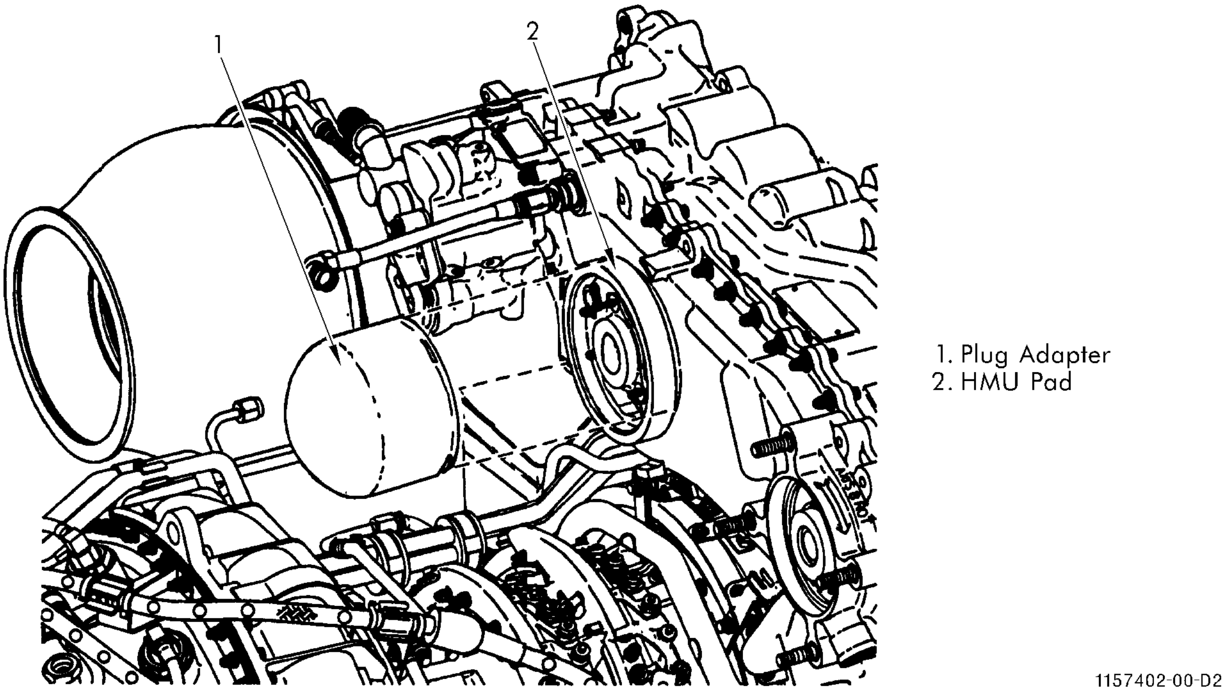


Figure 6-11. Plug Adapter 21C7086P01; Removal and Installation

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

f. Dry the HMU using dry, filtered, compressed air.

g. Clean T2 sensor as follows:

CAUTION

Do not dent or puncture T2 sensor cover during brush cleaning. Do not probe holes with brushes, wires, etc.

(1) Clean dry dirt from inside and outside surfaces with a soft bristle bottle brush (item 15, Appendix D).

(2) Clean oily, sticky dirt from T2 sensor as follows:

WARNING

Isopropyl Alcohol TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

(a) Immerse and agitate T2 sensor in clean isopropyl alcohol (item 3, Appendix D).

(b) Brush T2 sensor with a soft bristle bottle brush (item 15, Appendix D) to remove dirt.

(c) Rinse T2 sensor in clean isopropyl alcohol.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(d) Hold T2 sensor up and dry it with low-velocity, compressed air. Circulate air through aspirator holes to drain isopropyl alcohol through holes on HMU-end of T2 sensor.

6-42. Inspection of Hydromechanical Control Unit (HMU), Grooved Clamp Coupling, and Quick-Disconnect Pin.

See table 6-4.

6-42.1. Check Hydromechanical Unit (HMU) for LDS and PAS Binding:

a. Check LDS for binding:

(1) Disconnect the load demand rotary input from the HMU (TM1-1520-237-23).

(2) Install LDS socket (18C2268-2) onto load demand spindle, (figure 6-13).

(3) Using a torque wrench, rotate spindle in clockwise and counterclockwise directions.

(4) If torque exceeds 15 inch-pounds, replace HMU.

(5) Connect the load demand rotary input to the HMU (TM1-1520-237-23).

b. Check PAS for binding:

(1) Disconnect the power available rotary input from the HMU (TM1-1520-237-23).

(2) Install PAS socket (18C2268-1) onto power available spindle (figure 6-13).

(3) Using a torque wrench, rotate spindle in clockwise and counterclockwise directions.

(4) If torque exceeds 25 inch-pounds, replace HMU.

(5) Connect the power available rotary input to the HMU (TM1-1520-237-23).

Table 6-4. Inspection of Hydromechanical Control Unit (HMU), Grooved Clamp Coupling, and Quick-Disconnect Pin

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Hydromechanical control unit (HMU) (fig. 6-12).			
(1) Casing for:			
(a) Cracks except on Hamilton Standard HMUs only at lee plug.	None allowed.	Not repairable.	Replace HMU (para 6-44).
(b) (Hamilton Standard HMUs only) visible cracks at lee plug.	Any amount, up to 0.300 inch deep.	Not repairable.	Replace HMU (para 6-44).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(c) Leaks.	Not allowed.	Not repairable.	Replace HMU (para 6-44).
(d) Missing locating pin (4).	Not allowed.	Not repairable.	Replace HMU (para 6-44).
(e) High metal on pilot diameter (6).	Not allowed.	Any amount.	Blend high metal to adjacent contour.
(f) Power available and load demand spindle alinement slots for wear (fig. 6-13).	Up to 0.050 inch long.	Not repairable.	Replace HMU (para 6-44).
(g) Load demand spindle for binding (para 6-42.1).	0-15 inch-pounds.	Not repairable.	Replace HMU (para 6-44).
(h) Power available spindle for binding (para 6-42.1).	0-25 inch-pounds.	Not repairable.	Replace HMU (para 6-44).
(2) Drive spline (3, fig. 6-12) for visible steps.	None allowed.	Not repairable.	Replace HMU (para 6-44).

Table 6-4. Inspection of Hydromechanical Control Unit (HMU), Grooved Clamp Coupling, and Quick-Disconnect Pin (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Threaded fittings (5).	See paragraph H-24, Appendix H.	See paragraph H-24, Appendix H.	Replace fitting. Torque fitting to 40-50 inch-pounds.
(4) T2 sensor (2) for:			
(a) Dents or deformation.	Any amount, 1/16 inch from original shape.	Not repairable.	Replace HMU (para 6-44).
(b) Dirt in aspirating holes of inner and outer shells.	Not allowed.	Any amount.	Clean T2 sensor (para 6-41, step g).
(5) Conduit (8) for separations and sharp bends.	Not allowed.	Not repairable.	Replace HMU (para 6-44).

Table 6-4. Inspection of Hydromechanical Control Unit (HMU), Grooved Clamp Coupling, and Quick-Disconnect Pin (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(6) Electrical connector for:			
(a) Bent socket pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(b) Damaged threads.	Any amount, with no high metal, if connector can be assembled normally with its mating part.	Any amount that can be reworked to usable limits.	Remove high metal.
(7) Nicks and scratches on packing groove of drive shaft (7).	Up to 0.005 inch deep on bottom; up to 1/64 inch deep on wall of groove, with no sharp edges.	Not repairable.	Replace HMU (para 6-44).
b. Grooved clamp coupling (9) for:			
(1) Cracks in clamp.	None allowed.	Not repairable.	Replace clamp coupling (para 6-44).
(2) Bolt threads for:			
(a) Wear, looseness.	Not allowed.	Not repairable.	Replace clamp coupling (para 6-44).

WARNING

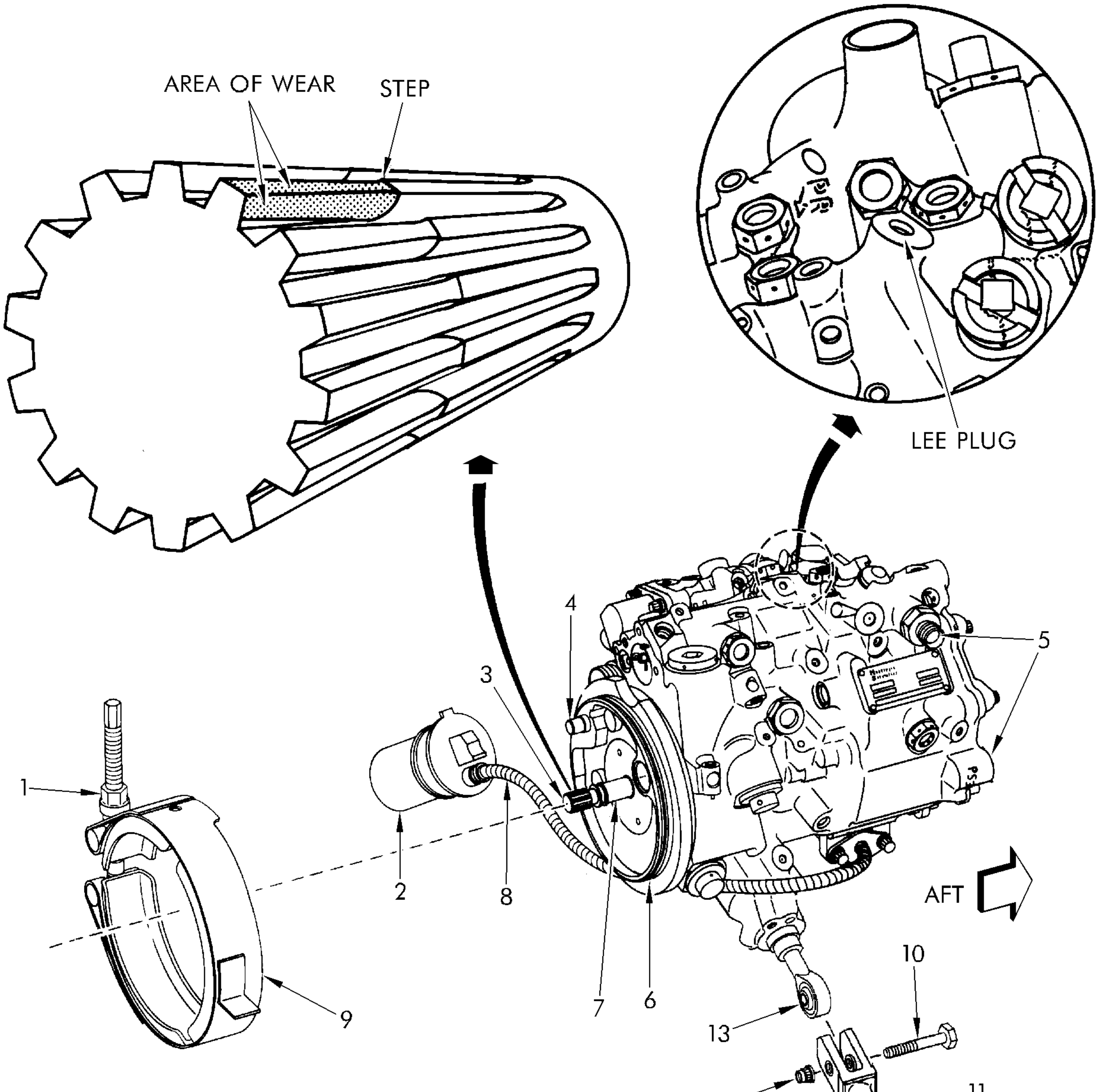
Penetrating Oil

- Do not use near flames or other heat source including smoking.
- Do not have any contact with liquid or vapor. Contact of eyes with vapor or liquid can cause severe irritation. Prolonged inhalation of vapor may cause headache, dizziness, and nausea.
- If liquid contacts eyes, flush them thoroughly with water. After prolongued skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air.
- When handling or applying liquid, wear goggles or face shield. If prolonged exposure to vapor is likely, wear approved respirator.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(b) Binding.	Not allowed.	Any amount.	Apply penetrating oil (item 88, Appendix D) and work locknut (1) free or replace locknut or replace grooved clamp coupling, as applicable (para 6-44).
(c) Damage.	Not allowed.	One thread missing, continuous or cumulative.	AVUM: Replace clamp coupling (para 6-44). AVIM: Chase threads.

Table 6-4. Inspection of Hydromechanical Control Unit (HMU), Grooved Clamp Coupling, and Quick-Disconnect Pin (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Cracks in butt welds and spot-welds.	None allowed.	Not repairable.	Replace clamp coupling (para 6-44).
(4) Rolled edges on locknut (1).	Any amount if wrench fits properly. No high metal allowed.	Same as usable limits, with high metal.	Remove high metal.
(5) Run-on torque of locknut (1).	Minimum of 6 inch-pounds.	Not repairable.	Replace clamp coupling (para 6-44).
c. Link assembly (11) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace link (para 6-43).
(2) Nicks, dents, scratches, and gouges.	Any number, up to 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
(3) Missing bushings.	None allowed.	Not repairable.	Replace link (para 6-43).
(4) Wear or visible out-of-roundness of bushing.	None allowed.	Not repairable.	Replace link (para 6-43).
d. Quick-disconnect pin (fig. 6-14):			
(1) Pin shaft (1) for:			
(a) Broken or missing lockring (3).	Not allowed.	Not repairable.	Replace pin (para 6-44, step i).
(b) Nicks, scratches, or wear.	None allowed that can be felt with fingernail.	Not repairable.	Replace pin (para 6-44, step i).
(c) Cracks.	None allowed.	Not repairable.	Replace pin (para 6-44, step i).
(2) Pinhead (2) for:			
(a) Nicks, scratches, dents, and gouges.	Any number, up to 1/32 inch deep.	Not repairable.	Replace pin (para 6-44, step i).
(b) Bends.	Any amount, up to 1/16 inch from original shape.	Any amount that can be reworked to usable limits.	Replace pin (para 6-44, step i).
(c) Cracks.	None allowed.	Not repairable.	Replace pin (para 6-44, step i).
e. Spindle alinement slots for wear.	0.050 inch maximum.	Not repairable.	Replace the HMU



1. Locknut
2. T2 Sensor
3. Drive Spline
4. Locating Pin
5. Threaded Fitting
6. Pilot Diameter
7. Drive Shaft
8. Conduit
9. Grooved Clamp Coupling
10. Bolt
11. Link Assembly
12. Locknut
13. HMU Actuating Arm

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Figure 6-12. Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling; Inspection

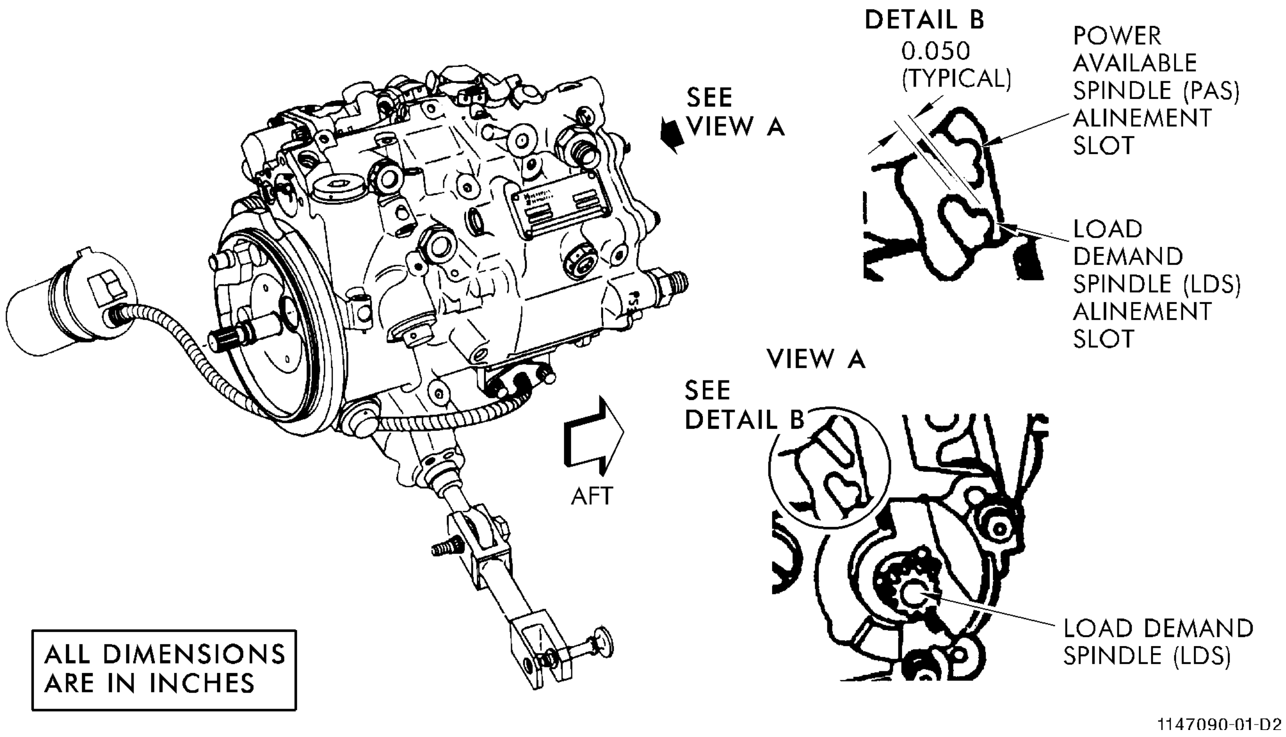

Figure 6-13. Hydromechanical Control Unit (HMU) Spindles; Location

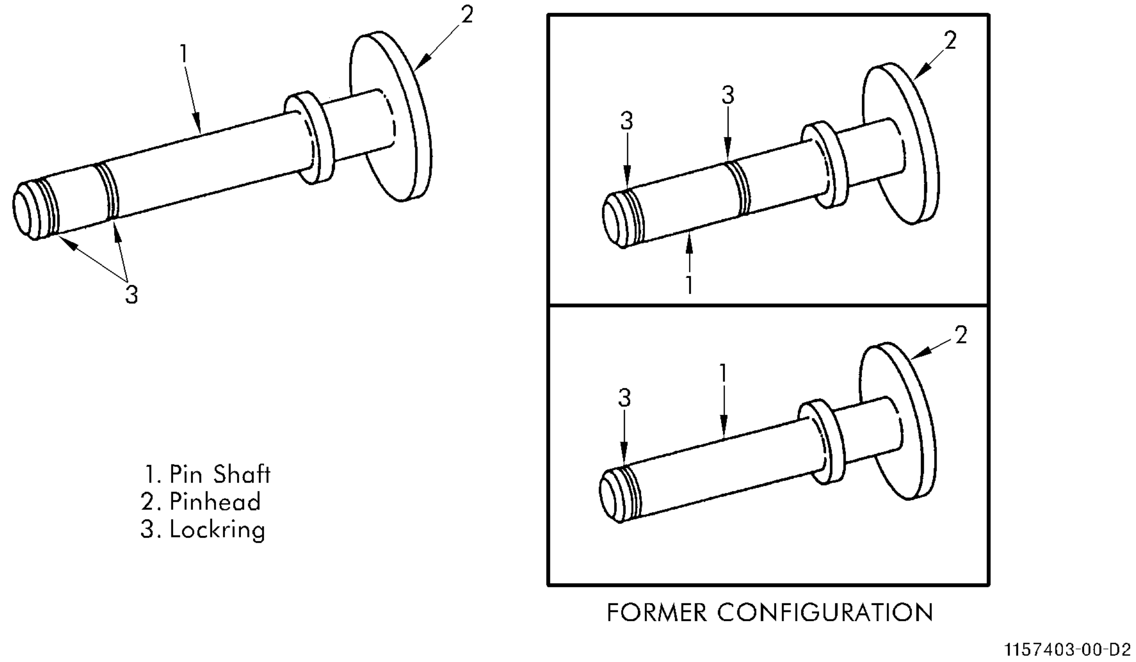

Figure 6-14. Quick-Disconnect Pin; Inspection

6-43. Repair of Hydromechanical Control Unit (HMU).

a. Remove link assembly (11, fig. 6-12) as follows:

(1) Remove locknut (12) and bolt (10).

(2) Remove link assembly (11).

b. Install new link assembly (11) as follows:

(1) Position larger opening of link assembly toward HMU actuating arm (13).

(2) Be sure that other end of link assembly has the thicker flange facing aft.

(3) Install link assembly onto HMU actuating arm (13).

(4) Install bolt (10) with head facing aft. Secure bolt with locknut (12).

(5) Torque locknut (12) to 45-50 inch-pounds.

6-44. Installation of Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling.

NOTE

- If HMU PN 4046T52G28 or 4046T52G29 (6068T97P07 or 6068T97P08) is removed from a T700-GE-701C or from a T700-GE-701D powered **AH-64A** Apache and replaced with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU, the opposite engine must be configured with a 4046T52G30 (6068T97P09) or with a 4046T52G38 (6068T97P13) HMU. Additionally, both engines must be configured with 5078T29G02 (6080T56P03) or higher DECs.
- If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with 4046T52G30 (6068T97P09) or 4046T52G38 (6068T97P13) HMU.

a. Remove plug adapter 21C7086P01 (1, fig. 6-11) from HMU pad (2).

b. Install grooved clamp coupling (13, fig. 6-9 **(T700)** or 6-10 **(T701, T701C, T701D)**) over attaching flange on gearbox.

c. Install packings (2, 3) on HMU (1). Install packings (10, 17) on fuel connectors in gearbox.

CAUTION

- Do not use tools to install T2 sensor.
- Do not bend or kink the conduit between the HMU and T2 sensor.
- Do not force T2 sensor when installing it. Dents in T2 sensor or dents and kinks in T2 cable can cause fuel scheduling errors.

d. While supporting HMU (1), carefully slide T2 sensor (9) into holster (16).

CAUTION

- Do not damage packings when installing HMU.
- Operation of engine with an improperly seated HMU flange can cause failure of the HMU and loss of engine power. If engine has operated with a mismounted HMU, even if only a start was attempted, replace suspect HMU and return it to Depot.

NOTE

- The Hamilton Standard HMU drive shaft can be rotated freely by hand.
- The Woodward Governor HMU will require up to approximately 24 inch-pounds of torque to rotate the drive shaft.

e. Keeping link assembly (6) above oil manifold (18), engage splines on HMU (1) with those of gearbox. If splines are not alined, do one of the following:

(1) Remove radial drive shaft cover assembly (para 5-30). Then, turn drive shaft using 5/16-inch socket with extension and ratchet until splines are alined.

(2) Rotate the entire HMU counterclockwise, mate with splines of AGB, and rotate the HMU clockwise to aline locating pin and hole on gearbox.

f. Engage locating pin on HMU (1) with hole in gearbox. Firmly seat HMU (1) against gearbox mounting flange.

NOTE

Strap end between points C and D must be straight within 0.050 inch. When locknut is fully torqued, it must not contact strap.

g. Position clamp coupling (13) over HMU (1) and gearbox flanges. Torque clamp coupling bolt (11) to 32-35 inch-pounds. Tighten (60° wrench arc) locknut (12).

h. See figure 6-15 and do the following inspections:

(1) Be sure that threads on clamp coupling bolt are visible below flat after tightening.

(2) Be sure that clamp coupling is seated correctly. Clamp coupling must be parallel to surface of gearbox. Gap between clamp coupling and surface of gearbox must be about 1/8 inch.

(3) Be sure the HMU mounting flange is flush with gearbox mounting flange. These flanges can be seen through inspection hole in clamp coupling.

(4) Be sure that locknut on clamp coupling does not contact strap.

i. Lift latch (15, fig. 6-9 **(T700)** or 6-10 **(T701, T701C, T701D)**) on holster (16) to secure T2 sensor (9). Be sure that latch (15) has enough tension to seat T2 sensor (9) tightly. If latch (15) is not tight, push down on center of latch (15).

j. Aline link assembly (6) in HMU actuating arm (4) with actuating shaft (7), and re-engage quick-disconnect pin (5). If pin (5) was removed from link assembly (6), be sure pin is installed from thick end of link assembly as shown in view A.

k. Connect gearbox-to-HMU hose assembly (20) to HMU.

l. If either hose assembly (20) or HMU union is new, tighten coupling nut as follows:

(1) Using open end wrench, seat nut snugly.

(2) Tighten (120° wrench arc) nut.

(3) Loosen nut and reseat it snugly.

(4) Tighten (60° wrench arc) nut.

(5) Repeat steps (3) and (4).

m. If both hose assembly (20) and HMU union are used, tighten (60° wrench arc) nut.

n. **(T700)** Connect P3 hose and tube assembly (19, fig. 6-9) to HMU union. Then, while holding tube to prevent rotation, tighten (60° wrench arc) coupling nut.

o. **(T701, T701C, T701D)** Connect P3 tube (19, fig. 6-10) to HMU union. Then, hold tube to prevent rotation, and tighten (60° wrench arc) coupling nut.

p. Connect electrical connector (yellow cable) (8, fig. 6-9 **(T700)** or 6-10 **(T701, T701C, T701D)**) as directed in paragraph H-7, Appendix H.

q. Install T2 sensor cable into clip support on compressor case.

r. If engine is installed in aircraft, connect engine control input assembly as directed in applicable aircraft maintenance manual.

s. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM)

6-45. FUEL FILTER.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

6-46. Fuel Filter Servicing When Impending Bypass Indicator Button Pops.

When impending bypass button on fuel filter pops, do not remove fuel filter bowl. First, try to reset button by pushing in popped button. If button stays in, continue the operation. (After next runup or flight, check to see if button popped.) If button will not stay in, replace filter element as follows:

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Unscrew fuel filter bowl (4, fig. 6-16).

b. Remove and discard filter element (3).

c. Remove and discard packings (2).

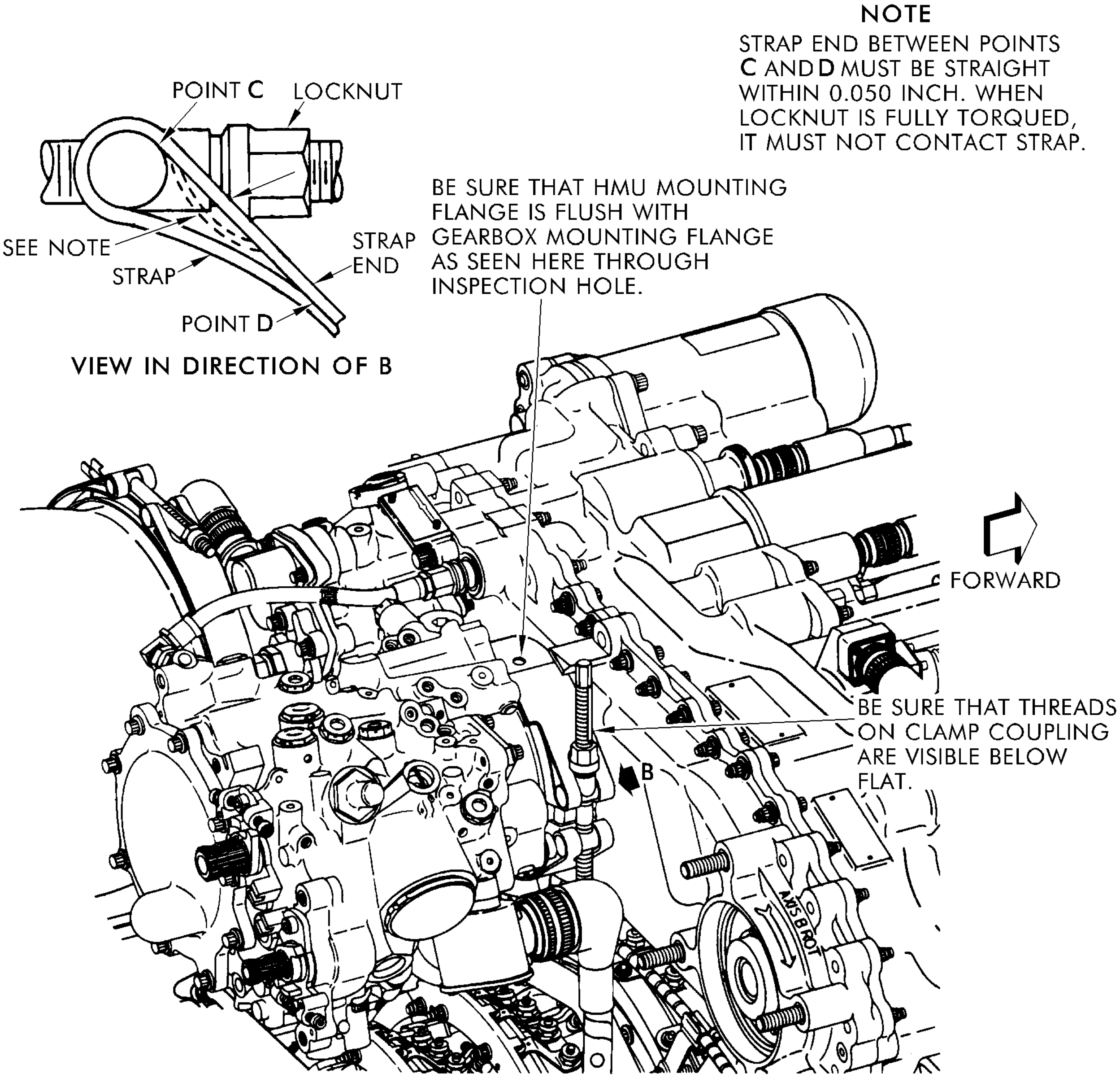

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Figure 6-15. Hydromechanical Control Unit (HMU) and Grooved Clamp Coupling; Inspection of Installation

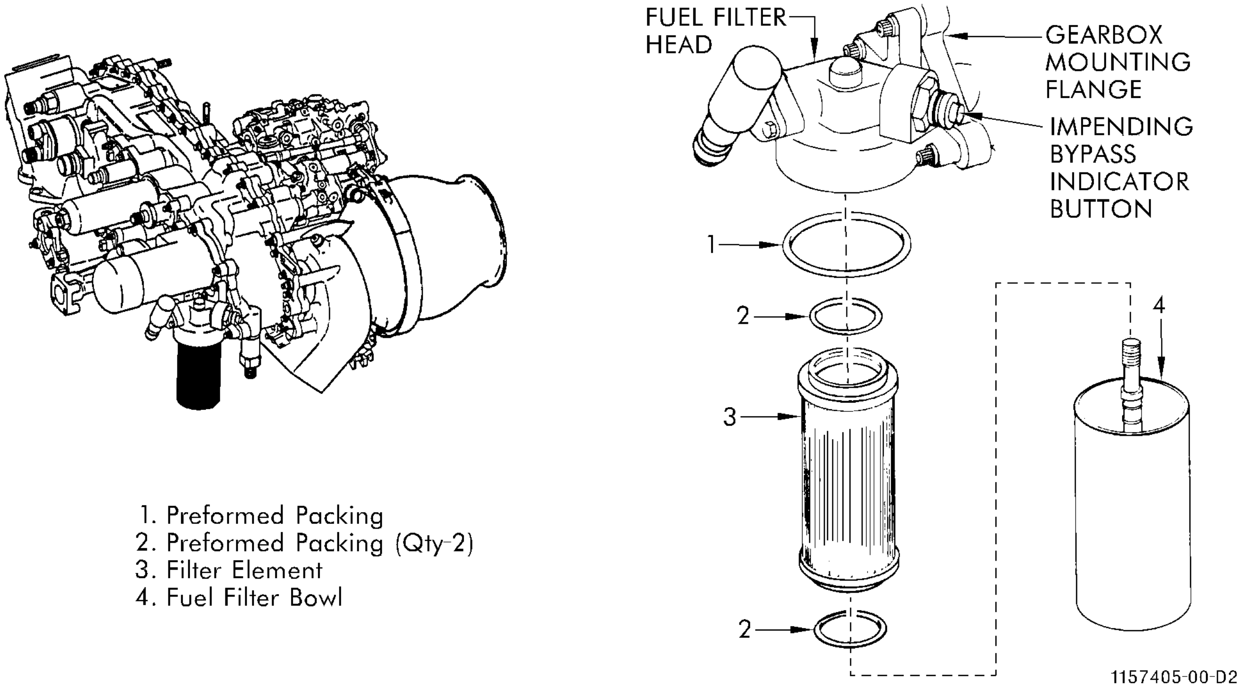


Figure 6-16. Fuel Filter Element and Bowl; Removal and Installation

d. Remove and discard packing (1) from fuel filter head. This packing is recessed inside fuel filter head.

CAUTION

Before resetting impending bypass button, be sure that screwdriver is clean.

e. If necessary, do the following to reset the impending bypass button:

NOTE

Be sure that spool in center of fuel filter head is all the way up.

(1) Using a small diameter screwdriver (5/16-inch max dia) (2, fig. 6-17), push spool in center of fuel filter head (3) all the way up until it stops. Be sure to push to stop.

(2) Push in impending bypass button (1).

f. Install two packings (2, fig. 6-16) onto new filter element (3).

g. Install packing (1) in groove in filter head.

h. Place element into bowl (4).

i. Screw bowl into filter head and hand-tighten bowl.

j. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-47. Removal of Fuel Filter.

WARNING

Handling Fuel System Components in Cold Weather

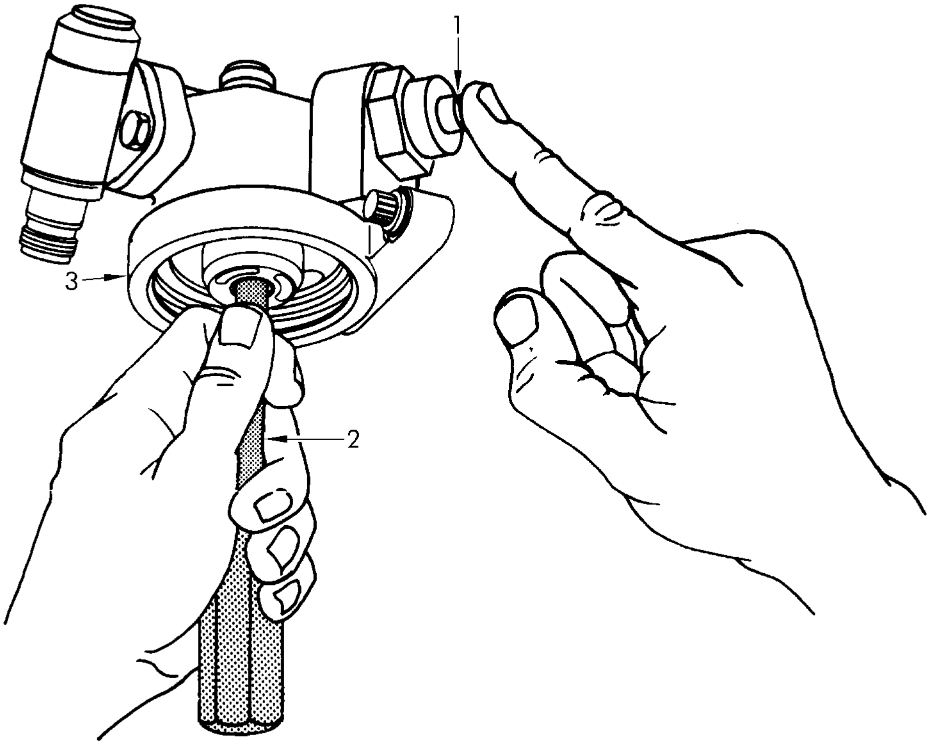
When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Disconnect electrical connector (green cable) (1, fig. 6-18). Cover connectors with clean, dry, protective caps (items 24, 34, Appendix D).

b. Loosen three captive bolts (3) and remove fuel filter (2).

c. Remove and discard two packings (4).

d. Cover all openings with protective caps/plugs.



1. Impending Bypass Indicator Button
2. Small Diameter Screwdriver (5/16-Inch Max Dia)
3. Fuel Filter Head

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Figure 6-17. Fuel Filter Indicator; Resetting

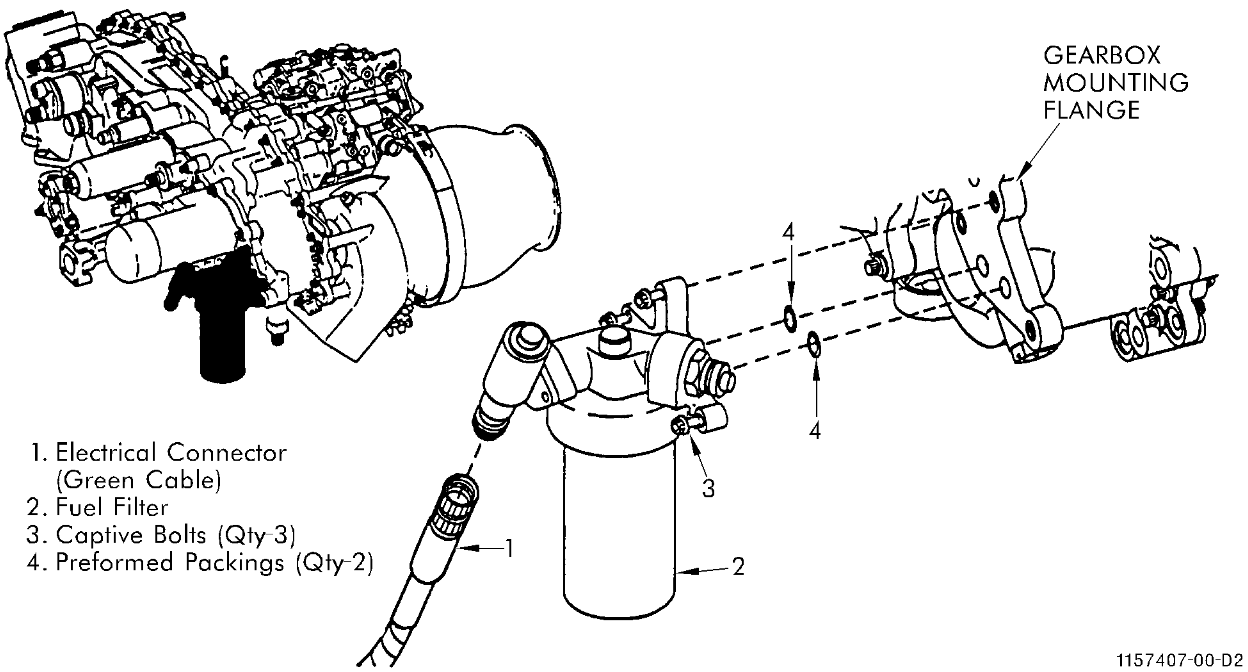


Figure 6-18. Fuel Filter; Removal and Installation

6-48. Cleaning of Fuel Filter.

a. Cover all openings with protective caps/plugs before cleaning.

b. Check electrical connector for moisture or contamination.

c. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry, protective cap (item 24, Appendix D).

d. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

e. Flush or spray-wash outer surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

f. Dry the fuel filter using dry, filtered, compressed air.

6-49. Inspection of Fuel Filter. See table 6-5.

Table 6-5. Inspection of Fuel Filter

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Fuel filter (1, fig. 6-19) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace filter (para 6-50).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Leaks.	Not allowed.	Not repairable.	Replace filter (para 6-50).
b. Electrical connector (2) for:			
(1) Bent socket pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(2) Damaged threads.	Any amount, without high metal, if connector can be assembled normally.	Any amount that can be reworked to usable limit.	Remove high metal.
c. Captive bolts (3) for damaged threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
d. Damaged threads on captive bolt flanges.	Any number of missing threads with no crossed threads or loose material.	Any number with crossed threads or loose material.	AVUM: Replace filter (para 6-50). AVIM: Remove loose material; mask all openings and chase threads to remove crossed threads.

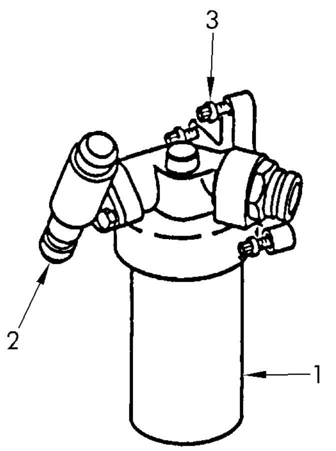


Figure 6-19. Fuel Filter; Inspection

6-50. Installation of Fuel Filter.

a. Install two packings (4, fig. 6-18) onto flange of fuel filter (2).

b. Place fuel filter onto gearbox mounting flange. Tighten three captive bolts (3). Torque bolts to 45-50 inch-pounds.

c. Connect electrical connector (green cable) (1) as directed in para H-7, Appendix H.

d. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-51. FUEL FILTER ELEMENT AND BOWL.

6-52. Removal of Fuel Filter Element and Bowl.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

CAUTION

(T701, T701C, T701D AH-64A) Be sure aircraft fuel system is depressurized. Otherwise, fuel flow will occur.

a. Unscrew fuel filter bowl (4, fig. 6-16).

b. Remove filter element (3).

c. Remove and discard packings (2).

d. Remove and discard packing (1) from fuel filter head. This packing is recessed inside fuel filter head.

6-53. Cleaning of Fuel Filter Bowl.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the fuel filter bowl using dry, filtered, compressed air.

6-54. Inspection of Fuel Filter Bowl.

See table 6-6.

Table 6-6. Inspection of Fuel Filter Bowl

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Fuel filter bowl (1, fig. 6-20) for:			
(1) Visible cracks.	None allowed.	Not repairable.	Replace bowl (para 6-55).
(2) Nicks or scratches in:			
(a) Area A.	No nicks allowed. Any amount of scratches, up to 0.003 inch deep, that run circumferentially. No axial scratches allowed. No high metal allowed.	Axial scratches and nicks not repairable. Any amount of circumferential scratches and nicks, up to 0.010 inch deep with high metal.	Remove superficial nicks, scratches, and high metal with fine grit, abrasive cloth (item 52, Appendix D). Move cloth in a circumferential direction.
(b) All other areas.	Any amount up to 0.015 inch deep.	Not repairable.	Replace bowl (para 6-55).

Table 6-6. Inspection of Fuel Filter Bowl (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Rod (2) for damaged threads.	One thread cumulative missing or damaged, without high metal, if thread can be used without cross-threading.	Not repairable.	Replace bowl (para 6-55).
c. Hex (3) for damage.	Enough flat surface to permit torquing to given limits without slipping to next set of flats.	Not repairable.	Replace bowl (para 6-55).

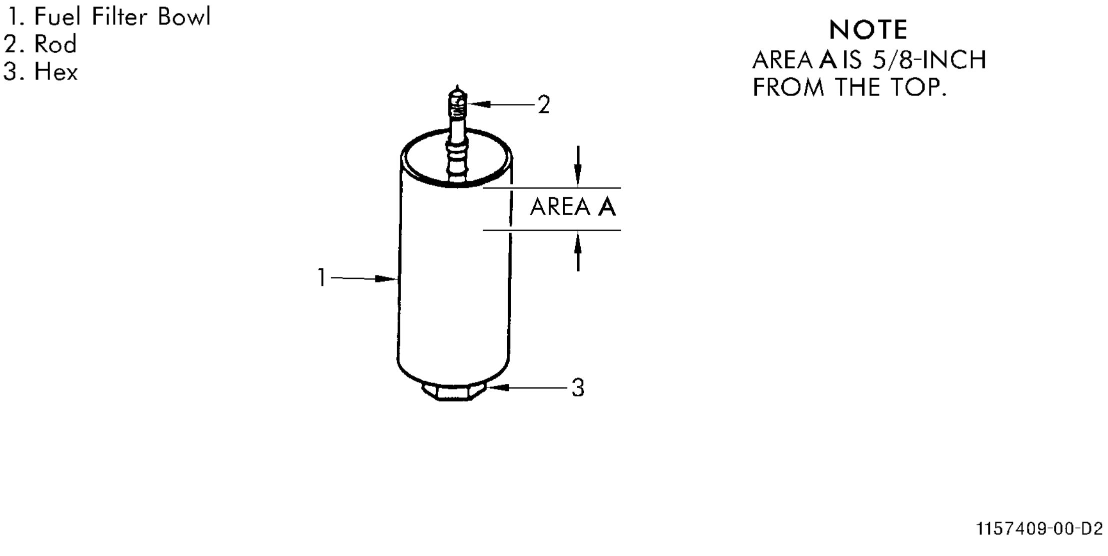


Figure 6-20. Fuel Filter Bowl; Inspection

6-55. Installation of Fuel Filter Element and Bowl.

a. Install two packings (2, fig. 6-16) onto filter element (3).

b. Install packing (1) in groove in fuel filter head.

c. Seat filter element (3) in the bottom of fuel filter bowl (4) with hand-pressure.

d. Screw bowl (4) into filter head. Hand-tighten bowl (4).

e. Make required engine checks listed in table 1-19 or table 1-39 (AVIM).

6-56. GEARBOX-TO-HMU HOSE ASSEMBLY.

6-57. Removal of Gearbox-to-HMU Hose Assembly.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Disconnect gearbox-to-HMU hose assembly (2, fig. 6-21) from gearbox union (3) and from HMU union (1).

b. Remove hose assembly (2).

6-58. Cleaning of Gearbox-to-HMU Hose Assembly. See paragraph H-23, Appendix H.

6-59. Inspection of Gearbox-to-HMU Hose Assembly. See paragraph H-24, Appendix H.

6-60. Testing of Gearbox-to-HMU Hose Assembly (AVIM). See paragraph H-25, Appendix H.

6-61. Installation of Gearbox-to-HMU Hose Assembly.

CAUTION

Before tightening coupling nuts, be sure that gearbox-to-HMU hose assembly is not twisted. Otherwise, hose could be damaged and could result in fuel leak.

a. Install straight end of gearbox-to-HMU hose assembly (2, fig. 6-21) onto gearbox union (3). Hand-tighten coupling nut.

b. Install elbow end of hose assembly (2) onto HMU union (1). Adjust hose assembly (2) so that it is not twisted. Hand-tighten coupling nut.

c. While keeping hose assembly (2) from twisting, tighten both coupling nuts as follows:

(1) If either hose assembly (2) or one or both unions (1, 3) are new, tighten nut(s) as follows:

(a) Using open end wrench, seat nut(s) snugly.

(b) Tighten (120° wrench arc) nut(s).

(c) Loosen nut(s) and reseat snugly.

(d) Tighten (60° wrench arc) nut(s).

(e) Repeat steps (c) and (d).

(2) If hose assembly (2) and one or both unions (1, 3) are used, tighten (60° wrench arc) nut(s).

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

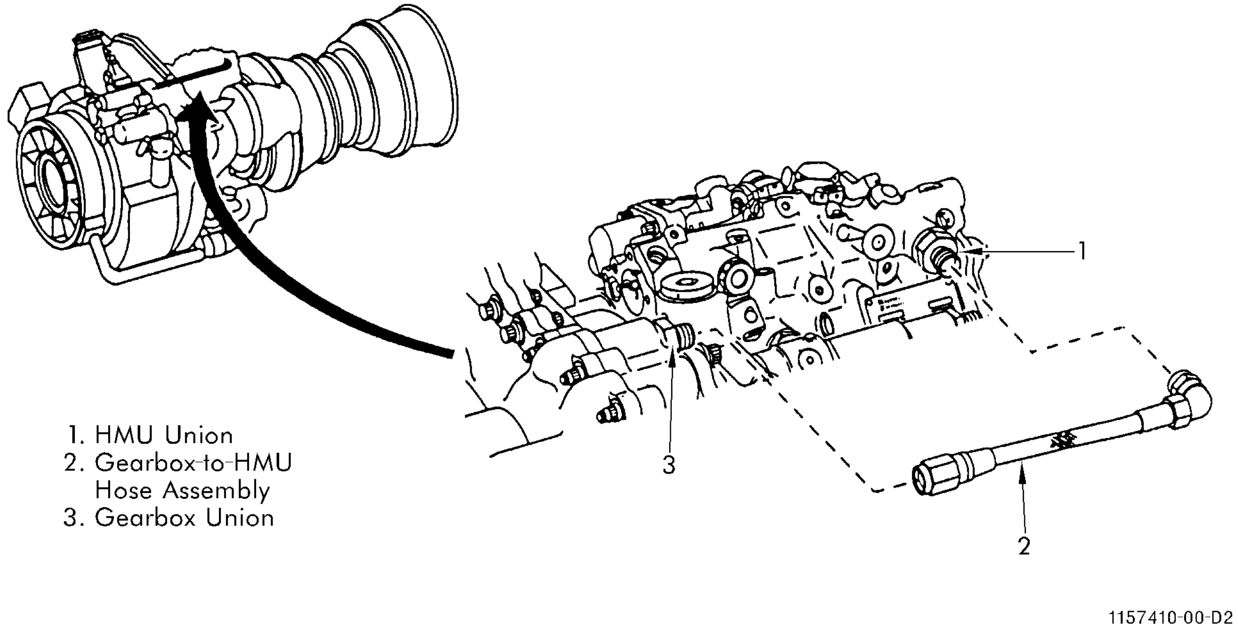


Figure 6-21. Gearbox-to-HMU Hose Assembly; Removal and Installation

6-62. FUEL PRESSURE SENSOR.

6-63. Removal of Fuel Pressure Sensor.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

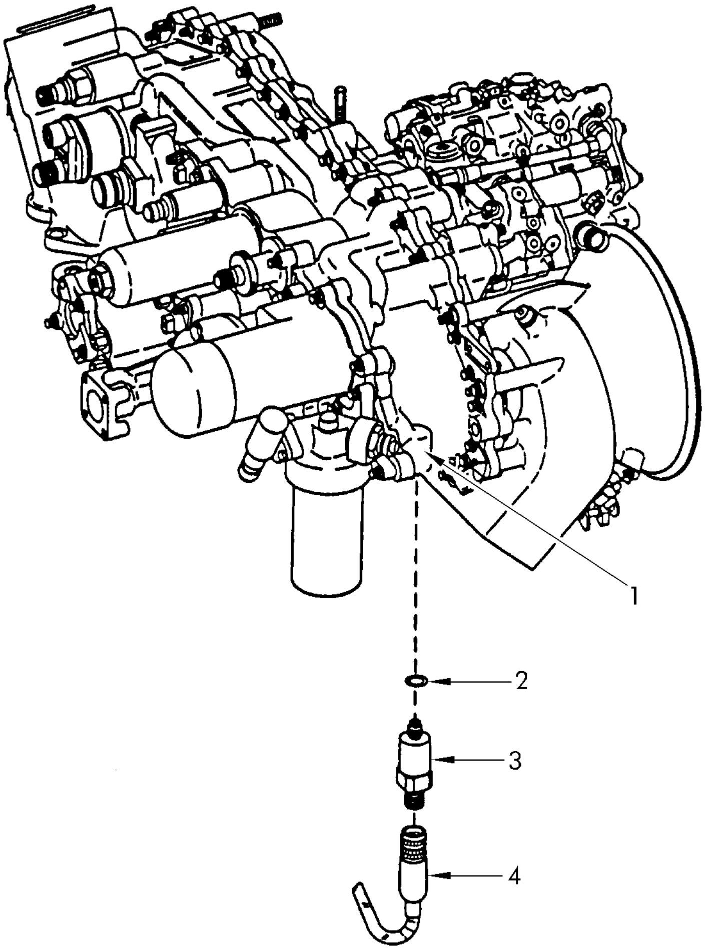
Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Disconnect electrical connector (green cable) (4, fig. 6-22) from fuel pressure sensor (3).

b. Use a wrench to loosen sensor. Remove sensor from accessory gearbox (1).

c. Remove and discard packings (2).



1. Accessory Gearbox
2. Preformed Packing
3. Fuel Pressure Sensor
4. Electrical Connector (Green Cable)

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Figure 6-22. Fuel Pressure Sensor; Removal and Installation

6-64. Inspection of Fuel Pressure Sensor.

See table 6-7.

Table 6-7. Inspection of Fuel Pressure Sensor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Fuel pressure sensor (1, fig. 6-23) for:			
(1) Visible cracks.	None allowed.	Not repairable.	Replace sensor (para 6-65).
WARNING Flight Safety Critical Aircraft Part (Critical Characteristic(s)) Leaks in fuel system components are critical characteristics. No fuel leaks allowed.			
(2) Leaks.	Not allowed.	Not repairable.	Replace sensor (para 6-65).
b. Electrical connector (2) for:			
(1) Bent socket pins.	None allowed.	Up to 1/16 inch out-of-position.	Straighten pin.
(2) Kinked or sharply bent pins.	None allowed.	Not repairable.	Replace sensor (para 6-65).
(3) Damaged threads.	Any amount, without high metal, if connector can be installed normally with its mating part.	Any amount that can be reworked to usable limits.	Blend high metal.
(4) Swelling of socket pin insulation or evidence of leakage.	Not allowed.	Not repairable.	Replace sensor (para 6-65).
(5) Looseness.	Not allowed.	Not repairable.	Replace sensor (para 6-65).
c. Mounting threads (3) for damage.	One-half of one thread in length (total), without high metal.	One-half of one thread (total), with high metal.	Blend high metal.

6-65. Installation of Fuel Pressure Sensor.

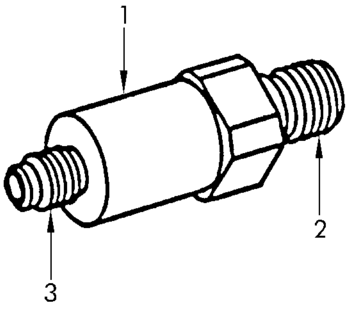
a. Install packing (2, fig. 6-22) on fuel pressure sensor (3).

b. Thread sensor into accessory gearbox (1). Hand-tighten sensor.

c. Tighten (15° wrench arc) sensor.

d. Connect electrical connector (green cable) (4) sensor.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).



1. Fuel Pressure Sensor
2. Electrical Connector
3. Mounting Threads

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Figure 6-23. Fuel Pressure Sensor; Inspection

6-66. (T701, T701C, T701D) OVERSPEED AND DRAIN VALVE (ODV) MANIFOLD ASSEMBLY.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

6-67. (T701, T701C, T701D) Cleaning of Overspeed and Drain Valve (ODV) Manifold Assembly.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) and remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the manifold assembly, using dry, filtered, compressed air.

6-68. (T701, T701C, T701D) Inspection of Overspeed and Drain Valve (ODV) Manifold Assembly. See paragraph H-24, Appendix H.

6-69. (T701, T701C, T701D) Removal of Overspeed and Drain Valve (ODV) Manifold Assembly.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. If necessary, remove blower exhaust ducting as directed in applicable aircraft maintenance manual.

b. Disconnect ODV manifold assembly (4, fig. 6-24) from main fuel manifold (6).

c. Remove bolt (5).

d. Loosen two captive bolts (3) that secure ODV manifold (4) to ODV (8).

e. Remove ODV manifold with adapter gasket (1) attached. Do not remove gasket.

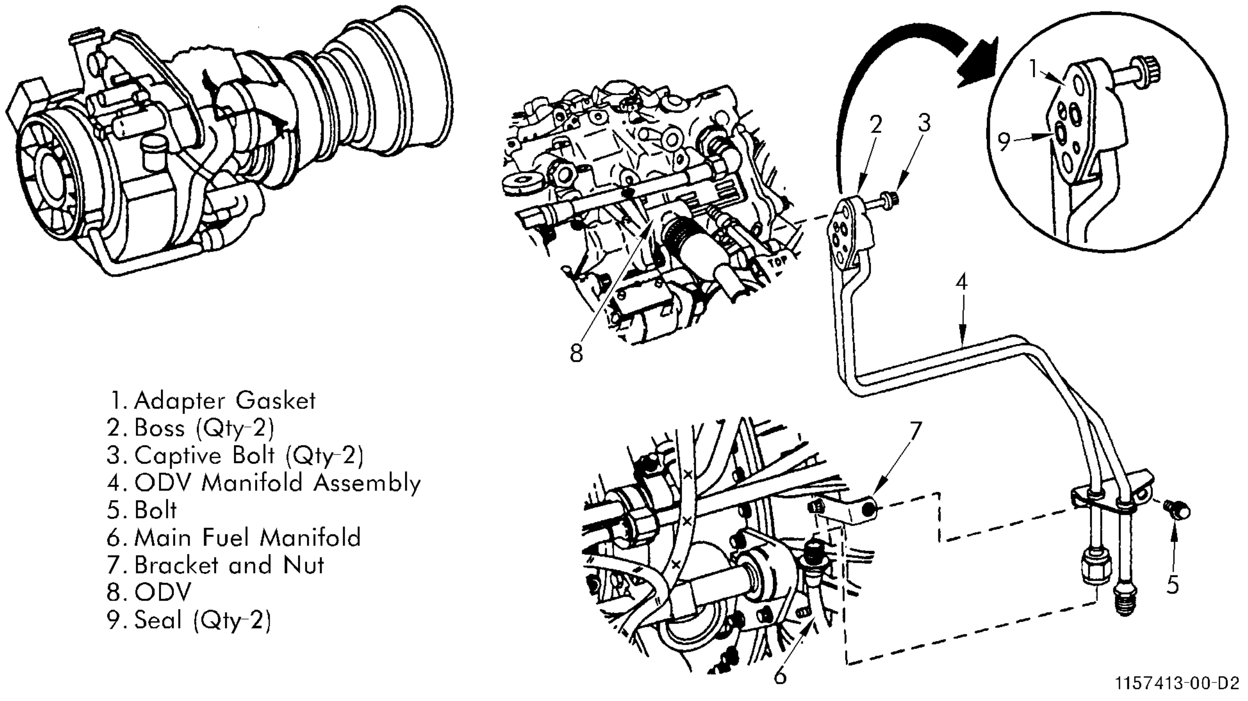

Figure 6-24. (T701, T701C, T701D) Overspeed and Drain Valve (ODV) Manifold Assembly; Removal, Inspection, and Installation

6-70. (T701, T701C, T701D) Cleaning of Overspeed and Drain Valve (ODV) Manifold Assembly.

See paragraph H-23, Appendix H.

6-71. (T701, T701C, T701D) Inspection of Overspeed and Drain Valve (ODV) Manifold Assembly.

See table 6-8.

*Table 6-8. **(T701, T701C, T701D)** Inspection of Overspeed and Drain (ODV) Manifold Assembly*

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. ODV manifold assembly (fig. 6-24) for damaged tubes and fittings.	See Inspection of Tubes, Hoses, and Fittings (para H-24 Appendix H).		
b. Captive bolts (3) for damaged threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
c. Boss (2) (with captive bolt (3) removed) for damaged threads.	No crossed threads or loose material.	Any amount.	AVUM: Replace ODV manifold assembly (para 6-72). AVIM: Cap and plug all openings. Remove loose material and debris. Chase threads.
d. Adapter gasket (1) for nicks, cuts, excessive compression set, and separation of seals (9).	Not allowed.	Not repairable.	Replace gasket (para 6-73).

6-72. (T701, T701C, T701D) Installation of Overspeed and Drain Valve (ODV) Manifold Assembly.

a. If adapter gasket (1, fig. 6-24) is not attached to ODV manifold assembly (4), attach it (para 6-73).

b. Hold manifold assembly (4) in position, and hand-tighten two captive bolts (3). Torque bolts (3) to 45-50 inch-pounds.

c. Attach manifold assembly (4) to bracket and nut (7) with bolt (5). Torque bolt (5) to 45-50 inch-pounds.

d. Attach manifold assembly (4) to fitting on main fuel manifold (6).

e. If either manifold assembly (4) or fitting on main fuel manifold (6) is new, tighten coupling nut as follows:

(1) Using open end wrench, seat nut snugly.

(2) Tighten (120° wrench arc) nut.

(3) Loosen nut and reseat snugly.

(4) Tighten (60° wrench arc) nut.

(5) Repeat steps (3) and (4).

f. If both manifold assembly (4) and fitting are used, tighten (60° wrench arc) nut.

g. If blower exhaust ducting was removed, install ducting as directed in applicable aircraft maintenance manual.

h. Make required engine checks listed in table 1-39.

6-73. (T701, T701C, T701D) Repair of Overspeed and Drain Valve (ODV) Manifold Assembly.

Replace adapter gasket (1, fig. 6-25) as follows:

a. Remove flathead screw (4), remove and discard adapter gasket (1).

b. Attach new gasket (1) to flange (2) of ODV manifold (3), and secure gasket (1) with screw (4).

c. Turn screw (4) until gasket (1) makes metal-to-metal contact with flange (2). Be sure that screw (4) is below surface of gasket (1).

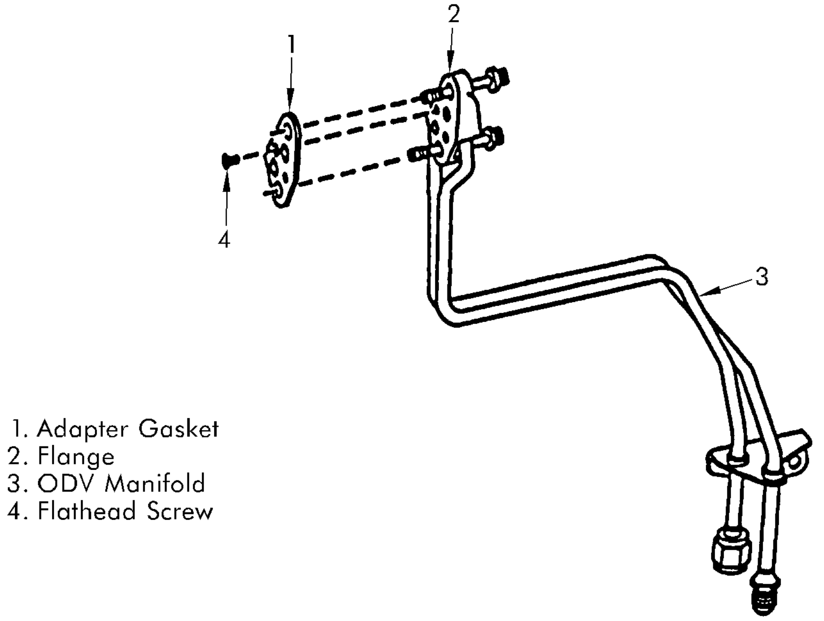

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Figure 6-25. ***(T701, T701C, T701D)*** *Adapter Gasket for ODV Manifold; Replacement*

6-74. (T701, T701C, T701D) OVERSPEED AND DRAIN VALVE (ODV).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

6-75. (T701, T701C, T701D) Removal of Overspeed and Drain Valve (ODV).

a. Disconnect electrical connector (blue cable) (1, fig. 6-26) from connector on ODV (5). Cover connectors with clean, dry, protective caps (items 25, 27, Appendix D).

WARNING

Handling Fuel System Components in Cold
Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

b. Loosen two captive bolts (8) that secure ODV manifold assembly (7) to ODV (5). Do not remove adapter gasket (6).

c. Loosen two captive bolts (2), and remove ODV (5).

d. Remove and discard two preformed packings (3).

CAUTION

Overspeed and drain valves which are removed from engine for more than 48 hours for maintenance, for storage, or for return to Depot will be preserved in accordance with paragraph 1-209, step d. This will prevent corrosion and damage to the overspeed and drain valve.

e. If ODV will not be reinstalled within 48 hours, or if it will be returned to Depot or stored, preserve it (para 1-209, step d).

f. Cover fuel openings with protective caps to prevent entry of foreign material.

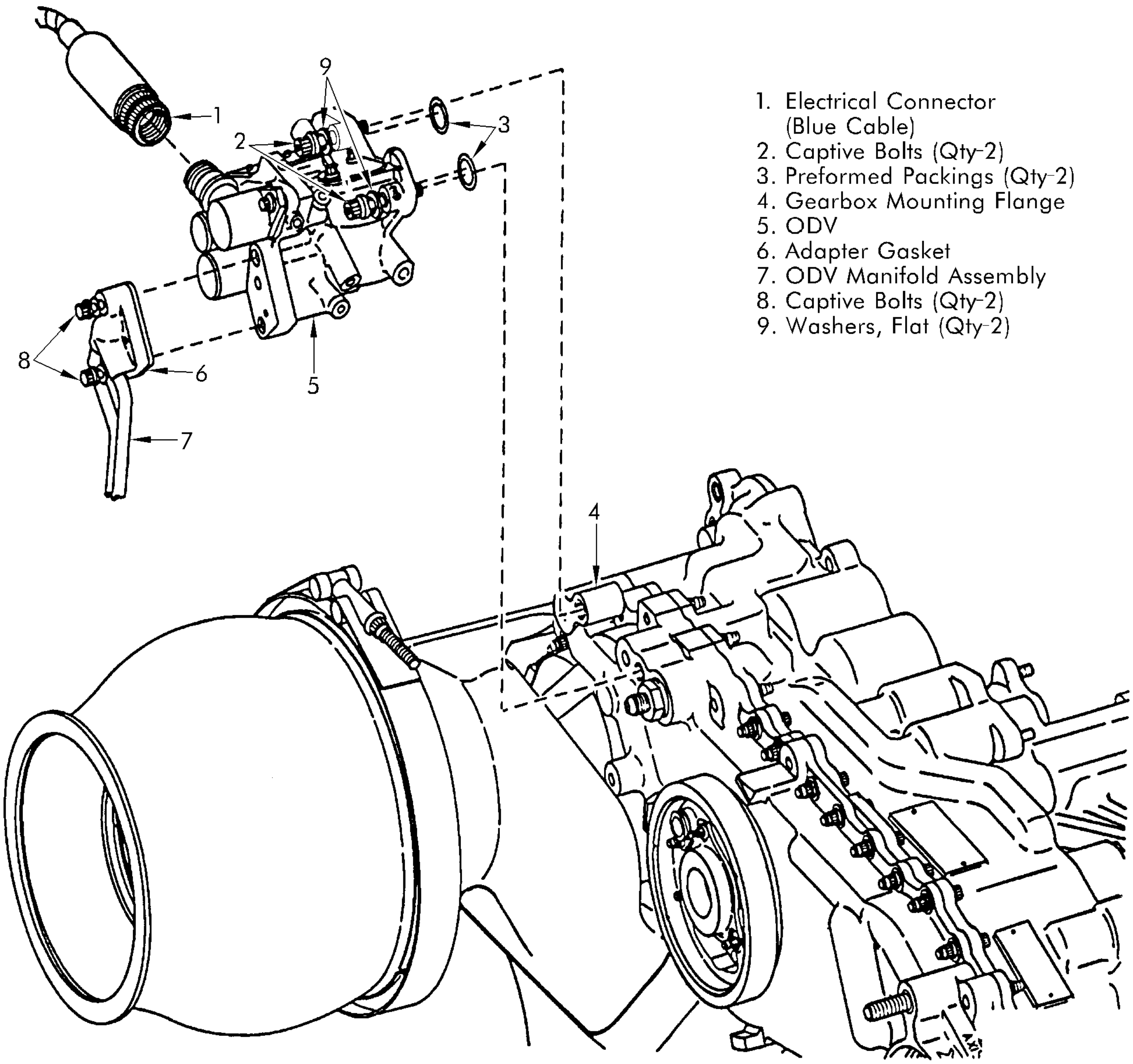


Figure 6-26. ***(T701, T701C, T701D)*** *Overspeed and Drain Valve (ODV); Removal and Installation*

6-76. (T701, T701C, T701D) Cleaning of Overspeed and Drain Valve (ODV).

a. Cover all openings with protective caps before cleaning.

b. Check electrical connector for moisture or contamination.

c. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap (item 25, Appendix D).

d. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

e. Flush or spray-wash external surface with dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

f. Dry the ODV using dry, filtered, compressed air.

6-77. (T701, T701C, T701D) Inspection of Overspeed and Drain Valve (ODV). See table 6-9.

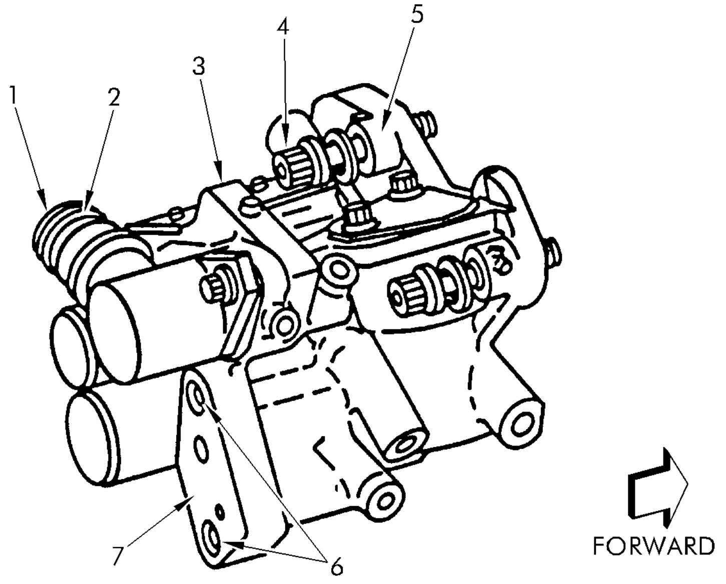
Table 6-9. (T701, T701C, T701D) Inspection of Overspeed and Drain Valve (ODV)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. ODV housing (3, fig. 6-27) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace ODV (para 6-78).
(2) Leaks.	Not allowed.	Not repairable.	Replace ODV (para 6-78).
(3) Damaged threads (6).	Up to two threads without high metal or crossed threads.	Up to two threads with high metal or crossed threads.	Remove high metal.
b. Captive bolts (4) for damaged threads.	Not allowed.	Not repairable.	Replace bolts (para H-6 Appendix H).
c. Boss (5) (with captive bolt (4) removed) for damaged threads.	No crossed threads or loose material.	Any amount.	AVUM: Replace ODV (para 6-78). AVIM: Cap and plug all openings. Remove loose material and debris. Chase threads.
d. Electrical connector (1) for:			
(1) Contamination or moisture.	Not allowed.	Any amount.	Clean connector (para H-11, Appendix H).
(2) Bent pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(3) Damaged threads (2).	Any amount, without high metal, if connector can be assembled normally with its mating part.	Any amount that can be reworked to usable limits.	Remove high metal.
e. Mating flange (7) for nicks and scratches.	Any number, 0.015 inch deep, without high metal.	Any number, 0.015 inch deep, with high metal.	Remove high metal.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.



1. Electrical Connector
2. Threads
3. Housing
4. Captive Bolt (Qty-2)
5. Boss (Qty-2)
6. Threads
7. Mating Flange

*Figure 6-27. **(T701, T701C, T701D)** Overspeed and Drain Valve (ODV); Inspection*

6-78. (T701, T701C, T701D) Installation of Overspeed and Drain Valve (ODV).

a. Install two preformed packings (3, fig. 6-26) onto ODV (5).

NOTE

Prior to ODV installation, ensure flat washers (9) seat without interference. If washer will not seat, replace washer or remove excess material from washer O.D.

b. Place ODV (5) onto gearbox mounting flange (4), using captive bolts (2) and flat washers (9). Be sure washers are seated and tighten two captive bolts (2). Torque bolts to 45-50 inch-pounds.

c. If adapter gasket (6) is not attached to ODV manifold assembly (7), attach gasket (para 6-73).

d. Position manifold assembly (7) onto ODV (5), and tighten two captive bolts (8). Torque bolts to 45-50 inch-pounds.

e. Connect electrical connector (blue cable) (1) to ODV (5) as directed in paragraph H-7 Appendix H.

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

6-79. (T700) PRESSURIZING AND OVERSPEED UNIT (POU) MANIFOLD ASSEMBLY.

6-80. (T700) Cleaning of Pressurizing and Overspeed Unit (POU) Manifold Assembly.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) and remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the manifold assembly, using filtered compressed air.

6-81. (T700) Inspection of Pressurizing and Overspeed Unit (POU) Manifold Assembly. See paragraph H-24, Appendix H.

6-82. (T700) Removal of Pressurizing and Overspeed Unit (POU) Manifold Assembly.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Remove particle separator blower (para 5-11)

b. Remove P3 hose and tube assembly (4, fig. 6-28) (para 10-5).

c. Disconnect fuel start feed tube (8).

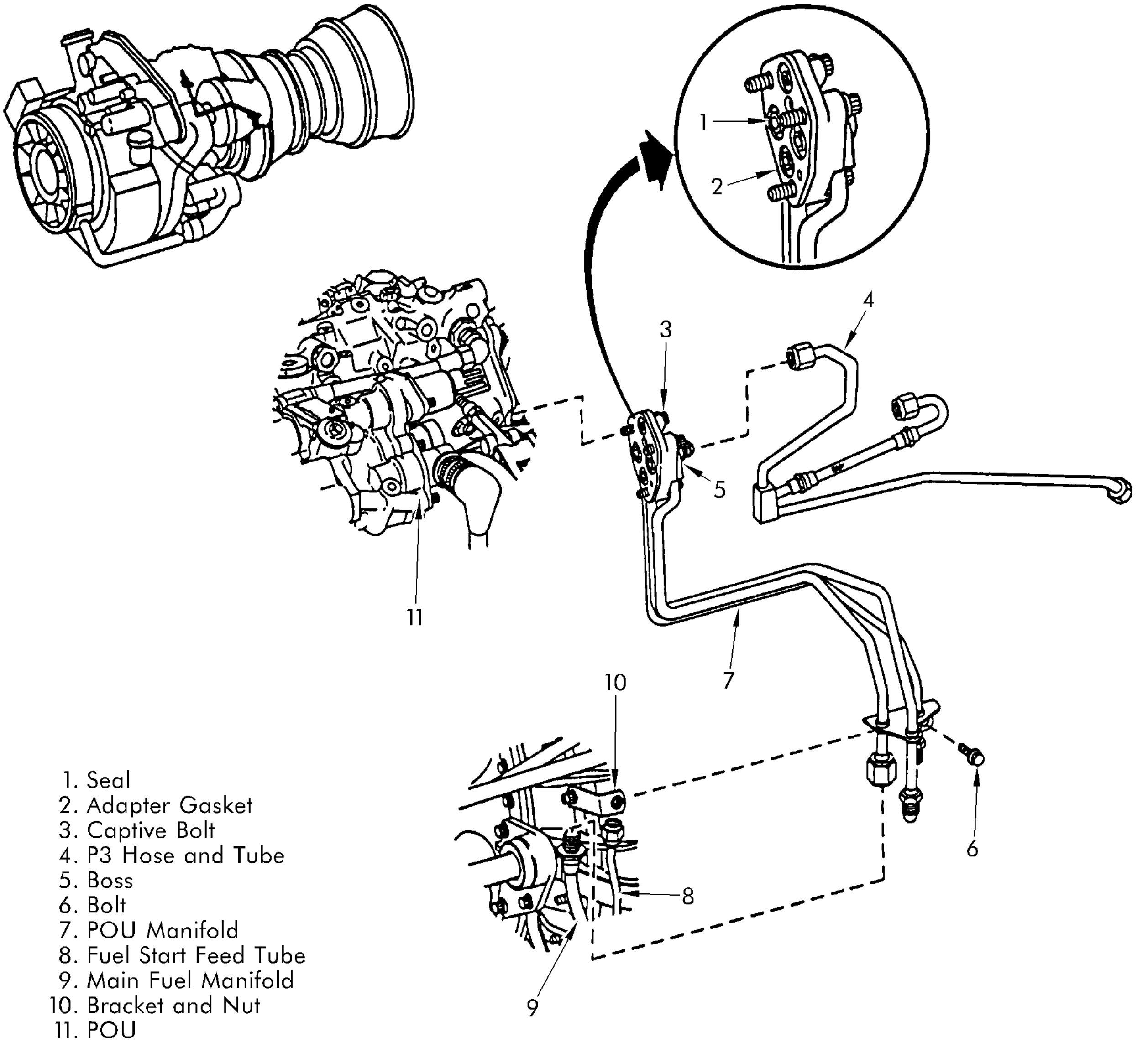
d. Disconnect POU manifold assembly (7) from main fuel manifold (9) and from fuel start from feed tube (8).

e. Remove bolt (6).

f. Loosen three captive bolts (3) that secure POU manifold assembly (7) to POU (11).

g. Remove POU manifold assembly with adapter gasket (2) attached. Do not remove gasket.

6-83. (T700) Cleaning of Pressurizing and Overspeed (POU) Manifold Assembly. See paragraph H-23, Appendix H.



1. Seal
2. Adapter Gasket
3. Captive Bolt
4. P3 Hose and Tube
5. Boss
6. Bolt
7. POU Manifold
8. Fuel Start Feed Tube
9. Main Fuel Manifold
10. Bracket and Nut
11. POU

Figure 6-28. *(T700)* ***Pressurizing and Overspeed Unit Manifold Assembly; Removal, Inspection, and Installation***

6-84. (T700) Inspection of Pressurizing and Overspeed (POU) Manifold Assembly.

See table 6-10

Table 6-10. *(T700)* ***Inspection of Pressurizing and Overspeed Unit (POU) Manifold Assembly***

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. POU manifold assembly (7, fig. 6-28) for damaged tubes and fittings.	See Inspection of Tubes, Hoses and Fittings (para H-24, Appendix H).		
b. Captive bolts (3) for damaged threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
c. Boss (5) (with captive bolt (3) removed) for damaged threads.	Any number of missing threads with no crossed threads or loose material.	Any amount.	AVUM: Replace POU manifold assembly (para 6-85). AVIM: Cap and plug all openings. Remove loose material and debris. Chase threads.
d. Adapter gasket (2) for nicks, cuts, excessive compression set, and separation of seals (1).	Not allowed.	Not repairable.	Replace gasket (para 6-86).

6-85. (T700) Installation of Pressurizing and Overspeed Unit (POU) Manifold Assembly.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

a. If adapter gasket (2, fig. 6-28) is not attached to POU manifold (7), attach it (para 6-86).

b. Position manifold (7) onto POU (11), and hand-tighten three captive bolts (3). Torque bolts (3) to 45-50 inch-pounds.

c. Loosely attach manifold (7) to main fuel manifold (9) and to fuel start feed tube (8).

d. Attach manifold (7) to bracket and nut (10) with bolt (6). Torque bolt (6) to 45-50 inch pounds.

e. If either manifold (7) or fitting on main fuel manifold (9) is new, tighten coupling nut as follows:

(1) Using open end wrench, seat nut snugly.

(2) Tighten (120° wrench arc) nut.

(3) Loosen nut and reseat it snugly.

(4) Tighten (60° wrench arc) nut.

(5) Repeat steps (3) and (4).

f. Tighten (60° wrench arc) the following:

(1) Coupling nut on manifold (7) if both manifold (7) and fitting on main fuel manifold (9) are used.

(2) Coupling nut on feed tube (8).

g. Install P3 hose and tube assembly (4) to union on POU manifold (7) and to midframe reducer (para 10-9).

h. Install particle separator blower and V-band coupling assembly (para 5-14).

6-86. (T700) Repair of POU Manifold Assembly.

Replace adapter gasket (2, fig. 6-29) as follows:

a. Remove flathead screw (1); remove and discard adapter gasket (2).

b. Attach new gasket (2) to flange (3) of POU manifold (4), and secure gasket (2) with screw (1).

c. Turn screw (1) until gasket (2) makes metal-to-metal contact with flange (3). Be sure that screw (1) is below surface of gasket (2).

6-87. (T700) PRESSURIZING AND OVERSPEED UNIT (POU).

6-88. (T700) Removal of Pressurizing and Overspeed Unit (POU).

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

a. Remove particle separator blower and V-band coupling assembly (para 5-11).

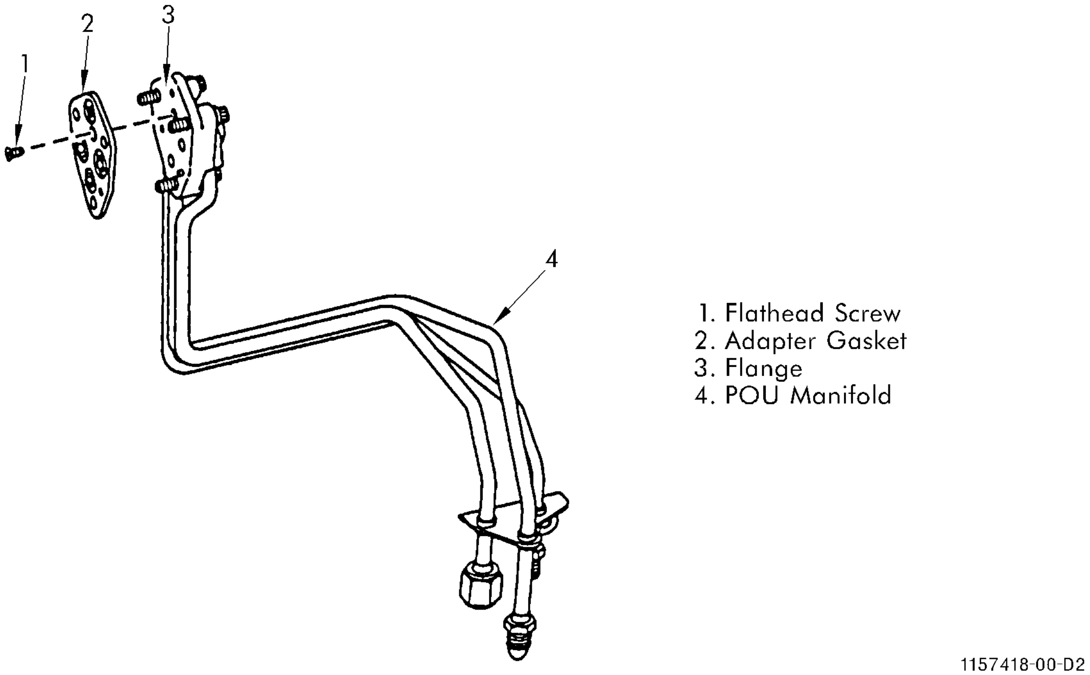


Figure 6-29. (T700) Adapter Gasket for POU Manifold; Replacement

b. Disconnect P3 hose and tube assembly (9, fig. 6-30) from POU manifold assembly (7).

c. Disconnect electrical connector (blue cable) (1) from POU (5). Cover connectors with clean, dry, protective caps (items 25, 27, Appendix D).

d. Loosen three captive bolts (8) that secure POU manifold assembly (7) to POU (5). Do not remove adapter gasket (6).

e. Loosen two captive bolts (2) and remove POU (5).

f. Remove and discard two packings (3).

CAUTION

> Overspeed and drain valves which are removed from engine for more than 48 hours for maintenance, for storage, or for return to Depot will be preserved in accordance with paragraph 1-209, step d. This will prevent corrosion and damage to the overspeed and drain valve.

g. If POU will not be reinstalled within 48 hours, or if it will be returned to Depot or stored, preserve it (para 1-209, step c).

h. Cover fuel openings with protective caps to prevent entry of foreign material.

6-89. (T700) Cleaning of Pressurizing and Overspeed Unit (POU).

a. Cover all openings with protective caps before cleaning.

b. Check electrical connector for moisture or contamination.

c. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry, protective cap (item 25, Appendix D). Otherwise, do the following:

(1) Clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

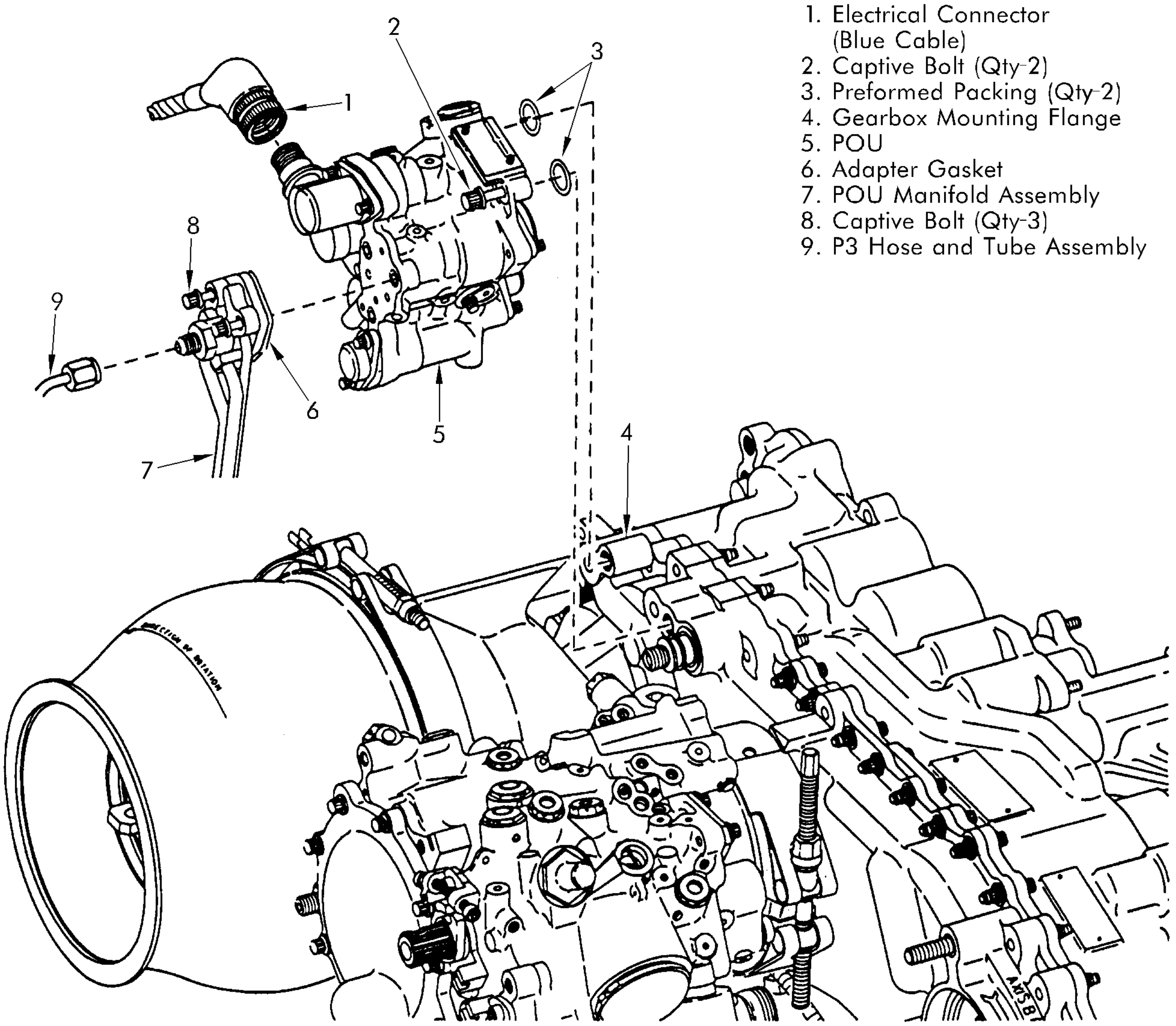
(2) Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) and remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(3) Dry the POU, using dry, filtered, compressed air.



1. Electrical Connector (Blue Cable)
2. Captive Bolt (Qty-2)
3. Preformed Packing (Qty-2)
4. Gearbox Mounting Flange
5. POU
6. Adapter Gasket
7. POU Manifold Assembly
8. Captive Bolt (Qty-3)
9. P3 Hose and Tube Assembly

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Figure 6-30. (T700) Pressurizing and Overspeed Unit (POU); Removal and Installation

6-90. (T700) Inspection of Pressurizing and Overspeed Unit (POU). See table 6-11.

Table 6-11. *(T700)* ***Inspection of Pressurizing and Overspeed Unit (POU)***

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. POU housing (3, fig. 6-31) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace POU (para 6-91).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

(2) Leaks.	Not allowed.	Not repairable.	Replace POU (para 6-91).
(3) Damaged threads (6).	Up to two threads without high metal or crossed threads.	Up to two threads with high metal or crossed threads.	Remove high metal.
b. Captive bolts (4) for damaged threads.	Not allowed.	Not repairable.	Replace bolts (para H-6, Appendix H).
c. Boss (5) (with captive bolt (4) removed) for damaged threads.	Any number of missing threads without crossed threads or loose material.	Any amount.	AVUM: Replace POU (para 6-91). AVIM: Cap and plug all openings. Remove loose material and debris. Chase threads.
d. Electrical connector (1) for:			
(1) Contamination or moisture.	Not allowed.	Any amount.	Clean connector (para H-11, Appendix H).
(2) Bent pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(3) Damaged threads (2).	Any amount, without high metal if connector can be installed normally with its mating part.	Any amount that can be reworked to usable limits.	Remove high metal.
e. Mating flange (7) for nicks and scratches.	Any number, 0.015 inch deep, without high metal.	Any number, 0.015 inch deep, with high metal.	Remove high metal.

6-91. (T700) Installation of Pressurizing and Overspeed Unit (POU).

a. When replacing sequence valve assembly with pressurizing and overspeed unit (POU), do the following:

(1) Replace sequence manifold assembly with POU manifold assembly.

(2) Replace P3 hose and tube assembly with P3 hose and tube assembly PN 5051T08P01.

b. Install two preformed packings (3, fig. 6-30) onto POU (5).

c. Place POU (5) onto gearbox mounting flange (4), and tighten two captive bolts (2). Torque bolts to 45-50 inch-pounds.

d. If adapter gasket (6) is not attached to POU manifold assembly (7), attach it with one screw. Turn screw until gasket makes a metal-to-metal contact with manifold flange.

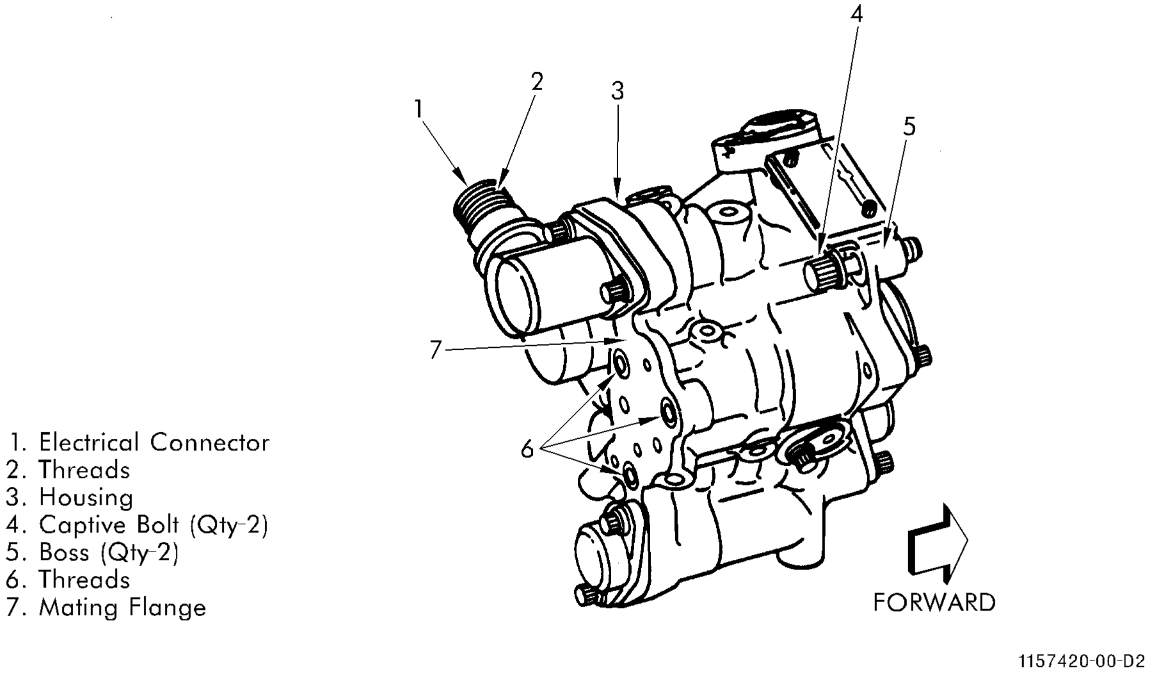
e. Position POU manifold assembly (7) onto POU (5) and tighten three captive bolts (8). Torque bolts to 45-50 inch-pounds.

f. Connect electrical connector (1) (blue cable) to POU (5) as directed in paragraph H-7, Appendix H.

g. Connect P3 hose and tube assembly (9) to fitting on POU manifold assembly (para 10-9).

h. Install particle separator blower and V-band coupling assembly (para 5-14).

i. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).



1. Electrical Connector
2. Threads
3. Housing
4. Captive Bolt (Qty-2)
5. Boss (Qty-2)
6. Threads
7. Mating Flange

Figure 6-31. *(T700)* **Pressurizing and Overspeed Unit (POU); Inspection**

CHAPTER 7

ELECTRICAL SYSTEM

ELECTRICAL AND IGNITION SYSTEM

7-1. CHAPTER OVERVIEW.

This chapter contains instructions for removing, cleaning, inspecting, repairing, testing, and installing electrical system components to the extent allowed by the Maintenance Allocation Chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

7-2. CHAPTER INDEX.

7-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. When removing or installing parts, prevent entry of foreign objects into fuel passages, and avoid damaging electrical connectors.

b. Do not use tape to cover fuel passages or openings. Use clean, dry protective caps to cover electrical connectors and other openings.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

c. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

d. Inspect replacement parts for serviceability before installation.

e. Always use a backup wrench on fittings when removing or installing hoses or tubes.

f. When connecting hoses or tubes, see wrench-arc tightening method (para H-14, Appendix H) for proper tightening procedure.

g. If electrical connector requires cleaning, clean its mating connector also. Refer to paragraph H-11, Appendix H for cleaning procedure.

h. Before connecting electrical connectors, refer to paragraph H-7, Appendix H for proper procedure.

i. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

(3) Inspect all electrical cables for correct routing, clamping and chafing.

7-4. IGNITER PLUGS.

7-5. (T700) Removal of Igniter Plugs.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that ignition lead(s) (igniter plug end) are correctly grounded.
- Do not attempt to ground ignition lead(s) to components made of composite material, such as the outer bypass duct. Composite materials do not conduct electricity.
- Ground lead(s) to the customer bleed duct.

WARNING

Excessive Force/Torque on Igniter Plug

Do not use excessive force/torque when removing or installing an igniter plug. Excessive force/torque will damage the igniter plug boss and may cause the midframe to rupture.

CAUTION

Do not damage fuel start manifold tube with wrench when disconnecting ignition lead and retaining nut.

NOTE

Igniter plugs are located at 4 and 8 o'clock positions on midframe. The removal procedure that follows can be used for both igniter plugs.

a. Disconnect coupling nut (2, fig. 7-1) on ignition lead (1) from igniter plug (5).

b. Ground ignition lead (1) as follows:

(1) Push back coupling nut (2) on lead (1) to expose socket (3).

(2) Hold an insulated screwdriver by the handle, and touch tip of screwdriver to midframe (6).

(3) Touch socket (3) to shank of screwdriver. Sparks observed during grounding indicate a defective ignition exciter; replace defective ignition exciter (para 7-29).

c. Remove retaining nut (4) from midframe port.

d. Remove igniter plug (5) from midframe port.

e. Using a flashlight and a magnifying glass (5× to 10×), inspect midframe boss to casing joint. No cracks allowed. If cracks are found, replace cold section module.

f. Repeat steps a thru e for other plug.

7-6. (T701, T701C, T701D) Removal of Igniter Plugs.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that ignition lead(s) (igniter plug end) are correctly grounded.
- Do not attempt to ground ignition lead(s) to components made of composite material, such as the outer bypass duct. Composite materials do not conduct electricity.
- Ground lead(s) to the customer bleed duct.

NOTE

Igniter plugs are located at 4 and 8 o'clock positions on midframe. The removal procedure that follows can be used for both igniter plugs.

a. Disconnect coupling nut (3, fig. 7-2) on ignition lead (4) from igniter plug (1).

b. Ground ignition lead (4) as follows:

(1) Push back coupling nut (3) on lead (4) to expose socket (2).

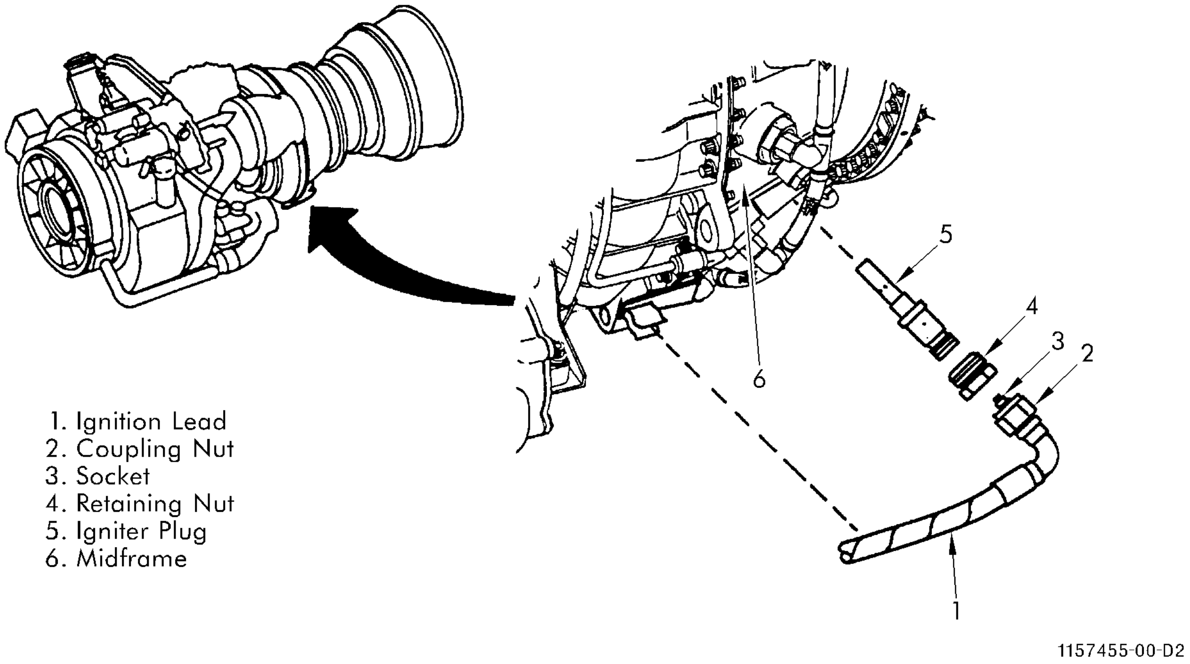


Figure 7-1. ***(T700)*** *Igniter Plugs; Removal and Installation*

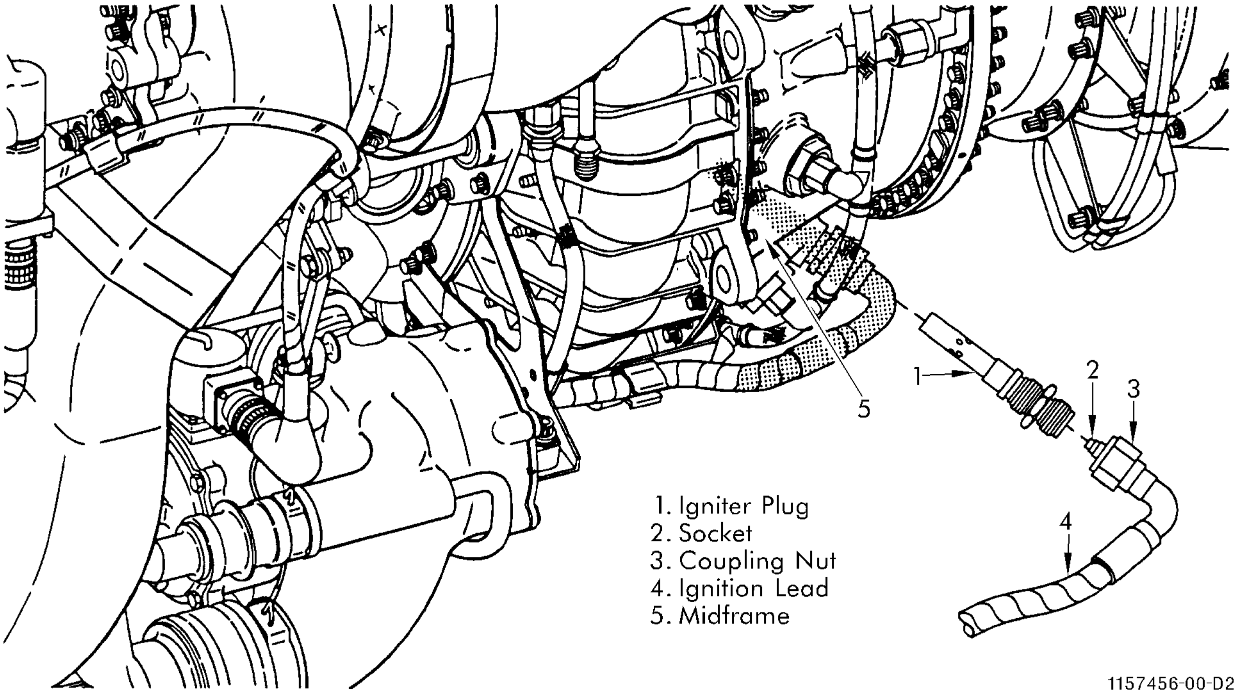


Figure 7-2. ***(T701, T701C, T701D)*** *Igniter Plugs; Removal and Installation*

(2) Hold an insulated screwdriver by the handle, and touch tip of screwdriver to midframe (5).

(3) Touch socket (2) to shank of screwdriver. Sparks observed during grounding indicate a defective ignition exciter; replace defective ignition exciter (para 7-29).

WARNING

Fluorescent Dye Penetrant

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged inhalation of vapor can result in dizziness, drowsiness, headache, and nausea.
- After any prolonged contact with skin, wash contacted area with soap and water. Remove oil-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When applying liquid by brush or aerosol spray at unexhausted workbench, wear approved respirator and goggles.

WARNING

Excessive Force/Torque on Igniter Plug

Do not use excessive force/torque when removing or installing an igniter plug. Excessive force/torque will damage the igniter plug boss and may cause the midframe to rupture.

NOTE

- Tip of igniter plug can enlarge due to swelling of the semiconductor material inside the tip as well as the outer shell material itself.
- When tip of igniter plug enlarges, igniter plug may be difficult to remove from combustion liner.

c. Remove igniter plug (1) from midframe (5). If igniter plug is hard to remove, apply Zyglo penetrant (item 91, Appendix D) to threads of igniter plug; let the penetrant soak for 30 minutes; then remove igniter plug. If igniter plug (1) is still hard to remove (due to tip enlargement), go to step d.

d. Remove fuel injector (para 6-23) adjacent to igniter plug that is hard to remove.

e. Using igniter removal fixture 21C7765G01 (fig. 7-3), remove igniter plug (11) as follows:

(1) Pull out igniter plug (11) as far as possible.

(2) Insert arm 21C7765P02 (part of 21C7765G02) (8) into fuel injector port (13) so that slotted foot (7) is perpendicular to axial centerline of engine and pointing downward.

(3) Pull the arm (8) outward slightly so that it clears combustion liner igniter ferrule (12).

(4) Slowly rotate arm (8) 90° clockwise until the slotted foot (7) engages the igniter barrel. Slowly push the arm (8) in until it bottoms on igniter ferrule (12).

(5) Using borescope (para 1-172), be sure that arm (8) is bottomed on igniter ferrule (12).

(6) Thread knurled nut 21C7765P03 (part of 21C7765G01) (9) into fuel injector port (13). While holding arm (8) firmly against igniter ferrule (12), hand-tighten nut (9).

(7) Thread igniter plug retaining nut (10) into igniter boss before installing puller 21C7765P05 (part of 21C7765G01) (6). This will prevent igniter plug (11) from rotating and will ease assembly of puller (6) into igniter plug (11).

CAUTION

Be sure that puller (6) is fully threaded onto igniter plug (11) to prevent damaging igniter threads.

(8) Thread puller (6) onto igniter plug (11). Be sure that puller (6) is fully threaded onto igniter plug (11).

(9) Back off igniter plug retaining nut (10) from igniter boss. Be sure that nut is fully disengaged from the igniter boss.

(10) Install one end of strap 21C7765P06 (part of 21C7765G01) (3), resting against stop (1), on arm (8) and other end of strap (3) on puller (6).

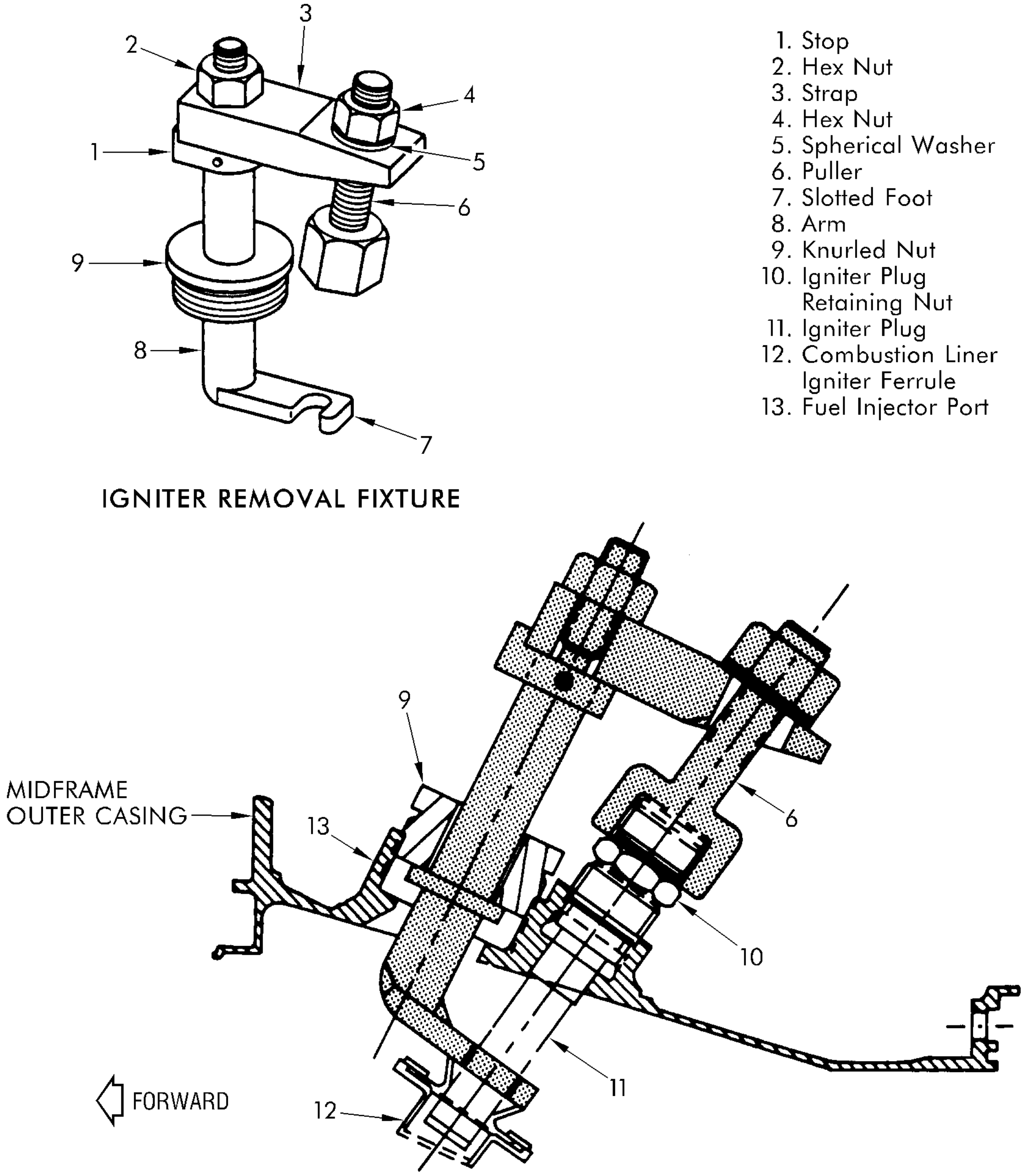


Figure 7-3. ***(T701, T701C, T701D)*** *Bulged Igniter Plug; Removal*

(11) Secure strap (3), using hex nut MS51972-2 (part of 21C7765G01) (2) on arm (8). Secure strap (3) on puller (6), using spherical washer (part of 21C7765G01) (5) and hex nut MS51972-3 (part of 21C7765G01) (4). Tighten (15° wrench-arc) both hex nuts (2, 4).

(12) Using a 9-16-inch open-end wrench on puller hex nut (4) and a 7/8-inch open-end wrench on flat of puller (6), hold puller (6) to prevent it from rotating while wrenching clockwise on puller hex nut (4). Continue wrenching nut until igniter tip is free from igniter ferrule (12).

(13) Remove strap (3), two hex nuts (2, 4), washer (5), puller/igniter assembly, and arm (8) from engine.

(14) Remove igniter plug (11) from the puller (6) and reassemble parts of fixture.

(15) Dispose of igniter plug (11).

(16) Using a flashlight and a magnifying glass (5× to 10×), inspect midframe boss to casing joint. No cracks allowed. If cracks are found, replace cold section module.

(17) Reinstall fuel injector (para 6-26).

f. Repeat steps a thru e for other plug.

7-7. Cleaning of Igniter Plugs.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash external surface with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the igniter plug using dry, filtered, compressed air.

7-8. Inspection of Igniter Plugs. See table 7-1.

Table 7-1. Inspection of Igniter Plugs

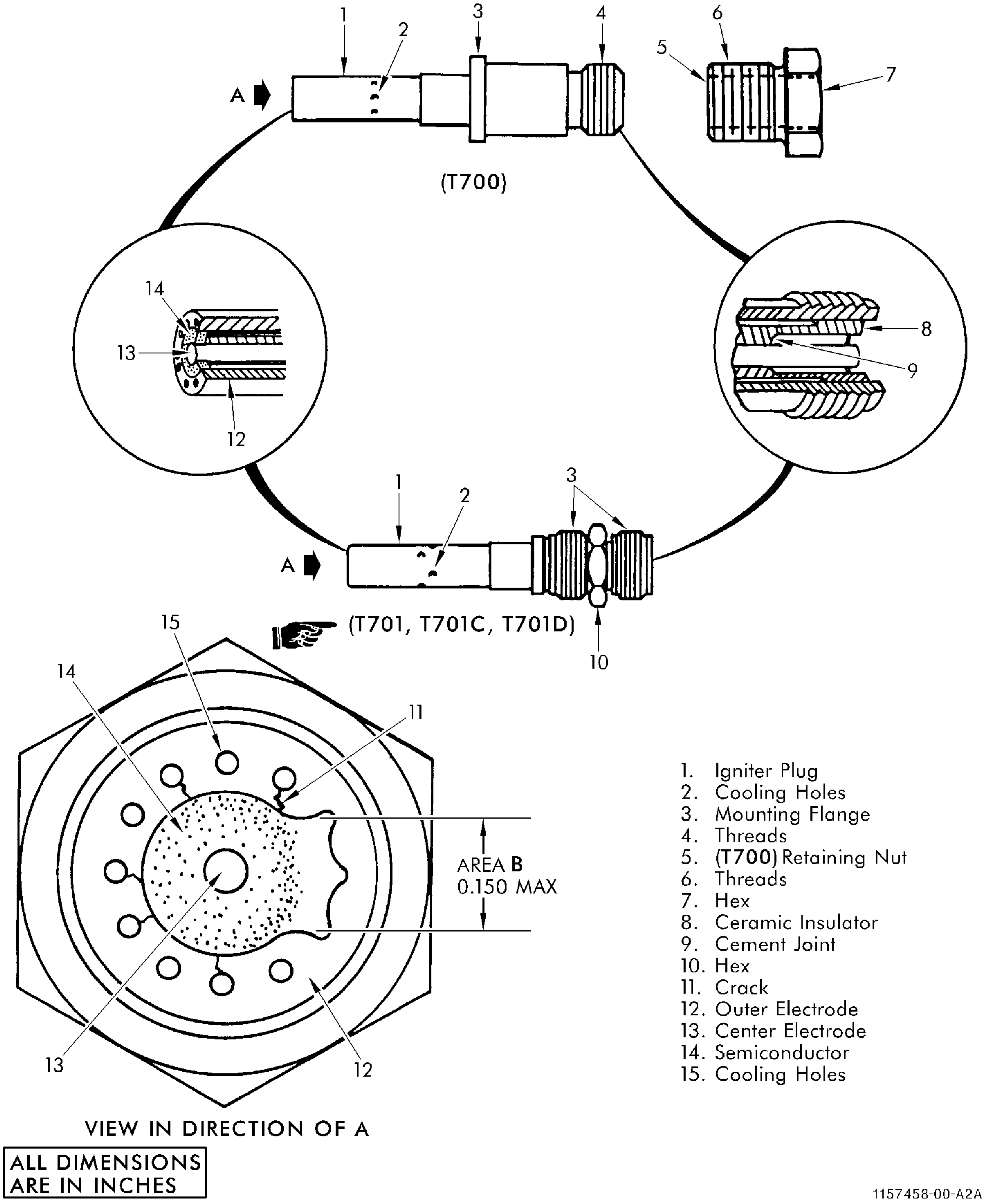
Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Threads (4, fig. 7-4) on igniter plug (1) for:			
(1) Damage.	Up to one thread length, cumulative, without high metal.	Same as usable limits, with high metal.	AVUM: Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**). AVIM: Chase threads and blend high metal.
(2) Missing silver plate.	Any amount, if mating part threads on smoothly.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(3) Missing dry-film lubricant.	Between 0.0008-0.0014 inch thick.	Any amount.	Apply solid film lubricant (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
b. Ceramic insulator (8) for:			
(1) Cracks.	Any number, if the crack is 1/8 inch minimum from ceramic edge.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(2) Looseness.	Any amount.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(3) Missing pieces.	Any number, if the missing piece is 1/8 inch from ceramic edge.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(4) Void in cement joint (9).	Any amount.	Not applicable.	Not applicable.
c. Semiconductor (14) (at tip between center and outer electrodes (13, 12)) for:			
(1) Cracks.	Any number.	Not applicable.	Not applicable.
(2) Erosion or missing material.	Any amount, up to 1/8 inch deep all around.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
d. Center electrode (13) for:			
(1) Looseness.	Up to 0.015 inch movement when using a 0.015 inch wire gage.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).

Table 7-1. Inspection of Igniter Plugs (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Erosion.	Any amount.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(3) Bends (at threaded end).	Not allowed.	Up to 3/32 inch out of position at tip without damage to ceramic insulator (4).	Straighten electrode.
(4) Carbon buildup.	Not allowed.	Any amount.	Clean plug (para 7-7).
e. Outer electrode (12) for:			
(1) Chafing.	Circumferentially, up to 0.010 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
(2) Nicks and scratches.	Any number, up to 0.010 inch deep without high metal.	Same as usable limits, with high metal.	Blend high metal.
(3) Plugged cooling air holes (2).	None allowed.	Any amount.	Using a 0.032 inch diameter wire, remove foreign material. Clean plug (para 7-7).
(4) Enlarged diameter at tip of outer electrode (12).	Any amount that will not prevent installation into combustion liner ferrule.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(5) Cracks (11) through outer electrode (12) to cooling holes (15).	Up to six places allowed.	Not applicable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(6) Missing material (Area B).	Circumferentially, up to 0.150 inch long or three holes inclusive.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(7) Erosion.	Any amount.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(8) Looseness.	Not allowed.	Not repairable.	Replace igniter plug (para 7-9 **(T700)** or 7-10 **(T701, T701C, T701D)**).
(9) Carbon buildup.	Not allowed.	Any amount.	Clean plug (para 7-7).

Table 7-1. Inspection of Igniter Plugs (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
f. **(T700)** Mounting flange (3) for:			
(1) Nicks, dents, and scratches.	Any number, 0.020 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
(2) Wear.	0.110 inch minimum thickness.	Not repairable.	Replace igniter plug (para 7-9).
g. **(T700)** Retaining nut (5) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace nut (para 7-9).
(2) Missing or damaged threads (6).	One thread total, missing or damaged, without high metal, if threads can be used without crossthreading.	One thread total, missing or damaged, that can be chased to usable limits.	AVUM: Replace nut (para 7-9). AVIM: Chase threads.
(3) Damage on corners of hex (7) caused by wrenching.	Any amount, without high metal, if wrench will not slip off hex.	Same as usable limits with high metal.	AVUM: Replace nut (para 7-9). AVIM: Remove high metal on hex.
(4) Distortion.	Any amount if wrench will fit on nut.	Not repairable.	Replace nut (para 7-9).
(5) Discoloration.	Any amount.	Not applicable.	Not applicable.
(6) Nicks and scratches, except on threads.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits with high metal.	AVUM: Replace nut (para 7-9). AVIM: Blend high metal to adjacent contour.
h. **(T701, T701C, T701D)** Hex (10) for:			
(1) Nicks, dents, and scratches on flats.	Any number, up to 0.020 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal.
(2) Damaged corners.	Any amount, without high metal, if wrench does not slip.	Any amount that can be reworked to usable limits with high metal.	Blend high metal.



1. Igniter Plug
2. Cooling Holes
3. Mounting Flange
4. Threads
5. **(T700)** Retaining Nut
6. Threads
7. Hex
8. Ceramic Insulator
9. Cement Joint
10. Hex
11. Crack
12. Outer Electrode
13. Center Electrode
14. Semiconductor
15. Cooling Holes

Figure 7-4. Igniter Plug; Inspection

7-9. (T700) Installation of Igniter Plugs.

WARNING

Thread Compound, Antiseize
Graphite-Petrolatum
AMS 2518

- Contact with eyes/face/skin may cause irritation or burning.
- Personal protective equipment required when handling or using this material.

NOTE

Igniter plugs are located at the 4 and 8 o'clock positions on midframe. The installation procedure that follows can be used for both plugs.

a. Before installing igniter plug (5, fig. 7-1) into midframe port, inspect threads of retaining nut (4) for presence of solid film lubricant. If threads are found dry, apply a coat of anti-seize compound (item 56, Appendix D).

b. Install igniter plug (5) into midframe port.

WARNING

Excessive Force/Torque on Igniter Plug

Do not use excessive force/torque when removing or installing an igniter plug. Excessive force/torque will damage the igniter plug boss and may cause the midframe to rupture.

CAUTION

When installing retaining nut and ignition lead, do not damage fuel start manifold tube with wrench.

c. Install retaining nut (4) onto plug (5) and torque to 140-150 inch-pounds.

CAUTION

Be careful not to bend pin in connector of igniter plug during assembly of ignition lead. Igniter plug may be damaged.

d. Aline socket (3) in ignition lead connector with pin in igniter plug. Carefully push connector onto pin. Be sure that connector is firmly seated.

e. Loosely connect coupling nut (2) of ignition lead (1) onto igniter plug.

CAUTION

Ignition lead (1) should be moved (jiggled) during tightening of coupling nut (2) to prevent lead from rotating with nut.

f. Tighten (15° wrench-arc) coupling nut (2). Jiggle lead when tightening nut to prevent lead from rotating.

g. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

7-10. (T701, T701C, T701D) Installation of Igniter Plugs.

WARNING

Solid Film Lubricant

- Flammable - do not use near open flames, near welding areas, or hot surfaces.
- Do not smoke or allow smoking in areas of use.
- Contact with liquid or vapor can cause skin and eye irritation, dermatitis, and drowsiness.
- After any prolonged contact of liquid with skin, wash contact area with soap and water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air. If irritation persists, get medical help.
- When handling liquid or liquid-soaked cloth, wear approved gloves and goggles.
- Dispose of liquid-soaked rags in approved metal container.
- During material transfer, metal containers must be grounded to maintain electrical continuity.

NOTE

Igniter plugs are located at the 4 and 8 o'clock positions on midframe. The installation procedure that follows can be used for both plugs.

a. Before installing igniter plug (1, fig. 7-2), inspect threads for presence of solid film lubricant. If threads are found dry, apply solid film lubricant (item 81A, Appendix D) on threads of plug (1).

b. Install igniter plug (1) into midframe port. Torque to 140-150 inch-pounds.

c. Connect ignition lead (4) to plug (1) as follows:

(1) Pull back coupling nut (3) to expose socket.

CAUTION

Be careful not to bend pin in connector of igniter plug during assembly of ignition lead.

(2) Aline socket (2) in ignition lead connector with pin in plug (1). Carefully push connector onto pin. Be sure that connector is firmly seated.

(3) Loosely connect coupling nut (3) of ignition lead (4) onto igniter plug (1).

CAUTION

Ignition lead (4) should be moved (jiggled) during tightening of coupling nut (3) to prevent lead from rotating with nut.

(4) Tighten (15° wrench arc) nut (3). Jiggle lead when tightening nut to prevent lead from rotating.

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

7-11. (T700, T701) ELECTRICAL CONTROL UNIT (ECU) OR (T701C, T701D) DIGITAL ELECTRONIC CONTROL AND SCROLL SEAL.

7-12. Removal of (T700, T701) Electrical Control Unit (ECU) or (T701C, T701D) Digital Electronic Control (DEC) and Scroll Seal.

NOTE

If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with a 4046T52G30 or 4046T52G38 (6068T97P09 or 6068T97P13) HMU.

a. (AVUM) If removing ECU/DEC from No. 1 position (aircraft), remove Allied Signal (Garrett) anti-icing bleed and start valve paragraph 10-25.

b. Disconnect electrical connectors (10, 11, 12, fig. 7-5 or fig. 7-6) and cover connectors with clean, dry protective caps (item 28, 30, Appendix D). (If engine has been removed from aircraft, connector (11) should already be capped.)

c. Loosen two bolts (13), but do not remove them.

d. Loosen captive bolt (5).

e. Remove **(T700, T701)** ECU (9) or **(T701C , T701D)** DEC (9) with scroll seal (8) attached, by sliding it out of slots in electrical unit bracket (7).

f. Remove scroll seal (8) if ECU or DEC is to be replaced.

g. If DEC is not being replaced and DEC has not been previously sealed, remove scroll seal and determine if DEC can be sealed at AVIM as follows:

(1) Place DEC on a clean piece of paper or cardboard.

(2) Shim the electrical connector end of DEC so that top cover of DEC is parallel to bench or table top.

(3) Allow DEC to sit for at least 24 hours.

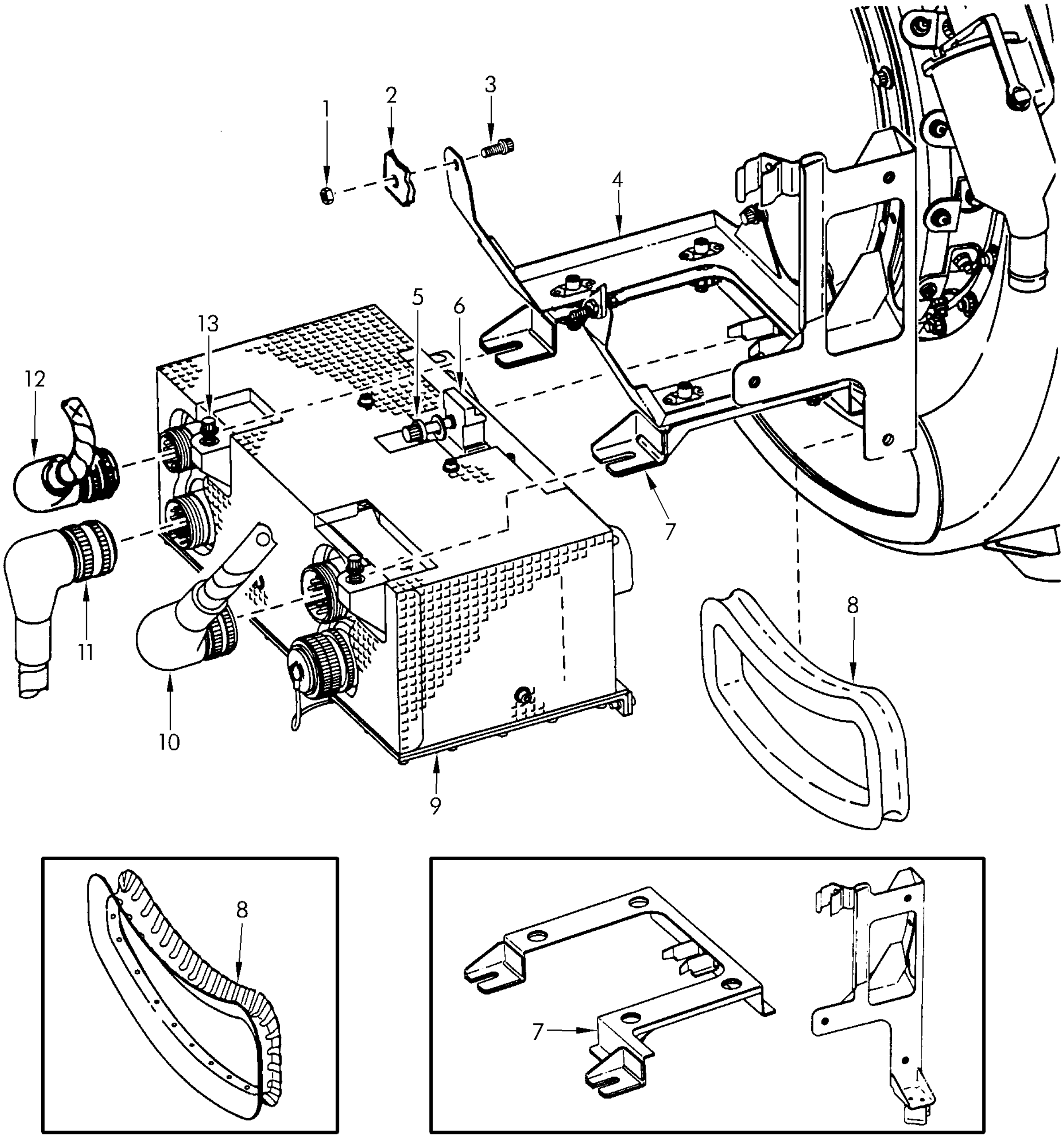
(4) After 24 hours, check paper/cardboard for evidence of fluid leakage as indicated by stains at the cover and heatsink interface (splitline) or at the four vent holes in the bottom of the cover.

(5) If leakage is confirmed, it will not be possible to adequately clean the DEC for good RTV sealant adhesion. DEC must be overhauled for proper cleaning of internal components and sealing of joints. Return DEC through normal supply channels and Mark: FOR COMPLIANCE WITH ECP 700118.

(6) If there is no evidence of fluid leakage, RTV 3145 sealant may be applied at AVIM.

h. Seal the DEC as follows:

(1) Apply masking tape (item 106, Appendix D) to four vent holes in bottom of cover assembly (fig. 7-7, sheet 1 of 3) to prevent dirt and cleaner fluid from entering DEC.

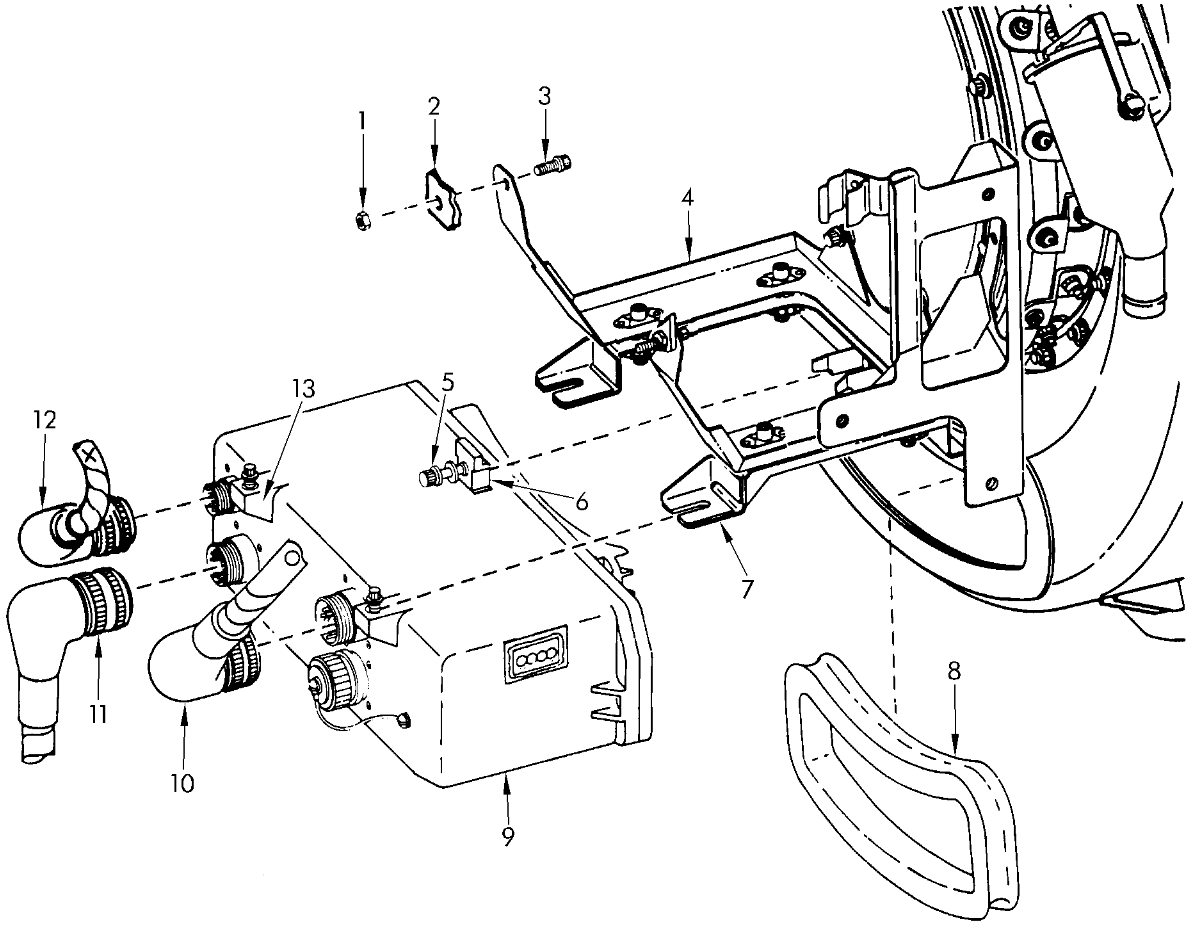


(T700) FORMER CONFIGURATION

(T700) PRESENT CONFIGURATIONS
(T701) FORMER CONFIGURATIONS

1. Nut (Qty-2)
2. Tab (Qty-2)
3. Bolt (Qty-2)
4. Amplifier Support Bracket
5. Captive Bolt
6. T-Shaped Mounting Lug
7. Electrical Unit Bracket
8. Scroll Seal
9. Electrical Control Unit (ECU)
10. Electrical Connector (Yellow Cable)
11. Electrical Connector (Aircraft Cable)
12. Electrical Connector (Blue Cable)
13. Bolt (Qty-2)

Figure 7-5. *(T700, T701)* ***Electrical Control Unit (ECU) and Scroll Seal; Removal and Installation***



1. Nut (Qty-2)
2. Tab (Qty-2)
3. Bolt (Qty-2)
4. Amplifier Support Bracket
5. Captive Bolt
6. T-Shaped Mounting Lug
7. Electrical Unit Bracket
8. Scroll Seal
9. Digital Electronic Control (DEC)
10. Electrical Connector (Yellow Cable)
11. Electrical Connector (Aircraft Cable)
12. Electrical Connector (Blue Cable)
13. Bolt (Qty-2)

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Figure 7-6. ***(T701C, T701D)*** *Digital Electronic Control (DEC) and Scroll Seal; Removal and Installation*

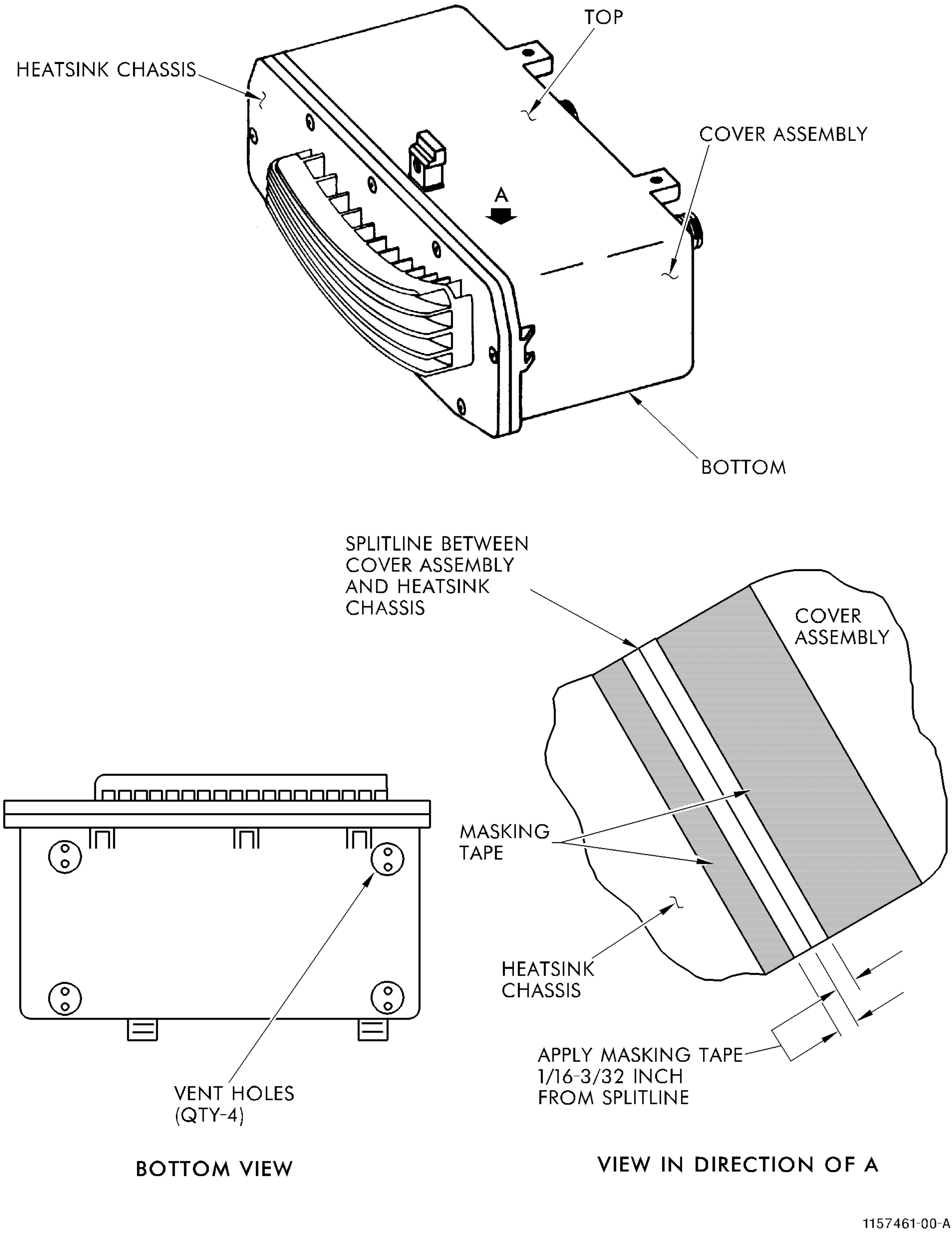
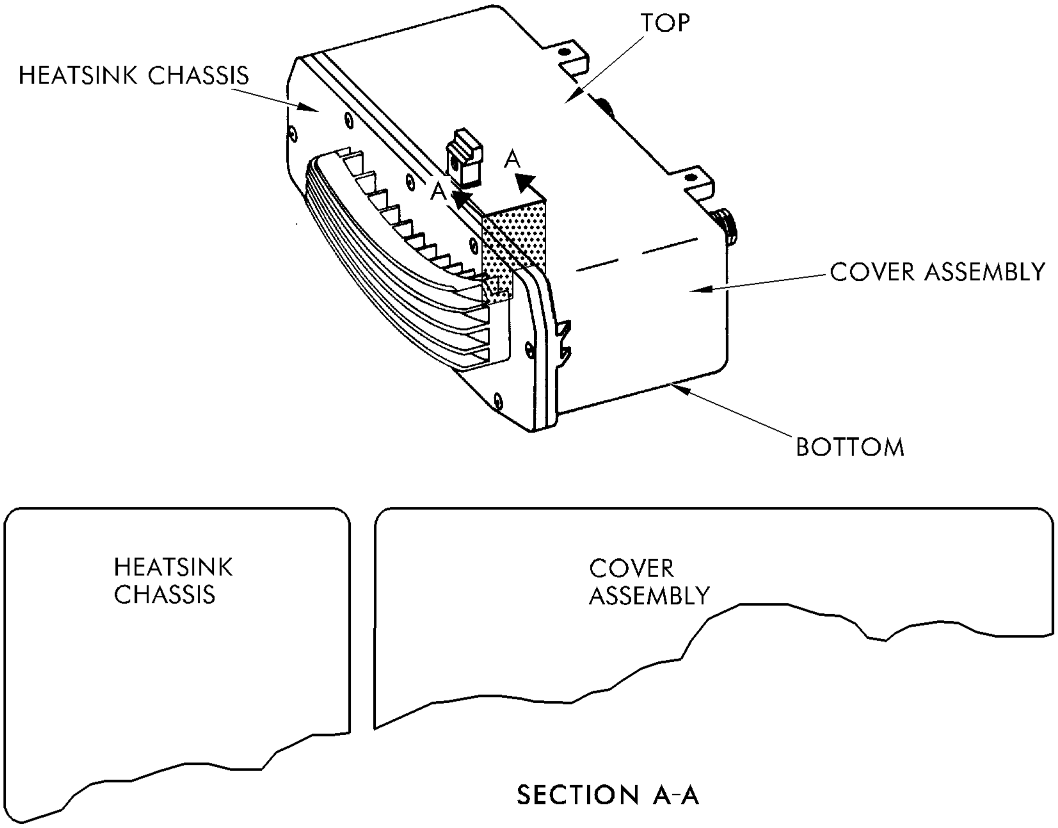
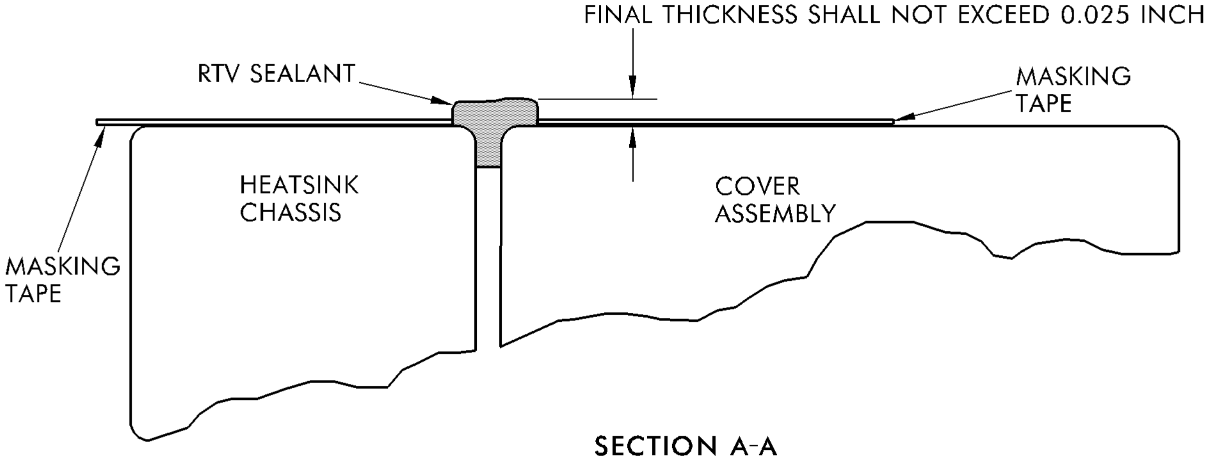


Figure 7-7. RTV Sealant on Digital Electronic Control (DEC); Installation (Sheet 1 of 3)



SECTION A-A

VIEW BEFORE APPLICATION OF RTV SEALANT



SECTION A-A

VIEW AFTER APPLICATION OF RTV SEALANT

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Figure 7-7. RTV Sealant on Digital Electronic Control (DEC); Installation (Sheet 2 of 3)

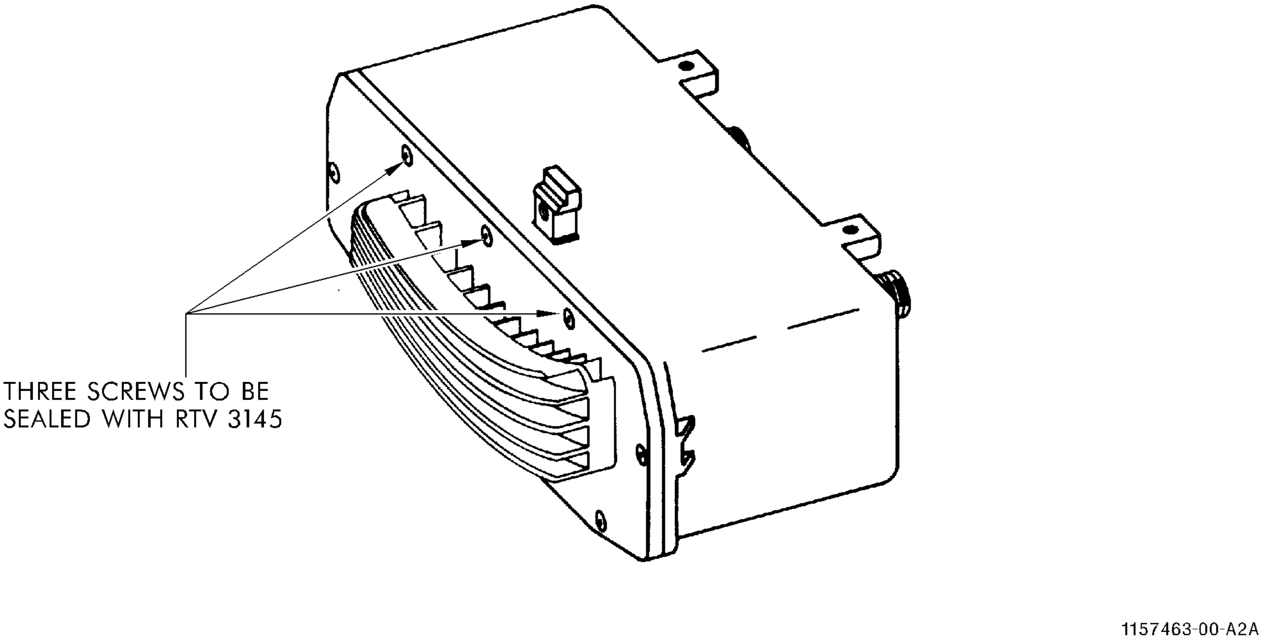


Figure 7-7. RTV Sealant on Digital Electronic Control (DEC); Installation (Sheet 3 of 3)

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

(2) Using a towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D), clean the area around the interface between the DEC cover assembly and the heatsink chassis. Do not loosen screws between cover and chassis. A toothbrush is helpful in removing contaminants and oil from splitline edges.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(3) Using clean, dry compressed air, dry the DEC. Using a towel (item 112, Appendix D), wipe off cleaner residue.

(4) Using 1/2 inch wide masking tape (item 106, Appendix D), apply tape to the cover assembly and to heatsink chassis maintaining a 1/16 inch to 3/32 inch distance from splitline for the entire circumference (see fig. 7-7, sheet 1). Use an X-acto knife or razor blade (item 14, Appendix D) to trim tape to clear all protrusions so that tape adheres smoothly to cover and chassis.

WARNING

RTV-3145 Adhesive/Sealant
Potting Compound

- In case of skin contact, flush contacted area with water. After contact, hands and skin should be washed before eating, drinking, or smoking.
- Eye protection should be worn when working with this material. If liquid contacts eyes, flush eyes thoroughly with water for 15 minutes.
- If prolonged contact with vapor is likely, wear approved respirator.

CAUTION

Do not apply RTV 3145 to the four ventholes in the bottom of the cover assembly.

NOTE

The elapsed time between starting the RTV application and completing the task is critical. At room temperature, the RTV becomes tacky after five to ten minutes. Within this time constraint, the RTV must be applied, smoothed over to cover the splitline, and the tape must be removed. As the RTV sets, peeling the tape can tear off and damage the sealing coat. It is recommended that 1/2 (180 degrees) of the circumference be sealed at a time.

(5) Apply RTV 3145 (item 2, Appendix D) to splitline as follows:

(a) Position DEC on a two inch high block with either top or bottom side of DEC facing up. Block material can be wood, foam, cardboard, etc. and is used to make turning DEC over easier without disturbing the wet sealant which will be applied to the other side.

(b) Fill a disposable pressure syringe (item 105, Appendix D), with a 1/32 inch opening, with RTV 3145.

(c) Starting at 3 o'clock or 9 o'clock location and working towards opposite side, inject a thin continuous bead of RTV onto the splitline on 1/2 the circumference without exhibiting voids or bubbles (fig. 7-7, sheet 2).

(d) While wearing disposable polyethylene gloves (item 77, Appendix D), dip index finger in Ivory liquid soap (item 71, Appendix D), or equivalent. Using finger pressure, push the RTV sealant into groove by wiping along the groove and across the groove. Keep glove finger lubricated with soap (item 71, Appendix D) and wipe off excess RTV from glove with a towel (item 112, Appendix D) as necessary.

CAUTION

Be sure that RTV 3145 sealant is no more than 0.025 inch above top surface of DEC cover assembly. Excess sealant may prevent assembly of DEC onto DEC bracket.

(e) Repeat step (4) until a thin even coat fully covers the space between masking tape strips. Final thickness of RTV shall not exceed 0.025 inch above top surface of DEC cover assembly (sheet 2).

(f) While RTV sealant is still soft and pliable, carefully remove masking tape from both sides of splitline for the half of the circumference sealed without disturbing the sealant in the splitline.

(g) Rotate DEC so the other side is facing up. Use care not to disturb the RTV sealant just applied.

(h) Repeat steps (2) through (5) to seal the other half of splitline.

(6) Using pressure syringe with RTV 3145 sealant, seal around each head of the three flat head screws (sheet 3) across the top of the heatsink chassis. Apply a continuous bead without voids or bubbles, without exceeding 0.025 inch above screw heads. Do not flatten sealant beads on screws.

(7) Allow RTV 3145 to air cure for 24 hours minimum at room temperature.

7-13. Cleaning of (T700, T701) Electrical Control Unit (ECU) or (T701C, T701D) Digital Electronic Control (DEC).

NOTE

If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with a 4046T52G30 or 4046T52G38 (6068T97P09 or 6068T97P13) HMU.

a. Check electrical connectors for moisture or contamination.

b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry protective caps (items 20, 21, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Cumbustible - do not use near opern flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the ECU or DEC using dry, filtered compressed air.

7-14. Inspection of Electrical Control Unit (ECU) or DEC and Scroll Seal.

See table 7-2.

Table 7-2. Inspection of Electrical Control Unit (ECU) or Digital Electronic Control (DEC) and Scroll Seal

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
NOTE • The insulation blanket is not removed for inspection of the ECU. • The DEC does not have an insulation blanket.			
a. Dropped ECU (fig. 7-8) or DEC (fig. 7-9).	Not allowed.	Not repairable.	Replace ECU or DEC (para 7-16).
b. ECU box (9) or DEC box (4) for:			
(1) Cracks in support area.	None allowed.	Not repairable.	Replace ECU or DEC (para 7-16).
(2) Nicks and scratches.	Any number.	Not applicable.	Not applicable.
(3) Dents.	Any number, up to 1/16 inch from original contour.	Not repairable.	Replace ECU or DEC (para 7-16).
(4) Missing protective coating.	Any amount.	Not applicable.	Not applicable.
(5) (DEC) Missing RTV sealant at splitline (12) and screws (13).	None allowed.	Any amount.	Replace RTV sealant (para 7-12).
(6) Missing locking seals.	Not allowed.	Not repairable.	Replace ECU (para 7-16).
c. DEC box (4) for missing protective coating on:			
(1) T-shaped mounting lug (11).	Up to 1/16 inch diameter (0.0004 inch square area).	Not repairable.	Replace DEC (para 7-16).
(2) All other areas.	Up to 1/4 inch diameter (0.060 inch square area).	Not repairable.	Replace DEC (para 7-16).
d. Electrical connectors (12) or (7) for:			
(1) Bent socket pins (13) or (8).	None allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.

Table 7-2. Inspection of Electrical Control Unit (ECU) or Digital Electronic Control (DEC) and Scroll Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Damaged threads.	Any amount, without high metal, if connector can be assembled normally with its mating part.	Any amount, with high metal, if threads can be reworked to usable limits.	Remove high metal.
(3) Missing protective cap (11) or (6).	Not allowed.	Not applicable.	Replace protective cap (para 7-15).
e. Captive bolt (14) or (9) for damaged threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
f. Captive bolt flanges for damaged threads.	Any number of missing threads without crossed threads or loose material.	Any number with crossed threads or loose material.	AVUM: Replace ECU or DEC (para 7-14). AVIM: Remove loose material, or mask all openings and chase threads to remove crossed threads.
g. **(T700)** Scroll seal (former configuration) (5) for:			
(1) Broken seal.	Not allowed if broken all the way through seal.	Not repairable.	Replace seal (para 7-16).
(2) Separation of steel and rubber.	Up to 50% of circumference, if no more than four consecutive stiffeners are separated.	Not repairable.	Replace seal (para 7-16).
(3) Cracks in:			
(a) Stiffeners.	Any number, up to 25% of stiffeners, if no more than two consecutive stiffeners are cracked.	Not repairable.	Replace seal (para 7-16).
(b) Seal support.	None allowed.	Not repairable.	Replace seal (para 7-16).
(c) Rubber.	Any number if forward and aft sealing bead is intact.	Not repairable.	Replace seal (para 7-16).

Table 7-2. Inspection of Electrical Control Unit (ECU) or Digital Electronic Control (DEC) and Scroll Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
h. Scroll seal (present configuration) (6) or (1) for:			
(1) Missing coating on:			
(a) Surface A.	Any amount.	Not applicable.	Not applicable.
(b) Surface B.	None allowed.	Not repairable.	Replace seal (para 7-16).
(2) Scratches, cuts or gouges on:			
(a) Surface A.	Any amount which does not affect base material.	Not repairable.	Replace seal (para 7-16).
(b) Surface B.	None allowed.	Not repairable.	Replace seal (para 7-16).
(3) Swelling of thickness C.	Not to exceed 0.90 inch.	Not repairable.	Replace seal (para 7-16).
i. ECU Insulation blanket (3) for:			
(1) Tears.	Any number, up to 0.250 inch long.	Not repairable.	Replace insulation blanket (para 7-15).
(2) Holes.	Any number, up to 0.063 inch diameter.	Not repairable.	Replace insulation blanket (para 7-15).
(3) Deformed sections.	Any amount if blanket effectively shields ECU, is not loose, and does not chafe on adjacent parts.	Any amount that can be repaired to meet usable limits.	Re-form to original shape.

NOTE

Spots on temperature decals may be blackened by air leaks from loosened or misalined anti-icing bleed and start valve seal housings or seal retainer.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
j. (ECU) If insulation blanket (3) is removed, inspect temperature decals (8) for blackened spots.	A black 225°F (107°C) spot is allowed if 250°F (121°C) spot is white. Temperature decals are normally white.	Not repairable.	Replace ECU (para 7-16) Check for loose or misalined anti-icing bleed and start valve seal housings or seal retainer (para 10-25).

Table 7-2. Inspection of Electrical Control Unit (ECU) or Digital Electronic Control (DEC) and Scroll Seal (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
k. DEC for blackened spots on temperature decals (8).	Two spots (250°F (121°C) and 275°C (135°C)) may be black if 300°F (149°C) remains white. Spots on temperature decals are normally white.	Not repairable.	Replace DEC (para 7-16). Check for loose or misalined anti-icing bleed and start valve seal housing or seal retainer (para 10-25).

7-15. Repair of Electrical Control Unit (ECU) or Digital Electronic Control (DEC).

a. **(T700, T701)** Replace insulation blanket as follows:

(1) Unscrew protective cap (11, fig. 7-8) from S39 connector.

(2) Remove five cap screws (1) and washers (2).

(3) Remove insulation blanket (3), and install replacement insulation blanket. Be sure there is about 1/8-inch clearance around the opening in the insulation blanket for the electrical connectors. Trim openings as required to obtain clearance.

(4) Install five screws (1) and washers (2). Run screws in until blanket is snug.

(5) Install protective cap (11) on S39 connector.

b. Replace protective cap as follows:

(1) Remove one sockethead screw that secures retaining strap (10, fig. 7-8) to ECU or (5, fig 7-9) to DEC.

(2) Screw replacement protective cap (11) onto S39 connector of ECU or DEC. Hand-tighten protective cap.

(3) Using sockethead screw removed in step (1), secure retaining strap of protective cap to ECU or DEC. Tighten screw until snug.

7-16. Installation of Electrical Control Unit (ECU) or Digital Electronic Control (DEC) and Scroll Seal.

NOTE

If DEC PN 5078T29G01 (6080T56P01) is removed from a T700-GE-701C or T700-GE-701D powered **AH-64A** Apache and replaced with a 5078T29G02 (6080T56P03) or higher DEC, the opposite engine must be configured with a 5078T29G02 (6080T56P03) or higher DEC. Additionally, both engines must be configured with a 4046T52G30 or 4046T52G38 (6068T97P09 or 6068T97P13) HMU.

a. Install scroll seal (8, fig. 7-5) onto ECU or (8, fig 7-6) onto DEC.

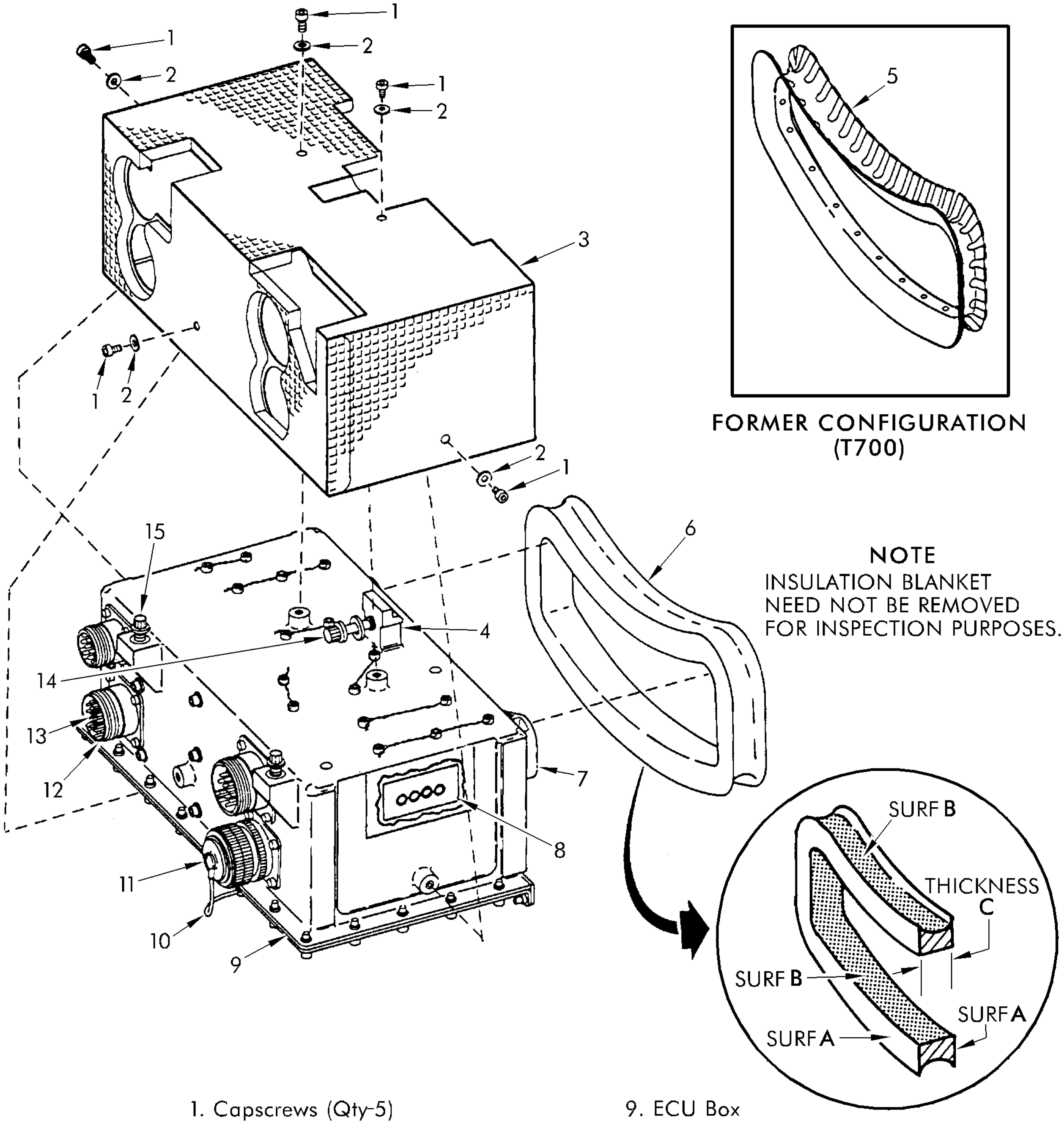
b. Position ECU or DEC so that T-shaped mounting lug (6) faces forward.

c. Install ECU or DEC (9) so that two bolts (13) slide into slots in electrical unit bracket (7).

d. Tighten captive bolt (5). Torque bolt to 45-50 inch-pounds.

e. Tighten two bolts (13) until there is metal-to-metal contact.

f. (AVUM) If required, install (Allied Signal (Garrett)) anti-icing bleed and start valve (para 10-31).



NOTE
INSULATION BLANKET NEED NOT BE REMOVED FOR INSPECTION PURPOSES.

1. Capscrews (Qty-5)
2. Washers (Qty-5)
3. Insulation Blanket
4. T-Shaped Mounting Lug
5. **(T700)** Scroll Seal
6. Scroll Seal
7. Cooling Surface
8. Temperature Decal (Qty-2)
9. ECU Box
10. Retaining Strap
11. Protective Cap
12. Electrical Connectors
13. Socket Pins
14. Captive Bolt
15. Bolts (Qty-2)

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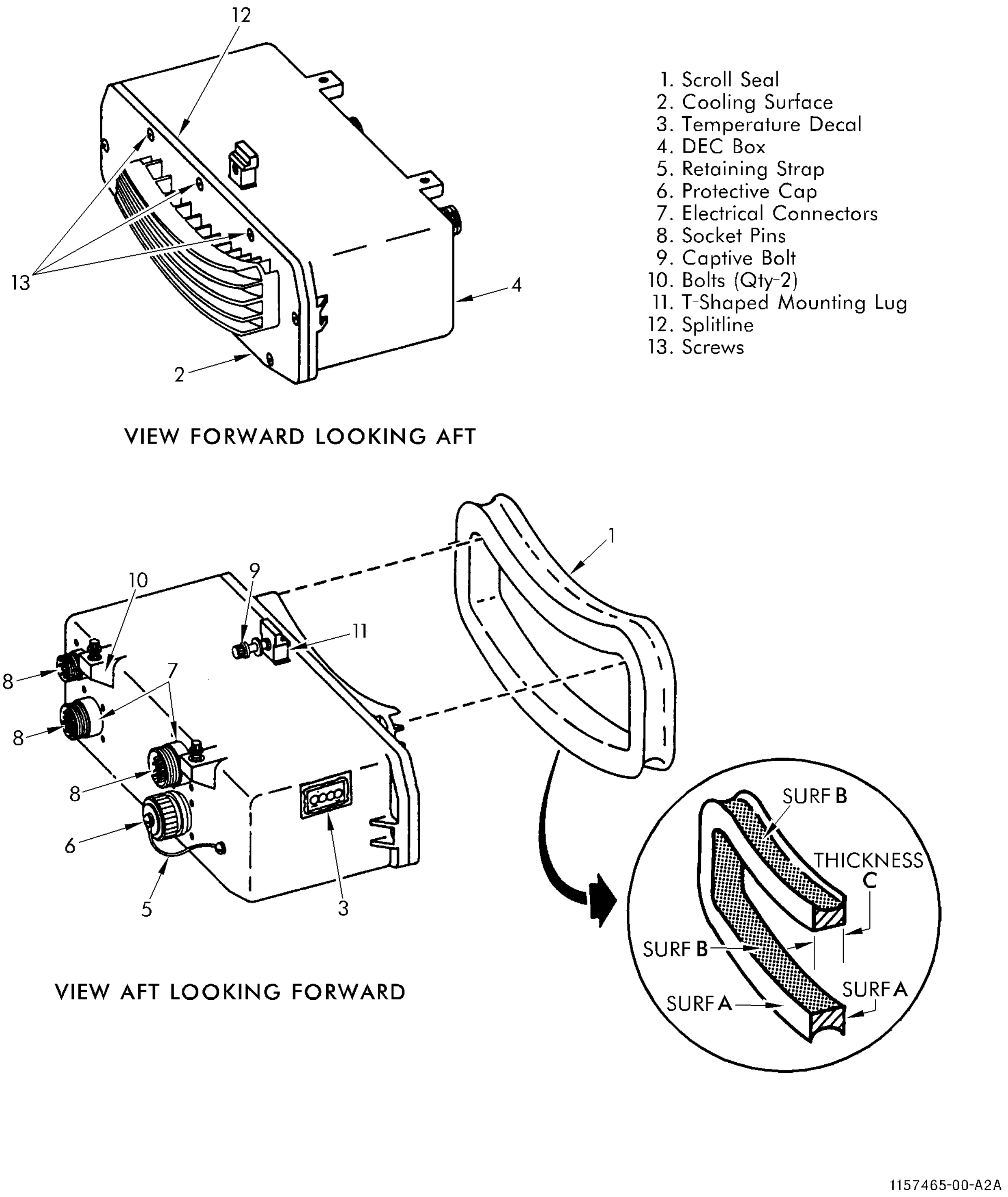
Figure 7-8.** (T700, T701)* ***Electrical Control Unit (ECU) and Scroll Seal; Inspection



1. Scroll Seal
2. Cooling Surface
3. Temperature Decal
4. DEC Box
5. Retaining Strap
6. Protective Cap
7. Electrical Connectors
8. Socket Pins
9. Captive Bolt
10. Bolts (Qty-2)
11. T-Shaped Mounting Lug
12. Splitline
13. Screws

Figure 7-9. Digital Electronic Control (DEC) and Scroll Seal; Inspection

CAUTION

Do not attempt to mate electrical connectors if seals are swollen. Electrical connectors could be damaged.

g. Connect electrical connectors (10, 11, 12) to ECU or DEC.

h. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

7-17. HISTORY RECORDER OR HISTORY COUNTER.

7-18. Removal of History Recorder or History Counter.

a. Before removing history recorder or history counter (3, fig. 7-10), record reading in engine records.

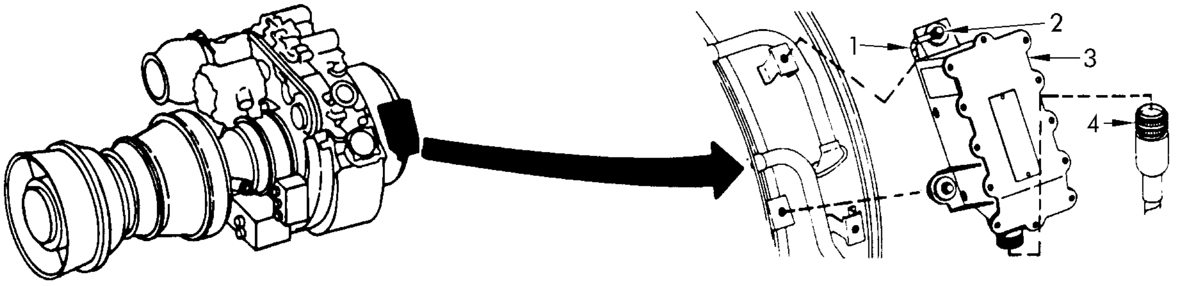
b. Disconnect electrical connector (yellow cable) (4). Cover connectors with clean, dry, protective caps (item 28, Appendix D).

CAUTION

Do not twist grounding strap when loosening captive bolts. Grounding strap could be damaged.

c. Loosen three captive bolts (2). Be sure that grounding strap (1) does not twist when loosening bolts.

d. Remove history recorder or history counter (3).



1. Grounding Strap
2. Captive Bolts (Qty-3)
3. History Recorder or History Counter
4. Electrical Connector (Yellow Cable)

Figure 7-10. History Recorder or History Counter; Removal and Installation

7-19. Cleaning of History Recorder or History Counter.

a. Check electrical connector for moisture or contamination.

b. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry, protective cap (item 20, Appendix D).

c. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the history recorder or history counter using dry, filtered compressed air.

7-20. Inspection of (T700, T701) History Recorder or (T701C, T701D) History Counter.

See table 7-3.

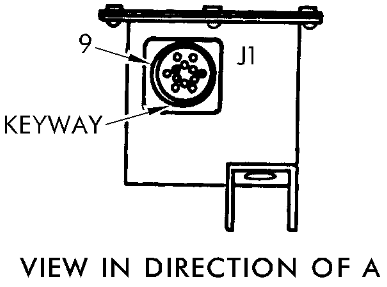
*Table 7-3. Inspection of **(T700, T701)** History Recorder or **(T701C, T701D)** History Counter*

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. History recorder or history counter chassis (8, fig. 7-11) and chassis cover (11) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace recorder or counter (para 7-22).
(2) Nicks and scratches.	Any number.	Not applicable.	Not applicable.
(3) Dents.	Any number, 1/16 inch from original contour.	Not repairable.	Replace recorder or counter (para 7-22).
(4) Missing paint.	Any amount.	Not applicable.	Not applicable.
b. Electrical connector (9) for:			
(1) Bent socket pins.	None allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(2) Damaged threads.	Any number, without high metal, if connector can be assembled normally with its mating part.	Any number that can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
c. History recorder or history counter for missing isolators (4).	Not allowed.	Not repairable.	Replace isolator (para 7-21, step d).
d. Readout windows (10) for:			
(1) Broken glass.	Not allowed.	Not repairable.	Replace recorder or counter (para 7-22).
(2) Dirt.	Numbers must be legible.	Any amount if the usable limit can be met.	Remove history recorder or history counter guard (7) (para 7-21), and clean window with soft, lint-free towel (item 112, Appendix D). Reinstall guard (para 7-21).
e. Captive bolts (1) for damaged threads.	None allowed.	Not repairable.	Replace bolt.

Table 7-3. Inspection of ***(T700, T701)*** *History Recorder or* ***(T701C, T701D)*** *History Counter (Cont)*

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
f. History recorder or history counter guard (12) for:			
(1) Missing guard.	Not allowed.	Not applicable.	Replace guard (para 7-21).
(2) Cracks.	Any number without missing pieces and numbers must be legible.	Not repairable.	Replace guard (para 7-21).
(3) Visibility of readout windows (10).	Numbers must be legible.	Not repairable.	Replace guard (para 7-21).
(4) Dirt.	Numbers must be legible.	Any amount if usable limit can be met.	Clean guard with a soft, lint-free towel (item 112, Appendix D).
(5) **(T701C, T701D)** (History Counter) Missing RTV sealant.	Not allowed.	Any amount.	AVUM: Replace history counter (para 7-22). AVIM Apply RTV sealant (para 7-21, step b).
g. Grounding strap (2) for:			
(1) Missing strap.	Not allowed.	Not applicable.	Replace strap (para 7-21).
(2) Cracks.	None allowed.	Not repairable.	Replace strap (para 7-21).
(3) Broken strands.	None allowed.	Not repairable.	Replace strap (para 7-21).

1. Captive Bolt (Qty-3)
2. Grounding Strap
3. Ferrule (Qty-3)
4. Isolator (Qty-3)
5. Ferrule (Qty-3)
6. Bolt
7. Locknut
8. History Recorder or History Counter Chassis
9. Electrical Connector
10. Readout Windows
11. Chassis Cover
12. History Recorder or History Counter Guard



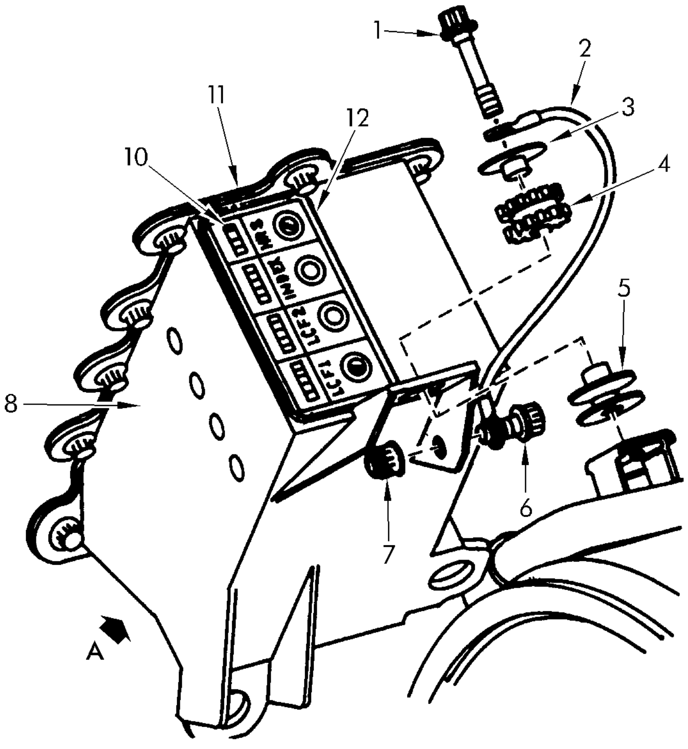


Figure 7-11. History Recorder or History Counter; Inspection and Repair

7-21. Repair of History Recorder or History Counter. Limit repair to that specified in Corrective Action column of table 7-3.

a. Replacement of History Recorder Guard.

(1) Remove two screws (1, fig. 7-12) and two washers (2).

(2) Remove guard (3) from history recorder (4).

(3) Install replacement guard (3) over readout windows (5) of history recorder.

(4) Install two washers (2) and hand-tighten two screws (1).

(5) Torque screws to 4.5-5.0 inch-pounds.

b. **(T701C , T701D)** Replacement of History Counter Guard.

(1) Remove two screws (1, fig. 7-12) and two washers (2).

(2) Remove history counter guard (3) from history counter (4).

(3) Using an X-acto knife or razor blade (item 14, Appendix D), remove RTV sealant from guard (3), and history counter (4).

1. Screw (Qty-2)
2. Washer (Qty-2)
3. History Recorder Guard or History Counter Guard
4. History Recorder or History Counter
5. Readout Window

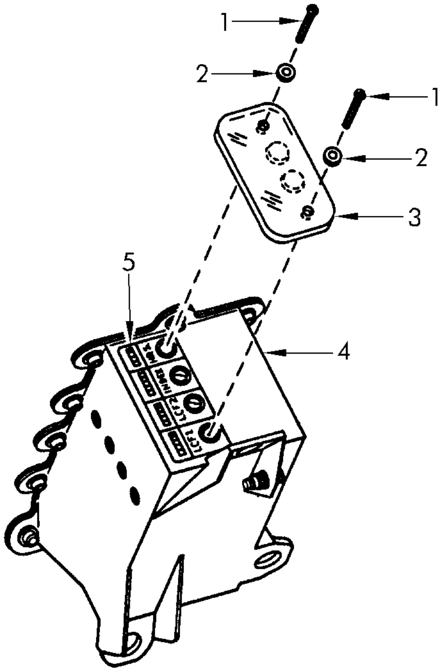


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Figure 7-12. History Recorder or History Counter Guard; Removal and Installation

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

(4) Using a towel (item 112, Appendix D) soaked with dry cleaning solvent (item 99, Appendix D), clean the guard (3) and the area around the interface between the guard (3) and history counter (4).

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(5) Using clean, dry compressed air, dry the guard and counter. Using a towel (item 102, Appendix D), wipe of cleaner residue.

(6) Install guard (3) over readout windows (5).

(7) Install two washers (2) and two screws (1) handtight.

(8) Torque screws to 4.5 - 5.0 lb in.

WARNING

RTV-3145 Adhesive/Sealant
Potting Compound

- In case of skin contact, flush contacted area with water. After contact, hands and skin should be washed before eating, drinking, or smoking.
- Eye protection should be worn when working with this material. If liquid contacts eyes, flush eyes thoroughly with water for 15 minutes.
- If prolonged contact with vapor is likely, wear approved respirator.

CAUTION

Do not apply RTV-3145 to the face of the guard (3).

NOTE

The elapsed time between starting the RTV application and completing the task is critical. At room temperature, the RTV becomes tacky after 5 to 10 minutes. Within this time constraint, the RTV must be applied, smoothed over to cover the splitline.

(9) Apply RTV-3145 (item 2, Appendix D) to splitline between guard (3) and counter (4) as follows:

(a) Fill a disposable pressure syringe (item 105, Appendix D), with a 1/32 inch opening, with RTV-3145.

(b) Inject a thin continuous bead of RTV onto the splitline on 1/2 the circumference without exhibiting voids or bubbles.

(c) While wearing disposable polyethylene gloves (item 76, Appendix D), dip index finger in dishwashing liquid (item 71, Appendix D), or equivalent. Using finger pressure, push the RTV sealant into groove by wiping along the groove and across the groove. Keep glove finger lubricated with soap and wipe off excess RTV from glove with a towel as necessary.

(d) Repeat step (c) until a thin even coat fully covers the space between guard (3) and counter (4). Final thickness of RTV shall not exceed 0.025 inch above top surface of guard.

(e) Allow RTV-3145 to air cure for 24 hours minimum at room temperature.

c. Replacement of History Recorder or History Counter Grounding Strap.

(1) Remove captive bolt (1, fig. 7-11) from ferrule (5).

(2) Remove locknut (7) and bolt (6).

(3) Remove grounding strap (2).

(4) Install bolt (6) through grounding strap (2) from rear face of history recorder or history counter chassis (8).

(5) Thread locknut (7) onto bolt (6).

(6) Torque bolt (6) to 27-30 inch-pounds.

d. Replacement of History Recorder or History Counter Isolators.

NOTE

There are three isolators on the history recorder or history counter assembly. The procedure that follows shall be used to replace all isolators.

(1) Remove captive bolt (1, fig. 7-11) from ferrule (5).

(2) Remove ferrules (3, 5).

(3) Remove isolator (4) from mounting hole of history recorder or history counter chassis (8).

(4) Press isolator (4) into mounting hole of history recorder or history counter chassis (8).

(5) Press ferrules (3, 5) into isolator (4).

(6) Thread captive bolt (1) through ferrule (3), isolator (4) and ferrule (5) until threaded end of bolt is exposed.

7-22. Installation of History Recorder or History Counter.

a. If history recorder or history counter is being replaced, record readings from both the removed and the replacement history recorder or history counter; log record readings in aircraft and engine records.

CAUTION

Do not twist grounding strap (1, fig. 7-10) when tightening captive bolts (2). Grounding strap may be damaged.

b. Install history recorder or history counter (3) onto brackets on swirl frame using three captive bolts (2). Be sure that grounding strap (1) does not twist when tightening bolts. Torque bolts to 18-22 inch-pounds.

CAUTION

Do not attempt to mate electrical connectors if seals are swollen. Electrical connector may be damaged.

c. Connect electrical connector (yellow cable) (4) to history recorder or history counter.

7-23. ELECTRICAL IGNITION LEADS.

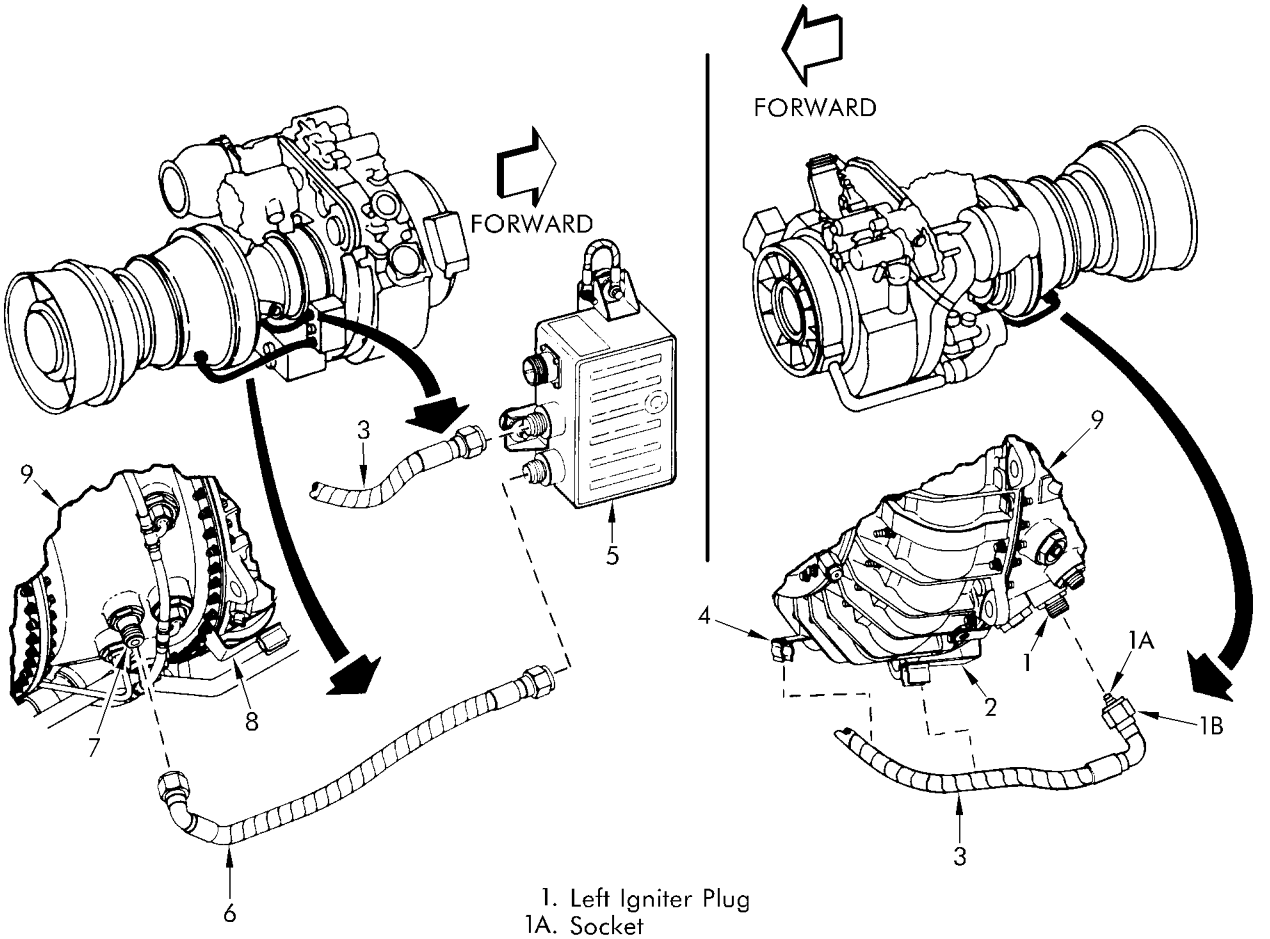
7-24. Removal of Electrical Ignition Leads.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that ignition lead(s) (igniter plug end) are correctly grounded.
- Do not attempt to ground ignition lead(s) to components made of composite material, such as the outer bypass duct. Composite materials do not conduct electricity.
- Ground lead(s) to the customer bleed duct.

a. Disconnect right ignition lead (6, fig. 7-13) from right igniter plug (7).



1. Left Igniter Plug
1A. Socket
1B. Coupling Nut
2. Bracket
3. Left Ignition Lead
4. Clip Support
5. Ignition Exciter
6. Right Ignition Lead
7. Right Igniter Plug
8. Bracket
9. Midframe

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Figure 7-13. Electrical Ignition Leads; Removal and Installation

b. Ground ignition lead (6) as follows:

(1) Push back coupling nut (1B) on lead (6) to expose socket (1A).

(2) Hold an insulated screwdriver by the handle, and touch tip of screwdriver to midframe (9).

(3) Touch socket (1A) to shank of screwdriver. Sparks observed during grounding indicate a defective ignition exciter; replace defective ignition exciter (para 7-29).

c. Disconnect right ignition lead (6) from ignition exciter (5).

d. Remove right ignition lead (6) from bracket (8).

e. Disconnect left ignition lead (3) from left igniter plug (1).

f. Repeat step b for grounding of ignition lead (3).

g. Disconnect left ignition lead (3) from ignition exciter (5).

h. Remove left ignition lead (3) from clip support (4) and from bracket (2).

i. Cover electrical connectors with clean, dry, protective caps (item 37, Appendix D).

7-25. Cleaning of Electrical Ignition Leads.

a. Check electrical connectors for moisture or contamination.

b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry, protective caps (item 37, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the ignition leads using dry, filtered, compressed air.

7-26. Inspection of Electrical Ignition Leads. See table 7-4.

Table 7-4. Inspection of Electrical Ignition Leads

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Outer conduit (4, fig. 7-14) for:			
(1) Nicks, scratches, and abrasions.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits with high metal.	Remove high metal (para H-21, Appendix H).
(2) Dents.	Any number, up to 1/32 inch deep.	Not repairable.	Replace ignition lead (para 7-28).
(3) Cracks.	None allowed.	Not repairable.	Replace ignition lead (para 7-28).
b. Flexible lead (2) for:			
(1) Missing teflon spiral wrap (5).	Not allowed.	Any amount.	Replace missing spiral wrap (item 118, Appendix D) and tape both ends with silicone tape (item 110, Appendix D).
(2) Broken wires and exposed inner conduit (6) in wirebraid shield (7).	Up to seven broken strands in any 1-square inch, provided break is not closer than 2.000 inches to another damaged area and the inner conduit is not exposed.	Same as usable limits.	Bend back broken wires. Otherwise, replace ignition lead (para 7-28).
(3) Exposed inner conduit (6) in wirebraid shield (7) for cracks, holes, or breaks, using a 10× magnifying glass.	None allowed.	Not repairable.	Replace ignition lead (para 7-28).
c. Electrical connectors (1) for:			
(1) Damaged sockets (3).	Not allowed.	Not repairable.	Replace ignition lead (para 7-28).
(2) Missing retaining washers (9).	Not allowed.	Not applicable.	Replace ignition lead (para 7-28).

Table 7-4. Inspection of Electrical Ignition Leads (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Damaged threads on coupling nuts (8).	Any amount, without high metal, if connector can be installed normally onto its mating part.	Any amount that can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
(4) Cracked, chipped, or missing ceramic insulator (11).	None allowed.	Not repairable.	Replace ignition lead (para 7-28).
(5) Missing or broken fingers (10).	Not allowed.	Not repairable.	Replace ignition lead (para 7-28).
(6) Electrical characteristics.	Must meet criteria in paragraph 1-89 (aircraft) or paragraph 1-270 (METS/FEDS/CETS).	Not repairable.	Replace ignition lead (para 7-28).

7-27. Testing of Electrical Ignition Leads. Refer to paragraph 1-89 for testing in aircraft, or to paragraph 1-270 for testing in METS/FEDS/CETS.

7-28. Installation of Electrical Ignition Leads.

a. Route left ignition lead (3, fig. 7-13) under engine to right side of engine to ignition exciter (5).

b. Pull back coupling nut on angled end of left ignition lead (3) to expose connector.

CAUTION

Be careful not to bend pin in connector of igniter plug during assembly of ignition lead. Igniter plug may be damaged.

c. Aline socket in ignition lead connector with pin in left igniter plug (1). Carefully push connector onto pin.

d. Pull back coupling nut on angled end of right ignition lead (6) to expose connector.

e. Aline socket in ignition lead connector with pin in right igniter plug (7). Carefully push connector onto pin. Be sure that connector is firmly seated.

f. Loosely connect coupling nuts of ignition leads onto igniter plugs (1, 7).

g. Pull back coupling nuts on straight ends of left and right ignition leads (3, 6, fig. 7-13), and expose connectors.

CAUTION

Be careful not to bend pin in connector of ignition exciter during installation of ignition lead. Ignition exciter may be damaged.

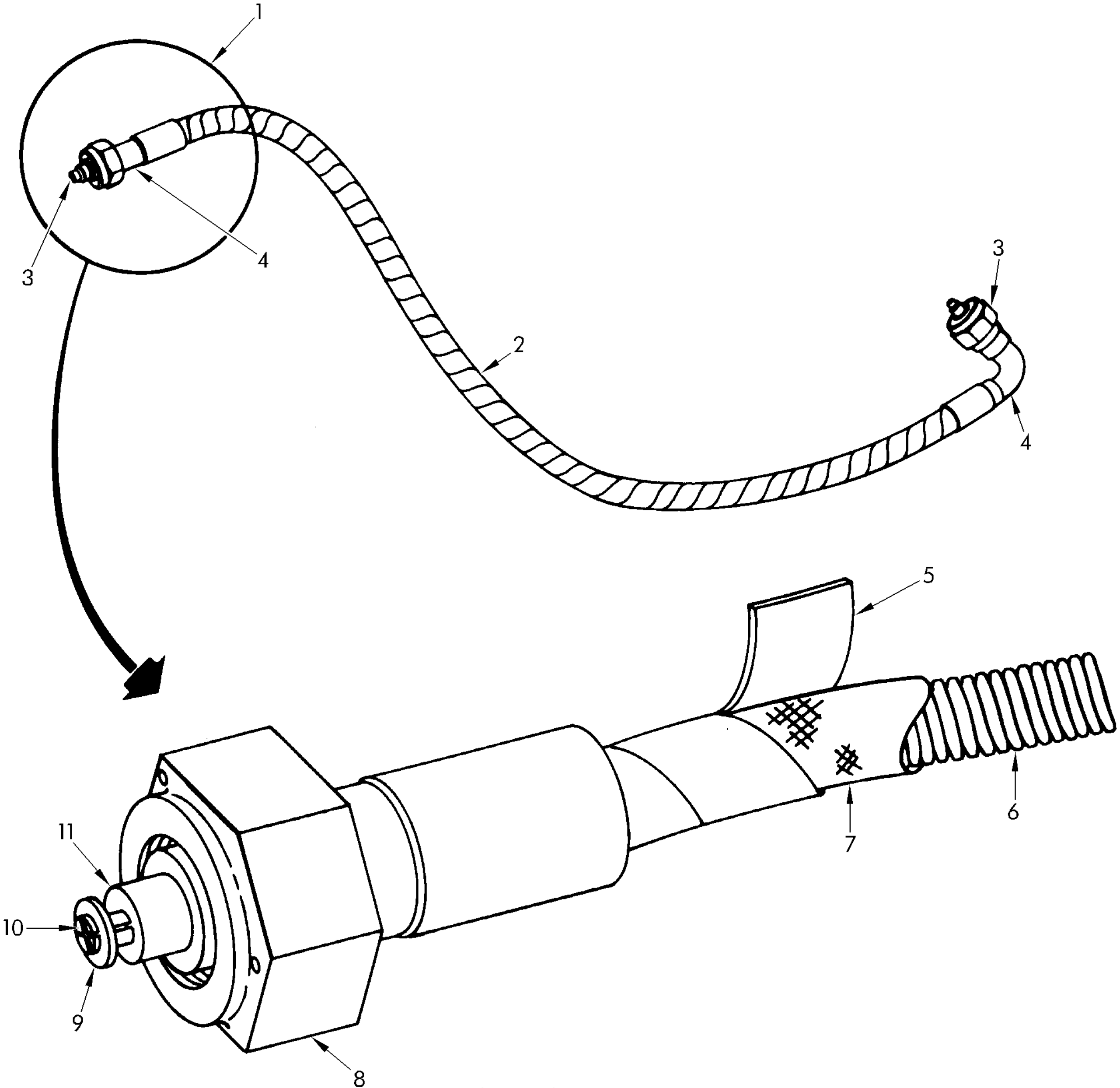
h. Aline socket in connector of left ignition lead (3) with pin in center connector of ignition exciter (5). Carefully push connector onto pin. Aline socket in connector of right ignition lead (6) with pin in lower connector of ignition exciter. Carefully push connector onto pin. Be sure that connectors are firmly seated.

i. Loosely connect coupling nut of left ignition lead (3) to center connector of exciter (5). Loosely connect coupling nut of right lead (6) to lower connector of exciter.

j. Attach right ignition lead (6) to bracket (8). Attach left ignition lead (3) into clip support (4) and to bracket (2).

k. Hand-tighten four coupling nuts on ignition leads; then tighten (15° wrench arc) coupling nuts.

l. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).



1. Electrical Connector
2. Flexible Lead
3. Sockets
4. Outer Conduit
5. Teflon Spiral Wrap
6. Inner Conduit
7. Wire-Braid Shield
8. Coupling Nut
9. Retaining Washer
10. Fingers
11. Ceramic Insulator

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Figure 7-14. Electrical Ignition Leads; Inspection

7-29. IGNITION EXCITER ASSEMBLY.

7-30. Removal of Ignition Exciter Assembly.

WARNING

Disconnecting Ignition Leads

- High voltage may be present. Contact with center conductor of electrical cable or center electrode of igniter plug will cause electric shock if the bleed resistors inside ignition unit have failed.
- Before removing igniter plug, be sure that ignition lead(s) (igniter plug end) are correctly grounded.
- Do not attempt to ground ignition lead(s) to components made of composite material, such as the outer bypass duct. Composite materials do not conduct electricity.
- Ground lead(s) to the customer bleed duct.

a. Ground ignition exciter as follows:

(1) Determine which ignition lead (3 or 6, fig. 7-13) and which igniter plug (1 or 7) is on outboard side of engine. Disconnect outboard ignition lead from outboard igniter plug.

(2) Ground ignition lead (3 or 6) as follows:

(a) Push back coupling nut (1B) on lead to expose socket (1A).

(b) Hold an insulated screwdriver by the handle, and touch tip of screwdriver to midframe (9).

(3) Touch socket (1A) to shank of screwdriver. Sparks observed during grounding indicate a defective ignition exciter; replace defective ignition exciter (para 7-29).

(4) Disconnect inboard ignition lead (4, fig. 7-15) from ignition exciter assembly (3), and cover electrical connector on lead with clean, dry, protective cap (item 37, Appendix D).

(5) Disconnect outboard ignition lead (4) from ignition exciter, and connect lead to inboard electrical connector on exciter.

(6) Repeat grounding procedure in (2).

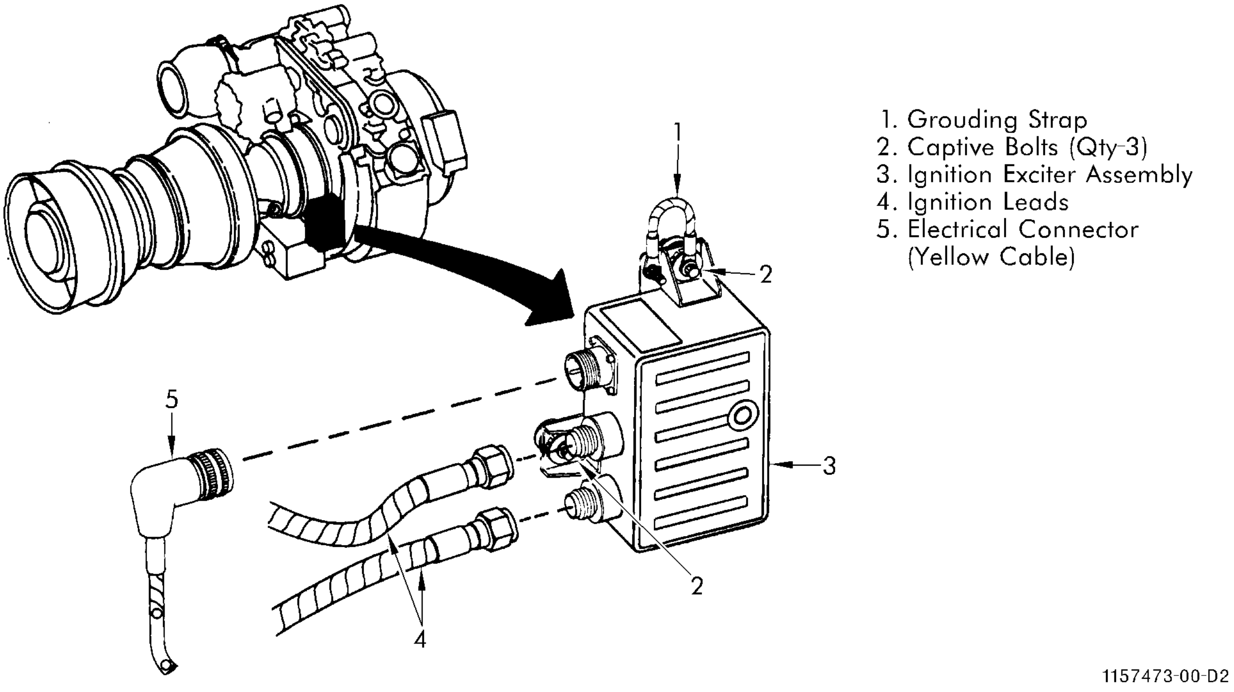


Figure 7-15. Ignition Exciter Assembly; Removal and Installation

(7) Reconnect outboard ignition lead to igniter plug by hand-tightening coupling nut until sharp rise in resistance is felt; then tighten (15° wrench arc) coupling nut.

(8) Disconnect outboard ignition lead from exciter, and cover electrical connector on lead with clean, dry, protective cap (item 37, Appendix D).

b. Disconnect electrical connector (yellow cable) (5) from ignition exciter (3). Cover connector on cable with clean, dry, protective cap (item 28, Appendix D).

CAUTION

Do not twist grounding strap (1) when loosening captive bolt.

c. Loosen three captive bolts (2). Be sure that grounding strap (1) does not twist when loosening bolts.

d. Remove ignition exciter assembly (3).

7-31. Cleaning of Ignition Exciter Assembly.

a. Check electrical connectors for moisture or contamination.

b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry, protective caps (items 25, 20, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the ignition exciter assembly using dry, filtered compressed air.

7-32. Inspection of Ignition Exciter Assembly.

See table 7-5.

Table 7-5. Inspection of Ignition Exciter Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Ignition exciter (4, fig. 7-16) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace ignition exciter assembly (para 7-34).
(2) Nicks and scratches.	Any number.	Not applicable.	Not applicable.
(3) Dents.	Any number, 1/16 inch from original contour.	Not repairable.	Replace ignition exciter assembly (para 7-34).
(4) Missing paint.	Any amount.	Not applicable.	Not applicable.
(5) Missing or damaged isolators (2).	Not allowed.	Not repairable.	Replace isolators (para 7-33).
b. Electrical connectors (3) for:			
(1) Bent socket pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(2) Damaged threads.	Any amount, without high metal, provided connector can be assembled normally.	Any amount with high metal, if connector can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
(3) Cracked or missing ceramic insulation (5).	Small cracks or chips allowed, provided electrical properties of the exciter are not affected.	Not repairable.	Replace ignition exciter assembly (para 7-34).
c. Captive bolts (1) for damaged threads.	Not allowed.	Not repairable.	Replace bolt.
d. Grounding strap (6) for:			
(1) Broken strands.	None allowed.	Not repairable.	Replace strap (para 7-33).
(2) Cracks.	None allowed.	Not repairable.	Replace strap (para 7-33).
(3) Strap missing.	Not allowed.	Not applicable.	Replace strap (para 7-33).

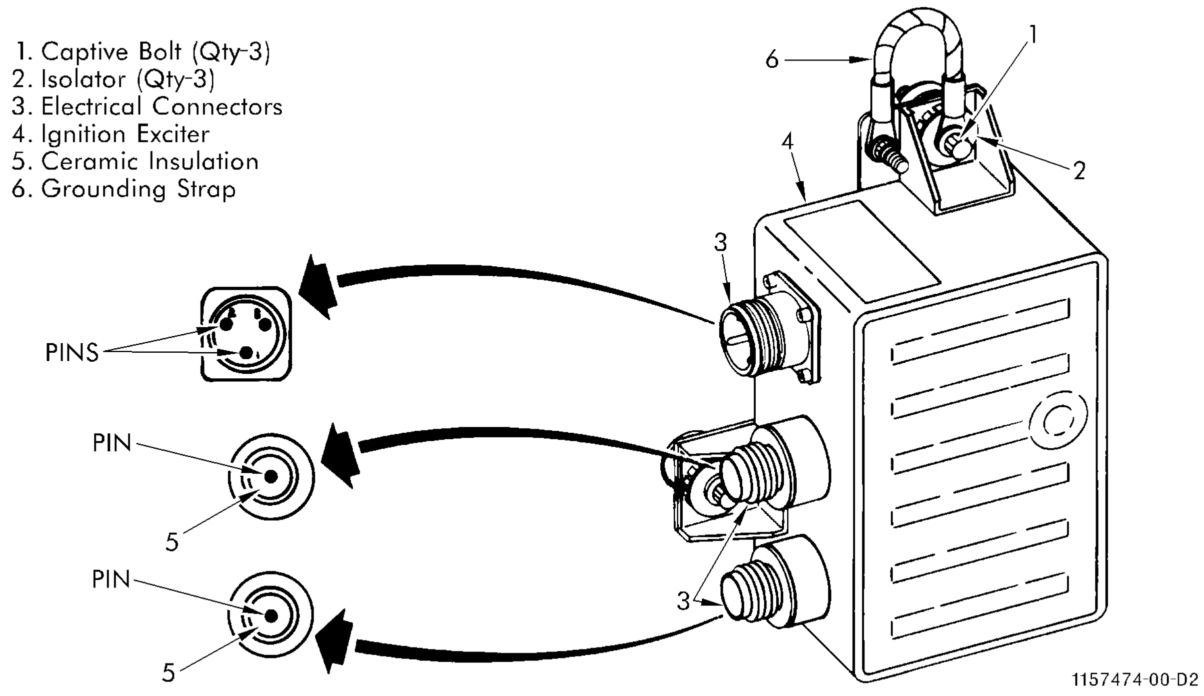


Figure 7-16. Ignition Exciter Assembly; Inspection

7-33. Repair of Ignition Exciter Assembly. Repair is limited to that specified in Corrective Action column of table 7-5.

a. Replacement of Isolators.

NOTE

There are three isolators on the ignition exciter assembly. The following procedure shall be used to replace all isolators.

(1) Remove isolator (5, fig. 7-17, view A) as follows:

(a) Unthread captive bolt (1) from ferrule (8). Remove bolt.

(b) Remove ferrules (4, 8).

(c) Remove isolator (5) from mounting hole on ignition exciter assembly (6).

(2) Install isolator (5, view A) as follows:

(a) Press in isolator (5) in mounting hole on ignition exciter assembly (6).

(b) Press in ferrule (8) in isolator (5) from rear face of ignition exciter assembly (6). (Refer to view B).

(c) Press in ferrule (4) in isolator (5) from front face of ignition exciter assembly (6). (Refer to view B).

(d) When installing bolt (1, view A), install it through ferrule (4), isolator (5), and ferrule (8). Thread bolt onto ferrule (8) until threaded end of bolt is exposed.

(e) When installing bolt (1, view C), install it through grounding strap (3), ferrule (4), isolator (5), and ferrule (8). Thread bolt onto ferrule (8) until threaded end of bolt is exposed.

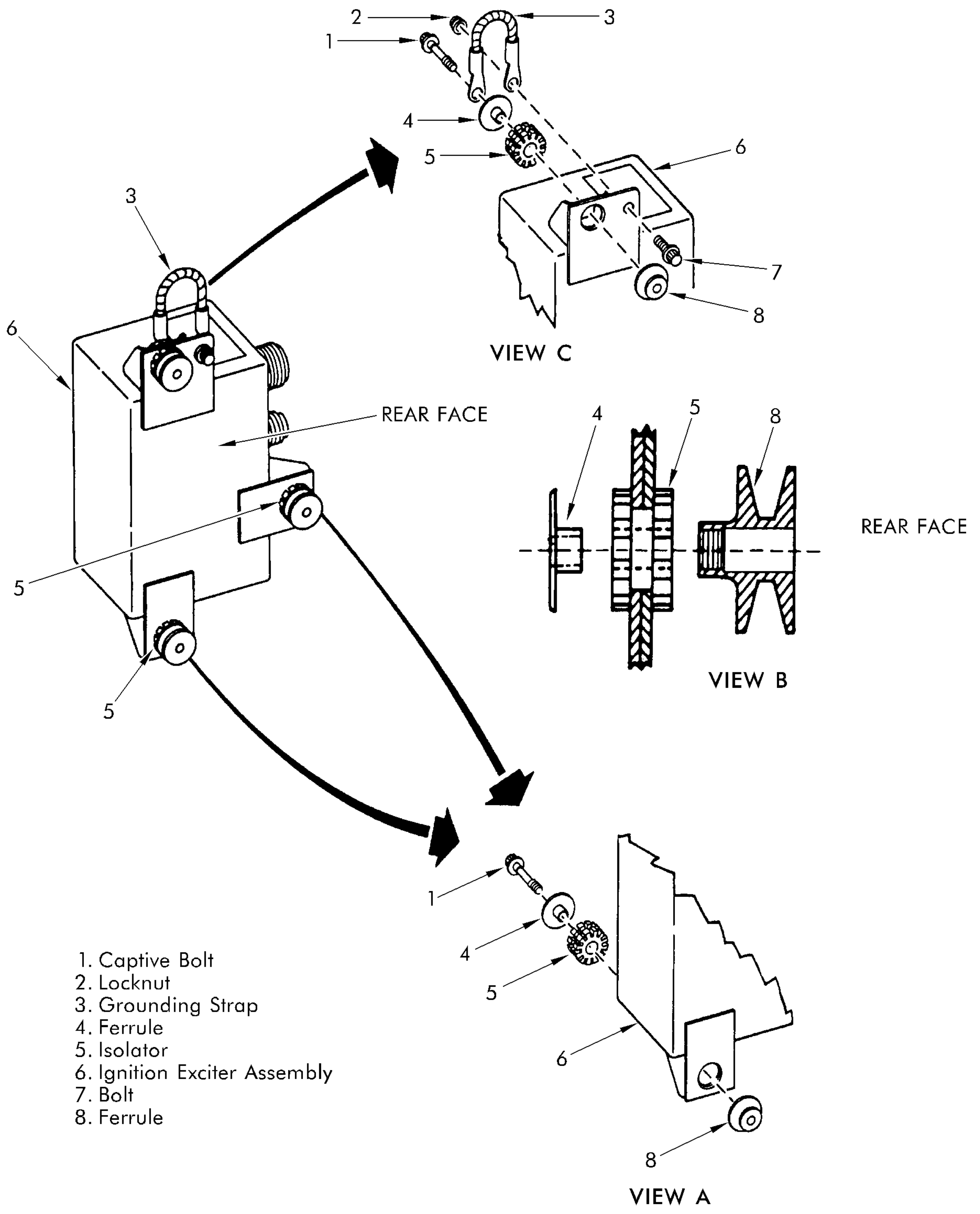
b. Replacement of Grounding Strap.

(1) Remove grounding strap (3, fig. 7-17) as follows:

(a) Unthread captive bolt (1, view C) from ferrule (8). Remove bolt.

(b) Remove locknut (2) and bolt (7).

(c) Remove grounding strap (3).



1. Captive Bolt
2. Locknut
3. Grounding Strap
4. Ferrule
5. Isolator
6. Ignition Exciter Assembly
7. Bolt
8. Ferrule

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Figure 7-17. Ignition Exciter Assembly; Repair

(2) Install grounding strap (3) as follows:

(a) Position grounding strap (3) as shown.

(b) Install bolt (7) from rear face of ignition exciter assembly (6) through mounting hole and through strap.

(c) Install locknut (2) onto bolt (7). Torque bolt (7) to 27-30 inch-pounds.

(d) Install bolt (1) through grounding strap (3), ferrule (4), isolator (5), and ferrule (8). Thread bolt onto ferrule (8) until threaded end of bolt is exposed.

7-34. Installation of Ignition Exciter Assembly.

CAUTION

Do not twist grounding strap when tightening captive bolt. Grounding strap may be damaged.

a. Position ignition exciter assembly (3, fig. 7-15) onto bracket on forward flange of compressor case. Secure exciter assembly with three captive bolts (2). Be sure that grounding strap (1) does not twist when tightening bolts. Torque bolts to 18-22 inch-pounds.

CAUTION

Be careful not to bend pin in connector of ignition exciter. Ignition exciter may be damaged.

b. Connect ignition leads (para 7-28).

c. Connect electrical connector (yellow cable) (5) to ignition exciter assembly.

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

7-35. GREEN ELECTRICAL CABLE (W3).

7-36. Removal of Green Electrical Cable (W3).

a. Remove two bolts (7, fig. 7-18 **(T700, T701C, T701D)** or 7-19 **(T701)**) from bracket (6).

b. Disconnect green electrical cable (2) from the following:

- **(T700, T701C, T701D)** Oil temperature sensor (12, fig. 7-18)
- Oil pressure sensor (11, fig. 7-18 **(T700, T701C, T701D)** or 7-19 **(T701)**)
- Alternator stator (10)
- Oil filter bypass sensor (9)
- Electrical chip detector (8)
- Fuel filter bypass sensor (5)
- Fuel pressure sensor (4)
- Anti-icing bleed and start valve (3)

c. Remove cable from four clip supports (1).

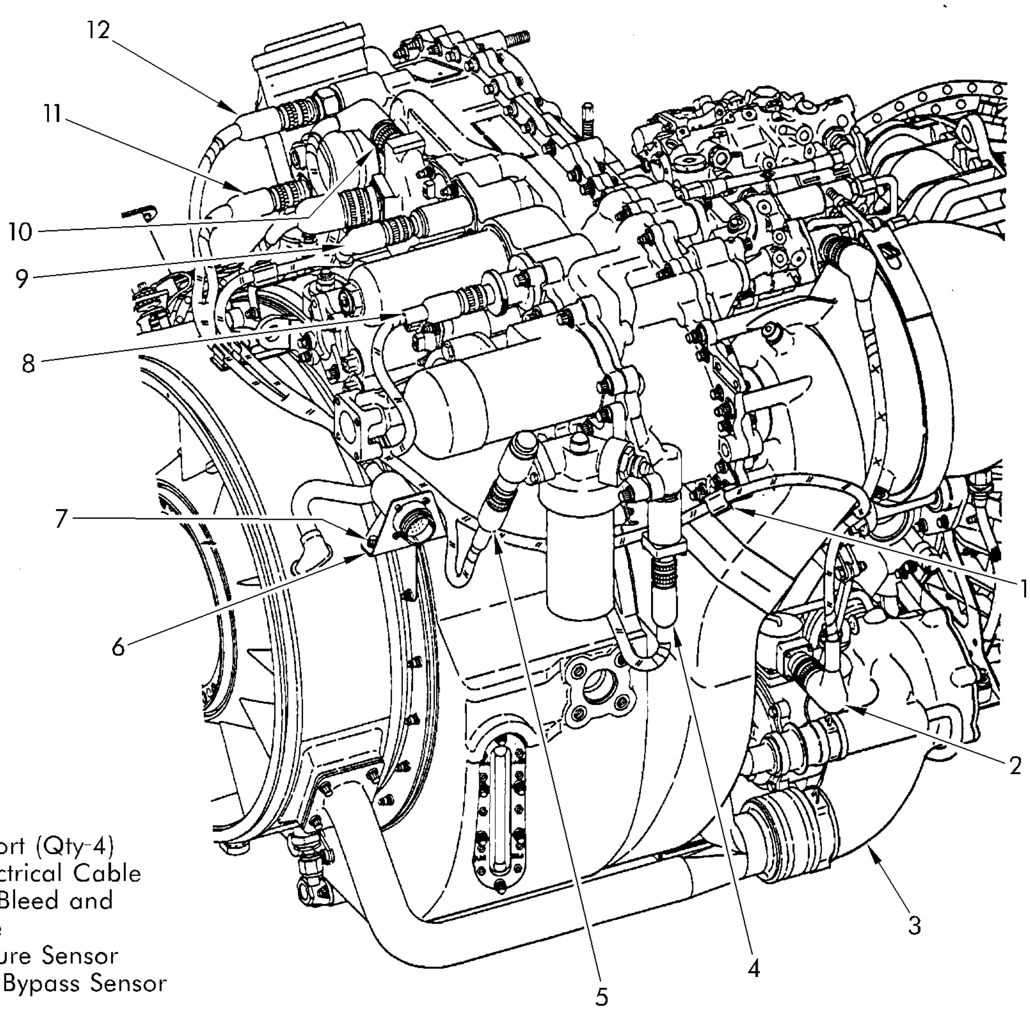
d. Cover electrical connectors with clean, dry protective caps (items 34, 29, Appendix D).

7-37. Cleaning of Green Electrical Cable (W3).

a. Check electrical connectors for moisture or contamination.

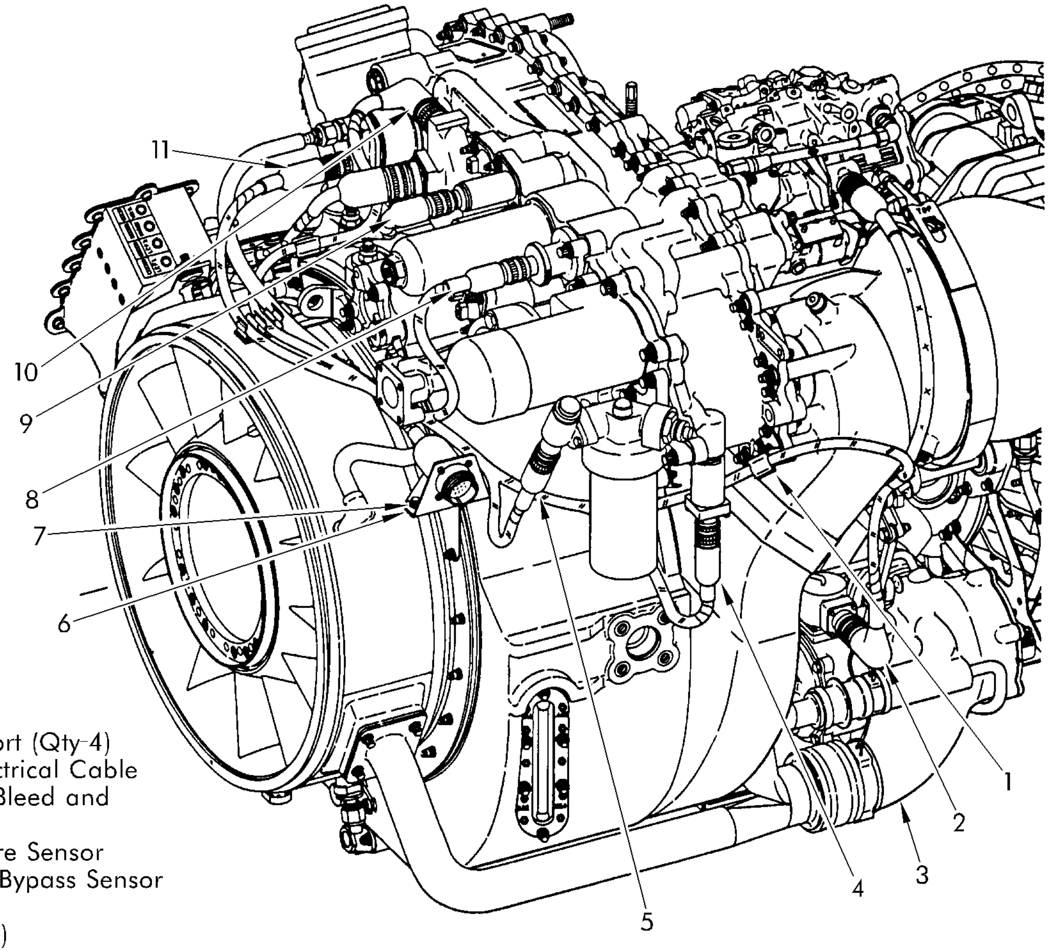
b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry protective caps (items 34, 29, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (para H-11, Appendix H).



1. Clip Support (Qty-4)
2. Green Electrical Cable
3. Anti-Icing Bleed and Start Valve
4. Fuel Pressure Sensor
5. Fuel Filter Bypass Sensor
6. Bracket
7. Bolt (Qty-2)
8. Electrical Chip Detector
9. Oil Filter Bypass Sensor
10. Alternator Stator
11. Oil Pressure Sensor
12. Oil Temperature Sensor

Figure 7-18. ***(T700, T701C, T701D)*** *Green Electrical Cable; Removal and Installation*



1. Clip Support (Qty-4)
2. Green Electrical Cable
3. Anti-Icing Bleed and Start Valve
4. Fuel Presure Sensor
5. Fuel Filter Bypass Sensor
6. Bracket
7. Bolt (Qty-2)
8. Electrical Chip Detector
9. Oil Filter Bypass Sensor
10. Alternator Stator
11. Oil Pressure Sensor

Figure 7-19. *(T701)* ***Green Electrical Cable; Removal and Installation***

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe electrical cable with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the electrical cable using dry, filtered, compressed air.

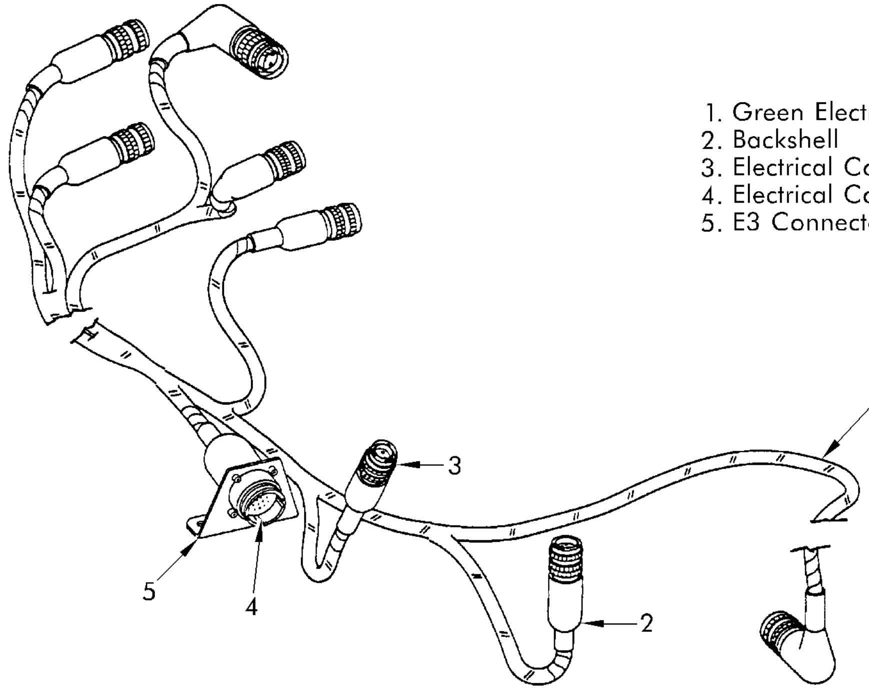
7-38. Inspection of Green Electrical Cable (W3). See table 7-6.

Table 7-6. Inspection of Green Electrical Cable (W3)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Green electrical cable (1, fig. 7-20 **(T700, T701C, T701D)** or 7-21 **(T701)**) for:			
(1) Worn or damaged backshells (2).	Any amount, if wire braid is not exposed. Exposed solid metal, up to one-half of circumference, is acceptable.	Not repairable.	Replace cable (para 7-40).
(2) Loose spiral wrap.	Wrap will fit snugly on cable and will not have projecting ends.	Any amount.	Rewrap and tape ends with silicone tape (item 110, Appendix D).
(3) Damaged or missing spiral wrap.	Not allowed.	Wrap is not repairable.	Replace damaged or missing wrap (item 119, Appendix D). Tape ends with silicone tape (item 110, Appendix D).

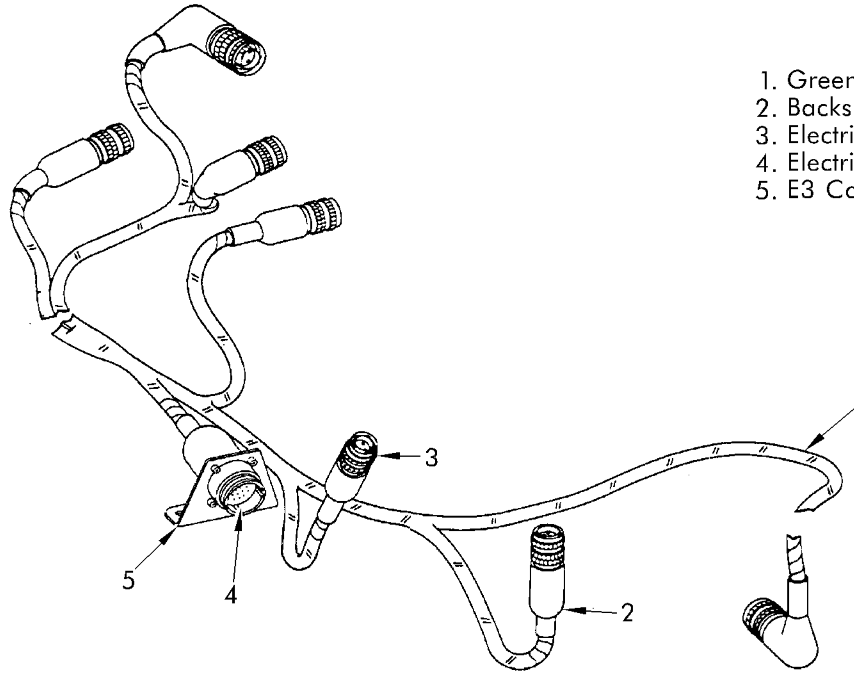
Table 7-6. Inspection of Green Electrical Cable (W3) (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Electrical connectors (3) for:			
(1) Damaged threads.	Any amount, with high metal, if connector can be installed normally onto its mating part.	Any amount, without if connector can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
(2) Cracked or missing ceramic insulation.	Small cracks or chips allowed, provided electrical properties of cable are not affected.	Not repairable.	Replace cable (para 7-40).
(3) Damaged or out-of-round knurled coupling rings.	Coupling rings must screw on mating parts with a ratcheting action and must attach securely.	Not repairable.	Replace cable (para 7-40).
c. Electrical connector (W3J1) (4) for:			
(1) Bent pins.	None allowed.	Up to 1/8 inch out-of-position.	Replace cable (para 7-40).
(2) Damaged threads.	Any number, without high metal, if connector can be installed normally with its mating part.	Any number, with high metal, if connector can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
d. E3 connector bracket (5) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace bracket (para 7-39).
(2) Nicks, dents, and scratches.	Any number.	Not applicable.	Not applicable.
(3) Deformation.	Any amount, if bracket can be installed normally with its mating parts.	Same as usable limits.	Cold-work to usable limits.



1. Green Electrical Cable
2. Backshell
3. Electrical Connector
4. Electrical Connector (W3J1)
5. E3 Connector Bracket

Figure 7-20. ***(T700, T701C, T701D)*** *Green Electrical Cable; Inspection*



1. Green Electrical Cable
2. Backshell
3. Electrical Connector
4. Electrical Connector (W3J1)
5. E3 Connector Bracket

Figure 7-21. ***(T701)*** *Green Electrical Cable; Inspection*

7-39. Repair of Green Electrical Cable (W3).

a. Limit repair to that specified in Corrective Action column of table 7-6.

b. Replace E3 connector bracket (2, fig. 7-22) as follows:

(1) Remove four screws (3) from two nut plates (4).

(2) Remove two nut plates (4) from green electrical cable (1).

(3) Slide E3 connector bracket (2) from cable (1).

(4) Position replacement bracket (2) as shown, and install it on cable (1).

(5) Install two nut plates (4) and secure them with four screws (3). Hand-tighten screws.

(6) Torque screws to 5-6 inch-pounds.

7-40. Installation of Green Electrical Cable (W3).

a. Position green electrical cable (2, fig. 7-18 **(T700, T701C, T701D)** or 7-19 **(T701)**) as shown.

b. Insert green electrical cable (2) into four clip supports (1).

c. Install two bolts (7) into bracket (6). Torque bolts to 45-50 inch-pounds.

d. Before connecting cable (2) to components listed in step e, refer to paragraph H-10 for instructions on mating electrical connectors with knurled coupling rings.

CAUTION

Do not attempt to mate electrical connectors if seals are swollen.

e. Connect green electrical cable to the following:

- Anti-icing bleed and start valve (3)
- Fuel pressure sensor (4)
- Fuel filter bypass sensor (5)
- Electrical chip detector (8)
- Oil filter bypass sensor (9)
- Alternator stator (10)
- Oil pressure sensor (11)
- **(T700, T701C, T701D)** Oil temperature sensor (12, fig. 7-18)

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

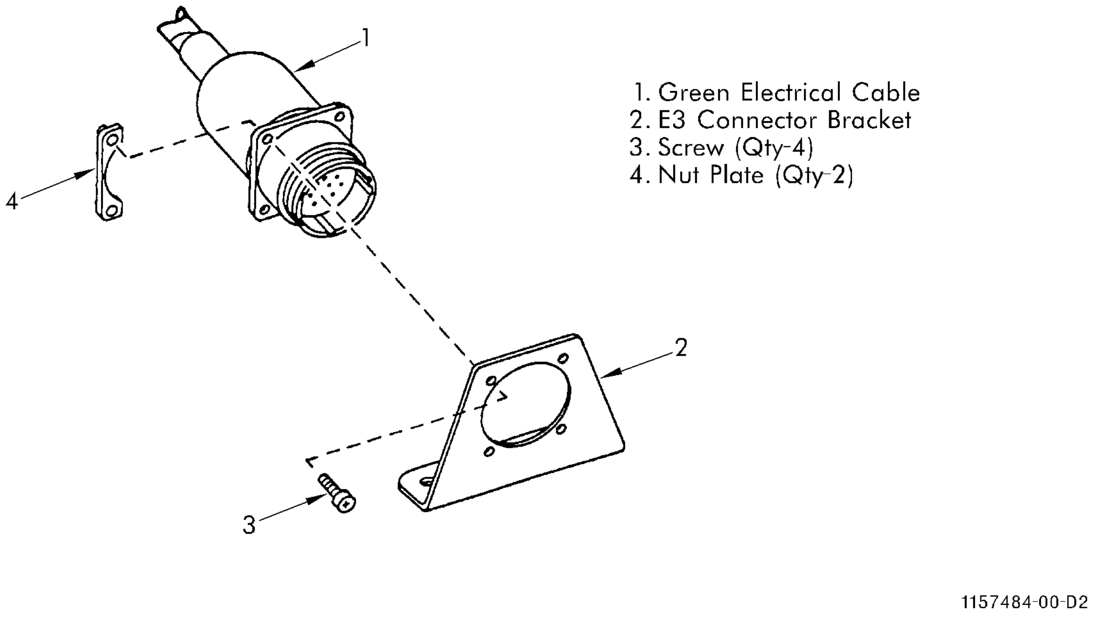


Figure 7-22. E3 Connector Bracket; Replacement

7-41. YELLOW ELECTRICAL CABLE (W4).

7-42. Removal of Yellow Electrical Cable (W4).

a. Disconnect yellow electrical cable (2, fig. 7-23) from the following:

- **(T700, T701)** Electrical control unit or **(T701C, T701D)** Digital electronic control (6)
- **(T700, T701)** History recorder or **(T701C, T701D)** History counter (3)
- Thermocouple assembly (8)
- Np sensor (9)
- Alternator stator (1)
- Ignition exciter (5)
- Hydromechanical control unit (7)

b. **(T700)** Remove cable (2) from nine clip supports (4).

c. **(T701, T701C , T701D)** Remove cable (2) from eight clip supports (4) and one yellow cable bracket (10).

d. Cover electrical connectors with clean, dry protective caps (items 34, 27, 28, 30, Appendix D).

7-43. Cleaning of Yellow Electrical Cable (W4).

a. Check electrical connectors for moisture or contamination.

b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry, protective caps (items 34, 27, 28, 30, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

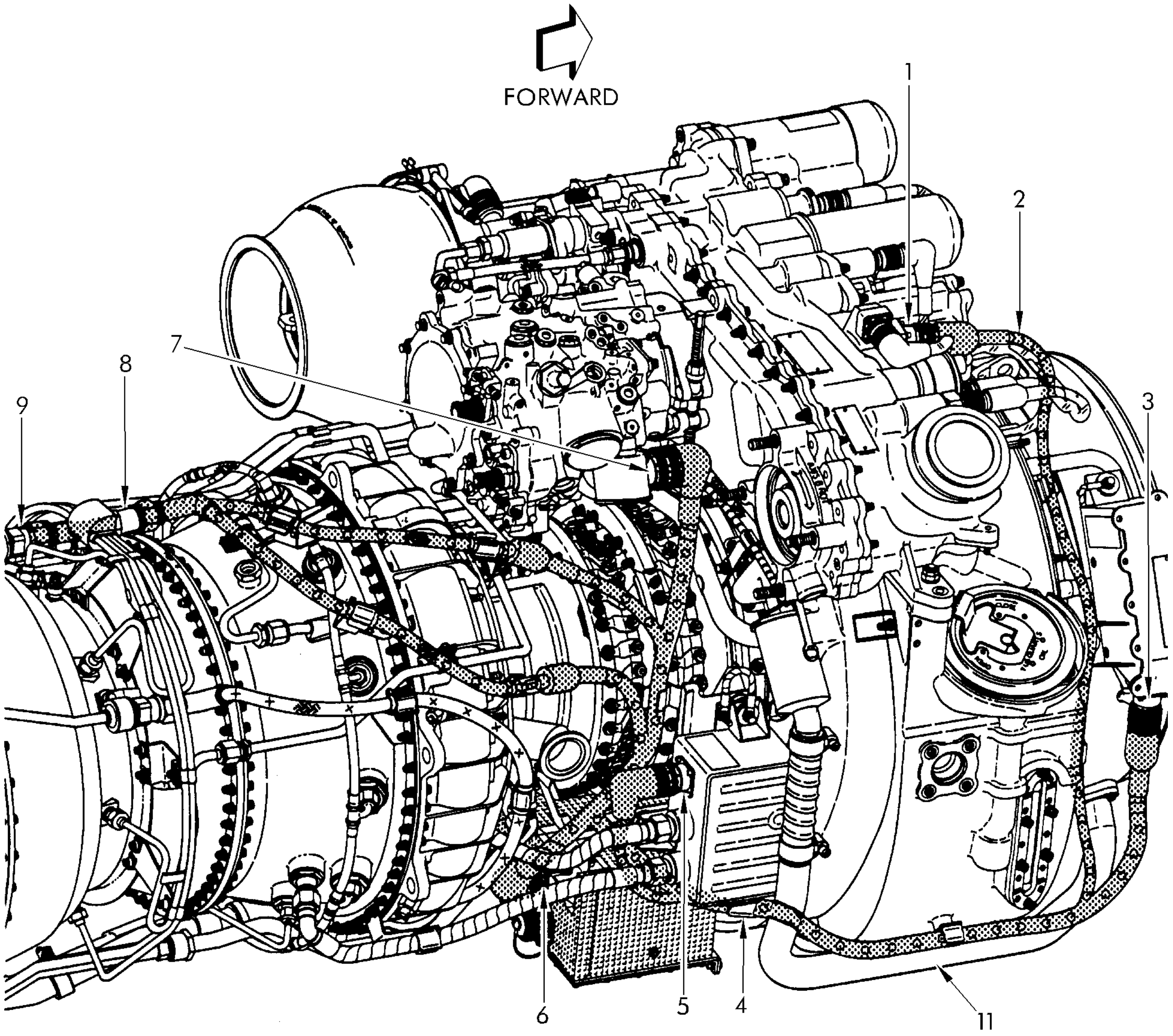
d. Wipe electrical cable with towel (item 112, Appendix D) and dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

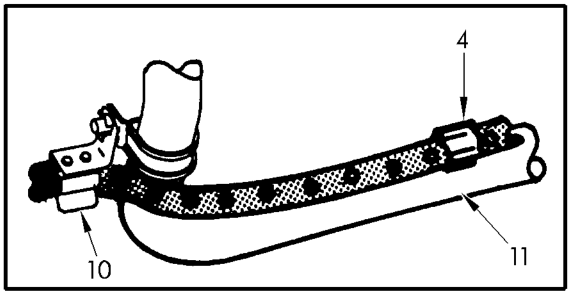
WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the electrical cable using dry, filtered, compressed air.





(T701, T701C, T701D)

1. Alternator Stator
2. Yellow Electrical Cable
3. History Recorder or History Counter
4. **(T700)** Clip Support (Qty-9)
   (T701, T701C, T701D) Clip Support (Qty-8)
5. Ignition Exciter
6. Electrical Control Unit or Digital Electronic Control
7. Hydromechanical Control Unit
8. Thermocouple Assembly
9. Np Sensor
10. **(T701, T701C, T701D)**Yellow Cable Bracket
11. Sensing Tube

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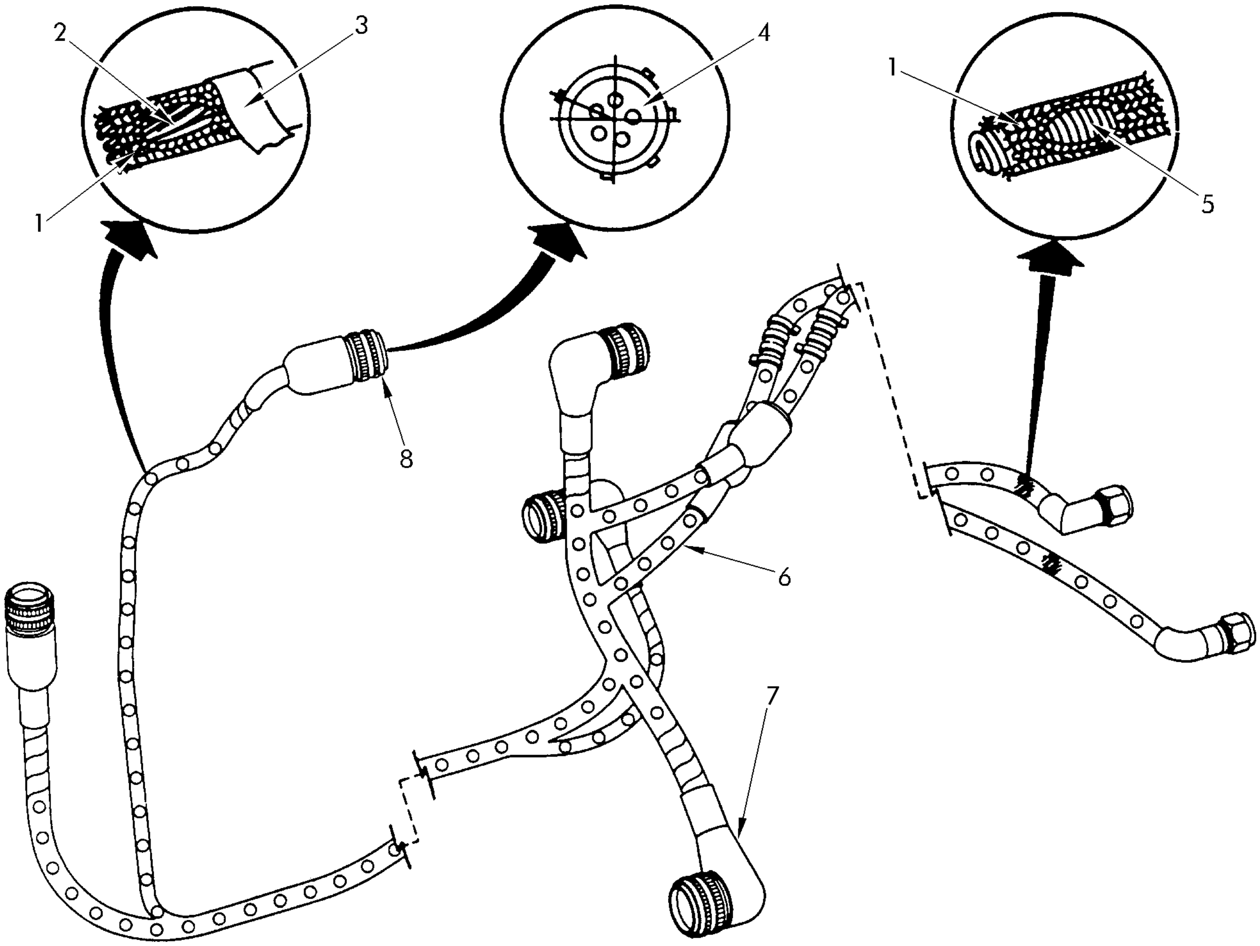
Figure 7-23. Yellow Electrical Cable; Removal and Installation

7-44. Inspection of Yellow Electrical Cable (W4). See table 7-7.

Table 7-7. Inspection of Yellow Electrical Cable (W4)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Yellow electrical cable (6, fig. 7-24) for:			
(1) Broken wires and exposed inner bundle (2) or inner conduit (5) in wirebraid shield (1).	Up to seven broken strands in any 1-square inch, provided break is not closer than 2.000 inches to another damaged area and the inner bundle is not exposed.	Same as usable limits.	Bend back broken wires. Otherwise, replace cable (para 7-45).
(2) Exposed inner bundle (2) and inner conduit (5) for cracks or breaks, using a 10× magnifying glass.	None allowed.	Not repairable.	Replace cable (para 7-45).
(3) Worn or damaged backshells (7).	Any amount, if wire braid is not exposed. Exposed solid metal up to one-half of circumference is acceptable.	Not repairable.	Replace cable (para 7-45).
(4) Loose teflon chafing sleeve (3).	Wrap will fit snugly on cable and will have no projecting ends.	Any amount.	Rewrap and tape ends with silicone tape (item 110, Appendix D).
(5) Damaged or missing chafing sleeve (3).	Not allowed.	Any amount.	Replace damaged or missing sleeve (item 121, Appendix D). Tape ends with silicone tape (item 110, Appendix D).
b. Electrical connectors (8) for:			
(1) Damaged threads.	Any number, without high metal, if connector can be installed normally onto mating parts.	Any number, with high metal, if connector can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
(2) Cracked or missing ceramic insulation (4).	Small cracks or chips allowed, provided electrical properties of cable are not affected.	Not repairable.	Replace cable (para 7-45).
(3) Damaged or out-of-round knurled coupling rings.	Coupling rings must screw on mating parts with a ratcheting action and must attach securely.	Not repairable.	Replace cable (para 7-45).



1. Wire-Braid Shield
2. Inner Bundle
3. Teflon Chafing Sleeve
4. Ceramic Insulation
5. Inner Conduit
6. Yellow Electrical Cable
7. Backshell (Qty-7)
8. Electrical Connector (Qty-5)

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Figure 7-24. Yellow Electrical Cable; Inspection

7-45. Installation of Yellow Electrical Cable (W4).

a. Position yellow electrical cable (2, fig. 7-23) as shown.

b. **(T700)** Insert electrical cable (2) into nine clip supports (4).

c. **(T701, T701C, T701D)** Insert cable (2) into eight clip supports (4) and into one yellow cable bracket (10). Cable (2) must be routed on the outside of sensing tube (11).

d. Before connecting cable (2) to components listed in step e, refer to paragraph H-10 for instructions on mating electrical connectors with knurled coupling rings.

CAUTION

Do not attempt to mate electrical connectors if seals are swollen.

e. Connect electrical cable (2) to the following:

- Hydromechanical control unit (7)
- Ignition exciter (5)
- Alternator stator (1)
- **(T700, T701)** History recorder or **(T701C, T701D)** History counter (3)
- **(T700, T701)** Electrical control unit or **(T701C, T701D)** Digital electronic control (6)

f. Connect cable (2) to Np sensor (9). Tighten (15° wrench-arc) connector.

g. Connect cable (2) to thermocouple assembly (8). Tighten (60° wrench-arc) connector.

h. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

i. After completion of final testing, seal connectors (para H-9, Appendix H).

7-46. BLUE ELECTRICAL CABLE (W5).

7-47. Removal of Blue Electrical Cable (W5).

a. Disconnect blue electrical cable (2, fig. 7-25 **(T700)** or 7-26 **(T701, T701C, T701D)**) from the following:

- Torque and overspeed sensor (5)
- **(T700, T701)** Electrical control unit or **(T701C, T701D)** Digital electronic control (3)
- **(T700)** POU (1, fig. 7-25)
- **(T701, T701C, T701D)** Overspeed and drain valve (1, fig. 7-26)

b. Remove cable (2) from seven clip supports (4, fig. 7-25 **(T700)** or 7-26 **(T701, T701C, T701D)**).

c. Cover electrical connectors with clean, dry protective caps (items 35, 28, Appendix D).

7-48. Cleaning of Blue Electrical Cable (W5).

a. Check electrical connectors for moisture or contamination.

b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry protective caps (items 35. 28, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe electrical cable with towel (item 112, Appendix D) and dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

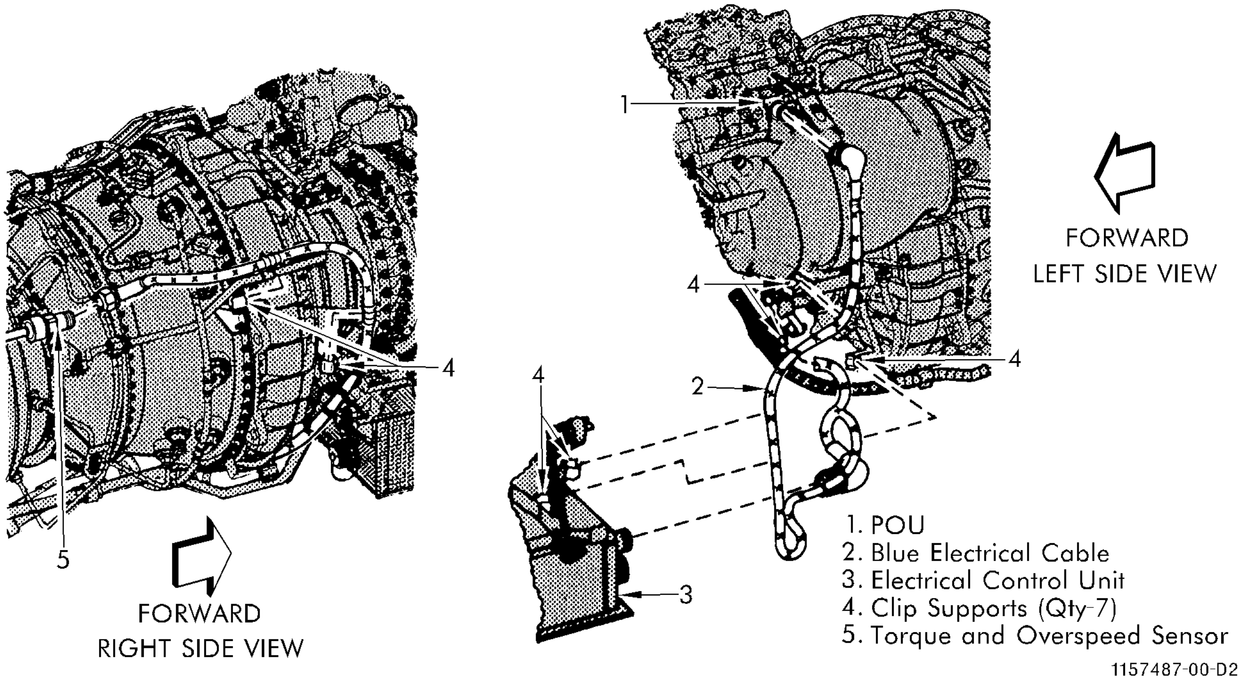


Figure 7-25. ***(T700)*** *Blue Electrical Cable; Removal and Installation*

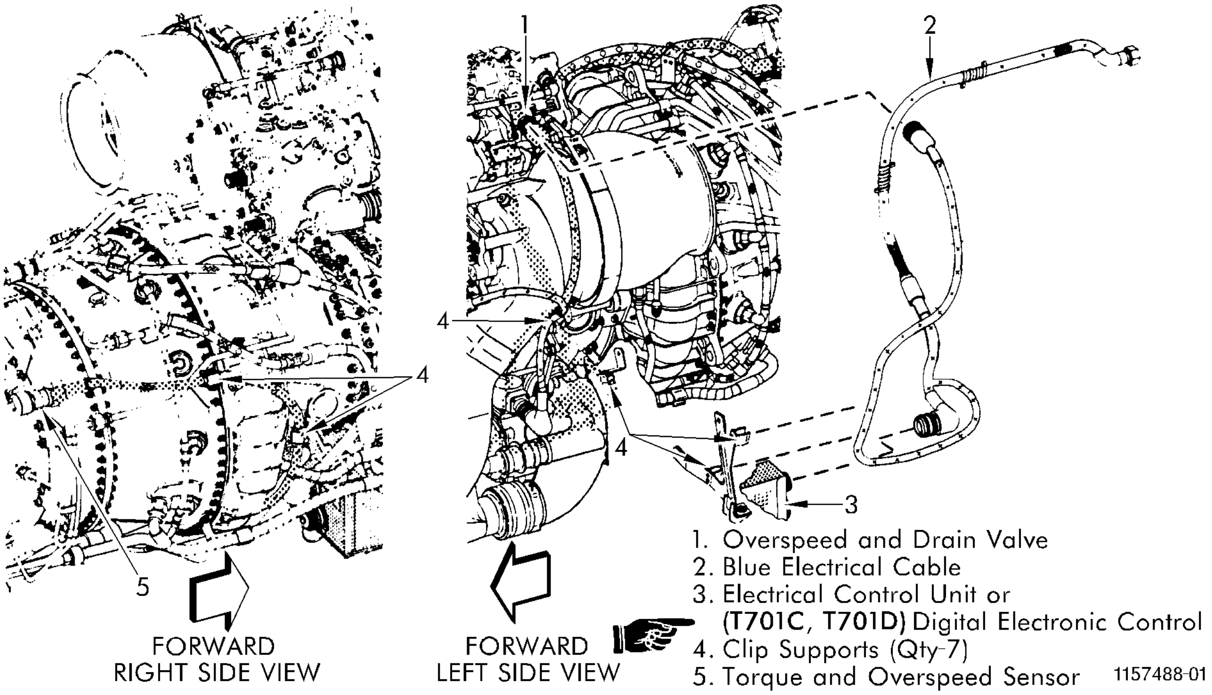


Figure 7-26. ***(T701, T701C, T701D)*** *Blue Electrical Cable; Removal and Installation*

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the electrical cable, using dry, filtered compressed air.

7-49. Inspection of Blue Electrical Cable (W5). See table 7-8.

Table 7-8. Inspection of Blue Electrical Cable (W5)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Blue electrical cable (8, fig. 7-27) for:			
(1) Broken wires and exposed inner bundle (6) in wirebraid shield (4).	Up to seven broken strands in any 1-square inch, provided break is not closer than 2.000 inches to another damaged area and the inner bundle is not exposed.	Same as usable limits.	Bend back broken wires. Otherwise, replace cable (para 7-50).
(2) Exposed inner bundle (6) and inner conduit (3) for cracks, or breaks, using a 10× magnifying glass.	None allowed.	Not repairable.	Replace cable (para 7-50).
(3) Worn or damaged backshells (2).	Any amount, if wire-braid is not exposed. Exposed solid metal up to one-half of circumference is acceptable.	Not repairable.	Replace cable (para 7-50).
(4) Loose teflon chafing sleeve (5).	Sleeve will fit snugly on cable and have no projecting ends.	Any amount.	Rewrap and tape ends with silicone tape (item 110, Appendix D).
(5) Damaged or missing teflon chafing sleeve (5).	Not allowed.	Any amount.	Replace damaged or missing sleeve (item 120, Appendix D). Tape ends with silicone tape (item 110, Appendix D).

Table 7-8. Inspection of Blue Electrical Cable (W5) (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
b. Electrical connectors (1) for:			
(1) Damaged threads.	Any number, without high metal, if connector can be installed normally onto its mating part.	Any number, with high metal, if connector can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
(2) Cracked or missing ceramic insulation (7).	Small cracks or chips allowed, provided electrical properties of the cable are not affected.	Not repairable.	Replace cable (para 7-50).
(3) Damaged or out-of-round knurled coupling rings.	Coupling rings must screw on mating parts with a ratcheting action and must attach securely.	Not repairable.	Replace cable (para 7-50).

7-50. Installation of Blue Electrical Cable (W5).

a. Position blue electrical cable (2, fig. 7-25 **(T700)** or 7-26 **(T701, T701C, T701D)**) as shown.

b. Insert electrical cable (2) into seven clip supports (4).

c. Before connecting cable (2) to components in step d, refer to paragraph H-10 for instructions on mating electrical connectors with knurled coupling rings.

CAUTION

Do not attempt to mate electrical connectors if seals are swollen. Electrical connector may be damaged.

d. Connect electrical cable to the following:

- **(T700)** POU (1, fig. 7-25)
- **(T701, T701C, T701D)** Overspeed and drain valve (1, fig. 7-26)
- **(T700, T701)** Electrical control unit or **(T701C, T701D)** Digital electronic control (3, fig. 7-25 **(T700)** or 7-26 **(T701, T701C, T701D)**)

e. Connect cable to torque and overspeed sensor (5). Tighten (15° wrench-arc) connector.

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

g. After completion of final testing, seal connectors (para H-9, Appendix H).

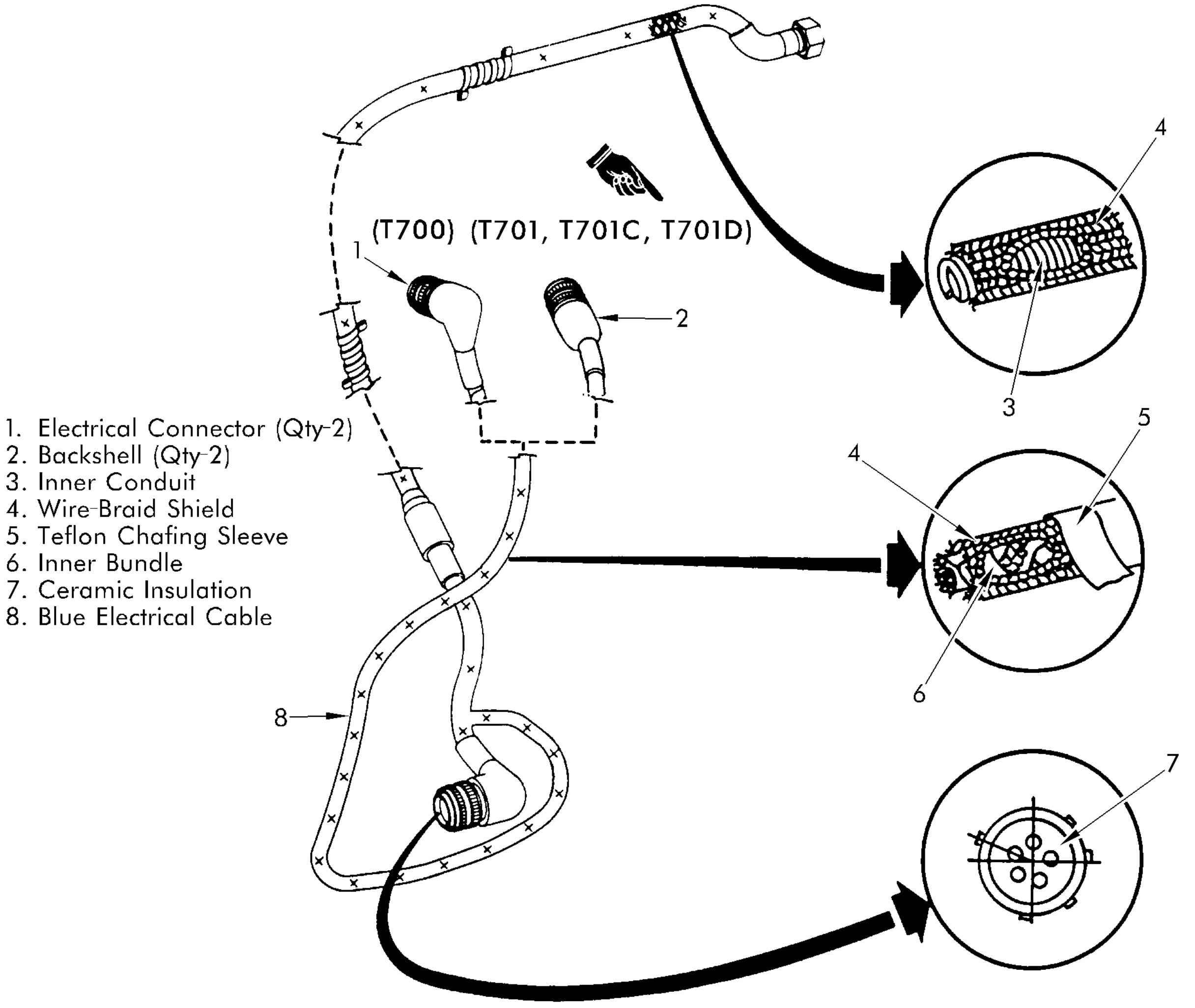


Figure 7-27. Blue Electrical Cable; Inspection

7-51. ALTERNATOR STATOR.

7-52. Removal of Alternator Stator.

a. Disconnect electrical connectors (1, 2, fig. 7-28). Cover connectors with clean, dry, protective caps (item 27, Appendix D).

b. Loosen three captive bolts (5).

CAUTION

Magnetic forces attract alternator stator (3) to rotor. Do not force stator with a tool during removal because stator will be damaged.

c. Remove alternator stator (3).

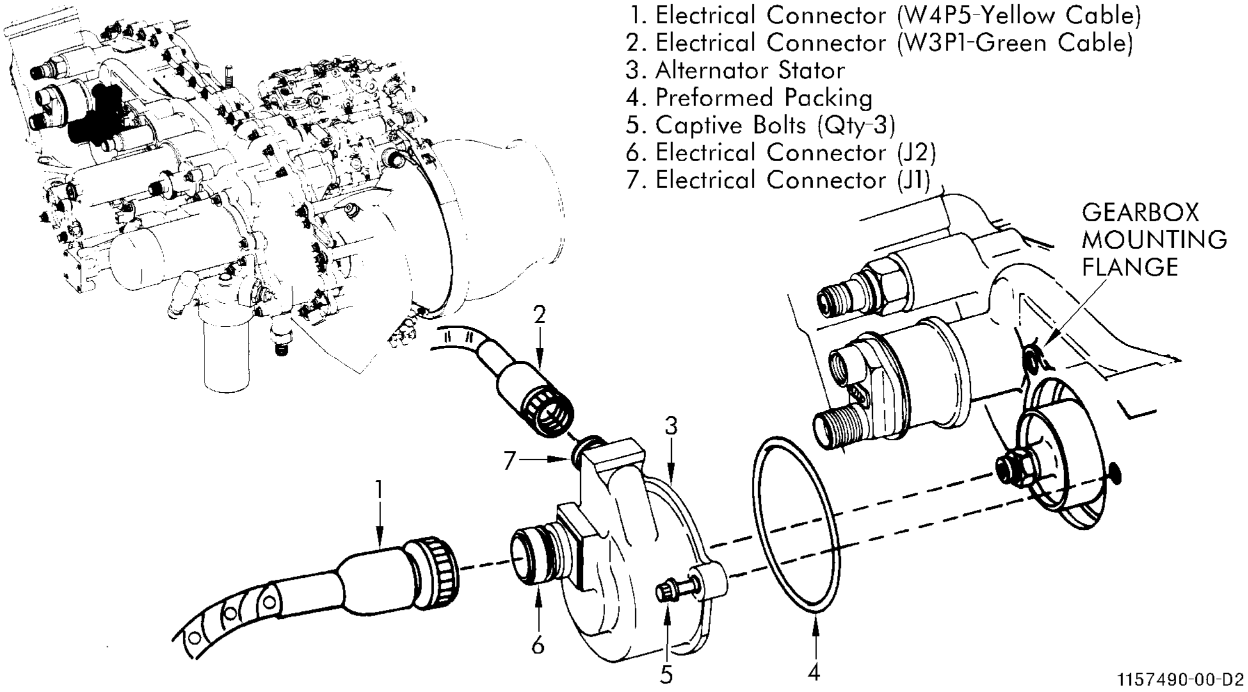
d. Discard packing (4).

7-53. Cleaning of Alternator Stator.

a. Check electrical connectors for moisture or contamination.

b. If no moisture or contamination is found in electrical connectors, do not clean them. Install clean, dry protective caps (item 25, Appendix D).

c. If moisture or contamination is found in electrical connectors, clean them (see para H-11, Appendix H).



1. Electrical Connector (W4P5-Yellow Cable)
2. Electrical Connector (W3P1-Green Cable)
3. Alternator Stator
4. Preformed Packing
5. Captive Bolts (Qty-3)
6. Electrical Connector (J2)
7. Electrical Connector (J1)

Figure 7-28. Alternator Stator; Removal and Installation

WARNING

Dry Cleaning Solvent
(Stoddard Solvent) P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the alternator stator, using dry, filtered compressed air.

7-54. Inspection of Alternator Stator.

See table 7-9.

Table 7-9. Inspection of Alternator Stator

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Alternator stator for:			
a. Damaged threads on captive bolts (3, fig. 7-29).	Not allowed.	Not repairable.	Replace bolt (para H-21, Appendix H).
b. Cracks.	None allowed.	Not repairable.	Replace alternator stator (para 7-56).
c. Boss (2) (with captive bolt (3) removed) for:			
(1) Missing threads.	Any number.	Not applicable.	Not applicable.
(2) Damaged threads.	No crossed threads or loose material.	Any number.	AVUM: Replace alternator stator (para 7-56). AVIM: Remove loose material and debris. Chase threads to remove crossed threads.

Table 7-9. Inspection of Alternator Stator (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. Diameter A for high metal.	Not allowed.	Any amount.	Remove high metal (para H-21, Appendix H).
e. Electrical connectors (4, 5) for:			
(1) Contamination or moisture.	Not allowed.	Any amount.	Clean connectors (para 7-53).
(2) Bent pins.	Not allowed.	Up to 1/8 inch out of position.	Straighten pin. Check alinement with mating connector.
(3) Damaged threads.	Any amount, without high metal, if connector can be assembled normally with its mating part.	Any amount that can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
NOTE Connector seal is commonly known as a grommet.			
(4) Swollen connector seal (6).	Flush or below surface X.	Not repairable.	Replace alternator stator (para 7-56).
f. Nicks, dents, pits, and scratches on:			
(1) Floor of packing groove (1).	Any number, 0.003 inch deep, without sharp edges.	Not repairable.	Replace alternator stator (para 7-56).
(2) Wall of packing groove (1).	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace alternator stator (para 7-56).

7-55. Testing of Alternator Stator. Electrical connector locations are shown in figure FO-2.

a. Disconnect yellow and green electrical cables from alternator stator (J1 and J2 connectors).

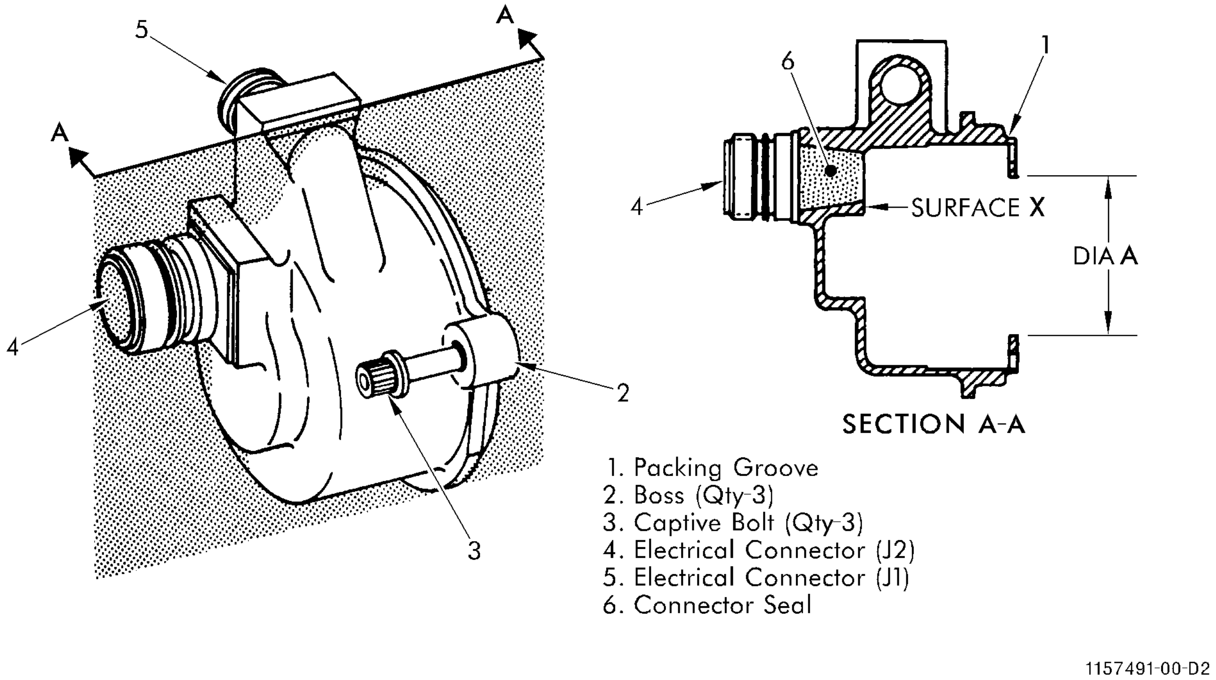
b. Use a multimeter for this test.

c. **(T700)** Measure resistance between pins in electrical connector (J1), using the following information. (Do not take measurements at pin 3.)

Pins	Resistance
1-2	11 to 14 ohms
4-5	2.5 to 3.5 ohms

d. **(T701, T701C, T701D)** Measure resistance between pins in electrical connector (J1), using the following information. (Do not take measurements at pin 3.)

Pins	Resistance
1-2	1.7 to 2.2 ohms
4-5	3.0 to 3.7 ohms



1. Packing Groove
2. Boss (Qty-3)
3. Captive Bolt (Qty-3)
4. Electrical Connector (J2)
5. Electrical Connector (J1)
6. Connector Seal

Figure 7-29. Alternator Stator; Inspection

e. **(T700)** Measure resistance between pins in electrical connector (J2), using the following information. (Do not take measurements at pins 1 and 2.)

Pins	Resistance
3-4	1.4 to 1.8 ohms
4-5	1.4 to 1.8 ohms
3-5	2.8 to 3.6 ohms

f. **(T701, T701C, T701D)** Measure resistance between pins in electrical connector (J2), using the following information. (Do not take measurements at pins 1 and 2.)

Pins	Resistance
3-4	0.6 to 1.0 ohms
4-5	0.6 to 1.0 ohms
3-5	1.2 to 2.0 ohms

g. Set selector switch on multimeter to read high resistance. Check all pins for short circuits-to-ground. No short circuits allowed.

h. If readings are outside these limits, circuit is faulty. Replace alternator stator.

7-56. Installation of Alternator Stator.

a. Install packing (4, fig. 7-28) on alternator stator (3).

b. Slide alternator stator (3) over alternator rotor. Magnetic forces will attract stator to rotor. Therefore, be sure that stator does not cock during installation.

c. Thread three captive bolts (5) into gearbox mounting flange, handtight. Torque bolts to 45-50 inch-pounds.

CAUTION

Do not attempt to mate electrical connectors if seals are swollen.

d. Connect electrical connectors (1, 2) to alternator stator.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

7-57. ALTERNATOR ROTOR.

7-58. Removal of Alternator Rotor (AVIM).

a. Remove alternator stator (para 7-52).

b. Insert short end of 7/32-inch hex key (4, fig. 7-30) into drive shaft.

c. Position long end of hex key so that it rests against bottom of oil and scavenge pump housing (3, view A).

d. Place 3/4-inch open-end wrench (1) on locknut (5).

e. Holding hex key in place, remove locknut.

f. Remove alternator rotor (2).

7-59. Cleaning of Alternator Rotor (AVIM).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

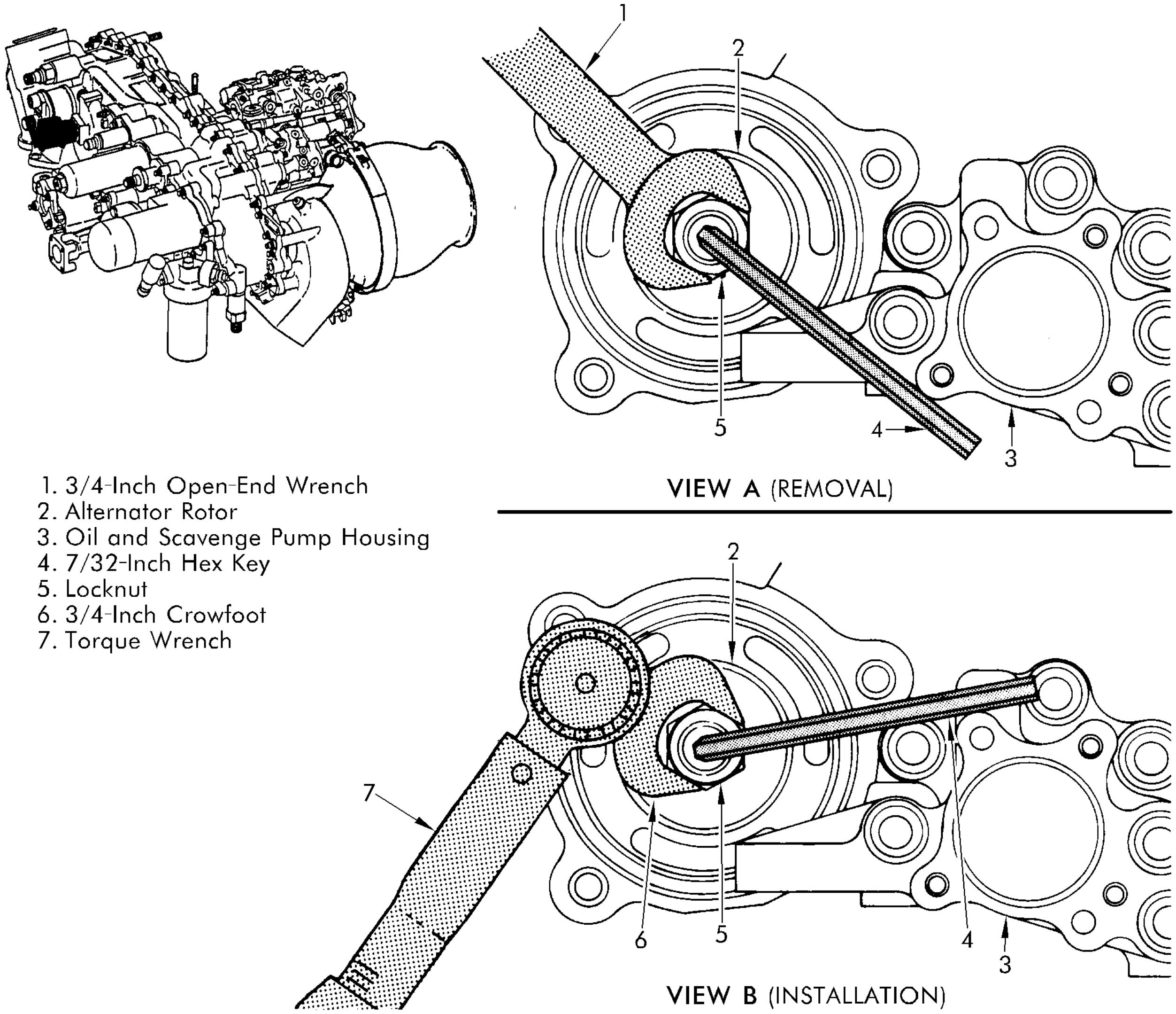
a. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the alternator rotor, using dry, filtered compressed air.



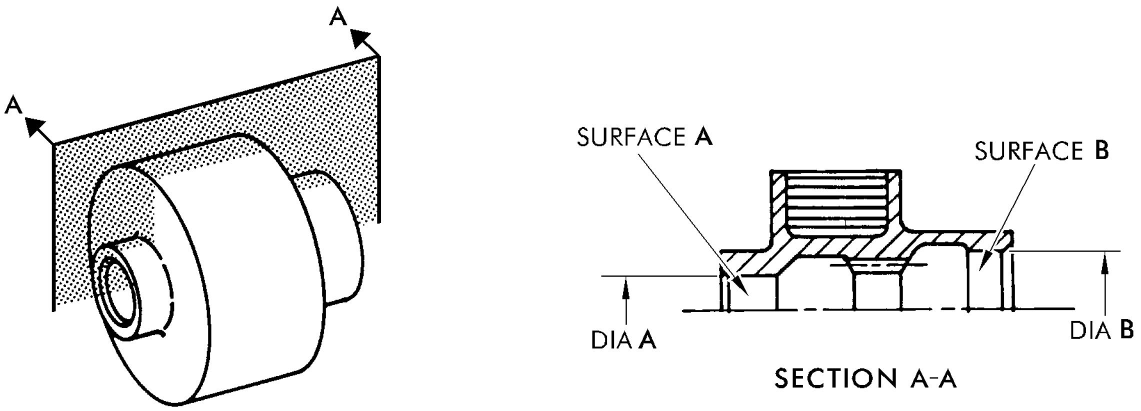
1. 3/4-Inch Open-End Wrench
2. Alternator Rotor
3. Oil and Scavenge Pump Housing
4. 7/32-Inch Hex Key
5. Locknut
6. 3/4-Inch Crowfoot
7. Torque Wrench

Figure 7-30. Alternator Rotor; Removal and Installation

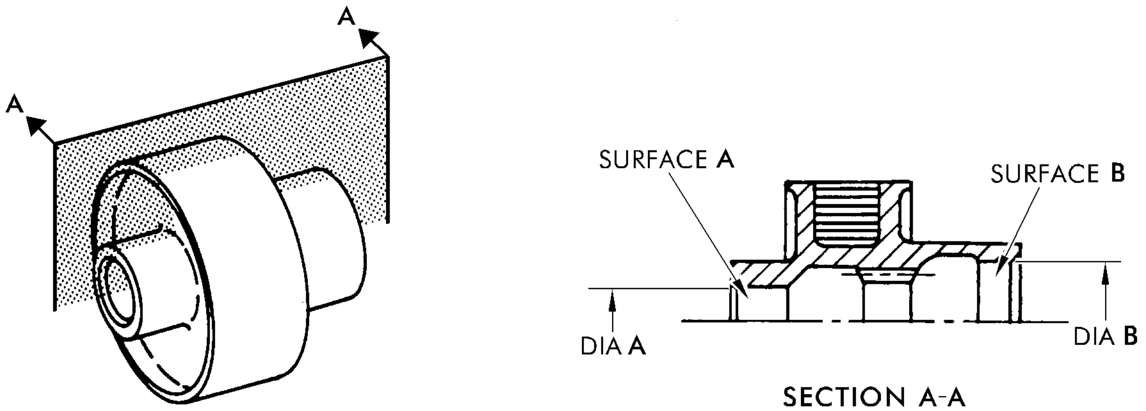
7-60. Inspection of Alternator Rotor (AVIM). See table 7-10.

Table 7-10. Inspection of Alternator Rotor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Alternator rotor (fig. 7-31) for:			
(1) Nicks and scratches.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
(2) Dents.	Any number, 1/32 inch deep.	Not repairable.	Replace rotor (para 7-61).
(3) Cracks.	None allowed.	Not repairable.	Replace rotor (para 7-61).
(4) Wear on diameter A.	0.4610 inch maximum diameter.	Not repairable.	Replace rotor (para 7-61).
(5) Wear on diameter B.	0.7810 inch maximum diameter.	Not repairable.	Replace rotor (para 7-61).
b. Surfaces A and B for:			
(1) Pickup and fretting.	Not allowed.	Any amount of high metal, if no more than 25% of area is affected.	Remove high metal (para H-21, Appendix H).
(2) Axial scratches and grooves.	4 per 1/4 inch of circumference, 0.010 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
(3) Circumferential grooves.	Any number, 0.005 inch deep, if no more than 10% of area is affected, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).



(T701, T701C, T701D)



(T700)

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Figure 7-31. Alternator Rotor; Inspection

7-61. Installation of Alternator Rotor (AVIM).

a. Slide alternator rotor (2, fig. 7-30) onto drive shaft.

b. Thread locknut (5) onto drive shaft as far as it will go by hand.

c. Insert short end of 7/32-inch hex key (4) into end of drive shaft.

d. Place hex key so that it rests on top of oil and scavenge pump housing (3, view B).

e. Place torque wrench (7) with 3/4-inch crowfoot (6) on locknut (5).

f. Holding hex key in place, turn locknut enough to check run-on torque. Run-on torque must be at least 14 inch-pounds. If it is not, use a new locknut.

g. Torque locknut (5) to 275-300 inch-pounds.

h. Loosen locknut (5, view A).

i. Torque locknut (5, view B) again to 275-300 inch-pounds.

j. Install alternator stator (para 7-56).

k. Make required engine checks listed in table 1-39.

7-62. THERMOCOUPLE ASSEMBLY.

7-63. Removal of Thermocouple Assembly.

a. Disconnect electrical connector (yellow cable) (11, fig. 7-32) from thermocouple assembly connector (10). Cover connectors with clean, dry protective caps (items 27, 28, 30, or 36, Appendix D).

b. Loosen seven coupling nuts (4) on lower, middle, upper, and center probes (5, 6, 7, 8).

c. Remove two bolts (9) from top of junction box bracket (1).

d. Remove five bolts (3) and one bolt (12) that secure thermocouple assembly to brackets (2).

CAUTION

Tips of probes can be easily damaged. Be extra careful when removing probes.

e. While expanding thermocouple assembly radially outward, withdraw lower probes (5) and middle probes (6). Then withdraw upper probes (7) and center probe (8).

7-64. Cleaning of Thermocouple Assembly.

a. Check electrical connector for moisture or contamination.

b. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap (item 26, Appendix D).

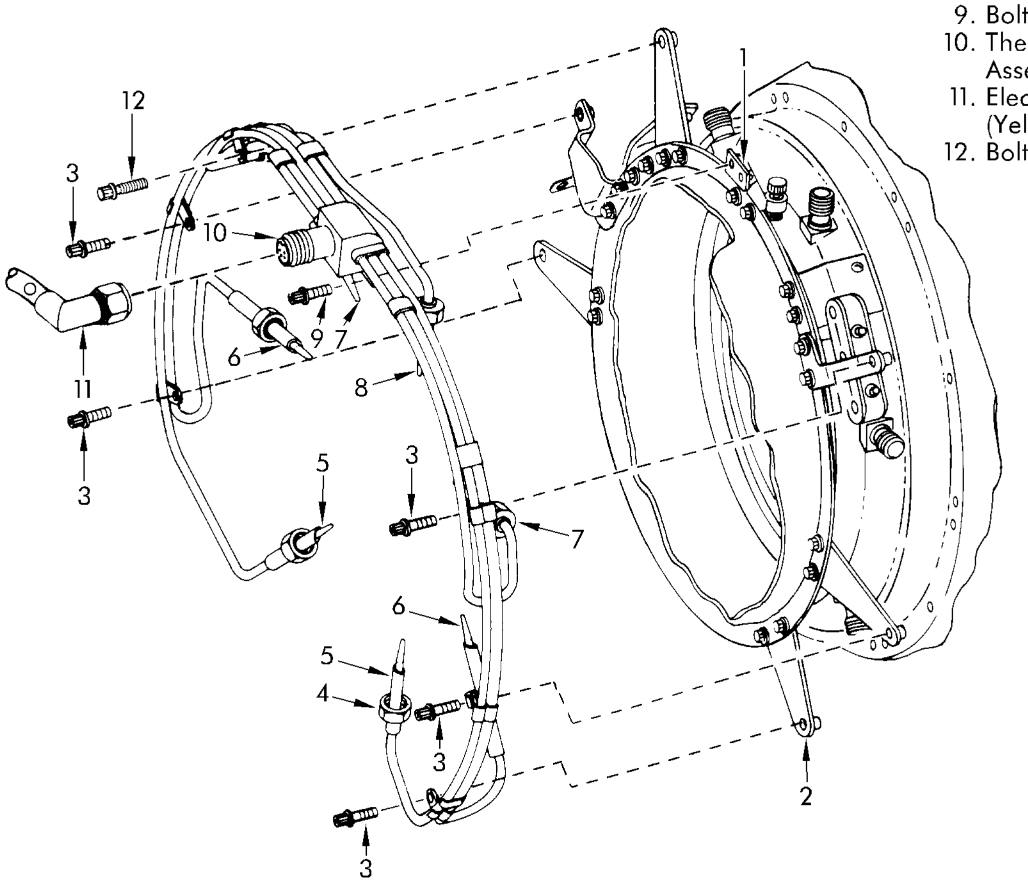
c. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Wipe external surfaces with towel (item 112, Appendix D) saturated with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt, and oil.



1. Junction Box Bracket
2. Brackets (Qty-6)
3. Bolts (Qty-5)
4. Coupling Nuts (Qty-7)
5. Lower Probes (Qty-2)
6. Middle Probes (Qty-2)
7. Upper Probes (Qty-2)
8. Center Probe
9. Bolts (Qty-2)
10. Thermocouple Assembly Connector
11. Electrical Connector (Yellow Cable)
12. Bolt (Qty-1)

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Figure 7-32. Thermocouple Assembly; Removal and Installation

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the thermocouple assembly, using dry, filtered compressed, air.

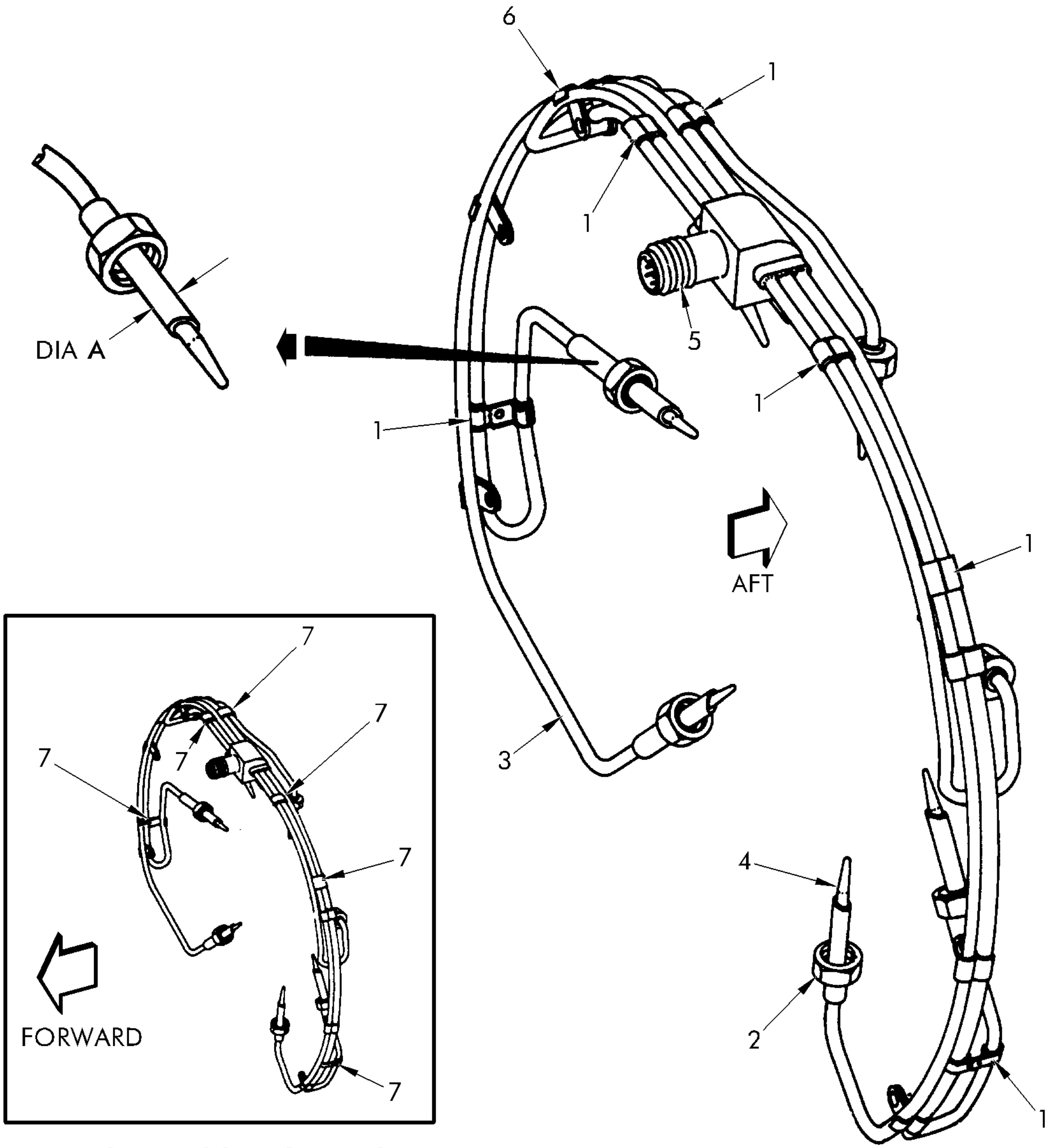
7-65. Inspection of Thermocouple Assembly. See table 7-11.

Table 7-11. Inspection of Thermocouple Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Rigid tubing (3, fig. 7-33) for:			
(1) Nicks, scratches, and abrasions.	Any amount, up to 0.015 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
(2) Dents.	Any number, up to 0.062 inch deep.	Not repairable.	Replace thermocouple assembly (para 7-68).
(3) Loose U-clamp (6) (braze separated).	Both tubes attached to clamp.	Not repairable.	Replace thermocouple assembly (para 7-68).
(4) Broken U-clamps (6).	Not allowed.	Not repairable.	Replace thermocouple assembly (para 7-68).
(5) Damaged threads on coupling nuts (2).	Any amount, if there is no loose or high metal and if connector can be sealed fingertight to mating boss.	Same as usable limits.	Remove loose burrs or high metal (para H-21, Appendix H).
(6) Discoloration or tarnishing of silver plating on coupling nuts (2).	Any amount.	Not applicable.	Not applicable.
b. Electrical connector (5) for:			
(1) Bent pins.	Not allowed.	Any amount.	Straighten pins, using care not to damage platinum plated contact surface. Check alinement with mating connector.

Table 7-11. Inspection of Thermocouple Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Cracked or missing ceramic insulation.	Small cracks or chips allowed provided electrical properties of the harness are not affected.	Not repairable.	Replace thermocouple assembly (para 7-68).
(3) Damaged threads.	Any number if there are no loose or hanging burrs, if there is no high metal, and if connector can be assembled normally with its mating part.	Same as usable limits, with loose or hanging burrs or with high metal.	Remove loose or hanging burrs or remove high metal (para H-21, Appendix H).
c. Probe (4) for:			
(1) Bends.	Maximum 1/16 inch.	Not repairable.	Replace thermocouple assembly (para 7-68). Do not straighten.
(2) Nicks and cracks.	None allowed.	Not repairable.	Replace thermocouple assembly (para 7-68).
(3) Smooth dents.	0.020 inch maximum.	Not repairable.	Replace thermocouple assembly (para 7-68).
(4) Wear or corrosion.	AVUM: Any amount if there are no cracks and no breakthrough in metal shield.	Not repairable.	Replace thermocouple assembly (para 7-68).
	AVIM: OD of metal of each probe at diameter A (fig. 7-33) will be 0.240 inch minimum. Cracks or breakthrough in metal shield are not allowed.	Not repairable.	Replace thermocouple assembly (para 7-68).
d. (Former Configuration) Wrap-around clamps (7) for cracks or breakage.	Not allowed.	Any amount.	Repair clamps (para 7-66).



FORMER CONFIGURATION

1. Rivetted Loop Clamp (Qty-6)
2. Coupling Nut (Qty-7)
3. Rigid Tubing
4. Probe (Qty-7)
5. Electrical Connector
6. U-Clamp (Qty-6)
7. Wrap Around Clamp (Qty-6)

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Figure 7-33. Thermocouple Assembly; Inspection

7-66. Repair of Thermocouple Assembly Wrap-Around Clamps (Former Configuration).

CAUTION

- Do not apply heat to wrap-around clamps; otherwise, thermocouple will be damaged.
- Do not grind or file into rigid tubing under clamp.

a. Using a hand-held grinder, file, or equivalent, carefully blend damaged areas of clamps (1, 6, fig. 7-34) smooth.

b. If clamp (1) is damaged, go to step c. If clamp (6) is damaged, proceed as follows:

(1) Install two clamps (5, view B) PN MS122901, adjacent to damaged clamp and on the side closest to electrical connector (7).

(2) Using bolt PN J643P05A (3, view B) and locknut PN 4046T32P01, P02, or P03, (4) secure clamps (5).

(3) Tighten (15° wrench-arc) bolt (3).

c. Repair clamp (1) as follows:

(1) Install two clamps, PN MS122901 (2, view A), adjacent to damaged clamp and on the side closest to electrical connector (7).

(2) Using bolt PN J643P05A (3, view A) and locknut PN 4046T32P01, P02, or P03 (4), secure clamps (2).

(3) Tighten (15° wrench-arc) bolt (3).

7-67. Testing of Thermocouple Assembly. Refer to paragraph 1-83, testing in aircraft, or to paragraph 1-264, testing in METS/FEDS/CETS.

7-68. Installation of Thermocouple Assembly.

CAUTION

Tips of probes can be easily damaged. Be extra careful when installing probes.

a. Position thermocouple assembly around power turbine case so that thermocouple assembly connector (10, fig. 7-32) is at 12 o'clock position and so that connector points forward.

b. Insert center probe (8) into mounting port at 11 o'clock position.

c. Insert upper probes (7), middle probes (6), and lower probes (5).

d. Connect and snug down seven coupling nuts (4) on probes. Tighten (15° wrench-arc) coupling nuts.

e. Secure assembly to forward side junction box of bracket (1) with two bolts (9). Torque bolts to 45-50 inch-pounds.

f. Secure assembly to forward side of six brackets (2) with five bolts (3) and one bolt (12). Torque bolts to 45-50 inch-pounds.

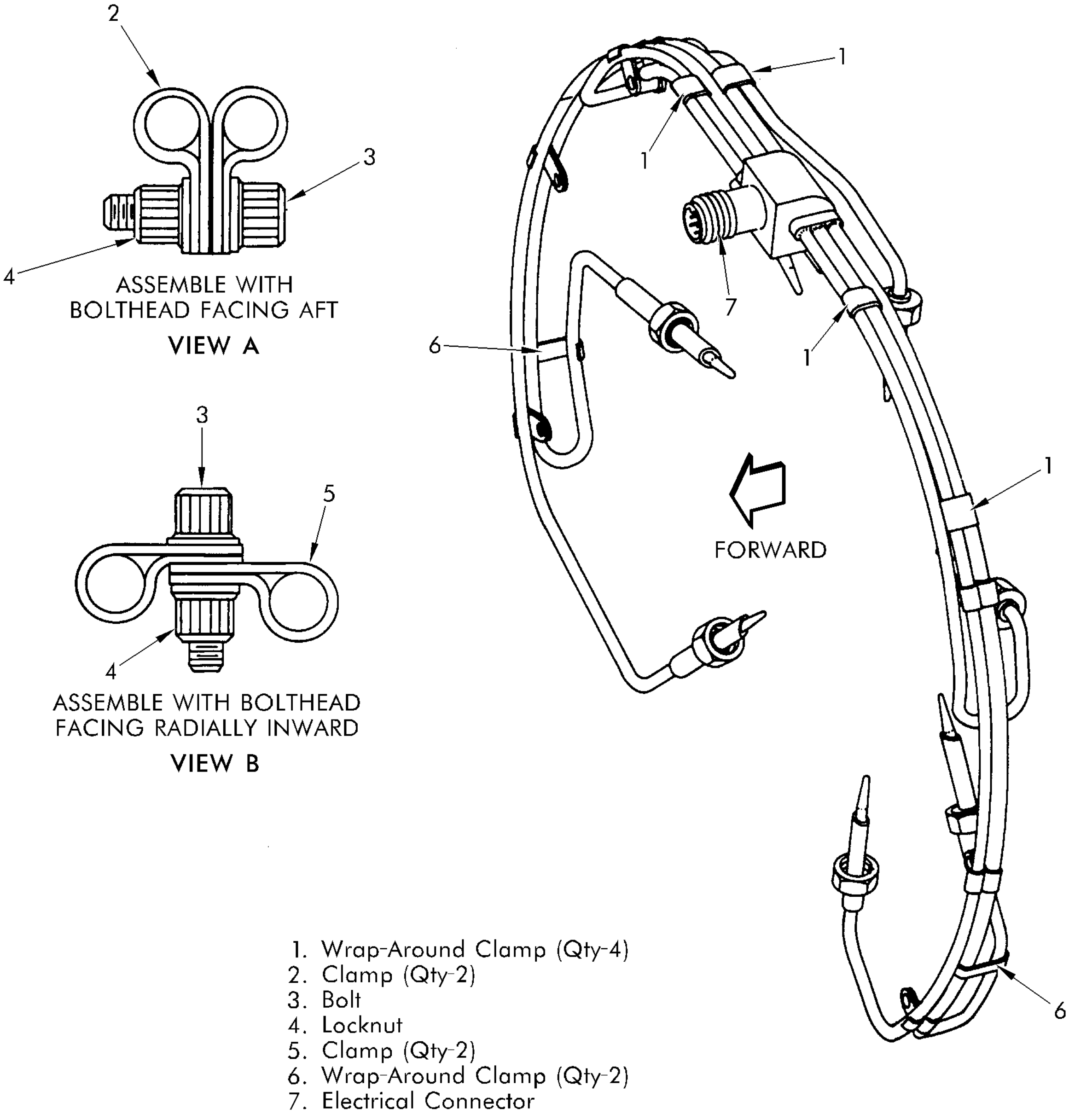
CAUTION

Do not attempt to mate electrical connector if seals are swollen. Electrical connectors could be damaged.

g. Install electrical connector (yellow cable) (11) onto connector (10). Tighten (60° wrench-arc) connector.

h. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

i. After completion of final testing, seal connectors (para H-9, Appendix H).



1. Wrap-Around Clamp (Qty-4)
2. Clamp (Qty-2)
3. Bolt
4. Locknut
5. Clamp (Qty-2)
6. Wrap-Around Clamp (Qty-2)
7. Electrical Connector

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Figure 7-34. Thermocouple Assembly Wrap-Around Clamps (Former Configuration); Repair

7-69. TORQUE AND OVERSPEED SENSOR.

NOTE

Torque and overspeed sensor (3, fig. 7-35) and Np sensor (4, fig. 7-37) are identical and interchangeable sensors.

7-70. Removal of Torque and Overspeed Sensor.

a. If required, remove RTV sealant and silicone tape from electrical connector (blue cable) (7, fig. 7-35) and from electrical connector (4).

b. Disconnect connector (7) from connector (4) on torque and overspeed sensor (3). Cover connectors with clean, dry protective caps (items 26, 36, Appendix D).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

c. Remove bolt (6) from clamp (PN R355P13B only).

d. Hold sensor flange (2) and remove three bolts (1). Do not remove scavenge tube flange bolt (9).

e. Remove torque and overspeed sensor (3).

f. Remove and discard two packings (8).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

g. Spread clamp (5) open and remove it from electrical connector (4).

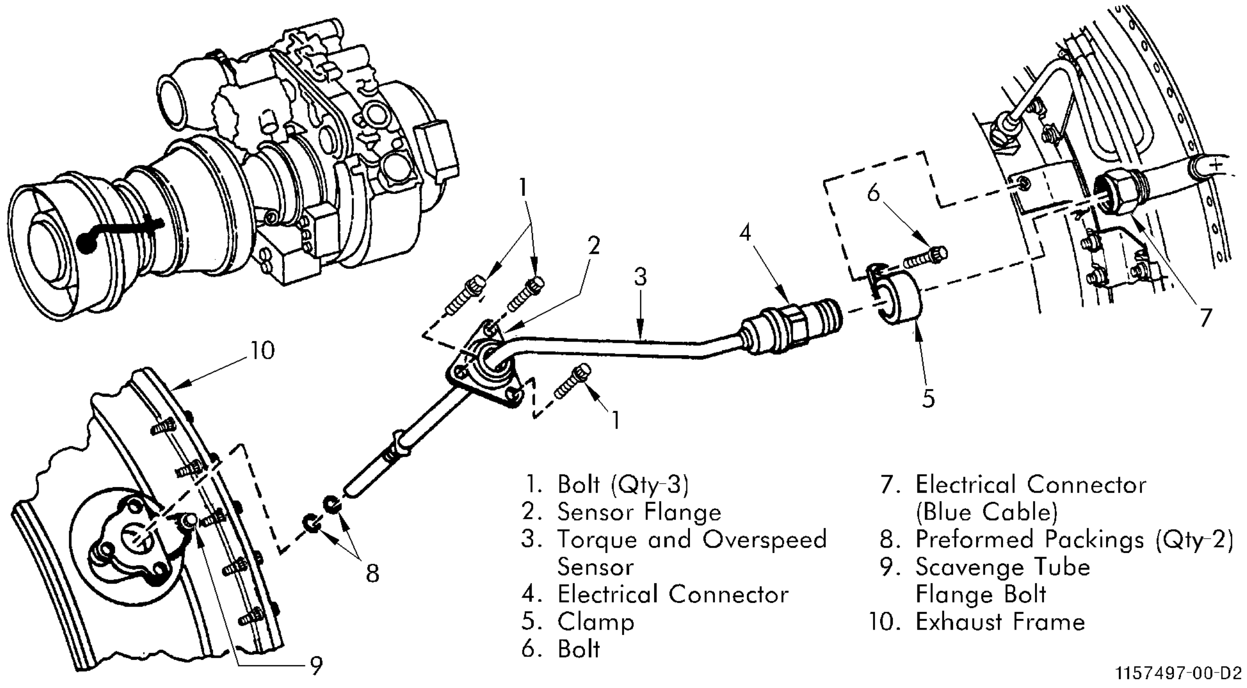


Figure 7-35. Torque and Overspeed Sensor; Removal and Installation

7-71. Cleaning of Torque and Overspeed Sensor.

a. Check electrical connector for moisture or contamination.

b. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap (item 26, Appendix D).

c. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

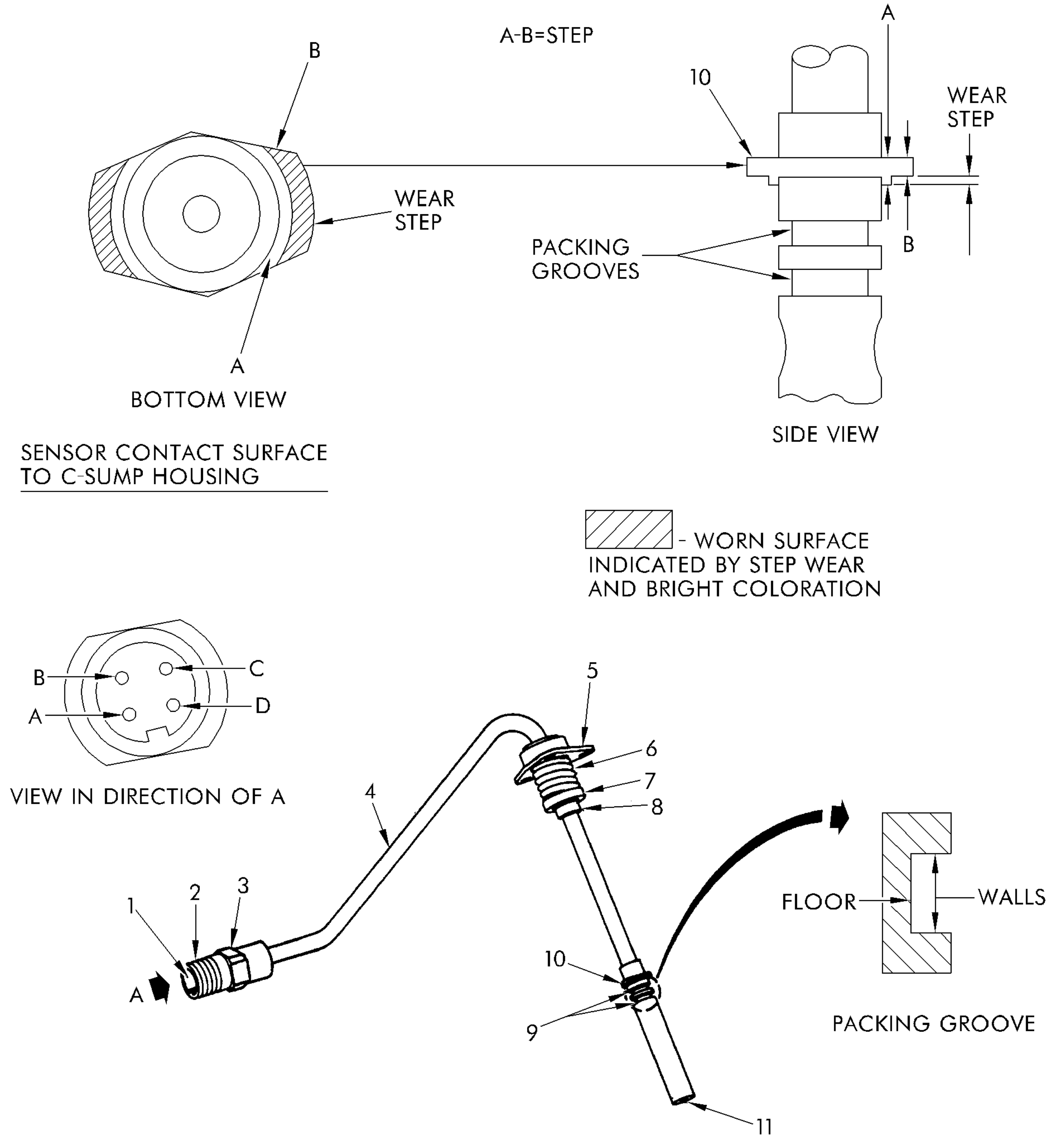
- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the sensor using dry, filtered compressed air.

7-72. Inspection of Torque and Overspeed Sensor and Np Sensor. See table 7-12.

Table 7-12. Inspection of Torque and Overspeed Sensor and Np Sensor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Rigid tubing (4, fig. 7-36) for:			
(1) Nicks, scratches, and abrasions.	Any number, 1/64 inch deep.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
(2) Dents.	Any number, 1/32 inch deep.	Not repairable.	Replace sensor (para 7-74).
(3) Cracks.	None allowed.	Not repairable.	Replace sensor (para 7-74).
b. Packing grooves (9) for nicks and scratches on:			
(1) Floor of groove.	Any number, 0.003 inch deep, without sharp edges.	Not repairable.	Replace sensor (para 7-74).
(2) Walls of groove.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace sensor (para 7-74).
(3) Shoulder wear.	G04/G05/G07: less than 0.010 inch.	Not repairable.	Replace sensor.
(4) Tip wear.	None allowed.	Not repairable.	Replace sensor.
c. Electrical connector (3) for:			
(1) Bent pins (1).	Not allowed.	Up to 1/8 inch out of position.	Straighten pin. Check alinement with mating connector.
(2) Damaged threads (2).	Up to one thread missing, without metal, if connector can be assembled normally with its mating part.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
(3) Cracked or missing ceramic insulation.	Small cracks or chips allowed, provided electrical properties of the sensor are not affected.	Not repairable.	Replace sensor (para 7-74).
d. Retainer lock (8) for nicks, dents, and scratches.	Any number, 1/32 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
e. Broken spring (6).	Not allowed.	Not repairable.	Replace sensor (para 7-74).
f. Electrical circuit.	Test and correct as specified in paragraph 7-73.		



1. Pins
2. Threads
3. Electrical Connector
4. Rigid Tubing
5. Cover
6. Spring
7. Retainer
8. Retainer Lock
9. Packing Grooves
10. Shoulder
11. Tip

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Figure 7-36. Torque and Overspeed Sensor and Np Sensor; Inspection

7-73. Testing of Torque, Overspeed, and NP Sensors. Electrical connector locations are shown in figure FO-2.

a. Disconnect electrical connector (blue cable) (7, fig. 7-35) from torque and overspeed sensor (3).

b. Use a multimeter for this test.

c. Measure resistance between pins A and C and between pins B and D. Normal resistance for both readings is 13 to 21 ohms.

d. Set selector switch on multimeter to read high resistance, and check each pin for short circuit-to- ground.

e. If readings are outside these limits, circuit is faulty. Replace torque and overspeed sensor (para 7-74).

7-74. Installation of Torque and Overspeed Sensor.

a. Install two packings (8, fig. 7-35) onto lower end of torque and overspeed sensor (3).

WARNING

Asbestos

> The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

b. Slide clamp (5) over end of electrical connector (4). Squeeze clamp to make it fit around connector.

c. Carefully install sensor (3) into strut of exhaust frame (10) so that tab on shaft of sensor alines with slot in strut.

CAUTION

> Use extra care when using bolts to seat sensor flange onto exhaust frame flange. If excessive force is used to seat sensor, its flange may be bent.

d. Install three bolts (1). Cross-tighten them until sensor flange (2) is seated on exhaust frame flange. Torque bolts to 70-75 inch-pounds.

e. Connect electrical connector (blue cable) (7) to electrical connector (4) on sensor (3). Tighten (15° wrench-arc) connector.

WARNING

Asbestos

> The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

f. Install bolt (6) through hole in clamp (5). Torque bolt to 45-50 inch-pounds.

g. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

h. After completion of final testing, seal (waterproof) connector (4) and connector (7) (para H-9, Appendix H).

7-75. NP SENSOR.

7-76. Removal of Np Sensor.

a. If required, remove RTV sealant and silicone tape from electrical connector (yellow cable) (10, fig. 7-37) and from electrical connector (3).

b. Disconnect connector (10) from connector (3) on Np sensor (4). Cover connectors with clean, dry protective caps (items 26, 36, Appendix D).

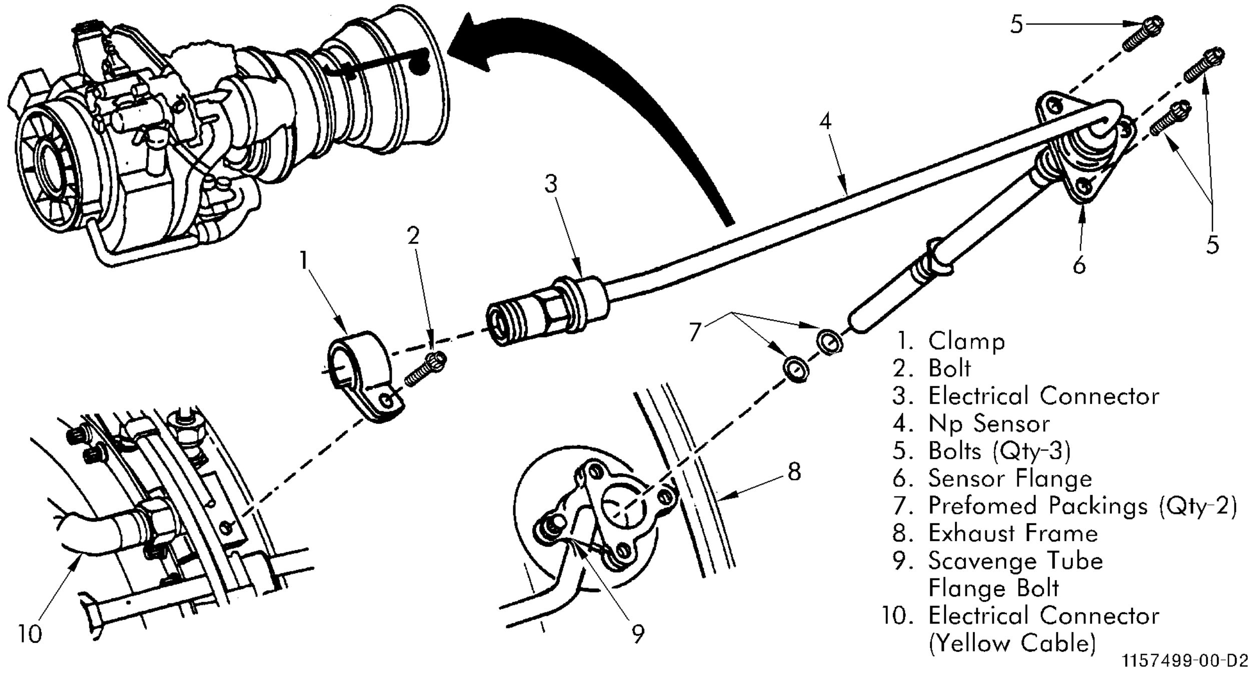


Figure 7-37. Np Sensor; Removal and Installation

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

c. Remove bolt (2) from clamp (PN R355P13B only) (1).

d. Hold sensor flange (6) and remove three bolts (5). Do not remove scavenge tube flange bolt (9).

e. Remove Np sensor (4).

f. Discard two packings (7).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

g. Spread clamp (1) open and remove it from electrical connector (3).

7-77. Cleaning of Np Sensor.

a. Check electrical connector for moisture or contamination.

b. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap (item 26, Appendix D).

c. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the Np sensor, using dry, filtered compressed air.

7-78. Inspection of Np Sensor. The Np sensor and the torque and overspeed sensor are identical parts. See table 7-12 and figure 7-36 for inspection data.

7-79. Testing of Np Sensor. Test Np sensor as directed in paragraph 7-73.

7-80. Installation of Np Sensor.

a. Install two preformed packings (7, fig. 7-37) onto lower end of Np sensor (4).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

b. Slide clamp (1) over end of electrical connector (3). Squeeze clamp to make it fit around connector.

c. Carefully install Np sensor (4) into strut of exhaust frame (8) so that tab on shaft of sensor alines with slot in strut.

CAUTION

Use extra care when using bolts to seat sensor flange onto exhaust frame flange. If excessive force is used to seat sensor, its flange may be bent.

d. Install three bolts (5). Cross-tighten them until sensor flange (6) is seated on exhaust frame flange. Torque bolts to 70-75 inch-pounds.

e. Connect electrical connector (yellow cable) (10) to electrical connector (3) on Np sensor (4). Tighten (15° wrench-arc) connector.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

f. Install bolt (2) through hole in clamp (1). Torque bolt to 45-50 inch-pounds.

g. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

h. After completion of final testing, seal (waterproof) connector (10) and connector (3) (para H-9, Appendix H).

CHAPTER 8

OIL SYSTEM

8-1. CHAPTER OVERVIEW.

This chapter contains instructions for servicing, removing, cleaning, inspecting, repairing, testing, and installing components of the oil system to the extent allowed by the Maintenance Allocation Chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C and T700-GE-701D is identified throughout the manual as follows:

NOTE

- Data common to all engine models is not identified.
- T700-GE-701C and T700-GE-701D engine model data unique to the Apache helicopter will be designated **AH-64A**.
- T700-GE-701C and T700-GE-701D engine model data unique to the Black Hawk helicopter will be designated **UH-60L**.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700 and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701 and T700-GE-701C	**(T701, T701C)**
T700-GE-700, T700-GE-701C, and T700-GE-701D	**(T700, T701C, T701D)**
T700-GE-701, T700-GE-701C, and T700-GE-701D	**(T701, T701C, T701D)**

8-2. CHAPTER INDEX.

Maintenance procedures in this chapter are arranged as follows:

8-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. When removing or installing parts, prevent entry of foreign objects into air and oil passages, and avoid damaging electrical connectors.

b. Do not use tape to cover oil passages or openings. Tape adhesive can dissolve in oil and can cause contamination. Use clean, dry, protective caps to cover electrical connectors and other openings.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

c. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

d. Inspect replacement parts for serviceability before installation.

e. Always use a backup wrench on fittings when removing or installing hoses or tubes.

f. When connecting hoses or tubes, see wrench-arc tightening method (para H-14, Appendix H).

g. Before connecting electrical connectors, refer to paragraph H-7, in Appendix H for proper procedure.

h. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

8-4. OIL COOLER.

8-5. Removal of Oil Cooler.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

WARNING

Handling Fuel System Components in Cold Weather

When removing fuel system components in cold weather, wear approved gloves to prevent frostbite.

CAUTION

Oil coolers which are removed from engine for more than 48 hours for maintenance, for storage, or for return to Depot will be preserved in accordance with paragraph 1-209, step e. This will prevent oil coolers from becoming damaged due to corrosion.

a. Loosen three captive bolts (2, fig. 8-1).

b. Remove oil cooler (1) from gearbox mounting flange (4).

c. Do not remove oil cooler seal (3) from oil cooler (1). Seal (3) is reusable if sealing material is not damaged.

d. Be sure that bolt at 9 o'clock position on fuel filter was not disturbed.

e. If oil cooler (1) will not be reinstalled within 48 hours, if it will be returned to Depot, or if it will be stored, preserve it (para 1-209, step e).

8-6. Cleaning of Oil Cooler.

a. Plug or cap all openings using clean, dry protective caps.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Flush or spray-wash external surfaces of oil cooler with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the oil cooler, using dry, filtered compressed air.

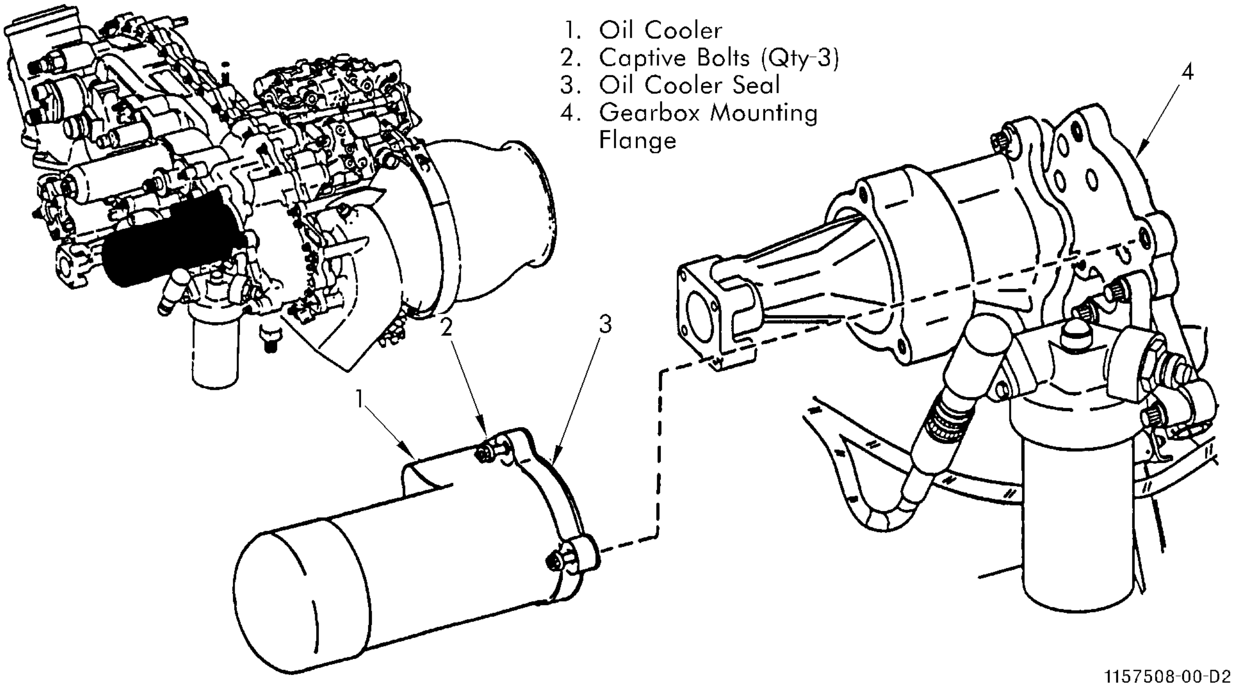


Figure 8-1. Oil Cooler; Removal and Installation

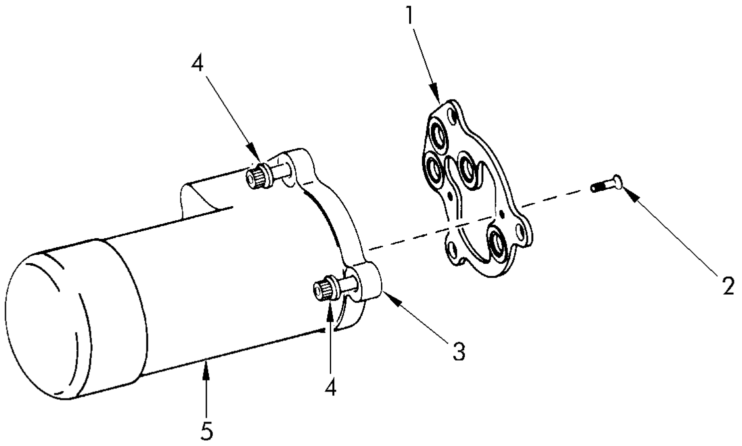
8-7. Inspection of Oil Cooler. See table 8-1.

Table 8-1. Inspection of Oil Cooler

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
WARNING Flight Safety Critical Aircraft Part (Critical Characteristic(s)) Leaks in fuel system components are critical characteristics. No fuel leaks allowed.			
a. Body (5, fig. 8-2):			
(1) Nicks, dents, and scratches.	Any number, 1/64 inch deep.	Not repairable.	Replace cooler (para 8-10).
(2) Cracks.	None allowed.	Not repairable.	Replace cooler (para 8-10).
b. Mounting flange (3) for:			
(1) Nicks, dents, and scratches, except in sealing area.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).

Table 8-1. Inspection of Oil Cooler (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Nicks, dents, and scratches in sealing area.	None allowed.	Not repairable.	Replace cooler (para 8-10).
c. Oil cooler seal (1) for nicks and cuts in sealing material.	None allowed.	Not repairable.	Replace seal (para 8-9).
d. Captive bolts (4) for damaged threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
e. Captive bolt flanges for damaged threads.	Any number of missing threads without crossed threads or loose material.	Any number with crossed threads or loose material.	AVUM: Replace cooler (para 8-10). AVIM: Remove loose material; mask all openings and chase threads to remove crossed threads.
f. Threaded insert for damaged threads or looseness.	Up to one damaged or missing thread without crossed threads or loose material.	Not repairable.	AVUM: Replace cooler (para 8-10). AVIM: Replace insert (para H-29, Appendix H).



1. Oil Cooler Seal
2. Flathead Screws (Qty-2)
3. Mounting Flange
4. Captive Bolts (Qty-3)
5. Body

1157509-00-D2

Figure 8-2. Oil Cooler; Inspection

8-8. Repair of Oil Cooler. Repair is limited to that specified in the Corrective Action column in table 8-1.

8-9. Replacement of Oil Cooler Seal.

a. Remove oil cooler (para 8-5).

b. Remove two flathead screws (2, fig. 8-2), and remove oil cooler seal (1).

c. Install replacement seal using two flathead screws. Tighten screws until seal makes metal-to-metal contact with oil cooler.

d. Install oil cooler (para 8-10).

8-10. Installation of Oil Cooler.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

a. Be sure that oil cooler seal (3, fig. 8-1) is properly installed on oil cooler.

b. Position oil cooler (1) on gearbox mounting flange (4).

c. Tighten three captive bolts (2). Torque bolts to 45-50 inch-pounds.

d. Be sure there is no gap between oil cooler mounting flange and seal (3), or between seal (3) and gearbox mounting flange (4).

e. Be sure that there is no exposed rubber material of the seal (3) showing beyond the mounting flange of the oil cooler (1) and gearbox mounting flange (4). If required, reposition seal (3) or replace seal (3) to ensure rubber material is not exposed.

f. Make required engine checks listed in table 1-19 or table 1-39 (AVIM).

8-11. OIL AND SCAVENGE PUMP.

8-12. Removal of Oil and Scavenge Pump.

CAUTION

- If oil and scavenge pump binds, do not use excessive force when removing or installing pump; otherwise, the pump or the accessory gearbox could be damaged.
- If pump binds, turn it, within the bore, while pulling or pushing it into position.
- Bolts may be used in jacking screw holes to help turn the pump. Do not attempt to thread bolts into jacking holes beyond unthreaded portion of bolt shanks; damage to pump will result.

a. Remove three bolts (1, fig. 8-3) and washers (2).

b. Thread two bolts (1) into jacking screw holes (3) until bolts contact flange on accessory gearbox.

c. Alternately turn bolts clockwise, one-quarter of a turn at a time, until oil and scavenge pump can be removed.

d. Discard preformed packing (5).

8-13. Cleaning of Oil and Scavenge Pump.

a. Cover housing of pump with barrier material (item 12, Appendix D) to prevent debris from entering pump.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

b. Wipe outer surface of pump forward flange using towel (112, Appendix D) soaked with dry cleaning solvent (item 99, Appendix D) to remove grease, dirt and oil.

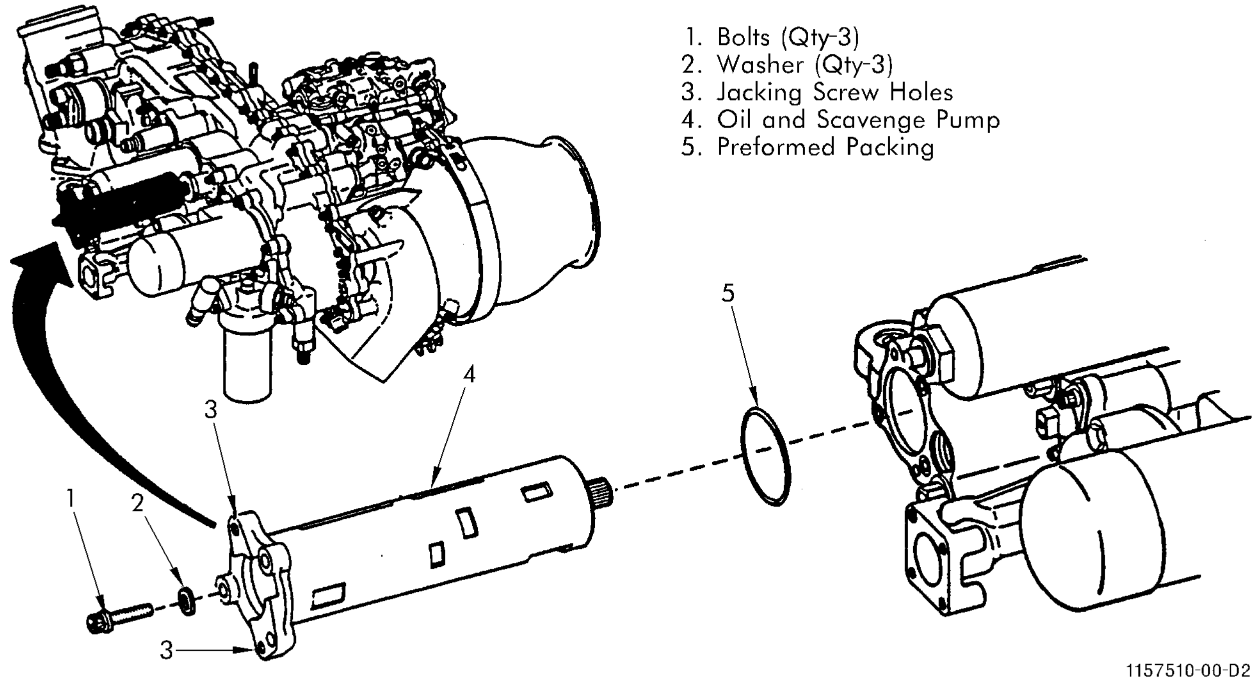


Figure 8-3. Oil and Scavenge Pump; Removal and Installation

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

c. Dry the oil and scavenge pump, using dry, filtered compressed air.

8-14. Inspection of Oil and Scavenge Pump. See table 8-2.

Table 8-2. Inspection of Oil and Scavenge Pump

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil and scavenge pump (fig. 8-4) for:			
a. Visible cracks.	None allowed.	Not repairable.	Replace pump (para 8-15).
b. Free rotation of pump elements.	Must rotate.	Not repairable.	Replace pump (para 8-15).
c. Spline (3) for wear.	0.015 step in spline.	Not repairable.	Replace pump (para 8-15).
d. Shaft (4) for shearing.	Not allowed.	Not repairable.	Replace pump (para 8-15).
e. OD of housing (2) for high metal, burrs, and pickups.	None allowed.	Any amount.	Blend high metal, burrs, and pickup to adjacent surface. Inspect bore of gearbox assembly for high metal (para 5-26).
f. Scratches on OD of housing (2).	(1) Any number, 0.005 inch deep and 0.010 inch wide, if they do not connect adjacent ports.	Not repairable.	Replace pump (para 8-15).
	(2) Any number, any depth across scavenge discharge port center web (6).	Not repairable.	Replace pump (para 8-15).
g. Mounting flange (5) for cracks.	None allowed.	Not repairable.	Replace pump (para 8-15).
h. Threads of jacking screw holes (1) for damage.	Jacking screws must thread freely.	Not repairable.	Replace pump (para 8-15).

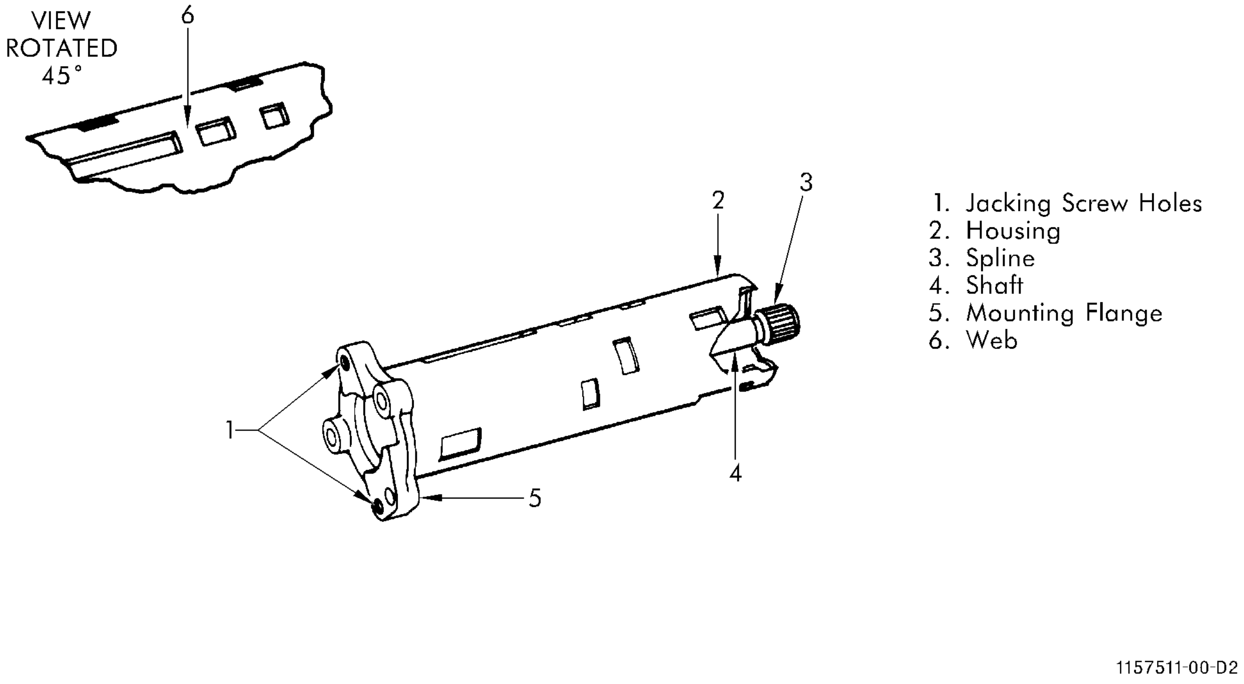


Figure 8-4. Oil and Scavenge Pump; Inspection

8-15. Installation of Oil and Scavenge Pump.

CAUTION

Preformed packing can be damaged if it is not carefully installed onto oil and scavenge pump housing.

a. Install preformed packing (5, fig. 8-3) onto oil and scavenge pump (4) by sliding it over pump housing. Inspect packing for nicks and cuts before it is seated.

CAUTION

- If oil and scavenge pump binds, do not use excessive force when removing or installing pump; otherwise, the pump or the accessory gearbox could be damaged.
- If pump binds, turn it, within the bore, while pulling or pushing it into position.
- Bolts may be used in jacking screw holes to help turn the pump. Do not attempt to thread bolts into jacking holes beyond unthreaded portion of bolt shanks; damage to pump will result.

b. Alining splined shaft of pump with splined member in gearbox, slide pump (4) into gearbox.

c. If splined shaft of pump does not engage the splined member in gearbox, remove pump. Rotate splined shaft of pump by hand, and try to engage it again. Several tries may be necessary to engage shaft.

NOTE

Length of bolts used to secure oil and scavenge pump has been changed to improve locking capability. Refer to RPSTL, **(T700)** TM 1-2840-248-23P, **(T701)** TM 1-2840-238-23P or **(T701C, T701D)** TM 1-2840-258-23P for part number of bolt.

d. Install three bolts (1) and washers (2). Torque bolts to 45-50 inch-pounds.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-16. SCAVENGE SCREENS.

8-17. (T700) Removal of Scavenge Screens.

a. Remove six scavenge screens (1, fig. 8-5).

b. Remove and discard six packings (2).

8-18. (T701) Removal of Scavenge Screens.

a. Remove B-sump scavenge screen (1, fig. 8-6) as follows:

(1) Disconnect coupling nut (8, fig. 8-39) from oil pressure sensor (1).

(2) Pull B-sump delta pressure tube (2, fig. 8-6) from forward suspension lug, located on swirl frame at the 12 o'clock position.

(3) Remove screen (1) and tube (2), as an assembly, from gearbox.

CAUTION

Packing (5) must be removed before pulling screen (1) through connector (4) of tube (2). Failure to do this may result in damage to screen.

(4) Remove and discard packing (5).

(5) Pull screen (1) through connector (4) of tube (2).

(6) Remove and discard packings (3) from screen.

NOTE

Tag each scavenge screen for proper identification at inspection.

b. Remove five remaining scavenge screens (7) at the following port locations on accessory gearbox:

- A-sump aft
- A-sump forward
- C-sump aft
- C-sump cover
- C-sump forward

c. Remove and discard five packings (6).

8-19. (T701C, T701D) Removal of Scavenge Screens.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

a. Using two wrenches, disconnect coupling nut (2, fig. 8-7) from oil pressure sensor (1).

b. Remove bolt (3) from clamp (12).

c. Loosen scavenge screen (4); then remove scavenge screen and B-sump delta pressure tube (7) as an assembly from accessory gearbox port (9).

d. Remove and dispose of packing (8).

e. While holding tube (7), remove scavenge screen (4).

f. Remove and dispose of packings (5, 6).

g. Remove five remaining scavenge screens (11) from the following accessory gearbox ports; A-sump aft, C-sump cover, C-sump aft, C-sump forward, and A-sump forward.

h. Remove and dispose of five packings (10).

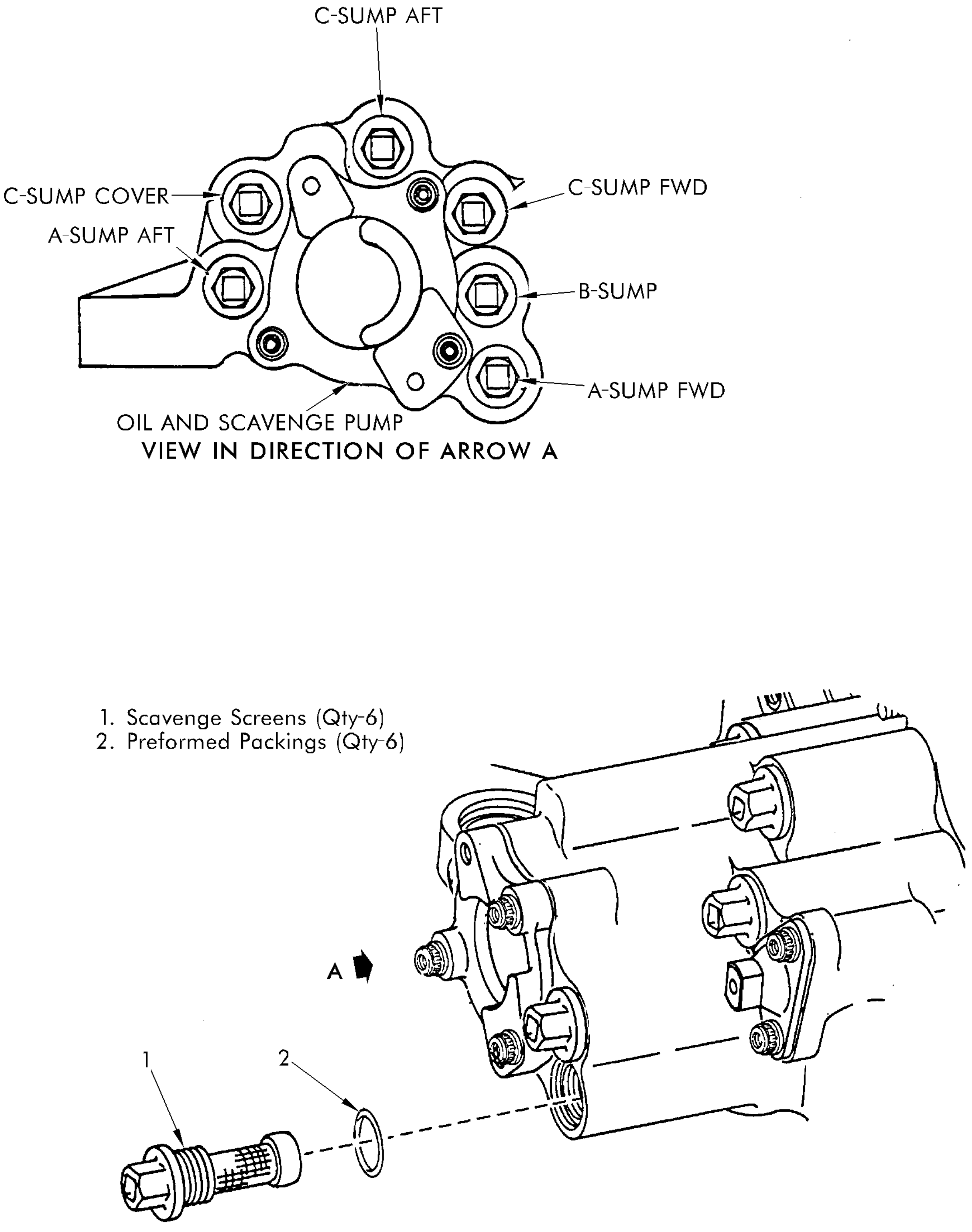
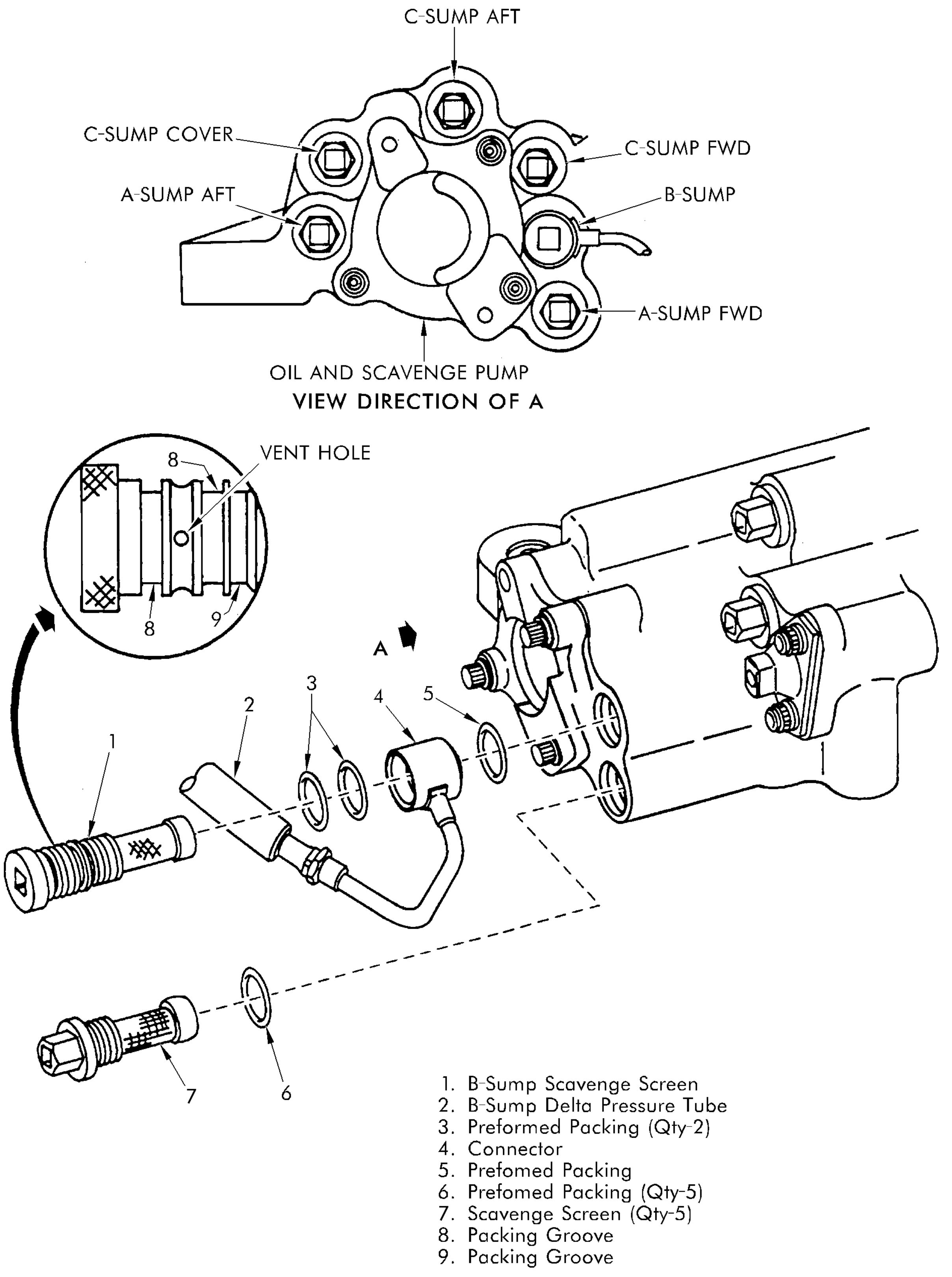


Figure 8-5.** (T700) **Scavenge Screens; Removal and Installation



1. B-Sump Scavenge Screen
2. B-Sump Delta Pressure Tube
3. Preformed Packing (Qty-2)
4. Connector
5. Prefomed Packing
6. Prefomed Packing (Qty-5)
7. Scavenge Screen (Qty-5)
8. Packing Groove
9. Packing Groove

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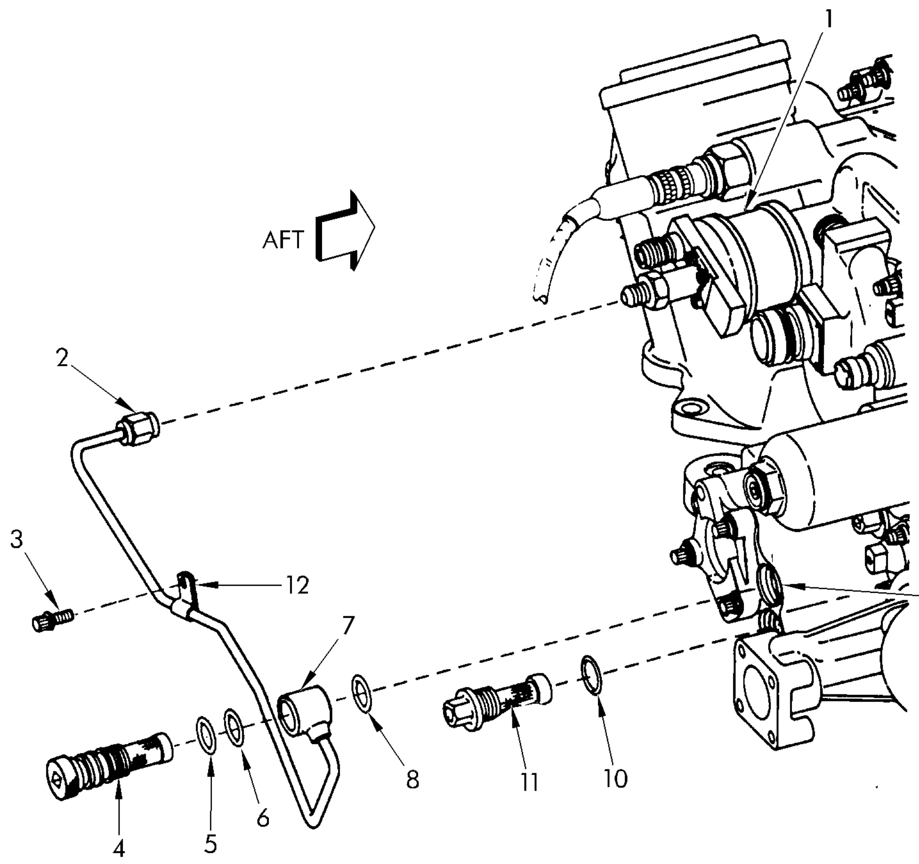
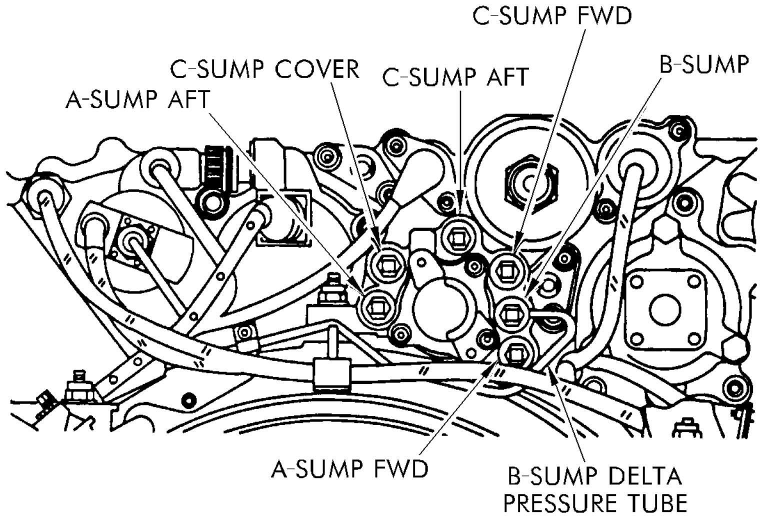
Figure 8-6. *(T701)* ***Scavenge Screens; Removal and Installation***





VIEW FORWARD LOOKING AFT

1. Oil Pressure Sensor
2. Coupling Nut
3. Bolt
4. Scavenge Screen
5. Packing
6. Packing
7. B-Sump Delta Pressure Tube
8. Packing
9. Accessory Gearbox Port
10. Packing
11. Scavenge Screen
12. Clamp

1157514-00-A2A

Figure 8-7. (T701C, T701D) Scavenge Screens; Removal and Installation

8-20. Cleaning of Scavenge Screens.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
MIL-PRF-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Flush or spray-wash scavenge screens with dry cleaning solvent (item 99, Appendix D) to remove oil and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the scavenge screens using dry, filtered compressed air.

8-21. Inspection of Scavenge Screens. See table 8-3.

Table 8-3. Inspection of Scavenge Screens

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Scavenge screens (fig. 8-8) for:			
(1) Broken screen mesh (3).	Not allowed.	Not repairable.	Replace scavenge screen (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).

NOTE

Do not straighten a distorted screen.

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) **(T701, T701C, T701D)** Bent or collapsed screen mesh (3).	Any amount if a 0.300 inch diameter drill rod (or size “N” drill) can be inserted the full length of the screen mesh (3) from DIA B, and DIM A is 1.900 minimum.	Not repairable.	Replace scavenge screen (para 8-23).
(3) Nicks and burrs on seating area (7).	Not allowed.	Any number.	Blend to adjacent contour (para H-21, Appendix H).

Table 8-3. Inspection of Scavenge Screens (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Damaged threads (2).	Not allowed.	Not repairable.	Replace scavenge screen (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).
(5) Wrench damage in each corner of hex flat (1).	Any amount if screen can be installed properly.	Not repairable.	Replace scavenge screen (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).
b. Packing grooves (6) for nicks and scratches in:			
(1) Floor.	Any number, up to 0.003 inch deep without sharp edges.	Not repairable.	Replace scavenge screen (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).
(2) Walls.	Any number, up to 0.010 inch deep, without sharp edges.	Not repairable.	Replace scavenge screen (para 8-22 **(T700)** or 8-23 **(T701, T701C, T701D)**).
c. **(T701, T701C, T701D)** Surfaces (4) for nicks, dents, and scratches.	Any number, up to 0.005 inch deep, without sharp edges.	Not repairable.	Replace scavenge screen (para 8-23).
d. Vent hole (5) for blockage.	Not allowed.	Any amount.	Using 1/16-inch diameter wire, unplug hole; then clean scavenge screen (para 8-20).
e. **(T701, T701C, T701D)** Wrench damage in corners of square drive socket (8) on B-sump scavenge screen.	Any amount, without high metal, if screen can be installed properly.	Not repairable.	Replace scavenge screen (para 8-23).

8-22. (T700) Installation of Scavenge Screens.

a. Install six preformed packings (2, fig. 8-5) onto six scavenge screens (1).

b. Thread screens into gearbox. Torque screens to 145-150 inch-pounds.

c. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-23. (T701, T701C, T701D) Installation of Scavenge Screens.

a. Install five packings (6, fig. 8-6) onto five scavenge screens (7).

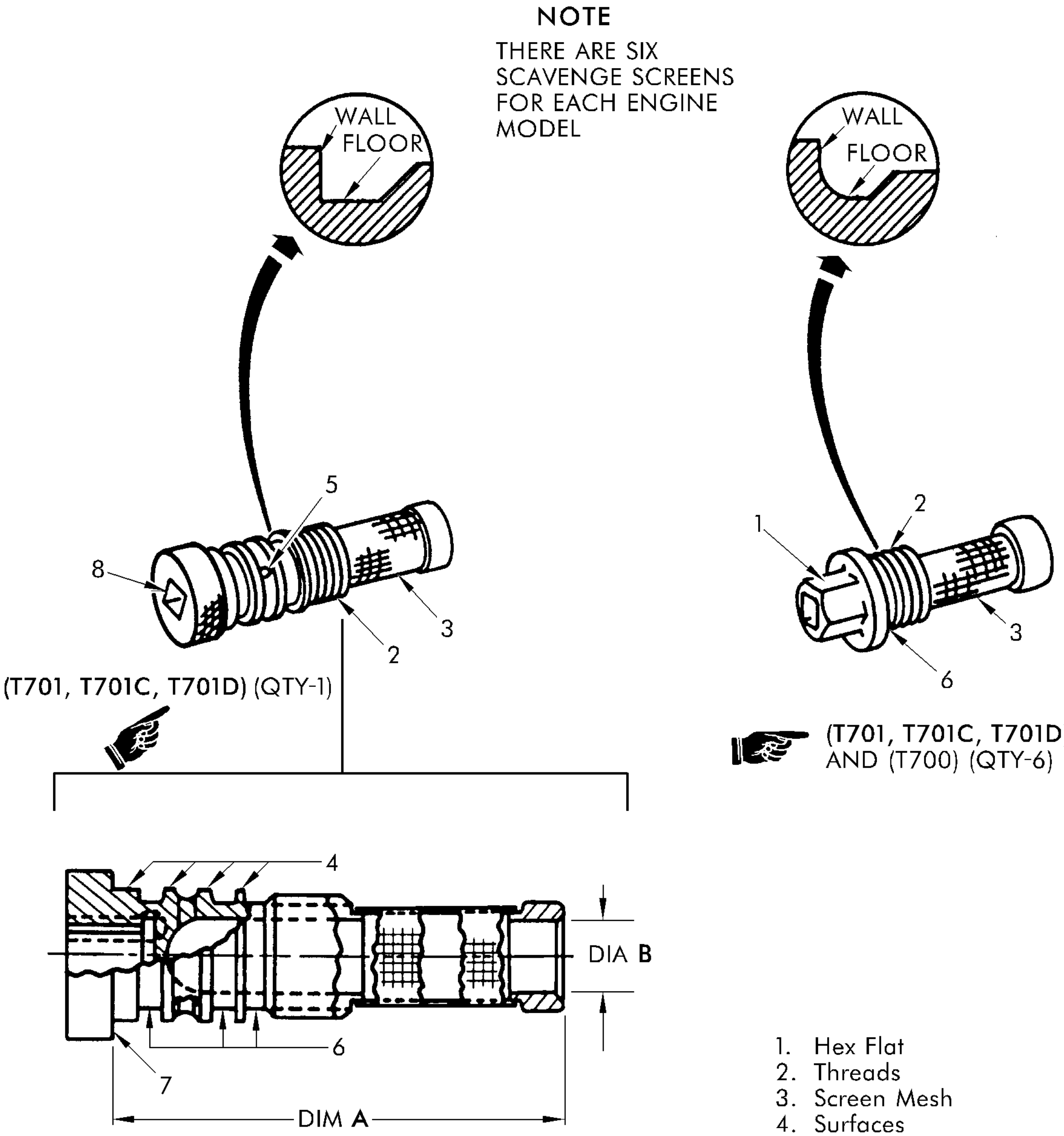
b. Thread screens (7) into accessory gearbox at the following port locations:

- A-sump aft
- A-sump forward
- C-sump aft
- C-sump cover
- C-sump forward

c. Torque screens (7) to 145-150 inch-pounds.

d. Install B-sump scavenge screen (1) as follows:

(1) Install two packings (3) into packing grooves (8) at forward end of screen (1). Be sure that packing is not installed in groove (9) that has vent hole.



NOTE
THERE ARE SIX SCAVENGE SCREENS FOR EACH ENGINE MODEL

(T701, T701C, T701D) (QTY-1)

(T701, T701C, T701D) (QTY-5) AND (T700) (QTY-6)

1. Hex Flat
2. Threads
3. Screen Mesh
4. Surfaces
5. Vent Hole
6. Packing Grooves
7. Seating Area
8. Square Drive Socket

1157516-01

Figure 8-8. Scavenge Screens; Inspection

(2) Insert screen (1) through connector (4) of B-sump delta pressure tube (2).

(3) Install packing (5) in packing groove (9).

(4) Install screen (1) and tube (2) as an assembly, into accessory gearbox. Thread screen into gearbox. Torque screen to 145-150 inch-pounds.

e. **(T701)** Push tube (2) into forward suspension lug, located on swirl frame at the 12 o'clock position.

f. **(T701)** Connect coupling nut (8, fig. 8-39) onto fitting of oil pressure sensor (1).

g. **(T701)** Tighten (60° wrench arc) coupling nut (8).

h. **(T701C, T701D)** Connect coupling nut (2, fig. 8-7) to oil pressure sensor (1).

i. **(T701C, T701D)** Install bolt (3) onto clamp (12). Hand-tighten bolt.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

j. **(T701C, T701D)** Using two wrenches, tighten (60° wrench arc) coupling nut (2).

k. Torque bolt (3) to 45-50 inch-pounds.

l. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-24. OIL FILTER BYPASS SENSOR.

8-25. Removal of Oil Filter Bypass Sensor.

a. Disconnect electrical connector (green cable) (5, fig. 8-9). Cap connectors with clean, dry protective caps (item 24, 34, Appendix D).

b. Loosen two captive bolts (3).

c. Remove oil filter bypass sensor (4).

d. Remove and discard packings (1, 2).

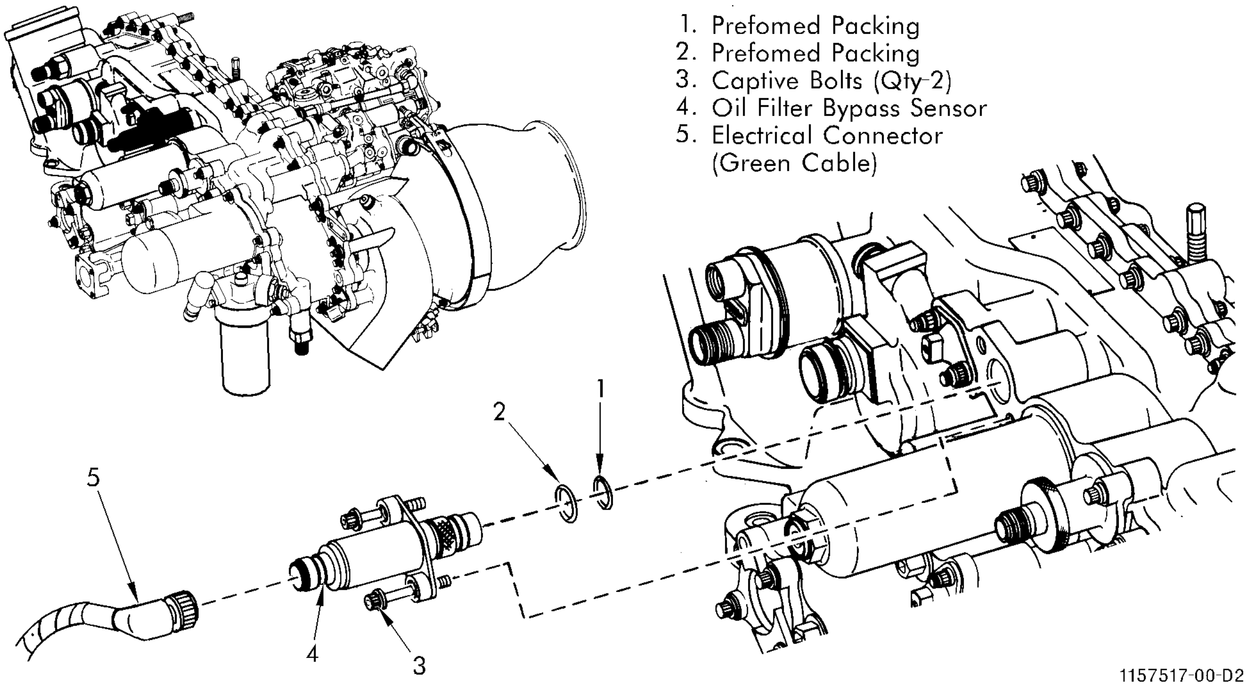


Figure 8-9. Oil Filter Bypass Sensor; Removal and Installation

8-26. Cleaning of Oil Filter Bypass Sensor.

a. Check electrical connector for moisture or contamination.

b. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap (item 24, Appendix D).

c. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

d. Flush or spray-wash external surfaces of bypass sensor with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

e. Dry the bypass sensor using dry, filtered compressed air.

8-27. Inspection of Oil Filter Bypass Sensor. See table 8-4.

Table 8-4. Inspection of Oil Filter Bypass Sensor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil filter bypass sensor (fig. 8-10) for:			
a. Cracks.	None allowed.	Not repairable.	Replace sensor (para 8-28).
b. Indication of leaks at joints.	Leaks not allowed.	Not repairable.	Replace sensor (para 8-28).
c. Electrical connector (1) for:			
(1) Looseness.	Not allowed.	Not repairable.	Replace sensor (para 8-28).
(2) Bent pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin. Check alinement with mating connector.
(3) Damaged threads.	Up to 1-1/2 total damaged or missing threads if crossthreading will not occur. No high metal.	Same as usable limits, with high metal.	AVUM: Replace sensor (para 8-28). AVIM: Blend high metal and chase threads.
d. Damaged threads on captive bolts (2).	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
e. Damaged threads on captive bolt flanges (3).	Up to one damaged or missing thread, with no crossed threads or loose material.	Same as usable limits, with crossed threads or loose material.	AVUM: Replace sensor (para 8-28). AVIM: Mask all openings and chase threads.

8-28. Installation of Oil Filter Bypass Sensor.

a. Install packings (1, 2, fig. 8-9) onto oil filter bypass sensor (4).

b. Install bypass sensor into gearbox, and tighten two captive bolts (3). Torque bolts to 45-50 inch-pounds.

c. Connect electrical connector (green cable) (5).

d. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

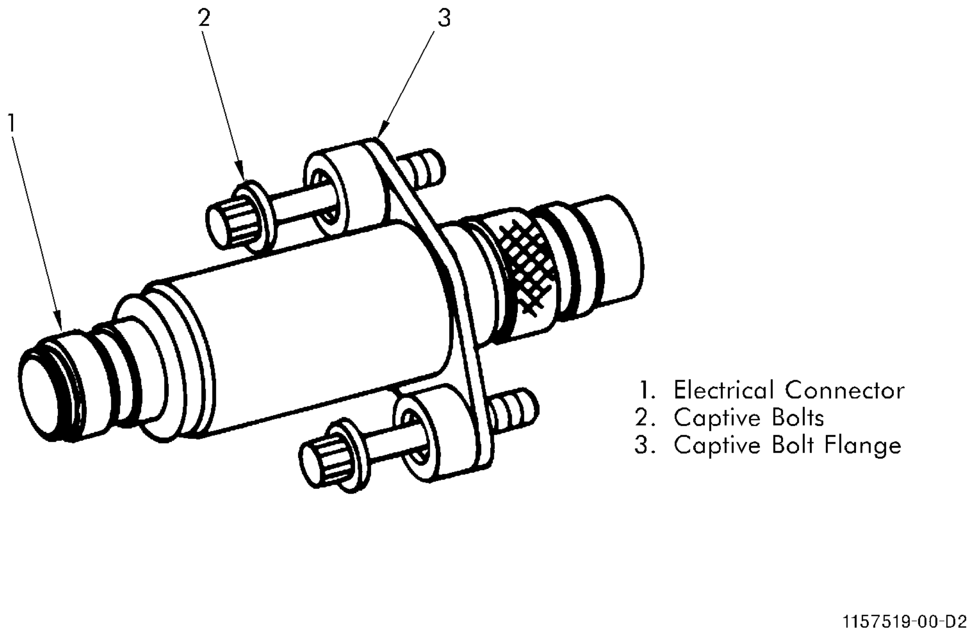


Figure 8-10. Oil Filter Bypass Sensor; Inspection

8-29. OIL FILTER BOWL AND INDICATOR ASSEMBLY.

8-30. Oil Filter Servicing when Impending Bypass Button Pops.

a. When oil filter impending bypass button pops, remove oil filter bowl and element (para 8-31).

b. Clean the bowl (para 8-32).

c. Install new packing (3, fig. 8-11) on bowl (2).

d. Install new packings (4) on each end of filter element (5).

e. Reset impending bypass button as follows:

NOTE

It may be difficult to reset the impending bypass button (1) if the filter element (5) is not firmly seated and if the filter bowl (2) is not held vertically.

(1) Seat the element firmly on bowl.

(2) Hold bowl with bypass button (1, fig. 8-11) facing up. This releases an internal latch.

(3) Depress button.

f. Install bowl and filter element on gearbox.

g. Tighten bowl, using a 15/16-inch open-end wrench, until there is metal-to-metal contact between flange of bowl and face of gearbox.

8-31. Removal of Oil Filter and Bowl.

a. Before removal, wipe outer surface of filter bowl and surrounding area with clean towel (item 112, Appendix D) to avoid contaminating oil system.

b. Unscrew bowl (2, fig. 8-11).

c. Remove and discard filter element (5) and packings (4).

d. Remove and discard packing (3).

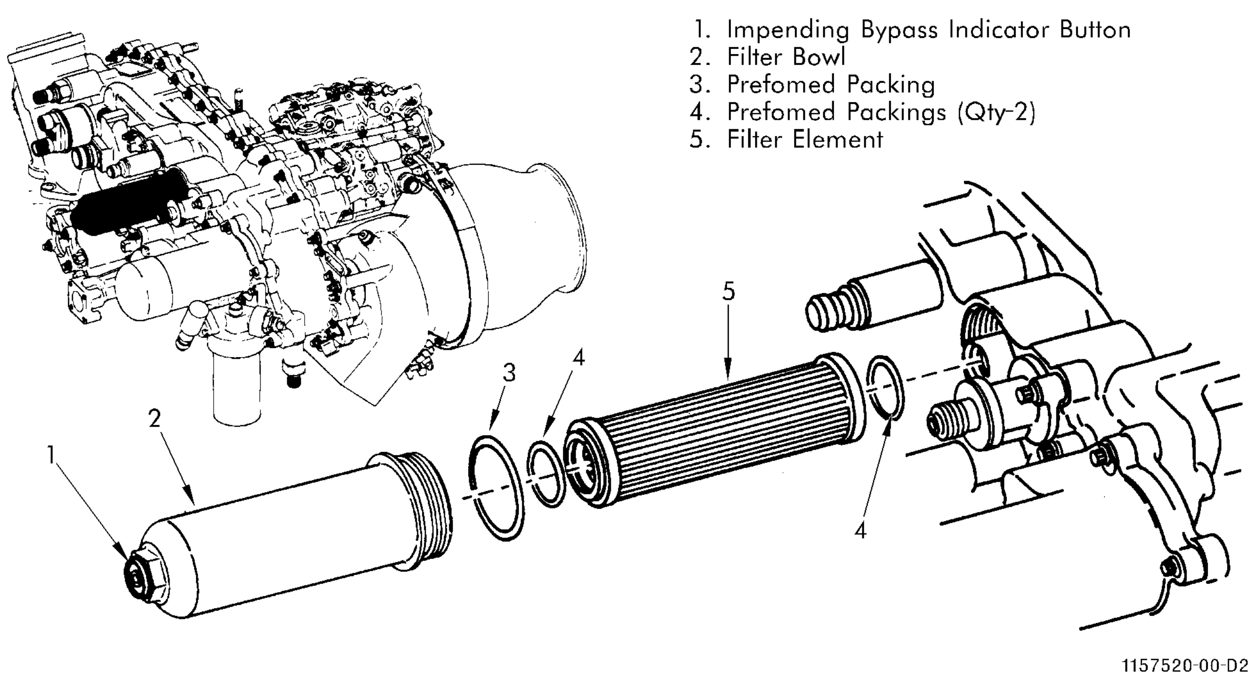


Figure 8-11. Oil Filter and Bowl; Removal and Installation

8-32. Cleaning of Oil Filter Bowl.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Clean outer surface of forward flange with towel (item 112, Appendix D) soaked with dry cleaning solvent (item 99, Appendix D) to remove, grease, dirt, and oil.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the oil filter bowl, using dry, filtered compressed air.

8-33. Inspection of Oil Filter Bowl. See table 8-5.

Table 8-5. Inspection of Oil Filter Bowl

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Oil filter bowl (fig. 8-12) for:			
(1) Visible cracks.	None allowed.	Not repairable.	Replace bowl (para 8-34).
(2) Leaks.	Not allowed.	Not repairable.	Replace bowl (para 8-34).
(3) Stripped threads.	One missing thread.	Not repairable.	Replace bowl (para 8-34).
(4) Nicks, dents, and scratches in:			
(a) Floor of packing groove.	Any number, up to 0.003 inch deep, without sharp edges.	Not repairable.	Replace bowl (para 8-34).
(b) Walls of packing groove.	Any number, up to 0.010 inch deep, without sharp edges.	Not repairable.	Replace bowl (para 8-34).
(c) All other areas.	Any number, up to 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal (para H-21, Appendix H).
(5) Damage to the hex flats on bottom of bowl.	Any amount if a wrench will hold. No burrs allowed.	Same as usable limits, with burrs.	Remove burrs.
b. Impending bypass indicator button reset operation.	Button will reset when bowl is in vertical position. Button will not reset in horizontal position.	Not repairable.	Replace bowl (para 8-34).

8-34. Installation of Oil Filter Bowl.

a. Install packing (3, fig. 8-11) on filter bowl (2).

b. Install new packings (4) onto a 3 micron filter element (5).

c. Place element into filter bowl. If impending bypass indicator button (1) is popped, reset it as follows:

NOTE

It may be difficult to reset the impending bypass button if the filter element is not firmly seated and if the filter bowl is not held vertically.

(1) Hold bowl with bypass button (1) facing up. This releases an internal latch.

(2) Depress bypass button (1).

d. Install oil filter bowl on gearbox. Tighten bowl until there is metal-to-metal contact between flange of bowl and face of gearbox.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

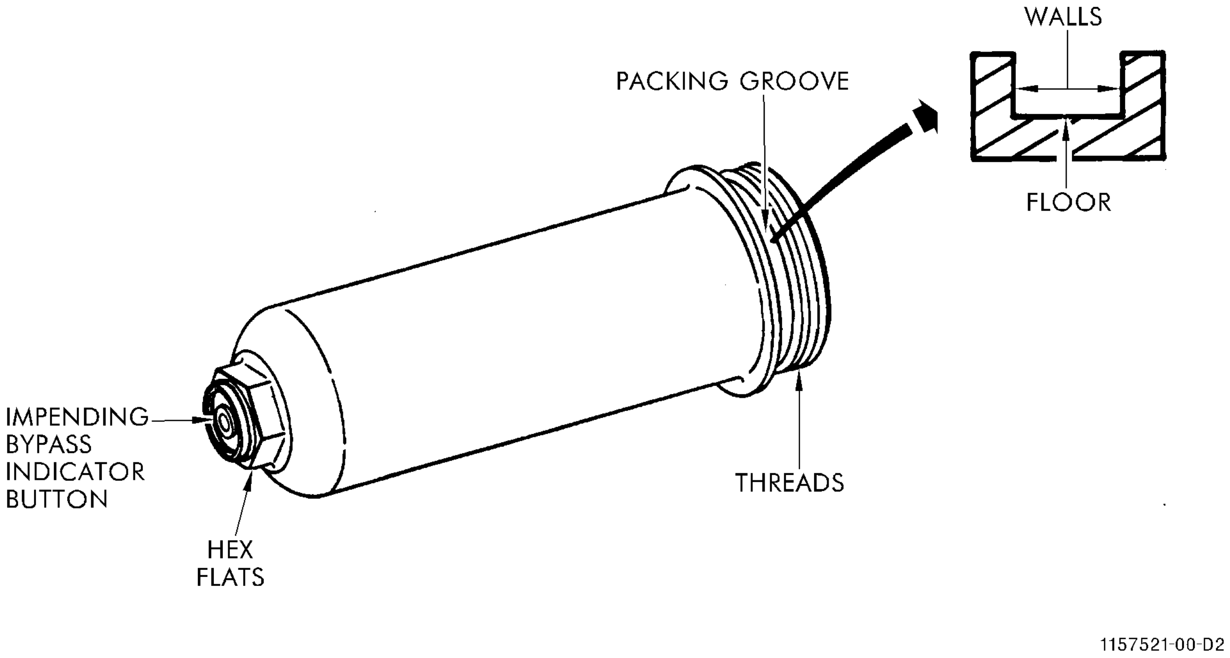


Figure 8-12. Oil Filter Bowl; Inspection

8-35. OIL FILTER ELEMENT.

8-36. Removal of Oil Filter Element. Remove oil filter element following instructions in paragraph 8-31.

8-37. Installation of Oil Filter Element.

a. Install oil filter element, following instructions in paragraph 8-34.

b. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-38. OIL COOLER BYPASS RELIEF VALVE.

8-39. Removal of Oil Cooler Bypass Relief Valve (AVIM).

a. Remove two locknuts (4, fig. 8-13) which secure oil cooler bypass relief valve (3) to gearbox.

b. Thread a no. 10-32 bolt into center of relief valve (3). Grasp bolt and pull relief valve out of gearbox.

c. Remove and discard packings (1, 2).

d. Cover all openings in gearbox to prevent dirt and foreign materials from entering.

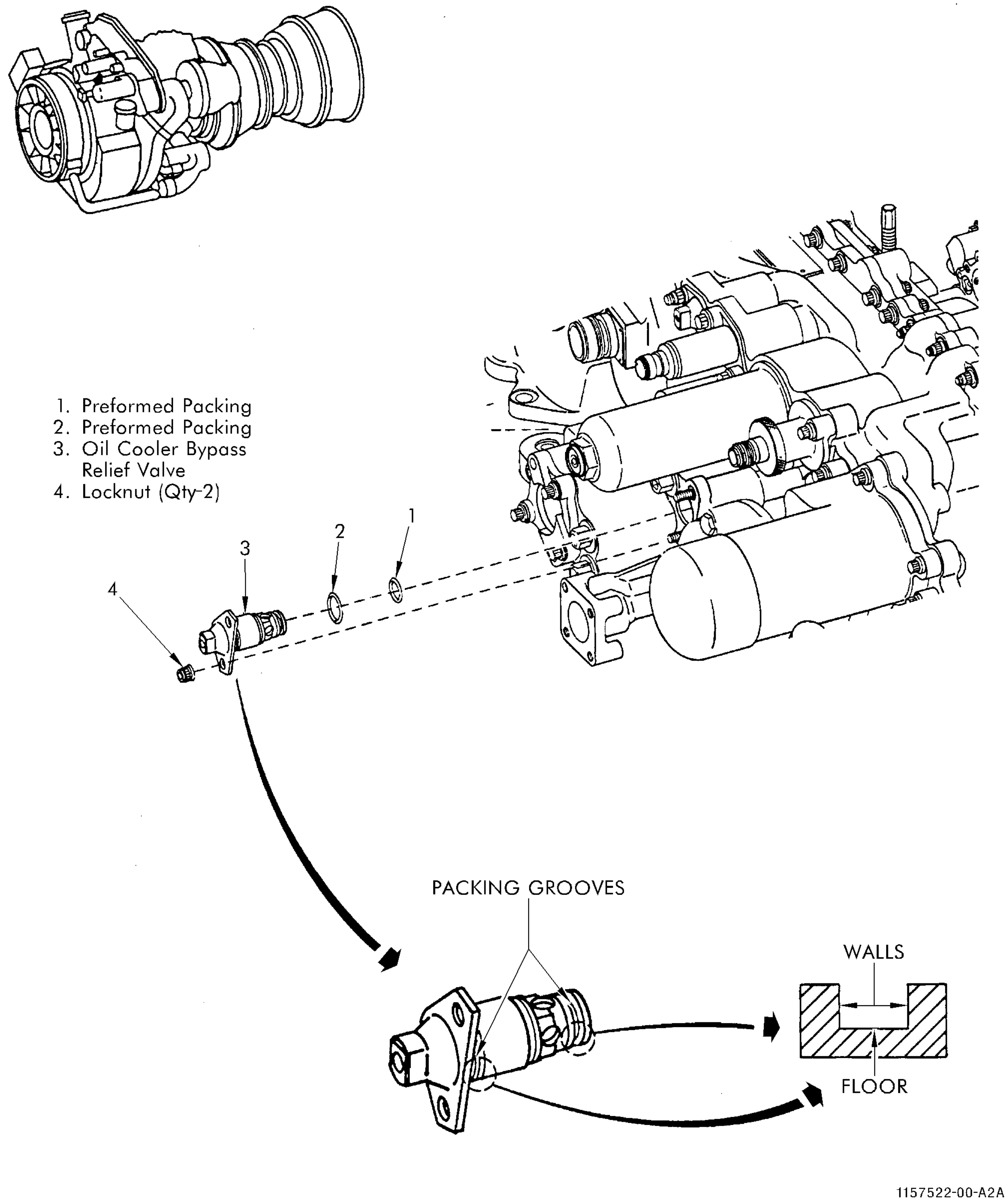


Figure 8-13. Oil Cooler Bypass Relief Valve; Removal, Inspection, and Installation

8-40. Inspection of Oil Cooler Bypass Relief Valve (AVIM).

See table 8-6.

Table 8-6. Inspection of Oil Cooler Bypass Relief Valve

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil cooler bypass relief valve (fig. 8-13) for:			
a. Cracks on external surfaces and seat.	None allowed.	Not repairable.	Replace valve (para 8-41).
b. Nicks and scratches (except in packing grooves).	Any number without high metal.	Not repairable.	Replace valve (para 8-41).
c. Nicks and scratches in:			
(1) Floor of packing groove.	Any number, 0.003 inch deep, without sharp edges.	Not repairable.	Replace valve (para 8-41).
(2) Walls of packing grooves.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace valve (para 8-41).

8-41. Installation of Oil Cooler Bypass Relief Valve (AVIM).

a. Install packings (1, 2, fig. 8-13) into packing grooves on oil cooler bypass relief valve (3).

b. Install relief valve into gearbox.

c. Using two locknuts (4), secure relief valve to gearbox. Torque locknuts to 45-50 inch-pounds.

d. Make required engine checks listed in table 1-39.

8-42. COLD OIL RELIEF VALVE.

8-43. Removal of Cold Oil Relief Valve (AVIM).

a. Remove two locknuts (4, fig. 8-14) which secure cold oil relief valve (3) to gearbox.

b. Thread a no. 10-32 bolt into center of relief valve (3). Grasp bolt and pull relief valve out of gearbox.

c. Remove and discard packings (1, 2).

d. Cover all openings in gearbox to prevent dirt and foreign materials from entering.

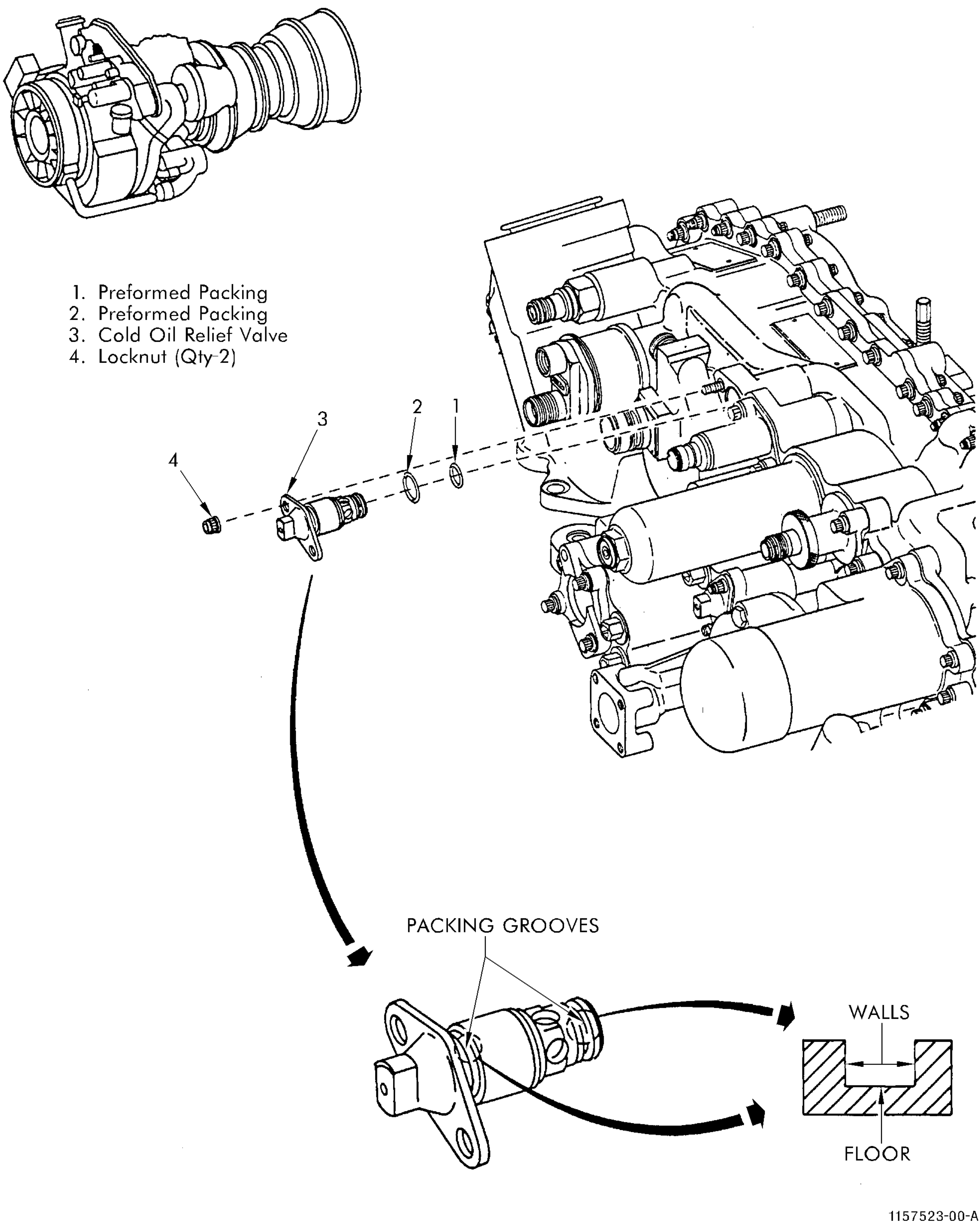


Figure 8-14. Cold Oil Relief Valve; Removal, Inspection, and Installation

8-44. Inspection of Cold Oil Relief Valve (AVIM).

See table 8-7.

Table 8-7. Inspection of Cold Oil Relief Valve

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Cold oil relief valve (fig. 8-14) for:			
a. Cracks on external surfaces and seat.	None allowed.	Not repairable.	Replace valve (para 8-45).
b. Nicks and scratches in:			
(1) Floor of packing grooves.	Any number, 0.003 inch deep, without sharp edges.	Not repairable.	Replace valve (para 8-45).
(2) Walls of packing grooves.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace valve (para 8-45.
(3) All other areas.	Any number, without high metal.	Not repairable.	Replace valve (para 8-45).

8-45. Installation of Cold Oil Relief Valve (AVIM).

a. Install packings (1, 2, fig. 8-14) into packing grooves on cold oil relief valve (3).

b. Install relief valve into gearbox.

c. Using two locknuts (4), secure relief valve to gearbox. Torque locknuts to 45-50 inch-pounds.

d. Make required engine checks listed in table 1-39.

8-46. BYPASS VALVE ASSEMBLY.

8-47. Removal of Bypass Valve Assembly (AVIM).

a. Remove oil filter (para 8-31).

b. Insert a 3/8-inch drive extension into center of bypass valve assembly (1, fig. 8-15). Attach a socket wrench to the extension, and unscrew valve from accessory gearbox.

c. Remove and discard preformed packing (2).

8-48. Cleaning of Bypass Valve Assembly (AVIM).

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Rinse bypass valve assembly in dry cleaning solvent (item 99, Appendix D).

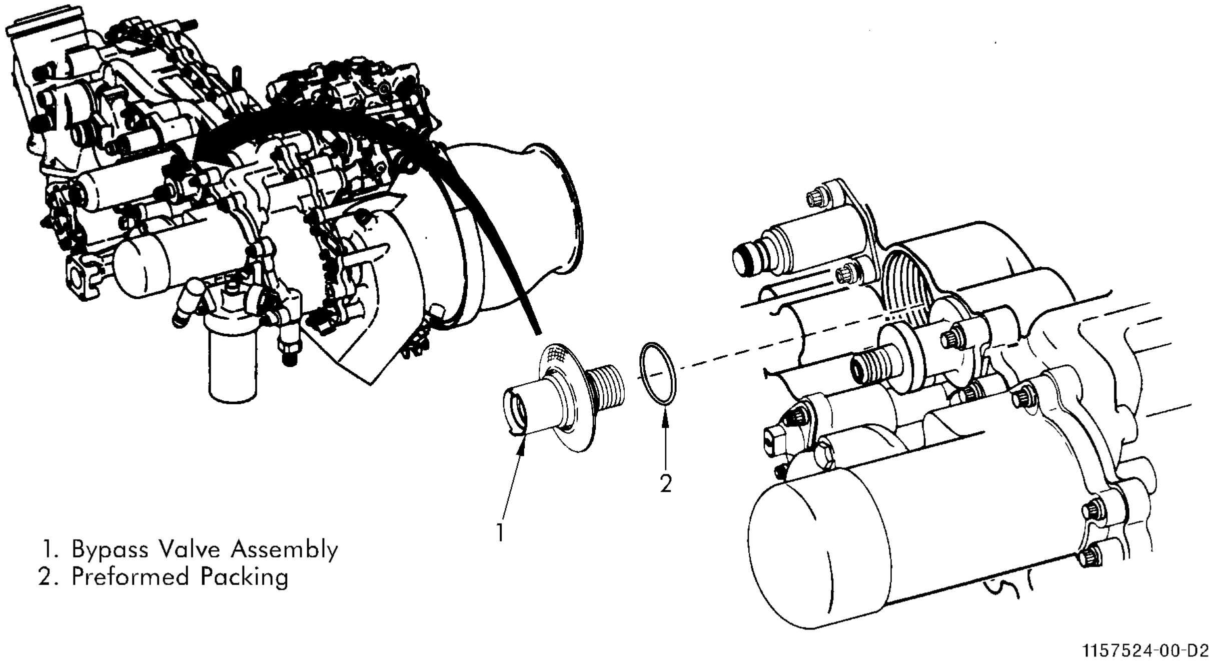


Figure 8-15. Bypass Valve Assembly; Removal and Installation

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the bypass valve assembly using dry, filtered compressed air.

8-49. Inspection of Bypass Valve Assembly (AVIM). See table 8-8.

Table 8-8. Inspection of Bypass Valve Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Bypass valve assembly (fig. 8-16) for:			
a. Metallic and nonmetallic particles.	Not allowed.	Any amount.	Remove particles using a soft-fiber brush.
b. Damaged screen.	Not allowed.	Not repairable.	Replace valve assembly (para 8-50).
c. Clogged screen.	Not allowed.	Not repairable.	Replace valve assembly (para 8-50).
d. Nicks and scratches on sealing surface.	Any number, up to 0.003 inch deep.	Not repairable.	Replace valve assembly (para 8-50).
e. Nicks and scratches on all other areas.	Any number, up to 0.010 inch deep, without high metal.	Any number, up to 0.010 inch deep, with high metal.	Blend high metal.

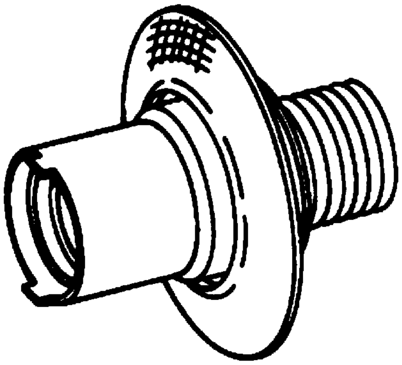


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Figure 8-16. Bypass Valve Assembly; Inspection

8-50. Installation of Bypass Valve Assembly (AVIM).

a. Attach preformed packing (2, fig. 8-15) to bypass valve assembly (1).

b. Thread valve assembly into accessory gearbox.

c. Insert a 3/8-inch drive extension into center of valve assembly.

d. Attach a torque wrench to the extension, and torque valve assembly to 145-150 inch-pounds.

e. Install oil filter (para 8-34).

f. Make required engine checks listed in table 1-39.

8-51. ELECTRICAL CHIP DETECTOR.

8-52. Removal of Electrical Chip Detector.

a. Disconnect electrical connector (green cable) (7, fig. 8-17) from electrical chip detector. Cap connectors with clean, dry, protective caps (item 24, 34, Appendix D).

b. Loosen two captive bolts (5).

CAUTION

If handle of wrench is pressed against gearbox, gearbox may be damaged.

c. Using open-end wrench, push on handle to loosen electrical chip detector (6). Remove detector (6).

d. Remove and discard preformed packing (2).

8-53. Cleaning of Electrical Chip Detector.

a. Check electrical connector for moisture or contamination.

b. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry, protective cap. (item 24, Appendix D).

c. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).

d. Hold electrical chip detector (6, fig. 8-17) by its knurled end, and unscrew screen (3).

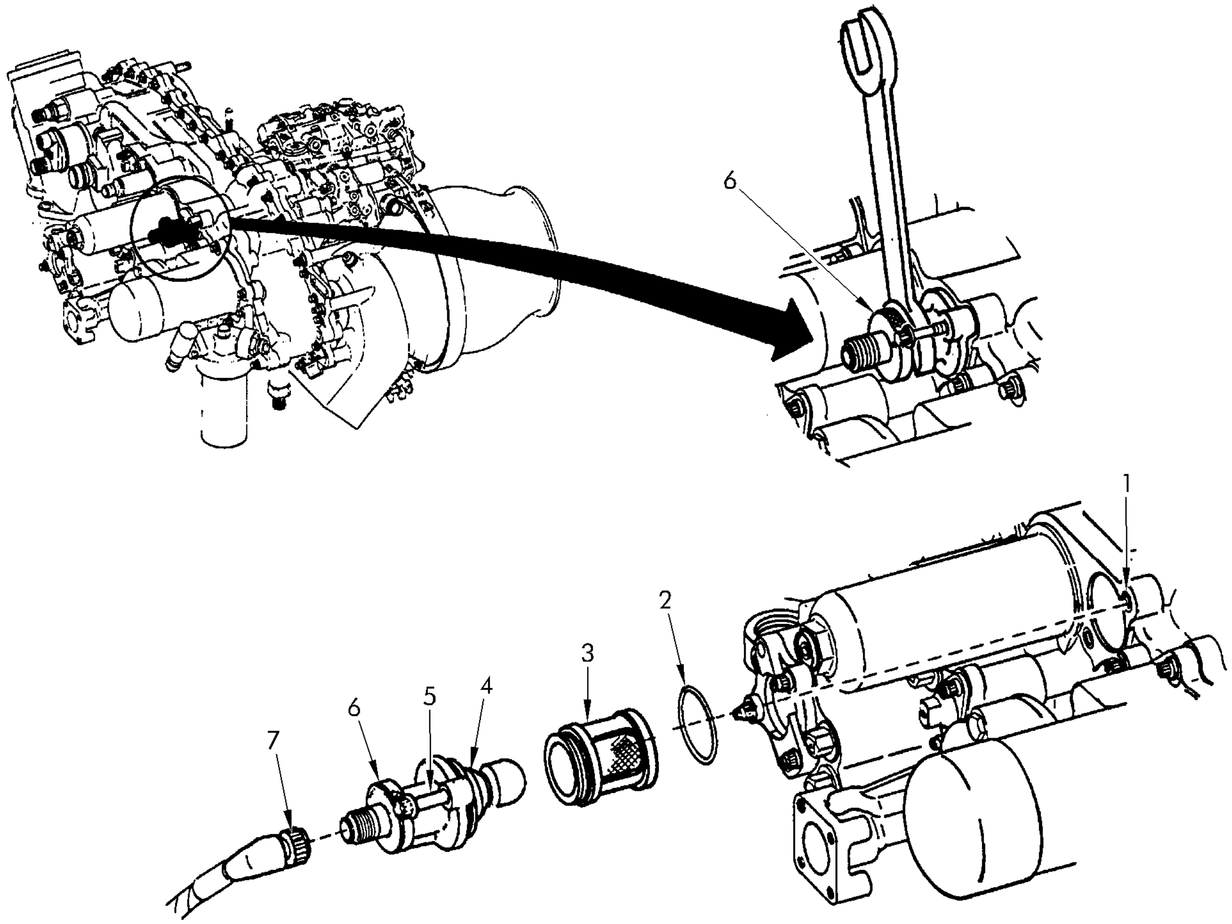
WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

e. Use clean lubricating oil (item 85 or 87, Appendix D) and a soft-fiber brush to clean the chip detector.

f. Use a towel (item 112, Appendix D) to dry the chip detector.



1. Gearbox Mounting Flange
2. Preformed Packing
3. Screen
4. Detecting Gap
5. Captive Bolt (Qty-2)
6. Electrical Chip Detector
7. Electrical Connector (Green Cable)

1157526-00-A2A

Figure 8-17. Electrical Chip Detector; Removal and Installation

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

WARNING

Trichloroethane
O-T-620

- Do not use near open flames, welding areas, or on very hot surfaces. Do not smoke when using it. Heat and flames can cause the formation of phosgene gas which is injurious to the lungs.
- Repeated or prolonged contact with liquid or inhalation of vapor can cause skin and eye irritation, dermatitis, narcotic effects, and heart damage.
- After prolonged skin contact, wash contacted area with soap and water. Remove contaminated clothing. If vapors cause irritation, go to fresh air. Get medical attention for overexposure of skin and eyes.
- When handling liquid in vapor-degreasing tank with hinged cover and air exhaust, or at air-exhausted workbench, wear approved gloves and goggles.
- When handling liquid at open, unexhausted workbench, wear approved respirator, gloves, and goggles.
- Dispose of liquid-soaked rags in approved metal container.

g. Gently clean screen (5, fig. 8-18) using a soft-bristle bottle brush (item 15, Appendix D) and dry cleaning solvent (item 99, Appendix D) or trichloroethane (item 114, Appendix D).

h. Screw screen (5) onto chip detector (2). Hand-tighten screen.

8-54. Inspection of Electrical Chip Detector. See table 8-9.

Table 8-9. Inspection of Electrical Chip Detector

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Electrical chip detector (2, fig. 8-18) for:			
a. Contamination.	Not allowed.	Any amount.	Clean chip detector (2) (para 8-53).
b. Continuity (use multimeter connected to pins 1 and 2 and short out gap (4)).	Must indicate continuity.	Not repairable.	Replace chip detector (para 8-55).
c. Captive bolts (3) for damaged threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).

Table 8-9. Inspection of Electrical Chip Detector (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. Captive bolt flanges for damaged threads.	Any number of missing threads, with no crossed threads or loose material.	Any number, with crossed threads or loose material.	AVUM: Replace chip detector (para 8-55). AVIM: Remove loose material; mask all openings and chase threads to remove crossed threads.
e. Electrical connector for:			
(1) Bent socket pins (1).	None allowed.	Up to 1/8 inch out-of-position.	Straighten pin.
(2) Kinked or sharply bent pins (1).	None allowed.	Not repairable.	Replace chip detector (para 8-55).
(3) Damaged threads.	Any amount, with no high metal, if connector can be assembled normally with its mating part.	Any amount that can be reworked to usable limits.	Remove high metal (para H-21, Appendix H).
f. Screen (5) for:			
(1) Breaks or tears.	None allowed.	Not repairable.	Replace chip detector (para 8-55).
(2) Debris.	Not allowed.	Any amount.	Clean screen (para 8-53).
(3) Screen frame for breaks or cracks.	None allowed.	Not repairable.	Replace chip detector (para 8-55).

8-55. Installation of Electrical Chip Detector.

a. Install preformed packing (2, fig. 8-17) onto chip detector.

b. Insert chip detector into gearbox mounting flange (1).

c. Tighten two captive bolts (5). Torque bolts to 45-50 inch-pounds.

d. Connect electrical connector (green cable) (7).

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

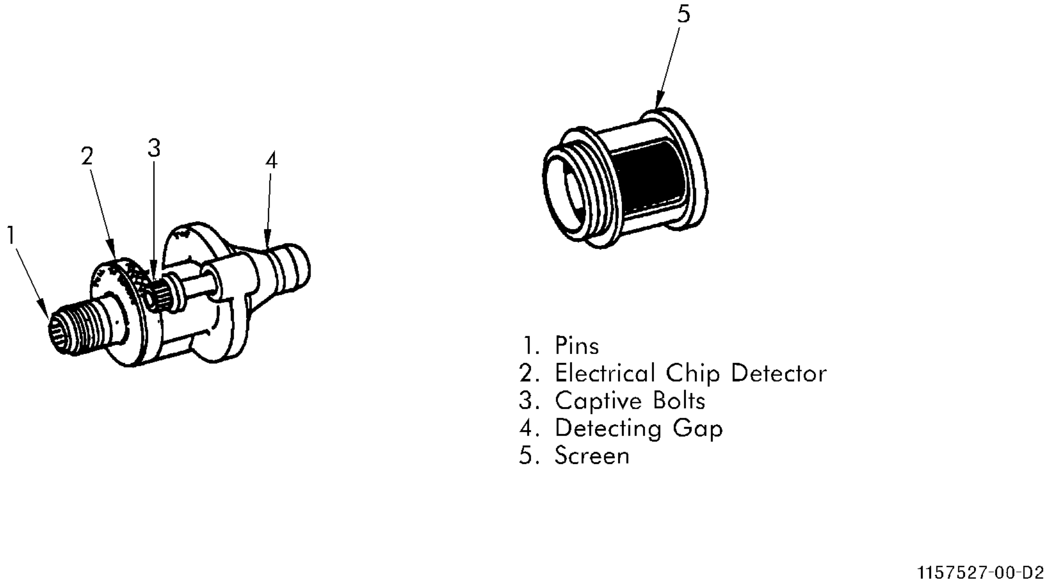


Figure 8-18. Electrical Chip Detector; Inspection

8-56. C-SUMP FORWARD SCAVENGE TUBE.

8-57. Removal of C-Sump Forward Scavenge Tube (AVIM).

a. If power turbine module is installed on engine, disconnect coupling nut on C-sump forward scavenge tube (4, fig. 8-19) from oil manifold assembly.

b. Remove torque and overspeed sensor (para 7-70).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

c. Remove two bolts (9) from tube clamp (PN 4042T56P01/P02 only) (10).

d. Remove tube clamp.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

e. Remove bolt (2) from clamp (PN 299C486P5 only) (3).

f. Remove bolt (1) from flange of C-sump forward scavenge tube (4).

g. Remove scavenge tube.

h. Remove and discard two preformed packings (5).

8-58. Cleaning of C-Sump Forward Scavenge Tube. See paragraph H-23, Appendix H.

8-59. Inspection of C-Sump Forward Scavenge Tube. See paragraph H-24, Appendix H.

8-60. Testing of C-Sump Forward Scavenge Tube (AVIM). See paragraph H-25, Appendix H.

1. Bolt
2. Bolt
3. Clamp
4. C-Sump Forward Scavenge Tube
5. Preformed Packings (Qty-2)
6. Bolt
7. C-Sump Aft Scavenge Tube
8. Preformed Packings (Qty-2)
9. Bolts (Qty-2)
10. Tube Clamp
11. Clamps (Qty-2)
12. Bolts (Qty-2)
13. Bolts (Qty-4)
14. Preformed Packings (Qty-2)
15. C-Sump Oil Supply Tube
16. B-Sump Drain Tube
17. Bolt
18. Clamp
19. Clamp
20. Compressor Leakage Air Tube
21. Locknut

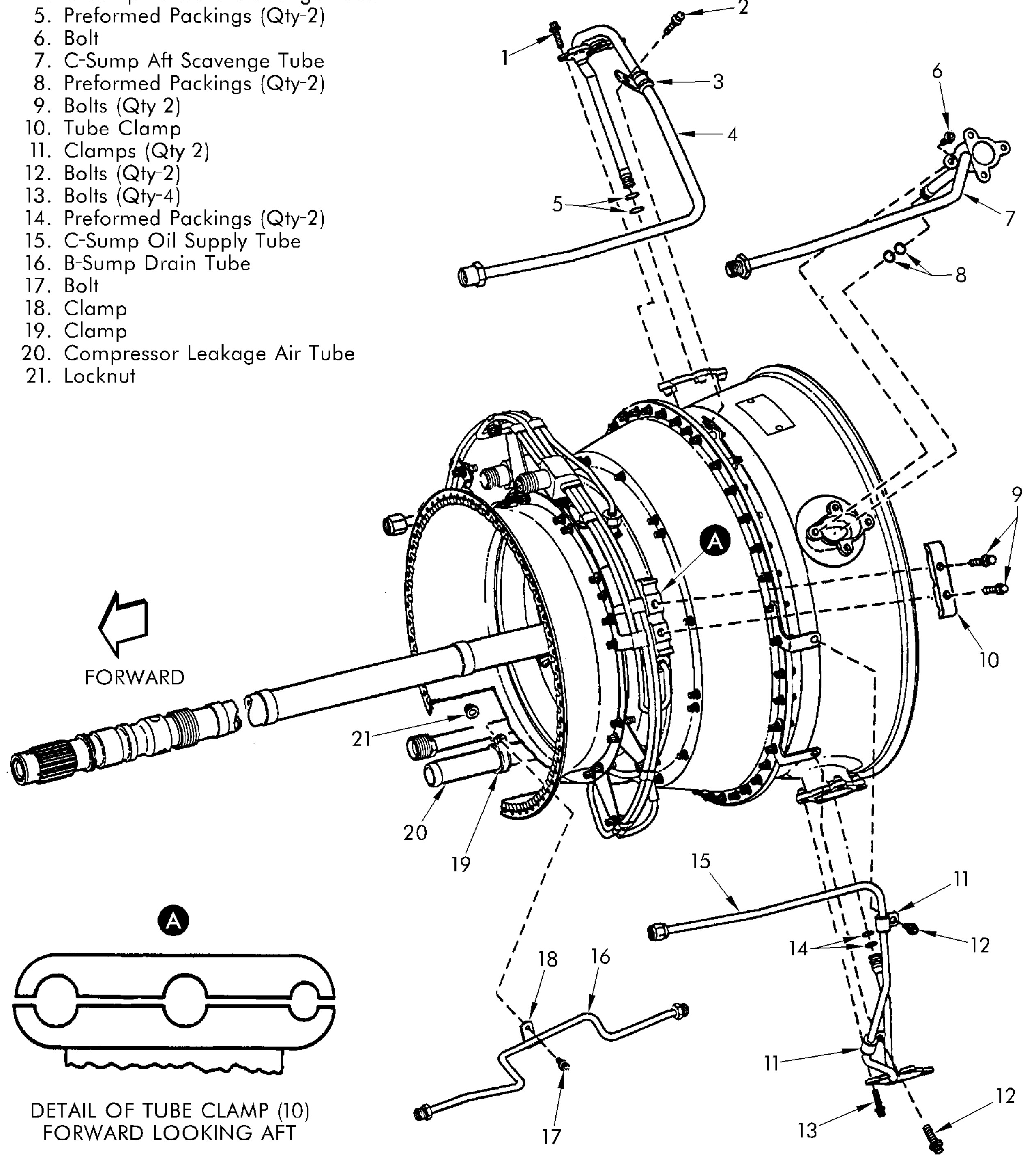


Figure 8-19. Power Turbine Module External Components; Removal and Installation

8-61. Installation of C-Sump Forward Scavenge Tube (AVIM).

a. Attach two preformed packings (5, fig. 8-19) to C-sump forward scavenge tube (4).

b. Insert aft end of scavenge tube into boss on exhaust frame as shown. Start bolt (1), but do not torque it.

c. If power turbine module is installed, connect coupling nut on scavenge tube to oil manifold assembly. Hand-tighten coupling nut.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

d. Position clamp (3) on scavenge tube, and secure it with bolt (2). Torque bolt to 45-50 inch- pounds.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

e. Position tube clamp (10) over forward end of scavenge tube and secure it with two bolts (9). Torque bolts to 45-50 inch-pounds.

f. Install torque and overspeed sensor (para 7-74).

g. Torque bolt (1) to 70-75 inch-pounds.

h. If power turbine module is installed, tighten (60° wrench arc) coupling nut on scavenge tube.

i. After installation, make required engine checks listed in table 1-39.

8-62. C-SUMP AFT SCAVENGE TUBE.

8-63. Removal of C-Sump Aft Scavenge Tube (AVIM).

a. If power turbine module is installed, disconnect coupling nut on oil manifold assembly from C-sump aft scavenge tube (7, fig. 8-19).

b. Remove Np sensor (para 7-76).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

c. Remove two bolts (9) from tube clamp (PN 4042T56P01/P02 only) (10), and remove tube clamp.

d. Remove bolt (6).

e. Remove scavenge tube.

f. Remove and discard two preformed packings (8).

8-64. Cleaning of C-Sump Aft Scavenge Tube. See paragraph H-23, Appendix H.

8-65. Inspection of C-Sump Aft Scavenge Tube. See paragraph H-24, Appendix H.

8-66. Testing of C-Sump Aft Scavenge Tube (AVIM). See paragraph H-25, Appendix H.

8-67. Installation of C-Sump Aft Scavenge Tube (AVIM).

a. Attach two preformed packings (8, fig. 8-19) to C-sump aft scavenge tube (7).

b. Insert aft end of scavenge tube into boss on exhaust frame as shown. Start bolt (6), but do not torque it.

c. If power turbine module is installed, connect scavenge tube to coupling nut on oil manifold assembly. Hand-tighten coupling nut.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

d. Position tube clamp (10) over forward end of scavenge tube and secure it with two bolts (9). Torque bolts to 45-50 inch-pounds.

e. Install Np sensor (para 7-80).

f. Torque bolt (6) to 70-75 inch-pounds.

g. If power turbine module is installed, tighten (60° wrench arc) coupling nut on oil manifold assembly.

h. After installation, make required engine checks listed in table 1-39.

8-68. C-SUMP OIL SUPPLY TUBE.

8-69. Removal of C-Sump Oil Supply Tube (AVIM).

a. If power turbine module is installed, disconnect coupling nut on C-sump oil supply tube (15, fig. 8-19) from oil manifold assembly.

b. Remove four bolts (13).

c. Remove two bolts (12) from two clamps (11).

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

d. Remove two bolts (9) and tube clamp (PN 4042T56P01/P02 only) (10).

e. Remove oil supply tube.

f. Remove and discard two preformed packings (14).

8-70. Cleaning of C-Sump Oil Supply Tube. See paragraph H-23, Appendix H.

8-71. Inspection of C-Sump Oil Supply Tube. See paragraph H-24, Appendix H.

8-72. Testing of C-Sump Oil Supply Tube (AVIM). See paragraph H-25, Appendix H.

8-73. Installation of C-Sump Oil Supply Tube (AVIM).

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

a. Attach two preformed packings (14, fig. 8-19) to C-sump oil supply tube (15).

b. Insert aft end of oil supply tube into boss on exhaust frame, as shown.

c. If power turbine module is installed, connect coupling nut on oil supply tube to oil manifold assembly. Hand-tighten coupling nut.

d. Install four bolts (13). Torque bolts to 70-75 inch-pounds.

e. Position two clamps (11) on oil supply tube, and secure them with two bolts (12). Torque bolts to 45-50 inch-pounds.

WARNING

Asbestos

The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

f. Position tube clamp (10) over forward end of supply tube, and secure it with two bolts (9). Torque bolts to 45-50 inch-pounds.

g. If power turbine module is installed, tighten (60° wrench arc) coupling nut on oil supply tube.

h. Make required engine checks listed in table 1-39.

8-74. B-SUMP DRAIN TUBE.

8-75. Removal of B-Sump Drain Tube. (T700) Use the list below to locate applicable removal procedure:

T700 Engine Serial Numbers	PT Module Installed on Engine	Procedure
207301 thru 207322	Yes	Step a
207323 and up	Yes	Step b
207301 and up	No	Step c

a. **(T700)** for engines serial-numbered 207301 thru 207322 (with power turbine module installed on engine), do the following:

CAUTION

Follow this procedure to prevent damage to B-sump drain tube.

(1) Remove locknut (21, fig. 8-19) and bolt (17) from clamps (18, 19).

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

(2) Using two wrenches, disconnect coupling nut on exhaust frame from B-sump drain tube (16).

(3) Loosen but do not disconnect coupling nut on midframe from drain tube.

(4) Separate drain tube from fitting on exhaust frame.

(5) Disconnect coupling nut on midframe from drain tube.

(6) Remove drain tube.

b. For both **T700** engines serial-numbered 207323 and up (with power turbine module installed on engine) and for **T701, T701C, T701D** engines (with power turbine module installed on engine), do the following:

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

(1) Using two wrenches, disconnect coupling nuts from both ends of B-sump drain tube (16, fig. 8-19).

(2) Remove locknut (21) and bolt (17) from clamps (18, 19).

(3) Remove drain tube.

c. For power turbine modules not installed on engines, do the following:

(1) Disconnect coupling nut on exhaust frame from B-sump drain tube (16).

(2) Remove locknut (21) and bolt (17) from clamps (18, 19).

(3) Remove drain tube.

8-76. Cleaning of B-Sump Drain Tube. See paragraph H-23, Appendix H.

8-77. Inspection of B-Sump Drain Tube. See paragraph H-24, Appendix H.

8-78. Testing of B-Sump Drain Tube. See paragraph H-25, Appendix H.

8-79. Installation of B-Sump Drain Tube.
(T700) Use the list below to locate applicable installation procedure:

T700 Engine Serial Numbers	PT Module Installed on Engine	Procedure
207301 thru 207322	Yes	Step a
207301 thru 207322	No	Step b
207323 and up	Yes	Step c
207323 and up	No	Step d

a. **(T700)** For engines serial-numbered 207301 thru 207322 (with power turbine module installed on engine), do the following:

CAUTION

Follow this procedure to prevent damage to B-sump drain tube.

(1) Position clamp (19, fig. 8-19) on compressor leakage air tube (20) so that clamp loop faces 6 o'clock position and its bolt end faces 9 o'clock position.

(2) Connect forward fitting on B-sump drain tube (16) to coupling nut on midframe. Tighten coupling nuts; then loosen coupling nut just enough to allow movement of drain tube.

(3) Connect aft fitting on drain tube to coupling nut on exhaust frame. Tighten coupling nut; then loosen coupling nut just enough to allow movement of drain tube.

(4) Insert bolt (17) through clamps (18, 19). Thread locknut (21) onto bolt. Torque locknut to 45-50 inch-pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

(5) Using two wrenches, tighten (60° wrench arc) both coupling nuts.

(6) Make required engine checks listed in table 1-19 or table 1-39 (AVIM).

b. **(T700)** For engines serial-numbered 207301 thru 207322 (without power turbine module installed), do the following:

(1) Position clamp (19, fig. 8-19) on compressor leakage air tube (20) so that clamp loop faces 6 o'clock position and its bolt end faces 9 o'clock position.

(2) Connect aft fitting on B-sump drain tube (16) to coupling nut on exhaust frame. Hand-tighten coupling nut.

(3) Insert bolt (17) through clamps (18, 19). Thread locknut (21) onto bolt. Hand-tighten locknut.

c. For **T700** engines serial-numbered 207323 and up, (with power turbine module installed on engine) and for **T701, T701C, T701D** engines, (with power turbine module installed on engine), do the following:

(1) Position clamp (19, fig. 8-19) on compressor leakage air tube (20) so that clamp loop faces 3 o'clock position and its bolt end faces 12 o'clock position.

(2) Connect forward fitting on B-sump drain tube (16) to coupling nut on midframe. Hand-tighten coupling nut.

(3) Connect aft fitting on drain tube to coupling nut on exhaust frame.

(4) Insert bolt (17) through clamps (18, 19). Thread locknut (21) onto bolt. Torque locknut to 45-50 inch-pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

(5) Using two wrenches, tighten (60° wrench arc) both coupling nuts.

(6) Make required engine checks listed in table 1-19 or table 1-39 (AVIM).

d. On **T700** engines serial-numbered 207323 and up, (without power turbine module installed) and for **T701, T701C, T701D** engines, (without power turbine module installed), do the following:

(1) Position clamp (19, fig. 8-19) on compressor leakage air tube (20) so that clamp loop faces 3 o'clock position and its bolt end faces 12 o'clock position.

(2) Connect aft fitting on B-sump drain tube (16) to coupling nut on exhaust frame. Hand-tighten coupling nut.

(3) Insert bolt (17) through clamps (18, 19). Thread locknut (21) onto bolt. Torque locknut to 45-50 inch-pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

(4) Using two wrenches, tighten (60° wrench arc) coupling nut on exhaust frame.

8-80. OIL TANK CAP AND ADAPTER.

8-81. Removal of Oil Tank Cap and Adapter.

a. Lift locking lever (1, fig. 8-20) from its seating position, and turn it counterclockwise.

b. Lift cap assembly (2) from adapter (4), and let cap hang loose near main frame (6).

c. Remove four screws (7).

d. If adapter (4) is of former configuration, remove adapter (4) from main frame (6).

e. If adapter (4) is of present configuration, remove adapter (4) from main frame (6) as follows:

(1) Be sure that locking lever (1) is turned fully counterclockwise toward the open position.

(2) Seat cap assembly (2) onto adapter (4).

(3) Turn locking lever (1) fully clockwise toward the closed position. This will lock cap assembly (2). Do not press lever (1) down.

(4) Grasp lever (1) and firmly pull upward to remove adapter (4).

f. Discard preformed packing (5).

8-82. Cleaning of Oil Tank Cap and Adapter.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

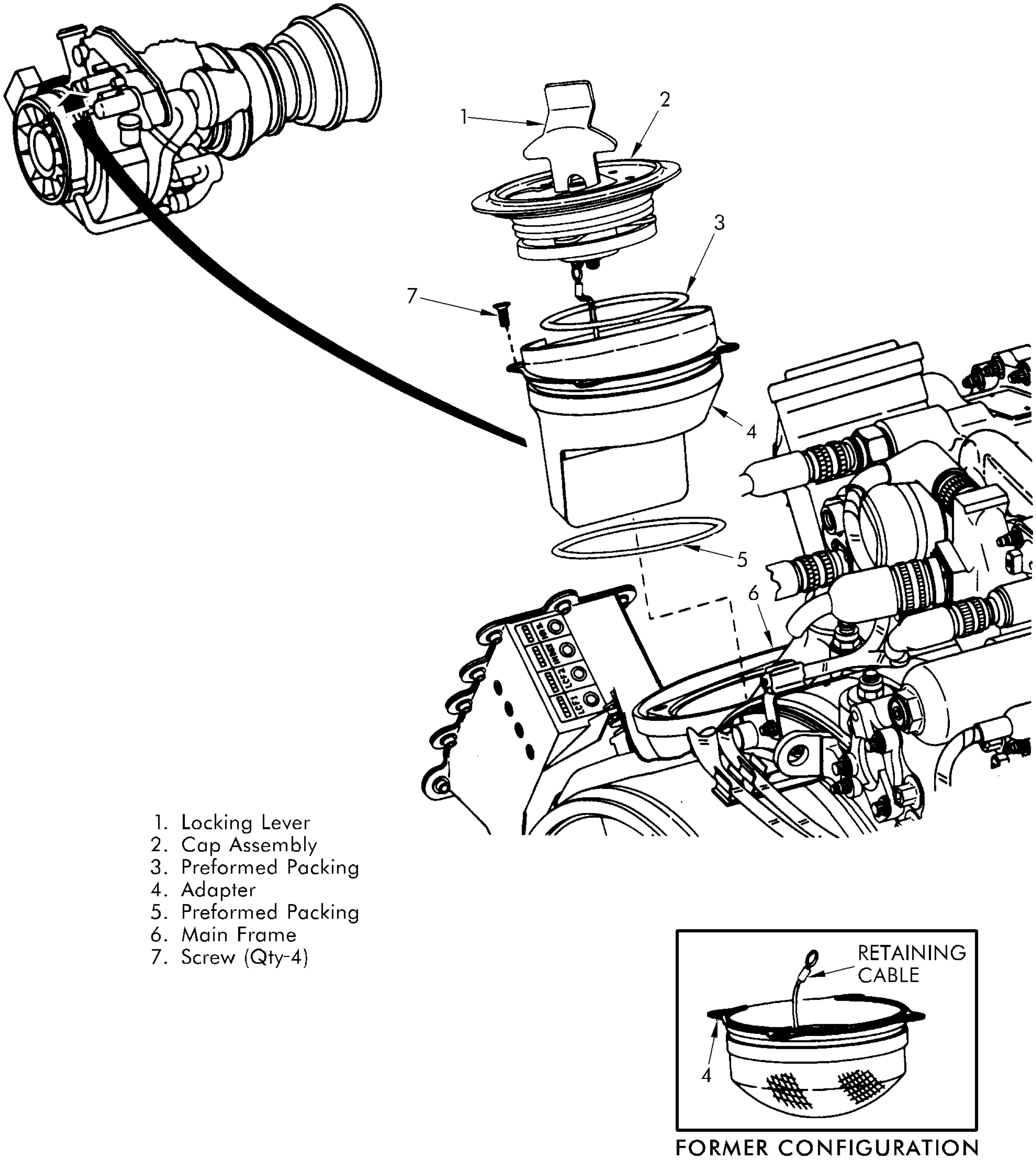
a. Flush or spray-wash oil tank cap and adapter using dry cleaning solvent (item 99, Appendix D) to remove oil and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the oil tank cap and adapter using dry, filtered compressed air.



1. Locking Lever
2. Cap Assembly
3. Preformed Packing
4. Adapter
5. Preformed Packing
6. Main Frame
7. Screw (Qty-4)

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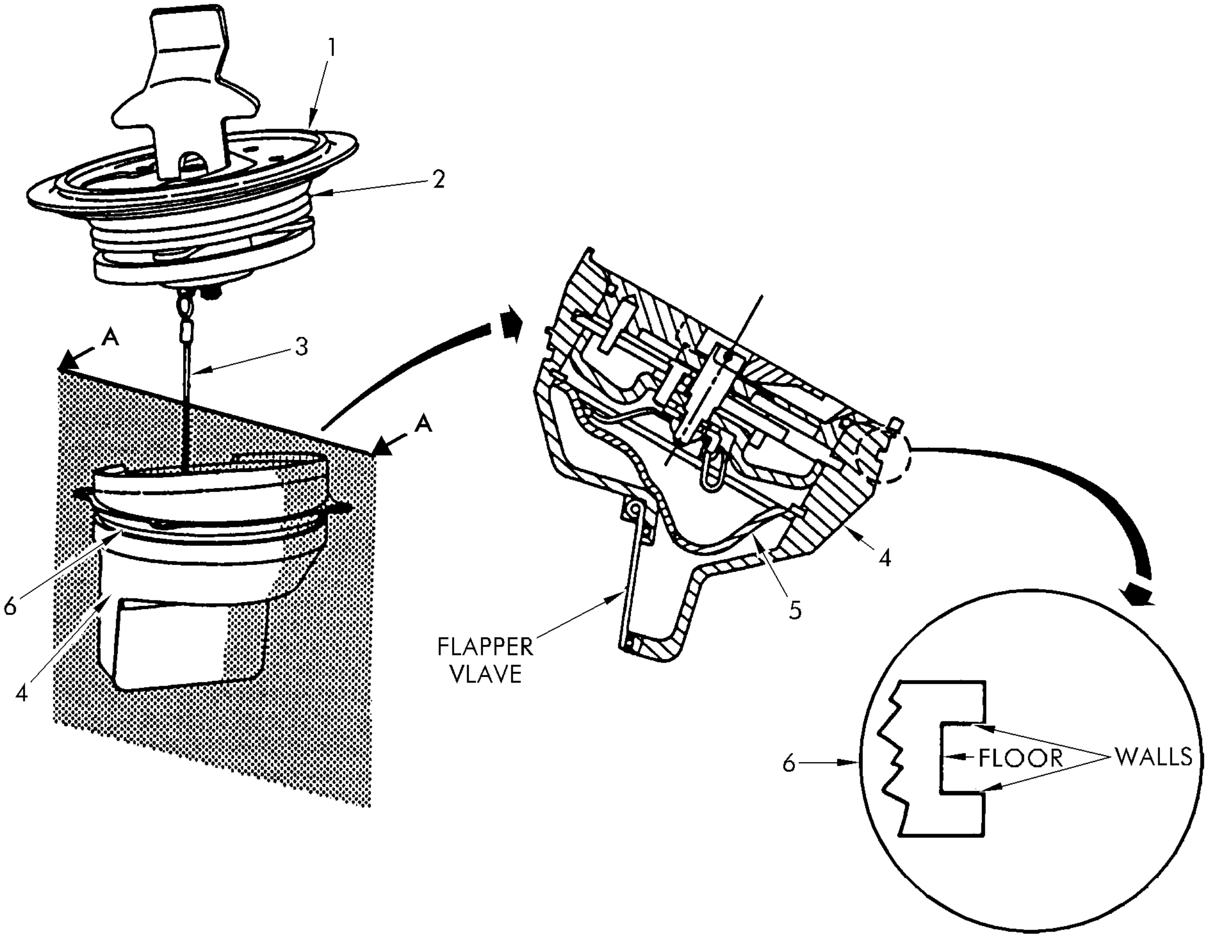
Figure 8-20. Oil Tank Cap and Adapter; Removal and Installation

8-83. Inspection of Oil Tank Cap and Adapter. See table 8-10.

Table 8-10. Inspection of Oil Tank Cap and Adapter

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
WARNING Flight Safety Critical Aircraft Part (Critical Characteristic(s)) Self-sealing feature on oil tank cap and adapter PN 6038T99P01 is a critical characteristic.			
a. Cap assembly (1, fig. 8-21) for damaged preformed packing (2).	Not allowed.	Packing not repairable.	Replace packing (para 8-84).
b. Adapter (4) for:			
(1) Broken mesh on screen (5).	Not allowed.	Not repairable.	Replace oil tank cap and adapter (para 8-85).
(2) Broken retaining cable (3).	Not allowed.	Not repairable.	Replace oil tank cap and adapter (para 8-85).
(3) Nicks and scratches in:			
(a) Floor of packing groove (6).	Any number, up to 0.003 inch deep, without sharp edges.	Not repairable.	Replace oil cap and adapter (para 8-85).
(b) Walls of packing groove (6).	Any number, up to 0.010 inch deep, without sharp edges.	Not repairable.	Replace oil cap and adapter (para 8-85).



1. Cap Assembly
2. Preformed Packing
3. Retaining Cable
4. Adapter
5. Screen
6. Packing Groove

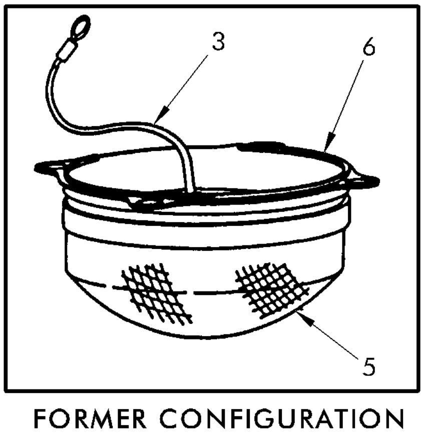


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Figure 8-21. Oil Tank Cap and Adapter; Inspection

8-84. Repair of Oil Tank Cap and Adapter.

a. Remove damaged preformed packing (8, fig. 8-22) from cap assembly (6) as follows:

(1) For cap assembly (6) with retaining cable (1) attached by cotter pin fastener (view A), remove cotter pin (3) from threaded bolt (2). Remove pin (3) from cable (1) and discard pin (3).

(2) For cap assembly (6) with retaining cable (1) attached by key ring fastener (view B), spread ends of key ring (5) until it slips off retaining cable (1).

(3) Remove and discard packing (8).

b. Inspect packing groove (7) for nicks and scratches as follows:

(1) If nicks and scratches are less than 0.003 inch deep on floor of packing groove (7), and less than 0.010 inch deep on walls of packing groove (7), but with sharp edges, remove high metal (para H-21, Appendix H).

(2) If nicks and scratches are more than 0.003 inch deep on floor of packing groove (7), or more than 0.010 inch deep on walls of packing groove (7), replace oil tank cap and adapter (para 8-85).

c. Install new packing (8) as follows:

(1) Install packing (8) into packing groove (7) of cap assembly (6).

(2) For cap assembly (6) with cotter pin fastener (view A), insert one end of cotter pin (3) into loop of retaining cable (1). Insert cotter pin (3) into hole of threaded bolt (2) and bend ends of pin (3) as shown.

(3) For cap assembly (6) with key ring fastener (view B), spread ends of key ring (5) and insert loop of retaining cable (1) into key ring (5).

8-85. Installation of Oil Tank Cap and Adapter.

a. Place preformed packing (5, fig. 8-20) on adapter (4). If preformed packing (3) on cap assembly (2) has been removed, replace packing (para 8-84).

b. Position adapter so that stiffener in screen is next to the wall of the main frame (6).

c. Secure adapter (4) to main frame (6) using four screws (7). Torque screws (7) to 18-22 inch-pounds.

d. Install oil tank cap. (See para 1-112, step d.)

e. Make required engine checks listed in table 1-19 or table 1-39 (AVIM).

8-86. OIL MANIFOLD ASSEMBLY.

8-87. Removal of Oil Manifold Assembly (AVIM).

a. Remove the following parts to provide access to oil manifold assembly:

- Particle separator blower (para 5-11)
- **(T700)** P3 hose and tube assembly (para 10-5)
- **(T701, T701C, T701D)** P3 tube (para 10-55)
- Mid C-sump scavenge tube (para 8-130)
- Oil supply tube (left-hand) (para 8-99)

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

b. If power turbine module is installed, disconnect, using two wrenches oil manifold assembly (14, fig. 8-23) from the following:

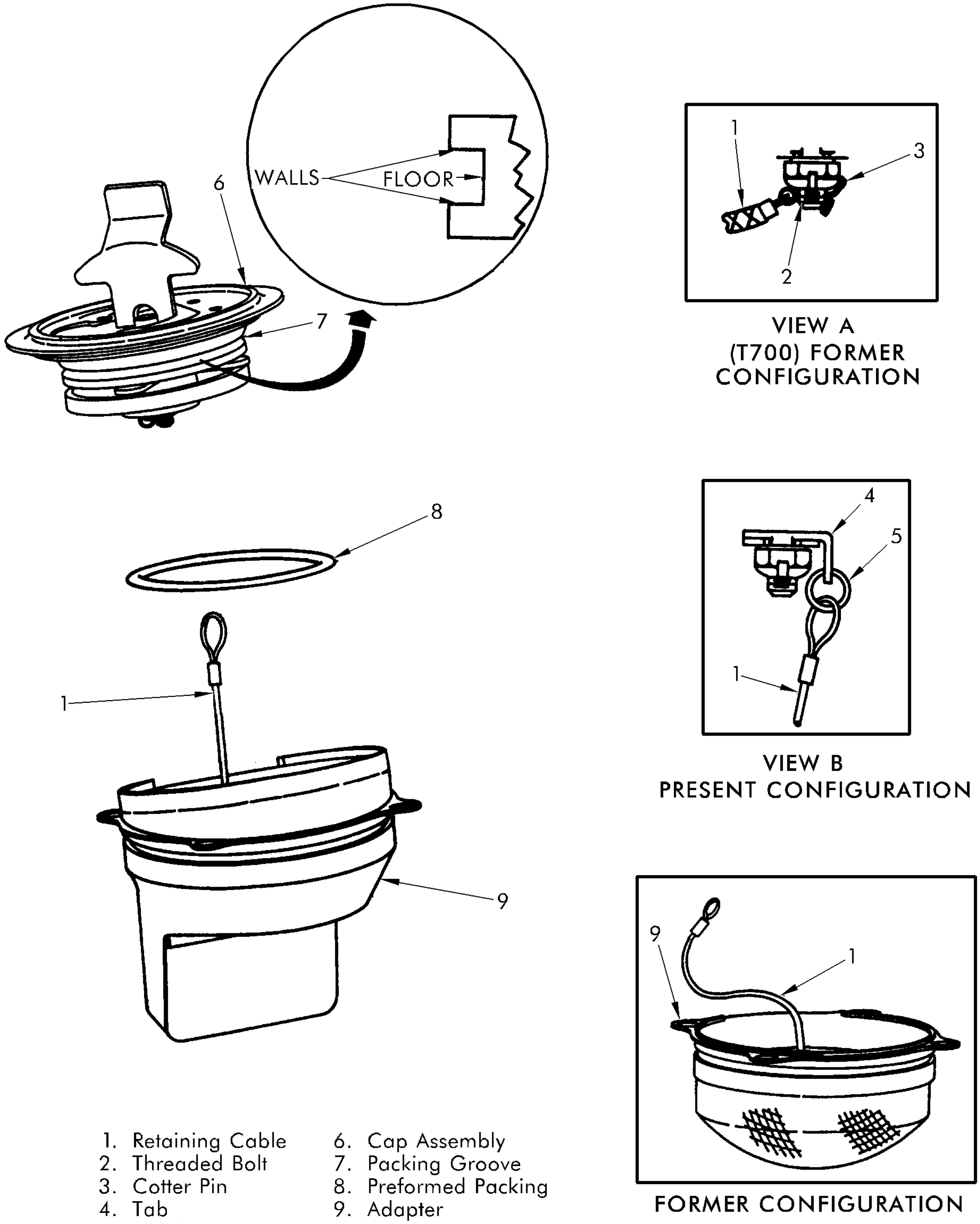
- C-sump forward scavenge tube (5)
- C-sump aft scavenge tube (6)
- C-sump oil supply tube (8)

c. Disconnect oil manifold from B-sump scavenge fitting (9) on midframe.

CAUTION

- Do not completely disconnect coupling nuts on main fuel manifold from each fuel injector without loosening the adjacent coupling nut. Otherwise, damage to coupling nuts or fuel injector threads will result.
- Be very careful not to damage adjacent tubes and hoses when backing off coupling nuts.

d. Release torque on coupling nuts (2, 4, 11) on main fuel manifold (10).



1. Retaining Cable
2. Threaded Bolt
3. Cotter Pin
4. Tab
5. Key Ring
6. Cap Assembly
7. Packing Groove
8. Preformed Packing
9. Adapter

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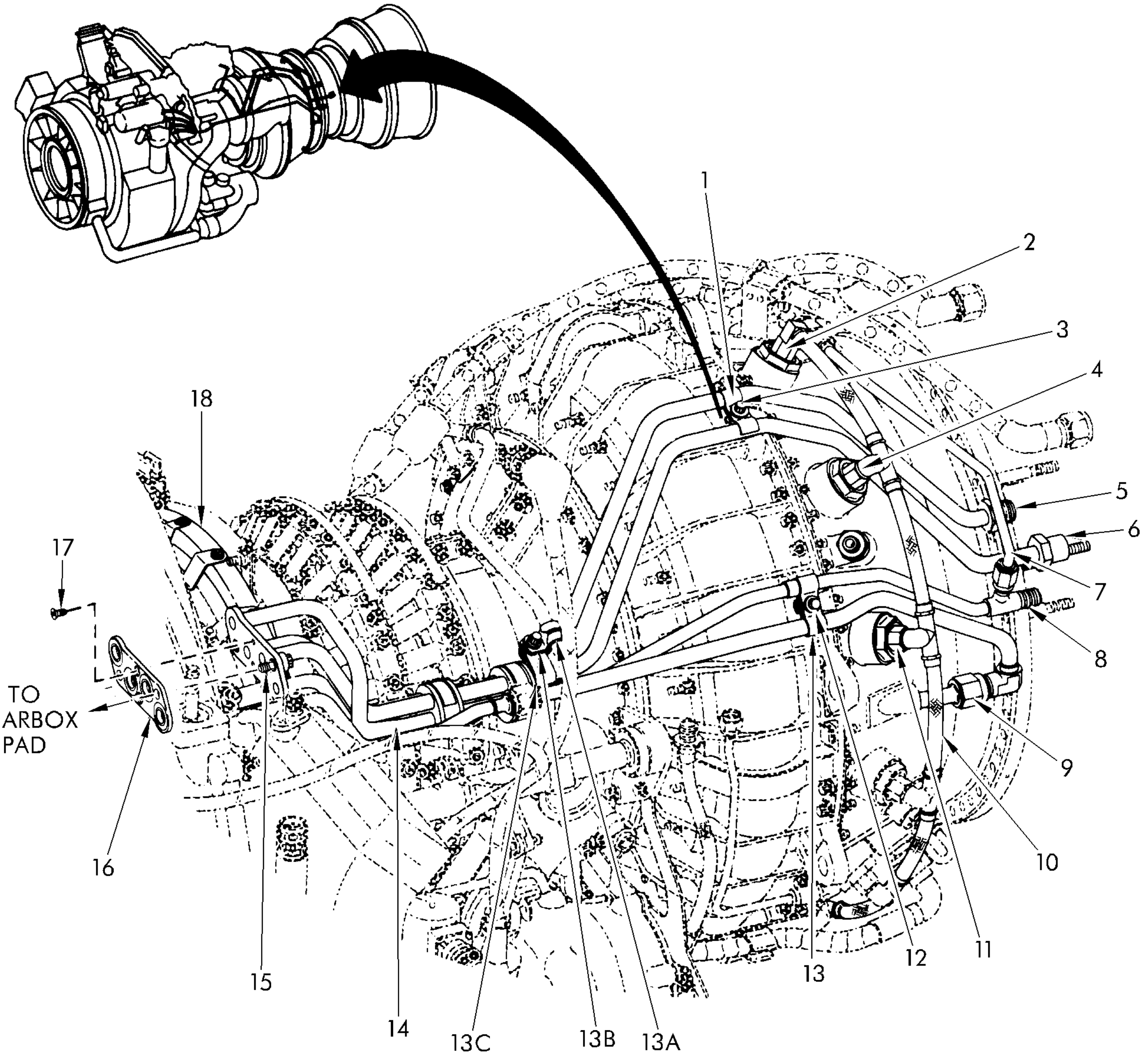
Figure 8-22. Oil Tank Cap and Adapter; Repair



1. Upper Clamp Bracket
2. Coupling Nut
3. Bolt
4. Coupling Nut
5. C-Sump Forward Scavenge Tube
6. C-Sump Aft Scavenge Tube
7. Oil Supply Tube (Left-Hand)
8. C-Sump Oil Supply Tube
9. B-Sump Scavenge Fitting
10. Main Fuel Manifold
11. Coupling Nut
12. Bolt
13. Upper Clamp Bracket
13A. Clamp
13B. Bolt
13C. Support Bracket
14. Oil Manifold Assembly
15. Captive Bolt (Qty-2)
16. Adapter Gasket
17. Flathead Screws (Qty-2)
18. IGV Actuating Ring

1157538-00-A2A

Figure 8-23. Oil Manifold Assembly; Removal, Inspection, and Installation

e. Using fingers or wrench, gently back off coupling nut (2) halfway, coupling nut (4) halfway, and coupling nut (11) halfway.

f. Disconnect coupling nuts (2, 4).

g. Loosen two bolts (3, 12) so that upper clamp brackets (1, 13) can be rotated 90° to release oil manifold assembly (14).

h. If accessory section module is installed, release quick-disconnect pin from HMU actuator link (para 6-40, step h).

i. Position IGV actuating ring (18) so that captive bolts (15) on flange of oil manifold can be removed.

j. Remove bolt (13B), and loosen captive bolts (15). Remove oil manifold assembly (14).

k. If sealing material on adapter gasket (16) is damaged, remove two flathead screws (17) and discard gasket.

8-88. Cleaning of Oil Manifold Assembly. See paragraph H-23, Appendix H.

8-89. Inspection of Oil Manifold Assembly. See table 8-11.

Table 8-11. Inspection of Oil Manifold Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Tubes and fittings on oil manifold assembly (14, fig. 8-23).	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
b. AVIM: Damaged threads on captive bolts (15).	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
c. AVIM: Damaged threads on flanges of captive bolts.	Up to one damaged or missing thread, with no crossed threads or loose material.	Same as usable limits, with crossed threads or loose material.	Mask all openings and chase threads.
d. AVIM: Adapter gasket (16) for nicks and cuts in sealing material.	None allowed.	Not repairable.	Replace gasket.

8-90. Repair of Oil Manifold Assembly (AVIM). Repair is limited to replacing the adapter gasket, only when the sealing material is damaged.

8-91. Testing of Oil Manifold Assembly (AVIM). See paragraph H-25, Appendix H.

8-92. Installation of Oil Manifold Assembly (AVIM).

a. If adapter gasket (16, fig 8-23) is attached to oil manifold assembly (14), make sure heads of flathead screws (17) are 0.004-0.022 inch below surface of plate of adapter gasket.

b. If adapter gasket (16) is not attached to oil manifold assembly (14), attach it using two flathead screws (17). Turn screws until adapter gasket contacts flange on oil manifold assembly. Heads of screws must be 0.004-0.022 inch below surface of plate of adapter gasket.

c. Position oil manifold assembly (14) on engine, as shown.

d. If power turbine module is installed, connect oil manifold assembly (14) handtight to the following:

- C-sump aft scavenge tube (6)
- C-sump forward scavenge tube (5)
- C-sump oil supply tube (8)

e. Connect B-sump scavenge fitting (9) handtight to oil manifold assembly.

f. Connect oil manifold assembly to accessory gearbox using two captive bolts (15). Torque bolts 45-50 inch-pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

g. Using two wrenches, tighten (60° wrench-arc) coupling nuts that were hand-tightened in steps d and e.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

h. Lubricate fuel injector threads with oil (item 85 or 87, Appendix D).

NOTE

It should be possible to screw coupling nuts of fuel manifold onto fuel injectors about three turns by hand.

i. Start coupling nut (4) on fuel injector using fingers, then start coupling nut (2). Screw on coupling nut (4) about three turns, and screw on coupling nut (2) three turns. If turns cannot be made, inspect coupling nuts and fuel injectors for dirt or damaged threads.

j. Completely screw on coupling nut (11), coupling nut (4), and then coupling nut (2). Use fingers or wrench (gently) until each coupling nut is seated.

k. Tighten (60° wrench-arc) coupling nuts (11, 4, 2).

l. Position upper clamp brackets (1, 13) and tighten bolts (3, 12) to secure oil manifold assembly to diffuser-midframe flange. Torque bolts to 45-50 inch-pounds.

m. Install bolt (13B) through clamp (13A), and into support bracket (13C). Torque bolt to 45-50 inch-pounds.

n. Install the following parts:

- **(T700)** P3 hose and tube assembly (para 10-9)
- **(T701, T701C, T701D)** P3 tube (para 10-59)
- Particle separator blower (para 5-14)
- Mid C-sump scavenge tube (para 8-134)
- Oil supply tube (left-hand) (para 8-103)

o. Make required engine checks listed in table 1-39.

8-93. OIL SUPPLY TUBES (LEFT-HAND AND RIGHT-HAND).

8-94. Removal of Oil Supply Tube (Right-Hand).

a. Hold B-sump oil inlet check valve (1, fig. 8-24) with a wrench, and loosen coupling nut on oil supply tube (7).

b. Loosen coupling nut (5) on the midframe.

c. Remove oil supply tube.

8-95. Cleaning of Oil Supply Tube (Right-Hand). See paragraph H-23, Appendix H.

8-96. Inspection of Oil Supply Tube (Right-Hand). See paragraph H-24, Appendix H.

8-97. Testing of Oil Supply Tube (Right-Hand) (AVIM). See paragraph H-25, Appendix H.

8-98. Installation of Oil Supply Tube (Right-Hand).

a. Inspect coupling nut (5, fig. 8-24) to verify that inlet screen is in place.

b. Position oil supply tube (7) as shown.

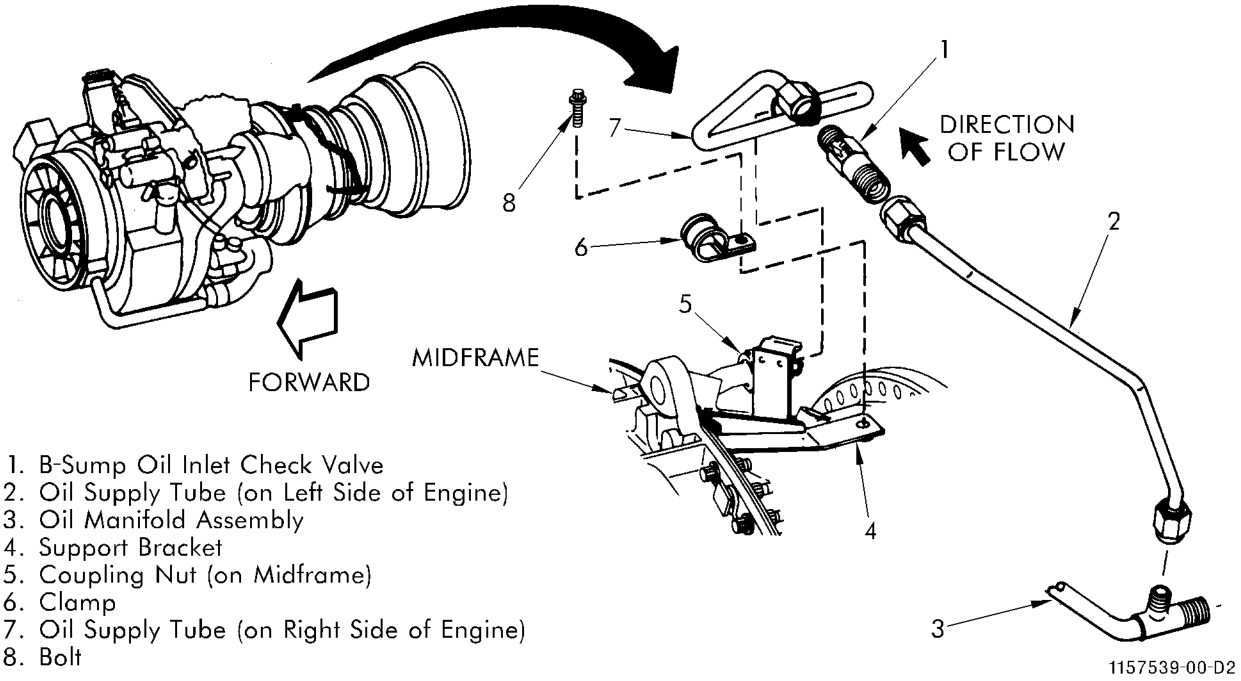


Figure 8-24. Oil Supply Tubes (Left-Hand and Right-Hand) and B-Sump Oil Inlet Check Valve; Removal and Installation

c. Loosely connect coupling nuts to B-sump oil inlet check valve (1) and to oil supply tube.

d. Tighten (60° wrench arc) coupling nuts. Hold check valve (1) with a wrench when tightening coupling nut.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-99. Removal of Oil Supply Tube (Left-Hand).

a. Hold B-sump oil inlet check valve (1, fig. 8-24) with a wrench, and loosen coupling nut on oil supply tube (2).

b. Loosen coupling nut at oil manifold assembly (3).

c. Remove oil supply tube (2).

8-100. Cleaning of Oil Supply Tube (Left-Hand). See paragraph H-23, Appendix H.

8-101. Inspection of Oil Supply Tube (Left-Hand). See paragraph H-24, Appendix H.

8-102. Testing of Oil Supply Tube (Left-Hand) (AVIM). See paragraph H-25, Appendix H.

8-103. Installation of Oil Supply Tube (Left-Hand).

a. Position oil supply tube (2) as shown in figure 8-24.

b. Loosely connect coupling nuts to B-sump oil inlet check valve (1) and to oil manifold assembly (3).

c. Tighten (60° wrench-arc) coupling nuts. Hold check valve (1) with a wrench when tightening coupling nut.

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-104. B-SUMP OIL INLET CHECK VALVE.

8-105. Removal of B-Sump Oil Inlet Check Valve.

NOTE

- There are two configurations of B-sump check valves, one with an inlet screen and one without an inlet screen. See figure 8-25. Except for the inlet screen, check valves are identical and have the same part number.
- If necessary, one of the oil supply tubes may be loosened or removed to make it easier to remove valve.

a. Hold B-sump oil inlet check valve (1, fig. 8-24) with a wrench while loosening coupling nuts on oil supply tubes (2, 7).

b. Remove bolt (8) from support bracket (4) and from clamp (6).

c. Remove check valve (1).

8-106. Inspection of B-Sump Oil Inlet Check Valve. See paragraph H-24, Appendix H.

8-107. Installation of B-Sump Oil Inlet Check Valve.

a. If an oil supply tube (2 or 7, fig. 8-24) was removed, reinstall it, but leave connections loose.

b. Position clamp (6) on B-sump oil inlet check valve (1).

c. Position check valve (1) between oil supply tubes (2, 7) with arrow on valve pointing in direction of flow (fig. 8-24). Attach clamp to support bracket (4) using bolt (8).

d. Hold check valve with a wrench, and tighten (60° wrench-arc) coupling nuts.

e. Tighten (60° wrench-arc) any loose coupling nuts, and torque bolt (8) to 45-50 inch-pounds.

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

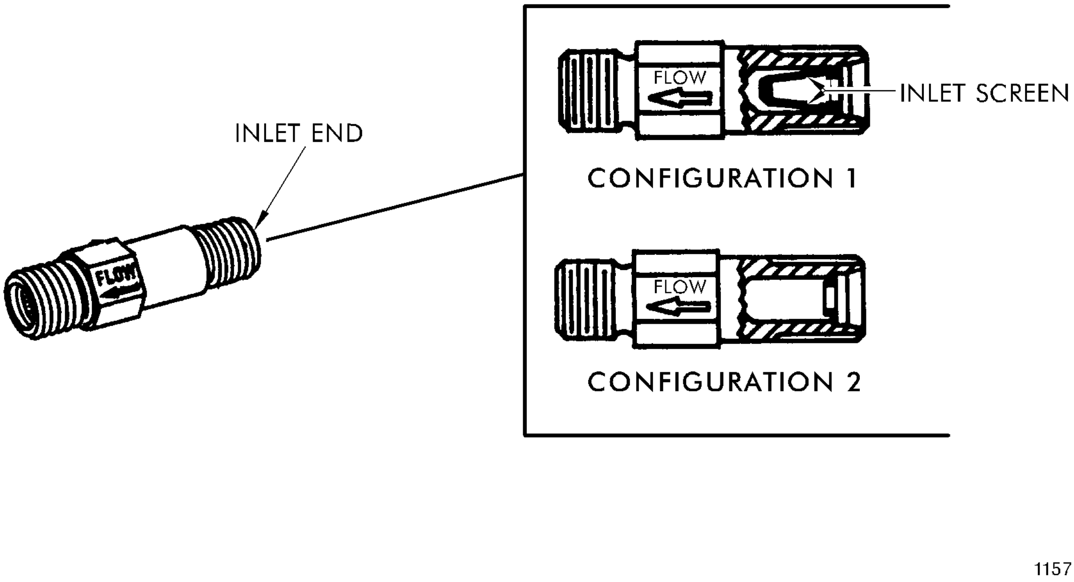


Figure 8-25. B-Sump Oil Inlet Check Valve, Cleaning

8-108. MAIN FRAME OIL STRAINER.

8-109. Removal of Main Frame Oil Strainer.

a. Drain engine oil tank (para 1-113).

b. Remove two locknuts (1, fig. 8-26).

c. Pull oil strainer (2) from main frame (5). Remove and discard preformed packing (4).

8-110. Cleaning Main Frame Oil Strainer.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

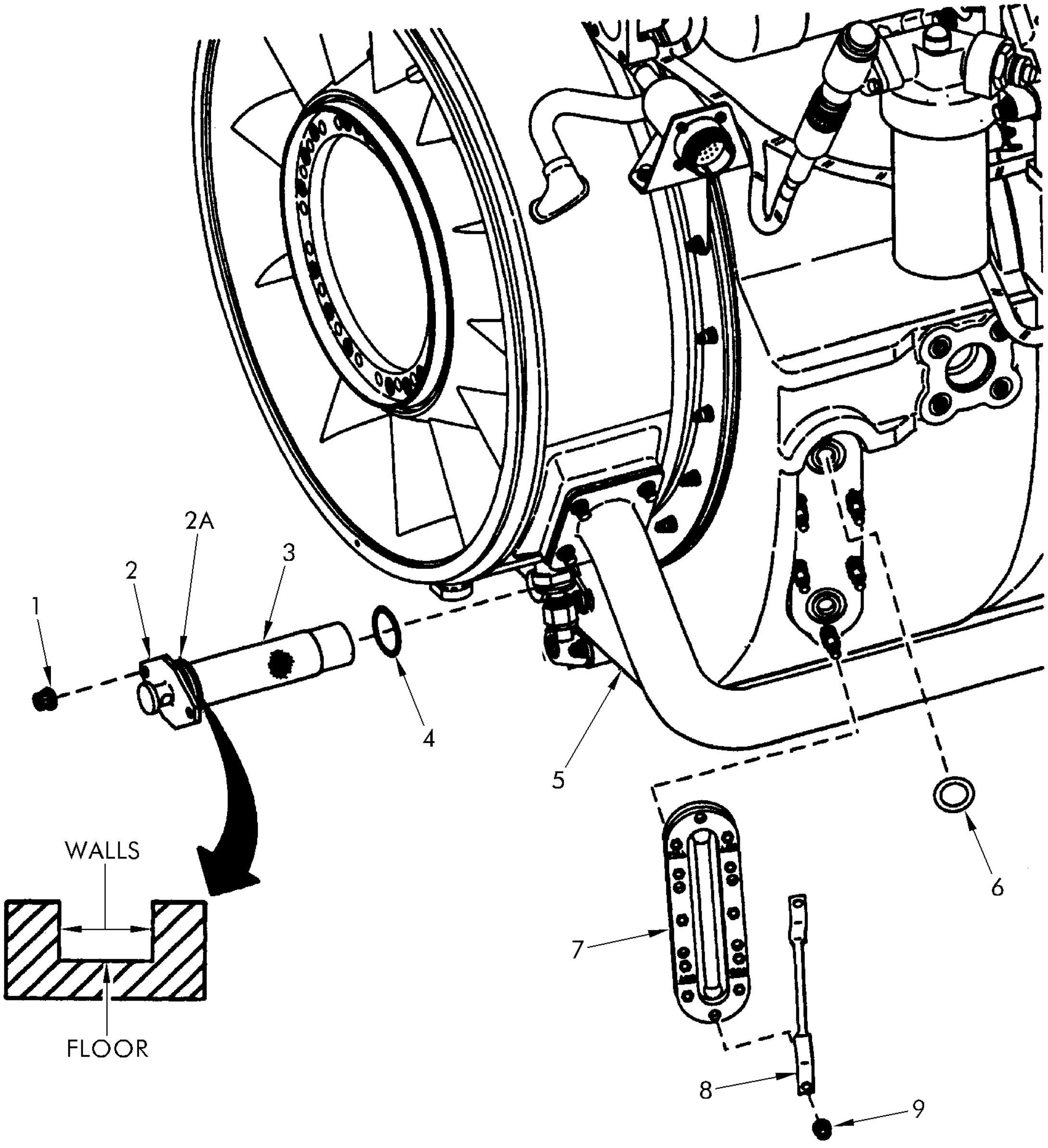
a. Flush or spray-wash main frame oil strainer with dry cleaning solvent (item 99, Appendix D) to remove oil and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the oil strainer using dry, filtered compressed air.



1. Locknut (Qty-2)
2. Oil Strainer
2A. Packing Groove
3. Screen Mesh
4. Preformed Packing
5. Main Frame
6. Preformed Packing (Qty-2)
7. Oil Level Indicator
8. Oil Level Indicator Guard
9. Locknut (Qty-6)

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Figure 8-26. Main Frame Oil Strainer and Oil Level Indicator; Removal, Inspection, and Installation

8-111. Inspection of Main Frame Oil Strainer.

See table 8-12.

Table 8-12. Inspection of Main Frame Oil Strainer

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil strainer (2, fig. 8-26) for:			
a. Broken screen mesh (3).	Not allowed.	Not repairable.	Replace oil strainer (para 8-112).
b. Clogged screen mesh (3).	Not allowed.	Any amount.	Clean oil strainer (para 8-110).
c. Nicks and scratches in:			
(1) Floor of packing groove (2A).	Any number, 0.005 inch deep, without sharp edges.	Not repairable.	Replace oil strainer (para 8-112).
(2) Walls of packing groove (2A).	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace oil strainer (para 8-112).

8-112. Installation of Main Frame Oil Strainer.

a. Attach preformed packing (4, fig. 8-26) to oil strainer (2).

b. Insert oil strainer (2) into main frame (5). Secure strainer with two locknuts (1). Torque locknuts to 45-50 inch-pounds.

c. Service oil tank (para 1-112).

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-113. OIL LEVEL INDICATOR.

8-114. Removal of Oil Level Indicator.

a. Drain oil (para 1-113) to below bottom of oil level indicator (7, fig. 8-26).

b. Remove six locknuts (9) that secure oil level indicator to main frame (5).

c. Remove oil level indicator guard (8) and oil level indicator. Remove and discard two preformed packings (6).

8-115. Inspection of Oil Level Indicator. See table 8-13.

Table 8-13. Inspection of Oil Level Indicator

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil level indicator (7, fig. 8-26) for:			
a. Cracked glass.	Not allowed.	Not repairable.	Replace indicator (para 8-116).
b. Clouded glass.	Oil level is visible.	Not repairable.	Replace indicator (para 8-116).
c. Loose locknuts (8).	Not allowed.	Any amount, if locknuts can be torqued to 45-50 inch-pounds.	Torque locknuts to 45-50 inch-pounds.

8-116. Installation of Oil Level Indicator.

a. Install two preformed packings (6, fig. 8-26) to main frame mounting flange for oil level indicator.

b. Attach oil level indicator (7) to main frame (5). Install oil level indicator guard (8) onto indicator (7). Secure indicator and guard with six locknuts (9). Torque locknuts to 45-50 inch-pounds.

c. Service oil tank (para 1-112).

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-117. OIL TRANSFER SLEEVES.

8-118. Removal of Oil Transfer Sleeves (AVIM).

a. Remove accessory section module (para 5-5).

b. Remove three screws (1, fig. 8-27) and three transfer sleeve lockplates (2, 7, and 8).

c. Remove oil transfer sleeves (3, 6).

d. Discard preformed packings (4, 5).

e. Cover openings on cold section module, using clean, dry, protective caps.

1. Screws (Qty-3)
2. Transfer Sleeve Lockplate
3. Oil Transfer Sleeve
4. Preformed Packing
5. Preformed Packings (Qty-4)
6. Oil Transfer Sleeves (Qty-4)
7. Transfer Sleeve Lockplate
8. Transfer Sleeve Lockplate

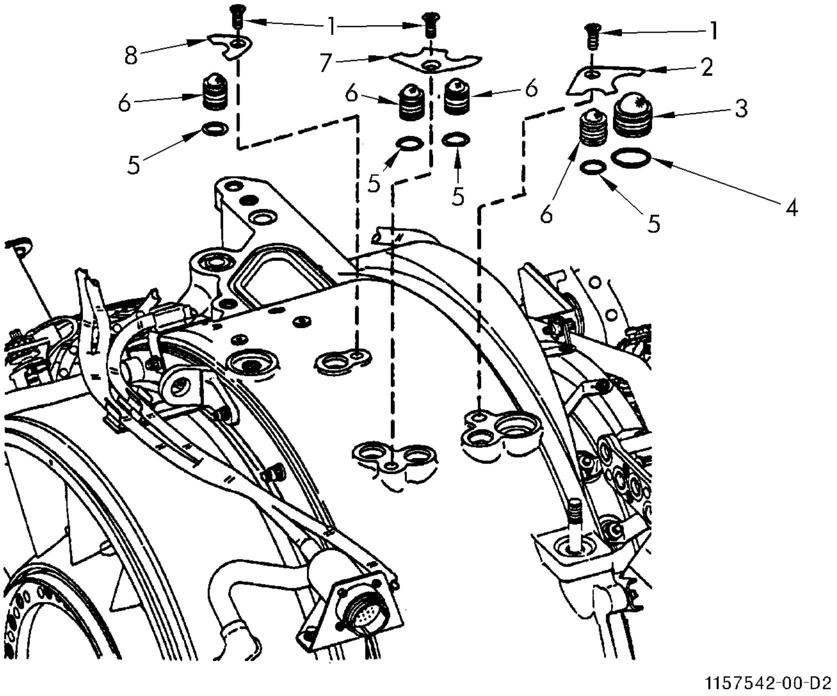


Figure 8-27. Oil Transfer Sleeves; Removal and Installation

8-119. Inspection of Oil Transfer Sleeves (AVIM).

See table 8-14.

Table 8-14. Inspection of Oil Transfer Sleeves

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil transfer sleeves (fig. 8-28) for:			
NOTE Oil transfer sleeves PN 4041T56G01 (quantity 4) are allowable with or without screens. Sleeves (PN 4041T56G01) without screens have been reworked and have a slot across end of sleeve where screen was removed.			
a. Broken screen (1) (if present).	Not allowed.	Not repairable.	Replace oil transfer sleeve (para 8-120).
b. Nicks and scratches in:			
(1) Floor of packing grooves (2).	Any number, 0.003 inch deep, without sharp edges.	Not repairable. (para 8-120).	Replace oil transfer sleeve.
(2) Walls of packing grooves (2).	Any number, 0.010 inch deep, without sharp edges.	Not repairable. (para 8-120).	Replace oil transfer sleeve.
(3) All other areas.	Any number, 0.002 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.
NOTE Oil transfer sleeves PN 4041T56G01 (quantity 4) are allowable with or without screens. Sleeves (PN 4041T56G01) without screens have been reworked and have a slot across end of sleeve where screen was removed.			
c. Broken tack welds at the screen (if present) ends.	Not allowed.	Not repairable.	Replace oil transfer sleeve (para 8-120).

8-120. Installation of Oil Transfer Sleeves (AVIM).

a. Attach preformed packings (4, 5, fig. 8-27) to oil transfer sleeves (3, 6).

CAUTION

When installing oil transfer sleeves, do not push down on (if present) screens. Insert oil transfer sleeves into main frame only to point where lockplate grooves on oil transfer sleeves aline with edge of main frame flange.

NOTE

Oil transfer sleeves PN 4041T56G01 (quantity 4) are allowable with or without screens. Sleeves (PN 4041T56G01) without screens have been reworked and have a slot across end of sleeve where screen was removed.

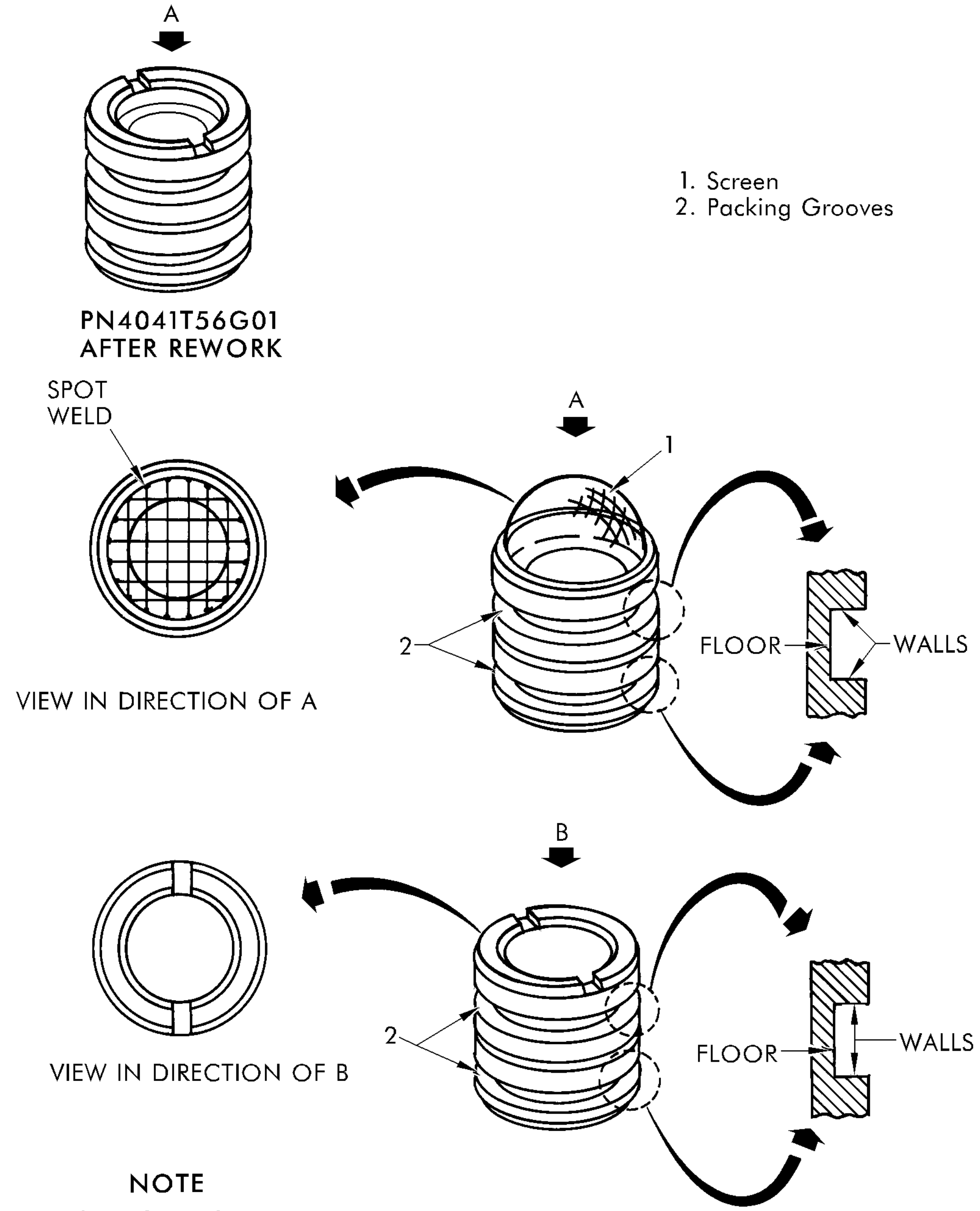
b. Insert oil transfer sleeves (3, 6) into ports on main frame.

c. Position transfer sleeve lockplates (2, 7, 8) on main frame so that they engage grooves on oil transfer sleeves.

d. Secure transfer sleeve lockplates with three screws (1). Torque screws to 18-22 inch-pounds.

e. Install accessory section module (para 5-8).

f. Make required checks listed in table 1-39.



NOTE

THERE IS A TOTAL OF FIVE MAIN FRAME OIL TRANSFER SLEEVES.

Figure 8-28. Oil Transfer Sleeves; Inspection

8-121. OIL DRAIN PLUG.

8-122. Removal of Oil Drain Plug.

a. If engine has been running, wait at least 10 minutes after engine shutdown to allow oil to drain back into oil tank before draining oil.

b. If engine is installed in aircraft, see applicable aircraft maintenance manual for oil draining instructions.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

WARNING

Draining of Oil Tank

To prevent being burned by hot oil, wear protective gloves when draining oil.

c. For engines not installed in aircraft, drain the oil tank as follows:

(1) Place an empty 2-gallon (minimum) container under oil drain plug (1, fig. 8-29) at six o'clock position on main frame (4).

(2) Remove oil drain plug (1) from oil drain insert (3), and allow oil to drain into container for at least 10 minutes.

(3) Remove and discard preformed packing (2).

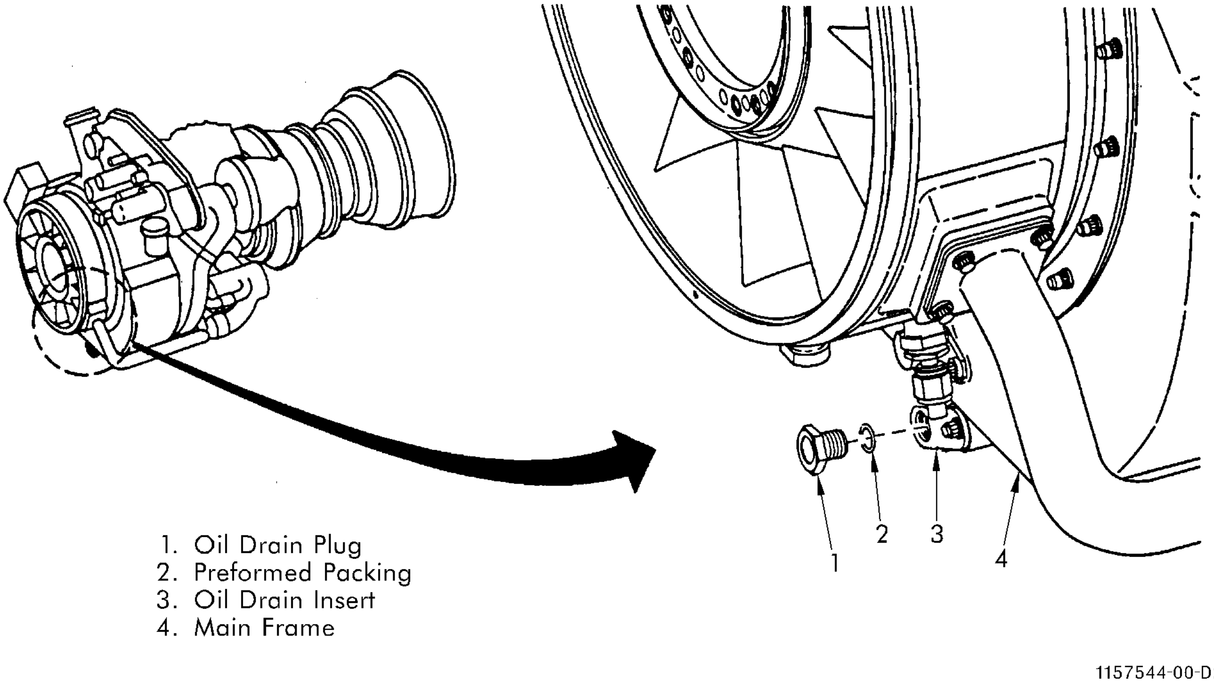


Figure 8-29. Oil Drain Plug; Removal and Installation

8-123. Inspection of Oil Drain Plug. See table 8-15.

Table 8-15. Inspection of Oil Drain Plug

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil drain plug (fig. 8-30) for:			
a. Damaged threads (1).	Not allowed.	Not repairable.	Replace plug (para 8-124).
b. Damaged hex flat (2).	Any amount, if wrench will hold. No burrs allowed.	Any amount of burrs.	Remove burrs.

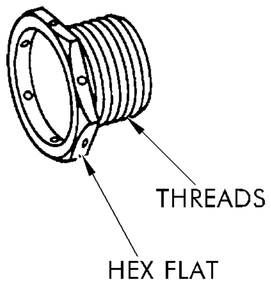


Figure 8-30. Oil Drain Plug; Inspection

8-124. Installation of Oil Drain Plug.

a. Install preformed packing (2, fig. 8-29) on oil drain plug (1).

b. Thread drain plug into oil drain insert (3) on main frame (4). Tighten (15° wrench arc) drain plug.

c. Service oil tank (para 1-112).

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-125. OIL DRAIN INSERT.

8-126. Removal of Oil Drain Insert.

a. Remove oil drain plug (para 8-122).

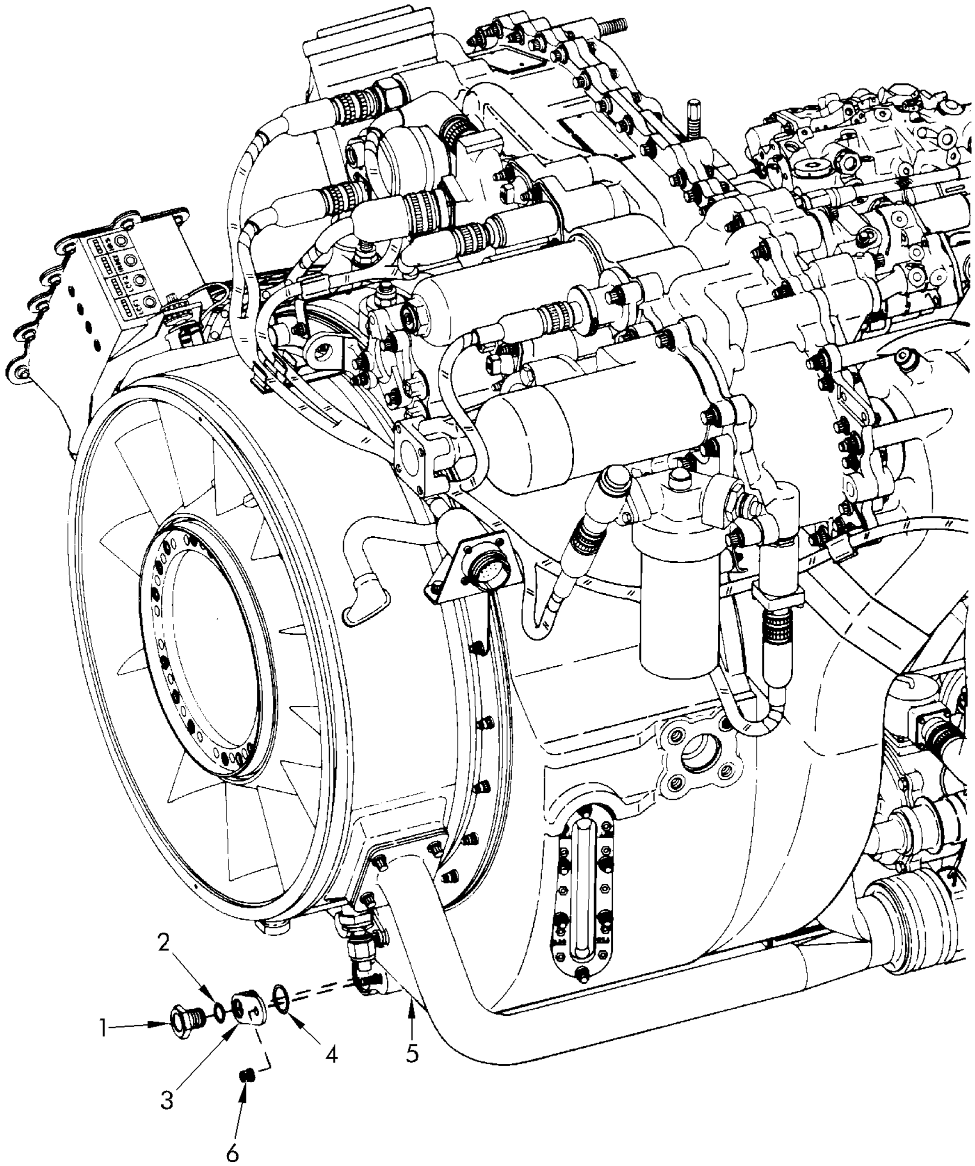
b. Remove locknut (6, fig. 8-31).

c. Screw oil drain plug (1) into oil drain insert (3), three turns minimum.

d. Remove oil drain insert (3) by pulling on oil drain plug (1).

e. Remove plug from insert.

f. Remove and discard preformed packing (4).



1. Oil Drain Plug
2. Preformed Packing
3. Oil Drain Insert
4. Preformed Packing
5. Main Frame
6. Locknut

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Figure 8-31. Oil Drain Insert; Removal and Installation

8-127. Inspection of Oil Drain Insert. See table 8-16.

Table 8-16. Inspection of Oil Drain Insert

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Oil drain insert (fig. 8-32) for:			
a. Damaged threads (1).	Not allowed.	Not repairable.	Replace oil drain insert (para 8-128).
b. Nicks and scratches in:			
(1) Floor of packing groove (2).	Any number, 0.005 inch deep, without sharp edges.	Not repairable.	Replace oil drain insert (para 8-128).
(2) Walls of packing groove (2).	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace oil drain insert (para 8-128).
(3) All other areas.	Any number, 1/64 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour.

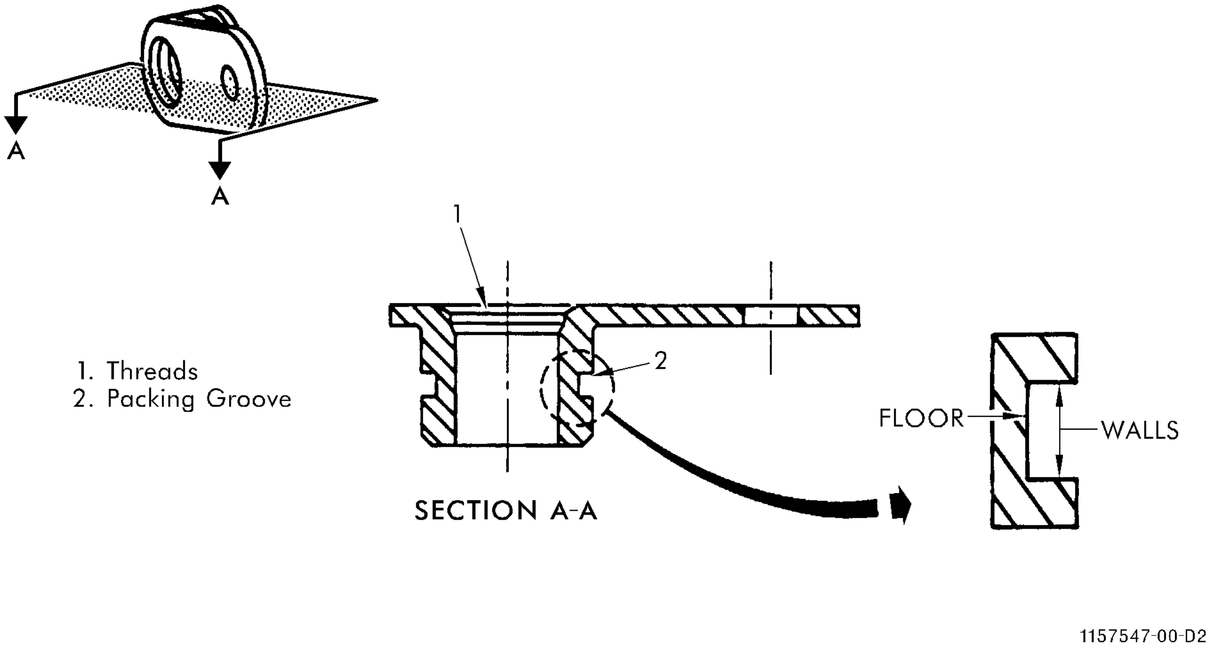


Figure 8-32. Oil Drain Insert; Inspection

8-128. Installation of Oil Drain Insert.

WARNING

Chemical Conversion Materials
for Coating Aluminum
and Aluminum Alloys
MIL-C-81706

- Highly reactive - do not mix with oxidizable materials such as cloth, paper, and wood.
- When mixing solutions, add acid to water, not water to acid.
- Contact with powder or vapors can cause severe skin and eye irritation, and skin ulcers. Repeated or prolonged inhalation or ingestion can result in nasal and kidney damage.
- If any liquid or powder contacts skin or eyes, immediately flush affected area thoroughly with water. Immediately change any contaminated clothing. If skin disorders appear, get medical attention.
- When handling powder or liquid at air-exhausted workbench or tank, wear approved gloves and apron.
- When handling powder or liquid at unexhausted workbench, wear approved respirator, gloves, and apron.
- Do not eat, smoke, or carry smoking materials in areas where powder is handled.
- Contains chromates. Follow approved toxic waste disposal procedures.

a. Inspect bore in main frame (5, fig. 8-31) where oil drain insert (3) is to be installed. If nicks, burrs and scratches are more than 0.005 inch deep, blend high metal to adjacent contour. Touch up blended area with Alodine 1200S (item 4, Appendix D).

b. Install preformed packing (4) onto oil drain insert (3).

c. Aline hole in insert with stud on main frame and push insert into main frame.

d. Install locknut (6) to secure insert (3). Torque locknut to 45-50 inch-pounds.

e. Install oil drain plug (para 8-124).

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-129. MID C-SUMP SCAVENGE TUBE.

8-130. Removal of Mid C-Sump Scavenge Tube (AVIM).

a. Remove three bolts (1, fig. 8-33) from clamps (2).

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

b. Using two wrenches, disconnect coupling nut on mid C-sump scavenge tube (3) from C-sump forward oil scavenge tube (12).

c. If power turbine module is installed, disconnect coupling nut on seal pressure and scavenge tube assembly (6) from mid C-sump scavenge tube (3).

d. Remove yellow electrical cable (8) from two clip supports (9).

e. Remove blue electrical cable (5) from two clip supports (4).

f. Disconnect two coupling nuts on main fuel manifold from two fuel injectors as follows:

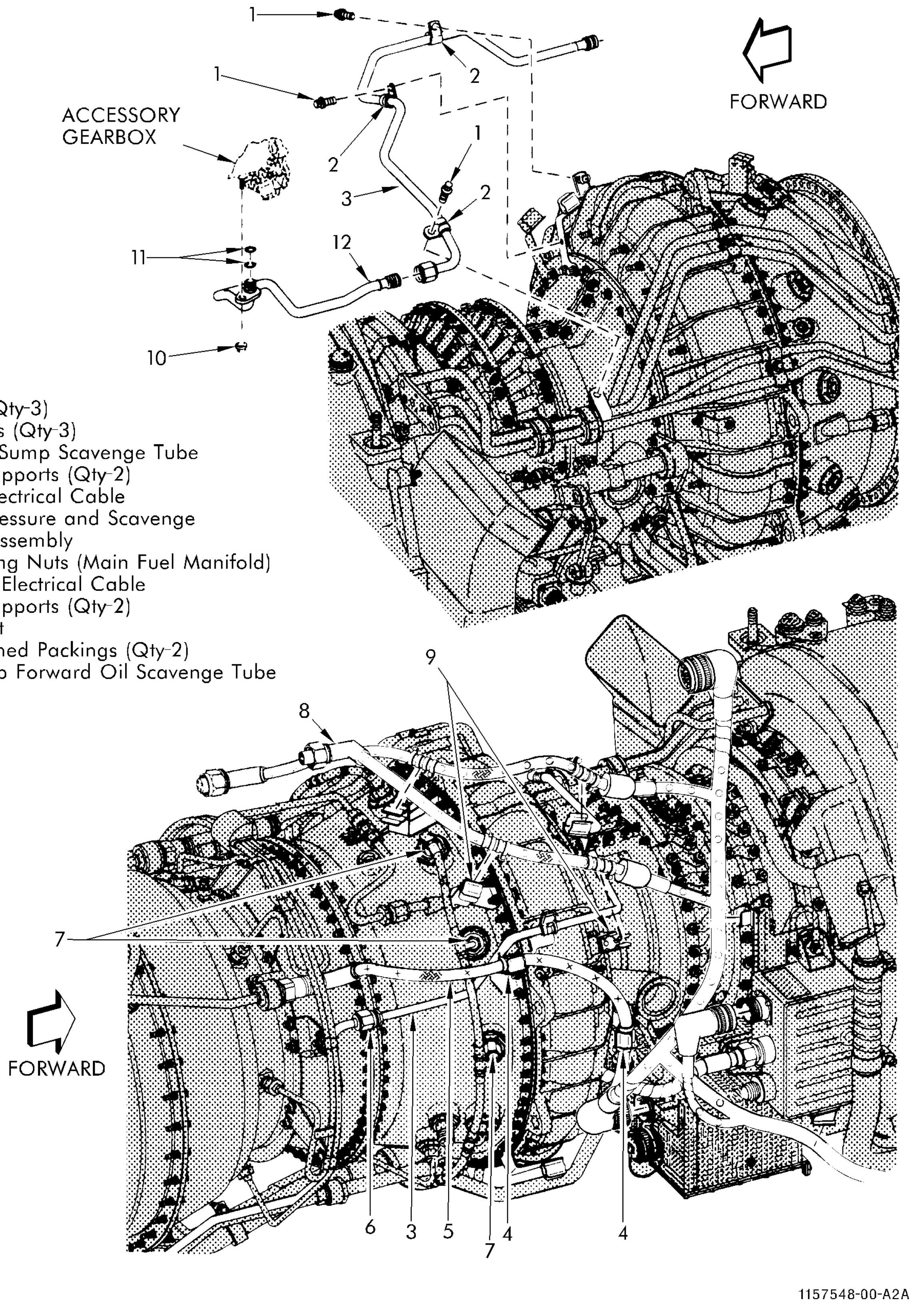
CAUTION

- Do not completely disconnect coupling nuts on main fuel manifold from each fuel injector without loosening the adjacent coupling nut. Otherwise, damage to coupling nuts or fuel injector threads will result.
- Be very careful not to damage adjacent tubes and hoses when backing off coupling nuts.

(1) Loosen three coupling nuts (7), one-half turn each.

(2) Loosen same three coupling nuts, three turns each.

(3) Disconnect coupling nut at 1 o'clock position.



1. Bolts (Qty-3)
2. Clamps (Qty-3)
3. Mid C-Sump Scavenge Tube
4. Clip Supports (Qty-2)
5. Blue Electrical Cable
6. Seal Pressure and Scavenge Tube Assembly
7. Coupling Nuts (Main Fuel Manifold)
8. Yellow Electrical Cable
9. Clip Supports (Qty-2)
10. Locknut
11. Preformed Packings (Qty-2)
12. C-Sump Forward Oil Scavenge Tube

Figure 8-33. Mid C-Sump Scavenge Tube and C-Sump Forward Oil Scavenge Tube; Removal and Installation

(4) Disconnect coupling nut at 2 o'clock position.

g. Remove mid C-sump scavenge tube (3).

8-131. Cleaning of Mid C-Sump Scavenge Tube. See paragraph H-23, Appendix H.

8-132. Inspection of Mid C-Sump Scavenge Tube (AVIM). See paragraph H-24, Appendix H.

8-133. Testing of Mid C-Sump Scavenge Tube (AVIM). See paragraph H-25, Appendix H.

8-134. Installation of Mid C-Sump Scavenge Tube (AVIM).

a. Position mid C-sump scavenge tube (3, fig. 8-33) on engine as shown.

b. Loosely connect mid C-sump scavenge tube to C-sump forward oil scavenge tube (12).

c. If power turbine module is installed, loosely connect mid C-sump scavenge tube to seal pressure and scavenge tube assembly (6).

d. Install three bolts (1) through clamps (2), and into support brackets. Torque bolts to 45-50 inch- pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

e. Using two wrenches, tighten (60° wrench-arc) coupling nuts on mid C-sump scavenge tube and on seal pressure and scavenge tube assembly.

f. Secure coupling nuts (7) on main fuel manifold to fuel injectors as follows:

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(1) Lubricate threads of fuel injectors using lubricating oil (item 85 or 87, Appendix D).

CAUTION

Do not completely connect coupling nuts on main fuel manifold to each fuel injector without partially connecting the adjacent coupling nut. Otherwise, damage to coupling nuts or fuel injector threads will result.

(2) Screw coupling nut at 2 o'clock position onto fuel injector, two turns by hand.

(3) Screw coupling nut at 1 o'clock position onto fuel injector, two turns by hand.

(4) Tighten (60° wrench arc) coupling nut at 3 o'clock position.

(5) Tighten (60° wrench arc) coupling nut at 2 o'clock position.

(6) Tighten (60° wrench arc) coupling nut at 1 o'clock position.

g. Insert yellow electrical cable (8) into two clip supports (9).

h. Insert blue electrical cable (5) into two clip supports (4).

i. Make required engine checks listed in table 1-39.

8-135. C-SUMP FORWARD OIL SCAVENGE TUBE.

8-136. Removal of C-Sump Forward Oil Scavenge Tube (AVIM).

a. Disconnect coupling nut on mid C-sump scavenge tube (3, fig. 8-33) from C-sump forward oil scavenge tube (12).

b. Remove locknut (10), and disconnect C-sump forward scavenge tube from accessory gearbox.

c. Remove accessory section module (para 5-5).

d. Remove C-sump forward oil scavenge tube from engine.

e. Remove and discard two preformed packings (11).

8-137. Cleaning of C-Sump Forward Oil Scavenge Tube.

See paragraph H-23, Appendix H.

8-138. Inspection of C-Sump Forward Oil Scavenge Tube.

See paragraph H-24, Appendix H.

8-139. Testing of C-Sump Forward Oil Scavenge Tube (AVIM).

See paragraph H-25, Appendix H.

8-140. Installation of C-Sump Forward Oil Scavenge Tube (AVIM).

a. Attach two packings (11, fig. 8-33) to C-sump forward oil scavenge tube (12).

b. Loosely connect coupling nut on mid C-sump scavenge tube (3) to C-sump forward oil scavenge tube (12).

c. Rest forward end of C-sump forward oil scavenge tube on main frame aft flange.

d. Install accessory section module (para 5-8).

e. Insert forward end of C-sump forward oil scavenge tube into boss on accessory gearbox.

f. Secure C-sump forward oil scavenge tube with locknut (10). Torque locknut to 24-27 inch-pounds.

g. Tighten (60° wrench arc) coupling nut on mid C-sump scavenge tube.

h. Make required engine checks listed in table 1-39.

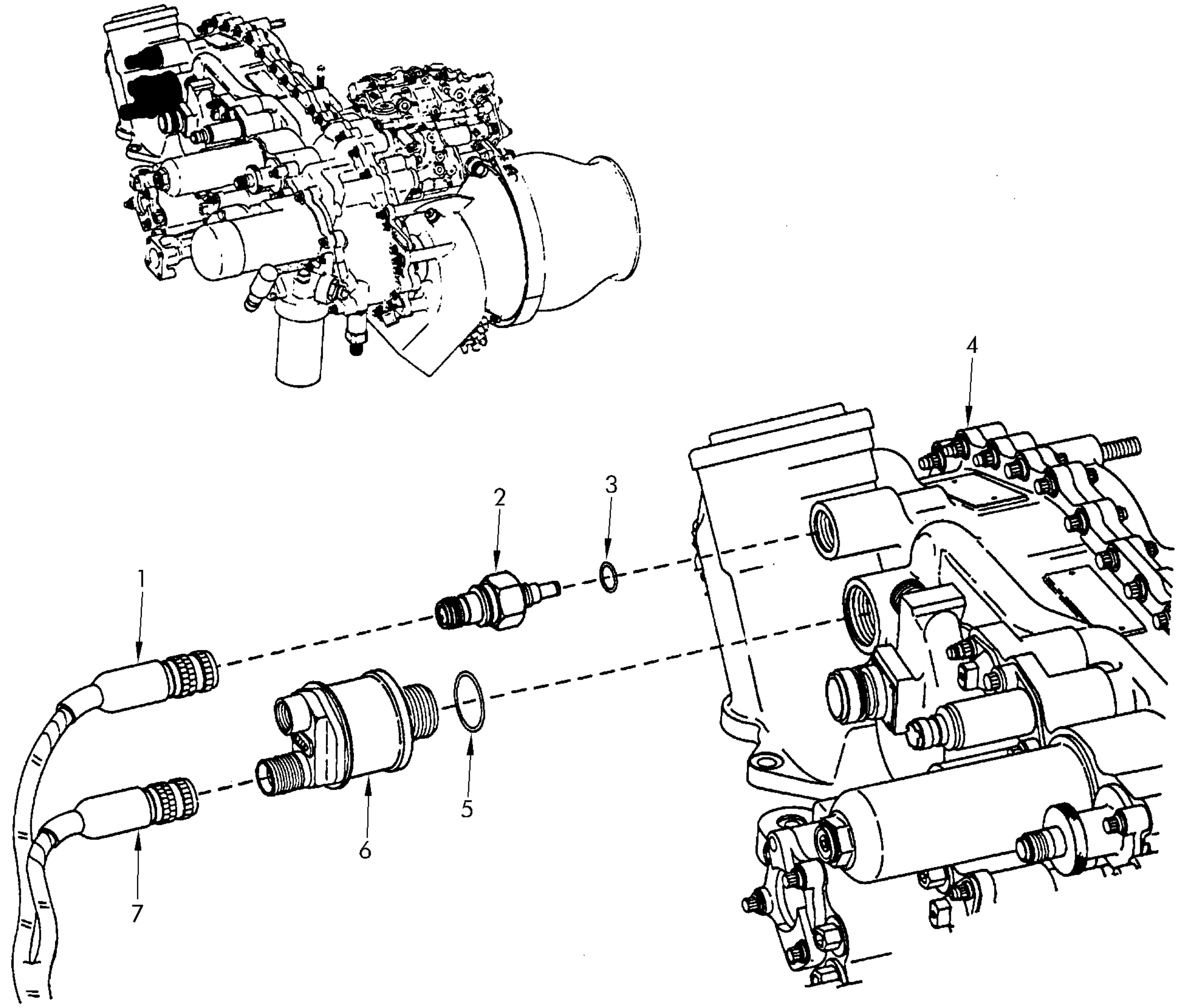
8-141. (T700, T701C, T701D) OIL TEMPERATURE SENSOR.

8-142. (T700, T701C, T701D) Removal of Oil Temperature Sensor.

a. Disconnect electrical connector (green cable) (1, fig. 8-34) from oil temperature sensor (2). Cover electrical connector with clean, dry protective cap (item 34, Appendix D).

b. Loosen and remove sensor (2).

c. Remove and discard preformed packing (3).



1. Electrical Connector (Green Cable)
2. Oil Temperature Sensor
3. Preformed Packing
4. Accessory Gearbox
5. Preformed Packing
6. Oil Pressure Sensor
7. Electrical Connector (Green Cable)

Figure 8-34. Oil Temperature and Oil Pressure Sensors; Removal and Installation

8-143. (T700, T701C, T701D) Inspection of Oil Temperature Sensor.

See table 8-17.

Table 8-17. (T700, T701C, T701D) Inspection of Oil Temperature Sensor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Temperature probe (3, fig. 8-35) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace oil temperature sensor (para 8-145).
(2) Leaks.	Not allowed.	Not repairable.	Replace oil temperature sensor (para 8-145).
b. Electrical connector (1) for:			
(1) Bent pins (4).	Not allowed.	Up to 1/16 inch out-of-position.	Straighten pin.
(2) Kinked or sharply bent pins.	Not allowed.	Not repairable.	Replace oil temperature sensor (para 8-145).
(3) Damaged threads.	Any amount up to one cumulative thread total, without high metal, if connector can be assembled normally to its mating part.	Any amount up to one cumulative thread total, with high metal, that can be reworked to usable limits.	Blend high metal.
(4) Swelling of pin insulation or evidence or oil leakage.	Not allowed.	Not repairable.	Replace oil temperature sensor (para 8-145).
(5) Looseness.	Not allowed.	Not repairable.	Replace oil temperature sensor (para 8-145).
c. Mounting threads (2) for damage.	One-half of one thread in length (total), without high metal.	One-half of one thread (total), with high metal.	Blend high metal.

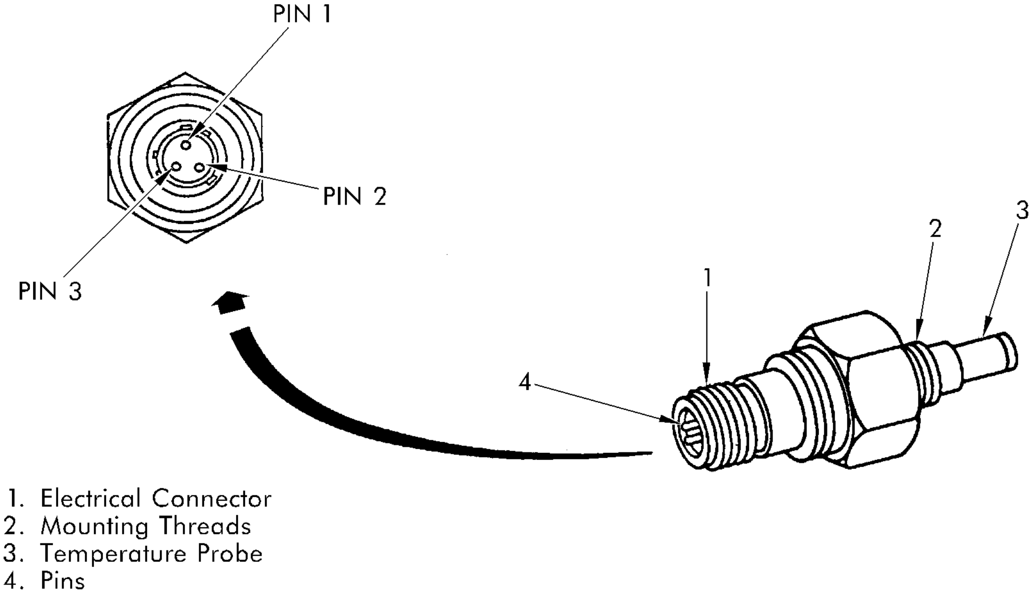


Figure 8-35. (T700, T701C, T701D) Oil Temperature Sensor; Inspection

8-144. (T700, T701C, T701D) Testing of Oil Temperature Sensor. Electrical connector locations are shown in figure FO-2.

a. Remove electrical connector (green cable) (1, fig. 8-34) from oil temperature sensor (2).

CAUTION

The following resistance tests are to be performed in an ambient temperature range between 70°F and 95°F. Otherwise, reading will be incorrect.

b. Using a multimeter, check resistance between pins 1 and 2 on electrical connector of oil temperature sensor.

c. Resistance must be 95-100 ohms with oil temperature sensor at ambient temperature range between 70°F and 95°F.

d. Check for short circuits between pins:

- 1 and 3
- 2 and 3
- 1 and ground
- 2 and ground

No short circuits allowed.

8-145. (T700, T701C, T701D) Installation of Oil Temperature Sensor.

a. Attach preformed packing (3, fig. 8-34) to oil temperature sensor (2).

b. Thread sensor into accessory gearbox (4).

c. Tighten (15° wrench arc) sensor.

d. Connect electrical connector (green cable) (1) to sensor.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-146. OIL PRESSURE SENSOR.

8-147. (T700) Removal of Oil Pressure Sensor.

a. Disconnect electrical connector (green cable) (7, fig. 8-34) from oil pressure sensor (6). Cover electrical connectors with clean, dry, protective caps (item 24, 34, Appendix D).

b. Loosen and remove sensor (6) from accessory gearbox (4).

c. Discard preformed packing (5).

8-148. (T701) Removal of Oil Pressure Sensor.

a. Disconnect electrical connector (green cable) (4, fig. 8-36) and coupling nut on B-sump delta pressure tube (5) from oil pressure sensor (3). Cover electrical connectors with clean, dry, protective caps (item 24, 34, Appendix D).

b. Loosen and remove sensor (3) from accessory gearbox (1).

c. Discard preformed packing (2).

8-149. (T701C, T701D) Removal of Oil Pressure Sensor.

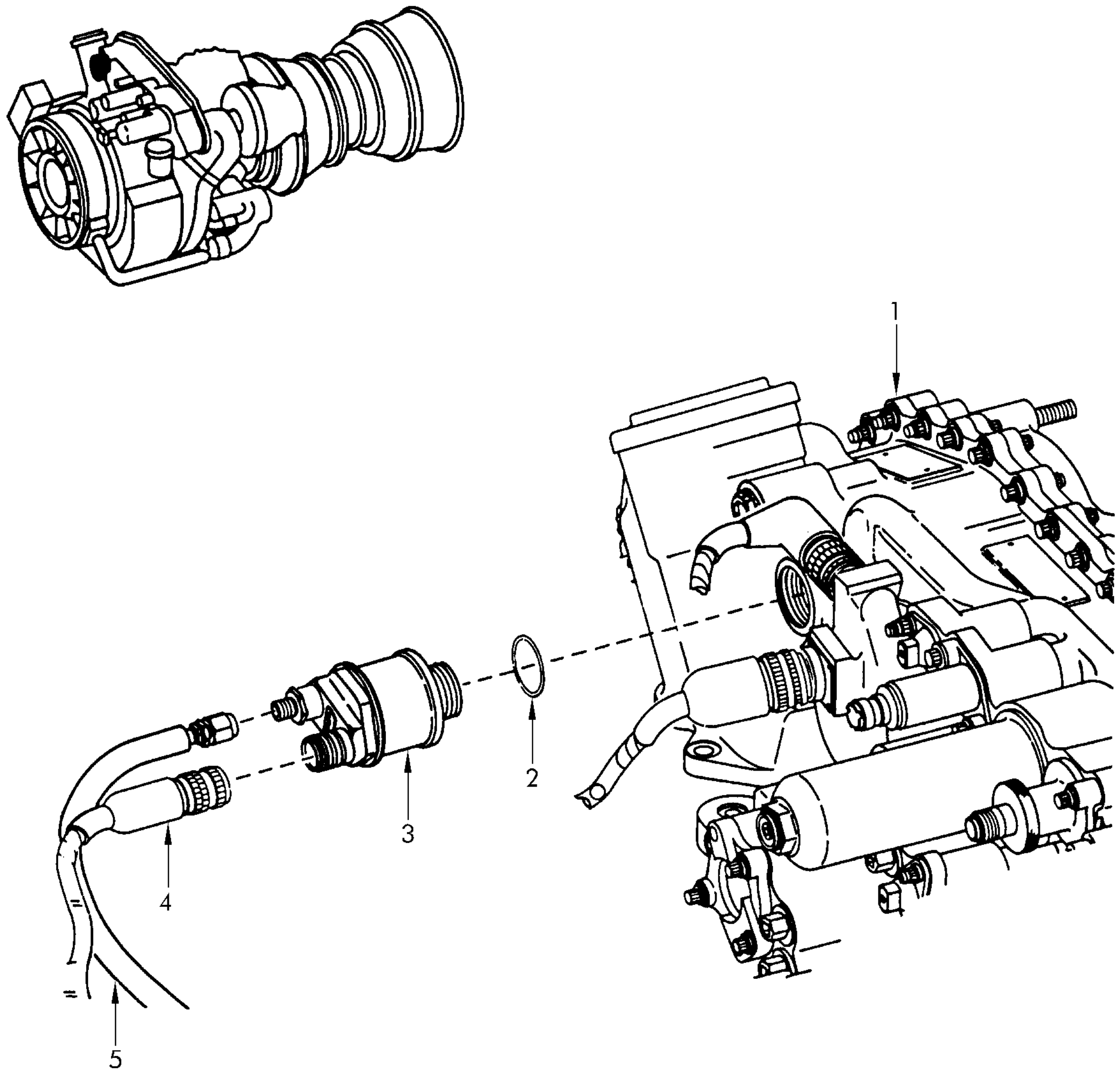
a. Disconnect electrical connector (green cable) (8, fig. 8-37). Cover electrical connectors with clean, dry, protective caps (item 24, 34, Appendix D)).

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

b. Using two wrenches, disconnect coupling nut (7) from oil pressure sensor.

c. Loosen and remove sensor (9) with oil pressure sensor spacer (4) and teflon backup washer (3) from accessory gearbox (1).



1. Accessory Gearbox
2. Preformed Packing
3. Oil Pressure Sensor
4. Electrical Connector (Green Cable)
5. B-Sump Delta Pressure Tube

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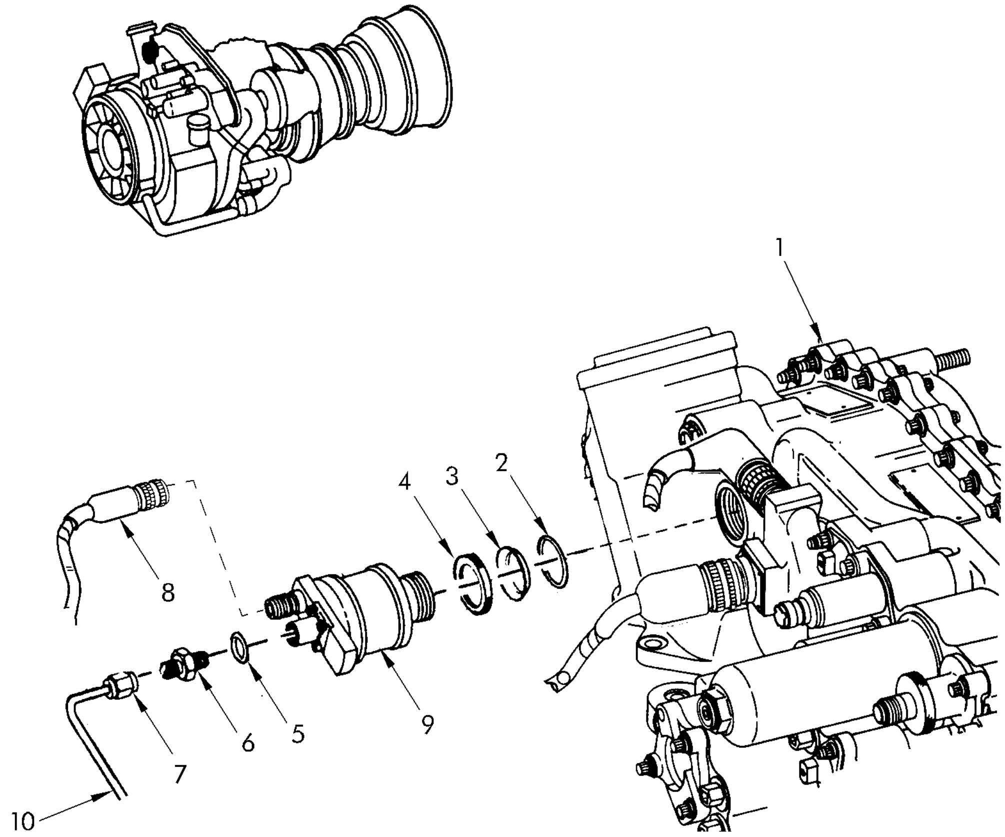
Figure 8-36. *(T701)* ***Oil Pressure Sensor; Removal and Installation***



1. Accessory Gearbox
2. Preformed Packing
3. Teflon Backup Washer
4. Oil Pressure Sensor Spacer
5. Packing
6. Flareless Tube Reducer
7. Coupling Nut
8. Electrical Connector (Green Cable)
9. Oil Pressure Sensor
10. B-Sump Delta Pressure Tube

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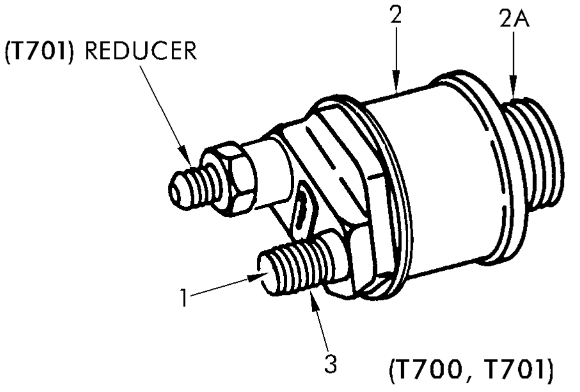
Figure 8-37. ***(T701C, T701D)*** ***Oil Pressure Sensor; Removal and Installation***

8-150. Inspection of Oil Pressure Sensor. See table 8-18.

Table 8-18. Inspection of Oil Pressure Sensor

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Oil pressure sensor (2, fig. 8-38) for:			
(1) Visible cracks.	None allowed.	Not repairable.	Replace oil pressure sensor (para 8-151 **(T700)** or 8-152 **(T701, T701C, T701D)**).
(2) Visible leaks.	Not allowed.	Not repairable.	Replace oil pressure sensor (para 8-151 **(T700)** or 8-152 **(T701, T701C, T701D)**).
b. Electrical connector (3) for:			
(1) Bent socket pins (1).	None allowed.	Up to 1/16 inch out-of-position.	Straighten pin.
(2) Kinked or sharply bent socket pins.	None allowed.	Not repairable.	Replace oil pressure sensor (para 8-151 **(T700)** or 8-152 **(T701, T701C, T701D)**).
(3) Damaged threads.	Any amount, without high metal, if connector can be installed normally to its mating part.	Same as usable limits, with high metal.	Blend high metal.
(4) Swelling of socket pin insulation or evidence of oil leakage.	Not allowed.	Not repairable.	Replace oil pressure sensor (para 8-151 **(T700)** or 8-152 **(T701, T701C, T701D)**).
(5) Looseness.	Not allowed.	Not repairable.	Replace oil pressure sensor (para 8-151 **(T700)** or 8-152 **(T701, T701C, T701D)**).
c. Mounting threads (2A) for damage.	One-half of one thread in length (total), without high metal.	One-half of one thread (total), with high metal.	Blend high metal.
d. **(T701)** Reducer **(T701C, T701D)** Union for:			
(1) Cracks.	None allowed.	Not repairable.	Replace reducer and packing or union and packing. Tighten (15° wrench arc) reducer or union.
(2) Nicks, dents, scratches, ridges, and pits on sealing surfaces.	Any number, if the defect does not extend in the axial direction across more than 1/2 the sealing surface: No high metal allowed.	Same as usable limits, with high metal.	Blend high metal.



1. Socket Pins
2. Oil Pressure Sensor
2A. Mounting Threads
3. Electrical Connector

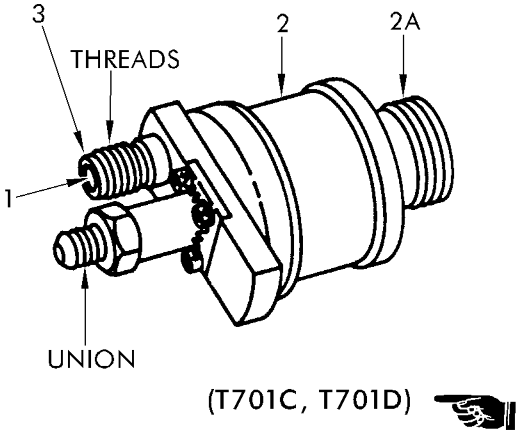


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Figure 8-38. Oil Pressure Sensor; Inspection

8-151. (T700) Installation of Oil Pressure Sensor.

a. Attach preformed packing (5, fig. 8-34) to oil pressure sensor (6).

b. Thread sensor into accessory gearbox (4).

c. Tighten sensor until its rear flange contacts mounting flange on gearbox. Then, tighten sensor 1° - 3° more. (Alternate method: Torque to 250-300 inch-pounds).

d. Connect electrical connector (green cable) (7) to sensor.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-152. (T701) Installation of Oil Pressure Sensor.

a. Attach preformed packing (2, fig. 8-36) to oil pressure sensor (3).

b. Thread sensor into accessory gearbox (1).

c. Tighten sensor (3) until its rear flange contacts mounting flange on gearbox. Then, tighten sensor 1° - 3° more. (Alternate method: Torque to 250-300 inch-pounds.)

d. Connect electrical connector (green cable) (4) and coupling nut on B-sump delta pressure tube (5) to sensor (3). Tighten coupling nut (60° wrench-arc).

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-153. (T701C, T701D) Installation of Oil Pressure Sensor.

a. If oil pressure sensor (9, fig. 8-37) is not being replaced, go to step b. If it is, do the following;

(1) Remove flareless tube reducer (6) from sensor (9).

(2) Remove and discard packing (5).

(3) Install new packing (5) onto reducer (6).

(4) Install reducer (6) into new sensor. Tighten (15° wrench arc) reducer.

b. Install oil pressure sensor spacer (4), teflon backup washer (3), and packing (2) onto sensor (9).

c. Install sensor (9) into gearbox. Torque sensor to 250-300 inch-pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

d. Install B-sump delta pressure tube (10) (para 8-162).

e. Be sure that electrical connector on sensor is at 10 o'clock position (forward looking aft). If sensor electrical connector is not at 10 o'clock position, remove sensor, teflon backup washer, and packing; then reinstall sensor, using alternate spacer (4).

8-154. (T701, T701C, T701D) B-SUMP DELTA PRESSURE TUBE.

8-155. (T701) Removal of B-Sump Delta Pressure Tube.

a. Loosen coupling nut (8, fig. 8-39) and disconnect B-sump delta pressure tube (6) from oil pressure sensor (1).

b. Pull tube (6) from forward suspension lug, located at the 12 o'clock position on the swirl frame.

c. Remove tube (6) and B-sump scavenge screen (7), as an assembly, from accessory gearbox (2).

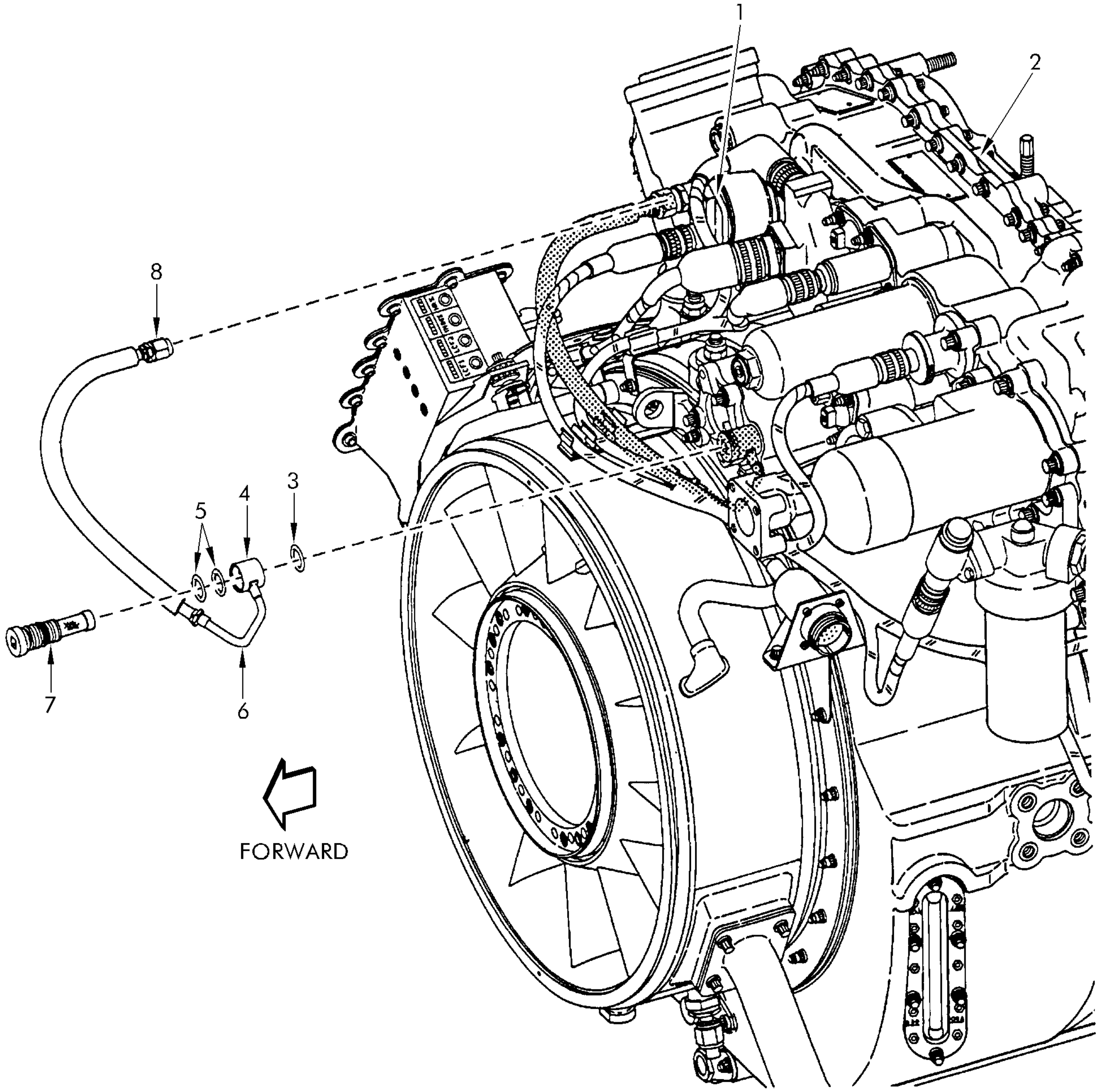
CAUTION

Preformed packing (3) must be removed before pulling screen (7) through connector (4) on tube (6). Failure to do this may result in damage to screen.

d. Remove and discard packing (3).

e. Pull screen (7) through connector (4) of tube (6).

f. Remove and discard packings (5) from screen.



1. Oil Pressure Sensor
2. Accessory Gearbox
3. Preformed Packing
4. Connector
5. Preformed Packing (Qty-2)
6. B-Sump Delta Pressure Tube
7. B-Sump Scavenge Screen
8. Coupling Nut

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Figure 8-39. *(T701)* ***B-Sump Delta Pressure Tube; Removal and Installation***

8-156. (T701C, T701D) Removal of B-Sump Delta Pressure Tube.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

a. Using two wrenches, disconnect coupling nut (1, fig. 8-40) from oil pressure sensor (2).

b. Remove bolt (3) from clamp (10).

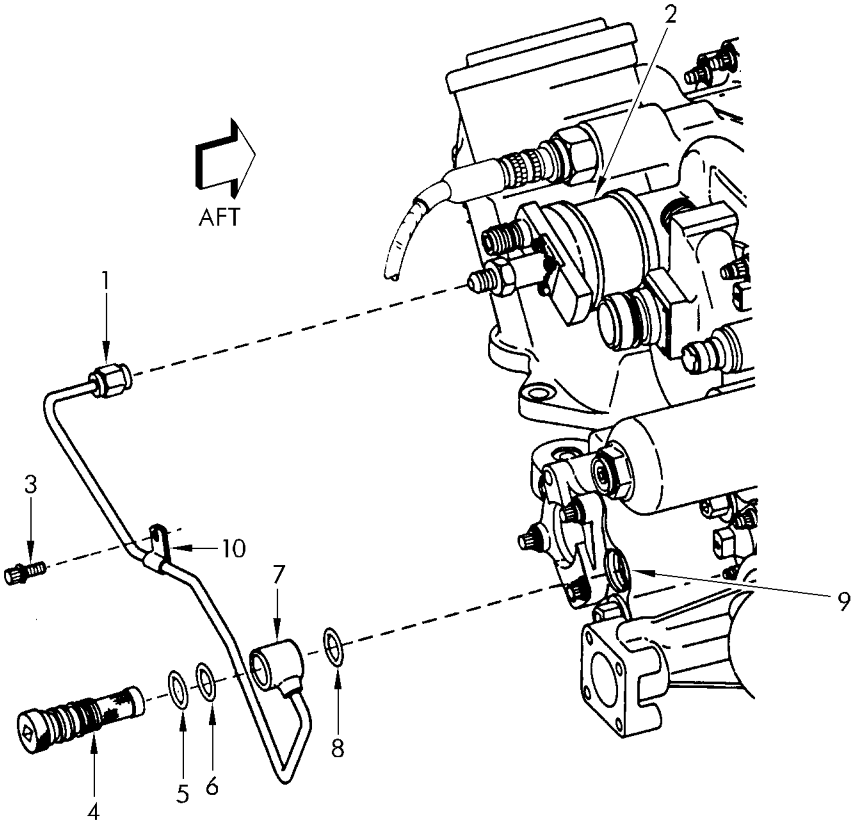
c. Loosen scavenge screen (4); then remove scavenge screen and B-sump delta pressure tube (7) as an assembly from accessory gearbox port (9).

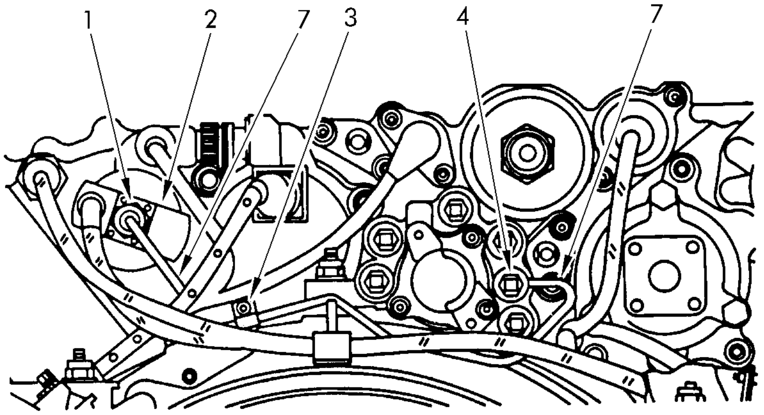
d. Remove and dispose of packing (8).

e. While holding tube (7), remove scavenge screen (4).

f. Remove and dispose of packings (5, 6).

8-157. (T701, T701C, T701D) Cleaning of B-Sump Delta Pressure Tube. See paragraph H-23, Appendix H.





1. Coupling Nut
2. Oil Pressure Sensor
3. Bolt
4. Scavenge Screen
5. Packing
6. Packing
7. B-Sump Delta Pressure Tube
8. Packing
9. Accessory Gearbox Port
10. Clamp

VIEW FORWARD LOOKING AFT

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Figure 8-40. ***(T701C, T701D)*** *B-Sump Delta Pressure Tube; Removal and Installation*

8-158. (T701, T701C, T701D) Inspection of B-Sump Delta Pressure Tube. See table 8-19.

Table 8-19. (T701, T701C, T701D) Inspection of B-Sump Delta Pressure Tube

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
B-sump delta pressure tube (fig. 8-41) for:			
a. **(T701)** Nicks, cuts, gouges, and abrasions on silicone sleeve (6).	Any number, 0.060 inch deep, if wire braid is not visible.	Any number, if wire braid is undamaged, and if silicone sleeve is not torn or missing.	Repair silicone sleeve (para 8-160).
b. **(T701)** Drying, cracking, or charring of silicone sleeve (6) (exposure to 500°F or higher).	Not allowed.	Not repairable.	Replace B-sump delta pressure tube (para 8-161).
c. Connector (4) for:			
(1) High metal at connector ends (2).	Not allowed.	Any amount, if 75% of original surface remains undamaged.	Remove high metal (para H-21, Appendix H).
(2) Nicks and scratches on sealing surfaces (3) and chamfers (5).	Any number, 0.003 inch deep without sharp edges.	Not repairable.	Replace B-sump delta pressure tube (para 8-161).
d. Damaged coupling nut (1) and tubing.	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
e. **(T701C, T701D)** Clamp (8) for cracks in parent metal or in braze.	Not allowed.	Not repairable.	Replace B-sump delta pressure tube (para 8-161).

8-159. (T701, T701C, T701D) Testing of B-Sump Delta Pressure Tube (AVIM). See paragraph H-25, Appendix H.

8-160. (T701, T701C, T701D) Repair of B-Sump Delta Pressure Tube. Repair silicone sleeve (6, fig. 8-41) on B-sump delta pressure tube as follows:

WARNING

Isopropyl Alcohol TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

a. Wipe damaged area with a lint-free cloth dampened with isopropyl alcohol (item 3, Appendix D). Allow area to dry for 15-20 minutes.

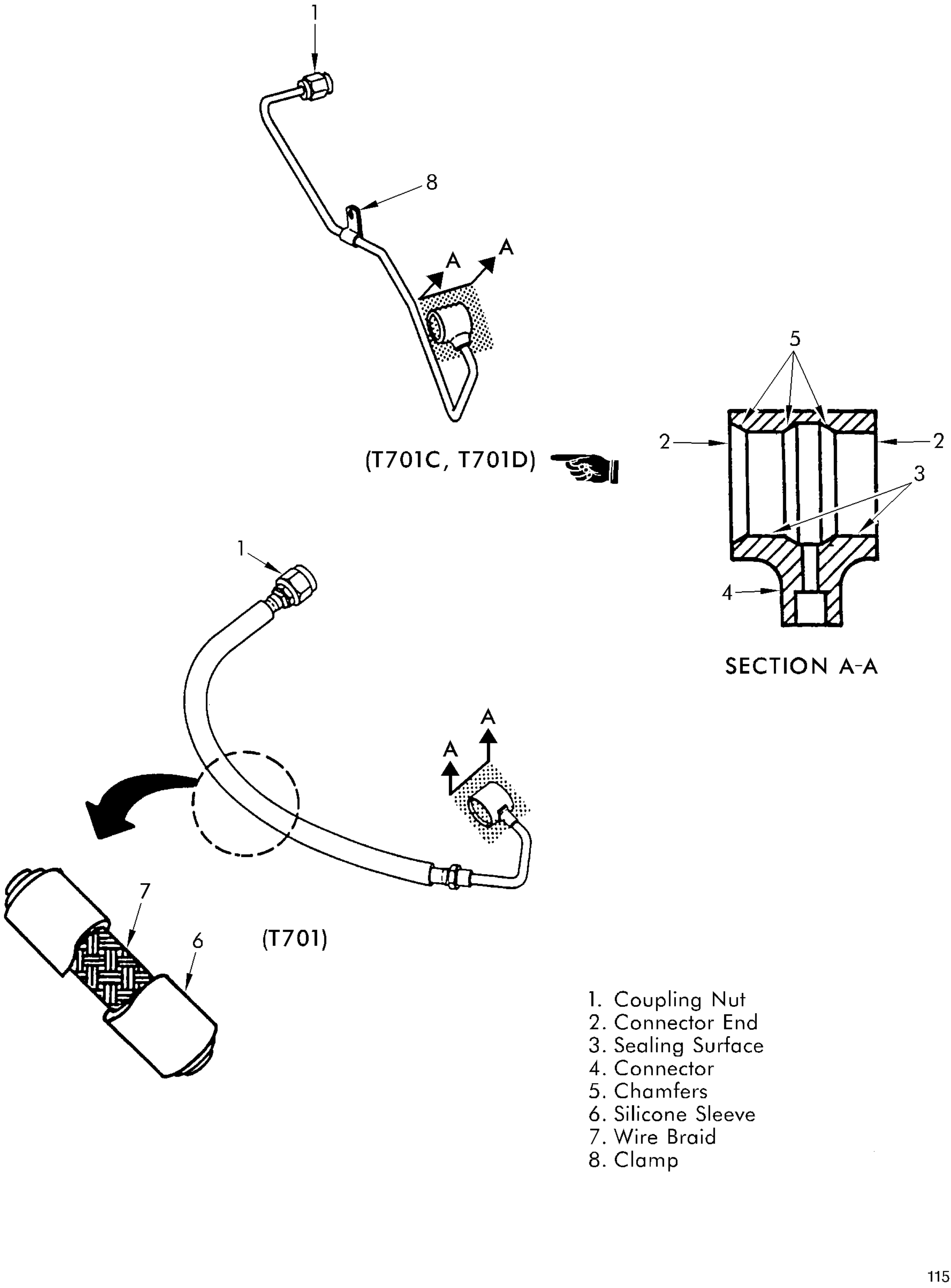


Figure 8-41. ***(T701, T701C, T701D)*** *B-Sump Delta Pressure Tube; Inspection*

WARNING

RTV Silicone Rubber Adhesive/Sealant
MIL-A-46106 or MIL-A-46106A
RTV-60 Silicone Rubber Potting Compound
A-A-56023

- Vapor released during curing is combustible. Do not use near open flames, near welding areas, or on hot surfaces.
- Vapor is corrosive. Contact of vapor with skin or eyes will cause burns. Inhalation of vapor may cause severe nose and throat irritation; repeated inhalation may result in chronic bronchitis.
- If any vapor contacts skin or eyes, immediately flush affected area thoroughly with water. If vapors cause irritation, go to fresh air. Get medical attention.
- When mixing uncured rubber, and during curing of rubber wear approved respirator, gloves, and goggles or face shield.

b. Fill damaged area with RTV sealant (item 96, Appendix D). When repairing cuts, bend hose slightly to open the cut, and then work the sealant into all areas.

c. Air-dry repaired area at room temperature for 24 hours.

8-161. (T701) Installation of B-Sump Delta Pressure Tube.

a. Install B-sump delta pressure tube (6, fig. 8-39) and B-sump scavenge screen (7) as follows:

(1) Install two preformed packings (5) into two packing grooves at forward end of screen (7).

(2) Insert screen (7) through connector (4) of tube (6).

(3) Install preformed packing (3) onto screen (7).

(4) Install screen (7) and tube (6), as an assembly, into accessory gearbox (2). Thread screen into gearbox.

b. Connect tube (6) to fitting on oil pressure sensor (1). Torque coupling nut (8) (60° wrench arc).

c. Push tube (6) into forward suspension lug, located at the 12 o'clock position on swirl frame.

d. Torque screen (7) to 145-150 inch-pounds.

e. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

8-162. (T701C, T701D) Installation of B-Sump Delta Pressure Tube.

a. Position B-sump delta pressure tube (7, fig. 8-40) with coupling nut (1) end towards oil pressure sensor (2).

b. Install packings (5, 6) onto scavenge screen (4).

c. Insert scavenge screen (4) into connector of tube (7).

d. Install packing (8) onto scavenge screen (4).

e. Insert scavenge screen (4) with tube (7) into accessory gearbox port (9).

f. Hand-tighten scavenge screen.

g. Connect coupling nut (1) onto fitting of oil pressure sensor (2). Hand-tighten coupling nut.

h. Install bolt (3) onto clamp (10). Hand-tighten bolt.

i. Torque scavenge screen (4) to 145-150 inch-pounds.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

j. Using two wrenches, tighten (60° wrench-arc) coupling nut (1).

k. Torque bolt (3) to 45-50 inch-pounds.

8-163. (T700, T701C, T701D) AXIS-G DRAIN TUBES.

8-164. (T700, T701C, T701D) Removal of Axis-G Drain Tubes.

a. Disconnect coupling nut on drain tube (6, fig 8-42) from drain lower tube (4).

b. Remove bolts (5) from brackets (9) and cushioned clamps (3).

c. Loosen drain fitting (1). Remove fitting (1) and tube (4).

d. Remove and discard packings (2).

e. Loosen bottom clamp (7) and remove drain tube (6).

f. Loosen top clamp (7) from drain seal cavity (10), and remove nonmetallic hose (8).

8-165. (T700, T701C, T701D) Installation of Axis-G Drain Tubes.

a. Install top clamp (7, fig. 8-42) and the nonmetallic hose (8) on the drain seal cavity (10). Tighten clamp.

b. Connect drain tube (6) on drain lower tube (4). Hand-tighten coupling nut.

c. Install packings (2) onto drain fitting (1) and tube (4).

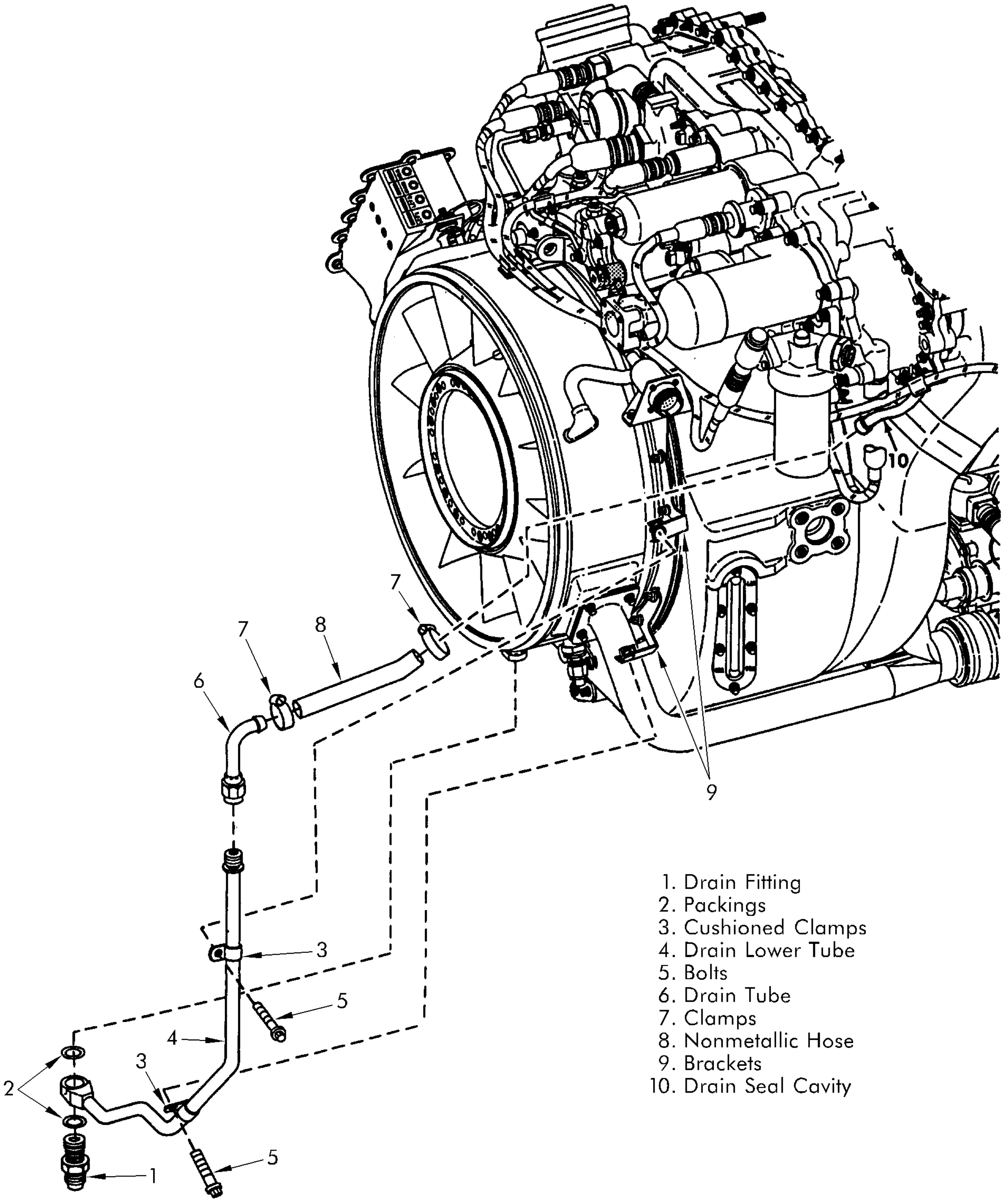
d. Insert drain fitting (1) with tube (4) into swirl frame port. Hand-tighten drain fitting (1).

e. Install drain tube (6) into nonmetallic hose (8), and secure with bottom clamp (7).

f. Install bolts (5) through cushioned clamps (3) to brackets (9). Hand-tighten bolts.

g. Tighten (60° wrench-arc) coupling nut and drain fitting (1).

h. Torque bolts (5) to 45-50 inch-pounds.



1. Drain Fitting
2. Packings
3. Cushioned Clamps
4. Drain Lower Tube
5. Bolts
6. Drain Tube
7. Clamps
8. Nonmetallic Hose
9. Brackets
10. Drain Seal Cavity

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Figure 8-42. ***(T700, T701C, T701D)*** *Axis-G Oil Drain Tubes; Removal and Installation*

CHAPTER 9

DRIVE SYSTEM

(Not Applicable)

CHAPTER 10

MISCELLANEOUS EQUIPMENT/AIR SYSTEM

10-1. CHAPTER OVERVIEW.

This chapter contains instructions for removing, cleaning, inspecting, repairing, and installing the air system components to the extent allowed by the maintenance allocation chart (MAC).

Data peculiar to engine models T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D is identified throughout the manual as follows:

NOTE

Data common to all engine models is not identified.

Engine Model	Identification
T700-GE-700	**(T700)**
T700-GE-701	**(T701)**
T700-GE-701C	**(T701C)**
T700-GE-701D	**(T701D)**
T700-GE-700 and T700-GE-701	**(T700, T701)**
T700-GE-700, and T700-GE-701C	**(T700, T701C)**
T700-GE-701C and T700-GE-701D	**(T701C, T701D)**
T700-GE-701, T700-GE-701C and T700-GE-701D	**(T701, T701C, T701D)**

10-2. CHAPTER INDEX.

Maintenance procedures in this chapter are arranged as follows:

10-3. PRELIMINARY INSTRUCTIONS.

Before starting any of the following procedures, read the general maintenance practices and inspection procedures in Appendix H.

a. When removing or installing parts, prevent entry of foreign objects into oil and air passages, and avoid damaging electrical connectors.

b. Do not use tape to cover oil passages or openings. Tape adhesive is soluble in oil and can cause contamination. Use clean, dry protective caps to cover electrical connectors and other openings.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

WARNING

Asbestos

This engine may contain small amounts of asbestos. When working with this engine, the following precautions must be rigidly adhered to:

- Before any maintenance activities are undertaken, review the illustrated parts breakdown/catalog index to determine if the hardware to be worked on or used contains asbestos.
- Whenever mechanical removal of material, such as machining, grinding, buffing, drilling, sanding or any type of material build-up on parts that contain asbestos is necessary, appropriate personal protective equipment must be worn, and national environmental controls required for the handling of asbestos-containing material must be complied with.
- Before handling, replacing, or disposing of asbestos-containing hardware, appropriate personal protective equipment and national environmental controls must be strictly adhered to for handling asbestos-containing hardware.

c. Do not damage preformed packing grooves when removing or installing preformed packings. Unless otherwise specified, lubricate packings and grooves with a light coat of lubricating oil (item 85 or 87, Appendix D) before installing packings. Ultrachem fluid no. 1 (item 117, Appendix D) may be used as an alternate lubricant for packings and grooves.

d. Inspect replacement parts for serviceability before installation.

e. Always use a backup wrench on fittings when removing or installing hoses and tubes.

f. When connecting hoses or tubes, use wrench- arc tightening method (para H-14, Appendix H).

g. Before connecting electrical connectors, refer to paragraph H-7, Appendix H for proper procedure.

h. Observe the following inspection rules:

(1) In the inspection tables, some requirements apply only when the part is removed from the engine. If the part to be inspected is installed on the engine, inspect only for those defects that can be seen without removing the part. Do not remove the part just to inspect it.

(2) When inspection limits are in decimals, compare size of defect with size of thickness gage (feeler gage).

10-4. (T700) P3 HOSE AND TUBE ASSEMBLY.

10-5. (T700) Removal of P3 Hose and Tube Assembly.

a. Disconnect P3 hose and tube assembly (2, fig. 10-1) from POU manifold union (1), from HMU union (4), and from midframe reducer (3).

b. Remove P3 hose and tube assembly. Cap tube ends, using protective caps (item 24, Appendix D).

10-6. (T700) Cleaning of P3 Hose and Tube Assembly. See paragraph H-23, Appendix H.

10-7. (T700) Inspection of P3 Hose and Tube Assembly. See paragraph H-24, Appendix H.

10-8. (T700) Testing of P3 Hose and Tube Assembly (AVIM). See paragraph H-25, Appendix H.

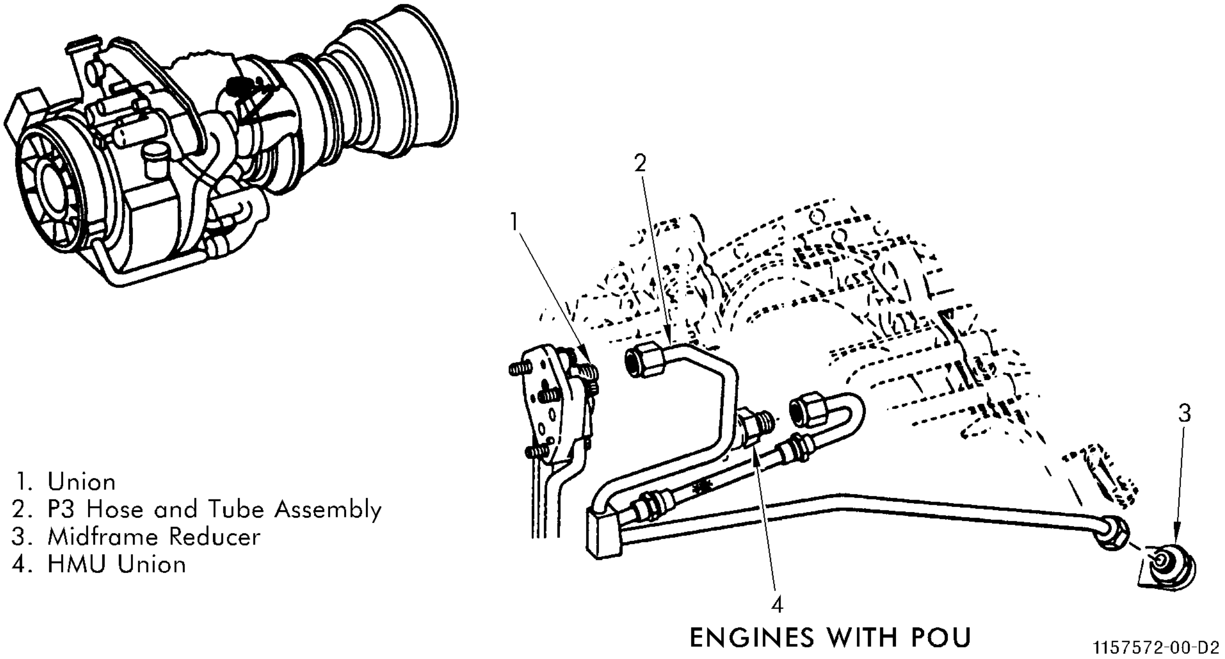


Figure 10-1. (T700) P3 Hose and Tube Assembly; Removal and Installation

10-9. (T700) Installation of P3 Hose and Tube Assembly.

a. Loosely connect P3 hose and tube assembly (2, fig. 10-1) to union (1) on POU manifold assembly, to HMU union (4), and to midframe reducer (3).

b. Hold P3 hose and tube assembly to prevent it from rotating, and tighten (60° wrench arc) coupling nut at union (1) on POU manifold assembly. Tighten (60° wrench arc) coupling nut at the midframe reducer (3).

c. Hold U-shaped section of P3 hose and tube assembly at HMU end, and tighten (60° wrench arc) coupling nut at HMU union (4).

d. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

10-10. ANTI-ICING BLEED DUCT.

10-11. Removal of Anti-Icing Bleed Duct (AVIM).

a. Remove anti-icing bleed and start valve (para 10-26).

b. Remove bolt (4, fig. 10-2), nut (7), and key-head screw (10) from anti-icing valve forward bracket (5), and then remove bracket.

c. Remove two nuts (9, 12) from scroll case studs and remove bracket (11).

d. Remove four bolts (15).

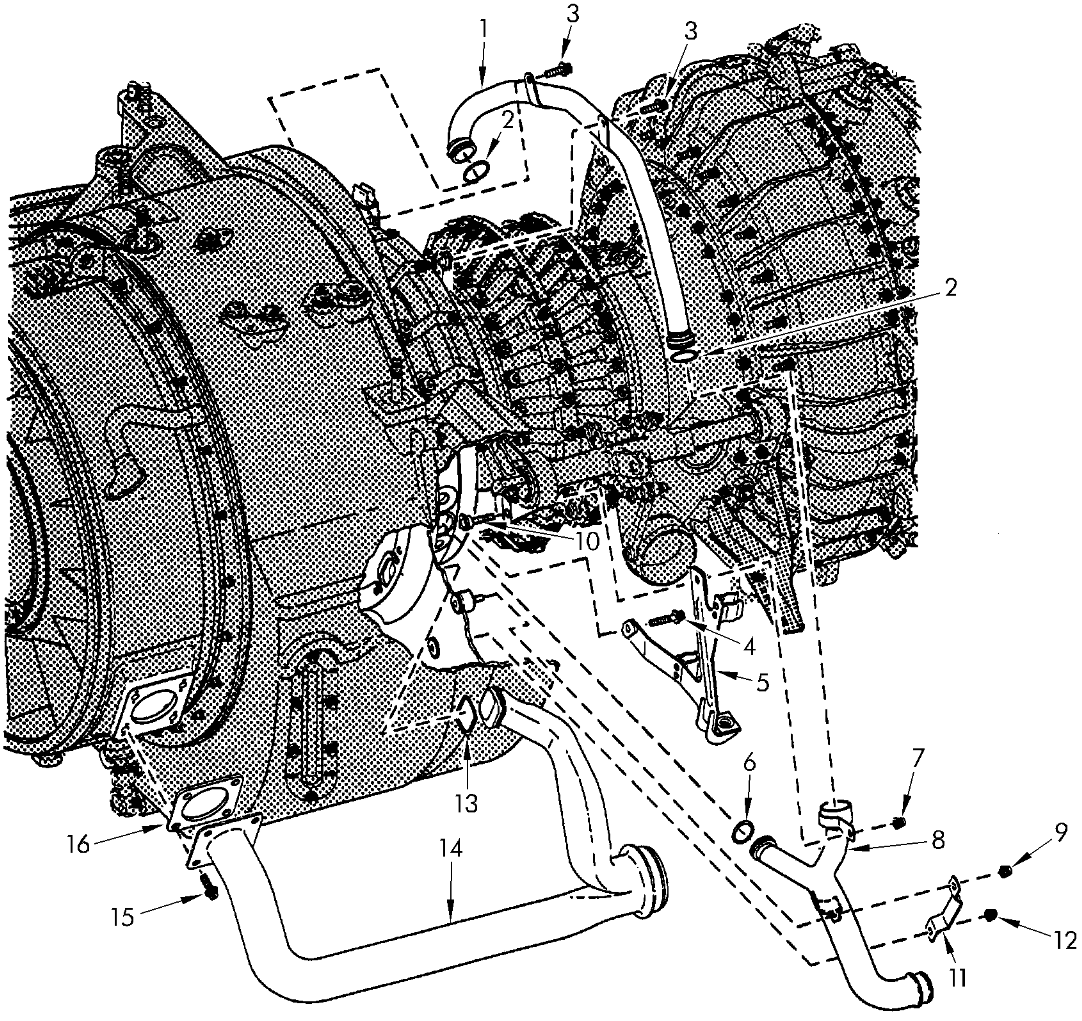
WARNING

Asbestos

> The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

e. Slide anti-icing bleed duct (14) aft to remove it from scroll case. Remove and discard packing (13) and gasket (PN 3032T42P01 only) (16).

f. Cover openings in duct using barrier material (item 12, Appendix D) and secure material with adhesive tape (item 107, Appendix D).



1. IGV Anti-Icing Feed Tube
2. Preformed Packings (Qty-2)
3. Bolt
4. Bolt
5. Anti-Icing Valve Forward Bracket
6. Preformed Packing
7. Nut
8. Anti-Icing IGV Duct
9. Nut
10. Key-Head Screw
11. Bracket
12. Nut
13. Preformed Packing
14. Anti-Icing Bleed Duct
15. Bolt
16. Anti-Ice Line Gasket

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Figure 10-2. Anti-Icing Ducts; Removal and Installation

10-12. Cleaning of Anti-Icing Bleed Duct. See paragraph H-23, Appendix H.

10-13. Inspection of Anti-Icing Bleed Duct. See table 10-1.

Table 10-1. Inspection of Anti-Icing Bleed Duct

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Anti-icing bleed duct (fig. 10-3) for:			
a. Damage.	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
b. AVIM: Nicks and scratches on:			
(1) Floor of packing groove.	Any number, 0.005 inch deep, without sharp edges.	Not repairable.	Replace duct (para 10-14).
(2) Walls of packing groove.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace duct (para 10-14).

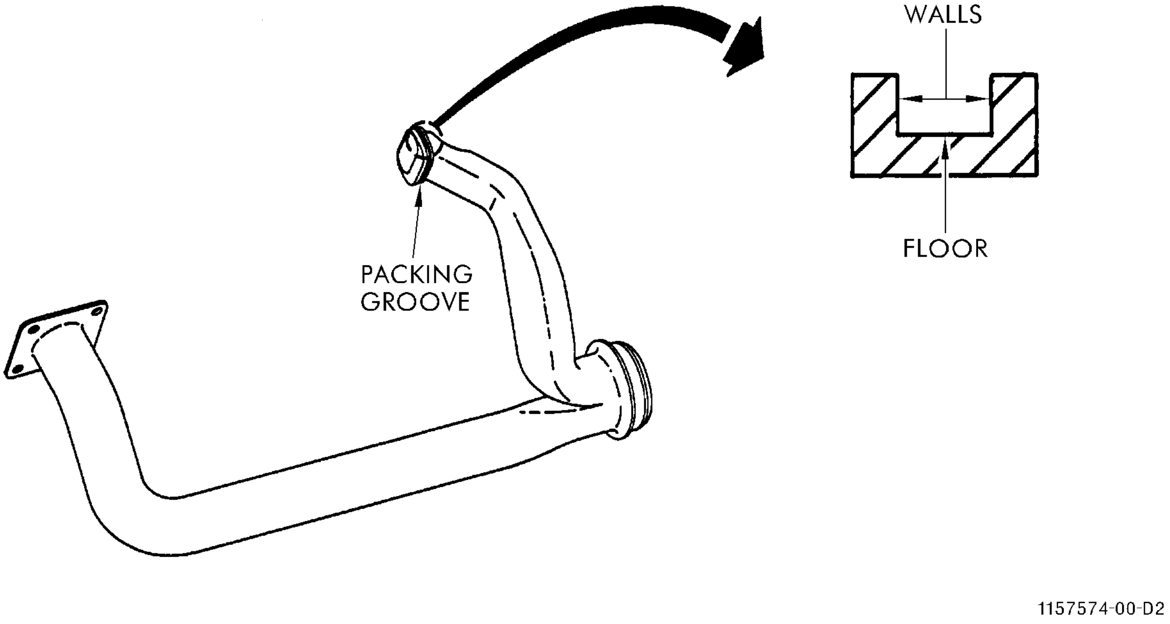


Figure 10-3. Anti-Icing Bleed Duct; Inspection

10-14. Installation of Anti-Icing Bleed Duct (AVIM).

a. Install packing (13, fig. 10-2) on bleed duct (14).

b. Position duct as shown, and insert aft end of duct into scroll port. Secure aft end of duct to scroll case studs using bracket (11) and two nuts (9, 12).

WARNING

Asbestos

> The following procedure may involve a part that contains asbestos, which is highly toxic to skin, eyes, and respiratory tract. Read general information before proceeding, and adhere to all site safety and environmental controls concerning asbestos. Otherwise, personal injury may result.

c. Position gasket (16) as shown. Secure duct and gasket using four bolts (15).

d. Torque bolts (15) and nuts (9, 12) to 45-50 inch-pounds.

e. Position bracket (5) as shown. Secure bracket, using bolt (4), key-head screw (10), and nut (7).

f. Torque bolt (4) and nut (7) to 45-50 inch-pounds.

g. Install anti-icing bleed and start valve (para 10-31).

h. Make required engine checks listed in table 1-39.

10-15. ANTI-ICING IGV DUCT.

10-16. Removal of Anti-Icing IGV Duct (AVIM).

a. Remove anti-icing bleed and start valve (para 10-26).

b. Remove key-head screw (10, fig. 10-2) and nut (7) from top of anti-icing valve forward bracket (5).

c. Remove nut (9) from upper scroll case stud and remove duct (8) by pulling it down and out. Remove and discard packings (2, 6).

d. Cap or plug openings in tube using protective caps (item 22, 29, 30, Appendix D).

10-17. Cleaning of Anti-Icing IGV Duct. See paragraph H-23, Appendix H.

10-18. Inspection of Anti-Icing IGV Duct. See table 10-2.

Table 10-2. Inspection of Anti-Icing IGV Duct

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Anti-icing IGV duct (fig. 10-4) for:			
a. Damage.	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
b. AVIM: Nicks and scratches on:			
(1) Floor of packing groove.	Any number, 0.005 inch deep, without sharp edges.	Not repairable.	Replace duct (para 10-19).
(2) Walls of packing groove.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace duct (para 10-19).

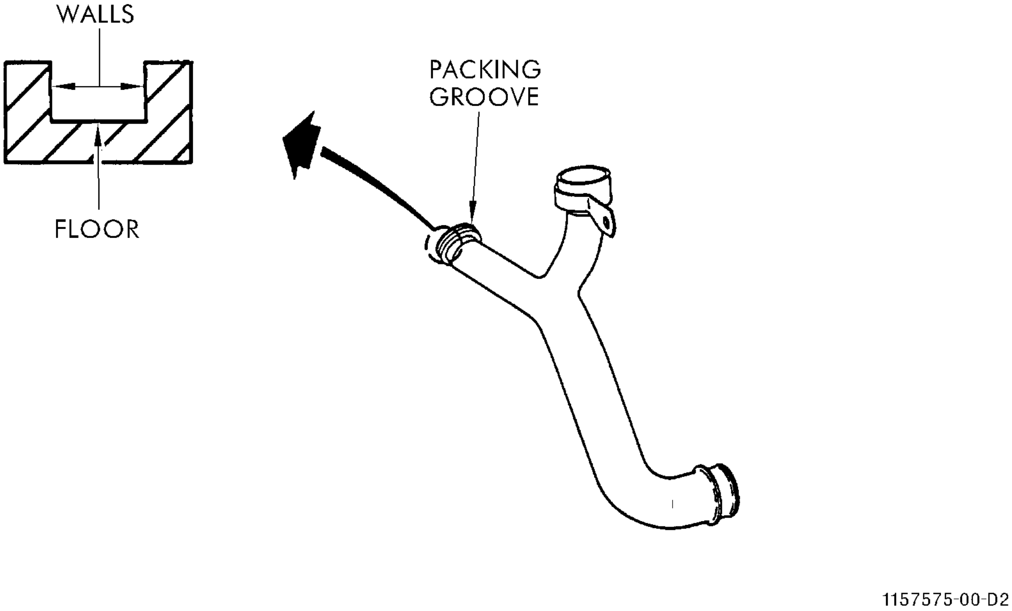


Figure 10-4. Anti-Icing IGV Duct; Inspection

10-19. Installation of Anti-Icing IGV Duct (AVIM).

a. Install packing (6, fig. 10-2) in groove on end of anti-icing IGV duct (8), and install packing (2) on end of IGV anti-ice feed tube (1).

b. Position duct as shown.

c. Secure duct to anti-icing valve forward bracket (5) using key-head screw (10) and nut (7).

d. Secure duct to upper scroll case stud on aft side of bracket (11), using nut (9).

e. Torque nuts (7, 9) to 45-50 inch-pounds.

f. Install anti-icing bleed and start valve (para 10-31).

g. Make required engine checks listed in table 1-39.

10-20. ANTI-ICING IGV FEED TUBE.

10-21. Removal of Anti-Icing IGV Feed Tube (AVIM).

a. Remove HMU (para 6-40).

b. Remove two bolts (3, fig. 10-2) that secure feed tube (1) to brackets on compressor case forward flange.

c. Remove tube (1) and remove and discard two packings (2).

d. Cap ends of tube using protective caps (item 34, Appendix D).

10-22. Cleaning of Anti-Icing IGV Feed Tube. See paragraph H-23, Appendix H.

10-23. Inspection of Anti-Icing IGV Feed Tube.

See table 10-3.

Table 10-3. Inspection of Anti-Icing IGV Feed Tube

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
Anti-icing IGV feed tube (fig. 10-5) for:			
a. Damage.	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
b. AVIM: Nicks and scratches on:			
(1) Floor of packing groove.	Any number 0.005 inch deep, without sharp edges.	Not repairable.	Replace tube (para 10-24).
(2) Walls of packing groove.	Any number, 0.010 inch deep, without sharp edges.	Not repairable.	Replace tube (para 10-24).

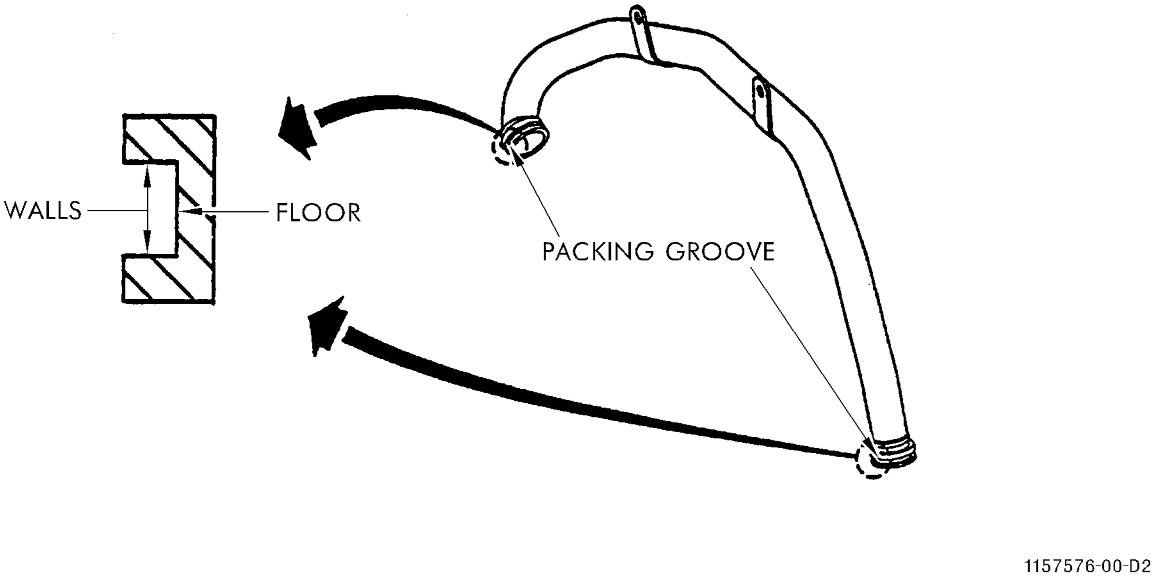


Figure 10-5. Anti-Icing IGV Feed Tube; Inspection

10-24. Installation of Anti-Icing IGV Feed Tube (AVIM).

CAUTION

To protect packings, do not install anti-icing IGV feed tube until after anti-icing IGV duct is installed.

a. Install two packings (2, fig. 10-2) on feed tube (1).

b. Position feed tube as shown, and secure it using two bolts (3). Torque bolts to 45-50 inch-pounds.

c. Install HMU (para 6-44).

d. Make required engine checks listed in table 1-39.

10-25. ANTI-ICING BLEED AND START VALVE, ANTI-ICING SEAL HOUSINGS, ANTI-ICING SEAL RETAINER, (ALLIED SIGNAL (GARRETT)) LANYARD AND COUPLING ASSEMBLY, AND LANYARD AND CLIP ASSEMBLY.

10-26. Removal of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housing, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly.

WARNING

Removing Anti-Icing Bleed
and Start Valve

- The anti-icing bleed and start valve can reach a temperature of about 300°F (149°C) during engine operation.
- If engine has been operating, allow valve to cool before removing it with bare hands.

a. Disconnect electrical connector (green cable) (3, fig. 10-6, sheet 1). Cap electrical connector using clean, dry protective cap (item 27, Appendix D).

b. Using a 7/16-inch open-end wrench (view A, sheet 2), pull out quick-disconnect pin (9, sheet 1) to disengage valve actuating linkage (10) and actuating shaft (11). Do not remove pin from actuating shaft.

c. Remove clips of **(Eaton (Consolidated Control))** lanyard and clip assembly (4).

d. Slide **(Eaton (Consolidated Control))** anti-icing seal housing (6) and **(Eaton (Consolidated Control))** anti-icing seal retainer (2) aft, away from anti-icing bleed duct (7).

e. Loosen three captive bolts (1).

f. Remove anti-icing bleed and start valve (5). Leave anti-icing seal housing (8) on compressor casing outlet.

g. If valve is going to be replaced, do the following:

(1) **(Eaton (Consolidated Control))** Remove seal housing (6) from valve.

(2) **(Eaton (Consolidated Control))** Remove seal retainer (2) from valve.

(3) **(Eaton (Consolidated Control))** Remove lanyard and clip assembly (4) by passing small clip through hole in valve (view B).

(4) Remove **(Allied Signal (Garrett))** lanyard and clip assembly (12) from valve.

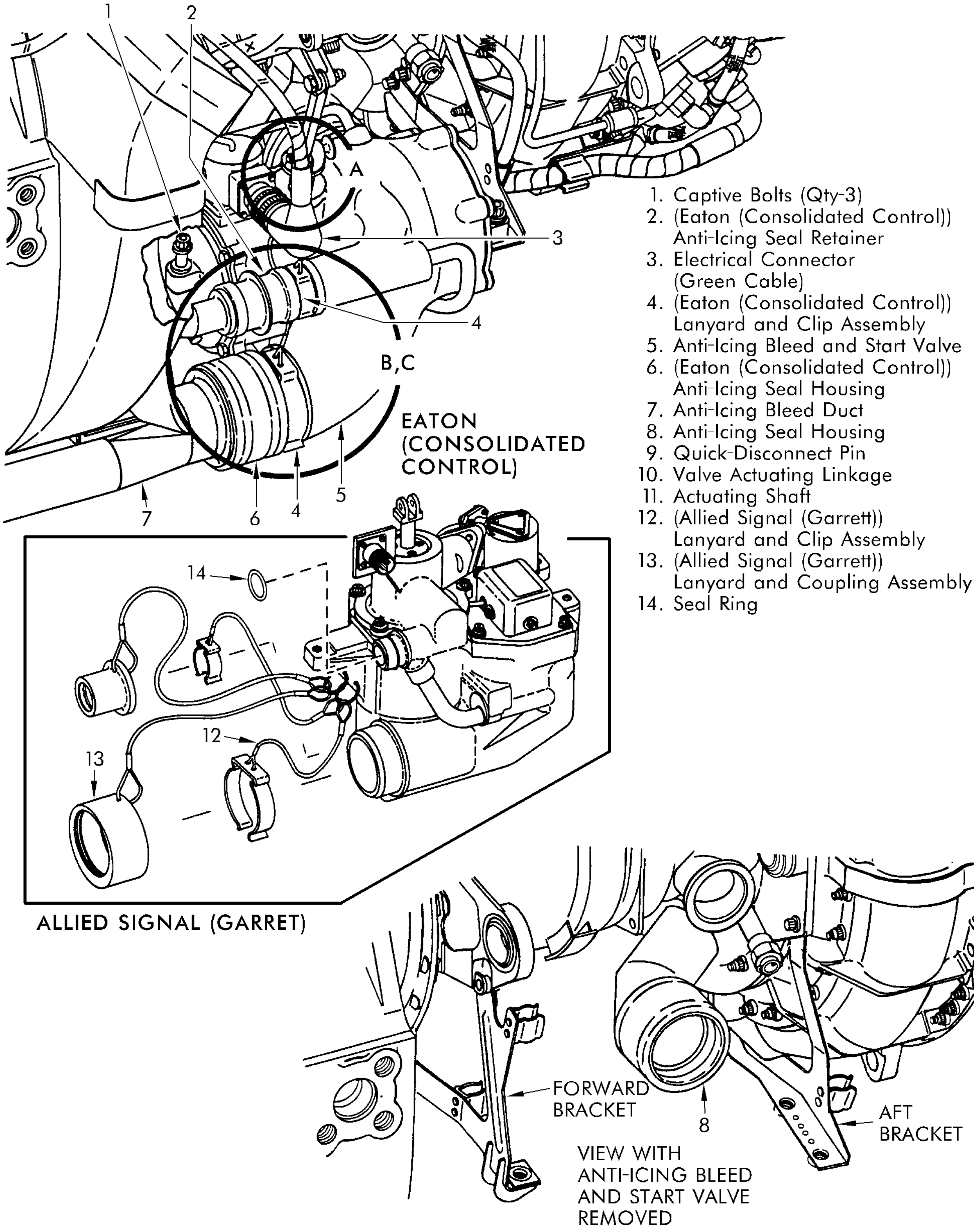
(5) Remove **(Allied Signal (Garrett))** lanyard and coupling assembly (13) from valve.

(6) Cover openings on engine and valve using barrier material and adhesive tape (item 12 or 107, Appendix D).

10-27. Cleaning of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly.

a. Check electrical connector for moisture or contamination. If no moisture or contamination is found in electrical connector, do not clean it. Install clean, dry protective cap (item 25, Appendix D).

b. If moisture or contamination is found in electrical connector, clean it (para H-11, Appendix H).



1. Captive Bolts (Qty-3)
2. (Eaton (Consolidated Control)) Anti-Icing Seal Retainer
3. Electrical Connector (Green Cable)
4. (Eaton (Consolidated Control)) Lanyard and Clip Assembly
5. Anti-Icing Bleed and Start Valve
6. (Eaton (Consolidated Control)) Anti-Icing Seal Housing
7. Anti-Icing Bleed Duct
8. Anti-Icing Seal Housing
9. Quick-Disconnect Pin
10. Valve Actuating Linkage
11. Actuating Shaft
12. (Allied Signal (Garrett)) Lanyard and Clip Assembly
13. (Allied Signal (Garrett)) Lanyard and Coupling Assembly
14. Seal Ring

Figure 10-6. Anti-Icing Bleed and Start Valve; Removal and Inspection (Sheet 1 of 2)

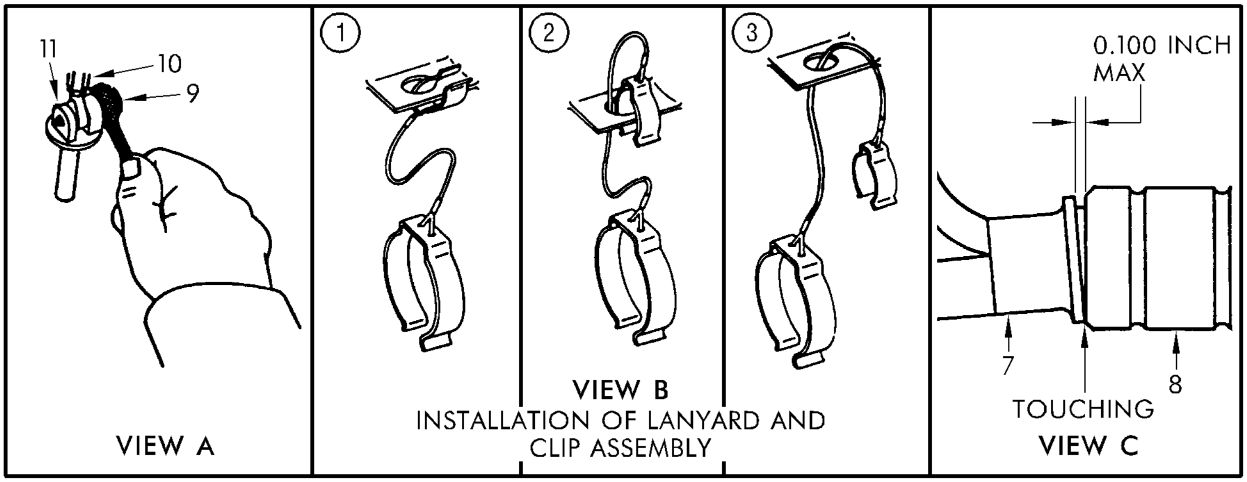


Figure 10-6. Anti-Icing Bleed and Start Valve; Removal and Inspection (Sheet 2 of 2)

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

c. Flush or spray-wash external surfaces with dry cleaning solvent (item 99, Appendix D) to remove grease, oil, and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

d. Dry all external surfaces using dry, filtered compressed air.

10-28. Inspection of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly.

See table 10-4.

Table 10-4. Inspection of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Housing of anti-icing bleed and start valve (5, fig. 10-6, sheet 1) for:			
(1) Visible cracks.	None allowed.	Not repairable.	Replace valve (para 10-31).
(2) Nicks, dents, scratches on sealing area.	Any number not detectable by feel. High metal is not allowed.	Same as usable limits, with high metal.	Blend high metal to usable limit, using fine abrasive cloth (item 52, Appendix D) (para H-21, Appendix H).
(3) Nicks, dents, scratches on other areas.	Any number, 0.030 inch deep, without high metal.	Same as usable limits, with high metal.	Blend high metal (para H-21, Appendix H).
(4) Leaks.	Not allowed.	Not repairable.	Replace valve (para 10-31).
b. Electrical connector (3) for:			
(1) Bent socket pins.	Not allowed.	Up to 1/8 inch out-of-position.	Straighten pin.
(2) Kinked or sharply bent pins.	Not allowed.	Not repairable.	Replace valve (para 10-31).
(3) Damaged threads.	Any amount, without high metal, if connector can be assembled normally with its mating part.	Any amount that can be reworked to usable limits.	Blend high metal (para H-21, Appendix H).
c. Captive bolts (1) for:			
(1) Missing threads.	Not allowed.	Not repairable.	Replace bolt (para H-6, Appendix H).
(2) Nicks or burred threads.	Any amount that does not prevent installation. No high metal.	Any amount.	AVUM: Replace valve (para 10-31). AVIM: Remove high metal. Chase threads.

Table 10-4. Inspection of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
d. Captive bolt flanges for damaged threads.	Any number of missing threads with no crossed threads or loose material.	Any number with crossed threads or loose material.	AVUM: Replace valve (para 10-31). AVIM: Remove loose material. Chase threads to remove crossed threads, using a 0.250 × 28 UNF tap.
e. Anti-icing seal housings **(Eaton (Consolidated Control))** (6), and (8) for:			
(1) Distortion and dents on both ends of housing where seals seat.	Not allowed.	Not repairable.	Replace seal housing (para 10-31).
(2) Distortion and dents on remaining areas.	Any amount that does not prevent seal housing from seating properly on valve and on respective duct.	Not repairable.	Replace seal housing (para 10-31).
(3) Cracks.	None allowed.	Not repairable.	Replace seal housing (para 10-31).
(4) Cuts, breaks, or nicks on seals.	Not allowed.	Not repairable.	Replace seal housing (para 10-31).
(5) Flattened or distorted seals, including outer cover of seal and seal spring.	Not allowed.	Not repairable.	Replace seal housing (para 10-31).
f. **(Eaton (Consolidated Control))** Anti-icing seal retainer (2) for:			
(1) Distortion and dents on both sides at retainer housing where seals seat.	Not allowed.	Not repairable.	Replace retainer (para 10-31).
(2) Distortion and dents on remaining area.	Any amount that does not prevent seal housing from seating properly on valve and on respective duct.	Not repairable.	Replace retainer (para 10-31).
(3) Cracks.	None allowed.	Not repairable.	Replace retainer (para 10-31).

Table 10-4. Inspection of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(4) Cuts, breaks, nicks, or twists on seal and seal ring.	Not allowed.	Not repairable.	Replace seal (para 10-30).
g. **(Allied Signal (Garrett))** Lanyard and coupling assembly (13):			
(1) Distortion and dents on both ends of housing where seals seat.	Not allowed.	Not repairable.	Replace **(Allied Signal (Garrett))** lanyard and coupling assembly (para 10-31).
(2) Distortion and dents on remaining areas.	Any amount that does not prevent seal housing from seating properly on valve and on respective duct.	Not repairable.	Replace **(Allied Signal (Garrett))** lanyard and coupling assembly (para 10-31).
(3) Cracks.	None allowed.	Not repairable.	Replace **(Allied Signal (Garrett))** lanyard and coupling assembly (para 10-31).
(4) Cuts, breaks, or nicks on seals.	Not allowed.	Not repairable.	Replace **(Allied Signal Garrett))** lanyard and coupling assembly (para 10-31).
(5) Flattened or distorted seals, including outer cover of seal and seal spring.	Not allowed.	Not repairable.	Replace **(Allied Signal Garrett))** lanyard and coupling assembly (para 10-31).
h. **(Eaton (Consolidated Control))** Lanyard and clip assembly (4) for:			
(1) Distorted clips.	Snug fit on valve.	Any amount that can be bent to fit snugly on valve.	Bend to usable limits.
(2) Frayed or broken lanyard.	Not allowed.	Not repairable.	Replace assembly (para 10-31).

Table 10-4. Inspection of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
i. Quick-disconnect pin (fig. 10-7).			
(1) Pin shaft (1) for:			
(a) Broken or missing lockring (3).	Not allowed.	Not repairable.	Replace pin (para 10-31).
(b) Nicks, scratches, or wear.	Not allowed if they can be felt with fingernail.	Not repairable.	Replace pin (para 10-31).
(c) Cracks.	None allowed.	Not repairable.	Replace pin (para 10-31).
(2) Pinhead (2) for:			
(a) Nicks, scratches, dents, and gouges.	Any number, 1/32 inch deep.	Not repairable.	Replace pin (para 10-31).
(b) Bends.	Any amount, 1/16 inch from original shape.	Any amount that can be removed to meet usable limits.	Replace pin (para 10-31).
(c) Cracks.	None allowed.	Not repairable.	Replace pin (para 10-31).
j. External tubes for:			
(1) Nicks, dents, scratches.	Any number, 0.020 inch deep, with no high metal.	Same as usable limits, with high metal.	Blend high metal (para H-21, Appendix H).
(2) Cracks or breaks.	None allowed.	Not repairable.	Replace valve (para 10-31).
k. Vent tube for:			
(1) Nicks, dents, scratches.	Any number, 0.005 inch deep, with no high metal.	Same as usable limits, with high metal.	Blend high metal (para H-21, Appendix H).
(2) Cracks, breaks, or crushed tubes.	Not allowed.	Not repairable.	Replace valve (para 10-31).

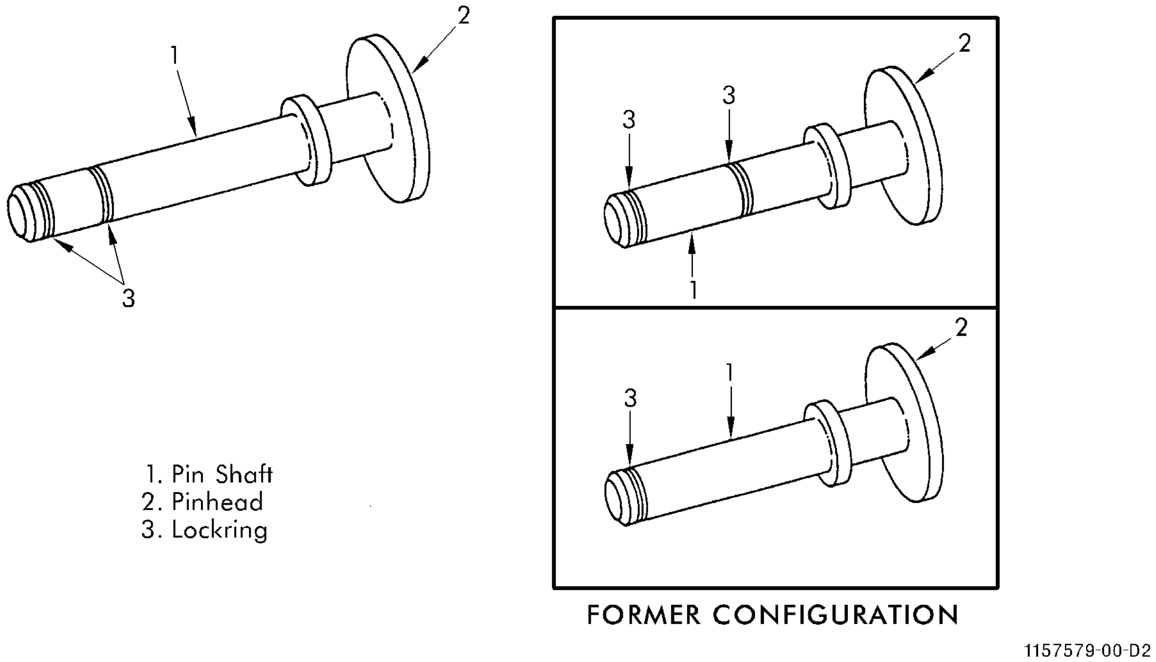


Figure 10-7. Quick-Disconnect Pin; Inspection

10-29. Repair of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainer, and Lanyard and Clip Assembly. Repair is limited to that specified in corrective action column of table 10-4.

10-30. (T700, T701) Repair of Anti-Icing Seal Housing. See fig. 10-8.

a. Removal of seals from housing:

CAUTION

Do not bend anti-icing seals when removing or inserting them. Squeeze OD of seal only enough to remove or insert it in bore. Excessive bending will deform seals and cause leaks.

(1) Push seal towards center of housing.

(2) Gently squeeze OD of seal at any one diameter, and tilt seal at angle to remove it from bore of housing.

b. Installation of seals in housing:

(1) Install replacement seal by gently squeezing seal at any one diameter, and by tilting it enough to insert it in bore of housing.

(2) Pull innermost edge of seal back against outer lip of housing until seal seats all around lip as shown. Open sides of seal will face each other as shown in figure 10-8.

10-31. Installation of Anti-Icing Bleed and Start Valve, Anti-Icing Seal Housings, Anti-Icing Seal Retainers, (Allied Signal (Garrett)) Lanyard and Coupling Assembly, and Lanyard and Clip Assembly.

a. If not already on engine, install the following:

- Anti-icing bleed duct (para 10-14)
- Anti-icing IGV duct (para 10-19)

CAUTION

Be sure that seal housing (15, fig. 10-9) is installed on compressor case outlet.

b. **(Eaton (Consolidated Control Valve))** Install anti-icing bleed and start valve (4) as follows:

(1) Slide seal housing (9) and seal retainer (12) onto anti-ice bleed and start valve (4).

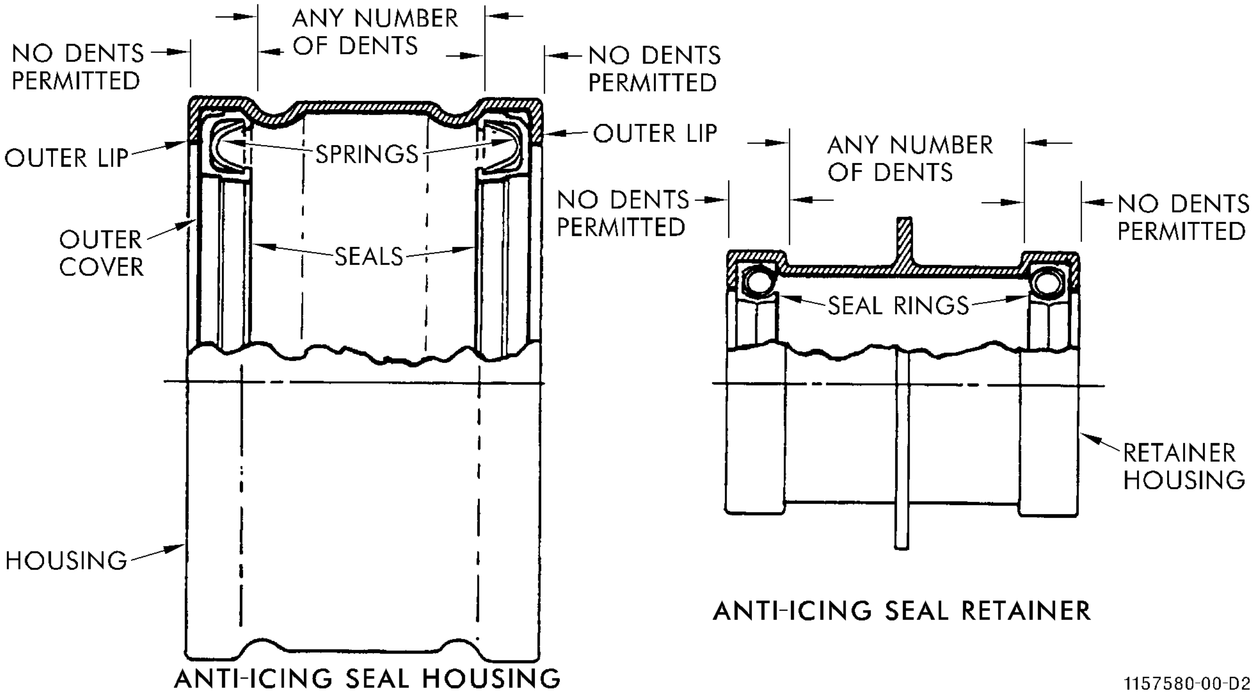


Figure 10-8. Anti-Icing Seal Retainer and Anti-Icing Seal Housing Seals; Removal and Installation

(2) Install lanyard and clip (13) on valve (4) by passing small clip (8, view A) through hole in valve.

(3) Back up two captive bolts (5) and captive bolt (14) into mounting bosses to keep bolts from interfering with positioning of valve.

(4) Position valve (4) between forward and aft brackets (16, 17); rotate valve, as necessary, to clear anti-icing bleed duct (10) and anti-icing IGV duct (11).

(5) Center the seal housing (15) between valve inlet and compressor case outlet (18).

(6) Install and hand-tighten electrical connector (green cable) (6).

(7) Tighten two captive bolts (5) on aft bracket (17). Tighten captive bolt (14) on forward bracket (16).

(8) Slide seal housing (9) and seal retainer (12) forward onto bleed duct (10) and IGV duct (11).

(9) Install lanyard and clip (13) onto valve (4) to hold housing (9) and retainer (12) in the forward position.

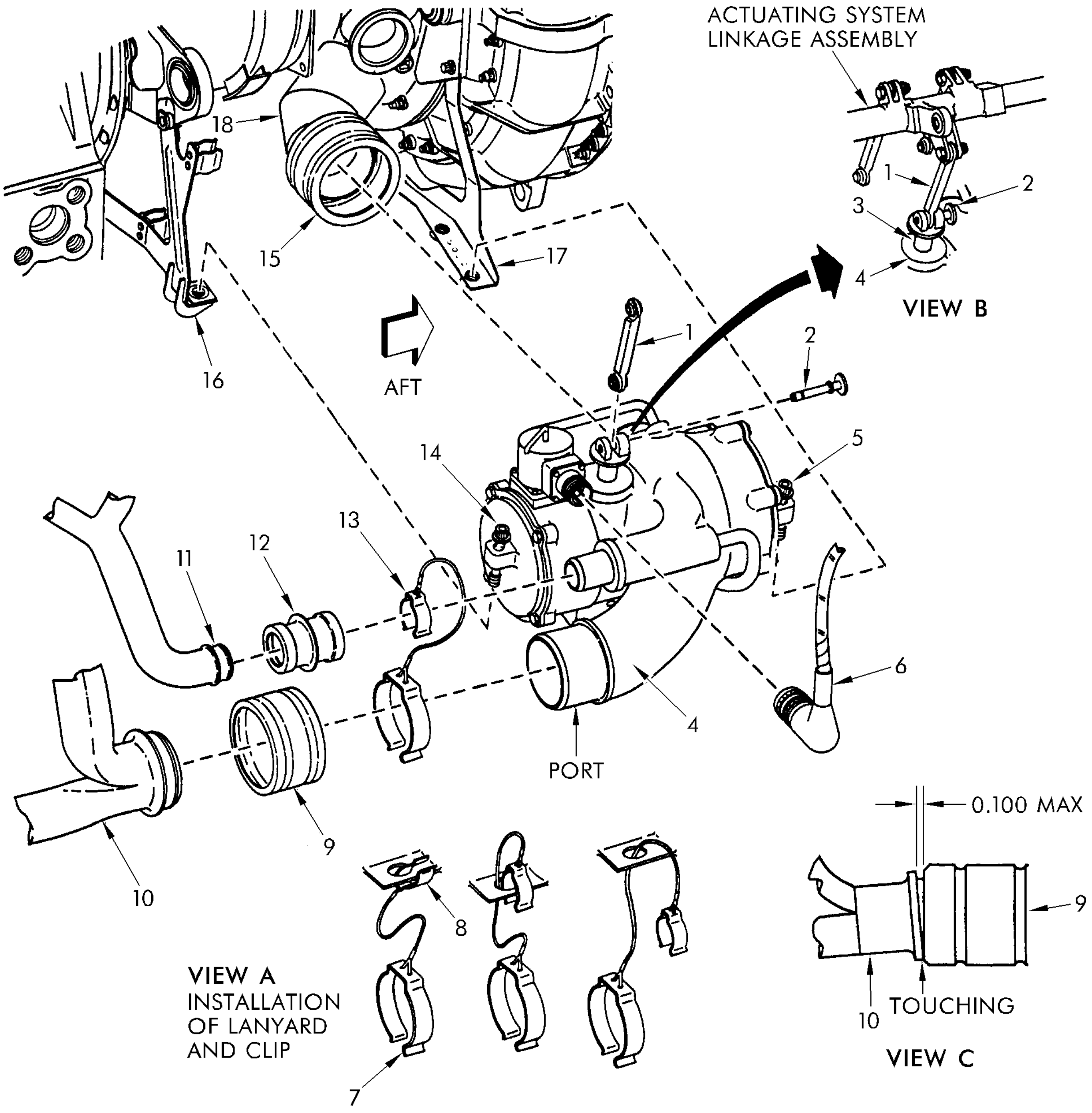
(10) Torque three captive bolts (5, 14) to 45-50 inch-pounds.

(11) Check gap between flange of bleed duct (10) and seal housing (9) for 0.100-inch maximum (view C). If gap exceeds limit at any point, loosen bolts (5, 14) and reposition valve as required to meet limit. Torque bolts (5, 14) to 45-50 inch-pounds.

c. **(Allied Signal (Garrett) Valve)**. Install anti-icing bleed and start valve (4, fig. 10-10) as follows:

(1) If not already assembled, install retaining ring (20) of lanyard and clip assembly (13) to lower hole in cast rib of valve (4). Position clip so that small clip (8) is inboard and large clip (7) is outboard.

(2) If not already assembled, install retaining ring (20) of seal housing and lanyard assembly (9) and seal retainer and lanyard assembly (12) to upper hole in cast rib of valve (4). Position small coupling inboard and large coupling outboard.



1. Link Assembly
2. Quick-Disconnect Pin
3. Shaft
4. Anti-Icing Bleed and Start Valve
5. Captive Bolt
6. Electrical Connector (Green Cable)
7. Large Clip
8. Small Clip
9. Seal Housing
10. Anti-Icing Bleed Duct
11. Anti-Icing IGV Duct
12. Seal Retainer
13. Lanyard and Clip
14. Captive Bolt
15. Seal Housing
16. Forward Bracket
17. Aft Bracket
18. Compressor Case Outlet

ALL DIMENSIONS
ARE IN INCHES

EATON (CONSOLIDATED CONTROL)

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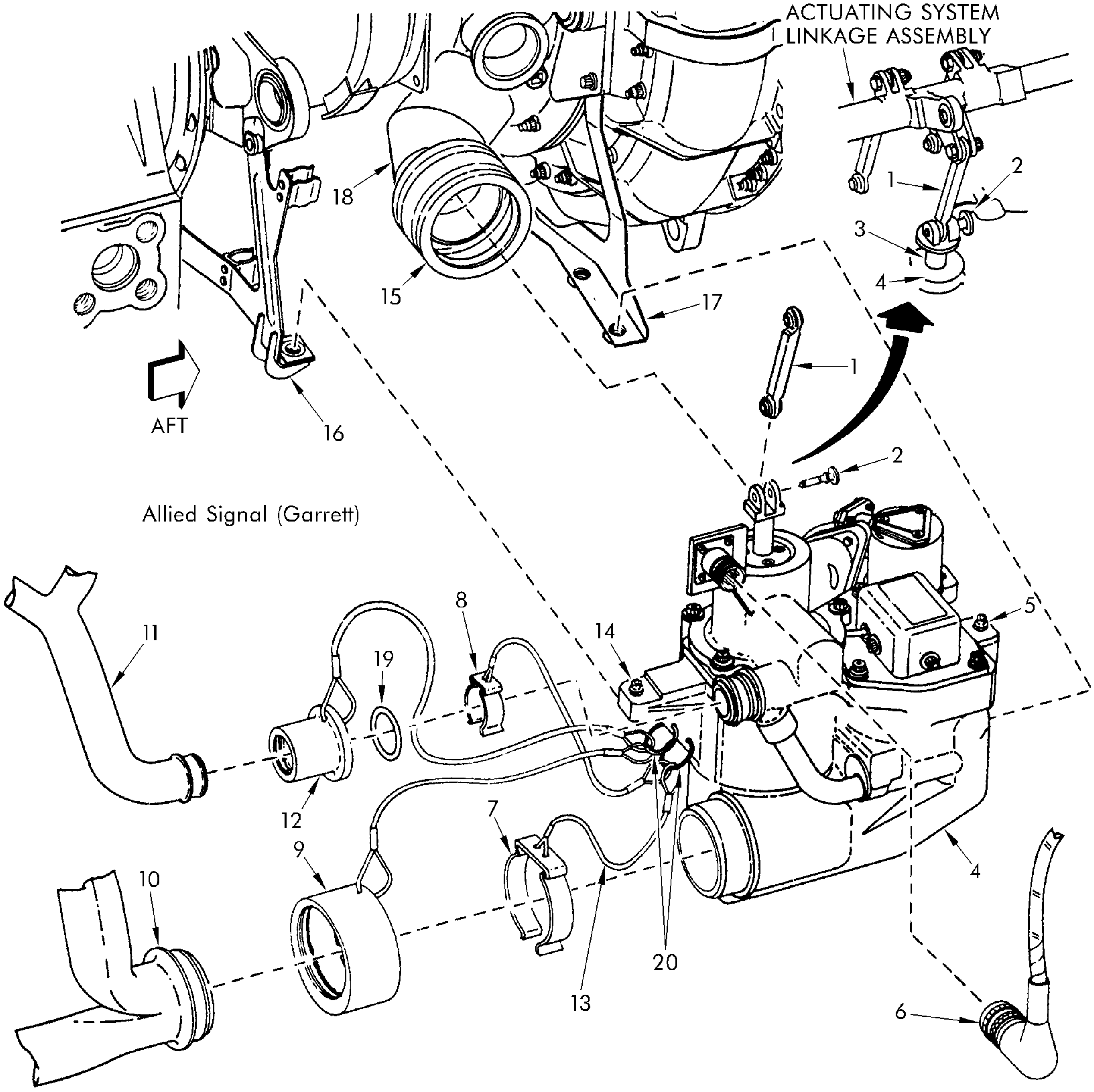
Figure 10-9. Anti-Icing Bleed and Start Valve, Lanyard and Clip, Seal Housing, and Seal Retainer; Installation



1. Link Assembly
2. Quick-Disconnect Pin
3. Shaft
4. Anti-Icing Bleed and Start Valve
5. Captive Bolt
6. Electrical Connector (Green Cable)
7. Large Clip
8. Small Clip
9. Seal Housing and Lanyard Assembly
10. Anti-Icing Bleed Duct
11. Anti-Icing IGV Duct
12. Seal Retainer and Lanyard Assembly
13. Lanyard and Clip Assembly
14. Captive Bolt
15. Seal Housing
16. Forward Bracket
17. Aft Bracket
18. Compressor Case Outlet
19. Seal Ring
20. Retaining Ring

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Figure 10-10. Anti-Icing Bleed and Start Valve, Lanyard and Clip, Seal Housing, and Seal Retainer; Installation

NOTE

Seal ring (19) may be packaged in seal retainer (12).

(3) If seal ring (19) is packaged in seal retainer (12) remove it.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

(4) Apply a small amount of lubricating oil (item 85 or 87, Appendix D) to inside diameter of seal ring (19).

(5) Install seal ring (fig. 10-11) onto sealing surface of valve as follows:

(a) With open side of seal ring facing forward, and using fingers, evenly push seal ring into groove of sealing surface.

NOTE

Seal ring will remain expanded after it is seated in the groove of the sealing surface.

(b) Apply a small amount of lubricating oil (item 85 or 87, Appendix D) to outside diameter of seal ring.

(c) Slide **(Allied Signal (Garrett) Valve)** Sizing Tool LMT 841 onto seal ring until a sharp increase in resistance is felt.

(d) Push LMT 841 beyond the maximum resistance and rotate LMT 841, 180 degrees clockwise and 180 degrees counterclockwise. Remove, push, and rotate LMT 841 at least three times.

(6) Install seal retainer and lanyard assembly (12, fig. 10-10) onto small port of valve (4).

(7) Install seal housing and lanyard assembly (9) onto large port of valve (4), with eccentric side of assembly facing valve (4).

(8) Secure valve (4) onto forward bracket (16) and aft bracket (17) using three captive bolts (5, 14).

(9) Slide seal retainer (12) and seal housing (9) to a forward position.

CAUTION

- Small clip (8) must be fully seated otherwise, an air leak could occur.
- Be sure that anti-ice bleed and start valve seal housings and seal retainer are secure and alined. Otherwise, stage 5 air leakage could cause the replacement of the ECU/DEC.

(10) Install small clip (8) onto IGV boss to hold seal retainer (12) in the forward position.

(11) Check to be sure the small clip (fig. 10-12) is fully seated in the correct position. If necessary loosen bolts (5, 14, fig. 10-10) and move valve (4) aft to allow correct seating of clip (8).

(12) Install large clip (7) to hold seal housing assembly and lanyard assembly (9) in the forward position.

(13) Torque bolts (5, 14) to 45-50 inch-pounds.

(14) Check gap between flange of bleed duct (10) and seal housing (9) for 0.100 inch maximum. If gap exceeds limit at any point, loosen bolts (5, 14) and reposition valve as required to meet limit. Torque bolts (5, 14) to 45-50 inch-pounds.

d. Aline hole in link assembly (1) with holes in shaft (3) and engage quick-disconnect pin (2). Be sure that locking ring on pin passes through the shaft (3) and ring shows outside of shaft.

e. Connect electrical connector (6) to valve (4).

f. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

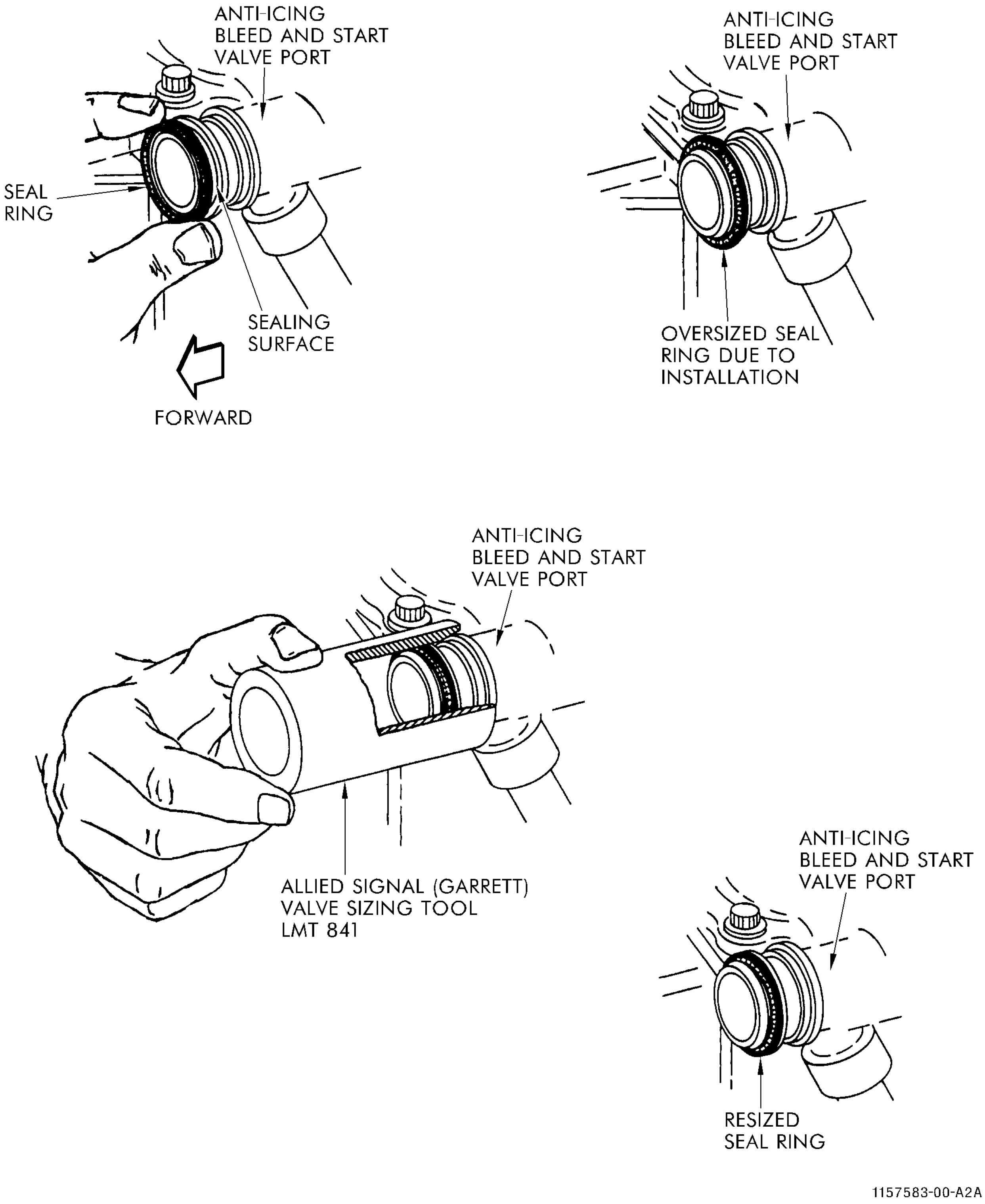
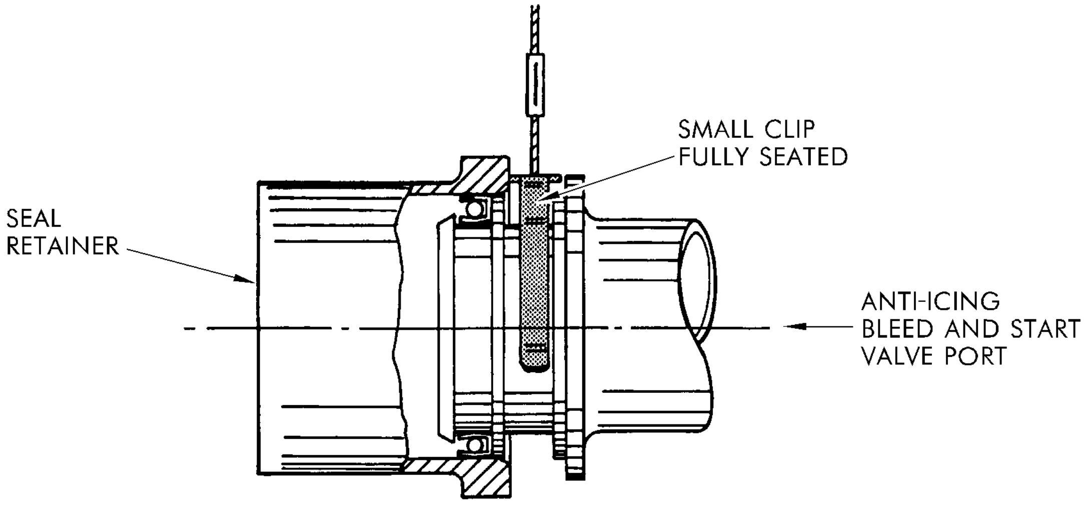
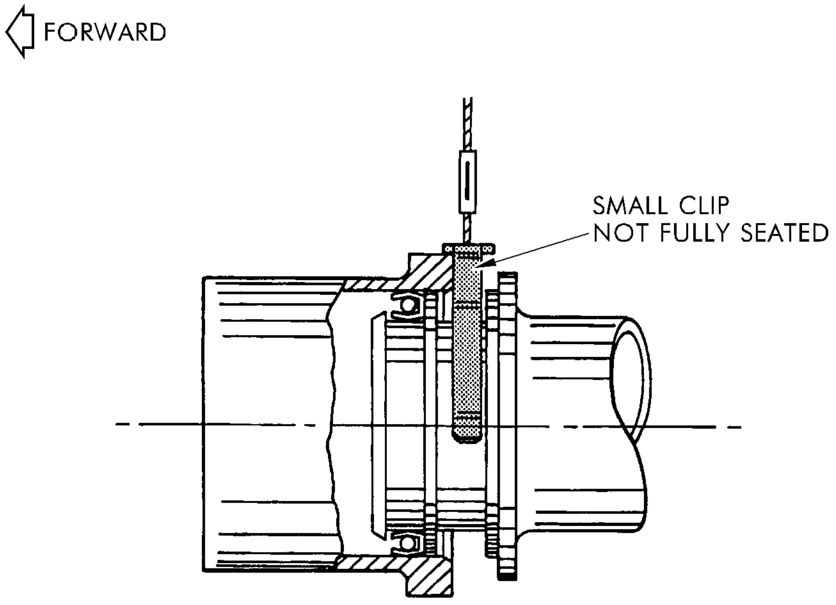


Figure 10-11. Seal Ring; Installation



CORRECT INSTALLATION



INCORRECT INSTALLATION

Figure 10-12. Small Clip; Installation

10-32. FORWARD SEAL PRESSURE TUBE.

10-33. Removal of Forward Seal Pressure Tube (AVIM).

a. Remove **(T700, T701)** ECU or **(T701C, T701D)** DEC (fig. 10-13) or (fig. 10-14) as follows:

(1) Disconnect electrical connectors (10, 11, 12).

(2) Loosen two bolts (13), but do not remove them.

(3) Loosen captive bolt (5).

(4) Remove **(T700, T701)** ECU or **(T701C, T701D)** DEC by sliding it out of slots in electrical unit bracket (7).

b. Remove two bolts that secure amplifier support bracket (4) to forward flange of compressor case.

c. Remove two bolts (3) and nuts (1) that secure support bracket (4) to tabs (2) on compressor case.

d. Remove **(T700, T701)** ECU or **(T701C, T701D)** DEC brackets (4, 7) assembled.

WARNING

Excessive Force/Torque on Seal Pressure and Scavenge Tube

Do not use excessive force/torque when connecting/disconnecting seal pressure and scavenge tube. A damaged tube may cause a loss of power turbine cooling and engine damage.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

e. Using two wrenches, disconnect forward seal pressure tube (3, fig. 10-15) from coupling nuts as follows:

(1) Turn coupling nut (1) clockwise to release tube from compressor case.

(2) Disconnect coupling nut (4) from seal pressure and scavenge tube assembly (8).

f. Install protective caps (item 17, Appendix D) on ends of tube.

10-34. Cleaning of Forward Seal Pressure Tube. See paragraph H-23, Appendix H.

10-35. Inspection of Forward Seal Pressure Tube. See paragraph H-24, Appendix H.

10-36. Testing of Forward Seal Pressure Tube (AVIM). See paragraph H-25, Appendix H.

10-37. Installation of Forward Seal Pressure Tube (AVIM).

a. Connect forward seal pressure tube (3, fig. 10-15) to coupling nut (1) on compressor case. Engage threads of coupling nut (1).

NOTE

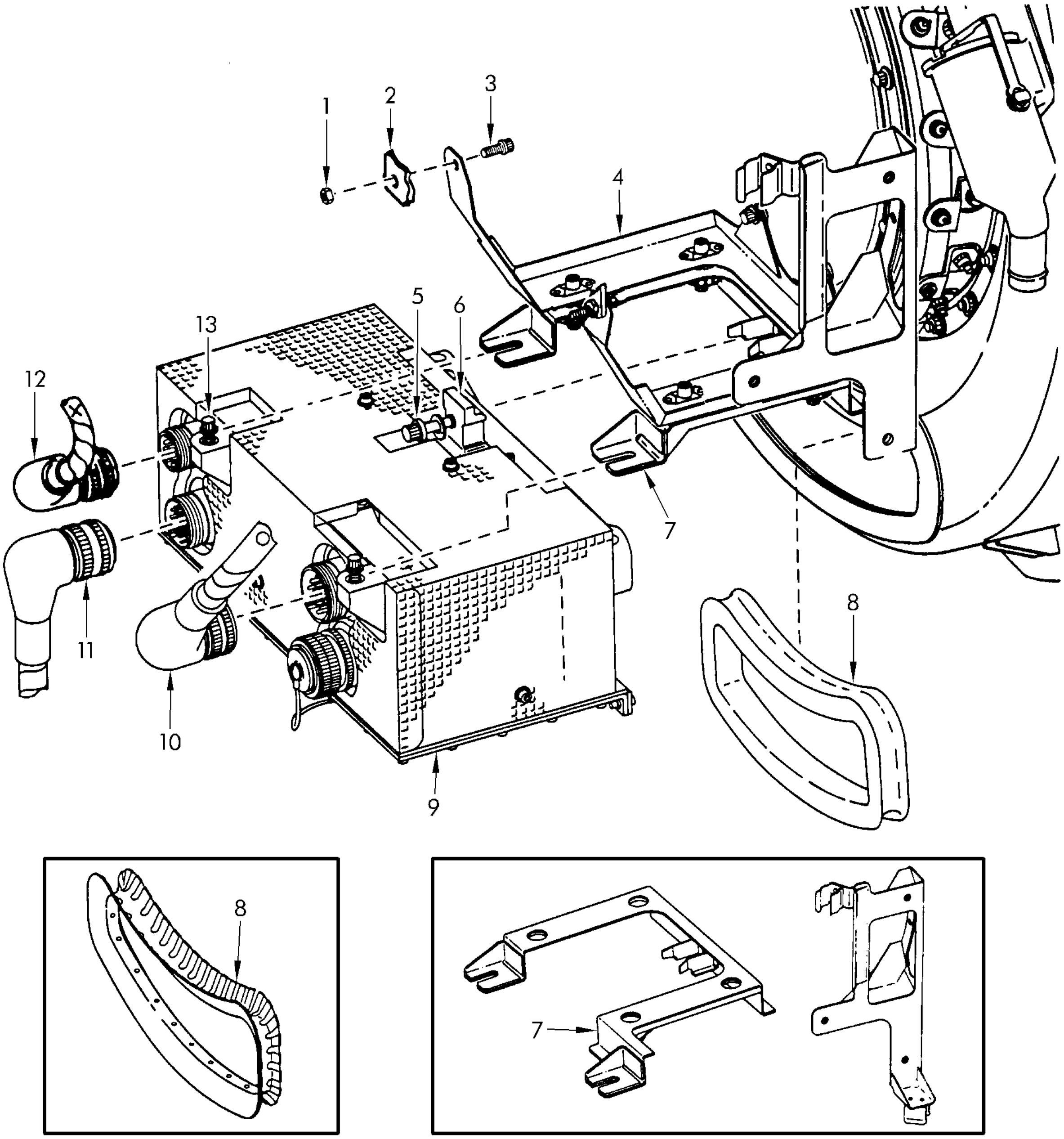
It may be necessary to disconnect the seal pressure and scavenge tube assembly from the mid C-sump scavenge tube to make installation easier.

b. Loosen coupling nut (5) and disconnect seal pressure and scavenge tube assembly (8) from mid C-sump scavenge tube (2).

c. Remove bolt (7) from bracket (20).

d. Using one hand, gently pull down on tube assembly (8), and with the other hand, connect pressure tube (3) to tube assembly (8). Engage threads of coupling nut (4).

e. Secure tube assembly (8) to bracket (20) with bolt (7). Torque bolt (7) to 45-50 inch-pounds.



(T700) FORMER CONFIGURATION

(T700) PRESENT CONFIGURATIONS
(T701) FORMER CONFIGURATIONS

1. Nut (Qty-2)
2. Tab (Qty-2)
3. Bolt (Qty-2)
4. Amplifier Support Bracket
5. Captive Bolt
6. T-Shaped Mounting Lug
7. Electrical Unit Bracket
8. Scroll Seal
9. Electrical Control Unit (ECU)
10. Electrical Connector (Yellow Cable)
11. Electrical Connector (Aircraft Cable)
12. Electrical Connector (Blue Cable)
13. Bolt (Qty-2)

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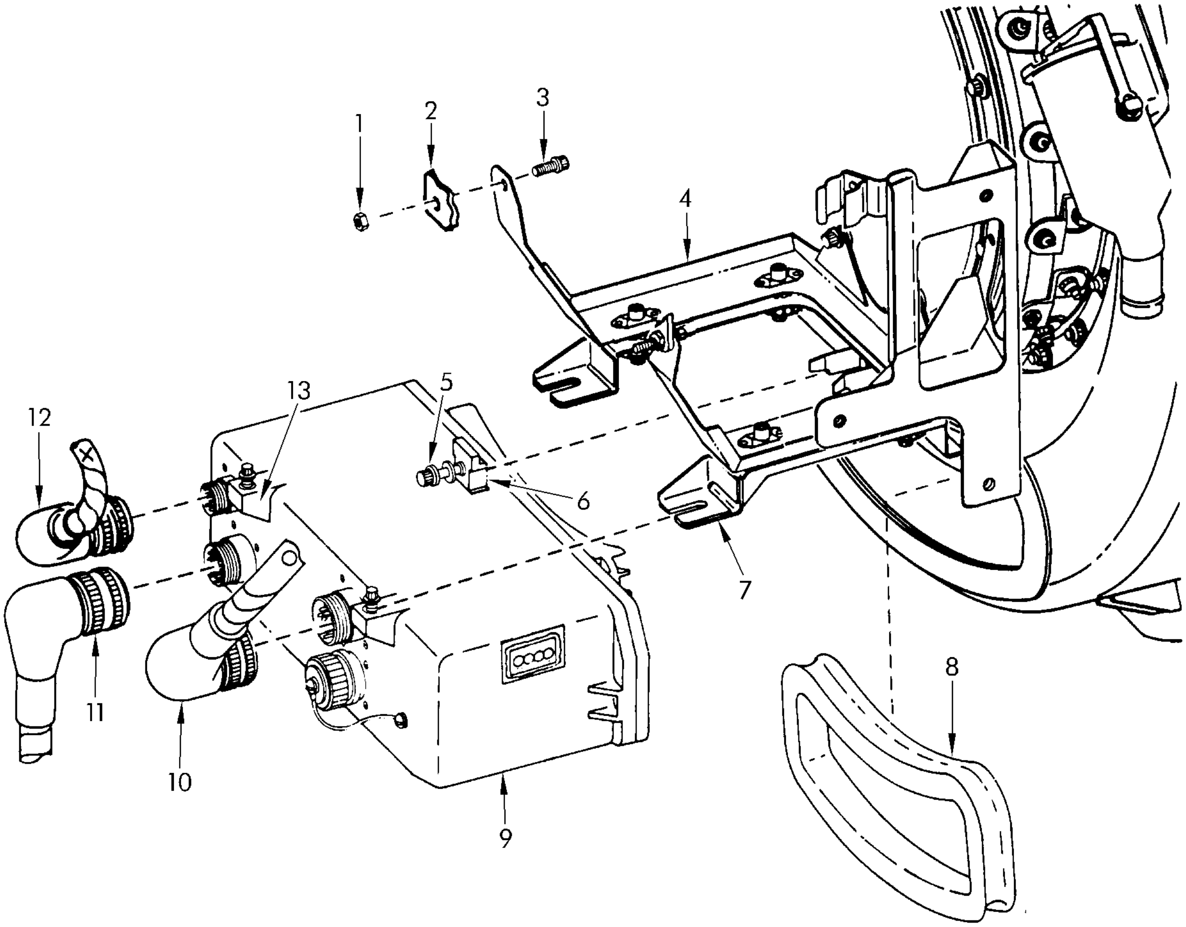
Figure 10-13. (T700, T701) Electrical Control Unit (ECU); Removal and Installation



1. Nut (Qty-2)
2. Tab (Qty-2)
3. Bolt (Qty-2)
4. Amplifier Support Bracket
5. Captive Bolt
6. T-Shaped Mounting Lug
7. Electrical Unit Bracket
8. Scroll Seal
9. Digital Electronic Control (DEC)
10. Electrical Connector (Yellow Cable)
11. Electrical Connector (Aircraft Cable)
12. Electrical Connector (Blue Cable)
13. Bolt (Qty-2)

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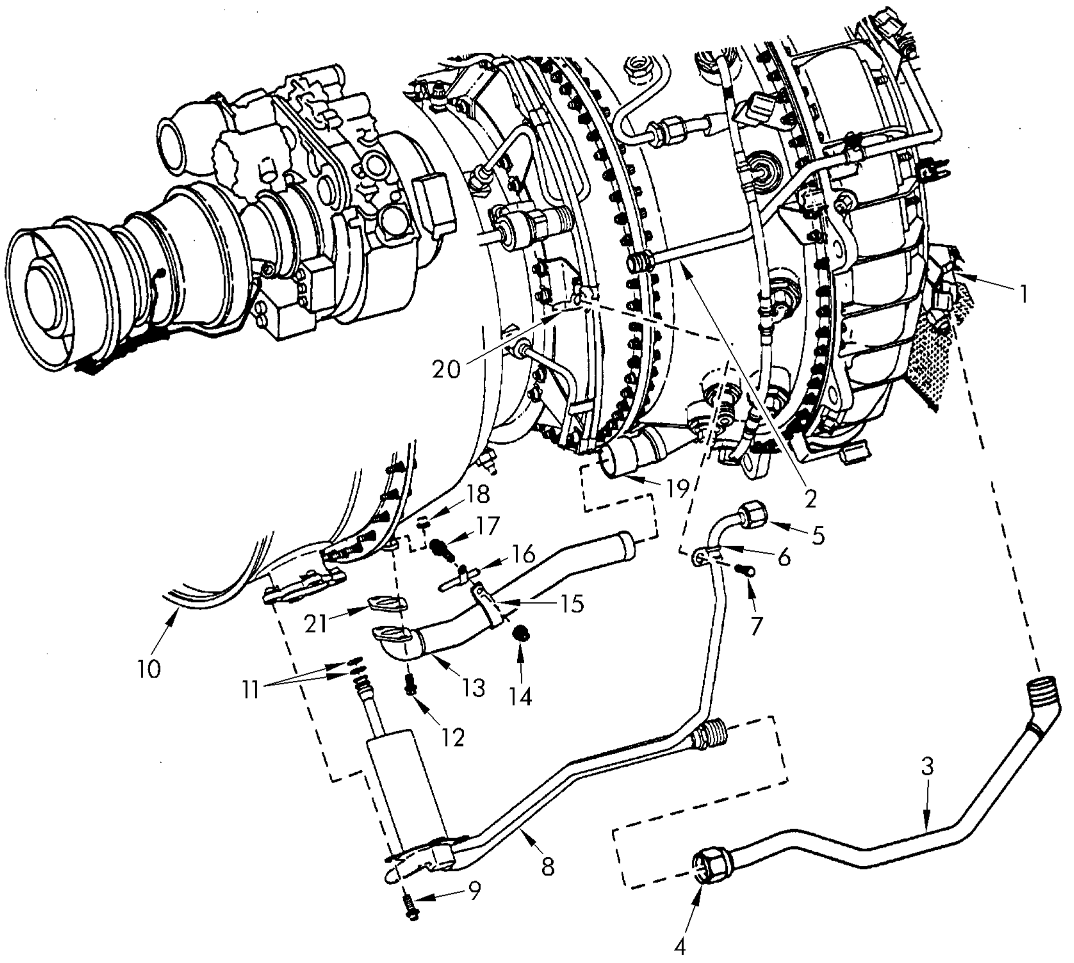
*Figure 10-14. **(T701C, T701D)** Digital Electronic Control (DEC) and Scroll Seal; Removal and Installation*



1. Coupling Nut
2. Mid C-Sump Scavenge Tube
3. Forward Seal Pressure Tube
4. Coupling Nut
5. Coupling Nut
6. Clamp
7. Bolt
8. Seal Pressure and Scavenge Tube Assembly
9. Bolt (Qty-4)
10. Exhaust Frame
11. Preformed Packings (Qty-2)
12. Bolt (Qty-2)
13. Compressor Leakage Air Tube
14. Nut
15. Clamp
16. B-Sump Drain Tube
17. Bolt
18. Nut (Qty-2)
19. Compressor Leakage Air Fitting
20. Bracket
21. (T701C, T701D) Gasket

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Figure 10-15. Air Tubes; Removal and Installation

WARNING

Excessive Force/Torque on Seal Pressure and Scavenge Tube

Do not use excessive force/torque when connecting/disconnecting seal pressure and scavenge tube. A damaged tube may cause a loss of power turbine cooling and engine damage.

CAUTION

Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

f. Using two wrenches, connect tube assembly (8) to scavenge tube (2). Tighten (60° wrench-arc) coupling nuts (1, 4, and 5).

g. Position bracket (4, fig. 10-13) on tabs (2) of compressor case and on forward flange of compressor case.

h. Install two bolts (3) (boltheads forward) and two nuts (1). Secure bracket (4) onto tabs (2) of compressor case. Torque nuts (1) to 45-50 inch-pounds.

i. Install two bolts to secure support bracket (4) to forward flange of compressor case. Torque bolts to 45-50 inch-pounds.

j. Install **(T700, T701)** ECU or **(T701C, T701D)** DEC (fig. 10-13) or (fig. 10-14) as follows:

(1) Make sure scroll seal (8) is in place on ECU.

(2) Install **(T700, T701)** ECU or **(T701C, T701D)** DEC so that two bolts (13) fit into slots in electrical unit bracket (7).

(3) Tighten captive bolt (5). Torque bolt (5) to 45-50 inch-pounds.

(4) Secure two bolts (13). Make sure there is metal-to-metal contact.

(5) Connect electrical connectors (10, 11, 12).

k. Make required engine checks listed in table 1-39.

10-38. SENSING TUBE.

10-39. Removal of Sensing Tube.

a. Remove yellow electrical cable (3, fig. 10-16) from clip (4).

b. **(T701, T701C, T701D)** Remove cable (3) from yellow cable bracket (9).

c. Remove two bolts (1) from forward end of sensing tube (2).

d. Remove bolt (5) that secures sensing tube to main frame pad.

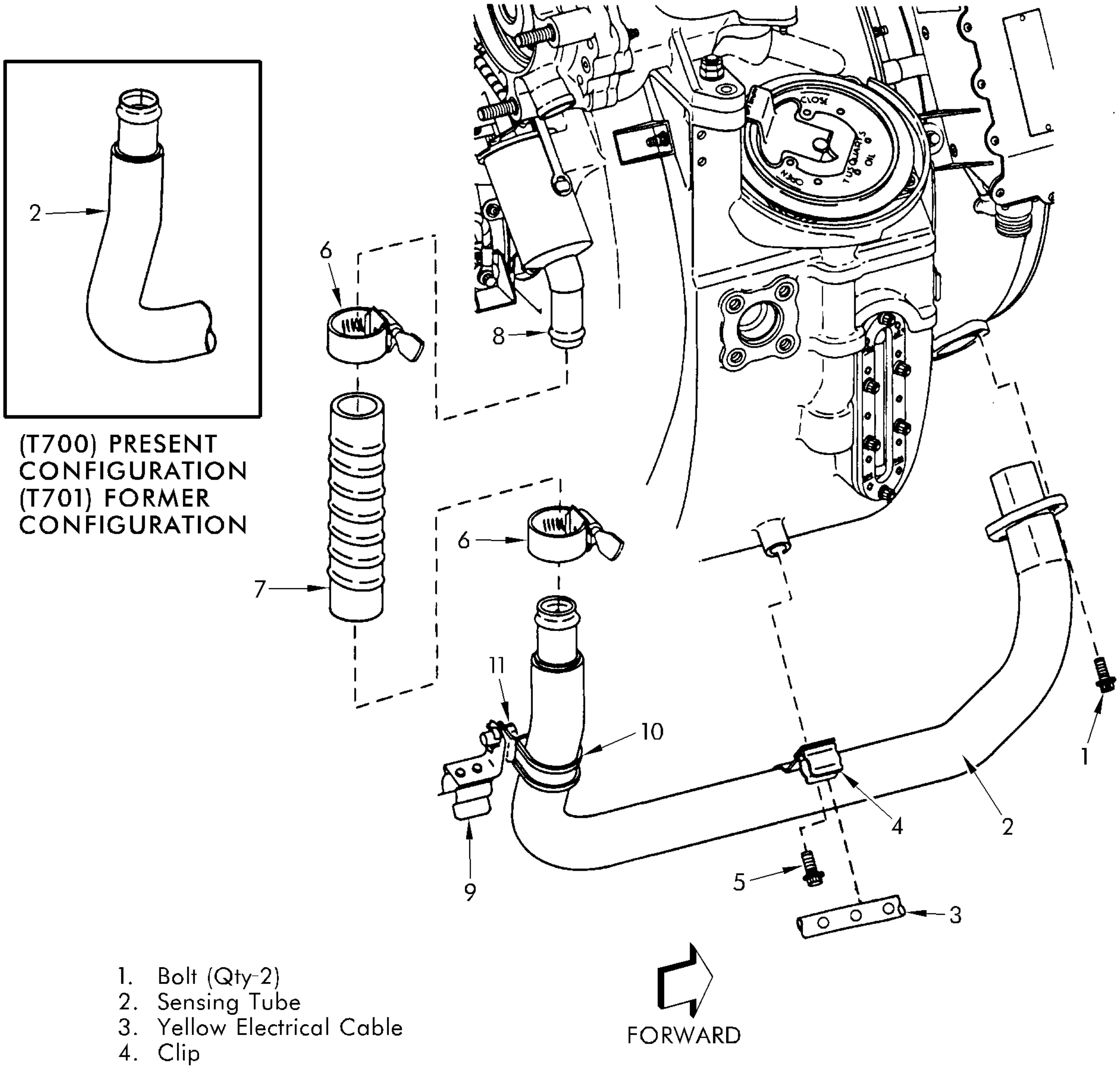
e. Loosen clamps (6) that connect temperature-sensing nonmetallic tube (7) to neck of T2 sensor holster (8) and to tube (2).

f. Remove sensing tube (2). Cap each end, using protective cap, barrier material, and adhesive tape (item 28, 12, 107, Appendix D).

NOTE

(T701, T701C, T701D) It will be necessary to loosen loop type cushioned clamp (10) in order to thoroughly inspect tube (2).

g. **(T701, T701C, T701D)** Loosen bolt (11) securing clamp (10) to tube (2).



1. Bolt (Qty-2)
2. Sensing Tube
3. Yellow Electrical Cable
4. Clip
5. Bolt
6. Clamps (Qty-2)
7. Temperature-Sensing Nonmetallic Tube
8. T2 Sensor Holster
9. **(T701, T701C, T701D)** Yellow Cable Bracket ☚
10. **(T701, T701C, T701D)** Loop Type Cushioned Clamp ☚
11. **(T701, T701C, T701D)** Bolt ☚

Figure 10-16. Sensing Tube; Removal, Inspection, and Installation

10-40. Cleaning of Sensing Tube.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

a. Wipe external surfaces of sensing tube (2) and temperature-sensing non-metallic tube (7) with towel (item 112, Appendix D) saturated in dry cleaning solvent (item 99, Appendix D) to remove oil and dirt.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

b. Dry the sensing tube, using dry, filtered compressed air.

10-41. Inspection of Sensing Tube. See table 10-5.

Table 10-5. Inspection of Sensing Tube

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Sensing tube (2, fig. 10-16).	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
b. Temperature-sensing nonmetallic tube (7) for:			
(1) Crazing or splits when tube is flexed.	Not allowed.	Not repairable.	Replace tube (para 10-42).
(2) Cuts or tears.	Not allowed.	Not repairable.	Replace tube (para 10-42).
(3) Split or heat swollen ends.	Not allowed.	Not repairable.	Replace tube (para 10-42).

10-42. Installation of Sensing Tube.

a. Install clamps (6, fig. 10-16) on temperature-sensing nonmetallic tube (7). Do not tighten clamps.

b. Slide tube (7) onto sensing tube (2) and onto T2 sensor holster (8).

c. Using two bolts (1), secure flange of sensing tube (2) to swirl frame pad.

d. Using bolt (5), secure sensing tube (2) to main frame pad.

e. Torque bolts (1, 5) to 45-50 inch-pounds.

f. Tighten clamps (6) handtight.

g. **(T701, T701C, T701D)** Reposition loop type cushioned clamp (10), and hand-tighten bolt (11).

h. Install yellow electrical cable (3) in clip (4).

i. **(T701, T701C, T701D)** Install cable (3) in yellow cable bracket (9) so that cable (3) is on the outside of tube (2).

j. **(T701, T701C, T701D)** Torque bolt (11) to 45-50 inch-pounds.

k. After installation, make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

10-43. COMPRESSOR LEAKAGE AIR TUBE.

10-44. Removal of Compressor Leakage Air Tube.

a. Remove two bolts (12, fig. 10-15) and two nuts (18) that secure compressor leakage air tube (13) to turbine case.

b. Remove bolt (17) and nut (14) to separate clamp (15) from clamp on B-sump drain tube (16).

c. Remove tube (13).

d. **(T701C, T701D)** Remove gasket (21) from flanged end of tube.

e. Remove clamp (15) from tube.

f. Cap or plug tube using protective caps (item 27, 29, Appendix D).

10-45. Cleaning of Compressor Leakage Air Tube. See paragraph H-23, Appendix H.

10-46. Inspection of Compressor Leakage Air Tube. See table 10-6.

Table 10-6. Inspection of Compressor Leakage Air Tube

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Tubing (2, fig 10-17).	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
b. Flange (3) for:			
(1) Flatness.	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
(2) Cracks.	See Inspection of Tubes, Hoses, and Fittings (para H-24, Appendix H).		
(3) Nicks and gouges.	Any number, 1/64 inch deep, with no high metal, if no more than 50% of flange sealing path is damaged.	Any number that can be repaired to meet usable limits. Original flange thickness can be reduced up to 25% to meet usable limits.	Remove high metal. Rework to usable limits by lapping, stoning, or machining (if possible).
c. Spherical end fitting (1) for:			
(1) Out-of-roundness.	Max diameter: 0.876 inch. Min diameter: 0.868 inch. There will be no chips in flame-sprayed surface.	Not repairable.	Replace tube (para 10-47).
(2) Wear.	Min diameter: 0.868 inch.	Not repairable.	Replace tube (para 10-47).

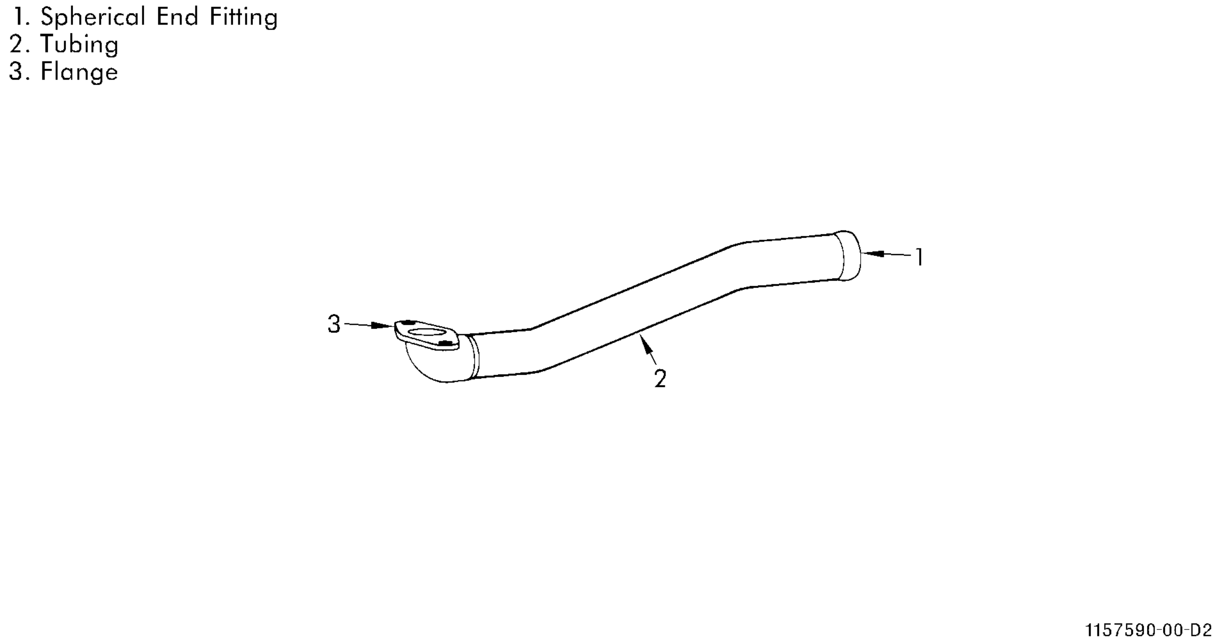


Figure 10-17. Compressor Leakage Air Tube; Inspection

10-47. Installation of Compressor Leakage Air Tube.

a. Install clamp (15, fig. 10-15) on compressor leakage air tube (13).

b. Place tube (13) in position shown. If power turbine module is installed on engine, insert spherical end of tube into compressor leakage air fitting (19).

c. **(T701C, T701D)** Install gasket (21) on flanged end of tube.

d. Secure flanged end of tube to turbine case, using two bolts (12) and nuts (18). Torque bolts to 45-50 inch-pounds.

e. Slide clamp (15) on tube to aline hole with hole in clamp on B-sump drain tube (16).

f. Secure clamp, using bolt (17) and nut (14). Torque bolt to 45-50 inch-pounds.

g. After installation, make required engine checks listed in table 1-19 or table 1-39 (AVIM).

10-48. SEAL PRESSURE AND SCAVENGE TUBE ASSEMBLY.

10-49. Removal of Seal Pressure and Scavenge Tube Assembly (AVIM).

a. If power turbine module is installed on engine, disconnect coupling nut (4, fig. 10-15) that secures forward seal pressure tube (3) to seal pressure and scavenge tube assembly (8), and disconnect coupling nut (5) that secures tube assembly to mid C-sump scavenge tube (2).

b. Remove bolt (7) that secures clamp (6) to bracket (20).

c. Remove four bolts (9) that secure tube assembly (8) to exhaust frame (10).

d. Remove tube assembly (8); remove two preformed packings (11).

10-50. Cleaning of Seal Pressure and Scavenge Tube Assembly. See paragraph H-23, Appendix H.

10-51. Inspection of Seal Pressure and Scavenge Tube Assembly. See paragraph H-24, Appendix H.

10-52. Testing of Seal Pressure and Scavenge Tube Assembly (AVIM). See paragraph H-25, Appendix H.

10-53. Installation of Seal Pressure and Scavenge Tube Assembly (AVIM).

a. Install two new packings (11) onto seal pressure and scavenge tube assembly (8).

b. Install tube assembly (8) into exhaust frame (10) and secure with four bolts (9). Torque bolts to 70-75 inch-pounds.

c. Install clamp (6) around tube assembly (8) and secure it to bracket (20) with bolt (7). Torque bolt to 45-50 inch-pounds.

CAUTION

> Two wrenches (counter-torque) are required for removing and installing coupling nuts. Otherwise, nuts or tubes will be damaged.

d. Connect tube assembly (8) to forward seal pressure tube (3) and to mid C-sump scavenge tube (2). Tighten (60° wrench arc) coupling nuts (4, 5).

e. After installation, make required engine checks listed in table 1-39.

10-54. (T701, T701C, T701D) P3 TUBE.

10-55. (T701, T701C, T701D) Removal of P3 Tube.

a. Disconnect P3 tube (1, fig. 10-18) from HMU union (3) and from midframe reducer (2).

b. Remove P3 tube. Cap tube ends, using protective caps (item 24, Appendix D).

10-56. (T701, T701C, T701D) Cleaning of P3 Tube. See paragraph H-23, Appendix H.

10-57. (T701, T701C, T701D) Inspection of P3 Tube. See paragraph H-24, Appendix H.

10-58. (T701, T701C, T701D) Testing of P3 Tube (AVIM). See paragraph H-25, Appendix H.

10-59. (T701, T701C, T701D) Installation of P3 Tube.

a. Loosely connect P3 tube (1, fig. 10-18) to HMU union (3) and to midframe reducer (2).

b. While holding P3 tube to prevent it from rotating into ODV manifold, tighten (60° wrench arc) coupling nuts on P3 tube.

c. Make required engine checks listed in table 1-19 or in table 1-39 (AVIM).

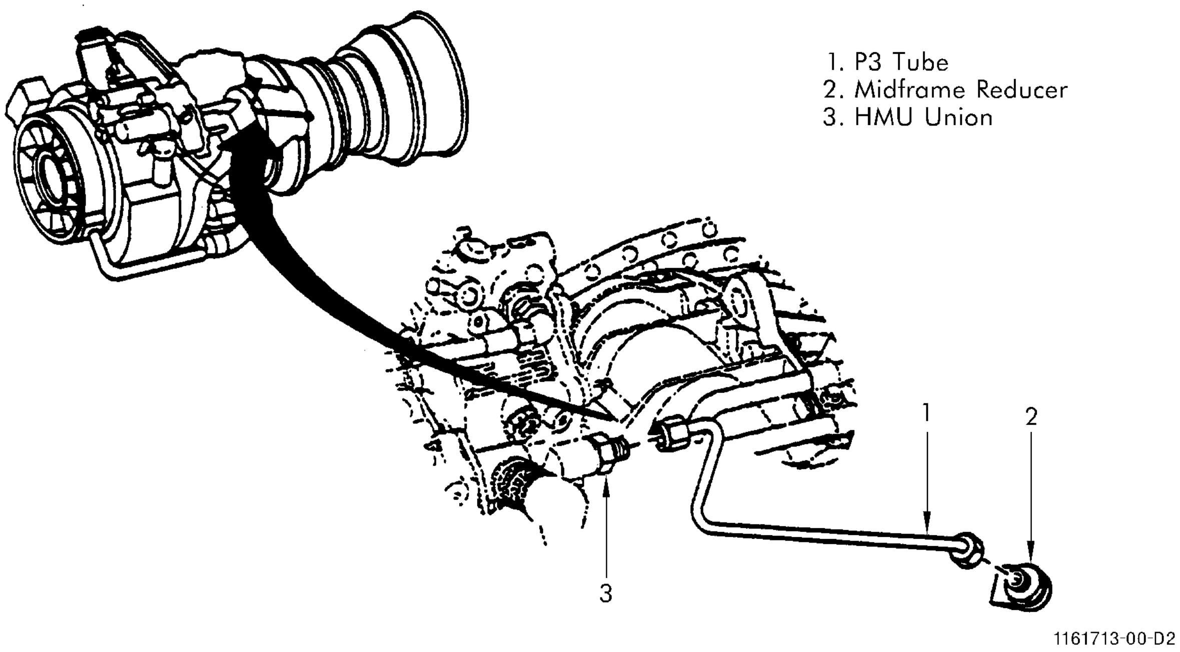


Figure 10-18. ***(T701, T701C, T701D)*** *P3 Tube; Removal and Installation*

APPENDIX A

REFERENCES

AR 95-1	Army Aviation General Provisions and Flight Regulations
AR 750-1	Army Material Maintenance Concepts and Policies
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA PAM 738-751	Functional User's Manual for the Army Maintenance Management System - Aviation (TAMMS-A)
FM 21-11	First Aid Data
FM 3-04.500	Army Aviation Maintenance
MIL-PRF-85704	Cleaning Compound, Turbine Engine Gas Path
MIL-STD-129	Marking for Shipment and Storage
Deleted	Deleted
T.O. 00-20-1	Preventive Maintenance Program (General Requirements and Procedures)
TM 1-1500-204-23-	Volumes 1-10
TM 1-1500-204-23-1	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (General Maintenance and Practices)
TM 1-1500-204-23-2	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Pneudraulics Maintenance and Practices)
TM 1-1500-204-23-3	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Maintenance Practices for Fuel and Oil Systems)
TM 1-1500-204-23-4	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Electrical and Instrument Maintenance Procedures and Practices)
TM 1-1500-204-23-5	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Propeller, Rotor, and Powertrain Maintenance Practices)

TM 1-1500-204-23-6	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Hardware and Consumable Materials)
TM 1-1500-204-23-7	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Nondestructive Testing and Flaw Detection Procedures and Practices)
TM 1-1500-204-23-8	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Machine and Welding Shop Practices)
TM 1-1500-204-23-9	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Tools and Ground Support Equipment)
TM 1-1500-204-23-10	Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) Manual for General Aircraft Maintenance (Sheet Metal Shop Practices)
TM 1-1520-238-23	AH-64A Aviation Unit and Intermediate Maintenance Manual
TM 1-1520-238-23-1	AH-64A Aircraft General Information
TM 1-1520-238-23-4	AH-64A Aviation Unit and Intermediate Power Plants
TM 1-2840-238-23P	**(T701)** Repair Parts and Special Tools List
TM 1-2840-248-23P	**(T700)** Repair Parts and Special Tools List
TM 1-2840-258-23P	**(T701C, T701D)** Repair Parts and Special Tools List
TM 55-4920-328-13	Modular Engine Test System
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use
SE-876-03-1006	Compact Engine Test System
No Number	Flexible Engine Diagnostic System Operations and Maintenance Instructions

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. MAINTENANCE ALLOCATION CHART.

a. The Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance categories; Aviation Unit Maintenance (AVUM); Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM which corresponds to an O Code in the Repair Parts and Special Tools List (RPSTL)

AVIM which corresponds to an F Code in the Repair Parts and Special Tools List (RPSTL)

DEPOT which corresponds to an D Code in the Repair Parts and Special Tools List (RPSTL)

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM) activities will be staffed and equipped to perform high frequency “On-Aircraft” maintenance tasks required to retain or return aircraft systems to a serviceable condition. The maintenance capability of the AVUM will be governed by the Maintenance Allocation Chart (MAC) and limited by the amount and complexity of ground support equipment (GSE), facilities required, authorized manning strength and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements.)

(a) Company Size Aviation Unit: Perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built-in-test equipment (BITE), installed aircraft instruments, or test, measurement and diagnostic equipment (TMDE). Replace worn or damaged modules/components that do not require complex adjustments or system alinement and which can be removed/installed with available skills, tools and ground support equipment. Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service and make operational, capacity and pressure checks to hydraulic systems. Perform servicing, functional adjustments, and minor repair/replacement to the flight control, propulsion, power train and fuel systems. Accomplish aircraft repair which does not require extensive disassembly, jigging, or alinement. The manufacture of aircraft parts will be limited to those items which can be fabricated with tools and equipment found in current air mobile tool and shop sets. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units: Aviation elements organic to brigade, group, battalion headquarters and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repairman and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/component fault diagnosis and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM) provides mobile, responsive “One-Stop” maintenance support. (Maintenance functions which are not conductive to sustaining air mobility will be assigned to depot

maintenance.) Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools, and equipment. AVIM establishes the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. The AVIM level inspects, troubleshoots, performs diagnostic tests, repairs, adjusts, calibrates, and alines aircraft system modules/components. AVIM units will have capability to determine the serviceability of specified modules/components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Module/component disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings, and items of common hardware. Aircraft repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable repairable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. AVIM will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. Provides quick response maintenance support, including aircraft recovery and air evacuation, on-the-job training, and technical assistance through the use of mobile maintenance contact teams. Maintains authorized operational readiness float aircraft. Provides collection and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-1. (The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit.)

B-2. USE OF THE MAINTENANCE ALLOCATION CHART (SECTION II).

NOTE

Nomenclatures used throughout the MAC are approved item names. Those terms/nomenclatures expressed in parentheses are generic in nature and are not to be considered as official terminology.

a. The Maintenance Allocation Chart assigns maintenance functions to the lowest level of maintenance based on past experience and the following consideration:

(1) Skills available.

(2) Work time required.

(3) Tools and test equipment required and/or available.

b. Only the lowest level of maintenance authorized to perform a maintenance function is indicated. If the lowest level of maintenance cannot perform all tasks of any single maintenance function (e.g., test, repair), then the higher maintenance level(s) that can accomplish additional tasks will also be indicated.

c. A maintenance function assigned to a maintenance level will automatically be authorized to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts or spares in stock. Information to requisition or otherwise secure the necessary repair parts will be as specified in the Repair Parts and Special Tools List (RPSTL).

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the level of maintenance to which the function is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

g. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

B-3. DEFINITIONS.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontamination when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measurement and diagnostic equipment (TMDE) used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable, like-type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunctions, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying army equipment/components.

B-4. STANDARD GROUPS.

The standard groupings shown below are used, as applicable, throughout this MAC. Maintenance manuals and RPSTL's will reflect these standard groupings as individual chapters with sections in each chapter relative to the individual complete systems, subsystems, modules, components, assemblies, or specific parts noted.

Group Number	Description
0400	ENGINE SYSTEM
0401	ENGINE GENERAL Servicing, handling, inspection requirements, lubrication charts, overhaul & retirement schedules. External lines & hoses. (As applicable.)
0402	COMPRESSOR SECTION (COLD SECTION MODULE) Rotor, blades, vanes, impeller, stators, inlet guide vanes, main frame, particle separator, bleed valve, bearings, seals, external lines & hoses.
0403	COMBUSTION SECTION (HOT SECTION MODULE) Liners, nozzles, stators, rotor, seals, couplings, blades.

Group Number	Description
0404	POWER TURBINE (POWER TURBINE MODULE) Nozzles, rotors, blades, exit guide vanes, exhaust frame, drive shaft, bearings, seals, external lines & hoses.
0405	ACCESSORY GEARBOX (ACCESSORY SECTION MODULE) Input and output gears, seals, chip detector, housings, drive shaft, bearings, seals.
0406	FUEL SYSTEM Fuel control, fuel boost pump, governors, fuel filter assembly, **(T700)** POU, **(T701)** overspeed and drain valve, fuel manifold, fuel nozzle, external lines & hoses.
0407	ELECTRICAL SYSTEM Electrical control units, exciters, thermocouples, ignition harness, electrical cables, history recorder, torque and overspeed sensor, Np sensor, alternator stator, blowers.
0408	OIL SYSTEM Tanks, oil filter, oil cooler, lube and scavenge pumps, oil filter bypass sensor, external lines & hoses.
0409	NOT APPLICABLE FOR T700 OR T701 ENGINE
0410	MISCELLANEOUS EQUIPMENT (AIR SYSTEM FOR T700 AND T701 ENGINES)

B-5. MAINTENANCE CATEGORIES AND WORK TIMES.

The maintenance categories (levels) AVUM, AVIM, and DEPOT are listed on the Maintenance Allocation Chart with individual columns that indicate the work times for maintenance functions at each maintenance level. Work time presentations such as 0.1 indicate the average time it requires a maintenance level to perform a specified maintenance function. If a work time has not been established, the columnar presentation shall indicate “--”. Maintenance levels higher than the level of maintenance indicated are authorized to perform the indicated function.

B-6. TOOLS AND TEST EQUIPMENT (SECTION III).

Common tool sets (not individual tools), special tools, test and support equipment required to perform maintenance functions are listed alphabetically with a reference number to permit cross-referencing to column 5 in the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number (NSN) and, if applicable, the tool number to aid in identifying the tool/device.

B-7. REMARKS (SECTION IV).

Remarks contained in column 6, with an alphabetical code and other columnar notes identified by a number in parentheses, are listed to provide a ready reference to the definition of the remark/note.

Section II. MAINTENANCE ALLOCATION CHART

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
0400	ENGINE SYSTEM						
0401	TURBOSHAFT ENGINE	Inspect	0.1				M
			1.3			6	A,K,N
		Test	0.3	8.0		7	B,C
		Service	0.1			4	I
		Install	1.2		1,2,5,8		
		Replace	2.0		1,2,5,8		
		Repair	0.3	1.9			D
		Overhaul			32.0		
0402	COMPRESSOR SECTION (COLD SECTION MODULE)	Inspect	0.1			6	A,K
		Test		8.0	8.0		C,P,Q
		Install		1.6		1,5,10,11	
		Replace		2.7		1,5,10,11	
		Overhaul			24.0		
040201	SWIRL FRAME	Inspect	0.1	0.4			J
		Test		8.0			C,P,Q
		Service		0.1			
		Install		0.3		1	
		Replace		0.6		1	
		Repair		1.0	20.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040202	A-SUMP OUTPUT SHAFT ASSEMBLY	Inspect		0.1			
		Test		8.0	2.0		C,P,Q
		Install		0.5		1	
		Replace		0.7		1	R
		Overhaul			4.0		
040202	NO. 1 CARBON SEAL	Inspect		0.2			
01		Test		0.5	2.0		Q
		Install		0.1		17	
		Replace		0.1		17	
		Repair			4.0		
040202	NO. 1 BEARING	Inspect			0.5		
02		Install			0.7		
		Replace			1.4		
040202	NO. 2 BEARING	Inspect			0.5		
03		Install			0.8		
		Replace			1.4		
040202	OUTPUT SHAFT	Inspect			2.0		
04		Install			0.8		
		Replace			1.5		
		Repair			8.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040202	NO. 1 AND NO. 2 BEARING HOUSING	Inspect			2.0		
		Install			0.8		
		Replace			1.5		
		Repair			12.0		
040203	POWER TAKE-OFF DRIVE ASSEMBLY	Inspect		0.2			
		Test		8.0	1.0		C,P,Q
		Install		1.9		1	
		Replace		3.0		1	
040204	NO. 3 BEARING	Inspect			0.5		
		Install			3.0		
		Replace			5.1		
040205	NO. 3 BEARING SUPPORT	Inspect			1.0		
		Install			3.1		
		Replace			5.2		
		Repair			4.0		
040206	OIL INLET AND SCAVENGE TUBES	Inspect		0.1			
		Test		8.0			
		Install		0.4			C,P,Q
		Replace		0.7			

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040207	FRONT FRAME	Inspect	0.2	0.2			J
		Install			2.8		
		Replace			5.2		
		Repair		0.2	16.0		
040208	MAIN FRAME	Inspect	0.2	0.6			
		Install			5.4		
		Replace			8.3		
		Repair		0.6	16.0		
040209	MAIN FRAME BORESCOPE PLUG	Inspect	0.1				
		Install	0.1				
		Replace	0.1				
040210	SCROLL CASE	Inspect	0.2				
		Install			4.8		
		Replace			7.2		
		Repair			1.5		
040211	INLET SEPARATOR BOOT	Inspect	0.1				
		Test	0.3				B,Q
		Install	0.1				
		Replace	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040212	IGV ACTUATING RING	Inspect	0.2				
		Install			4.7		
		Replace			7.0		
040213	INLET GUIDE VANE ACTUATOR LEVERS	Inspect	0.2				
		Install			4.7		
		Replace			7.0		
040214	INLET GUIDE VANES	Inspect	0.3			6	A,K
		Install			4.8		
		Replace			7.1		
040215	COMPRESSOR STATOR ASSEMBLY	Inspect		3.0	3.0		
		Install			4.9		
		Replace			8.1		
		Repair			1.1		
040215 01	COMPRESSOR CASE	Inspect	0.1	0.1			
		Install			5.6		
		Replace		5.2	9.8	18	V
		Repair			20.0		
040215	STAGE 1 VARIABLE VANES	Inspect		0.2	0.2		
		Install			5.1		
		Replace			9.6		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040215	STAGE 2 VARIABLE VANES	Inspect		0.2	0.2		
		Install			5.1		
		Replace			9.6		
04021504	STAGE 3 VANE SECTORS	Inspect		2.0	2.0		
		Install			4.5		
		Replace			8.4		
04021505	STAGE 4 VANE SECTORS	Inspect		2.0	2.0		
		Install			4.5		
		Replace			8.4		
04021506	STAGE 5 VANE SECTORS	Inspect	0.3		2.0	6	A,K
		Install			4.5		
		Replace			8.4		
04021507	STAGES 1 AND 2 VANE ACTUATING RINGS	Inspect	01				
		Install			5.3		
		Replace			10.4		
04021508	STAGES 1 AND 2 VANE ACTUATOR LEVERS	Inspect	0.3				
		Install			5.5		
		Replace			10.6		
04021509	CAP OR PLUG (BORESCOPE PORTS)	Inspect	0.1				
		Install	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Replace	0.1				
040216	COMPRESSOR ROTOR ASSEMBLY	Inspect	0.3	4.5		6	A,K
		Install			4.7		
		Replace			8.5		
		Repair		4.8	2.7	23,24,25	W
040216	GAS GENERATOR TURBINE SHAFT	Inspect			1.0		
		Install			1.2		
		Replace			2.2		
		Repair			12.0		
040216	COMPRESSOR DISCHARGE ROTATING SEAL	Inspect			1.0		
		Install			4.7		
		Replace			8.6		
		Repair			12.0		
040216	COMPRESSOR TIE ROD	Inspect			1.0		
03		Install			5.5		
		Replace			9.8		
		Repair			1.0		
040216	IMPELLER	Inspect	0.3	1.0	1.0	6	A,K
04		Install			5.5		
		Replace			9.8		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Repair			12.0		
04021605	STAGE 5 BLADE DISK	Inspect	0.3	1.0	1.0	6	A,K
		Install			5.5		
		Replace			9.8		
		Repair			12.0		
04021606	STAGES 3 AND 4 BLADE-DISK	Inspect			1.0		
		Install			5.5		
		Replace			9.8		
		Repair			16.0		
04021607	STAGE 2 BLADE-DISK	Inspect			1.0		
		Install			5.5		
		Replace		9.8			
		Repair			12.0		
04021608	STAGE 1 BLADE-DISK	Inspect	0.3		1.0	6	A,K
		Install			5.5		
		Replace			9.8		
		Repair		8.0	14.0		W
04021609	NO. 3 LABYRINTH SEAL	Inspect			1.0		
		Install			4.5		
		Replace			8.4		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Repair			12.0		
040217	SWIRL PLATE	Inspect			1.0		
		Install			2.2		
		Replace			4.0		
		Repair			2.0		
040218	NO. 4 BEARING SUPPORT	Inspect			2.0		
		Install			2.4		
		Replace			4.6		
		Repair			2.5		
040219	NO. 4 BEARING	Inspect			0.5		
		Install			2.4		
		Replace			4.6		
040220	DIFFUSER AND MIDFRAME CASING ASSEMBLY	Inspect	0.2	0.4	2.0		
		Install			2.1		
		Replace			4.1		
		Repair			0.8		
04022001	DIFFUSER CASE	Inspect			2.0		
		Install			3.8		
		Replace			6.7		
		Repair			20.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040220	COMPRESSOR CENTRIFUGAL DIFFUSER	Inspect			3.0		
		Install			3.8		
		Replace			6.7		
		Repair			20.0		
040220 03	MIDFRAME ASSEMBLY	Inspect	3.0	3.0	3.0		
		Install			4.8		
		Replace			7.7		
		Repair			20.0		
040220 04	COMBUSTOR INNER SHROUD	Inspect		0.1			
		Install			1.2		
		Replace			2.1		
		Repair			1.0		
040221	MIDFRAME BORESCOPE PORT PLUG	Inspect	0.1				
		Install	0.1				
		Replace	0.1				
040222	ACTUATING SYSTEM LINKAGE ASSEMBLY	Inspect	0.1	1.5			
		Install		0.6			
		Replace		1.0			
		Repair		8.0			

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040223	FORWARD SUSPENSION LUG	Inspect	0.1				
		Install	0.1				S
		Replace	0.1				S
0403	COMBUSTION SECTION (HOT SECTION MODULE)	Inspect	0.3	0.8	2.0	6	A,K
		Test		8.0	8.0		P
		Install		1.1		1 14 **(T701, T701C, T701D)**	
		Replace		1.9		1 14 **(T701, T701C, T701D)**	
		Overhaul			8.0		
040301	STAGES 1 AND 2 GAS GENERATOR TURBINE ROTOR	Inspect		0.7			
		Test		8.0	8.0		P,Q
		Service		0.1			
		Install		0.9		1 14 **(T701, T701C, T701D)**	
		Replace		1.5		1 14 **(T701, T701C, T701D)**	L
		Overhaul			2.1		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040301 01	STAGE 1 TURBINE ROTOR BLADES	Inspect		0.4			
		Install			1.1		
		Replace			1.8		
040301 02	STAGE 1 TURBINE DISK	Inspect		0.4			
		Install			1.1		
		Replace			1.8		
040301 03	STAGE 2 TURBINE ROTOR BLADES	Inspect		0.4			
		Install			1.1		
		Replace			1.8		
		Repair			2.0		
040301 04	STAGE 2 TURBINE DISK	Inspect		0.4			
		Install			1.1		
		Replace			1.8		
040302	GAS GENERATOR STATOR	Inspect		0.4			
		Test		8.0	8.0		P,Q
		Service		0.5			
		Install		0.9		1,22 14 **(T701, T701C, T701D)**	
		Replace		1.5		1,22 14 **(T701, T701C, T701D)**	L

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	 Avim	 Depot	(5) Tools and Equipment	(6) Remarks
		Overhaul			8.6		
040302 01	STAGE 1 TURBINE SHROUD SEGMENTS (STAGE 1 TURBINE SHROUD SECTORS)	Inspect		0.4			
		Install			1.1		
		Replace			1.8		
		Repair			4.0		
040302 02	STAGE 2 TURBINE NOZZLE SEGMENTS	Inspect		0.3			
		Test			8.0		
		Install			1.3		
		Replace			2.1		
		Repair			12.0		
040302 03	STAGE 2 TURBINE SHROUD SECTORS	Inspect		0.4			
		Install			1.1		
		Replace			1.8		
040303	FACE TYPE SEAL	Inspect		0.2			
		Service		0.1			
		Install		0.9		1 14 **(T701, T701C, T701D)**	
		Replace		1.6		1 14 **(T701, T701C, T701D)**	

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040304	STAGE 1 NOZZLE ASSEMBLY	Inspect	0.3	0.4		6	A,K
		Test		8.0	8.0		P,Q
		Service		0.1			
		Install		1.0		1 14 **(T701, T701C, T701D)**	
		Replace		1.7		1 14 **(T701, T701C, T701D)**	
		Repair			2.5		
04030401	OUTER BALANCE PISTON SEAL	Inspect		0.4			A,K
		Install		1.0			
		Replace		1.7			
040305	COMBUSTION LINER	Inspect	0.3	0.4		6	A,K
		Test		8.0			P,Q
		Service		0.1			
		Install		1.1		1 14 **(T701, T701C, T701D)**	
		Replace		1.9		1 14 **(T701, T701C, T701D)**	
		Repair			20.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040306	CURVIC COUPLING SEALS	Inspect		0.2			
		Install		0.9			
		Replace		1.6			
0404	POWER TURBINE (POWER TURBINE MODULE)	Inspect	0.3	0.5			O
		Test		8.0	8.0		P,Q
		Serviced		0.2			
		Install		0.7		1.12	
		Replace		1.3		1.12	
		Repair	0.3	0.3			F,S
		Overhaul			4.5		
040401	C-SUMP COVER AND C-SUMP HEAT SHIELD	Inspect	0.1	0.2			
		Test	0.3				B
		Test		8.0			C,P,Q
		Service	0.1				
		Install	0.1				
		Replace	0.2				
		Repair			5.0		
040402	NO. 6 BEARING	Inspect			0.5		
		Install			1.5		
		Replace			2.4		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040403	NO. 5 BEARING	Inspect			0.5		
		Install			1.6		
		Replace			2.7		
040404	NO. 5 CARBON SEAL	Inspect			0.5		
		Install			1.7		
		Replace		2.9			
		Repair			4.0		
040405	C-SUMP HOUSING	Inspect			2.0		
		Install			1.7		
		Replace			2.9		
		Repair			20.0		
040406	EXHAUST FRAME	Inspect	0.1	0.1	1.0		
		Install			1.9		
		Replace			3.5		
		Repair			12.0		
040407	STAGE 4 TURBINE SHROUD SECTORS	Inspect			1.0		
		Install			2.3		
		Replace			4.2		
		Repair			2.0		
040408	POWER TURBINE ROTOR ASSEMBLY	Inspect			1.5		
		Test			8.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Install			2.0		
		Replace			3.2		
		Repair			4.1		
040408 01	STAGE 3 TURBINE ROTOR BLADES	Inspect			2.0		
		Install			4.8		
		Replace			5.9		
040408 02	STAGE 3 TURBINE DISK	Inspect			2.0		
		Install			4.8		
		Replace			5.9		
		Repair			1.0		
		Inspect	0.2	0.2	2.0		
040408 03	STAGE 4 TURBINE ROTOR BLADES	Inspect	0.2	0.2	2.0		
		Install			4.8		
		Replace			5.9		
040408 04	STAGE 4 TURBINE DISK	Inspect			2.0		
		Install			4.8		
		Replace			5.9		
		Repair			1.0		
040408 05	STAGE 4 SEAL AND TURBINE NOZZLE	Inspect	0.2	0.2	2.0		
		Test			8.0		
		Adjust			4.3		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Install			2.5		
		Replace			4.1		
		Repair			8.0		
040409	STAGE 3 TURBINE NOZZLE SEGMENTS	Inspect		0.3	2.0		
		Test			8.0		
		Adjust			0.5		
		Install			2.3		
		Replace			4.2		
		Repair			8.0		
040410	STAGE 3 TURBINE SHROUD SECTORS	Inspect			1.0		
		Install			2.3		
		Replace			4.2		
040411	OUTER TURBINE DUCT	Inspect		0.3	1.0		
		Install			2.2		
		Replace			4.1		
		Repair			2.0		
040412	TURBINE CASE	Inspect	0.1	0.3	2.0		M,N
		Install			2.3		
		Replace			4.2		
		Repair			12.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040413	POWER TURBINE DRIVE SHAFT ASSEMBLY	Inspect		0.3	12.0		
		Install			2.0		
		Replace			3.2		
		Repair			4.5		
040422	STAGE 3 INNER DUCT AND AIR SEAL	Inspect			0.2		
		Repair			4.0		
0405	ACCESSORY GEARBOX (ACCESSORY SECTION MODULE)	Test		8.0			C,P,Q
		Service		0.1			
		Install		0.3		1,13	
		Replace		0.7		1,13	
		Overhaul			8.0		
040501	INLET DUCT BORESCOPE PLUG	Inspect	0.1				
		Install	0.1				
		Replace	0.1				
040502	PARTICLE SEPARATOR BLOWER AND V-BAND COUPLING ASSEMBLY	Inspect	0.2	0.2	1.0		
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Service	0.1				
		Install	0.1				21
		Replace	0.1				21

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	 Avim	 Depot	(5) Tools and Equipment	(6) Remarks
040503	PARTICLE SEPARATOR INLET DUCT	Inspect	0.1	0.3	1.0		
		Service		0.1			
		Install		0.6		1	
		Replace		1.1		1	
		Repair		3.0			
040504	ACCESSORY DRIVE GEARBOX ASSEMBLY	Inspect	0.2	0.2	4.0		
		Test	0.5	0.5	8.0		Q
		Service	0.1				
		Install			1.3		
		Replace			2.2		S
		Repair	1.4	1.0		15,26	G
		Overhaul			7.8		
040504 01	AXIS-A COVER ASSEMBLY (RADIAL DRIVE SHAFT COVER ASSEMBLY) AND RETAINING RING	Inspect	0.1				
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.1				
040505	AXIS-A BOOT (RADIAL DRIVE SHAFT COVER BOOT)	Inspect	0.1				
		Test	0.3				B,Q

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.1				
040506	RADIAL DRIVE SHAFT ASSEMBLY	Inspect	0.2				
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Service	0.1				
		Install	0.1				
		Replace	0.1				
040507	AXIS-A LUBE NOZZLE	Install	0.1				
		Replace	0.1				
0406	FUEL SYSTEM						
040601	**(T700)** PRIMER NOZZLES	Inspect	0.2		0.4		
		Test	0.2				Q
		Test		0.3			T
		Install	0.1				
		Replace	0.1				
		Repair			4.0		
040603	MAIN FUEL MANIFOLD	Inspect	0.2	0.3			M
		Test		0.5			Q

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
		Test		0.7			T
		Service	0.1	0.3			
		Install	0.2			1	
		Replace	0.3			1	
040604	**(T700)** FUEL START FEED TUBE	Inspect	0.2				
		Test	0.5				Q
		Test		0.5			T
		Service	0.1				
		Install	0.1				
		Replace	0.2				
040605	FUEL INJECTOR ASSEMBLIES	Inspect	0.2				
		Test			0.5		T
		Install	0.3				
		Replace	0.4				
		Repair			2.0		
040606	**(T700)** FUEL START MANIFOLD TUBE	Inspect	0.2				
		Test	0.5				Q
		Test		0.5			T
		Service	0.1				
		Install	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Replace	0.2				
040607	FUEL BOOST PUMP	Inspect	0.2				
		Test	0.5	0.5	1.0		Q
		Service	0.1				
		Install	0.1			19	
		Replace	0.1			19	
		Repair	0.1	0.5	5.3		
		Overhaul			6.0		
040608	HYDROMECHANICAL CONTROL UNIT AND GROOVED CLAMP COUPLING	Inspect	0.2				
		Test	0.7	0.7	12.0		Q
		Test	0.2	0.2		7,9	U
		Service	0.1				
		Adjust			30.0		
		Install	0.1			16,21	
		Replace	0.2			16,21	
		Overhaul			24.0		
040610	FUEL FILTER	Inspect	0.1				
		Test	0.5	0.5	2.0		Q
		Service	0.1				
		Install	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	(4) Maintenance Category Avim	(4) Maintenance Category Depot	(5) Tools and Equipment	(6) Remarks
		Replace	0.1				
		Overhaul			10.0		
04061001	FUEL FILTER ELEMENT AND BOWL	Inspect	0.1				
		Test	0.5	0.5			Q
		Service	0.2				
		Install	0.1				
		Replace	0.1				
04061002	DIFFERENTIAL PRESSURE INDICATOR (FUEL FILTER IMPENDING BYPASS INDICATOR ASSEMBLY)	Inspect		0.2			
		Adjust	0.1				H
		Install			0.1		
		Replace			0.1		
		Repair			1.0		
04061003	FUEL FILTER BYPASS SENSOR	Inspect			0.2		
		Install			0.1		
		Replace			0.1		
		Repair			1.0		
040611	GEARBOX-TO-FUEL CONTROL HOSE ASSEMBLY (GEARBOX-TO-HMU HOSE ASSEMBLY)	Inspect	0.1				
		Test	0.5				Q
		Test		0.5			T
		Service	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	 Avim	 Depot	(5) Tools and Equipment	(6) Remarks
		Install	0.1				
		Replace	0.1				
040612	FUEL PRESSURE SENSOR	Inspect	0.1				
		Test	0.3				Q
040613	**(T701, T701C, T701D)** OVERSPEED AND DRAIN VALVE (ODV) MANIFOLD ASSEMBLY	Install	0.1				
		Replace	0.2				
		Inspect	0.2	0.3			
		Test		0.5			Q
040614	**(T701, T701C, T701D)** OVERSPEED AND DRAIN VALVE (ODV)	Service	0.1	0.3			
		Install	0.1			1	
		Repair	0.1				
		Replace	0.1			1	
		Inspect	0.2				
		Test	0.7	0.7	2.0		Q
		Test	0.2	0.2		7,9	U
		Service	0.1				
		Install	0.1			19	
		Repair			12.0		
		Replace	0.1			19	

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040615	**(T700)** PRESSURIZING AND OVERSPEED UNIT (POU) MANIFOLD ASSEMBLY	Inspect	0.2	0.3			
		Test		0.5			Q
		Service	0.1	0.3			
		Install	0.1			1	
		Repair	0.1				
		Replace	0.1			1	
040616	**(T700)** PRESSURIZING AND OVERSPEED UNIT (POU)	Inspect	0.2				
		Test	0.7	0.7	2.0		Q
		Test	0.2	0.2		7,9	U
		Service	0.1				
		Install	0.1			19	
		Repair			12.0		
		Replace	0.1			19	
0407	ELECTRICAL SYSTEM (ELECTRICAL AND IGNITION SYSTEM)						
040701	IGNITER PLUGS	Inspect	0.1	0.1			
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Test			0.3		T
		Service	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Install	0.1				
		Replace	0.1				
040702	**(T700, T701)** ELECTRICAL CONTROL UNIT OR **(T701C, T701D)** DIGITAL ELECTRONIC CONTROL	Inspect	1.0	1.0			
		Test	0.5	0.5	3.0	9	Q
		Service	1.0				
		Adjust			3.0		
		Install	0.1			20	
		Replace	0.1			20	
		Repair	0.3				
		Overhaul			20.0		
040703	**(T700, T701)** ELECTRICAL CONTROL UNIT OR **(T701C, T701D)** DIGITAL ELECTRONIC CONTROL SCROLL SEAL	Inspect	0.1				
		Install	0.1				
		Replace	0.1				
040704	**(T700, T701)** HISTORY RECORDER OR **(T701C, T701D)** HISTORY COUNTER	Inspect	0.1	0.1			
		Test			3.0		
		Service	0.1				
		Install	0.1			19	
		Replace	0.1			19	
		Repair	0.1				
		Overhaul			10.0		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040705	ELECTRICAL IGNITION LEADS	Inspect	0.1				
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2		7	U
		Service	0.1				
		Install	0.1				
		Replace	0.1				
040706	IGNITION EXCITER ASSEMBLY	Inspect	0.1	0.1			
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Test			2.0		
		Service	0.1				
		Install	0.1				
		Replace	0.1				
		Repair	0.1				
040707	GREEN ELECTRICAL CABLE (W3)	Inspect	0.2				
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2	0.2	7	U
		Service	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
040708	YELLOW ELECTRICAL CABLE (W4)	Install	0.1				
		Replace	0.1				
		Repair	0.3				
		Inspect	0.2				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2	0.2	7	U
040709	BLUE ELECTRICAL CABLE (W5)	Service	0.1				
		Install	0.1				
		Replace	0.1				
		Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2	0.2	7	U
040710	ALTERNATOR STATOR	Service	0.1				
		Install	0.1				
		Replace	0.1				
		Inspect	0.1	0.1			
		Test	0.3				B,Q
		Test		8.0	C,P,Q		

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Test	0.2	0.2	7,9	U	
		Service	0.1				
		Install	0.1				
		Replace	0.1				
040711	ALTERNATOR ROTOR	Inspect		0.1			
		Service		0.1			
		Install		0.1		1	
		Replace		0.1		1	
040712	THERMOCOUPLE ASSEMBLY	Inspect	0.3				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2		7,9	U
		Service	0.1				
		Install	0.1				
		Replace	0.2				
		Repair	1.0	1.0	4.1		X
040713	POWER TURBINE SPEED AND TORQUE SENSOR ASSEMBLY (TORQUE AND OVERSPEED SENSOR)	Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2		7,9	U

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Service	0.1				
		Install	0.1				
		Replace	0.1				
		Repair		2.0	2.0		
040714	POWER TURBINE SPEED AND TORQUE SENSOR ASSEMBLY (NP SENSOR)	Inspect	0.1	2.0			
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test	0.2	0.2		7,9	U
		Service	0.1				
		Install	0.1				
		Replace	0.1				
		Repair			2.0		
0408	OIL SYSTEM						
040801	LUBE OIL COOLER (OIL COOLER)	Inspect	0.1	0.1	0.6		
		Test	0.5	0.5	2.0		Q
		Service	0.1				
		Install	0.1				
		Replace	0.1				
		Repair	0.2	0.6			

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040802	LUBE AND SCAVENGE PUMP (OIL AND SCAVENGE PUMP)	Inspect	0.1				
		Test	0.5	0.5	2.0		Q
		Service	0.2				
		Install	0.1			19	
		Replace	0.1			19	
		Repair			3.0		
		Overhaul			5.0		
040803	SCAVENGE SCREENS	Inspect	0.1				
		Service	0.1				
		Install	0.1				
		Replace	0.2				
040804	OIL FILTER BYPASS SENSOR	Inspect	0.1	0.1			
		Test	0.5	0.5			Q
		Service	0.1				
		Install	0.1				
		Replace	0.1				
		Repair		0.1			
040805	FILTER BOWL AND INDICATOR ASSEMBLY (OIL FILTER BOWL AND INDICATOR ASSEMBLY)	Inspect	0.1				
		Test	0.5				Q
		Service	0.1				
		Adjust	0.1				H

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Install	0.1				
		Replace	0.1				
		Repair			2.5		
040805	FILTER ELEMENT (OIL FILTER ELEMENT)	Test	0.5	0.5		Q	
01		Install	0.1				
		Replace	0.1				
040806	OIL COOLER BYPASS RELIEF VALVE	Inspect		0.5			
		Test			0.8		
		Install		0.1			
		Replace		0.1			
		Repair			2.0		
040807	COLD OIL RELIEF	Inspect		0.5			
		Test			0.8		
		Install		0.1			
		Replace		0.1			
		Repair			2.0		
040808	BYPASS VALVE ASSEMBLY	Inspect		0.2			
		Test		8.0			C,P,Q
		Test			0.8		T
		Service		0.3			

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
		Install		0.1		1	
		Replace		0.1		1	
		Replace			2.0		
040809	ELECTRICAL CHIP DETECTOR	Inspect	0.3	0.3			
		Test	0.3	0.3			Q
		Service	0.2				
		Install	0.1				
		Replace	0.1				
040810	C-SUMP FORWARD SCAVENGE TUBE	Inspect	0.1	0.3			
		Test		0.5			T
		Test		8.0			C,P,Q
		Service	0.1	0.3			
		Install		0.1		1	
		Replace		0.2		1	
040811	C-SUMP AFT SCAVENGE TUBE	Inspect	0.1	0.3			
		Test		0.5			T
		Test		8.0			C,P,Q
		Service	0.1	0.3			
		Install		0.1		1	
		Replace		0.2		1	

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040812	C-SUMP OIL SUPPLY TUBE	Inspect	0.1	0.3			
		Test		0.5			T
		Test		8.0			C,P,Q
		Service	0.1	0.3			
		Install		0.1		1	
		Replace		0.2		1	
040813	B-SUMP DRAIN TUBE	Inspect	0.1				
		Test	0.5				B,Q
		Service	0.1				
		Install	0.1				
		Replace	0.1				
040814	OIL TANK CAP AND ADAPTER	Inspect	0.2				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Service	0.1				
		Install	0.1				
		Repair	1.0				
		Replace	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040815	LUBE MANIFOLD ASSEMBLY (OIL MANIFOLD ASSEMBLY)	Inspect	0.2	0.3			
		Test		0.5			Q
		Test		0.5			T
		Service	0.2	0.3			
		Install		0.3		1	
		Replace		0.6		1	
		Repair	0.2	0.5			E
040816	OIL SUPPLY TUBES (LEFT-HAND AND RIGHT-HAND)	Inspect	0.1				
		Test	0.5	0.5			Q
		Test		0.5			T
		Service	0.1				
		Install	0.1				
		Replace	0.1				
040817	B-SUMP OIL INLET CHECK VALVE	Inspect	0.1				
		Test	0.5	0.5			Q
		Install	0.1				
		Replace	0.1				
040818	MAIN FRAME OIL STRAINER	Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
		Service	0.3				
		Install	0.1				
		Replace	0.1				
040819	FLUID LEVEL INDICATORS (OIL LEVEL INDICATORS)	Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.2				
040820	OIL TRANSFER SLEEVES	Inspect		0.2			
		Test		8.0			C,P,Q
		Install		0.5		1	
		Replace		0.9		1	
040821	MACHINE THREAD PLUG (OIL DRAIN PLUG)	Inspect	0.1				
		Test	0.3				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.1				
040822	OIL DRAIN INSERT	Inspect	0.1				
		Test	0.3				
		Test		8.0			C,P,Q

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Install	0.1				
		Replace	0.1				
040824	MID C-SUMP SCAVENGE TUBE	Inspect	0.2	0.3			
		Test		0.5			T
		Test		8.0			C,P,Q
		Service	0.1	0.3			
		Install		0.2		1	
		Replace		0.3		1	
040825	C-SUMP FORWARD OIL SCAVENGE TUBE	Inspect	0.2	0.3			
		Test		0.5			T
		Test		8.0			C,P,Q
		Service	0.1	0.3			
		Install		0.5		1	
		Replace		0.8		1	
040826	**(T700, T701C, T701D)** OIL TEMPERATURE SENSOR	Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.2				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category: Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
040827	OIL PRESSURE SENSOR	Inspect	0.2				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.2				
040828	**(T700, T701C, T701D)** B-SUMP DELTA PRESSURE TUBE	Inspect	0.2				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.1				
0410	AIR SYSTEM						
041001	**(T700)** P3 HOSE AND TUBE ASSEMBLY	Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test		0.5			T
		Service	0.1				
		Install	0.1				
		Replace	0.1				
041002	ANTI-ICING BLEED DUCT	Inspect	0.1	0.1			
		Test		8.0			C,P,Q

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
		Service	0.1	0.3			
		Install		0.2			
		Replace		0.3		1	
041003	ANTI-ICING IGV DUCT	Inspect	0.1	0.3			
		Test		8.0			C,P,Q
		Service	0.1	0.2			
		Install		0.1		1	
		Replace		0.2		1	
041004	ANTI-ICING IGV FEEDTUBE	Inspect	0.2	0.3			
		Test		8.0			C,P,Q
		Service	0.1	0.3			
		Install		0.2		1	
		Replace		0.3		1	
041006	ANTI-ICING BLEED AND START VALVE, ANTI-ICING SEAL HOUSINGS. ANTI-ICING SEAL RETAINER, LANYARD AND CLIP ASSEMBLY	Inspect	0.2	0.2			
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Test			0.5		T
		Service	0.2				
		Install	0.1			20	
		Replace	0.1			20	

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category Avum	Avim	Depot	(5) Tools and Equipment	(6) Remarks
		Repair	0.2				
		Overhaul			16.0		
041007	FORWARD SEAL PRESSURE TUBE	Inspect	0.1	0.2			
		Test		1.0			Q
		Test		0.5			T
		Service	0.1	0.3			
		Install		0.2		1	
		Replace		0.3		1	
041008	SENSING TUBE	Inspect	0.2	0.2			
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Service	0.2				
		Install	0.1				
		Replace	0.1				
		Repair			0.5		
041009	COMPRESSOR LEAKAGE AIR TUBE	Inspect	0.2	0.3			
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Service	0.2				
		Install	0.1				

Section II. MAINTENANCE ALLOCATION CHART (Cont)

Maintenance Allocation Charts
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Category			(5) Tools and Equipment	(6) Remarks
			Avum	Avim	Depot		
		Replace	0.1				
041010	SEAL PRESSURE AND SCAVENGE TUBE ASSEMBLY	Inspect	0.1	0.3			
		Test		8.0			C,P,Q
		Test		0.5			T
		Service	0.1	0.3			
		Install		0.1		1	
		Replace		0.1		1	
041011	**(T701, T701C, T701D)** P3 TUBE	Inspect	0.1				
		Test	0.5				B,Q
		Test		8.0			C,P,Q
		Install	0.1				
		Replace	0.1				

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

Tool and Test Equipment Requirements
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T701D Turbine Engines O-AVUM F-AVIM D-DEPOT

Tool or Test Equipment Reference Code	Maintenance Category	Nomenclature	National/Nato Stock Number	Tool Number
1	F	Adapter, Maintenance Stand	4920-01-109-2491	21C7071G01
2	O,F	Adapter, Engine Transportation	4920-01-128-3121	21C7082G02
3	F,D	Analyzer, Vibration	6625-00-226-5699	1784471-901 (FSCM 56232)
4	O,F,D	Wash Unit, Universal	2830-01-185-6215	21C2438G01
5	O,F,D	Container, Shipping and Storage	8145-01-059-5689	8145OCN004-1
6	O,F,D	**(T700)** Borescope Kit	6650-01-111-1011	21C7190P01
6	O,F,D	**(T700)** Borescope Kit	6650-01-219-8644	21C7744P01
6	O,F,D	**(T700)** Borescope Kit	6650-01-210-6935	21C7744P02
6	O,F,D	**(T701, T701C, T701D)** Borescope Kit	6650-01-150-1566	21C7190P02
6	O,F,D	Borescope Kit	6650-01-234-0468	21C7700P03
6	O,F,D	Borescope Kit	6650-01-227-9634	21C7744P03
6	O,F,D	Borescope Kit	6650-01-234-0467	21C7779P03
7	O,F,D	Multimeter	6625-00-553-0142	TS-352 B/U
8	O,F,D	Sling, Lifting	4920-01-108-3484	21C7081G02
9	O,F,D	**(T700, T701C, T701D)** Switch Box, ECU/DEC Circuit Continuity	4920-01-108-3474	21C7085G01
9	O,F,D	**(T701)** Switch Box, ECU Circuit Continuity	4920-01-319-3960	21C7085G02
10	F,D	Adapter, Cold Section Module Shipping	4920-01-172-4967	21C7437G01
11	F,D	Adapter, Gas Generator Shaft Tie-bolts Restraining	4730-01-198-7868	21C7439P01

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS (Cont)

Tool and Test Equipment Requirements
(AVSCOM Reg 310-10)

Nomenclature of End Items
T700-GE-700, T700-GE-701, T700-GE-701C, and T701D Turbine Engines O-AVUM F-AVIM D-DEPOT

Tool or Test Equipment Reference Code	Maintenance Category	Nomenclature	National/Nato Stock Number	Tool Number
12	F,D	Container, Power Turbine Module Shipping and Storage	8145-01-128-1855	21C7300G01
13	F,D	Container, Accessory Section Module Shipping and Storage	8145-01-128-1842	21C7301G01
14	F,D	**(T701, T701C, T701D)** Adapter, Gas Generator Rotor/Midframe Lock/Support	4920-01-151-0759	21C7247G01
15	O,F,D	Puller, Seal Mating Ring	7120-01-198-2308	21C7702G01
16	O,F,D	Adapter, Plug	4920-01-135-9671	21C7086P01
17	F,D	Guide, No. 1 Carbon Seal Assembly	4920-01-110-1430	21C7109G01/G02
18	F,D	Support, Dummy Compressor Casing Bar	4920-01-110-1429	21C7112G01
19	O,F,D	Case, Shipping and Storage	8145-01-130-3364	21C7302P01
20	O,F,D	Case, Shipping and Storage	8145-01-128-6333	21C7303P01
21	O,F,D	Case, Shipping and Storage	8145-01-128-6332	21C7304P01
22	F,D	Bar, Gas Generator Rotor Antirotation	4920-01-151-9225	21C7399G01
23	F,D	Bench Set, Compressor Rotor Stage 1 Blade-Disk (Bridge 17A8744P04)	5120-01-136-9670	21C7419G01
24	F,D	Lock, Compressor Rotor	4920-01-133-5659	21C7422G01
25	O,F	Set Dresser, Leading Edge, Stage 1 Blade-Disk		21C7478G01
26	F,D	Puller, Carbon Seal, Axis-G	5120-01-128-4467	21C7239G01/G02

Section IV. REMARKS

Remarks	
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701DTurbine Engines	
Reference Code	Remarks/Notes
A	Diagnostic inspection using borescope.
B	Functional test at AVUM-engine in aircraft.
C	Functional test at AVIM-engine in METS.
D	Repairs at AVIM includes the complete engine assembly, individual Line Replaceable Units (LRU's) (Accessories), and Modules.
E	Replace seal.
F	Repair limited to replacement of external lines, hoses, and Line Replaceable Units (LRU's) (Accessories).
G	Replacement of carbon seals and mating rings.
H	Reset button.
I	Compressor cleaning.
J	Visual inspection without detailed disassembly.
K	Will be accomplished at AVUM with assistance of AVIM.
L	The stages 1 and 2 gas generator turbine rotor and the gas generator stator are parts of a matched assembly. Both assemblies will be replaced. Refer to **(T700)** TM 1-2840-248-23P, **(T701)** TM 1-2840-238-23P or **(T701C, T701D)** TM 1-2840-258-23P to identify replacement part.
M	Ten-hour/fourteen-day inspection requirement (THIR).
N	Periodic inspection requirement (500 flight hours).
O	For power turbine module inspection, see individual components for inspection requirements.
P	Includes required task time for installation and removal of engine into METS.
Q	Accomplished after component replacement.
R	Only external preformed packings will be removed or replaced.
S	Only locknuts securing brackets will be removed or replaced.
T	Bench test.
U	Accomplished during troubleshooting.

Section IV. REMARKS (Cont)

Remarks	
T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D Turbine Engines	
Reference Code	Remarks/Notes
V	Removal of right-hand compressor case allowed at AVIM for access to compressor rotor for blending and chamfering of stages 1 thru 5 blades and for clipping of stage 1 blades.
W	AVIM repair limited to blending and chamfering of stages 1 thru 5 compressor rotor blades and clipping of stage 1 blades.
X	Repair limited to installation of cushioned clamps when wrap-around clamps (former configuration) are cracked or broken.

APPENDIX C

REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)

(Not Applicable)

The RPSTL is published as a separate document.

See TM 1-2840-248-23P for T700-GE-700 engine,
TM 1-2840-238-23P for T700-GE-701 engine, or
TM 1-2840-258-23P for T700-GE-701C and T700-GE-701D engines.

APPENDIX D

EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists expendable supplies and materials needed to operate and maintain the T700-GE-700, T700-GE-701, T700-GE-701C, and T700-GE-701D turboshaft engines. These items are authorized to you by CTA 50-970, Expendable Items (except medical, Class V, repair parts, and Heraldic Items).

NOTE

Expendable supplies and materials with no NSN listed may be purchased from the manufacturer, indicated by the FSCM (five-digit number in parentheses) listed in the Description column.

D-2. EXPLANATION OF COLUMNS.

a. Column 1 - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., “Use cleaning compound item 5, Appendix D”).

b. Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item. AVUM corresponds to the O code. AVIM corresponds to the F code.

c. Column 3 - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the Federal item name alphabetically and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. TABULAR LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	O	8040-01-005-1742	Adhesive, EPON (EPON 934A, EPON 934 B) (33564)	PT
1A	I	6810-00-223-2739	Acetone, ASTM-D329 (81348) (Supersedes O-A-51)	PT
2	F	8040-00-145-0020	Adhesive/Sealant, RTV-3145 (71984)	EA
3	O	6810-00-855-6160	Alcohol, Isopropyl, TT-I-735, Grade B, (5-gal can) (81348)	EA
4	O	8030-00-057-2354	Alodine No. 1200S, MIL-DTL-81706 (84063) (Supersedes MIL-C-81706)	EA
5	O	8105-00-822-4336	Bag, Plastic, (10 x 24 in.) (81348) (PPP-B-26 Cancelled)	EA
6	O	8105-00-837-7757	Bag, Plastic, (12 x 12 in.) (81348) (PPP-B-26 Cancelled)	EA
7	O	8105-00-837-7752	Bag, Plastic, (3 x 4 in.) (81348) (PPP-B-26 Cancelled)	EA
8	O	8105-00-837-7753	Bag, Plastic, (4 x 4 in.) (81348) (PPP-B-26 Cancelled)	EA
9	O	8105-00-837-7754	Bag, Plastic, (6 x 6 in.) (81348) (PPP-B-26 Cancelled)	EA
10	O	8105-00-837-7755	Bag, Plastic, (8 x 8 in.) (81348) (PPP-B-26 Cancelled)	EA
11	O	8105-00-159-4998	Bag, Plastic, (9 x 12 in.) (81348) (PPP-B-26 Cancelled)	EA
12	O	8135-00-543-6574	Barrier Material (Greaseproof, Water-proof), MIL-B-121, Type 1, Grade A (4 x 300 ft)	FT
13	F	9160-00-253-1171	Beeswax, (1 lb) (81349) (C-B-191C Cancelled)	EA
14	F	8530-00-162-5629	Blade, Razor (Single Edge) (Box of 20)	EA
15	O	7920-00-205-0445	Brush, Bottle, A-A-2954 STD CL 1SZ2-1/4, Model TW (80244) (Supersedes H-B-1050)	EA
16	O	7920-00-514-2417	Brush, Soft-Bristle, A-A-289 (58536)	EA
17	O	5340-01-261-1723	Cap, Protective, B-319-4 (95760)	EA
18	O	5340-01-194-9069	Cap, Protective, B-319-5 (95760)	EA
19	O		Cap, Protective, B-319-6 (95760)	EA
20	O	5340-00-727-4777	Cap, Protective, CD-10 (95760)	EA
21	O	5340-00-727-4778	Cap, Protective, CD-12 (95760)	EA
22	O	5340-00-515-0525	Cap, Protective, CD-3 (95760)	EA
23	O	5340-00-605-5416	Cap, Protective, CD-4 (95760)	EA
24	O	5340-00-664-0671	Cap, Protective, CD-6 (95760)	EA
25	F	5365-00-773-0760	Plug, Machine Thread, Magnetic (36540)	EA
26	O	5340-00-680-4394	Cap, Protective, CD-8 (95760)	EA

Section II. TABULAR LIST (Cont)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
27	F	5340-00-616-4796	Cap, Protective, EC-10 (95760)	EA
28	O	5340-00-811-5959	Cap, Protective, EC-12 (95760)	EA
29	F	5340-00-461-0949	Cap, Protective, EC-14 (95760)	EA
30	O	5340-00-200-5904	Cap, Protective, EC-16 (95760)	EA
31	O	5340-00-732-7462	Cap, Protective, EC-17 (95760)	EA
32	O	5935-00-500-5011	Cap, Protective, EC-18 (95760)	EA
33	O	5935-00-259-2546	Cap, Protective, EC-19 (95760)	EA
34	O	5340-00-817-6937	Cap, Protective, EC-8 (95760)	EA
35	O	5340-01-240-8292	Cap, Protective, EC-9 (95760)	EA
36	O	5340-00-530-6818	Cap, Protective, EP-12 (95760)	EA
37	O	5935-00-990-8321	Cap, Protective, EP-8 (95760)	EA
38	O	5340-00-589-6020	Cap, Protective, FF-26 (99017)	EA
39	O	5340-01-064-1361	Cap, Protective, FF-28 (99017)	EA
40	O	5340-00-123-3355	Cap, Protective, WW-11 (99017)	EA
41	O	5340-00-792-2683	Cap, Protective, WW-2 (99017)	EA
42	O	5340-00-237-7165	Cap, Protective, WW-6 (99017)	EA
43	O	5340-00-849-6375	Cap, Protective, WW-8X (99017)	EA
44	O	5340-00-882-2784	Cap, Protective, WW2X (99017)	EA
45	O	5340-00-074-4291	Cap, Protective, W5 (99017)	EA
46	O	5340-00-826-0423	Cap, Protective, 1/2 SC x 7/8 (99017)	EA
47	O		Cap, Protective, 1/4 SC x 1/2 (95760)	EA
48	F	5340-00-825-4586	Cap, Protective, 3/8 SC x 7/8 (95760)	EA
49	O	5340-00-777-4620	Cap, Protective, 5/16 SC x 7/8 (95760)	EA
50	O	5340-00-827-0802	Cap, Protective, 5/8 SC x 7/8 (99017)	EA
51	O	5340-00-722-9073	Cap, Protective, 9/16 SC x 7/8 (95760)	EA
52	O	5350-00-174-0995	Cloth, Abrasive, ANSI-B74.18, Fine, Type 1, Class 1 (9 x 11 in.) (81348) (Supersedes GGG-C-520)	EA
53	O	5350-00-192-5049	Cloth, Abrasive, ANSI-B71.18, Type 1, Class 1 (9 x 11 in.) (81348) (Supersedes P-C-451)	EA
54	F	5350-00-192-5049	Cloth, Abrasive, ANSI-B17.18, 220-230 Grit, Type 1, Class 1 (9 x 11 in.) (81348) (Supersedes P-C-451)	EA
55	O	5350-00-221-0872	Cloth, Crocus, ANSI-B17.18 (9 x 11 in.) (81348) (Supersedes P-C-458)	EA

Section II. TABULAR LIST (Cont)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
		NOTE Antiseize Thread Compound AMS 2518 will be replaced by Synthetic Graphite Grease GP460 (Antiseize), Synthetic Graphite (60218).		
56	O	8030-01-044-5034	Compound, Antiseize Thread, AMS 2518 and GP-460 (1-lb can) (81349) (Supersedes MIL-T-5544)	LB
	O	8030-01-138-1666	Compound, Antiseize Thread, AMS 2518 (250 grams) (81349) (Supersedes MIL-T-5544)	TU
57	O	6850-00-181-7594	Compound, Cleaning, B&B 3100 (5-gal can) (21361)	EA
	O	6850-00-181-7597	Compound, Cleaning, B&B 3100 (55-gal drum) (21361)	EA
58	O	6850-01-372-8303	Cleaner (MIL-PRF-85704, Type II) (Supersedes MIL-C-85704)	5 Gal
59	O	6850-01-372-8304	Cleaner (MIL-PRF-85704, Type II) (Supersedes MIL-C-85704)	55 Gal
60	O	6850-01-370-5244	Cleaner (MIL-PRF-85704, Type IIA) (Supersedes MIL-C-85704)	55 Gal
61	O	6850-01-370-5245	Cleaner (MIL-PRF-85704, Type IIA) (Supersedes MIL-C-85704)	5 Gal
62	O		Compound, Corrosion Preventive, MIL-PRF-16173, Grade 3 (81349) (Supersedes MIL-C-16173)	EA
63	O	5350-01-348-2789	Compound, Lapping, Grade A, Fine, 280 Grit, (71536)	LB
64	O		Compound, Lapping, Grade B, Medium Fine, 240 Grit, (71536)	LB
65	O		Compound, Lapping, Grade C, Medium Fine, 220 Grit, (71536)	LB
66	F	8030-01-268-5917	Compound, Retaining, Loctite RC 620 (05972)	EA
67			Container, Plastic (5-gallon) (Commercial)	
68	O	8135-00-142-8911	Cushioning Material, Bound Fiber, PPP-C-1120, Type 3, Class A (72 x 24 x 12 in.)	EA
69	O	6850-01-493-4408	Deoxalume 2310 (235870) (61102)	DR
70	O	6850-00-264-6572	Desiccant, Activated, MIL-D-3464 Type 1 (150 bags, 16-unit bags, 200-lb drum) (81349)	EA
71	O		Detergent, Liquid Dish-Washing (Commercial)	
72	F	9150-00-159-5012	Fluid, Assembly, Mobil RT403C (4-oz tube) (19135) (Also see item 117.)	EA
73	O	9130-00-256-8613	Fuel, Turbine, MIL-DTL-5624JP4, Grade JP4 (1-gal can) (81349) (Supersedes MIL-T-5624JP4)	EA
74	O	9130-00-273-2379	Fuel, Turbine, MIL-DTL-5624JP5, Grade JP5 (1-gal can) (81349) (Supersedes MIL-T-5624JP5)	EA
75	O	9130-01-031-5816	Fuel, Turbine, MIL-DTL-83133, Grade JP8 (1-gal can) (81349) (Supersedes MIL-T-83133)	EA

Section II. TABULAR LIST (Cont)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
76	F	8415-01-363-1637	Gloves, Disposable Polyethylene	PR
77	F	8415-00-069-5414	Gloves, Thermally-Insulated (5325S11) (39428)	PR
78	O	8030-01-044-5034	Graphite-Petrolatum Lubricant A50TF201 (70079)	LB
79	O		Grease GP460 (Antiseize), Synthetic Graphite (60218)	EA
80	O	6830-00-247-0619	Ice, Dry CGA G-6.2 (81348) (Supersedes BB-C-104)	LB
81	O	7510-00-161-0813	Ink, Stencil Marking, A-A-208 (1-qt can) (Supersedes TT-I-1795)	EA
81A	O		Lubricant, Solid Film, MIL-PRF-81329	EA
82	O	6850-00-664-9067	Marker, Blue Dykem, DX-100, A-A-59168 (81349) (Supersedes MIL-L-83795)	EA
83	F	7520-00-904-1268	Marker, Blue Felt Tip, Fine - Line, A-A-2778 (81348) (Supersedes GG-M-001130)	EA
84	O	6810-00-597-3608	Methanol, O-M-232 (81348)	EA
85	O	9150-00-985-7099	Oil, Lubricating, MIL-PRF-23699 (1-qt can) (81349) (Supersedes MIL-L-23699)	EA
86	O	9150-00-273-2388	Oil, Lubricating, MIL-PRF-6081, Grade 1010 (1-qt can) (81349) (Supersedes MIL-L-6081)	EA
87	O	9150-00-782-2627	Oil, Lubricating, MIL-PRF-7808 (1-qt can) (81349) (Supersedes MIL-L-7808)	EA
88	O	9150-00-261-7899	Oil, Penetrating, A-A-50493 (1-pt can) (81348) (Supersedes VV-P-216)	EA
89	O	7920-00-659-9175	Pad, Scotch Brite (No. 7447, 6-1/2 x 9-1/2 inches) (81348) (L-P-0050 Cancelled)	EA
90	F	8010-00-409-3810	Paint, SermeTel No. 196 (1-gallon can) (78710)	EA
91	F	6850-00-065-8418	Penetrant, Zyglo, ZL-22A (37676)	EA
92	O	5120-01-370-6693	Pliers, Slip Joint: Electrical Connector Type, Steel Alloy, Replaceable Plastic Jaws	EA
93	O	5935-00-352-9077	Plug, Protective, 1080	EA
94	F	8040-00-083-8403	Primer, Adhesive (GE Co.) Silicone Products Business Division Hudson River Road Waterford, NY 12188	EA
95	O	8010-00-297-0593	Primer, Zinc-Chromate, TT-P-1757 (16-oz aerosol can) (81348)	EA
96	F	8040-00-546-8604	Sealant, RTV-162 (01139) MIL-A-46146A, Type 1	EA
97	O	–	Sealant, RTV-3145 (Gray) Adhesive Potting Compound	EA
98	O	6850-00-621-1820	Solution, Leak Test Oxygen System, MIL-PRF-25567 (81349) (Supersedes MIL-L-25567)	EA
99	O	6850-00-264-9038	Solvent, Dry Cleaning, MIL-PRF-680, Type I (5-gal pail) (81348) (Supersedes P-D-680)	EA

Section II. TABULAR LIST (Cont)

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
100	O	6850-00-405-9386	Solvent, Miller-Stephenson (MS-160) (18598)	EA
101	F		Steel, Stainless (sheet stock) (300 Series) 0.180-0.200 in. thick	
102	F		Steel, Stainless (sheet stock) (300 Series) 0.203-0.209 in. thick	
103	F		Steel, Stainless (sheet stock) (300 Series) 0.240-0.260 in. thick	
104	O	5345-00-243-6087	Stone, Abrasive, A-A-3068, Type 1 (1/4 x 1/4 x 3-1/2 in.) (81348) (Supersedes SS-S-736)	EA
105	F		Syringe, Pressure Disposable Plastic (1/2 inch diameter x 2 1/2 inch long with a 1/32 inch ID)	EA
106	O	5970-00-541-6458	Tape, Masking (roll) (37695)	EA
107	O	7510-00-074-5124	Tape, Pressure-Sensitive Adhesive, ASTM-D5486, Type IV (2 in. x 60 yds) (Supersedes PPP-T-60)	EA
108	O	7510-00-476-5276	Tape, Scotch No. 470 HHT-0025 (04963)	EA
109	O	5970-00-480-1329	Tape, Silicone (Roll) (3003M70P01) (07482)	EA
110	O	5970-00-949-4846	Tape, Silicone (1 in. x 36 ft)	EA
111	O	5970-00-541-6458	Tape, Vinyl, No. 199C (83334)	EA
112	O	7920-00-260-1279	Towels, Machinery (81348) (DDD-T-541 Cancelled)	EA
113	O	7920-00-682-6710	Towels, Paper, A-A-1432 (81348) (Supersedes UU-T-595)	EA
114	O	6810-00-930-6311	Trichloroethane, ASTM-D4126 (81348) (Supersedes O-T-620)	EA
115	O	6850-00-033-8851	Trichlorotrifluoroethane, MIL-C-81302 (Type II, TF Freon) (81349)	EA
116	O		Tubing, Tygon (1/2 Inch OD x 3/8 Inch ID) (61501)	EA
117	F	9150-00-159-5012	Ultrachem Assembly Fluid, No. 1 (4-oz tube) (substitute for Mobil RT403C) (56385)	EA
118	O	2925-01-142-0981	Wrap, Teflon Spiral (Black) (1/2-in. wide) (99207)	EA
119	O	2925-01-110-1467	Wrap, Teflon Spiral (Green) (1/2-in. wide) (99207)	EA
120	O	2925-01-110-1466	Wrap, Teflon Spiral (Sleeve, Teflon Chafing) (Blue) (1/2-in. wide) (99207)	EA
121	O	2925-01-129-1261	Wrap, Teflon Spiral (Sleeve, Teflon Chafing) (Yellow) (1/2-in. wide) (99207)	EA

APPENDIX E

SCHEMATIC DIAGRAMS

Engine schematic diagrams for the fuel, electrical, oil, and air systems are shown in the following figures:

- Figure 1-14. **(T700)** Fuel System Schematic
- Figure 1-15. **(T701, T701C, T701D)** Fuel System Schematic
- Figure 1-20. **(T700)** Oil System Schematic
- Figure 1-21. **(T701)** Oil System Schematic
- Figure 1-22. **(T701C, T701D)** Oil System Schematic
- Figure FO-1. Air System Schematic
- Figure FO-2. Electrical Schematic Diagram

APPENDIX F

ILLUSTRATED LIST OF MANUFACTURED ITEMS

F-1. APPENDIX OVERVIEW

F-2. Introduction.

a. This appendix includes complete instructions for making items authorized to be manufactured or fabricated at organizational level.

b. A part number index in alphanumeric order is provided (table F-1) for cross-referencing the part number of the item to be manufactured to the figure number which covers fabrication criteria.

c. All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

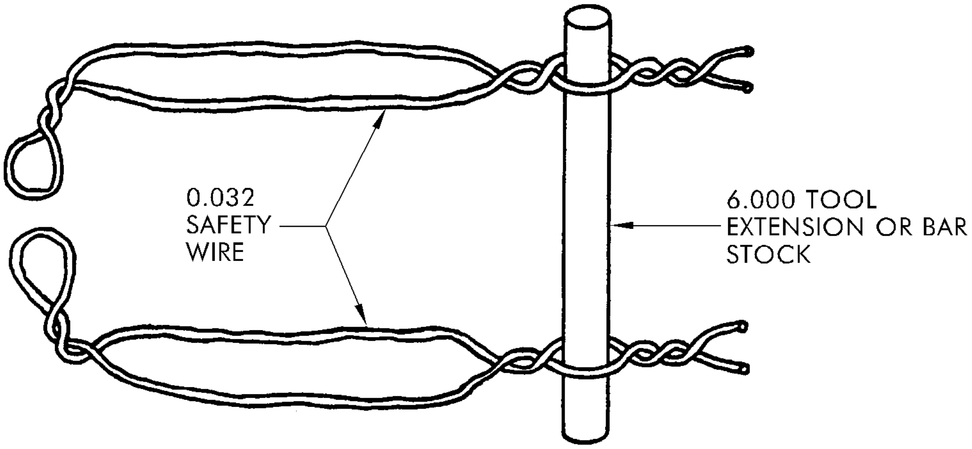
Table F-1. Manufactured Item Part Number Index

Part No.	Nomenclature	Figure No.
LMT 747	Axis-G Seal Mating Ring Puller	F-1
LMT 748	Axis-G Seal Mating Ring Guide Assembly	F-2
LMT 749	Swirl Frame Sleeve Pusher	F-3
LMT 754	Fuel Injector Boss Lapping Fixture	F-4
LMT 777	Hot Section Module Sprayer	F-5
LMT 806	Spherical Bearing Swaging Tool	F-17
LMT 807	Spherical Bearing Swaging Tool	F-18
LMT 808	Spherical Bearing Swaging Tool	F-19
LMT 841	Allied Signal (Garrett) A/I Valve Sizing Tool	F-6
LMT 893	Three O'clock Lug Drill Fixture	F-7
LMT 894	Six O'clock Lug Drill Fixture	F-8
LMT 895	Nine O'clock Lug Drill Fixture	F-9
LMT 896	Bushing Pusher	F-10
LMT 933	Outer Balance Piston Seal Puller	F-11
LMT 942	**(T700)** Series Engine Hot Section Wash Kit	F-12
LMT 943	**(T701, T701C, T701D)** Series Engine Hot Section Wash Kit	F-13
LMT 954	Go-NoGo Pin (0.208 in. Dia)	F-14
LMT 955	Go-NoGo Pin (0.207 in. Dia)	F-14
LMT 956	Go-NoGo Pin (0.206 in. Dia)	F-14
LMT 957	Go-NoGo Pin (0.205 in. Dia)	F-14

Table F-1. Manufactured Item Part Number Index (Cont)

Part No.	Nomenclature	Figure No.
LMT 958	Go-NoGo Pin (0.204 in. Dia)	F-14
LMT 959	Go-NoGo Pin (0.203 in. Dia)	F-14
LMT 960	Go-NoGo Pin (0.202 in. Dia)	F-14
LMT 962	Clinch Nut Flaring Set	F-15
LMT 964	Tie Bolt Guide	F-16

MATERIAL BLOCK	
STOCK SIZE	DESCRIPTION
0.032 DIAMETER MINIMUM	SAFETY WIRE
6.000 LONG	TOOL EXTENSION OR BAR STOCK



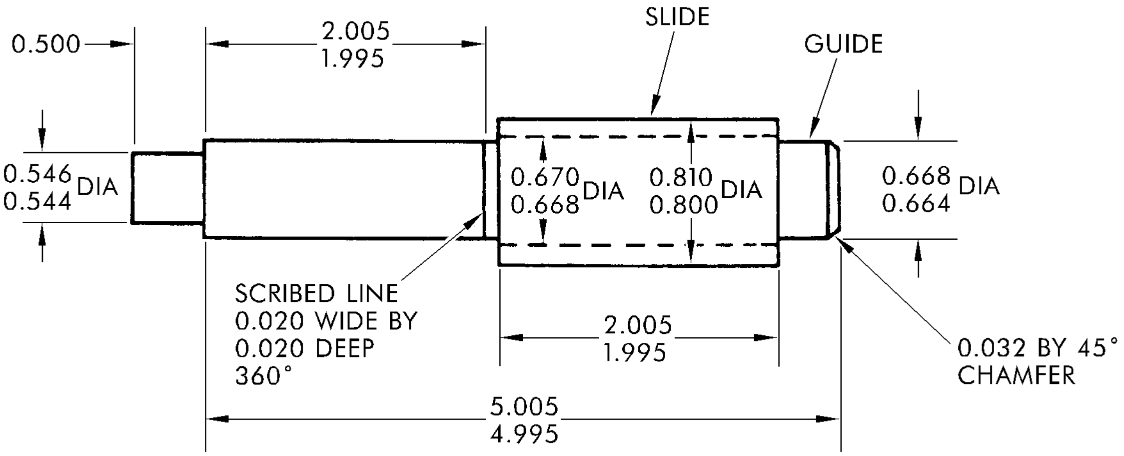
LMT 747

ALL DIMENSIONS ARE IN INCHES

1157657-00-A2A

Figure F-1. Axis-G Seal Mating Ring Puller LMT 747

MATERIAL BLOCK		
NOMENCLATURE	STOCK SIZE	DESCRIPTION
GUIDE	0.750 DIAMETER BY 6.000 LONG	ALUMINUM
SLIDE	1.000 DIAMETER BY 2.250 LONG	HARD PLASTIC OR PHENOLIC



LMT 748

MATERIAL: SLIDE - HARD PLASTIC OR PHENOLIC

GUIDE - ALUMINUM STOCK

ALL DIMENSIONS
ARE IN INCHES

1157658-00-A2A

Figure F-2. Axis-G Seal Mating Ring Guide Assembly LMT 748

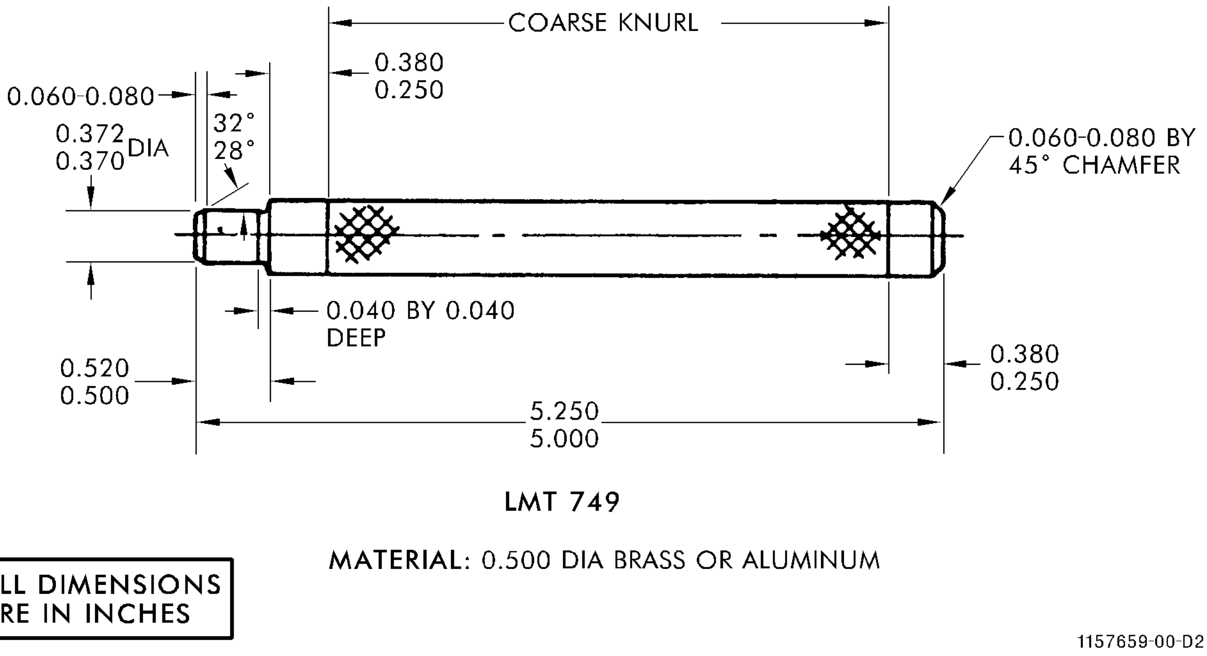
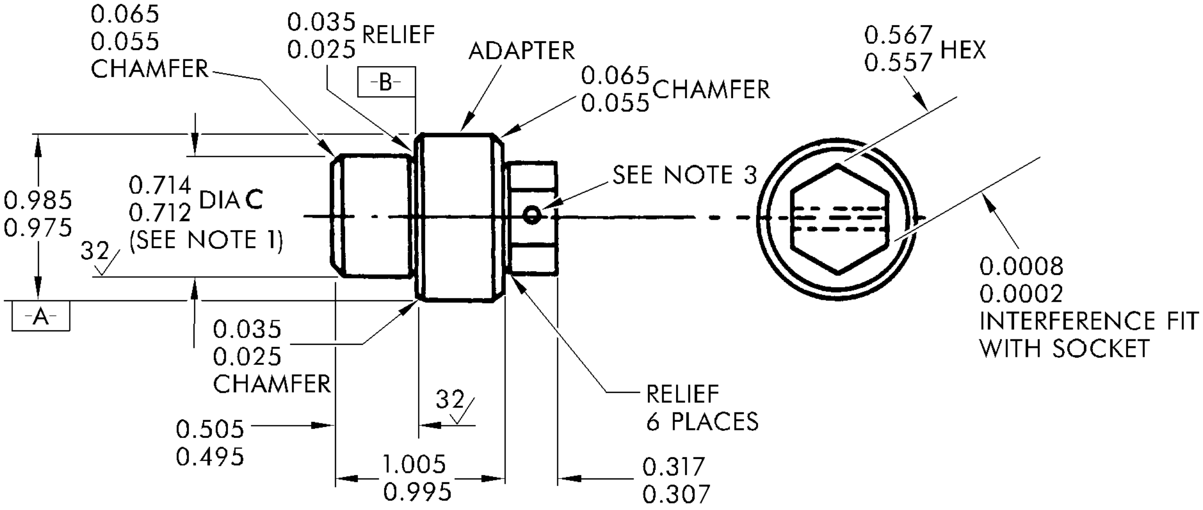
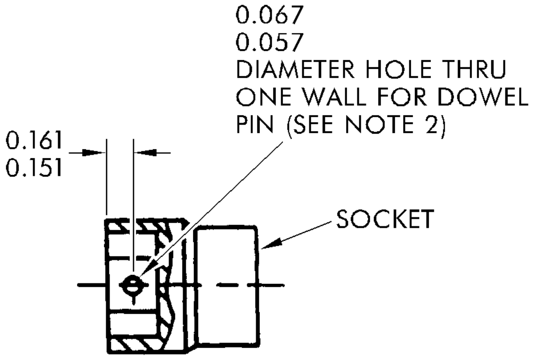


Figure F-3. Swirl Frame Sleeve Pusher LMT 749

MATERIAL BLOCK		
NOMENCLATURE	STOCK SIZE	DESCRIPTION
ADAPTER	1.125 DIAMETER BY 1.375 LONG	440 C STAINLESS STEEL HEAT TREAT RC 50-55
SOCKET	————	6 POINT FLANGE DRIVE WITH VENDOR IDENTIFICATION NUMBER REMOVED
PIN, DOWEL, STRAIGHT, HEADLESS	0.094 DIAMETER BY 0.870 LONG	STAINLESS STEEL





NOTE

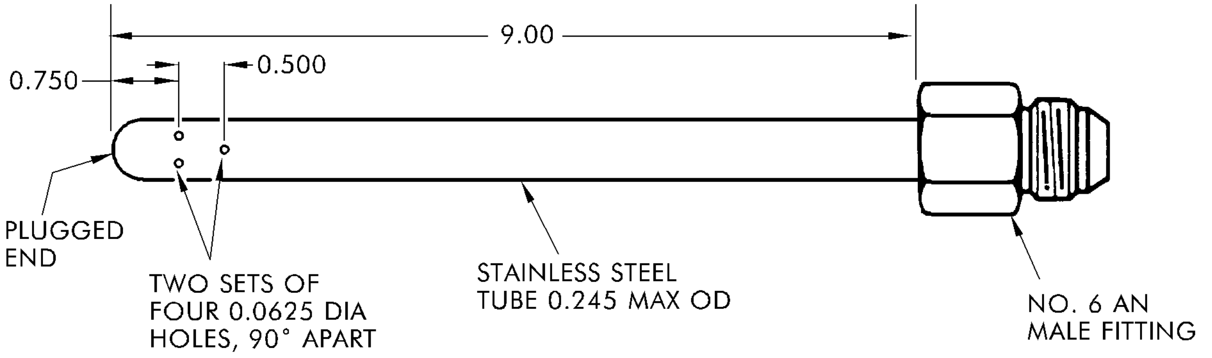
1. DIAMETER **C** MUST BE PERPENDICULAR TO DATUM **B** WITHIN 0.001 AND MUST NOT EXCEED 0.005 TIR WITH DATUM **A**.
2. 0.0002-0.0008 INTERFACE FIT OF DOWEL PIN IN ADAPTER AND SOCKET AT ASSEMBLY.
3. HOLE LOCATION IS DETERMINED BY LOCATION OF HOLE IN SOCKET.

LMT 754

ALL DIMENSIONS
ARE IN INCHES

1157660-00-A2A

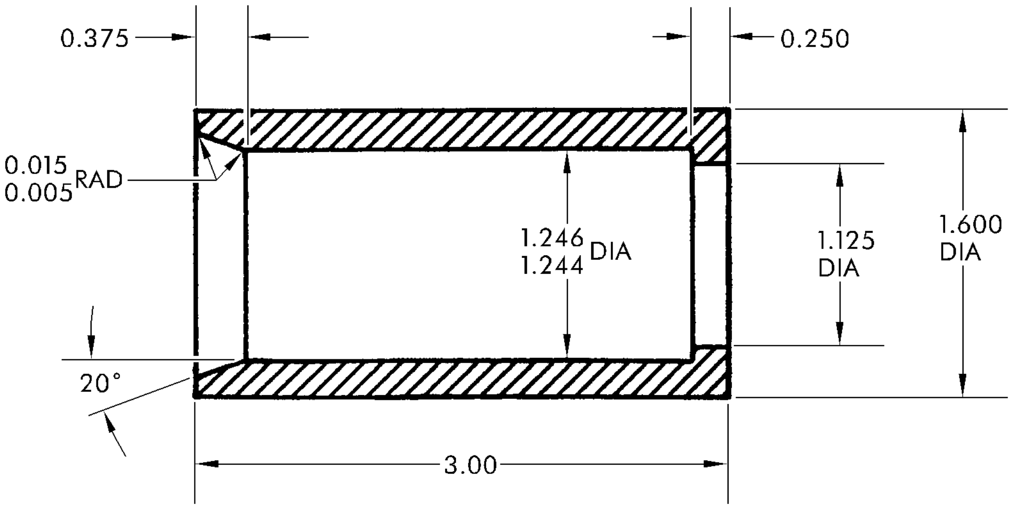
Figure F-4. Fuel Injector Boss Lapping Fixture LMT 754



ALL DIMENSIONS ARE IN INCHES

1157662-00-D2

Figure F-5. Hot Section Module Sprayer LMT 777



LMT 841

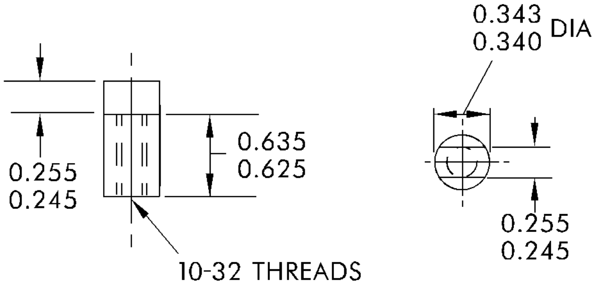
NOTE

1. MATERIAL - ALUMINUM.
2. FINISH - 125 MICROINCHES.
3. UNTOLERANCE DIMENSIONS ± 0.020 INCH.
4. UNTOLERANCE ANGLES ± 5°.

ALL DIMENSIONS
ARE IN INCHES

1157663-00-A2A

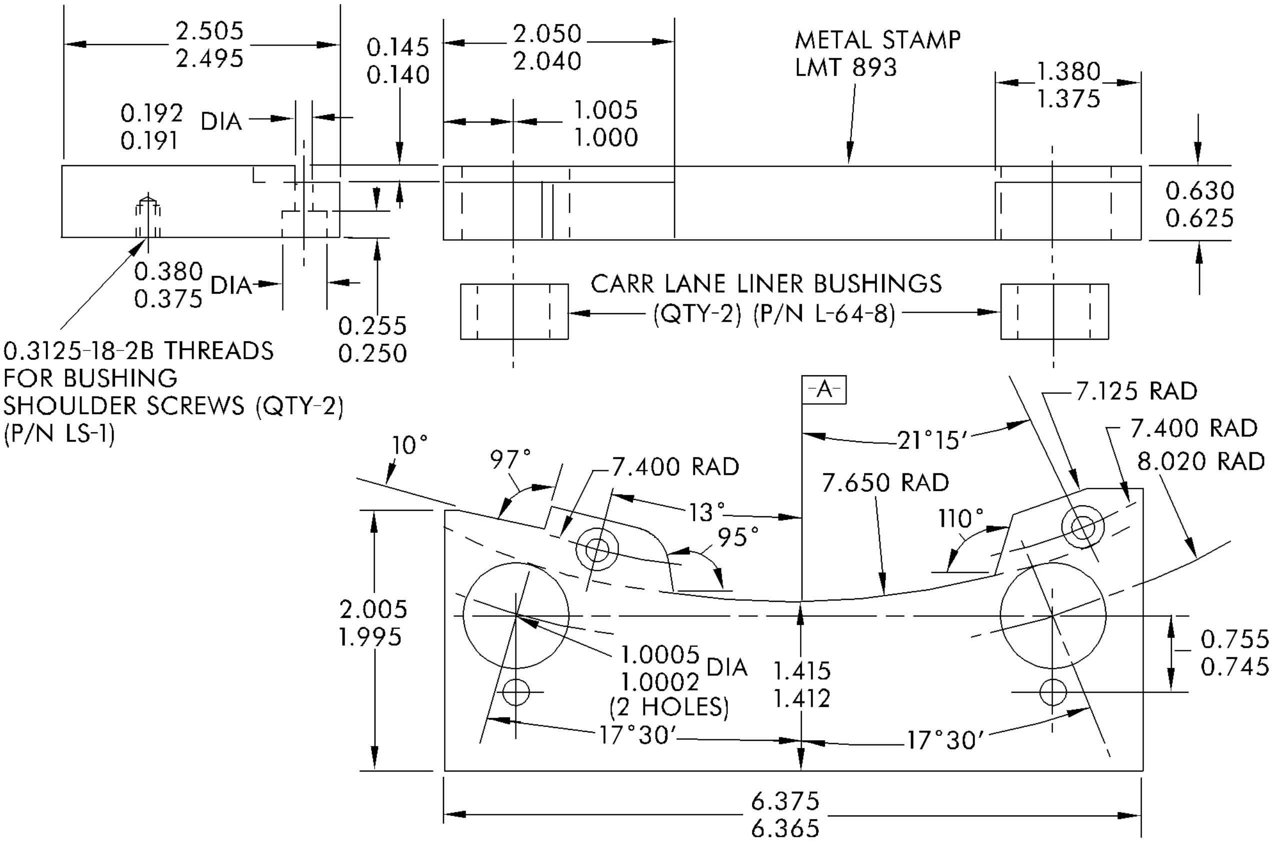
Figure F-6. Allied Signal (Garrett) A/I Valve Sizing Tool LMT 841



CAPNUTS

NOTE
Carr Lane Mfg. Co.
4200 Carr Lane CT.
St. Louis, MO 63119-2129

MATERIAL: STAINLESS STEEL (AISI 301 or EQUIVALENT)



MATERIAL: ALUMINUM (AISI 6061 or EQUIVALENT)

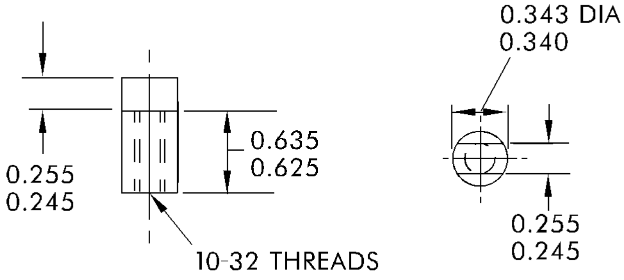
PARTS LIST

- Shoulder Screw (Qty-2) P/N LS-1
- Press-Fit Bushing (Qty-2) P/N L-64-8
  (3/4 ID X 1 OD X 1/2 LENGTH)
- Slip-Fit Bushing (Qty-2) P/N SF-48-8- 0.5313
  (17/32 ID X 3/4 OD X 1/2 LENGTH)
- Slip-Fit Bushing (Qty-2) P/N SF-48-8- 0.5625
  (9/16 ID X 3/4 OD X 1/2 LENGTH)

ALL DIMENSIONS
ARE IN INCHES

1157664-00-A2A

Figure F-7. Three O'clock Lug Drill Fixture LMT 893

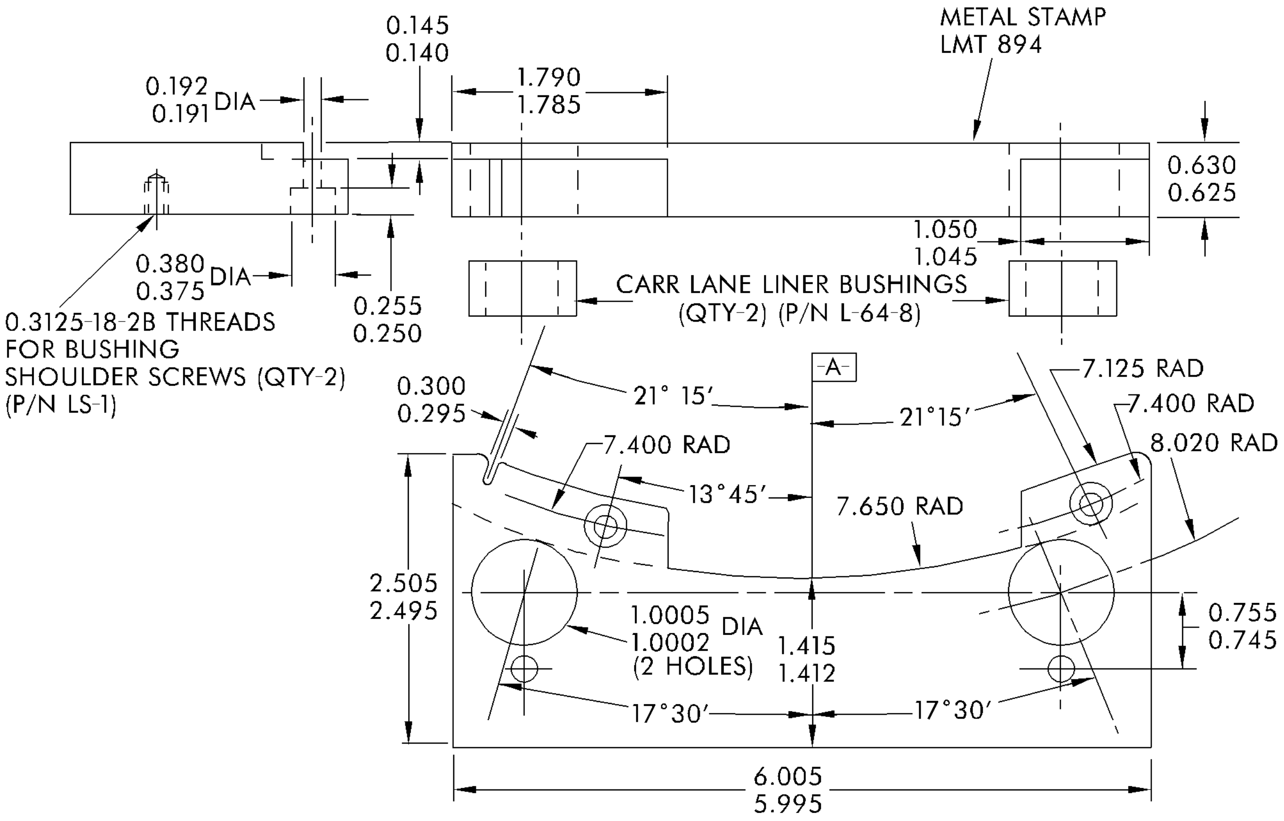


NOTE

Carr Lane Mfg. Co.
4200 Carr Lane CT.
St. Louis, MO 63119-2129

CAPNUTS

MATERIAL: STAINLESS STEEL (AISI 301 or EQUIVALENT)



MATERIAL: ALUMINUM (AISI 6061 or EQUIVALENT)

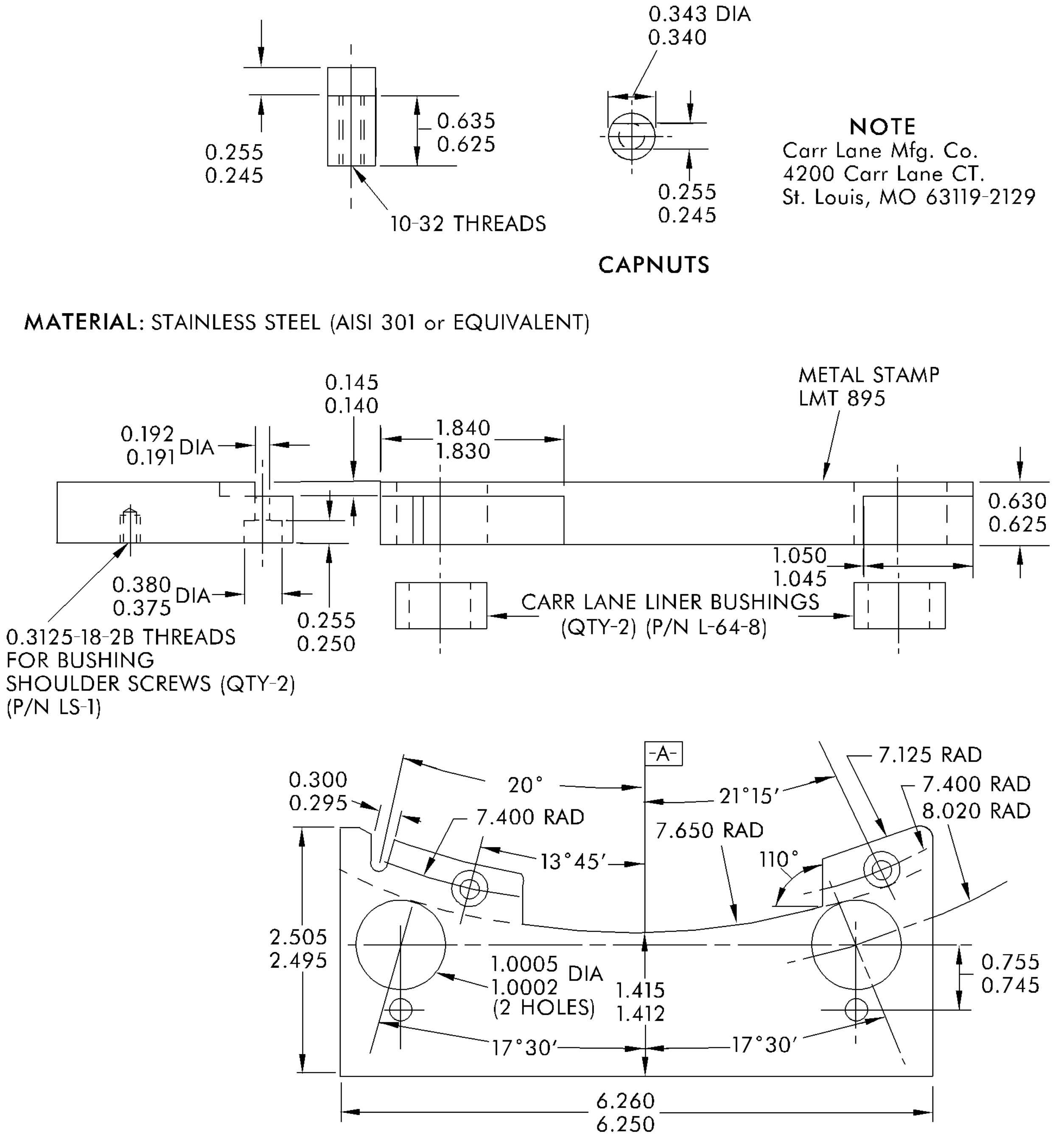
PARTS LIST

- Shoulder Screw (Qty-2) P/N LS-1
- Press-Fit Bushing (Qty-2) P/N L-64-8
  (3/4 ID X 1 OD X 1/2 LENGTH)
- Slip-Fit Bushing (Qty-2) P/N SF-48-8- 0.5313
  (17/32 ID X 3/4 OD X 1/2 Length)
- Slip-Fit Bushing (Qty-2) P/N SF-48-8- 0.5625
  (9/16 ID X 3/4 OD X 1/2 Length)

ALL DIMENSIONS
ARE IN INCHES

1157665-00-A2A

Figure F-8. Six O'clock Lug Drill Fixture LMT 894



MATERIAL: ALUMINUM (AISI 6061 or EQUIVALENT)

PARTS LIST

- Shoulder Screw (Qty-2) P/N LS-1
- Press-Fit Bushing (Qty-2) P/N L-64-8
  (3/4 ID X 1 OD X 1/2 LENGTH)
- Slip-Fit Bushing (Qty-2) P/N SF-48-8- 0.5313
  (17/32 ID X 3/4 OD X 1/2 Length)
- Slip-Fit Bushing (Qty-2) P/N SF-48-8- 0.5625
  (9/16 ID X 3/4 OD X 1/2 Length)

ALL DIMENSIONS
ARE IN INCHES

1157666-00-A2A

Figure F-9. Nine O'clock Lug Drill Fixture LMT 895

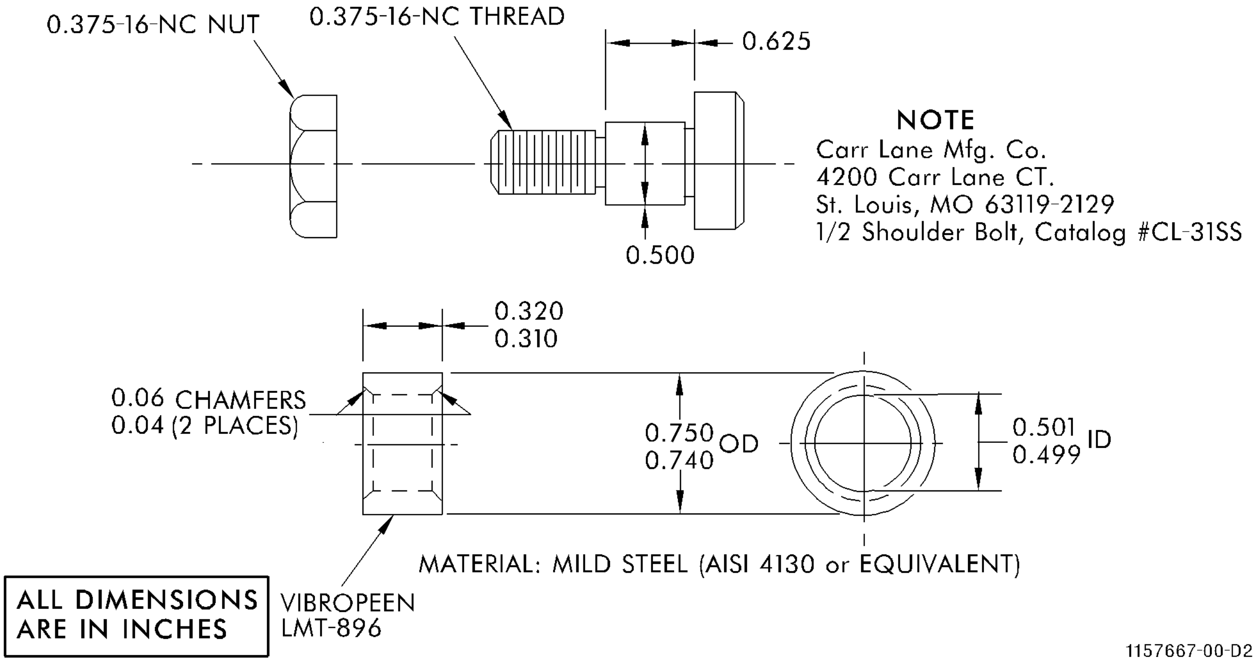
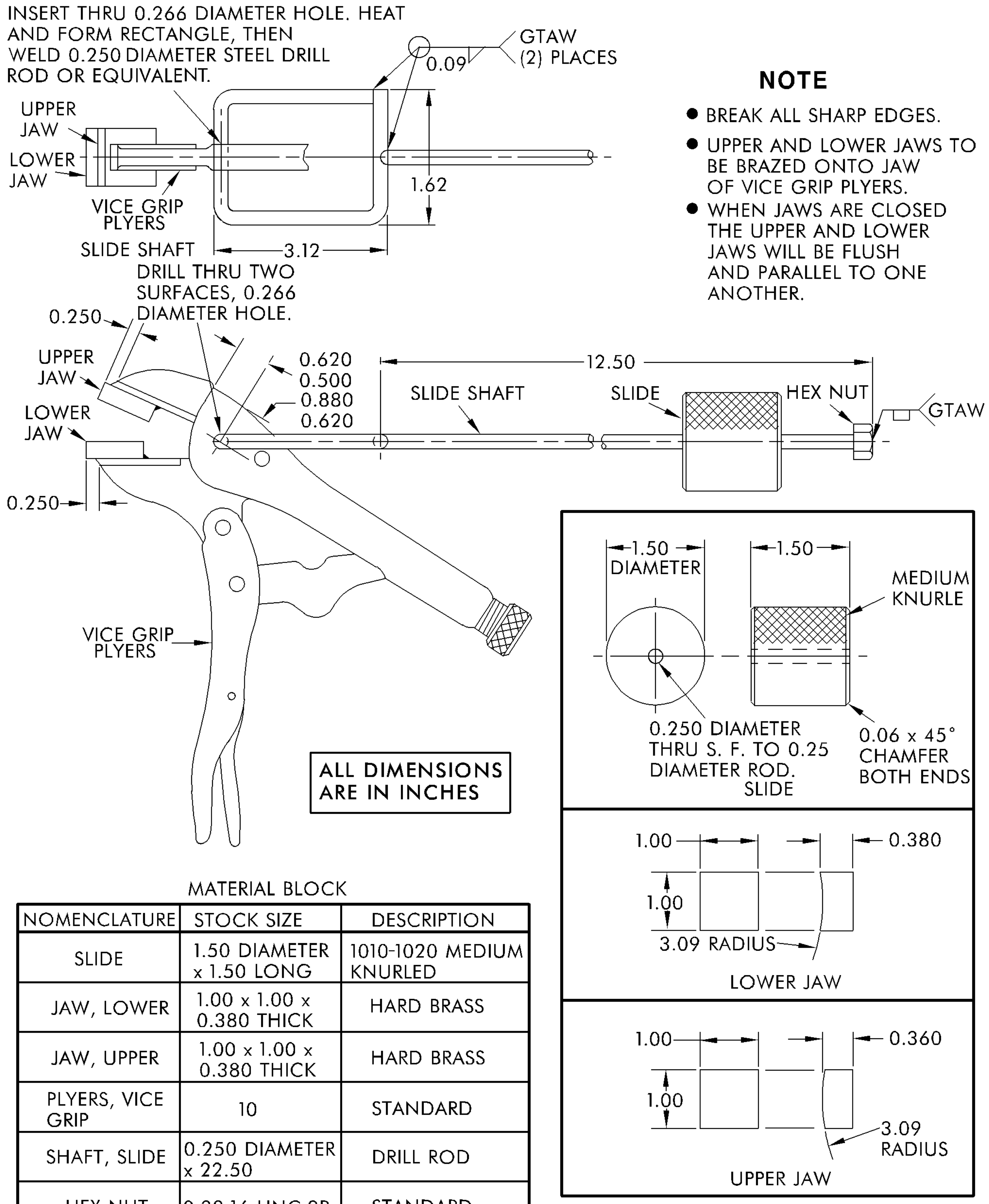


Figure F-10. Bushing Pusher LMT 896



NOTE

- BREAK ALL SHARP EDGES.
- UPPER AND LOWER JAWS TO BE BRAZED ONTO JAW OF VICE GRIP PLYERS.
- WHEN JAWS ARE CLOSED THE UPPER AND LOWER JAWS WILL BE FLUSH AND PARALLEL TO ONE ANOTHER.

ALL DIMENSIONS ARE IN INCHES

MATERIAL BLOCK

NOMENCLATURE	STOCK SIZE	DESCRIPTION
SLIDE	1.50 DIAMETER x 1.50 LONG	1010-1020 MEDIUM KNURLED
JAW, LOWER	1.00 x 1.00 x 0.380 THICK	HARD BRASS
JAW, UPPER	1.00 x 1.00 x 0.380 THICK	HARD BRASS
PLYERS, VICE GRIP	10	STANDARD
SHAFT, SLIDE	0.250 DIAMETER x 22.50	DRILL ROD
HEX NUT	0.38-16 UNC-2B	STANDARD

Figure F-11. Outer Balance Piston Seal Puller LMT 933

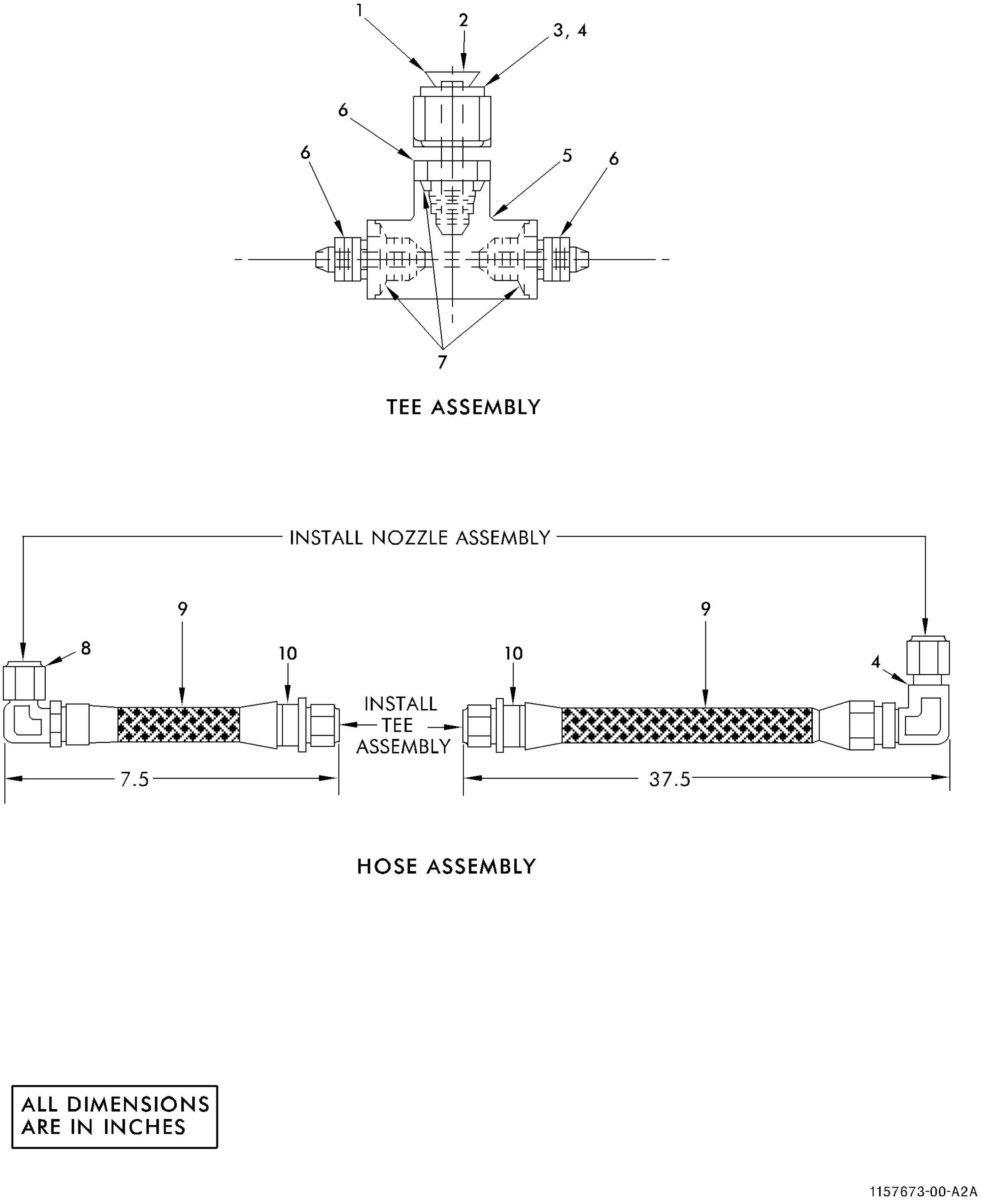
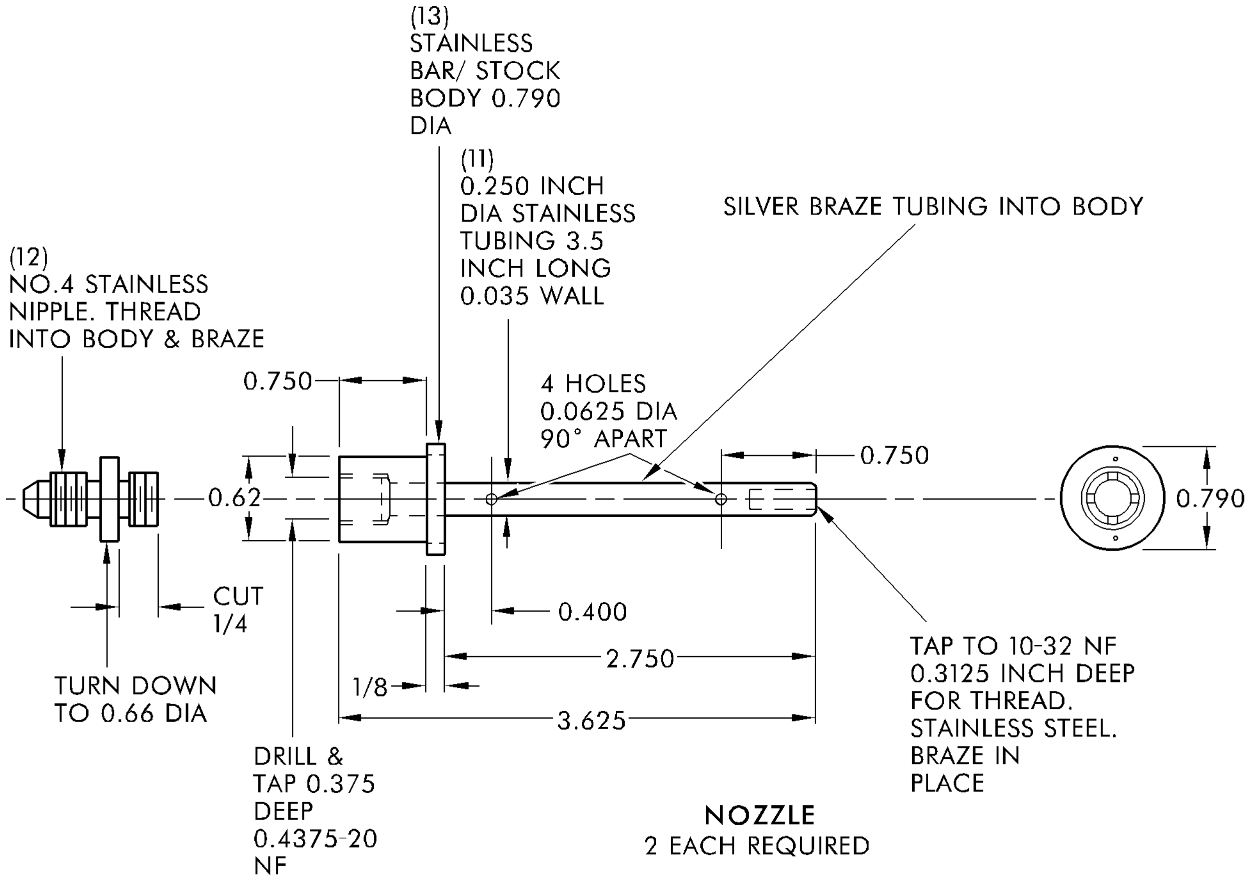


Figure F-12. *(T700)* ***Series Engine Hot Section Wash Kit LMT 942 (Sheet 1 of 2)***



NOZZLE
2 EACH REQUIRED

ITEM	QUANTITY	FED. STOCK NUMBER	PART NUMBER	NOMENCLATURE
1	1EA	4723-01-142-2853	AE80711G	COUPLING HALF
2	1FT	4710-00-278-3282	MIL-T-6845D	0.375 INCH DIA TUBING-STAINLESS, 1.375 INCH LONG, FLARED AND BRAZED IN NO. 6 AN NIPPLE
3	1EA	4730-00-203-3831	AN818-6	NUT
4	1EA	4730-00-595-3102	AN819-6	SLEEVE
5	1EA	4730-00-277-5026	AN 938 D6	NO. 6 TEE TUBE
6	3EA	4730-00-803-5408	MS24399J7	NO. 6 TO NO. 4 REDUCER
7	3EA	5330-00-804-5695	MS28778-6	PREFORMED PACKING
8	2EA	4730-00-013-6970	MS27060-4C	NO. 4 90° ELBOW
9	4FT	4720-00-857-1732	124-4	NO. 4 BRAIDED TEFLON HOSE
10	2EA	4730-00-889-2474	MS27053-4C	NO. 4 STRAIGHT ADAPTER
11	1FT	4710-00-273-7948	MIL-T-8606C	0.250 INCH DIA TUBING-STAINLESS
12	2EA	4730-00-684-6912	MS24392J4	NO. 4 NIPPLE/STRAIGHT
13	1FT	9510-00-189-0677	ASTM A582	0.875 INCH DIA 303 STAINLESS BAR

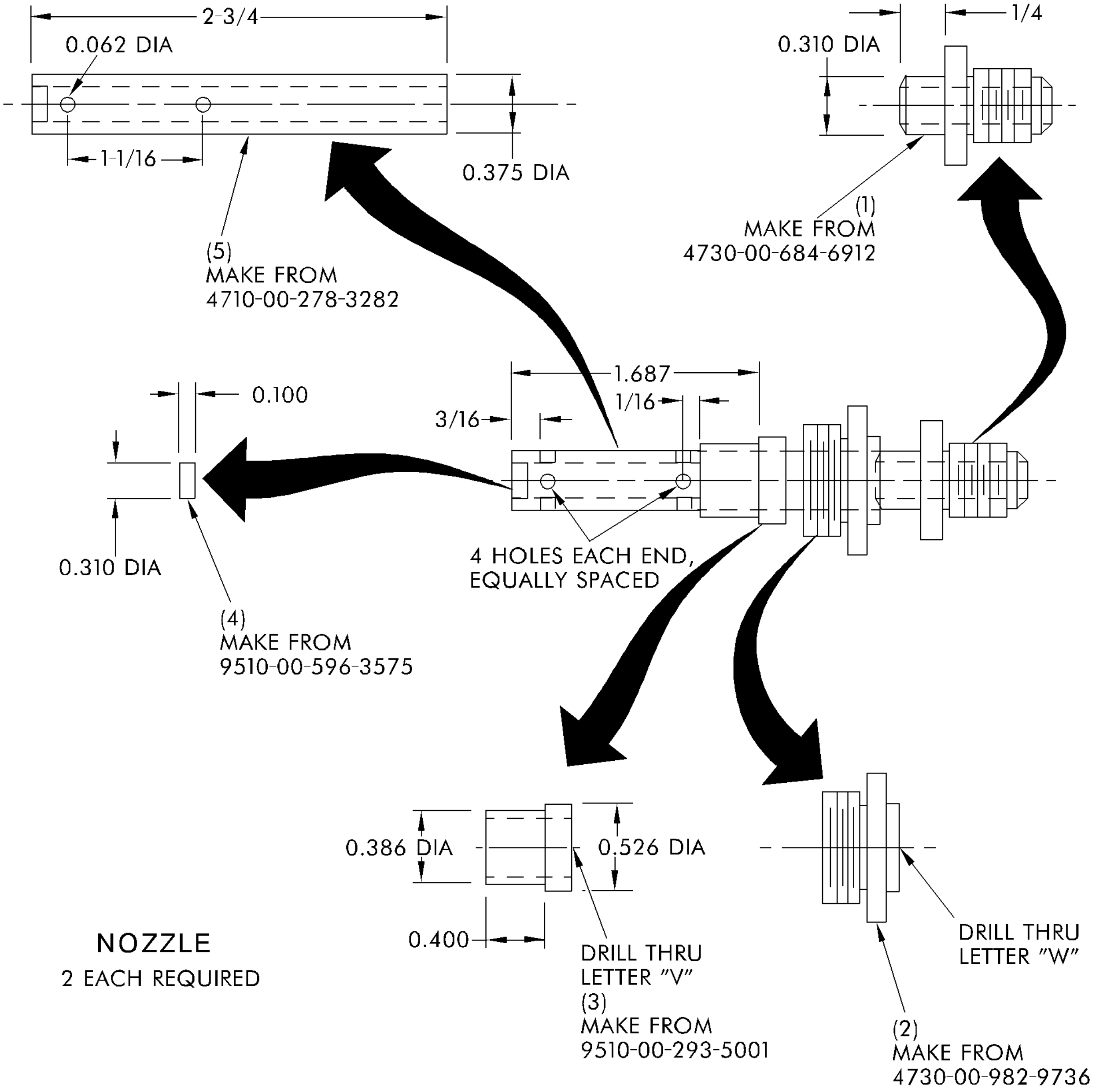
ALL DIMENSIONS
ARE IN INCHES

NOTE

USE THESE PARTS OR EQUIPMENT TO
ASSEMBLE HOT SECTION WASH KIT

1147089-01-A2A

Figure F-12. (T700) Series Engine Hot Section Wash Kit LMT 942 (Sheet 2 of 2)



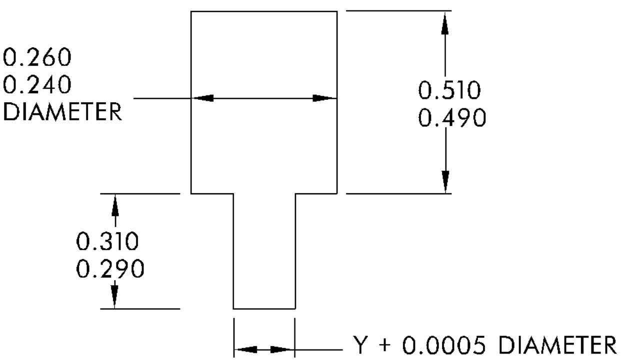
ITEM	QUANTITY	FED. STOCK NUMBER	PART NUMBER	NOMENCLATURE
1	2EA	4730-00-684-6912	MS24392J4	TUBE NIPPLE (NO. 4 STAINLESS STEEL)
2	2EA	4730-00-982-9736	MS27053-6C	ADAPTER
3	1FT	9510-00-293-5001	ASTM A582	BUSHING (SILVER BRAZE TO TUBING)
4	1FT	9510-00-596-3575	MILS7720	PLUG (SILVER BRAZE)
5	1FT	4710-00-278-3282	8837-193	TUBE (STAINLESS STEEL)

ALL DIMENSIONS
ARE IN INCHES

1157674-00-A2A

Figure F-13. (T701, T701C, T701D) Series Engine Hot Section Wash Kit LMT 943

VIBROPEEN A NUMBER ON PIN THAT REPRESENTS DIAMETER
EXAMPLE 2 (REPRESENTS 0.202)
EXAMPLE 3 (REPRESENTS 0.203)



PIN NUMBER	SIZE
LMT 954 PIN 8	(0.208 IN. DIA)
LMT 955 PIN 7	(0.207 IN. DIA)
LMT 956 PIN 6	(0.206 IN. DIA)
LMT 957 PIN 5	(0.205 IN. DIA)
LMT 958 PIN 4	(0.204 IN. DIA)
LMT 959 PIN 3	(0.203 IN. DIA)
LMT 960 PIN 2	(0.202 IN. DIA)

MATERIAL

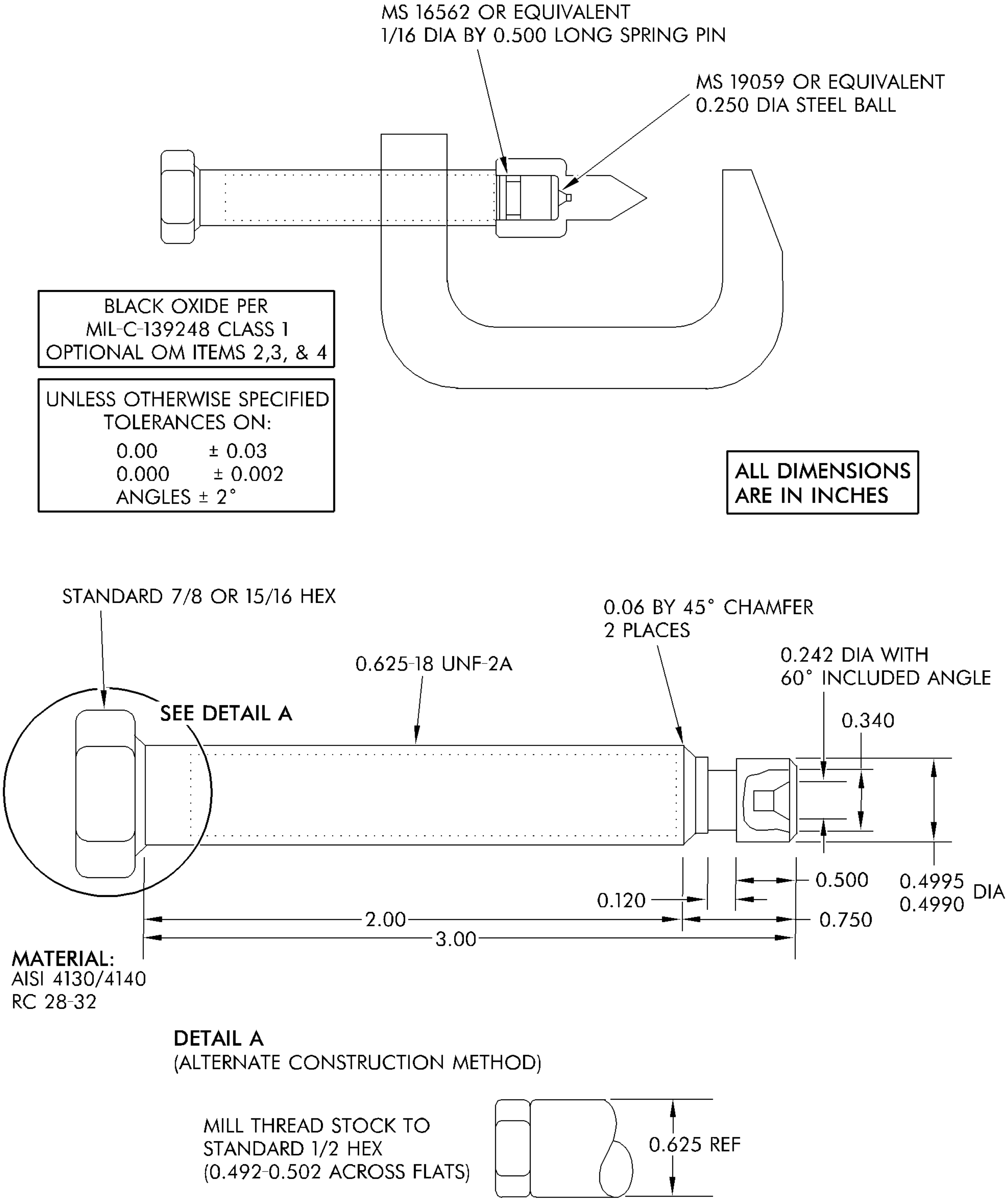
STAINLESS STEEL
(300 SERIES)

FABRICATE 7 PINS WITH THE ABOVE SHOWN DIMENSIONS EXCEPT DIAMETER Y TO BE AS FOLLOWS: PIN 2=0.202, PIN 3=0.203, PIN 4=0.204, PIN 5=0.205, PIN 6=0.206, PIN 7=0.207, PIN 8=0.208

ALL DIMENSIONS
ARE IN INCHES

1157675-00-D2

Figure F-14. Compressor Repair Pins LMT 954 thru LMT 960 Fabrication



1157676-00-A2A

Figure F-15. Clinch Nut Flaring Set LMT 962 (Sheet 1 of 3)

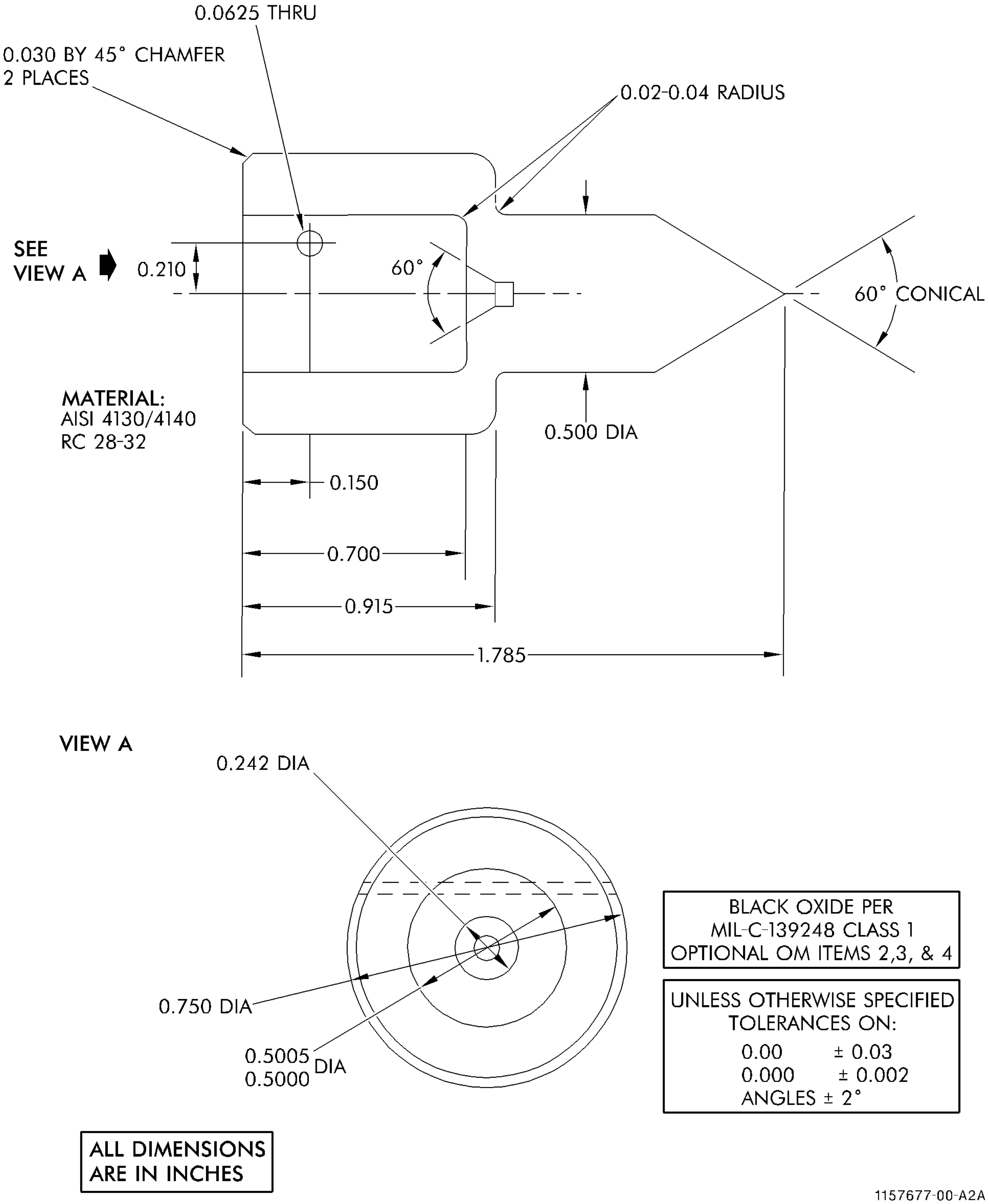
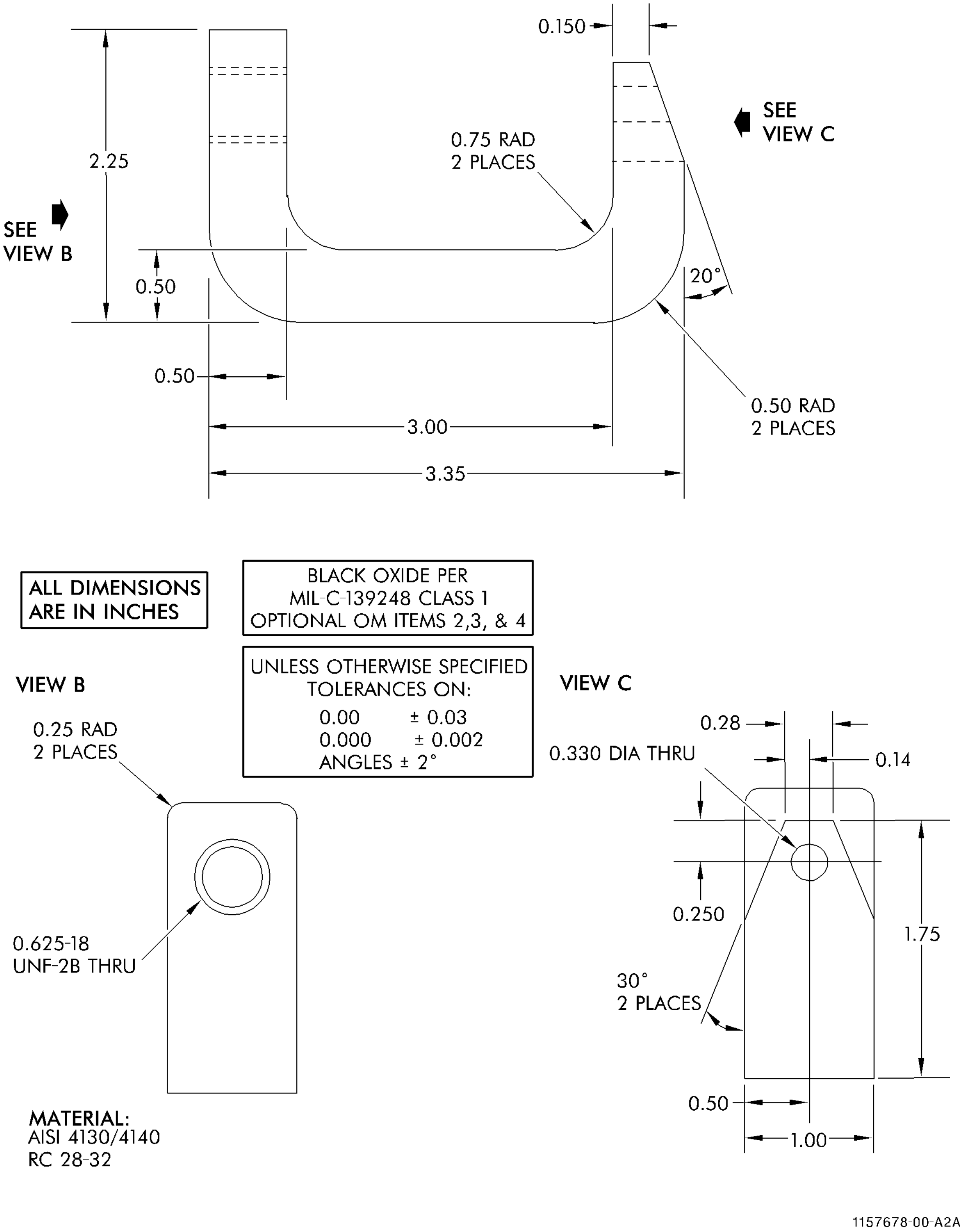


Figure F-15. Clinch Nut Flaring Set LMT 962 (Sheet 2 of 3)



ALL DIMENSIONS
ARE IN INCHES

BLACK OXIDE PER
MIL-C-139248 CLASS 1
OPTIONAL OM ITEMS 2,3, & 4

UNLESS OTHERWISE SPECIFIED
TOLERANCES ON:

0.00	± 0.03
0.000	± 0.002
ANGLES ± 2°	

MATERIAL:
AISI 4130/4140
RC 28-32

Figure F-15. Clinch Nut Flaring Set LMT 962 (Sheet 3 of 3)

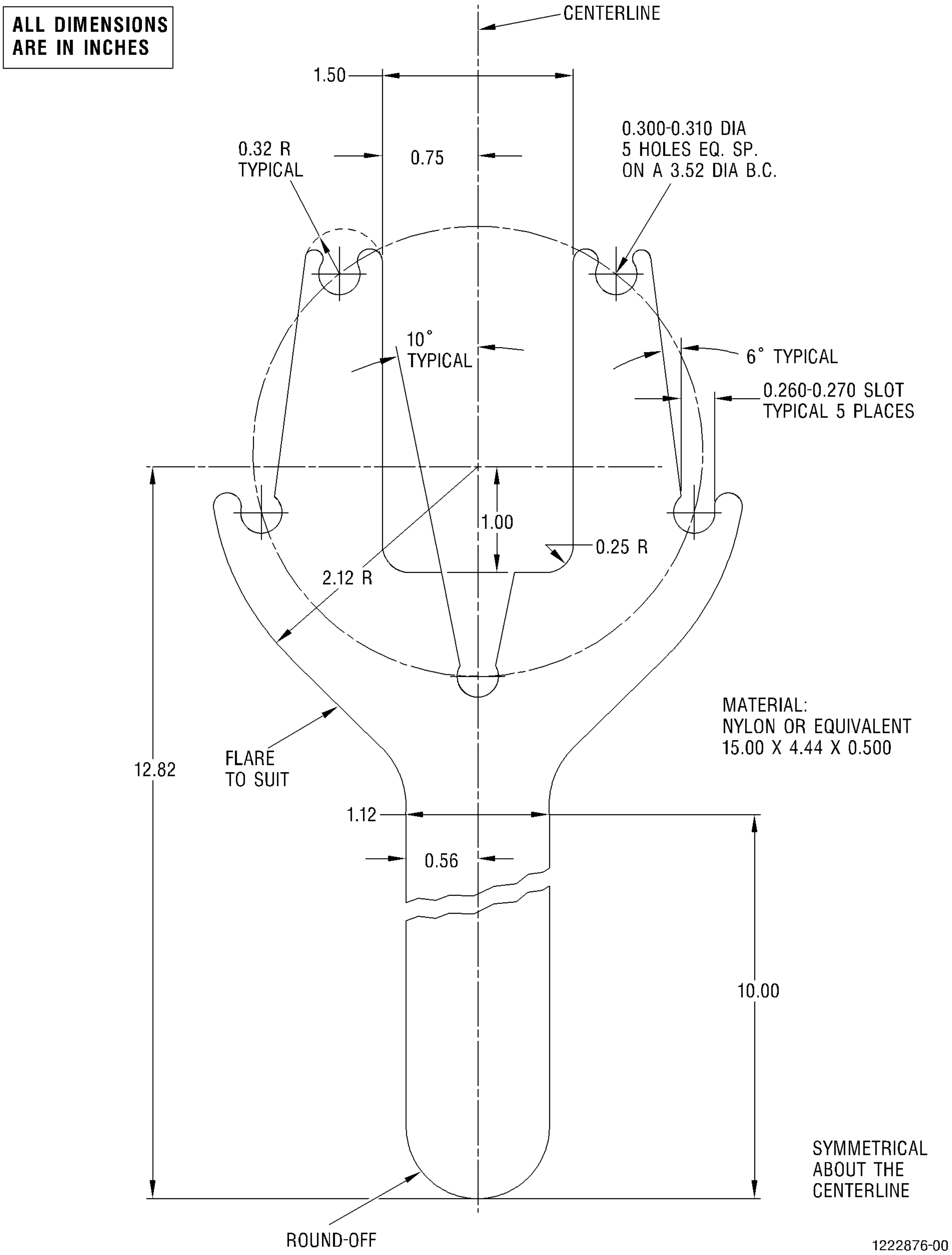


Figure F-16. Tie Bolt Guide LMT 964

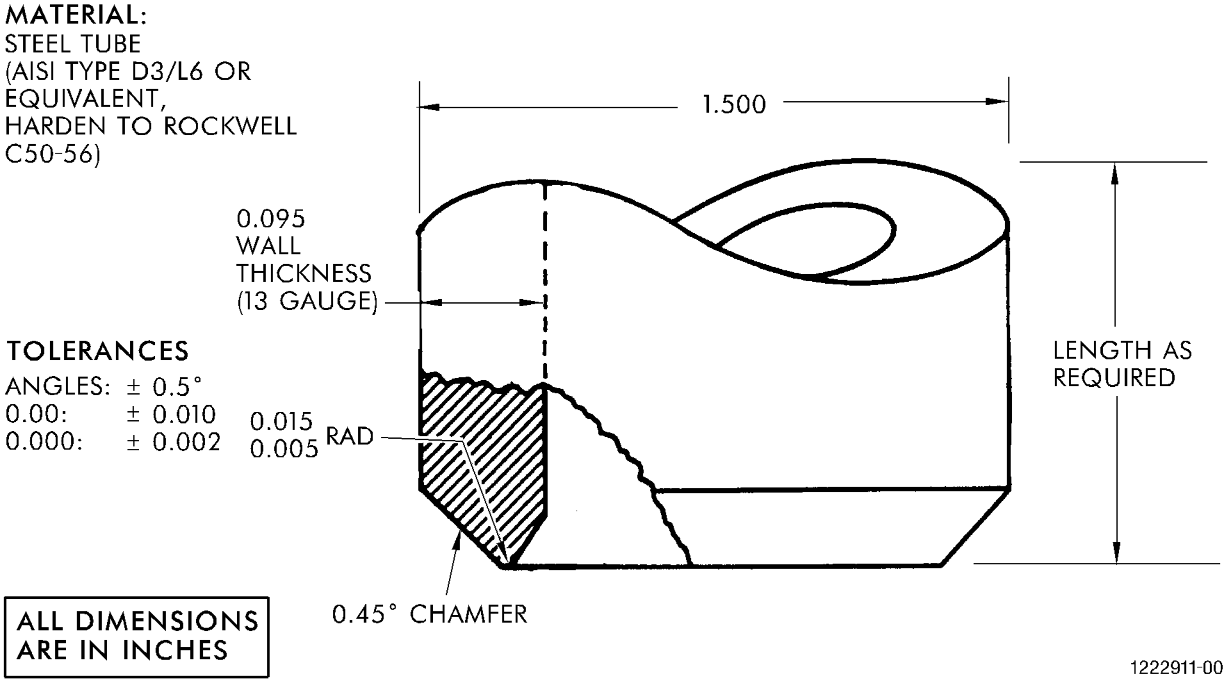


Figure F-17. Spherical Bearing Swaging Tool LMT 806

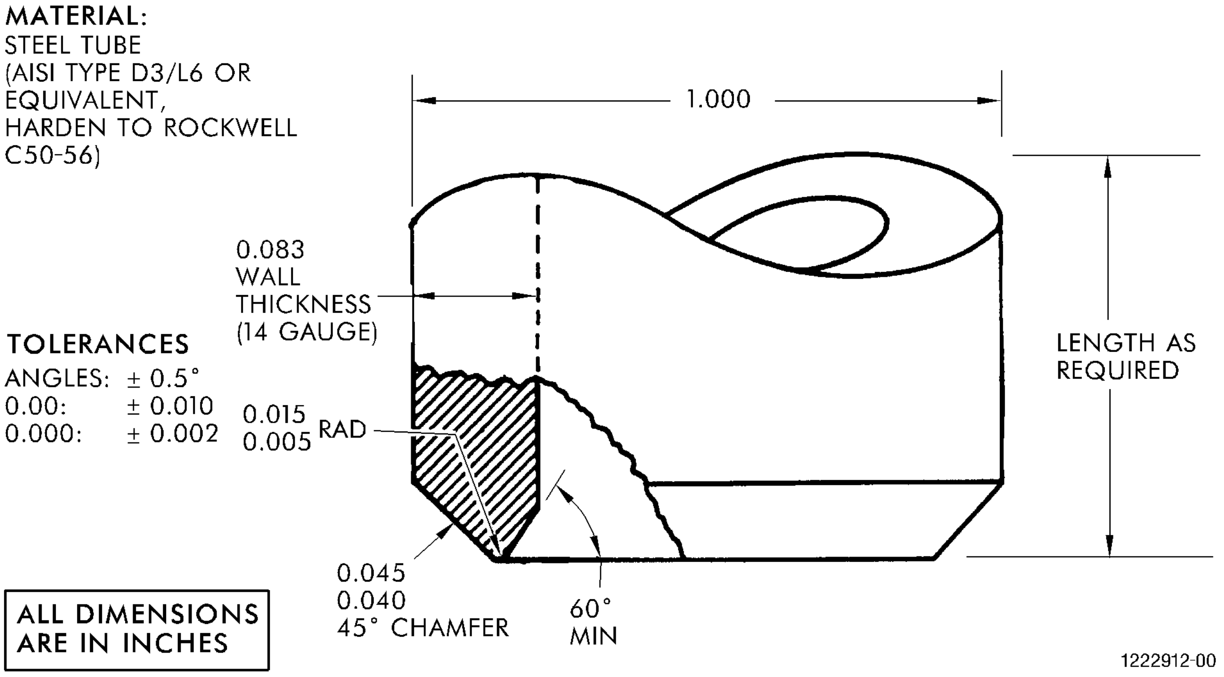


Figure F-18. Spherical Bearing Swaging Tool LMT 807

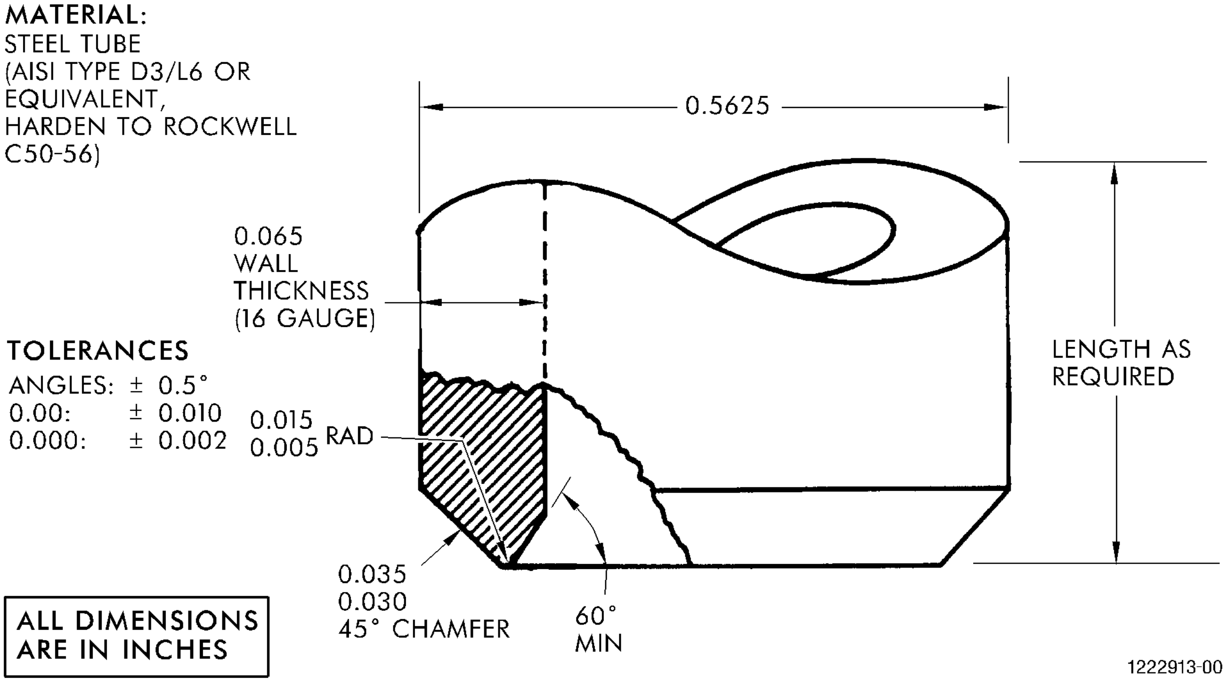


Figure F-19. Spherical Bearing Swaging Tool LMT 808

APPENDIX G

TORQUE LIMITS

G-1. APPENDIX OVERVIEW.

Table G-1 gives information for tightening the bolts, nuts, and connectors used for components and modular assemblies of the engine. This information includes max and min torque values, wrench-arc angles, and special instructions. For engine hardware tightened by the wrench-arc method, see paragraph H-14, Appendix H.

Table G-1. Torque Values

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
1-33	4	Container Sealing Bolt	70 foot-pounds	75 foot-pounds
1-36	6	Support Bolt	140 inch-pounds	160 inch-pounds
1-36	7	Aft Support Bolt	480 inch-pounds	570 inch-pounds
1-36	8	Front Support Bolt	100 inch-pounds	130 inch-pounds
1-39	5	Forward Adapter Captive Bolts	45 inch-pounds	50 inch-pounds
1-40	10	Clamping Bar Bolt	35 inch-pounds	42 inch-pounds
1-40	11	Access Cover Bolt	30 inch-pounds	60 inch-pounds
1-41	5	Electrical Chip Detector Captive Bolt	45 inch-pounds	50 inch-pounds
1-95	1	**(T700)** Borescope Plug	15° wrench arc	–
1-95	2	**(T700)** Borescope Plug	90 inch-pounds	110 inch-pounds
1-95	3, 5	**(T700)** Borescope Port Cap	100 inch-pounds	125 inch-pounds
1-95	3, 5	**(T700)** Borescope Plug	55 inch-pounds	70 inch-pounds
1-96	2	**(T701, T701C, T701D)** Borescope Plug	90 inch-pounds	110 inch-pounds
1-96	4, 7	**(T701, T701C, T701D)** Borescope Plug	15° wrench arc	–
1-96	3, 5	**(T701, T701C, T701D)** Borescope Port Cap	100 inch-pounds	125 inch-pounds
1-96	3, 5	**(T701, T701C, T701D)** Borescope Plug	55 inch-pounds	70 inch-pounds
2-1	1, 4	Main Frame Flange Bolts	45 inch-pounds	50 inch-pounds

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
2-2	1	Diffuser Flange Bolts	45 inch-pounds	50 inch-pounds
2-3	1	Actuating Ring Nuts	16 inch-pounds	19 inch-pounds
2-3	13, 14	Compressor Flange Nuts	See figure 2-8 for torquing procedure.	–
2-9	3	Swirl Frame OD Locknuts	45 inch-pounds	50 inch-pounds
2-9	8	Anti-Icing Bleed Duct Bolts	45 inch-pounds	50 inch-pounds
2-9	10	Swirl Frame ID Nuts	145 inch-pounds	150 inch-pounds
2-9	17, 20	Temperature Sensing Tube Bolts	45 inch-pounds	50 inch-pounds
2-27	1	No. 1 Carbon Seal Nuts	45 inch-pounds	50 inch-pounds
2-29	–	Power Takeoff Drive Assembly Nuts	See paragraph 2-29 for torquing procedure.	–
2-31	1	Oil Inlet and Scavenge Tube Retainer Locknuts	45 inch-pounds	50 inch-pounds
2-36	13	Actuating Ring Bolts	16 inch-pounds	19 inch-pounds
2-51	3	**(T700, T701C, T701D)** Forward Suspension Lug Nuts	45 inch-pounds	50 inch-pounds
2-52	5	**(T701)** Forward Suspension Lug Nuts	45 inch-pounds	50 inch-pounds
2-54	3	GG Shaft Tie Bolts Restraining Adapter Nuts	45 inch-pounds	50 inch-pounds
2-55	4	Cold Section Module Shipping Adapter Locknuts	45 inch-pounds	50 inch-pounds
3-1	12	**(T700)** Gas Generator Turbine Rotor Nuts	See paragraph 3-13 for torquing procedure.	–
3-2	12	**(T701, T701C, T701D)** Gas Generator Turbine Rotor Nuts	See paragraph 3-13 for torquing procedure.	–
3-3	2	Nuts	70 inch-pounds	75 inch-pounds
3-20	3	**(T700)** Igniter Plug Nut	140 inch-pounds	150 inch-pounds
3-20	4	**(T700)** Ignition Lead Coupling Nut	15° wrench arc	–

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
3-20	6	**(T700)** Primer Nozzle Nut	140 inch-pounds	150 inch-pounds
3-20	7	**(T700)** Fuel Start Manifold Coupling Nuts	60° wrench arc	–
3-21	1, 7	Stage 1 Nozzle Assembly Bolts	45 inch-pounds	50 inch-pounds
3-22	2	**(T701, T701C, T701D)** Igniter Plug	140 inch-pounds	150 inch-pounds
3-22	3	**(T701, T701C, T701D)** Ignition Lead Coupling Nut	15° wrench arc	–
4-1	5	C-Sump Aft Scavenge Tube Coupling Nut	60° wrench arc	–
4-1	6	C-Sump Forward Scavenge Tube Coupling Nut	60° wrench arc	–
4-1	7	C-Sump Oil Supply Tube Coupling Nut	60° wrench arc	–
4-1	8	Power Turbine Module Flange Nuts	80 inch-pounds	85 inch-pounds
4-1	13	Electrical Connector (Yellow Cable) to Np Sensor Connector	15° wrench arc	–
4-1	14	Electrical Connector (Yellow Cable) to Thermocouple Connector	60° wrench arc	–
4-1	15	Electrical Connector (Blue Cable) to Torque and Overspeed Sensor Connector	15° wrench arc	–
4-1	18	Seal Pressure and Scavenge Tube Coupling Nuts	60° wrench-arc	–
4-1	19	B-Sump Drain Tube Fittings	60° wrench-arc	–
4-4	1	C-Sump Heat Shield Nuts	70 inch-pounds	75 inch-pounds
4-4	3	C-Sump Cover Bolts	45 inch-pounds	50 inch-pounds
4-5	6	Stage 3 Turbine Nozzle Bolts	30 inch-pounds	35 inch-pounds
4-7	12	Clamp Bolts	5 foot-pounds	7 foot-pounds
4-7	16	Support Plate Bolts	20 inch-pounds	22 inch-pounds
4-7	18	Support Frame Bolts	23 foot-pounds	25 foot-pounds
4-7	19	PT Container Sealing Bolts	75 foot-pounds	85 foot-pounds

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
5-1	7	**(T700)** Locknut	24 inch-pounds	27 inch-pounds
5-1	17	**(T700)** Captive Bolts	45 inch-pounds	50 inch-pounds
5-1	18	**(T700)** Mid C-Sump Scavenge Tube Coupling Nut	60° wrench arc	–
5-1	24	**(T700)** Nuts	30° wrench arc	–
5-2	10	**(T701, T701C, T701D)** Locknut	24 inch-pounds	27 inch-pounds
5-2	26	**(T701, T701C, T701D)** Nuts	30° wrench arc	–
5-3	10	**(T701, T701C, T701D)** Locknut	24 inch-pounds	27 inch-pounds
5-3	8	**(T701, T701C, T701D)** Captive Bolts	45 inch-pounds	50 inch-pounds
5-3	20	**(T701, T701C, T701D)** Mid C-Sump Scavenge Tube Coupling Nut	60° wrench arc	–
5-3	26	**(T701, T701C, T701D)** Nuts	30° wrench arc	–
5-4	2	**(T700)** P3 Hose and Tube Assembly Coupling Nuts	60° wrench arc	–
5-5		**(T701, T701C, T701D)** P3 Tube Coupling Nuts	60° wrench arc	–
5-6	2	V-Band Coupling Assembly Self-locking Nut	30 inch-pounds	35 inch-pounds
5-7	3	Impeller Shroud Screws	7 inch-pounds	9 inch-pounds
5-8	13	Bolt	45 inch-pounds	50 inch pounds
5-8	18	Clip Support Nut	45 inch-pounds	50 inch-pounds
5-8, 5-9	3	Duct Retaining Nuts	45 inch-pounds	50 inch-pounds
5-8, 5-9	7	Clip Support Bolt	45 inch-pounds	50 inch-pounds
5-9	17	Clip Support Nut	45 inch-pounds	50 inch-pounds
5-13	6	Seal Retainer Nut	32 inch-pounds	35 inch-pounds
5-13	12	Seal Retainer Nut	32 inch-pounds	35 inch-pounds

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
5-20	5	Container Sealing Bolts	75 foot-pounds	85 foot-pounds
5-21	3	Support Bolts	160 inch-pounds	170 inch-pounds
5-21	8, 10, 11	Frame Bolts	120 inch-pounds	130 inch-pounds
6-1	3	**(T700)** Primer Nozzle Retaining Nuts	140 inch-pounds	150 inch-pounds
6-3	2	Main Fuel Manifold Coupling Nuts	60° wrench arc	–
6-3	5	**(T700)** POU Manifold, or **(T701, T701C, T701D)** ODV Manifold	60° wrench arc	–
6-3	8	Main Fuel Manifold Clamp Bolt	45 inch-pounds	50 inch-pounds
6-3	10	Locknut	70 inch-pounds	75 inch-pounds
6-4	1, 8	**(T700)** Fuel Start Feed Tube Coupling Nuts	60° wrench arc	–
6-4	2, 4	**(T700)** Fuel Start Manifold Tube Coupling Nuts	60° wrench arc	–
6-4	3	**(T700)** Fuel Start Manifold Tube Bracket Bolt	45 inch-pounds	50 inch-pounds
6-4	6	**(T700)** Fuel Start Feed Tube Bracket Bolt	45 inch-pounds	50 inch-pounds
6-5	7	Fuel Injector Retaining Nuts	320 inch-pounds	340 inch-pounds
6-7	2	Fuel Boost Pump Captive Bolts	45 inch-pounds	50 inch-pounds
6-9	11	**(T700)** Clamp Coupling Bolt	32 inch-pounds	35 inch-pounds
6-9	12	**(T700)** Clamp Coupling Locknut	60° wrench arc	–
6-9	19	**(T700)** P3 Hose and Tube Coupling Nut	60° wrench arc	–
6-9	20	**(T700)** Gearbox-to-HMU Hose Assembly Coupling Nut	60° wrench arc	–
6-10	11	**(T701, T701C, T701D)** Clamp Coupling Bolt	32 inch-pounds	35 inch-pounds
6-10	12	**(T701, T701C, T701D)** Clamp Coupling Locknut	60° wrench arc	–
6-10	19	**(T701, T701C, T701D)** P3 Tube Coupling Nut	60° wrench arc	–

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
6-10	20	**(T701, T701C, T701D)** Gearbox-to-HMU Hose Assembly Coupling Nut	60° wrench arc	–
6-12	5	HMU Threaded Fittings	40 inch-pounds	50 inch-pounds
6-12	12	Link Assembly Locknut	45 inch-pounds	50 inch-pounds
6-18	3	Fuel Filter Captive Bolts	45 inch-pounds	50 inch-pounds
6-21	2	Gearbox-to-HMU Hose Assembly Coupling Nuts	60° wrench arc	–
6-22	3	Fuel Pressure Sensor	15° wrench arc	–
6-24	3	**(T701, T701C, T701D)** ODV Manifold Assembly Captive Bolts	45 inch-pounds	50 inch-pounds
6-24	5	**(T701, T701C, T701D)** ODV Manifold Bracket Bolt	45 inch-pounds	50 inch-pounds
6-26	2	**(T701, T701C, T701D)** ODV Captive Bolts	45 inch-pounds	50 inch-pounds
6-28	3	**(T700)** POU Manifold Assembly Captive Bolts	45 inch-pounds	50 inch-pounds
6-28	6	**(T700)** POU Manifold Bracket Bolt	45 inch-pounds	50 inch-pounds
6-30	2, 8	**(T700)** POU Captive Bolts	45 inch-pounds	50 inch-pounds
7-1	2	**(T700)** Ignition Lead Coupling Nut	15° wrench arc	–
7-1	4	**(T700)** Igniter Plug Retaining Nuts	140 inch-pounds	150 inch-pounds
7-2	1	**(T701, T701C, T701D)** Igniter Plug	140 inch-pounds	150 inch-pounds
7-2	3	**(T701, T701C, T701D)** Ignition Lead Coupling Nut	15° wrench arc	–
7-5	1	**(T700, T701)** ECU Captive Bolt	45 inch-pounds	50 inch-pounds
7-6	1	**(T701C, T701D)** DEC Captive Bolt	45 inch-pounds	50 inch-pounds
7-10	2	**(T700, T701)** History Recorder or **(T701C, T701D)** History Counter Captive Bolts	18 inch-pounds	22 inch-pounds

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
7-11	6	**(T700, T701)** History Recorder or **(T701C, T701D)** History Counter Grounding Strap Bolt	27 inch-pounds	30 inch-pounds
7-12	1	**(T700, T701)** History Recorder or **(T701C, T701D)** History Counter Guard Screws	4.5 inch-pounds	5.0 inch-pounds
7-13	1B	Ignition Lead Coupling Nuts	15° wrench arc	–
7-15	2	Ignition Exciter Captive Bolts	18 inch-pounds	22 inch-pounds
7-15	4	Ignition Lead Coupling Nuts	15° wrench arc	–
7-17	7	Ignition Exciter Grounding Strap Bolt	27 inch-pounds	30 inch-pounds
7-18	7	**(T700)** Green Cable Bracket Bolts	45 inch-pounds	50 inch-pounds
7-19	7	**(T701, T701C, T701D)** Green Cable Bracket Bolts	45 inch-pounds	50 inch-pounds
7-22	3	E3 Connector Bracket Screws	5 inch-pounds	6 inch-pounds
7-23	8	Electrical Connector (Yellow Cable) to Thermocouple Assembly Connector	60° wrench arc	–
7-23	9	Electrical Connector (Yellow Cable) to Np Sensor Connector	15° wrench arc	–
7-25	5	**(T700)** Electrical Connector (Blue Cable) to Torque and Overspeed Sensor Connector	15° wrench arc	–
7-26	5	**(T701, T701C, T701D)** Electrical Connector (Blue Cable) to Torque and Overspeed Sensor Connector	15° wrench arc	–
7-28	5	Alternator Stator Captive Bolts	45 inch-pounds	50 inch-pounds
7-30	5	Alternator Rotor Locknut	275 inch-pounds	300 inch-pounds
7-32	3, 12	Thermocouple Bracket Bolts	45 inch-pounds	50 inch-pounds
7-32	4	Thermocouple Coupling Nuts	15° wrench arc	–
7-32	9	Thermocouple Junction Box Bracket Bolts	45 inch-pounds	50 inch-pounds
7-32	11	Electrical Connector (Yellow Cable) to Thermocouple Assembly Connector	60° wrench arc	–

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
7-35	1	Torque and Overspeed Sensor Bolts	70 inch-pounds	75 inch-pounds
7-35	6	Torque and Overspeed Sensor Clamp Bolt	45 inch-pounds	50 inch-pounds
7-35	7	Electrical Connector (Blue Cable) to Torque and Overspeed Sensor Connector	15° wrench arc	–
7-37	2	Np Sensor Clamp Bolt	45 inch-pounds	50 inch-pounds
7-37	5	Np Sensor Bolts	70 inch-pounds	75 inch-pounds
7-37	10	Electrical Connector (Yellow Cable) to Np Sensor Connector	15° wrench arc	–
8-1	2	Oil Cooler Captive Bolts	45 inch-pounds	50 inch-pounds
8-3	1	Oil and Scavenge Pump Bolts	45 inch-pounds	50 inch-pounds
8-5	1	**(T700)** Scavenge Screens	145 inch-pounds	150 inch-pounds
8-6	1	**(T701, T701C, T701D)** B-Sump Scavenge Screen	145 inch-pounds	150 inch-pounds
8-6	6	**(T701, T701C, T701D)** Scavenge Screens	145 inch-pounds	150 inch-pounds
8-9	3	Oil Filter Bypass Sensor Captive Bolts	45 inch-pounds	50 inch-pounds
8-13	4	Oil Cooler Bypass Relief Valve Locknuts	45 inch-pounds	50 inch-pounds
8-14	4	Cold Oil Relief Valve Locknuts	45 inch-pounds	50 inch-pounds
8-15	1	Bypass Valve Assembly	145 inch-pounds	150 inch-pounds
8-17	5	Electrical Chip Detector Captive Bolts	45 inch-pounds	50 inch-pounds
8-19	1, 6	C-Sump Scavenge Tube Bolts	70 inch-pounds	75 inch-pounds
8-19	2	C-Sump Forward Scavenge Tube Clamp Bolt	45 inch-pounds	50 inch-pounds
8-19	9	Tube Clamp Bolts	45 inch-pounds	50 inch-pounds
8-19	12	C-Sump Oil Supply Tube Clamp Bolts	45 inch-pounds	50 inch-pounds
8-19	13	C-Sump Oil Supply Tube Bolts	70 inch-pounds	75 inch-pounds
8-19	15	C-Sump Oil Supply Tube Coupling Nut	60° wrench arc	–

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
8-20	6	Oil Tank Cap and Adapter Screws	18 inch-pounds	22 inch-pounds
8-23	2, 4, 11	Fuel Injector Coupling Nuts	60° wrench arc	–
8-23	3, 12, 13B	Oil Manifold Clamp Bolts	45 inch-pounds	50 inch-pounds
8-23	5	C-Sump Forward Scavenge Tube Coupling Nut	60° wrench arc	–
8-23	6	C-Sump Aft Scavenge Tube Coupling Nut	60° wrench arc	–
8-23	7	Oil Supply Tube (Left-Hand) Coupling Nut	60° wrench arc	–
8-23	8	C-Sump Oil Supply Tube Coupling Nut	60° wrench arc	–
8-23	9	B-Sump Scavenge Fitting	60° wrench arc	–
8-23	15	Oil Manifold Captive Bolts	45 inch-pounds	50 inch-pounds
8-24	2	Oil Supply Tube (Left-Hand) Coupling Nuts	60° wrench arc	–
8-24	7	Oil Supply Tube (Right-Hand) Coupling Nut	60° wrench arc	–
8-24	8	B-Sump Oil Inlet Check Valve Clamp Bolt	45 inch-pounds	50 inch-pounds
8-26	1	Main Frame Oil Strainer Locknuts	45 inch-pounds	50 inch-pounds
8-26	8	Oil Level Indicator Locknuts	45 inch-pounds	50 inch-pounds
8-27	1	Transfer Sleeve Lockplate Screws	18 inch-pounds	22 inch-pounds
8-29	1	Oil Drain Plug	15° wrench arc	–
8-31	6	Oil Drain Insert Locknut	45 inch-pounds	50 inch-pounds
8-33	1	Mid C-Sump Scavenge Tube Clamp Bolts	45 inch-pounds	50 inch-pounds
8-33	3	Mid C-Sump Scavenge Tube Coupling Nut	60° wrench arc	–
8-33	6	Seal Pressure and Scavenge Tube Assembly Coupling Nut	60° wrench arc	–
8-33	7	Main Fuel Manifold Coupling Nuts	60° wrench arc	–
8-33	10	C-Sump Forward Oil Scavenge Tube Locknut	24 inch-pounds	27 inch-pounds

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
8-34	2	**(T700, T701C, T701D)** Oil Temperature Sensor	15° wrench arc	–
8-34	6	**(T700)** Oil Pressure Sensor	See paragraph 8-151 for torquing procedure.	–
8-36	3	**(T701, T701C, T701D)** Oil Pressure Sensor	See paragraph 8-152 for torquing procedure.	–
8-39	7	**(T701, T701C, T701D)** B-Sump Delta Pressure Tube Coupling Nut	60° wrench arc	–
8-40	3	**(T701C, T701D)** Bolt	45 inch-pounds	50 inch-pounds
10-1	2	**(T700)** P3 Hose and Tube Assembly Coupling Nuts	60° wrench arc	–
10-2	3	Anti-Icing IGV Feed Tube Bracket Bolts	45 inch-pounds	50 inch-pounds
10-2	4	Anti-Icing Valve Forward Bracket Bolt	45 inch-pounds	50 inch-pounds
10-2	7	Anti-Icing IGV Duct Clamp Nut	45 inch-pounds	50 inch-pounds
10-2	9, 12	Anti-Icing IGV Duct Bracket Nuts	45 inch-pounds	50 inch-pounds
10-2	15	Anti-Icing Bleed Duct Flange Bolts	45 inch-pounds	50 inch-pounds
10-6	1	Anti-Icing Bleed and Start Valve Captive Bolts	45 inch-pounds	50 inch-pounds
10-13	3	Captive Bolts	45 inch-pounds	50 inch-pounds
10-15	1	Coupling Nut on Compressor Case to Forward Seal Pressure Tube	60° wrench arc	–
10-15	4	Forward Seal Pressure Tube Coupling Nut	60° wrench arc	–
10-15	5	Seal Pressure and Scavenge Tube Assembly Coupling Nut	60° wrench arc	–
10-15	7	Seal Pressure and Scavenge Tube Assembly Clamp Bolt	45 inch-pounds	50 inch-pounds
10-15	9	Seal Pressure and Scavenge Tube Assembly Flange Bolts	70 inch-pounds	75 inch-pounds
10-15	12	Compressor Leakage Air Tube Flange Bolts	45 inch-pounds	50 inch-pounds

Table G-1. Torque Values (Cont)

Figure No.	Index No.	Nomenclature	Min Torque	Max Torque
10-15	17	Compressor Leakage Air Tube Clamp Bolt	45 inch-pounds	50 inch-pounds
10-16	1, 5	Sensing Tube Bolts	45 inch-pounds	50 inch-pounds
10-18	1	**(T701, T701C, T701D)** P3 Tube Coupling Nuts	60° wrench arc	–
H-10	1, 6, 7, 11, 16, 18, 23	Bracket and Clip Support Nuts/Bolts	45 inch-pounds	50 inch-pounds

APPENDIX H

GENERAL MAINTENANCE PRACTICES

H-1. APPENDIX OVERVIEW.

This appendix contains general maintenance practices. Maintenance personnel will become familiar with them before starting to work on the engine or on any of the engine subassemblies or components.

H-2. LUBRICANTS.

a. Be sure to comply with all assembly lubrication procedures. Failure to do so could result in oil system contamination.

CAUTION

- Antiseize compounds will not be used to lubricate a surface that will come in contact with engine oil.
- Do not use a lubricant on carbon seals.

b. The lubricants used during assembly are listed under Expendable Supplies and Materials in Appendix D.

c. Be sure all surfaces that need lubrication are clean and free of moisture and solvents before applying the lubricant.

d. Do not contaminate highly-finished surfaces with body moisture or other agents before lubricating. This could cause corrosion after lubricant is applied.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

e. Lubricating oil (item 85 or 87, Appendix D) or ultrachem fluid no. 1 (item 117, Appendix D) is the type of oil meant wherever the term “light coat of oil” or the word “oil” is used in assembly procedures.

f. Unless otherwise noted, use a light coat of lubricating oil to lubricate threads of bolts, screws, studs, coupling nuts, and fasteners used in assembly. Failure to do this may cause bolts to be improperly torqued, may cause shank nuts to become loosened during assembly, and may cause bolt seizure and/or failure during removal.

H-3. USE OF JACKING SCREWS.

a. Jacking screws are used to remove tight-fitting covers and flanged parts.

b. Bolts referenced in disassembly procedures are used as jacking screws.

c. In procedures that specify using jacking screws, do the following:

(1) Manually thread bolts into holes until they bottom.

(2) Alternately turn bolts clockwise 1/4-turn at a time, until part being jacked can be freely removed from engine.

H-4. CAPTIVE BOLTS.

H-5. Preliminary Information.

a. Captive bolts are part of a component and remain installed (captive) on the component after being unthreaded from the mounting surface in which they are threaded.

b. When the word “loosen” is used in reference to a captive bolt, it means that the captive bolt must be removed from the mounting surface, but not from the component to which it is captive.

H-6. Replacement of Captive Bolts.

a. AVUM: If bolt threads appear undamaged, try to remove bolt using hand pressure only. If bolt hangs up, return component to AVIM.

CAUTION

Do not remove damaged captive bolts through flange. Be sure all open ports and splines are capped or plugged.

b. AVIM: Try to remove bolt by hand. If bolt can not be removed by hand pressure, proceed as follows:

(1) Hold head of bolt against flange of unit with a wrench.

(2) Using a hacksaw, carefully cut off threaded portion of bolt.

(3) Remove bolthead from flange.

(4) Clean all chips from component.

(5) Using appropriate size tap, re-tap damaged threaded hole.

(6) Clean all chips from retapped hole.

(7) Using thread gage (or equivalent), inspect hole for proper fit.

(8) Install new captive bolt.

H-7. ELECTRICAL CONNECTORS.

CAUTION

- Do not allow fuel, oil, or water to enter connectors, plugs, or receptacles.
- Cap all unmated electrical connectors (plugs and receptacles) with clean, dry, approved caps, except when cable or component is being cleaned as specified in paragraph H-11.

H-8. Mating Electrical Connectors, Preliminary Information.

a. There are two types of electrical connectors: those with hex coupling nuts and those with knurled coupling rings.

b. Prior to mating, perform the following inspections:

WARNING

Handling Hot Parts

- When handling hot parts, wear approved gloves.
- Handling of hot parts with bare hands may cause reddening and blistering of skin, or third-degree burns.
- If skin is burned, immerse contacted area in cold water for 10 minutes. If pain or blistering persists, immediately get medical attention.

(1) Inspect electrical connectors (plugs and receptacles) to be sure they are free of moisture. If moisture is found, remove harness or component and bake dry at 250°F (121°C) for two hours.

(2) Inspect electrical connectors to be sure plugs and receptacles are clean and free of fuel and oil. If fuel or oil is found, clean and dry as described in paragraph H-11.

(3) Inspect all electrical connectors for bent pins. If bent pins are found, refer to applicable inspection paragraph for repair limits.

(4) Inspect rubber seals in receptacle connectors. Seals must not be swollen, cut, or torn. If seal is damaged, replace component.

c. All electrical connectors will be assembled dry. Do not lubricate seals or threads.

d. Before insertion of plug, aline keyways with those in receptacle. Avoid angular insertion, as this may damage pins in receptacle.

H-9. Mating and Sealing Electrical Connectors with Hex Coupling Nuts.

CAUTION

Improperly engaged/backed-off harness electrical connectors can create a potential flame-out condition.

a. Thread coupling nut onto receptacle, being careful to avoid cross-threading.

b. Push plug axially into receptacle and then tighten hex coupling nut until snug with wrench.

c. Using wrench-arc method, tighten hex coupling nuts according to assembly instructions in this manual.

d. Parts having hex coupling nuts on electrical connectors are:

- Yellow cable (connectors at thermocouple assembly and Np sensor)
- Blue cable (connector at Np sensor)
- Ignition leads

NOTE

After completion of final testing, it is necessary to seal (waterproof) the hex connectors of the torque and overspeed sensor and Np sensor.

e. After completion of final testing, seal (waterproof) the torque and overspeed sensor and Np sensor (fig. H-1) located at two and ten o'clock as follows:

(1) Clean hex connector (para H-11) of each sensor.

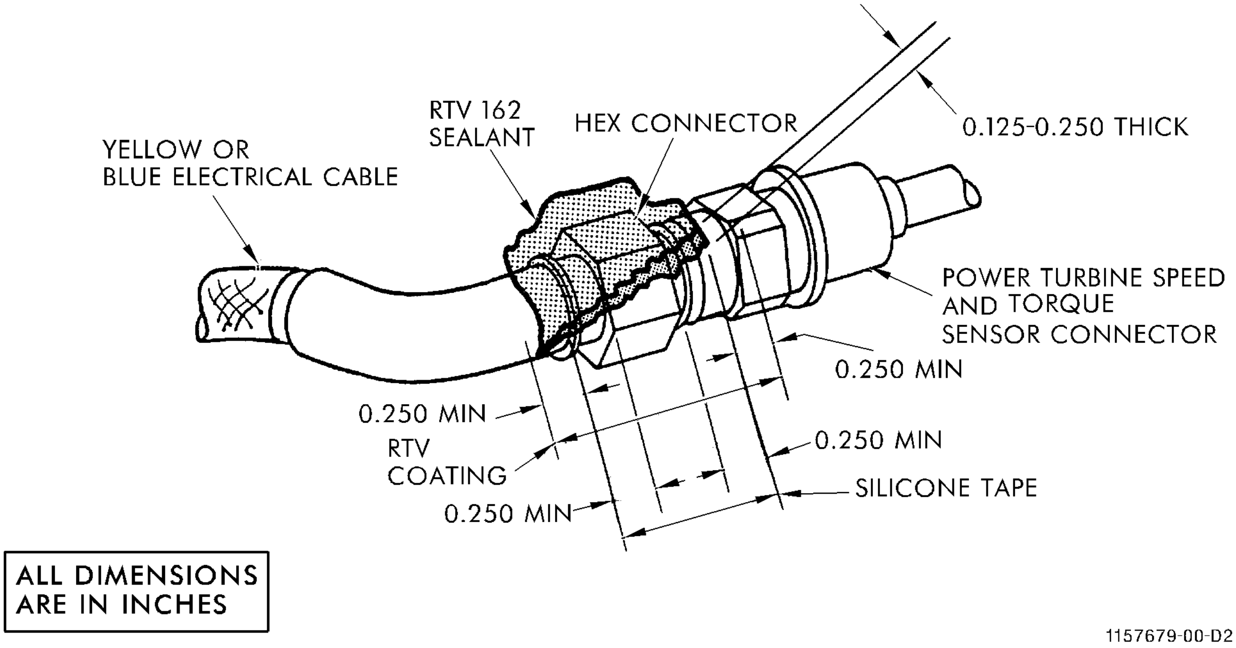


Figure H-1. Torque and Overspeed Sensor and Np Sensor Electrical Connectors; Sealing

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(2) Using dry, filtered, compressed air, dry the hex connector.

(3) Apply silicone tape (item 109, Appendix D) to each hex connector. Overlap tape approximately one-half the tape width on each rotation. Start wrapping tape at the middle of the connector and wrap to a point approximately 0.250 inch beyond one end of the fitting. Continue wrapping back across the middle, to approximately 0.250 inch beyond the other end of the fitting. Then wrap tape back to the middle of the connector and cut it off. Use sufficient tension on each rotation to conform to the shape being covered. Pat down all folds and wrinkles.

(4) Apply adhesive primer (item 94, Appendix D) to external metal surfaces of each sensor to a minimum of 0.750 inch beyond both edges of the tape.

(5) Let primer coating dry for 1 hour minimum.

WARNING

RTV Silicone
Rubber Sealant
MIL-A-46146

- Wear approved gloves and goggles/face shield.
- Vapors released during curing are combustible. Do not use near open flames, near welding areas, or on hot surfaces.
- Do not breathe vapors. Use in a well-ventilated area.
- Repeated inhalation of vapor can cause mild respiratory irritation.
- If any vapor contacts eyes, immediately flush affected area thoroughly with water for at least 15 minutes and get medical attention if irritation persists.
- Do not ingest. May be harmful if swallowed.
- In case of ingestion, do not induce vomiting. Slowly dilute using 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.
- In case of skin contact, remove material completely with dry cloth or paper towel before washing with detergent and water. After contact, hands and skin should be washed before eating, drinking, or smoking. Skin irritation is not expected, but may occur in certain sensitive individuals.

WARNING

RTV-3145 Adhesive/Sealant
Potting Compound

- In case of skin contact, flush contacted area with water. After contact, hands and skin should be washed before eating, drinking, or smoking.
- Eye protection should be worn when working with this material. If liquid contacts eyes, flush eyes thoroughly with water for 15 minutes.
- If prolonged contact with vapor is likely, wear approved respirator.

CAUTION

- Do not allow any RTV sealant to come in contact with any other hardware, particularly at the sensor located at the ten o'clock position.
- Do not exceed 0.250 inch maximum thickness of sealant, as it may not cure properly.

NOTE

Use of RTV-3145 (gray) is optional.

(6) Apply a thin coat of RTV-162 or RTV-3145 (gray) sealant (item 96 or 97, Appendix D) 0.125-0.250 inch thick, over taped connector of each sensor, extending

0.250 inch minimum out beyond the edges of the tape. Apply RTV sealant, 360° around, until the tape is completely covered.

H-10. Mating Electrical Connectors with Knurled Coupling Rings.

NOTE

- When mating or disconnecting a connector having a knurled coupling ring, ratcheting will be felt as ring turns. This is normal and is part of the self-locking feature of the connector. If there is no ratcheting, cable must be replaced.
- Aircraft electrical connectors may also have a colored circumferential line and may require a different installation procedure. See applicable aircraft manual for instructions.

a. Thread coupling ring onto receptacle; avoid cross-threading.

NOTE

- As an alternate to hand tightening, soft jaw conduit type pliers may be used for connecting and disconnecting electrical connectors.
- The colored circumferential line (dark band) on the receptacle must be covered by the coupling ring.

b. Alternately push plug axially into receptacle and rotate coupling ring clockwise with hand torque until plug is firmly seated (coupling ring covers colored circumferential line) and until knurled coupling ring is tightened to maximum extent. In some cases, use of soft jaw electrical connector pliers (Item 92, Appendix D) may be required to rotate the coupling nut to fully cover the colored circumferential line on the receptacle.

CAUTION

Use only soft jaw conduit type pliers on knurled coupling rings. Do not use hard jaw pliers.

c. Grasp plug backshell and apply a light side load. No relative motion between plug and receptacle shell is permissible. If motion is noted, repeat step b until connector is firmly seated.

H-11. Cleaning Electrical Connectors.

WARNING

Isopropyl Alcohol
TT-I-735

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Inhalation of vapors can cause drowsiness, dizziness, and headache. Contact of liquid with skin may cause dermatitis and irritation.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause drowsiness, go to fresh air.
- When handling large quantities (greater than one gallon (3.8 liters)), work at air-exhausted workbench or covered tank.
- Store solvent and dispose of liquid-soaked clothes in approved metal safety container.
- Metal containers of liquid must be grounded to maintain electrical continuity.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

WARNING

Cleaning With Freon

- Freon may affect skin, eyes and respiratory tract. Use in a well ventilated area. Avoid prolonged breathing of vapors. Avoid eye and repeated skin contact. Keep away from sparks and flames.
- Do not immerse hands in cleaner during cleaning process as ultrasonic vibration can be injurious to skin.

WARNING

Trichlorotrifluoroethane
MIL-C-81302

- Repeated or prolonged contact with liquid or inhalation of vapor can cause skin and eye irritation, dermatitis, drowsiness, and heart damage.
- After prolonged skin contact, wash contacted area with soap and water. Remove contaminated clothing. If vapors cause irritation, go to fresh air; get medical attention.
- When handling liquid in vapor-degreasing tank with hinged cover and air-exhaust, or at air-exhausted workbench, wear approved gloves and goggles.
- When handling liquid at open, unexhausted workbench, wear approved respirator, gloves, and goggles.
- Dispose of liquid-soaked rags in approved metal container.

NOTE

- Electrical connectors will be cleaned if inspection shows connector is contaminated, or if connector was left exposed.
- There are two methods for cleaning electrical connectors. The preferred method (step a) is to use cleaning solvent and dry, filtered, compressed air. The alternate method (step b) is to use dry, filtered, compressed air only.
- Use authorized solvents only to clean connectors.
- Allow connectors to air dry for 1 hour prior to mating.

a. Using solvent (item 3, 99, or 115, Appendix D), clean electrical connector as follows:

(1) Hold spray nozzle 4-6 inches away from connector, and spray connector with solvent (item 3, 99, or 115, Appendix D) to loosen contaminants.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

CAUTION

- Use low velocity (15 psig) air; high velocity may damage rubber seals.
- Do not soak or dip connectors in solvent.

(2) Drain excess liquid from connector immediately. Blow-dry with low velocity (15 psig), dry, filtered, compressed air; and allow connector to dry for a minimum of 1 hour prior to mating.

b. Using dry, filtered, compressed air, clean electrical connector as follows:

(1) Blow dry, filtered, compressed air at low velocity (15 psig) onto connector to remove contaminants.

(2) Cap all unmated electrical connectors (plugs and receptacles) with clean, dry, approved protective caps.

H-12. Uncoupling of Electrical Connectors with Failed Nondecoupling Mechanism. Forceful uncoupling of an electrical connector with a failed nondecoupling mechanism can damage mating connector on component. By following instructions below, you can remove cable connector without damage to component. If there is not enough space around connector to work on it, remove entire cable and component from engine. If necessary, you can cut cable at connector in order to remove component. Proceed as follows:

a. There are two types of electrical connectors. See figure H-2 to see which type you have.

(1) **(T700)** Proceed to step b for older type connector. This connector is used only on the T700-GE-700 engine.

(2) Proceed to step c for newer type connector.

b. **(T700)** For the older type, shown in view A, disengage snapring from its groove using a sharp-pointed tool. This will release the cap and the nondecoupling mechanism. Unscrew coupling ring to remove connector.

c. For the new type, shown in view B, do the following:

(1) Grind or file through rolled-over section of cap to release it from coupling ring.

(2) Grind or file away section of cap that is pressed on coupling ring.

(3) Use a screwdriver to pry cap loose from coupling ring. This will release the spring.

(4) Unscrew coupling ring to remove connector.

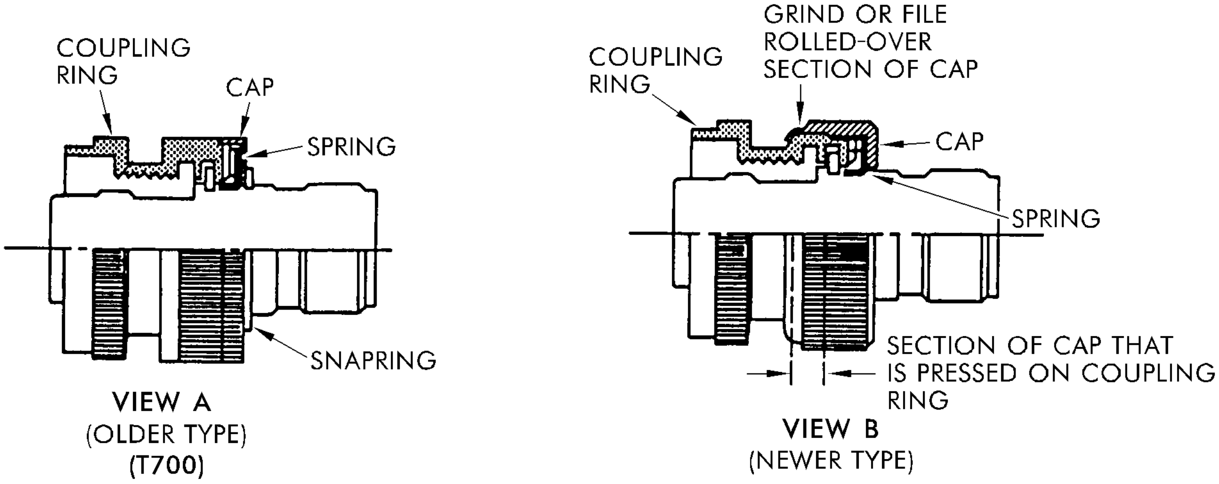


Figure H-2. Electrical Connectors with Failed Nondecoupling Mechanism; Removal

H-13. PREFORMED PACKINGS.

WARNING

Lubricating Oil

- If oil is decomposed by heat, toxic gases are released.
- Prolonged contact with liquid or mist may cause dermatitis and irritation.
- If there is any prolonged contact with skin, wash area with soap and water. If solution contacts eyes, flush eyes with water immediately. Remove saturated clothing.
- If oil is swallowed, do not try to vomit. Get immediate medical attention.
- When handling liquid, wear rubber gloves. If prolonged contact with mist is likely, wear approved respirator.

a. Unless otherwise specified, apply a light coat of lubricating oil (item 85 or 87, Appendix D) to packings.

b. Before installing packings and parts containing packings, lubricate all grooves, lead-in chamfers, bores, and surfaces with lubricating oil.

c. Wipe off excess oil before assembling parts.

d. Do not reuse packings that were removed during disassembly. Use new packings at final assembly.

e. Remove packings by hand if possible. If not, remove packings as follows:

CAUTION

Be careful when using scriber because it can damage packing grooves, causing fuel or oil leaks.

(1) Stick a scriber into the packing. Do not touch packing groove with the scriber.

(2) Lift packing out of groove.

(3) Discard packing.

H-14. WRENCH-ARC METHOD FOR TIGHTENING.

H-15. Preliminary Information.

a. Before tightening, be sure that all threads, sealing, and mating surfaces are clean and free of nicks, burrs, and scratches.

b. Lubricant used on threads will be the same as that used in the engine oil system. Do not lubricate electrical connectors.

NOTE

- All wrench-arc tasks require the nut to be seated snug with an open-end wrench.
- The snug (no torque) condition is reached when, using an open-end wrench, a positive increase in resistance (on the nut) to turning is felt (greater than run-on torque), when parts appear to be properly seated, and when no looseness between mating parts is noted.

c. Open-end wrenches with 15° offset angled heads will normally be used to snug nut and for wrench-arc tightening.

H-16. Tightening to 15° Wrench Arc.

a. Using an open-end wrench, snug the nut.

b. With wrench still positioned on nut, establish a line of sight using wrench handle (fig. H-3, view A).

c. Use angular difference between handle and wrench flats (15°) to visually measure amount that nut will have to be turned.

d. Turn wrench until flats on nut (engaged by wrench) are alined with line of sight established by handle in step c.

H-17. Alternate Method for Tightening to 15° Wrench Arc.

a. Using an open-end wrench, snug the nut.

b. With wrench still positioned on nut, use engaged nut flats to establish a line of sight (fig. H-3, view B).

c. Turn wrench until handle is alined with line of sight.

H-18. Tightening to 60° or 120° Wrench Arc. In this method of tightening, primarily used for tube fittings, the flats on the union are used as a reference. Wrenches other than open-end wrenches (crowfeet or tubing wrenches) may be used.

a. Using an open-end wrench, snug the nut.

b. Use the corners of coupling nut and of mating union to gage amount that coupling nut will have to move (fig. H-3, view C).

c. Turn coupling nut 1 flat for 60° wrench arc.

d. Turn coupling nut 2 flats for 120° wrench arc.

H-19. Tightening to 30° Wrench Arc.

a. Using an open-end wrench, snug the nut.

b. With wrench still positioned on nut, note position of wrench handle, and pick out point of reference (on engine) in line with handle (fig. H-3, view D).

c. Invert wrench using same nut flats. Angular difference between centerlines of wrench in the two positions is 30°.

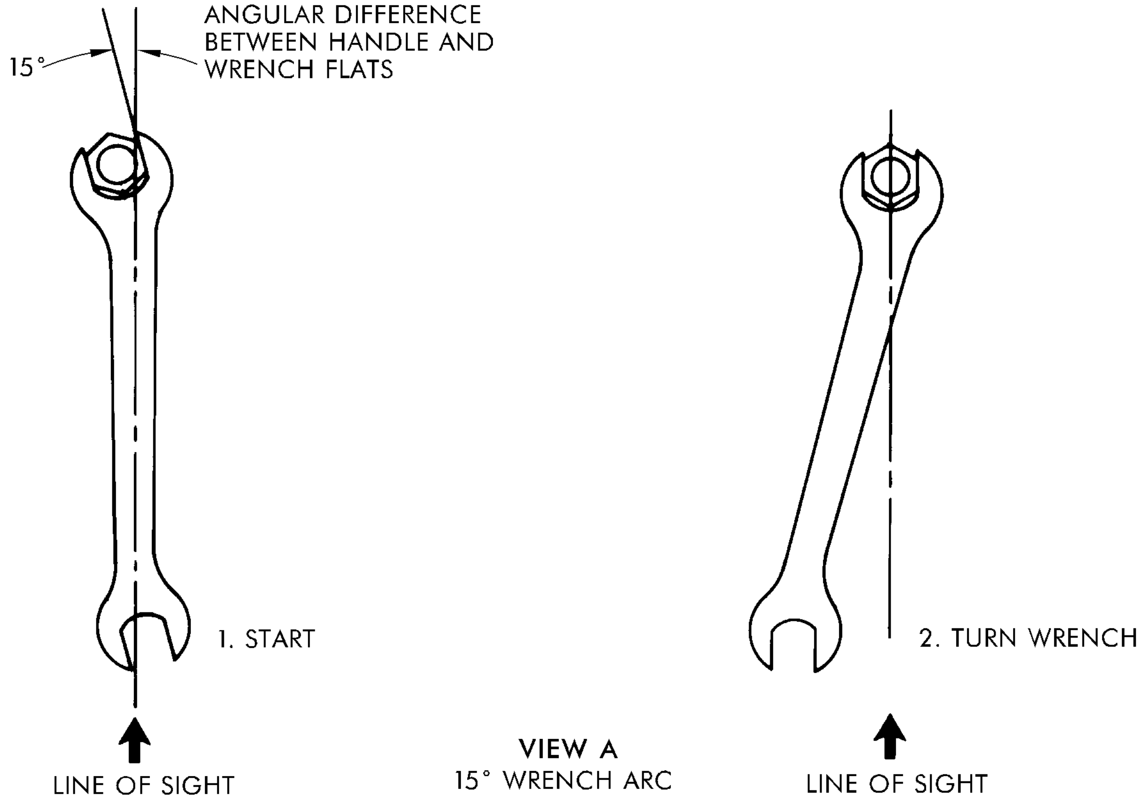
d. Turn wrench to position established in step b.

H-20. Tightening to 90° or 180° Wrench Arc. In this procedure, wrenches other than open-end (box, tubing, crow-feet) may be used. Any local reference, such as the engine or component centerline may be used to judge wrench travel.

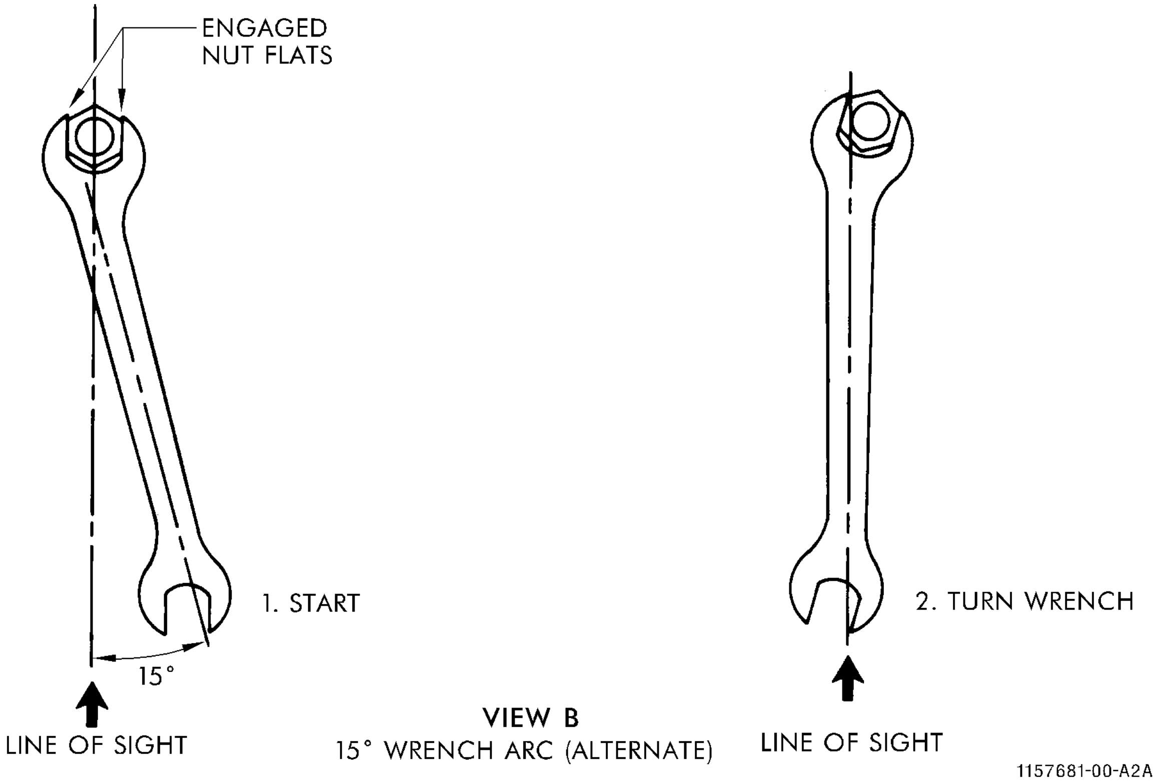
a. Using an open-end wrench, snug the nut.

b. For 90° arc, turn wrench until handle is perpendicular (at a right angle) to its starting position (fig. H-3, view E).

c. For 180° arc, turn wrench until handle points in opposite direction (fig. H-3, view F).

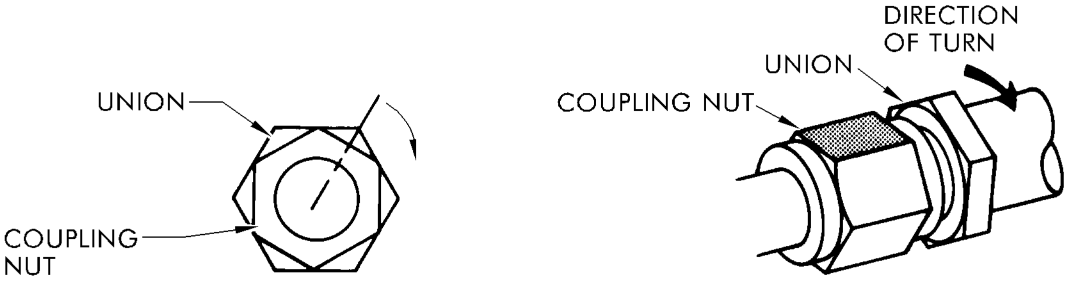


VIEW A
15° WRENCH ARC



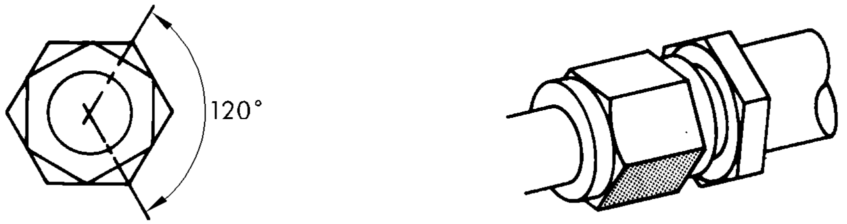
VIEW B
15° WRENCH ARC (ALTERNATE)

Figure H-3. Wrench-Arc Tightening Techniques (Sheet 1 of 3)



1. START

2. ONE FLAT (60° WRENCH ARC)



3. TWO FLATS (120° WRENCH ARC)

VIEW C
60° AND 120° WRENCH ARC

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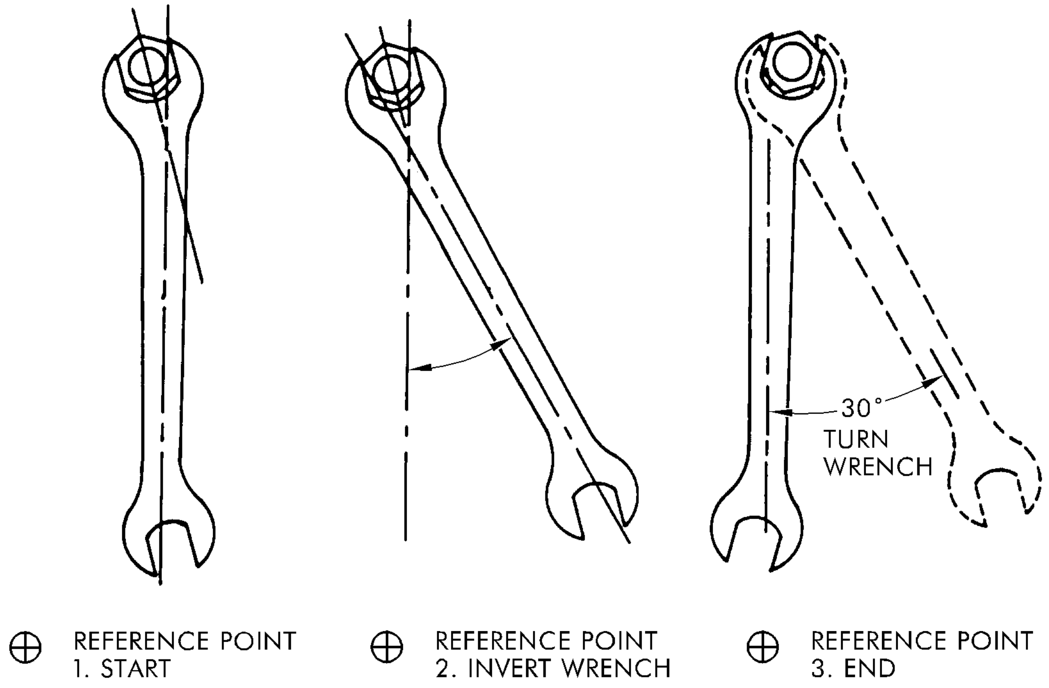
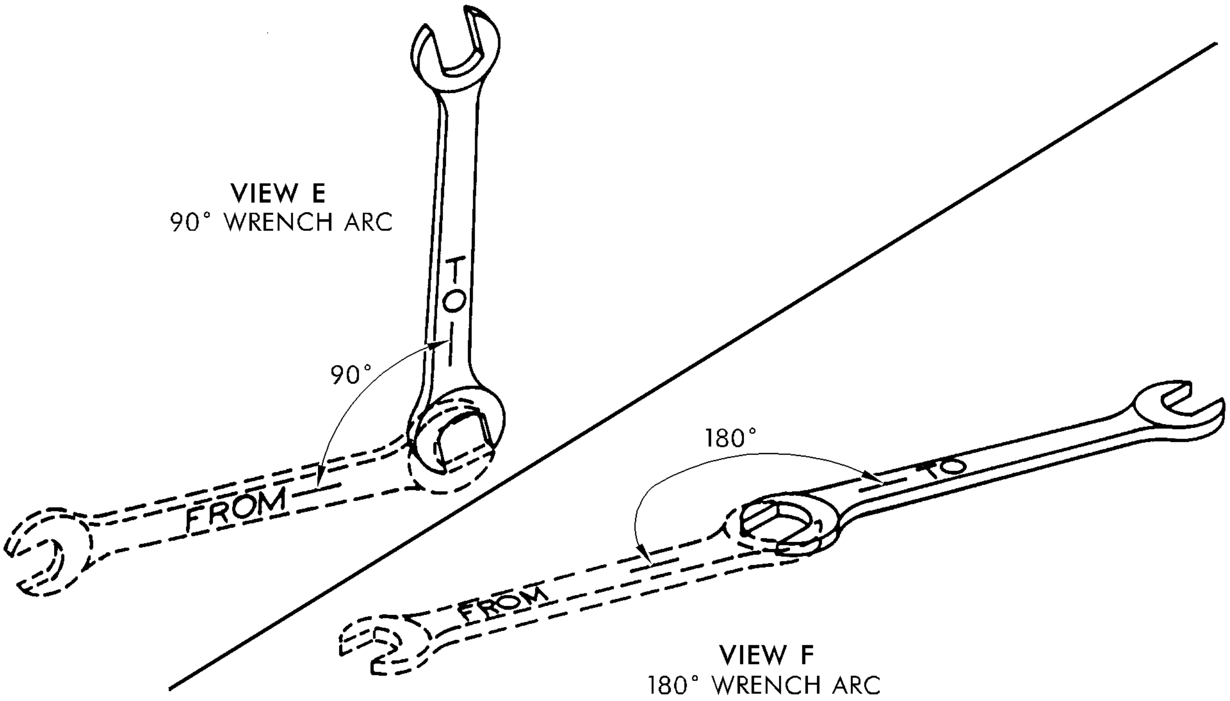
Figure H-3. Wrench-Arc Tightening Techniques (Sheet 2 of 3)



VIEW D
30° WRENCH ARC



VIEW E
90° WRENCH ARC

VIEW F
180° WRENCH ARC

Figure H-3. Wrench-Arc Tightening Techniques (Sheet 3 of 3)

H-21. GENERAL BLENDING PROCEDURE.

a. Blending is done to remove high stress areas caused by nicks, scratches, etc. on critical parts. Removal of the material that surrounds the high stress area (in a smooth contour) relieves this high stress area and permits further use of the part by lessening the danger of cracking.

b. Blending may be done with a fine file, a fine abrasive stone, or abrasive cloth (items 104 or 52, Appendix D). If you have to make a large or deep blend, use a medium file or heavy grade abrasive cloth (item 53, Appendix D) to shorten time required to remove metal; however, you must make the finish smooth with abrasive cloth.

c. When blending a cylindrically shaped part, blend around the curved surface, not along the length of the part.

d. The finish on blended area must be as close as practical to original finish of part.

H-22. TUBES, HOSES, AND FITTINGS.

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

The following paragraphs contain general instructions for cleaning, inspecting, and testing tubes, hoses, and fittings.

H-23. Cleaning Tubes and Hoses.

a. Exterior Cleaning.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

(1) Wipe exterior with cloth soaked in solvent (item 99, Appendix D).

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(2) Blow external surfaces dry using dry, filtered compressed air.

b. Interior and Exterior Cleaning (AVIM).

(1) Cover openings to prevent entry of dirt or foreign material.

WARNING

Dry Cleaning Solvent
(Stoddard Solvent)
P-D-680

- Combustible - do not use near open flames, near welding areas, or on hot surfaces.
- Prolonged contact of skin with liquid can cause dermatitis. Repeated inhalation of vapor can irritate nose and throat and can cause dizziness.
- If any liquid contacts skin or eyes, immediately flush affected area thoroughly with water. Remove solvent-saturated clothing. If vapors cause dizziness, go to fresh air.
- When handling liquid or when applying it in an air-exhausted, partially covered tank, wear approved gloves and goggles.
- When handling liquid or when applying it at unexhausted, uncovered tank or workbench, wear approved respirator, gloves, and goggles.

(2) Wipe exterior with cloth soaked in solvent (item 99, Appendix D).

(3) If internal passages require cleaning, thoroughly clean exterior first; then pour solvent (item 99, Appendix D) through the tube or hose in both directions.

WARNING

Compressed Air

- When using compressed air for any cooling, cleaning, or drying operation, do not exceed 30 psig at the nozzle.
- Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapor can damage lungs.
- When using air for cleaning at an air-exhausted workbench, wear approved goggles or face shield.
- When using air for cleaning at an unexhausted workbench, wear approved respirator and goggles.

(4) Blow internal and external surfaces dry using dry, filtered compressed air.

(5) Always cover openings immediately after cleaning.

H-24. Inspection of Tubes, Hoses, and Fittings. See table H-1.

CAUTION

If an engine has operated with a cracked, split, or leaking seal pressure air tube (8, fig. 10-15) for any length of time, damage to the stage 3 and 4 turbine disk could result, therefore; replace the PT module.

Table H-1. Inspection of Tubes, Hoses, and Fittings

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
WARNING Flight Safety Critical Aircraft Part (Critical Characteristic(s)) Leaks in fuel system components are critical characteristics. No fuel leaks allowed.			
a. Tubes for:			
(1) Splits and cracks.	None allowed.	Not repairable.	Replace tube.
(2) Nicks, scratches, gouges, wear, and chafing on:			
(a) Non-fuel-carrying tubes.	Any number, 0.005 inch deep, without high metal.	Same as usable limits, with high metal.	Remove high metal and blend to adjacent contour, using a fine abrasive stone (item 104, Appendix D). Replace tube if blending has been previously done in same area.
(b) Fuel-carrying tubes.	Not usable if depth of defect can be measured.	Not repairable.	Replace tube.
(3) Dents (see list in fig. H-4).	Dented area not over 20% of tube OD on straight or curved section having a radius over twice the tube OD (fig. H-4, view A). On a sharply bent radius, not over 10% of tube OD may be dented (fig. H-4, view B).	Not repairable.	Replace tube.
(4) Flattened area (see list in fig. H-4).	OD not less than 75% of original OD (fig. H-4, view C).	Not repairable.	Replace tube.

Table H-1. Inspection of Tubes, Hoses, and Fittings (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(5) AVIM: Nicks and scratches on packing grooves.	Up to 0.005 inch deep on bottom, 1/64 inch deep on wall of groove without sharp edges.	Not repairable.	Replace tube.
b. Flanges for:			
(1) Flatness of mating surface.	Flat within 0.005 inch. Place on flat surface or against flange and insert 0.005 inch thickness (feeler) gage.	Up to 25% of original flange thickness can be removed to meet usable limit.	Rework to usable limit by lapping, stoning, or machining (if possible).
(2) Cracks.	None allowed.	Not repairable.	Replace tube.
c. Hoses for:			
(1) Kinks and buckling.	Not allowed.	Not repairable.	Replace hose.
(2) Frayed and broken wire braid.	None allowed.	Not repairable.	Replace hose.
d. Hex coupling nuts for:			
(1) Damaged corners.	Any number as long as wrench can be used.	Not repairable.	Replace part.
(2) Cracks.	None allowed.	Not repairable.	Replace part.
(3) Nicks and burrs.	Any number, with no high metal.	Any number, with high metal.	Blend high metal.
(4) AVIM: Damaged threads.	One-half of one thread (total) with no high metal.	Same as usable limits, with high metal.	Chase threads using a bottoming tap.
e. Male fittings for:			
(1) AVIM: Nicks, dents, scratches, ridges, and pits on sealing surfaces.	Any number if the defect does not extend in the axial direction across more than 1/2 the sealing surface. No high metal allowed.	Same as usable limits, with high metal.	Carefully blend sealing surfaces, maintaining the original contour, using a fine, abrasive stone (item 104, Appendix D).
(2) AVIM: Nicks, dents, scratches, gouges, burrs, and stripped threads.	Total length of defects no more than 1/2 of one thread length with no high metal.	Same as usable limits, with high metal.	Blend high metal, using a die, fine file, or equivalent.

Table H-1. Inspection of Tubes, Hoses, and Fittings (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(3) Nicks, dents, scratches, and gouges on remaining surfaces of fittings.	Any number, 0.005 inch deep, with no high metal.	Same as usable limits, with high metal.	Blend high metal to adjacent contour, using a fine abrasive stone (item 104, Appendix D).
(4) Cracks.	None allowed.	Not repairable.	Replace assembly.
f. AVIM: Female fittings for nicks, dents, scratches, ridges, and pits on sealing surfaces.	Any number if the defect does not extend in the axial direction across more than 1/2 the sealing surface.	Same as usable limits, with high metal.	Blend high metal to usable limits.

H-25. Pressure-Testing of Tubes or Hoses (AVIM).

WARNING

Flight Safety Critical Aircraft Part
(Critical Characteristic(s))

Leaks in fuel system components are critical characteristics. No fuel leaks allowed.

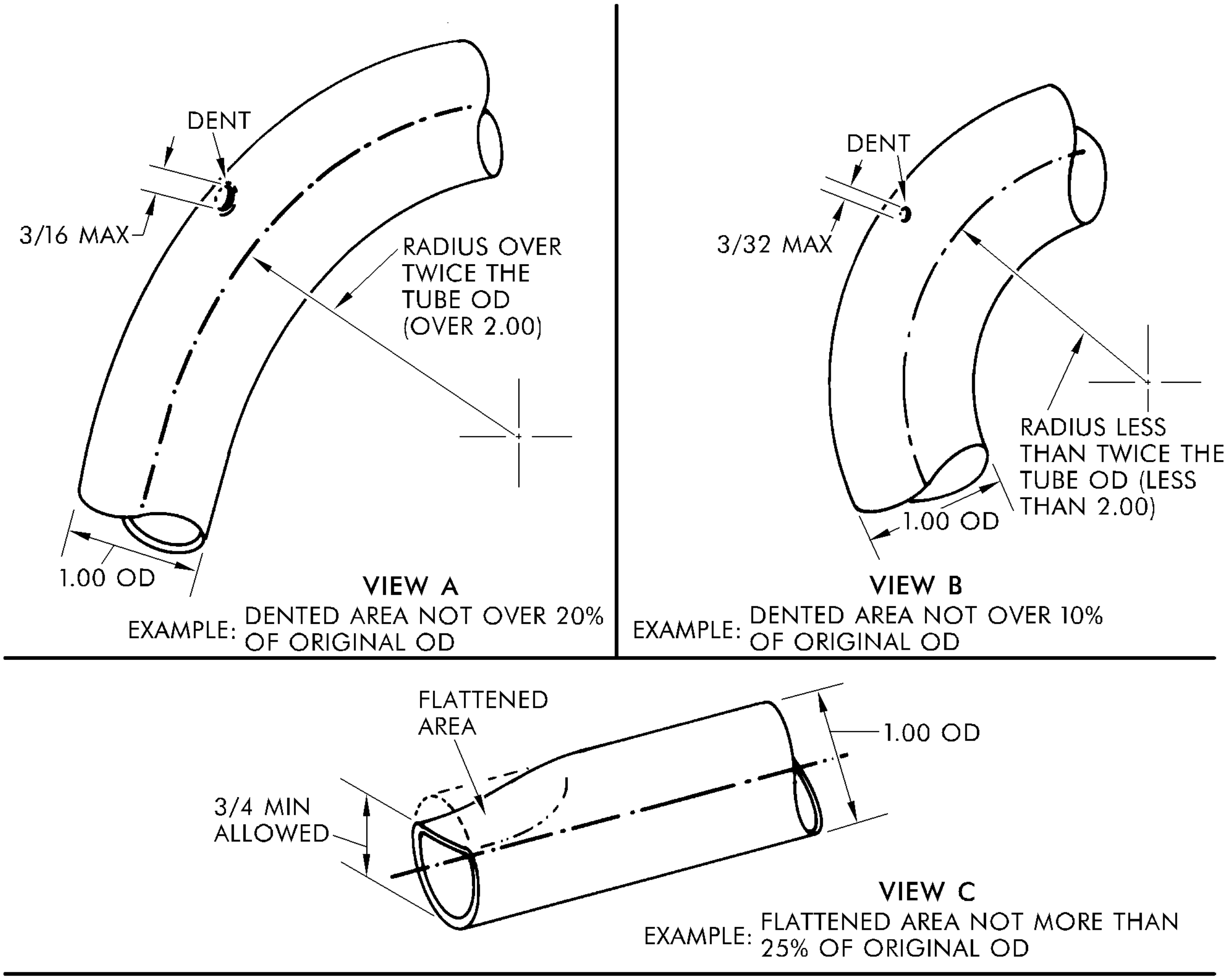
a. Connect tube or hose to a 90-100 psig source of clean, dry air.

b. Assemble suitable caps or plugs to all remaining openings.

c. Immerse tube or hose in tank of clean tap water. Remove any clinging air bubbles.

d. Pressurize tube or hose to 90-110 psig.

e. After 3 minutes, look at all sections of tube or hose for escaping air bubbles. No leaks allowed.



EXAMPLE: DENTED AREA NOT OVER 20% OF ORIGINAL OD

EXAMPLE: DENTED AREA NOT OVER 10% OF ORIGINAL OD

EXAMPLE: FLATTENED AREA NOT MORE THAN 25% OF ORIGINAL OD

TUBE OD	20% OF OD	10% OF OD	25% OF OD
1/4	3/64	1/32	1/16
5/16	1/16	1/32	5/64
3/8	5/64	3/64	3/32
5/8	1/8	1/16	5/32
3/4	5/32	5/64	3/16
1 AND OVER	3/16	3/32	1/4

ALL DIMENSIONS
ARE IN INCHES

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Figure H-4. Dented and Flattened Tubes; Usable Limits

H-26. STUDS AND THREADED INSERTS.

H-27. Inspection of Studs and Threaded Inserts (AVIM). See table H-2.

Table H-2. Inspection of Studs and Threaded Inserts

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Threads of studs and inserts (except locking inserts) for damage.	Up to one damaged or missing thread without crossed threads or loose material.	Same as usable limits, with crossed threads or loose material.	Remove loose material and chase threads.
b. Threads of locking inserts for damage.	Up to one damaged or missing thread without crossed threads or loose material.	Not repairable.	Replace insert (para H-28 or H-29 as applicable).
c. **(T701, T701C, T701D)** Locking inserts in main frame mounting pad for engine mount breakaway torque.	Breakaway torque shall not be less than 6.5 lb in.	Not repairable.	AVUM: Replace engine. AVIM: Replace insert (para H-28 or H-29 as applicable).
d. Studs for looseness:			
(1) On accessory gearbox.	None allowed.	Not repairable.	Replace stud (para H-28 or H-29 as applicable).
(2) At other locations.	Radial looseness is allowed if there is no axial looseness. Make sure that retainer (key ring, lockring, Kee) is not loose or missing.	Not repairable.	Replace stud (para H-28 or H-29 as applicable).

H-28. Replacement of Kelox and Rosan Studs and Threaded Inserts (AVIM).

a. Refer to **(T700)** TM 1-2840-248-23P, **(T701)** TM 1-2840-238-23P or **(T701C, T701D)** TM 1-2840-258-23P Repair Parts and Special Tools List (RPSTL) to identify stud and insert.

b. Remove defective part using information in table H-3 and in figures H-5, H-6, and H-7.

c. Be sure threaded hole is clean and not damaged; up to one full thread may be missing.

d. Refinish threaded hole with Alodine 1200S (para H-30).

Table H-3. Threaded Inserts/Stud Replacement Data

MS Locked-In Inserts (Keenserts)

Internal (UNJF-3B)	External (UNC-2A)	Part Number	Removal Drill	Removal Depth	Greenfield No. 8 Series Extractor	Drive Tool
0.3125-24	0.500-13	MS51831CA203L	13/32	3/16	5-1/4	TD624L
0.190-32	0.3125-18	MS51830CA201L	7/32	5/32	4	TD1024L
0.250-28	0.375-16	MS51830CA202	5/16	3/16	5	TD428L
0.375-24	0.500-13	MS51830CA204L	13/32	3/16	6	TD624L

MS Locked-in Studs (Keenserts)

Nut End (UNJF-3A)	Stud End (UNC-2A)	Length Nut End (Inches) ±0.030	Part Number	Removal Drill	Max Removal Depth	Installation Tool
0.190-32	0.3125-18	0.500	MS51833A201-8	7/32	5/32	TNS010
0.190-32	0.3125-18	0.688	MS51833A201-11	7/32	5/32	TNS010
0.190-32	0.3125-18	0.750	MS51833A201-12	7/32	5/32	TNS010
0.3125-24	0.4375-14	0.875	MS51833A203-14	11/32	3/16	TNS5
0.3125-24	0.4375-14	0.938	MS51833A203-15	11/32	3/16	TNS5
0.3125-24	0.4375-14	1.312	MS51833A203-21	11/32	3/16	TNS5

Miscellaneous Inserts

Thread Size		External Thread Length (Inches) ±0.015	Part Number	Removal Drill	Max Removal Depth	Drive Tool
Internal (UNJF-3B)	External (UNC-2A)					
0.190-32	0.3125-18	0.312	MS51830-201	7/32	5/32	TD1024L

Rosan Locked-in Studs

Thread Size			Replacement Data				
Stud End (NS)	Nut End (UNJF-3A)	Length Nut End (Inches)	Part Number		Removal Tool	Wrench	Drive Tool
			Stud	Lockring			
0.250-20	0.164-36	0.385/0.365	4041T29P01	4041T35P01	SM81-16	R1103-W	S81D-10
0.250-20	0.164-36	0.510/0.490	4041T29P02	4041T35P01	SM81-16	R1103-W	S81D-10
0.3125-18	0.190-32	0.453/0.423	4041T29P03	4041T35P02	SM91-16	R1104-W	S91D-10
0.375-16	0.250-28	0.724/0.694	4041T29P05	4041T35P03	SM101-18	R1105-W	S101D-12
0.375-16	0.250-28	0.890/0.860	4041T29P07	4041T35P03	SM101-18	R1105-W	S101D-12
0.4375-14	0.3125-24	0.881/0.851	4041T29P08	4041T35P04	BT1575	R1106-W	SF5902-4D

Rosan Solid Inserts

Thread Size	Insert	Lockring	Removal Drill	Removal Depth	Wrench	Drive Tool
0.500-20	4041T46P02	MS51990E108P	29/64	0.172	R1108-W	R1108-D

Studs (Keenserts)

Thread Size			Replacement Data			
Nut End (UNJF-3A)	Stud End (UNJF-3A)	Length Nut End (Inches)	Part Number	Removal Drill	Max Removal Depth	Installation Tool
0.190-32	0.250-28	0.562	4041T43P01	0.189	1/8	TS8
0.190-32	0.250-28	0.500	4041T43P02	0.189	1/8	TS8
0.250-28	0.3125-24	0.550	4041T38P01	1/4	5/32	TS4

Table H-3. Threaded Inserts/Stud Replacement Data (Cont)

Solid Inserts (Kelox)

Thread Size (UNF-3A)	Part Number	Ring Removal Drill	Max Removal Depth	Insert Removal Drill	Greenfield No. 8 Series Extractor	Kelox Drive Tool
0.500-20	4042T87P01	0.4040Y	0.234	3/8	4	249-5

Solid Inserts (Tridair)

External Thread Size (UNC-2A)	Length (Inches)	Part Number	Removal Drill	Max Removal Depth	Greenfield No. 8 Series Extractor	Drive Tool
0.3125-18	0.30-0.32	4042T88P01	7/32	5/32	4	TD1024L

Inserts (Kelox)

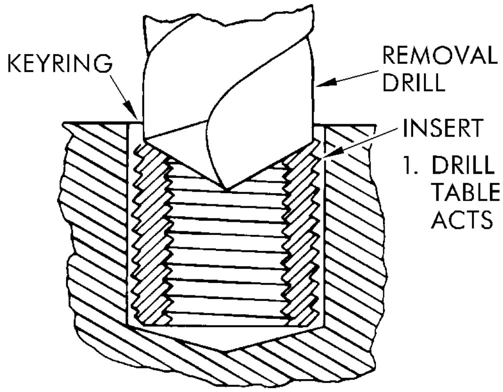
Nut End (UNJF-3B)	Stud End (UNJC-3A)	Part Number		Removal Drill	Max Removal Depth	Greenfield No. 8 Series Extractor	Drive Tool
		Insert	Lockring				
0.250-28	0.375-16	4046T53P02		5/16	0.175	5	249-4
0.190-32	0.3125-18	4046T53P01		1/4	0.145	4	249-3

Rosan Double Seal Fitting Insert

Thread Size			Replacement Data				
Stud End (UNJF-3A)	Nut End (UNJF-3A)	Length Nut End (Inches)	Part Number		Removal Tool	Wrench	Drive Tool
			Stud	Lockring			
0.4375-20	0.562-24	0.787/0.767	4052T22P01	AS3077-04	RZA12344	RZA12349W	RF9504DA

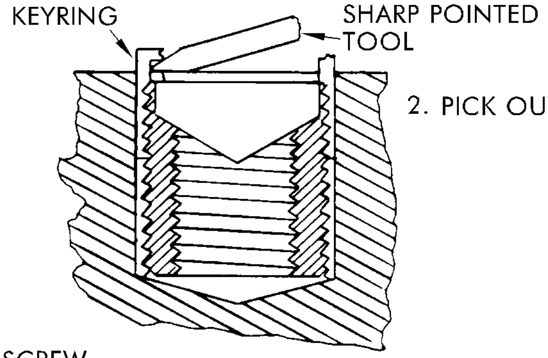
Locked-in Studs (Tridair)

Thread Size			Replacement Data			
Stud End (UNC-2A)	Nut End (UNJF-3A)	Length Nut End (Inches) ±0.020	Part Number	Removal Drill	Max Removal Depth	Installation Tool
0.3125-18	0.190-32	0.500 +2 Complete Threads	4041T37P01	7/32	5/32	TNS010
0.3125-18	0.190-32	0.477 +2 Complete Threads	4045T24P01	7/32	5/32	TNS010
0.3125-18	0.190-32	0.642 +2 Complete Threads	4045T24P02	7/32	5/32	TNS010

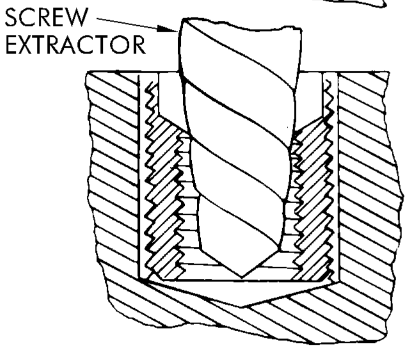


KELOX INSERT/STUD REMOVAL

1. DRILL OUT TOP OF INSERT (SEE INSERT/STUD REPLACEMENT DATA TABLE H-3 FOR DRILL SIZE AND DEPTH). THE HARDENED KEYRING ACTS AS A DRILL BUSHING.



2. PICK OUT KEYRING, USING POINTED TOOL.

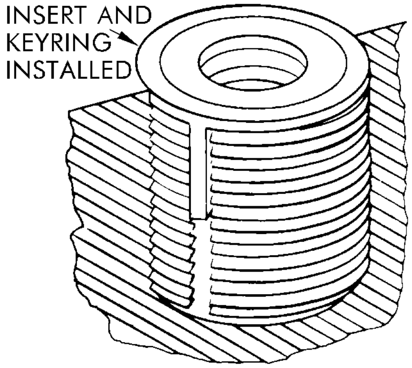


3. REMOVE INSERT, USING SCREW EXTRACTOR SPECIFIED IN TABLE H-3.

NOTE

STUDS ARE REMOVED IN THE SAME MANNER EXCEPT THAT THEY MUST FIRST BE CUT OFF FAIRLY FLUSH WITH SURFACE.

REPLACEMENT INSERT OR STUD OF THE SAME SIZE MAY NOW BE INSTALLED IN THE ORIGINAL HOLE.



KELOX INSERT/STUD INSTALLATION

1. REFINISH THREADED HOLE WITH ALODINE 1200S (PARA H-30)
2. COAT EXTERNAL THREADS WITH ZINC-CHROMATE PRIMER (ITEM 93, APPENDIX D).
3. SLIDE ONE-PIECE INSERT (OR STUD) AND KEYING ASSEMBLY ONTO INSTALLATION TOOL MANDREL.
4. SCREW ASSEMBLY INTO TAPPED HOLE UNTIL KEYS OF KEYRING FIRST THREAD.
5. DRIVE KEYRING FLUSH WITH OR SLIGHTLY BELOW SURFACE.

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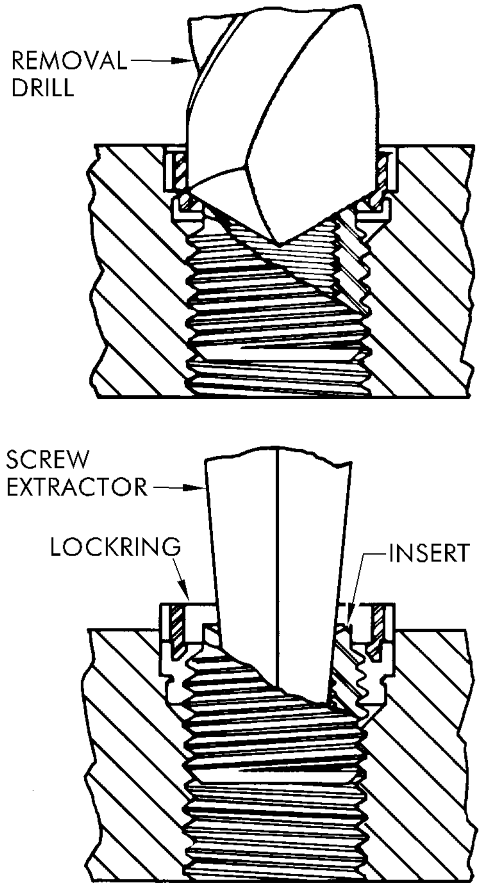
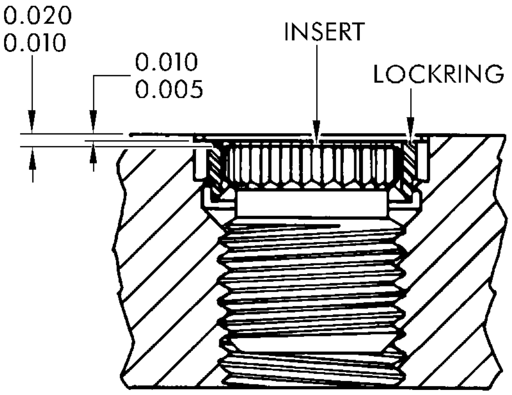
Figure H-5. Kelox Insert/Stud; Replacement



ROSAN INSERT REMOVAL

1. CLAMP PART, FROM WHICH INSERT IS TO BE REMOVED, SECURELY TO DRILL PRESS TABLE. ALINE SPINDLE WITH HOLE IN PART.
2. SECURE REMOVAL DRILL IN CHUCK AND SET SPINDLE SPEED AT 300 TO 700 RPM.
3. DRILL THROUGH LOCKRING AND NECK OF INSERT TO DESTROY SERRATION INTERLOCK. DO NOT DRILL BEYOND THE DEPTH OF THE COUNTERBORE IN THE PARENT MATERIAL.
4. WHEN REMOVING HYDRAULIC RING LOCKED INSERTS, DRILL ONLY THROUGH SERRATED FLANGE OF INSERT. DO NOT DRILL THROUGH SECOND FLANGE. SEE TABLE H-3 FOR DEPTH.
5. DRIVE SQUARE SCREW EXTRACTOR INTO INSERT AND APPLY REMOVAL TORQUE. WHEN INSERT THREAD FLANKS PUSH AGAINST LOWER SURFACE OF LOCKRING, CONTINUED REMOVAL TORQUE WILL REMOVE THE LOCKRING.
6. IF LOCKRING HAS BEEN DRILLED COMPLETELY THROUGH AND FAILS TO LIFT OUT WITH INSERT, THE REMAINING PORTION MAY BE COLLAPSED WITH A PUNCH AND REMOVED.



ROSAN INSERT INSTALLATION

1. REFINISH THREADED HOLE WITH ALODINE 1200S (PARA H-30)
2. COAT EXTERNAL THREADS WITH ZINC-CHROMATE PRIMER (ITEM 93, APPENDIX D).
3. INSTALL INSERT, USING WRENCH SPECIFIED IN TABLE H-3. INSTALL TO DEPTH SHOWN.
4. WITH APPLICABLE DRIVE TOOL, INSTALL THE LOCKRING TO DEPTH SHOWN.

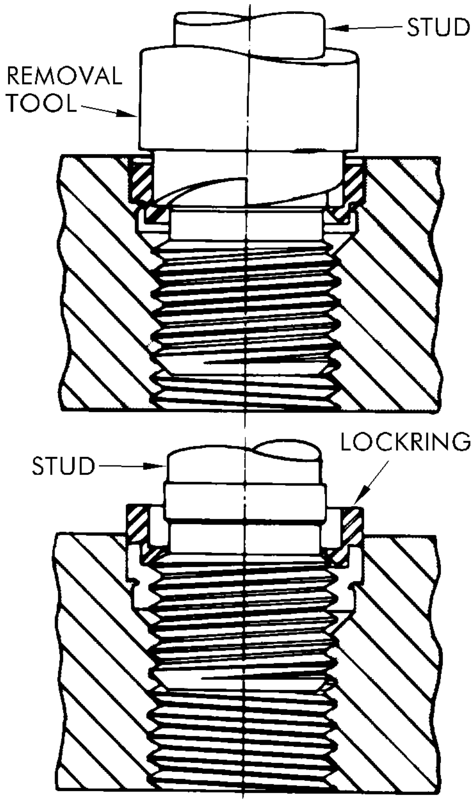
NOTE

REPLACEMENT OF ROSAN INSERTS AND LOCKRINGS IS MADE WITH SAME SIZE PARTS AS THOSE REMOVED AND IN SAME MANNER AS ORIGINALLY INSTALLED, ROTATE NEW LOCKRING IF NECESSARY, BEFORE DRIVING, TO A POSITION IN WHICH THE EXTERNAL SERRATIONS ARE ALINED WITH THOSE IN PARENT MATERIAL.

ALL DIMENSIONS
ARE IN INCHES

1157687-01-A2A

Figure H-6. Rosan Insert; Replacement



ROSAN STUD REMOVAL

1. CLAMP PART FROM WHICH STUD IS TO BE REMOVED SECURELY TO DRILL PRESS TABLE AFTER CAREFULLY ALINING AXES OF STUD AND DRILL PRESS SPINDLE. SET SPINDLE SPEED AT 300 TO 700 RPM.

2. SECURE REMOVAL TOOL IN CHUCK AND LOWER OVER STUD SHANK BEFORE STARTING MOTOR.

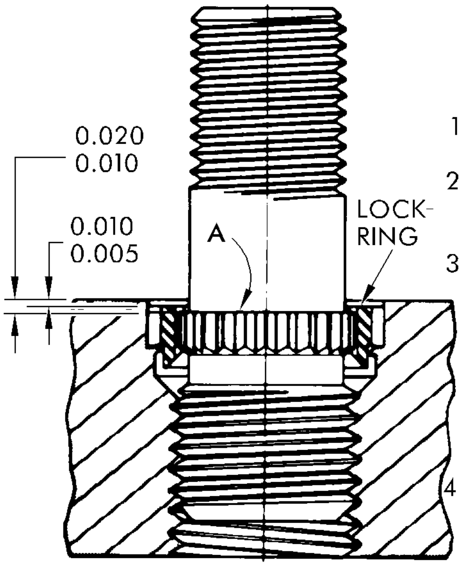
3. WITHOUT RAISING SPINDLE, START MOTOR. MILL THROUGH LOCKRING, RAISING TOOL EVERY FEW SECONDS TO ALLOW CHIPS TO CLEAR CUTTING TEETH. BEST RESULTS WILL BE OBTAINED BY NOT MILLING COMPLETELY THROUGH LOCKRING.

4. WHEN REMOVING HYDRAULIC RING LOCKED STUDS, MILL ONLY THROUGH SERRATED FLANGE OF INSERT. DO NOT MILL THROUGH SECOND FLANGE. SEE TABLE H-3 FOR DEPTH.

5. APPLY REMOVAL TORQUE TO STUD. WHEN STUD THREAD FLANKS PUSH AGAINST LOWER SURFACE OF LOCKRING, CONTINUED REMOVAL TORQUE WILL REMOVE THE LOCKRING TO BE JACKED OUT. STUD REMOVAL MAY THUS BE COMPLETED.

6. IF LOCKRING HAS BEEN MILLED COMPLETELY THROUGH AND FAILS TO LIFT OUT WITH STUD, THE PORTION REMAINING MAY BE COLLAPSED WITH A PUNCH AND REMOVED.

7. IF STUD HAS SHEARED OFF AT BASE, DRILL THROUGH STUD, USING DRILL THAT IS 1/2 DIAMETER OF STUD. REMOVE REMAINDER OF STUD, USING SCREW EXTRACTOR.



ROSAN STUD INSTALLATION

1. REFINISH THREADED HOLE WITH ALODINE 1200S (PARA H-30)

2. COAT THE STUD THREADS WITH ZINC-CHROMATE PRIMER (ITEM 93, APPENDIX D). ☞

3. WITH APPLICABLE WRENCH, INSTALL STUD TO DEPTH SHOWN.

CAUTION

DEPTH OF SURFACE **A** IS IMPORTANT SO THAT THE LOCKRING DRIVE TOOL WILL NOT TOUCH SURFACE **A**. ANY IMPACT OR PRESSURE ON THIS SURFACE MAY CAUSE DAMAGE TO THREADS IN PARENT MATERIAL, RESULTING IN A LOOSE FIT.

4. WITH PROPER DRIVE TOOL, INSTALL LOCKRING TO DEPTH SHOWN.

NOTE

TO REPLACE ROSAN STUDS AND LOCKRINGS, USE THE SAME SIZE PARTS AS THOSE USED IN REMOVAL AND IN SAME MANNER AS ORIGINALLY INSTALLED. ROTATE NEW LOCKRING IF NECESSARY, BEFORE DRIVING, SO THAT THE EXTERNAL SERRATIONS ARE ALINED WITH THOSE IN THE PARENT MATERIAL.

ALL DIMENSIONS ARE IN INCHES

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Figure H-7. Rosan Stud; Replacement

WARNING

Zinc Chromate Primer
TT-P-1757

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Contact with liquid or vapor can cause skin or eye irritation, dizziness, and headache. Prolonged inhalation can result in kidney and liver damage.
- After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air. If irritation persists, get medical attention.
- When handling small quantities (less than one gallon), wear approved gloves.
- When handling large quantities of liquid (greater than one gallon) at unexhausted workbench, wear approved respirator, gloves, goggles, apron, and long sleeves.
- Do not eat, smoke, or carry smoking materials in areas where liquid is handled.
- Dispose of liquid-soaked rags in approved metal container.
- Contains chromates. Follow approved toxic waste disposal procedures.

e. Coat the external threads with zinc-chromate primer (item 95, Appendix D).

CAUTION

If insert is not properly seated, threads of insert can be distorted when keyring is driven in.

f. Install replacement part(s) as described in figures H-5, H-6, and H-7, as applicable.

g. Check for zero run-on torque on inserts by threading appropriate size bolt into insert. No resistance must be felt. If resistance is felt, threads of insert may be distorted.

h. Remove bolt from insert.

i. Repeat steps a thru h, if necessary.

H-29. Replacement of Keensert/Tridair Studs and Threaded Inserts (AVIM).

a. Refer to **(T700)** TM 1-2840-248-23P, **(T701)** TM 1-2840-238-23P or **(T701C, T701D)** TM 1-2840-258-23P Repair and Special Tools List (RPSTL) to identify stud and insert.

b. Using information in table H-3 and in figures H-8 and H-9, remove defective part.

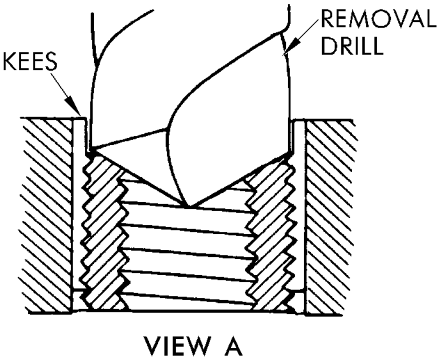
c. Be sure threaded hole is clean and not damaged. Up to one full thread may be missing.

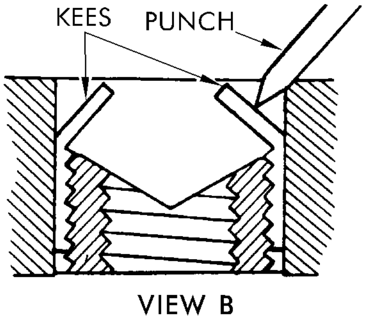
WARNING

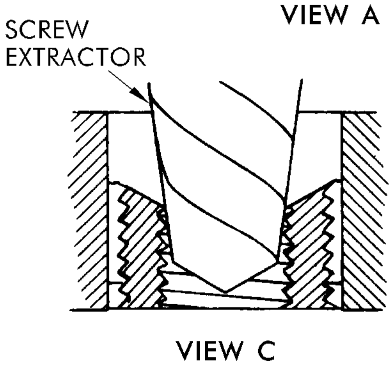
Chemical Conversion Materials
for Coating Aluminum
and Aluminum Alloys
MIL-DTL-81706

- Highly reactive - do not mix with oxidizable materials such as cloth, paper, and wood.
- When mixing solutions, add acid to water, not water to acid.
- Contact with powder or vapors can cause severe skin and eye irritation, and skin ulcers. Repeated or prolonged inhalation or ingestion can result in nasal and kidney damage.
- If any liquid or powder contacts skin or eyes, immediately flush affected area thoroughly with water. Immediately change any contaminated clothing. If skin disorders appear, get medical attention.
- When handling powder or liquid at air-exhausted workbench or tank, wear approved gloves and apron.
- When handling powder or liquid at unexhausted workbench, wear approved respirator, gloves, and apron.
- Do not eat, smoke, or carry smoking materials in areas where powder is handled.
- Contains chromates. Follow approved toxic waste disposal procedures.

d. Using alodine 1200S (item 4, Appendix D), refinish threaded hole (para H-30).



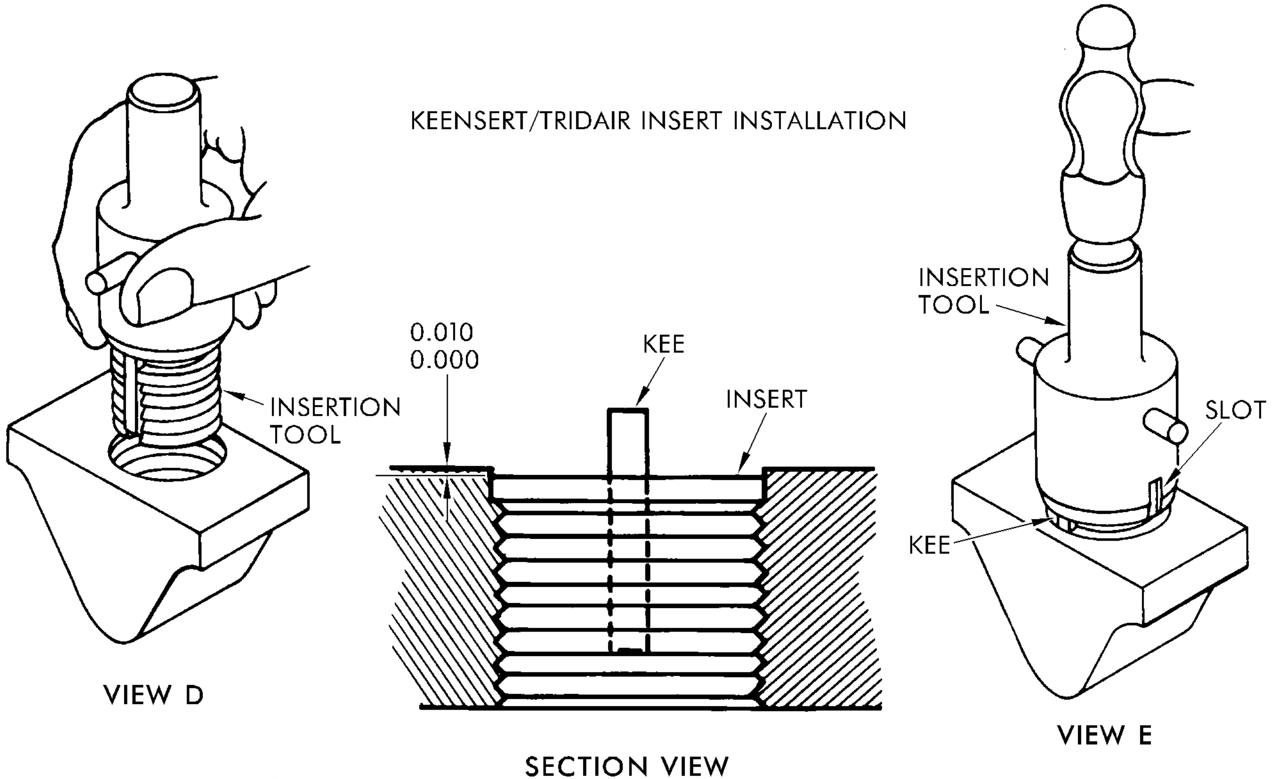




KEENSERT/TRIDAIR INSERT REMOVAL

1. DRILL INSERT TO DEPTH AND DIAMETER SPECIFIED IN INSERT/ STUD REPLACEMENT DATA TABLE H-3. (VIEW **A**)
2. USING SMALL HAMMER AND PUNCH, DEFLECT KEES INWARD AND BREAK OFF. (VIEW **B**)
3. USING SCREW EXTRACTOR, REMOVE RETAINING PORTION OF INSERT. (VIEW **C**)
4. USING TAP SPECIFIED IN TABLE H-3, CHASE THREADS IN PARENT MATERIAL; REMOVE ALL BURRS AND CHIPS FROM HOLE.

KEENSERT/TRIDAIR INSERT INSTALLATION



ALL DIMENSIONS ARE IN INCHES

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Figure H-8. Keensert/Tridair Insert; Replacement

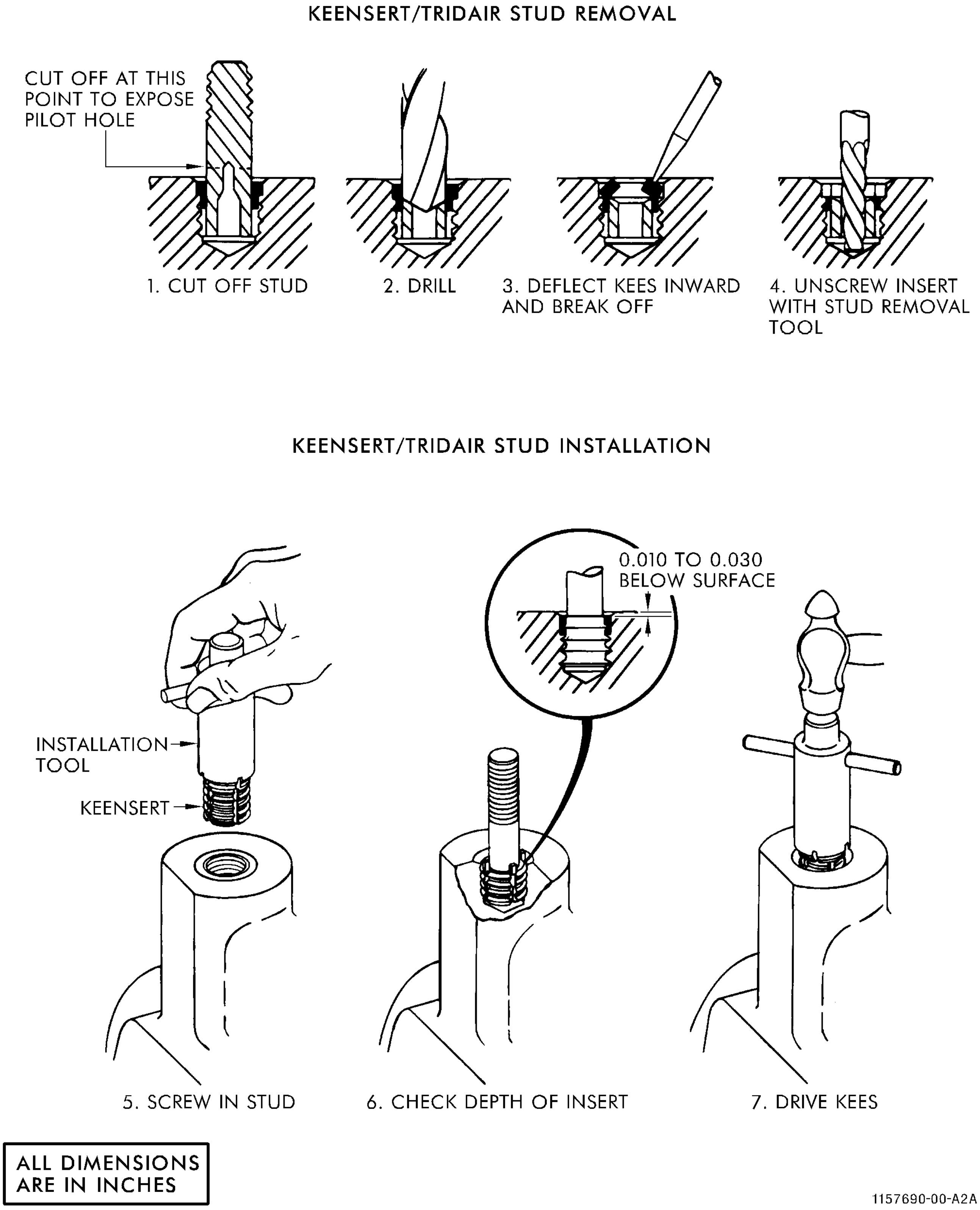


Figure H-9. Keensert/Tridair Stud; Replacement

WARNING

Zinc Chromate Primer
TT-P-1757

- Flammable - do not use near open flames, near welding areas, or on hot surfaces.
- Do not smoke when using it, and do not use it where others are smoking.
- Contact with liquid or vapor can cause skin or eye irritation, dizziness, and headache. Prolonged inhalation can result in kidney and liver damage.
- After prolonged skin contact, wash contacted area with soap and water. If vapors cause dizziness, go to fresh air. If irritation persists, get medical attention.
- When handling small quantities (less than one gallon), wear approved gloves.
- When handling large quantities of liquid (greater than one gallon) at unexhausted workbench, wear approved respirator, gloves, goggles, apron, and long sleeves.
- Do not eat, smoke, or carry smoking materials in areas where liquid is handled.
- Dispose of liquid-soaked rags in approved metal container.
- Contains chromates. Follow approved toxic waste disposal procedures.

e. Using zinc-chromate primer (item 95, Appendix D), coat external threads.

CAUTION

If insert is not properly seated, threads of insert can be distorted when kees are driven in.

f. Using information in table H-3 and in figures H-8 and H-9, install new insert or stud onto tool. Thread insert or stud into hole so that they are 0.000-0.010 inch below surface of part.

g. Lift and turn tool so that kees clear slots on tool.

h. Using hammer or arbor press, drive kees until kees are seated as follows:

(1) For inserts, kees must be flush with top of insert or part.

(2) For studs, kees must be 0.010 to 0.030 inch below surface of part.

i. Check for run-on torque on inserts by threading appropriate size bolt in insert. Mating bolts should not be able to be threaded completely through insert using fingers.

j. Remove bolt from insert.

k. Repeat steps a thru j, if necessary.

H-30. ALODINE NO. 1200S COATING.

The Alodine No. 1200S process (similar to the one specified in MIL-A-8625) is used to touch up and protect reworked and corroded aluminum surfaces. It can be used in place of anodizing and is either brushed or sprayed onto the part. This process produces a coating that is thin, golden, and iridescent. The color may vary with different aluminum alloys.

WARNING

Deoxalume 2310

- Poisonous if ingested or absorbed through skin.
- May react with metals to form flammable hydrogen gas and is a serious fire and explosion risk.
- Inhalation may cause severe irritation or burning of respiratory system.
- Contact with eyes/face/skin may cause severe irritation or burning.
- Ingestion may cause severe irritation or burning of digestive system.
- Material contains chemicals known to be carcinogenic.
- Personal protective equipment required when handling or using this material.
- Thermal decomposition may release toxic byproducts.

a. Clean the part with Deoxalume 2310 solution (item 69, Appendix D). Keep the part wet for 1 to 5 minutes.

b. Rinse the part thoroughly with clean water.

WARNING

Chemical Conversion Materials
for Coating Aluminum
and Aluminum Alloys
MIL-DTL-81706

- Highly reactive - do not mix with oxidizable materials such as cloth, paper, and wood.
- When mixing solutions, add acid to water, not water to acid.
- Contact with powder or vapors can cause severe skin and eye irritation, and skin ulcers. Repeated or prolonged inhalation or ingestion can result in nasal and kidney damage.
- If any liquid or powder contacts skin or eyes, immediately flush affected area thoroughly with water. Immediately change any contaminated clothing. If skin disorders appear, get medical attention.
- When handling powder or liquid at air-exhausted workbench or tank, wear approved gloves and apron.
- When handling powder or liquid at unexhausted workbench, wear approved respirator, gloves, and apron.
- Do not eat, smoke, or carry smoking materials in areas where powder is handled.
- Contains chromates. Follow approved toxic waste disposal procedures.

c. Brush or spray Alodine 1200S (item 4, Appendix D) on the surfaces of the part and allow it to set for 3 to 5 minutes.

d. Remove the excess solution with a wet cloth or sponge and rinse the part thoroughly in water.

e. Allow coating to air-dry.

f. Inspect the refinished area. The finish must cover tightly and be free from dust.

H-31. BRACKETS AND CLIP SUPPORTS.

H-32. Removal of Brackets and Clip Supports.

a. Remove green electrical cable (3, fig. H-10 **(T700)** or H-11 **(T701, T701C, T701D)**) from clip support (5).

b. Remove two nuts (1), two washers (2), two bolts (4), and clip support (5).

c. **(T700)** Remove bolt (6) from POU manifold assembly; remove nut (7) and bracket (8).

d. **(T701, T701C, T701D)** Remove bolt (6) from ODV manifold assembly; remove nut (7) and bracket (8).

e. Remove blue electrical cable (9) from clip support (10).

f. Remove electrical ignition lead (12) from clip support (10).

g. Remove two bolts (11) and remove clip support (10).

h. Remove blue electrical cable (13) from anti-icing valve forward bracket (15).

i. Remove anti-icing bleed and start valve (14) (para 10-26).

j. Remove two bolts (16) and remove anti-icing valve forward bracket (15).

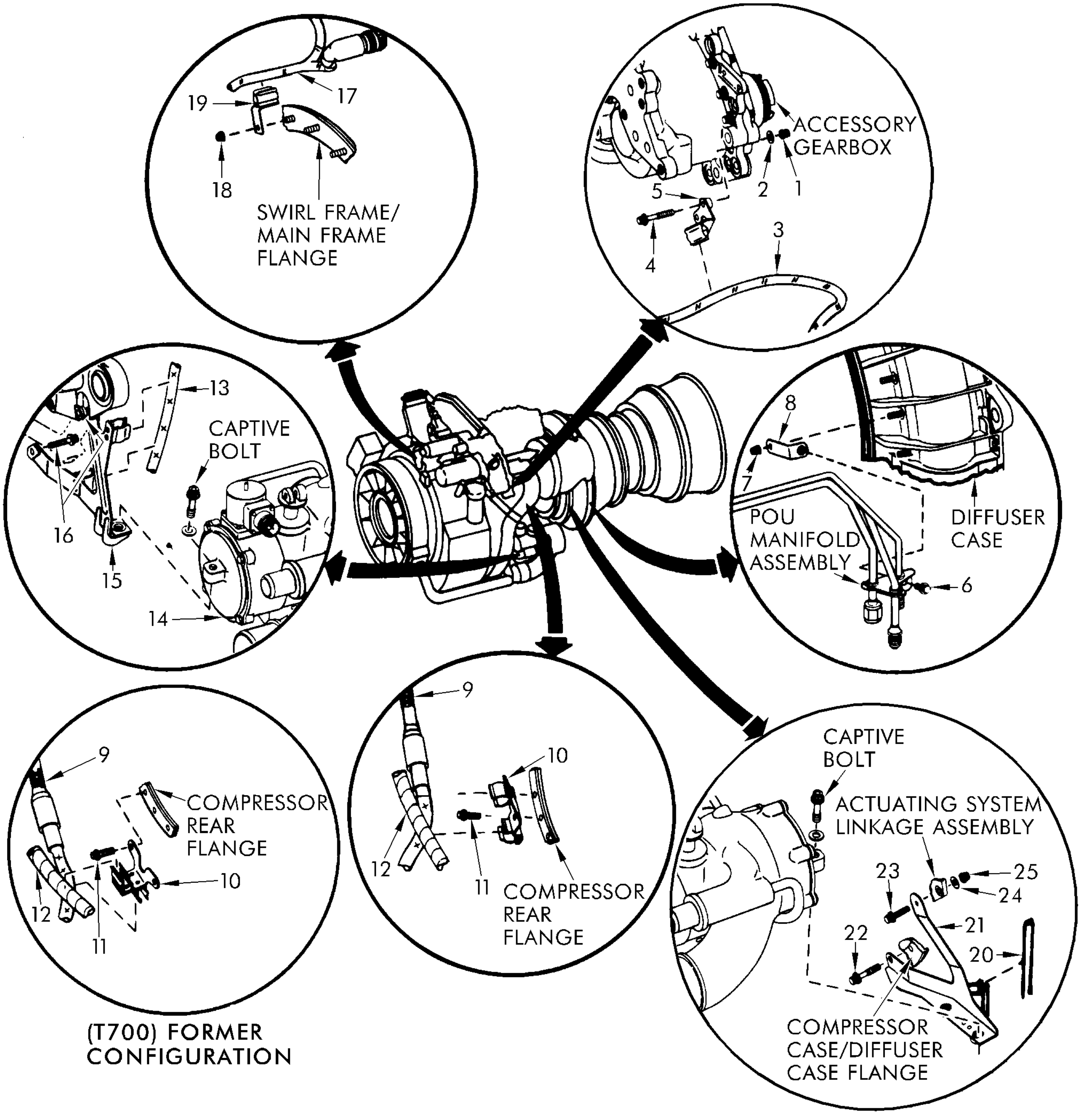
k. Remove green electrical cable (17) from clip support (19).

l. Remove nut (18) and remove clip support (19).

m. Remove main fuel manifold (20) from anti-icing valve aft bracket (21).

n. Remove nut (25), washer (24) and bolt (23) from top of bracket (21).

o. Remove bolt (22), and remove bracket (21).



1. Nut (Qty-2)
2. Washer (Qty-2)
3. Green Electrical Cable
4. Bolt (Qty-2)
5. Clip Support
6. Bolt
7. Nut
8. Bracket
9. Blue Electrical Cable
10. Clip Support
11. Bolts (Qty-2)
12. Electrical Ignition Cable
13. Blue Electrical Cable
14. Anti-Icing Bleed and Start Valve
15. Anti-Icing Valve Forward Bracket
16. Bolts (Qty-2)
17. Green Electrical Cable
18. Nut
19. Clip Support
20. Main Fuel Manifold
21. Anti-Icing Valve Aft Bracket
22. Bolt
23. Bolt
24. Washer
25. Nut

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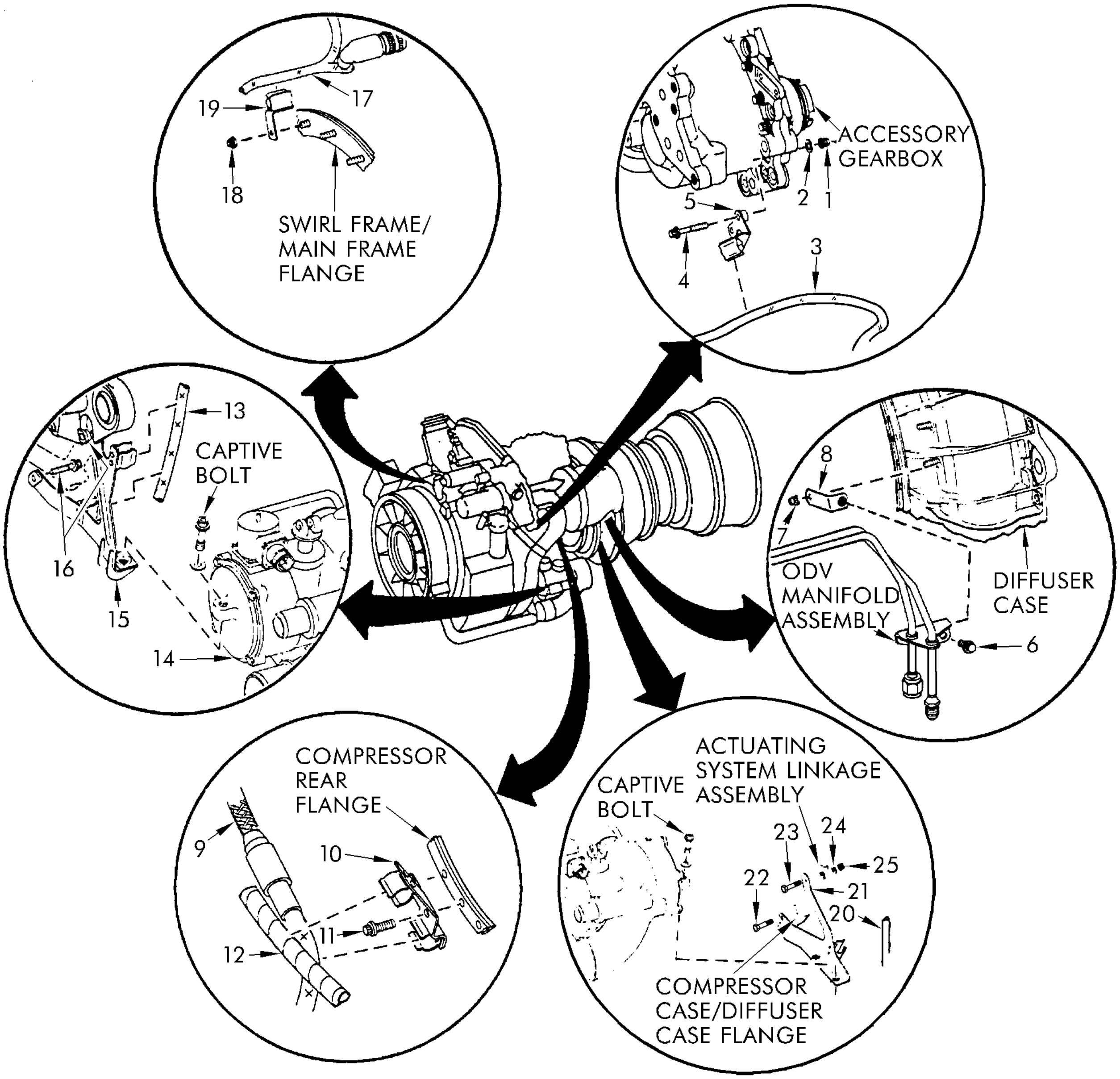
Figure H-10. (T700) Brackets and Clip Supports; Removal and Installation



1. Nut (Qty-2)
2. Washer (Qty-2)
3. Green Electrical Cable
4. Bolt (Qty-2)
5. Clip Support
6. Bolt
7. Nut
8. Bracket
9. Blue Electrical Cable
10. Clip Support
11. Bolt (Qty-2)
12. Electrical Ignition Cable
13. Blue Electrical cable
14. Anti-Icing Bleed and Start Valve
15. Anti-Icing Valve Forward Bracket
16. Bolt (Qty-2)
17. Green Electrical Cable
18. Nut
19. Clip Support
20. Main Fuel Manifold
21. Anti-Icing Valve Aft Bracket
22. Bolt
23. Bolt
24. Washer
25. Nut

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Figure H-11. ***(T701, T701C, T701D)*** *Brackets and Clips Supports; Removal and Installation*

H-33. Inspection of Brackets and Clip Supports. See table H-4.

Table H-4. Inspection of Brackets and Clip Supports

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
a. Bracket (1, fig. H-12) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace bracket and nut (para H-34).
(2) Deformation.	Any amount if bracket can be assembled normally with its mating parts.	Same as usable limits.	Cold-work to usable limits. Fluorescent-penetrant inspect. No cracks allowed.
(3) Nicks, dents, and scratches.	Any number.	Not applicable.	Not applicable.
(4) Damaged or worn anchor nut element.	Usable if mating screw cannot be threaded all the way through nut by hand, (using fingers only).	Not repairable.	Replace bracket and nut (para H-34).
(5) Damaged nut element holder.	Usable if nut element can be properly retained in holder.	Not repairable.	Replace bracket (para H-34).
b. Clip support (2, 3, 5) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace clip support (para H-34).
(2) Deformation.	Any amount, if clip support can be assembled normally with mating parts.	Same as usable limits.	Cold-work to usable limits. Visually inspect. No cracks allowed.
(3) Nicks, dents, and scratches.	Any number.	Not applicable.	Not applicable.
(4) Damaged electrical clips for:			
(a) Cracks.	None allowed.	Not repairable.	Replace clip support (para H-34).
(b) Distortion.	Any amount, if clamps can be securely attached to its mating parts.	Not repairable.	Replace clip support (para H-34).
c. Forward and aft brackets (6, 4) for:			
(1) Cracks.	None allowed.	Not repairable.	Replace bracket (para H-34).

Table H-4. Inspection of Brackets and Clip Supports (Cont)

Inspect	Usable Limits	Max Repairable Limits	Corrective Action
(2) Deformation.	Any amount, if bracket can be assembled normally with mating parts.	Same as usable limits.	Cold-work to usable limits. Fluorescent-penetrant inspect. No cracks allowed.
(3) Damaged or worn anchor nuts.	Usable if mating screw cannot be threaded all the way through nut (using fingers).	Not repairable.	Replace bracket (para H-34).
(4) Nicks, dents, and scratches.	Any number.	Any amount.	Not applicable.
(5) Damaged electrical clips for:			
(6) Cracks.	None allowed.	Not repairable.	Replace bracket (para H-34).
(7) Distortion.	Any amount, if clamp can be securely attached to its mating part.	Not repairable.	Replace bracket (para H-34).

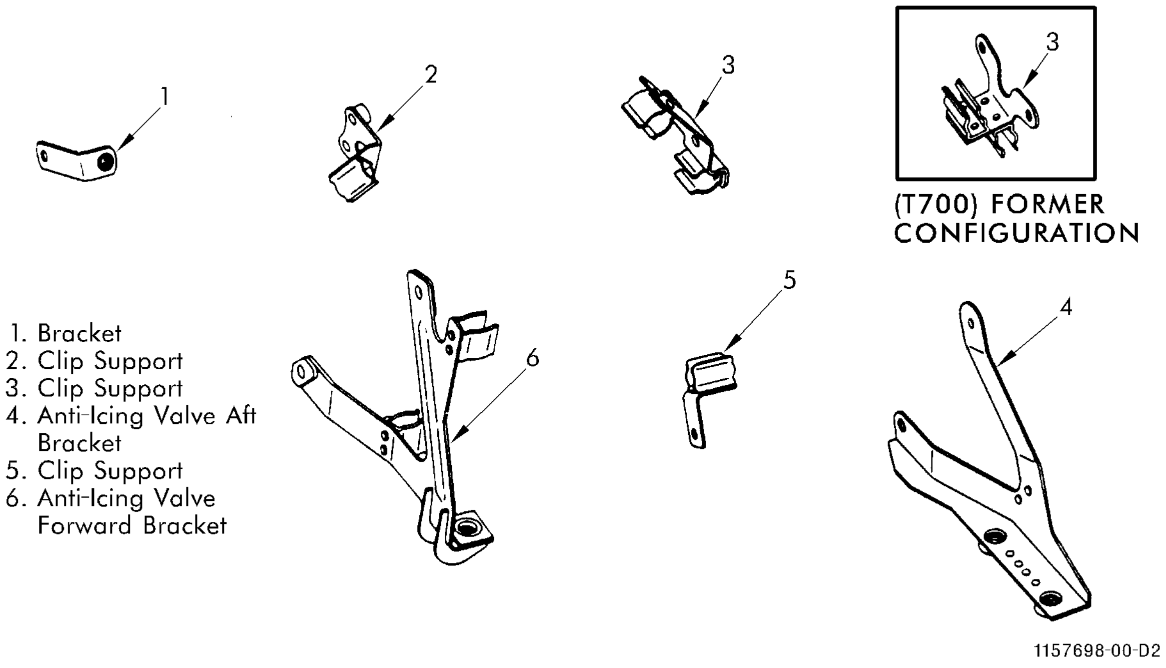


Figure H-12. Brackets and Clip Supports; Inspection

H-34. Installation of Brackets and Clip Supports.

a. Install clip support (5, fig. H-10 **(T700)** or H-11 **(T701, T701C, T701D)**), using bolts (4), washers (2), and nuts (1). Torque nut to 45-50 inch-pounds.

b. Install green electrical cable (3) in clip support (5).

c. **(T700)** Install bracket (8) using nut (7), and attach sequence valve manifold, using bolt (6). Torque bolt and nut to 45-50 inch-pounds.

d. **(T701, T701C, T701D)** Install bracket (8) using nut (7), and attach ODV manifold assembly using bolt (6). Torque bolt and nut to 45-50 inch-pounds.

e. Install clip support (10) using two bolts (11). Torque bolts to 45-50 inch-pounds.

f. Install electrical ignition lead (12) and blue electrical cable (9) to clip support (10).

g. Install anti-icing valve forward bracket (15) to main frame-compressor flange and front shaft support of linkage assembly using two bolts (16). Torque bolts to 45-50 inch-pounds.

h. Install blue electrical cable (13) in bracket (15).

i. Install clip support (19) using nut (18). Torque nut to 45-50 inch-pounds.

j. Attach green electrical cable (17) to clip support (19).

k. Attach anti-icing valve aft bracket (21) to compressor case-to-diffuser case flange using bolt (22) and to aft shaft support of linkage assembly using bolt (23), washer (24), and nut (25). Torque bolts to 45-50 inch-pounds.

l. Attach main fuel manifold (20) into clip on back side of bracket (21).

m. Install anti-icing bleed and start valve (14) (para 10-31).

GLOSSARY

This glossary lists the first word of each term alphabetically, the way the term is used in the manual. Every effort has been made to include all the terms that might cause disagreement among those using this manual.

A

Abrasion - A roughened surface.

Abrasive Cloth - A cloth coated with grit, used for hand cleaning, polishing, removing corrosion and paint, etc. Sometimes referred to as emery cloth.

Accessory - A self-contained unit, mounted on a higher assembly, designed to do a specific job. Fuel pumps, fuel controls, and like parts are typical accessories.

Adapter - Any device that makes it possible to use parts or pieces of equipment that were not designed to be used together.

Aerospace Ground Equipment (AGE) - All non-airborne equipment required to inspect, repair, assemble, and test parts to make them operational.

Airfoil - In turboshaft engines, that part of a vane or blade that affects or is affected by the flow of air.

Assembly - A unit normally removed and reassembled as a single item, consisting of accessories and components that operate together for a specific purpose. Typical assemblies are: engine, torque sensor shaft and sleeve assembly, power takeoff assembly.

Average Diameter - A number found by adding several measurements, usually 3 or more, of the same diameter and dividing the sum by the number of measurements taken.

Axial - Relating to the axis of a part.

Axial Clearance - Clearance measured in a direction parallel to the engine centerline.

Axial Looseness - The amount of looseness between parts that have a common center or whose axes are parallel.

Axial Movement - The distance that a part travels in an axial direction, relative to the axis of the part, when a load is applied first in one direction and then in the other.

Axial Play - A term used mostly in bearing inspection to describe the total movement of the inner race relative to the outer race when a load is applied first in one direction and then in the other.

Axis - An imaginary straight line through the center of a part, as in the case of a rotor, or through some feature of a part as in the case of a gearbox.

B

Backlash - A term used to describe the distance that a working part has to move before it moves its mating part. The motion lost between two connected parts when the direction of motion is changed is also considered backlash. This loss of motion or looseness, is caused by design tolerances or by the wearing of working parts (such as clevis pin in rod-end bearing).

Bench - To do the work described in the term *Benching*.

Benching - A general shop term that refers to a particular kind of work (stoning, grinding, filing, buffing, etc.) done by hand at a bench.

Bench Check - The action taken by maintenance for determining whether an accessory or component is working properly.

Bend - Distortion in a part.

Blending - An operation in which surfaces are worked by hand to produce a smooth surface without abruptly changing its contour.

Blister - A raised portion of a surface caused by separation either of the outer layers of the parent metal or of a coating applied to it.

Blueing - A term that describes the bluish color on the surfaces of some metals exposed to high temperatures.

Body-Bound Bolt - A bolt used to keep mating parts from moving sideways. The size of the body is held to a close tolerance so that it will fit tightly in the hole of the mating parts.

Bore - A hole made by machining with a boring tool.

Boss - A raised portion of a casting or forging generally used in a seating surface to keep another part from the main body of the part.

Break - Separation of part.

Breakaway Torque - The amount of torque required to loosen a nut or a bolt.

Brinnel (False) - A specialized form of fretting recognized by the occurrence of a series of shallow indentations in the race at each roller position on the loaded side of the bearing. Often, red oxide of iron may be found where this has occurred.

Brinnel (True) - Often related to ball and roller bearings having been improperly installed or subjected to extremely high shock/or impact loads at zero revolutions per minute. Usually occurs as a series of shallow depressions in the load area of the race-way.

Brittleness - A loss in the resiliency of the parent metal, usually due to aging, extreme cold, chemical action, or cold-working (metal).

Buckling - A large-scale deformation of the original contour of a part, usually due to pressure or impact from a foreign object, structural stresses, excessive localized heating, high-pressure differentials, or to any combination of these.

Bulge - An area on a sheet metal part that has swelled outward.

Burn - A rapid destructive oxidizing action usually caused by higher temperatures than the material can withstand structurally. Change in color and appearance often indicates this condition.

Burnishing - Smoothing of a metal surface by mechanical action, but without a loss of material, generally found on plain bearing surfaces. Surface discoloration is sometimes present around the outer edges. Normal burnishing from operational service is not detrimental if the coverage approximates the carrying load and there is no evidence of burns.

Burn-Through - A portion of parent metal, usually sheet metal, that has burned through, leaving a hole.

Burr - A rough or sharp edge on a hole or corner, usually caused by machining or sometimes caused by wearing.

C

Calibrate - The work done in testing and adjusting an instrument or accessory to known standards.

Captive Nut - A nut permanently attached to a piece of equipment.

Chafing - A worn or rubbed area caused by friction: refers to the wear produced by parts such as fuel and air lines rubbing against other parts.

Chamfer - A beveled edge, usually made by machining, or sometimes by forming.

Chase Threads - To remove high spots, dirt, etc. from threads, using a hand tap or hand die.

Chatter Mark - Surface irregularity.

Chipping - Breaking away of metallic particles.

Chord - A straight line drawn between the leading and trailing edges of an airfoil.

Chordal Length - The distance between the leading and trailing edges of an airfoil measured along the chord.

Cocked - A term generally used to describe a condition in which close-fitting parts are not square with one another either before or after being assembled.

Coking - Carbon-like deposits (caused by improperly burned fuel) left on parts in hot section of engine.

Cold-Work - To rework metal parts at normal room temperature, using hand tools. The removal of dents in sheet metal parts and the enlargement of louvers in liners are examples of cold-working.

Cold-Working - The work done in re-forming or reshaping a part, using hand tools. *See Cold-Work.*

Component - A unit somewhat similar to an accessory in that it is self-contained but differing in that it is designed to control operations. Valves, switches, solenoids, etc., are typical components.

Concave - A hollow surface curved like the inside of a bowl.

Concentric - Outside or inside diameters of different size but which have the same center or axis are called concentric.

Configuration - A term referring to the form, shape or contour of a part or parts.

Contamination (Foreign Material) - Any foreign substance such as metal chips, lint, rust, and water that would be harmful to the functioning of a part or system.

Convex - A surface shaped like the outside of a sphere or a ball.

Copper Backup - A copper block, shaped to suit part being repaired, used during welding to take away some of the heat.

Corrosion - A mass of small pits which cumulatively create a large cavity (usually shallow) in the surface of the parent metal.

Crack - Parting of parent metal.

Crazing - A mesh of very small hairlike cracks found in glazed or baked-on coated surfaces, generally caused by temperature changes or by deformation of parent metal. Cracks do not penetrate into parent metal.

D

Defect - A general term covering any flaw affecting the usefulness of serviceability of a part.

Deformation - An undesirable change in shape of the part, usually of a permanent nature.

Demineralized Water - Water from which minerals such as salt, lime, sulphur, etc. have been removed, usually by distilling or boiling.

Dent - A completely smooth surface depression caused by pressure or impact from a smooth ball-like foreign object. The parent material is displaced, but usually none is separated.

Desiccant - A drying agent; usually placed in containers, along with parts being stored, to absorb moisture and prevent rusting.

Diagnostic Equipment - Test equipment used to determine what the defective part is.

Diameter - The length of a chord passing through the center of a circle.

Diametral - Referring to the diameter.

Diametral Runout - The total indicator reading of an indicator in contact with a cylindrical or conical surface when the piece or indicator is rotated 360 degrees about an established axis. This includes both eccentricity and out-of-roundness.

Discoloration - The change in color of a surface, which usually becomes darker. Usually caused by heat or buildup of varnish film.

Dishing - The concave shape taken by a normally flat surface, usually after being subjected to excessive pressures.

Distortion - Twisting or bending out of a normal, natural, or original shape, usually caused from being exposed to excessive pressure or temperature either when restrained or unrestrained.

Dowel Pin - A pin pressed or tapped into a reamed hole through two parts, so that about 1/2 of its length is in each part. Principally used to make it possible to accurately realine parts.

Drift - A flat, tapered piece of steel used to remove tapered shank drills and other tools from their holder.

Drop - The distance that one surface is below another parallel surface.

Dynamic-Balance - To determine the area of unbalance of a rotating part so that material can be removed or added to make part run without vibration.

E

Electrochemical Etch - Method of marking parts in which the characters are produced by removing material by an electrolytic process.

Entrance Thread - The first or lead thread in a tapped hole or in a nut.

Erosion - The gradual wearing away of material caused by the hot flow of gases, or foreign particles. An eroded surface may appear similar to a corroded surface.

Etching - The process of treating the surface of a part with acid to expose and exaggerate the surface conditions of the metal.

External Component - A component attached to the outside of the engine.

F

Face Runout - The total reading of an indicator measuring the runout on the face of a part rotating about an established axis.

Fatigue - The progressive weakening of a material under repeated cycles of stress.

Filler Material - The metal used, usually in rod form, in making a weld.

Filler Weld - A weld having a triangular crosssection, usually joining two surfaces at right-angles to one another.

Fit - The amount of tightness or looseness between mating parts when assembled together.

Flaking - Breaking away of paint or plate.

Flatness - *See Out-of-Flatness.*

Flush - A shop term used in describing two surfaces that are even with each other. The term is a also used to describe the washing or cleaning of chips or dirt by pressure flushing. *See Pressure-Flush.*

Flight Safety Critical Aircraft Parts - Any part, assembly, or installation procedure with one or more critical characteristics that, if not conforming to the design data or quality requirements, could result in serious injury or death of crew members and/or serious damage to the aircraft.

Foreign Material - *See Contamination.*

Foreign Object - Any object such as a tool, piece of equipment, engine part (nut, bolt, lockwire) that could in any way damage the engine.

Fraying - Wearing or rubbing of areas, generally used in reference to damage on wire-braid covering (of Teflon hose) or on thermocouple harnesses.

Free-Stage Variation - The amount that a part (bolted or tightly held to another part) may distort after being removed from that part or after being released from a fixture (as when machining).

Fret Corrosion - Oxidation (rusting) of metal, usually bearings, that takes place at loaded surfaces subjected to relatively slight motion.

Fretting - Wearing away of metal by rubbing against another metal (generally associated with press fit or close fitting parts).

G

Galling - A defect caused by the movement of two surfaces in contact with each other. In most cases an accumulation of foreign material is deposited on the parent metal.

Gap - An opening or space; a break in continuity.

Gas Backing - Gas, usually argon, used to back up a joint during welding to keep oxygen away from the weld and to help get a sound weld at the root.

Glazing - A hard, glossy surface.

Gouge - A wide rough scratch or group of scratches, usually with one or more sharply impressed corners, and frequently accompanied by deformation or removal of parent material.

Groove - A long narrow, continuous cavity or impression caused by pressure of a moving surface in contact with the parent material.

H

Hang Up - Failure of an engine to accelerate to the speed at which the throttle has been set.

Hardware - Miscellaneous nuts, bolts, studs, washers, etc. used as fasteners.

Hex Key - An L-shaped hand tool used for turning socket head screws, studs, etc.; frequently called an “Allen wrench”.

High Metal - Displaced metal next to a defect such as a scratch, nick, or gouge.

Hot Spot - A condition caused by a defective fuel nozzle (poor spray patterns) causing fuel to burn unevenly in the combustion chamber, which caused metal on outside of combustion casing to turn blue.

I

Imbalance - The state of being out of balance. An unequal distribution of weight about the axis of rotation.

Indications - Surface defect, not necessarily a crack.

Interference - Anything that prevents a part, component, etc. from being assembled or disassembled.

J

Jacking Holes - Threaded holes through which jacking screws are threaded to force off a tight-fitting part that could otherwise be difficult to remove. They serve no other purpose.

Jacking Screw - A screw used in jacking holes to remove a tight-fitting part from another.

K

Kinks - Short, tight twists or curls caused by a doubling or winding of a hose or line upon itself. Likely to cause difficulties in the operation of something.

Kit - A group or set of parts or tools usually used for repair or replacement of worn or damaged assemblies.

L

Laminated - Anything laminated, such as certain kinds of shims, that consists of layers of material, each of identical thickness.

Lapping - Smoothing or polishing two surfaces, with or without abrasives, to a high degree of accuracy.

Leak - The entering, escaping, or bypassing (contrary to intention) of liquids or gases from their normal passage or containment, usually caused by a hole or improper sealing. The act of leaking is called leakage and the measurement of leakage is called leakage rate.

Leakage - The flow of liquid drop(s) or streak(s) that are continuously running and reappear within 30 minutes after surface is cleaned.

Loose - Abnormal movement of a part.

M

Manufactured Head - On a rivet, the head formed by the manufacturer.

Map - Doing the work described in mapping.

Mapping - Layout of parts, usually blades, so that they are in the same relative position on a mapping sheet that they were in the engine.

Matched - Fitted together or made suitable to be fitted together.

Matchmark - A mark made on the surfaces of two or more mating parts so that they can be realined to these marks at reassembly.

Match-Mark - Doing the work described in matchmark.

Mating Surfaces - Two surfaces that join or fit together.

Max Average Clearance - The maximum permissible value of average clearance.

Microinch - One millionth of an inch; largely used in measuring imperfections of surface finishes.

Micron - A unit of length in the metric system equal to 0.001 millimeter.

Misalined - A mismatching or malformation of any parts which either prevents assembly or results in faulty operation and/or ultimate part failure.

Missing Piece - Removal or loss of a portion of parent material due to a combination of defects or damage.

N

Nick - A surface impression with sharp corners or bottom, usually caused by pressure or impact from a sharp-edged foreign body. The parent material is displaced but usually none is separated.

Noisy - An abnormal sound condition of moving parts, usually an increase in volume or a change of pitch.

O

Of No Apparent Depth - A term which means the depth of a defect (nick, dent, scratch, or pit) is, after visually inspecting, so slight that it would not be worth measuring.

Oil-Canning - Displacement of sheet metal as in action of the bottom of an oil can.

Orifice - A small-diameter hole, machined to close tolerances, used to accurately control the flow of fluid or air through accessories and components, especially in fuel and oil systems.

Out-Of-Flatness - The total amount that a surface deviates from a true, flat surface.

Out-Of-Roundness - Total variation, in a radial direction, from a true circle. When measured with an indicator, it is the total indicator reading when the part is rotated 360°; when measured with a micrometer, it is one-half the total difference between the maximum and minimum diameters.

P

Parent Metal - The basic metal of a part, sometimes referred to as base metal; the term is used particularly in connection with welding, where the parent metal is that being welded rather than that used in welding rod.

Peening - Surface deformation.

Pickup - Transfer of one material onto another.

Pitting - Very shallow depressions in a surface, usually caused by chemical reaction (rusting chemical corrosion).

Potting - The sealant in an electrical junction box or fitting, usually applied as a liquid or paste, which sets to a firm moisture-proof seal.

Pressure-Flush - To force a liquid (water, solvent) under pressure through all inside passages or over the outside of a part to wash it clean.

R

Radial Clearance - Clearance measured in a direction perpendicular to the engine centerline.

Radial Crack - A crack that runs perpendicular to the axial centerline of the engine.

Radial Movement - Movement of a part in a direction perpendicular to the engine centerline.

Rigging - The procedure for preadjusting the linkages that control engine operation.

Route - Doing what is described in routing.

Routing - The path usually taken by lines, hoses, etc. on the outside of engine connecting the various fittings.

Rub - A surface cavity or impression caused by two surfaces moving against each other.

Run-On Torque - The torque required to screw a self-locking nut onto a thread until threads are fully engaged.

Runout - *See Diametral Runout and Face Runout.*

S

Scoring - Multiple scratches, usually parallel and resulting from the same cause.

Scratch - A long, narrow sharp-cornered impression caused by the movement of a sharp object across the surface of the parent metal.

Seepage - A drop of oil is formed. Oil does not reappear within 30 minutes after cleaning. This condition is acceptable.

Seizure - A wedging or binding of two surfaces, which prevents further movement.

Setup - A general term used to describe the work done in setting up tools, fixtures, etc. to do a specific job.

Sheet Metal - Rolled metal up to one-quarter inch thick; the type used in making fabricated parts such as nozzles, turbine casings, etc.

Snug Fit - The closest that two-parts (usually threaded parts like nuts and bolts) can be assembled by hand without forcing.

Spalling - Cracking off, or flaking off of small particles of metal from the surface, usually in thin layers.

Staking - An operation in which the metal around a pin or shaft or the end of a pin (or shaft) itself is displaced to hold part firmly in place.

Static Balance - An operation, usually done before dynamic balancing, in which blades are shifted or weight is added, depending on the assembly being balanced, to eliminate unbalance.

Stop-Drill - Drilling a small-diameter hole in the end of a crack, usually in sheet metal parts, to keep it from getting longer.

Stress - A cause of part failures, generally divided into five groups: compression, shear, shock, tension, and torsion.

Subassembly - A self-contained unit of an ASSEMBLY that can be removed, replaced and repaired separately. Turbine nozzles and combustion liners are typical subassemblies.

Sudden Stoppage - The act of stopping or significantly decelerating the engine’s core or power turbine (PT) shaft via external mechanical forces such as air vehicle drive train failure/lock-up or forces from a crash or hard landing that stops or abnormally decelerates the airframe’s main rotor, potentially causing engine damage. Sudden stoppage does not result from termination of fuel flow nor does it result from emergency stopping where restart and reuse of the engine is allowable.

Surface Finish - A shop term that refers to surface roughness. Surface roughness, a standard term used in industry to accurately express the degree of roughness of a surface, is expressed in microinches. In the text, the allowable surface finish is given in microinches. But on an illustration, the symbol is used, as in the following example:

63✓

The apex of the symbol is always shown touching the surface in question.

T

Through-Crack - A crack, usually V-shaped and relatively narrow, deep enough to penetrate the total thickness of the parent metal.

Tear - A forcible, somewhat crude pulling or wrenching away of material so that ragged or irregular edges result.

Tip-Shake - The amount that the tip of a blade can be moved (circumferentially) by hand.

Torque - To tighten a nut, bolt, or fitting, using a torque wrench, to a specified torque value expressed as inch-pounds or as foot-pounds.

Total Indicator Reading (TIR) - The total movement of the pointer of an indicator when measuring the amount of out-of-roundness, out-of-flatness, or other deviations of a part.

True Contour - The basic shape of a surface.

U

Ultrasonic Cleaning - A cleaning process in which parts are immersed in a solvent and subjected to high frequency (ultrasonic) vibrations to free deposits.

Unbalance - Unequal distribution of weight about the axis of rotation; usually results in vibration.

Upset Head - On a rivet, the head formed after the body has been inserted through the holes of the pieces being held together.

W

Warped - Not true to an established plane or line; out of true shape.

Wear - Relatively slow removal of parent material from any cause, frequently not visible to the naked eye.

Weepage - No liquid drops or visible running streaks. However, staining/discoloration or change in appearance of a surface due to oil getting onto or into a surface. Discoloration may feel damp when touched. This condition is acceptable.

Weld - Metal fused by heating, with or without pressure applied, with or without using filler material. *See Weld Bead.*

Weld Bead - A deposit of weld made when the bare electrode melts during arc welding.

Weldment - An assembly made up of parts joined by welding. Also called a fabrication.

ALPHABETICAL INDEX

Subject — Paragraph Fig (F), Table (T), Number — Page

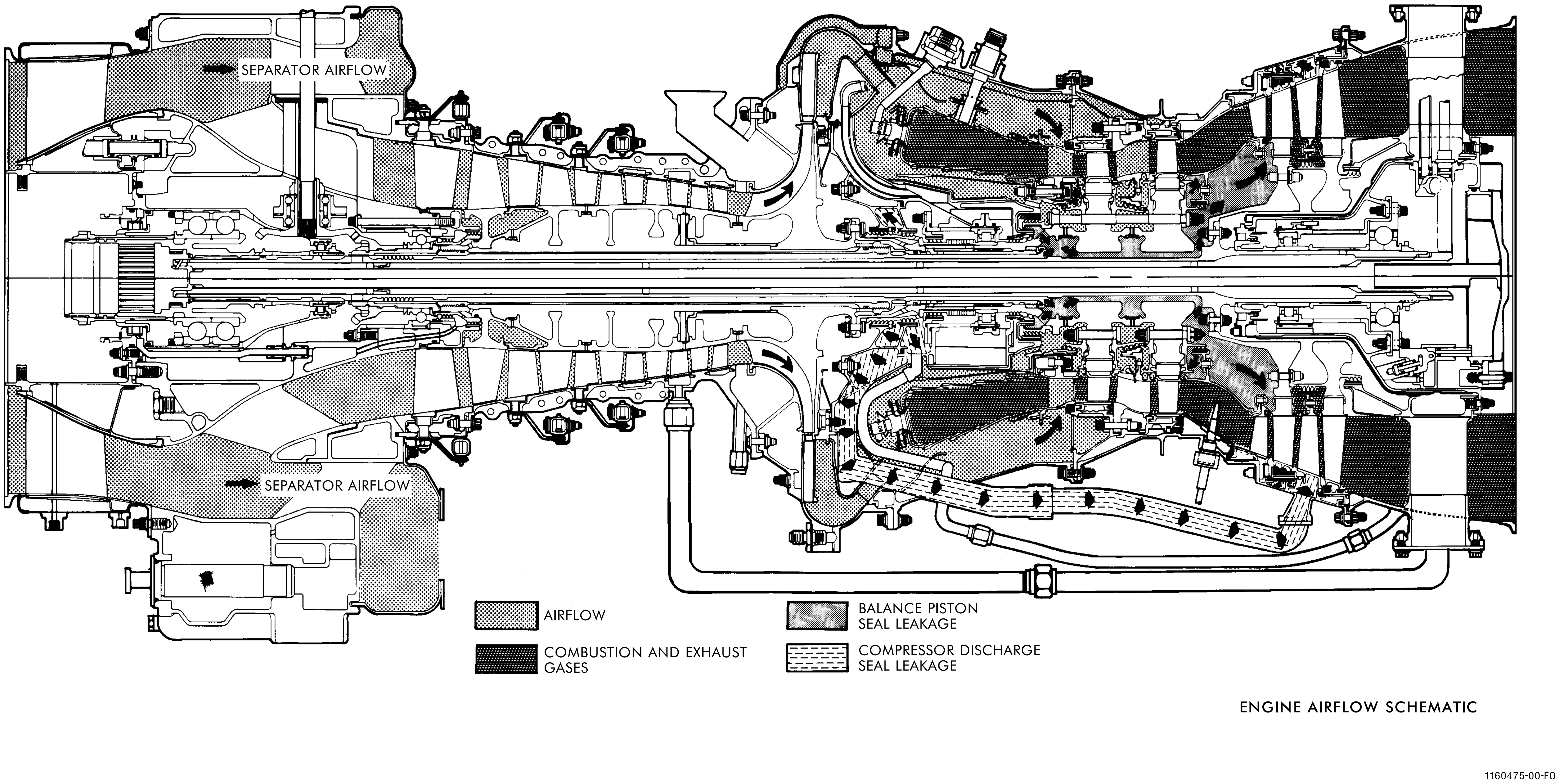
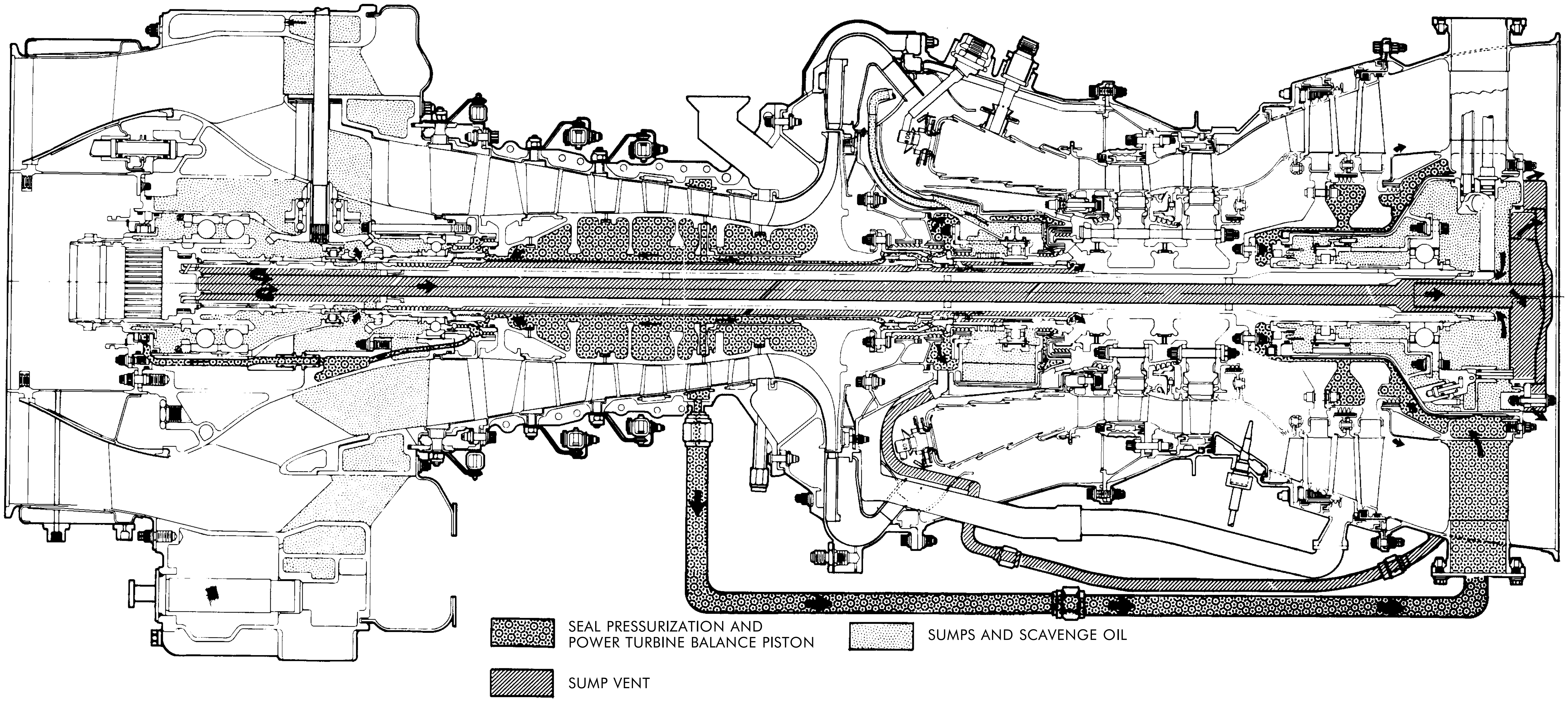


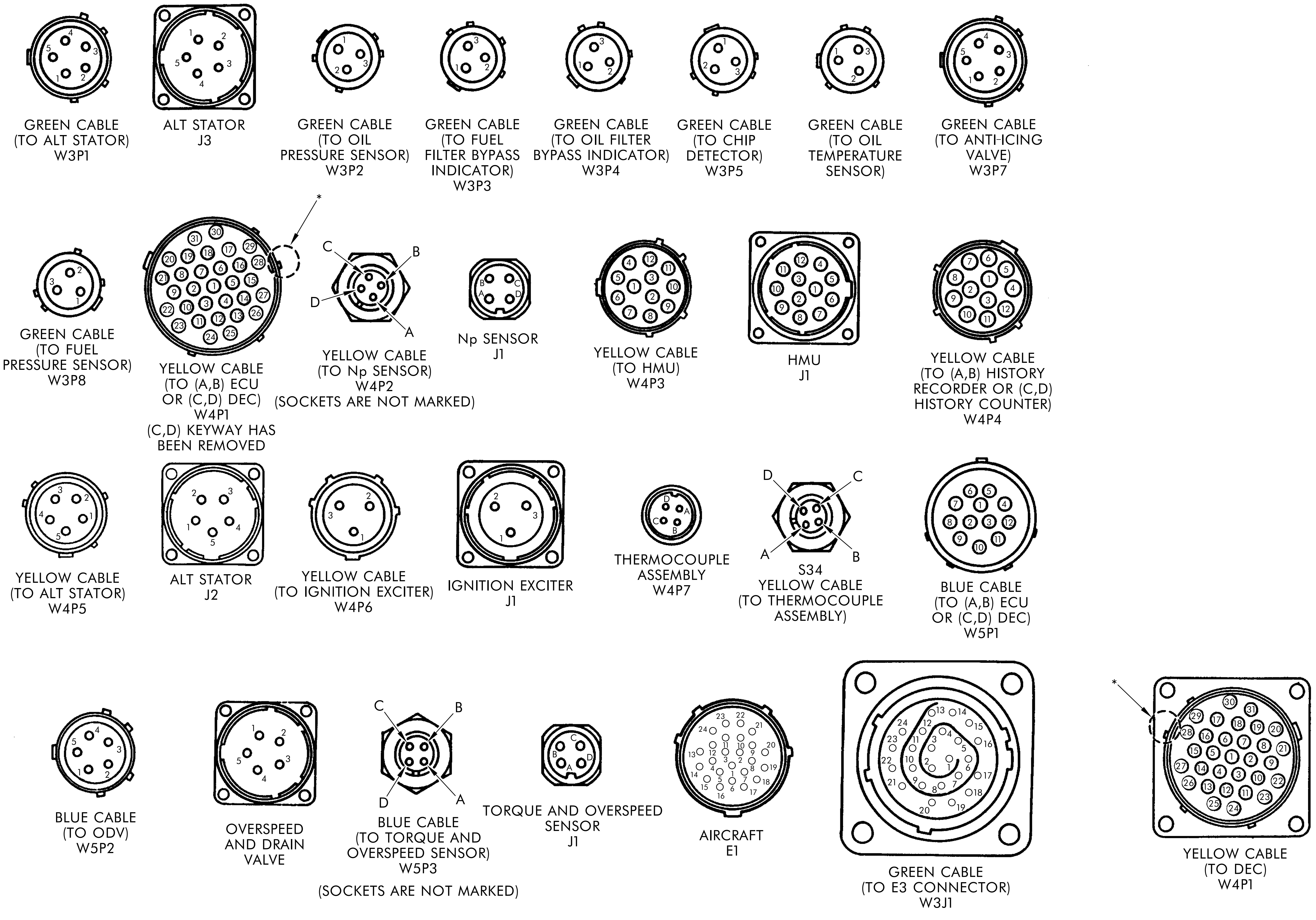
Figure FO-1. Air System Schematic (Sheet 1 of 2)



ENGINE AIRFLOW SCHEMATIC

1160476-00-FO

Figure FO-1. Air System Schematic (Sheet 2 of 2)



GREEN CABLE
(TO ALT STATOR)
W3P1

ALT STATOR
J3

GREEN CABLE
(TO OIL
PRESSURE SENSOR)
W3P2

GREEN CABLE
(TO FUEL
FILTER BYPASS
INDICATOR)
W3P3

GREEN CABLE
(TO OIL FILTER
BYPASS INDICATOR)
W3P4

GREEN CABLE
(TO CHIP
DETECTOR)
W3P5

GREEN CABLE
(TO OIL
TEMPERATURE
SENSOR)

GREEN CABLE
(TO ANTI-ICING
VALVE)
W3P7

GREEN CABLE
(TO FUEL
PRESSURE SENSOR)
W3P8

YELLOW CABLE
(TO (A,B) ECU
OR (C,D) DEC)
W4P1
(C,D) KEYWAY HAS
BEEN REMOVED

YELLOW CABLE
(TO Np SENSOR)
W4P2
(SOCKETS ARE NOT MARKED)

Np SENSOR
J1

YELLOW CABLE
(TO HMU)
W4P3

HMU
J1

YELLOW CABLE
(TO (A,B) HISTORY
RECORDER OR (C,D)
HISTORY COUNTER)
W4P4

YELLOW CABLE
(TO ALT STATOR)
W4P5

ALT STATOR
J2

YELLOW CABLE
(TO IGNITION EXCITER)
W4P6

IGNITION EXCITER
J1

THERMOCOUPLE
ASSEMBLY
W4P7

S34
YELLOW CABLE
(TO THERMOCOUPLE
ASSEMBLY)

BLUE CABLE
(TO (A,B) ECU
OR (C,D) DEC)
W5P1

BLUE CABLE
(TO ODV)
W5P2

OVERSPEED
AND DRAIN
VALVE

BLUE CABLE
(TO TORQUE AND
OVERSPEED SENSOR)
W5P3
(SOCKETS ARE NOT MARKED)

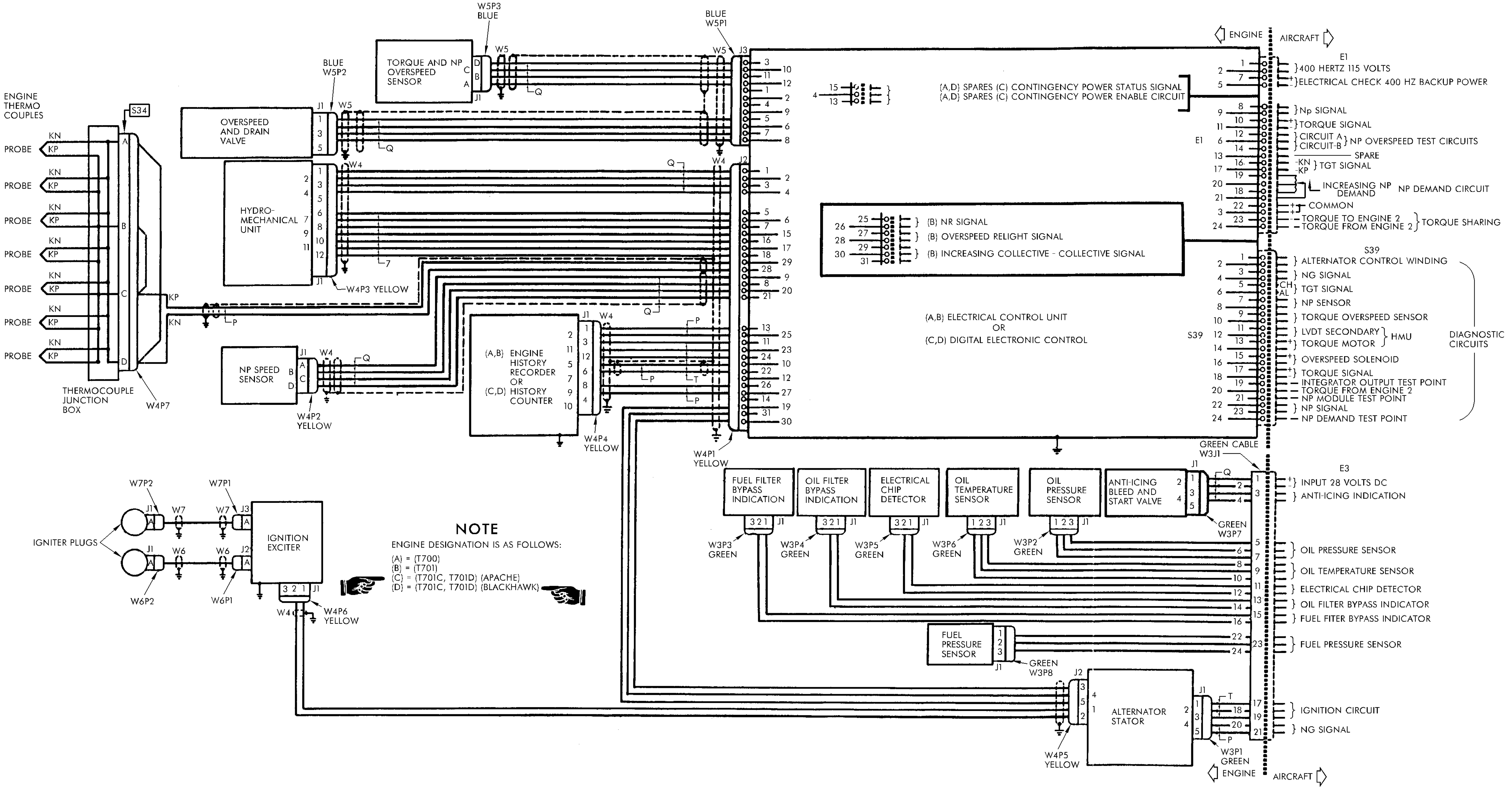
TORQUE AND OVERSPEED
SENSOR
J1

AIRCRAFT
E1

GREEN CABLE
(TO E3 CONNECTOR)
W3J1

YELLOW CABLE
(TO DEC)
W4P1

Figure FO-2. Electrical Schematic Diagram (Sheet 1 of 2)



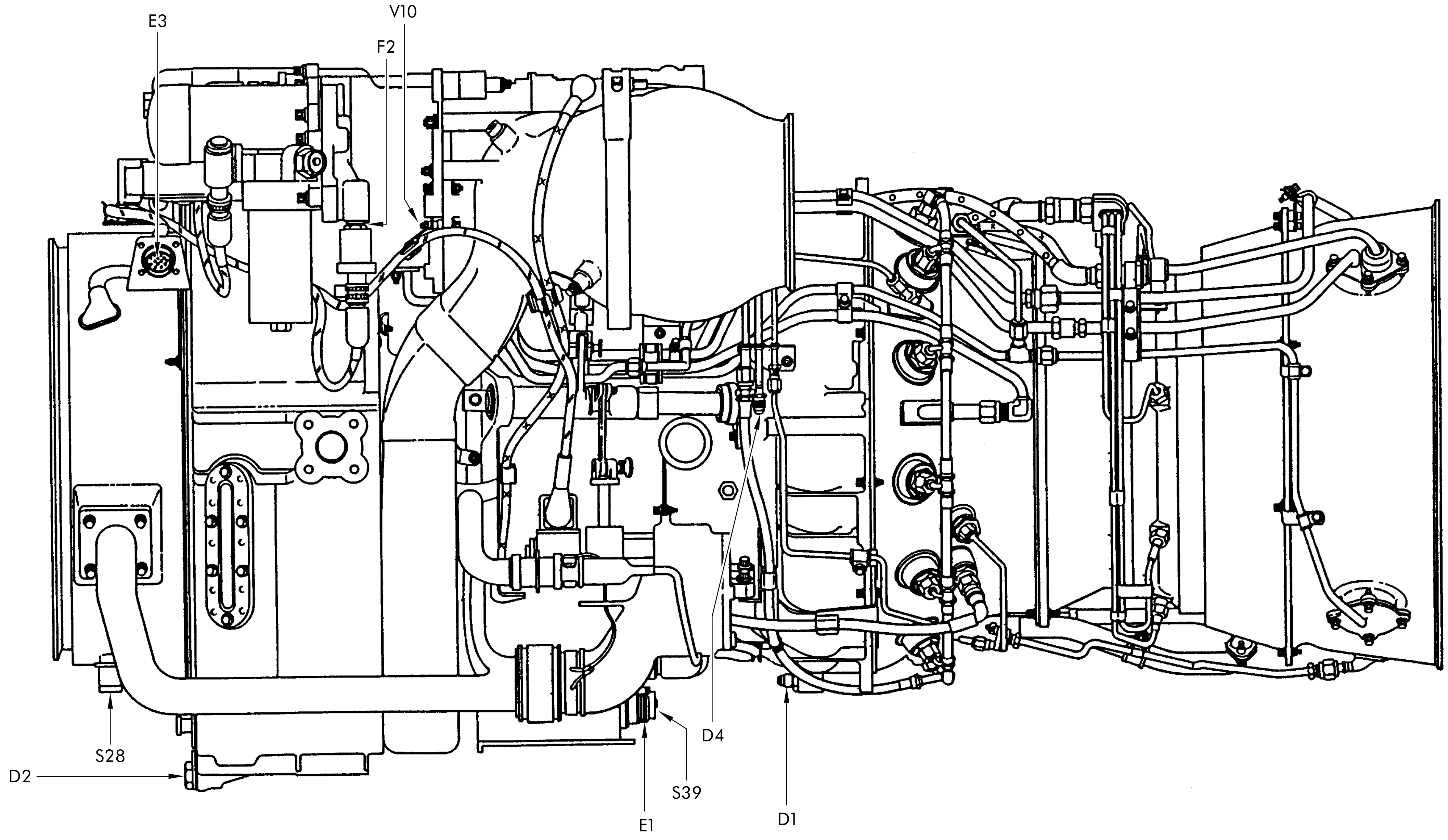
NOTE

ENGINE DESIGNATION IS AS FOLLOWS:

(A) = (T700)
(B) = (T701)
(C) = (T701C, T701D) (APACHE)
(D) = (T701C, T701D) (BLACKHAWK)

1161732-02-F0

Figure FO-2. Electrical Schematic Diagram (Sheet 2 of 2)



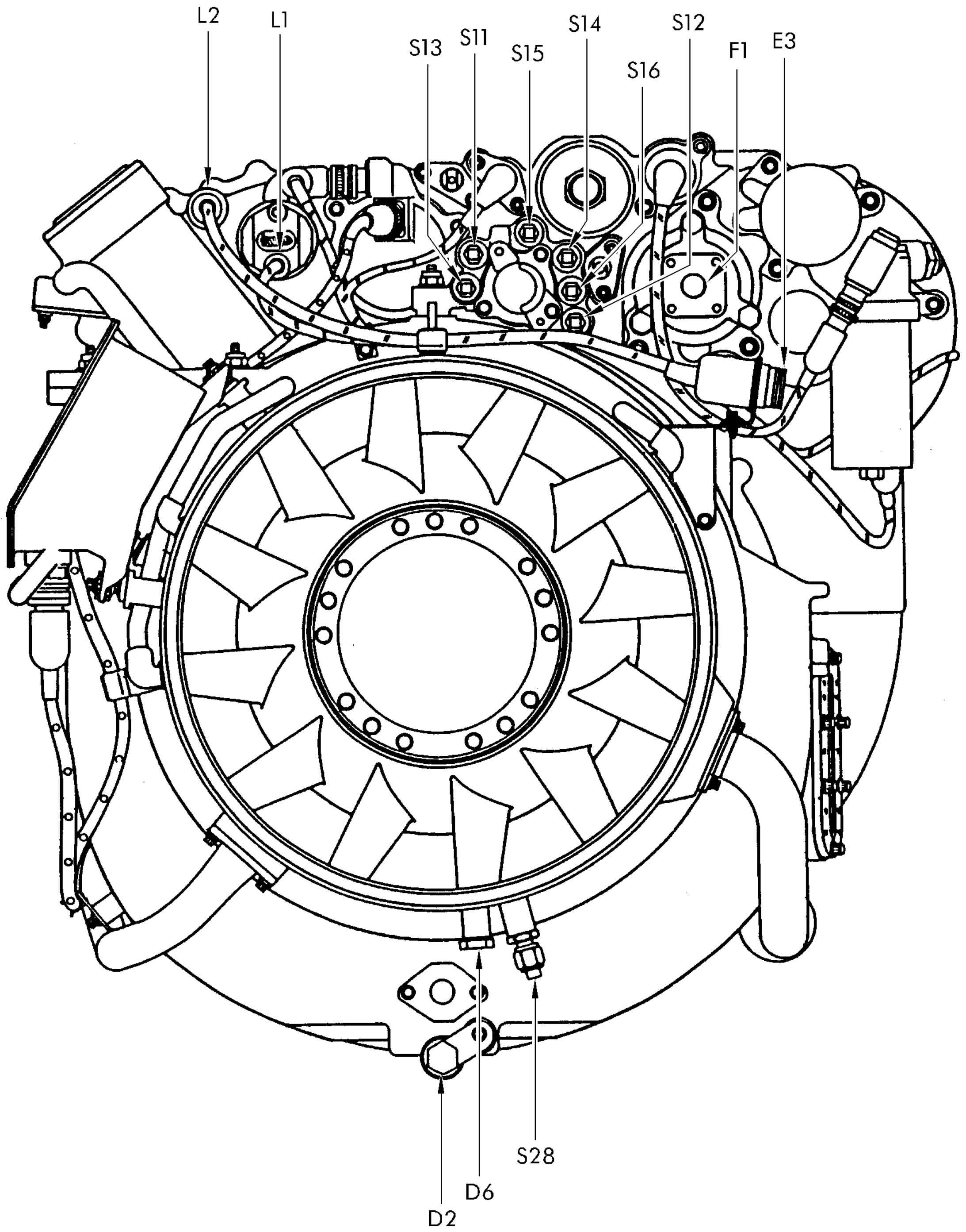
CONN PT	NOMENCLATURE
D1	Combustor Drain
D2	Oil Tank Drain Plug
D4	(T700) POU Drain, or (T701, T401) ODV Drain
D6	Swirl Frame Drain

CONN PT	NOMENCLATURE
E1	Engine Harness
E3	Engine Harness (W3J1)
F1	Fuel Boost Pump Inlet
F2	Fuel Boost Pump Pressure Sensing Boss
L1	Engine Oil Discharge Pressure
L2	Engine Oil Temperature
S11	Oil Scavenge Temperature, C-Sump Cover
S12	Oil Scavenge Temperature, A-Sump Forward

CONN PT	NOMENCLATURE
S13	Oil Scavenge Temperature, A-Sump Aft
S14	Oil Scavenge Temperature, C-Sump Forward
S15	Oil Scavenge Temperature, C-Sump Aft
S16	Oil Scavenge Tempertaure, B-Sump
S28	Water Wash Connection
S39	ECU Circuit Continuity Tester Connection
V10	Accessory Gearbox Vibration Mount

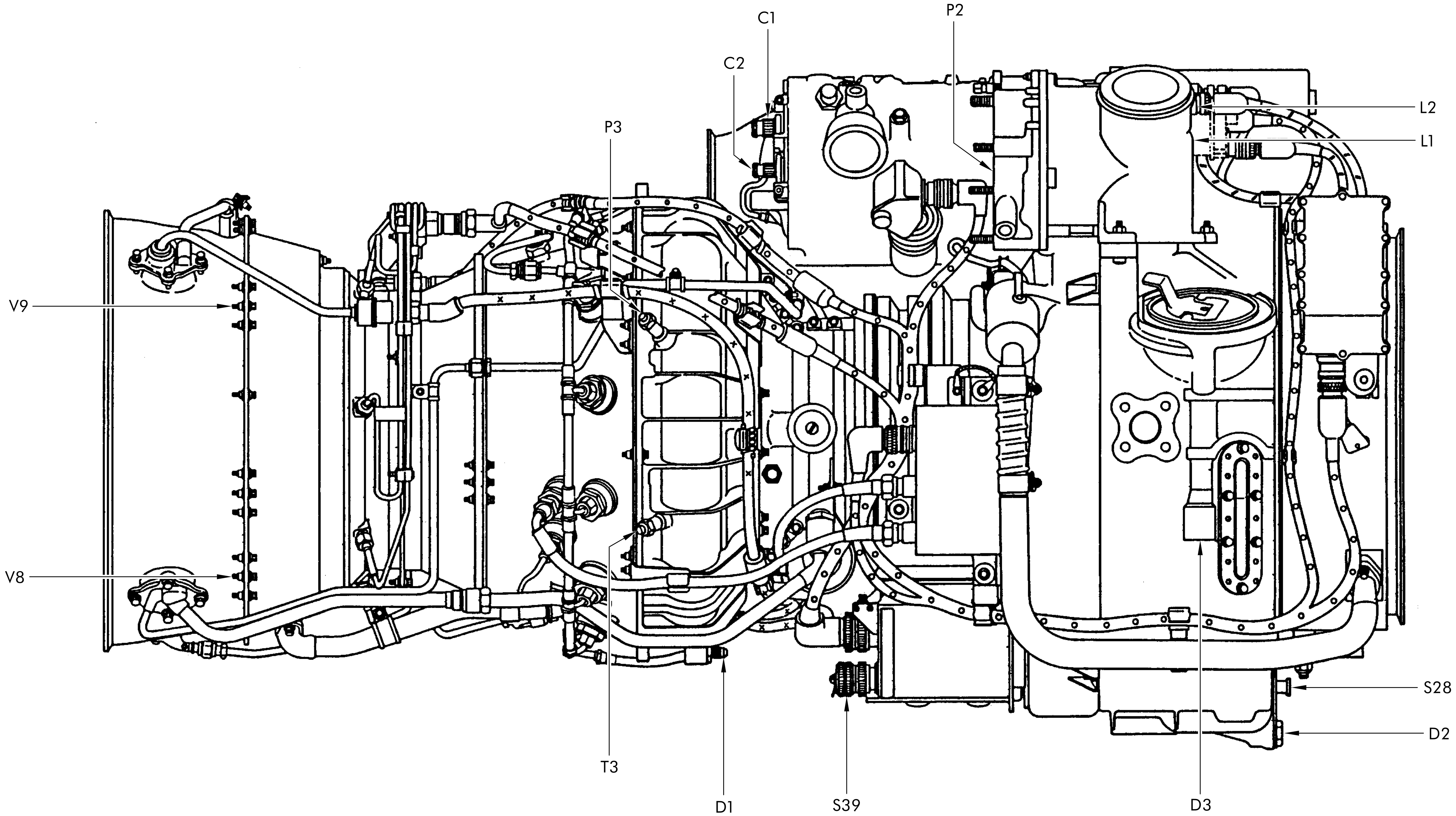
1161733-00-F0

Figure FO-3. Instrumentation Connecting Points (Sheet 1 of 4)



1161734-00-A2A

Figure FO-3. Instrumentation Connecting Points (Sheet 2 of 4)

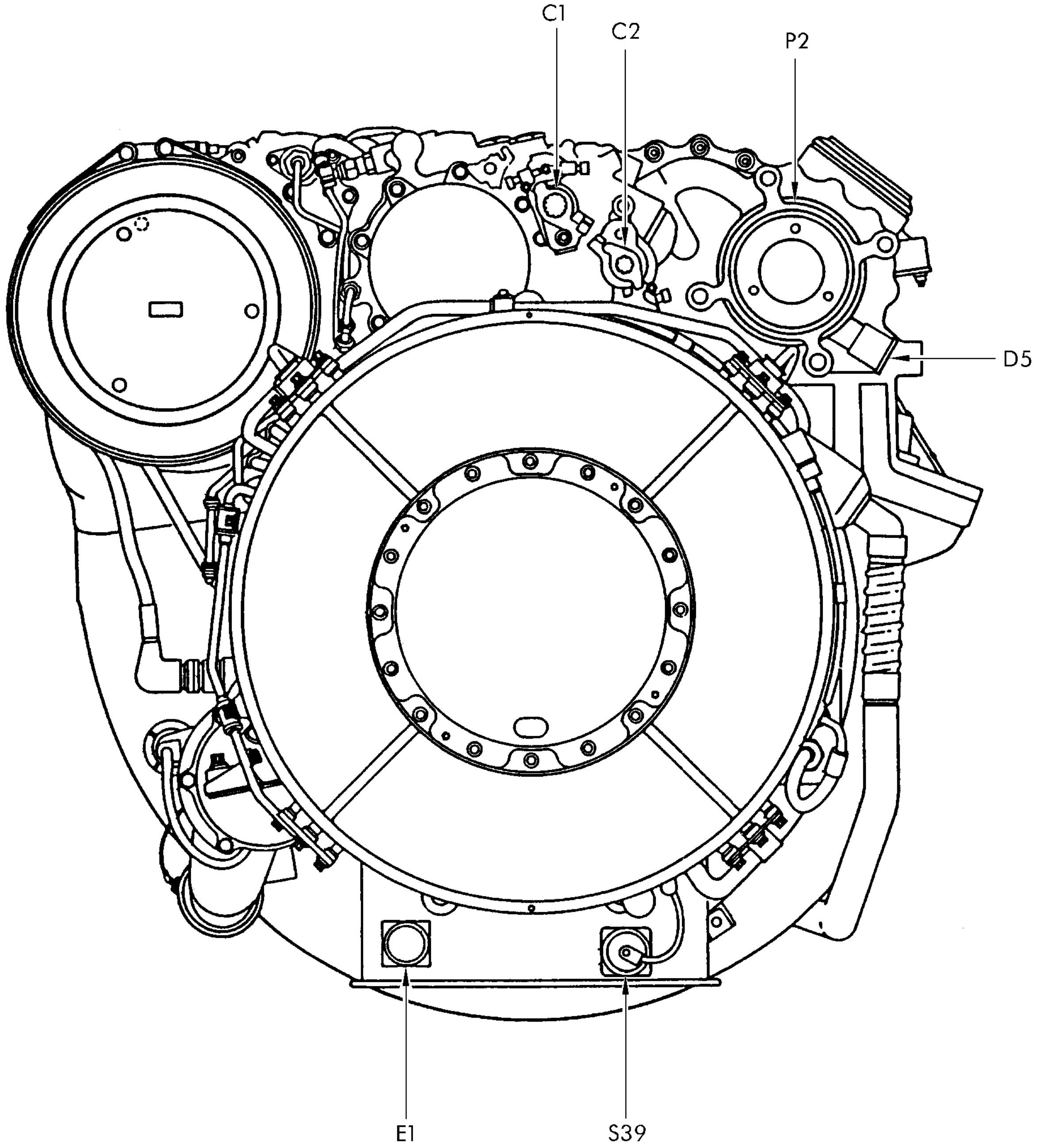


CONN PT	NOMENCLATURE
C1	PAS (power available spindle)
C2	LDS (load demand spindle)
D1	Combustor Drain
D2	Oil Tank Drain Plug
D3	Common Drain
D5	HMU Vent/Drain
E1	Engine Harness
L1	Engine Oil Discharge Pressure

CONN PT	NOMENCLATURE
L2	Engine Oil Temperature
P2	Starter Pad
P3	Compressor Discharge Pressure
S28	Water Washer Connection
S39	ECU Circuit Continuity Tester Connection
T3	Compressor Discharge Temperature
V8	Exhaust Frame Vibration Mount
V9	Exhaust Frame Vibration Mount

1161735-00-F0

Figure FO-3. Instrumentation Connecting Points (Sheet 3 of 4)



1161736-00-A2A

Figure FO-3. Instrumentation Connecting Points (Sheet 4 of 4)

By Order of the Secretaries of the Army and the Air Force:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

Joel B. Hudson
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
05482

RONALD R. FOGELMAN
General, United States Air Force
Chief of Staff

GEORGE T. BABBITT
General, United States Air Force
Commander, Air Force Materiel Command

DISTRIBUTION:
To be distributed in accordance with Initial Distribution Number (IDN) 311557, requirements for TM 1-2840-248-23.

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: “Whomever” <whomever@wherever.army.mil>
To: 2028@redstone.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19–OCT–93
8. ***Pub no:*** 55–2840–229–23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04–JUL–85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123–123–1234
17. ***Problem:*** **1**
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse*) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE 8/30/02

TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, AL 35898	FROM: (*Activity and location)(Include ZIP Code)* MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER TM 9–1005–433–24	DATE 16 Sep 2002	TITLE Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE MSG, Jane Q. Doe, SFC	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION 788–1234	SIGNATURE

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPA V3.01

TO: (*Forward direct to addressee listed in publication*) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, AL 35898	**FROM:** (*Activity and location) (Include ZIP Code)* MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	**DATE** 8/30/02

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE MSG, Jane Q. Doe, SFC	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION 788–1234	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 25–30; the proponent agency is ODISC4.

Use Part II (*reverse*) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)

DATE

TO: (*Forward to proponent of publication or form)(Include ZIP Code)*
Commander, U.S. Army Aviation and Missile Command
ATTN: AMSAM-MMC-MA-NP
Redstone Arsenal, AL 35898

FROM: (*Activity and location)(Include ZIP Code)*

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM NO.	PAGE NO.	PARA– GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPA V3.01

TO: (*Forward direct to addressee listed in publication*) Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

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PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 077016-000