TM 10-3930-675-34

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

ROUGH TERRAIN CONTAINER HANDLER (RTCH): RT 240; 53,000 LB CAPACITY; 4 X 4 (NSN 3930-01-473-3998)

Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 2001

LIST OF EFFECTIVE PAGES/WORK PACKAGES

Date of issue for original manual is:

Original 1 July 2001

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 26 AND TOTAL NUMBER OF WORK PACKAGES IS 90 CONSISTING OF THE FOLLOWING:

Page/WP No.	*Change No.
Cover (Back Blank)	0
A (B Blank)	0
a to g/(h blank)	0
i to vi	0
WP 0001 00 to 0090 00	0
Index-1 to Index-8	0

* Zero in this column indicates an original page or work package.

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WARNING SUMMARY

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within the technical manual.

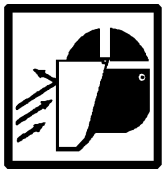
BIOLOGICAL - abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.

CHEMICAL - drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.

ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.

EYE PROTECTION - person with goggles shows that the material will injure the eyes.

FIRE - flame shows that a material may ignite and cause burns.



FLYING PARTICLES - arrows bouncing off face with face shield shows that particles flying through the air will harm face.

HEAVY OBJECT - human figure stooping over heavy object shows physical injury potential from improper lifting technique.

HEAVY PARTS - hand with heavy object on top shows that heavy parts can crush and harm.

HEAVY PARTS - heavy object on human figure shows that heavy parts present a danger to life or limb.

HOT AREA - hand over object radiating heat shows that part is hot and can burn.

RADIOACTIVE - identifies a material that emits radioactive energy and can injure human tissue or organs.

VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.

HYDRAULIC FLUID PRESSURE - hydraulic fluid spraying human figure shows that fluid escaping under great pressure can cause injury or death.

FOR INFORMATION ON FIRST AID, REFER TO FM 21-11.

WARNING

CARBON MONOXIDE (EXHAUST GASES) CAN KILL!

- Carbon monoxide is a colorless, odorless, deadly poison which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air containing carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, and coma. Permanent brain damage or death can result from severe exposure.
- Carbon monoxide occurs in exhaust fumes of internal combustion engines. Carbon monoxide can become dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed to ensure safety of personnel when engine of RTCH is operated.

1. DO NOT operate RTCH engine in enclosed areas.
2. DO NOT idle RTCH engine without adequate ventilation.
3. DO NOT drive RTCH with inspection plates or cover plates removed.
4. BE ALERT for exhaust poisoning symptoms. They are:
   - Headache
   - Dizziness
   - Sleepiness
   - Loss of muscular control
5. If you see another person with exhaust poisoning symptoms:
   - Remove person from area.
   - Expose to fresh air.
   - Keep person warm.
   - Do not permit physical exercise.
   - Administer cardiopulmonary resuscitation (CPR), if necessary.
   - Notify a medic.
6. BE AWARE. The field protective mask for nuclear-biological-chemical (NBC) protection will not protect you from carbon monoxide poisoning.

The Best Defense Against Carbon Monoxide Poisoning Is Good Ventilation!

WARNING

CLEANING AGENTS

Improper cleaning methods and use of unauthorized cleaning agents can injure personnel and damage equipment. To prevent this, refer to TM 9-247 for further instructions.

WARNING

COMPRESSED AIR

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

WARNING

DIESEL FUEL HANDLING

- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel.
- Wear fuel-resistant gloves when handling fuels and promptly wash exposed skin and change fuel-soaked clothing.

WARNING

DRY CLEANING SOLVENT

Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.

WARNING

ETHER COLD START SYSTEM

- Ether is extremely flammable and explosive. DO NOT perform ether cold start system checks, inspections or maintenance while smoking or near fire, flames or sparks. Failure to follow this warning may cause a fire and explosion, causing serious injury or death to personnel.
- Avoid breathing cold start system fluid vapors. Wear goggles and fuel-resistant gloves when handling fluid. Failure to follow this warning may cause serious injury or death to personnel.

WARNING

HAZARDOUS WASTE DISPOSAL

When servicing this vehicle, performing maintenance, or disposing of materials such as engine coolant, hydraulic fluid, lubricants, battery acids or batteries, and CARC paint, consult your unit/local hazardous wast disposal center or safety office for local regulartory guidance. If further information is needed, please contact The Army Environmental Hotline at 1-800-872-3845.

WARNING

HYDRAULIC SYSTEM

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

WARNING

LIFTING HEAVY COMPONENTS

- Hydraulic jacks are intended only for lifting RTCH, not for supporting vehicle to perform maintenance. DO NOT get under vehicle after it is raised unless it is properly supported with blocks or other suitable cribbing. Failure to observe this warning may result in death or injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Improper use of lifting equipment and improper attachment of cables to vehicle can result in serious personnel injury and equipment damage. Observe all standard rules of safety.

WARNING

NBC EXPOSURE

If NBC exposure is suspected, all air cleaner media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

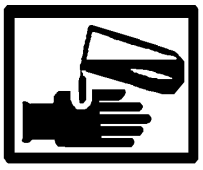
To order this NBC decal use:

National Stock Number (NSN) - 7690-01-114-3702
Part Number (PN) - 12296626
Commercial and Government Entity Code (CAGEC) - 19207

WARNING

PRESSURIZED COOLING SYSTEM

- DO NOT service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.
- Wear effective eye, glove, and skin protection when handling coolants. Failure to do so may cause injury.



WARNING

R-134A REFRIGERANT

- Liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Use care to prevent refrigerant from touching your skin or eyes. Serious injury or blindness may result if you come in contact with refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in a fire or explosion, which could cause personnel injury.
- DO NOT work in an area where refrigerant may contact an open flame or burning material such as a cigarette. When refrigerant contacts extreme heat, refrigerant breaks down into poisonous phosgene gas which, if breathed, causes severe respiratory irritation. DO NOT breathe fumes from an open flame leak detector.

WARNING

STEAM CLEANING

When using steam cleaner, wear protective clothing and eye protection. Hot steam will cause serious burns.

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DEPARTMENT OF THE ARMY
Washington, D.C., 1 July 2001

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (*Recommended Changes to Equipment Technical Publications*), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or e-mail your letter, DA Form 2028 direct to: AMSTA-LC-CI/TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is: TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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HOW TO USE THIS MANUAL

INTRODUCTION

1. This manual is designed to help you perform Direct Support and General Support Maintenance on the RT 240 Rough Terrain Container Handler (RTCH).

2. The *Repair Parts and Special Tools List (RPSTL)*, TM 10-3930-675-24P, is to be used in conjunction with this manual, to locate and obtain the repair parts and special tools needed to maintain this equipment.

3. This manual is written in Work Package format:

    a. Chapters divide the manual into major categories of information (e.g., *Introductory Information with Theory of Operation, Troubleshooting Procedures, Direct Support Maintenance Instructions, General Support Maintenance Instructions,* and *Supporting Information*).

    b. Each Chapter is divided into Work Packages, which are identified by a 6-digit number (e.g. 0001 00, 0002 00, etc.) located on the upper right-hand corner of each page. The Work Package page number (e.g. 0001 00-1, 0001 00-2, etc.) is located centered at the bottom of each page.

    c. If a Change Package is issued to this manual, added Work Packages use the 5^{th} and 6^{th} digits of their number to indicate new material. For instance, Work Packages inserted between WP 0001 00 and WP 0002 00 are numbered WP 0001 01, WP 0001 02, etc.

4. Scan thru this manual to become familiar with its organization and contents before attempting to maintain the equipment.

CONTENTS OF THIS MANUAL

1. A *Warning Summary* is located at the beginning of this manual. Become familiar with these warnings before operating or performing troubleshooting or maintenance on the vehicle.

2. A *Table of Contents*, located in the front of the manual, lists all Chapters and Work Packages in the publication.

    a. The Table of Contents also provides *Reporting Errors and Recommending Improvements* information and DA Form 2028 addresses, for the submittal of corrections to this manual.

    b. If you cannot find what you are looking for in the Table of Contents, refer to the alphabetical *Index* at the back of the manual.

3. Chapter 1, *Introductory Information with Theory of Information*, provides general information on the manual and the equipment.

4. Chapter 2, *Troubleshooting Procedures*, contains all applicable troubleshooting.

5. Chapter 3 covers all *Direct Support Maintenance Instructions*. Work Packages are organized in the same Functional Group Code (FGC) sequence as the Maintenance Allocation Chart (MAC) found in TM 10-3930-675-20-2.

6. Chapter 4 deals with *General Support Maintenance Instructions*. Work Packages are organized in the same Functional Group Code (FGC) sequence as the Maintenance Allocation Chart (MAC) found in TM 10-3930-675-20-2.

7. Chapter 5 includes *Supporting Information: References, Expendable and Durable Items List,* and the *Tool Identification List*.

FEATURES OF THIS MANUAL

1. WARNINGs, CAUTIONs, NOTEs, subject headings, and other important information are highlighted in **BOLD** print as a visual aid.

WARNING

A WARNING indicates a hazard which may result in death or serious injury.

CAUTION

A CAUTION is a reminder of safety practices or directs attention to usage practices that may result in damage to equipment.

NOTE

A NOTE is a statement containing information that will make the procedures easier to perform.

2. Statements and words of particular interest may be printed in CAPITAL LETTERS to create emphasis.
3. Within a procedural step, reference may be made to another Work Package in this manual or to another manual. These references indicate where you should look for more complete information.
   a. If you are told: "Install vibration damper (WP 0011 00)", go to the first page of Work Package 0011 00 in this manual for instructions on installing the vibration damper. Be sure to read the "Initial Setup" on page 1 of the Work Package, to determine contents of Work Package as well as information regarding tools and equipment, spare parts, and personnel required, etc.
   b. If you are told: "Install engine cover (TM 10-3930-675-20)", go to TM 10-3930-675-20 for complete instructions on installing the engine cover. Use the *Table of Contents* or alphabetical *Index* in TM 10-3930-675-20 to find the engine cover replacement procedure.
4. Illustrations are placed after, and as close to, the procedural steps to which they apply. Callouts placed on the art may be text or numbers, or both; whichever method is easier for the soldier.
5. Numbers located at lower right corner of art (e.g. 350-001; 350-002, etc.) are art control numbers and are used for tracking purposes. Disregard these numbers.
6. Dashed leader lines used in illustrations indicate that called out items are not visible in the view depicted (i.e. they are located within or behind the structure).
7. Technical instructions include metric units as well as standard units. For your reference, a *Metric Conversion Chart* is located on the inside back cover of the manual.

NOTE

If at any time you are unsure how to use this manual or you cannot locate the information you need, notify your supervisor.

CHAPTER 1
INTRODUCTORY INFORMATION WITH THEORY OF OPERATION

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GENERAL INFORMATION 0001 00

SCOPE

1. **Type of Manual.** This manual is for use in performing Direct Support and General Support Maintenance on the Rough Terrain Container Handler (RTCH), RT 240.

2. **Equipment Name and Model Number.** Rough Terrain Container Handler (RTCH): RT 240, 53,000 lb capacity, 4 X 4.

3. **Purpose of Equipment.** The RTCH-RT 240 is designed to lift and stack 20 and 40 ft International Standard Organization (ISO) containers, loaded to a gross weight of 53,000 lb (24,062 kg).

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for the equipment will be those prescribed by DA Pam 738-750, *Functional User's Manual for the Army Maintenance Management System (TAMMS*), as contained in the Maintenance Management Update.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS)

If your truck needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF Form 368 *(Product Quality Deficiency Report)*. Mail it to us at: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-AC-NML, Rock Island, Illinois 61299-7630. We'll send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

1. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

2. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using SF Form 368 *(Product Quality Deficiency Report)*. Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 738-750.

OZONE DEPLETING SUBSTANCES

Listing to be provided by requiring activity.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For destruction of Army materiel to prevent enemy use, refer to TM 750-244-6.

PREPARATION FOR STORAGE OR SHIPMENT

For preparation for storage or shipment procedures, refer to TM 10-3930-675-20.

WARRANTY INFORMATION

The vehicles are warranted by Kalmar RT in accordance with TB 10-3930-675-14. Warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your Organizational Maintenance shop.

LIST OF ABBREVIATIONS/ACRONYMS

NOTE

Refer to ASME Y14.38-1999 for standard abbreviations.

ABBREVIATION/ACRONYMS	DEFINITION
AOAP	Army Oil Analysis Program
C	Centigrade or Celsius
CAN-BUS	Controller Area Network-BUS
CID	Cubic Inch Displacement
cm	Centimeter
ECM	Electronic Control Module
ECS	Electronic Control System
F	Fahrenheit
GCWR	Gross Combination Weight Rating
GVWR	Gross Vehicle Weight Rating
IETM	Interactive Electronic Technical Manual
ISO	International Organization for Standardization
kg	Kilogram
km	Kilometer
kPa	Kilopascal
kph	Kilometers per Hour
kW	Kilowatt
l	Liter
lb-ft	Pound Foot
lph	Liters per Hour
mm	Millimeter
Nm	Newton Meter
OEM	Original Equipment Manufacturer
PMCS	Preventive Maintenance Checks and Services
PTO	Power Take-off
RTCH	Rough Terrain Container Handler
SPORT	Soldier's Portable On-System Repair Tool

EQUIPMENT DESCRIPTION AND DATA 0002 00

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

1. **Characteristics.**

   a. The Rough Terrain Container Handler (RTCH)-RT 240 is designed to lift, move, stack or unstack 20 and 40 ft by 8 ft wide ISO containers.

   b. The RTCH-RT 240 has a lift capacity of 53,000 lb (24,062 kg) and operates on hard and/or unimproved surfaces, to include beach operations.

   c. The RTCH-RT 240 can be utilized as a forklift with an operator-installed forklift kit.

2. **Capabilities and Features.**

   a. **Capabilities.**

      (1) Container handling capabilities:

      - Stack or unstack 8 ft high ISO containers stacked three (3) high with a gross weight of 53,000 lb (24,062 kg) in the first row.
      - Stack or unstack 8 ft high ISO containers stacked three (3) high with a gross weight of 27,500 lb (12,485 kg) in the second row.
      - Stack or unstack 4.3 ft high ISO containers stacked seven (7) high.
      - Container tophandler adjusts to 20 ft or 40 ft ISO container lengths.
      - Container tophandler oscillates 7° left and right.
      - Container tophandler rotates 195° clockwise and 105° counterclockwise.
      - Container tophandler tilts 8° forward and 12° to the rear.
      - Container tophandler side shifts ± 15 in (± 400 mm) from the center.

      (2) Forklift kit is operator-installed and attaches to the tophandler. The fork tines are adjustable from 24 in (61 cm) center-to-center to 81.5 in (207 cm) center-to-center. Lift capacity is 44,000 lb (19,976 kg).

      (3) Maximum speed of RTCH is 23 mph (37 kph) on level ground with NO LOAD; maximum speed on level ground LOADED is 15 mph (24 kph).

      (4) Maximum fording depth is 60 in (1.52 m).

      (5) Operation in temperatures from -25°F (-32°C) to +125°F (+52°C), and to -40°F (-40°C) with arctic kit installed.

   b. **Features.**

      (1) Electronically-controlled 400 hp, six-cylinder turbocharged engine.

      (2) Electronic semi-automatic shift controlled transmission with 4 ranges forward and 3 reverse. Operator selects range and ECM controls shift points.

      (3) The drive axles provide traction for two- or four-wheel drive.

      (4) Limited slip differentials and multi-disc-wet brakes are an integral part of the axle assemblies. Multi-disc-wet brakes are hydraulically cooled to prevent overheating. Accumulators store energy for the emergency braking system.

      (5) The steering system is capable of two-wheel, four-wheel, crab, and emergency modes of operation.

      (6) The parking brake is hydraulically released and spring-applied by disc brake assemblies mounted on the front and rear differentials.

      (7) The operator’s cab has a fully adjustable operator’s seat, fresh air (filtered) ventilation system, and heater/defroster/air conditioning systems.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - CONTINUED

(8) Operator's controls include: adjustable steering wheel; accelerator and brake pedals; transmission range selector; steering mode selection rocker switches; and a single joystick control for all boom, tophandler, and forklift operations.

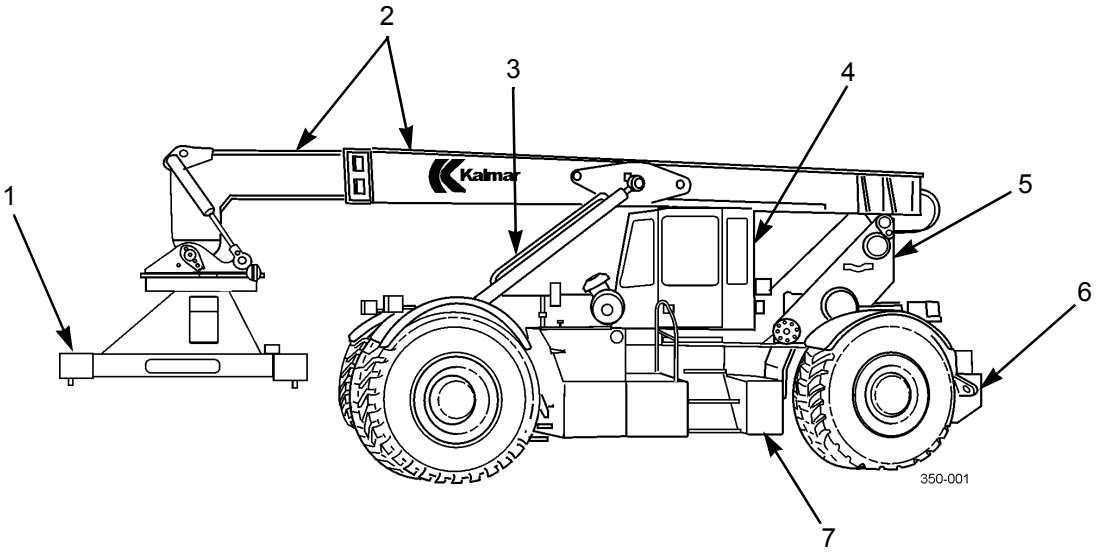
c. **Transport Modes.**

NOTE

Refer to TM 10-3930-675-10 for detailed instructions to prepare the RTCH for transport.

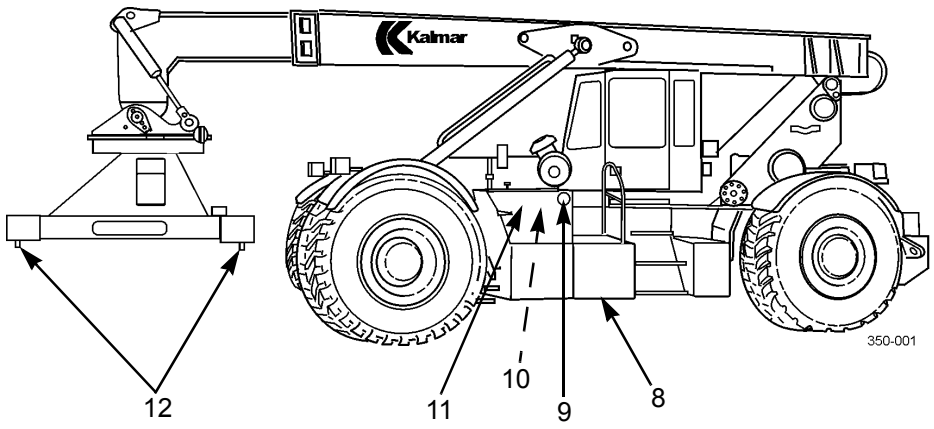
- Self Deployment
- Highway Transport
- Rail Transport
- Marine Transport
- Air Transport

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



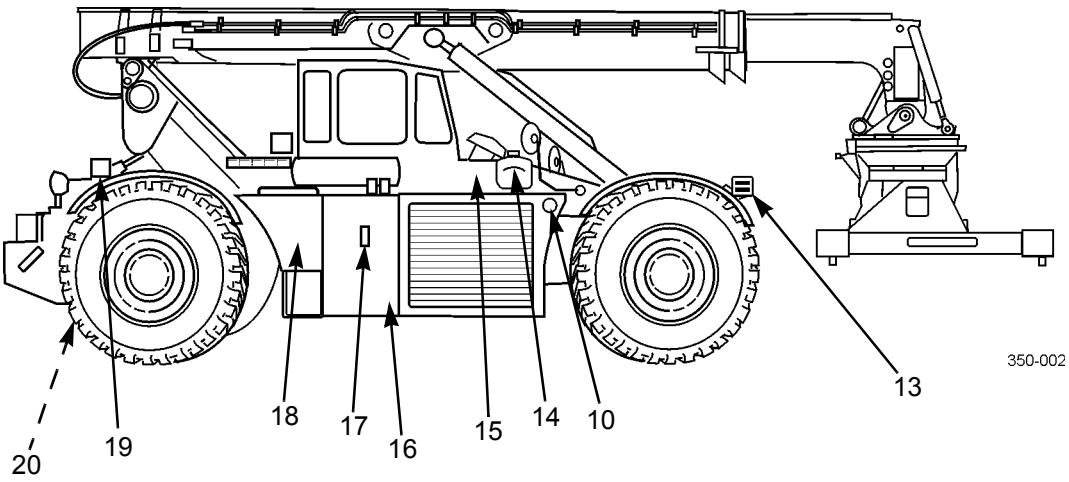
KEY	COMPONENT	DESCRIPTION
1	Tophandler	Electro-hydraulically operated 20-40 ft tophandler. Capable of sideshifting, rotation, forward/rear tilting, left/right tilting, and load position leveling and locking. Also interfaces with forklift attachment.
2	Boom Assembly	Electro-hydraulically operated heavy duty steel boom designed for moving, lifting, and stacking 20-40 ft ISO containers.
3	Boom Lift Cylinders	Electro-hydraulically operated cylinders raise, lower, and support the boom assembly.
4	Operator's Cab	Contains all driving and container handling controls as well as heating, air conditioning, and filtered ventilation system controls. During air transport operations the cab is moved to the left side of the chassis, then lowered and secured in place.
5	Boom Support	Rear support and pivot point for the boom to include an unlocking device that allows the boom assembly to be lowered into the transport position.
6	Frame	A heavy-duty steel construction with tie-downs, towing lugs, and pintle hook.
7	Remote Hydraulic Control Compartment	Location of selected hydraulic remote controls. Also access to hydraulic system test and AOAP sampling ports.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



KEY	COMPONENT	DESCRIPTION
8	Dolly Wheels Storage Compartment	Storage location for the tophandler air transport dolly wheels.
9	Master Battery Switch	ON/OFF control of electrical power from batteries to vehicle electrical system.
10	Slave Receptacle	Provides an electrical connection for slave starting. A receptacle is located on each side of the truck.
11	Battery Compartment	Stores four 12-volt batteries and required cabling. Batteries are accessible from the side and/or the top.
12	Twistlocks	Electro-hydraulically operated and monitored ISO twistlocks, located at each corner of the tophandler. Also utilized to attach forklift attachment to tophandler.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



KEY	COMPONENT	DESCRIPTION
13	Front Service and Blackout Lights	Headlight, blackout drive light, and composite turn signal with blackout markers.
14	Coolant Expansion Tank	Contains cooling system overflow. Provides means to visually check coolant level and add coolant to system.
15	Engine Compartment	Houses the six-cylinder turbocharged diesel engine that supplies power for the automotive, electrical, and hydraulic systems.
16	Hydraulic Reservoir	Stores and vents system hydraulic oil.
17	Hydraulic Reservoir Sight Gage	Visual indicator of hydraulic oil level. If oil is NOT visible in sight gage with boom completely lowered and tophandler retracted, do not start engine.
18	Fuel Tank	Stores fuel supply for vehicle.
19	Rear Service and Blackout Lights	Composite tail, stop, and blackout markers; turn signals; and backup lights.
20	Bogie Wheels	Distribute weight equally between bogie wheels and rear axle for air transportability.

EQUIPMENT DATA

Engine:

Manufacturer	Cummins
Model	QSM 11
Horsepower @ 2150 rpm	400 hp (298 kW)
Torque @ 1200 rpm	1450 lb-ft (1966 Nm)
Cylinders	6
Displacement	661 CID (10.8 liters)
Weight	2070 lb (940 kg)
Fuel System	Fully electronic
Cooling System, Thermostat Range	180° - 200°F (82° - 93°C)

Transmission:

Manufacturer	ZF-Hydromedia
Model	4 WG-260
Type	4 forward and 3 reverse speeds
Range Selection	Automatic, electronically-controlled

Axles:

Manufacturer	Kessler
Model:	
Front	LT102PL341/528NLB4650
Rear	LT102PL341/528NLB4460
Weight:	
Front	8379 lb (3804 kg)
Rear	5733 lb (2602 kg)

Tires:

Front and Rear:	
Manufacturer	Bridgestone
Size	29.5 R 35 XRB
Inflation	85 psi (586 kPa)
Weight	2315 lb (1050 kg)
Bogie Wheels (Transport Operations):	
Manufacturer	Michelin
Size	355/65 R 15 XZM
Inflation	85 psi (586 kPa)
Dolly Wheels (Tophandler Transport):	
Manufacturer	Michelin
Size	225/75 R 10 XZR
Inflation	85 psi (586 kPa)

Dimensions:

Length:	
Tophandler Lateral	37.7 ft (11.5 m)
Tophandler Longitudinal	49.2 ft (15.0 m)
Height:	
Operational w/ Boom Level	13.1 ft (4.0 m)
Highway Transport Mode	9.8 ft (3.0 m)
Width, Tophandler Longitudinal	12 ft (3650 mm)

EQUIPMENT DATA - CONTINUED

Weights:

GVWR . . . . . 118,000 lb (53,572 kg)
GVWR w/ Forklift Kit . . . . . 128,400 lb (58,294 kg)

Capacities:

Fuel Tank . . . . . 103 gal. (390 l)
Cooling System . . . . . 23.7 gal. (90.1 l)
Cooling Engine Only . . . . . 3.4 gal. (12.9 l)
Hydraulic Oil Reservoir . . . . . 180 gal. (680 l)
Engine Crankcase w/Filter . . . . . 38.6 qt (36.5 l)
Transmission w/Filter . . . . . 36 qt (34 l)

Electrical System:

Type . . . . . 24 volt, negative ground
Batteries:
  Quantity 4
  Voltage . . . . . 12 volt

Miscellaneous:

Maximum Lifting Capacity:
  First Stacking Row . . . . . 53,000 lb (24,062 kg)
  Second Stacking Row . . . . . 27,500 lb (12,485 kg)
Maximum Lift Height . . . . . 33 ft (10.06 m)
Maximum Lifting Capacity, w/Forklift Kit
  First Stacking Row . . . . . 44,000 lb (19,976 kg)
  Second Stacking Row . . . . . 24,600 lb (11,168 kg)
Maximum Lift Height, w/Forklift Kit . . . . . 21.8 ft (6.65 m)
Forklift Kit, Fork Tines Center-to-Center Range . . . . . 24-81.5 in (61-207 cm)
Maximum Forward Reach (Boom Level) . . . . . 20.6 ft (6.28 m)
Curb-to-Curb Turning Circle:
  Four-Wheel Steering . . . . . 65 ft (19.8 m)
Ground Clearance . . . . . 18 in (45.7 cm)
Fording Depth . . . . . 60 in (1.5 m)
Maximum Travel Speeds:
  Empty . . . . . 23 mph (37 kph)
  Loaded . . . . . 15 mph (24 kph)

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THEORY OF OPERATION 0003 00

INTRODUCTION

1. The RTCH-RT 240 consists of the following major components and functional systems: drive train, fuel system, exhaust system, cooling system, electrical and electronic systems, steering and brake systems, hydraulic system, cab system, air conditioning system, and lifting boom with tophandler. A forklift kit may be added as required.
2. This work package explains how the components and systems of the RT 240 work together. A functional description is provided for each major component and system.

DRIVE TRAIN

1. The engine is a six-cylinder turbocharged diesel which supplies power to the transmission. The engine cooling system is pressurized and includes a thermostat, controlled bypass, and coolant recovery bottle. Engine lubrication is pressurized and full-flow filters continuously clean oil.
2. The transmission is a semi-automatic electronically-controlled unit. The operator electronically selects range of gears and the transmission ECM controls shift points up to the highest selected gear. A shift inhibitor circuit controls down-shifts in forward and reverse gears. The transmission can be manually or electronically shifted thru 4 forward and 3 reverse gears. A torque converter provides interface to the engine.
3. The drive shafts transmit rotation of the transmission output to the front and rear axles. Connections at both ends are made thru universal joints to compensate for any misalinements due to operating on uneven surfaces.
4. The front and rear axles are identical in operating principles. Both axles are hydraulically steered with planetary wheel ends and wet-disc brakes. The rear axle oscillates above and below horizontal to allow for operation on uneven surfaces.

FUEL SYSTEM

1. Fuel to power the engine is pumped from the fuel tank by a fuel transfer pump to the electronically controlled fuel injector nozzles.
2. The engine electronic control module manages, monitors, and stores key engine functions, to include engine idle speed, limits maximum engine speed, and engine diagnostic data.
3. The engine-mounted fuel/water separator is a spin-on replaceable type with drain.

EXHAUST SYSTEM

The exhaust system removes exhaust gases from the engine thru the exhaust manifold and turbocharger. The gases flow into exhaust pipes and muffler to the atmosphere along the right side and to the rear of the operator’s cab.

COOLING SYSTEM

1. The cooling system consists of an engine-mounted circulating pump, 180°- 200°F (82°- 93°C) thermostat, oil cooler/ after cooler manifolds, a radiator, engine-mounted coolant filter, and hydraulically-driven cooling fan.
2. The cooling system cools the engine by means of circulating pressurized ethylene glycol-based coolant thru the engine and radiator.

ELECTRICAL SYSTEM

1. The system voltage is 24 volts. Four 12-volt batteries, connected in series/parallel configuration and charged by an alternator across electronic rectifying and voltage stabilization circuits, provide the voltage.
2. The negative and positive poles are both connected across the master battery switch. The negative pole is connected to the chassis.
3. NATO slave-starting receptacles are provided.

STEERING SYSTEM

1. The electro-hydraulic steering system provides three modes of steering control; two-wheel steer, four-wheel steer, and crab steer.
2. The variable rate steering system utilizes two front and two rear hydraulic steer cylinders and electronic wheel position sensors connected to an electronic control module to maintain direction and control. The variable rate system allows the system to change or adjust to different modes of operation.
3. An emergency steering pump is provided in the event the engine is inoperative. If the engine quits while operating the RTCH, the emergency steering pump provides sufficient hydraulic pressure to control the truck until it is brought to a safe stop.

BRAKE SYSTEM

1. The brakes are totally enclosed within the front and rear drive axle housings, next to the wheel ends.
2. The brake system is a wet brake system that is comprised of three separate hydraulic circuits: service brake circuit, cooling circuit, and parking brake circuit.
3. The brake system also includes six pressurized accumulators that provide adequate stored energy to stop the RTCH in the event of engine shutdown.
4. The service brake circuit is applied by depressing either the left or right floor-mounted hydraulic brake pedals. Brake pressure is applied to eight cylinders per side within the front axle and one cylinder per side in the rear axle.
5. The brake system cooling circuit cools the brake discs using oil pumped from the main hydraulic system thru brake chambers during operation.
6. The parking brake assemblies are mounted at the input flanges of the front and rear axles. The brakes are applied by spring pressure and released hydraulically. A warning buzzer sounds if driver leaves seat without applying the parking brakes. In the event of an emergency, the parking brake may be utilized to stop the truck.

HYDRAULIC SYSTEM

The RTCH hydraulic system is comprised of the following major components that provide hydraulic power to operate and control the container tophandler, boom, steering, and brake systems. In addition, the hydraulic system is used to place the cab and bogie wheels into transport mode.

1. Three variable piston-type hydraulic pumps are driven by the transmission power take-off (PTO). The pumps provide hydraulics for the steering system and tophandler.
2. One double vane-type pump is driven by the transmission PTO. It provides hydraulics for the boom cylinders, service, and parking brake systems.
3. One single-vane pump is driven by the engine. It provides hydraulics for a cooling fan.
4. Main valves control the main hydraulics. The valves are controlled by an electro-hydraulic servo system from the joystick control in the operator’s cab.
5. High-pressure oil filters clean hydraulic oil before returning oil to the reservoir. Breather filters allow venting of the hydraulic reservoir.
6. Hydraulic system oil cooler and fan maintain and control hydraulic oil temperature. The cooling fan is powered by hydraulics from an engine-driven hydraulic pump.
7. Emergency systems: one ground-driven hydraulic pump maintains steering control in the event of engine failure; a 24-volt electric hydraulic pump provides power to lower boom and release the twistlocks in the event of engine failure. The electric pump also provides a means to place the operator’s cab into the transport mode.

THEORY OF OPERATION - CONTINUED **0003 00**

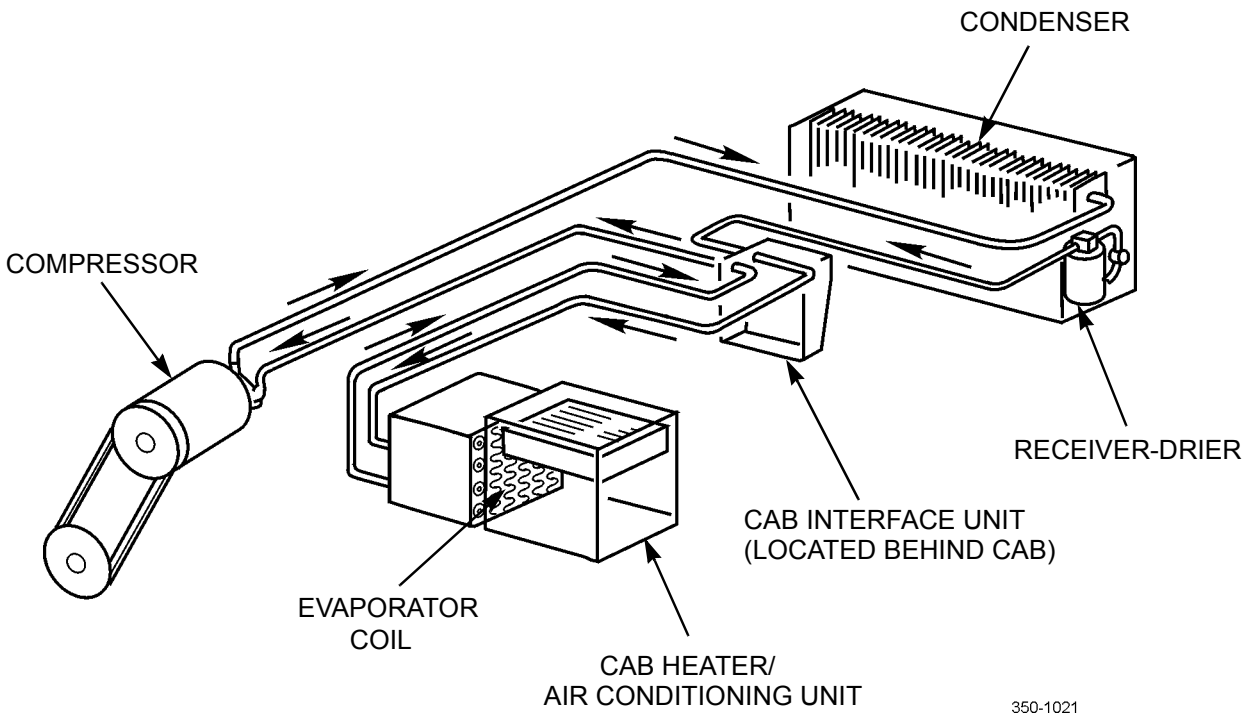
CAB SYSTEM

The operator's cab is a sound and weather insulated unit that provides the operator with the systems to control and monitor both standard automotive functions and container handling functions. The following components or systems are also contained within the cab:

1. Adjustable steering column and adjustable suspension seat.
2. Heater, air conditioning, and filtered ventilation system.
3. Portable fire extinguisher and rifle mount.

AIR CONDITIONING SYSTEM

1. The air conditioning system unit is part of the heater and is mounted at the front of cab. It is a single unit consisting of a heater core, air conditioning evaporator coil, blower motor, control valves, and air ducts.
2. The system is turned on by the air conditioning control switch on the instrument panel in the cab. The three-speed blower switch controls flow rate.
3. An even cab temperature is maintained by controlling the refrigerant flow thru the evaporator coil, by the air conditioner temperature control switch.



ELECTRONIC SYSTEM

The RT 240 is equipped with several electronic modules, all connected using CAN-BUS technology. The modules can be diagnosed using the IETM and OEM testing equipment. They assist in the operation of major systems such as engine, transmission shifting, steering mode and wheel position, the safe working load control, and many related functions that require data input to operate correctly for the intended uses of the RT 240.

LIFTING BOOM AND TOPHANDLER

The lifting boom and tophandler is an electro-hydraulically operated heavy-duty telescoping boom and spreader assembly, designed to lift, move, and stack/unstack 20-40 ft (6.1-12.2 m) ISO containers. The operator joystick provides complete control of the lifting boom and tophandler during container handling operations. The boom provides lifting/lowering, extending/retracting operations. The tophandler or spreader provides for sideshifting, rotation, forward/rear tilting, left/right tilting, and load leveling and locking operations. The tophandler also provides interface capability with a forklift attachment.

FORKLIFT KIT

The forklift kit is attached to the tophandler twistlocks and two hydraulic hose quick disconnects. Forklift operation is controlled from the tophandler joystick to include adjustable fork tines. The fork tines and vertical support beams fold under the forklift framework for transport.

CHAPTER 2
TROUBLESHOOTING PROCEDURES

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TROUBLESHOOTING INTRODUCTION 0004 00

NOTE

Due to the complexity and interrelationships of the vehicle systems, all troubleshooting is found in TM 10-3930-675-20.

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CHAPTER 3
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

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ENGINE ASSEMBLY REPLACEMENT 0005 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Fixture, engine lifting (Item 27, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, engine and transmission (Item 83, WP 0090 00)

Stand, engine support (Item 88, WP 0090 00)

Stud, guide (WP 0085 00)

Wrench, torque 50-250 lb-ft capacity (Item 104, WP 0090 00)

Wrench, torque 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Compound, gasket forming, silicone (Item 6, WP 0089 00)

Fuel, diesel (Item 12, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Gasket (P/N 182459)

Gasket (P/N 3026134)

Nut, lock (P/N 920076.002)

Washer, lock (98174) (12)

Personnel Required

Three

References

LO 10-3930-675-12

WP 0006 00

WP 0032 00

WP 0055 00

Equipment Condition

Boom raised to maximum angle (TM 10-3930-675-10)

Cab in transport position (TM 10-3930-675-10)

Engine cover removed (TM 10-3930-675-20)

Access covers and skid plates removed (TM 10-3930-675-20)

Battery cables disconnected (TM 10-3930-675-20)

Alternator removed (TM 10-3930-675-20)

Coolant drained and coolant lines disconnected from engine (TM 10-3930-675-20)

Oil drained from engine (TM 10-3930-675-20)

Oil sampling supply hose disconnected (TM 10-3930-675-20)

Transmission dipstick removed (TM 10-3930-675-20)

Fuel supply and drain return hoses disconnected (TM 10-3930-675-20)

Air intake ducts removed (TM 10-3930-675-20)

Exhaust system disconnected from turbocharger (TM 10-3930-675-20)

Turbocharger removed (WP 0025 00)

Electrical interface wiring harness disconnected from ECU and removed (TM 10-3930-675-20)

Electrical wiring harness and leads disconnected from starter (TM 10-3930-675-20)

Ether cold start system removed (TM 10-3930-675-20)

Air conditioning compressor drive belt removed (TM 10-3930-675-20)

CAUTION

- If engine and/or transmission is not operational and boom must be elevated, auxiliary pump can be used to provide hydraulic power for boom operation. Operate pump for not more than 4 minutes and allow pump to cool for not less than two minutes. Perform operate and cool cycle as many times as needed to elevate boom. Failure to allow pump to cool may cause damage to pump.
- Do not begin engine assembly replacement without first having all required tools and equipment to complete the procedure. This will help in reducing the time boom must remain at maximum elevation.

NOTE

Remove engine from front of vehicle using suitable lift.

REMOVAL

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Engine weighs 2070 lb (940 kg). Lifting device must have sufficient capacity to lift engine. Failure to follow this warning may result in death or injury to personnel.
- Improper use of lifting equipment and improper attachment of cable to vehicle can result in serious personnel injury and equipment damage. Observe all standard rules of safety.
- Fuel lines and hoses may contain residual amounts of fuel that may be spilled. To prevent personnel injury from slipping on spilled fuel, spilled fuel should be cleaned up immediately.

NOTE

If AC compressor is being removed for access, it is not necessary to disconnect refrigerant lines.

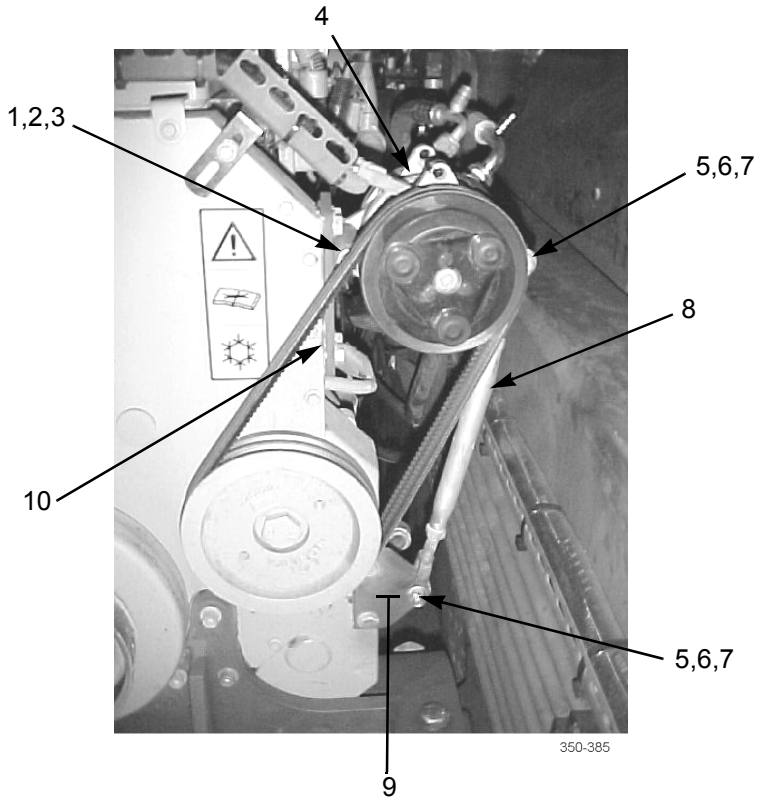
1. Remove all tiedown straps and clamps securing air conditioning refrigerant lines to engine. Discard tiedown straps.
2. Remove screw (5), washer (6), and nut (7) securing drive belt adjustment arm (8) to AC compressor (4).
3. Remove screw (5), washer (6), and nut (7) securing drive belt adjustment arm (8) to engine mount bracket (9). Remove drive belt adjustment arm and retain for installation.
4. Remove screw (1), washer (2), and nut (3) securing AC compressor to engine mount bracket (10).

NOTE

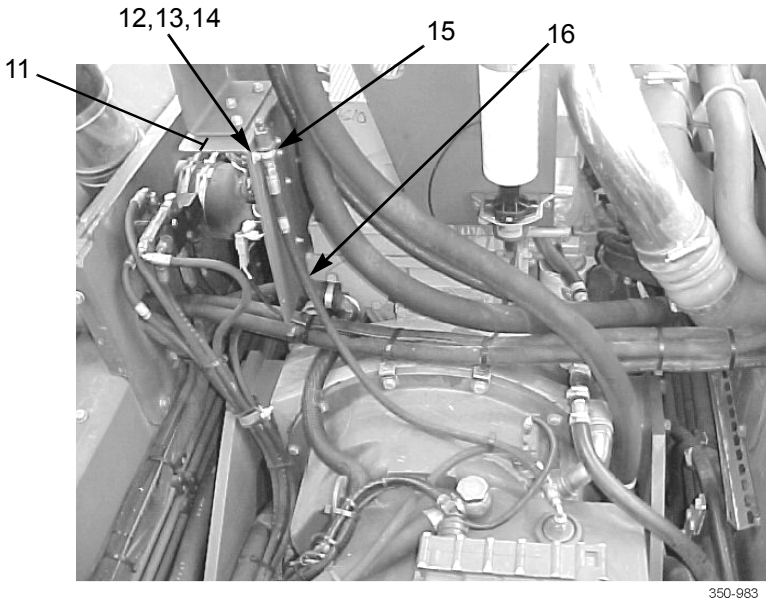
When positioning AC compressor and refrigerant lines free of engine, ensure that refrigerant line connections are not loosened or broken, allowing refrigerant to escape from system.

5. With assistance, remove AC compressor (4) with refrigerant lines attached and position free of engine compartment.

REMOVAL - CONTINUED



6. Remove screw (14), two washers (13), locknut (12), hose clamp (15), and transmission vent hose (16) from bracket (11). Secure vent hose free of engine and discard locknut.



REMOVAL - CONTINUED

NOTE

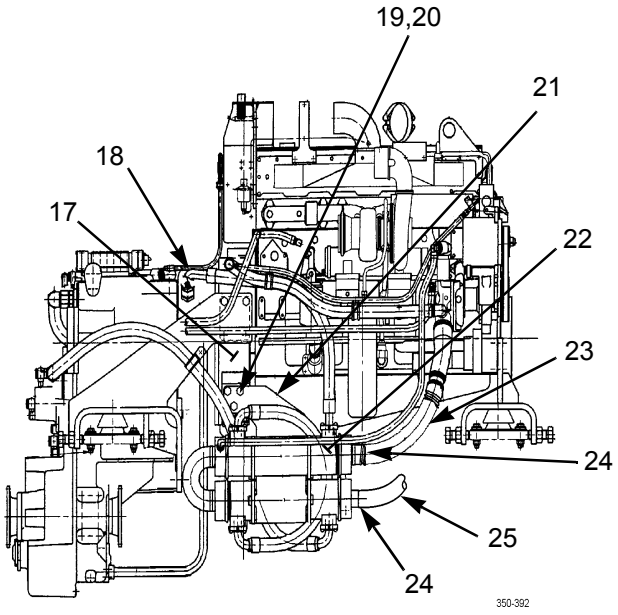
Tag transmission coolant lines to ensure correct installation.

7. Loosen hose clamp (24) and disconnect coolant inlet hose (23) from transmission oil cooler (22).
8. Loosen hose clamp (24) and disconnect coolant outlet hose (25) from transmission oil cooler (22).

NOTE

When removing transmission oil cooler for access, it is not necessary to disconnect oil hoses from transmission oil cooler.

9. Remove hose clamps, screws, washers, and nuts as needed to release transmission oil hoses.
10. Disconnect hydraulic hose (18).
11. Remove three screws (19) and washers (20) securing transmission oil cooler bracket (21) to flywheel housing (17).
12. With assistance, remove transmission oil cooler (22) with hoses attached from flywheel housing (17). Position transmission oil cooler and hoses free of engine lift area.

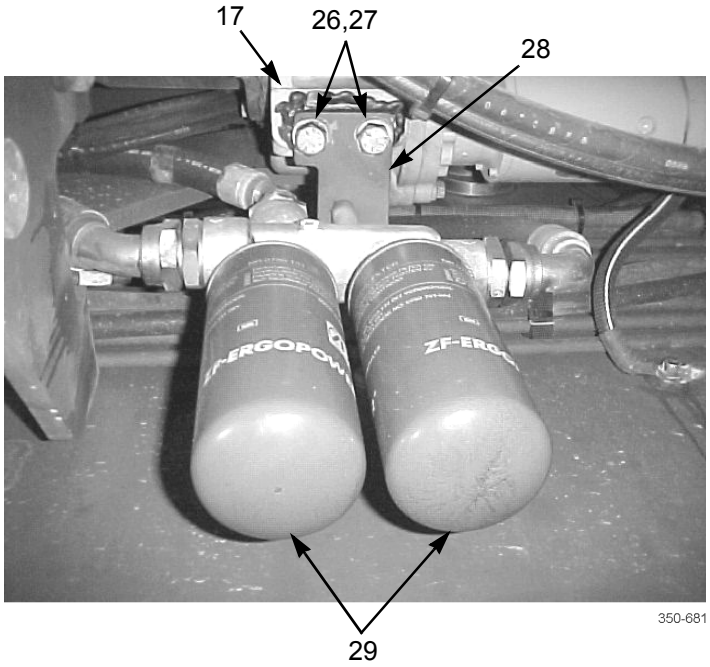


NOTE

When removing transmission oil filters and bracket for access, it is not necessary to disconnect transmission oil hoses from filters.

13. Remove two screws (26) and washers (27) securing transmission oil filter bracket (28) to flywheel housing (17).
14. Remove transmission oil filters (29) and bracket (28) from flywheel housing (17). Position free of engine lift area.

REMOVAL - CONTINUED



NOTE

When removing cooling fan hydraulic pump from engine, it is not necessary to disconnect two hydraulic hoses attached.

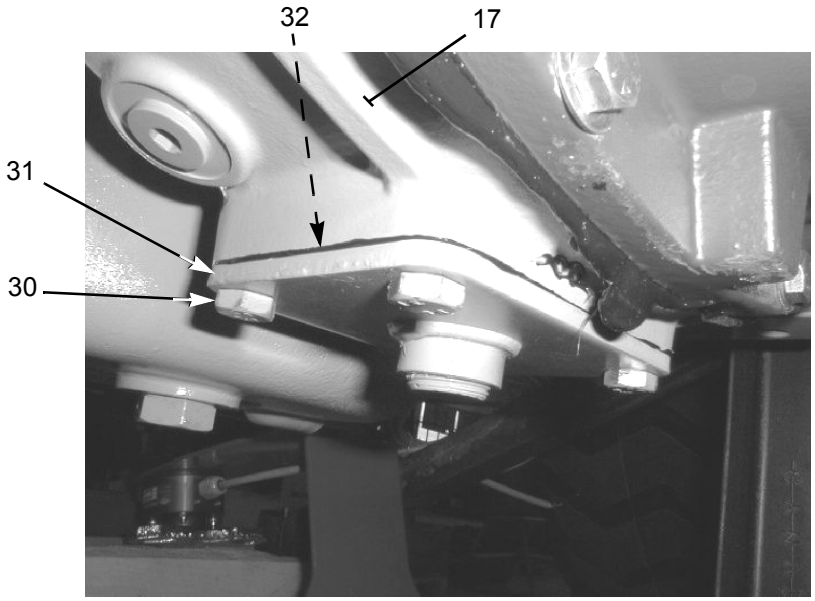
15. Remove cooling fan hydraulic pump from drive adapter of engine and set pump aside (WP 0055 00).

REMOVAL - CONTINUED

WARNING

Engine weighs 2070 lb (940 kg). Lifting device must have sufficient capacity to lift engine. Failure to follow this warning may result in death or injury to personnel.

16. Connect engine lifting fixture and suitable lifting device to engine front and rear lift brackets. Take slack out of chains.
17. Remove four screws (30), access cover (31), and gasket (32) from bottom of flywheel housing (17). Discard gasket.



350-388

18. Remove 12 screws (33) and lockwashers (34) securing transmission to engine flywheel housing (17). Discard lockwashers.

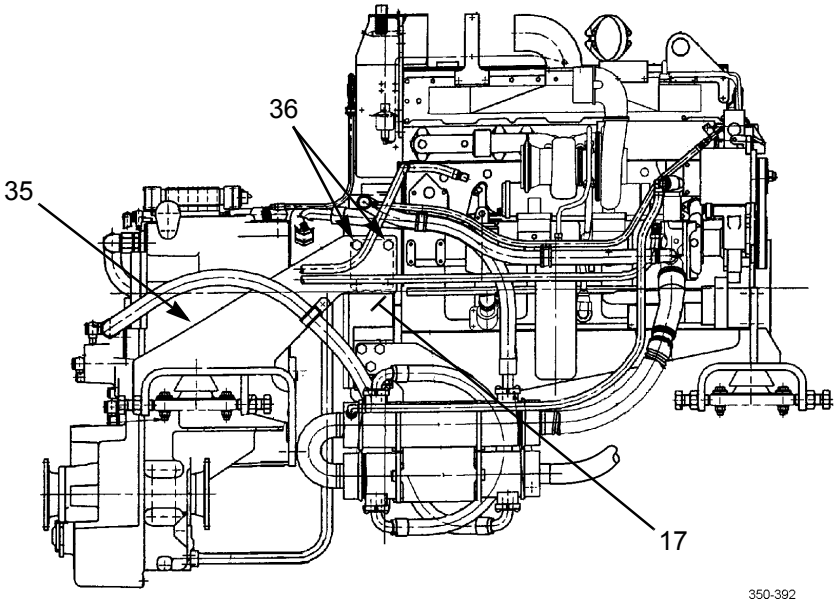
350-391

REMOVAL - CONTINUED

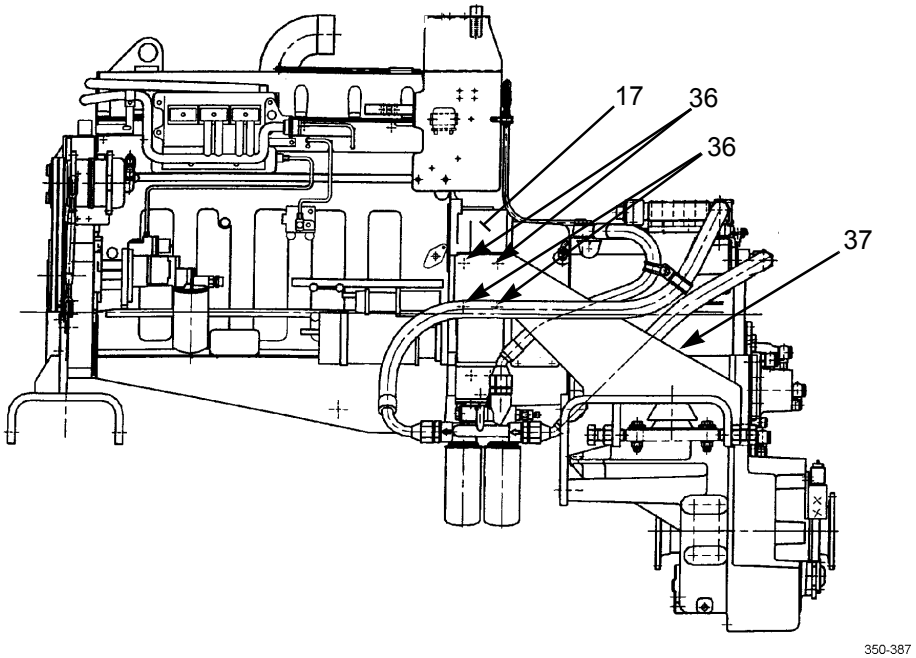
NOTE

Ensure engine weight is supported by lifting device.

19. Remove four screws (36) securing right-rear engine and transmission mounting bracket (35) to flywheel housing (17).



20. Remove four screws (36) securing left-rear engine and transmission mounting bracket (37) to flywheel housing (17).



REMOVAL - CONTINUED

21. Disconnect front engine mounts from engine and from frame. Move front engine mounts forward to gain access to remove engine. (WP 0006 00).

NOTE

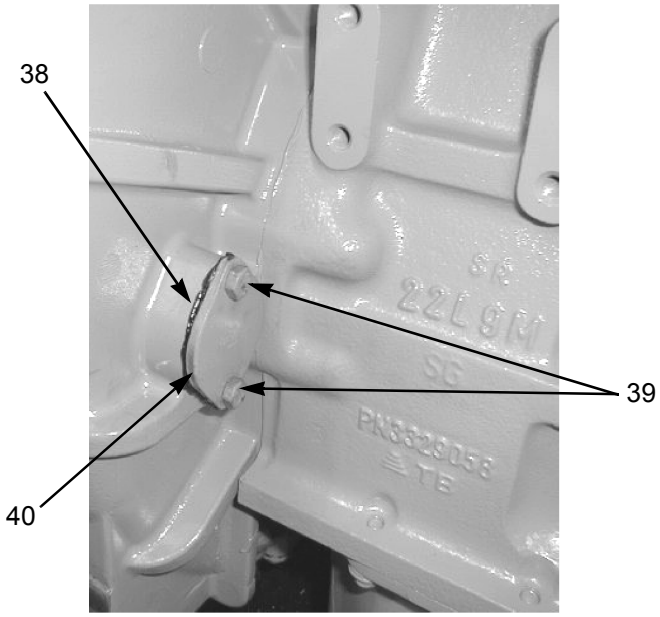
- Damper plates and torque converter should remain with engine during engine removal.
- It may be necessary to tap on transmission-to-engine connection point with plastic-faced hammer to break seal between two units.

22. Carefully separate engine from transmission and lift from vehicle.

NOTE

If replacement engine is being installed, inspect removed engine for components to be removed and transferred to replacement engine.

23. Secure engine on suitable stand or in container.
24. Remove two screws (39), cover (40), and gasket (38) from flywheel-to-damper plate mounting screw access.

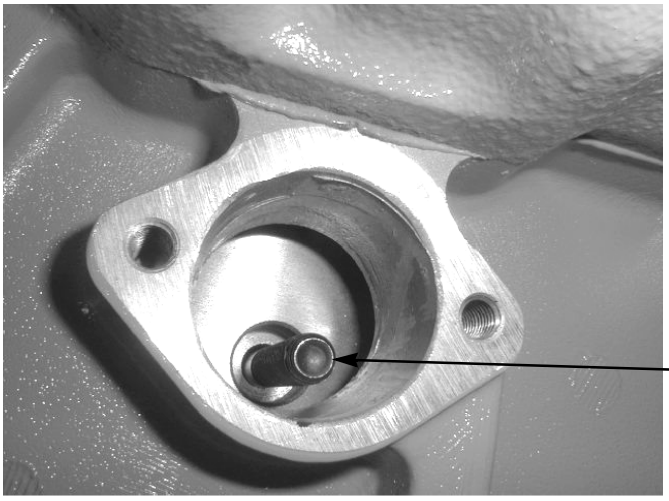


REMOVAL - CONTINUED

NOTE

Flywheel is secured to transmission damper plates with 12 screws.

25. With assistance, bar engine in clockwise direction using accessory drive while observing thru access hole. Stop rotation when screw is visible thru access hole.
26. Remove screw (41) securing flywheel to damper plate.



350-390

27. Repeat steps 25 and 26 to remove remaining eleven screws (41).
28. Upon removal of last screw, insert guide stud and secure to damper plate.

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

29. Remove torque converter and damper plates from engine.

INSTALLATION

WARNING

Engine weighs 2070 lb (940 kg). Lifting device must have sufficient capacity to lift engine. Failure to follow this warning may result in death or injury to personnel.

NOTE

- Ensure all bracket mounting, engine mating, and transmission mating surfaces have been cleaned and are free of old gasket forming compound and gasket material.
- Prior to lowering engine into vehicle, ensure flywheel-to-damper plate screw hole is visible thru access hole in flywheel housing.

1. Install torque converter and damper plates to transmission (WP 0032 00).
2. Using suitable lifting device and engine lifting fixture, lower engine into vehicle.
3. Apply coat of silicone gasket forming compound to engine and transmission mating surface.

NOTE

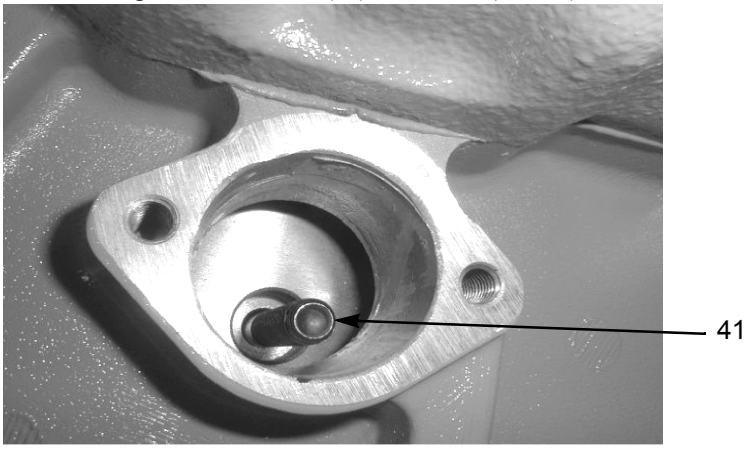
It may be necessary to adjust transmission damper plate by hand to aline guide stud with mating flywheel screw hole.

4. Position engine to allow damper plate guide stud to pass thru flywheel-to-damper screw hole and flywheel housing access.

NOTE

Flywheel and damper plates are secured with 12 screws; final tightening is done after all screws are installed.

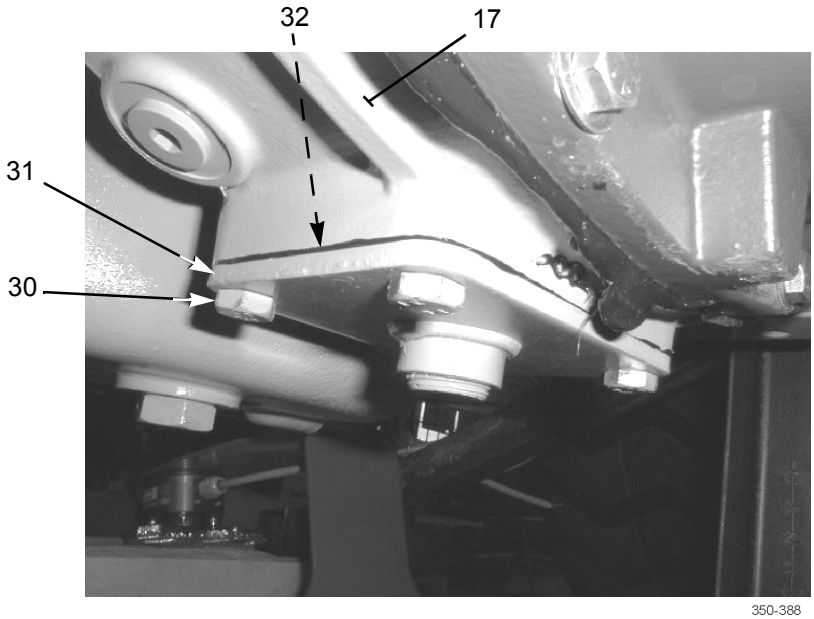
5. Remove guide stud and install screw (41). Tighten screw hand tight.
6. Bar engine over until next screw hole is visible and install screw (41). Tighten screw hand tight.
7. Repeat step 6 for remaining screws until 12 screws are installed securing flywheel to damper plate.
8. Bar engine over clockwise and final tighten each screw (41) to 48 lb-ft (65 Nm).



INSTALLATION - CONTINUED

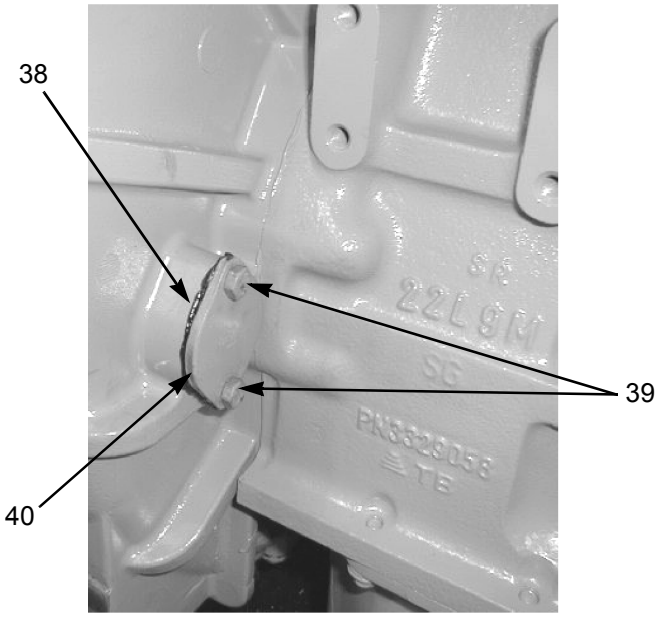
9. Install 12 screws (33) and new lockwashers (34) to secure transmission to flywheel housing (17). Tighten screws to 38 lb-ft (52 Nm).

10. Install access cover (31) and new gasket (32) on bottom of flywheel housing (17) with four screws (30).

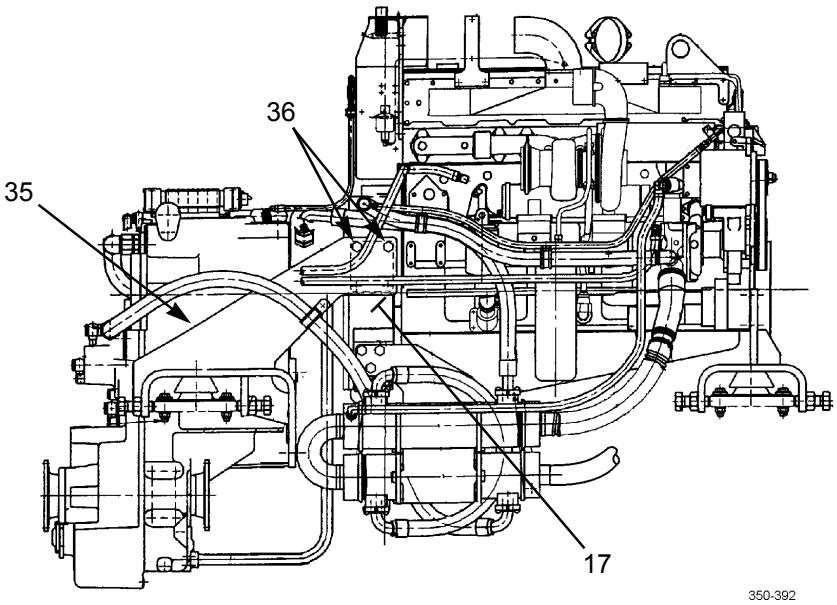


INSTALLATION - CONTINUED

11. Install cover (40) and new gasket (38) with two screws (39) over flywheel-to-damper plate screw access.

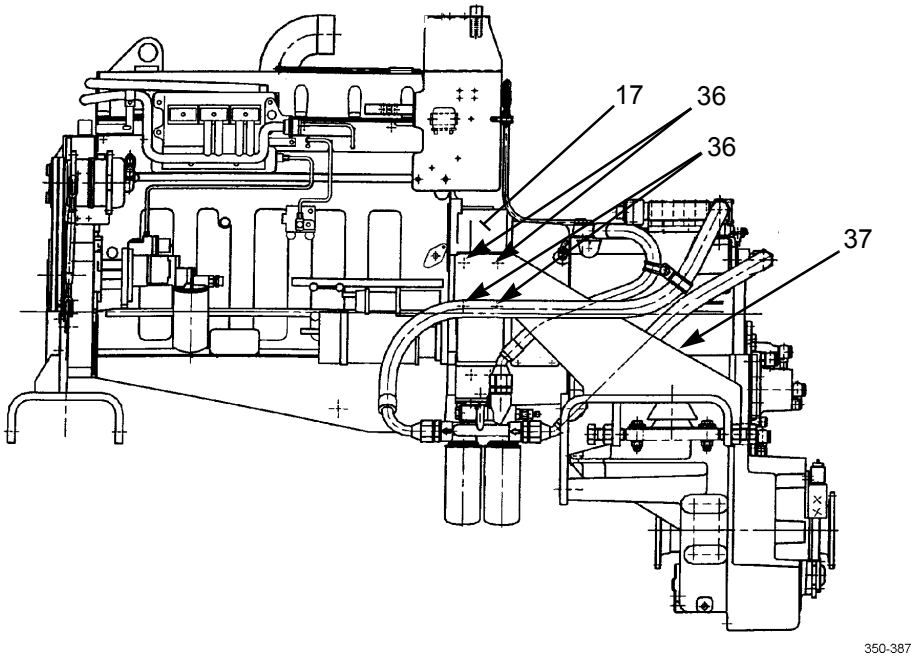


12. Apply gasket forming compound to mounting surface and install 4 screws (36) to secure right-rear engine and transmission mounting bracket (35) to flywheel housing (17). Tighten screws to 116 lb-ft (157 Nm).



INSTALLATION - CONTINUED

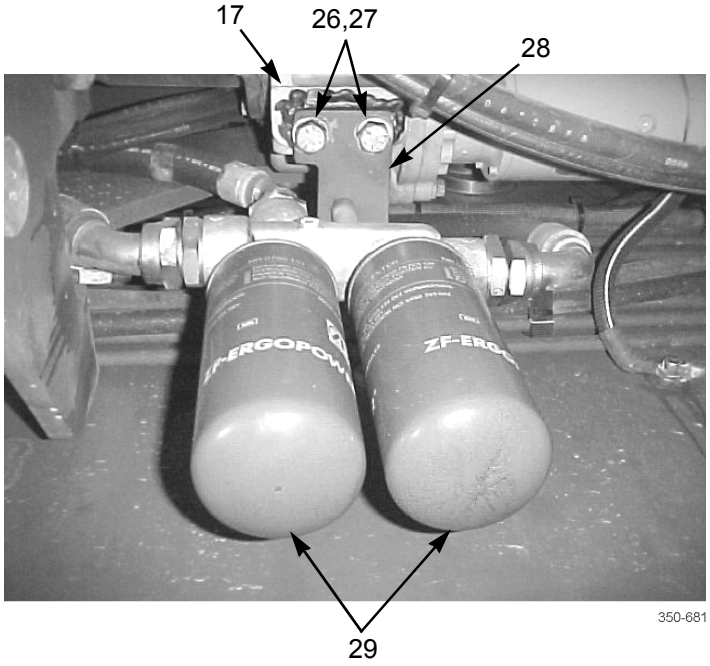
13. Apply gasket forming compound to mounting surface and install four screws (36) to secure left-rear engine and transmission mounting bracket (37) to flywheel housing (17). Tighten screws to 116 lb-ft (157 Nm).



14. Install front engine mounts to frame and to engine (WP 0006 00).

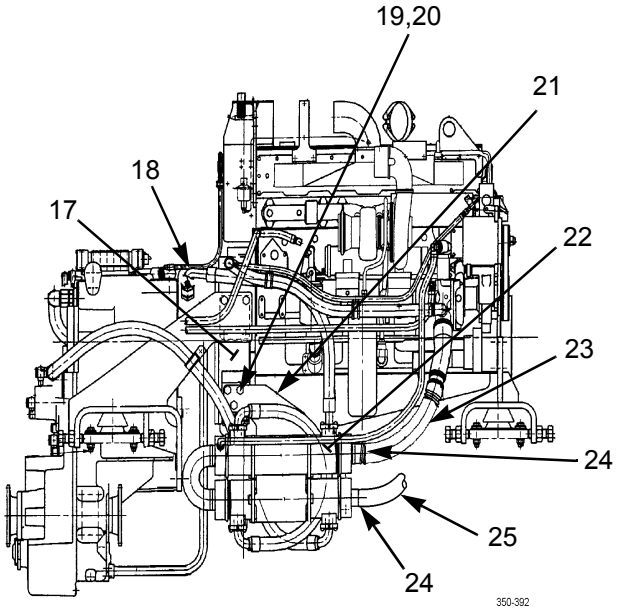
15. Release tension on engine lifting fixture chains and disconnect lifting device and lifting fixture from engine lift brackets.

16. Apply gasket forming compound to mounting surface on flywheel housing (17) and install two screws (26) and washers (27) to secure transmission oil filter bracket (28) with transmission oil filters (29) and hoses in place. Tighten screws to 116 lb-ft (157 Nm).

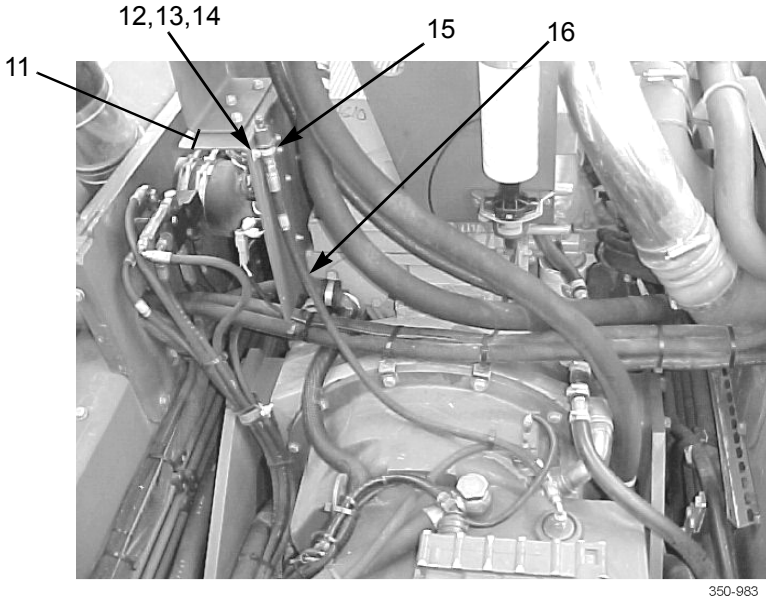


INSTALLATION - CONTINUED

17. Install cooling fan hydraulic pump to drive adapter of engine (WP 0055 00).
18. Apply gasket forming compound to mounting surface on flywheel housing (17) and install three screws (19) and washers (20) to secure transmission oil cooler bracket (21) with oil cooler (22) and transmission oil hoses. Tighten screws to 116 lb-ft (157 Nm).
19. Connect hydraulic hose (18).
20. Install hose clamps, screws, washers, and nuts as necessary to secure transmission oil hoses.
21. Install coolant inlet hose (23) and coolant hose outlet (25) to transmission oil cooler (22) and secure with hose clamps (24).

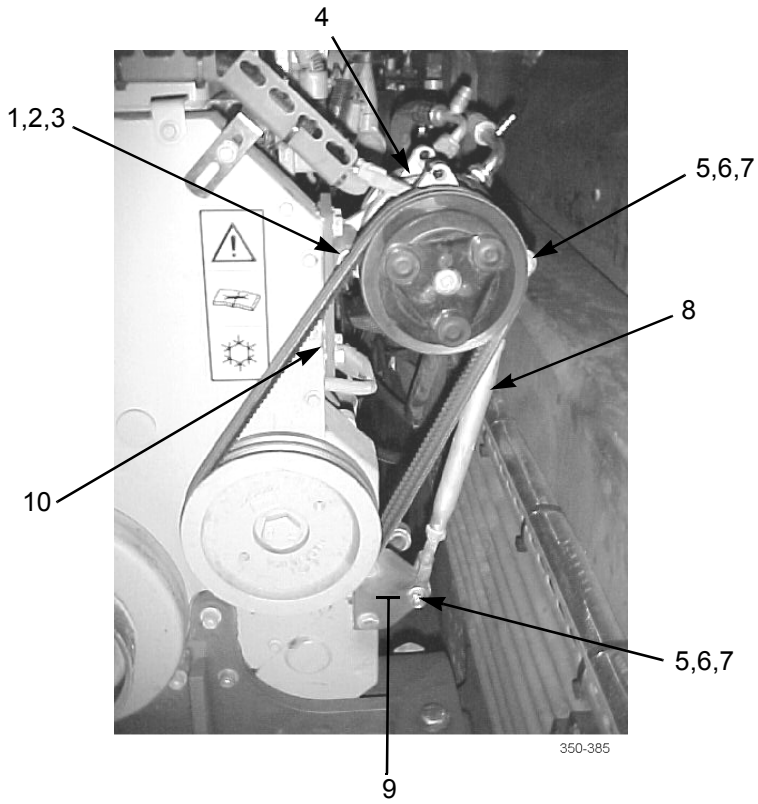


22. Install transmission vent hose (16), hose clamp (15), screw (14), two washers (13), and new locknut (12) to bracket (11).



INSTALLATION - CONTINUED

23. Position AC compressor (4) with refrigerant lines on engine mount bracket (10) and secure with screw (1), washer (2), and nut (3).
24. Position drive belt adjustment arm (8) and secure one end to engine mount bracket (9) and opposite end to AC compressor (4) with two screws (5), washers (6), and nuts (7).



25. Install and adjust AC compressor drive belt (TM 10-3930-675-20).
26. Install ether cold start system (TM 10-3930-675-20).
27. Connect electrical wiring harness and leads to starter (TM 10-3930-675-20).
28. Connect electrical interface wiring harness to ECU (TM 10-3930-675-20).
29. Install turbocharger (WP 0025 00).
30. Connect exhaust system to turbocharger (TM 10-3930-675-20).
31. Install air intake ducts (TM 10-3930-675-20).
32. Connect coolant lines to engine (TM 10-3930-675-20).
33. Install transmission dipstick (TM 10-3930-675-20).
34. Connect oil sampling supply hose to engine (TM 10-3930-675-20).
35. Connect fuel supply and drain return hoses (TM 10-3930-675-20).
36. Install alternator (TM 10-3930-675-20).
37. Connect battery cables (TM 10-3930-675-20).
38. Check and fill all fluids (fuel, coolant, engine oil, transmission oil) to proper level (LO 10-3930-675-12).

INSTALLATION - CONTINUED

CAUTION

If normal engine oil pressure is not indicated within 15 seconds, shut down engine immediately. Failure to follow this caution may result in serious engine damage.

39. Operate engine for three minutes, shut down, and check for fluid leaks and proper indications (TM 10-3930-675-10).
40. Operate engine to normal temperature and check operation (TM 10-3930-675-10).
41. Install access covers and skid plates (TM 10-3930-675-20).
42. Install engine cover (TM 10-3930-675-20).
43. Return cab to operational position and lower boom (TM 10-3930-675-10).

END OF WORK PACKAGE

ENGINE MOUNTS AND LIFTING BRACKETS REPLACEMENT 0006 00

THIS WORK PACKAGE COVERS

Lifting Brackets: Removal, Installation

Front Engine Mount: Removal, Installation

Rear Engine Mount: Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Trestle, hoist, portable: 7 ton capacity (Item 94, WP 0090 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Compound, sealing (Item 9, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Personnel Required

Two

Equipment Condition

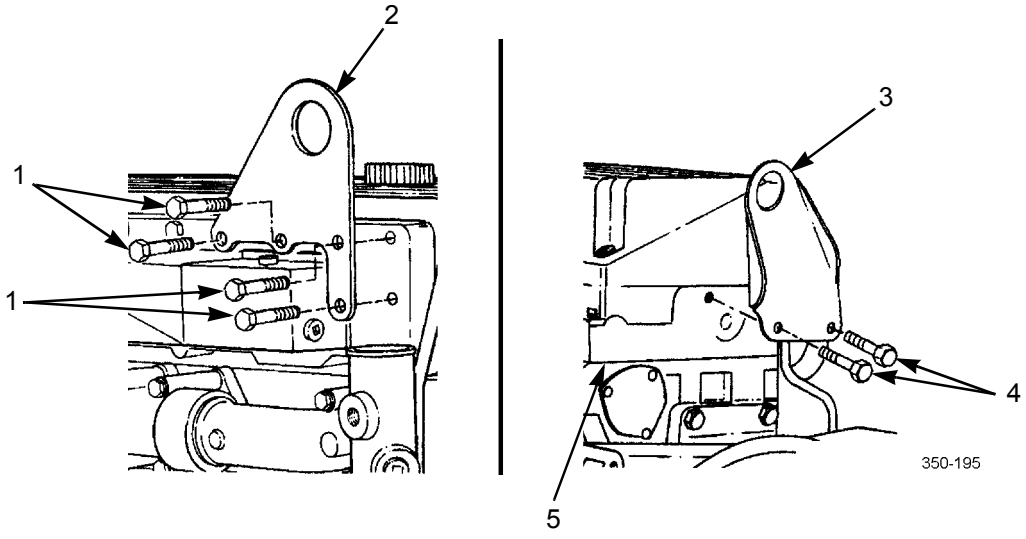
Engine cover removed (TM 10-3930-675-20)

Cab in transport position (TM 10-3930-675-10)

Access covers removed (TM 10-3930-675-20)

LIFTING BRACKETS REMOVAL

1. Remove four screws (1) securing front lifting bracket (2) and two screws (4) securing rear lifting bracket (3).
2. Remove front and rear lifting brackets (2 and 3) from cylinder head (5).



LIFTING BRACKETS INSTALLATION

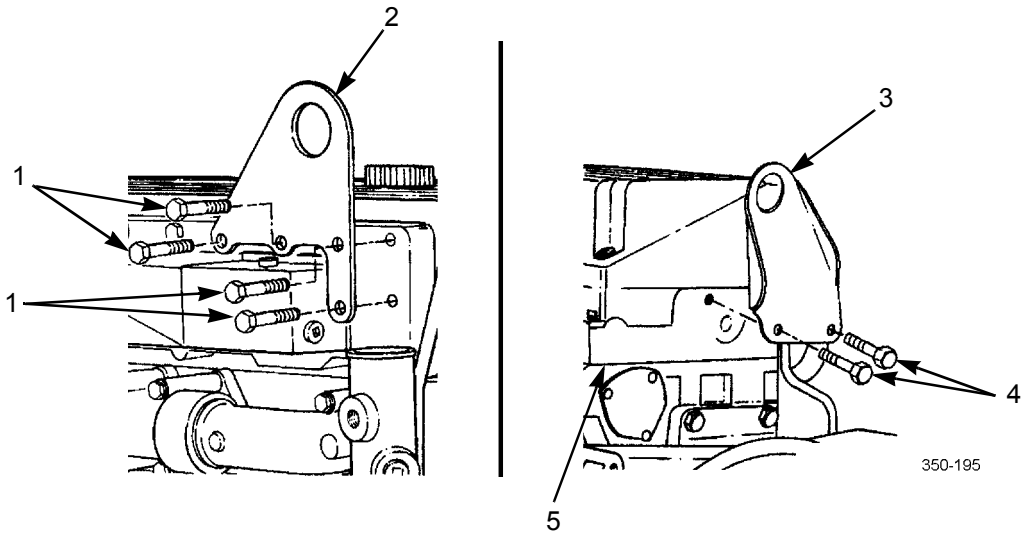
CAUTION

Do not use or install a cracked, bent or otherwise damaged lifting bracket. Do not weld a cracked bracket.

NOTE

Ensure lifting brackets are not cracked or bent and are clean and free of dirt.

1. Position front lifting bracket (2) and secure with four screws (1). Tighten screws to 35 lb-ft (47 Nm).
2. Position rear lifting bracket (3) and secure with two screws (4). Tighten screws to 60 lb-ft (81 Nm).



3. Install access covers (TM 10-3930-675-20).
4. Return cab to operational position (TM 10-3930-675-10).
5. Install engine cover (TM 10-3930-675-20).

FRONT ENGINE MOUNT REMOVAL

CAUTION

Position trestle under front of engine to assist with supporting weight while front engine mounts are not in place. DO NOT, however, position trestle under oil pan. Damage to oil pan may result.

1. Position suitable lifting device and attach to engine front lifting bracket (2).

NOTE

Right- and left-front engine shock mounts are removed in same manner. Perform step 2 thru 5 on both front engine shock mounts.

2. Loosen two jamnuts (14) and loosen two adjusting screws (13).

NOTE

Adjust lifting device to support weight of engine without applying tension on mounting hardware.

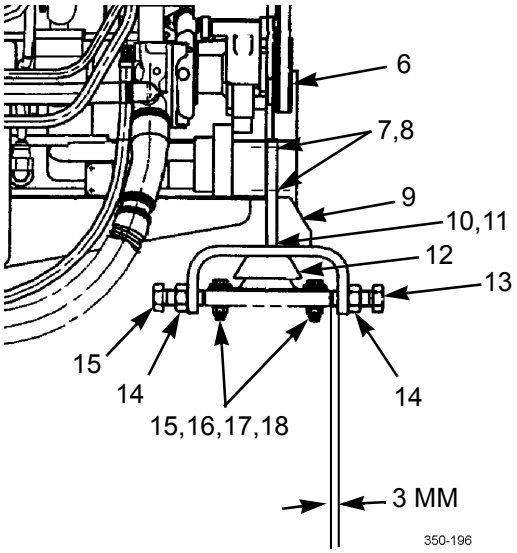
FRONT ENGINE MOUNT REMOVAL - CONTINUED

3. Remove screw (10) and washer (11) securing front engine mount (9) to shock mount (12).
4. Remove two nuts (18), four washers (16 and 17), and two screws (15) securing shock mount (12) in place.
5. Lift engine (6) slightly to relieve pressure on shock mount (12). Remove shock mount.

NOTE

To remove front engine mount, perform steps 6 and 7.

6. Remove six screws (7) and washers (8) securing front engine mount (9) to engine (6).
7. Remove front engine mount (9) from vehicle.



FRONT ENGINE MOUNT INSTALLATION

NOTE

If front engine mount was removed, install as follows.

1. Apply a light coat of sealing compound to front engine mount (9) and install on engine (6) with six washers (8) and screws (7). Tighten screws to 50 lb-ft (68 Nm).

NOTE

Ensure engine is supported by suitable lifting device and remove trestle from under front of engine.

2. Position shock mount (12) and secure in place with two screws (15), four washers (16 and 17), and two nuts (18). Tighten nuts to 125 lb-ft (169 Nm).
3. Position front engine mount (9) over shock mount (12) and secure with screw (10) and washer (11). Tighten screw to 288 lb-ft (390 Nm).
4. Set front engine mount adjusting screws (13) for a clearance of 3 mm (0.12 in) and tighten jamnuts (14).
5. Install access covers (TM 10-3930-675-20).
6. Return cab to operational position (TM 10-3930-675-10).

FRONT ENGINE MOUNT INSTALLATION - CONTINUED

7. Install engine cover (TM 10-3930-675-20).

REAR ENGINE MOUNT REMOVAL

CAUTION

Position trestle under rear of engine to assist with supporting weight while rear engine mount is not in place. DO NOT, however, position trestle under oil pan. Damage to oil pan may result.

1. Position suitable lifting device and attach to engine lifting brackets.

NOTE

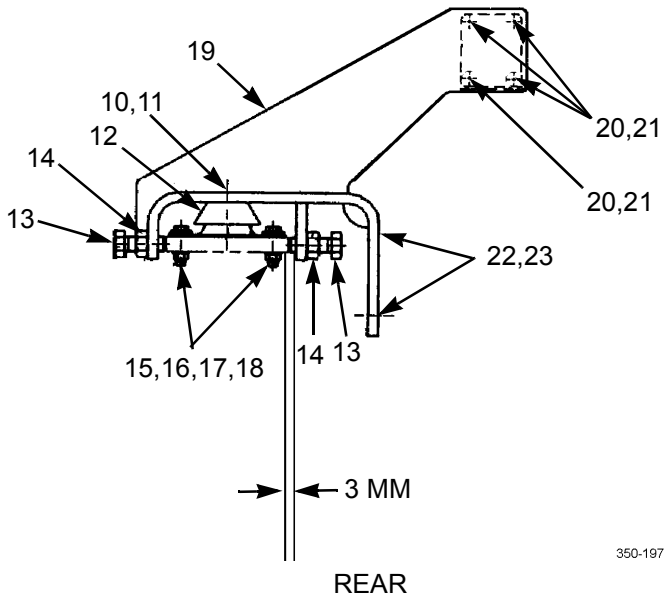
Left- and right-rear engine shock mounts are removed in same manner.

2. Loosen two jamnuts (14) and loosen two adjusting screws (13).

NOTE

Adjust lifting device to support weight of engine without applying tension on mounting hardware.

3. Remove four screws (20) and washers (21) to disconnect rear support bracket (19) from engine.
4. Remove two screws (22) and washers (23) to disconnect rear support bracket (19) from transmission.
5. Remove screw (10) and washer (11) securing rear support bracket (19) to shock mount (12).
6. With assistance, lift rear support bracket (19) from installed location.
7. Remove two nuts (18), four washers (16 and 17), two screws (15), and shock mount (12).



REAR ENGINE MOUNT INSTALLATION

1. Position shock mount (12) and secure in place with two screws (15), four washers (16 and 17), and two nuts (18). Tighten nuts to 125 lb-ft (169 Nm).

NOTE

Ensure engine and transmission are supported by suitable lifting device and remove trestle from under engine.

2. With assistance, lower rear support bracket (19) into position over shock mount (12) and secure with screw (10) and washer (11). Tighten screw to 288 lb-ft (390 Nm).
3. Position rear support bracket (19) on engine and secure four screws (20) and washers (21). Tighten screws to 115 lb-ft (156 Nm).
4. Position rear support bracket (19) to transmission and secure with two screws (22) and washers (23). Tighten screws to 100 lb-ft (135 Nm).
5. Set rear support bracket adjusting screws (13) for a clearance of 3 mm (0.12 in) and tighten jamnuts (14).
6. Install access covers (TM 10-3930-675-20).
7. Return cab to operational position (TM 10-3930-675-10).
8. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

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CYLINDER HEAD REPLACEMENT 0007 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Bracket, lifting, cylinder head (Item 7, WP 0090 00)

Gage, capscrew, cylinder head (Item 28, WP 0090 00)

Wrench set, socket attachment, torx (Item 95, WP 0090 00)

Wrench, torque 50-250 lb-ft capacity (Item 104, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Abrasive pad (Item 1, WP 0089 00)

Fuel, diesel (Item 12, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Materials/Parts - Continued

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Gasket set (P/N 3803293)

References

TM 10-3930-675-10

WP 0014 00

WP 0023 00

Equipment Condition

Air intake ducts removed (TM 10-3930-675-20)

Rocker arm cover removed (TM 10-3930-675-20)

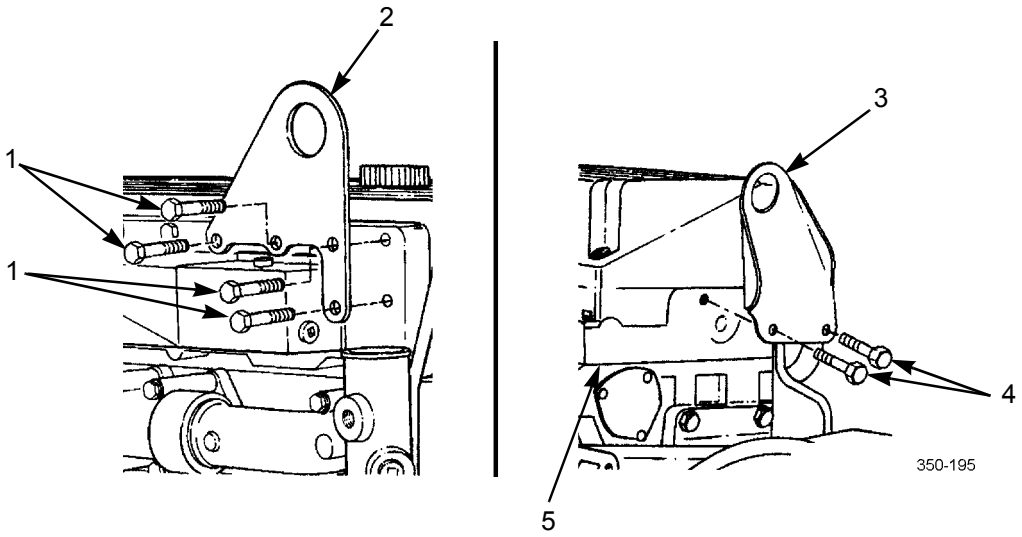
Turbocharger removed (WP 0025 00)

Exhaust manifold removed (WP 0018 00)

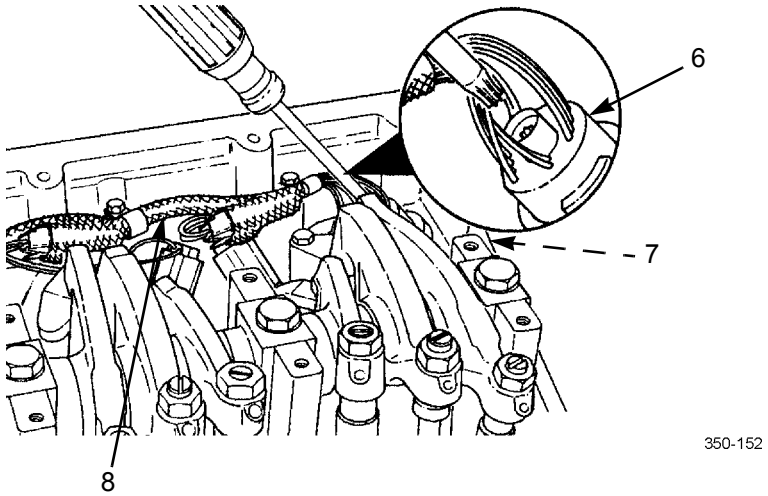
Cooling system drained (TM 10-3930-675-20)

REMOVAL

1. Remove four screws (1) securing front lifting bracket (2) and two screws (4) securing rear lifting bracket (3) to cylinder head (5).



2. Disconnect connector (6) of cylinder head wiring harness (8) from engine harness (7).

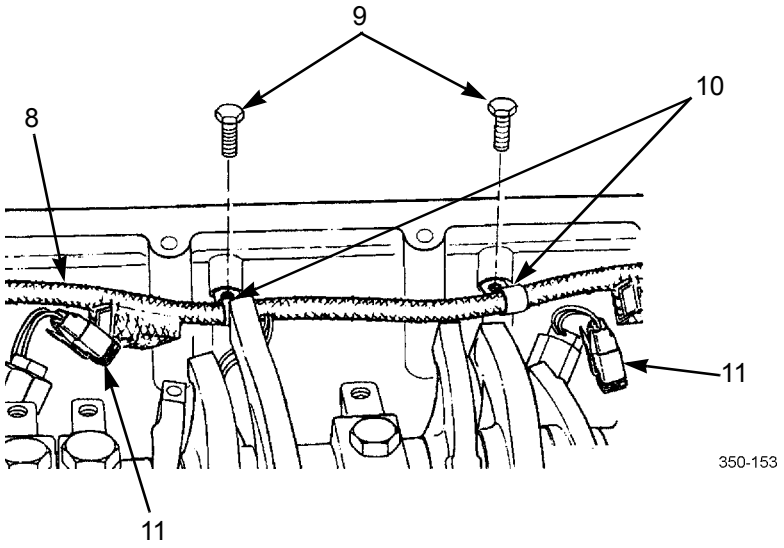


NOTE

Tag wiring harness to identify injector connections and positions prior to removal to ensure correct connection on installation.

REMOVAL - CONTINUED

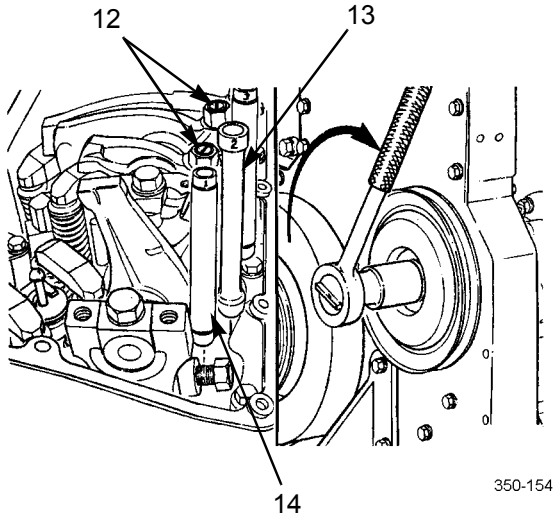
3. Disconnect six fuel injector connectors (11) from cylinder head wiring harness (8).
4. Remove screws (9) securing clamps (10) and cylinder head wiring harness (8) in place and remove cylinder head wiring harness.



NOTE

Mark position of valve push tubes and injector push rods. Push tubes and rods must be installed in same positions during installation.

5. Loosen rocker lever adjusting screws (12). Remove valve push tubes (14) and injector push rods (13).



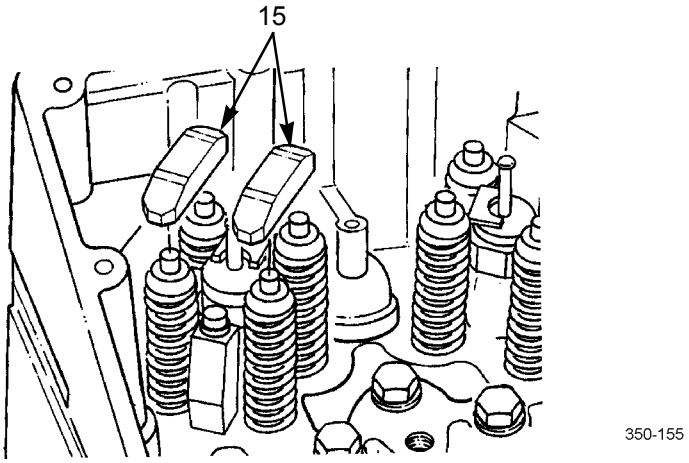
REMOVAL - CONTINUED

6. Remove rocker arm assembly (WP 0014 00).

NOTE

Mark position of crossheads prior to removal. Crossheads must be installed in same position during assembly.

7. Remove crossheads (15).

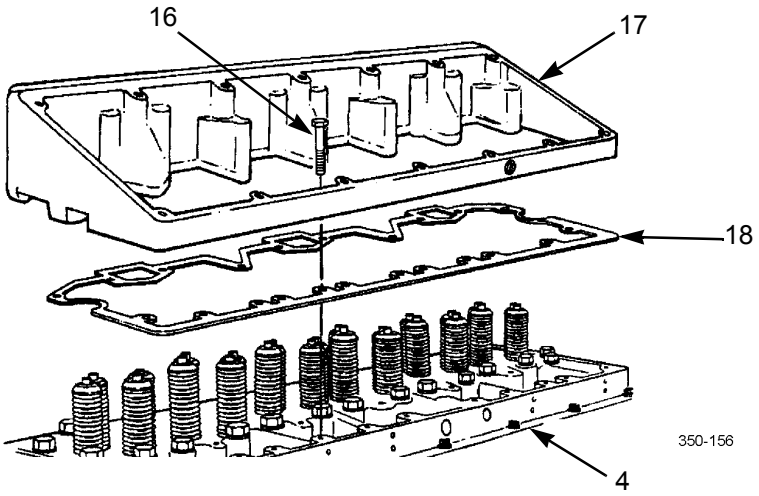


8. Remove fuel injectors (WP 0023 00).

NOTE

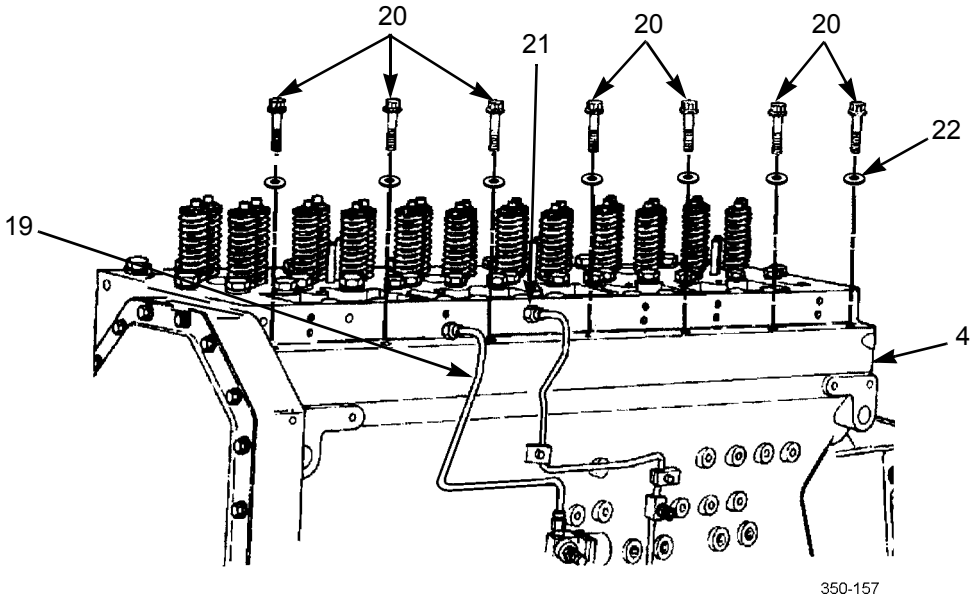
Rocker lever housing and intake manifold are removed as a single unit.

9. Remove 24 screws (16) securing rocker lever housing (17) and gasket (18) to cylinder head (4). Remove rocker lever housing and intake manifold as a single unit.



REMOVAL - CONTINUED

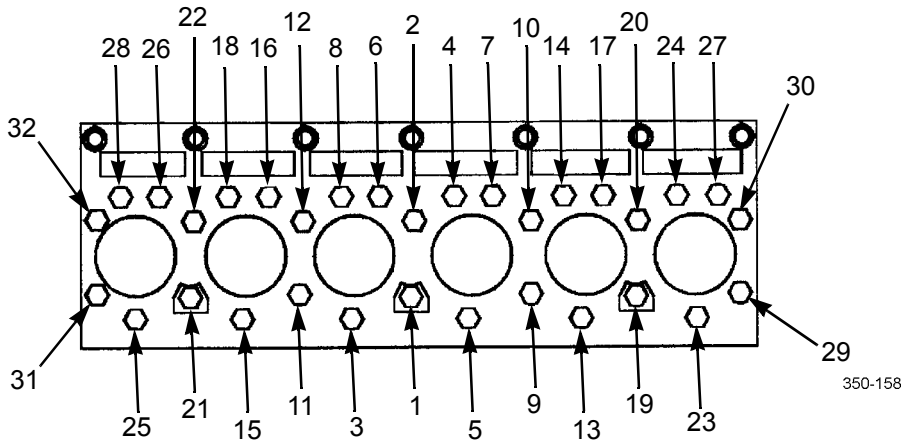
10. Disconnect fuel supply line (19) and fuel drain line (21) from cylinder head (4).
11. Remove seven 12-point cylinder head screws (20) and sealing washers (22) on fuel pump side of engine.



NOTE

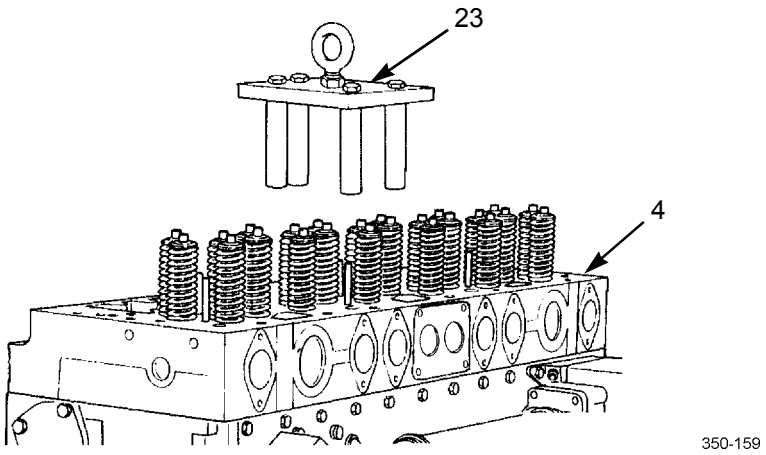
Three cylinder head screws are located inside intake ports.

12. Remove remaining 32 cylinder head screws (20) in sequence shown.



REMOVAL - CONTINUED

13. Install cylinder head lifting bracket (23) to cylinder head (4) and secure with two rocker lever support mounting screws and two long rocker housing screws. Tighten screws to 35 lb-ft (47 Nm).



WARNING

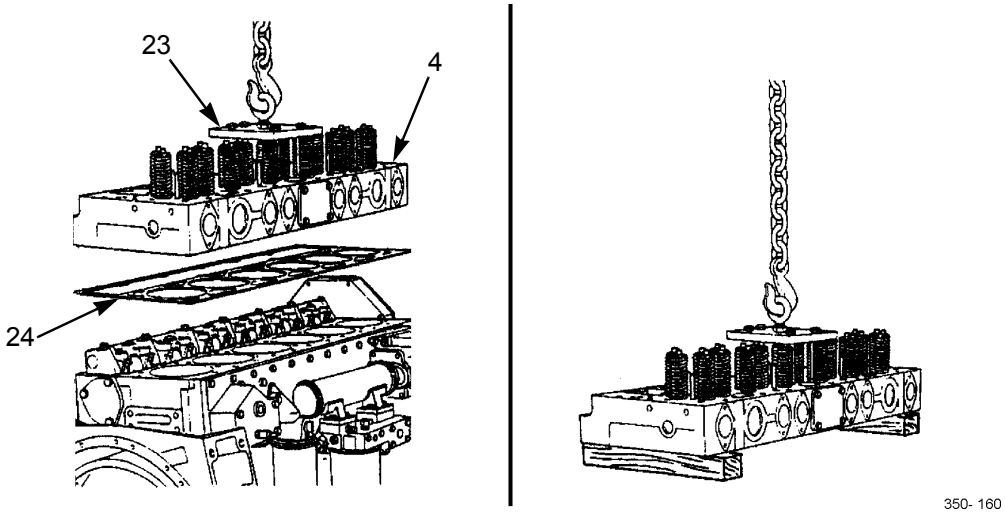
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury to personnel.

CAUTION

Place cylinder head on wooden blocks to prevent damage to combustion face.

REMOVAL - CONTINUED

14. Attach lifting device to cylinder head lifting bracket (23). Lift cylinder head (4) from engine and place on wooden blocks. Remove and discard head gasket (24).



CLEANING

WARNING

Dry cleaning solvent P-D-680 type III is toxic and flammable. Use protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200ºF (94ºC). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contact eyes, wash your eyes and get medical aid immediately.

NOTE

Place clean, lint-free rags over cam followers and above pistons to prevent dirt and other foreign matter from entering engine. Plug or cover coolant and oil passages in cylinder block deck.

1. Remove all gasket material from cylinder block deck surface.

CAUTION

Do not use caustic or acid solutions to clean cylinder head screws.

2. Clean threads of cylinder head screws with dry cleaning solvent and wire brush.

CLEANING - CONTINUED

WARNING

- When using steam cleaner, wear protective clothing and eye protection. Hot steam will cause serious burns.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

3. Steam clean cylinder head and dry with compressed air.
4. Use abrasive pad to clean exhaust gasket surface, rocker housing gasket surface, and combustion face of cylinder head.

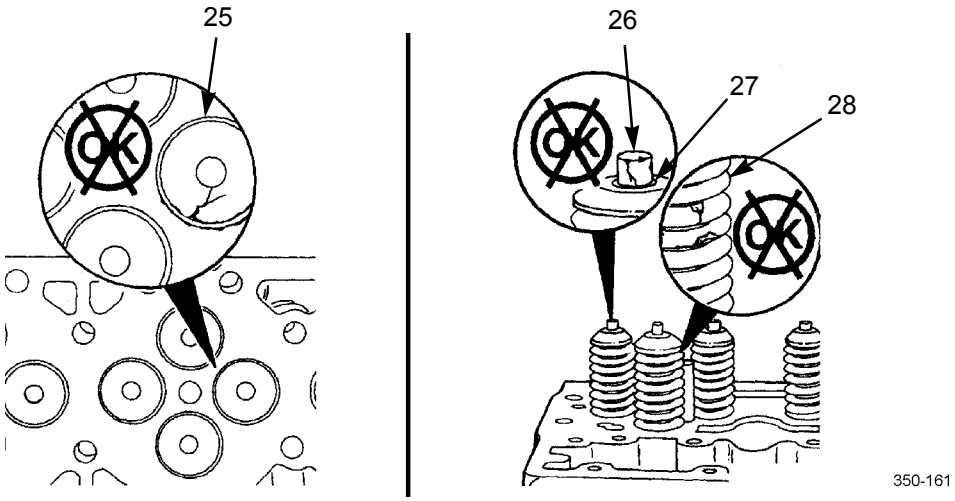
INSPECTION

1. Visually inspect fuel drillings and water passages for restrictions or foreign material. Remove any obstructions.

NOTE

If conditions in steps 2 and 3 below are found, cylinder head must be disassembled and repaired. If conditions are not noted, proceed to step 4.

2. Visually inspect valves (25) and valve springs (28) for cracks, bent or broken valve stems (26), broken valve spring collets (27) or other damage.
3. Visually inspect valves (25) for indications of leakage or burning.

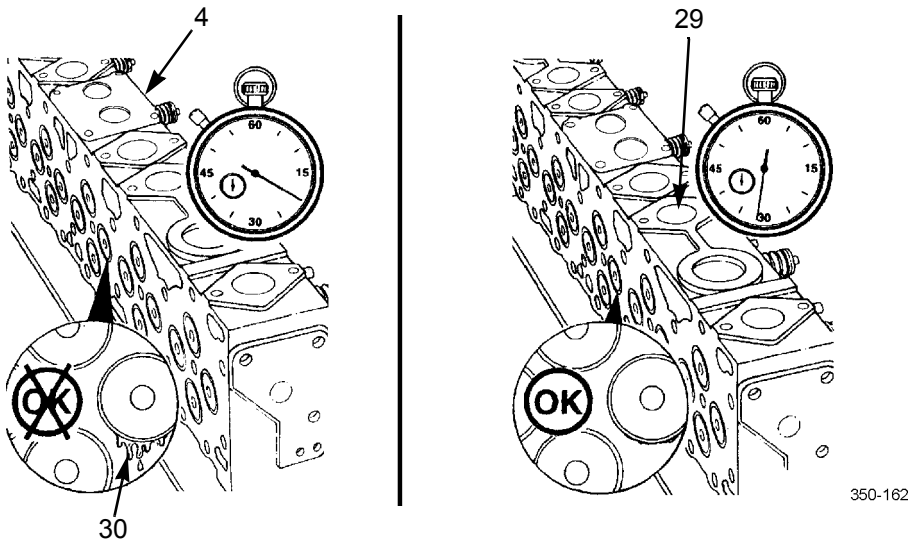


NOTE

Leak test is performed to determine if intake or exhaust valves must be resurfaced. If any valve fails test, all valves and valve seats must be replaced.

INSPECTION - CONTINUED

4. Perform leak test for exhaust valves as follows:
   a. Place cylinder head (4) on work bench with exhaust ports facing up.
   b. Pour fuel into exhaust port (29) until full.
   c. If fuel drips (30) or runs down face of head within 30 seconds, disassemble and repair cylinder head.
   d. Perform steps b and c for each exhaust port.



5. Perform leak test for intake valves as follows:
   a. Place cylinder head on work bench with exhaust ports facing up.
   b. Pour fuel into one intake port until full.

NOTE

Each intake port supplies two cylinders on M Series cylinder heads.

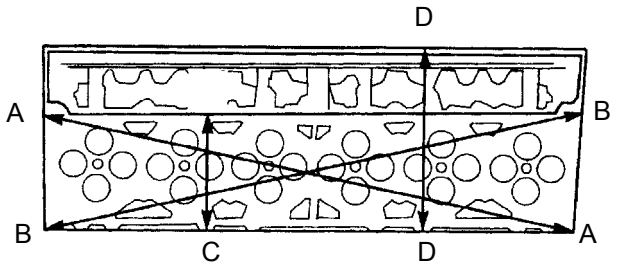
   c. If fuel drips or runs down face of cylinder head within 30 seconds, disassemble and repair cylinder head.
   d. Perform steps b and c for all six cylinders.

INSPECTION - CONTINUED

NOTE

Dimensions CC and DD must be checked from front to rear of cylinder head.

6. Measure flatness of cylinder head combustion face surface as follows:
   a. AA and BB (corner to corner)
   b. CC (across combustion face)
   c. DD (across entire head surface)
   d. Measurements must be as noted in Table 1.



350-163

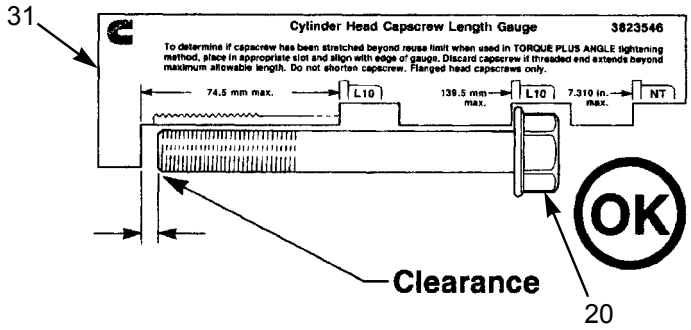
Table 1. Cylinder Head Flatness Measurements.

CYLINDER HEAD FLATNESS	MM		IN
AA and BB	0.200	MAX	0.008
CC	0.076	MAX	0.003
DD	0.127	MAX	0.005

NOTE

Use slot marked for L10 cylinder head screws when checking M11 cylinder head screws.

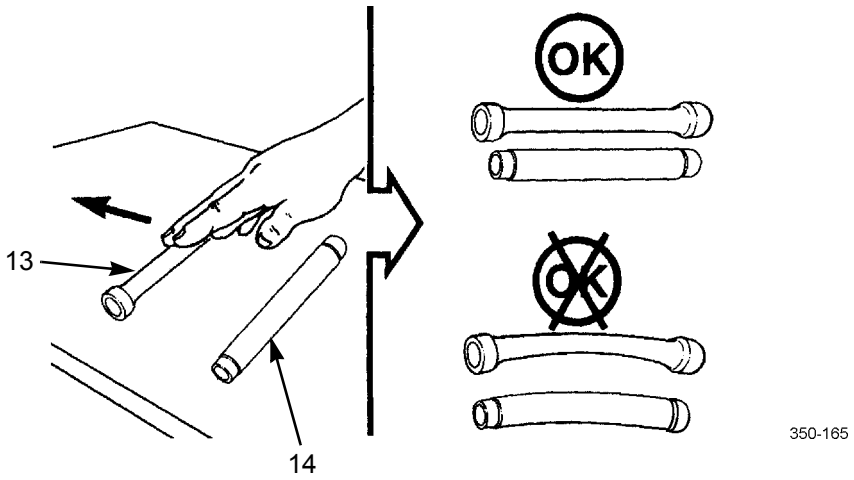
7. Check free length of 32 cylinder head screws (20), using screw length gage (31). If end of screw touches foot of gage, screw is too long and must be replaced. If there is clearance between end of screw and bottom base of gage, screw can be reused.



350-164

INSPECTION - CONTINUED

8. Inspect push rods (13) and push tubes (14) for excessive or uneven wear and bending. If push rod or tube is bent, shows excessive wear or is filled with oil, it must be replaced.



INSTALLATION

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

CAUTION

Do not drop cylinder head on gasket. Gasket material can be damaged.

NOTE

Ensure shipping plug and plastic insert are removed from fuel inlet and fuel drain passage. If plastic insert is not removed from passage of fuel inlet line connection, engine will not start.

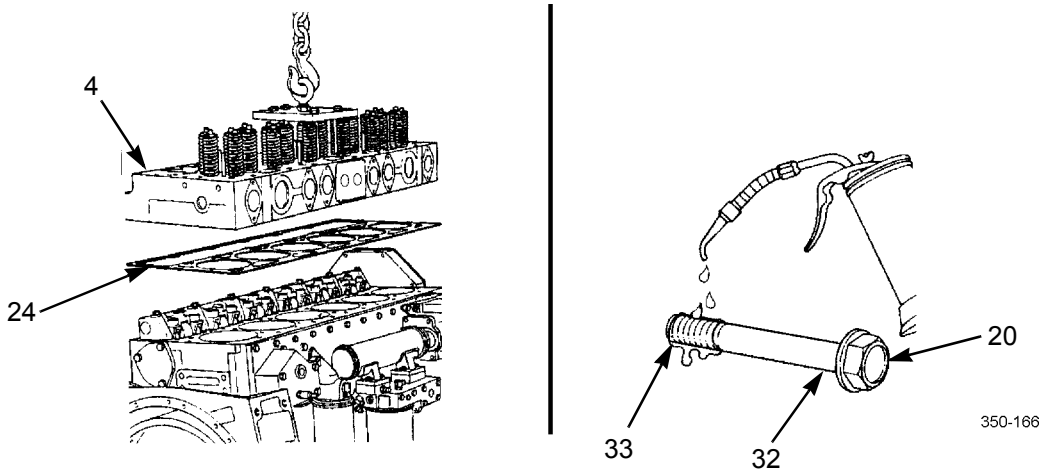
INSTALLATION - CONTINUED

1. Position new cylinder head gasket (24) on engine block and set cylinder head (4) in place.
2. Apply a light coating of clean lubricating oil to thread (33) and flange (32) area of cylinder head screws (20).

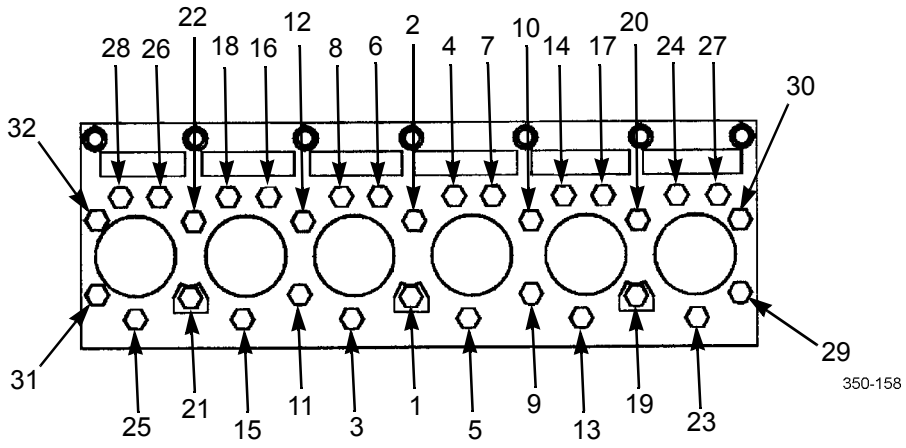
NOTE

Ensure three cylinder head screws are installed inside intake ports.

3. Install and hand tighten 32 cylinder head screws (20).



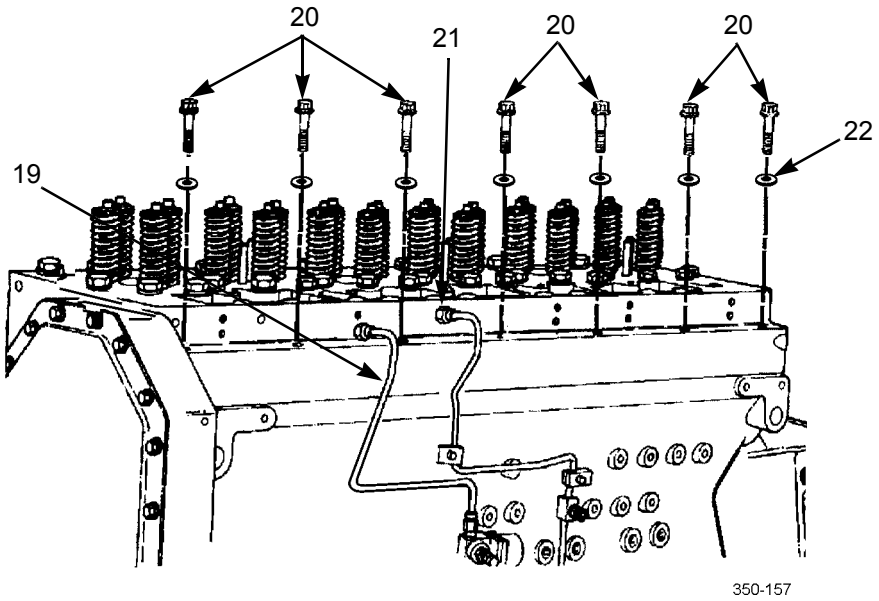
4. Tighten cylinder head screws (20) to 100 lb-ft (136 Nm) in sequence shown. Repeat sequence and tighten to 160 lb-ft (217 Nm).



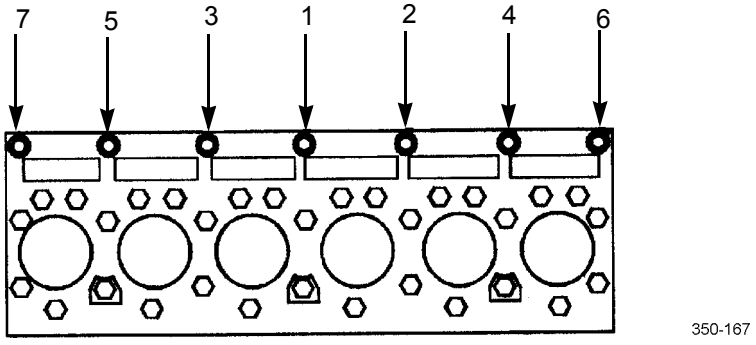
TIGHTENING SEQUENCE

INSTALLATION - CONTINUED

5. Tighten cylinder head screws (20) an additional 90 degrees after completing step 4 above.
6. Install seven new sealing washers (22) and screws (20) on fuel pump side of cylinder head.



7. Tighten cylinder head screws (20) to 50 lb-ft (68 Nm) in sequence shown.



TIGHTENING SEQUENCE

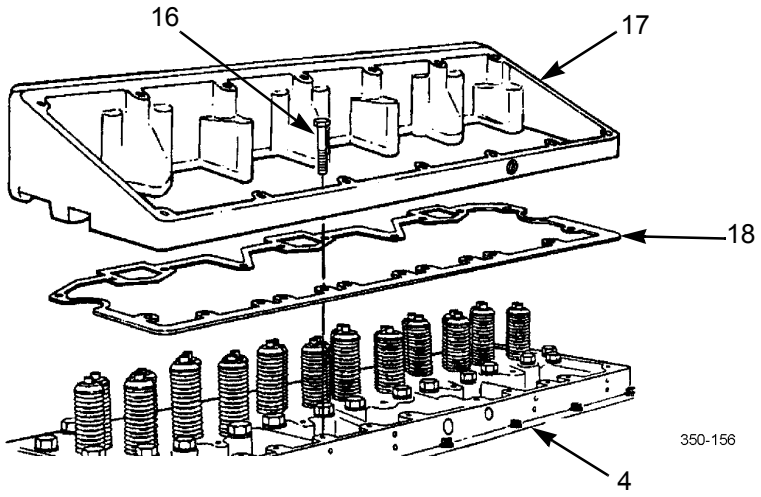
8. Connect fuel supply line (19) and fuel drain line (21).

INSTALLATION - CONTINUED

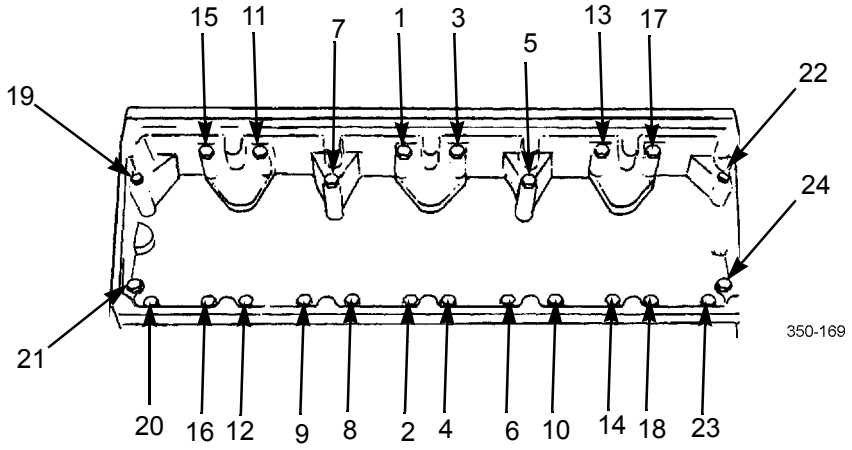
NOTE

Ensure rocker lever housing is clean and free of old gasket material

9. Install new gasket (18) and rocker lever housing (17) on cylinder head (4).



10. Install and tighten 24 screws (16) to 25 lb-ft (34 Nm) in sequence shown. Repeat sequence, tightening to 45 lb-ft (61 Nm).

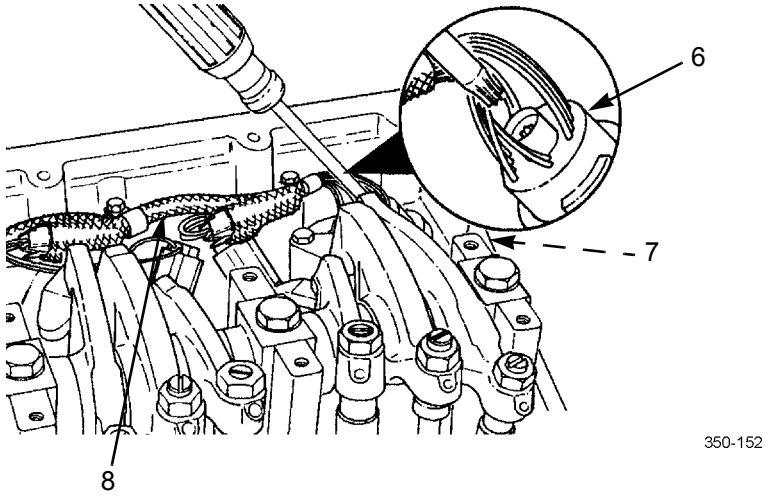


11. Install fuel injectors (WP 0023 00).

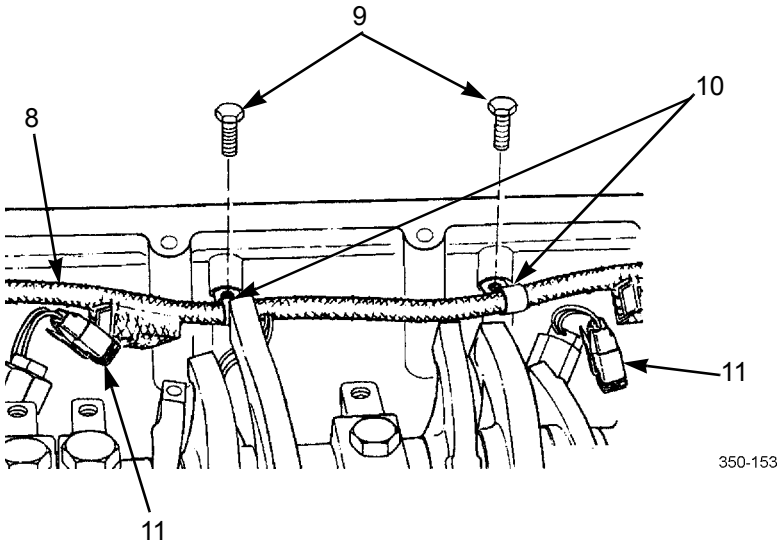
12. Install rocker arm assembly (WP 0014 00).

INSTALLATION - CONTINUED

13. Position cylinder head wiring harness (8). Connect cylinder head wiring harness connector (6) to engine wiring harness (7).



14. Install wire clamps (10) and secure cylinder head wiring harness (8) in place with screws (9). Tighten screws to 15 lb-ft (20 Nm).
15. Connect six fuel injector connectors (11) to cylinder head wiring harness (8).



INSTALLATION - CONTINUED

NOTE

Crossheads must be installed in same position they were removed from.

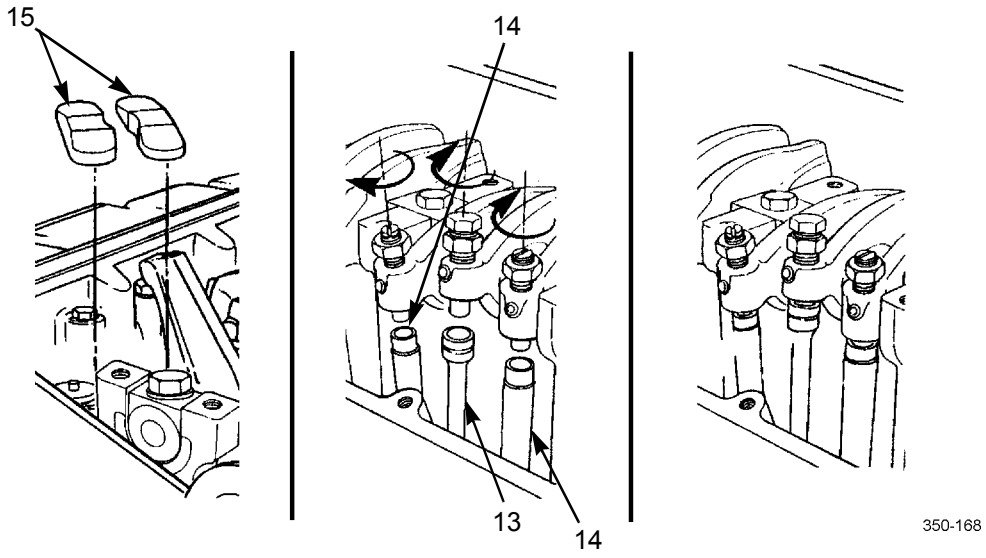
16. Install crossheads (15).

17. Apply a light coat of clean lubricating oil to ball end of valve push tubes (14) and injector push rods (13).

NOTE

Injector push rods are smaller diameter and longer than valve push tubes. Both push rods and push tubes must be installed as noted during removal.

18. Install valve push tubes (14) and injector push rods (13) as noted during removal.



19. Adjust valves and injectors (WP 0014 00).

20. Install exhaust manifold (WP 0018 00).

21. Install turbocharger (WP 0025 00).

22. Install rocker arm cover (TM 10-3930-675-20).

23. Install air intake ducts (TM 10-3930-675-20).

24. Fill cooling system (TM 10-3930-675-20).

25. Operate engine (TM 10-3930-675-10) and check for leaks.

END OF WORK PACKAGE

CYLINDER HEAD REPAIR 0008 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, micrometer, outside (Item 10, WP 0090 00)

Caliper, vernier, English and metric (Item 11, WP 0090 00)

Compressor, valve spring, valve (Item 14, WP 0090 00)

Driver, injector sleeve (Item 22, WP 0090 00)

Expander, tube (Item 24, WP 0090 00)

Extractor, valve seat (Item 26, WP 0090 00)

Gage, pressure, dial indicating (Item 33, WP 0090 00)

Holding tool, injector sleeve (Item 44, WP 0090 00)

Insert kit, valve seat (Item 46, WP 0090 00)

Installation tool, seal, valve (Item 49, WP 0090 00)

Kit, dye (Item 52, WP 0090 00)

Puller, mechanical (Item 75, WP 0090 00)

Tools and Special Tools - Continued

Removal tool, valve guide (Item 77, WP 0090 00)

Tester, valve spring (Item 91, WP 0090 00)

Wrench, torque, 0-200 lb-in capacity (Item 106, WP 0090 00

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Abrasive pad (Item 1, WP 0089 00)

Oil, cutting (Item 16, WP 0089 00)

Oil, lubricating (Item 17, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Collet, valve (P/N 3275354) (24)

Seal, o-ring (P/N 3007759) (6)

Seal, valve guide (P/N 3606766) (24)

Equipment Condition

Cylinder head removed (WP 0007 00)

Fuel injectors removed (WP 0023 00)

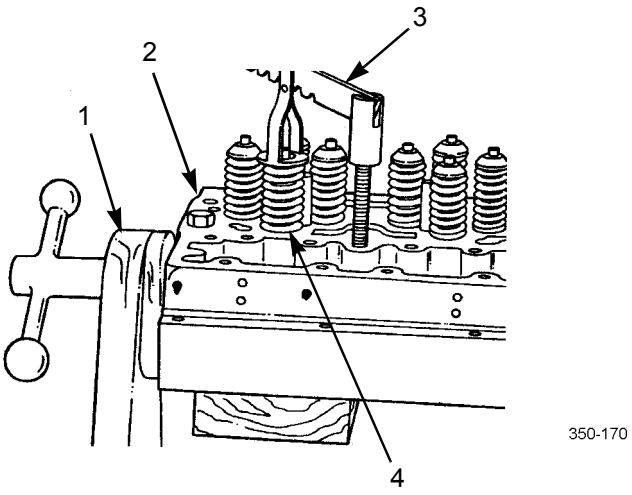
DISASSEMBLY

1. Install cylinder head (2) in holding fixture (1) and position wood blocks to support valves.

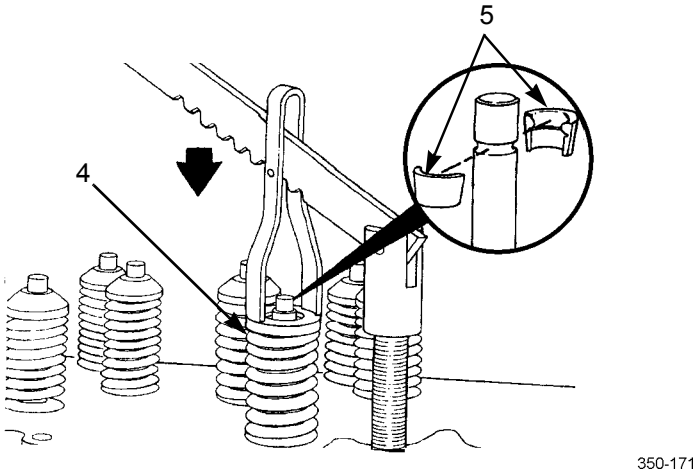
NOTE

Following steps will remove one valve. Perform steps 2 thru 6 for each valve to be removed.

2. Install valve spring compressor (3) with adapters to compress valve spring (4).

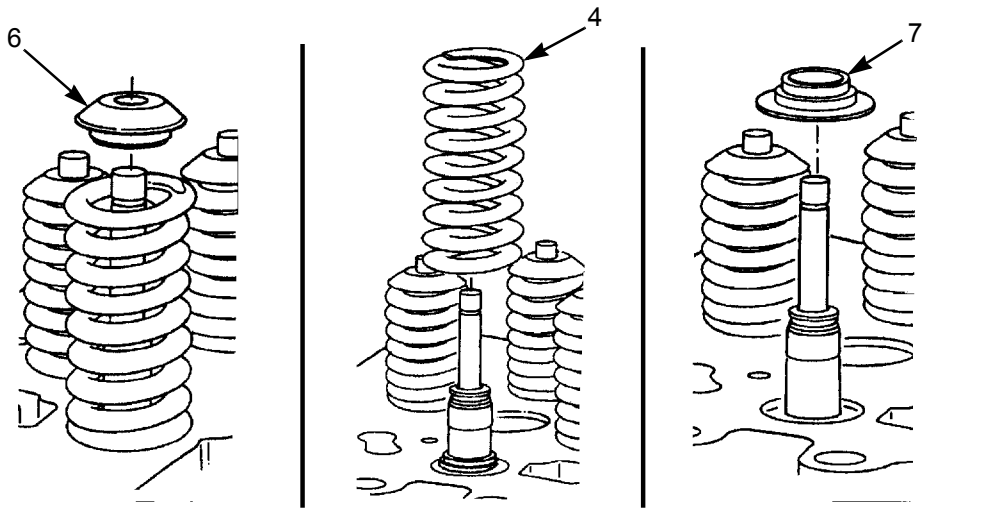


3. Compress valve spring (4) and remove collets (5). Discard collets.



DISASSEMBLY - CONTINUED

4. Release pressure on valve spring slowly.
5. Remove valve spring retainer (6), valve spring (4), and valve spring wear plate (7).

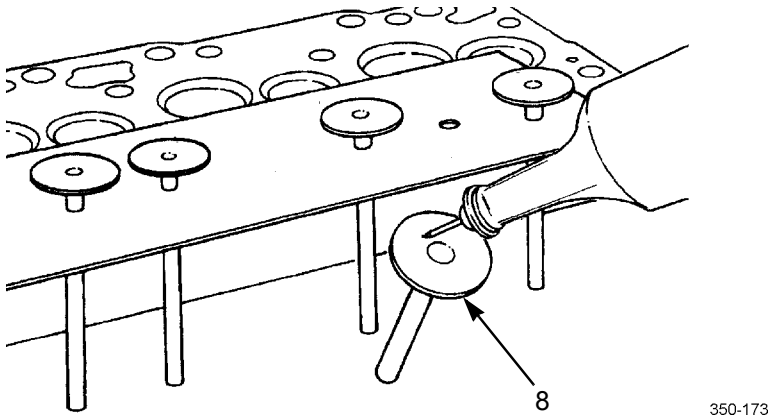


350-172

NOTE

Intake and exhaust valves are manufactured from different material and are NOT interchangeable. Mark each valve for location to ensure correct installation.

6. Remove valve (8).



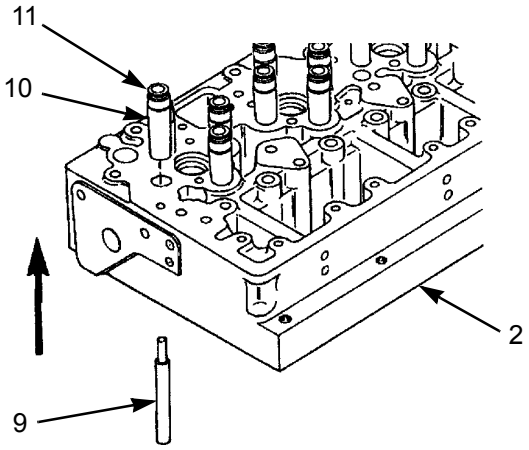
350-173

DISASSEMBLY - CONTINUED

NOTE

- Do not remove components in steps 7 thru 9 unless they do not meet inspection standards. Refer to *Inspection* for details.
- If valve guide does not meet inspection standards, remove valve guide. Following step will remove one valve guide. Any damaged valve guide is removed in the same manner.

7. Insert valve guide removal tool (9) from combustion surface side and drive valve guide (10) and valve guide seal (11) out of cylinder head (2). Discard seal.

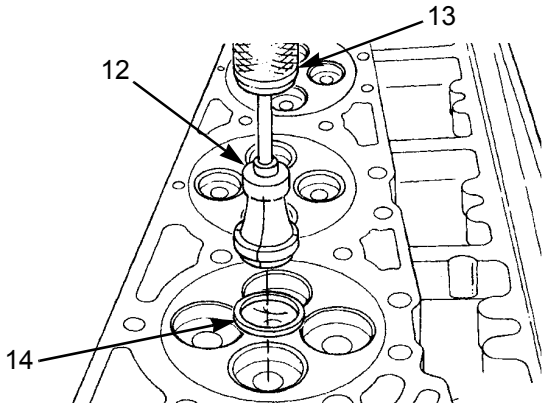


350-174

NOTE

If valve seat insert is defective, remove in following manner. Any damaged or defective valve seat insert is removed in same manner.

8. Install valve seat extractor (12) and slide hammer (13) on defective valve seat insert (14). Remove and discard valve seat insert.



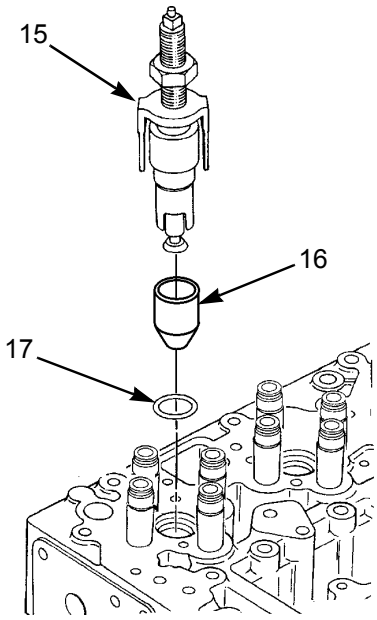
350-175

DISASSEMBLY - CONTINUED

NOTE

If injector sleeve is defective, remove in following manner. Any damaged or defective injector sleeve is removed in same manner.

9. Install injector sleeve puller tool (15). Remove injector sleeve (16) and o-ring (17). Discard o-ring.



350-176

CLEANING

WARNING

- When using steam cleaner, wear protective clothing and eye protection. Hot steam will cause serious burns.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

1. Steam clean cylinder head and dry with compressed air.
2. Remove all gasket deposits from rocker lever housing surface. Use abrasive pad to clean combustion face and exhaust gasket surface.
3. Clean fuel and oil passages with cleaning brush to remove deposits and obstructions.

CLEANING - CONTINUED

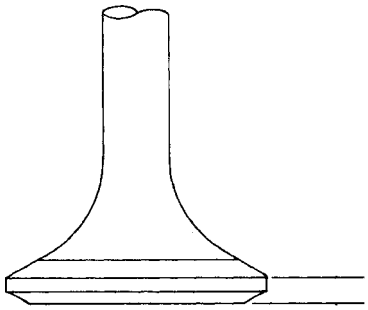
WARNING

Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.

4. Clean valve guide bore with solvent and brush to remove deposits.
5. Clean valve seat insert bores with solvent and brush to remove deposits.

INSPECTION

1. Visually inspect valve spring, valve spring retainers and valve spring wear plates for damage or worn areas. Discard damaged or worn parts.
2. Measure valve spring free height. Spring height is 4.0669 in (103.30 mm).
3. Using valve spring tester, measure valve spring working load at a working height of 2.8142 in (71.48 mm). If spring load is not as listed below, discard spring.
   a. Min 281 lb-ft (381 Nm)
   b. Max 356 lb-ft (482 Nm)
4. Visually inspect valves and collet grooves for damage. If damaged, replace valve.
5. Measure outside diameter (OD) of valve stem. If valve stem is not within limits, replace valve.
   a. Min OD 0.3772 in (9.580 mm)
   b. Max OD 0.3793 in (9.633 mm)
6. Place valve on flat surface and measure head thickness. If valve head is not within limits, replace valve.
   a. Min 0.124 in (3.15 mm)
   b. Max 0.143 in (3.62 mm)



HEAD THICKNESS 350-177

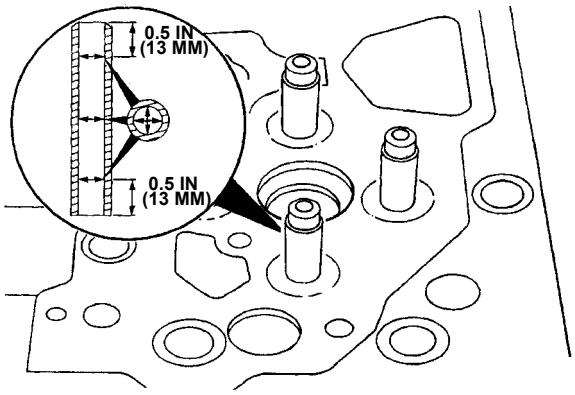
INSPECTION - CONTINUED

7. Visually inspect valve guides for chips or cracks. If damage is found, or valve guide does not meet specification, replace valve guide.

NOTE

Valve guide inside diameter (ID) is measured at three points: ½ in (13 mm) from top and bottom and at center of guide. Installed height is measured from surface of cylinder head. If valve guide is not within limits, replace valve guide.

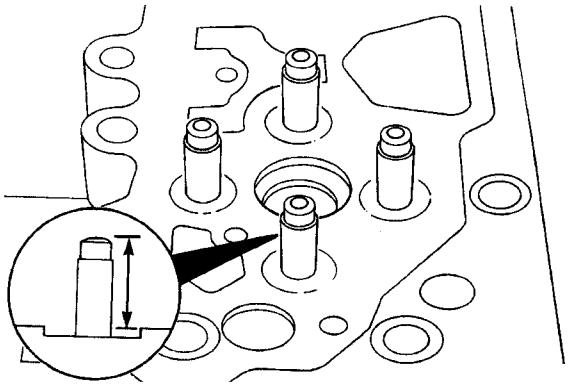
8. Measure inside diameter (ID) and installed height of valve guide.
   a. Min ID 0.3807 in (9.67 mm)
   b. Max ID 0.3831 in (9.73 mm)



350-178

INSIDE DIAMETER, VALVE GUIDE

   c. Min installed height 1.069 in (27.15 mm)
   d. Max installed height 1.089 in (27.65 mm)



350-179

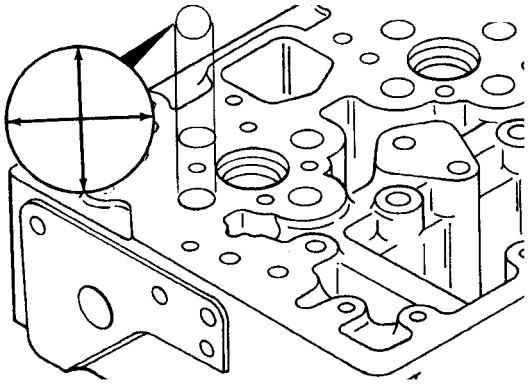
INSTALLED HEIGHT, VALVE GUIDE

INSPECTION - CONTINUED

NOTE

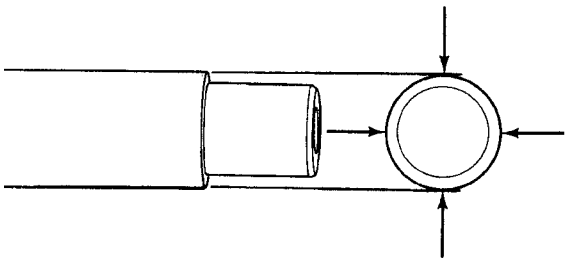
If valve guide bore exceeds maximum limits, replace valve guide with oversize valve guide.

9. Measure ID of valve guide bore in cylinder head.
   a. Min valve guide bore ID 0.6488 in (16.48 mm)
   b. Max valve guide bore ID 0.6496 in (16.50 mm)



INSIDE DIAMETER, VALVE GUIDE BORE

10. Measure base and seal area OD of valve guide. If valve guide is not within limits, replace valve guide.
    a. Min base OD 0.6501 in (16.51 mm)
    b. Max base OD 0.6506 in (16.53 mm)

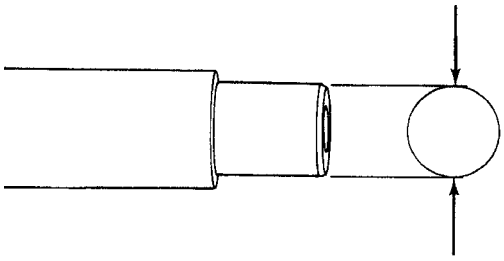


OUTSIDE DIAMETER, VALVE GUIDE BASE

INSPECTION - CONTINUED

c. Min seal area OD 0.561 in (14.25 mm)

d. Max seal area OD 0.566 in (14.37 mm)



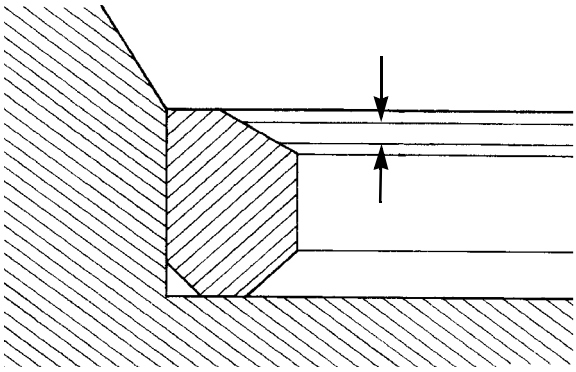
350-185

OUTSIDE DIAMETER, VALVE GUIDE SEAL

11. Measure width of valve seat area of valve seat insert. If valve seat area is worn wider than maximum, replace valve seat insert.

a. Min width 0.064 in (1.63 mm)

b. Max width 0.106 in (2.69 mm)



350-180

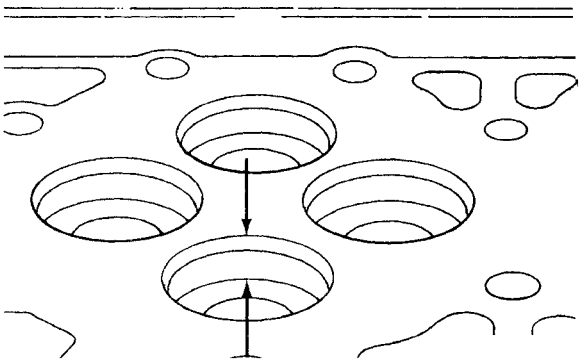
VALVE SEAT AREA

NOTE

If bore is not within limits, machine head and use oversize valve seat inserts for assembly.

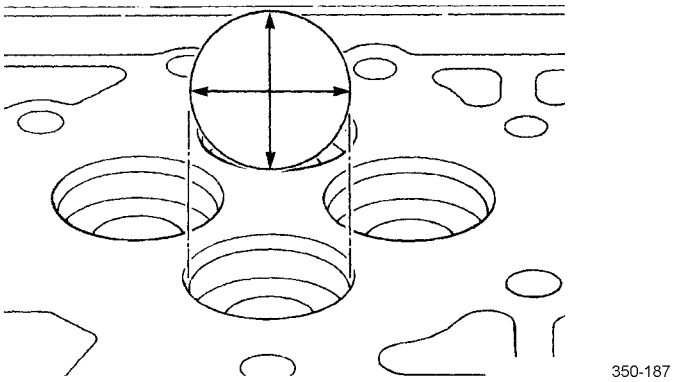
INSPECTION - CONTINUED

12. Measure valve seat insert bore depth.
    a. Insert depth min 0.370 in (9.40 mm)
    b. Insert depth max 0.374 in (9.50 mm)



INSERT BORE DEPTH, VALVE SEAT

13. Measure valve seat insert bore ID.
    a. Insert bore ID min 1.803 in (45.92 mm)
    b. Insert bore ID max 1.8085 in (45.94 mm)



INSIDE DIAMETER, VALVE SEAT INSERT BORE

NOTE

If tip protrusion exceeds maximum or bluing pattern is not within limits, replace injector sleeve and o-ring.

14. Measure fuel injector tip protrusion and seating area as follows:
    a. Apply a bluing compound to outside diameter of injector at injector sleeve seat area.

INSPECTION - CONTINUED

CAUTION

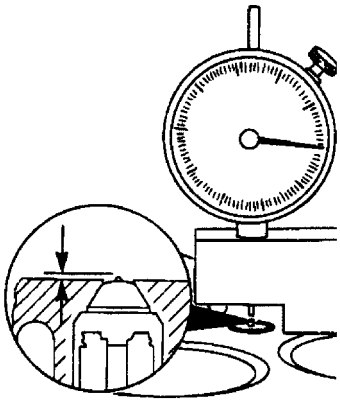
Support cylinder head in holding fixture to prevent damage to injector tip protruding from combustion face.

b. Install injector into cylinder head without o-rings. Tighten to 55 lb-ft (75 Nm).

NOTE

If measurements in step c and d are not within limits, replace injector sleeve and o-ring.

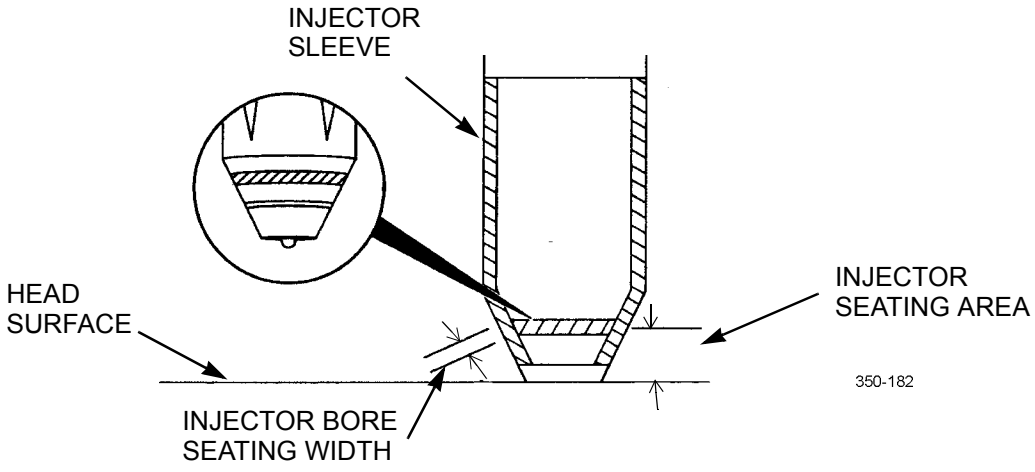
c. Turn cylinder head over and measure injector tip protrusion with depth gage.
   (1) Min 0.090 in (2.28 mm)
   (2) Max 0.104 in (2.65 mm)



FUEL INJECTOR TIP PROTRUSION

d. Remove injector and measure bluing pattern. Bluing pattern for injector seating area must be approximately 0.50 in (13 mm) from cylinder head combustion surface.

15. Measure injector bore seating width. Width must be a minimum of 0.060 in (1.52 mm)



ASSEMBLY

NOTE

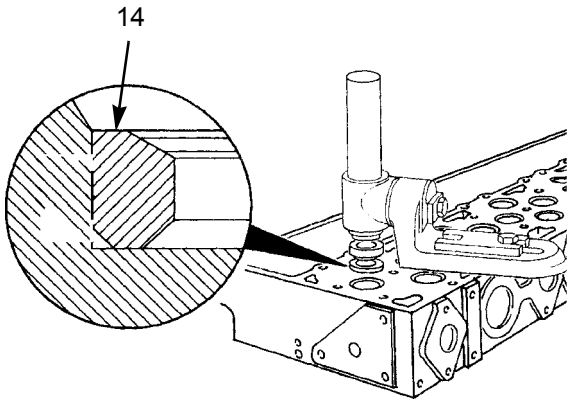
During assembly of cylinder head, each component must be checked and measured for proper installation.

1. Install base and swivel of valve seat insert tool and valve guide arbor on cylinder head.

NOTE

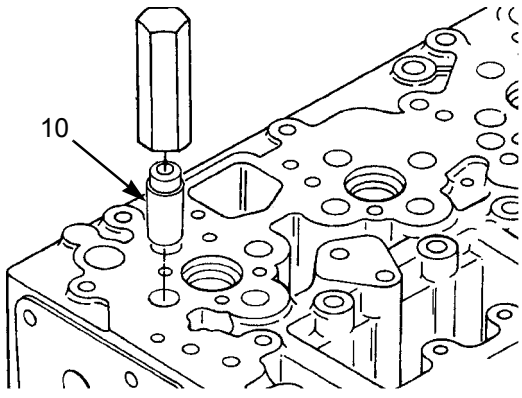
Ensure valve seat insert is positioned with chamfer installed toward bottom of counterbore and installed to bottom of counterbore.

2. Using valve seat driver with seat insert tool and guide arbor, install valve seat insert (14).



350-188

3. Install valve guide (10) using valve guide driver.



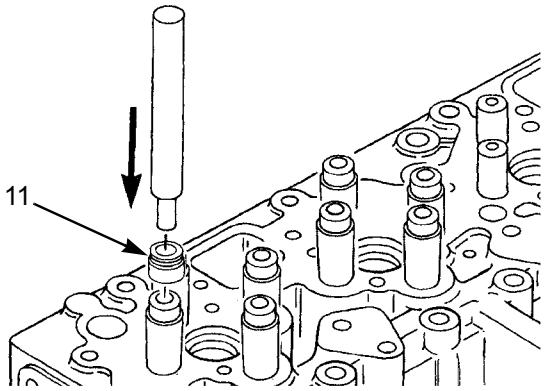
350-189

CAUTION

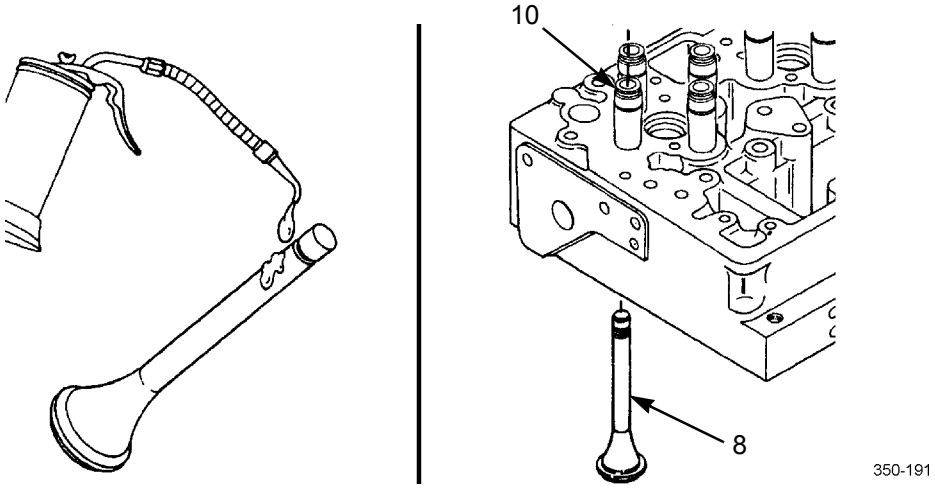
DO NOT use excessive force when installing valve guide seals.

ASSEMBLY - CONTINUED

4. Install new valve guide seal (11) using valve seal driver.



5. Apply a coating of 80W, or higher, gear oil to valve stem and install valve (8) in valve guide (10).

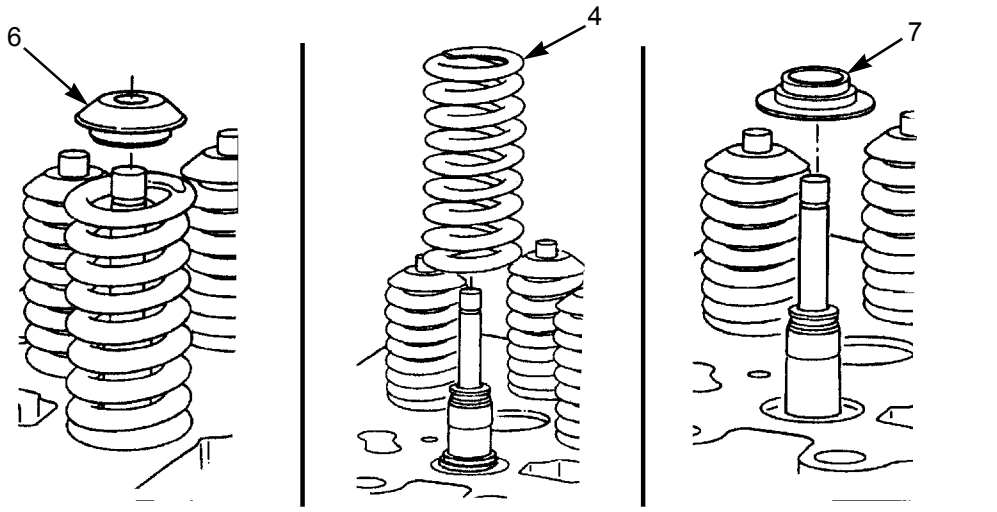


NOTE

Position cylinder head with installed valves on flat surface that will NOT damage cylinder head surface.

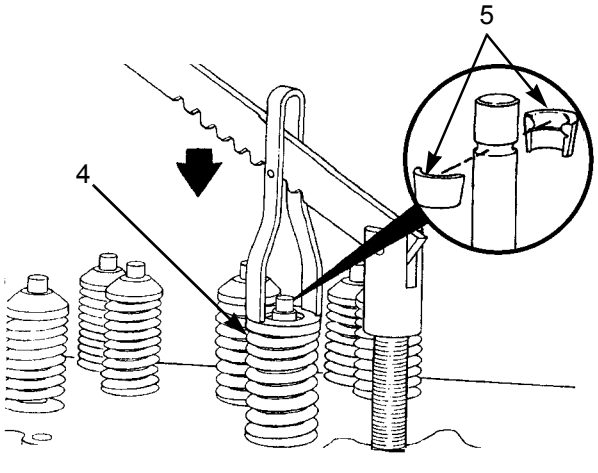
ASSEMBLY - CONTINUED

6. Install valve spring wear plate (7), valve spring (4), and valve spring retainer (6).



350-172

7. Attach valve spring compressor (3) to cylinder head (2), compress valve spring (4) and install new collets (5).

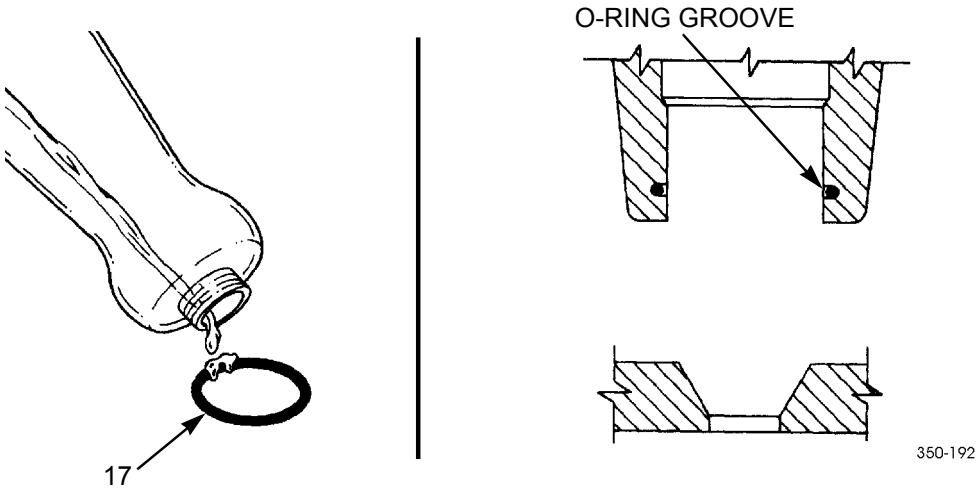


350-171

ASSEMBLY - CONTINUED

8. Remove valve spring compressor (3).

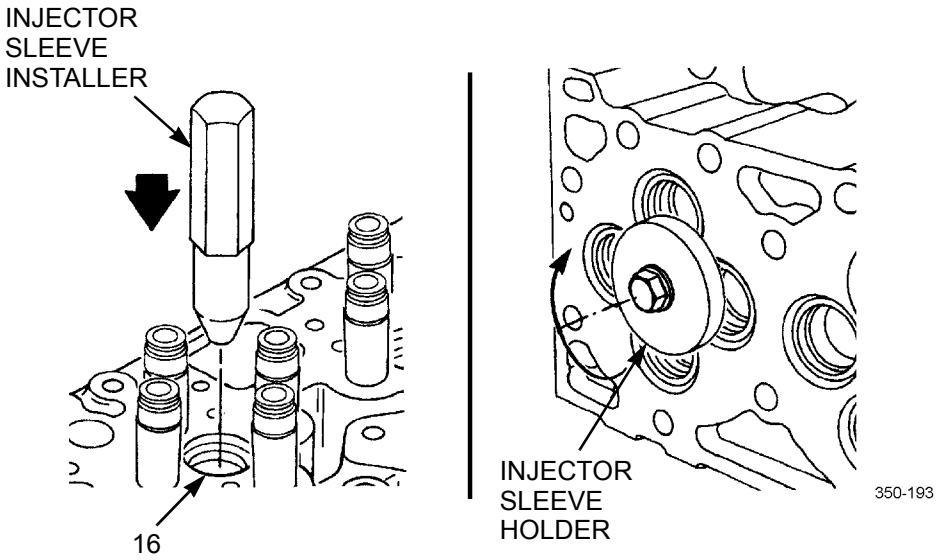
9. Lubricate new injector sleeve o-ring (17) with oil and install o-ring in groove of injector sleeve bore.



10. Position new injector sleeve (16) and install using injector sleeve driver.

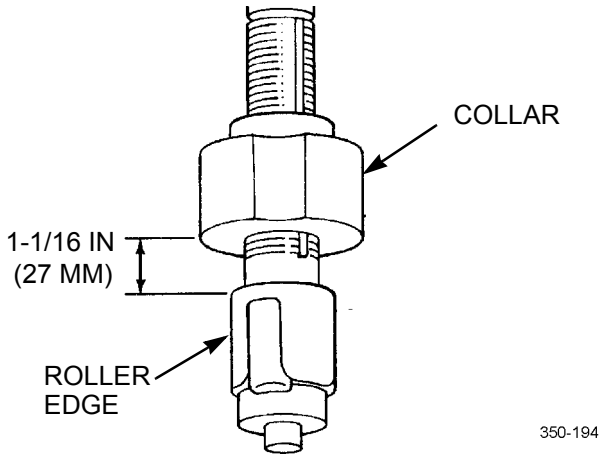
11. Remove injector sleeve driver and install injector sleeve holding tool. Tighten screw to 38 lb-ft (50 Nm).

12. Reinstall injector sleeve driver and strike with mallet to seat injector sleeve (16). Retighten injector sleeve holding tool screw as needed.



ASSEMBLY - CONTINUED

13. Adjust tube expander to 1-1/16 in (27 mm) between collar and roller edge. Install tube expander, tighten expander to 75 lb-in (9 Nm), and expand upper portion of injector sleeve.



14. Remove tube expander and injector sleeve holding tool.

NOTE

Ensure cutting oil is used to lubricate injector sleeve cutter.

15. Machine injector sleeve until sealing area is smooth, using injector seal cutter, pilot, and holder.
16. Install fuel injectors (WP 0023 00).

END OF WORK PACKAGE

FRONT MAIN OIL SEAL REPLACEMENT 0009 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Wrench, torque 0-200 lb-in capacity (Item 106, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

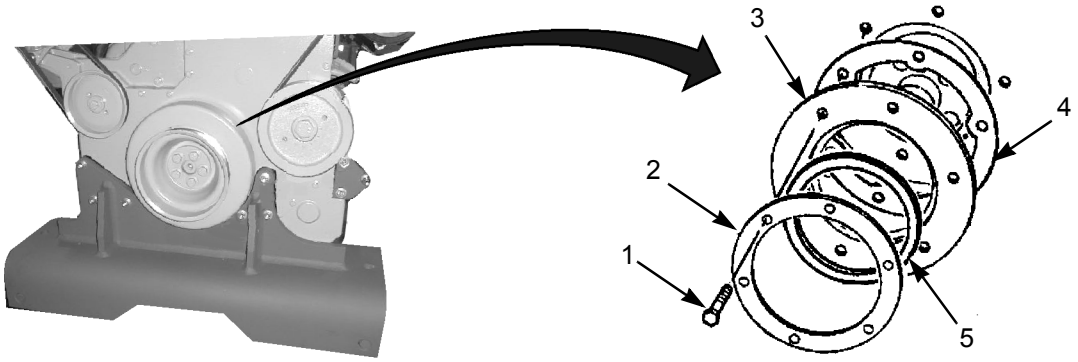
Kit, oil seal (P/N 3804744)

Equipment Condition

Vibration damper removed (0011 00)

REMOVAL

1. Remove six screws (1) and clamping ring (2).
2. Remove oil seal (3) and dust seal (5) together. Discard oil seal and dust seal.
3. Remove and discard gasket (4).



350-202

INSTALLATION

NOTE

- Ensure gasket surface on crankshaft and front gear cover have been thoroughly cleaned and all old gasket and seal material have been removed.
- Front gear cover, seal, and gasket are marked for correct orientation with an arrow. Clamping ring is marked with four punch marks.

1. Orient new gasket (4) with arrow mark on front gear cover (6) and install gasket.

NOTE

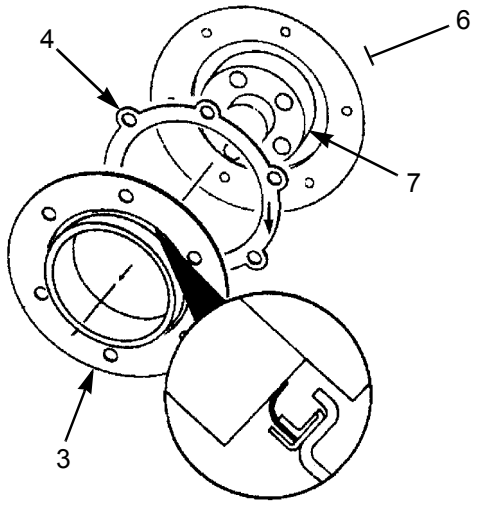
DO NOT use lubricant of any kind to install oil seal. Oil seal must be installed with lip of seal and crankshaft clean and dry. Ensure yellow dust lip of oil seal is facing out.

2. Position new oil seal (3) on crankshaft (7) and match arrow mark on oil seal with mark on front gear cover.

CAUTION

To prevent damage to new seal, seal installer provided with oil seal kit must be used.

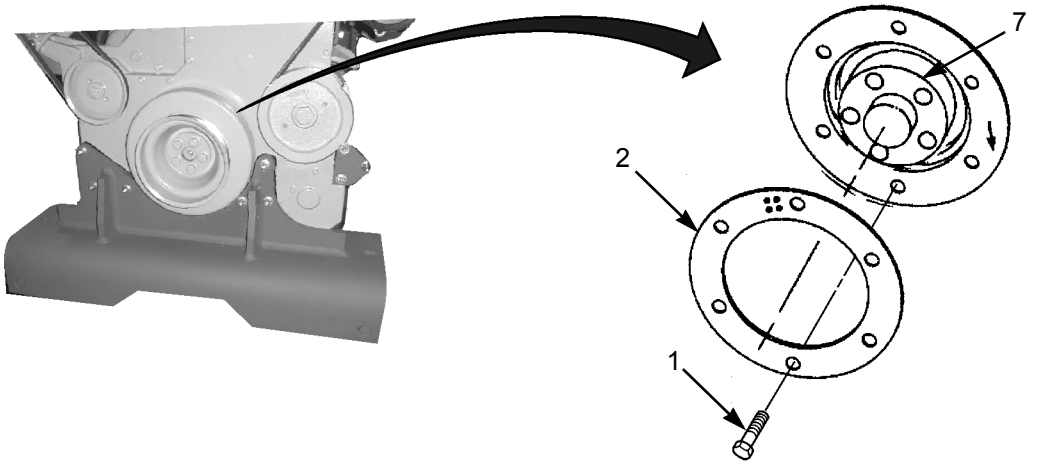
3. Using installation tool, install oil seal (3).



350-203

4. Position clamping ring (2) on crankshaft (7) with four punch marks orientated at 11:30 o'clock position.
5. Apply a coating of thread sealant to six mounting screws (1) and install hand tight.
6. Tighten screws (1) in star pattern to 60 lb-in (7 Nm). Retighten screws in same pattern to 180 lb-in (20 Nm).

INSTALLATION - CONTINUED

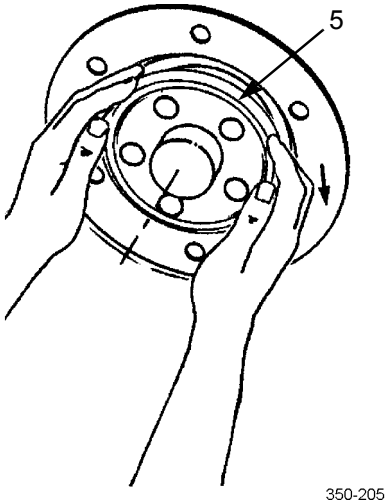


350-204

NOTE

Ensure dust seal is installed with larger outside diameter facing engine and seal is pushed back until entire seal contacts oil seal case.

7. Apply a light coat of oil to inside diameter of new dust seal (5) and install dust seal.



350-205

8. Install vibration damper (WP 0011 00).

END OF WORK PACKAGE

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REAR MAIN OIL SEAL REPLACEMENT 0010 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Wrench, torque, 0-300 lb-in capacity (Item 107, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Kit, oil seal (P/N 3804744)

Seal, dust (P/N 3895023)

Equipment Condition

Flywheel assembly removed (WP 0012 00)

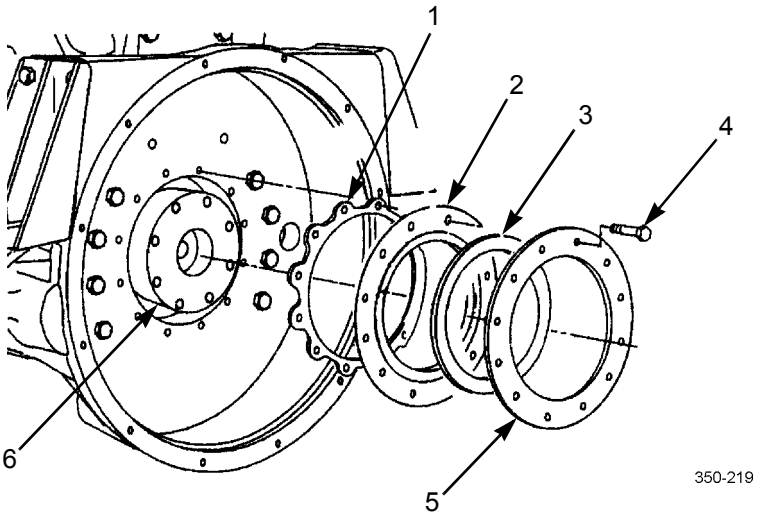
REMOVAL

1. Remove 12 screws (4) and clamping ring (5).

NOTE

Ensure oil seal and dust seal are removed as a unit.

2. Remove oil seal (2) and dust seal (3) from crankshaft (6). Discard oil seal and dust seal.
3. Remove and discard gasket (1).



INSTALLATION

NOTE

Ensure all old gasket and seal material has been removed from crankshaft.

1. Install new gasket (1).

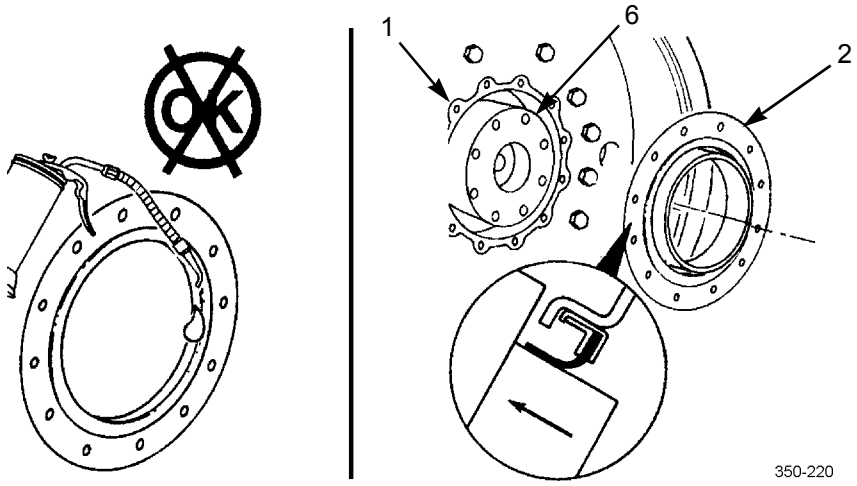
CAUTION

Installation tool provided with seal kit must be used to install oil seal. Failure to use proper tool may result in damage to oil seal.

NOTE

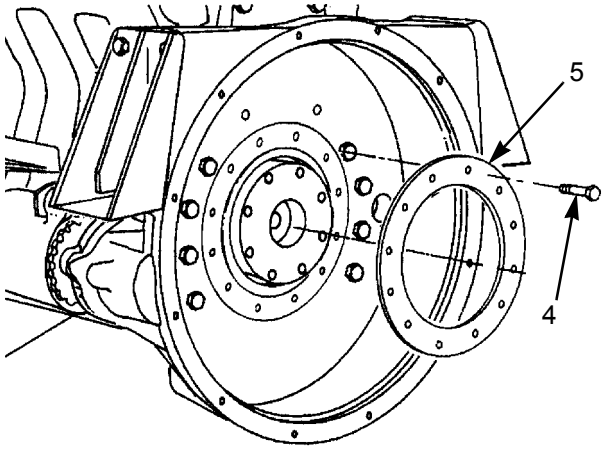
DO NOT use lubricant of any kind to install oil seal. Oil seal must be installed with lip of seal and crankshaft clean and dry.

2. Install new oil seal (2) on crankshaft (6).



3. Position clamping ring (5) and install 12 screws (4) hand tight.
4. Tighten screws (4) in a star pattern to 60 in-lb (7 Nm). Retighten screws in star pattern to 180 lb-in (20 Nm).

INSTALLATION - CONTINUED

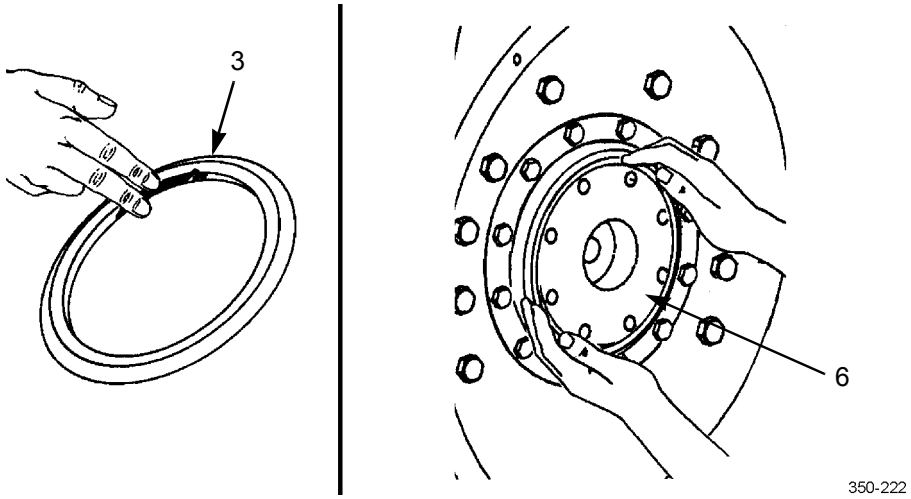


350-221

NOTE

Ensure dust seal is oriented with larger diameter facing toward engine.

5. Apply a light coat of lubricating oil to inside diameter of new dust seal (3) and install dust seal on crankshaft (6).
6. Push dust seal (3) back by hand until entire dust seal contacts oil seal case.



350-222

7. Install flywheel assembly (WP 0012 00).

END OF WORK PACKAGE

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VIBRATION DAMPER REPLACEMENT 0011 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Barring tool, engine (Item 5, WP 0090 00)

Indicator, dial (Item 45, WP 0090 00)

Pin kit, guide (Item 58, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

References

TM 10-3930-675-10

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

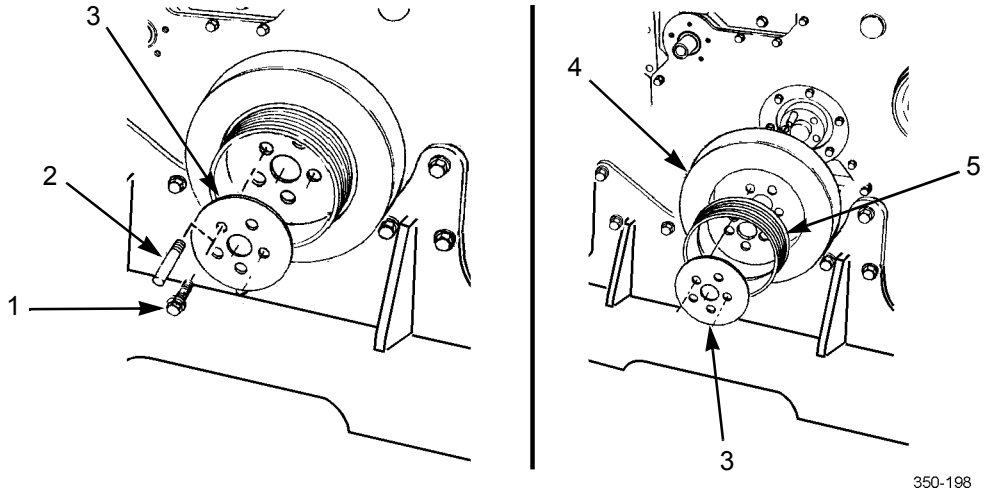
REMOVAL

1. Remove two screws (1) from clamping plate (3). Install guide studs (2) in holes.
2. Remove three remaining screws (1) and replace with guide studs (2).

CAUTION

Do not use hammer or screwdriver to remove vibration damper. These tools can damage vibration damper.

3. Remove clamping plate (3), crankshaft pulley (5), and vibration damper (4) from engine.



INSPECTION

NOTE

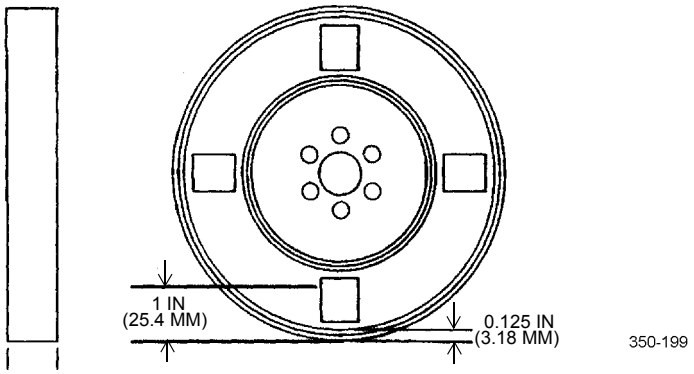
Ensure vibration damper has been cleaned and is free of dirt, grease, and other foreign matter.

1. Check mounting web for cracks and housing for dents or raised surfaces. If any of these conditions are noted, vibration damper must be replaced.
2. Scrape paint from four locations on either side of vibration damper

NOTE

- Thickness check will result in a total of eight measurements.
- If thickness recorded varies more than 0.010 in (0.25 mm) between any of eight measurements, or if thickness at any one point exceeds 1.772 in (45 mm), replace vibration damper.

3. Measure and record thickness of vibration damper at two places on each of four selected locations as follows:
   a. Measure thickness at 0.125 in (3.18 mm) from outer lip.
   b. Measure thickness at 1.0 in (25.4 mm) from outer lip.



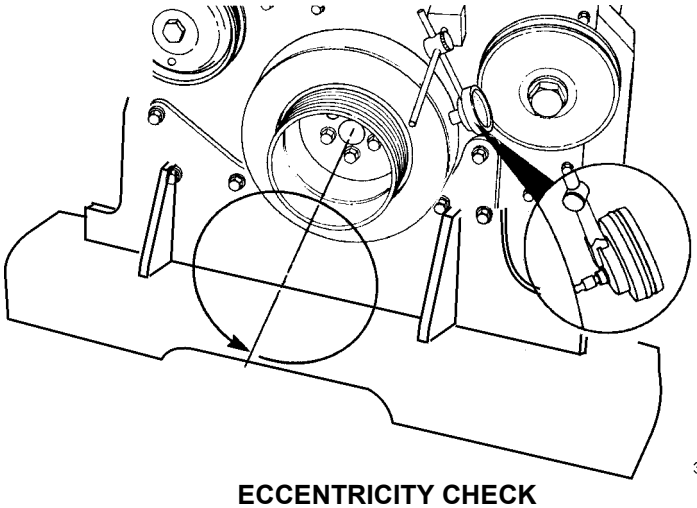
THICKNESS MEASUREMENT

NOTE

Eccentricity (out of round) and wobble (face alinement) checks are performed to verify correct installation and serviceability of vibration damper. If either check exceeds 0.011 in (0.28 mm), vibration damper is defective and must be replaced.

4. Attach dial indicator to front cover as indicated and “0” dial indicator. Manually bar engine over one complete revolution (360°) and record total movement of dial indicator.

INSPECTION - CONTINUED

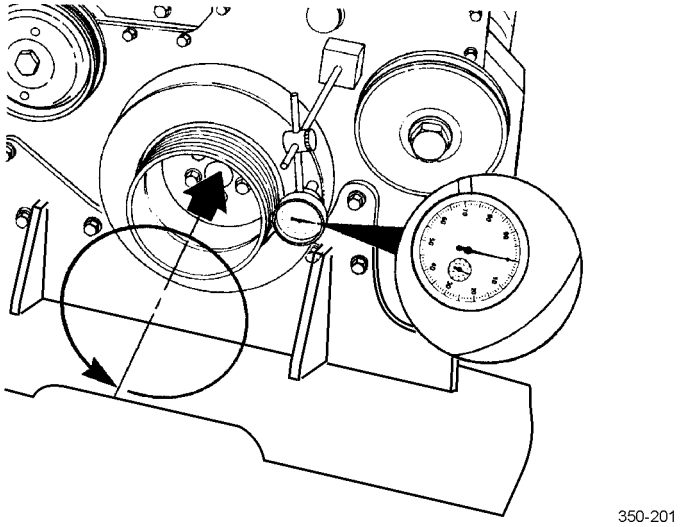


ECCENTRICITY CHECK

NOTE

Ensure crankshaft is to front or rear of engine and “0” dial indicator.

5. Position dial indicator to measure wobble (face alinement) as shown. Manually bar engine over one complete revolution (360°) and record total indicator movement.



WOBBLE CHECK

INSTALLATION

NOTE

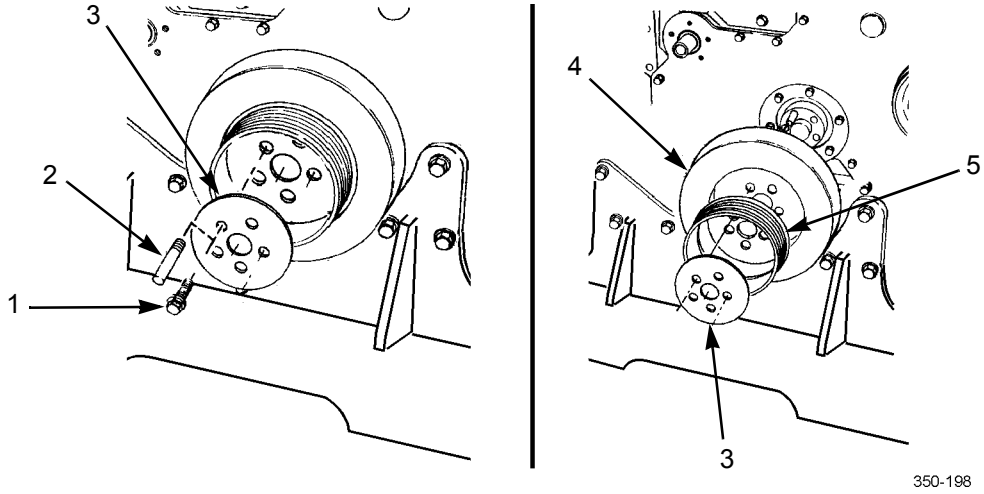
Ensure mounting surface of crankshaft is clean and free of dirt.

1. Position vibration damper (4) over guide studs (2) and slide in place.

NOTE

Ensure mounting screw threads are lubricated with clean oil prior to installation.

2. Install clamping plate (3) and crankshaft pulley (5). Remove three guide studs (2) and install screws (1) hand tight.
3. Remove two guide studs (2) and install remaining screws (1). Tighten all screws in a star pattern to 150 lb-ft (203 Nm).



4. Start engine (TM 10-3930-675-10) and check operation.

END OF WORK PACKAGE

FLYWHEEL ASSEMBLY REPLACEMENT 0012 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Attachment, dial (Item 4, WP 0090 00)

Barring tool, engine (Item 5, WP 0090 00)

Indicator, dial (Item 45, WP 0090 00)

Pin kit, guide (Item 58, WP 0090 00)

Tools and Special Tools - Continued

Sling, endless (Item 82, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Personnel Required

Two

Equipment Condition

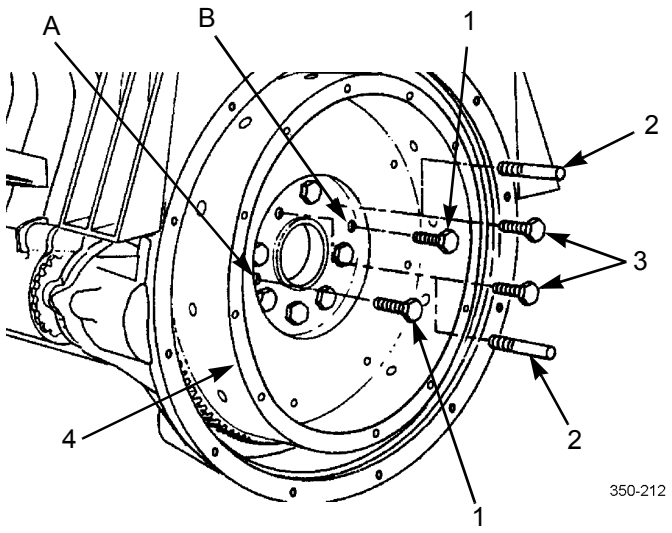
Engine removed (WP 0005 00)

REMOVAL

NOTE

Two screws are installed into tapped holes in flywheel and are used to loosen flywheel from crankshaft.

1. Install two screws (1) at positions "A" and "B" on flywheel (4).
2. Remove two mounting screws (3) and replace with guide pins (2).



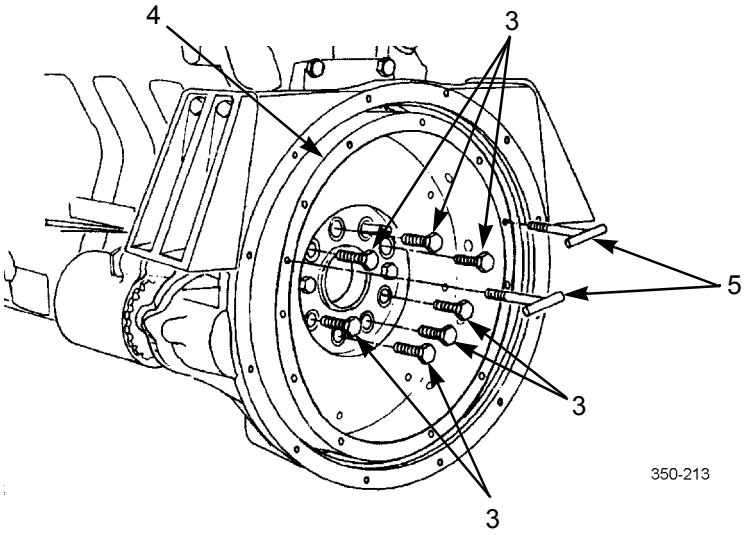
REMOVAL - CONTINUED

NOTE

- T-handles, or similar devices, are used to provide attachment points for lifting device sling. T-handles are normally fabricated using bar stock. Suitably-sized bolts or eyebolts may also be used.
- Check torque converter mounting holes for thread size and use appropriate T-handles. Normal U. S. customary thread sizes are 3/8-16, 7/16-20, and ½-13. Ensure correct size is used.

3. Install two T-handles (5) into flywheel (4) at opposite points suitable for lifting.

4. Remove remaining mounting screws (3) from flywheel (4).



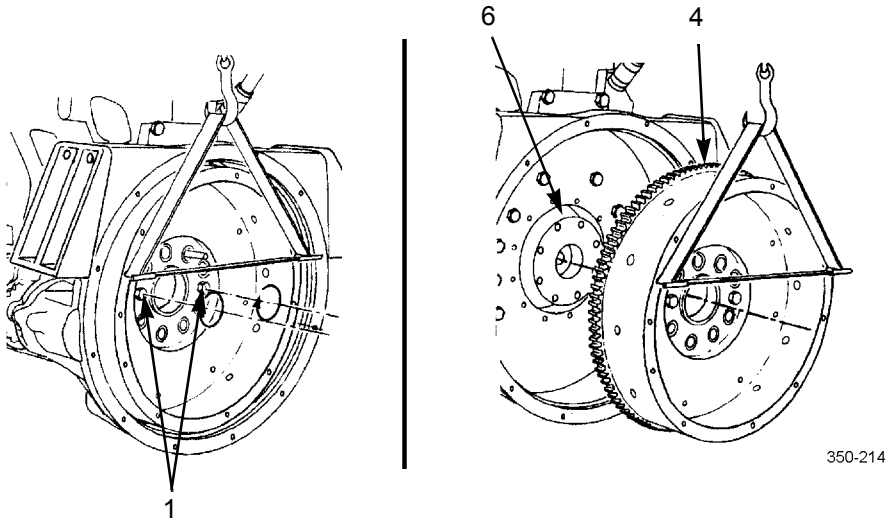
WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Flywheel weighs 50 lb (23 kg) or more. Use suitable lifting device or assistance to lift flywheel.

5. Install nylon sling on T-handles and attach to suitable lifting device.

6. Tighten screws (1) in positions “A” and “B” in alternating sequence to loosen and remove flywheel (4) from crankshaft (6).

REMOVAL - CONTINUED

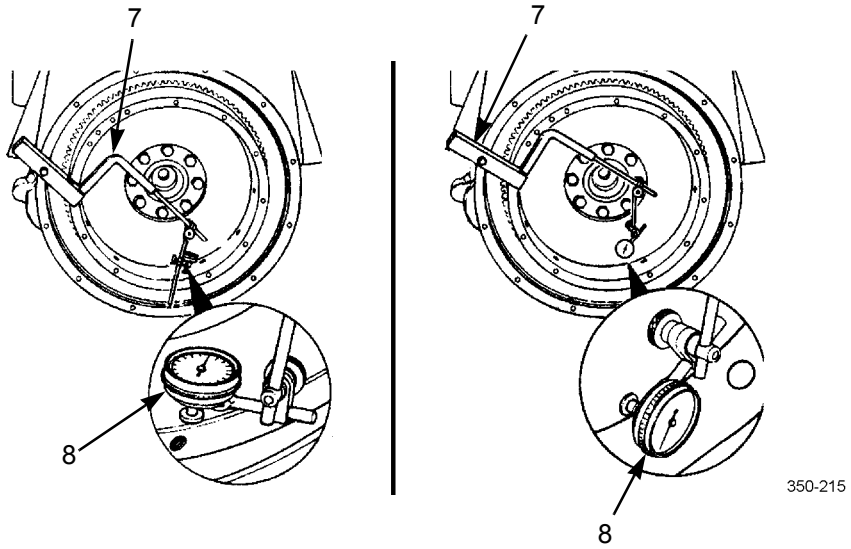


INSPECTION

NOTE

Flywheel bore runout and face runout checks confirm serviceability and proper installation of flywheel. If flywheel does not meet requirements of either check, flywheel must be replaced.

1. Install dial indicator (8) and attachments (7) and check flywheel bore runout.



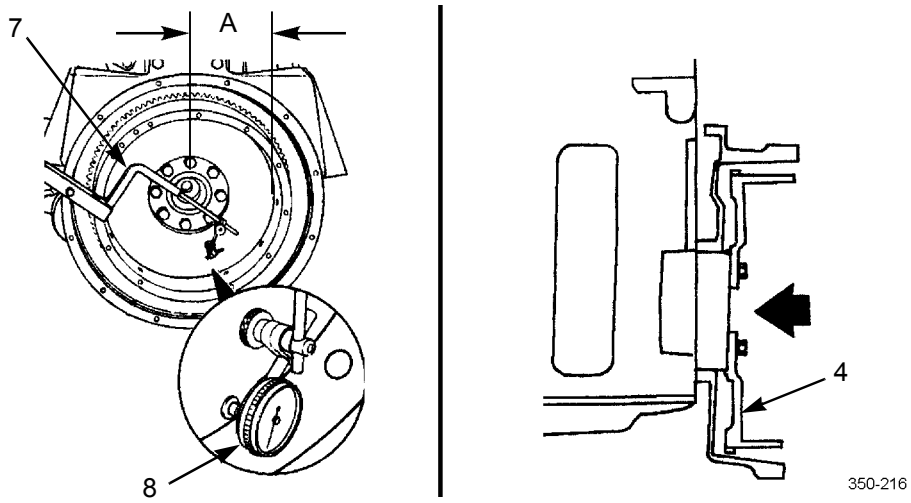
INSPECTION - CONTINUED

2. Rotate flywheel, using engine barring tool, one revolution and record indication. Maximum total indicator reading MUST NOT exceed 0.0050 in (0.127 mm).

NOTE

Flywheel face runout check results in five readings. If any one of the readings exceeds the maximum, flywheel must be replaced.

3. Measure flywheel face runout as follows:
   a. Install dial indicator (8) and attachments (7).
   b. Push flywheel (4) forward to remove crankshaft end thrust.



   c. Zero and position dial indicator at radius indicated in Table 1, *Flywheel Face Runout*.
   d. Rotate crankshaft, using engine barring tool, one revolution and record maximum total indicator reading.
   e. Perform step a thru d for each radius setting listed in Table 1, *Flywheel Face Runout*.

Table 1. Flywheel Face Runout.

RADIUS (A)		MAXIMUM TIR	
MM	IN	MM	IN
203	8	0.203	0.008
254	10	0.254	0.010
305	12	0.305	0.012
356	14	0.356	0.014
406	16	0.406	0.016

INSTALLATION

NOTE

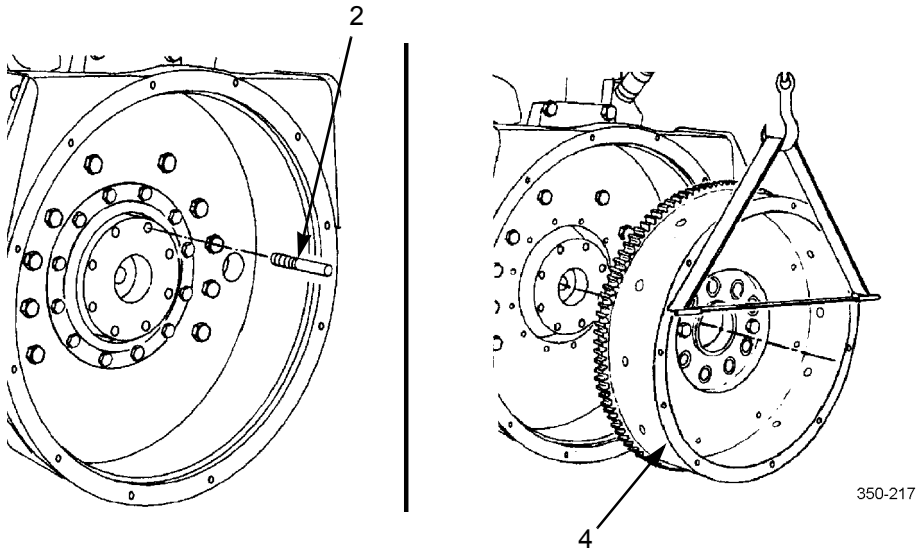
Ensure flywheel mounting surface and crankshaft is free of dirt.

1. Install guide pin (2).

WARNING

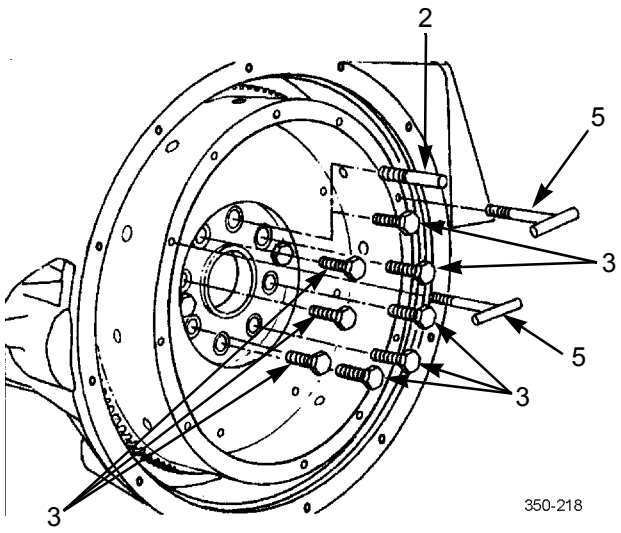
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Flywheel weighs 50 lb (23 kg) or more. Use suitable lifting device or assistance to lift flywheel.

2. Using nylon sling, T-handles, and suitable lifting device, position flywheel (4) on guide pin (2).



INSTALLATION - CONTINUED

3. Secure flywheel (4) in place with seven screws (3) hand tight.
4. Disconnect lifting device and sling. Remove T-handles (5).
5. Remove guide pin (2) and install last mounting screw (3). Tighten screws in star pattern to 135 lb-ft (183 Nm).



END OF WORK PACKAGE

FLYWHEEL HOUSING REPLACEMENT 0013 00

THIS WORK PACKAGE COVERS

Removal, Installation, Alinement

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Alinement plate, flywheel housing (Item 3, WP 0090 00)

Barring tool, engine (Item 5, WP 0090 00)

Gage, depth, dial indicating (Item 30, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Pin kit, guide (Item 58, WP 0090 00)

Sling, endless (Item 82, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Wrench, torque, 0-200 lb-in capacity (Item 106, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Kit, oil seal (P/N 3803727)

Personnel Required

Two

References

WP 0010 00

Equipment Condition

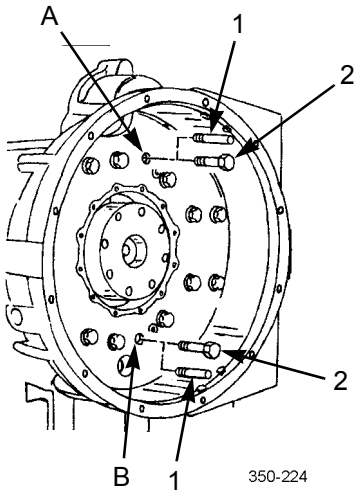
Starter removed (TM-10-3930-675-20)

Flywheel assembly removed (WP 0012 00)

Engine oil pan removed (WP 0016 00)

REMOVAL

1. Remove and discard rear main oil seal (WP 0010 00).
2. Remove screws (2) from position “A” and “B” and install guide pins (1).



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

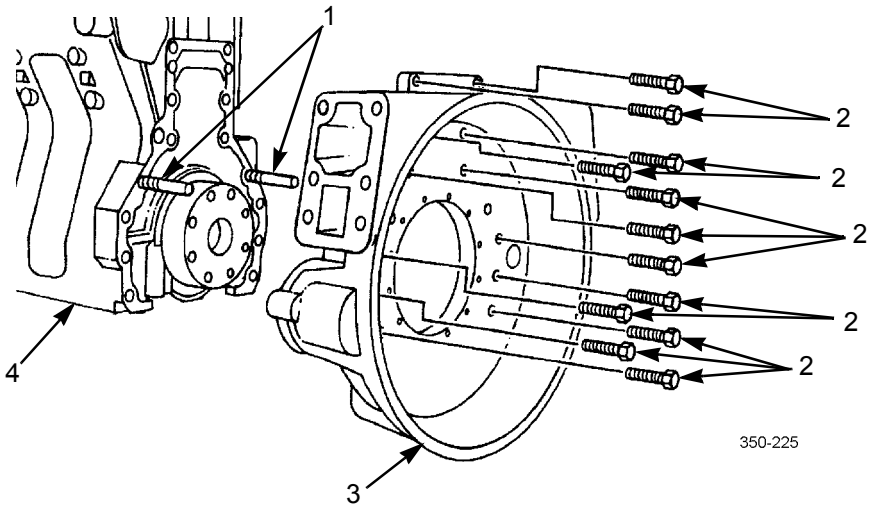
NOTE

Flywheel housing weighs 50 lb (23 kg) or more. Use sling and lifting device to support and remove flywheel housing.

3. Remove 12 screws (2) securing flywheel housing (3) to cylinder block (4).
4. Use a plastic-faced hammer, if needed, to loosen flywheel housing (3). With assistance, remove flywheel housing.

REMOVAL - CONTINUED

5. Remove guide pins (1) from cylinder block (4).



INSTALLATION

1. Measure inside diameter of flywheel housing bore. Compare reading to Table 1 below and determine SAE no. and size of housing being installed.

Table 1. Flywheel Housing Bore Maximum Inside Diameter (ID).

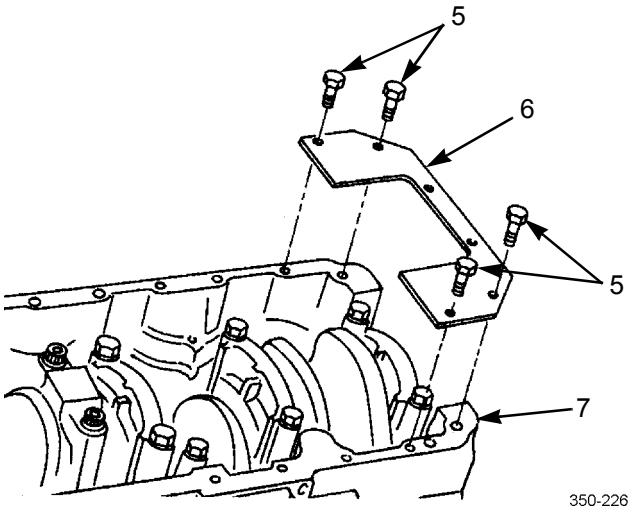
MM	SAE NO.	IN
787.7	00	31.01
648.0	0	25.51
584.4	½	23.01
511.3	1	20.13
447.8	2	17.63
409.7	3	16.13

INSTALLATION - CONTINUED

NOTE

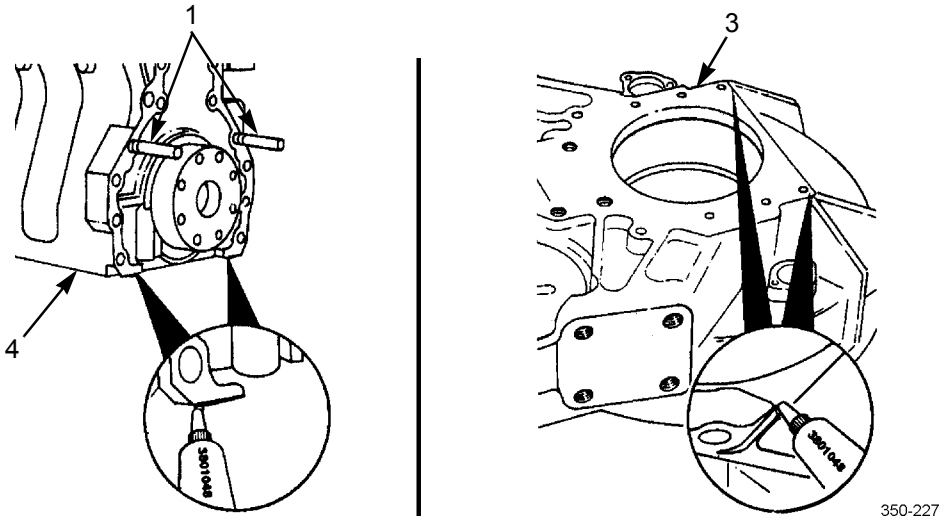
Ensure flywheel housing mounting surface and cylinder block surface has been cleaned and all old sealant removed.

2. Install flywheel alinement plate (6) on oil pan mounting flange (7) and secure with four oil pan screws (5). Tighten screws to 35 lb-ft (47 Nm).



3. Apply bead of silicone sealant to mounting surface on flywheel housing (3) and cylinder block (4).

4. Install two guide pins (1) in cylinder block (4).



INSTALLATION - CONTINUED

WARNING

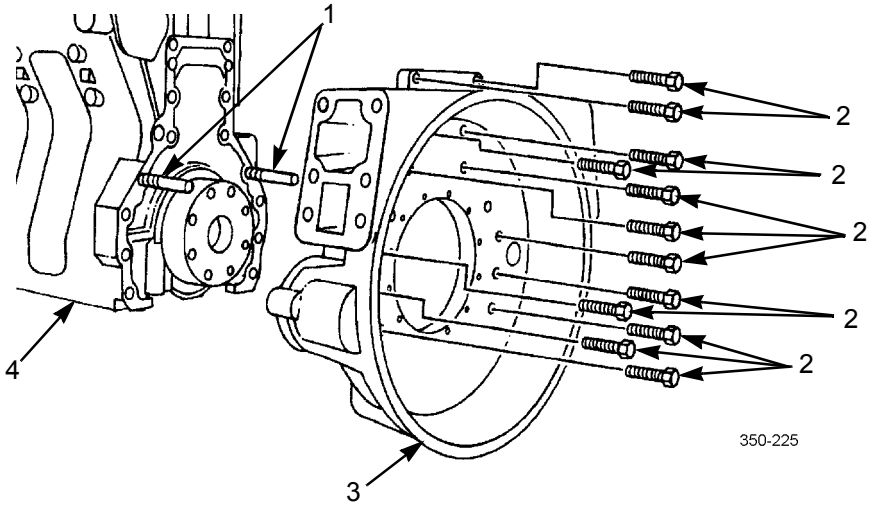
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

5. With assistance, using sling and lifting device, position flywheel housing (3) over guide pins (1).

NOTE

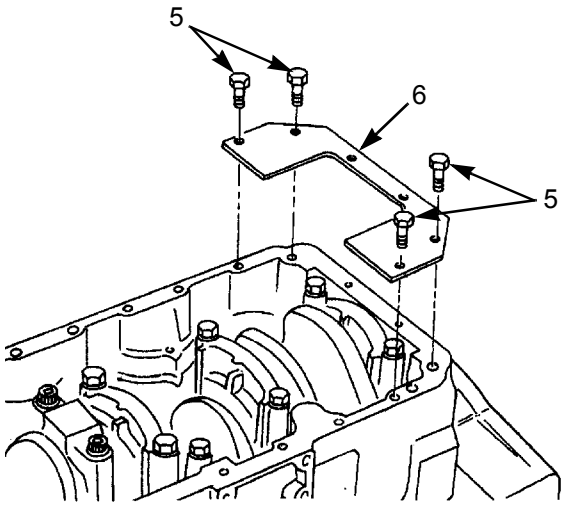
Retaining screws are not fully tightened until flywheel housing has been alined with crankshaft.

6. Secure flywheel housing (3) with 12 screws (2) and tighten screws initially to 60 lb-in (7 Nm).
7. Remove guide pins (1) and install remaining screws (2). Tighten screws to 60 lb-in (7 Nm).



INSTALLATION - CONTINUED

8. Remove four oil pan screws (5) and flywheel alinement plate (6).



ALINEMENT

CAUTION

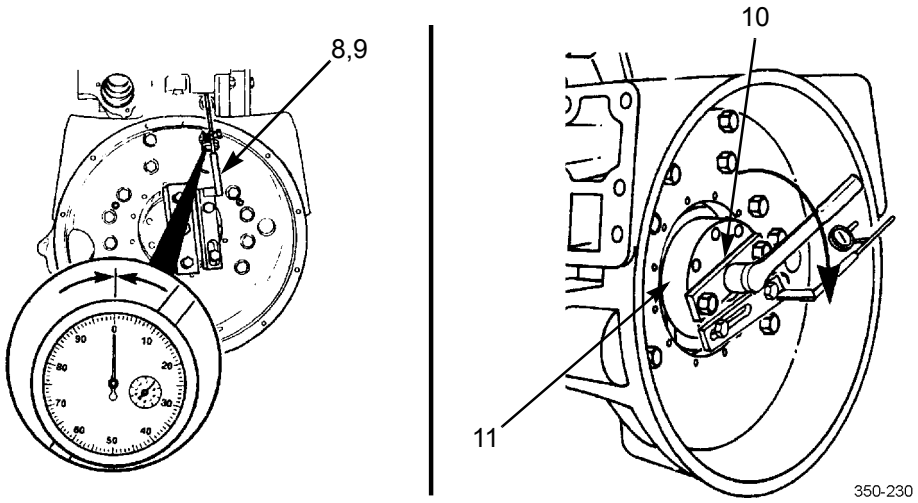
Flywheel housing must be properly positioned in relation to crankshaft for rear main oil seal to fully seat and for flywheel to be centered in housing. Failure to properly aline flywheel housing may result in early seal failure and other equipment damage.

NOTE

If bore alinement is not within specification and bore is not round, flywheel housing must be replaced.

1. Perform flywheel housing bore alinement check as follows:
   a. Install dial indicator gage (8), attachments (9), and engine barring tool (10).
   b. Position dial indicator at 12 o'clock position and adjust gage for "0" (zero).
   c. Using engine barring tool (10), rotate crankshaft (11) one complete revolution and record total indicator reading.

ALINEMENT - CONTINUED



d. Compare recorded reading to Table 2 below for SAE no. flywheel housing being installed. If maximum bore alinement does not meet specification, use a plastic-faced hammer to adjust position of flywheel housing.

Table 2. Flywheel Housing Bore Alinement Maximum TIR.

MM	SAE NO.	IN
0.31	00	0.012
0.25	0	0.010
0.25	½	0.010
0.20	1	0.008
0.20	2	0.008
0.20	3	0.008

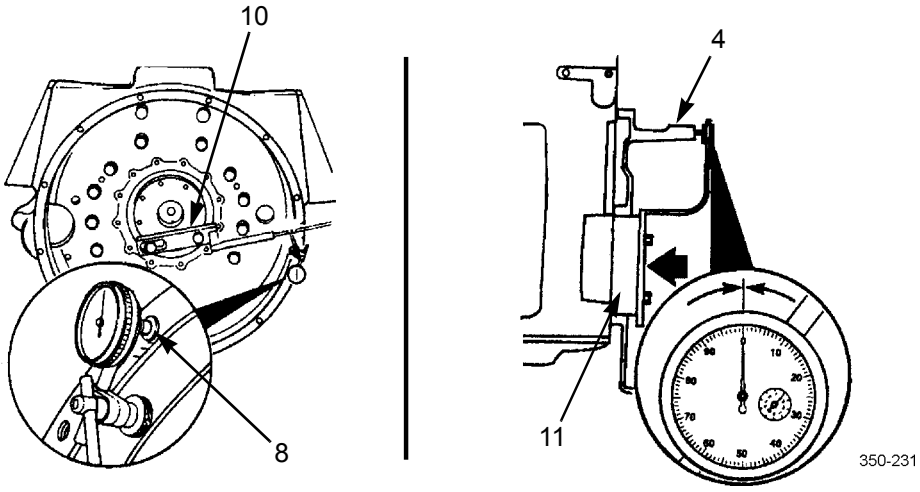
e. Repeat bore alinement check steps a thru d until recorded reading is within specifications. If flywheel housing cannot be alined, it must be replaced.

ALINEMENT - CONTINUED

CAUTION

DO NOT allow tip of gage to enter capscrew holes while performing face alinement check. If tip of gage enters holes, gage will be damaged.

2. Perform flywheel housing face alinement as follows:
   a. Position contact tip of dial indicator gage (8) against flywheel housing (4) face.
   b. Push crankshaft (11) toward front of engine.
   c. Adjust gage dial to “0” (zero).



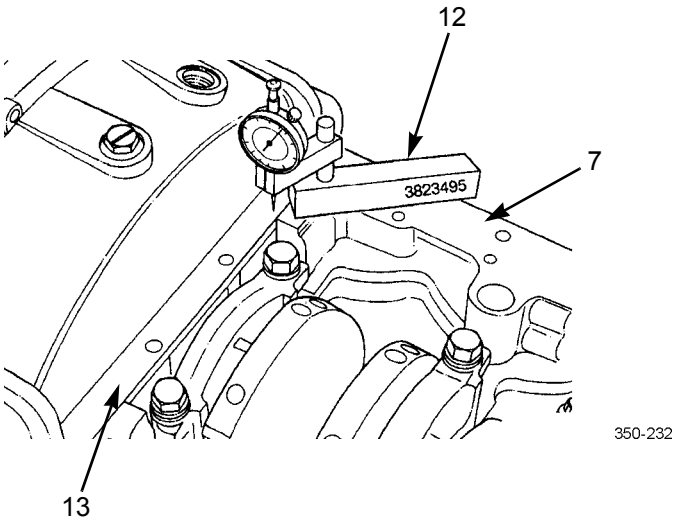
   d. Using engine barring tool (10), rotate crankshaft one complete revolution and record reading.
   e. Compare recorded reading to Table 3 below for SAE no. flywheel housing being installed. If maximum face alinement does not meet specification, and no visible damage or defects have been detected, flywheel housing must be replaced.

Table 3. Flywheel Housing Face Alinement Maximum TIR.

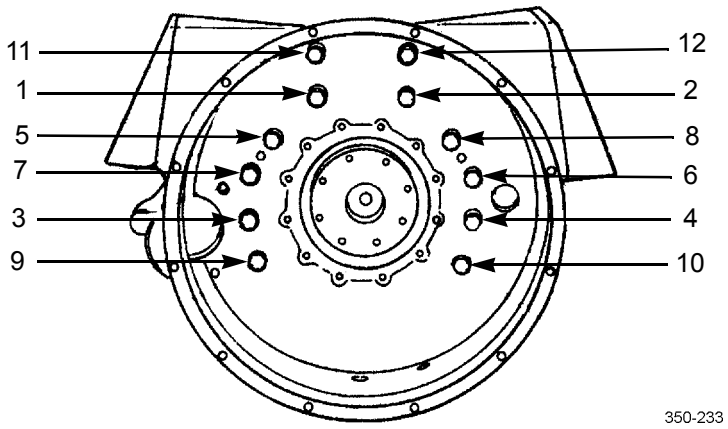
MM	SAE NO.	IN
0.31	00	0.012
0.25	0	0.010
0.25	½	0.010
0.20	1	0.008
0.20	2	0.008
0.20	3	0.008

3. Using gage block (12), check alinement of oil pan flange of flywheel housing (13) with oil pan mounting flange (7) of cylinder block. Flywheel housing oil pan flange must be even with cylinder block flange to within ± 0.006 in (0.15 mm).

ALINEMENT - CONTINUED



4. Using tightening sequence pattern shown, fully tighten 12 screws in three steps as follows:
   a. In first sequence, tighten screws to 50 lb-ft (68 Nm).
   b. In second sequence, tighten screws to 95 lb-ft (129 Nm).
   c. In third sequence, tighten screws to 145 lb-ft (197 Nm).



TIGHTENING SEQUENCE

5. Recheck bore and face alinement measurements. If measurements are within specification, remove measurement tools and engine barring tool.
6. Install new rear main oil seal (WP 0010 00).
7. Install flywheel assembly (WP 0012 00).

ALINEMENT - CONTINUED

8. Install starter (TM 10-3930-675-20).
9. Install engine oil pan (WP 0016 00).

END OF WORK PACKAGE

ROCKER ARM ASSEMBLY MAINTENANCE 0014 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Inspection, Assembly, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Gage, thickness (Item 34, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Wrench, torque, 0-200 lb-in capacity (Item 106, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

References

WP 0015 00

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

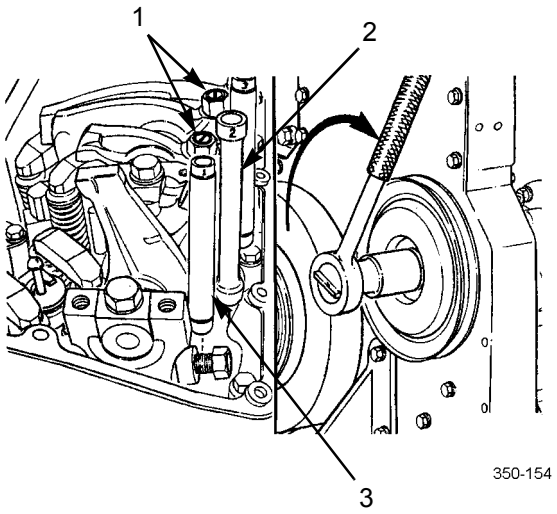
Rocker arm cover removed (TM 10-3930-675-20)

NOTE

Tag or mark all items removed or disassembled while performing these procedures. For proper operation and adjustment, items must be assembled and installed in the location from which they were removed.

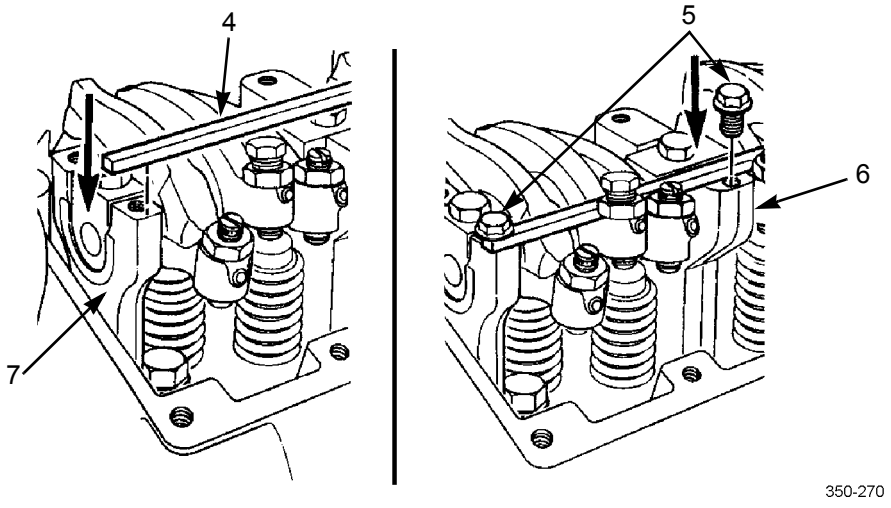
REMOVAL

1. Loosen rocker lever adjusting screws (1) and remove push rods (3) and push tubes (2).

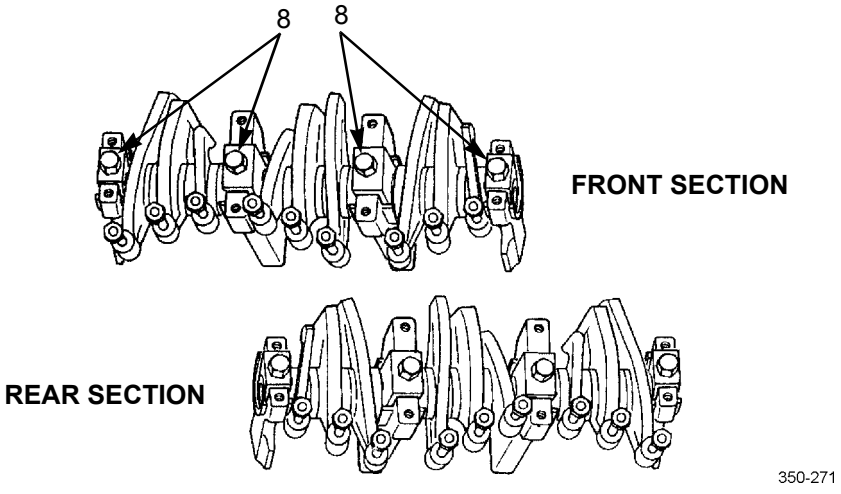


REMOVAL - CONTINUED

2. Position ¼ x 18 in key stock (4) or similar item on top of rocker lever assembly supports (6 and 7). Secure in place with four screws (5).



3. Loosen four rocker shaft screws (8). Remove front section of rocker arm assembly.



4. Perform steps 1 thru 3 and remove rear section of rocker arm assembly.

DISASSEMBLY

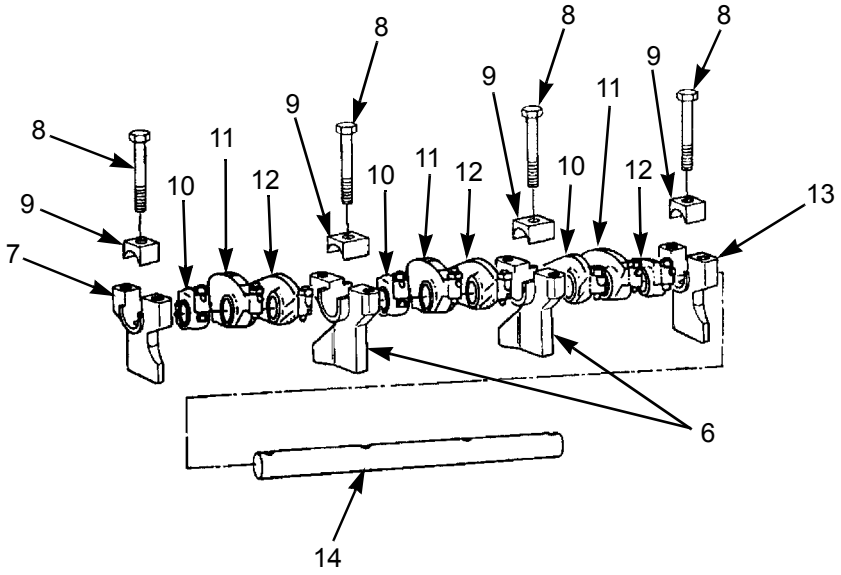
NOTE

Mark or tag each rocker lever, shaft, and support with relative position in rocker assembly.

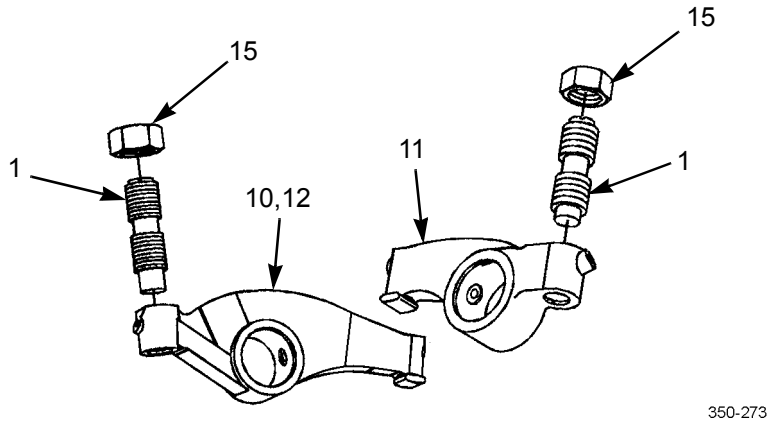
1. Remove four rocker shaft screws (8) and retaining clamps (9).
2. Lift shaft (14) and rocker levers (10, 11, and 12) out of supports (6, 7, and 13).

DISASSEMBLY - CONTINUED

3. Remove rocker levers (10, 11, and 12) from shaft (14).



4. Remove adjusting nut (15) and adjusting screw (1) from each rocker lever (10, 11, and 12).

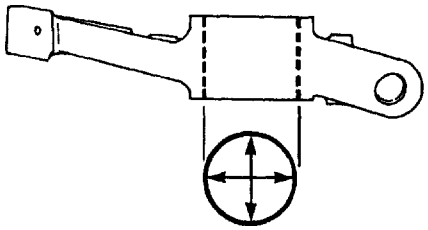


INSPECTION

NOTE

If following conditions are noted or specifications not met, item being inspected must be replaced.

1. Ensure components have been thoroughly cleaned and visually inspect rocker levers for the following conditions:
   a. Cracks, excessive pitting or other visible damage
   b. Thread damage to adjusting screw threads
   c. Sockets and pads for cracks, pits, wear or other damage
2. Visually inspect adjusting nut and adjusting screw for damaged threads.
3. Visually inspect shaft for pitting, scoring or other damage.
4. Visually inspect supports for cracks, pitting or other damage.
5. Measure rocker lever bushing inside diameter. Measurement must be 1.3735-1.3776 in (34.887-34.99 mm). If not within range, replace bushing.



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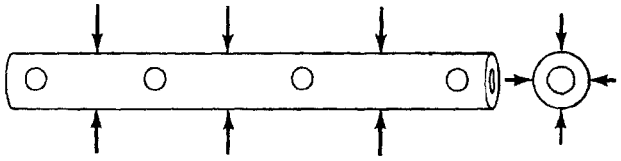
INSIDE DIAMETER, ROCKER LEVER BUSHING

6. Measure outside diameter of rocker lever shaft. Diameter must be 1.3715-1.3726 in (34.837-34.864 mm). If diameter is not within range, replace rocker lever shaft.



350-275

OUTSIDE DIAMETER, ROCKER LEVER SHAFT

ASSEMBLY

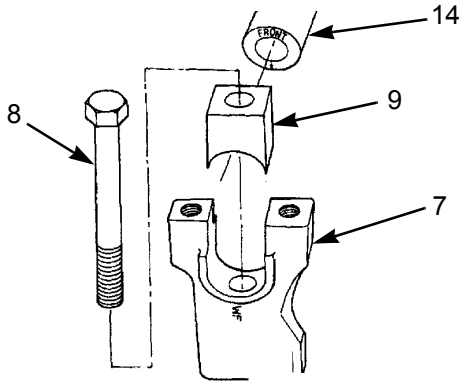
CAUTION

Ensure rocker lever shafts are installed in support with arrow on end of shaft pointed down. Failure to install rocker lever shafts with arrow down will have an adverse effect on rocker lever lubrication and may cause damage to rocker arm assemblies.

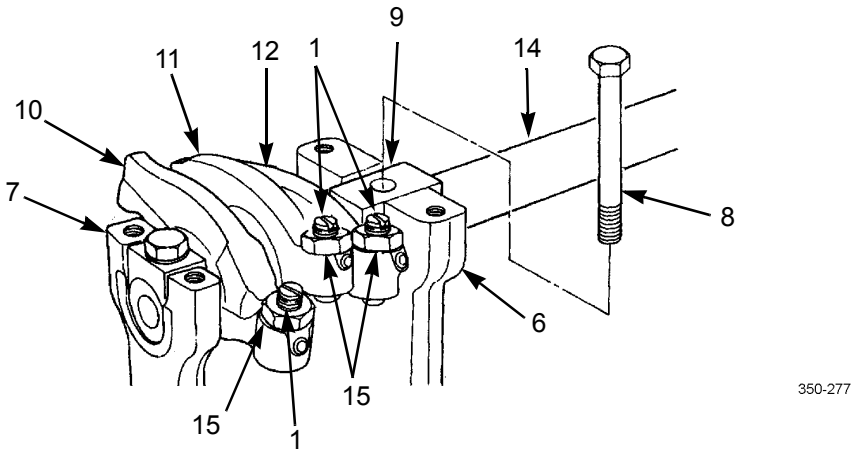
NOTE

Ensure rocker lever shafts are oriented according to marking on shaft ends.

1. Apply a light coat of clean lubricating oil to each rocker lever shaft (14) and install front end support (7) on each rocker lever shaft.
2. Install screw (8) and retaining clamp (9) to secure rocker lever shaft (14) to front end support (7).

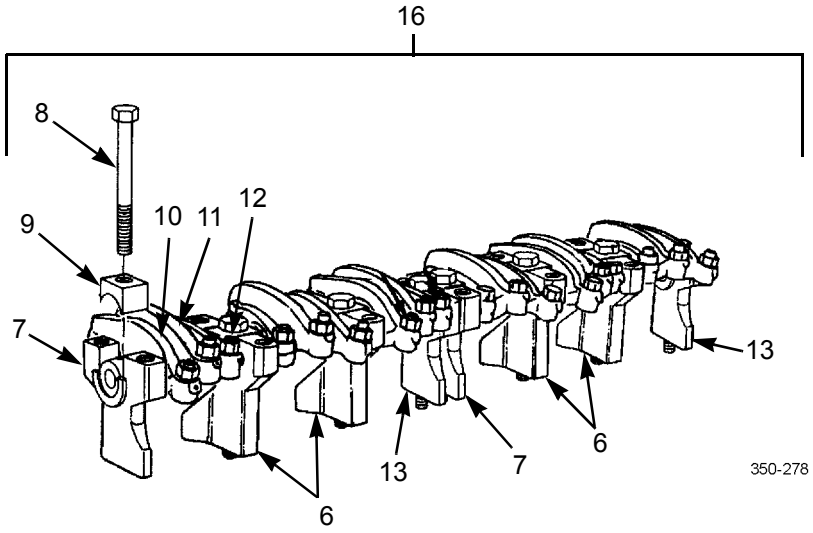


3. Install adjusting screw (1) and adjusting nut (15) in rocker levers (10, 11, and 12) and position rocker levers on shaft (14) in correct sequence as noted in disassembly.
4. Position one center support (6) and secure in place with retaining clamp (9) and screw (8).
5. Install remaining rocker levers (10, 11, and 12), supports (6 and 13) with rocker levers in correct position as noted in disassembly.

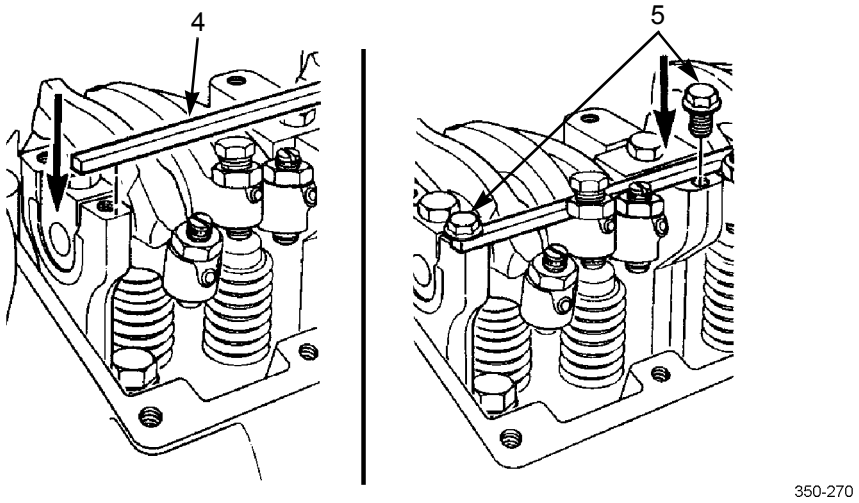


ASSEMBLY - CONTINUED

6. Install remaining retaining clamps (9) and screws (8) on front and rear sections of rocker arm assembly (16).



7. Position key stock (4) used to remove assembly on top of supports and secure in place with four screws (5).

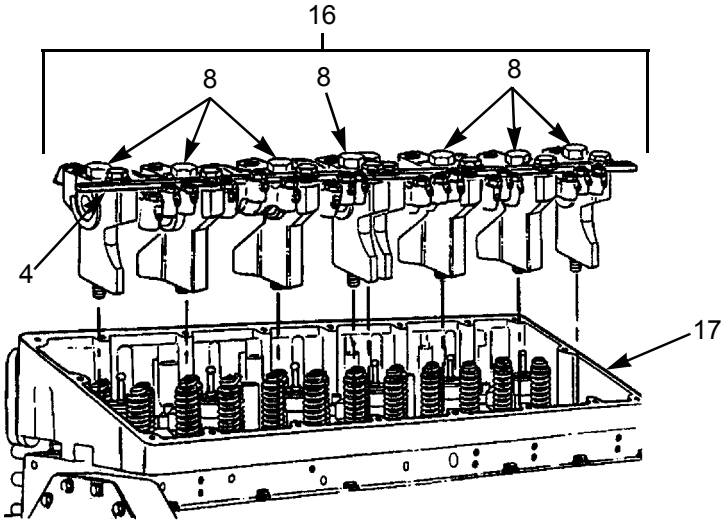


INSTALLATION

NOTE

Rocker arm assembly must be installed in same position from which it was removed.

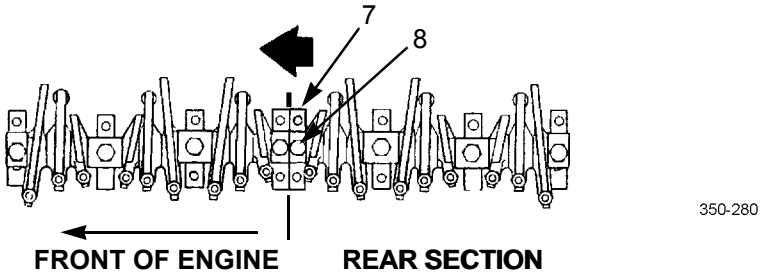
1. Position rocker arm assembly (16) on cylinder head (17). Hand tighten eight screws (8), and remove key stock (4).



NOTE

Rocker lever side clearance MUST be adjusted before screws are fully tightened.

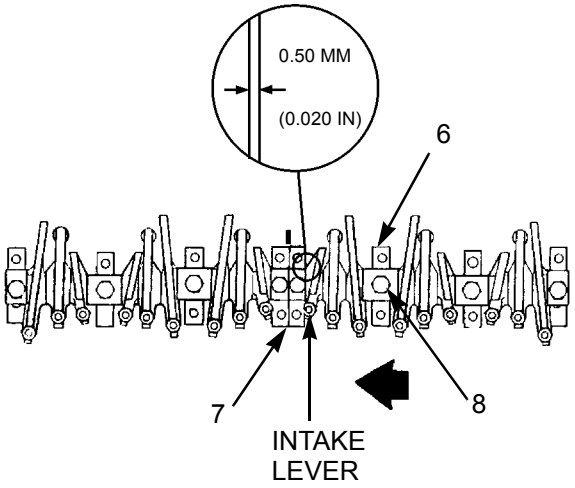
2. Set side clearance for rear section of rocker arm assembly as follows:
   a. Tap number five rocker lever support (7) toward front of engine. Tighten mounting screw (8) to 45 lb-in (5 Nm).



INSTALLATION - CONTINUED

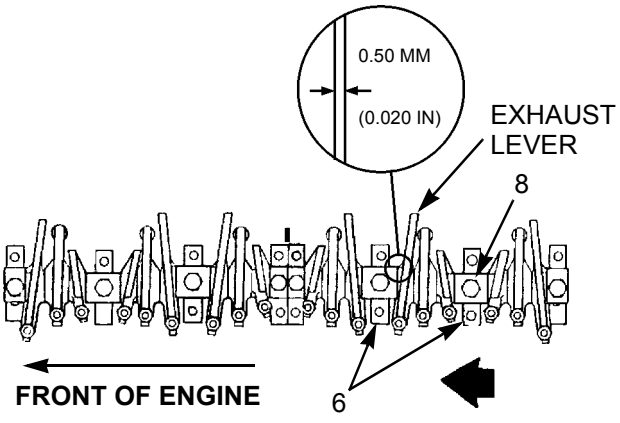
b. Insert 0.020 in (0.50 mm) feeler gage between number five support (7) and intake lever for number four cylinder.

c. Push or tap number six support (6) toward front of engine. Tighten mounting screw (8) to 45 lb-in (5 Nm).



d. Insert 0.020 in (0.50 mm) feeler gage between number six support (6) and exhaust lever for number five cylinder.

e. Push or tap number seven support (6) toward front of engine. Tighten mounting screw (8) to 45 lb-in (5 Nm).

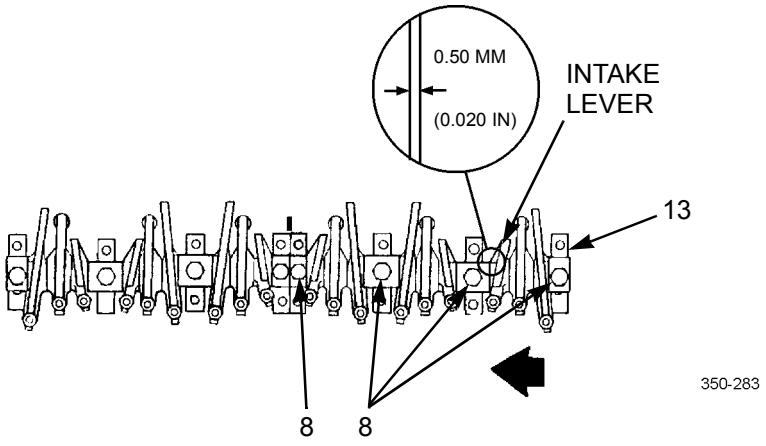


INSTALLATION - CONTINUED

f. Insert 0.020 in (0.50 mm) feeler gage between number seven support (6) and intake lever for number six cylinder.

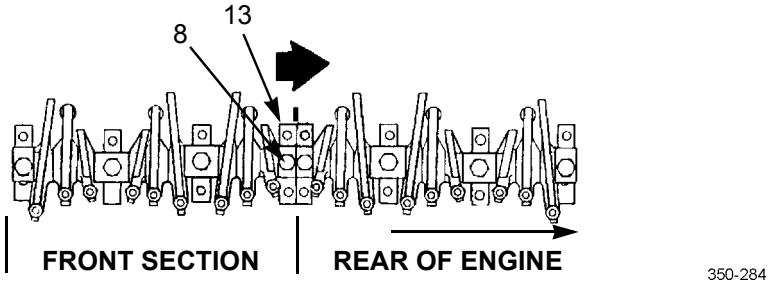
g. Push or tap number eight support (13) toward front of engine.

h. Fully tighten four support mounting screws (8) to 135 lb-ft (183 Nm).



3. Set side clearance for front section of rocker arm assembly as follows:

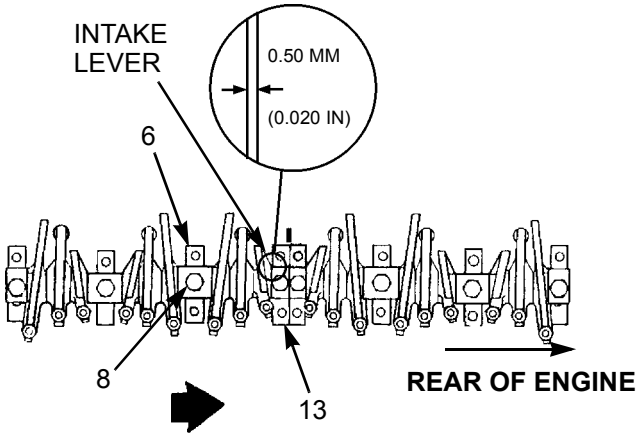
a. Push or use hammer to tap number four support (13) toward rear of engine. Tighten mounting screw (8) to 45 lb-in (5 Nm).



INSTALLATION - CONTINUED

b. Insert 0.020 in (0.50 mm) feeler gage between number four support (13) and intake lever of number three cylinder.

c. Push or tap number three support (6) toward rear of engine. Tighten mounting screw (8) to 45 lb-in (5 Nm).



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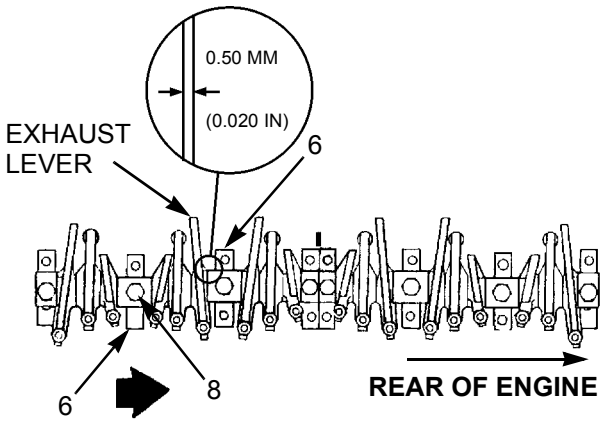
d. Insert 0.020 in (0.50 mm) feeler gage between number three support (6) and exhaust lever for number two cylinder.

e. Push or tap number two support (6) toward rear of engine. Tighten mounting screw (8) to 45 lb-in (5 Nm).



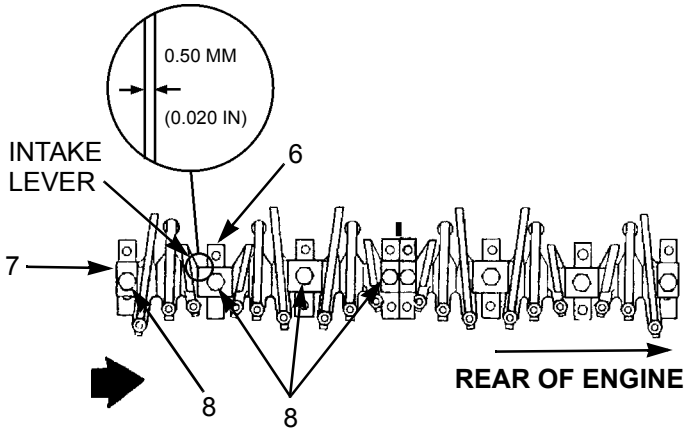
350-286

INSTALLATION - CONTINUED

f. Insert 0.020 in (0.50 mm) feeler gage between number two support (6) and intake lever for number one cylinder.

g. Push or tap number one support (7) toward rear of engine.

h. Fully tighten four support mounting screws (8) to 135 lb-ft (183 Nm).



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NOTE

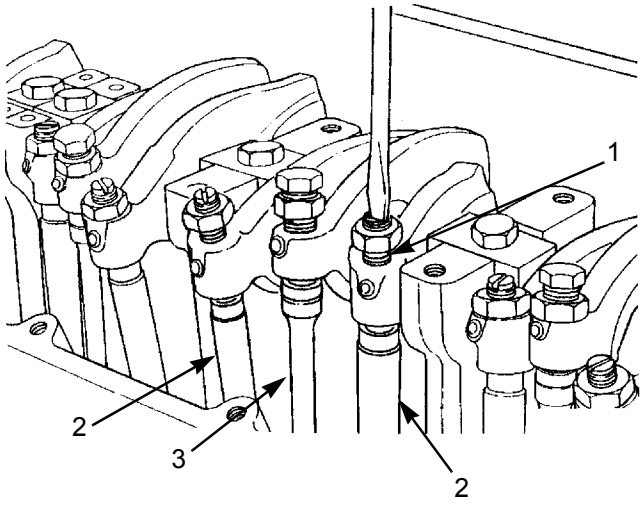
Injector push rods are smaller in diameter and longer than valve push tubes.

4. Apply a light coat of clean lubricating oil to ball end of push rods (3) and push tubes (2).

NOTE

Ensure push rods and tubes are installed in position as noted in removal.

5. Install valve push tubes (2) and injector push rods (3) and tighten adjusting screws (1) enough to hold push rods and tubes in position.



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INSTALLATION - CONTINUED

6. Adjust valves and injectors (WP 0015 00).
7. Install rocker arm cover (TM 10-3930-675-20).
8. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

VALVE AND INJECTOR ADJUSTMENTS 0015 00

THIS WORK PACKAGE COVERS

Valve Lash Check
Injector Lash Check
Injector Adjustment
Valve Adjustment

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Adapter, wrench, torque (Item 1, WP 0090 00)

Adjustment kit, injector (Item 2, WP 0090 00)

Gage, thickness (Item 34, WP 0090 00)

Tools and Special Tools - Continued

Wrench, torque (Item 103, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Equipment Condition

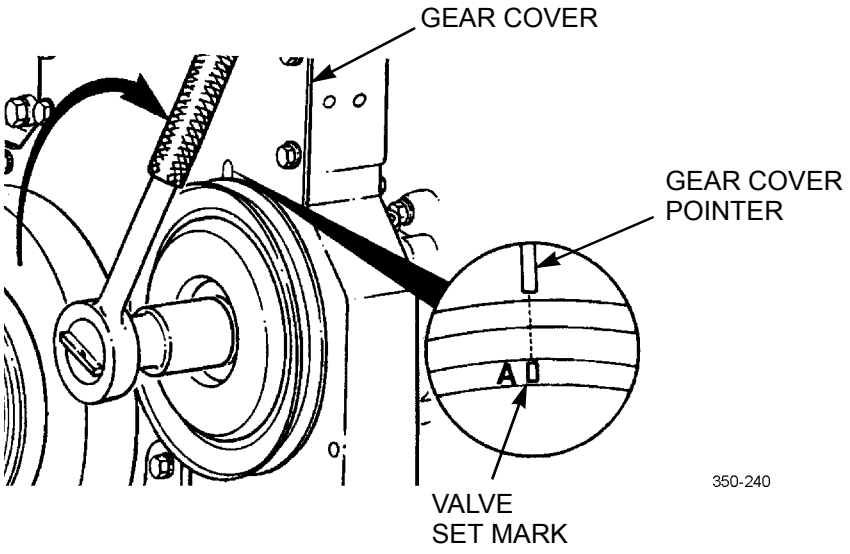
Rocker arm cover removed (TM 10-3930-675-20)

NOTE

- All overhead valve and injector lash measurements and adjustments MUST be made when engine is cold.
- Valve set marks "A", "B", and "C" are located on accessory drive pulley. Marks aline with pointer on gear housing.
- Engine cylinders are numbered from front to rear 1-2-3-4-5-6.
- Crankshaft rotation is clockwise when viewed from front of engine. Firing order is 1-5-3-6-2-4.
- One pair of valves and one injector are checked or adjusted at each pulley index mark before rotating accessory drive to next mark.
- Two crankshaft rotations are required to check or adjust all valves and injectors.

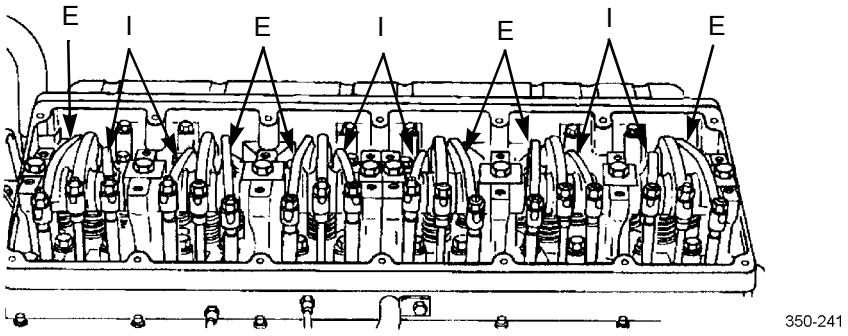
VALVE LASH CHECK

1. Perform valve lash check on each cylinder until all cylinders have been checked.
2. Rotate accessory drive clockwise until valve set mark “A” is alined with pointer on gear cover.



NOTE

Each cylinder has three rocker levers: long lever (E)--exhaust valve; middle lever–injector; short lever (I)--intake valve.



VALVE LASH CHECK - CONTINUED

3. Observe rocker lever arms of cylinder and compare rocker lever arm positions to Table 1 below. Intake and exhaust valves must be closed and injector plunger must be at bottom of stroke for cylinder 1. If this is not correct, cylinder 6 must be ready to check.

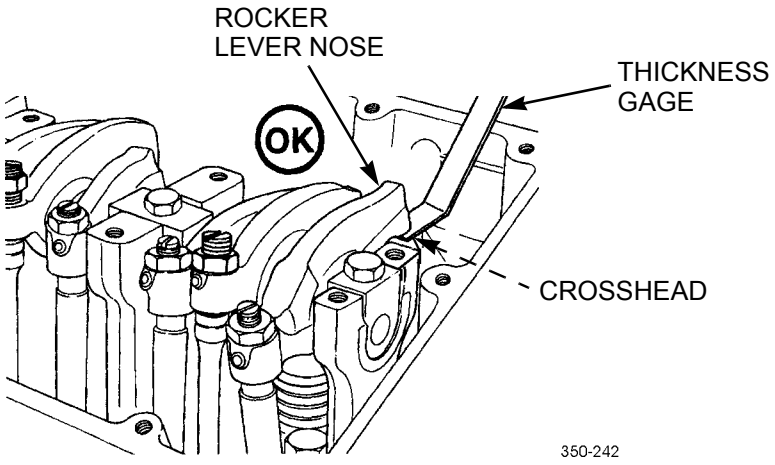
Table 1. Injector and Valve Measurement Sequence.

BAR ENGINE IN DIRECTION OF ROTATION	PULLEY POSITION	SET CYLINDER	
		INJECTOR	VALVE
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4
Firing Order: 1-5-3-6-2-4			

NOTE

Ensure rocker levers on both intake and exhaust valves of cylinder being checked can be “rattled” or push tubes can be freely rotated.

4. With thickness gage, measure and record amount of clearance between crosshead and rocker lever nose for both intake and exhaust valve.



VALVE LASH CHECK - CONTINUED

5. If valve lash clearance is not within specifications listed in Table 2 below, valves must be adjusted.

Table 2. M Series Valve Lash Recheck Limits.

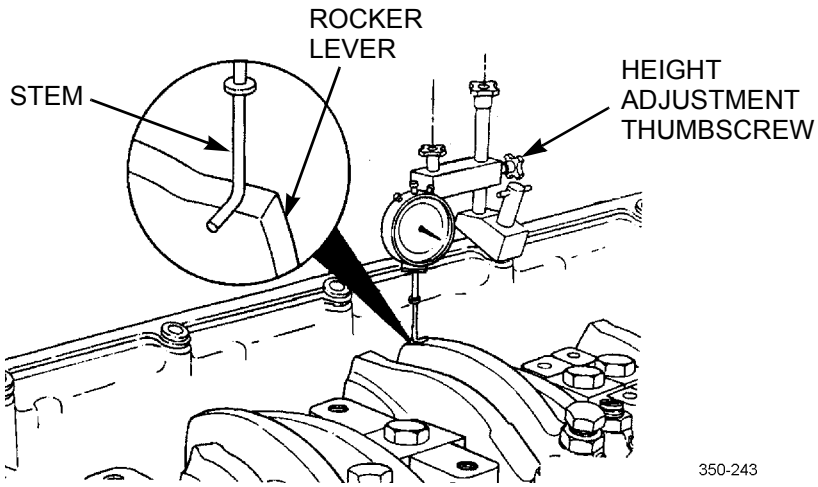
	MM		IN
INTAKE	0.10	MIN	0.004
	0.41	MAX	0.016
EXHAUST	0.46	MIN	0.018
	0.76	MAX	0.030

INJECTOR LASH CHECK

NOTE

To ensure accurate measurement, securely tighten all hold-down screws and thumbscrews.

1. Install dial indicator on cylinder being checked to measure injector rocker arm lever.
2. Adjust and set dial indicator for reading as follows:
   a. Set tip of dial indicator to rest on rocker lever directly above socket.
   b. Loosen height adjustment thumbscrew and lower indicator against injector rocker lever until stem is fully compressed.
   c. Raise indicator approximately 0.500 in (12.7 mm) and tighten height adjustment thumbscrew to hold position.

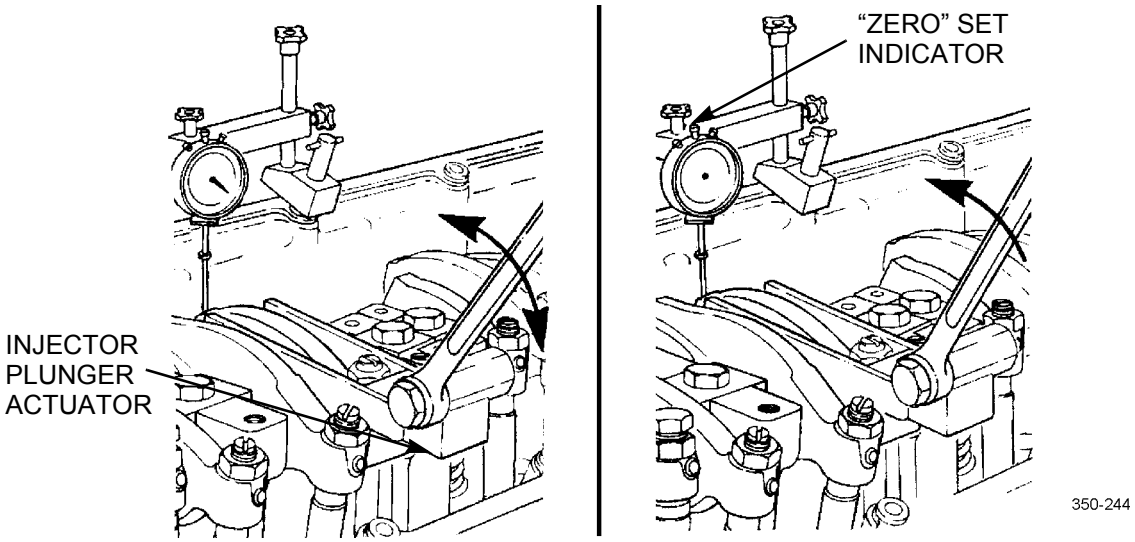


INJECTOR LASH CHECK - CONTINUED

WARNING

Injector plunger is under spring tension. DO NOT allow tool to slip. Serious personal injury can result.

3. With actuator, operate injector plunger three or four times to ensure fuel has been removed from injector assembly.
4. With actuator, operate lever again and, while holding injector plunger to bottom of travel, set dial indicator at “0” (zero).



5. Slowly release actuator and check dial indicator travel. Record measured value. If injector lash setting is not within specifications listed in Table 3 below, injector must be adjusted.

Table 3. M Series Injector Lash Recheck Limits.

MM		IN
0.51	MIN	0.020
2.04	MAX	0.080

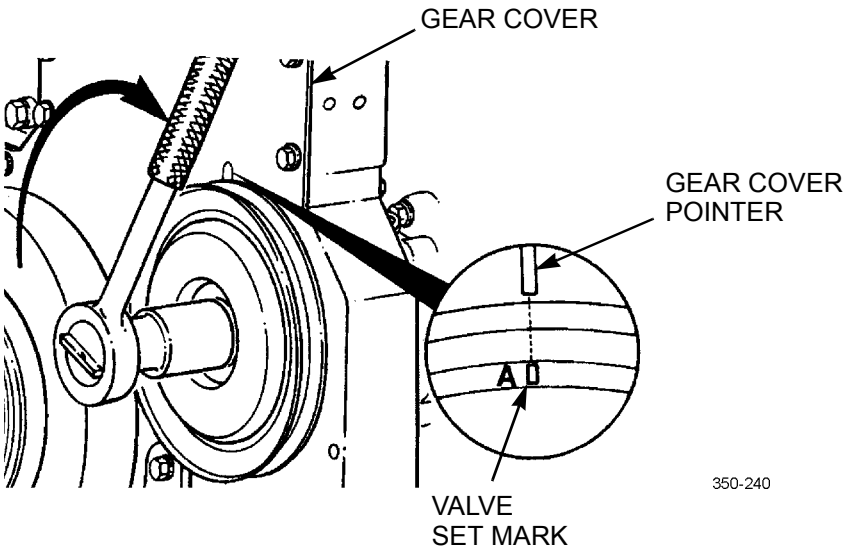
INJECTOR ADJUSTMENT

NOTE

- Set injectors on cylinders before setting valves.
- Adjustment may begin with any valve set mark. Position “A” is described in the following steps.

INJECTOR ADJUSTMENT - CONTINUED

1. Rotate accessory drive clockwise until “A” valve set mark on accessory drive pulley is alined with pointer on gear cover.

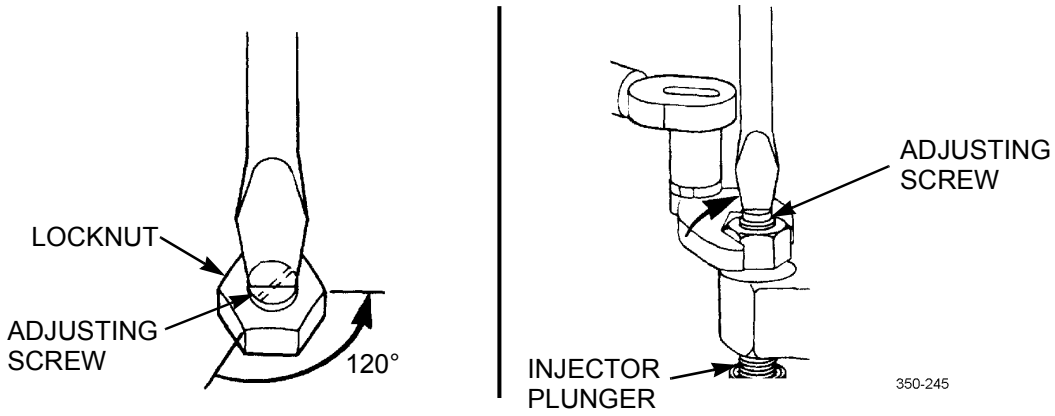


2. With valve set mark “A” alined with pointer, observe both valve rocker levers for cylinder 1. Intake and exhaust valves for cylinder must be closed. If condition is not met, then cylinder 6 injector and valves must be ready to set.
3. Adjust injector as follows:
   a. Loosen injector adjusting screw locknut.
   b. Bottom injector plunger three or four times to remove fuel.

NOTE

Do not use excessive force when bottoming plunger.

   c. Turn adjusting screw in until you can feel it lightly bottom plunger.
   d. Back out adjusting screw two flats or 120°.
   e. Hold adjusting screw and tighten locknut to 45 ft-lb (61 Nm).



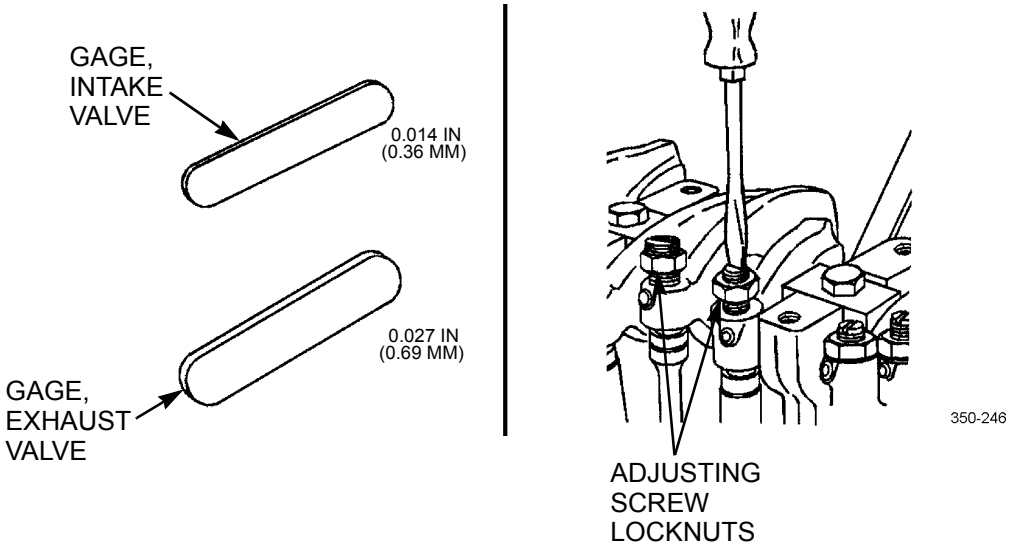
4. Perform valve adjustments on same cylinder.

VALVE ADJUSTMENT

NOTE

Ensure valve set mark “A” is alined with pointer on gear cover and both valves are closed on cylinder to be adjusted.

1. Loosen adjusting screw locknuts on intake and exhaust valves.
2. Select thickness gage for correct valve lash specification listed:
   a. Intake valve--0.014 in (0.36 mm)
   b. Exhaust valve--0.027 in (0.69 mm)



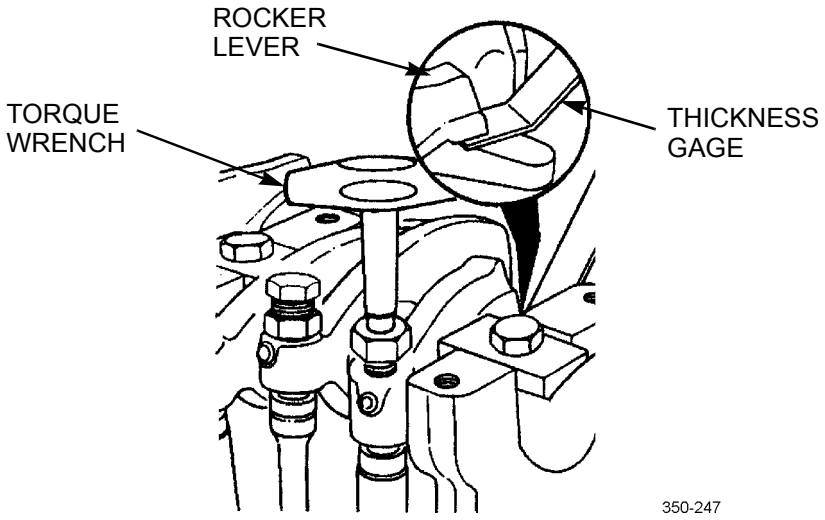
VALVE ADJUSTMENT - CONTINUED

3. Insert thickness gage between top of crosshead and rocker lever pad.

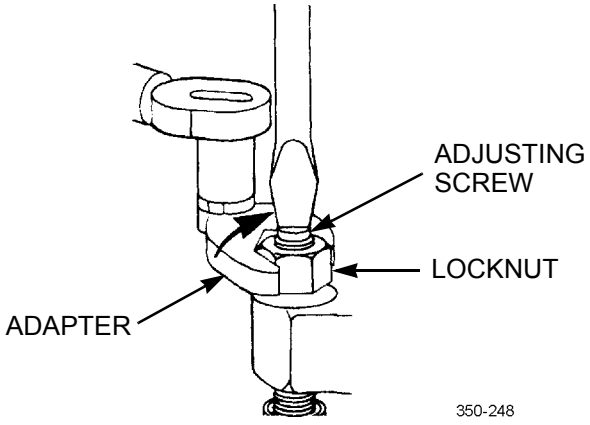
NOTE

Two methods of adjusting valve lash can be used: The first method, which is preferred, is described in steps 4 thru 7, and uses the inch-pound torque wrench; the second method is described in steps 8 thru 11.

4. With inch-pound torque wrench, tighten adjusting screw to 6 lb-in (0.7 Nm).

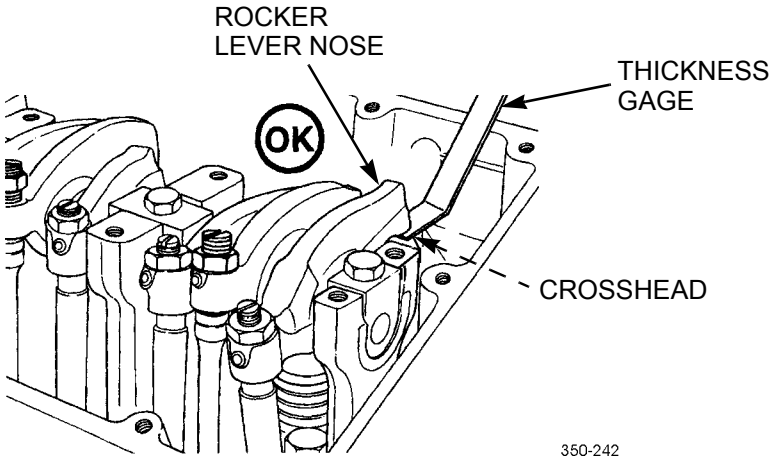


5. Hold adjusting screw in position and tighten locknut.
6. With adapter, tighten locknut to 35 lb-ft (47 Nm).

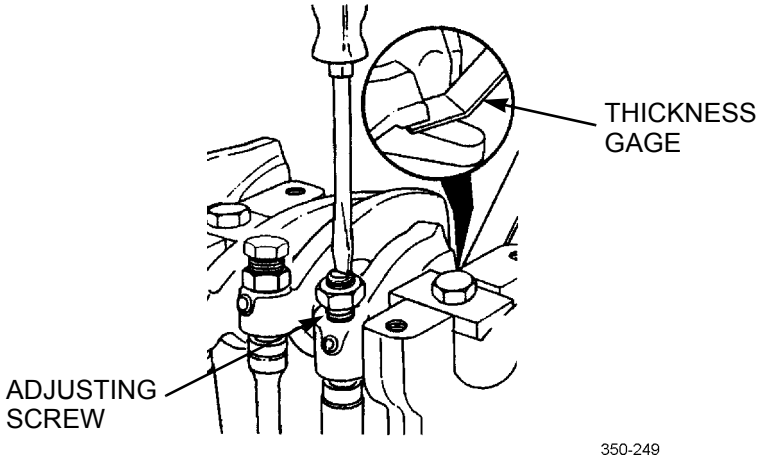


VALVE ADJUSTMENT - CONTINUED

7. Check adjustment by ensuring thickness gage will slide backward and forward with only slight drag.

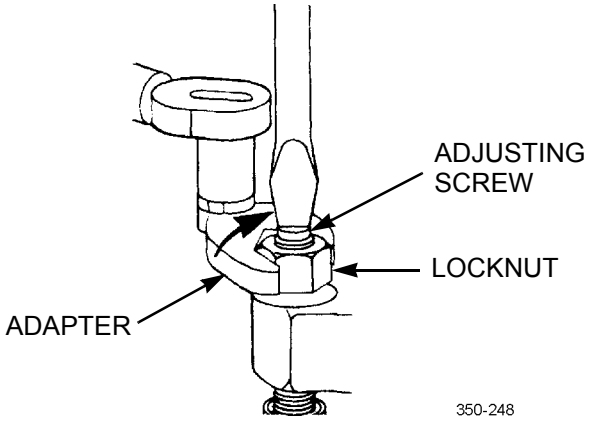


8. Tighten adjusting screw until a slight drag is felt on thickness gage.



VALVE ADJUSTMENT - CONTINUED

9. Hold adjusting screw and tighten locknut.
10. With adapter, tighten locknut to 35 lb-ft (47 Nm).



11. Check adjustment by attempting to insert a 0.001 in (0.03 mm) feeler gage between crosshead and rocker lever pad. Valve lash is not correct if gage can be inserted.
12. Perform injector and valve adjustments for remaining cylinders.
13. Install rocker arm cover (TM 10-3930-675-20).

END OF WORK PACKAGE

OIL PAN REPLACEMENT 0016 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Materials/Parts - Continued

Gasket (P/N 3882733)

Seal, o-ring (P/N 3032787) (2)

References

LO 10-3930-675-12

TM 10-3930-675-10

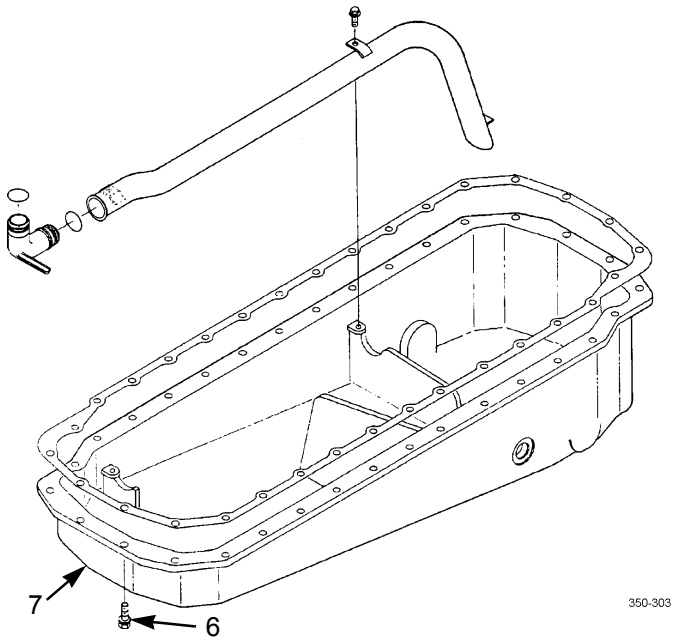
Equipment Condition

Engine oil drained (TM 10-3930-675-20)

Front propeller shaft disconnected (TM 10-3930-675-20)

REMOVAL

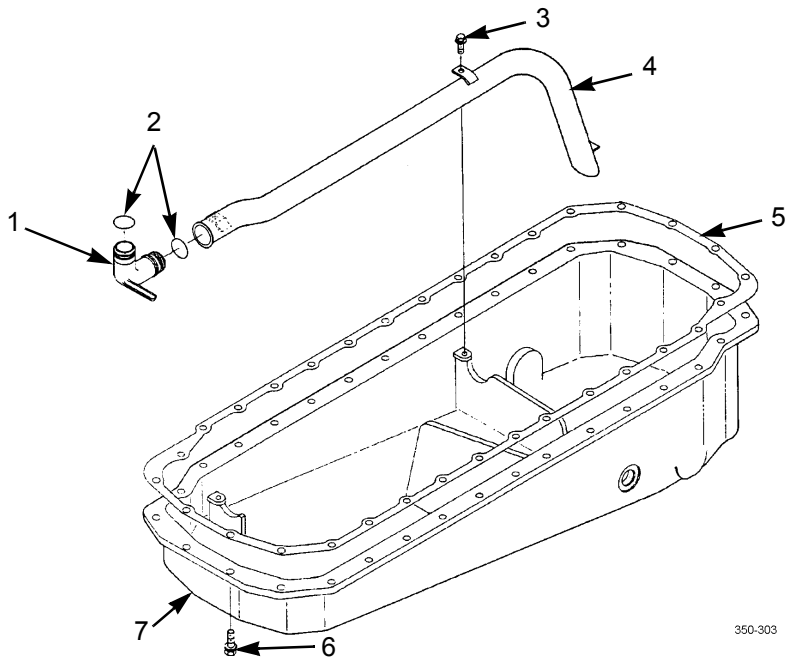
1. Remove 32 screws (6) securing oil pan (7) to engine block.



REMOVAL - CONTINUED

NOTE

It may be necessary to tap lightly on oil pan with a plastic-faced hammer to break seal between oil pan and engine block.



2. Lower oil pan (7) and remove from engine.
3. Remove and discard oil pan gasket (5).
4. Remove o-ring seals (2) and oil transfer tube (1) from oil pan suction tube (4). Discard o-ring seals.

NOTE

If replacing oil pan, oil suction tube must be removed and transferred to new oil pan.

5. Remove oil suction tube (4) as follows:
   a. Remove three screws (3) securing oil suction tube (4) to oil pan (7).
   b. Remove oil suction tube (4) from oil pan (7).

INSTALLATION

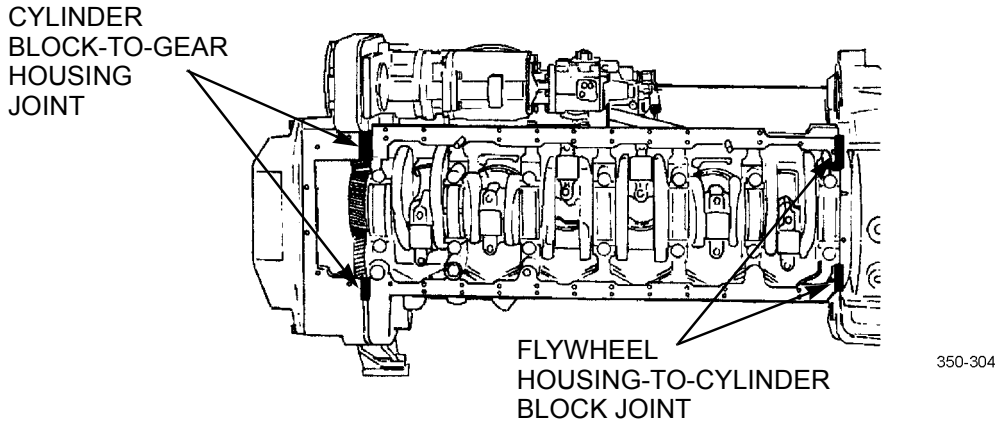
1. Install oil suction tube (4) as follows:
   a. Apply a thin coat of clean engine oil to two new o-ring seals (2) and install o-ring seals on oil transfer tube (1).
   b. Position oil suction tube (4) in oil pan (7) and secure with three screws (3).
   c. Install oil transfer tube (1) with two o-ring seals (2).

NOTE

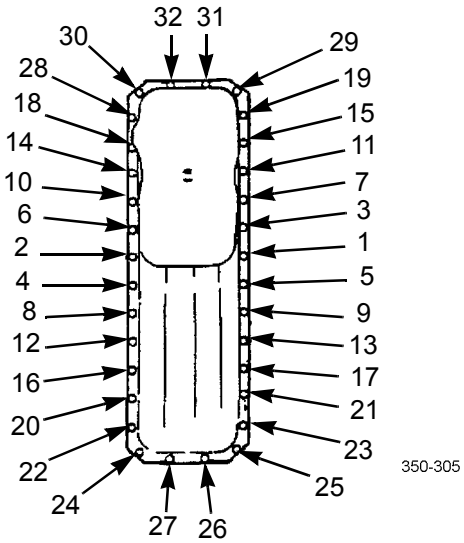
Ensure oil pan is clean and engine block mating flanges are clean and free of old gasket material.

2. Apply a bead of sealant to oil pan mounting surfaces at cylinder block-to-gear housing joint and flywheel housing-to-cylinder block joint.

INSTALLATION - CONTINUED



3. Place new gasket (5) on oil pan (7) mounting flange.
4. Aline oil suction tube (4) with engine block and install oil pan (7) to engine block.
5. Secure oil pan (7) with 32 screws (6). Tighten screws to 35 lb-ft (47 Nm) in sequence shown.



TIGHTENING SEQUENCE

6. Fill engine oil (LO 10-3930-675-12).
7. Start engine (TM 10-3930-675-10) and build up oil pressure. Shut down engine
8. Check oil pan for leaks.
9. Connect front propeller shaft (TM 10-3930-675-20).

END OF WORK PACKAGE

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OIL FILTER HEAD AND OIL COOLER MAINTENANCE 0017 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Test, Assembly, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pliers, retaining ring (Item 63, WP 0090 00)

Pliers, retaining ring (Item 64, WP 0090 00)

Test kit, pressure (Item 90, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Gasket (P/N 3820629)

Materials/Parts - Continued

Gasket (P/N 3892625) (2)

Seal, o-ring (P/N 109080) (2)

Seal (P/N 3080769) (2)

Personnel Required

Two

References

LO 10-3930-675-12

TM 10-3930-675-10

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

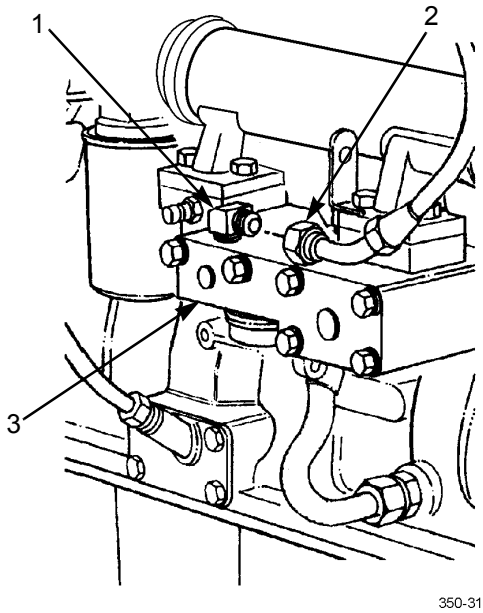
Oil filter removed (TM 10-3930-675-20)

Radiator drained (TM 10-3930-675-20)

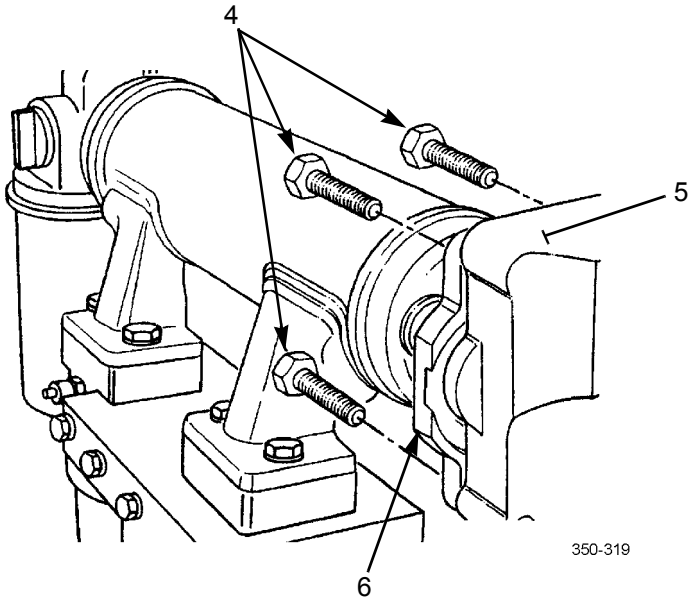
Turbocharger removed (WP 0025 00)

REMOVAL

1. Disconnect turbocharger oil supply line (2) and remove elbow fitting (1) from oil filter head (3).



2. Remove four screws (4) securing oil cooler thermostat housing flange (6) to thermostat housing (5).



REMOVAL - CONTINUED

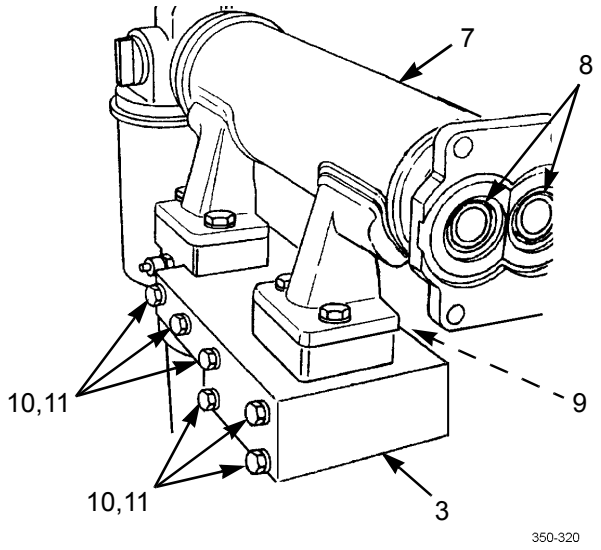
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury to personnel.

NOTE

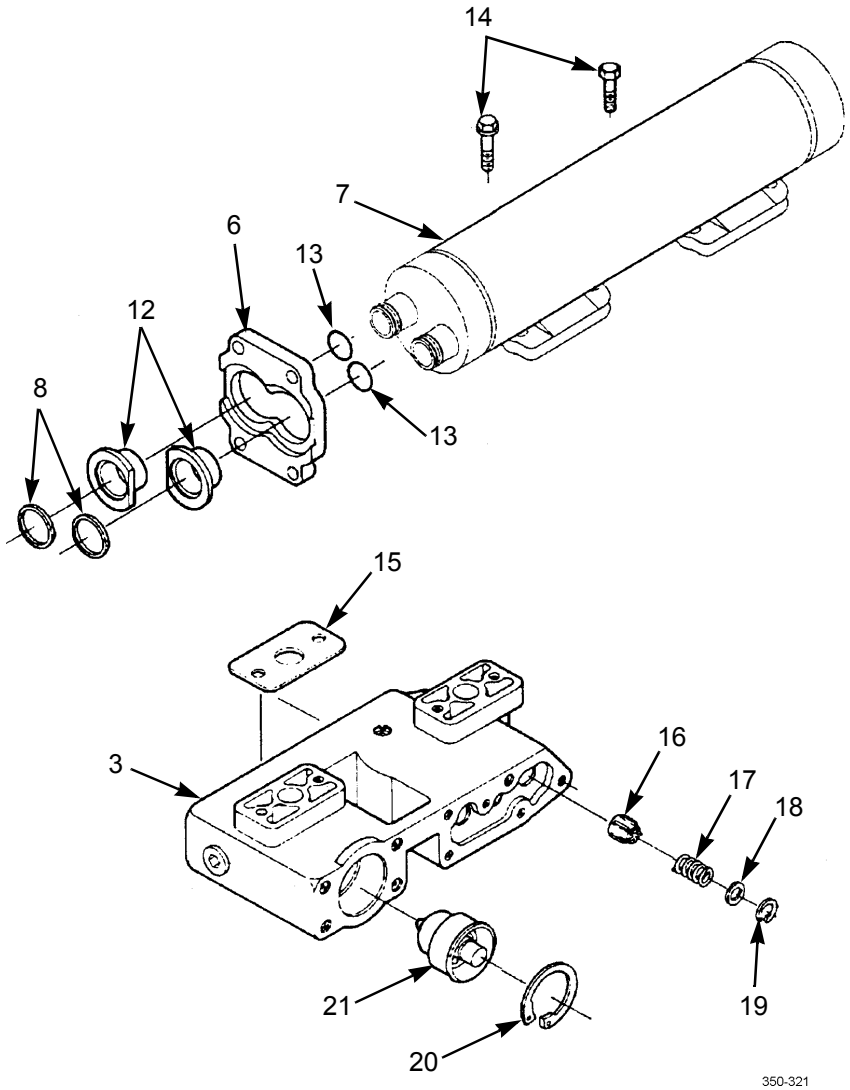
When removing oil filter head and oil cooler as a unit, ensure oil cooler thermostat housing flange, o-ring adapters, and thermostat housing flange o-rings are removed with oil cooler.

3. Remove six screws (10) and washers (11) securing oil filter head (3) to engine and with assistance, remove oil cooler (7) and oil filter head as a unit from engine. Discard oil filter head gasket (9) and oil cooler thermostat housing flange o-rings (8).



DISASSEMBLY

1. Slide thermostat housing flange (6) and two o-ring adapters (12) from oil cooler (7).
2. Remove and discard two oil cooler inlet and outlet o-rings (13).
3. Remove four screws (14) securing oil cooler (7) to oil filter head (3).
4. Remove oil cooler (7) and two gaskets (15) from oil filter head (3). Discard gaskets.
5. Remove retaining ring (20) securing oil filter head thermostat (21) in oil filter head (3). Remove thermostat.
6. Remove retaining ring (19) securing bypass valve plunger (16) in oil filter head (3).
7. Remove washer (18), spring (17), and bypass valve plunger (16) from oil filter head (3).



CLEANING

WARNING

- Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

1. Clean thermostat and bypass valve plunger with solvent and dry with compressed air.

NOTE

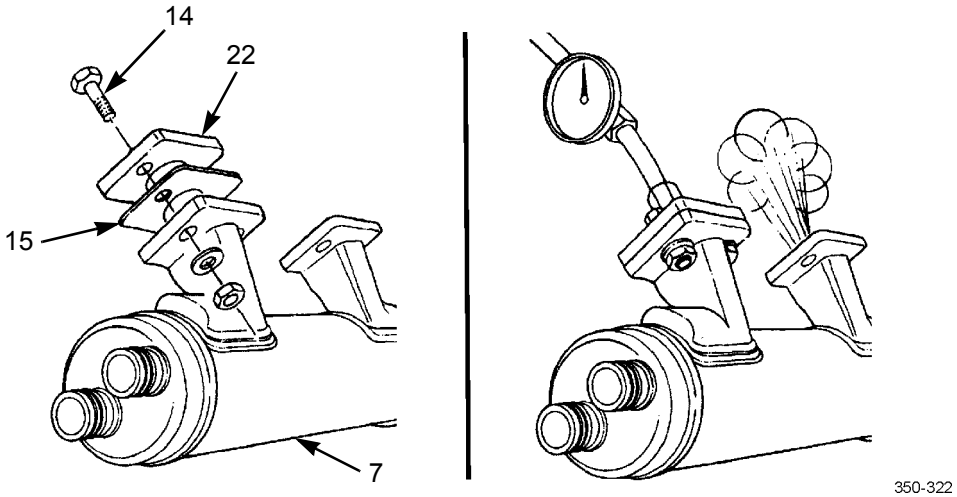
Ensure oil filter head open passages are cleaned and dried.

2. Clean oil filter head with solvent and dry with compressed air.
3. Clean all mating surfaces of oil cooler, oil filter head, and engine to remove old gasket material.
4. Clean oil cooler as follows:
   a. Install pressure test plate (22), gasket (15), and two screws (14) on one of two oil passage openings of oil cooler (7).

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

   b. Attach air pressure line to pressure test plate (22) and clear oil from inside oil passage.



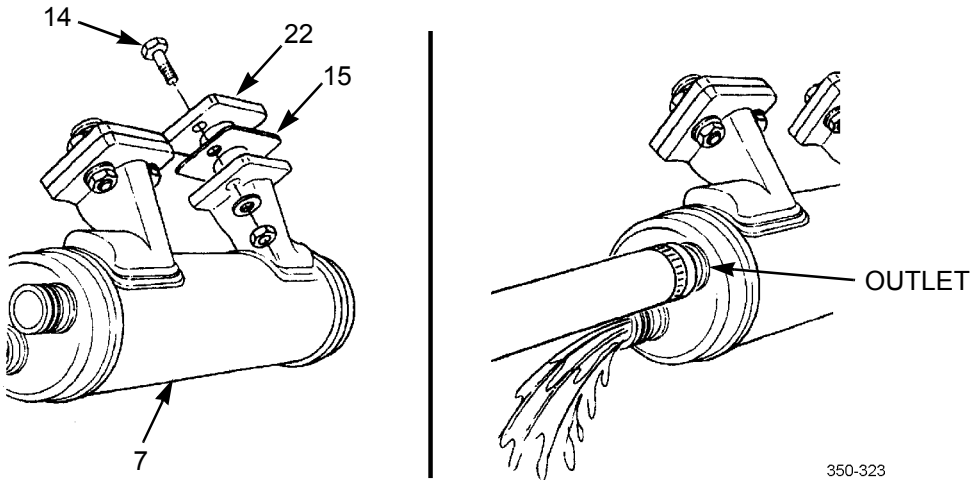
CLEANING - CONTINUED

c. Install pressure test plate (22), gasket (15), and two screws (14) on second oil passage opening in oil cooler (7).

NOTE

Both oil passage openings must be sealed before cleaning oil cooler water core.

d. Use water pressure, attached to outlet side of housing, to clean oil cooler water core.



INSPECTION

1. Inspect oil filter head for cracks or other damage. If damaged, replace oil filter head.
2. Inspect oil thermostat and bypass valve for cracks or other damage. If damaged, replace.
3. Inspect oil cooler for cracks or other damage. If damaged, replace.

TEST

NOTE

Oil cooler is not a repairable component. If oil cooler is defective, it must be replaced.

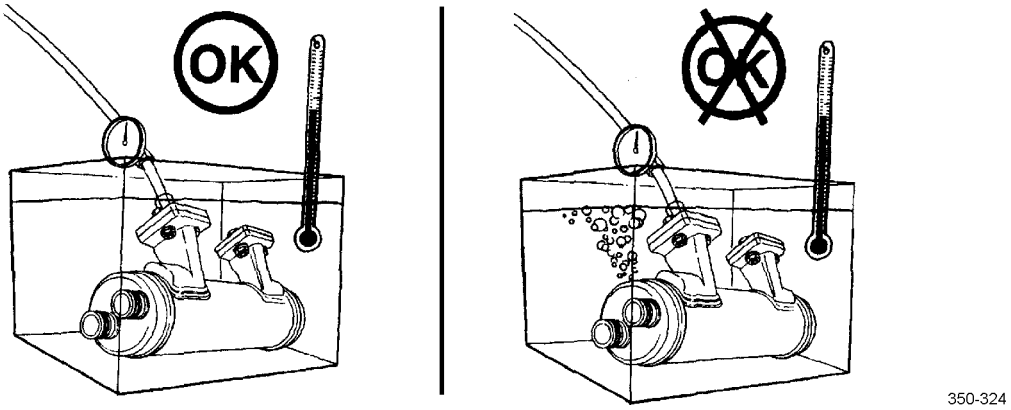
To determine oil cooler serviceability, perform pressure test as follows:

a. Ensure both oil passages are sealed with pressure test plates and install air pressure line to one pressure test plate.

b. Place oil cooler in tank of water heated to 180°F (82° C).

c. Apply air pressure not to exceed 60 psi (414 kPa) and observe oil cooler. If leaks are detected, oil cooler is defective and must be replaced.

TEST - CONTINUED

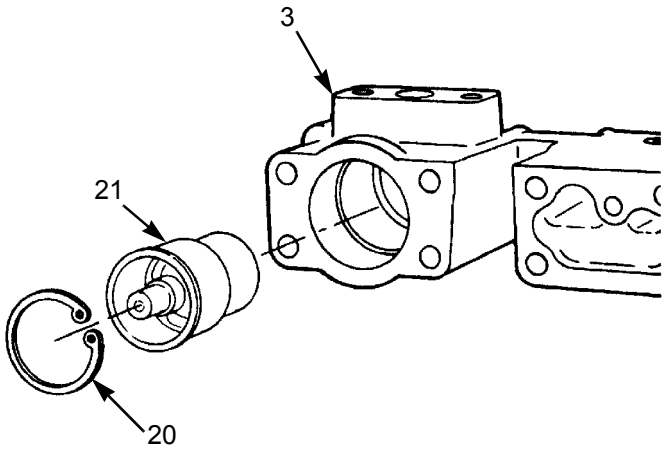


350-324

OIL COOLER PRESSURE TEST

ASSEMBLY

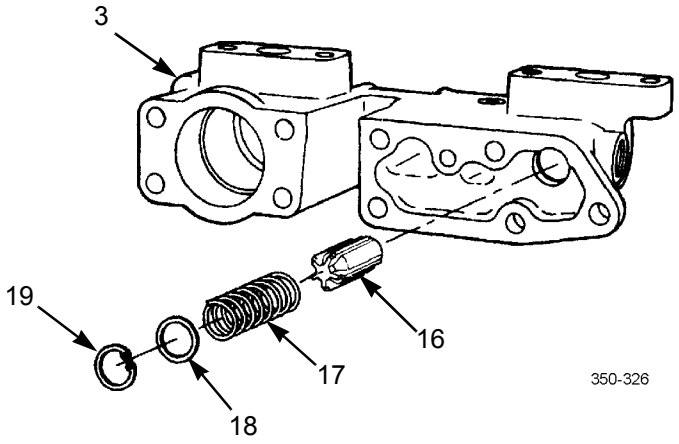
1. Install thermostat (21) in oil filter head (3) and secure with retaining ring (20).



350-325

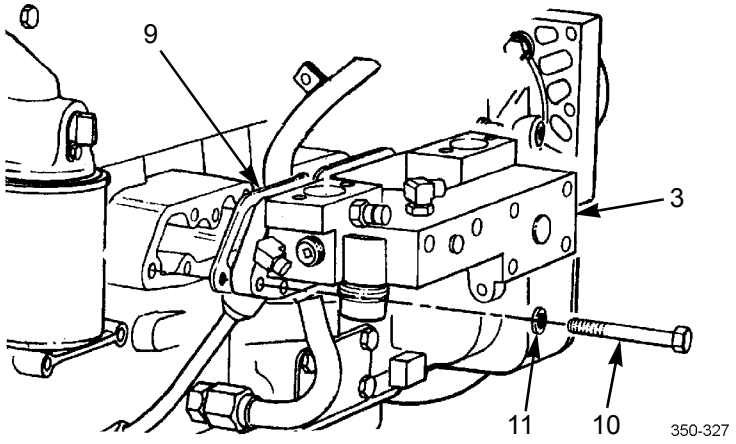
ASSEMBLY - CONTINUED

2. Install bypass valve plunger (16), spring (17), and washer (18) in oil filter head (3) and secure with retaining ring (19).



INSTALLATION

1. With assistance, position oil filter head (3) with new gasket (9) on engine.
2. Secure oil filter head (3) with six washers (11) and screws (10). Tighten screws to 35 lb-ft (47 Nm).



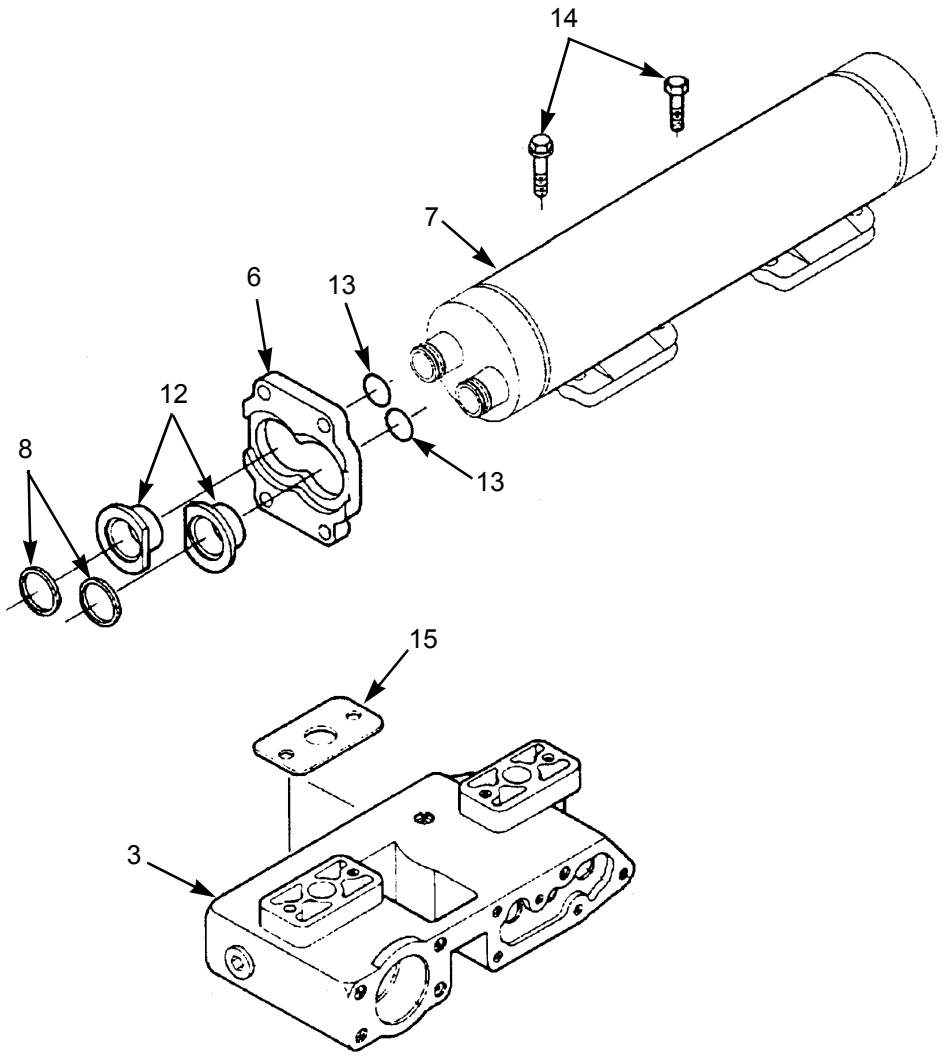
3. Lubricate two new o-rings (13) with clean engine oil and install on oil cooler inlet and outlet tubes.

NOTE

Ensure o-ring adapter flat sides are facing each other when inserted into thermostat housing flange.

4. Place thermostat housing flange (6) on oil cooler (7) and insert, as far as possible, two o-ring adapters (12).
5. Lubricate two new o-rings (8) with clean engine oil and insert into o-ring adapters (12).
6. Position new gaskets (15) on oil filter head (3).
7. Install oil cooler (7) into thermostat housing and on oil filter head (3). Secure oil cooler to oil filter head with four screws (14). Tighten screws to 35 lb-ft (47 Nm).

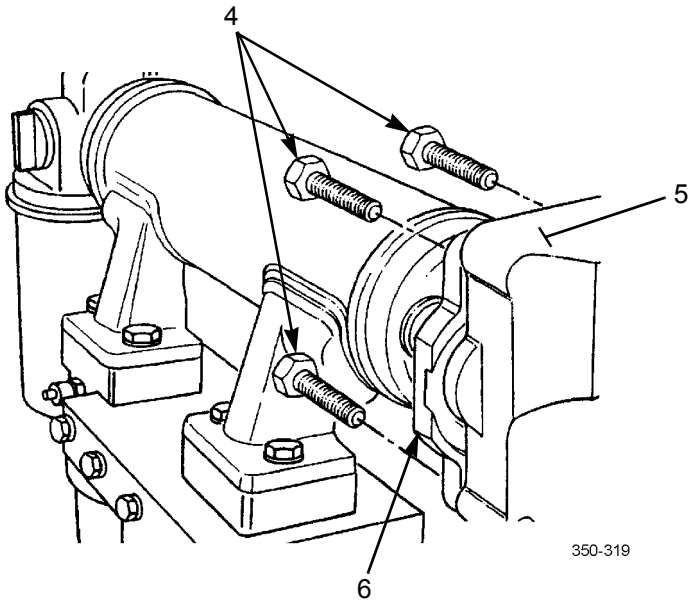
INSTALLATION - CONTINUED



350-1077

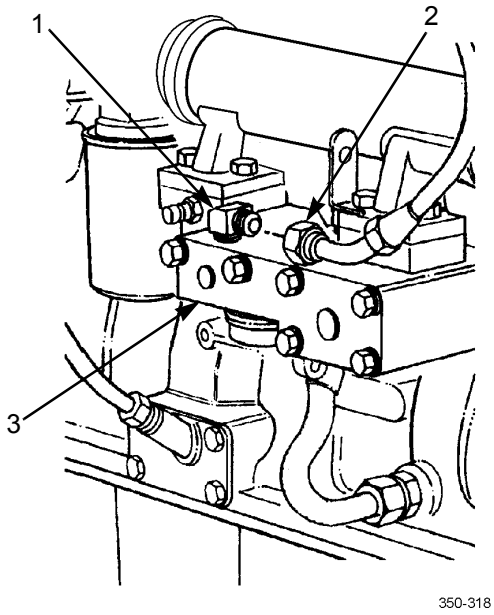
INSTALLATION - CONTINUED

8. Secure oil cooler thermostat housing flange (6) in thermostat housing (5) with four screws (4). Tighten screws to 35 lb-ft (47 Nm).



9. Install turbocharger (WP 0025 00).

10. Install elbow fitting (1) to oil filter head (3) and connect turbocharger oil supply line (2).



INSTALLATION - CONTINUED

11. Install oil filter (TM 10-3930-675-20).

NOTE

Ensure cooling system drains are closed.

12. Fill cooling system (TM 10-3930-675-20).
13. Top off oil (LO 10-3930-675-12).

CAUTION

Engine oil pressure MUST be indicated on gage within 15 seconds after starting. If oil pressure is not registered within 15 seconds, shut off engine immediately to avoid engine damage.

14. Start engine (TM 10-3930-675-10). Operate engine at idle for 3 minutes to check for leaks.
15. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

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EXHAUST MANIFOLD REPLACEMENT 0018 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pin, guide (Item 59, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Compound, antiseize (Item 5, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Materials/Parts - Continued

Gasket (P/N 3328948) (6)

References

TM 10-3930-675-10

Equipment Condition

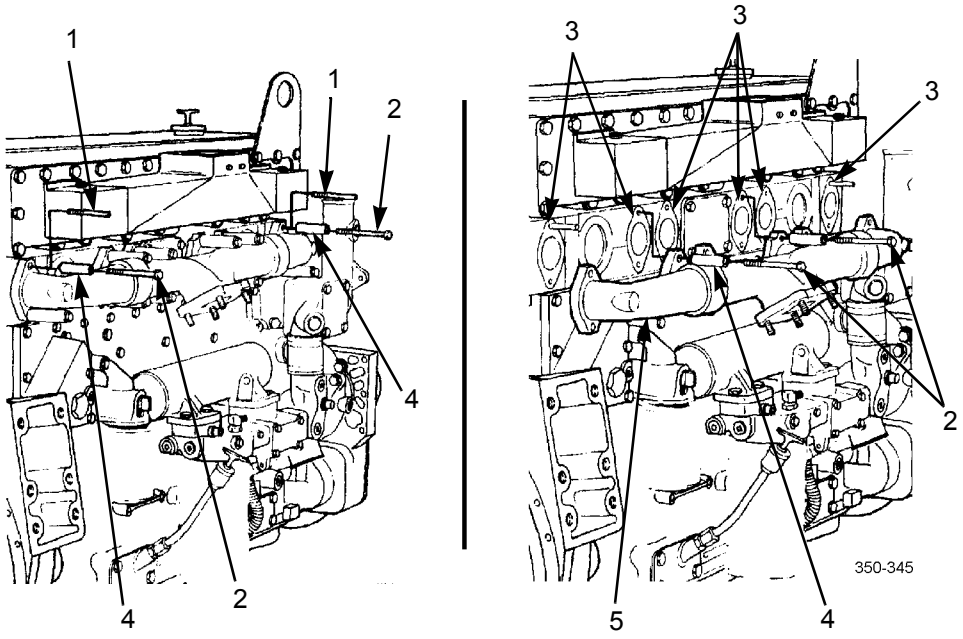
Engine cover removed (TM 10-3930-675-20)

Air duct removed (TM 10-3930-675-20)

Turbocharger removed (WP 0025 00)

REMOVAL

1. Remove two screws (2) and spacers (4) from end sections of exhaust manifold (5).
2. Install guide pins (1) in place of removed screws (2).
3. Remove ten remaining screws (2), spacers (4), exhaust manifold (5), and six gaskets (3). Discard gaskets.



INSTALLATION

NOTE

- Ensure exhaust manifold is free of cracks or other damage. If cracks are present, replace exhaust manifold.
- Ensure old gasket material is removed from exhaust ports and exhaust manifold mating surfaces.

1. If guide pins (1) were removed, install guide pins in outside top holes of exhaust ports.

NOTE

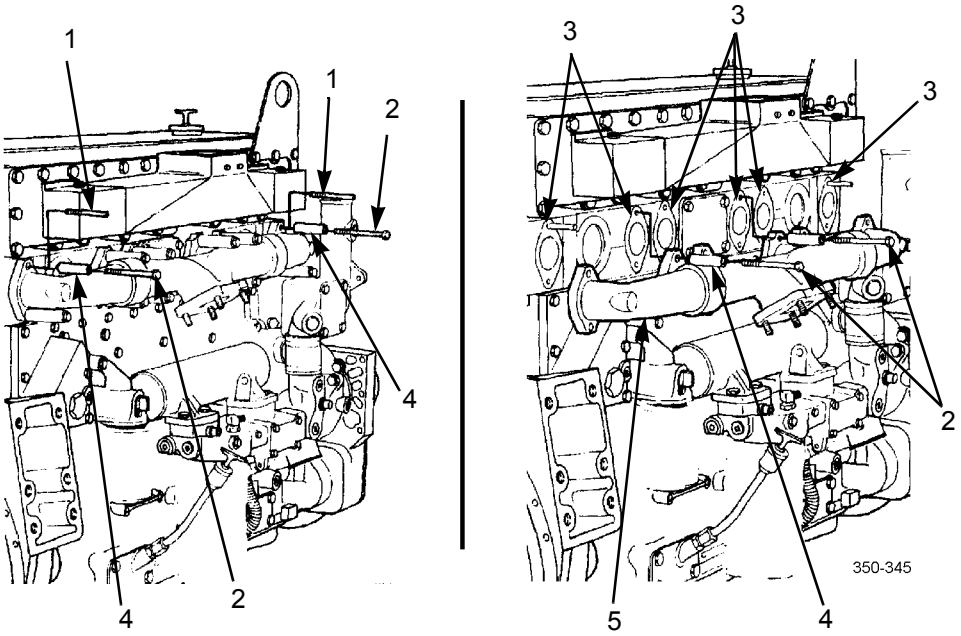
Do not use adhesive of any kind to hold gaskets in place.

2. Place new gasket (3) on each guide pin (1).
3. Position exhaust manifold (5) on guide pins (1).

NOTE

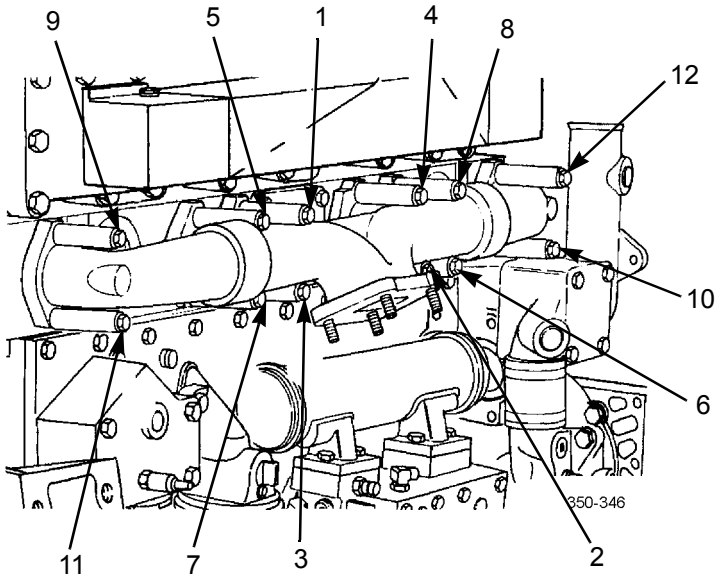
Apply a light coat of antiseize compound to screw threads only.

4. Install four new gaskets (3), ten spacers (4), and screws (2) to secure exhaust manifold (5) in place. Tighten screws hand tight.
5. Remove guide pins (1) and replace with two spacers (4) and screws (2). Tighten screws hand tight.



INSTALLATION - CONTINUED

6. Final tighten screws (2) in two steps following sequence shown.
   a. First step – 20 lb-ft (27 Nm)
   b. Second step – 35 lb-ft (47 Nm)



TIGHTENING SEQUENCE

7. Install turbocharger (WP 0025 00).
8. Install air ducts (TM 10-3930-675-20).
9. Start engine (TM 10-3930-675-10). Operate engine and check for exhaust leaks.
10. Install engine cover (TM 10-3930-765-20).

END OF WORK PACKAGE

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INTAKE MANIFOLD REPLACEMENT 0019 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Wrench, torque 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Detergent (Item 10, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Gasket (P/N 3069786)

References

TM 10-3930-675-10

Equipment Condition

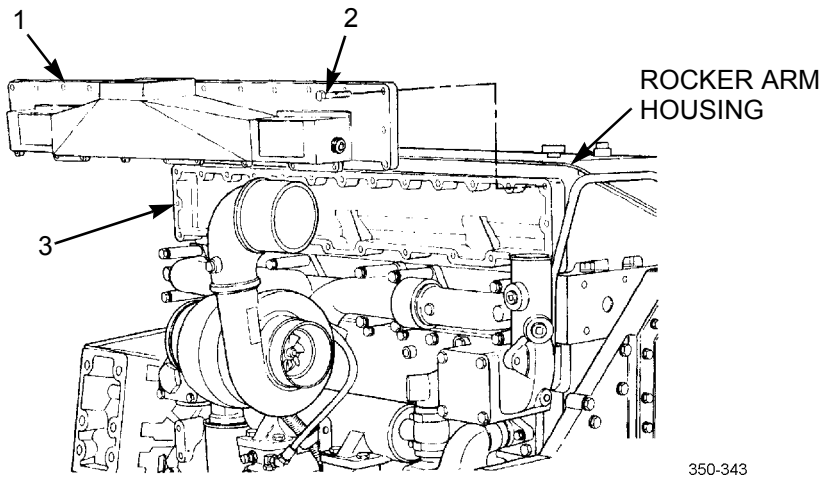
Engine cover removed (TM 10 3930-675-20)

Air duct removed (TM 10-3930-675-20)

Engine sensors removed from intake manifold (TM 10-3930-675-20)

REMOVAL

1. Remove 24 screws (2) securing intake manifold (1) in position.
2. Remove intake manifold (1) and gasket (3). Discard gasket.

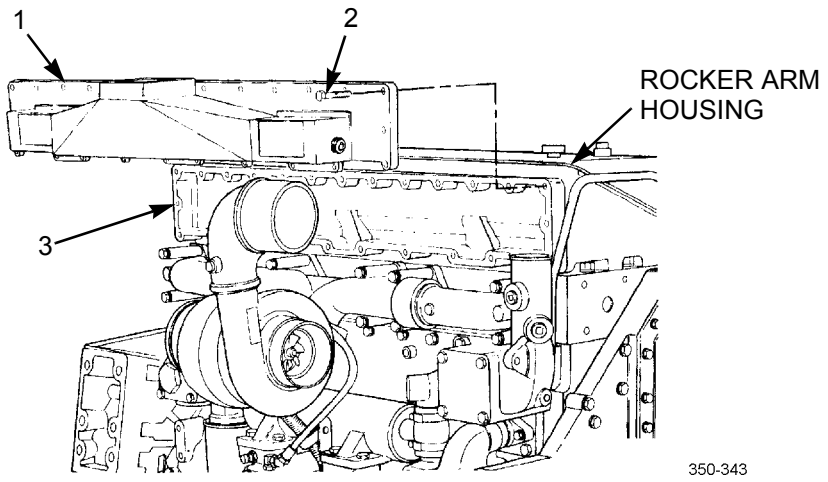


INSTALLATION

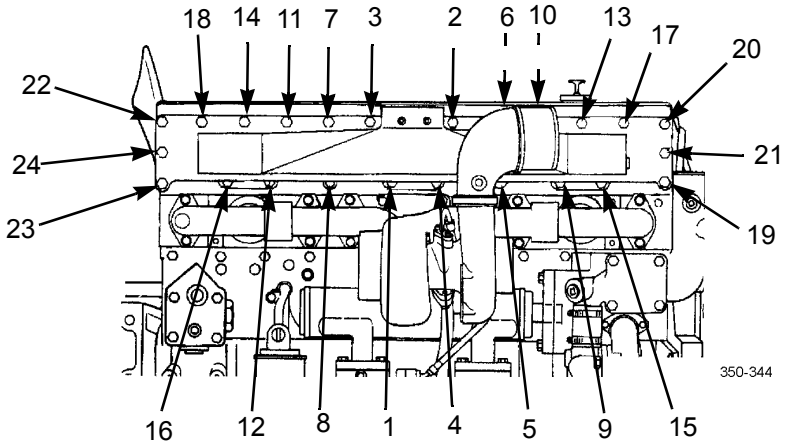
NOTE

Ensure intake manifold and rocker arm housing mating surfaces have been cleaned and all old gasket material removed.

1. Position new gasket (3) and intake manifold (1).
2. Secure intake manifold (1) with 24 screws (2).



3. Tighten screws (2) in sequence shown to 35 lb-ft (47 Nm).



TIGHTENING SEQUENCE

4. Install engine sensors to intake manifold (TM 10-3930-675-20).
5. Install air ducts (TM 10-3930-675-20).
6. Start engine (TM 10-3930-675-10). Operate engine at high idle and use a solution of soapy water to check for air leaks.
7. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

FRONT GEAR COVER REPLACEMENT 0020 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Wrench, torque, 0-200 lb-in capacity (Item 106, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

O-ring, seal (P/N 3883510)

Seal, rectangular ring (P/N 3200945)

Materials/Parts - Continued

Seal, rectangular ring (P/N 3200946)

Seal, rectangular ring (P/N 3201659) (6)

Seal, rectangular strip (P/N 3893964)

Personnel Required

Two

References

TM 10-3930-675-10

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Alternator drive belt and pulley removed (TM 10-3930-675-20)

AC compressor drive belt and pulley removed (TM 10-3930-675-20)

Vibration damper removed (WP 0011 00)

Front main oil seal removed (WP 0009 00)

Water pump oil seal removed (TM 10-3930-675-20)

Accessory drive oil seal removed (WP 0021 00)

Front engine mount removed (WP 0006 00)

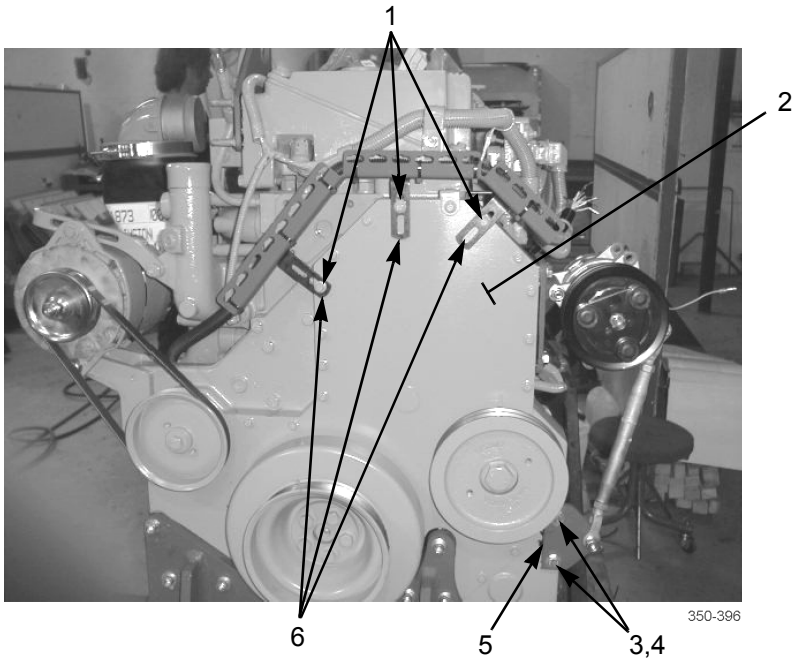
REMOVAL

NOTE

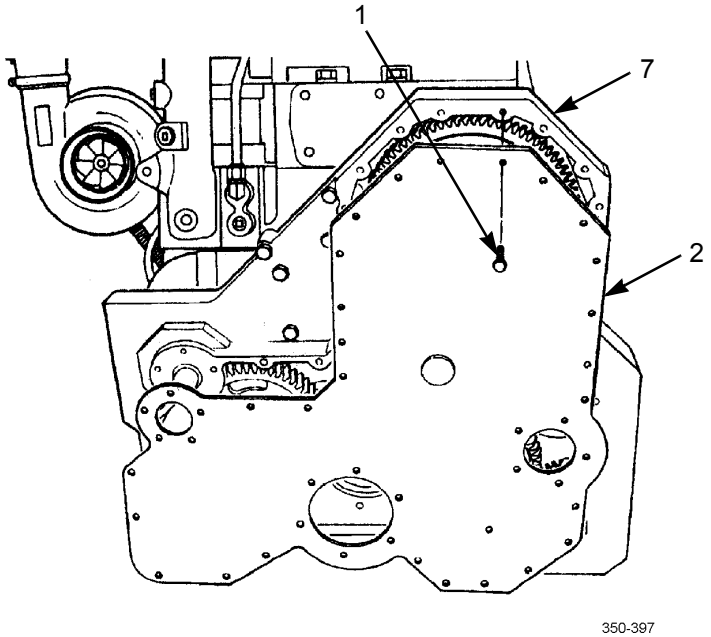
Wiring harness attachment brackets and belt tensioning arm bracket are mounted to front cover. Ensure these additional items and accessories are tagged or marked for location prior to removal.

REMOVAL - CONTINUED

1. Remove three flange head screws (1) securing wiring harness brackets (6). Remove two screws (3) and washers (4) securing belt tensioning arm bracket (5) to front cover (2).

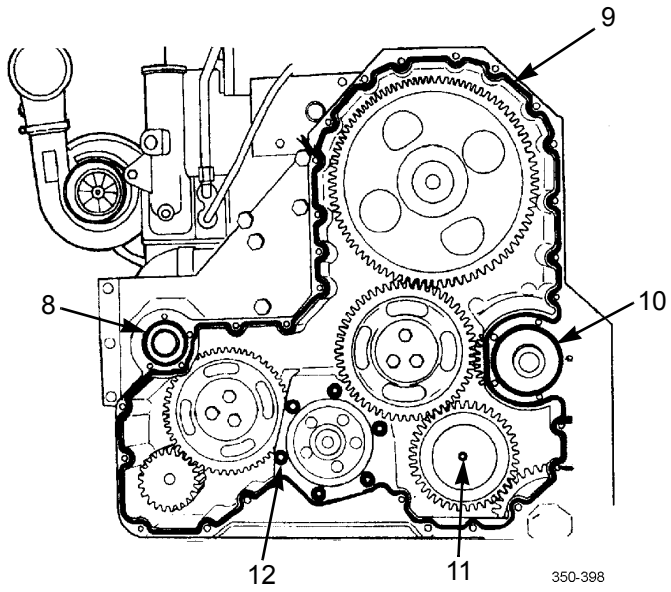


2. Remove 18 remaining flange head screws (1) securing front cover (2) to gear housing (7).
3. With assistance, remove front cover (2) from gear housing (7).



REMOVAL - CONTINUED

4. Remove six rectangular seals (12) at crankshaft seal mounting. Discard seals.
5. Remove rectangular seal (8 and 10) at accessory drive mounting and water pump mounting. Discard seals
6. Remove o-ring (11) from hydraulic drive idler retainer. Discard o-ring.
7. Remove front gear cover seal (9) from gear housing groove. Discard seal.



CLEANING

WARNING

Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.

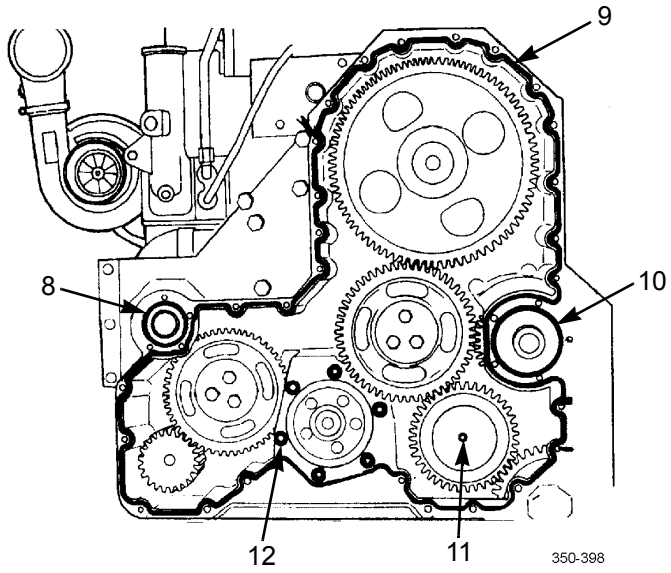
1. Clean mating surface of front cover and gear housing with cleaning solvent and remove old gasket material.
2. Clean seal grooves with cleaning solvent and remove all residue of old seals.

INSTALLATION

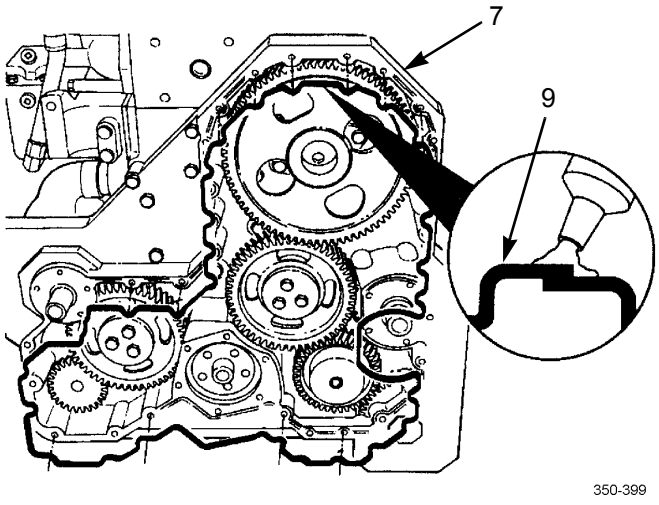
NOTE

Ensure o-ring and seal grooves are clean and free of old material. Apply a light coat of lubricating oil to new o-ring and seals prior to installing.

1. Install new rectangular seals (8 and 10) in grooves around water pump mounting and accessory drive mounting.
2. Install six new rectangular seals (12) at crankshaft seal mounting.
3. Install new o-ring (11) at hydraulic drive idler retainer.

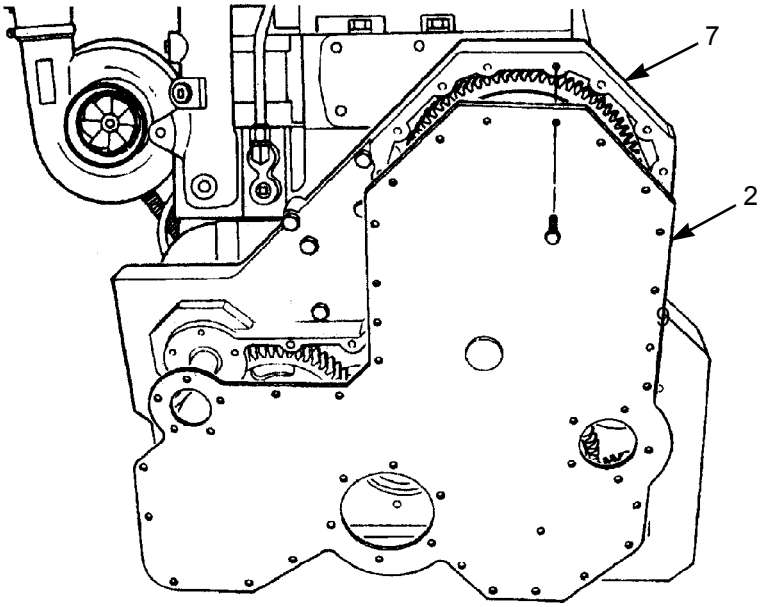


4. Install new front gear cover seal (9) in gear housing groove. Apply silicone sealant to overlap joint at top of gear housing (7).

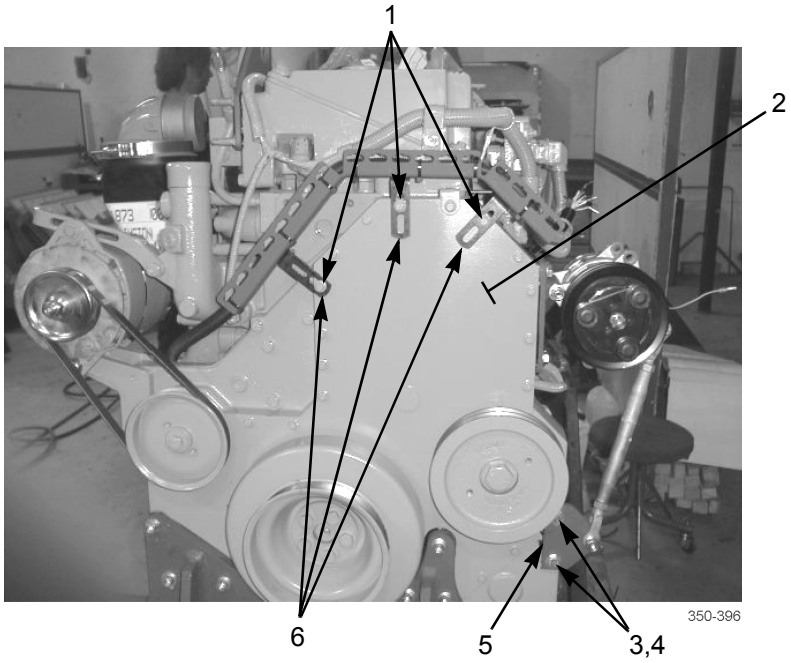


5. With assistance, position gear cover (2) on gear housing (7).

INSTALLATION - CONTINUED

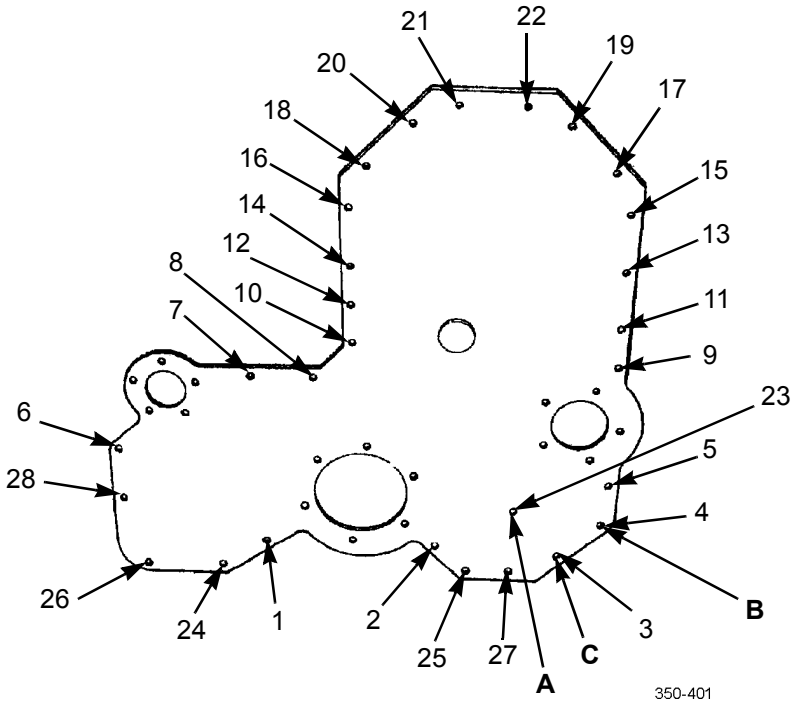


6. Install three wiring harness brackets (6) and belt tensioning arm bracket (5) on front cover (2). Secure in place with three flange head screws (1) and two washers (4) and screws (3). Initial tighten screws to 55 lb-in (6 Nm).



INSTALLATION - CONTINUED

7. Apply silicone sealant to threads of screws at location A, B, and C.
8. Install remaining flange head screws (1). Initial tighten screws to 55 lb-in (6 Nm).
9. Tighten all front cover screws in sequence as shown:
    a. Screws 1-22: 15 lb-ft (20 Nm)
    b. Screws 23-28: 50 lb-ft (68 Nm)



TIGHTENING SEQUENCE

10. Remove six flange head screws used to mount front engine mount. Install front engine mount (WP 0006 00).
11. Final tighten six front engine mount flange head screws in sequence and tightness as in step 9.
12. Install accessory drive (WP 0021 00).
13. Install front main oil seal (WP 0009 00).
14. Install vibration damper (WP 0011 00).
15. Install water pump oil seal (TM 10-3930-675-20)
16. Install and adjust alternator and AC compressor pulleys and drive belts (TM 10-3930-675-20).
17. Start and run engine to operational temperature (TM 10-3930-675-10). Shut down and check for leaks.

END OF WORK PACKAGE

ACCESSORY DRIVE ASSEMBLY MAINTENANCE 0021 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Inspection, Assembly, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, inside (Item 8, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Driver, gear, fuel pump (Item 21, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Press, arbor (Item 65, WP 0090 00)

Puller kit, universal (Item 71, WP 0090 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Wrench, torque, 0-300 lb-in capacity (Item 107, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

References

TM 10-3930-675-10

Materials/Parts

Compound, gasket forming (Item 7, WP 0089 00)

Compound, sealing (Item 8, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Lubriplate (Item 15, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Gasket (P/N 3883538)

Kit, oil seal (P/N 3804304)

O-ring (P/N 3034412) (2)

Washer (P/N 3882885) (6)

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Air conditioning compressor drive belts removed (TM 10-3930-675-20)

Fuel pump assembly removed (WP 0024 00)

REMOVAL

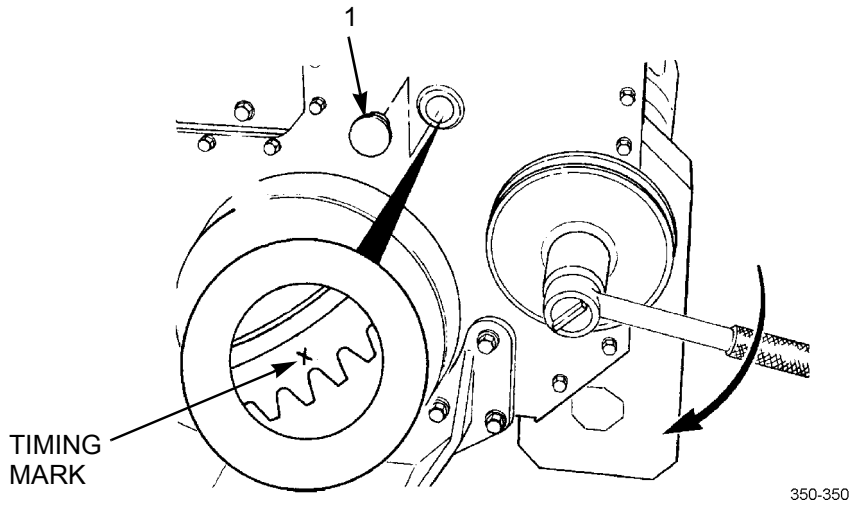
1. Mark accessory drive pulley position as follows:

   a. Remove inspection hole plug (1) in gear cover.

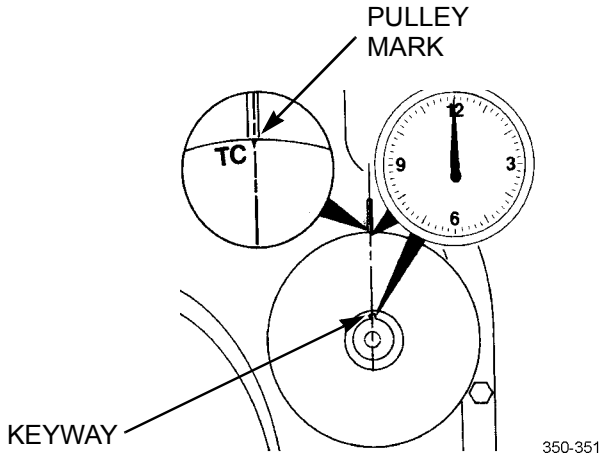
NOTE

When timing mark is visible, cylinder no. 1 and 6 are at top dead center and accessory drive pulley T-C mark and keyway are at 12 o'clock position.

   b. Rotate engine using accessory driveshaft until camshaft gear timing mark is visible.



   c. Check to ensure accessory drive pulley T-C mark and keyway are at 12 o'clock position.



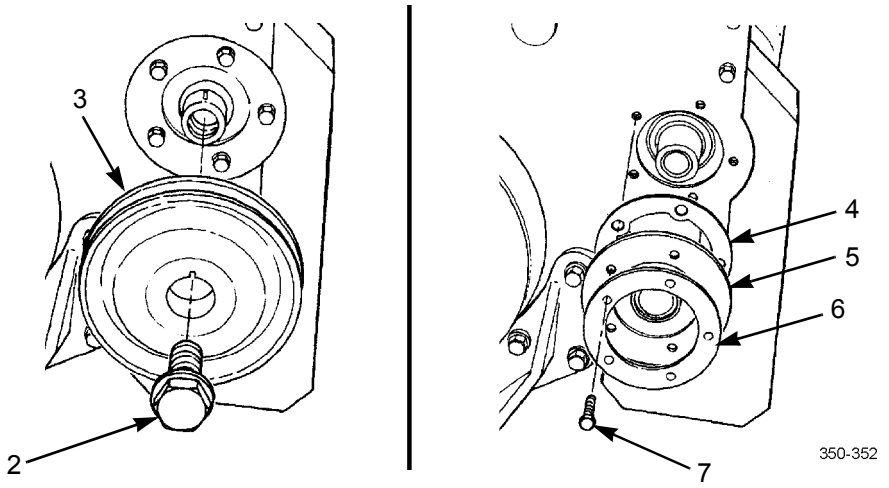
REMOVAL - CONTINUED

NOTE

Accessory drive pulley is a slip fit pulley and does not require use of a puller for removal. Tapping with a plastic-faced hammer may be necessary to remove pulley.

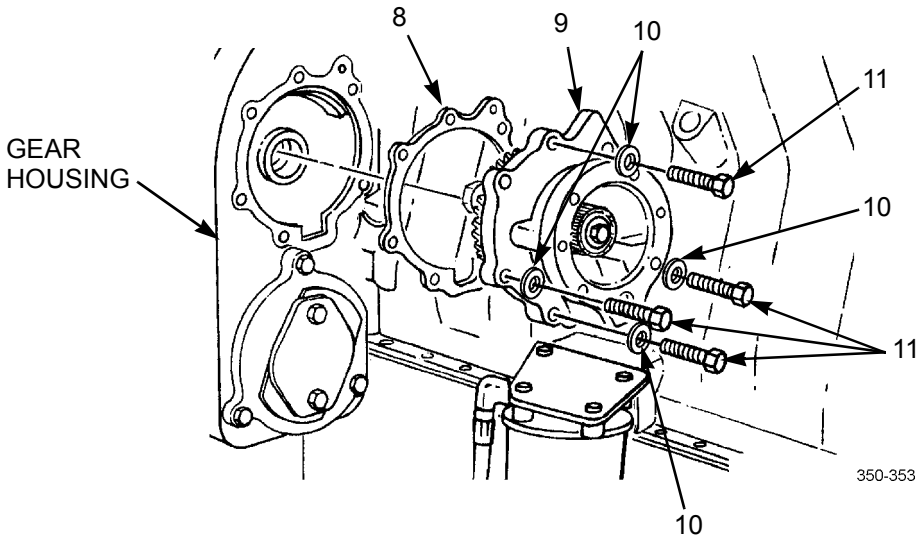
d. Remove screw (2) and pulley (3) from shaft.

2. Remove five screws (7), clamping ring (6), oil seal (5), and gasket (4) from front of gear housing. Discard oil seal and gasket.



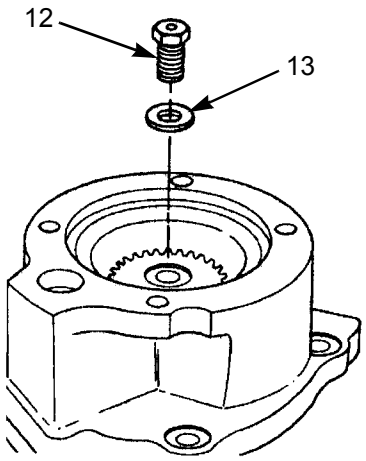
3. Remove six screws (11) and washers (10) securing accessory drive assembly (9) to engine. Discard washers.

4. Remove accessory drive assembly (9) and gasket (8). Discard gasket.



DISASSEMBLY

1. Remove retaining screw (12) and washer (13).

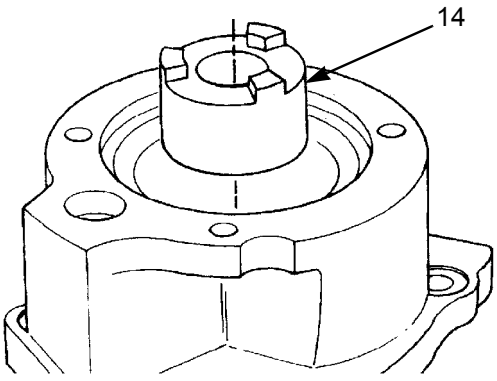


350-354

CAUTION

Do not use hydraulic press to remove hub coupling. Using hydraulic press may cause damage to thrust bearing.

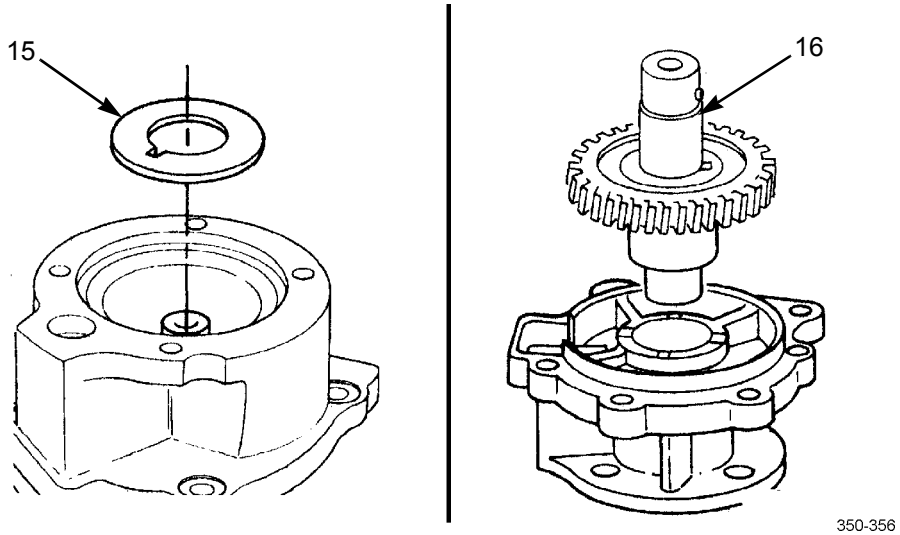
2. Use three jaw puller to remove hub coupling (14).



350-825

DISASSEMBLY - CONTINUED

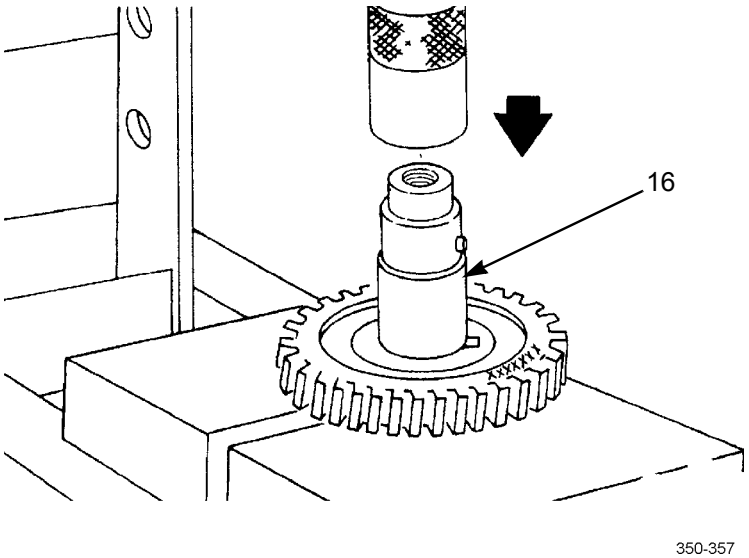
3. Remove thrust bearing (15) and shaft and gear assembly (16).



NOTE

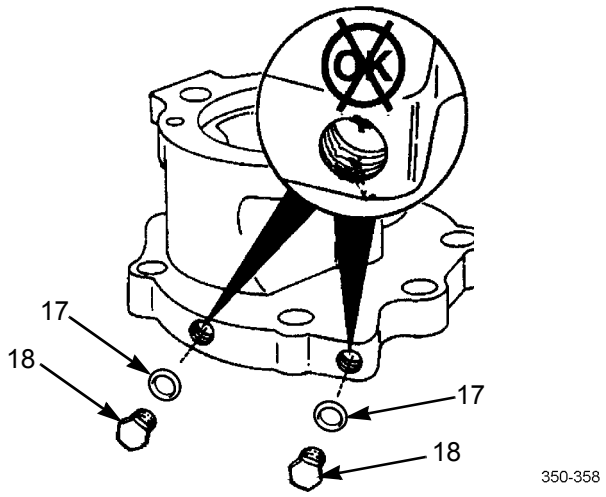
Ensure shaft and gear assembly is placed on press with gear part number facing up.

4. Position shaft and gear assembly (16) on press and press shaft from gear.



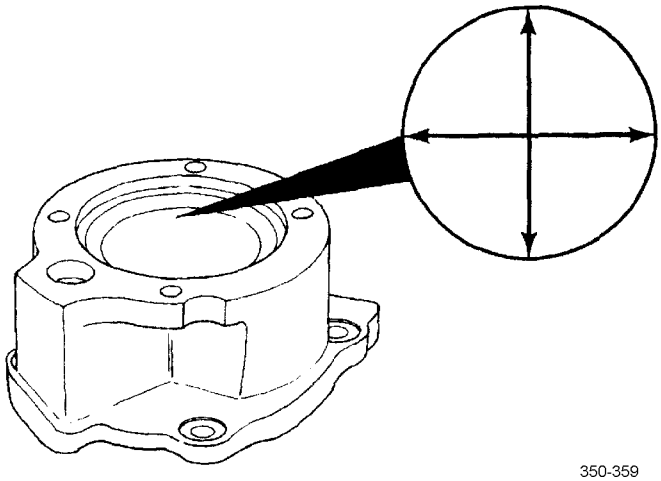
DISASSEMBLY - CONTINUED

5. Remove two threaded plugs (18) and o-rings (17) from drive housing. Discard o-rings.



INSPECTION

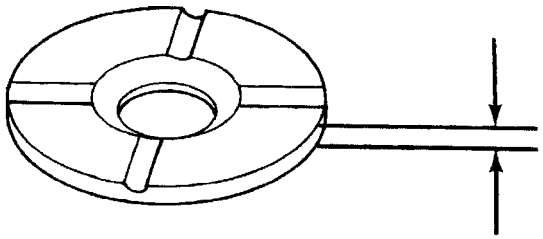
1. Visually inspect all component parts for the following conditions. If noted conditions are found, replace defective component.
   a. Cracks
   b. Scoring and scratches
   c. Severely worn gear teeth
2. Measure inside diameter of drive housing bearing bore. Inside diameter must be 1.8809-1.8770 in (47.775-47.676 mm). If inside diameter is not within standard, replace drive housing.



HOUSING INSIDE DIAMETER

INSPECTION - CONTINUED

3. Measure thrust bearing thickness. Thickness must be 0.2395-0.2485 in (6.084-6.312 mm). If thrust bearing is not within these standards, replace thrust bearing.



350-360

THRUST BEARING THICKNESS

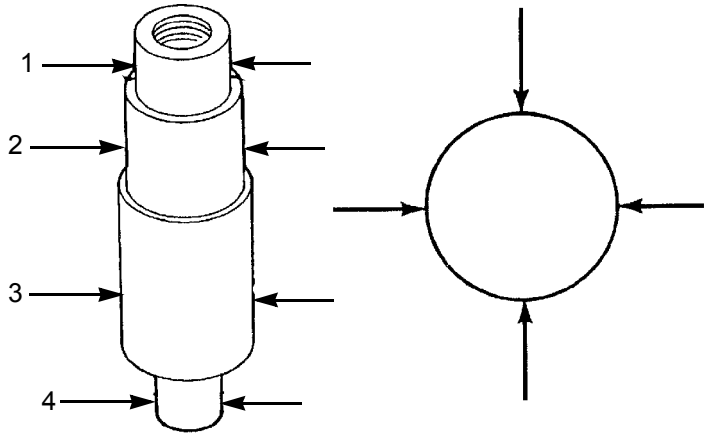
4. Measure drive shaft journals at four points indicated. Measurement must be as indicated below. If drive shaft journals are not within standard, replace shaft.

   a. Point 1: 1.3773-1.3779 in (34.984-35.000 mm)

   b. Point 2: 1.7706-1.7716 in (44.975-45.000 mm)

   c. Point 3: 1.8772-1.8728 in (47.554-47.570 mm)

   d. Point 4: 1.0030-1.0035 in (25.476-25.489 mm)

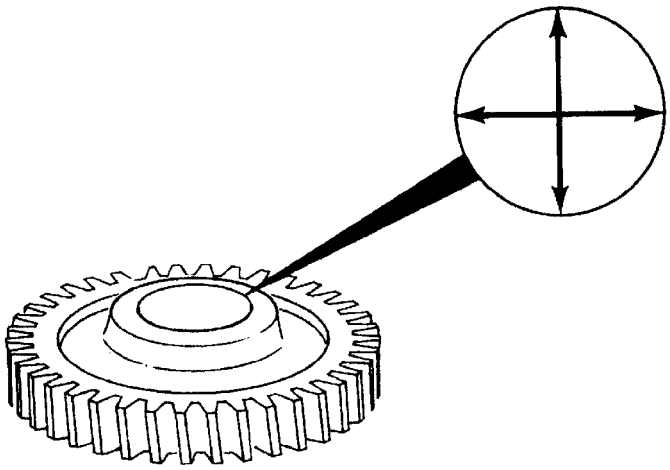


350-361

DRIVE SHAFT JOURNALS

INSPECTION - CONTINUED

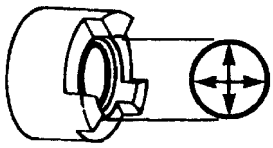
5. Measure inside diameter of drive gear. Measurement must be 1.8694-1.8704 in (47.484-47.509 mm). If diameter is not within standard, replace drive gear.



350-362

DRIVE GEAR INSIDE DIAMETER

6. Measure inside diameter of hub coupling. Measurement must be 1.0010-1.0015 in (25.425-25.438 mm). If diameter is not within standard, replace hub coupling.



350-363

HUB COUPLING INSIDE DIAMETER

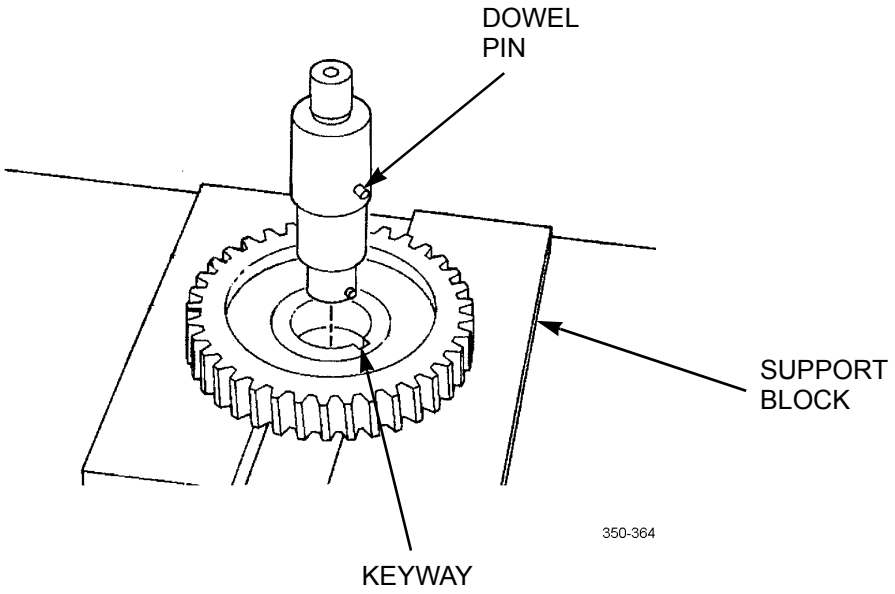
ASSEMBLY

NOTE

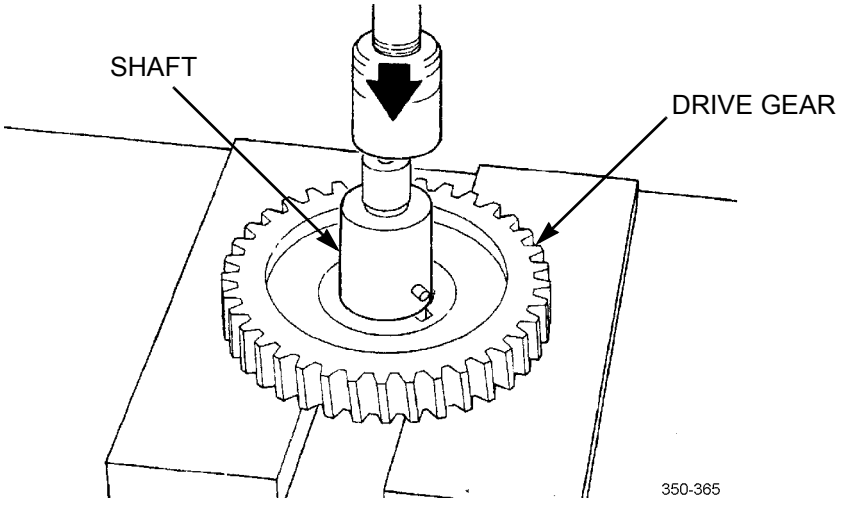
Ensure all parts have been cleaned and are free of old gasket material.

1. Place drive gear in press with gear part number face down. Provide support for drive gear as shown.
2. Install larger diameter end of shaft thru gear bore.
3. Aline keyway in gear with dowel pin in shaft.

ASSEMBLY - CONTINUED

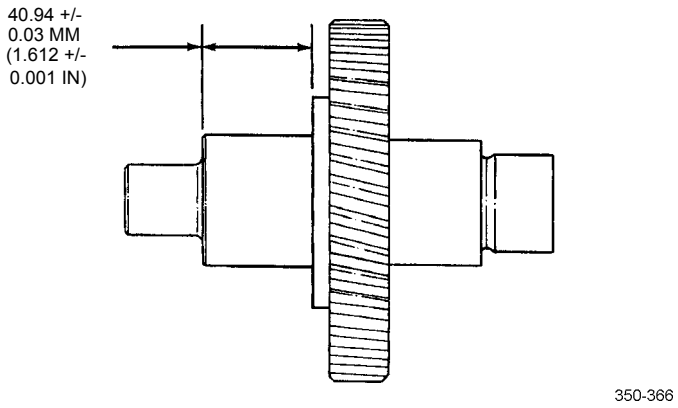


4. Using accessory drive assembly tool, press shaft into gear until tool comes in contact with gear surface.



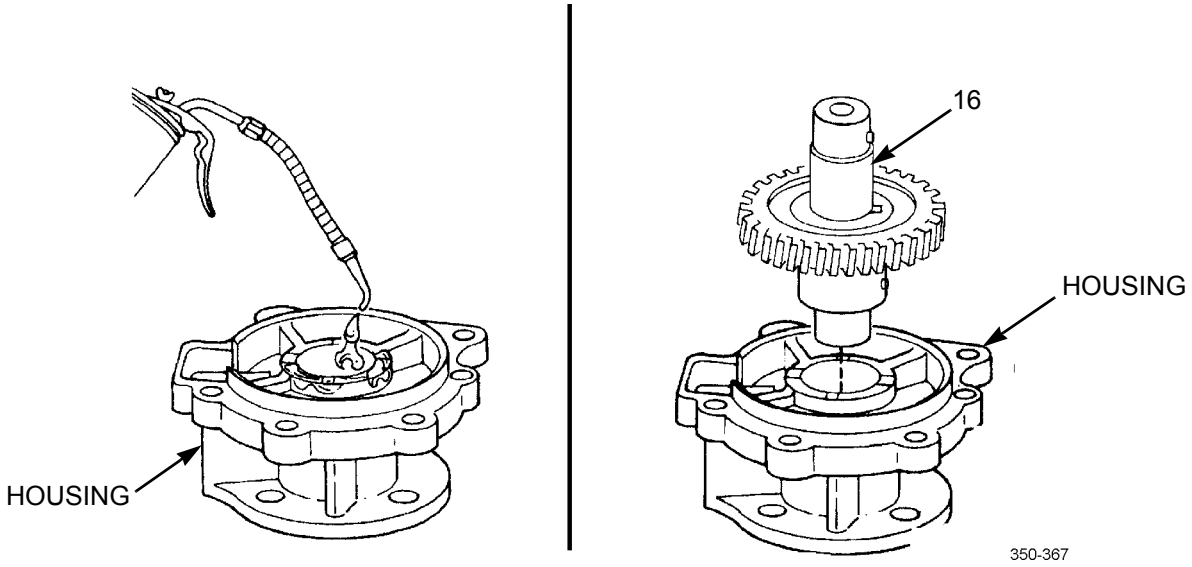
ASSEMBLY - CONTINUED

5. Remove tool and measure shaft as shown. If measurement is not within range, remove shaft from gear (refer to *Disassembly* step 4) and repeat above steps 1 thru 4.



SHAFT POSITION MEASUREMENT

6. Apply a coating of clean lubricating oil to housing shaft bore and thrust bearing (15) surface.
7. Install shaft and gear assembly (16) into housing.

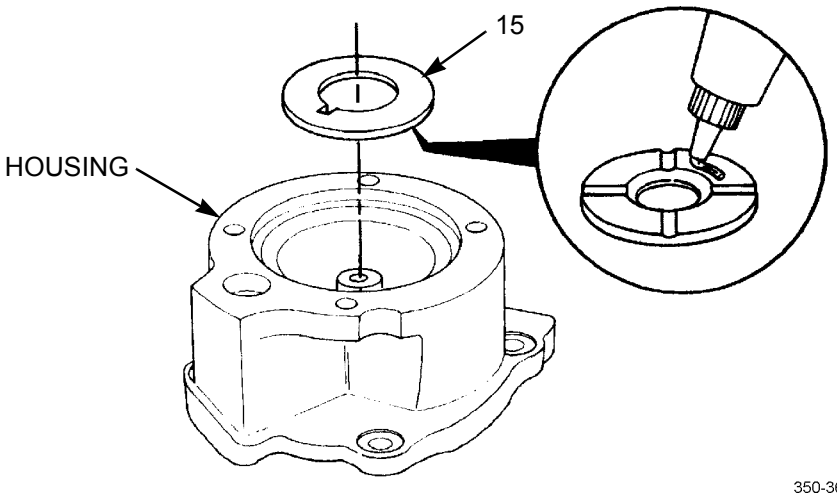


CAUTION

Thrust bearing MUST be installed with grooved surface facing thrust surface of housing. Failure to install thrust bearing correctly may cause improper lubrication and damage to drive assembly.

ASSEMBLY - CONTINUED

8. Apply a coating of lubriplate to grooved surface of thrust bearing (15) and install thrust bearing over shaft.



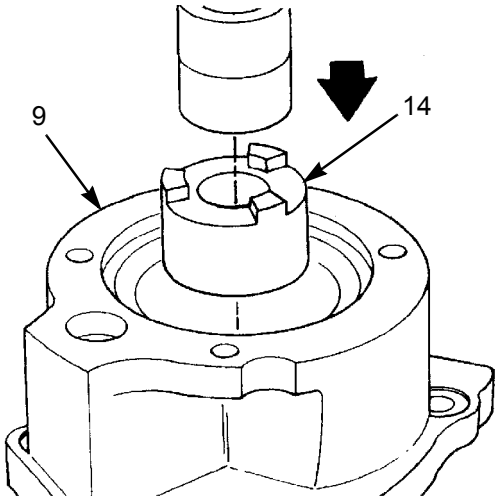
350-368

NOTE

Ensure end of drive shaft is supported.

9. Install accessory drive assembly (9) in press with drive gear facing down.

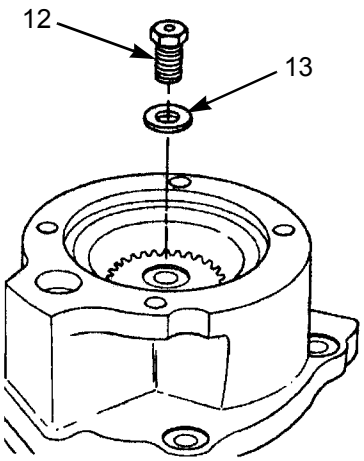
10. Apply a coating of clean lubricating oil to bore of hub coupling (14) and press hub coupling onto shaft.



350-355

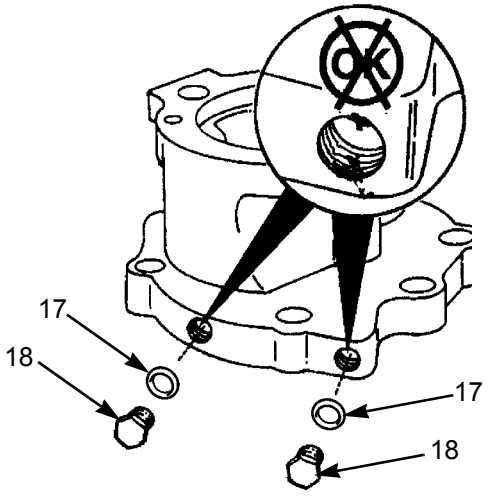
ASSEMBLY - CONTINUED

11. Install washer (13) and retaining screw (12) on shaft. Tighten screw to 35 lb-ft (47 Nm).



350-354

12. Install two plugs (18) and new o-rings (17) in accessory drive housing.



350-358

INSTALLATION

CAUTION

Use care when installing accessory drive gasket. A twisted gasket may cause a leak path or block oil passages resulting in damage to equipment.

1. Apply a light amount of gasket forming compound to hold new gasket (8) in place and position gasket on gear housing.

INSTALLATION - CONTINUED

NOTE

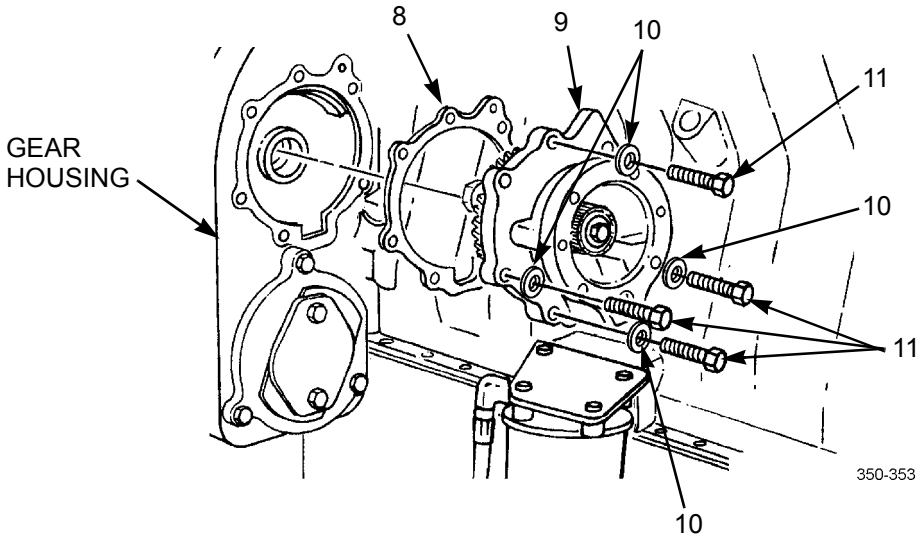
Drive shaft dowel pin MUST be at 12 o'clock position when installing accessory drive gear assembly.

2. Rotate drive shaft by hand to orient position of drive shaft dowel pin. Install accessory drive gear assembly (9).

NOTE

Apply thread sealant to threaded portion of screws only.

3. Secure accessory drive assembly (9) with six screws (11) and new washers (10). Tighten screws evenly to 35 lb-ft (47 Nm).

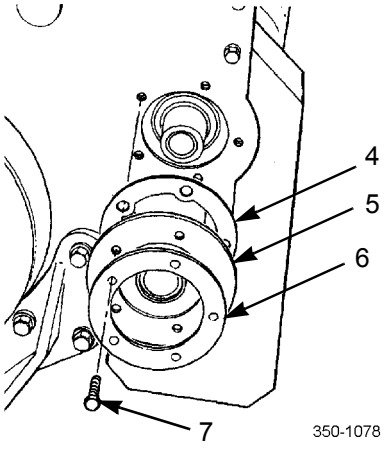


INSTALLATION - CONTINUED

NOTE

Yellow dust lip of oil seal MUST be facing out.

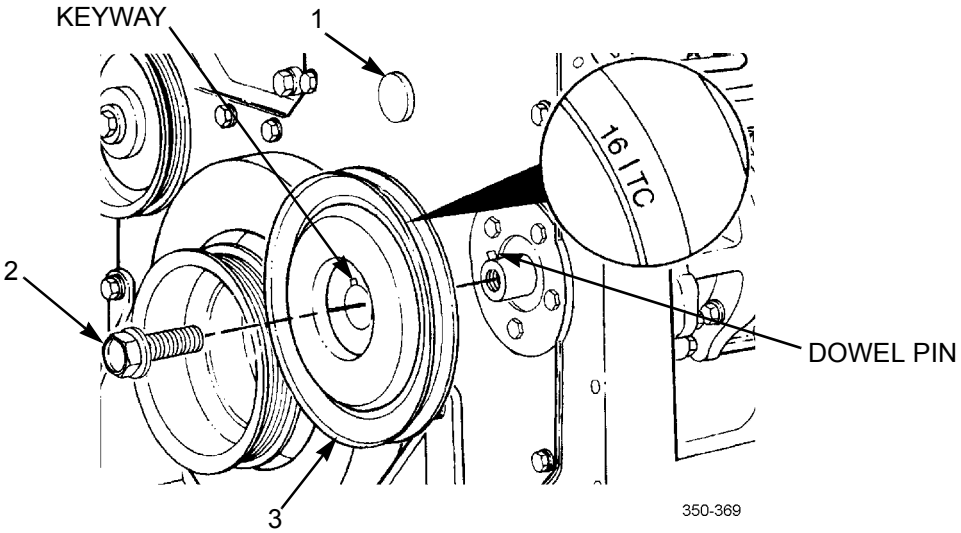
4. Install new gasket (4) and new oil seal (5).
5. Apply a coating of sealing compound to screws (7) and install clamping ring (6) and five screws. Tighten screws using a star pattern in two steps as follows:
   a. Step 1: 60 lb-in (7 Nm)
   b. Step 2: 175 lb-in (20 Nm)



NOTE

Ensure timing marks on pulley face out.

6. Aline keyway in pulley (3) with dowel pin in drive shaft and install pulley by hand on drive shaft.
7. Secure pulley (3) with screw (2). Tighten screw to 400 lb-ft (542 Nm).
8. Install plug (1) in inspection hole on gear cover.



INSTALLATION - CONTINUED

9. Install fuel pump assembly (WP 0024 00)
10. Install air conditioning compressor drive belts (TM 10-3930-675-20)
11. Operate engine (TM 10-3930-675-10) and check for fuel and oil leaks.
12. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

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COOLING FAN HYDRAULIC PUMP DRIVE GEAR REPLACEMENT 0022 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Barring tool, engine (Item 5, WP 0090 00)

Bearing kit, needle (Item 6, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Gage, depth, dial indicating (Item 30, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Hammer, slide (Item 43, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Bearing, needle (P/N 3025354)

Bearing, needle (P/N 3084899)

Seal, o-ring (P/N 388304)

References

TM 10-3930-675-10

WP 0005 00

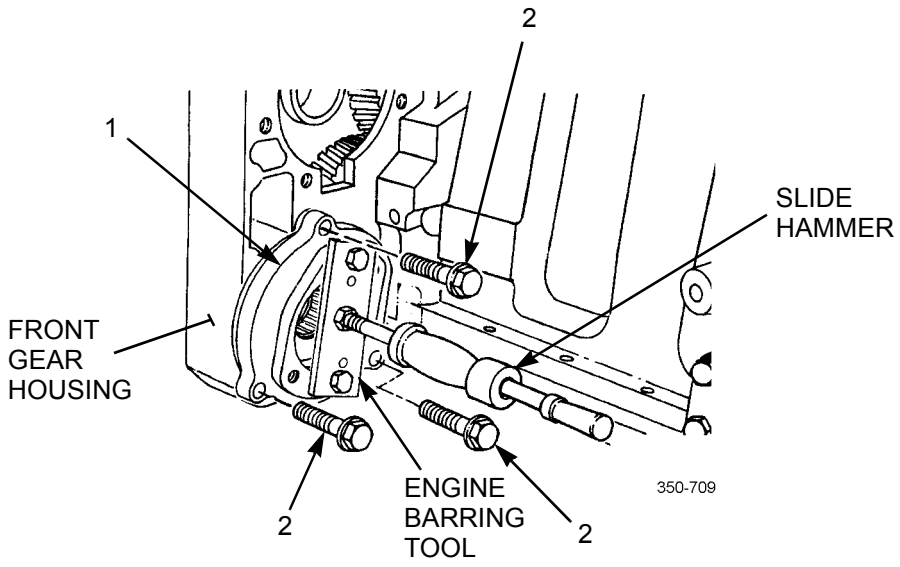
Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Cooling fan hydraulic pump removed (WP 0055 00)

REMOVAL

1. Remove three screws (2) securing hydraulic pump drive adapter (1) to engine front gear housing.
2. Install engine barring tool and slide hammer on hydraulic pump drive adapter (1).

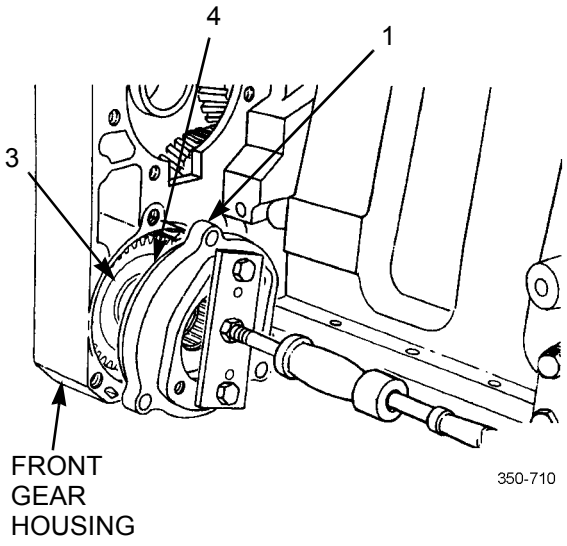


REMOVAL - CONTINUED

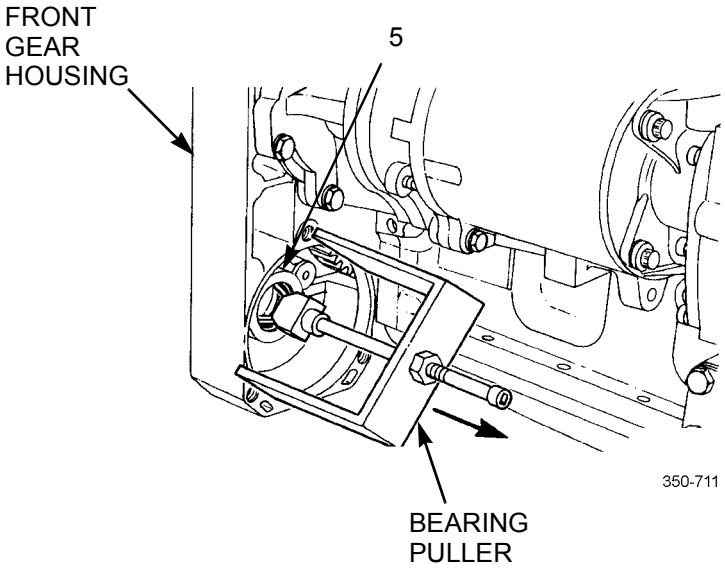
CAUTION

DO NOT allow drive gear to slide out of adapter or gear housing during removal. Damage to gear will result.

3. Remove hydraulic pump drive adapter (1), o-ring seal (4), and drive gear (3) from front gear housing.

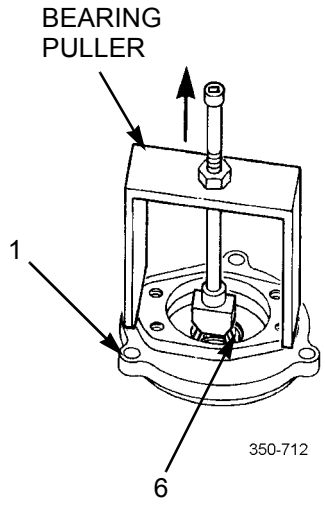


4. Using bearing puller, remove needle bearing (5) from front gear housing. Discard needle bearing.



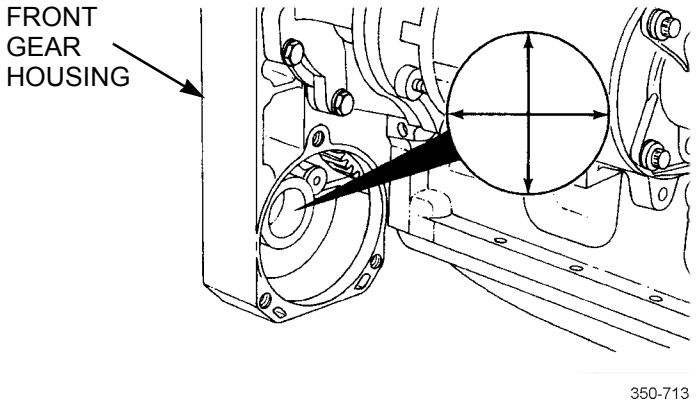
REMOVAL - CONTINUED

5. Using bearing puller, remove needle bearing (6) from hydraulic pump drive adapter (1). Discard needle bearing.



INSPECTION

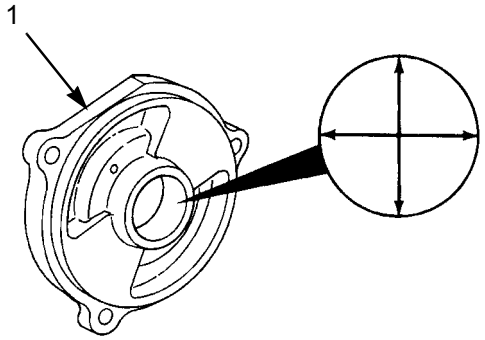
1. Visually inspect all components for damage. Replace damaged components.
2. Inspect drive gear for chipped or broken teeth. If found, replace drive gear.
3. Measure inside diameter of needle bearing bore in front gear housing as shown. Measurement must be 1.6522-1.6532 in (41.967-41.992 mm). If not as specified, front gear housing is defective. Replace engine (WP 0005 00).



INSIDE DIAMETER, BEARING BORE

INSPECTION - CONTINUED

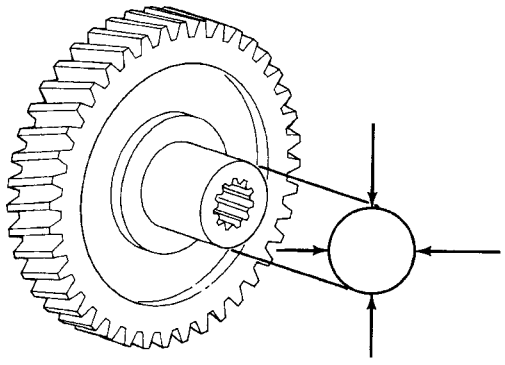
4. Measure inside diameter of needle bearing bore in hydraulic pump drive adapter (1) as shown. Measurement must be 1.6522-1.6532 in (41.967-41.992 mm). If not as specified, replace hydraulic pump drive adapter.



350-714

INSIDE DIAMETER, BEARING BORE

5. Measure drive gear drive shaft outside diameter as shown. Measurement must be 1.3773-1.3780 in (34.984-35.000 mm). If not as specified, replace drive gear.



350-715

OUTSIDE DIAMETER, DRIVE GEAR SHAFT

INSTALLATION

NOTE

Ensure all components have been cleaned and are free of old sealants and gasket material.

1. Apply a light coat of clean lubricating oil to needle bearing bore in front gear housing and hydraulic pump drive adapter.

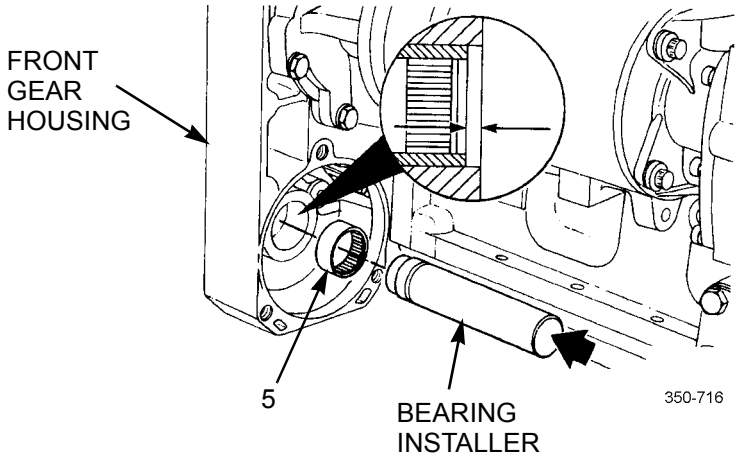
INSTALLATION - CONTINUED

2. Apply a light coat of clean lubricating oil to outside diameter of both needle bearings.

NOTE

Front gear housing needle bearing MUST be installed to 0.010-0.030 in (0.25-0.76 mm) below gear housing surface.

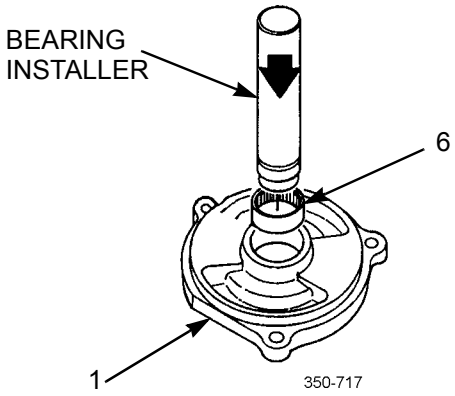
3. Using bearing installer provided, install new needle bearing (5) in front gear housing.



NOTE

Hydraulic pump drive adapter needle bearing MUST be centered between front and rear surface of adapter.

4. Install new needle bearing (6) in hydraulic pump gear drive adapter (1) from side closest to front gear housing.

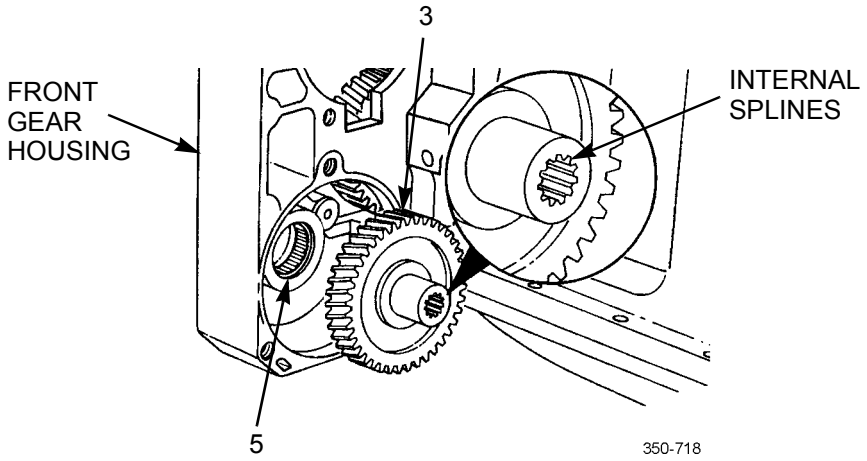


NOTE

Ensure hydraulic pump drive gear is installed with shaft internal splines facing rear of engine.

INSTALLATION - CONTINUED

5. Apply a coat of clean lubricating oil to drive gear shaft, front gear housing needle bearing (5), and install hydraulic pump drive gear (3) in front gear housing.

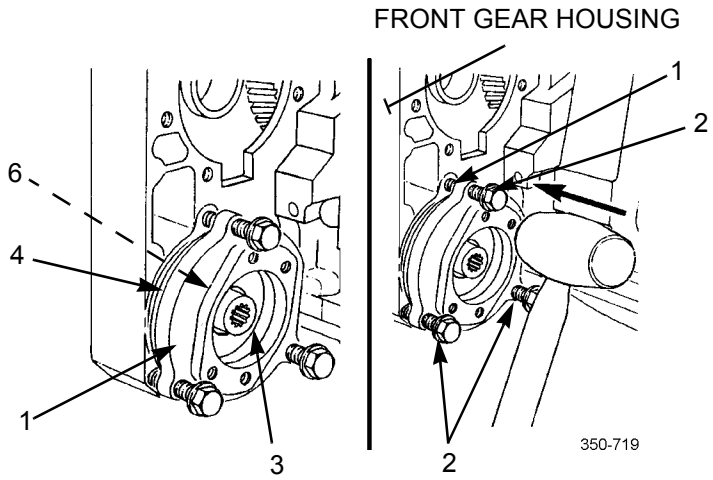


6. Install new o-ring seal (4) on hydraulic pump drive adapter (1).
7. Apply a coat of clean lubricating oil to o-ring seal (4) and hydraulic pump drive adapter needle bearing (6).
8. Install hydraulic pump drive adapter (1) over shaft drive gear (3).
9. Install three screws (2) by hand to aline hydraulic pump drive adapter (1) with front gear housing.

CAUTION

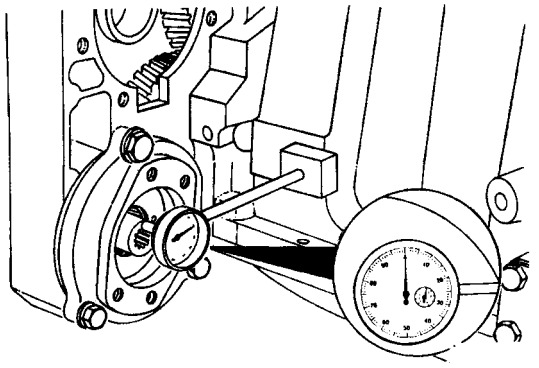
Use care when tapping around outside surface of adapter. Damage to o-ring seal may result.

10. Using plastic-faced hammer, install hydraulic pump drive adapter (1) in front gear housing.
11. Tighten three screws (2) evenly to 35 lb-ft (47 Nm).



INSTALLATION - CONTINUED

12. Measure drive shaft end clearance as shown. Measurement must be 0.003-0.025 in (0.076-0.635 mm). If not as specified, remove and reinstall needle bearings.



350-720

DRIVE SHAFT END CLEARANCE

13. Install cooling fan hydraulic pump (WP 0055 00).
14. Start engine (TM 10-3930-675-10) and check for leaks.
15. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

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FUEL INJECTOR REPLACEMENT 0023 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Puller and driver, injector (Item 66, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Materials/Parts - Continued

Seal, o-ring (P/N 3070136)

Seal, o-ring (P/N 3070137)

Seal, o-ring (P/N 3070138)

References

WP 0015 00

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Rocker arm cover removed (TM 10-3930-675-20)

WARNING

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel.

REMOVAL

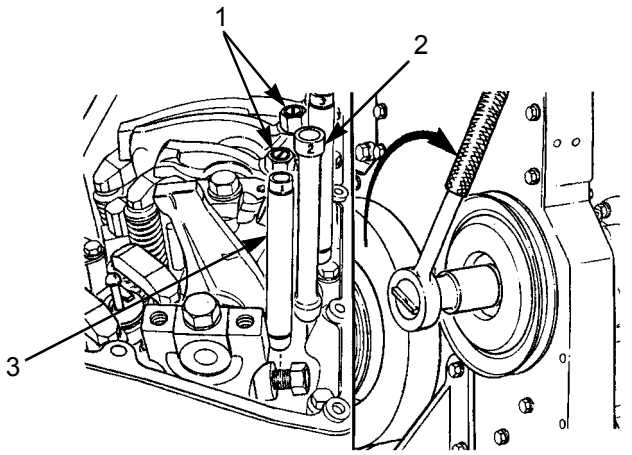
NOTE

- Due to engine operating characteristics, adjustments, and alinements, mark or tag push rods, push tubes, crossheads, and injector assemblies for identification as they are removed. If removed, these items MUST be replaced in original locations during installation.
- Some push rods are under compression due to valve position. To relieve spring tension, hold push rod while rotating crankshaft CLOCKWISE with accessory drive.

FUEL INJECTOR REPLACEMENT - CONTINUED 0023 00

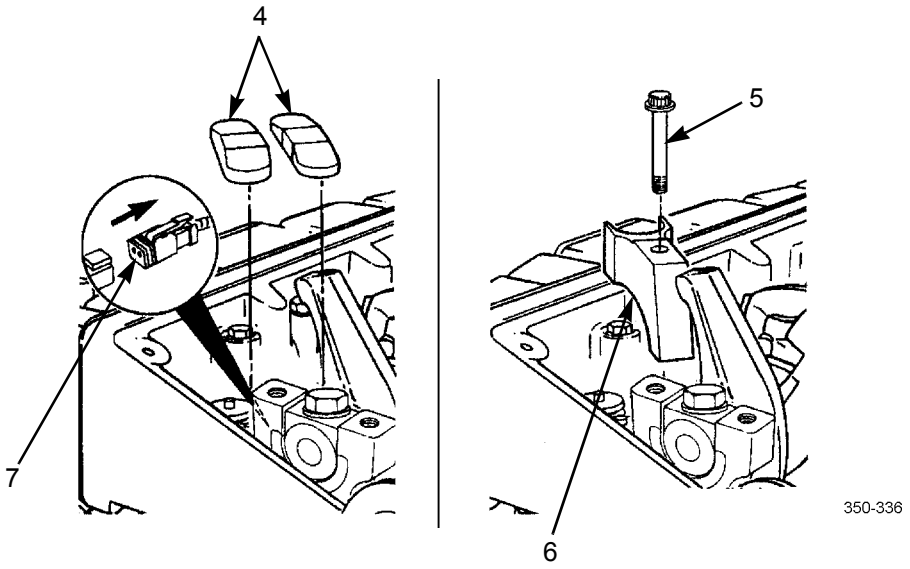
REMOVAL - CONTINUED

1. Loosen injector and valve adjusting screws (1) and remove push rods (3) and push tubes (2) on cylinder requiring injector replacement.



350-154

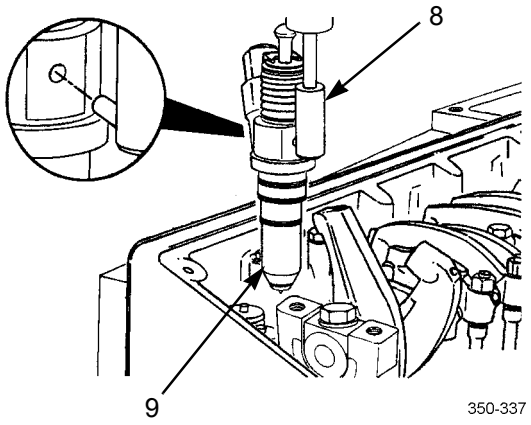
2. Remove crossheads (4) and disconnect injector connector (7).
3. Remove screw (5) and injector hold-down clamp (6).



350-336

REMOVAL - CONTINUED

4. Using injector tool (8), remove injector (9) from cylinder head.



INSTALLATION

NOTE

Ensure three new o-rings have been properly installed on injector. O-rings are color coded for location as follows: red – top; white – middle; blue – bottom.

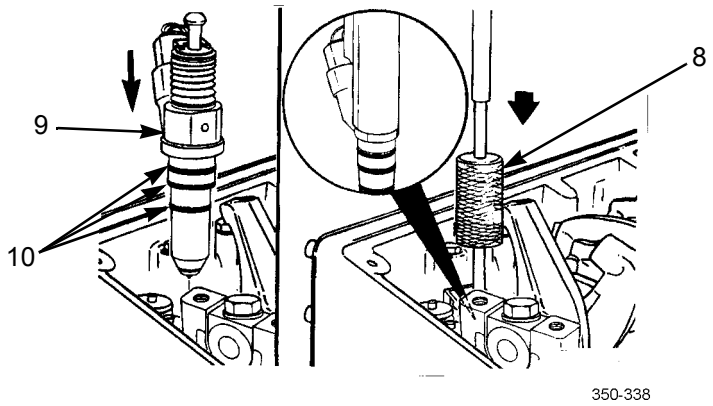
INSTALLATION - CONTINUED

1. Lubricate three new o-rings (10) with clean engine oil.
2. Position injector (9) in cylinder head injector bore with solenoid valve toward intake port.
3. Aline injector (9) equally between valve springs.

CAUTION

Do not drive injector in by striking solenoid valve area. This can damage solenoid or cause injector to be out of alinement in bore, which will result in o-ring damage.

4. Using injector tool (8), seat injector (9) in bore.

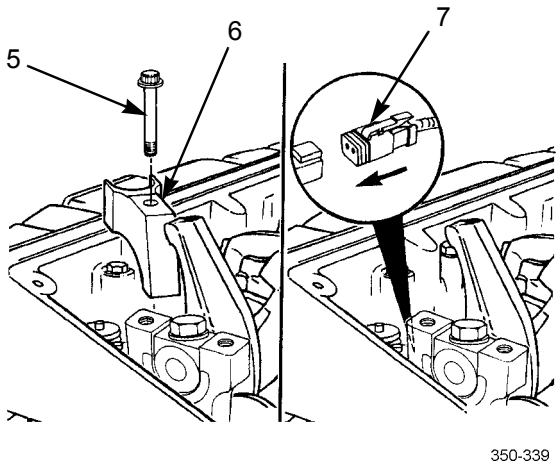


CAUTION

Injector must be fully seated before installing hold-down clamp. Engine damage can occur if injector is not fully seated.

5. Install injector hold-down clamp (6) and screw (5). Tighten screw to 55 lb-ft (75 Nm).
6. Connect injector connector (7). Check lock tab to ensure connector is locked in place.

INSTALLATION - CONTINUED



NOTE

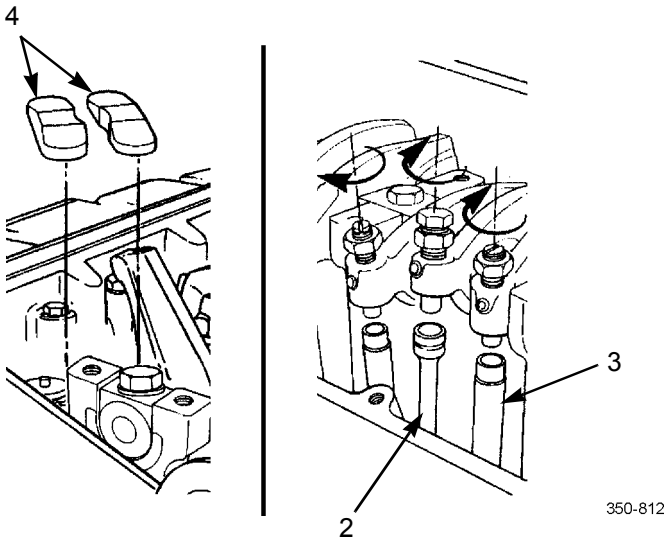
Ensure crossheads are installed in same position from which they were removed.

7. Install crossheads (4) on intake and exhaust valves.

NOTE

Ensure push rods and push tubes are installed in same position from which they were removed.

8. Rotate rocker arms down and install push rods (3) and push tubes (2).



INSTALLATION - CONTINUED

9. Adjust valves and injectors (WP 0015 00).

END OF WORK PACKAGE

FUEL PUMP ASSEMBLY REPLACEMENT 0024 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Fuel, diesel (Item 12, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Gasket (P/N 3609103)

References

TM 10-3930-675-10

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Battery cables disconnected (TM 10-3930-675-20)

Fuel line and hose disconnected from fuel pump (TM 10-3930-675-20)

Fuel filter/water separator removed (TM 10-3930-675-20)

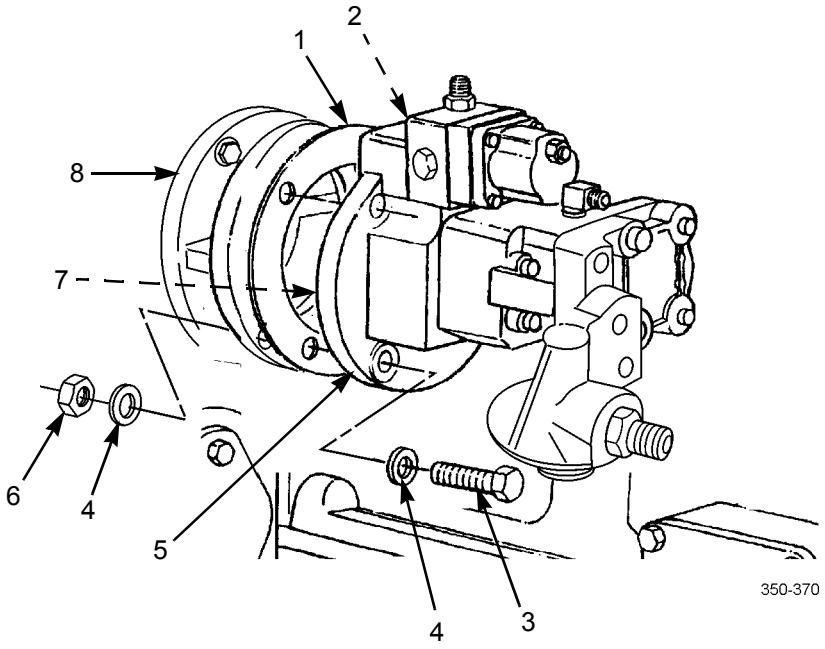
Wire lead disconnected from fuel solenoid shutoff valve (TM 10-3930-675-20)

WARNING

- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel.
- Some residual fuel may remain in fuel lines and hoses. Spilled fuel is slippery and must be cleaned up as soon as possible. Failure to clean up spills may result in injury to personnel.

REMOVAL

1. Remove four screws (3), nuts (6), and eight washers (4) securing fuel pump (5) to accessory drive (8).
2. Remove fuel pump (5), gasket (1), and jaw coupling spider (7) from accessory drive (8). Discard gasket.



INSPECTION

1. Inspect fuel pump mounting flange for cracks and other damage. If cracks are found, replace fuel pump.
2. Inspect jaw coupling spider and jaw coupling hub for wear and other damage. If worn or damaged, replace jaw coupling spider or fuel pump or both.

INSTALLATION

NOTE

Ensure both fuel pump and accessory drive mating flanges are clean and free of old gasket material.

1. Install jaw coupling spider (7), new gasket (1), and fuel pump (5) on accessory drive (8).
2. Secure in place with four screws (3), nuts (6), and eight washers (4). Tighten screws to 35 lb-ft (47 Nm).
3. Connect fuel hose from fuel tank to pump. Connect fuel line from fuel pump to cylinder head (TM 10-3930-675-20).
4. Install fuel filter/water separator (TM 10-3930-675-20).
5. Connect wire lead to fuel solenoid shutoff valve (TM 10-3930-675-20).

INSTALLATION - CONTINUED

NOTE

To reduce engine cranking time it may be necessary to prime fuel pump.

6. Prime fuel pump (5) as follows:
   a. Remove filler cap (2) from top of fuel pump.
   b. Fill fuel pump with clean fuel.
   c. Install filler cap.
7. Connect battery cables (TM 10-3930-675-20).
8. Operate engine (TM 10-3930-675-10) and check for fuel leaks.
9. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

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TURBOCHARGER REPLACEMENT 0025 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Gage, depth (Item 29, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Compound, antiseize (Item 5, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Materials/Parts - Continued

Gasket (P/N 3088984)

Gasket (P/N 3899343)

Seal, o-ring (P/N 3037537)

Seal, o-ring (P/N 3883284)

Seal, o-ring (P/N 3922794)

Personnel Required

Two

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Cooling system hoses removed (TM 10-3930-675-20)

WARNING

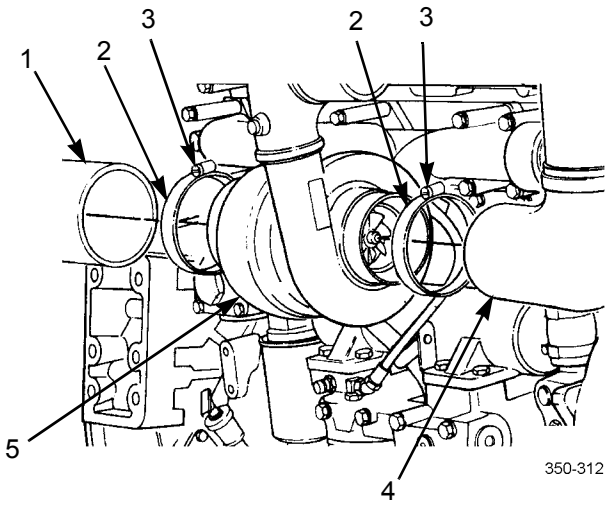
DO NOT perform maintenance on turbocharger unless engine has been allowed to cool down. Turbocharger maintenance involves working around exhaust system. Exhaust manifold and pipes may be hot and will cause serious burns.

NOTE

If removal of turbocharger is for access, perform steps identified in *Removal*. Prior to removal of turbocharger for other reasons, perform *Inspection* to verify need to remove and replace turbocharger.

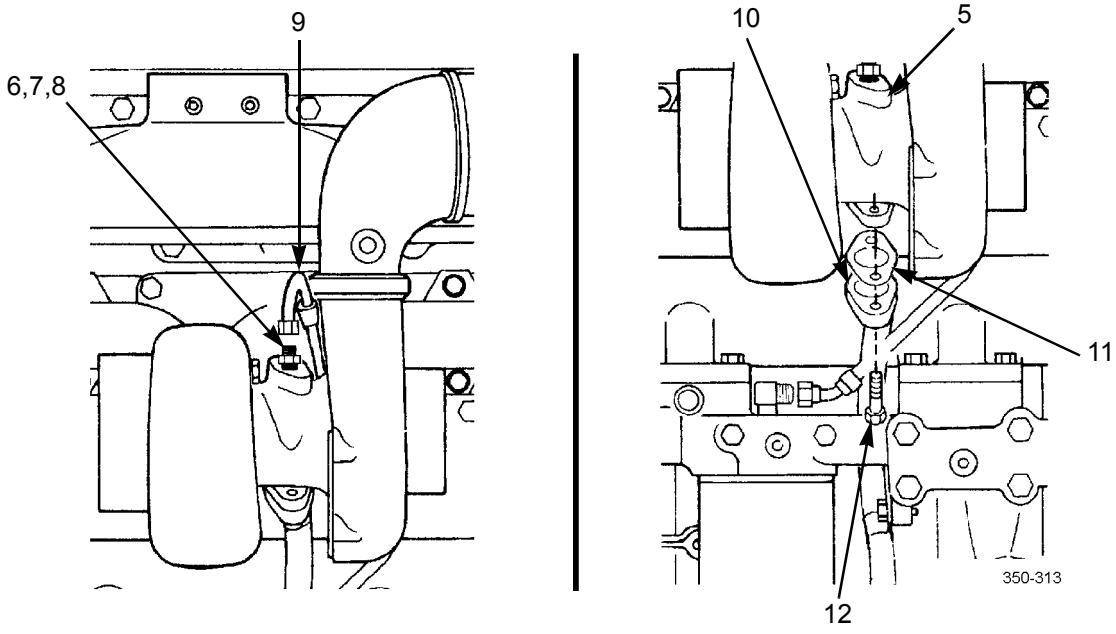
REMOVAL

1. Loosen hose clamp screws (3) and remove clamps (2) from exhaust and intake pipes (1 and 4) and from turbocharger (5).



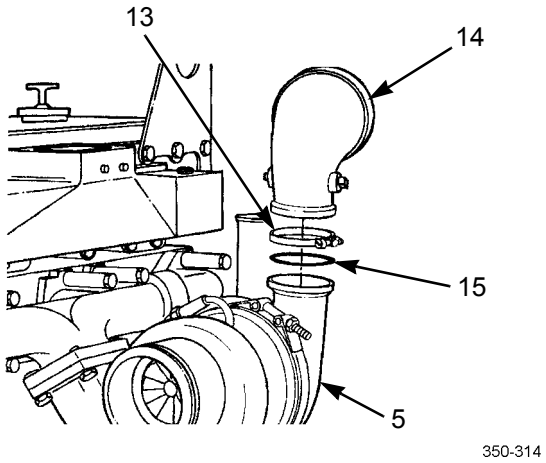
2. Disconnect oil supply line (9) from fitting (6) on top of turbocharger (5). Remove fitting and two o-ring seals (7 and 8) from turbocharger. Discard o-ring seals.

3. Remove two screws (12) securing oil drain line (10) and gasket (11) to bottom of turbocharger (5). Disconnect oil drain line. Discard gasket.

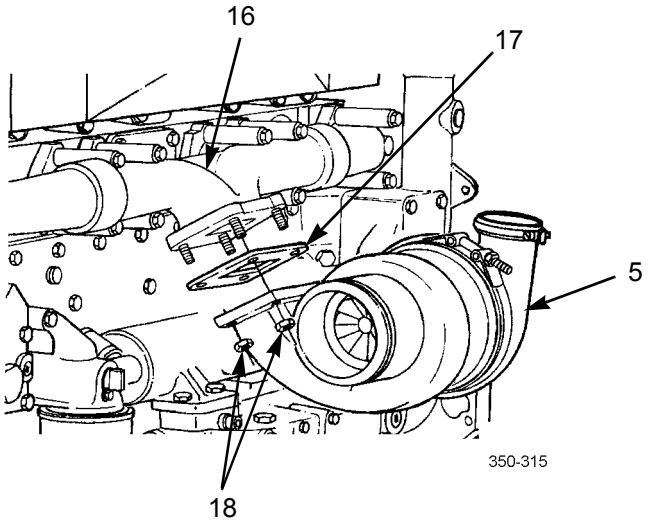


REMOVAL - CONTINUED

4. Remove v-band clamp (13), discharge elbow (14), and o-ring seal (15) from turbocharger (5). Discard o-ring seal.

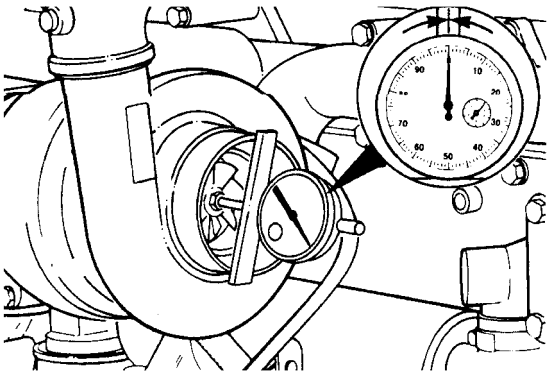


5. Remove four nuts (18) securing turbocharger (5) to exhaust manifold (16). With assistance, remove turbocharger and gasket (17) from exhaust manifold. Discard gasket.



INSPECTION

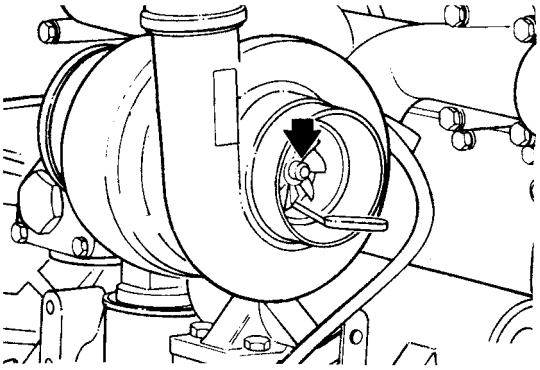
1. Perform turbocharger axial clearance check as follows:
   a. Loosen hose clamp screws and remove intake and exhaust pipes from turbocharger. Install dial depth gage as shown and push rotor assembly away from gage.
   b. Set gage to zero.
   c. Push rotor assembly toward gage and record reading.
   d. Recorded reading must be 0.0015-0.0035 in (0.038-0.089 mm). If axial clearance reading is not within specified range, replace turbocharger.



350-316

AXIAL CLEARANCE CHECK

2. Perform turbocharger radial bearing clearance check as follows:
   a. Loosen hose clamp screws and remove intake and exhaust pipes from turbocharger.
   b. Push compressor wheel toward compressor housing. Measure clearance with gage and record reading.
   c. Push compressor wheel away from housing. Measure clearance, in same location, with gage and record reading.
   d. Subtract smaller clearance from larger clearance to obtain radial bearing clearance reading. Radial bearing clearance must be 0.006-0.025 in (0.152-0.635 mm). If reading is not within specified range, replace turbocharger.



350-317

RADIAL BEARING CLEARANCE CHECK

INSPECTION - CONTINUED

3. Inspect compressor impeller blades and turbine wheel for damage. If damage is found, replace turbocharger.
4. Visually check turbine and compressor housings for cracks. If cracks exist on outer walls, replace turbocharger.
5. Visually check turbocharger intake and discharge for oil. If noted on turbine side, and oil discharge line is not restricted, replace turbocharger. If oil is on intake side and no restriction is found, replace turbocharger.

NOTE

Mounting flanges must be inspected after removal of turbocharger from engine.

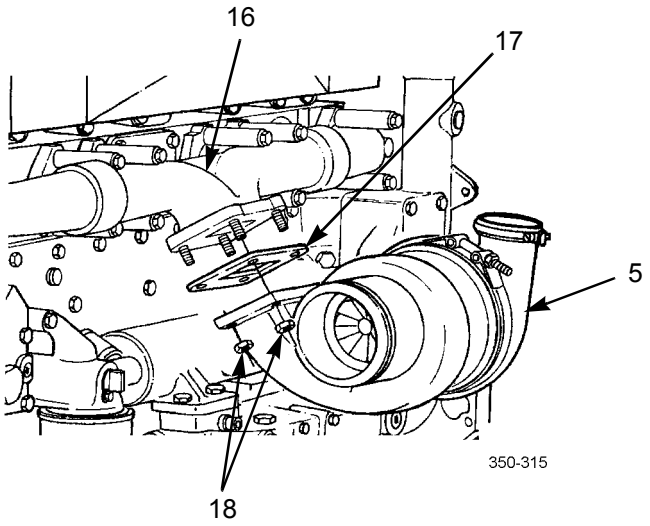
6. Visually check mounting flange surfaces for cracks. Cracks longer than 0.6 in (15.2 mm) or cracks which extend to mounting holes are not acceptable. Cracks of any length, which extend thru the divider, are acceptable only if separated by at least 0.5 in (12.7 mm).

INSTALLATION

NOTE

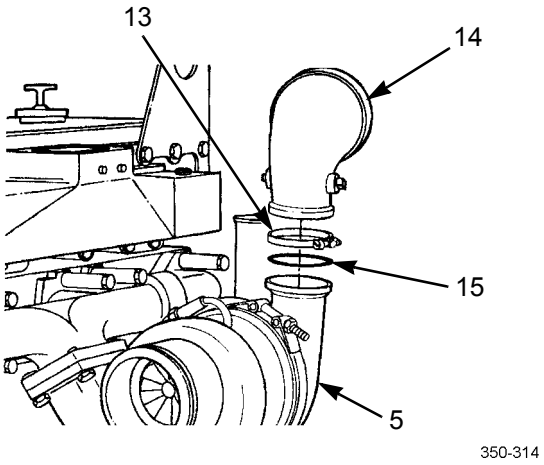
Ensure mounting flanges on exhaust manifold and turbocharger are clean and free of old gasket material.

1. Apply a thin coat of antiseize compound to mounting studs of exhaust manifold (16).
2. With assistance, install new gasket (17) and turbocharger (5) on exhaust manifold (16). Secure with four nuts (18). Tighten nuts to 45 lb-ft (61 Nm).

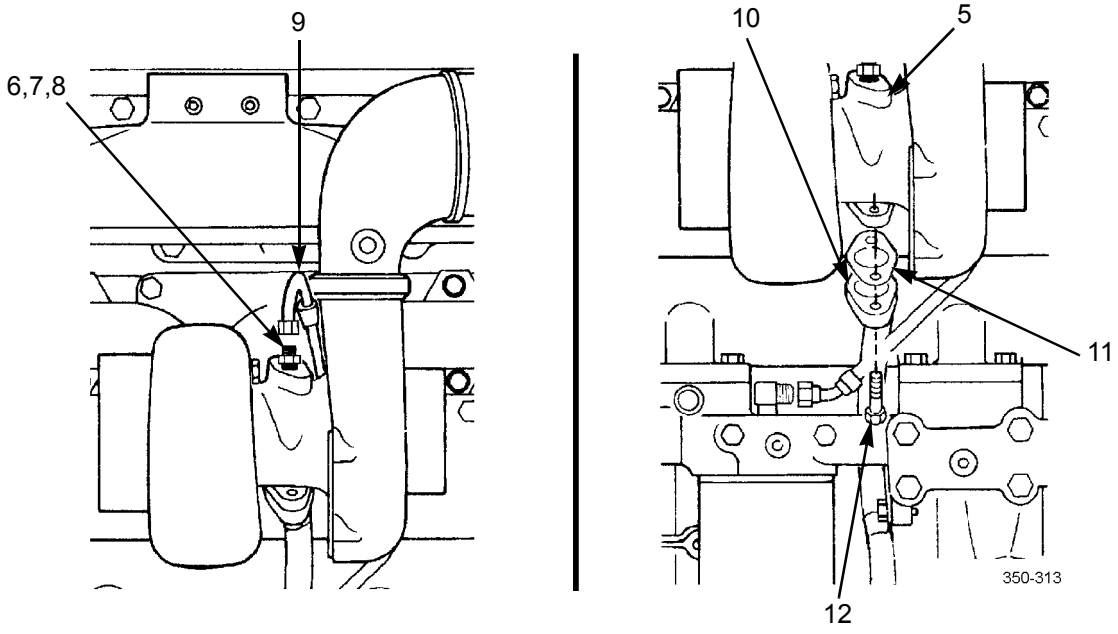


INSTALLATION - CONTINUED

3. Install discharge elbow (14), v-band clamp (13), and new o-ring seal (15) on turbocharger (5). Tighten v-band clamp.



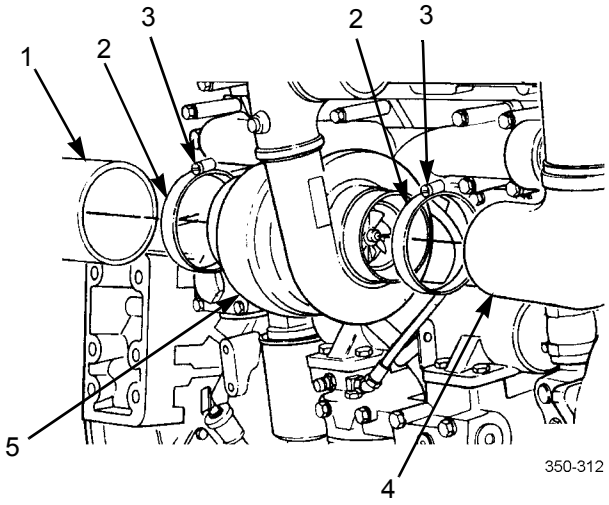
4. Install oil drain line (10) and new gasket (11) on turbocharger (5) with two screws (12). Tighten screws to 20 lb-ft (27 Nm).
5. Pour 2-3 oz (50-60 cc) of clean engine oil into turbocharger inlet port.
6. Install fitting (6) and new o-ring seals (7 and 8) on turbocharger inlet port and connect oil supply line (9) to fitting.



TURBOCHARGER REPLACEMENT - CONTINUED **0025 00**

INSTALLATION - CONTINUED

7. Install exhaust and intake pipes (1 and 4) and clamps (2) on turbocharger (5). Tighten hose clamp screws (3).



8. Install cooling system hoses (TM 10-3930-675-20).
9. Start engine (TM 10-3930-675-10). Check for air, exhaust, coolant, and oil leaks.
10. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

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FUEL TANK REPLACEMENT 0026 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Nut, lock (P/N 920076.003) (5)

References

TM 10-3930-675-10

Personnel Required

Three

Equipment Condition

Fuel level sending unit removed (TM 10-3930-675-20)

Muffler removed (TM 10-3930-675-20)

Fuel drained from fuel tank (TM 10-3930-675-20)

Arctic heater fuel lines disconnected from fuel tank, if equipped with arctic heater (TM 10-3930-675-20)

Fuel supply and return hoses disconnected from fuel tank (TM 10-3930-675-20)

Right-side step removed (TM 10-3930-675-20)

Cab sliding cylinder disconnected from fuel tank (TM 10-3930-675-20)

WARNING

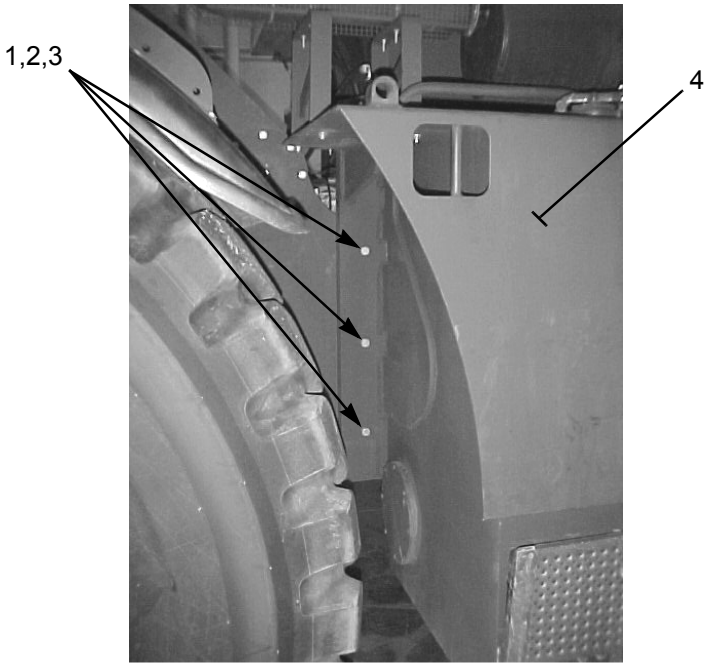
- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy objects supported only by a lifting device. Failure to follow this warning may result in death or injury to personnel.

NOTE

Fuel tank may contain residual amounts of fuel, which may be spilled when replacing tank. Spilled fuel should be cleaned up immediately.

REMOVAL

1. Attach a nylon sling to lifting eyes at top of fuel tank (4) and to suitable lifting device. Take up slack in sling.
2. Remove three locknuts (1), screws (2), and six washers (3) from fuel tank (4) and frame. Discard locknuts.

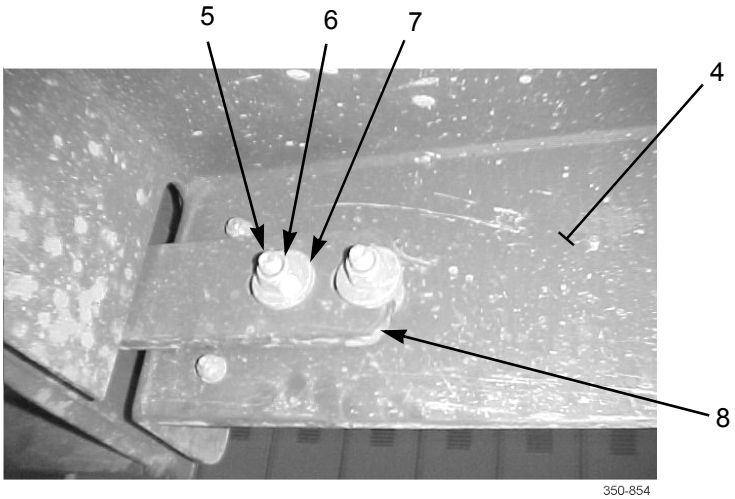


3. Remove two locknuts (6), screws (5), and four spacer washers (7) from fuel tank (4) and bracket (8). Discard locknuts.

CAUTION

Use caution not to allow fuel tank to contact hydraulic reservoir or other components of RTCH as it is being removed.

4. Raise fuel tank (4) and remove from frame.



INSTALLATION

1. Attach a nylon sling to lifting eyes at top of fuel tank (4) and to suitable lifting device. Take up slack in sling.

CAUTION

Use caution not to allow fuel tank to contact hydraulic reservoir or other components of RTCH as it is being installed.

2. Raise fuel tank (4) and position fuel tank at frame.
3. Secure fuel tank (4) to frame with three screws (2), six washers (3), and three new locknuts (1).
4. Install four spacer washers (7), two screws (5), and new locknuts (6) to fuel tank (4) and bracket (8).
5. Connect cab sliding cylinder to fuel tank (TM 10-3930-675-20).
6. Install right-side step (TM 10-3930-675-20).
7. Connect fuel supply and return hoses to fuel tank (TM 10-3930-675-20).
8. Connect arctic heater fuel lines to fuel tank, if equipped with arctic heater (TM 10-3930-675-20).
9. Fill fuel tank (TM 10-3930-675-10).
10. Start engine (TM 10-3930-675-10) and check for leaks.
11. Install muffler (TM 10-3930-675-20).
12. Install fuel level sending unit (TM 10-3930-675-20).

END OF WORK PACKAGE

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RADIATOR ASSEMBLY REPLACEMENT 0027 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Nut, lock (P/N 920076.003) (2)

Washer, lock (P/N 923657.0005) (6)

Personnel Required

Two

Equipment Condition

Radiator assembly drained (TM 10-3930-675-20)

Fording water level sensor removed (TM 10-3930-675-20)

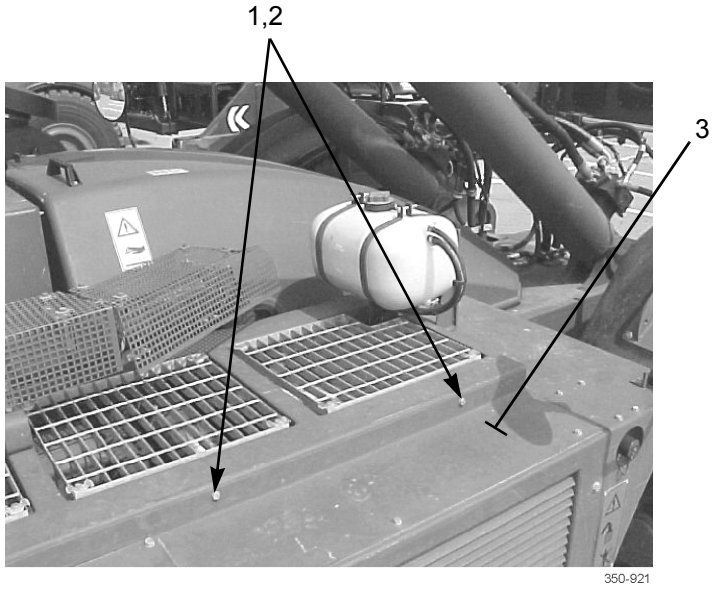
Hydraulic system pressure relieved (TM 10-3930-675-20)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

REMOVAL

1. Remove eight screws (1), washers (2), and angle plate (3) from top of vehicle.



2. Disconnect air intake hoses and tubes from radiator assembly (TM 10-3930-675-20).
3. Disconnect cooling system hoses from radiator assembly (TM 10-3930-675-20).
4. Disconnect hydraulic cooling fan hoses and fittings from radiator assembly (TM 10-3930-675-20).
5. Disconnect hydraulic hoses from cooling fan motor and bypass valve (TM 10-3930-675-20).
6. Disconnect electrical connection from bypass valve. Remove wiring harness from radiator fan support.

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy objects supported only by a lifting device. Failure to follow this warning may result in injury or death to personnel.
- Lifting device must have a capacity of approximately 1000 lb (454 kg) to lift radiator grille and radiator. Failure to follow this warning may result in injury or death to personnel.

7. Attach a suitable lifting device to radiator grille (6).

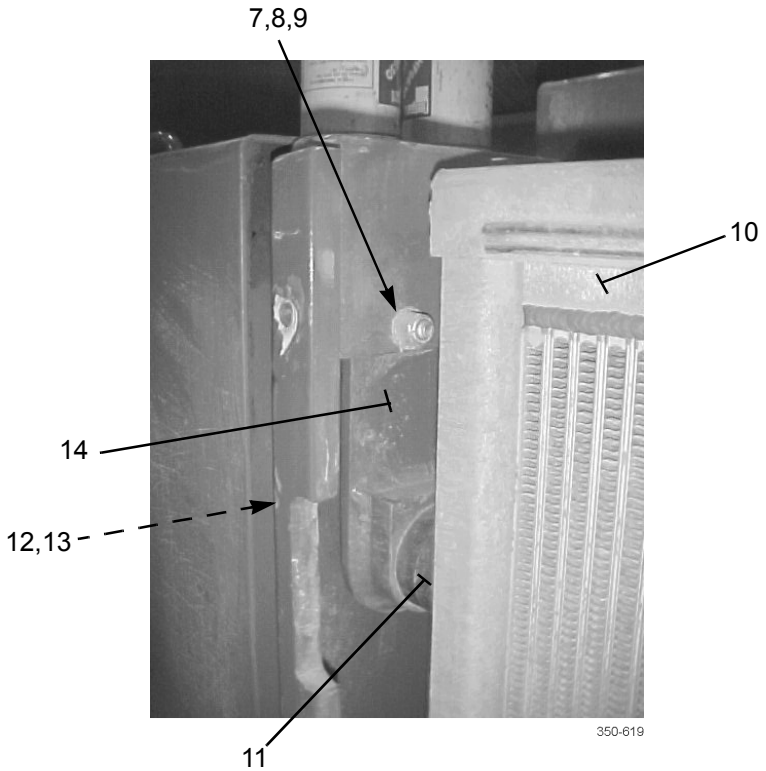
NOTE

Radiator grille is composed of an inner grille and an outer grille. Separate two grilles, if necessary, by removing an additional six screws and washers.

8. Remove six screws (4), washers (5), and radiator grille (6) from side of vehicle.

REMOVAL - CONTINUED

9. Attach a suitable lifting device to top of radiator assembly (10) with two bolts.
10. Remove two locknuts (7), washers (8), and screws (9) to separate radiator bracket (14) from vehicle. Discard locknuts.
11. Remove six screws, lockwashers, rubber bushings, and radiator assembly (10) from frame. Remove two bolts and lifting device. Discard lockwashers.
12. Remove two screws (12), washers (13), radiator bracket (14), and two rubber bushings (11) from radiator assembly (10).



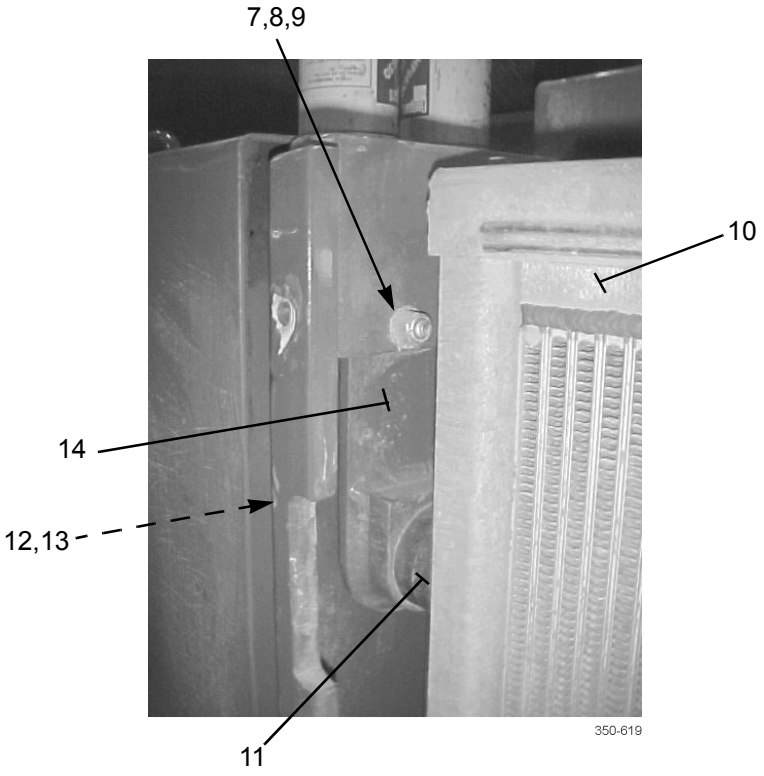
INSTALLATION

1. Install two rubber bushings (11) and radiator bracket (14) to radiator assembly (10) with two washers (13) and screws (12).

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy objects supported only by a lifting device. Failure to follow this warning may result in injury or death to personnel.
- Lifting device must have a capacity of approximately 1000 lb (454 kg) to lift radiator grille and radiator. Failure to follow this warning may result in injury or death to personnel.

2. Attach a suitable lifting device to top of radiator assembly (10) with two bolts.
3. Install radiator assembly (10) to frame with six rubber bushings, new lockwashers, and screws. Remove two bolts and lifting device.
4. Secure radiator bracket (14) to vehicle with two screws (9), washers (8), and new locknuts (7).
5. Attach lifting device to radiator grille (6).
6. Install radiator grille (6) to side of vehicle with six washers (5) and screws (4).



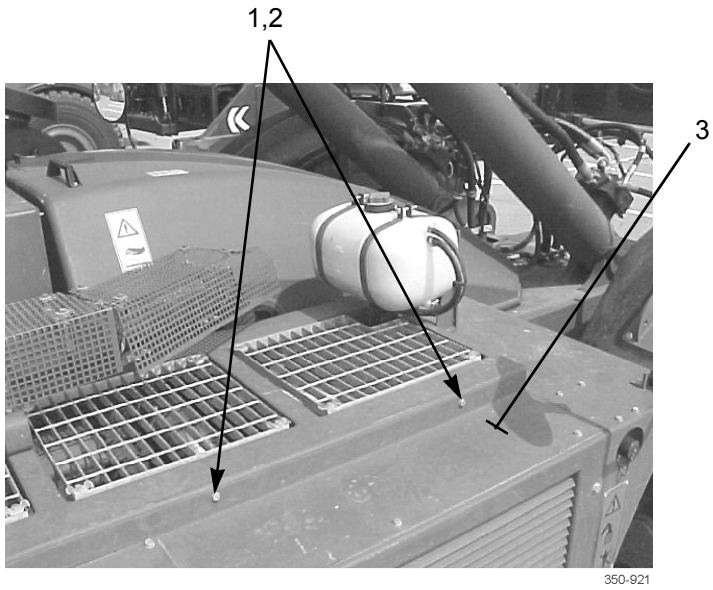
INSTALLATION - CONTINUED

7. Connect electrical connection to bypass valve. Screw wiring to radiator fan support.

NOTE

Refer to *General Maintenance Instructions* (TM 10-3930-675-20) for complete instructions on connecting hydraulic hoses and applying proper torque.

8. Connect hydraulic hoses to cooling fan motor and bypass valve (TM 10-3930-675-20).
9. Connect hydraulic cooling fan hoses and fittings to radiator assembly (TM 10-3930-675-20).
10. Connect cooling system hoses to radiator assembly (TM 10-3930-675-20).
11. Connect air intake hoses and tubes to radiator assembly (TM 10-3930-675-20).
12. Install angle plate (3) to top of vehicle with eight washers (2) and screws (1).



13. Install fording water level sensor (TM 10-3930-675-20).
14. Fill radiator (TM 10-3930-675-20).

NOTE

Notify Organization Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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RADIATOR ASSEMBLY REPAIR 0028 00

THIS WORK PACKAGE COVERS

Disassembly, Repair, Assembly

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Personnel Required

Two

References

TM 750-254

WP 0056 00

Equipment Condition

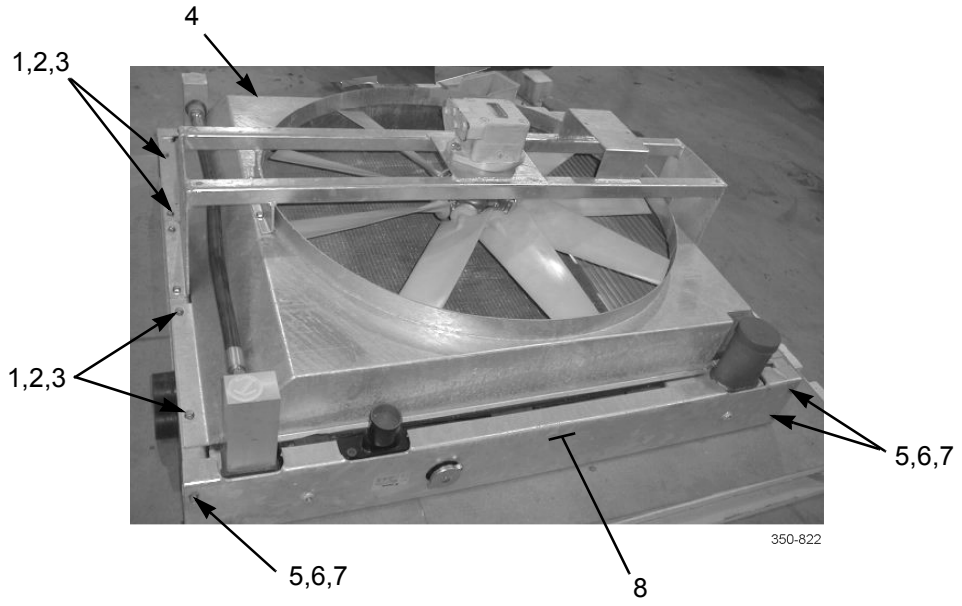
Radiator assembly removed from vehicle (WP 0027 00)

DISASSEMBLY

CAUTION

Ensure radiator assembly is positioned on a flat work surface which will not damage core vanes and with fan motor up. If not placed on a suitable work surface, damage may be done to radiator cores.

1. Remove hydraulic cooling fan (WP 0056 00).
2. Remove eight screws (1), washers (2), nuts (3), and fan shroud (4) from radiator assembly.
3. Remove four screws (5), washers (6), nuts (7), and radiator frame top (8).



DISASSEMBLY - CONTINUED

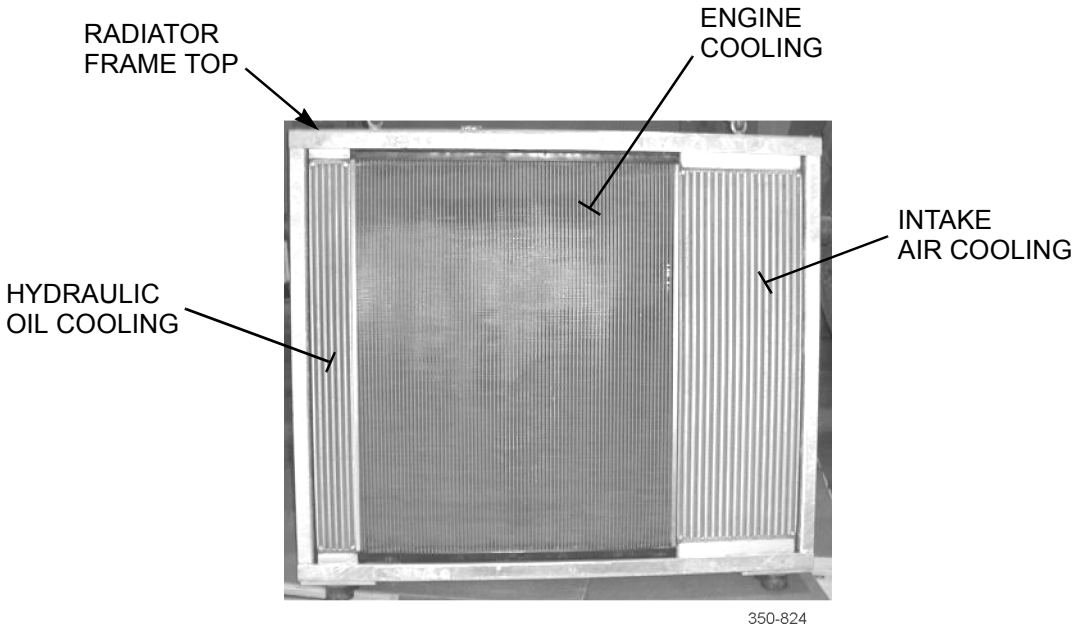
WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Radiator cores have sharp edges and vanes that can cut. Use appropriate protective equipment when handling radiator cores. Failure to follow this warning may result in serious injury to personnel.

NOTE

Note position of each radiator assembly cooling section (hydraulic oil, engine, and intake air cooling) as an aid for assembly.

4. With assistance, remove three radiator sections from radiator frame.



REPAIR

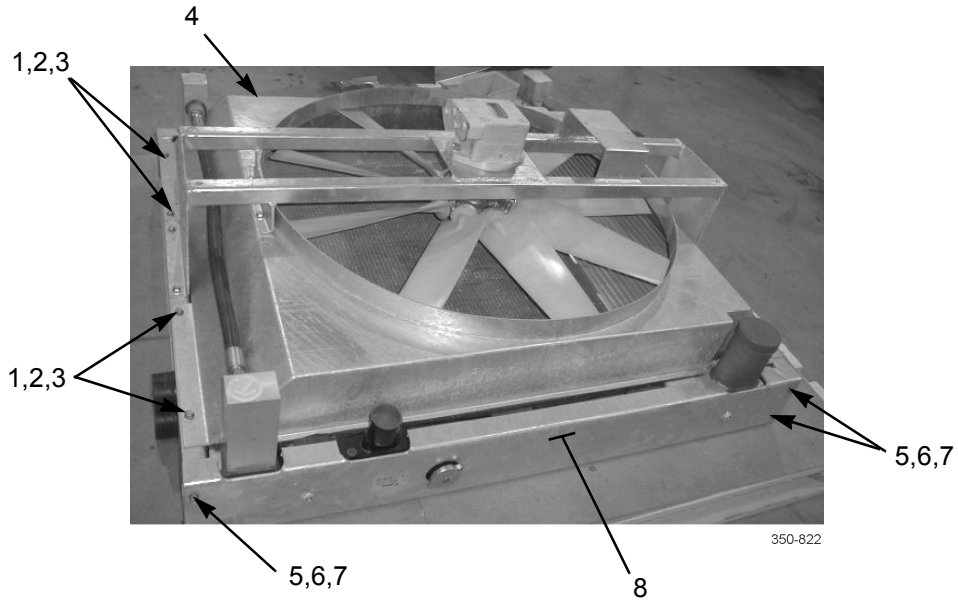
Refer to TM 750-254 to repair radiator.

ASSEMBLY

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Radiator cores have sharp edges and vanes that can cut. Use appropriate protective equipment when handling radiator cores. Failure to follow this warning may result in serious injury to personnel.

1. With assistance, install three radiator sections in radiator frame.
2. Install radiator frame top (8) and secure with four screws (5), washers (6), and nuts (7).
3. Position fan shroud (4) and secure with four screws (1), washers (2), and nuts (3).



4. Install hydraulic cooling fan (WP 0056 00).
5. Install radiator assembly (WP 0027 00).

END OF WORK PACKAGE

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BOOM WIRING HARNESSES REPLACEMENT 0029 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Strap, tiedown (Item 30, WP 0089 00)

References

WP 0031 00

Equipment Condition

Master battery switch in OFF position

NOTE

Two wiring harnesses are routed along right side of boom and boom extension and terminate at tophandler junction box. This work package describes replacement of these two wiring harnesses.

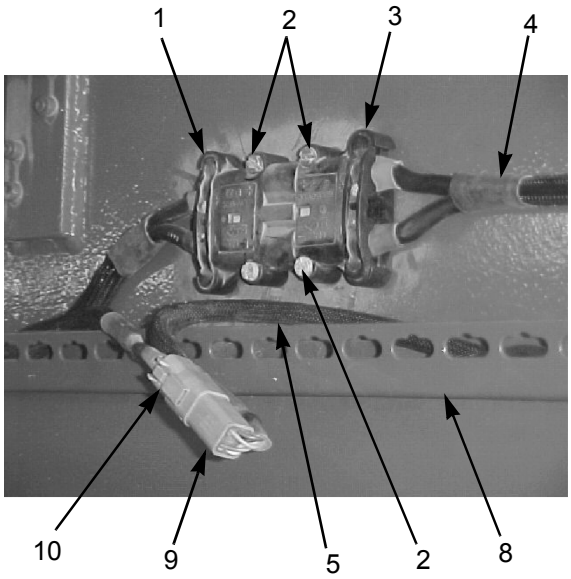
REMOVAL

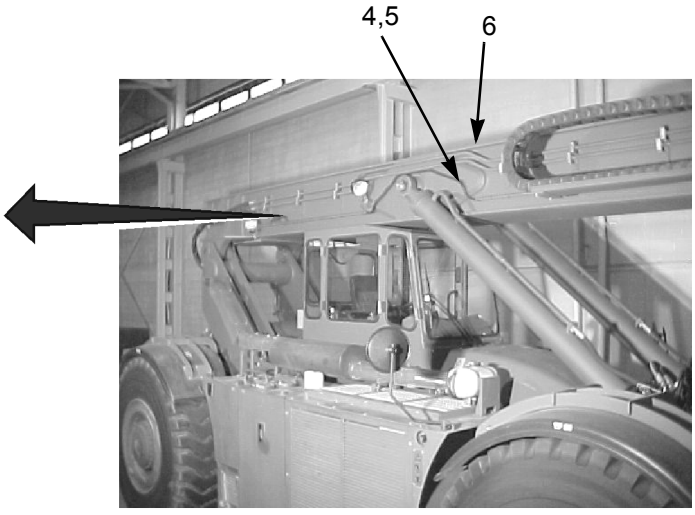
1. Disconnect connector (9) of wiring harness (5) from chassis wiring harness connector (10).
2. Remove four screws (2). Disconnect connector (3) of wiring harness (4) from chassis wiring harness connector (1).

NOTE

Note routing of wiring harnesses and positioning of tiedown straps to assist in installation.

3. Trace wiring harnesses (4 and 5) along boom (6), removing and discarding all tiedown straps that secure wiring harnesses to channels (8).





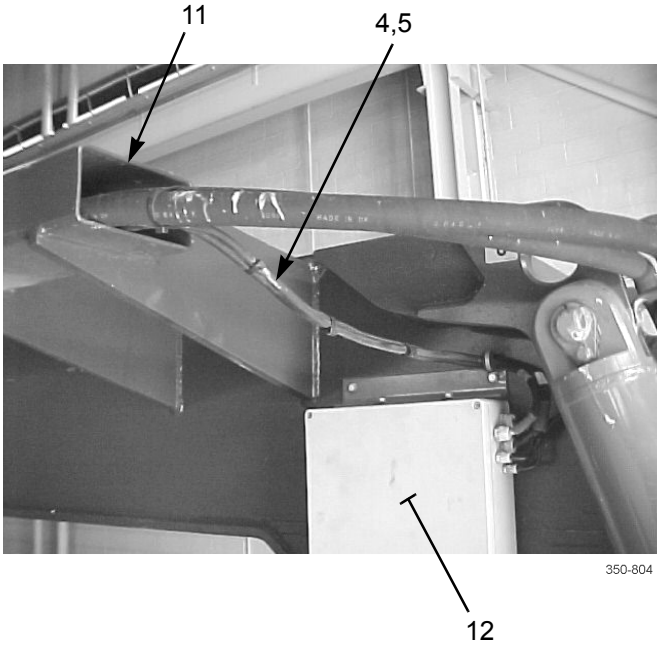
REMOVAL - CONTINUED

4. Trace wiring harnesses (4 and 5) to tophandler junction box (12) and disconnect from junction box (WP 0031 00).
5. Remove and discard tiedown straps that secure wiring harnesses (4 and 5) together at tophandler junction box (12) end.

NOTE

Note routing of wiring harnesses through middle portion of flexible conveyer.

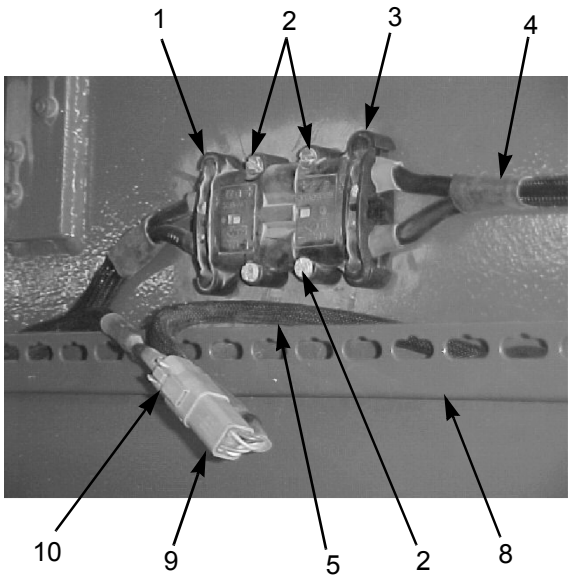
6. Pull wiring harnesses (4 and 5) toward front of vehicle, pulling them thru box channel (11) and flexible conveyer (7).
7. Remove wiring harnesses (4 and 5) from vehicle.

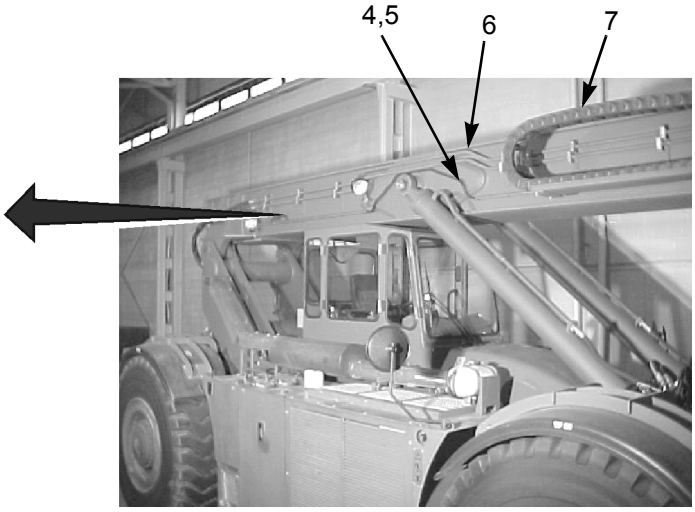


INSTALLATION

1. Starting from rear of flexible conveyer (7) and working toward tophandler, feed wiring harnesses (4 and 5) through middle portion of flexible conveyer and into box channel (11), until wiring harness ends reach tophandler junction box (12).
2. Connect wiring harnesses (4 and 5) to tophandler junction box (12) (WP 0031 00).
3. Install new tiedown straps to secure wiring harnesses (4 and 5) together at tophandler junction box (12) end.
4. Position wiring harnesses (4 and 5) inside channels (8) along boom (6), until ends of wiring harnesses reach connection points to chassis wiring harnesses.
5. Connect connector (3) of wiring harness (4) to chassis wiring harness connector (1). Install four screws (2).
6. Connect connector (9) of wiring harness (5) to chassis wiring harness connector (10).
7. Secure wiring harnesses (4 and 5) to channels (8) with new tiedown straps.

INSTALLATION - CONTINUED





END OF WORK PACKAGE

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TOPHANDLER WIRING HARNESSES REPLACEMENT 0030 00

THIS WORK PACKAGE COVERS

Wiring Harness A, Tophandler Junction Box-to-Junction Box 182: Removal, Installation

Wiring Harness B, Tophandler Junction Box-to-Control Valve: Removal, Installation

Wiring Harness C, Tophandler Junction Box-to-Control Valve: Removal, Installation

Wiring Harness D, Junction Box 182-to-Junction Box 183: Removal, Installation

Wiring Harness E, Junction Box 182-to-Junction Box 184: Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Screwdriver set, jeweler's (Item 79, WP 0090 00)

Materials/Parts

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Wire, nonelectrical (Item 34, WP 0089 00)

Personnel Required

Two

References

WP 0074 00

WP 0087 00

Equipment Condition

Boom and tophandler fully lowered (TM 10-3930-675-10)

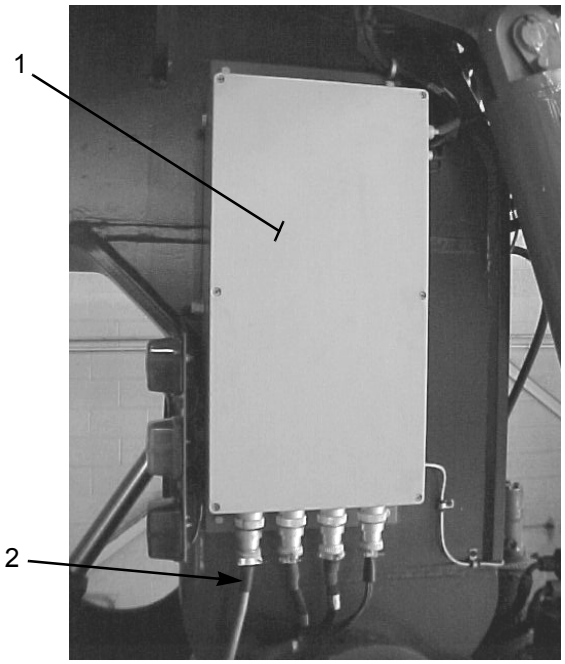
Master battery switch in OFF position

NOTE

Replacement of wiring harnesses D and E is easier to perform with tophandler extended to 40-ft width.

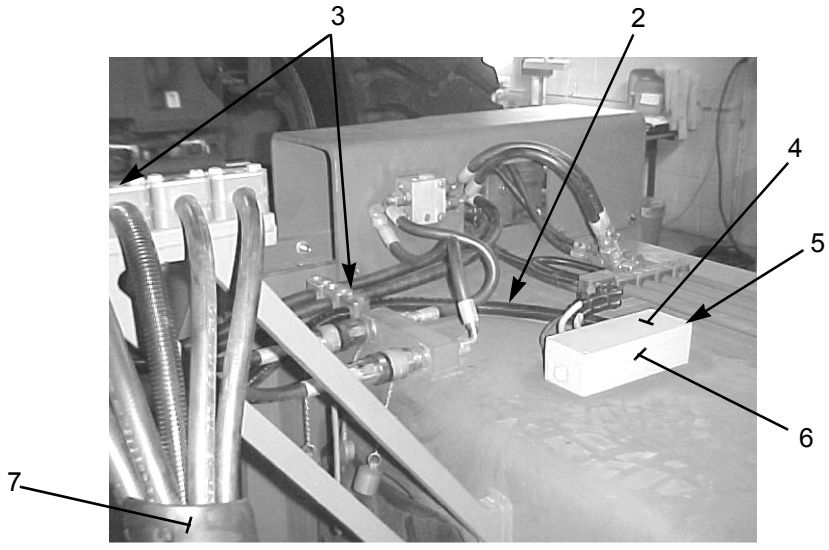
WIRING HARNESS A, TOPHANDLER JUNCTION BOX-TO-JUNCTION BOX 182: REMOVAL

1. Disconnect connector of wiring harness A (2) from connector of tophandler junction box (1).



350-1022

2. Trace routing of wiring harness A (2). Loosen cable clamps (3) and cut tiedown straps as needed to gain free movement of harness A.
3. Unwrap upper and lower cable guard (7) from harness A (2) routing. Retain for installation.
4. Loosen four screws (5) and remove cover (4) from junction box 182 (6). Inspect rubber seal in groove of cover. Replace only if damaged.



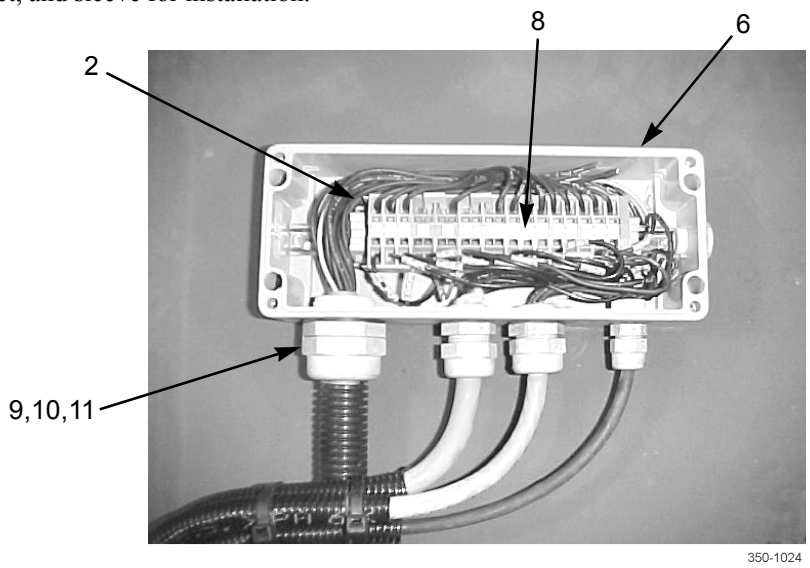
350-1023

WIRING HARNESS A, TOPHANDLER JUNCTION BOX-TO-JUNCTION BOX 182: REMOVAL - CONTINUED

NOTE

Use wiring diagrams in WP 0087 00, as needed, and note terminal block numbers to wire lead numbers for installation.

5. Using jeweler's screwdriver, disconnect wiring harness A (2) leads from terminal block (8) of junction box 182 (6).
6. Remove retainer nut (9), grommet (10), sleeve (11), and wiring harness A (2) from junction box 182 (6). Retain retainer nut, grommet, and sleeve for installation.



350-1024

7. From tophandler junction box end, with assistance, pull wiring harness A (2) from routing until wiring harness A is approximately 18 in (46 cm) from tophandler carriage frame above control valve.

NOTE

Nonelectrical wire is secured to wiring harness to be used as a guide wire during installation of new harness.

8. Secure approximately 6 ft (183 cm) of nonelectrical wire to wiring harness A (2).
9. With assistance, continue to pull wiring harness A (2) and nonelectrical wire thru cable routing until wiring harness is free of tophandler carriage frame.
10. Remove wiring harness A (2) from nonelectrical wire leaving nonelectrical wire in place thru wiring harness routing.

WIRING HARNESS A, TOPHANDLER JUNCTION BOX-TO-JUNCTION BOX 182: INSTALLATION

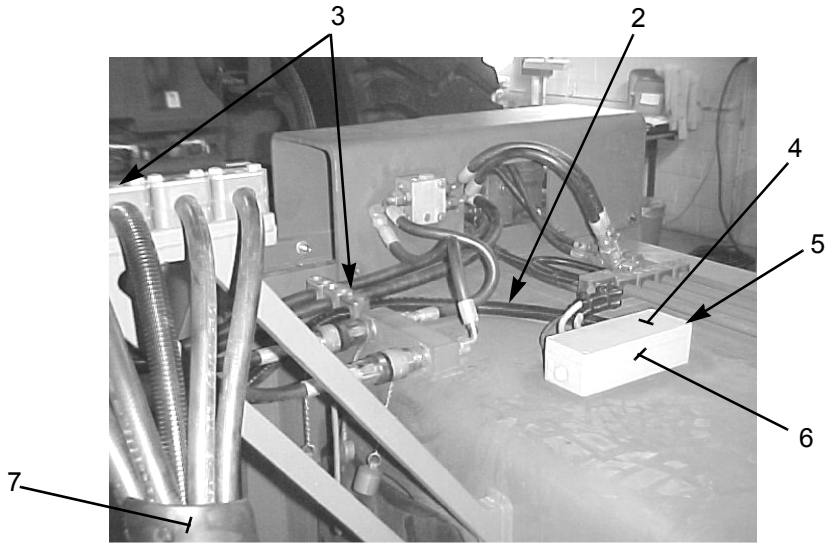
CAUTION

Ensure sufficient length of wiring harness is coiled within tophandler opening, so that tophandler can rotate freely in both directions without damaging harness.

1. Attach junction box 182 (6) end of wiring harness A (2) to nonelectrical wire at tophandler junction box (1) end.
2. With assistance, pull other end of nonelectrical wire and wiring harness A (2) thru tophandler carriage frame until approximately 18 in (46 cm) of wiring harness A is exposed.
3. Remove nonelectrical wire from wiring harness A (2) and continue to route wiring harness A to junction box 182 (6).
4. Install wiring harness A (2) thru retainer nut (9), grommet (10), sleeve (11), and use a jeweler's screwdriver to connect leads to terminal block (8) as noted during removal. Tighten retainer nut.

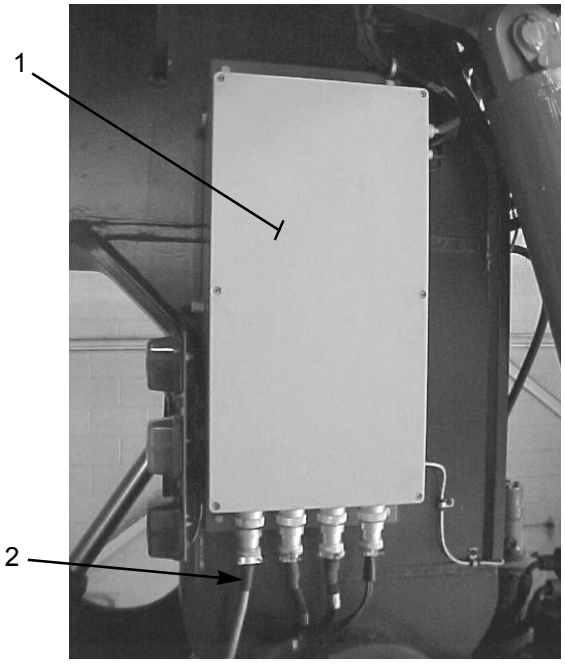
WIRING HARNESS A, TOPHANDLER JUNCTION BOX-TO-JUNCTION BOX 182: INSTALLATION - CONTINUED

5. Install cover (4) on junction box 182 (6) and tighten four screws (5).
6. Tighten cable clamps (3) and install new tiedown straps as needed to secure wiring harness A (2).
7. Install upper and lower cable guard (7).



350-1023

8. Connect connector of wiring harness A (2) to connector of tophandler junction box (1).



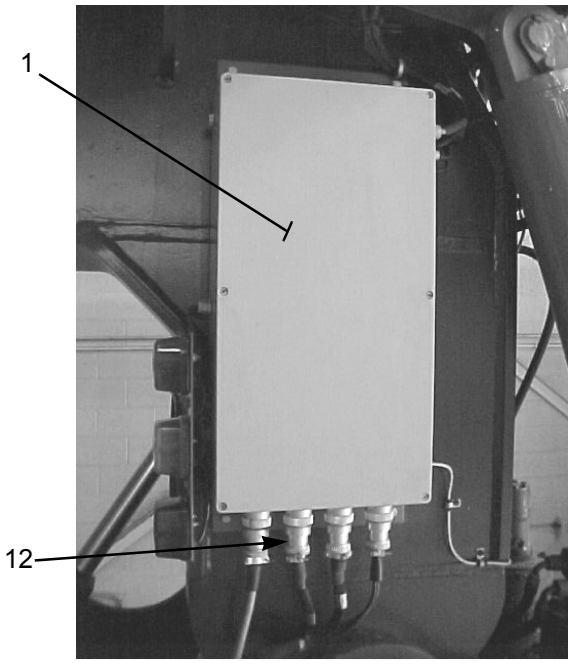
350-1022

WIRING HARNESS A, TOPHANDLER JUNCTION BOX-TO-JUNCTION BOX 182: INSTALLATION - CONTINUED

9. Perform boom and tophandler calibration (WP 0074 00).

WIRING HARNESS B, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: REMOVAL

1. Disconnect connector of wiring harness B (12) from connector of tophandler junction box (1).
2. Remove upper cable guard from wiring harness B (12). Retain cable guard for installation.



350-1022

WIRING HARNESS B, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: REMOVAL - CONTINUED

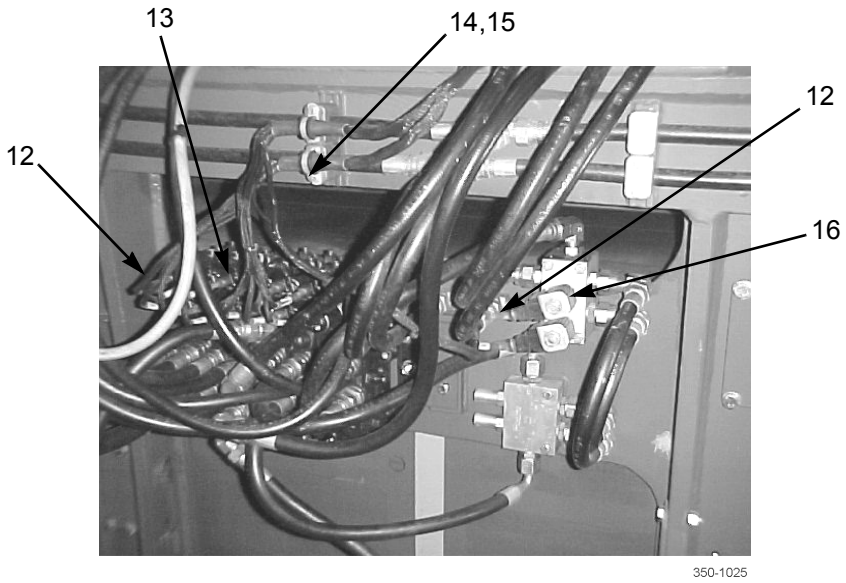
3. Remove screw (14) and cable clamp (15) from grommet of wiring harness B (12).

NOTE

Use wiring diagrams in WP 0087 00, as needed, and ensure diagram or record of wire lead connections is made prior to disconnection to ensure correct connection of leads.

4. At control valve, locate the following wire leads, press in on retaining clips, and disconnect leads from solenoids (13) as follows:

WIRE NUMBER	SOLENOID FUNCTION
6008	Rotation Clockwise
6009	Rotation Counterclockwise
6010	Tilt Out
6011	Tilt In
6018	Spreader Out
6019	Spreader In



5. Disconnect wire lead 6034-1 from leveling lock solenoid (16).

NOTE

Nonelectrical wire is secured to wiring harness to be used as a guide wire during installation of new harness.

6. Secure all loose leads of wiring harness B (12) to nonelectrical wire.

7. With assistance, pull wiring harness B (12) up thru tophandler carriage until nonelectrical wire is exposed approximately 18 in (46 cm).

WIRING HARNESS B, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: REMOVAL - CONTINUED

8. Remove wiring harness B (12) from nonelectrical wire leaving nonelectrical wire in place as a guide wire.

WIRING HARNESS B, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: INSTALLATION

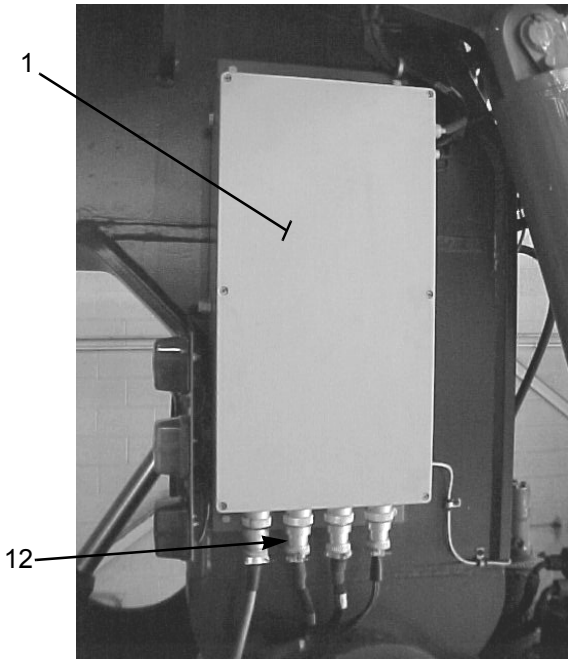
CAUTION

Ensure sufficient length of wiring harness is coiled within tophandler opening, so that tophandler can rotate freely in both directions without damaging harness.

1. Attach wiring harness B (12) control valve wire leads to upper end of nonelectrical wire.
2. With assistance, pull nonelectrical wire and wiring harness B (12) down thru tophandler carriage frame.
3. Remove wiring harness B (12) leads from nonelectrical wire.
4. Connect wire leads to solenoids (13) as follows:

WIRE NUMBER	SOLENOID FUNCTION
6008	Rotation Clockwise
6009	Rotation Counterclockwise
6010	Tilt Out
6011	Tilt In
6018	Spreader Out
6019	Spreader In

5. Connect lead 6034-1 to leveling lock solenoid (16).
6. Install cable clamp (15) to grommet of wiring harness B (12) with screw (14).
7. Connect connector of wiring harness B (12) to connector of tophandler junction box (1) and install cable guard.



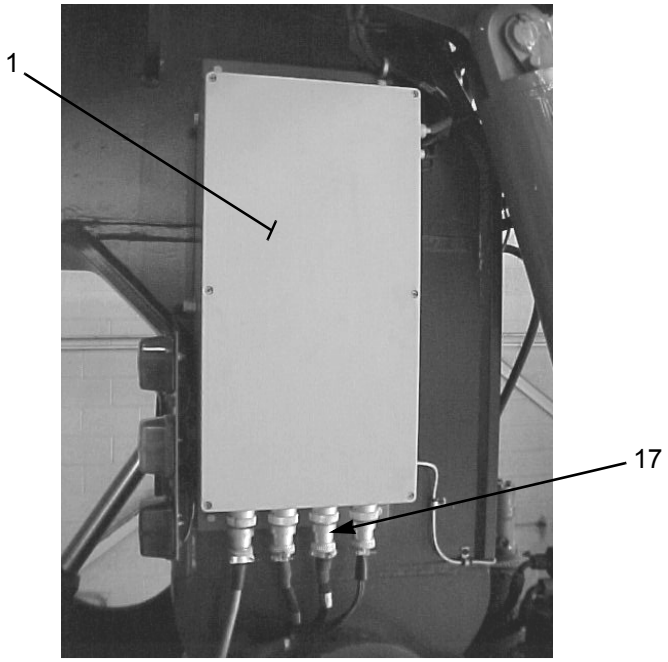
350-1022

WIRING HARNESS B, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: INSTALLATION - CONTINUED

8. Perform boom and tophandler calibration (WP 0074 00).

WIRING HARNESS C, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: REMOVAL

1. Disconnect connector of wiring harness C (17) from connector of tophandler junction box (1).



2. Remove upper cable guard from wiring harness C (17). Retain cable guard for installation.
3. Remove screw (18) and cable clamp (19) from grommet of wiring harness C (17).

NOTE

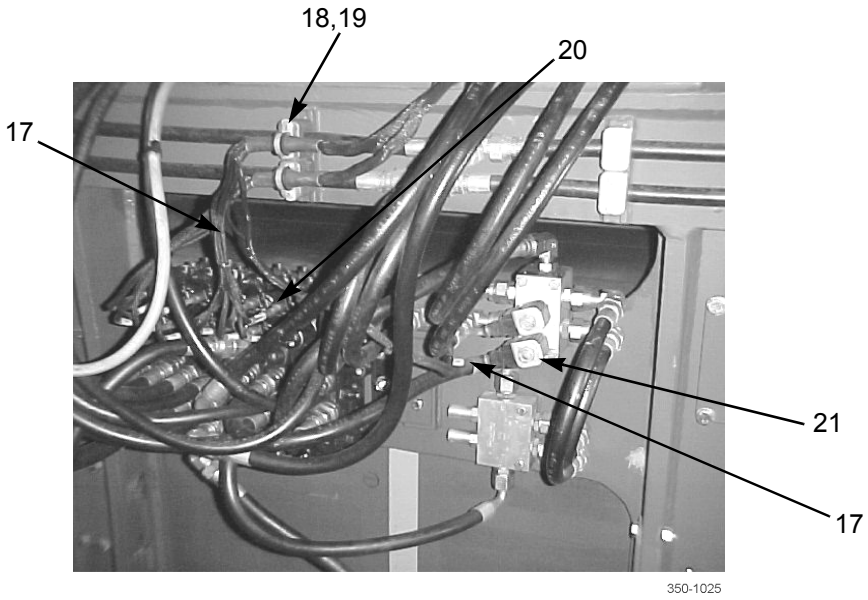
Use wiring diagrams in WP 0087 00, as needed, and ensure a diagram or record of wire lead connections is made prior to disconnection to ensure correct connection of leads.

WIRING HARNESS C, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: REMOVAL - CONTINUED

4. At control valve, locate the following wire leads, press in on retaining clips, and disconnect leads from solenoids (20) as follows:

WIRE NUMBER	SOLENOID FUNCTION
6020	Sideshift Left
6021	Sideshift Right
6035	Leveling Right
6036	Leveling Left
6039	Unlock Twistlocks
6040	Lock Twistlocks

5. Disconnect wire lead 6034-2 from leveling lock solenoid (21).



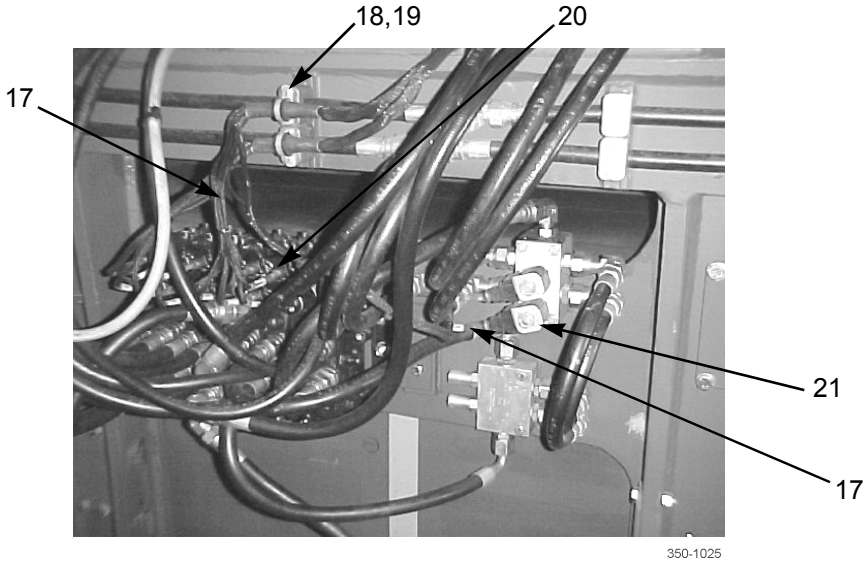
NOTE

Nonelectrical wire is secured to wiring harness to be used as a guide wire during installation of new harness.

6. Secure all loose leads of wiring harness C (17) to nonelectrical wire.
7. With assistance, pull wiring harness C (17) up thru tophandler carriage until nonelectrical wire is exposed approximately 18 in (46 cm).

WIRING HARNESS C, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: REMOVAL - CONTINUED

8. Remove wiring harness C (17) from nonelectrical wire and leave nonelectrical wire in place as a guide wire.



WIRING HARNESS C, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: INSTALLATION

CAUTION

Ensure sufficient length of wiring harness is coiled within tophandler opening, so that tophandler can rotate freely in both directions without damaging harness.

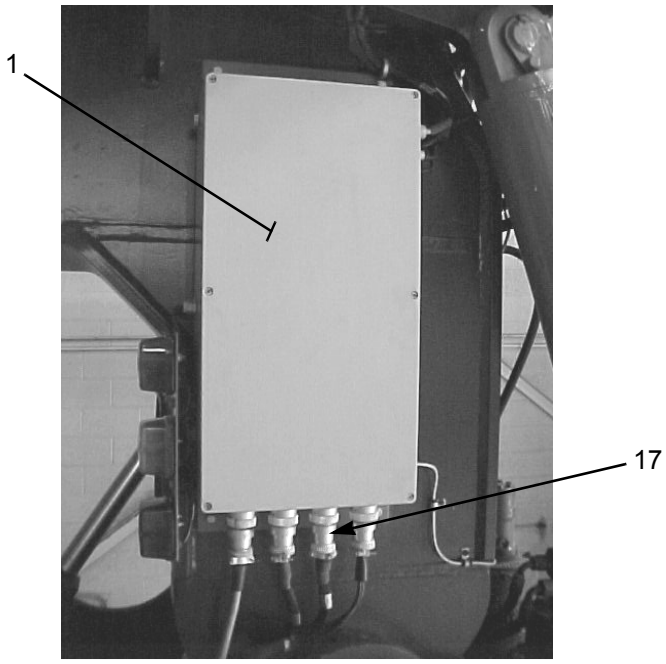
1. Attach wiring harness C (17) control valve wire leads to upper end of nonelectrical wire.
2. With assistance, pull nonelectrical wire and wiring harness C (17) down thru tophandler carriage frame.
3. Remove wiring harness C (17) leads from nonelectrical wire.
4. Connect wire leads to solenoids (20) as follows:

WIRE NUMBER	SOLENOID FUNCTION
6020	Sideshift Left
6021	Sideshift Right
6035	Leveling Right
6036	Leveling Left
6039	Unlock Twistlocks
6040	Lock Twistlocks

5. Connect lead 6034-2 to leveling lock solenoid (21).
6. Install cable clamp (19) to grommet of wiring harness C (17) with screw (18).

WIRING HARNESS C, TOPHANDLER JUNCTION BOX-TO-CONTROL VALVE: INSTALLATION - CONTINUED

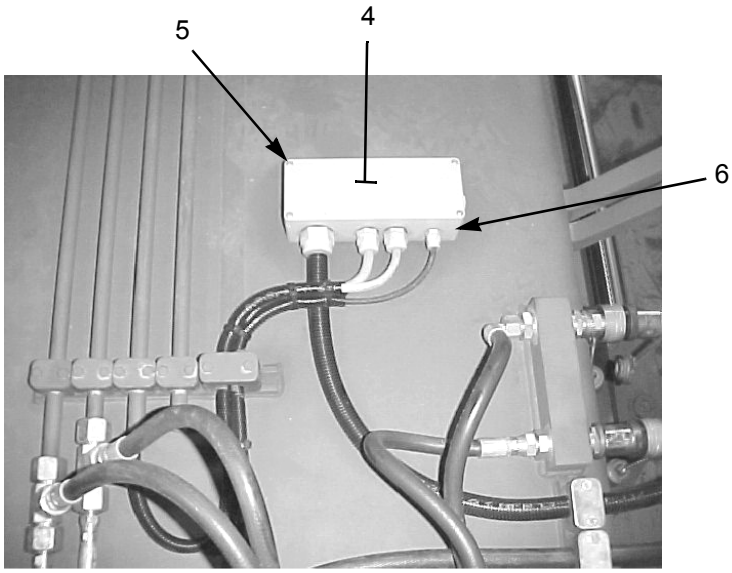
7. Connect connector of wiring harness C (17) to connector of tophandler junction box (1) and install cable guard.



350-1022

WIRING HARNESS D, JUNCTION BOX 182-TO-JUNCTION BOX 183: REMOVAL

1. Loosen four screws (5) and remove cover (4) from junction box 182 (6). Inspect rubber seal in groove of cover. Replace only if damaged.

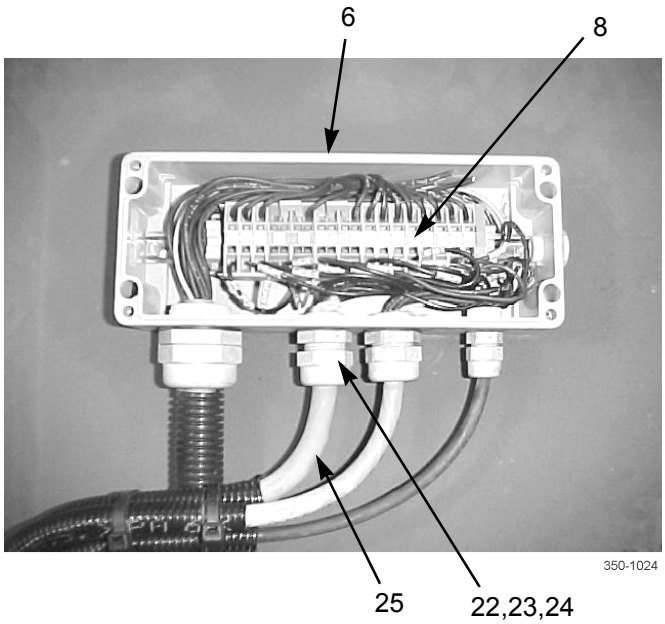


2. Remove retainer nut (22), grommet (23), and sleeve (24).

NOTE

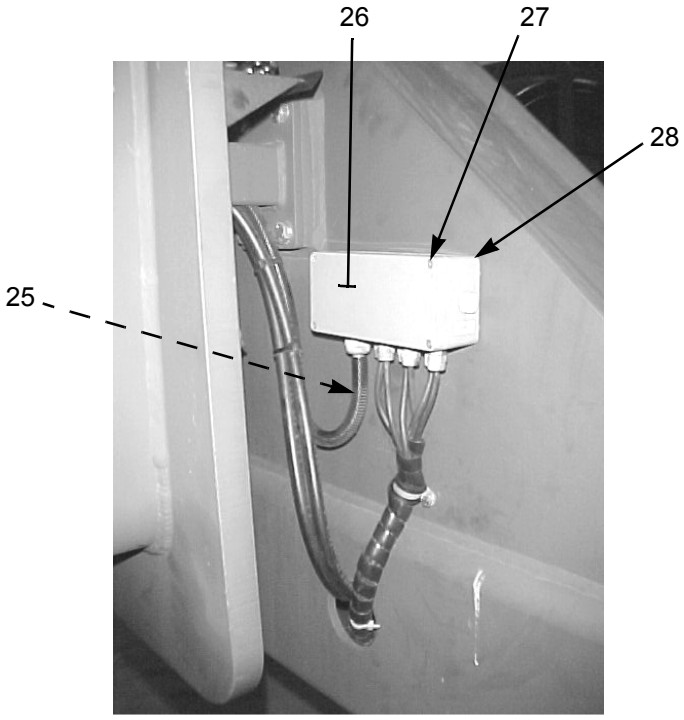
Use wiring diagrams in WP 0087 00, as needed, and note terminal block numbers to wire lead numbers for installation.

3. Using jeweler's screwdriver, disconnect wiring harness D (25) leads from terminal block (8) of junction box 182 (6). Remove harness from junction box.



WIRING HARNESS D, JUNCTION BOX 182-TO-JUNCTION BOX 183: REMOVAL - CONTINUED

4. Trace wiring harness D (25) from junction box 182 (6) to junction box 183 (28). Cut tiedown straps and loosen clamps, as needed, to gain free movement of wiring harness. Discard tiedown straps.
5. Loosen four screws (27) and remove cover (26) from junction box 183 (28). Inspect rubber seal in groove of cover. Replace only if damaged.



WIRING HARNESS D, JUNCTION BOX 182-TO-JUNCTION BOX 183: REMOVAL - CONTINUED

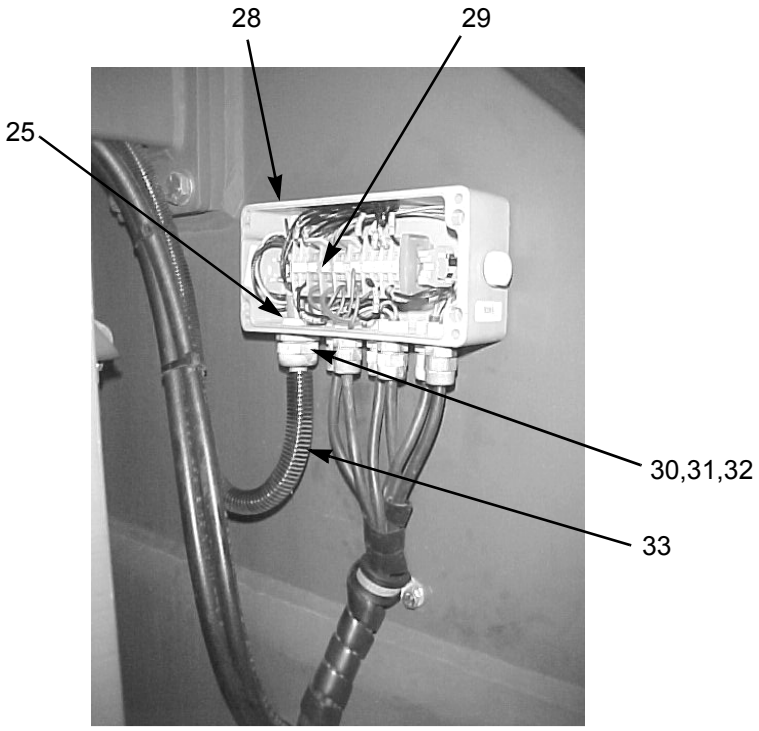
6. Remove retainer nut (30), grommet (31), and sleeve (32).

NOTE

Use wiring diagrams in WP 0087 00, as needed, and note terminal block numbers to wire lead numbers for installation.

7. Using jeweler's screwdriver, disconnect wiring harness D (25) leads from terminal block (29) of junction box 183 (28). Remove harness from junction box.

8. Remove wiring harness D (25) from cable guard (33) along cable routing. Retain cable guard.



WIRING HARNESS D, JUNCTION BOX 182-TO-JUNCTION BOX 183: INSTALLATION

1. Install wiring harness D (25) thru cable guard (33) and position wiring harness along cable routing.

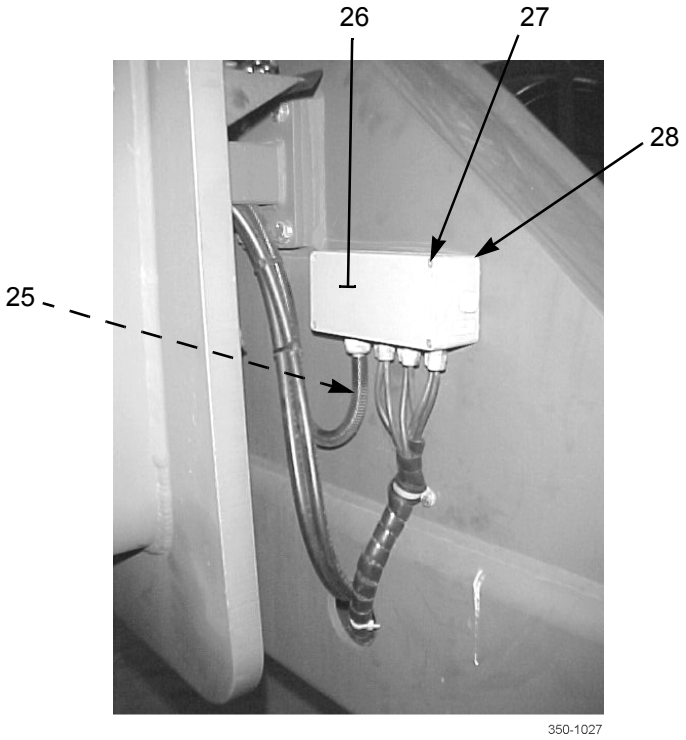
2. Position retainer nut (30), grommet (31), and sleeve (32) to wiring harness D (25) at junction box 183 (28). Install harness into junction box.

3. Using jeweler's screwdriver, connect wiring harness D (25) leads to terminal block (29).

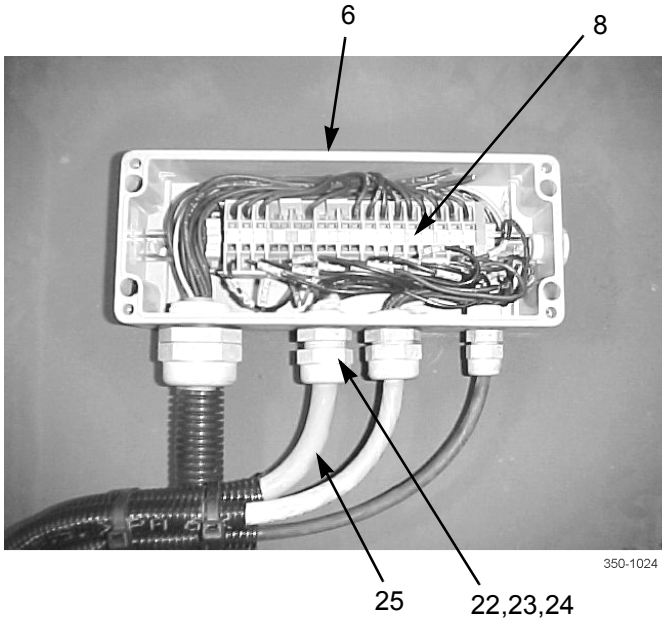
4. Install sleeve (32), grommet (31), and retainer nut (30).

5. Install cover (26) to junction box 183 (28) and tighten four screws (27).

WIRING HARNESS D, JUNCTION BOX 182 -TO-JUNCTION BOX 183: INSTALLATION - CONTINUED

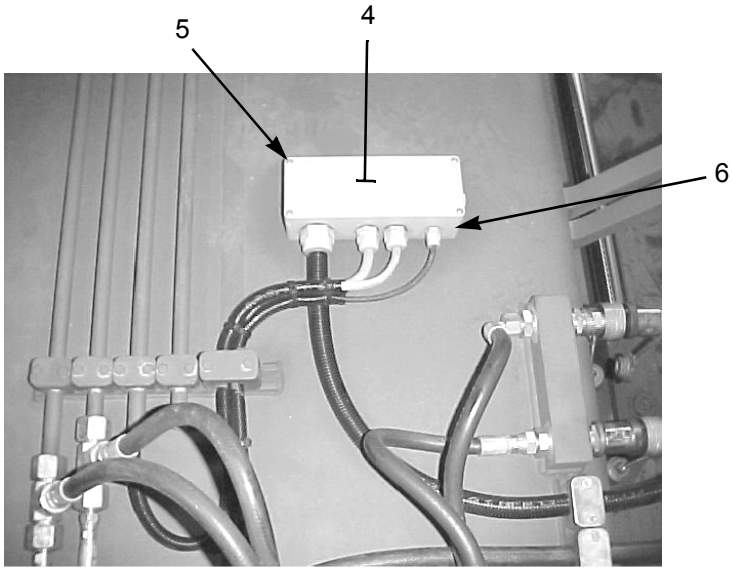


6. Position retainer nut (22), grommet (23), and sleeve (24) to other end of wiring harness D (25) at junction box 182 (6). Install harness into junction box.
7. Using jeweler's screwdriver, connect wiring harness D (25) leads to terminal block (8).
8. Install sleeve (24), grommet (23), and retainer nut (22).



WIRING HARNESS D, JUNCTION BOX 182-TO-JUNCTION BOX 183: INSTALLATION - CONTINUED

9. Install cover (4) to junction box 182 (6) and tighten four screws (5).



10. Secure wiring harness D along cable routing by tightening clamps and installing new tiedown straps as needed.
11. Perform operational check of tophandler (TM 10-3930-675-10).

WIRING HARNESS E, JUNCTION BOX 182-TO-JUNCTION BOX 184: REMOVAL

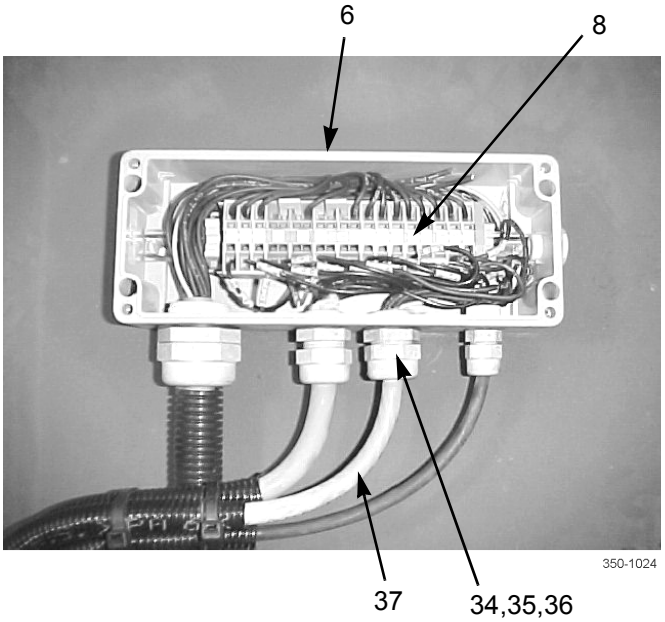
1. Loosen four screws (5) and remove cover (4) from junction box 182 (6). Inspect rubber seal in groove of cover. Replace only if damaged.
2. Remove retainer nut (34), grommet (35), and sleeve (36).

NOTE

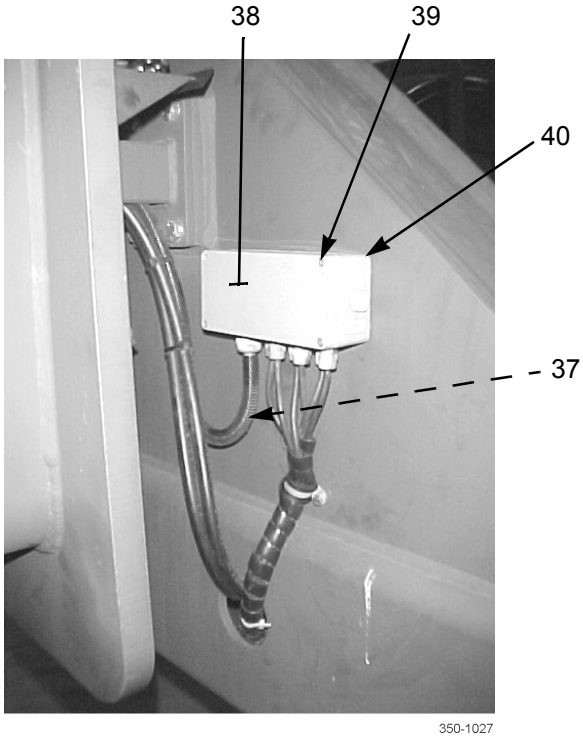
Use wiring diagrams in WP 0087 00, as needed, and note terminal block numbers to wire lead numbers for installation.

3. Using jeweler's screwdriver, disconnect wiring harness E (37) leads from terminal block (8) of junction box 182 (6). Remove harness from junction box.

WIRING HARNESS E, JUNCTION BOX 182-TO-JUNCTION BOX 184: REMOVAL - CONTINUED



4. Trace wiring harness E (37) from junction box 182 (6) thru conduit along top of tophandler to junction box 184 (40).
5. Loosen four screws (39) and remove cover (38) from junction box 184 (40). Inspect rubber seal in groove of cover. Replace only if damaged.



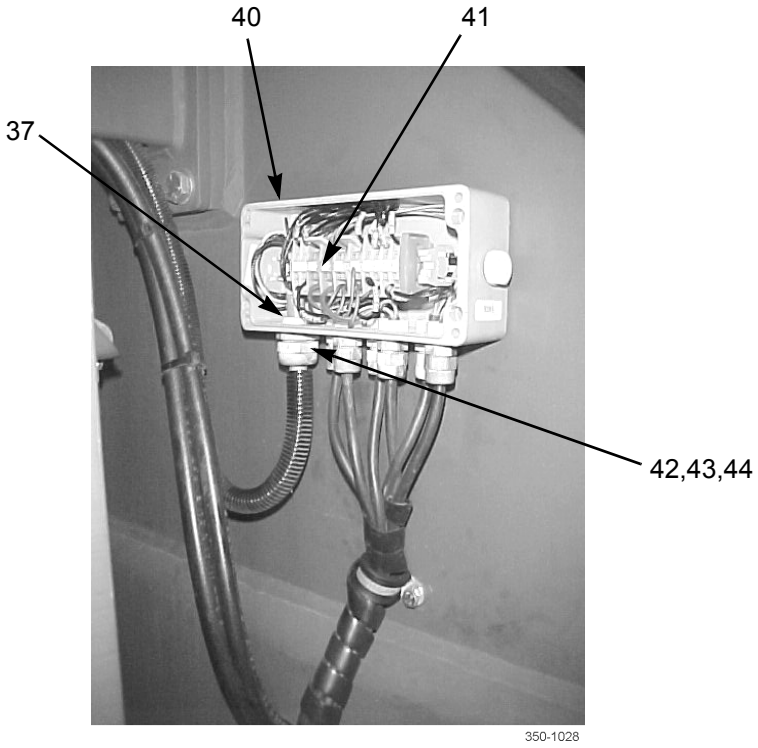
WIRING HARNESS E, JUNCTION BOX 182-TO-JUNCTION BOX 184: REMOVAL - CONTINUED

6. Remove retainer nut (42), grommet (43), and sleeve (44).

NOTE

Use wiring diagrams in WP 0087 00, as needed, and note terminal block numbers to wire lead numbers for installation.

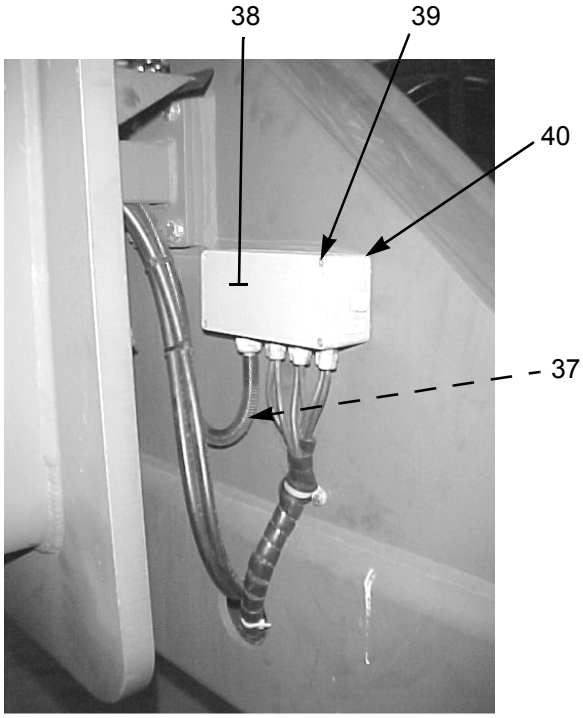
7. Using jeweler's screwdriver, disconnect wiring harness E (37) leads from terminal block (41) of junction box 184 (40). Remove harness from junction box.
8. Secure all loose leads of wiring harness E (37) to nonelectrical wire.
9. With assistance, pull wiring harness E (37) out from conduit until approximately 18 in (46 cm) of nonelectrical wire is exposed.
10. Remove wiring harness E (37) leads from nonelectrical wire and leave nonelectrical wire in place as a guide wire.



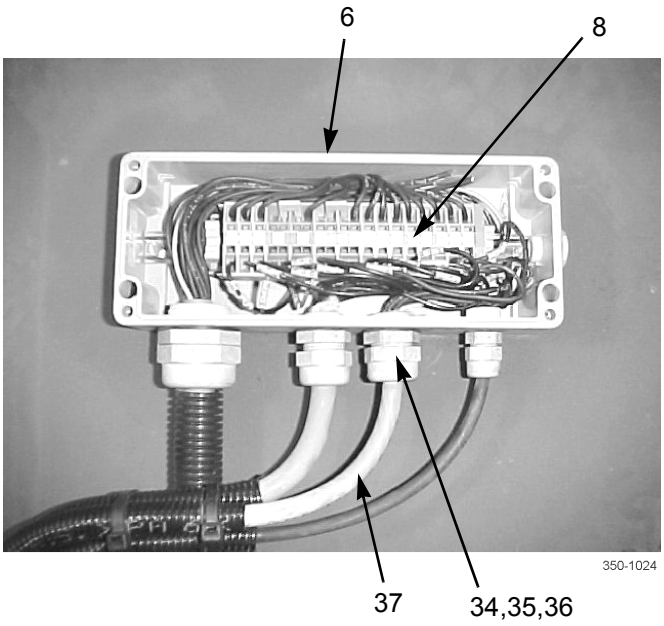
WIRING HARNESS E, JUNCTION BOX 182-TO-JUNCTION BOX 184: INSTALLATION

1. At junction box 182 (6), secure all loose leads of wiring harness E (37) to nonelectrical wire.
2. With assistance, pull wire harness E (37) thru conduit until sufficient length is exposed to reach junction box 184 (40).
3. Remove wiring harness E (37) from nonelectrical wire..
4. Position retainer nut (42), grommet (43), and sleeve (44) to wiring harness E (37) at junction box 184 (40). Install harness into junction box.
5. Using jeweler's screwdriver, connect wiring harness E (37) leads to terminal block (41).
6. Install sleeve (44), grommet (43), and retainer nut (42).
7. Install cover (38) to junction box 184 (40) and tighten four screws (39).

WIRING HARNESS E, JUNCTION BOX 182-TO-JUNCTION BOX 184: INSTALLATION - CONTINUED

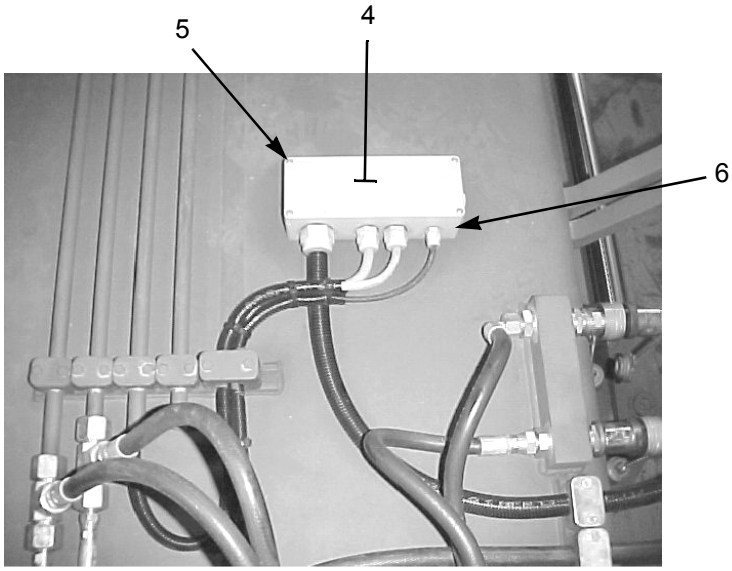


8. Position retainer nut (34), grommet (35), and sleeve (36) to other end of wiring harness E (37) at junction box 182 (6). Install harness into junction box.
9. Using jeweler's screwdriver, connect wiring harness E (37) leads to terminal block (8).
10. Install sleeve (36), grommet (35), and retainer nut (34).



WIRING HARNESS E, JUNCTION BOX 182-TO-JUNCTION BOX 184: INSTALLATION - CONTINUED

11. Install cover (4) to junction box 182 (6) and tighten four screws (5).



12. Perform operational check of tophandler (TM 10-3930-675-10).

END OF WORK PACKAGE

TOPHANDLER JUNCTION BOX REPLACEMENT 0031 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Screwdriver set, jeweler's (Item 79, WP 0090 00)

Materials/Parts

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Nut, lock (P/N 920076.003) (4)

References

TM 10-3930-675-10

TM 10-3930-675-20

WP 0074 00

Equipment Condition

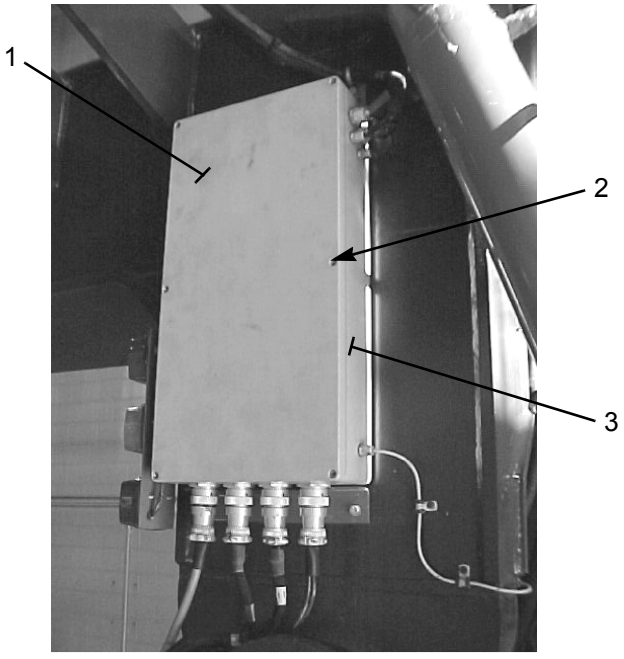
Master battery switch in OFF position

REMOVAL

NOTE

Tag wires to ensure proper connection on installation.

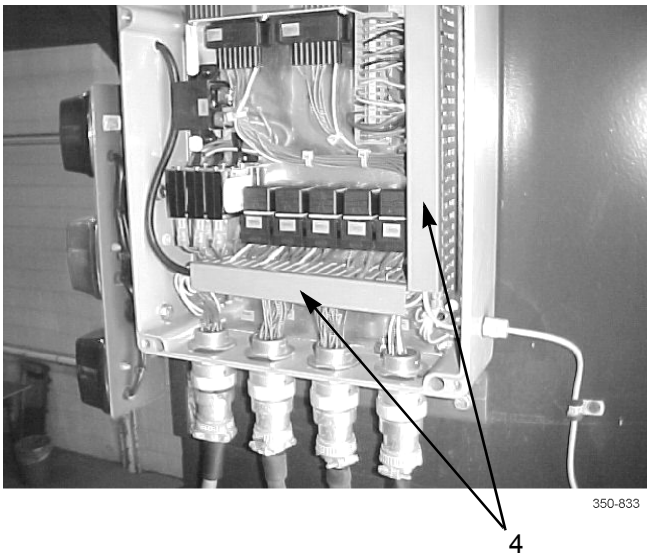
1. Loosen six screws (2) and remove cover (1) from tophandler junction box (3). Inspect rubber seal in groove of cover. Replace only if damaged.



350-832

REMOVAL - CONTINUED

2. Remove two plastic covers (4).



NOTE

Remove and discard tiedown straps as necessary.

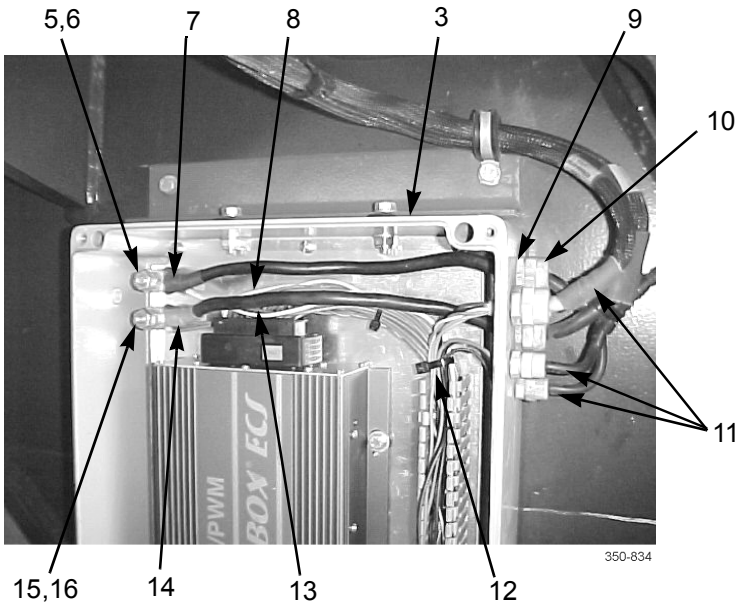
3. At top of junction box (3), remove locknut (5) and washer (6) and disconnect terminal of large black wire (7), marked “black”, and terminal of small white wires (8) from terminal stud.
4. Remove locknut (15) and washer (16) and disconnect terminal of large black wire (14), marked “red”, and terminal of small black wires (13) from terminal stud.

NOTE

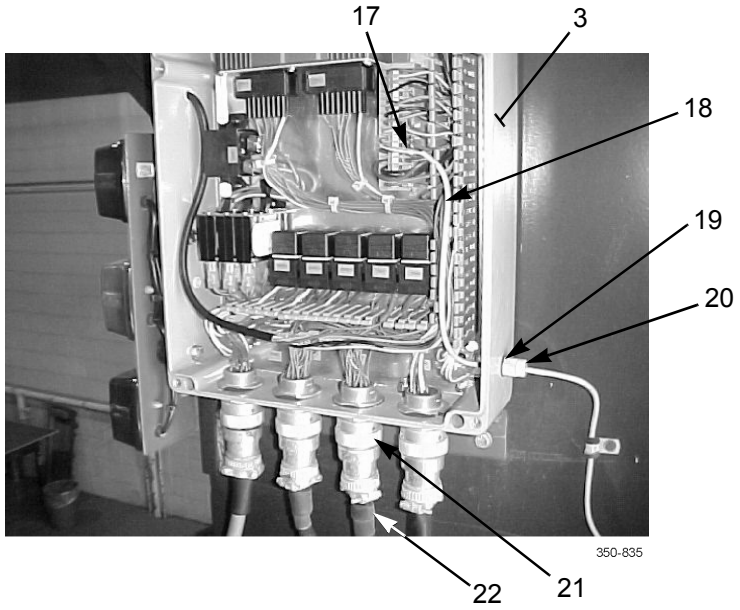
Note location of fittings for installation.

5. Loosen cap (10) of each of five fittings (9) and remove fittings from junction box (3).
6. Pull large black wires (7 and 14) out from junction box (3).
7. Trace route of each wire (12) in three cables (11) to connecting point and disconnect wire. Note connecting point.
8. Pull each wire (12) out from junction box (3).

REMOVAL - CONTINUED

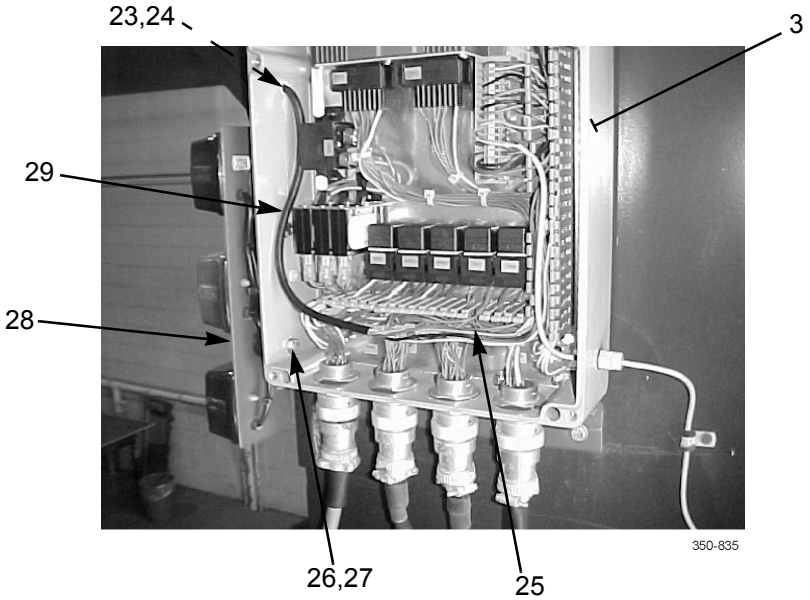


9. At bottom of junction box (3), disconnect connectors (21) of four cables (22).
10. Loosen cap (20) of fitting (19) and remove fitting from junction box (3).
11. Trace route of three wires (17) of cable (18) to connecting point and disconnect wires. Note connecting point.
12. Pull cable (18) out from junction box (3).

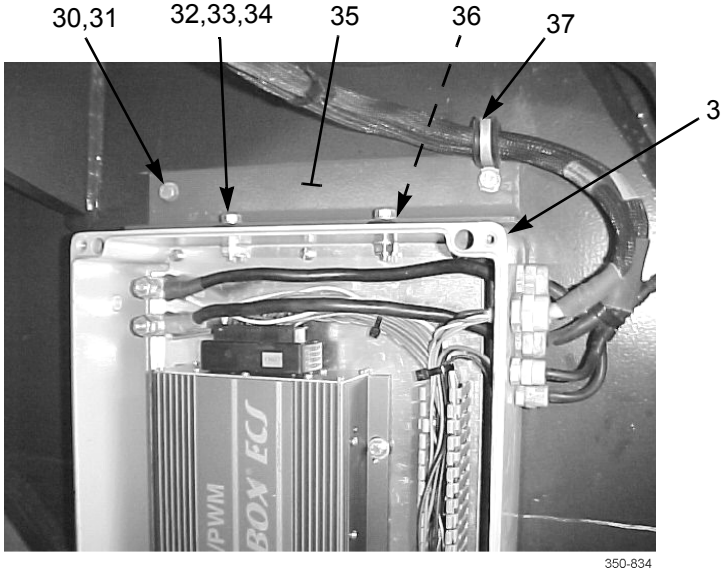


REMOVAL - CONTINUED

13. Loosen cap (23) of fitting (24) and remove fitting from junction box (3).
14. Trace route of eight wires (25) of cable (29) to connecting point and disconnect wires. Note connecting point.
15. Pull cable (29) out from junction box (3).
16. Disconnect twistlock indicator IR lights wiring harness leads from junction box (3) and remove harness from box (TM 10-3930-675-20).
17. Remove two screws (26), washers (27) and twistlock indicator light assembly (28) from side of junction box (3). Also remove twistlock indicator IR lights (TM 10-3930-675-20).

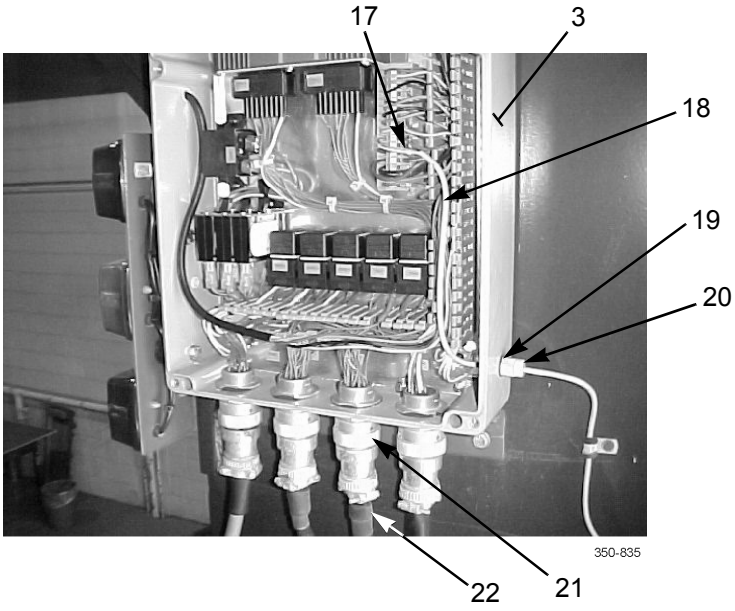


18. Remove four screws (30), washers (31), loop clamp (37), and junction box (3), with two brackets (35) from tophandler.
19. Remove four locknuts (32), screws (33), eight washers (34), two brackets (35), and four rubber grommets (36) from junction box (3). Discard locknuts.



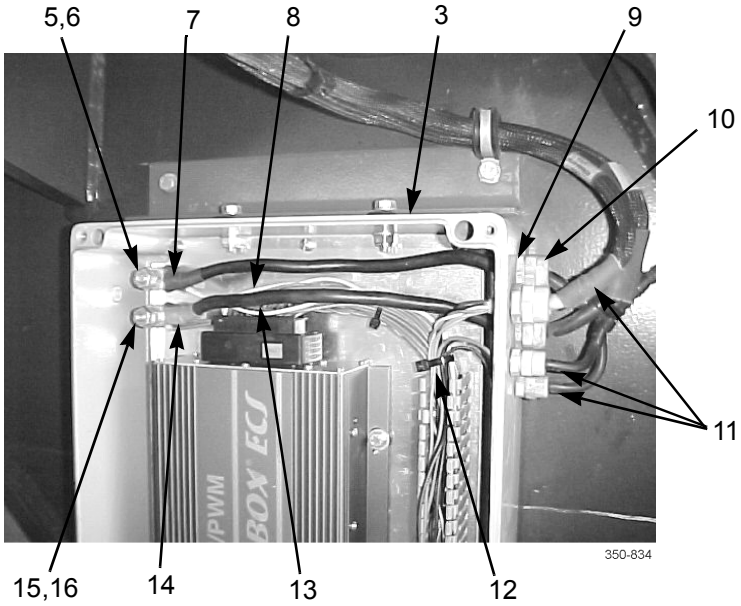
INSTALLATION

1. Install four rubber grommets (36) and two brackets (35) to junction box (3) with eight washers (34), four screws (33), and four new locknuts (32).
2. Install two brackets (35), with junction box (3), and loop clamp (37) to tophandler with four washers (31) and screws (30).
3. Install twistlock indicator light assembly (28) to side of junction box (3) with two washers (27) and screws (26). Also install twistlock indicator IR lights (TM 10-3930-675-20).
4. Install twistlock indicator IR lights wiring harness to junction box (3) and connect harness leads.
5. Push cable (29) of twistlock indicator light assembly (28) into junction box (3).
6. Connect eight wires (25) of cable (29) to connecting points, as noted during removal.
7. Install fitting (24) to junction box (3) and tighten cap (23).
8. Push cable (18) into junction box (3).
9. Connect three wires (17) of cable (18) to connecting points, as noted during removal.
10. Install fitting (19) to junction box (3) and tighten cap (20).
11. At bottom of junction box (3), connect connectors (21) of four cables (22).



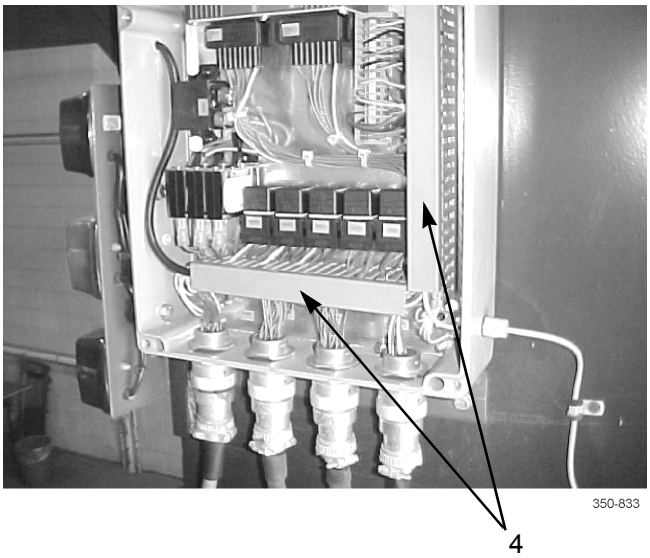
INSTALLATION - CONTINUED

12. Push wires (12) of three cables (11) into junction box (3).
13. Connect wires (12) of three cables (11) to connecting points, as noted during removal.
14. Push wires (7 and 14) into junction box (3).
15. Install five fittings (9) to junction box (3) and tighten five caps (10).
16. Connect terminal of small black wires (13) and terminal of large black wire (14), marked “red”, to terminal stud and install washer (16) and new locknut (15).
17. Connect terminal of small white wires (8) and terminal of large black wire (7), marked “black”, to terminal stud and install washer (6) and new locknut (5).

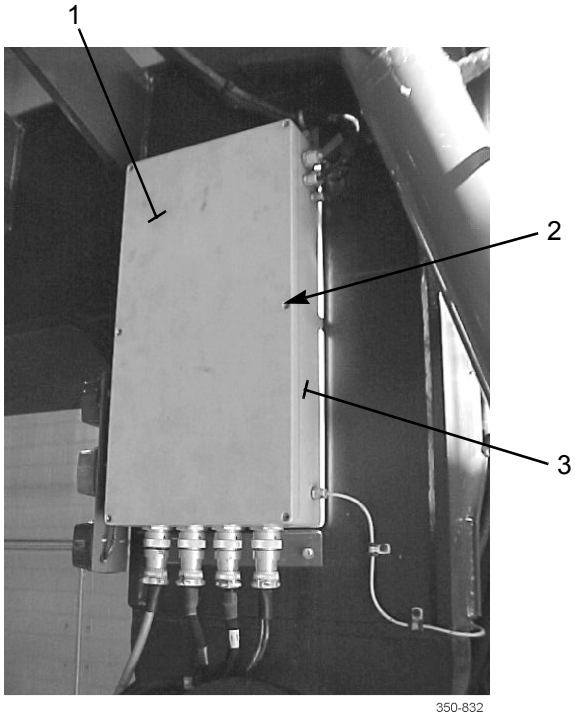


INSTALLATION - CONTINUED

18. Install two plastic covers (4).



19. Install cover (1) to tophandler junction box (3) and tighten six screws (2).



INSTALLATION - CONTINUED

NOTE

Calibration must be performed only if ECU inside tophandler junction box is new.

20. Perform boom and tophandler calibration (WP 0074 00).
21. Operate tophandler to check operation (TM 10-3930-675-10).

END OF WORK PACKAGE

TRANSMISSION TORQUE CONVERTER REPLACEMENT 0032 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Personnel Required

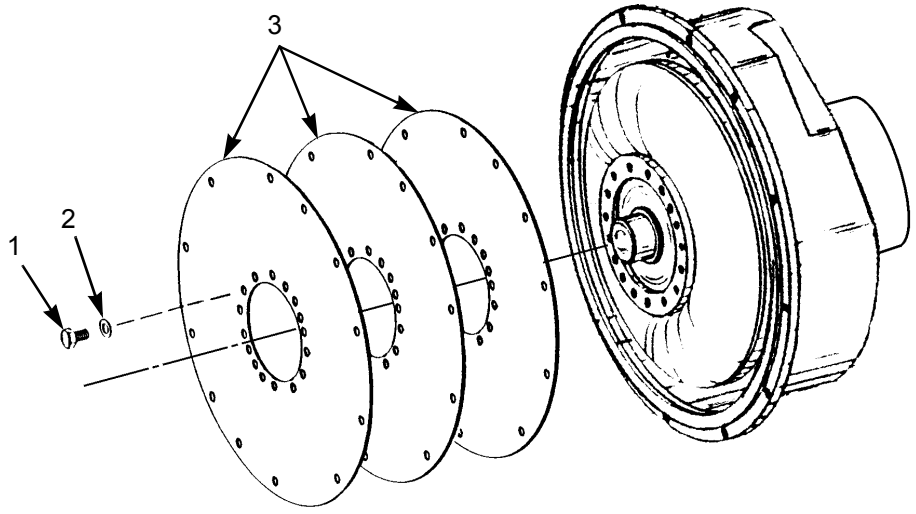
Two

Equipment Condition

Transmission assembly removed (WP 0033 00)

REMOVAL

1. Remove 16 screws (1), washers (2), and three damper plates (3).



350-771

REMOVAL - CONTINUED

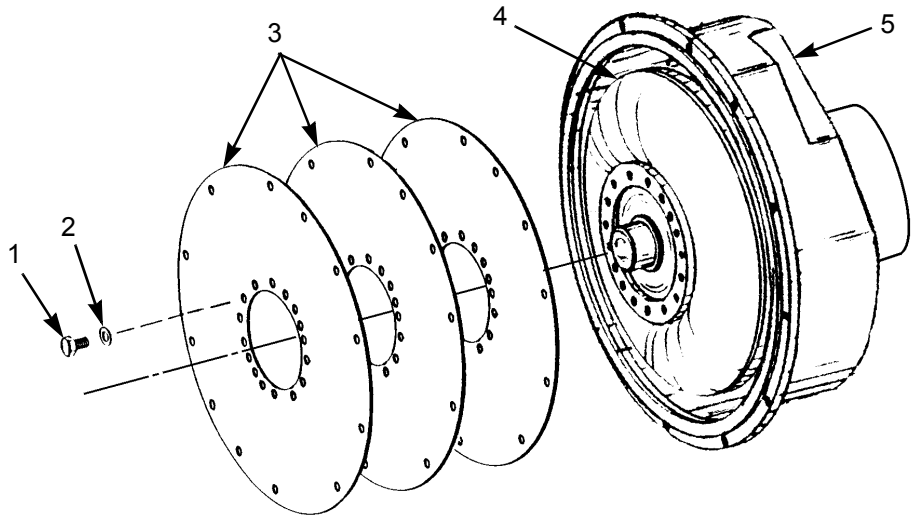
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

NOTE

Torque converter contains oil and is subject to spillage if positioned shaft side down when removed. Ensure spills are cleaned up immediately.

2. Slide torque converter (4) from transmission bell housing (5).
3. Place torque converter (5) with transmission side up on suitable cribbing.



350-771

INSTALLATION

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

INSTALLATION - CONTINUED

1. Position torque converter (4) on input shaft and slide into transmission bell housing (5).

NOTE

Ensure damper plates are not bent or damaged.

2. Install three damper plates (3), 16 washers (2), and screws (1).
3. Rotate damper plates (3) and torque converter (4) by hand to ensure no binding occurs.
4. Install transmission assembly (WP 0033 00).

END OF WORK PACKAGE

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TRANSMISSION ASSEMBLY REPLACEMENT 0033 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Handle, socket wrench (Item 41, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, engine and transmission (Item 83, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Socket, socket wrench, 46 mm (Item 86, WP 0090 00)

Stud, guide (WP 0085 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag wiping (Item 23, WP 0089 00)

Sealant, pipe (Item 26, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Materials/Parts - Continued

Gasket (P/N 182459)

Gasket (P/N 3026134)

Gasket (P/N 4642 331 216)

Washer, lock (P/N 98174) (12)

Personnel Required

Three

References

LO 10-3930-675-12

WP 0032 00

WP 0034 00

WP 0047 00

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Boom raised to maximum angle (TM 10-3930-675-10)

Engine cover removed (TM 10-3930-675-20)

Transmission skid plate and access covers removed (TM 10-3930-675-20)

Transmission oil drained (TM 10-3930-675-20)

Front and rear propeller shafts disconnected (TM 10-3930-675-20)

Boom and brake system hydraulic pump removed (WP 0054 00)

Tophandler and steering hydraulic pump assembly removed (WP 0045 00)

REMOVAL

CAUTION

- If engine and/or transmission is not operational and boom must be elevated, auxiliary pump can be used to provide hydraulic power for boom operation. Operate pump for not more than four minutes and allow pump to cool for not less than two minutes. Perform operate and cool cycle as many times as needed to elevate boom. Failure to allow pump to cool may cause damage to pump.
- Do not begin transmission assembly replacement without first having all required tools and equipment to complete the procedure. This will help in reducing the time boom must remain at maximum elevation.

WARNING

- Use extreme caution when handling heavy parts. Transmission weighs approximately 1654 lb (750 kg). Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Improper use of lifting equipment and improper attachment of cable or chains to vehicle can result in serious personnel injury and equipment damage. Observe all standard rules of safety.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

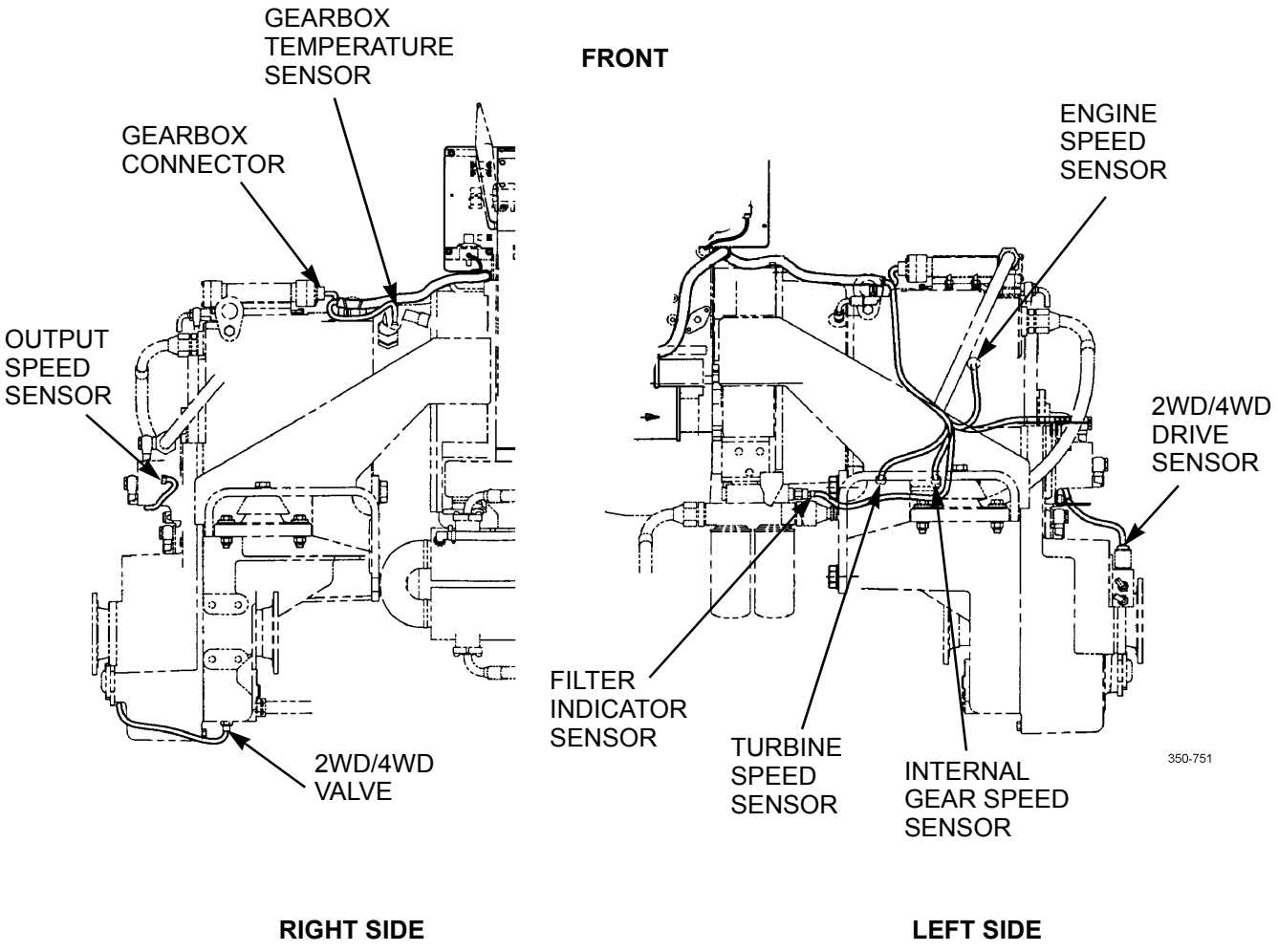
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Ensure all hydraulic hoses, lines, fittings, and electrical wiring harnesses and leads are tagged for identification and location prior to disconnection.
- When disconnecting hydraulic lines or hoses, position suitable container to catch hydraulic oil retained in lines and hoses.

1. Disconnect electrical wiring connectors from following connections shown on locator diagrams:
   a. Gearbox temperature sensor and gearbox connectors
   b. 2wd/4wd valve and output speed sensor connectors
   c. 2wd/4wd sensor connector
   d. Filter indicator, turbine speed sensor, and internal gear speed sensor connectors
   e. Engine speed sensor connector

REMOVAL - CONTINUED

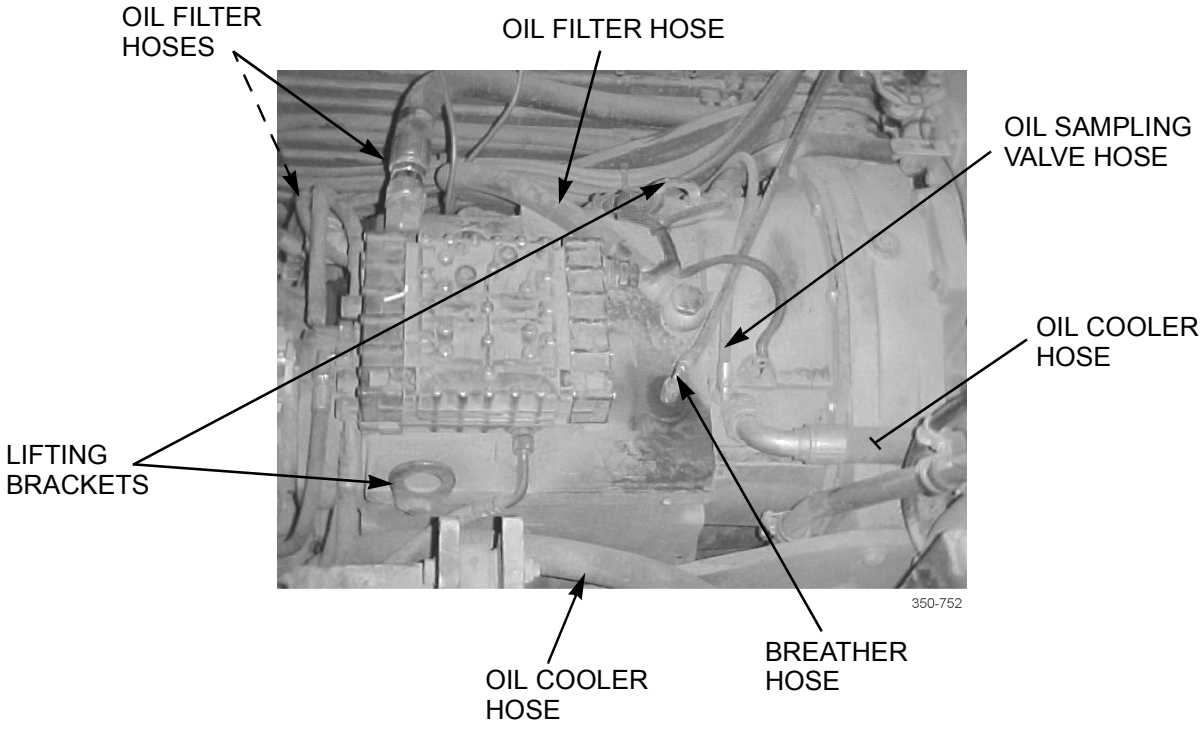


NOTE

Ensure all wiring harnesses and connectors are secured away from transmission with temporary tiedowns.

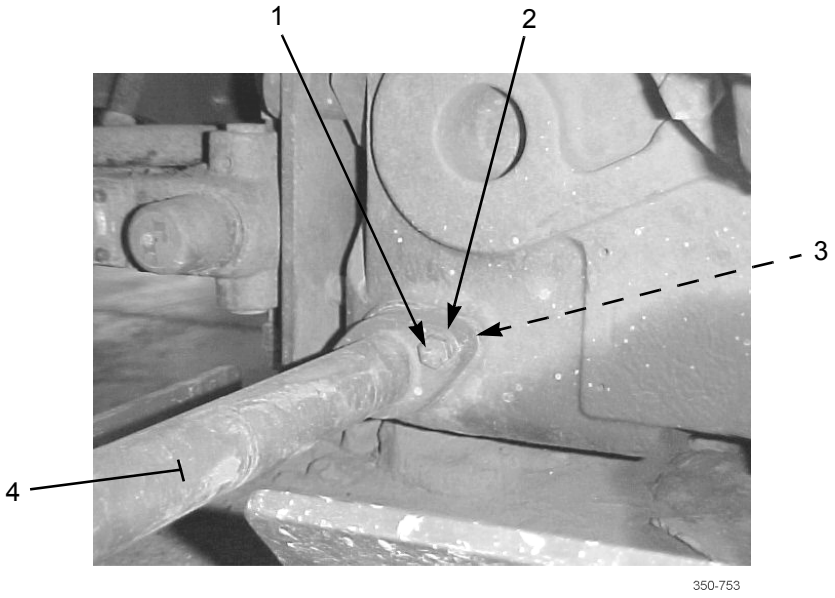
REMOVAL - CONTINUED

2. Remove and discard all tiedown straps as necessary to remove wiring harnesses from transmission.
3. Disconnect the following:
   a. Two transmission oil cooler hoses
   b. Oil sampling valve hose
   c. Breather hose
   d. Three oil filter hoses
4. Install lifting sling between two lifting brackets of transmission assembly. Connect to suitable lifting device. Raise lighting device and take up slack in sling.



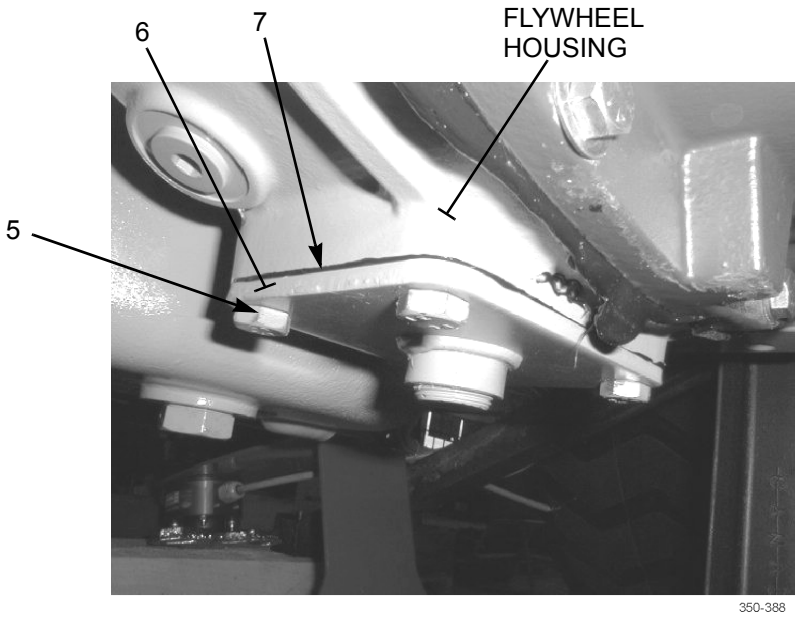
REMOVAL - CONTINUED

5. Remove two screws (1), flange (2), gasket (3), and oil fill tube (4) from transmission assembly. Discard gasket.
6. Remove all screws, washers, nuts, and clamps securing oil fill tube (4) to vehicle. Remove oil fill tube and retain for later installation.

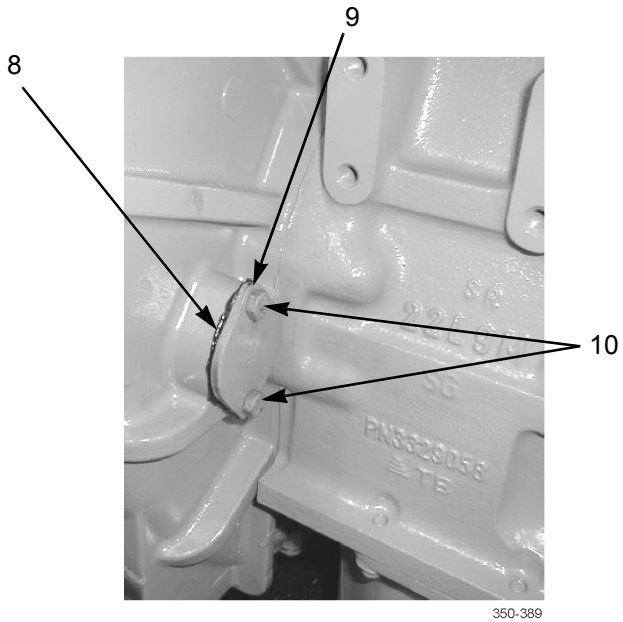


REMOVAL - CONTINUED

7. Disconnect two hydraulic hoses from emergency steering pump (WP 0047 00). DO NOT remove pump at this time.
8. Remove 4 screws (5), access cover (6), and gasket (7) from bottom of flywheel housing. Discard gasket.



9. Remove 2 screws (10), cover (9), and gasket (8) from flywheel-to-damper plate mounting screw access.

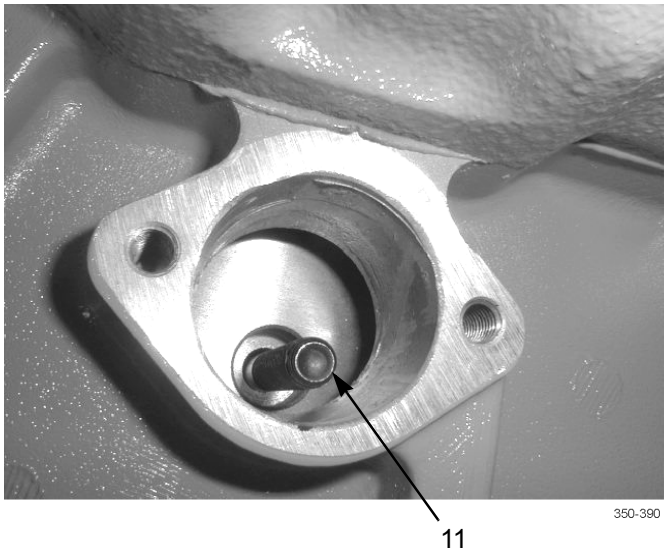


NOTE

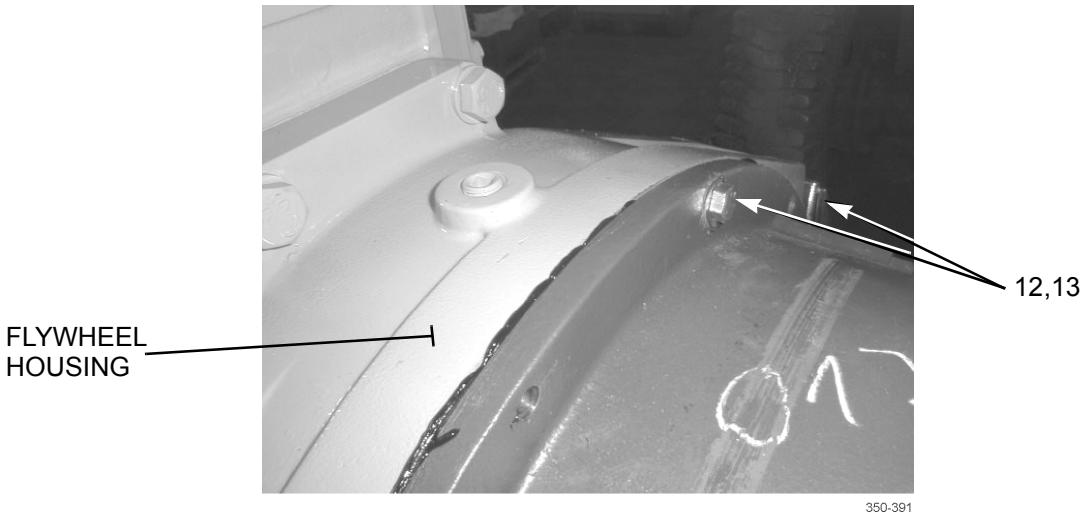
Transmission damper plates and torque converter are secured to flywheel with 12 screws.

REMOVAL - CONTINUED

10. With assistance, bar engine in clockwise direction using accessory drive while observing thru access hole. Stop rotation when screw is visible thru access hole.
11. Remove screw (11) securing damper plates to flywheel.
12. Repeat steps 10 and 11 to remove remaining eleven screws (11).

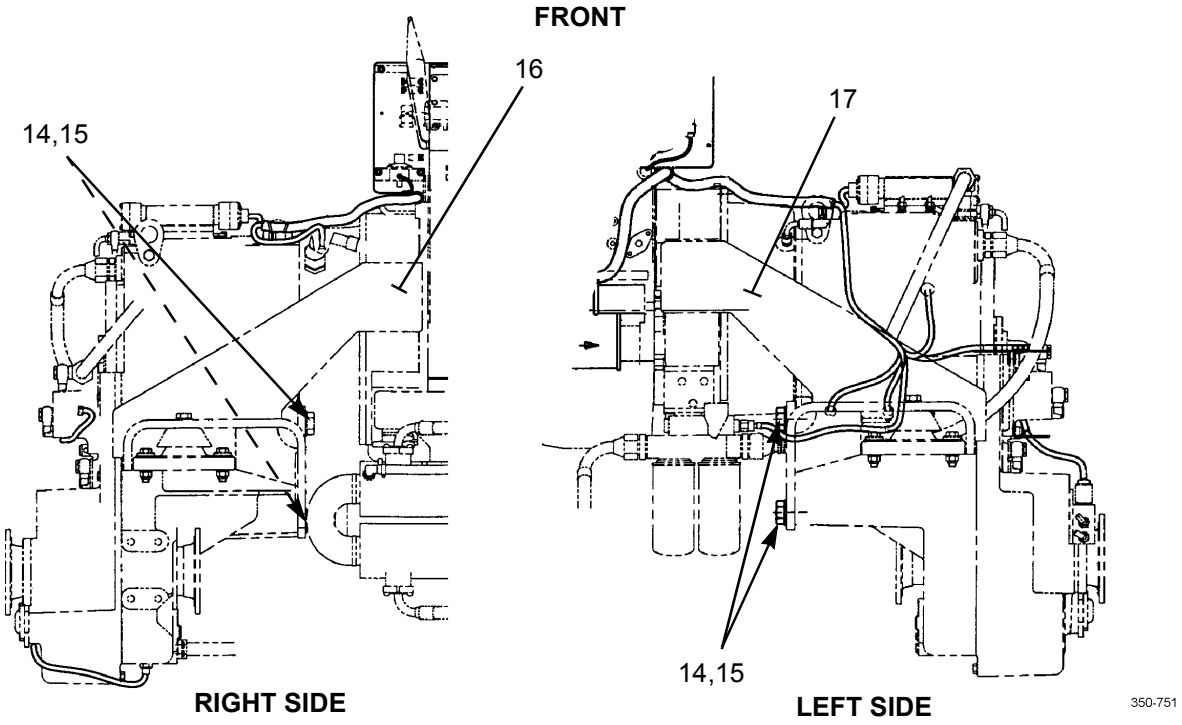


13. Upon removal of last screw, insert guide stud and secure to damper plate.
14. Remove 12 screws (12) and lockwashers (13) securing transmission to engine flywheel housing. Discard lockwashers.



REMOVAL - CONTINUED

15. Remove four screws (14) and washers (15) securing transmission to mounting brackets (16 and 17).



NOTE

Ensure transmission is slid toward rear, away from engine, to allow damper plate guide stud to clear flywheel housing.

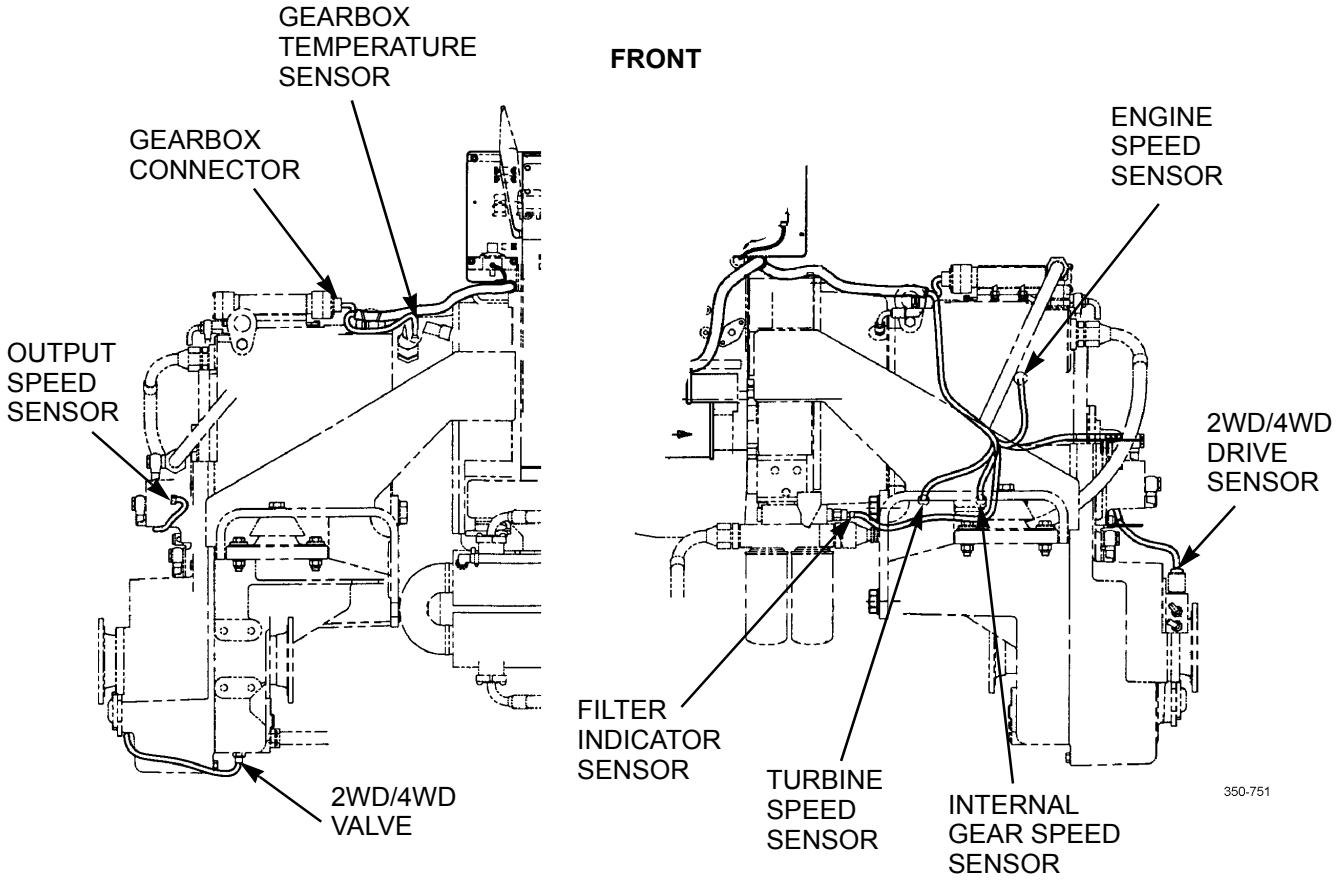
16. Separate transmission from engine and use nylon sling to ensure damper plates and torque converter remain with transmission.
17. Lift transmission from vehicle and place on temporary cribbing.

NOTE

Perform steps 18 thru 21 only if a replacement transmission is to be installed.

18. Remove and retain damper plates and torque converter (WP 0032 00).
19. Remove and retain the following sensors (TM 10-3930-675-20):
    a. Gearbox temperature sensor
    b. Output speed sensor
    c. Engine speed sensor
    d. 2wd/4wd sensor
    e. Turbine speed sensor
    f. Internal gear speed sensor

REMOVAL - CONTINUED



REMOVAL - CONTINUED

20. Remove fittings for oil filter, oil sampling valve, oil cooler, and breather hoses.
21. Remove emergency steering pump (WP 0047 00).

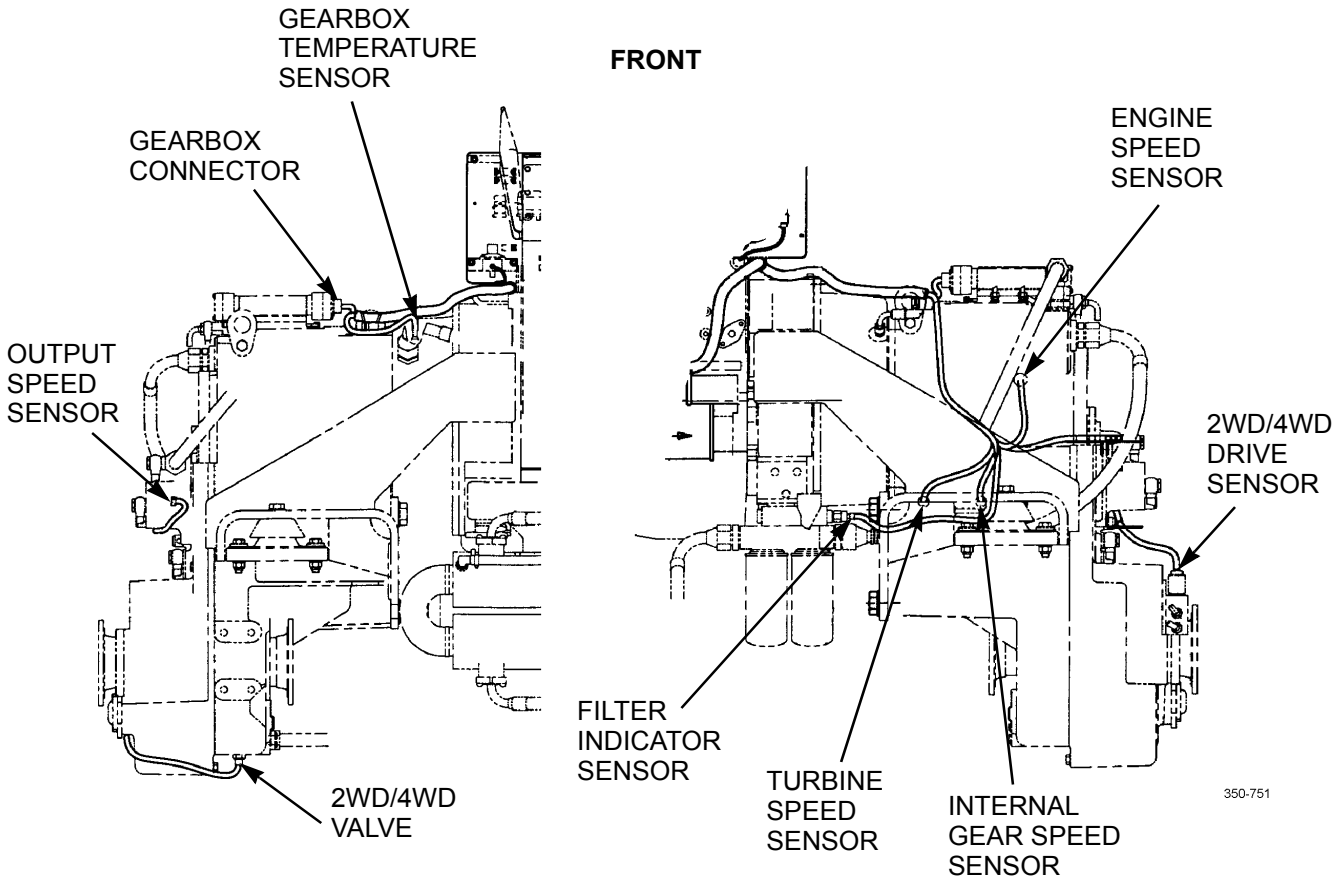
INSTALLATION

NOTE

If a replacement transmission is not being installed proceed to step 5.

1. Install emergency steering pump (WP 0047 00).
2. Apply sealant to threads and install fittings for oil filter, oil sampling valve, oil cooler, and breather hoses.
3. Apply sealant to threads and install the following sensors (TM 10-3930-675-20):
    a. Gearbox temperature sensor
    b. Output speed sensor
    c. Engine speed sensor
    d. 2wd/4wd sensor
    e. Turbine speed sensor
    f. Internal gear speed sensor

INSTALLATION - CONTINUED



4. Install torque converter and damper plates (WP 0032 00).

WARNING

- Use extreme caution when handling heavy parts. Transmission weighs approximately 1654 lb (750 kg). Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Improper use of lifting equipment and improper attachment of cable or chains to vehicle can result in serious personnel injury and equipment damage. Observe all standard rules of safety.

INSTALLATION - CONTINUED

NOTE

Ensure transmission and engine mating surfaces are clean and free of old sealant.

5. Install lifting sling between two lifting brackets of transmission assembly and connect to suitable lifting device.
6. Install nylon sling to hold damper plates and torque converter in place.

NOTE

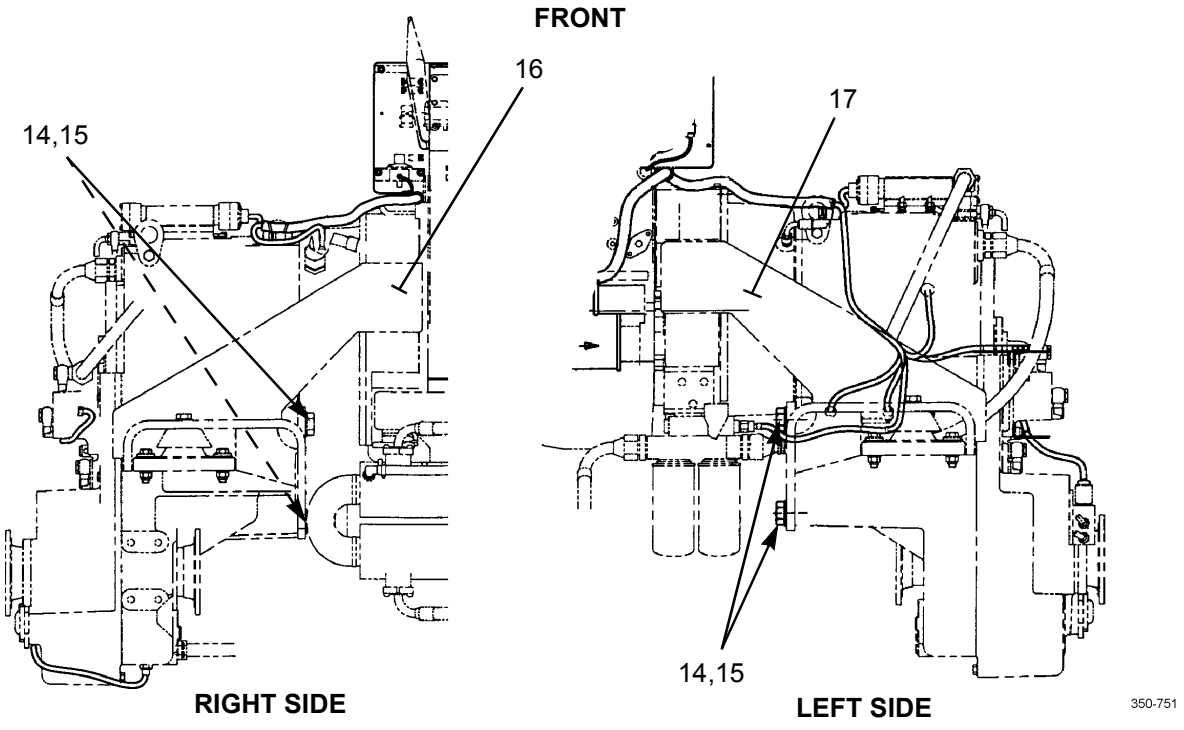
- Position damper plate guide stud to mate with flywheel housing screw hole.
- Ensure guide stud will clear flywheel housing while transmission is lowered.

7. Using suitable lifting device, lift transmission assembly and lower into vehicle.
8. Remove nylon sling holding damper plates and torque converter in place.
9. Apply a coat of silicone sealant to engine and transmission mating surface.

NOTE

It may be necessary to adjust transmission damper plate by hand to aline guide stud with mating flywheel screw hole.

10. Position transmission to allow damper plate guide stud to pass thru flywheel-to-damper screw hole and flywheel housing access.
11. Install four washers (15) and screws (14) securing transmission to mounting brackets (16 and 17). DO NOT fully tighten screws at this time.

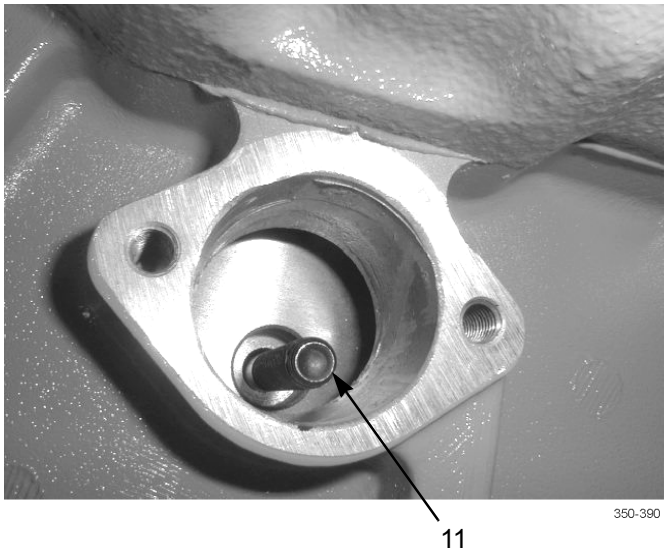


INSTALLATION - CONTINUED

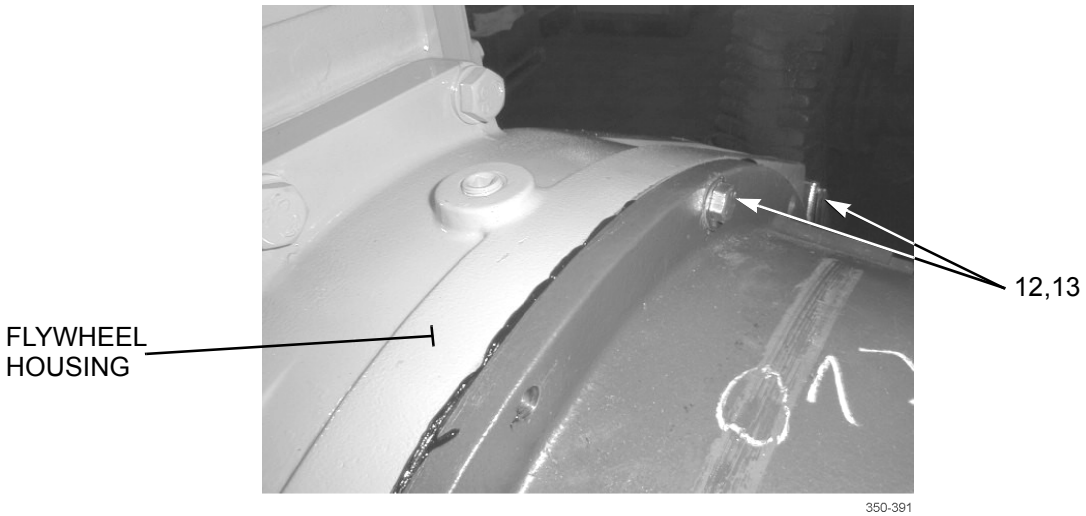
NOTE

Flywheel and damper plates are secured with 12 screws. Final tightening is done after all screws are installed.

12. Remove guide stud and install screw (11). Tighten screw hand tight.
13. Bar engine over until next screw hole is visible and install screw (11). Tighten screw hand tight.
14. Repeat step 14 for remaining screws until 12 screws are installed securing flywheel to damper plate.
15. Bar engine over clockwise and final tighten each screw (11) to 48 lb-ft (65 Nm).

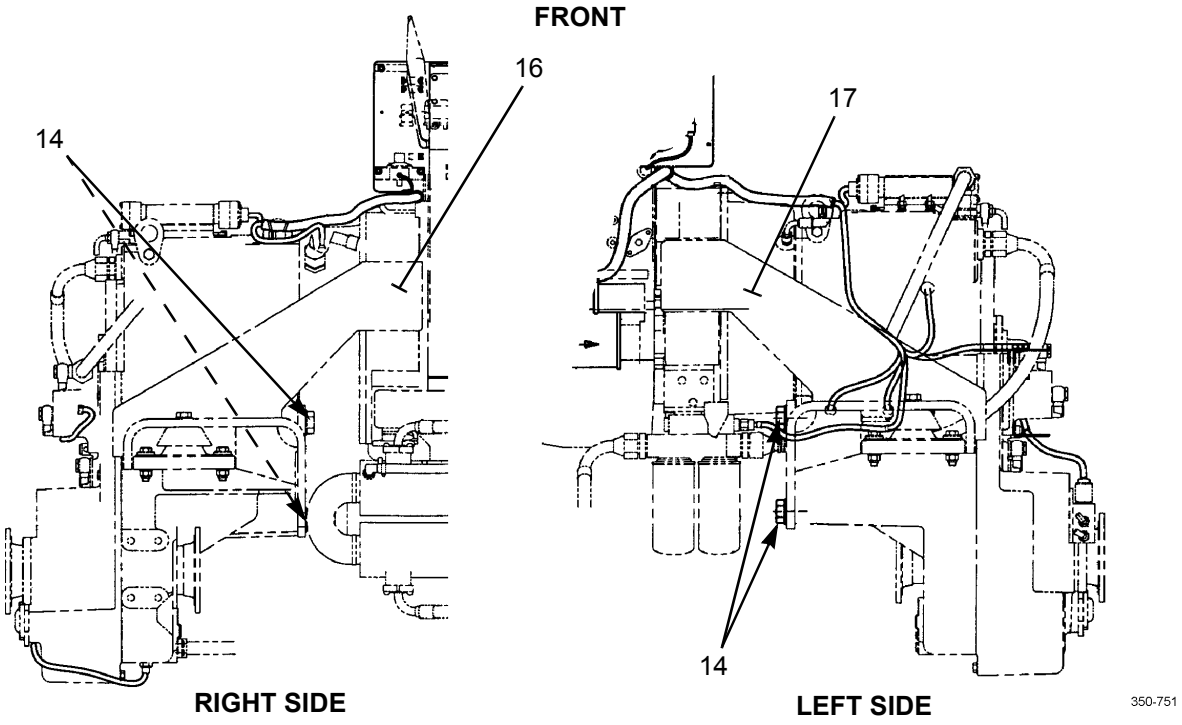


16. Install 12 new lockwashers (13) and screws (12) to secure transmission to flywheel housing. Tighten screws to 38 lb-ft (52 Nm).



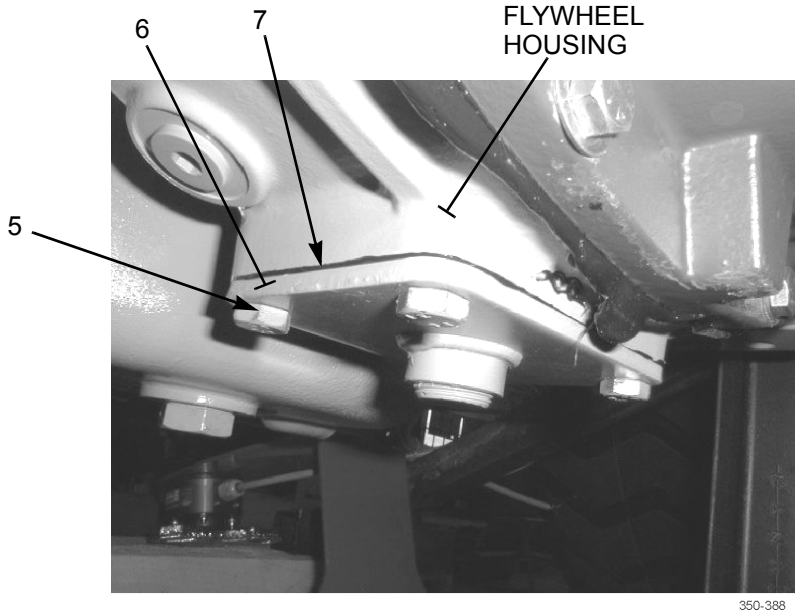
INSTALLATION - CONTINUED

17. Tighten four screws (14) securing transmission to mounting brackets (16 and 17) to 146 lb-ft (198 Nm).



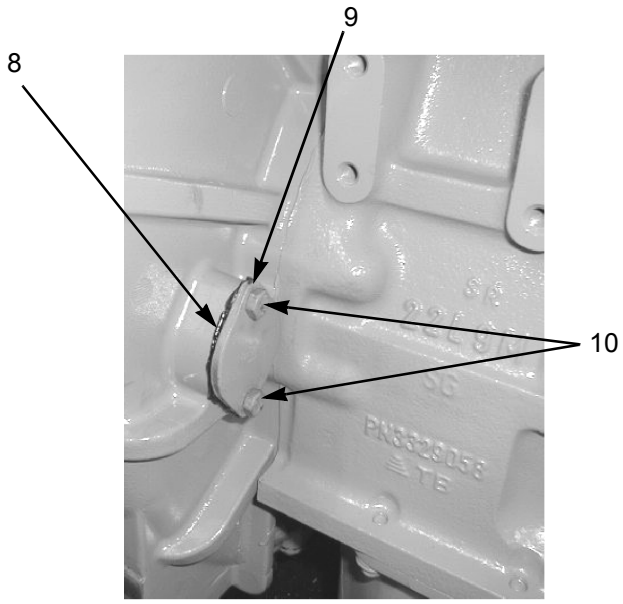
18. Remove lifting sling and lifting device.

19. Install new gasket (7) and access cover (6) on bottom of flywheel housing with four screws (5).

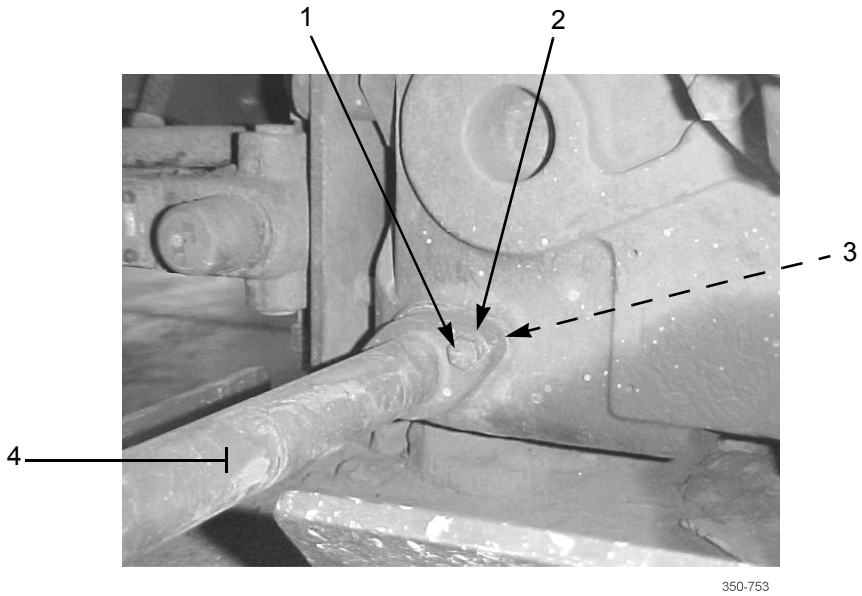


INSTALLATION - CONTINUED

20. Install new gasket (8) and cover (9) over flywheel-to-damper plate screw access with two screws (10).

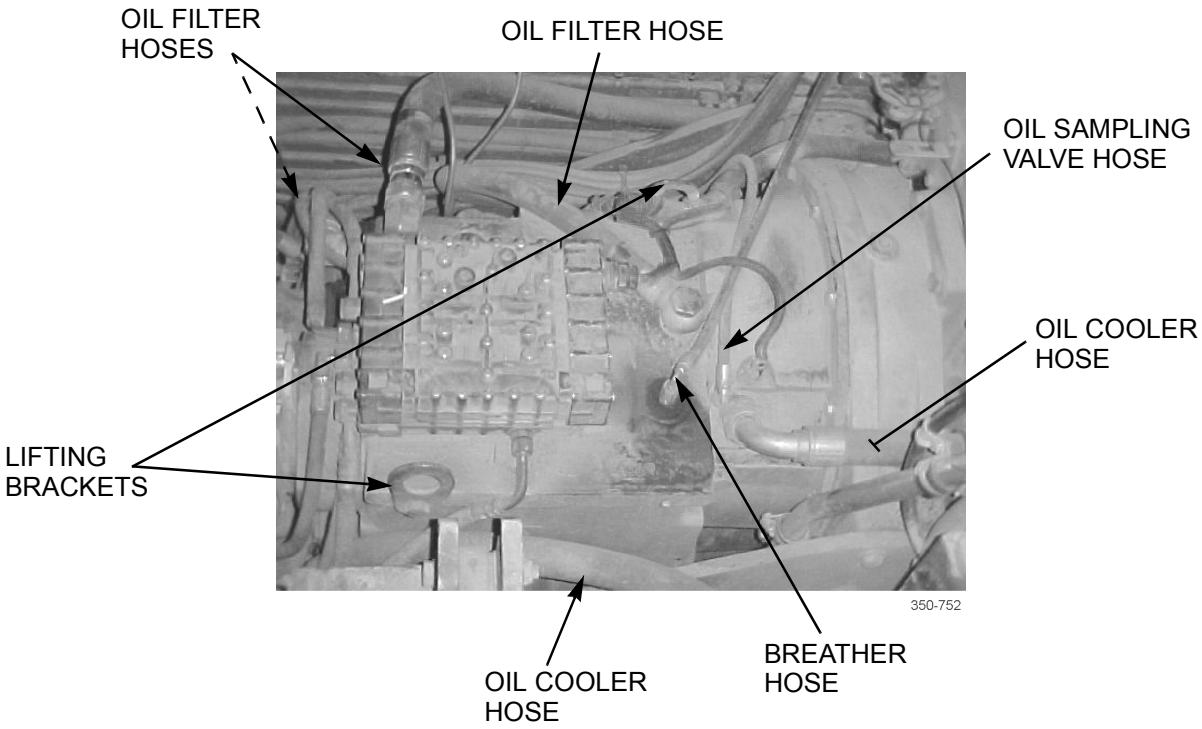


21. Install new gasket (3), flange (2), and oil fill tube (4) with two screws (1).



INSTALLATION - CONTINUED

22. Secure oil fill tube to vehicle with screws, nuts, washers, and clamps as needed.
23. Connect two hydraulic hoses to emergency steering pump (WP 0047 00).
24. Connect the following hoses:
    a. Two transmission oil cooler hoses
    b. Oil sampling valve hose
    c. Breather hose
    d. Three oil filter hoses

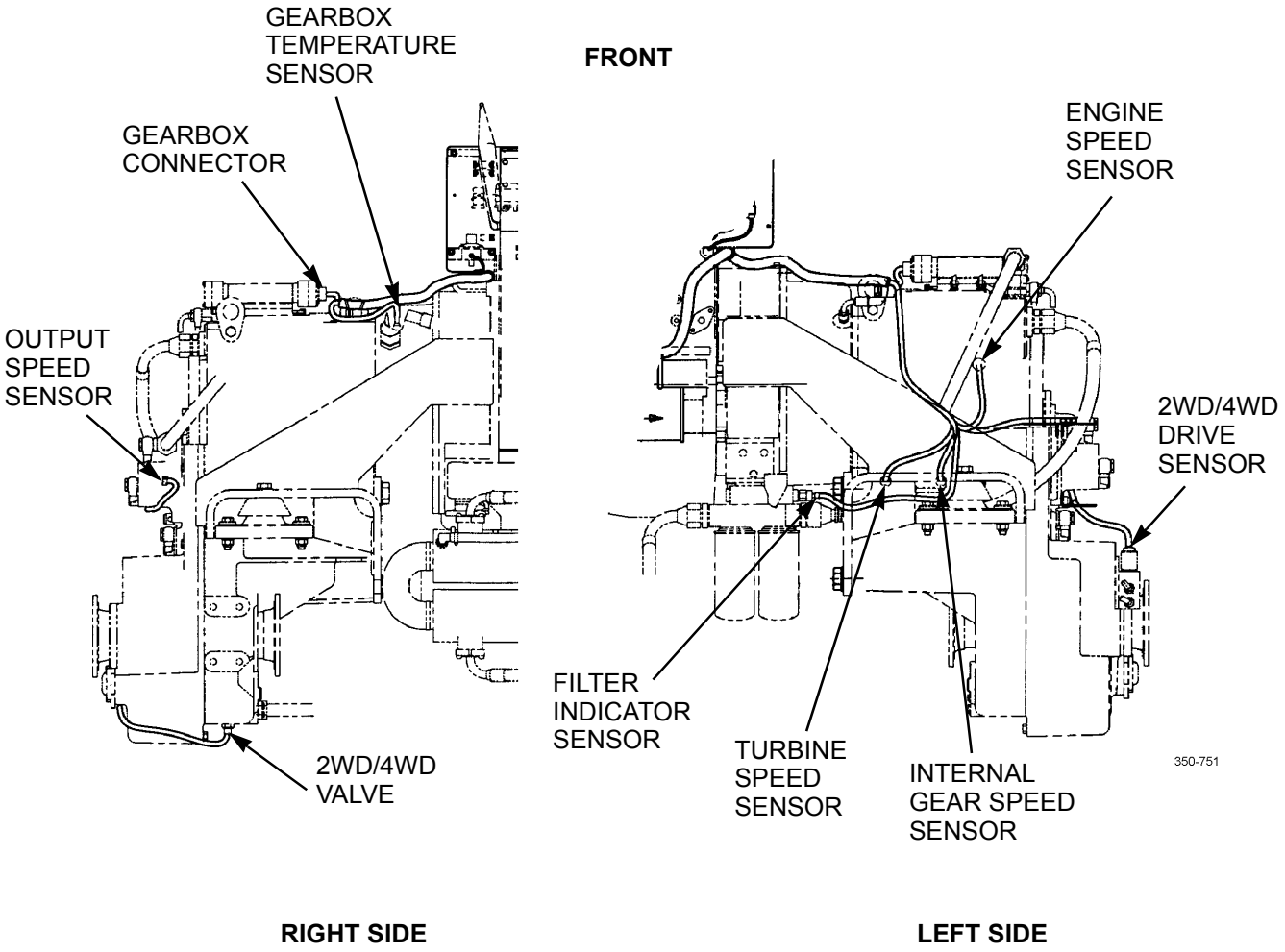


INSTALLATION - CONTINUED

NOTE

- Remove temporary tiedowns from electrical harnesses and install wiring harnesses using locator diagrams as a routing guide.
- Ensure wiring harnesses are secured after connection to terminal points using new tiedown straps as required.

25. Connect wiring harnesses to the following:
    a. Gearbox temperature sensor and gearbox connectors
    b. 2wd/4wd sensor connector
    c. 2wd/4wd valve and output speed sensor connectors
    d. Engine speed sensor connector
    e. Filter indicator, turbine speed sensor, and internal gear speed sensor connectors



INSTALLATION - CONTINUED

26. Fill transmission and check fluid level (LO 10-3930-675-12).
27. Install tophandler and steering hydraulic pump assembly (WP 0045 00).
28. Install boom and brake system hydraulic pump (WP 0054 00).
29. Connect front and rear propeller shafts (TM 10-3930-675-20).

NOTE

DO NOT install transmission skid plate at this time.

30. Install transmission access covers (TM 10-3930-675-20)
31. Perform operational check of all systems (TM 10-3930-675-10).
32. Perform transmission calibration (WP 0034 00).
33. Shut down vehicle (TM 10-3930-675-10) and check for leaks.
34. Install skid plate under transmission (TM 10-3930-675-20).

END OF WORK PACKAGE

TRANSMISSION CALIBRATION 0034 00

THIS WORK PACKAGE COVERS

Calibration

INITIAL SETUP

References

TM 10-3930-675-10

CALIBRATION

NOTE

Calibration procedures and checks must be performed if any of the following maintenance actions have occurred:

- Transmission ECM replaced or disconnected
- Transmission oil replaced
- Repairs or adjustment to transmission
- Transmission assembly replaced

1. **Access to Calibration Menus.**
   a. Turn master battery switch to ON position.
   b. Turn ignition ON.
   c. Place transmission shift control lever in Neutral (N) position.
   d. Apply parking brake.
   e. Start engine and operate at idle speed.
   f. Wait for transmission oil temperature to reach operating range (55° C to 90° C).
   g. Select Kalmar service menu on driver's Electronic Control System (ESC) display screen and press "Enter".
   h. Enter calibration program access number "13221" and press "Enter".
   i. Press right arrow button to locate "CALIBR GEAR BOX" menu, then press "Enter".

CALIBRATION - CONTINUED

2. **Transmission Calibration, ECM to Clutch Modulation Cycles.**

   a. To initiate calibration process, press “Enter”.

   b. When calibration process is completed without error, ECS display will show an AEB MAIN CODE of no. 7 (refer to Table 1 below). Calibration data will be saved within the transmission ECM when ignition is turned off.

   c. When an error is identified during calibration process, the AEB MAIN CODE will show a range of error codes of 0 thru 14 identifying the transmission component under calibration and an AEB SUB CODE range of error codes of 1 thru 8 (refer to Main Codes and Sub Codes in Table 1 and Table 2 below).

CALIBR GEAR BOX	1 (2)
AEB CYCLE NR AEB MAIN CODE AEB SUB CODE	0 0 0

   d. When calibration process is completed without error, press “Enter” to return to main menu. ECS display screen should look like the following:

CALIBR GEAR BOX	2 (2)
CALIBRATION OF GEAR BOX DONE	 ENTER

CALIBRATION - CONTINUED

Table 1. Main Code Identification.

MAIN CODE	COMPONENT BEING CALIBRATED
0	AEB mode not selected
1	AEB mode selected, calibrating K1
2	AEB mode selected, calibrating K2
3	AEB mode selected, calibrating K3
4	AEB mode selected, calibrating K4
5	AEB mode selected, calibrating KV
6	AEB mode selected, calibrating KR
7	AEB mode selected, calibration finished
8	AEB mode selected, calibration aborted
9	AEB mode selected, calibration aborted while adjusting K1
10	AEB mode selected, calibration aborted while adjusting K2
11	AEB mode selected, calibration aborted while adjusting K3
12	AEB mode selected, calibration aborted while adjusting K4
13	AEB mode selected, calibration aborted while adjusting KV
14	AEB mode selected, calibration aborted while adjusting KR

CALIBRATION - CONTINUED

Table 2. Sub Code Identification.

SUB CODE	CORRECTIVE ACTION
1	Stop and restart truck if fault code is “0”. Repeat calibration procedure. If failure continues, transmission maintenance may be required.
2	Stop and restart truck. Ensure transmission shift control lever is in Neutral (N) position. Repeat calibration procedure.
3	Stop and restart truck. Ensure parking brake is applied. Repeat calibration procedure.
4	Stop and restart truck. Test parking brake operation. If parking brake operates properly, repeat calibration procedure. If parking brake is not operating properly, service parking brake. Repeat calibration procedure.
5	Stop and restart truck. Allow transmission to warm to operating temperature. Repeat calibration procedure.
6	Allow transmission oil to cool by idling engine but not operating transmission. When oil temperature has cooled, transmission ECM will resume calibration program.
7	Increase engine RPMs. Transmission ECM will resume calibration program when RPMs are within a specified range.
8	Decrease engine RPMs. Transmission ECM will resume calibration program when RPMs are within a specified range.

END OF WORK PACKAGE

TRANSMISSION OIL COOLER REPLACEMENT 0035 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, pipe (Item 26, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Seal, o-ring (P/N 920798.0002) (4)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Radiator splash shield removed (TM 10-3930-675-20)

Engine coolant drained (TM 10-3930-675-20)

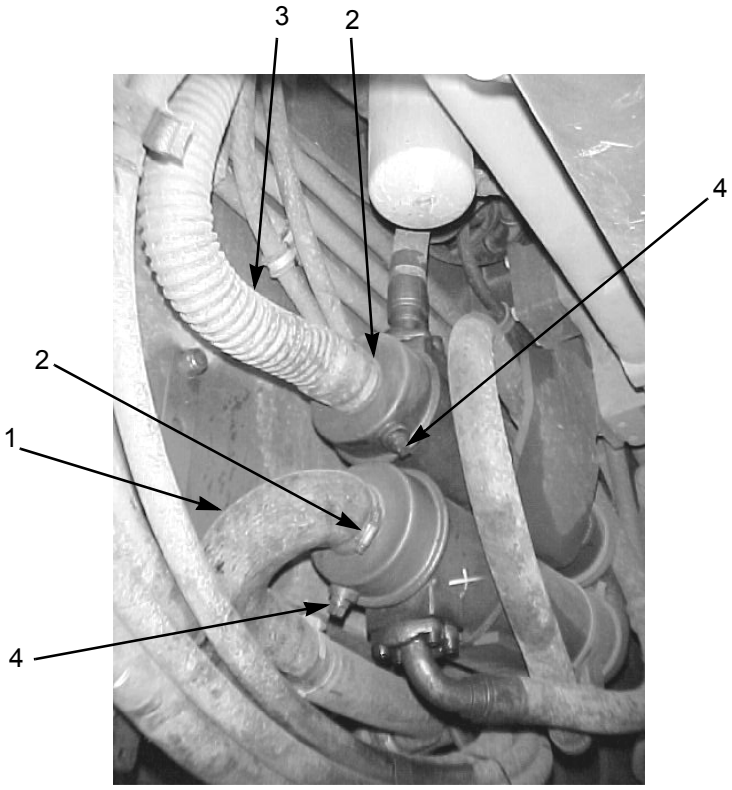
REMOVAL

NOTE

- Transmission oil cooler consists of two units interconnected with coolant and hydraulic hoses. The two units are mounted on a common bracket attached to engine flywheel housing.
- Coolant may remain in transmission oil coolers even when cooling system has been drained. To aid in removal, drain residual coolant from transmission oil coolers. Ensure suitable container is positioned to catch draining transmission oil from disconnected hoses or components.
- Tag hoses for installation.

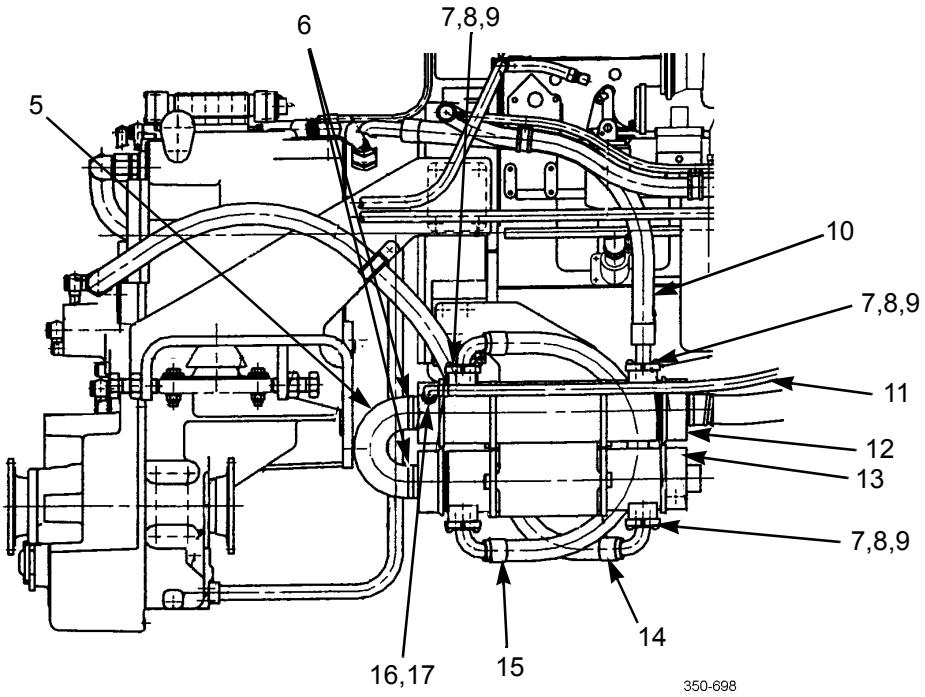
REMOVAL - CONTINUED

1. Position suitable container under transmission oil coolers and remove two plugs (4).
2. Loosen hose clamps (2) and disconnect coolant hoses (1 and 3).



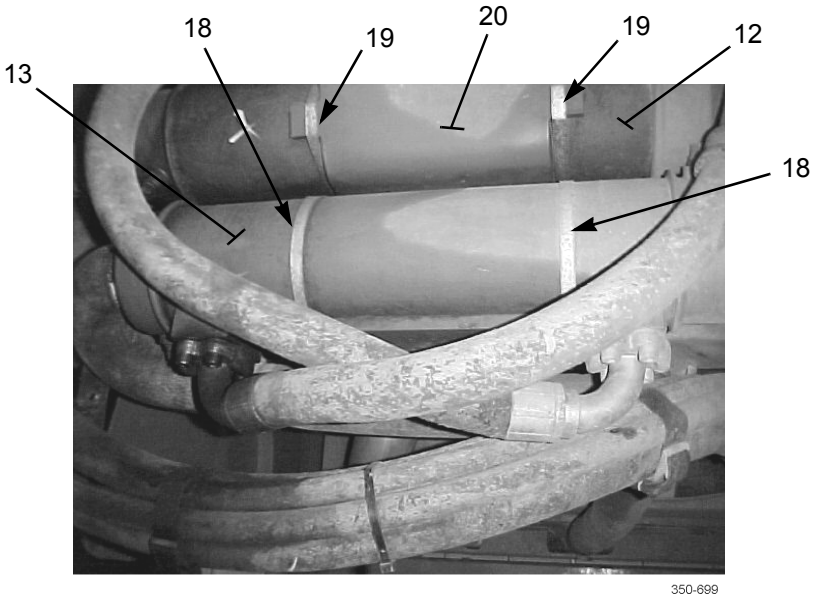
3. Loosen two hose clamps (6) and remove coolant hose (5).
4. Remove eight screws (7), two flanges (8), two o-ring seals (9), and disconnect two hoses (14 and 15) from bottom of transmission oil cooler lower unit (13). Discard o-ring seals.
5. Remove eight screws (7), two flanges (8), two o-ring seals (9), and disconnect two hoses (10 and 15) from top of transmission oil cooler upper unit (12). Discard o-ring seals.
6. Loosen hose clamp (16) and disconnect water hose (11) from fitting (17).
7. Remove fitting (17) from transmission oil cooler upper unit (12).

REMOVAL - CONTINUED



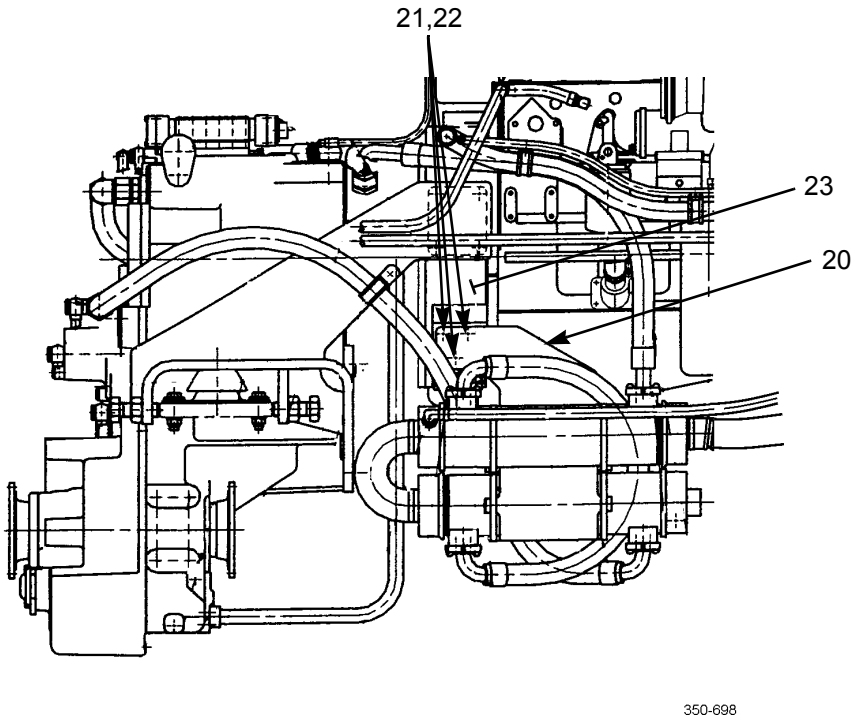
8. With assistance, loosen two hose clamp bands (18) securing transmission oil cooler lower unit (13) to mounting bracket (20). Remove lower unit from bracket.

9. With assistance, loosen two hose clamp bands (19) securing transmission oil cooler upper unit (12) to mounting bracket (20). Remove upper unit from bracket.



REMOVAL - CONTINUED

10. If damaged, remove three screws (21), washers (22), and bracket (20) from flywheel housing (23).



INSTALLATION

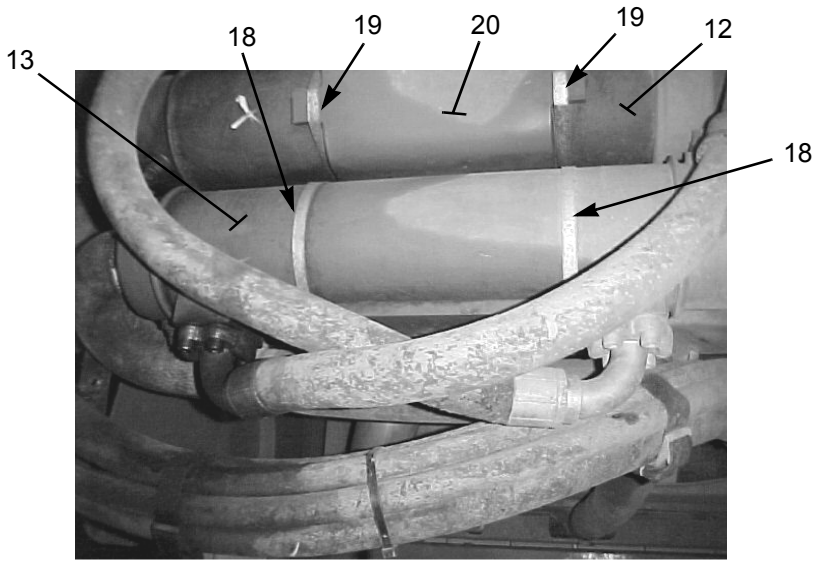
1. If removed, install bracket (20) on flywheel housing (23) with three washers (22) and screws (21).

NOTE

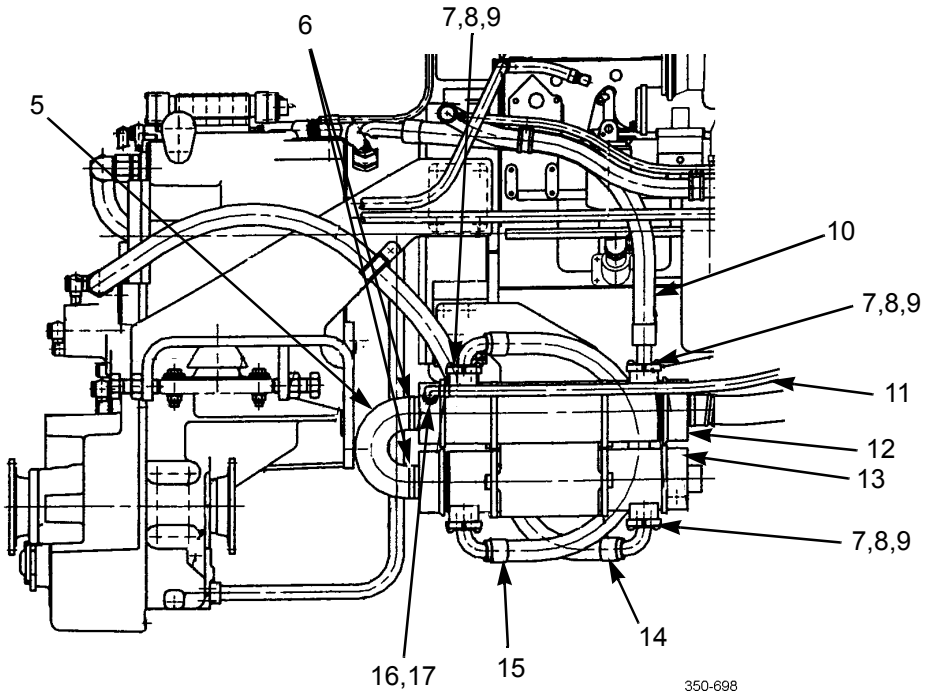
Ensure hydraulic hose mounting flange surfaces on transmission oil cooler units are clean and free of residue.

2. With assistance, position transmission oil cooler upper unit (12) on bracket (20) and secure with two hose clamp bands (19).
3. With assistance, position transmission oil cooler lower unit (13) on bracket (20) and secure with two hose clamp bands (18).

INSTALLATION - CONTINUED

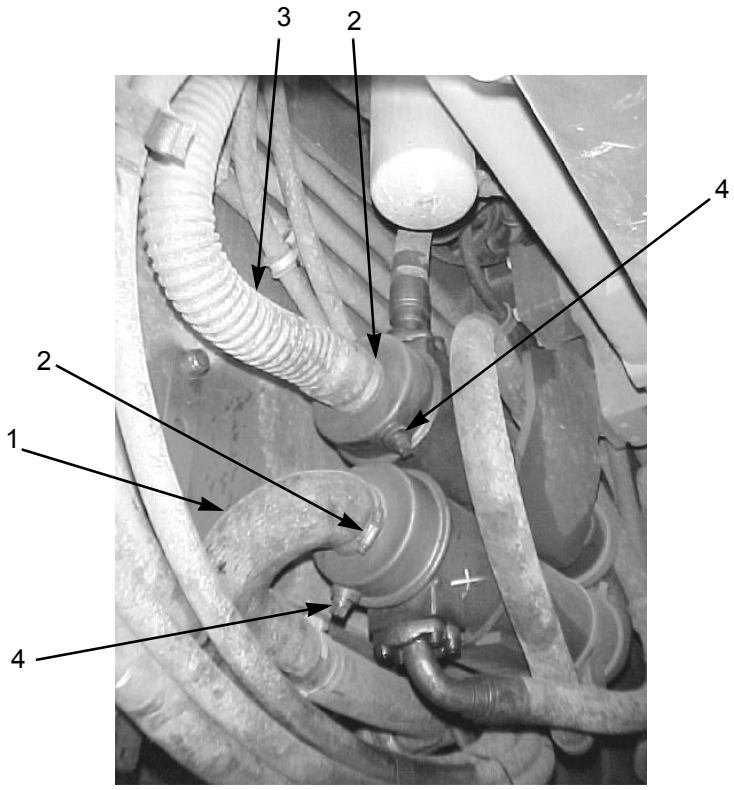


4. Install two hoses (10 and 15) to top of transmission oil cooler upper unit (12) with two new o-ring seals (9) and flanges (7). Secure flanges with eight screws (8).
5. Install two hoses (14 and 15) to bottom of transmission oil cooler lower unit (13) with two new o-ring seals (9) and flanges (7). Secure flanges with eight screws (8).
6. Apply pipe sealant to fitting (17) and install fitting in transmission oil cooler upper unit (12). Install water hose (11) to fitting with hose clamp (16).
7. Install coolant hose (5) and secure with two hose clamps (6).



INSTALLATION - CONTINUED

8. Connect coolant hose (3) from water pump and secure with hose clamp (2).
9. Connect coolant hose (1) from radiator and secure with hose clamp (2).
10. Apply pipe sealant and install two plugs (4).



11. Check transmission oil level and add oil as needed (LO 10-3930-675-12).
12. Add coolant (TM 10-3930-675-20).
13. Start engine (TM 10-3930-675-10) and check for leaks. Shut down engine.
14. Install radiator splash shield (TM 10-3930-675-20).
15. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

FRONT AXLE ASSEMBLY REPLACEMENT 0036 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Jack kit, hydraulic (Item 51, WP 0090 00) (2)

Multiplier, torque wrench (Item 56, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Truck, forklift, 10,000 lb capacity (Atlas)

Wrench set, socket, 3/4 in drive (Item 97, WP 0090 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Materials/Parts

Washer, lock (P/N 923657.0011) (16)

Personnel Required

Two

References:

LO 10-3930-675-12

WP 0042 00

WP 0050 00

Equipment Condition

Vehicle parked on level, hard surface

Rear wheels chocked

Boom raised as required (TM 10-3930-675-10)

Front fender assemblies removed (TM 10-3930-675-20)

Wheel temperature sensors removed (TM 10-3930-675-20)

Front brake lines and brackets removed (TM 10-3930-675-20)

Front propeller shaft removed (TM 10-3930-675-20)

Front steering cylinders removed (TM 10-3930-675-20)

Front steering sensors removed (TM 10-3930-675-20)

Front parking brake cylinder removed (WP 0038 00)

WARNING

- Hydraulic jacks are intended only for lifting RTCH, not for supporting vehicle to perform maintenance. DO NOT get under vehicle after it is raised unless it is properly supported with blocks or other suitable cribbing. Failure to observe this warning may result in death or injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Forklift truck used to replace front axle assembly must have a 10,000 lb capacity to ensure task is performed in a safe manner. Failure to follow this warning may result in death or injury to personnel.

REMOVAL

NOTE

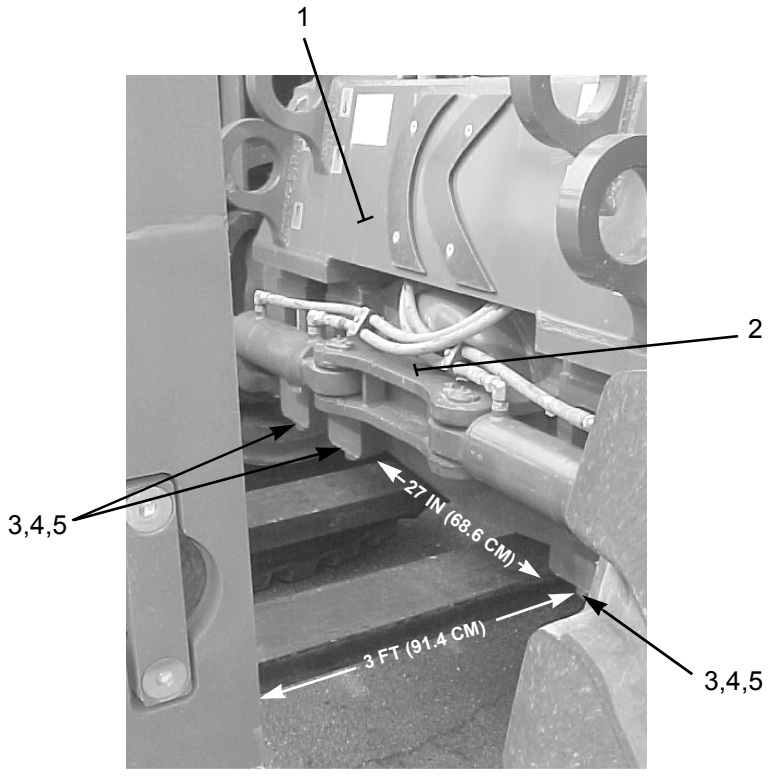
Blocking both sides of rear axle will prevent vehicle from tilting when front of vehicle is raised.

1. Block left and right sides of rear axle between axle and axle stops.
2. Place two hydraulic jacks under front of vehicle frame (1), just behind front axle (2). Raise jacks to contact bottom of frame.
3. Place wood blocks under front of vehicle frame (1) close to hydraulic jacks. Lower jacks and support frame on wood blocks.
4. Drain front axle differential (LO 10-3930-675-12).
5. Remove front wheel and tire assemblies (WP 0042 00).

NOTE

Width of fork tines outside-to-outside should be 27 in (68.6 cm). Front face of axle should be 3 ft (91.4 cm) away from forklift back plate.

6. Using forklift truck, support front axle (2).
7. Remove eight nuts (3), bolts (4), and 16 lockwashers (5) to free front axle (2) from vehicle. Discard lockwashers.
8. Slightly lower front axle (2) with forklift truck, then move front axle to work area. Place axle on wood blocks or trestles.



INSTALLATION

1. Using forklift truck, lift and move front axle (2) to vehicle.

NOTE

Two or more bolts inserted thru frame from above may be used to help aline axle with frame.

2. Aline front axle (2) with front of vehicle frame (1). Install axle to frame with eight bolts (4), 16 new lockwashers (5), and eight nuts (3).
3. Move forklift truck away from vehicle.
4. Install front wheel and tire assemblies (WP 0042 00).
5. Raise two hydraulic jacks and remove wood blocks.
6. Lower hydraulic jacks to lower vehicle frame (1).
7. Remove blocks from left and right sides of rear axle.
8. Using torque wrench and torque multiplier, tighten eight nuts (3) to 1733 lb-ft (2350 Nm).
9. Install front parking brake cylinder (WP 0038 00).
10. Install front steering sensors (TM 10-3930-675-20).
11. Install front steering cylinders (TM 10-3930-675-20).
12. Install front propeller shaft (TM 10-3930-675-20).
13. Install front brake lines and brackets (TM 10-3930-675-20).
14. Install wheel temperature sensors (TM 10-3930-675-20).
15. Install front fender assemblies (TM 10-3930-675-20).
16. Fill front axle differential (LO 10-3930-675-12) and check for leaks.
17. Perform steering calibration (WP 0050 00).

NOTE

Notify Organization Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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REAR AXLE ASSEMBLY REPLACEMENT 0037 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Jack kit, hydraulic (Item 51, WP 0090 00) (2)

Shackle, lifting (Item 81, WP 0090 00) (2)

Sling, eye (Item 84, WP 0090 00) (4)

Materials/Parts

Compound, antiseize (Item 4, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

O-ring (P/N 923873.0006) (2)

Personnel Required

Three

References

LO 10-3930-675-12

WP 0042 00

WP 0050 00

Equipment Condition

Vehicle parked on level, hard surface

Front wheels chocked

Bogie wheel assembly removed (WP 0043 00)

Cab and boom support in transport position (TM 10-3930-675-10)

Rear propeller shaft removed (TM 10-3930-675-20)

Rear parking brake cylinder removed (WP0038 00)

Rear brake lines and brackets removed (TM 10-3930-675-20)

Rear steering sensors removed (TM 10-3930-675-20)

Rear wheel temperature sensors removed (TM 10-3930-675-20)

Rear steering cylinders removed (TM 10-3930-675-20)

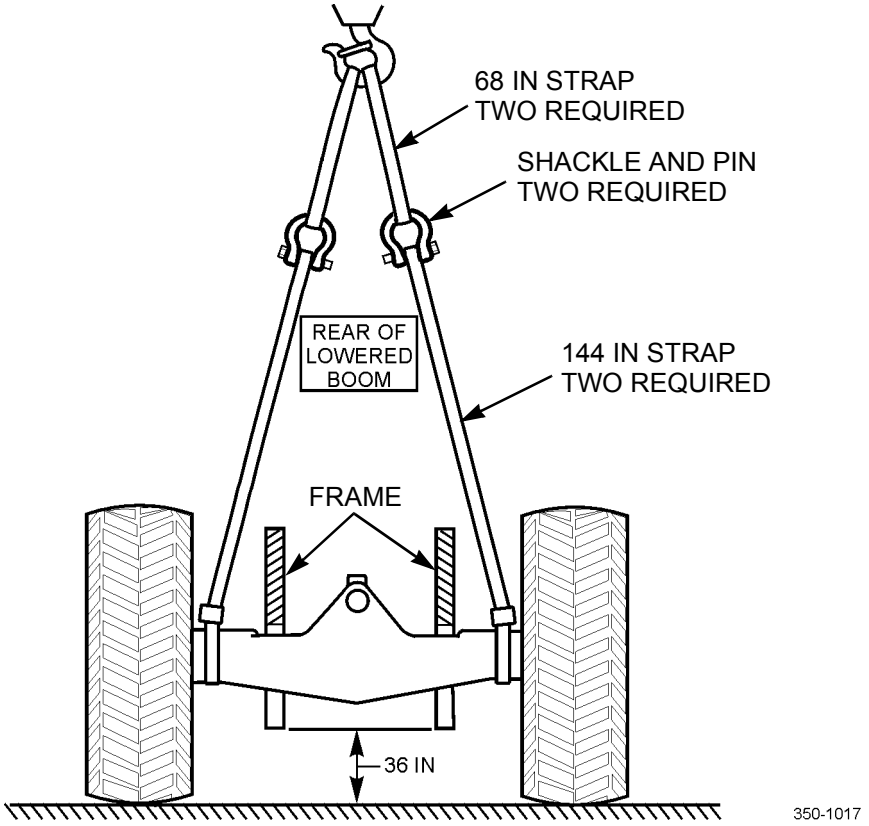
Rear fender assemblies removed (TM 10-3930-675-20)

WARNING

- Hydraulic jacks are intended only for lifting RTCH, not for supporting vehicle to perform maintenance. DO NOT get under vehicle after it is raised unless it is properly supported with blocks or other suitable cribbing. Failure to observe this warning may result in death or injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

REMOVAL

1. Place two hydraulic jacks under flat section of vehicle frame (7) in front of rear axle (8). Raise jacks to contact bottom of frame. Ensure that jacks are positioned securely under frame.
2. Raise vehicle frame (7) to provide enough clearance to remove two rear wheel and tire assemblies from rear axle (8).
3. Remove two rear wheel and tire assemblies (WP 0042 00).
4. Assemble rigging to rear axle (8). Refer to *Rear Axle Rigging* diagram. Attach rigging to suitable lifting device and support rear axle.



REAR AXLE RIGGING

5. Using hydraulic jacks under frame (7), raise frame to 36 in height as indicated in *Rear Axle Rigging* diagram and remove two hydraulic jacks (WP 0042 00) from under rear axle (8).
6. Place wood blocks or trestles under vehicle frame (7) in front of, and close to, hydraulic jacks. Lower jacks and support frame on wood blocks.
7. At rear of rear axle (8), remove 12 screws (4) and washers (5) holding flange of shaft (6) to crossmember (1).
8. At front of rear axle (8), remove 12 screws (12), washers (13), and cover (14). Remove o-ring (9) and grease fitting (10) from cover. Discard o-ring.

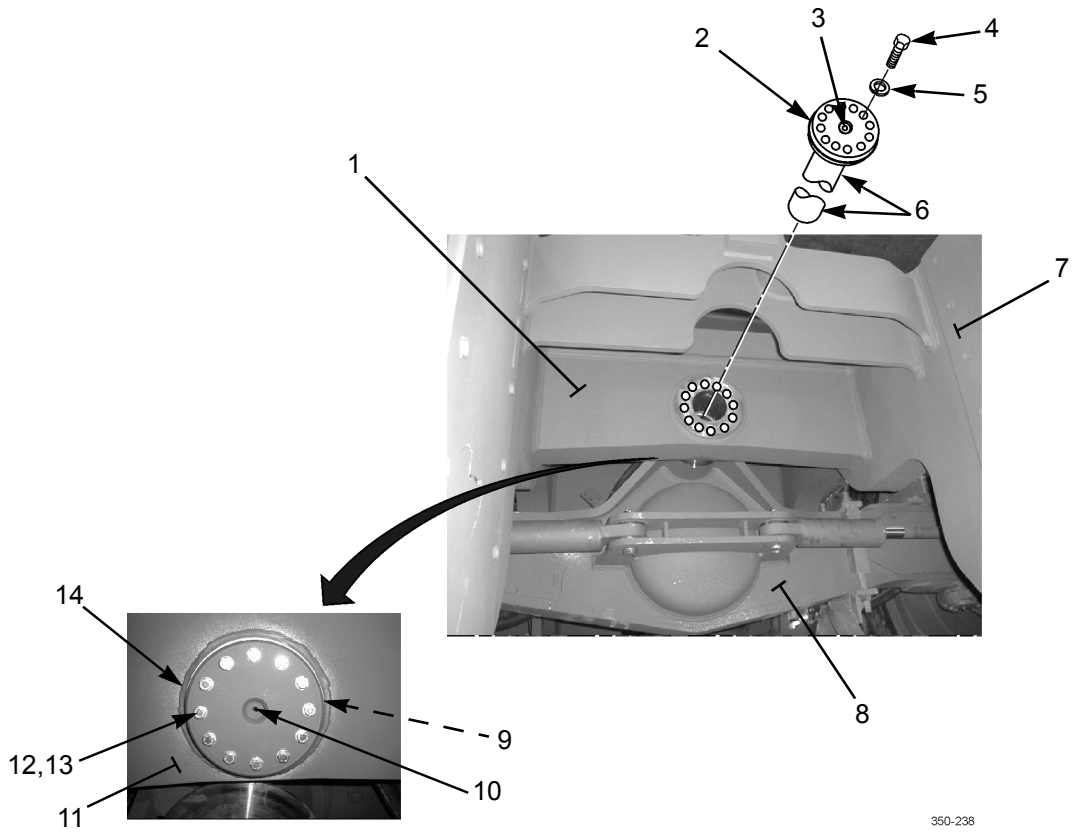
REMOVAL - CONTINUED

NOTE

Raise or lower rear axle slightly, as necessary, for ease in shaft removal.

9. Remove shaft (6) holding rear axle (8) to crossmembers (1 and 11). Remove o-ring (2) and grease fitting (3) from flange of shaft. Discard o-ring.

10. Lower rear axle (8) to clear frame (7) and move rear axle away from vehicle. Place axle on wood blocks or trestles. Remove rigging.



INSTALLATION

1. Assemble rigging to rear axle (8). Refer to *Rear Axle Rigging* diagram. Attach rigging to suitable lifting device.

2. Position rear axle (8) to vehicle.

3. Apply antiseize compound to bearing surface of shaft (6).

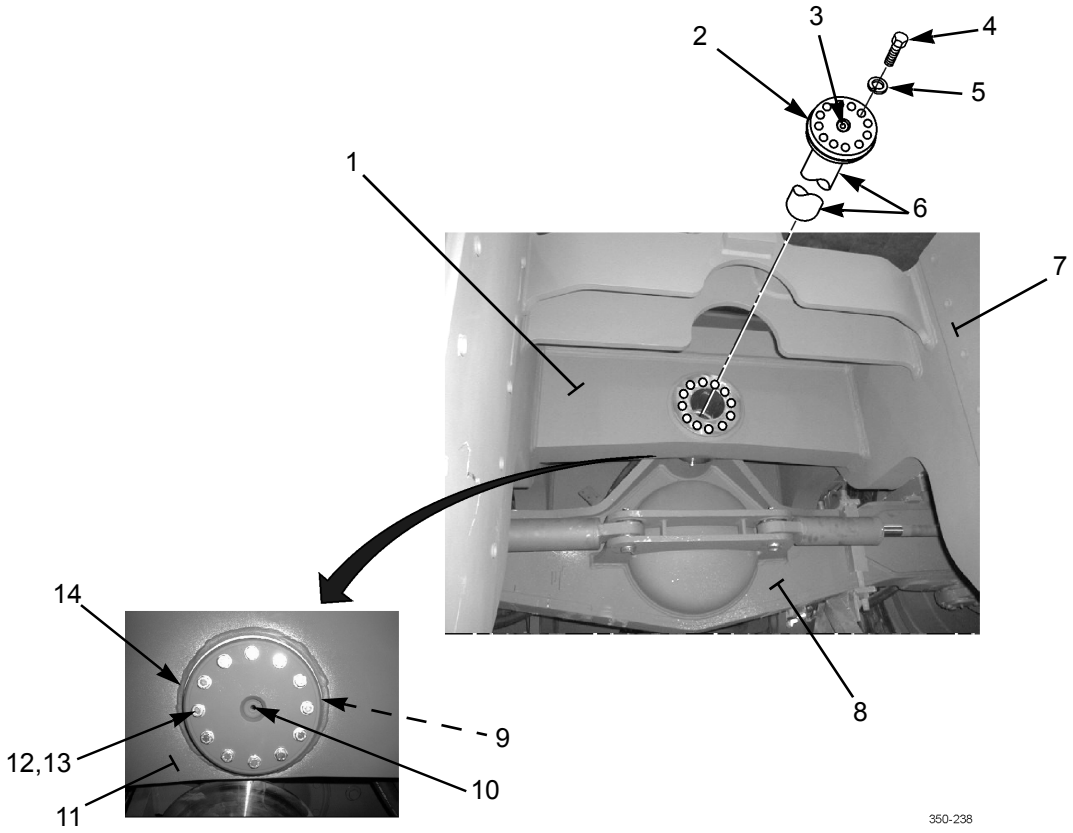
4. Install grease fitting (3) and new o-ring (2) to flange of shaft (6).

NOTE

Adjust position of rear axle slightly to ensure accurate alinement of rear axle with crossmembers.

INSTALLATION - CONTINUED

5. Install shaft (6) thru crossmembers (1 and 11) and rear axle (8).
6. At front of rear axle (8), install grease fitting (10) and new o-ring (9) to cover (14). Install cover to crossmember (11) with 12 washers (13) and screws (12).
7. At rear of rear axle (8), install flange of shaft (6) to crossmember (1) with 12 washers (5) and screws (4).
8. Install two rear wheel and tire assemblies (WP 0042 00).
9. Remove rigging from rear axle.
10. Position and raise two hydraulic jacks to support vehicle frame (7) and remove trestles or wood blocks.
11. Lower and remove hydraulic jacks from under frame (7).



12. Install rear fender assemblies (TM 10-3930-675-20).
13. Install rear steering cylinders (TM 10-3930-675-20).
14. Install rear wheel temperature sensors (TM 10-3930-675-20).
15. Install rear brake lines and brackets (TM 10-3930-675-20).
16. Install rear parking brake cylinder (WP 0038 00).
17. Install rear propeller shaft (TM 10-3930-675-20).
18. Return cab and boom support to operational position (TM 10-3930-675-10).
19. Install bogie wheel assembly (WP 0043 00).

INSTALLATION - CONTINUED

20. Apply grease to two grease fittings (3 and 10) (LO 10-3930-675-12).
21. Fill rear axle differential. Check and/or fill hub end of new axle (LO 10-3930-675-12).
22. Remove blocks from front wheels.
23. Install rear steering sensors (TM 10-3930-675-20).
24. Operate vehicle (TM 10-3930-675-10) and check for hydraulic leaks.
25. Perform steering calibration (WP 0050 00).

NOTE

Notify Organization Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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PARKING BRAKE CYLINDER MAINTENANCE 0038 00

THIS WORK PACKAGE COVERS

Parking Brake Cylinder: Removal, Disassembly, Assembly, Installation

Parking Brake Rotor: Removal, Installation

Parking Brake Bracket: Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Goggles, industrial (Item 38, WP 0090 00)

Multiplier, torque wrench (Item 56, WP 0090 00)

Wrench, pipe, strap (Item 101, WP 0090 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Materials/Parts - Continued

Wire, nonelectrical (Item 34, WP 0089 00)

O-ring (P/N 923727.0504) (2)

Pin, cotter (P/N 923726.0433)

Seal kit (P/N 923828.0504)

Equipment Condition

Wheels chocked

Brake hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake pads removed (TM 10-3930-675-20)

NOTE

- Maintenance tasks for parking brake cylinder at front axle and rear axle are performed the same way.
- After performance of this task, notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

PARKING BRAKE CYLINDER REMOVAL

NOTE

A strap wrench may be required to remove cover.

1. Remove cover (6) and o-ring (8) from pressure ring (4). Remove and discard o-ring only if damaged.

CAUTION

Parking brake is under spring tension. Parts could become loose and fly out suddenly if parking brake is not correctly disassembled. Be sure to follow instructions in step 2 before proceeding to avoid injury to personnel.

2. Loosen nut (5) and remove adjusting screw (7) from adjusting cylinder (9). Position adjusting screw back into adjusting cylinder a few turns.

3. Position cover (6) back onto pressure ring (4) a few turns.

4. Remove cotter pin (14) from one remaining castle nut (13). Discard cotter pin.

5. Remove castle nut (13), bolt (15), and parking brake cylinder (2) from rotor (12) and parking brake bracket (1). Support parking brake cylinder with nonelectrical wire.

WARNING

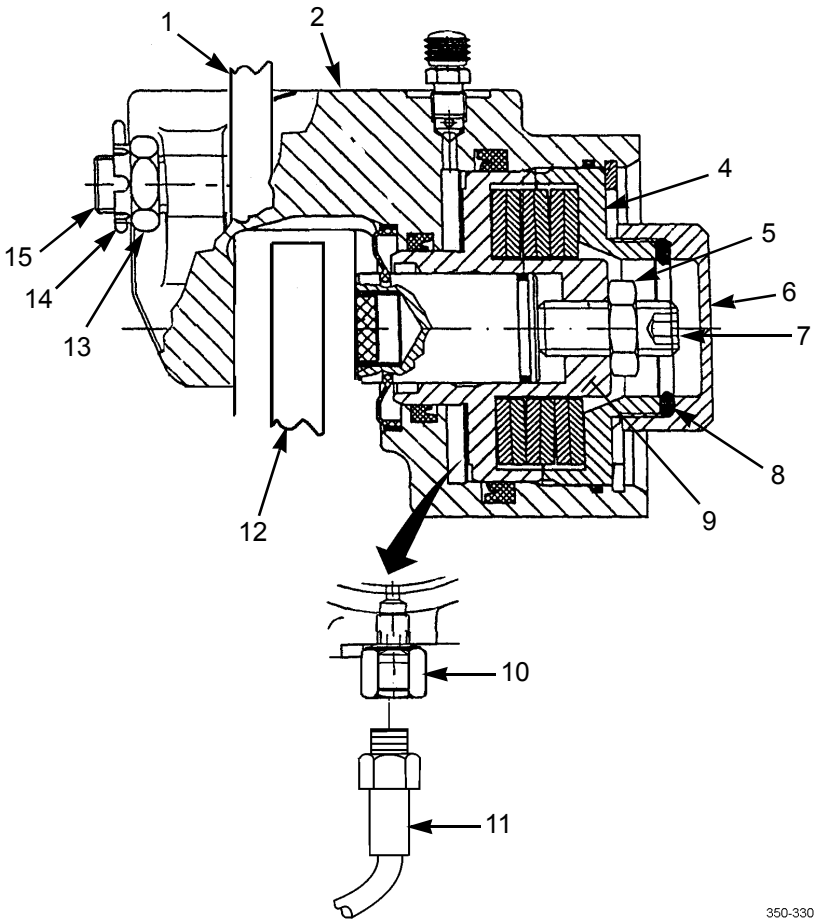
- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

6. Disconnect hydraulic hose (11) from fitting (10) and remove parking brake cylinder (2) from vehicle.

PARKING BRAKE CYLINDER REMOVAL - CONTINUED



PARKING BRAKE CYLINDER DISASSEMBLY

1. Remove cover (6), adjusting screw (7), and nut (5) from parking brake cylinder.
2. Remove fitting (10) and seal ring (23) from housing (16). Discard seal ring.
3. Remove bleeder valve (3) from housing (16).

NOTE

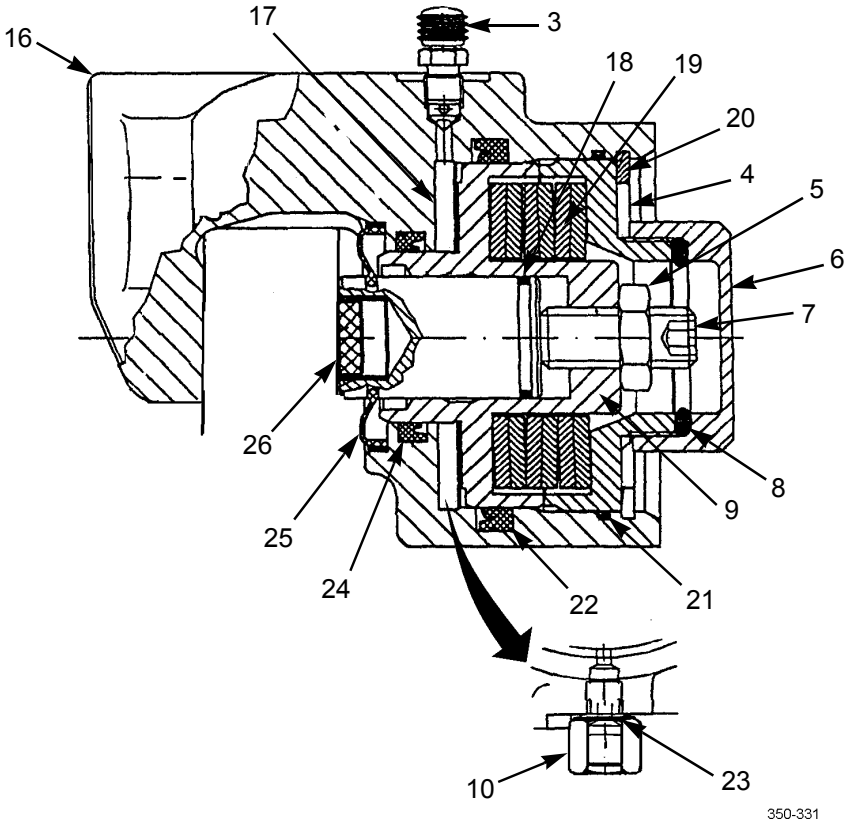
Note position of spring washers for assembly.

4. Remove lock ring (20), pressure ring (4), and six spring washers (19).
5. Remove dust seal (25) from groove of adjusting cylinder (9) and remove piston (17) with adjusting cylinder from housing (16).
6. Remove adjusting cylinder (9) from piston (17) and remove o-ring (18) and magnet (26) from adjusting cylinder. Discard o-ring.

NOTE

Note position of seal rings for assembly.

7. Remove o-ring (21), dust seal (25), and two seal rings (22 and 24) from housing (16). Discard o-ring, dust seal, and two seal rings.



PARKING BRAKE CYLINDER ASSEMBLY

1. Install two new seal rings (22 and 24), new dust seal (25), and new o-ring (21) to housing (16).
2. Apply a thin coat of grease to inner and outer sealing surfaces of piston (17).
3. Install magnet (26) and new o-ring (18) to adjusting cylinder (9) and install adjusting cylinder into piston (17).
4. Install piston (17), with adjusting cylinder (9), into housing (16). Install dust seal (25) into groove of adjusting cylinder.
5. Install six spring washers (19), pressure ring (4), and lock ring (20).
6. Install bleeder valve (3) to housing (16).
7. Install new seal ring (23) and fitting (10) to housing (16).
8. Loosely install adjusting screw (7) and nut (5) to piston (17).
9. If removed, install new o-ring (8) to cover (6). Loosely install cover.

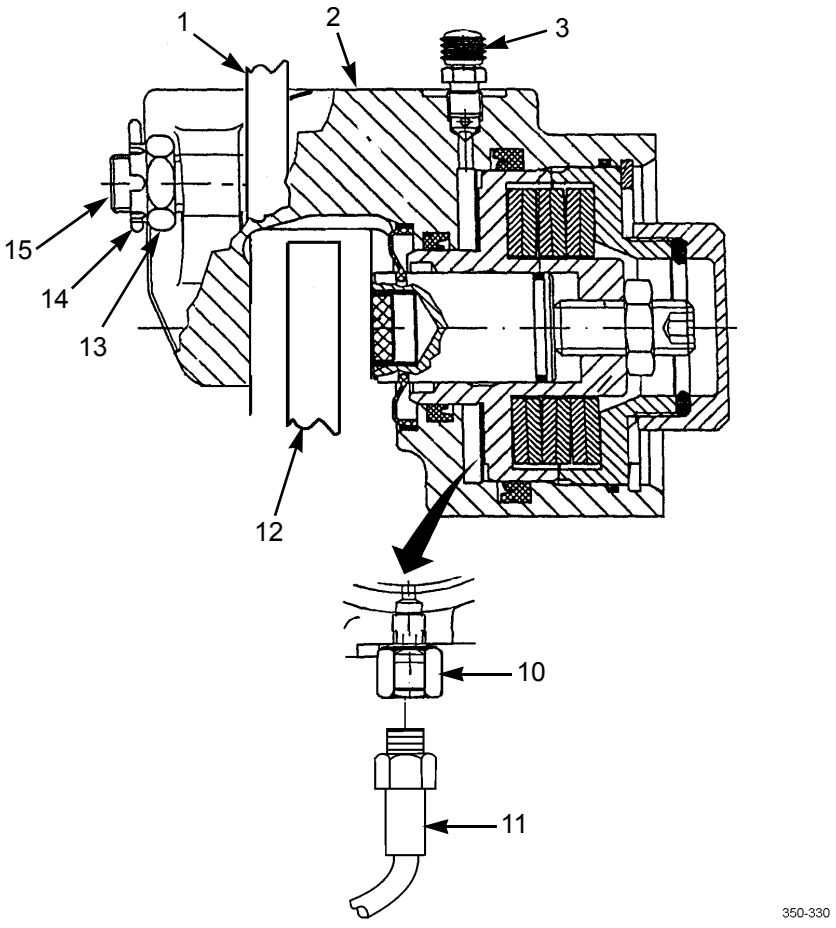
PARKING BRAKE CYLINDER INSTALLATION

1. Support parking brake cylinder (2) to vehicle with nonelectrical wire and connect hydraulic hose (11) to fitting (10).
2. Install parking brake cylinder (2) to rotor (12) and parking brake bracket (1) with one of two bolts (15) and one of two castle nuts (13). Remove nonelectrical wire.
3. Install new cotter pin (14) to one of two castle nuts (13).
4. Install parking brake pads (TM 10-3930-675-20).
5. Start engine (TM 10-3930-675-10) to provide hydraulic pressure.

WARNING

Wear eye protection when opening bleeder valve to avoid eye injury.

6. Open bleeder valve (3) slowly until air and a small quantity of hydraulic oil is expelled. Close bleeder valve.

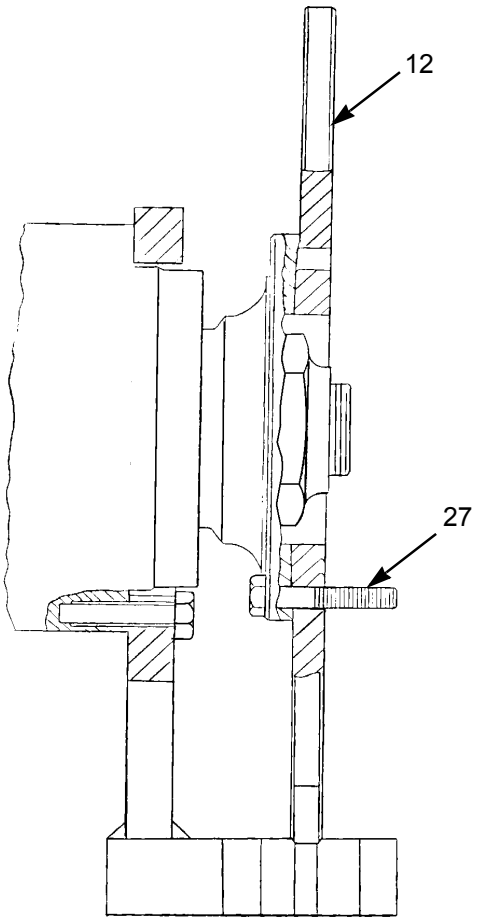


PARKING BRAKE ROTOR REMOVAL

NOTE

Front and rear parking brake rotors are removed the same way.

1. Remove front or rear propeller shaft (TM 10-3930-675-20).
2. Remove parking brake cylinder (refer to *Parking Brake Cylinder Removal*).
3. Remove parking brake rotor (12) from 12 bolts (27).



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PARKING BRAKE ROTOR INSTALLATION

NOTE

Front and rear parking brake rotors are installed the same way.

1. Install parking brake rotor (12) to 12 bolts (27).
2. Install parking brake cylinder (refer to *Parking Brake Cylinder Installation*).
3. Install front or rear propeller shaft (TM 10-3930-675-20).

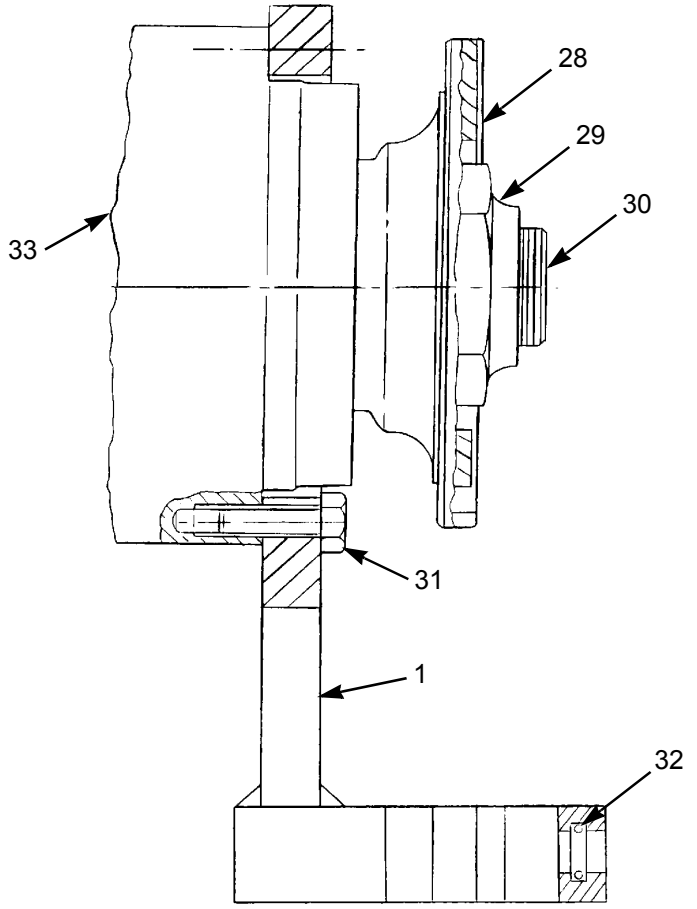
PARKING BRAKE BRACKET REMOVAL

1. Remove parking brake rotor (refer to *Parking Brake Rotor Removal*).
2. Remove nut (29) and flange (28) from differential shaft (30).

NOTE

Note position of parking brake bracket on axle for installation.

3. Remove 12 screws (31) and parking brake bracket (1) from front or rear axle (33).
4. Remove two o-rings (32) from parking brake bracket (1). Discard o-rings.



350-333

PARKING BRAKE BRACKET INSTALLATION

1. Install two new o-rings (32) to parking brake bracket (1).
2. Install parking brake bracket (1) to front or rear axle (33) with 12 screws (31).
3. Install flange (28) to differential shaft (30) with nut (29). Tighten nut to 774-811 lb-ft (1050-1100 Nm).
4. Install parking brake rotor (refer to *Parking Brake Rotor Installation*).

END OF WORK PACKAGE

BRAKE PAD WEAR CHECK 0039 00

THIS WORK PACKAGE COVERS

Inspection

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Gage, depth (Item 31, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Personnel Required

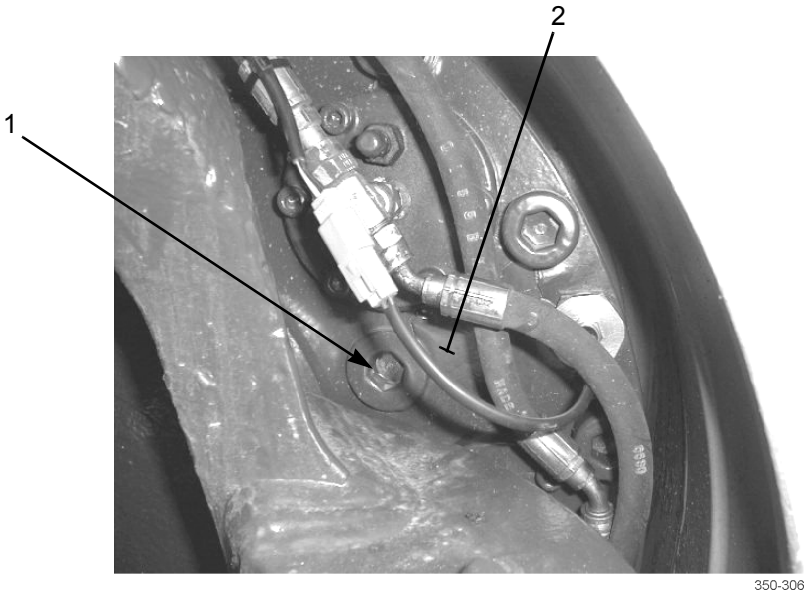
Two

NOTE

Perform inspection steps to determine if brake discs should be replaced due to excessive wear.

INSPECTION

1. Position vehicle for access to inspection plug (1) and chock wheels. Clean inspection plug and area around inspection plug.
2. Remove inspection plug (1) from housing plate (2).



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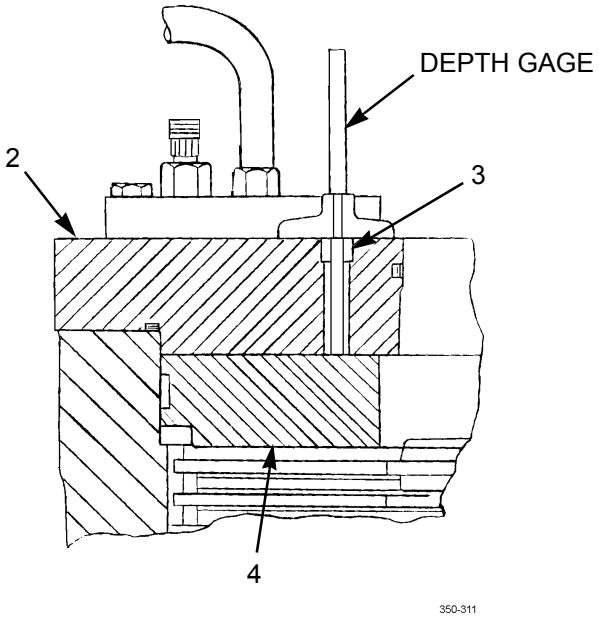
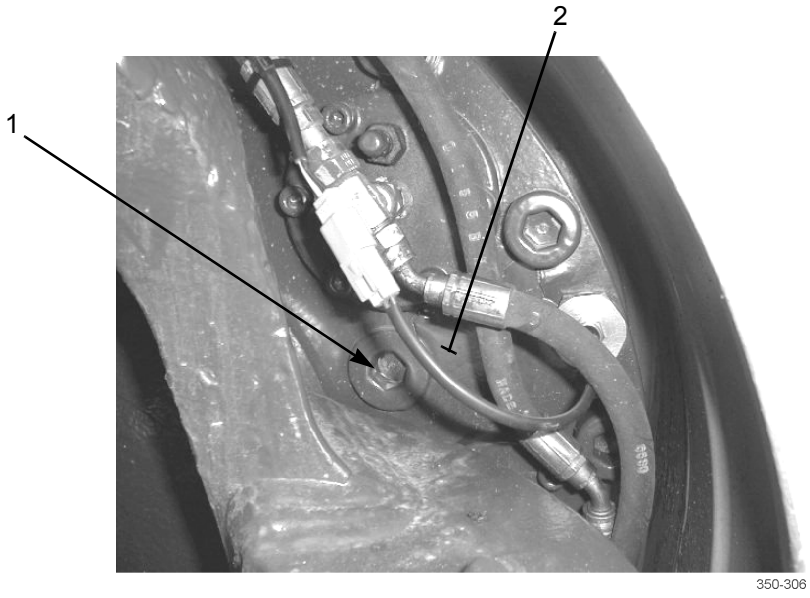
INSPECTION - CONTINUED

3. With service brakes applied, insert depth gage thru brake inspection hole (3).
4. Measure distance from face of housing plate (2) to washer plate (4). Record this measurement.
5. Note number stamped on housing plate (2) near brake inspection hole (3). Subtract this number from measurement taken in step 4. If result is greater than 0.063 in (1.6 mm), brake discs are excessively worn and must be replaced.



6. Install inspection plug (1) in housing plate (2).



END OF WORK PACKAGE

BRAKE ACCUMULATOR REPLACEMENT 0040 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Goggles, industrial (Item 38, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Wrench, adjustable (Item 99, WP 0090 00)

Wrench, strap (Item 102, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Materials/Parts - Continued

Rag, wiping (Item 23, WP 0089 00)

Nut, lock (P/N 920076.003) (2)

O-ring (P/N 5936)

O-ring (P/N 920002.011)

References

LO 10-3930-675-12

TM 10-3930-675-10

WP 0041 00

Equipment Condition

Brake hydraulic system pressure relieved (TM 10-3930675-20)

WARNING

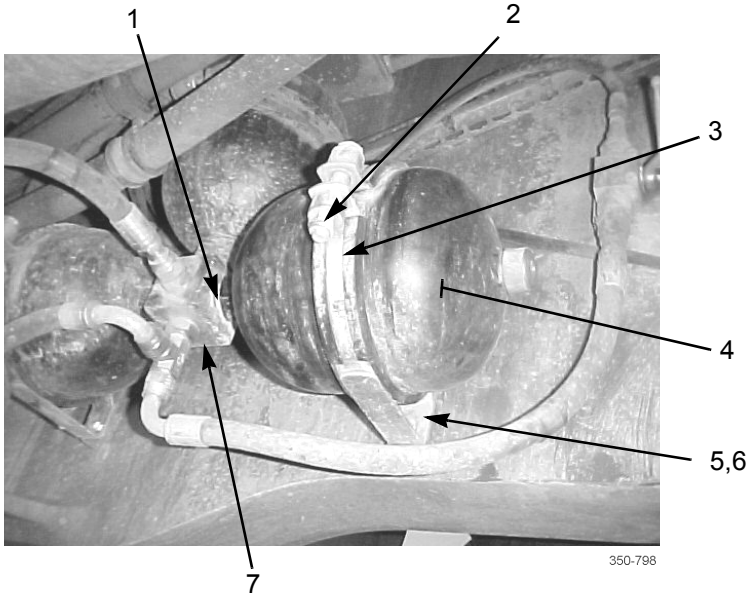
- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

REMOVAL

1. Place a suitable container under terminal block (7) to catch any spillage.
2. Loosen nut (2) so that accumulator (4) can be rotated in clamp (3).
3. Use a strap wrench to turn accumulator (4) counterclockwise, while holding terminal block (7) with an adjustable wrench. Remove accumulator and o-ring from nipple (1). Discard o-ring.
4. Remove nipple (1) and o-ring from terminal block (7). Discard o-ring.
5. If damaged, remove two locknuts (5), screws (6), and clamp (3) from welded bracket at frame. Discard locknuts.
6. If accumulator is unserviceable, ensure it is drained of nitrogen before disposal (WP 0041 00).



INSTALLATION

1. If removed, install clamp (3) to welded bracket at frame with two screws (6) and new locknuts (5).

NOTE

O-rings should be lubricated before installation.

2. Install new o-ring and nipple (1) to terminal block (7).
3. Position accumulator (4) inside clamp (3).
4. Install new o-ring and accumulator (4) to nipple (1), while holding terminal block (7) with an adjustable wrench.
5. Tighten nut (2) to secure accumulator (4) inside clamp (3).
6. Verify accumulator pre-charge pressure and charge as required (WP 0041 00).
7. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
8. Start engine (TM 10-3930-675-10). Make several brake applications and check for leaks.

NOTE

Notify Organization Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

BRAKE AND STEERING ACCUMULATOR SERVICE 0041 00

THIS WORK PACKAGE COVERS

Brake Accumulator: Checking Pre-Charge Pressure, Charging

Steering Accumulator: Checking Pre-Charge Pressure, Charging

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Goggles (Item 38, WP 0090 00)

Kit, nitrogen charging (Item 53, WP 0090 00)

Materials/Parts

Detergent (Item 10, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Equipment Condition

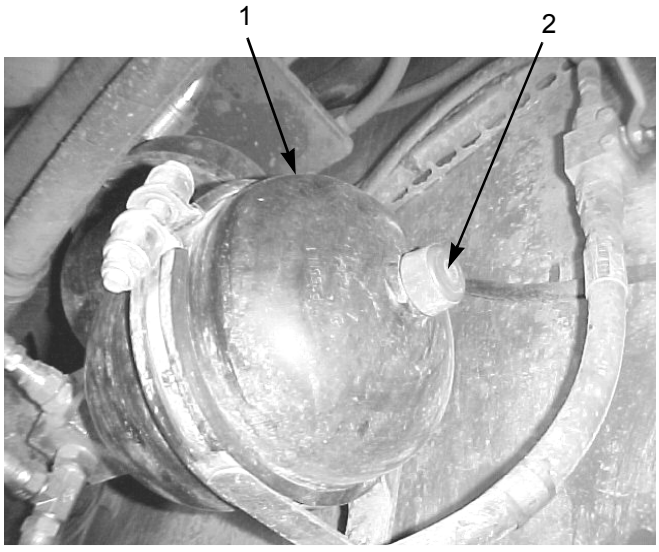
Brake or steering hydraulic system pressure relieved, if checking pre-charge pressure on vehicle (TM 10-3930675-20)

NOTE

- Annually, brake and steering accumulators must have pre-charge pressure checked to ensure accumulator serviceability. This check may be performed on vehicle or off.
- New brake and steering accumulators are not shipped charged. They must be charged prior to installation on vehicle.

CHECKING BRAKE ACCUMULATOR PRE-CHARGE PRESSURE

1. Remove cap (2) from valve end of brake accumulator (1)



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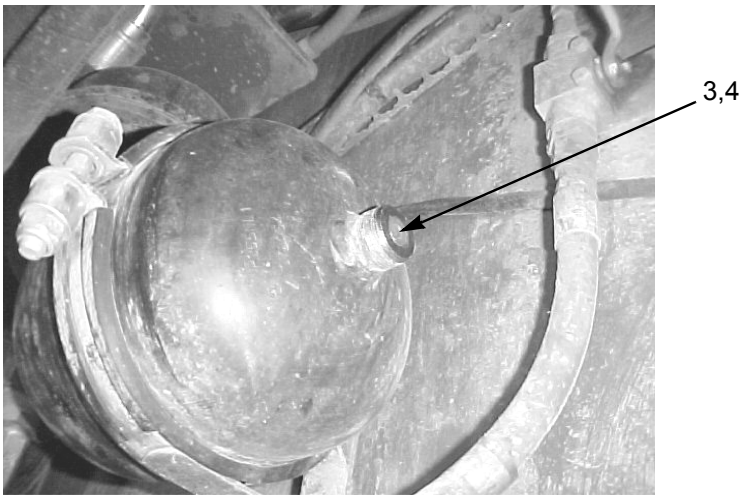
CHECKING BRAKE ACCUMULATOR PRE-CHARGE PRESSURE - CONTINUED

2. Remove plug (3) and connect hose assembly of nitrogen charging kit to valve (4).



350-814

3. Slowly open pressure regulator valve.
4. Take pressure reading from low pressure gage. Pre-charge pressure for brake accumulator must be 1305 psi (90 bar). If pressure is OK, close pressure regulator valve.

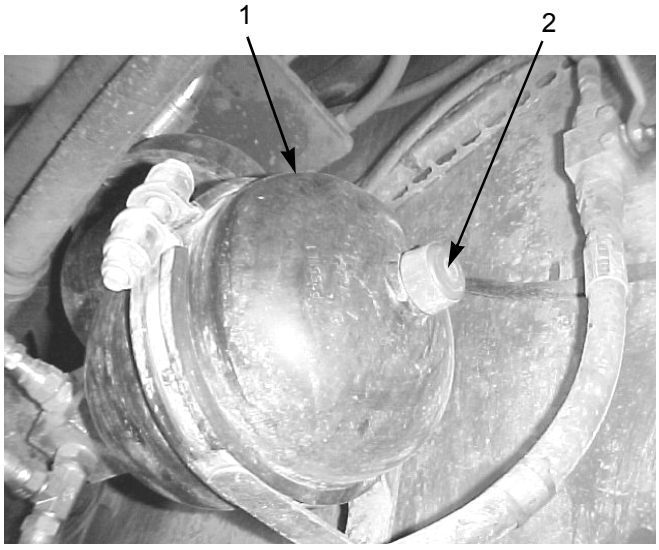
NOTE

If pressure reading on low pressure gage is less than 1305 psi (90 bar), perform *Brake Accumulator Charging*.

5. If pressure reading on low pressure gage is more than 1305 psi (90 bar), bleed off excess pressure using bleeder valve, then close pressure regulator valve.
6. Disconnect hose assembly of nitrogen charging kit from valve (4). Install plug (3).
7. Install cap (2) on valve end of brake accumulator (1).
8. Perform a soapsuds leak check at valve end of brake accumulator (1).

BRAKE ACCUMULATOR CHARGING

1. Remove cap (2) from valve end of brake accumulator (1). Remove plug (3).



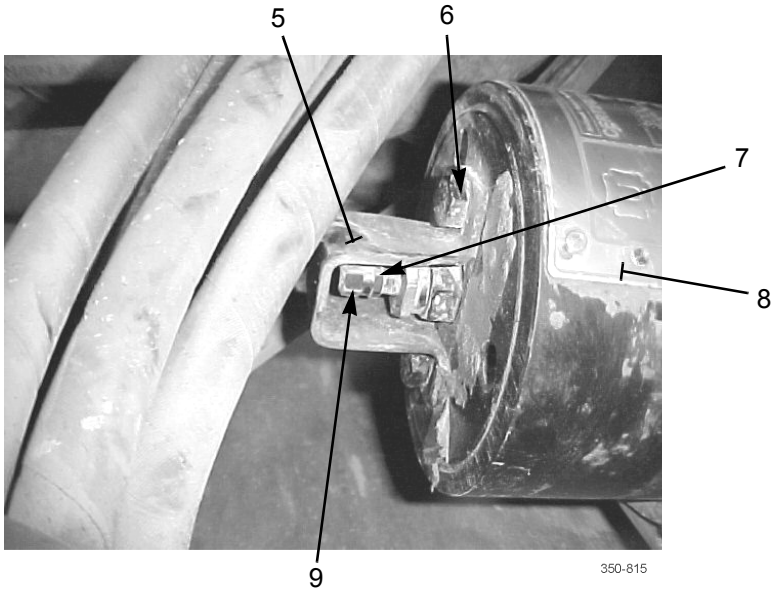
2. Remove plug (3) and connect hose assembly of nitrogen charging kit to valve (4).
3. Open nitrogen tank valve.
4. Slowly open pressure regulator valve.
5. Charge accumulator with nitrogen until pressure reading on low pressure gage is 1305 psi (90 bar). Bleed off excess pressure using bleeder valve, then close pressure regulator valve.
6. Close nitrogen tank valve.
7. Disconnect hose assembly of nitrogen charging kit from valve (4). Install plug (3).
8. Install cap (2) on valve end of brake accumulator (1).
9. Perform a soapsuds leak check at valve end of brake accumulator (1).

CHECKING STEERING ACCUMULATOR PRE-CHARGE PRESSURE

NOTE

It may be necessary to remove screws, washers, and brackets securing hoses to release hoses to gain access to valve protector.

1. Remove two screws (6) and valve protector (5) from valve end of steering accumulator (8).
2. Remove cap (9) from valve (7).
3. Connect hose assembly of nitrogen charging kit to valve (7).



4. Slowly open pressure regulator valve.
5. Take pressure reading from low pressure gage. Pre-charge pressure for steering accumulator must be 1450 psi (100 bar). If pressure is OK, close pressure regulator valve.

NOTE

If pressure reading on low pressure gage is less than 1450 psi (100 bar), perform *Steering Accumulator Charging*.

6. If pressure reading on low pressure gage is more than 1450 psi (100 bar), bleed off excess pressure using bleeder valve, then close pressure regulator valve.
7. Disconnect hose assembly of nitrogen charging kit from valve (7).
8. Install cap (9) on valve (7).
9. Perform a soapsuds leak check at valve end of steering accumulator (8).
10. Install valve protector (5) to valve end of steering accumulator (8) with two screws (6).

STEERING ACCUMULATOR CHARGING

1. Remove two screws (6) and valve protector (5) from valve end of steering accumulator (8).
2. Remove cap (9) from valve (7) of steering accumulator (8).

STEERING ACCUMULATOR CHARGING - CONTINUED

3. Connect hose assembly of nitrogen charging kit to valve (7).
4. Open nitrogen tank valve.
5. Slowly open pressure regulator valve.
6. Charge accumulator with nitrogen until pressure reading on low pressure gage is 1450 psi (100 bar). Bleed off excess pressure using bleeder valve, then close pressure regulator valve.
7. Close nitrogen tank valve.
8. Disconnect hose assembly of nitrogen charging kit from valve (7).
9. Install cap (9) on valve (7) of steering accumulator (8).
10. Perform a soapsuds leak check at valve end of steering accumulator (8).
11. Install valve protector (5) to valve end of steering accumulator (8) with two screws (6).

END OF WORK PACKAGE

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WHEEL AND TIRE REPLACEMENT 0042 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Chain assembly (Item 12, WP 0090 00)

Jack kit, hydraulic (Item 51, WP 0090 00) (2)

Sling, nylon (Item 85, WP 0090 00)

Truck, forklift

Tools and Special Tools - Continued

Wrench set, socket, impact (Item 96, WP 0090 00)

Wrench, impact, pneumatic (Item 100, WP 0090 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Personnel Required

Two

Equipment Condition

Vehicle parked on level, hard surface

WARNING

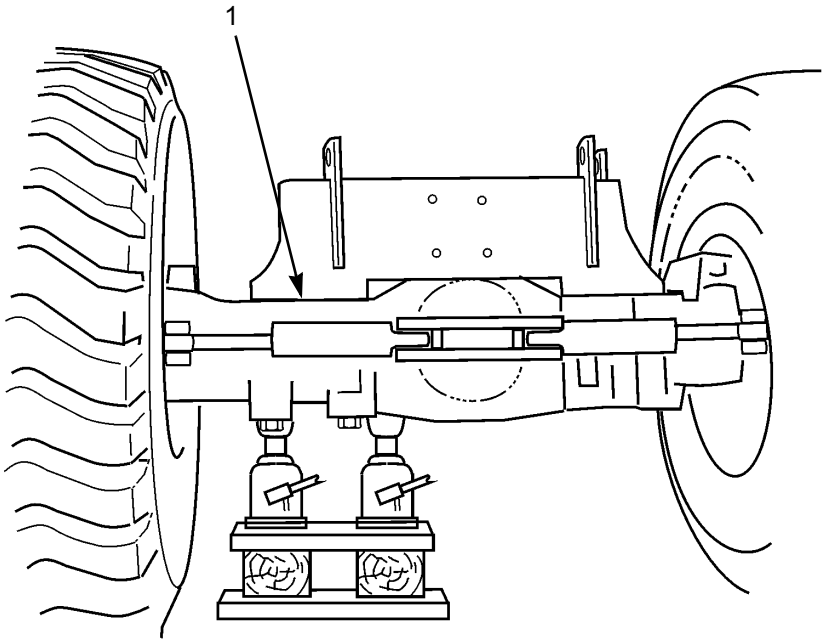
- Hydraulic jacks are intended only for lifting RTCH, not for supporting vehicle to perform maintenance. DO NOT get under vehicle after it is raised unless it is properly supported with blocks or other suitable cribbing. Failure to observe this warning may result in death or injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

REMOVAL

NOTE

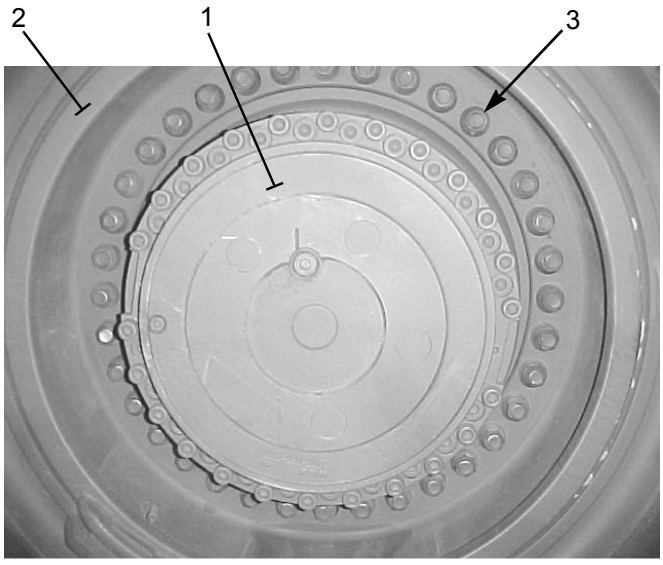
Use two 20-ton jacks placed side-by-side on wood blocks to raise end of front or rear axle.

1. Position two hydraulic jacks on wood blocks under axle (1). Raise jacks to contact bottom of axle.



350-1345

2. Using wood blocks, chock tires of wheels NOT being removed.
3. Raise jacks to lift wheel and tire assembly (2) clear of ground. Place wood blocks under axle (1).



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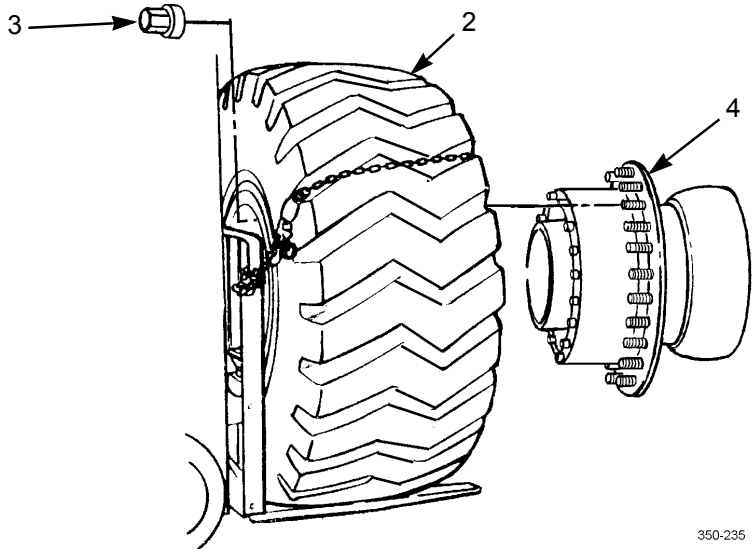
REMOVAL - CONTINUED

4. Using forklift truck, support wheel and tire assembly (2).
5. Secure wheel and tire assembly (2) to forklift truck with chain assembly.
6. Remove 36 nuts (3) to separate wheel and tire assembly (2) from axle flange (4).
7. Attach nylon sling to wheel and tire assembly (2). Attach nylon sling to overhead lifting device.
8. Remove chain assembly and lift wheel and tire assembly (2) from forklift truck.



INSTALLATION

1. Attach nylon sling to wheel and tire assembly (2) and attach nylon sling to overhead lifting device.
2. Lift wheel and tire assembly (2) and place on forklift truck. Secure wheel and tire assembly to forklift truck with chain assembly.
3. Move wheel and tire assembly (2) to vehicle and install wheel and tire assembly to axle flange (4) with 36 nuts (3).
4. Remove chain assembly and move forklift truck away from vehicle.
5. Remove wood blocks from under axle (1) and lower wheel and tire assembly (2) to ground. Remove hydraulic jacks.
6. Tighten 36 nuts (3) to 479 lb-ft (650 Nm).
7. Remove wood blocks from tires not replaced.

END OF WORK PACKAGE

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BOGIE WHEEL ASSEMBLY MAINTENANCE 0043 00

THIS WORK PACKAGE COVERS

Bogie Wheel: Removal, Installation
Hydraulic Cylinders: Removal, Installation
Screw Assembly: Removal, Installation
Bogie Wheel Frame: Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Personnel Required

Two

References

LO 10-3930-675-12

TM 9-2610-200-14

TM 10-3930-675-10

Equipment Condition

Wheels chocked

Cab in transport position (TM 10-3930-675-10)

Hydraulic system pressure relieved (TM 10-3930-675-20)

BOGIE WHEEL REMOVAL

1. Lower bogie wheels (2) (TM 10-3930-675-10) until wheels touch ground.

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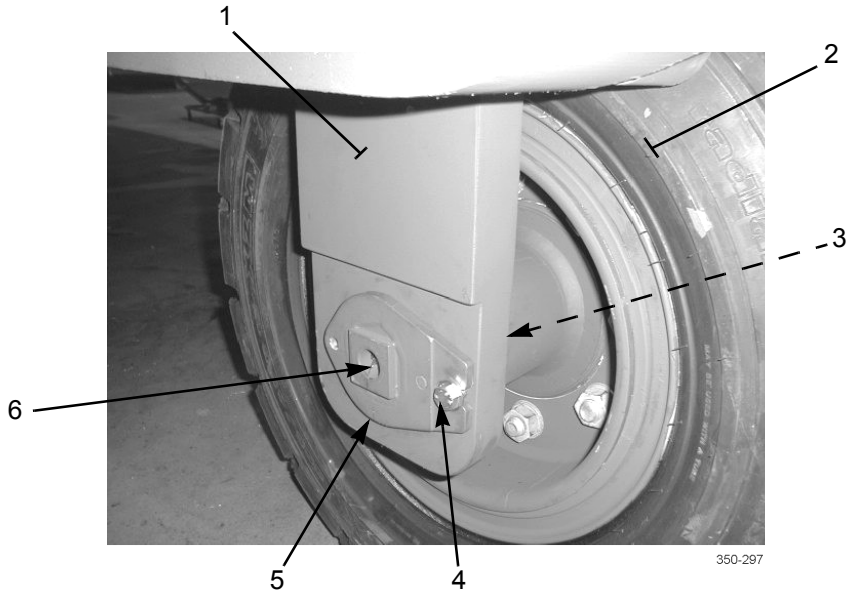
BOGIE WHEEL REMOVAL - CONTINUED

NOTE

Perform steps 3 thru 5 for each of two bogie wheels.

2. Remove allen head screw (4) from end of axle shaft (5).
3. Rotate axle shaft (5) 180 degrees and remove axle shaft, bogie wheel (2), and two o-rings (3) from frame (1). Retain o-rings if not damaged.
4. Remove grease fitting (6) from axle shaft (5).
5. Roll bogie wheel (2) away from vehicle.



6. For tire maintenance, refer to TM 9-2610-200-14.

BOGIE WHEEL INSTALLATION

1. Roll bogie wheel (2) to vehicle.

NOTE

Perform steps 2 thru 6 for each of two bogie wheels.

2. Temporarily place one o-ring (3) on each side of bogie wheel (2) hub and position bogie wheel to frame (1).
3. Install grease fitting (6) to end of axle shaft (5).
4. Apply coat of grease to bearing surface of axle shaft (5) and install axle shaft thru frame (1) and bogie wheel (2). Rotate axle shaft, as necessary, until fully seated.
5. Rotate axle shaft (5) an additional 180 degrees and install allen head screw (4).
6. Move each of two o-rings (3) over to snap into notch between wheel (2) hub and frame (1).

BOGIE WHEEL INSTALLATION - CONTINUED

7. Start engine (TM 10-3930-675-10).
8. Lubricate bogie wheels (LO 10-3930-675-12).
9. Raise bogie wheels (2) (TM 10-3930-675-10).

HYDRAULIC CYLINDERS REMOVAL

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connectors prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

Tag hydraulic lines for installation.

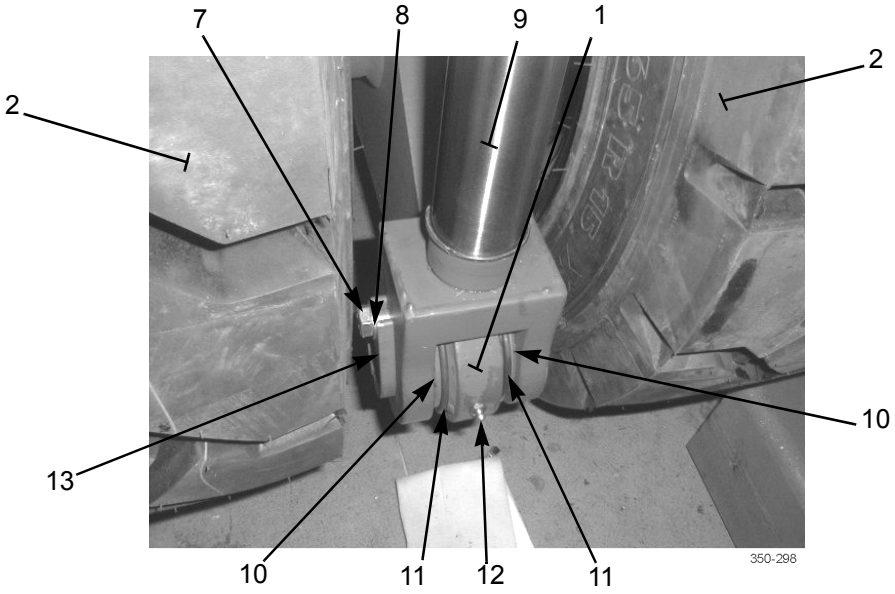
1. Remove bogie wheels (refer to *Bogie Wheel Removal*).

HYDRAULIC CYLINDERS REMOVAL - CONTINUED

NOTE

If bogie wheel frame is to be removed from vehicle after hydraulic cylinders are removed, support bogie wheel frame with nylon sling and overhead lifting device instead of wood blocks.

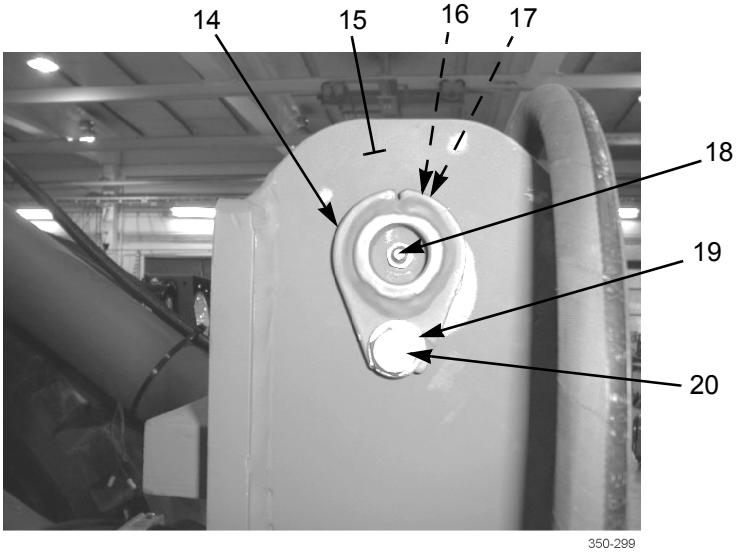
2. Support frame (1) with wood blocks.
3. Disconnect hydraulic hoses from each of two hydraulic cylinders (9).



NOTE

Perform steps 4 thru 6 at top end of each hydraulic cylinder.

4. Remove screw (20) and washer (19) from end of upper pin (14).
5. Remove upper pin (14), two washers (16), and o-rings (17) from vehicle frame (15). Retain o-rings if not damaged.
6. Remove grease fitting (18) from upper pin (14).



HYDRAULIC CYLINDERS REMOVAL - CONTINUED

NOTE

Perform steps 7 and 8 at bottom end of each hydraulic cylinder.

7. Remove screw (7) and washer (8) from end of lower pin (13).
8. Remove lower pin (13), two washers (10), and o-rings (11) from frame (1) and hydraulic cylinders (9). Remove hydraulic cylinder. Retain o-rings if not damaged.
9. Remove grease fitting (12) from frame (1) as necessary.

HYDRAULIC CYLINDERS INSTALLATION

1. If removed, install grease fitting (12) to frame (1).
2. Position two hydraulic cylinders (9) to vehicle.

NOTE

Perform steps 3 and 4 at lower end of each hydraulic cylinder.

3. Install two o-rings (11), washers (10) and hydraulic cylinder (9) to frame (1) and install lower pin (13).
4. Install washer (8) and screw (7) to end of lower pin (13).

NOTE

Perform steps 5 thru 7 at upper end of each hydraulic cylinder.

5. Install grease fitting (18) to upper pin (14).
6. Install two o-rings (17), washers (16), and hydraulic cylinder (9) to vehicle frame (15) and install upper pin (14).
7. Install washer (19) and screw (20) to end of upper pin (14).
8. Connect hydraulic hoses to each of two hydraulic cylinders (9).

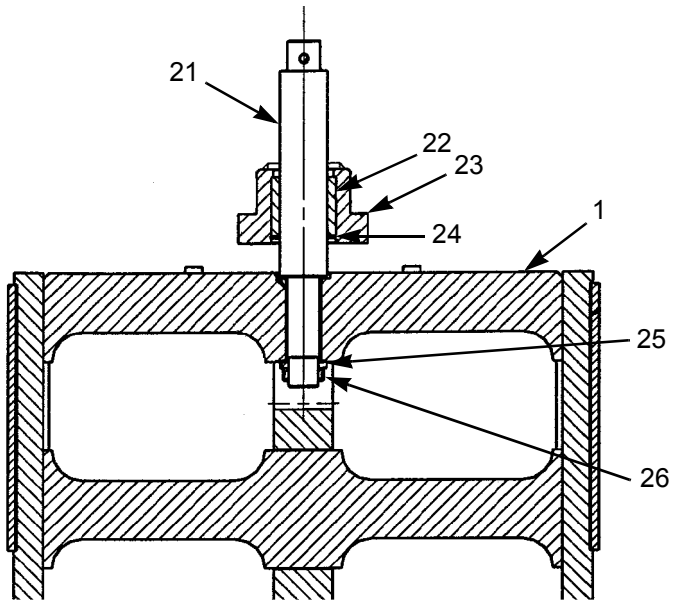
NOTE

Remove wood blocks, or nylon sling and overhead lifting device, as bogie wheels are installed.

9. Install bogie wheels (2) (refer to *Bogie Wheel Installation*).
10. Apply grease to grease fittings (LO 10-3930-675-12).
11. Check level of oil in hydraulic reservoir (LO 10-3930-675-12).
12. Raise bogie wheels (TM 10-3930-675-10).

SCREW ASSEMBLY REMOVAL

1. Lower bogie wheels (TM 10-3930-675-10).
2. Remove two locknuts (26) and ring (25) from lower end of screw (21).
3. Lift screw (21) assembly out of frame (1).
4. Remove swivel lock (23) assembly from screw (21).
5. Remove retaining ring (24) from swivel lock (23) and press out nut (22).



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SCREW ASSEMBLY INSTALLATION

1. Press nut (22) into swivel lock (23) and install retaining ring (24).
2. Install swivel lock (23) assembly to screw (21).
3. Position screw (21) assembly to frame (1).

NOTE

After installation of ring and two locknuts, screw must be able to rotate freely in frame. Adjust position of two locknuts as necessary.

4. Install ring (25) and two locknuts (26) to lower end of screw (21). Tighten one locknut against the other.
5. Apply grease to frame grease fitting (LO 10-3930-675-12).
6. Raise bogie wheels (TM 10-3930-675-10).

BOGIE WHEEL FRAME REMOVAL

NOTE

To remove bogie wheel frame, clearance between ground and vehicle frame at rear of vehicle must be at least 40 in (100 cm). Position rear of vehicle on ramps or over maintenance location that provides proper clearance.

1. Remove hydraulic cylinders (refer to *Hydraulic Cylinders Removal*).
2. Remove screw assembly (refer to *Screw Assembly Removal*).
3. Lower frame (1) to ground and remove nylon sling.
4. Remove frame (1) from under vehicle.

BOGIE WHEEL FRAME INSTALLATION

1. Position frame (1) under vehicle.
2. Install nylon sling to top of frame (1) and attach nylon sling to overhead lifting device.
3. Raise frame (1) and guide frame into vehicle.
4. Continue to raise frame (1) until frame is positioned into vehicle.
5. Install screw assembly (refer to *Screw Assembly Installation*).
6. Install hydraulic cylinders (refer to *Hydraulic Cylinders Installation*).
7. Remove nylon sling with overhead lifting device from top of frame (1) and position vehicle on level ground.

END OF WORK PACKAGE

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STEERING COLUMN REPAIR 0044 00

THIS WORK PACKAGE COVERS

Disassembly, Assembly

INITIAL SETUP

Maintenance Level

Direct Support

Equipment Condition

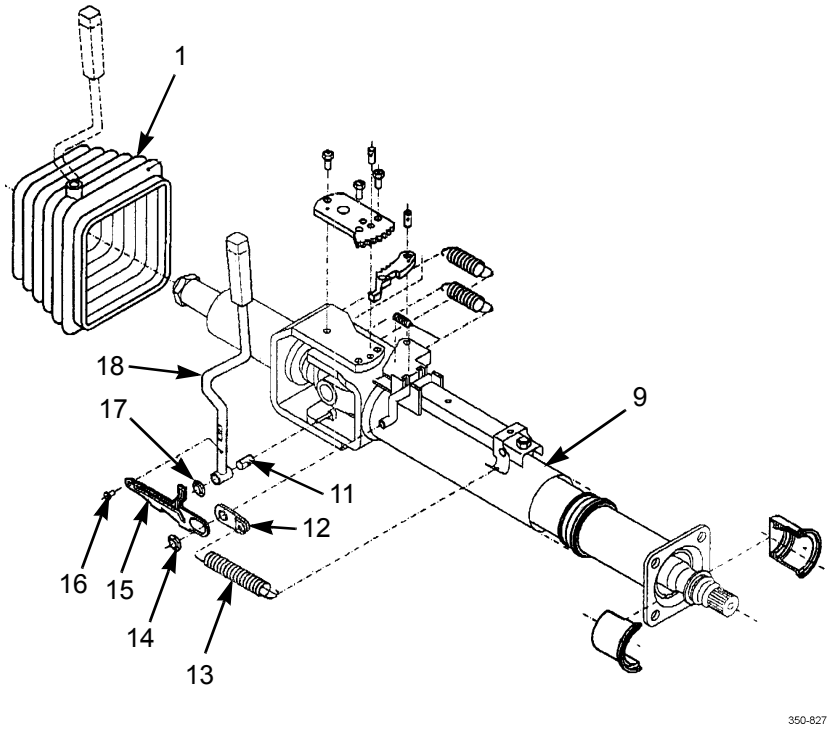
Steering column removed (TM 10-3930-675-20)

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

DISASSEMBLY

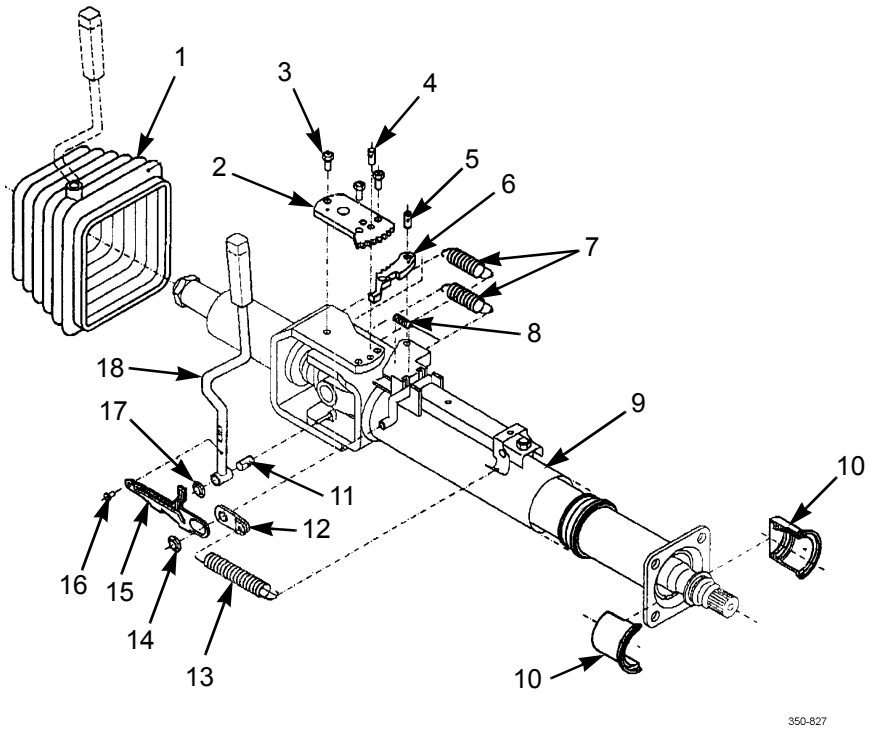
1. Lift edge of rubber bellows (1) to expose inner end of tilt lever (18).



2. Remove screw (16) to disconnect end of link (15) from tilt lever (18).
3. Remove nut (17), tilt lever (18), and rubber bellows (1) from steering column (9). Remove rubber bellows and bushing (11) from tilt lever.
4. Remove pushnut (14), link (15), connector (12), and spring (13) from steering column (9).

DISASSEMBLY - CONTINUED

5. Remove two springs (7).
6. Remove three screws (3), plate (2), and pin (4).
7. Remove locking plate (6), pin (5), and spring (8).
8. Remove two halves of bearing (10) from end of steering column (9).



ASSEMBLY

1. Install two halves of bearing (10) to end of steering column (9).
2. Install spring (8), pin (5), and locking plate (6) to steering column (9).
3. Install pin (4) and plate (2) with three screws (3).
4. Install two springs (7).
5. Install spring (13), connector (12), link (15), and pushnut (14).
6. Install bushing (11) to tilt lever (18) and position tilt lever thru rubber bellows (1).
7. Install tilt lever (18), with rubber bellows (1), to steering column (9) with nut (17).
8. Connect end of link (15) to tilt lever (18) with screw (16).
9. Install steering column (TM 10-3930-675-20).

END OF WORK PACKAGE

TOPHANDLER AND STEERING HYDRAULIC PUMP ASSEMBLY REPLACEMENT 0045 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Nut, lock (P/N 920076.003) (3)

Materials/Parts - Continued

O-ring (P/N 920052.011) (2)

O-ring (P/N 3503) (7)

O-ring (P/N 3505)

O-ring (P/N 3507)

O-ring (P/N 5933) (4)

Personnel Required

Two

References

LO 10-3930-675-12

WP 0046 00

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Steering hydraulic system pressure relieved (TM 10-3930-675-20)

Transmission access covers removed (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

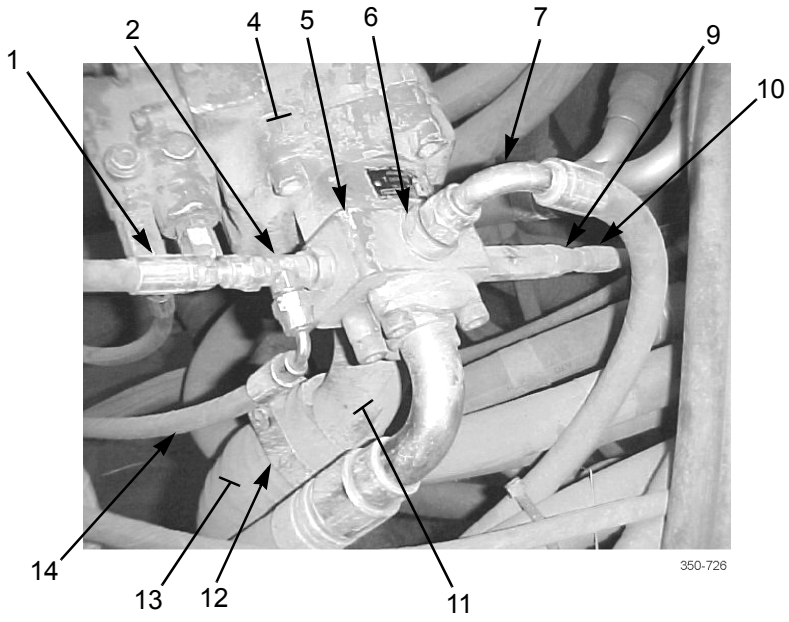
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Remove nylon straps and remove and discard tiedown straps as necessary to gain free movement in hydraulic hoses.
- Tag all hydraulic lines.

REMOVAL

1. Trace two supply hoses (13) under pump (4) back to hydraulic reservoir. Close ball valves in supply hoses at reservoir.
2. Loosen clamp (12) and disconnect supply hose (13) from hose (11). Also loosen two hose clamps and disconnect other supply hose from hose connection.
3. Disconnect hoses (1 and 14) from tee (2).
4. Disconnect hose (7) from fitting (6).
5. Disconnect hose (10) from fitting (9).

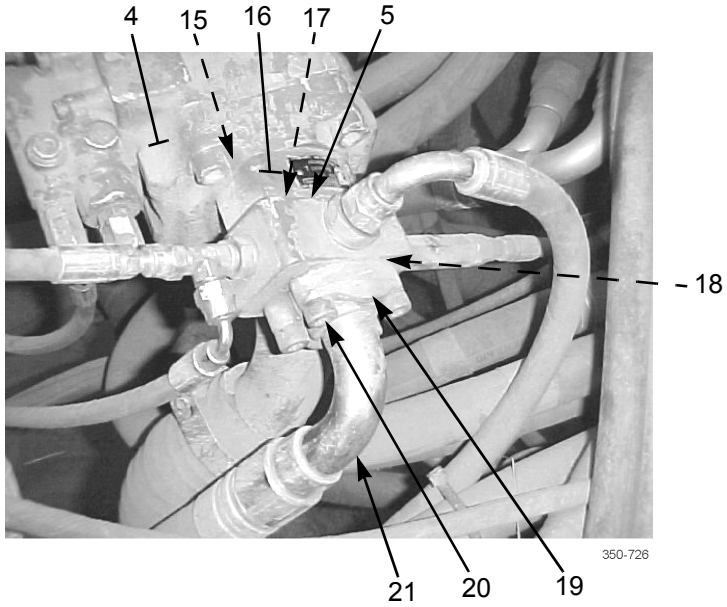


NOTE

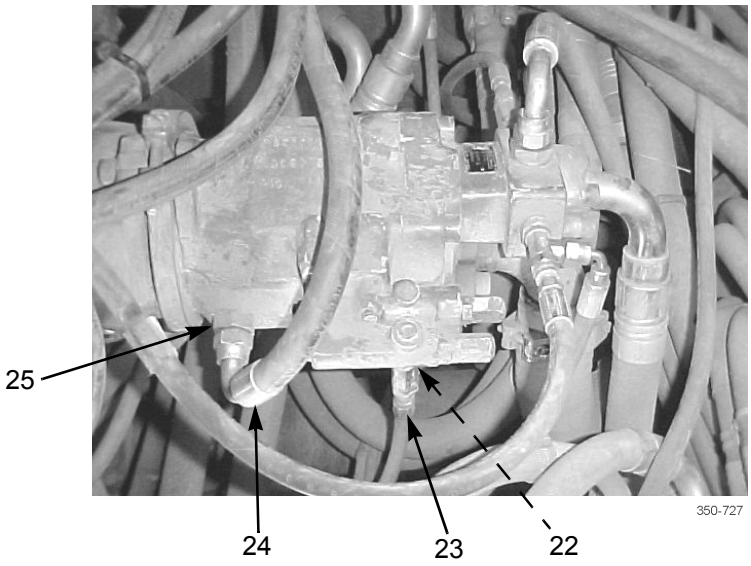
Witness mark terminal block, check valve, and pump to ensure correct installation.

6. Remove four screws (20), flange (19), hose (21), and o-ring (18) from terminal block (5). Discard o-ring.
7. Remove terminal block (5), o-ring (17), check valve (16), and o-ring (15) from pump (4). Discard o-rings.

REMOVAL - CONTINUED

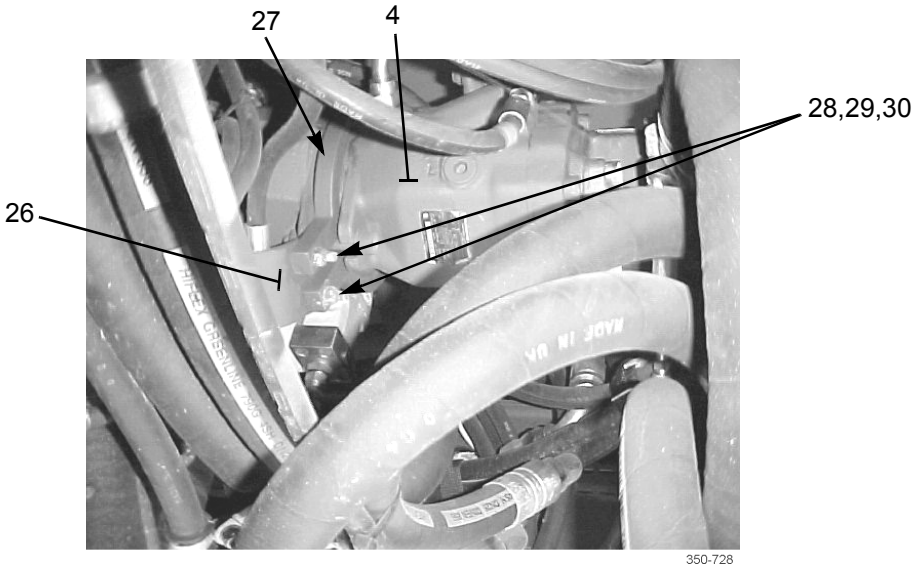


8. Disconnect two hoses (23 and 24) from fittings (22 and 25).

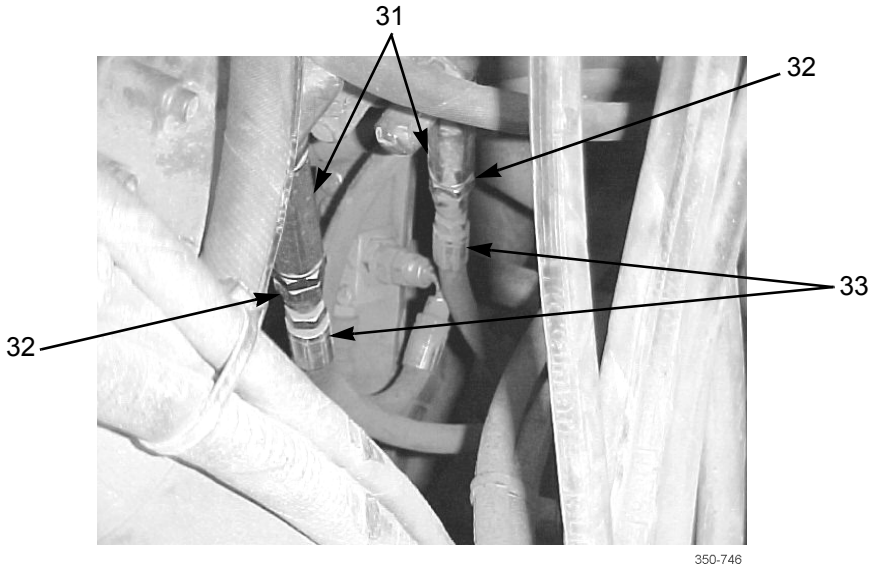


REMOVAL - CONTINUED

9. On underside of pump (4), remove two locknuts (28), washers (29), and screws (30) and release yoke (27) from brace (26). Discard locknuts.



10. Disconnect two hoses (33) from fittings (32) at check valves (31).



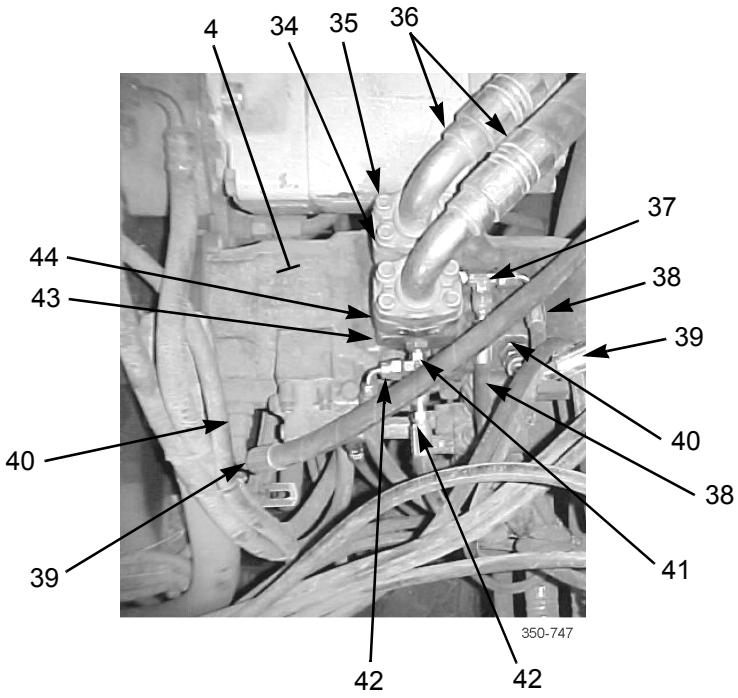
11. Disconnect two hoses (39) from fittings (40).
12. Disconnect two hoses (42) from tee (41).
13. Disconnect two hoses (38) from tee (37).

REMOVAL - CONTINUED

NOTE

Witness mark check valves, terminal block, and pump to ensure correct installation.

14. Remove eight screws (35), two flanges (34), and disconnect two hoses (36) from check valves (44). Remove and discard two o-rings.
15. Remove two check valves (44), terminal block (43), and two o-rings from pump (4). Discard o-rings.

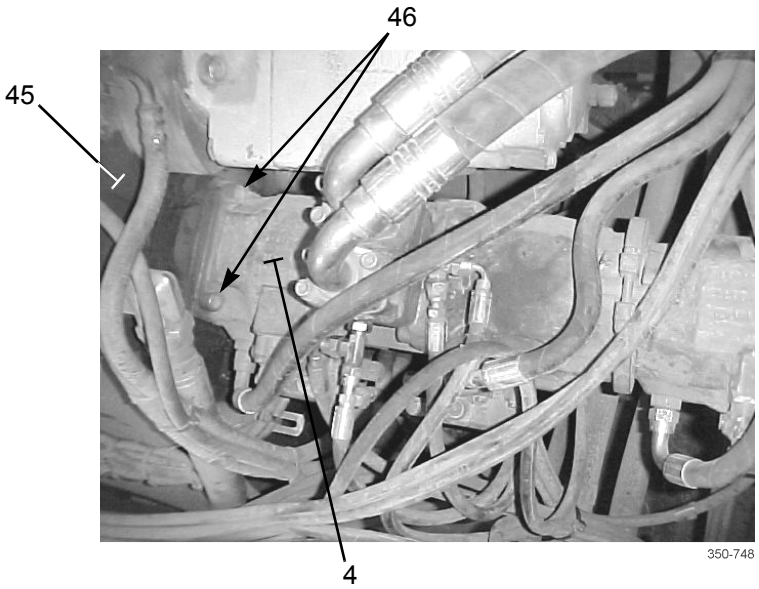


WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury to personnel.

REMOVAL - CONTINUED

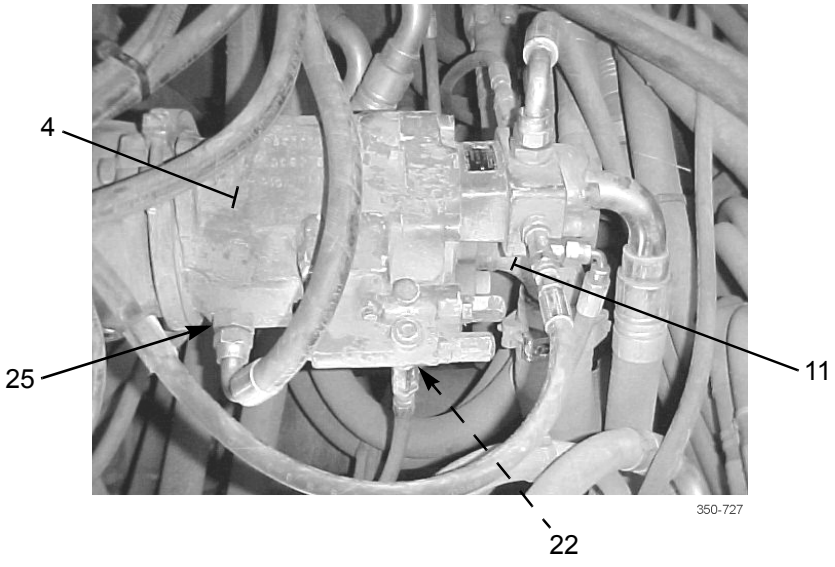
16. Wrap a nylon sling around pump (4) and attach sling to a suitable lifting device.
17. With assistance, remove four screws (46) and pump (4) from transmission (45).



NOTE

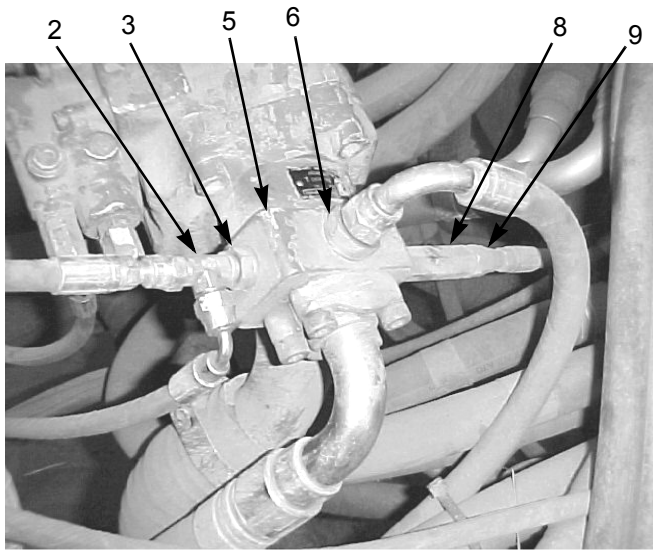
Perform steps 18 thru 25 to remove fittings from pump, if a new pump is being installed.

18. Remove fittings (22 and 25) from pump (4).
19. On underside of pump (4), remove four screws, flange, hose (11), and o-ring. Discard o-ring.



REMOVAL - CONTINUED

20. Remove tee (2), fitting (3), and fitting (6) from terminal block (5).
21. Remove fitting (9), check valve (8), o-ring, adapter, and seal ring from terminal block (5). Discard o-ring.



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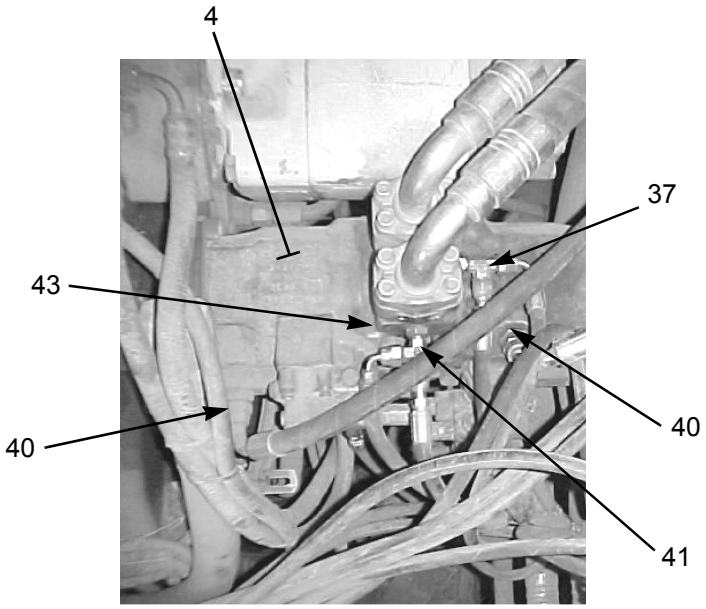
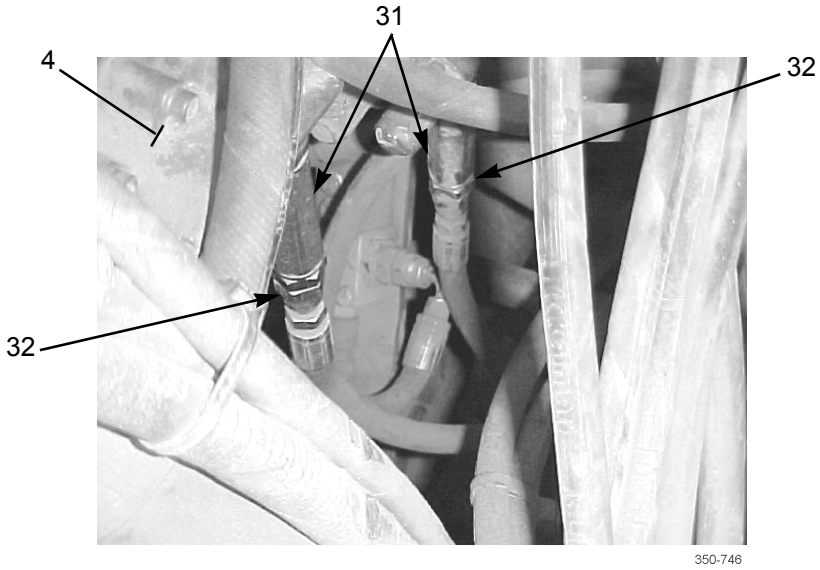
22. Remove two fittings (40) from pump (4).
23. Remove two tees (37 and 41) from terminal block (43).



350-747

REMOVAL - CONTINUED

24. On underside of pump (4), remove two fittings (32), check valves (31), o-rings, nipples, and o-rings. Discard o-rings.
25. On underside of pump (4), remove four screws, flange, hose connection, and o-ring. Discard o-ring.



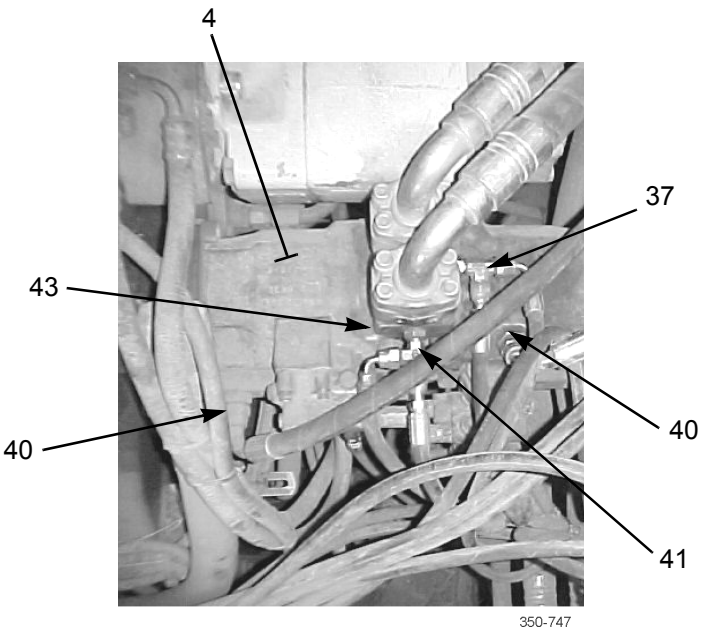
INSTALLATION

NOTE

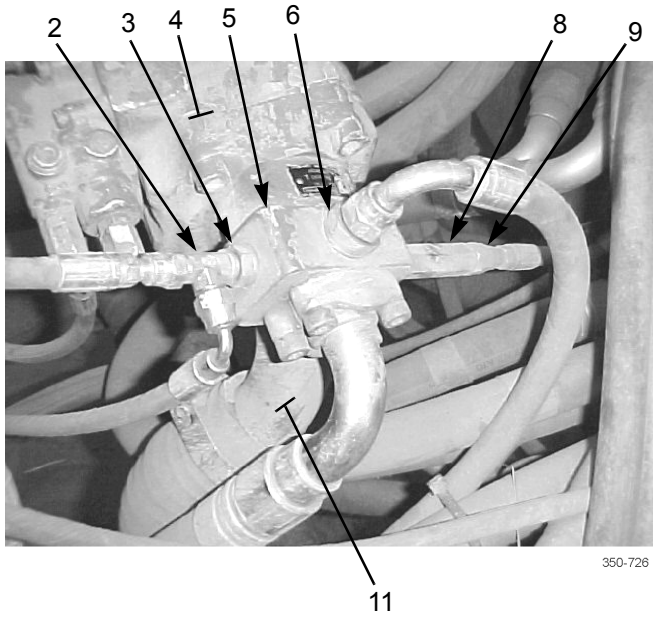
- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform steps 1 thru 8 to install fittings removed from old pump, if a new pump is being installed.
- Lubricate new o-rings with lubricating oil as they are installed.

1. On underside of pump (4), install new o-ring and hose connection with flange and four screws.
2. On underside of pump (4), install two new o-rings, nipples, new o-rings, check valves (31), and fittings (32).
3. Install two tees (37 and 41) to terminal block (43).

INSTALLATION - CONTINUED

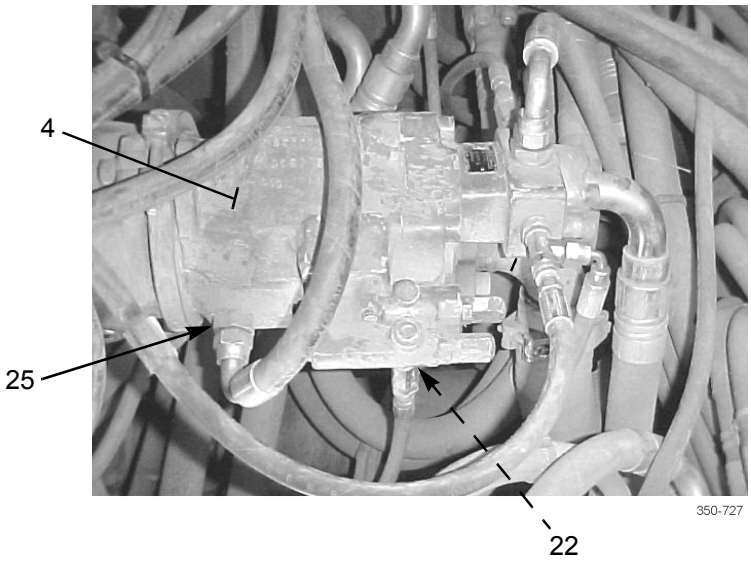


4. Install two fittings (40) to pump (4).
5. Install seal ring, adapter, new o-ring, check valve (8), and fitting (9) to terminal block (5).
6. Install fitting (6), fitting (3), and tee (2) to terminal block (5).
7. On underside of pump (4), install new o-ring and hose (11) with flange and four screws.



INSTALLATION - CONTINUED

8. Install fittings (22 and 25) to pump (4).

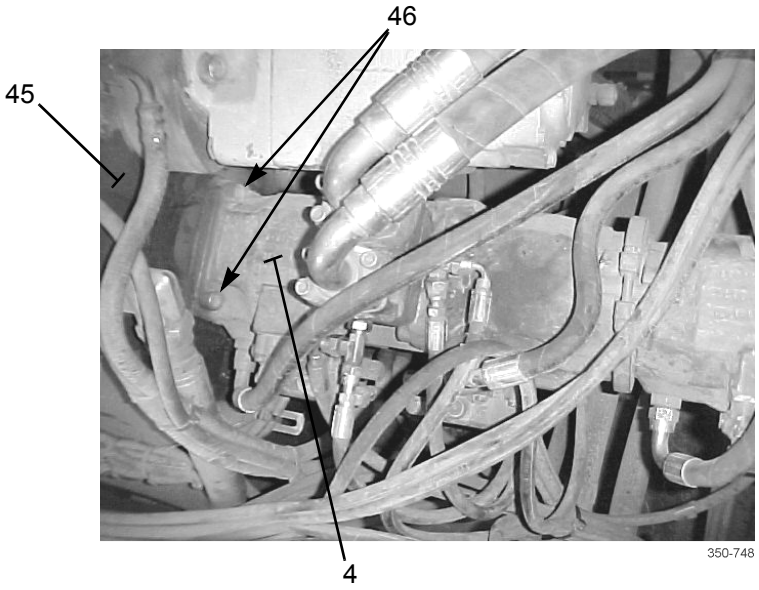


WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury to personnel.

9. Apply sealant to mounting surface of pump (4).
10. With assistance and using a nylon sling, position pump (4) at transmission (45) and install four screws (46).

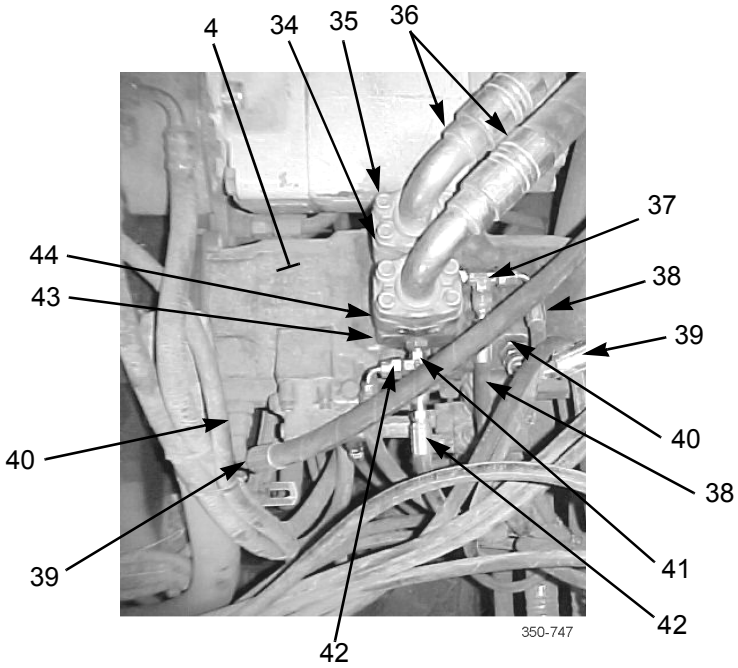
INSTALLATION - CONTINUED



NOTE

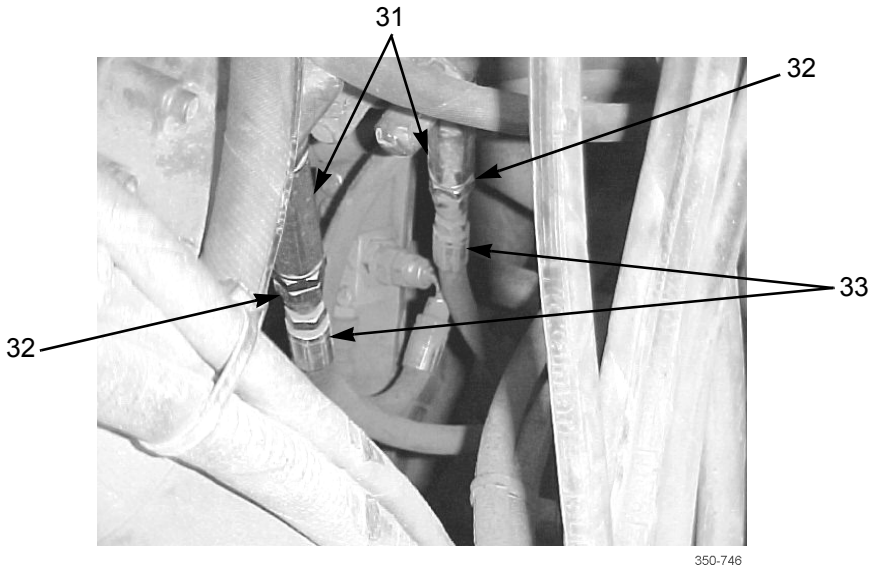
Ensure terminal block and check valves are installed on pump in accordance with witness marks.

11. Assemble two new o-rings, terminal block (43), and two check valves (44) to pump (4). Install two new o-rings and hoses (36) to check valves with two flanges (34) and eight screws (35).
12. Connect two hoses (38) to tee (37).
13. Connect two hoses (42) to tee (41).
14. Connect two hoses (39) to fittings (40).

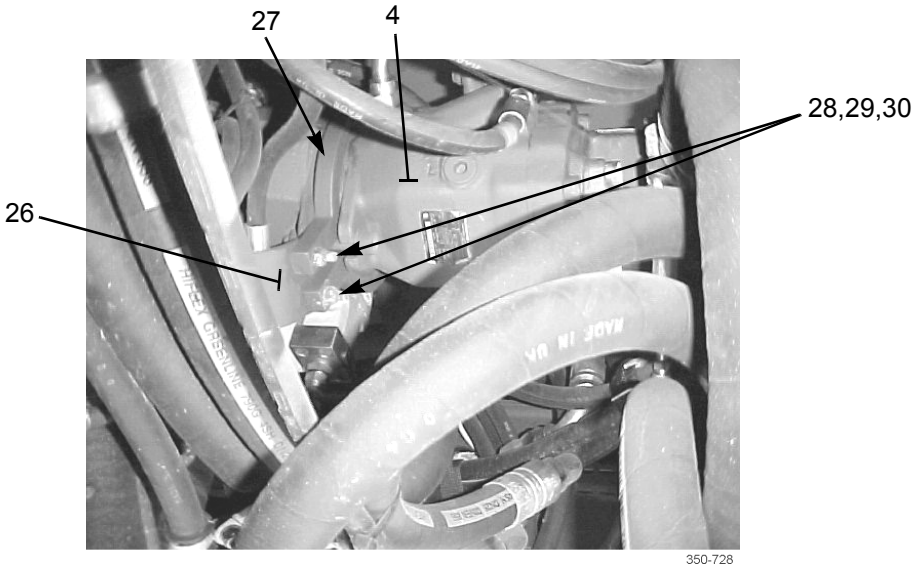


INSTALLATION - CONTINUED

15. Connect two hoses (33) to fittings (32) at check valves (31).

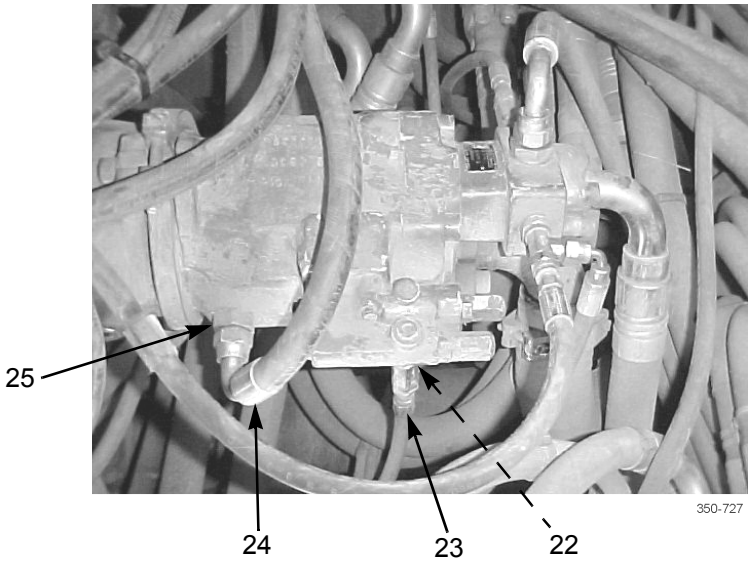


16. Secure yoke (27) to brace (26) on underside of pump (4) with two screws (30), washers (29), and new locknuts (28).



INSTALLATION - CONTINUED

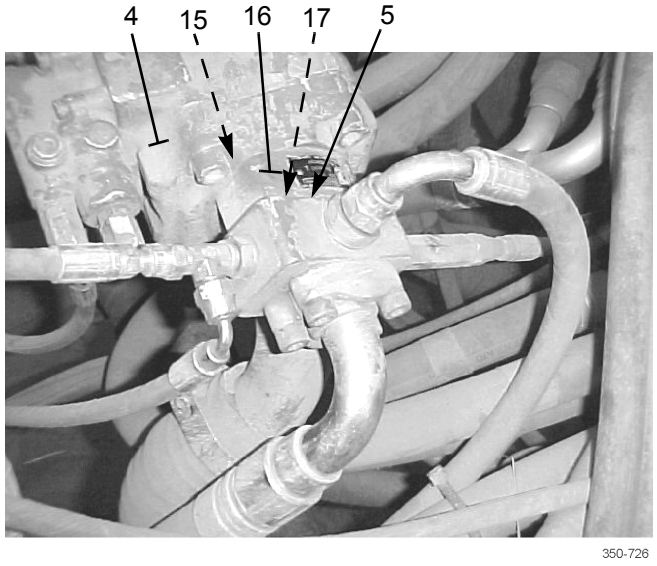
17. Connect two hoses (23 and 24) to fittings (22 and 25).



NOTE

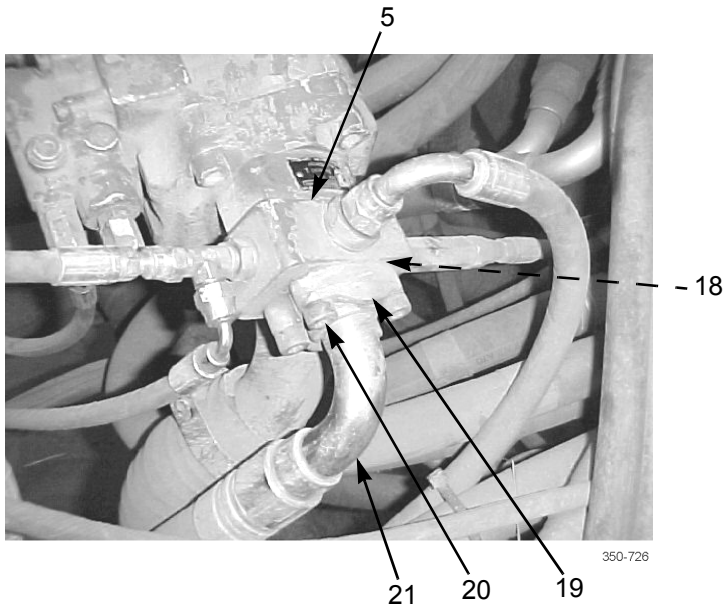
Ensure check valve and terminal block are installed on pump in accordance with witness marks.

18. Assemble new o-ring (15), check valve (16), new o-ring (17), and terminal block (5) to pump (4).

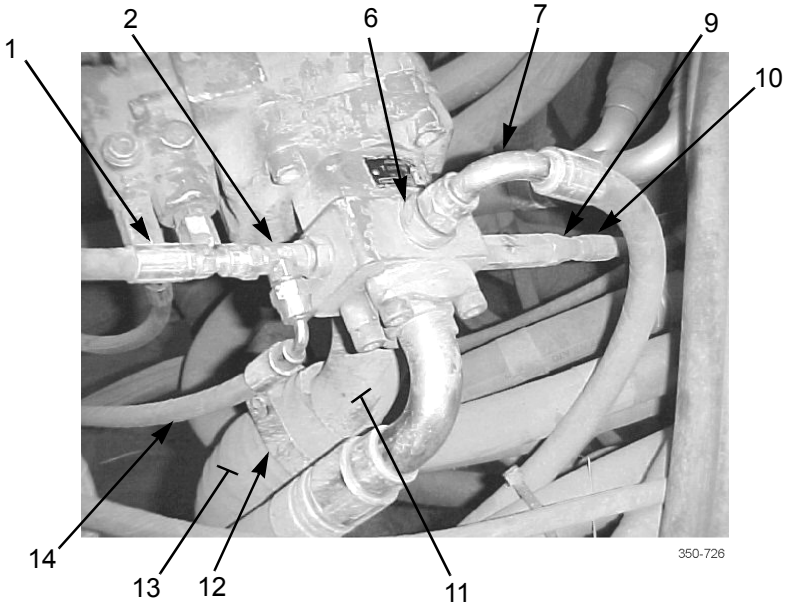


INSTALLATION - CONTINUED

19. Install new o-ring (18) and hose (21) to terminal block (5) with flange (19) and four screws (20).



20. Connect hose (10) to fitting (9).
21. Connect hose (7) to fitting (6).
22. Connect hoses (1 and 14) to tee (2).
23. Connect supply hose (13) to hose (11) and tighten clamp (12). Also connect other supply hose to hose connection and tighten two hose clamps.
24. Open two ball valves at reservoir for supply hoses (13).



INSTALLATION - CONTINUED

25. Check oil level in hydraulic reservoir (LO 10-3930-675-12).

CAUTION

Failure to prime pump assembly may damage pump.

26. Trace and locate return hoses for pump assembly at top of hydraulic reservoir. Disconnect return hoses and fill hoses with hydraulic fluid. Reconnect hoses.
27. Start engine (TM 10-3930-675-10), operate tophandler and steering systems, and check for leaks.
28. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
29. If a new tophandler and steering pump assembly was installed, adjust each pump (WP 0046 00).
30. Install nylon straps and new tiedown straps as necessary to support hydraulic hoses.
31. Install transmission access covers (TM 10-3930-675-20).
32. Return cab to operational position (TM 10-3930-675-10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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TOPHANDLER AND STEERING HYDRAULIC PUMPS ADJUSTMENT 0046 00

THIS WORK PACKAGE COVERS

Standby and Operating Hydraulic Pressure Adjustment:
Tophandler Pump, Steering Pumps No. 1 and 2

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Personnel Required

Two

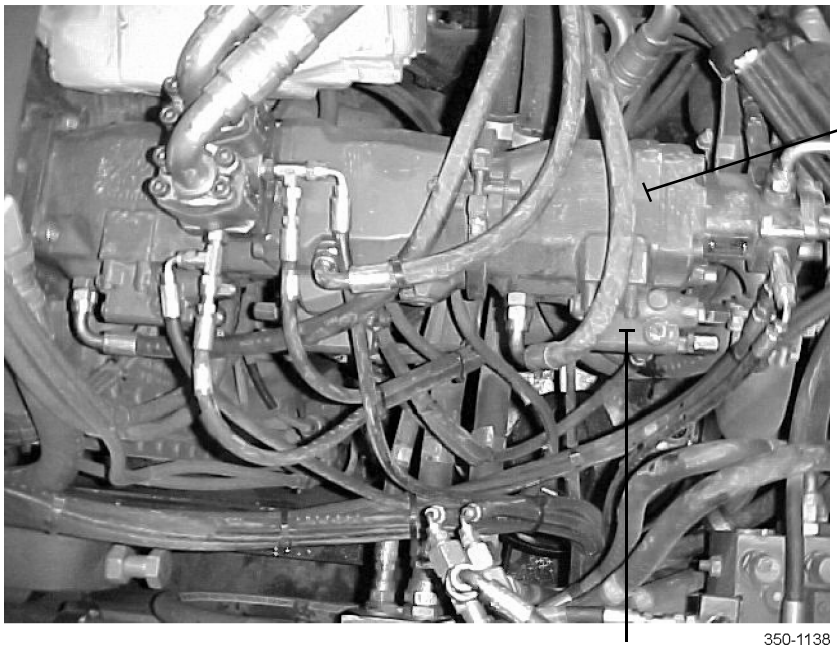
Equipment Condition

Cab moved to the left, but not lowered (TM 10-3930-675-10)

Steering hydraulic system pressure relieved (TM 10-3930-675-20)

Transmission access covers removed (TM 10-3930-675-20)

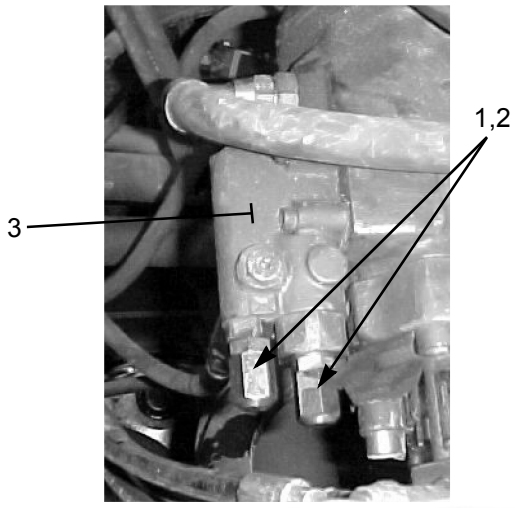
TOPHANDLER PUMP STANDBY AND OPERATING HYDRAULIC PRESSURE ADJUSTMENT



1. Access maintenance diagnostic menus by entering diagnostic code "12443" into driver's ECS display panel (TM 10-3930-675-10).
2. Using left/right arrows, locate DIAG EXTRA FUNCT menu, then press "Enter".
3. Using left/right arrow, locate EXTRA FUNCT screen 2 (13) and press "+" button to turn OFF hydraulic pumps.
4. Connect hydraulic pressure test gage to hydraulic test point no. 11 (TM 10-3930-675-20).

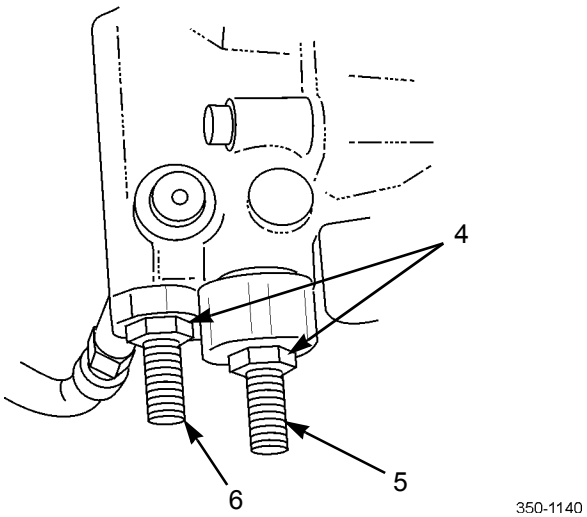
TOPHANDLER PUMP STANDBY AND OPERATING HYDRAULIC PRESSURE ADJUSTMENT - CONTINUED

5. Remove protective caps (1) and washers (2) from tophandler pump adjusting valves (3).



350-1139

6. Start engine (TM 10-3930-675-10).
7. Note tophandler standby hydraulic pressure on test gage. Pressure should be 261 psi (18 bar):
   a. If pressure is correct, no adjustment is required.
   b. If pressure is not correct, loosen adjusting screw jamnut (4) and turn adjusting screw (6) inward to increase pressure and outward to decrease pressure. Secure adjusting screw with jamnut.



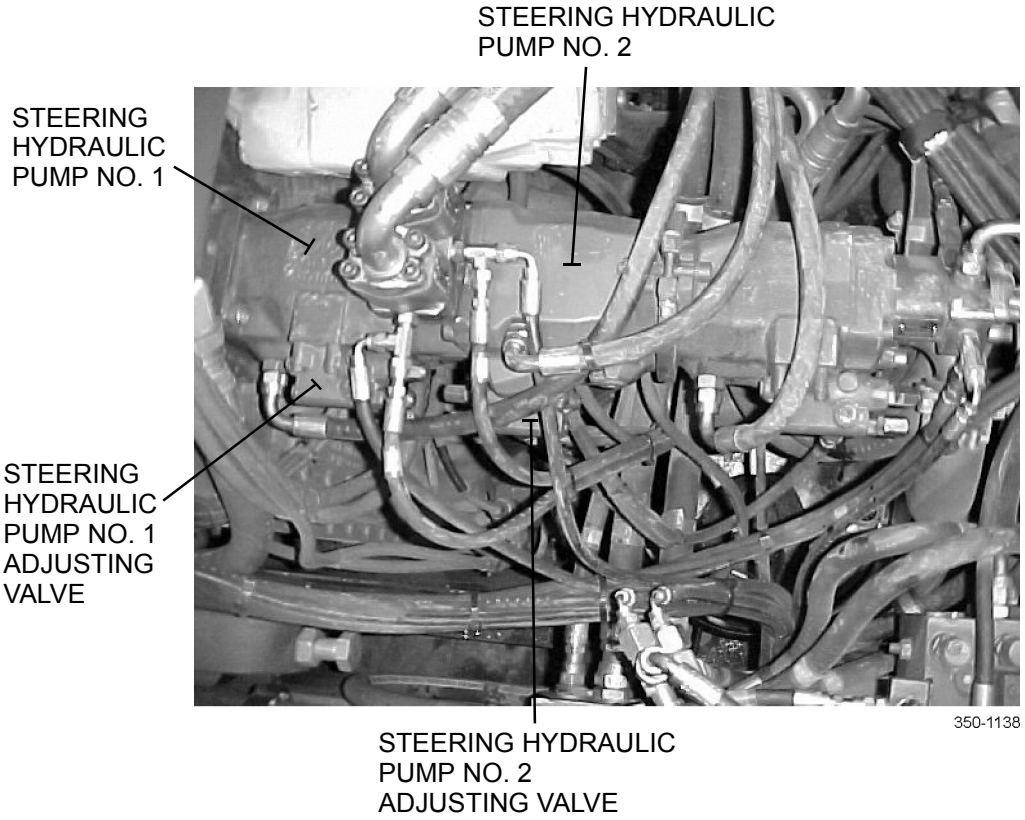
350-1140

8. At EXTRA FUNCT screen 2 (13), press "-" button to turn ON hydraulic pumps.

TOPHANDLER PUMP STANDBY AND OPERATING HYDRAULIC PRESSURE ADJUSTMENT - CONTINUED

9. Note tophandler operating hydraulic pressure on test gage. Pressure should be 3045 psi (210 bar):
   a. If pressure is correct, no adjustment is required.
   b. If pressure is not correct, loosen adjusting screw jamnut (4) and turn adjusting screw (5) inward to increase pressure and outward to decrease pressure. Secure adjusting screw with jamnut.
10. Shut down engine.
11. Reinstall washers (2) and protective caps (1) on adjusting screws (5 and 6).
12. Relieve hydraulic system pressure (TM 10-3960-675-20).
13. Disconnect hydraulic test gage.

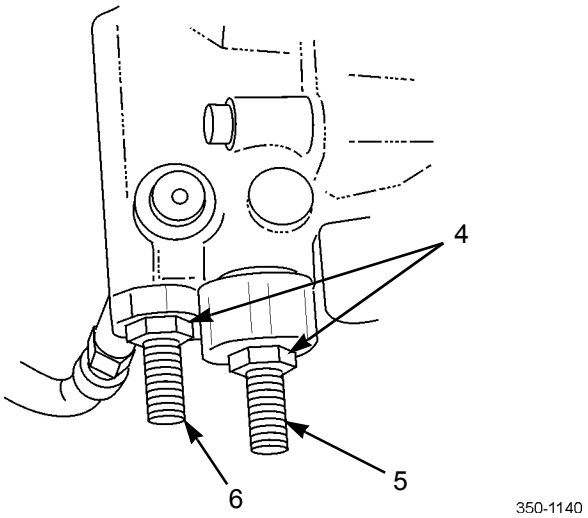
STEERING PUMPS NO. 1 AND 2 STANDBY AND OPERATING HYDRAULIC PRESSURE ADJUSTMENT



1. Access maintenance diagnostic menus by entering diagnostic code “12443” into driver’s ECS display panel (TM 10-3930-675-10).
2. Using left/right arrows, locate DIAG EXTRA FUNCT menu, then press “Enter”.
3. Using left/right arrow, locate EXTRA FUNCT screen 2 (13) and press “+” button to turn OFF hydraulic pumps.
4. Connect hydraulic pressure test gage to hydraulic test point no. 6 for steering pump no. 1 or test point no. 7 for steering pump no. 2 (TM 10-3930-675-20).
5. Remove protective caps (1) and washers (2) from steering pump adjusting valves (3).

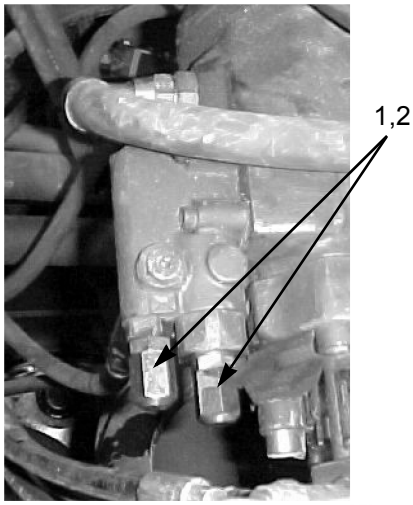
STEERING PUMPS NO. 1 AND 2 STANDBY AND OPERATING HYDRAULIC PRESSURE ADJUSTMENT - CONTINUED

6. Start engine (TM 110-3930-675-10).
7. Note steering pump standby hydraulic pressure on test gage. Pressure should be 261 psi (18 bar):
   a. If pressure is correct, no adjustment is required.
   b. If pressure is not correct, loosen adjusting screw jamnut (4) and turn adjusting screw (6) inward to increase pressure and outward to decrease pressure. Secure adjusting screw with jamnut.



8. At EXTRA FUNCT screen 2 (13), press "-" button to turn ON hydraulic pumps.
9. Note steering pump operating hydraulic pressure on test gage. Pressure should be 3045 psi (210 bar):
   a. If pressure is correct, no adjustment is required.
   b. If pressure is not correct, loosen adjusting screw jamnut (4) and turn adjusting screw (5) inward to increase pressure and outward to decrease pressure. Secure adjusting screw with jamnut.
10. Shut down engine.
11. Reinstall washers (2) and protective caps (1) on adjusting screws (5 and 6).

STEERING PUMPS NO. 1 AND 2 STANDBY AND OPERATING HYDRAULIC PRESSURE ADJUSTMENT - CONTINUED



350-1139

12. Relieve hydraulic system pressure (TM 10-3930-675-20).
13. Disconnect hydraulic test gage.

END OF WORK PACKAGE

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EMERGENCY STEERING PUMP REPLACEMENT 0047 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Wrench, adjustable (Item 99, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Materials/Parts - Continued

Sealant, pipe (Item 26, WP 0089 000)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

O-ring (P/N 923899.0521)

References

LO 10-3930-675-12

Equipment Condition

Steering hydraulic system pressure relieved (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Emergency steering pump is located on lower right rear surface of transmission.
- Tag all hydraulic lines.
- Remove and discard tiedown straps as necessary to gain free movement in hydraulic hoses.

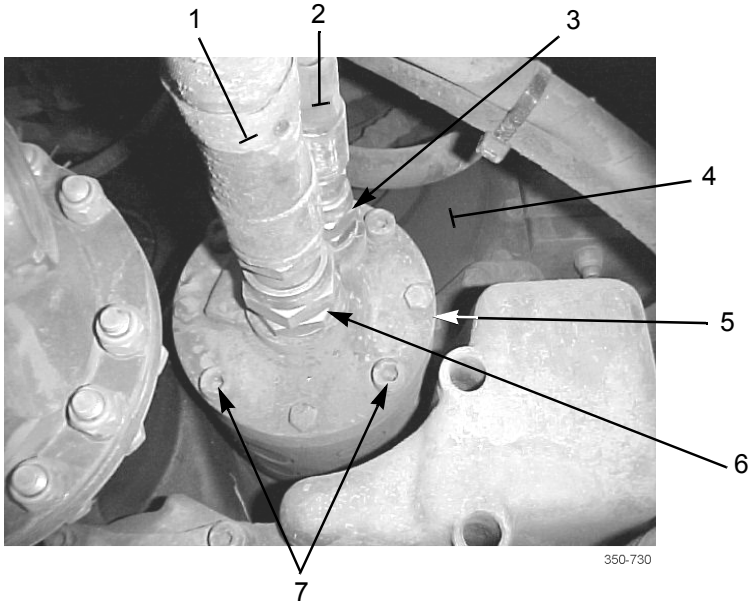
REMOVAL

1. Trace supply hose (1) back to hydraulic reservoir. Close ball valve in supply hose at reservoir.
2. Disconnect hose (2) from fitting (3).
3. Disconnect supply hose (1) from fitting (6).
4. Remove four screws (7) and pump (5) from transmission (4).

NOTE

Perform step 5 to remove fittings from pump, if a new pump is being installed.

5. Remove fittings (3 and 6) from pump (5).



INSTALLATION

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Ensure a light coat of sealant is applied to fitting threads.
- Perform step 1 to install fittings removed from old pump, if a new pump is being installed.

1. Install fittings (3 and 6) to pump (5).
2. Install pump (5) to transmission (4) with four screws (7).
3. Connect supply hose (1) to fitting (6).
4. Connect hose (2) to fitting (3).
5. Open ball valve at reservoir for supply hose (1).
6. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
7. Install new tiedown straps as necessary to support hydraulic hoses.

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

STEERING CONTROL VALVE REPLACEMENT 0048 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Steering hydraulic system pressure relieved (TM 10-3930-675-20)

Transmission access covers removed (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

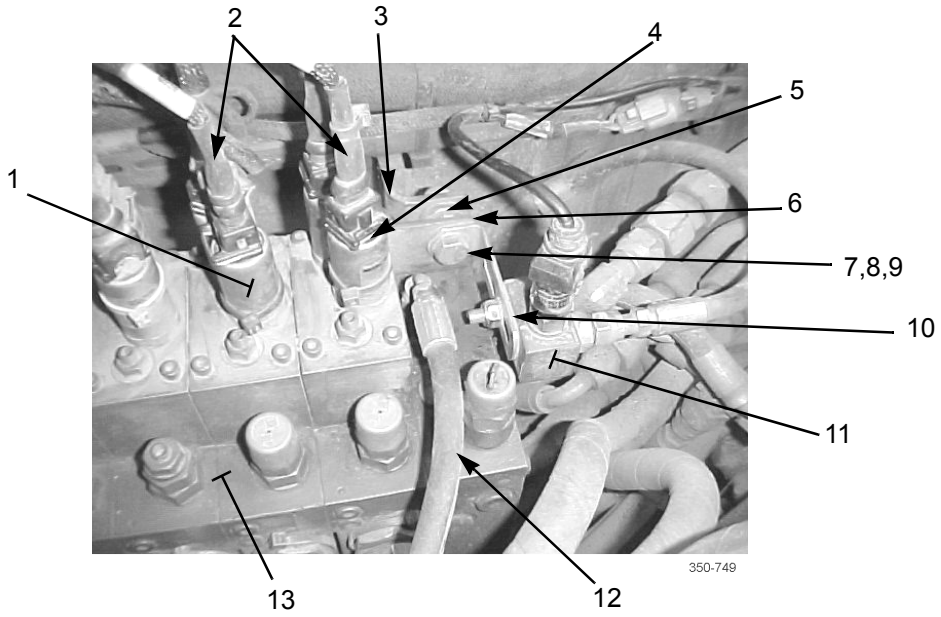
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Tag all hydraulic lines, fittings, and electrical leads.
- Remove and discard tiedown straps as necessary to gain free movement in hydraulic hoses.

REMOVAL

1. Press in on eight retaining clips (4) and disconnect eight electrical leads (2) from solenoids (1).



2. Disconnect 12 hoses (12) from fittings (14) at control valve (13).

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Steering control valve weighs approximately 100 lb (45 kg). Lifting device must have sufficient capacity to lift control valve. Failure to follow this warning may result in injury to personnel.

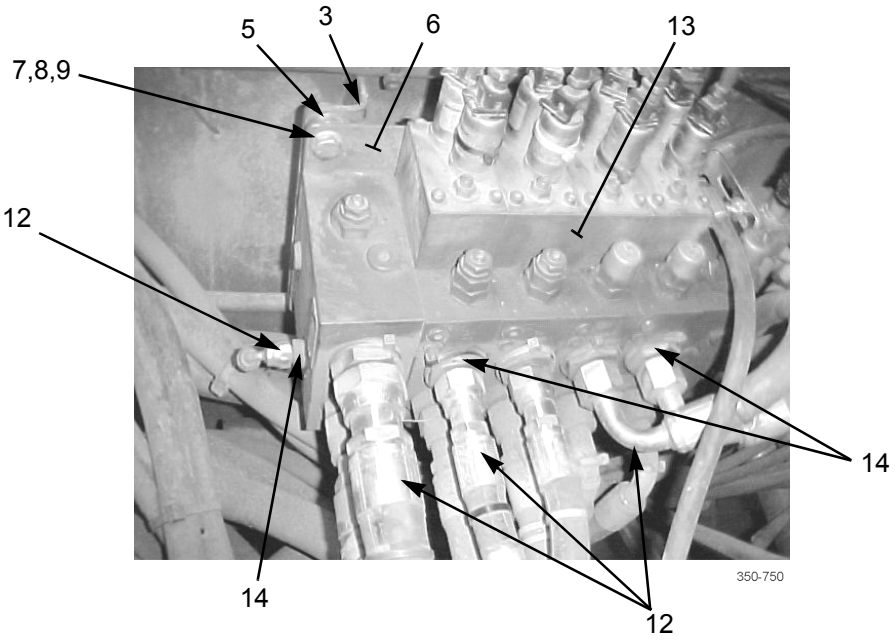
3. Wrap a nylon sling around control valve (13) and attach sling to a suitable lifting device.
4. Remove four nuts (7), screws (8), eight washers (9), spacers (5), and control valve (13) with plate (6) from two welded angle brackets (3). Set solenoid valve (11) with bracket (10) aside.
5. Remove four screws and washers and separate control valve (13) from plate (6).

NOTE

Perform step 6 to remove fittings from control valve, if a new control valve is being installed.

6. Remove 12 fittings (14) from control valve (13).

REMOVAL - CONTINUED



INSTALLATION

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform step 1 to install fittings removed from old control valve, if a new control valve is being installed.

1. Install 12 fittings (14) to control valve (13).
2. Install control valve (13) to plate (6) with four washers and screws.

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Steering control valve weighs approximately 100 lb (45 kg). Lifting device must have sufficient capacity to lift control valve. Failure to follow this warning may result in injury to personnel.

3. With a nylon sling wrapped around control valve (13) and sling supported by a suitable lifting device, position control valve with plate (6) and spacers (5) at two welded angle brackets (3). Position solenoid valve (11) with bracket (10). Install four screws (8), eight washers (9), and four nuts (7).
4. Connect 12 hoses (12) to fittings (14) at control valve (13).
5. Connect eight electrical leads (2) to solenoids (1).

INSTALLATION - CONTINUED

6. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
7. Start engine (TM 10-3930-675-10), operate steering system, and check for leaks.
8. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
9. Install new tiedown straps as necessary to support hydraulic hoses.
10. Install transmission access covers (TM 10-3930-675-20).
11. Return cab to operational position (TM 10-3930-675-10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

STEERING ACCUMULATOR REPLACEMENT 0049 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Nut, lock (P/N 920076.003) (4)

References

LO 10-3930-675-12

WP 0041 00

Equipment Condition

Steering hydraulic system pressure relieved (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

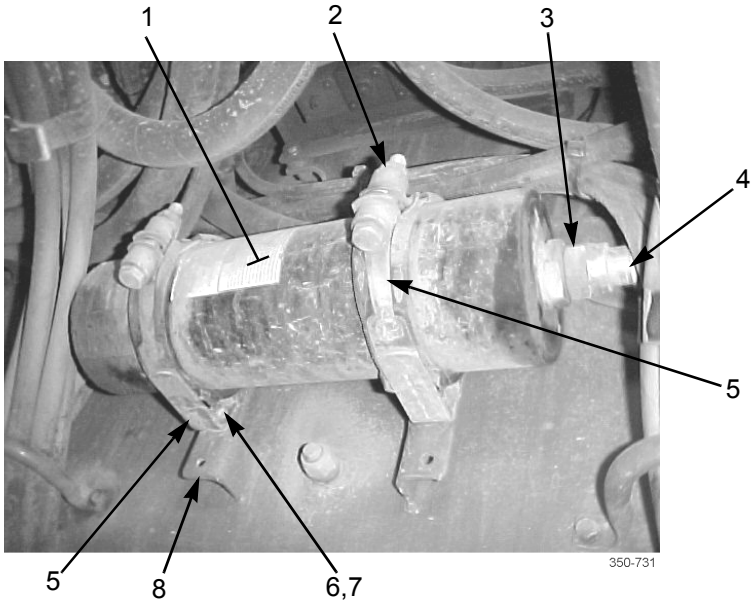
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Steering accumulator is located on inside of left-side frame.
- Remove and discard tiedown straps as necessary to gain free movement in hydraulic hose.

REMOVAL

1. Disconnect hose (4) from fitting (3).
2. Remove two nuts (2) and loosen clamps (5).
3. Remove accumulator (1) from clamps (5).
4. If damaged, remove four locknuts (6), screws (7), and two clamps (5) from welded angle brackets (8). Discard locknuts.
5. If replacing accumulator (1), remove fitting (3) from accumulator.
6. If accumulator is unserviceable, ensure it is drained of nitrogen before disposal (WP 0041 00).



INSTALLATION

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

1. If installing a new accumulator (1), install fitting (3) to accumulator.
2. If removed, install two clamps (5) to welded angle brackets (8) with four screws (7) and new locknuts (6).
3. Position accumulator (1) inside clamps (5) and install and tighten two nuts (2).
4. Connect hose (4) to fitting (3).
5. Verify accumulator pre-charge pressure and charge as required (WP 0041 00).
6. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
7. Start engine (TM 10-3930-675-10), operate steering, and check for leaks.
8. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
9. Install new tiedown straps as necessary to support hydraulic hoses.

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

STEERING CALIBRATION 0050 00

THIS WORK PACKAGE COVERS

Calibration

INITIAL SETUP

Tools and Special Tools

Tape, measuring (Item 89, WP 0090 00)

References

TM 10-3930-675-10

NOTE

- When calibrating the steering system, perform all ten calibration steps in order. DO NOT skip or omit any steps.
- RTCH must be parked on level ground with all wheels pointing straight ahead.
- RTCH wheels are numbered as follows during calibration procedures:
  a. Right-front wheel is no. 1
  b. Right-rear wheel is no. 2
  c. Left-rear wheel is no. 3
  d. Left-front wheel is no. 4

CALIBRATION

1. **Access to Calibration Menus.**
   a. Turn master battery switch to ON position.
   b. Turn ignition ON and start the truck.
   c. Select Kalmar service menu on driver's Electronic Control System (ESC) display screen and press "Enter".
   d. Enter calibration program access number "13221" and press "Enter".
   e. Press right arrow button to locate "CALIBR STEERING" menu, then press "Enter".
2. **Emergency Steering System Turning Speed Calibration (Menu 1 of 10).**
   a. Press value increase "+" or value decrease "-" buttons until a value of "60" is displayed on ECS display screen.
   b. When value of "60 "is displayed, press "Enter". ECS display screen should look like the following:

CALIBR STEERING	1 (10)
TURNING SPEED FOR BUTTON STEERING	60

   c. Press right arrow button to advance thru remaining steering system calibration menus.

CALIBRATION - CONTINUED

3. **Steering System Hydraulic and Electrical Connections Check (Menu 2 of 10).**

   a. Pressing value increase "+" button will result in wheel no.1 (RF) moving to the right and an increase of values on ECS display screen.

   b. Pressing value decrease "-" button will result in wheel no.1 moving to the left and a decrease of values on ECS display screen. ECS display screen should look like the following:

CALIBR STEERING	2 (10)
AXLE 1	
ADJUST WHEEL	X
ANGLE	X

Range 0 +/-5

   c. Press right arrow button to advance thru remaining steering system calibration menus.

4. **Steering Cylinder No. 1 Calibration (Menu 3 of 10).**

   a. Steering cylinders position must be manually checked by measuring cylinder length. Measurement should be taken from center-to-center of cylinder mounting pins. Correct length is 31 5/16 inches (796 mm). If length is incorrect, adjust steering cylinder for wheel no.1 (RF) by pressing increase "+" or decrease "-" buttons.

   b. Press "Enter".

   c. Recheck steering cylinder position. Correct length should be 31 5/16 inches (796 mm).

   d. ECS display screen should look like the following:

CALIBR STEERING	3 (10)
AXLE 1	
SET WHEEL	0
ANGLE	0

   e. Press right arrow button to advance thru remaining steering system calibration menus.

5. **Steering System Hydraulic and Electrical Connections Check (Menu 4 of 10).**

   a. Pressing value increase "+" button will result in wheel no. 2 (RR) moving to the right and an increase of values on ECS display screen.

   b. Pressing value decrease "-" button will result in wheel no. 2 moving to the left and a decrease of values on ECS display screen. ECS display screen should look like the following:

CALIBR STEERING	4 (10)
AXLE 2	
ADJUST WHEEL	0
ANGLE	0

Range 0 +/-5

   c. Press right arrow button to advance thru remaining steering system calibration menus.

CALIBRATION - CONTINUED

6. **Steering Cylinder No. 2 Calibration (Menu 5 of 10).**
   a. Steering cylinders position must be manually checked by measuring cylinder length. Measurement should be taken from center-to-center of cylinder mounting pins. Correct length is 34 inches (868 mm). If length is incorrect, adjust steering cylinder for wheel no. 2 (RR) by pressing increase "+" or decrease "-" buttons.
   b. Press "Enter".
   c. Recheck steering cylinder position. Correct length should be 34 inches (868 mm).
   d. ECS display screen should look like the following:

CALIBR STEERING	5 (10)
AXLE 2	
SET WHEEL	0
ANGLE	0

   e. Press right arrow button to advance thru remaining steering system calibration menus.

7. **Steering System Hydraulic and Electrical Connections Check (Menu 6 of 10).**
   a. Pressing value increase "+" button will result in wheel no. 3 (LR) moving to the right and an increase of values on ECS display screen.
   b. Pressing value decrease "-" button will result in wheel no. 3 moving to the left and a decrease of values on ECS display screen. ECS display screen should look like the following:

CALIBR STEERING	6 (10)
AXLE 3	
ADJUST WHEEL	0
ANGLE	0

Range 0 +/-5

   c. Press right arrow button to advance thru remaining steering system calibration menus.

8. **Steering Cylinder No. 3 Calibration (Menu 7 of 10).**
   a. Steering cylinders position must be manually checked by measuring cylinder length. Measurement should be taken from center-to-center of cylinder mounting pins. Correct length is 34 inches (868 mm). If length is incorrect, adjust steering cylinder for wheel no. 3 (LR) by pressing increase "+" or decrease "-" buttons.
   b. Press "Enter".
   c. Recheck steering cylinder position. Correct length should be 34 inches (868 mm).
   d. ECS display screen should look like the following:

CALIBR STEERING	7 (10)
AXLE 3	
SET WHEEL	0
ANGLE	0

   e. Press right arrow button to advance thru remaining steering system calibration menus.

CALIBRATION - CONTINUED

9. **Steering System Hydraulic and Electrical Connections Check (Menu 8 of 10).**

   a. Pressing value increase "+" button will result in wheel no. 4 (LF) moving to the right and an increase of values on ECS display screen.

   b. Pressing value decrease "-" button will result in wheel no. 4 moving to the left and a decrease of values on ECS display screen. ECS display screen should look like the following:

CALIBR STEERING	8 (10)
AXLE 4 ADJUST WHEEL ANGLE	 0 0

Range 0 +/-5

   c. 3. Press right arrow button to advance thru remaining steering system calibration menus.

10. **Steering Cylinder No. 4 Calibration (Menu 9 of 10).**

   a. Steering cylinders position must be manually checked by measuring cylinder length. Measurement should be taken from center-to-center of cylinder mounting pins. Correct length is 31 5/16 inches (796 mm). If length is incorrect, adjust steering cylinder for wheel no. 4 (LF) by pressing increase "+" or decrease "-" buttons.

   b. Press "Enter".

   c. Recheck steering cylinder position. Correct length should be 31 5/16 inches (796 mm).

   d. ECS display screen should look like the following:

CALIBR STEERING	9 (10)
AXLE 4 SET WHEEL ANGLE	 0 0

   e. Press right arrow button to advance to remaining steering system calibration menu.

11. **Calibration of Steering System Completed (Menu 10 of 10).**

   a. With all calibration steps complete and corrections or adjustments made, press "Enter" to return to main menu.

   b. ECS display screen should look like the following:

CALIBR STEERING	10 (10)
CALIBRATION OF STEERING DONE	 ENTER

12. Turn off engine and restart to save data.

END OF WORK PACKAGE

CAB DOOR ASSEMBLY MAINTENANCE 0051 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Grease, GAA (Item 13, WP 0089 00)

Nut, lock (923863.7197) (4)

Nut, lock (923872.0391)

References

LO 10-3930-675-12

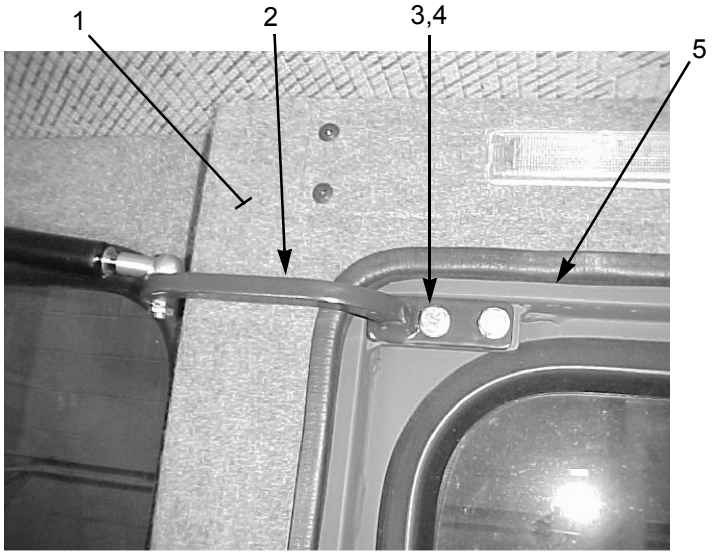
WP 0052 00

Personnel Required

Two

REMOVAL

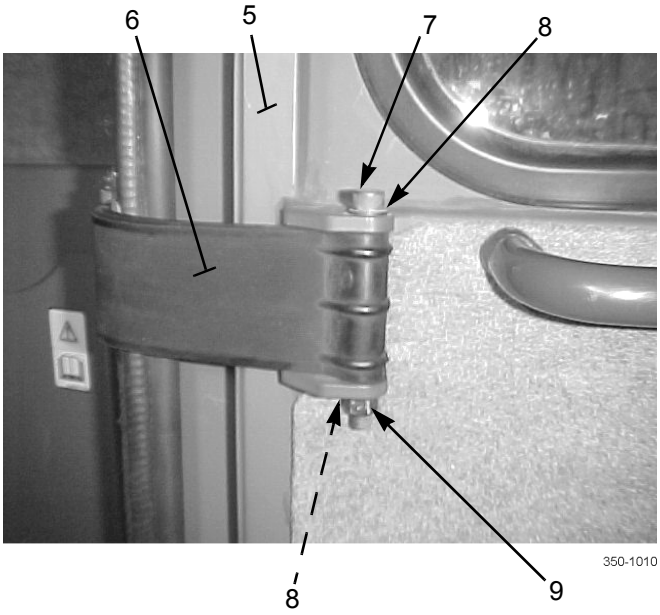
1. From inside cab (1), with cab door (5) closed, remove two screws (3), washers (4), and yoke (2) from cab door.



350-1009

REMOVAL - CONTINUED

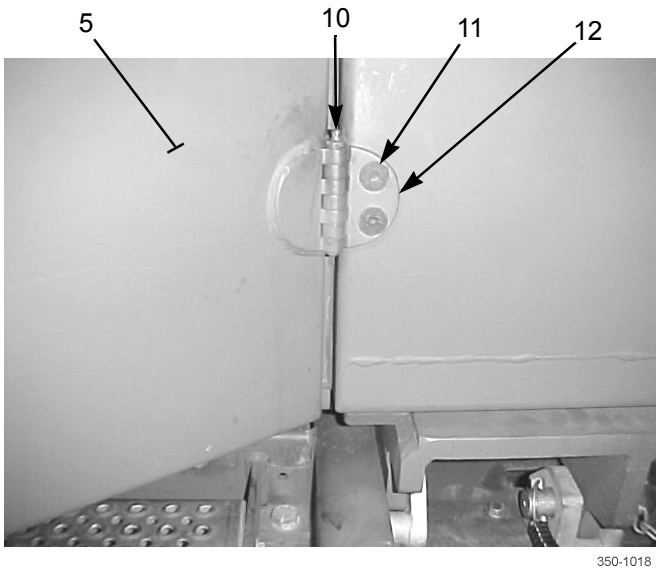
2. Remove locknut (9), two washers (8), screw (7), and door holder (6) from cab door (5). Discard locknut.



3. Partially open cab door (5) and, with assistance, remove four screws (11) and cab door from vehicle.

DISASSEMBLY

1. Remove grease fitting (10) from each of two cab door hinges (12).
2. Remove cab door window glass (WP 0052 00).

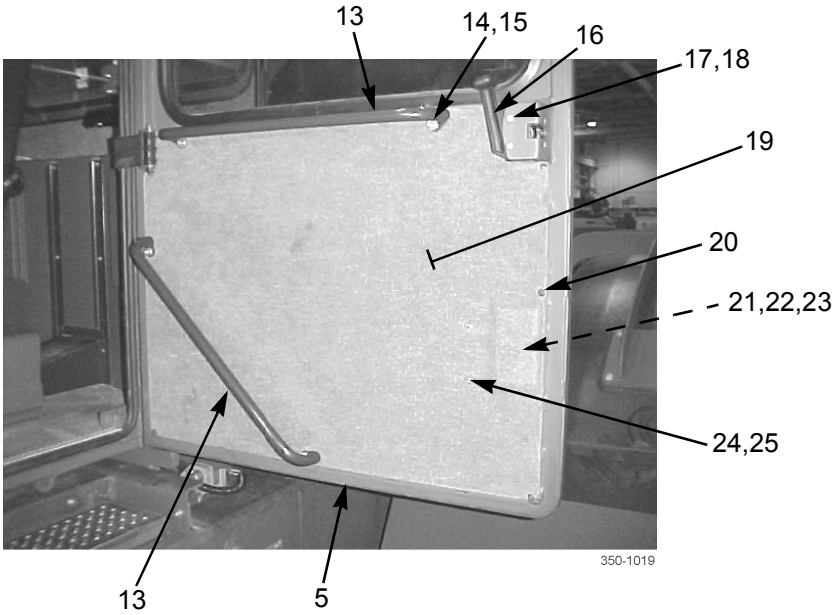


DISASSEMBLY - CONTINUED

NOTE

Perform step 3 for each of two handles.

3. Remove two screws (14), washers (15), and handle (13).
4. Remove four locknuts (17), screws (18), and door lock (16). Discard locknuts.
5. Remove two screws (24) and washers (25) from door panel (19).
6. Remove five screws (20) and door panel (19) from cab door (5).
7. Remove two screws (21), washers (22), and door latch (23).



ASSEMBLY

1. Install door latch (23) to cab door (5) with two washers (22) and screws (21).
2. Install door panel (19) with five screws (20).
3. Install two washers (25) and screws (24) to door panel (19).
4. Install door lock (16) with four screws (18) and new locknuts (17).

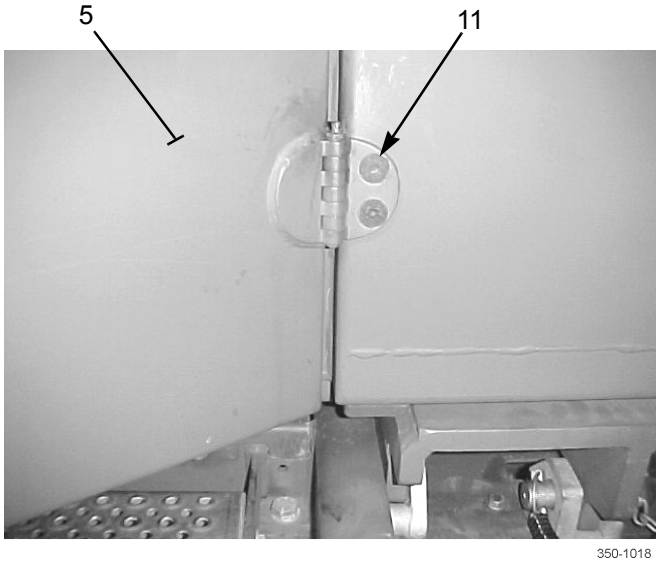
NOTE

Perform step 5 for each of two handles.

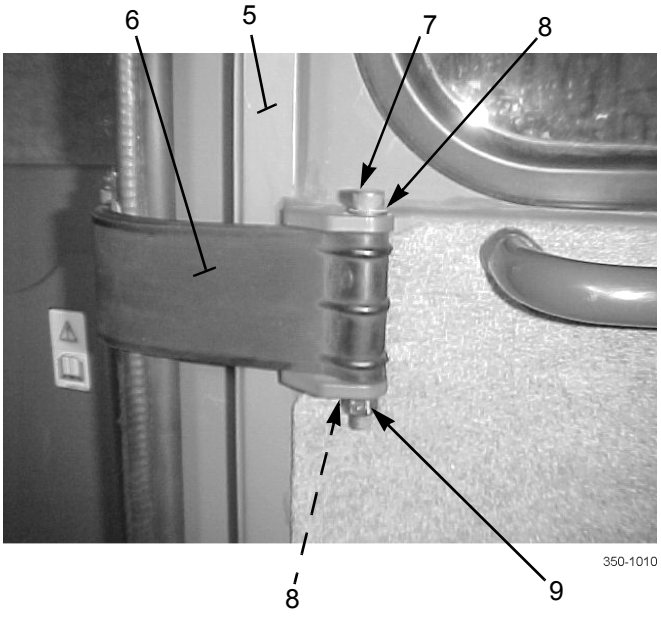
5. Install handle (13) with two washers (15) and screws (14).
6. Install cab door window glass (WP 0052 00).
7. Install grease fitting (10) to each of two cab door hinges (12).

INSTALLATION

1. With assistance, install cab door (5) to vehicle with four screws (11).

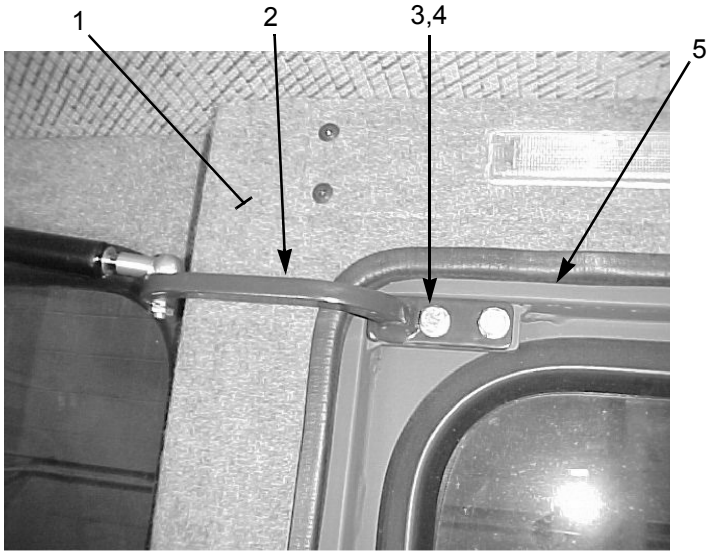


2. From inside cab (1), and with cab door (5) closed, install door holder (6) to cab door with screw (7), two washers (8), and new locknut (9).



INSTALLATION - CONTINUED

3. Install yoke (2) with two washers (4) and screws (3).



350-1009

4. Lubricate cab door hinges (LO 10-3930-675-12).

END OF WORK PACKAGE

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WINDSHIELD AND WINDOW GLASS REPLACEMENT 0052 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Dispenser, sealant (Item 15, WP 0090 00)

Gloves (Item 37, WP 0090 00)

Materials/Parts

Detergent (Item 10, WP 0089 00)

Materials/Parts - Continued

Weatherseal (P/N 923828.0654)

Personnel Required

Two

Equipment Condition

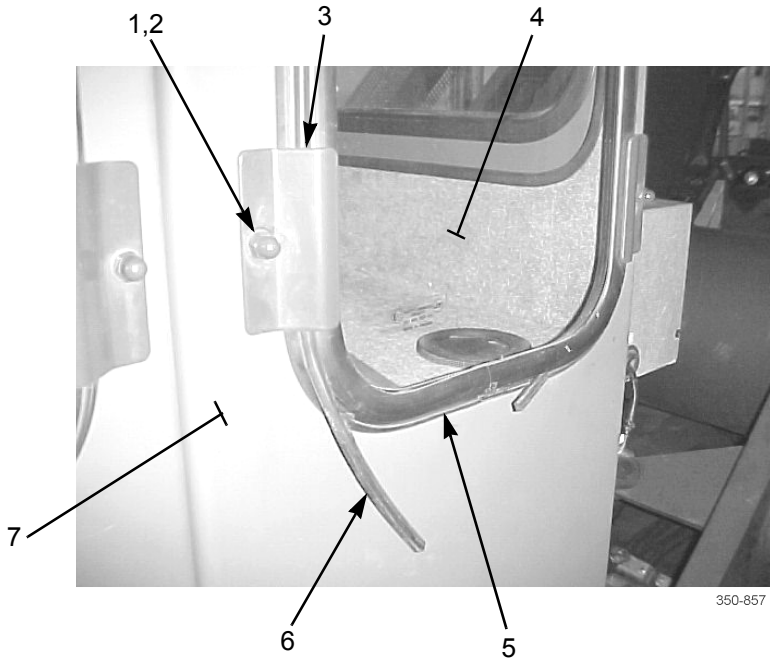
Windshield wiper removed, as applicable (TM 10-3930-675-20)

WARNING

- Handle windshield and window glass with care. Dropping or handling windows roughly may cause window to shatter. Failure to follow this warning may result in injury to personnel.
- Wear gloves when handling windshield and window glass to protect against possible injury.

REMOVAL

1. Remove four capnuts (1), washers (2), and brackets (3) from cab (7).
2. Trace locking strip (6) of weatherseal (5) to find where ends of locking strip join together.
3. Pry out one end of locking strip (6) and remove locking strip from weatherseal (5).
4. Starting at one INSIDE corner of window (4), pry up flange of weatherseal (5) while pressing outward on window.
5. Work around entire length of weatherseal (5), as necessary, until window (4) and weatherseal are removed from cab (7).
6. Remove weatherseal (5) from window (4).

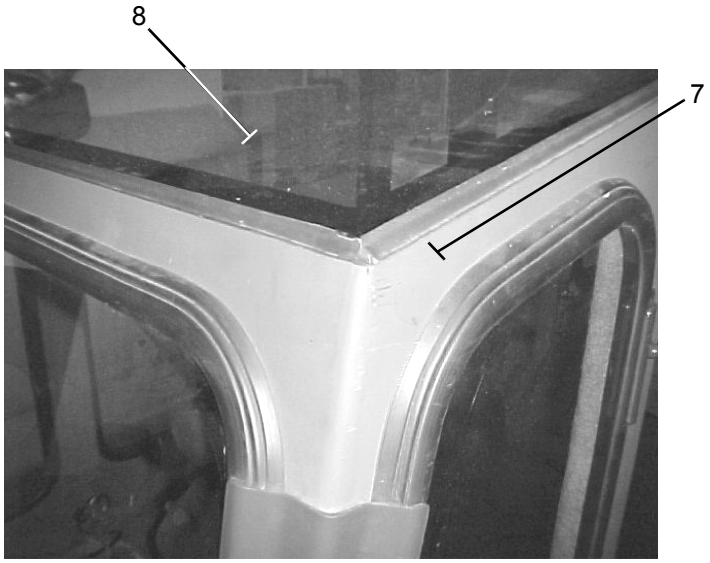


NOTE

Perform step 7 to remove cab roof window.

REMOVAL - CONTINUED

7. Cut thru gasket forming compound of cab roof window (8) and remove cab roof window from cab (7).



INSTALLATION

NOTE

Perform steps 1 and 2 to install cab roof window.

1. Apply gasket forming compound to all four edges of cab roof window (8) and top of cab (7).
2. Position cab roof window (8) to cab (7). Reapply gasket forming compound as needed and smooth to a beveled finish.
3. Position length of weatherseal (5) to edge of window (4) and cut weatherseal so that ends of weatherseal will meet in a straight line. Remove weatherseal.
4. Install weatherseal (5) to window (4) with recess for locking strip (6) facing toward outside of window.
5. Install locking strip (6) to weatherseal (5).
6. Lubricate weatherseal (5) with a solution of detergent and water.
7. Place window (4) with weatherseal (5) to outside of cab (7), with one lower corner of weatherseal installed to flange of cab.
8. Work around entire length of weatherseal (5) while gently pressing inward on window until weatherseal is fully installed to cab (7).
9. Install four brackets (3) with four washers (2) and capnuts (1).
10. Install windshield wiper, as applicable (TM 10-3930-675-20).

END OF WORK PACKAGE

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CAB HEATER/AIR CONDITIONING UNIT REPLACEMENT 0053 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Antifreeze (Item 2, WP 0089 00)

Cap set, protective (Item 3, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00) (2)

Tag, marker (Item 31, WP 0089 00)

Nut, lock (P/N 923899.0553) (3)

Personnel Required

Two

References

WP 0072 00

Equipment Condition

Cab moved to the left, but not lowered (TM 10-3930-675-10)

Air cleaner removed (TM 10-3930-675-20)

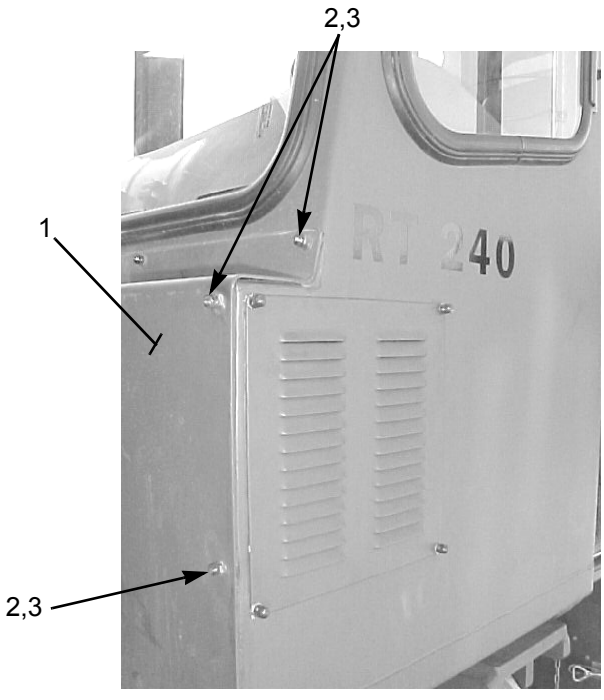
Windshield wiper assembly removed (TM 10-3930-675-20)

Refrigerant recovered from air conditioning system (WP 0068 00)

Coolant drained (TM 10-3930-675-20)

REMOVAL

1. Remove 14 capnuts (2), washers (3), and front panel (1) from cab.



350-782

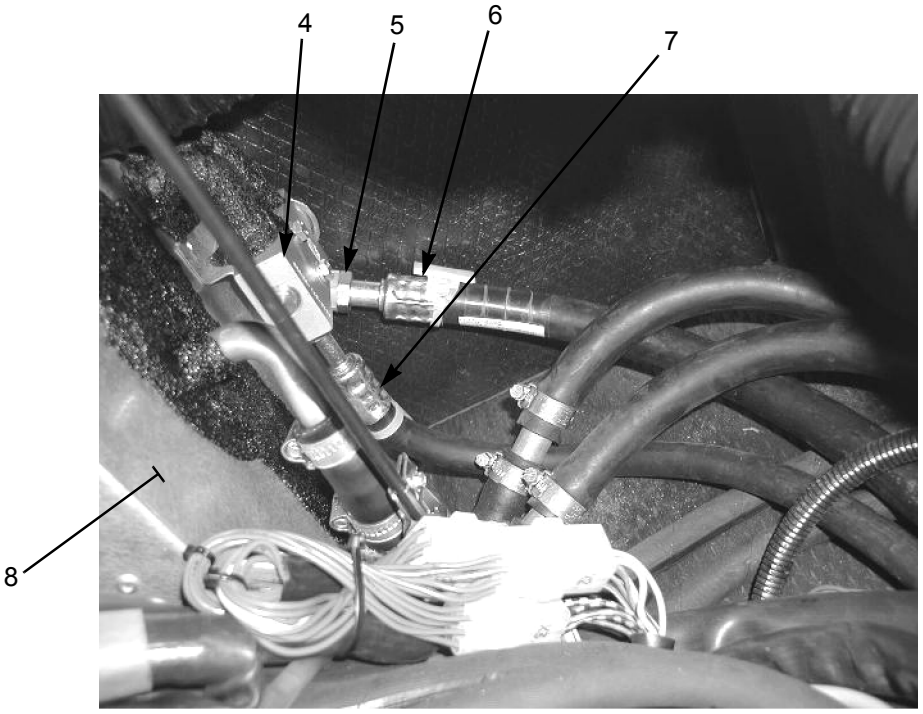
REMOVAL - CONTINUED

2. Underneath instrument panel, disconnect connectors from air conditioning control switch, disconnect cable from heater temperature control, and remove air conditioning temperature control (TM 10-3930-675-20).
3. Disconnect two heater hoses from side of cab heater/AC unit (TM 10-3930-675-20).

CAUTION

Water and dirt can damage refrigerant system. Refrigerant lines should be capped after disconnection to avoid contamination.

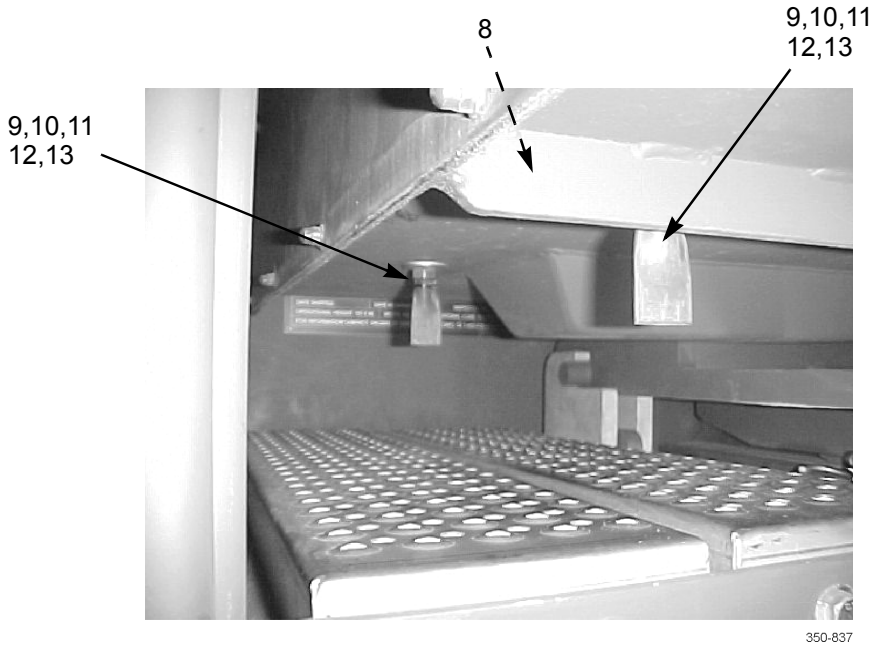
4. Loosen two fitting nuts (5) and disconnect two air conditioning hoses (6 and 7) from expansion valve (4).
5. Loosen four hose clamps and disconnect four flexible ducts from top of cab heater/AC unit (8).
6. Remove screw and disconnect white ground wire from top corner of cab heater/AC unit (8).



350-783

REMOVAL - CONTINUED

7. Underneath cab, remove two tiedown straps (9) and drain valves (10).
8. Remove three locknuts (11), washers (12), and grommets (13). Discard locknuts.
9. Remove cab heater/AC unit (8) from cab.



INSTALLATION

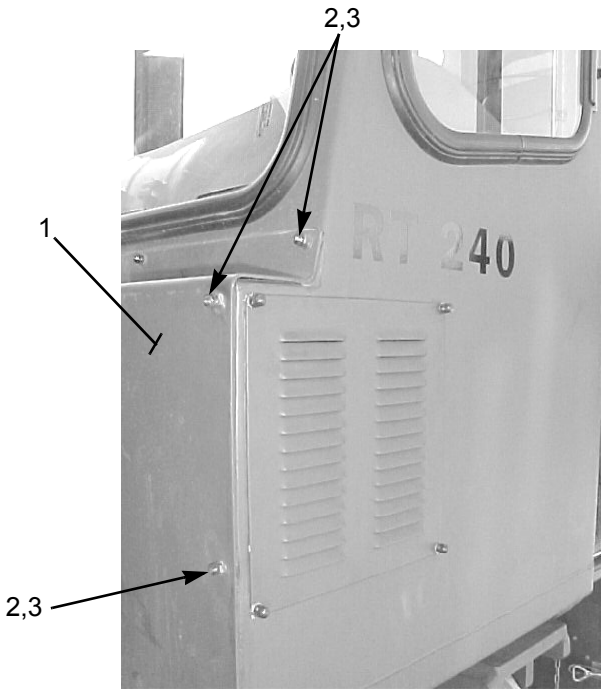
NOTE

Ensure that white ground wire, windshield wiper wiring harness, and clear plastic tube are accessible.

1. Position cab heater/AC unit (8) to cab.
2. Underneath cab, install three grommets (13), washers (12), and new locknuts (11).
3. Install two drain valves (10) with two new tiedown straps (9).
4. Connect white ground wire to top corner of cab heater/AC unit (8) with screw.
5. Connect four flexible ducts to top of cab heater/AC unit (8) and tighten four hose clamps.
6. Connect two air conditioning hoses (6 and 7) to expansion valve (4) and tighten two fitting nuts (5).
7. Replace receiver-drier (WP 0072 00).
8. Connect two heater hoses to side of cab heater/AC unit. Add coolant (TM 10-3930-675-20).
9. Underneath instrument panel, install air conditioning temperature control, connect cable to heater temperature control, and connect connectors to air conditioning control switch (TM 10-3930-675-20).
10. Install air cleaner (TM 10-3930-675-20).
11. Start engine (TM 10-3930-675-10) and check for coolant leaks.
12. Charge air conditioning system with refrigerant (WP 0068 00).

INSTALLATION - CONTINUED

13. Install front panel (1) to cab with 14 washers (3) and capnuts (2).



14. Install windshield wiper assembly (TM 10-3930-675-20).
15. Return cab to operational position (TM 10-3930-675-10).

END OF WORK PACKAGE

BOOM AND BRAKE SYSTEM HYDRAULIC PUMP REPLACEMENT 0054 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

O-ring (P/N 3503)

Materials/Parts - Continued

O-ring (P/N 3505)

O-ring (P/N 921039.0015)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Brake hydraulic system pressure relieved (TM 10-3930-675-20)

Transmission access covers and cab support removed (TM 10-3930-675-20)

Master battery switch in OFF position

Wheels chocked

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Tag all hydraulic lines and fittings.
- Remove nylon straps and remove and discard tiedown straps as necessary to gain free movement in hydraulic hoses.

REMOVAL

1. Trace supply hose (13) under pump (4) back to hydraulic reservoir. Close ball valve in supply hose at reservoir.

NOTE

Witness mark check valve and pump to ensure correct installation.

2. Remove four screws (10), flange (9), pump-to-primary filter hose (11), o-ring (8), and check valve (7) from pump (4). Discard o-ring.
3. Under pump (4), loosen two hose clamps (12) and disconnect supply hose (13) from hose connection (16).
4. Disconnect hose (18) from fitting (19) on underside of pump (4).
5. If required, loosen eight screws (3) and rotate two hydraulic pump assembly hoses (2) out of the way.

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Boom and brake system hydraulic pump weighs approximately 200 lb (91 kg). Lifting device must have sufficient capacity to lift pump. Failure to follow this warning may result in injury to personnel.

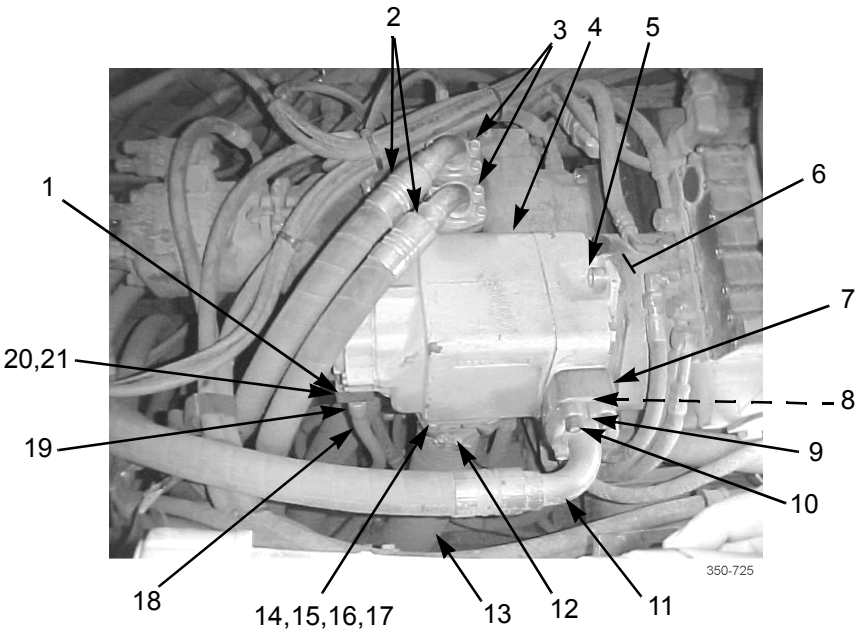
6. Wrap a nylon sling around pump (4) and attach sling to a suitable lifting device.
7. Remove two screws (5) and pump (4) from transmission (6).

NOTE

Perform steps 8 and 9 to remove fittings from pump, if a new pump is being installed.

8. On underside of pump (4), remove fitting (19) from flange (1). Remove four screws (20), flange, and o-ring (21) from pump. Discard o-ring.
9. On underside of pump (4), remove four screws (14), flange (15), hose connection (16), and o-ring (17) from pump. Discard o-ring.

REMOVAL - CONTINUED



INSTALLATION

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform steps 1 and 2 to install fittings removed from old pump, if a new pump is being installed.
- Lubricate new o-rings with lubricating oil as they are installed.

1. On underside of pump (4), install new o-ring (17) and hose connection (16) with flange (15) and four screws (14).
2. On underside of pump (4), install new o-ring (21) and flange (1) to pump with four screws (20). Install fitting (19) to flange.

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Boom and brake system hydraulic pump weighs approximately 200 lb (91 kg). Lifting device must have sufficient capacity to lift pump. Failure to follow this warning may result in injury to personnel.

INSTALLATION - CONTINUED

NOTE

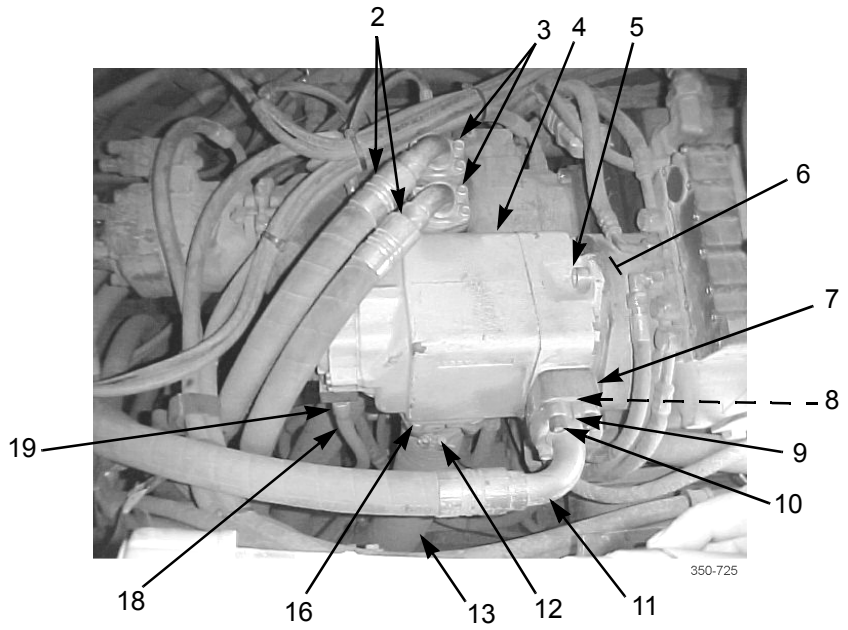
Ensure mating surfaces of pump and transmission are clean and free of old sealant material.

3. With a nylon sling wrapped around pump (4) and sling supported by a suitable lifting device, apply sealant to mating surfaces and install pump to transmission (6) with two screws (5).
4. Connect hose (18) to fitting (19) on underside of pump (4).
5. Connect supply hose (13) to hose connection (16) and tighten two hose clamps (12).
6. If loosened, reposition two hydraulic pump assembly hoses (2) and tighten eight screws (3).

NOTE

Ensure check valve is installed on pump in accordance with witness marks.

7. Install check valve (7), new o-ring (8), pump-to-primary filter hose (11), and flange (9) with four screws (10).
8. Open ball valve at reservoir for supply hose (13).



9. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
10. Start engine (TM 10-3930-675-10), operate boom and brakes, and check for leaks.
11. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
12. Install nylon straps and new tiedown straps as necessary to support hydraulic hoses.
13. Install transmission access covers and cab support (TM 10-3930-675-20).
14. Return cab to operational position (TM 10-3930-675-10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

COOLING FAN HYDRAULIC PUMP REPLACEMENT 0055 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Wrench, torque 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Materials/Parts - Continued

O-ring (P/N 3503)

O-ring (P/N 3505)

Personnel Required

Two

References

LO 10-3930-675-12

TM 10-3930-675-10

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

Hydraulic system pressure relieved (TM 10-3930-675-20)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

Tall hydraulic lines and fittings.

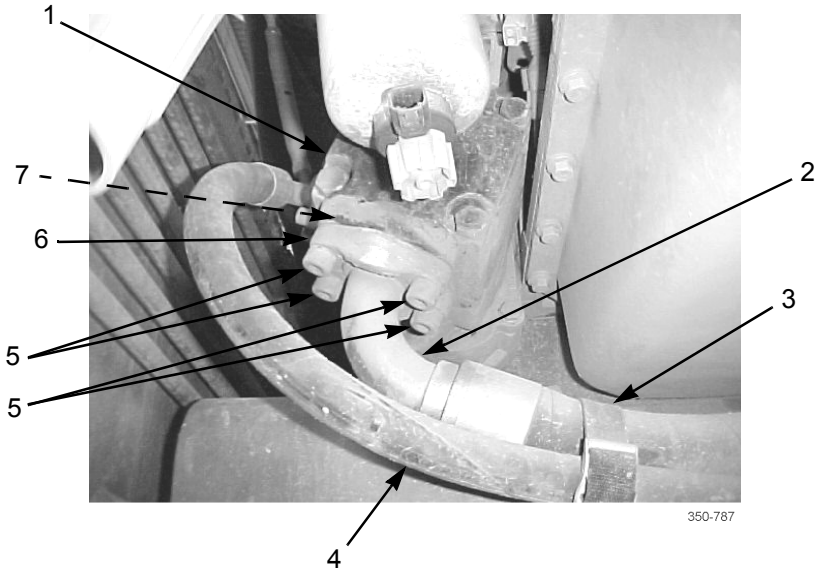
REMOVAL

1. Drain and remove fuel filter/water separator (TM 10-3930-675-20).
2. Trace hydraulic hose (2) from hydraulic pump (1) back to reservoir and locate ball valve. Close ball valve.
3. Remove canvas straps (3) and remove and discard tiedown straps, as needed, to allow free movement in hydraulic hoses (2 and 4).

NOTE

Position suitable container to catch hydraulic oil retained in hoses.

4. Remove four screws (5), flange (6), o-ring (7), and hydraulic hose (2) from hydraulic pump (1) input port. Discard o-ring.



5. Remove four screws (13), flange (12), o-ring (11), and hydraulic hose (4) from hydraulic pump (1) output port. Discard o-ring.

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury to personnel.

6. Remove two screws (8) and washers (9) securing hydraulic pump (1) to drive adapter (10).
7. Remove hydraulic pump (1) from drive adapter (10).

INSTALLATION

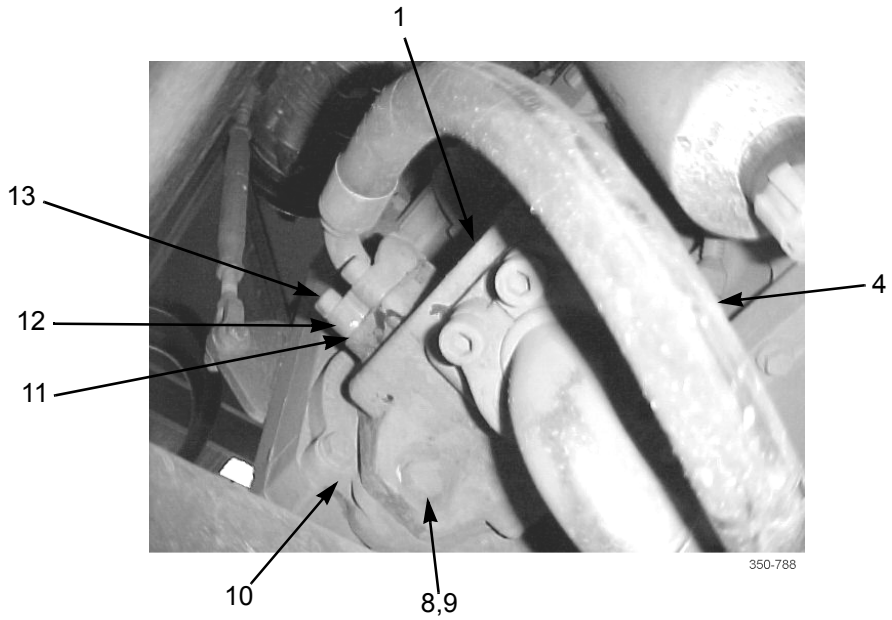
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury to personnel.

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Ensure mating surface on hydraulic pump and drive adapter are clean and free of old sealant material.
- Lubricate new o-rings with lubricating oil as they are installed.

1. Apply sealant to mating surfaces and install hydraulic pump (1) in position on drive adapter (10).
2. Install two screws (8) and washers (9). Tighten screws to 35 lb-ft (47 Nm).
3. Install new o-ring (11) and hydraulic hose (4) on hydraulic pump (1) outlet port with flange (12) and four screws (13).



4. Install new o-ring (7) and hydraulic hose (2) on hydraulic pump (1) inlet port with flange (6) and four screws (5).
5. Secure hydraulic hoses with canvas straps (3) and new tiedown straps as needed.
6. Install fuel filter/water separator filter (TM 10-3930-675-20).
7. Open ball valve at reservoir for supply hose.
8. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
9. Start engine (TM 10-3930-675-10) and check for leaks.

INSTALLATION

10. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
11. Install engine cover (TM 10-3930-675-20).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

HYDRAULIC COOLING FAN MAINTENANCE 0056 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Nut, lock (P/N 5590) (2)

Pin, cotter (P/N 95004)

Materials/Parts - Continued

Washer, lock (P/N 923657.0004)

Personnel Required

Two

Equipment Condition

Radiator assembly removed from vehicle (WP 0027 00)

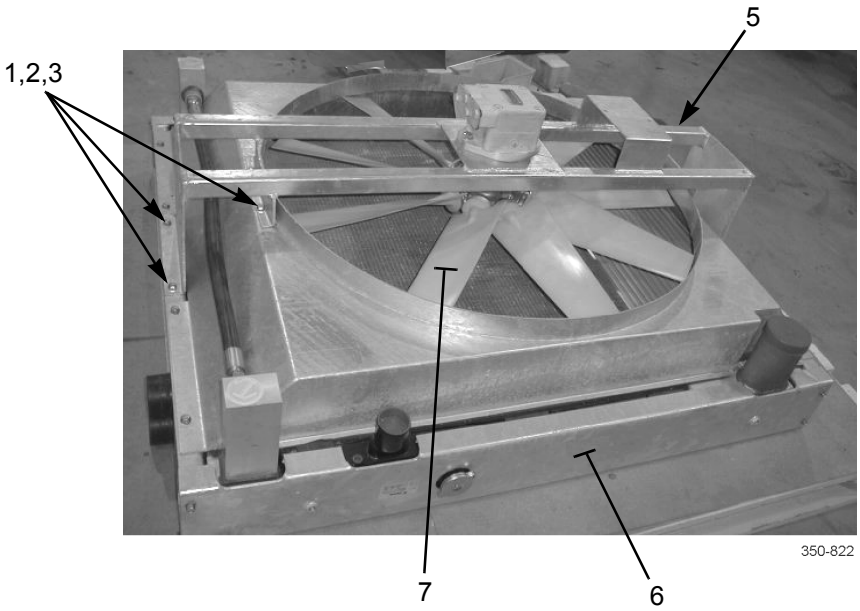
REMOVAL

1. Remove eight screws (1), washers (2), and nuts (3) securing fan support frame (5) to radiator assembly (6).

NOTE

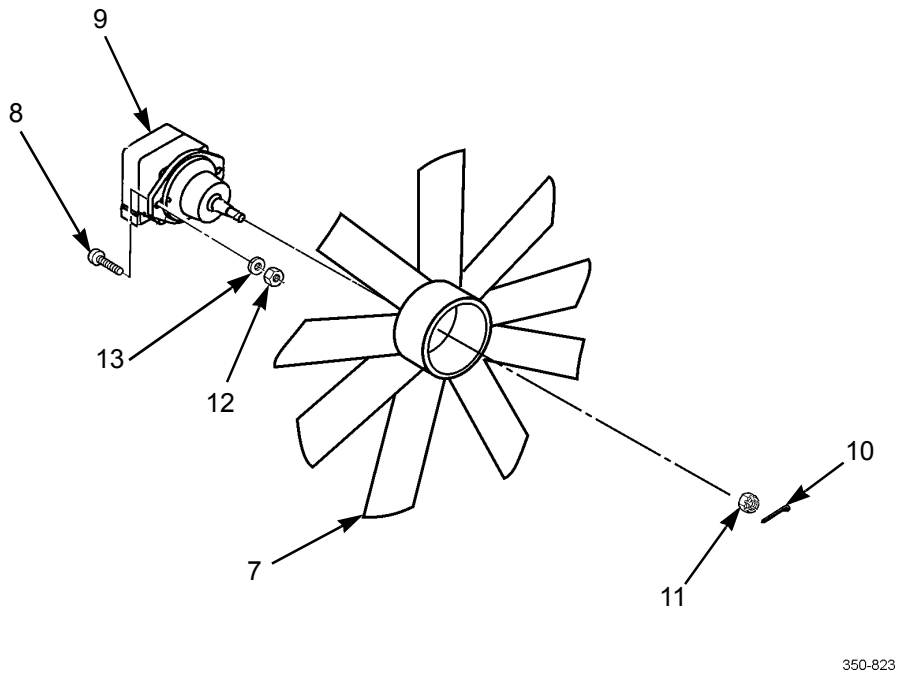
Fan motor, blade, bracket with bypass valve, and fan support frame are removed as a unit from radiator assembly.

2. With assistance, lift cooling fan from radiator assembly (6) and place on work surface with fan blade (7) facing up.



DISASSEMBLY

1. Remove cotter pin (10) and castle nut (11) and lift fan blade (7) from hydraulic motor (9). Discard cotter pin.
2. Remove two locknuts (12), screws (8), lockwashers (13), and hydraulic motor (9) and bracket (4) with bypass valve from fan support frame (5). Discard locknuts and lockwashers.



ASSEMBLY

1. Install bracket (4) with bypass valve and hydraulic motor (9) on fan support frame (5) with two screws (8), new lockwashers (13), and new locknuts (12).
2. Install fan blade (7) on hydraulic motor (9) and secure with castle nut (11) and new cotter pin (10).

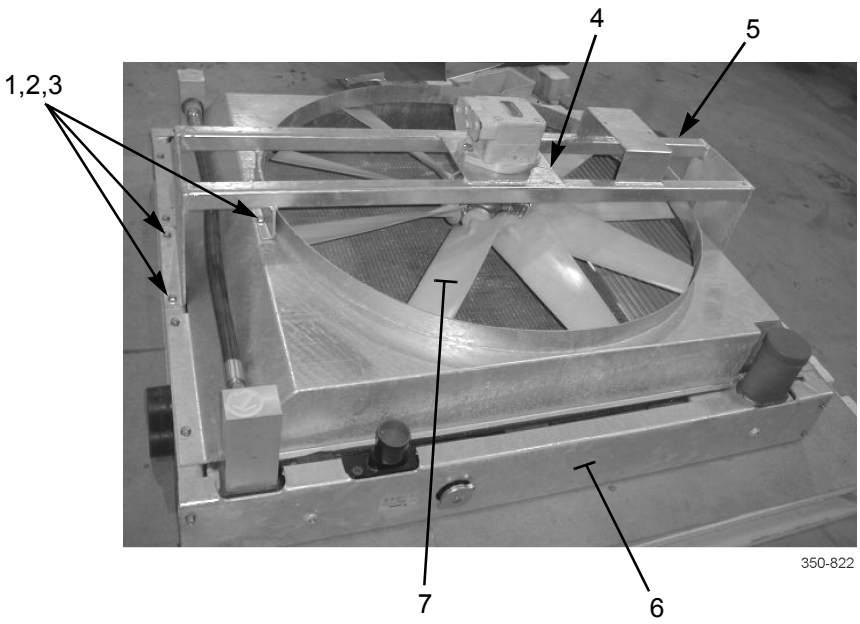
INSTALLATION

NOTE

Fan motor, blade, bracket with bypass valve, and fan support frame are installed as a unit on radiator assembly.

1. With assistance, install cooling fan on radiator assembly (6) and secure with eight screws (1), washers (2), and nuts (3).

INSTALLATION - CONTINUED



2. Rotate fan blade (7) by hand to ensure blade turns freely in fan shroud.
3. Install radiator assembly (WP 0027 00).

END OF WORK PACKAGE

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MAIN CONTROL VALVE REPLACEMENT 0057 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

O-ring (P/N 3503) (7)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Hydraulic system pressure relieved (TM 10-3930-675-20)

Transmission access covers and cab support frame removed (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

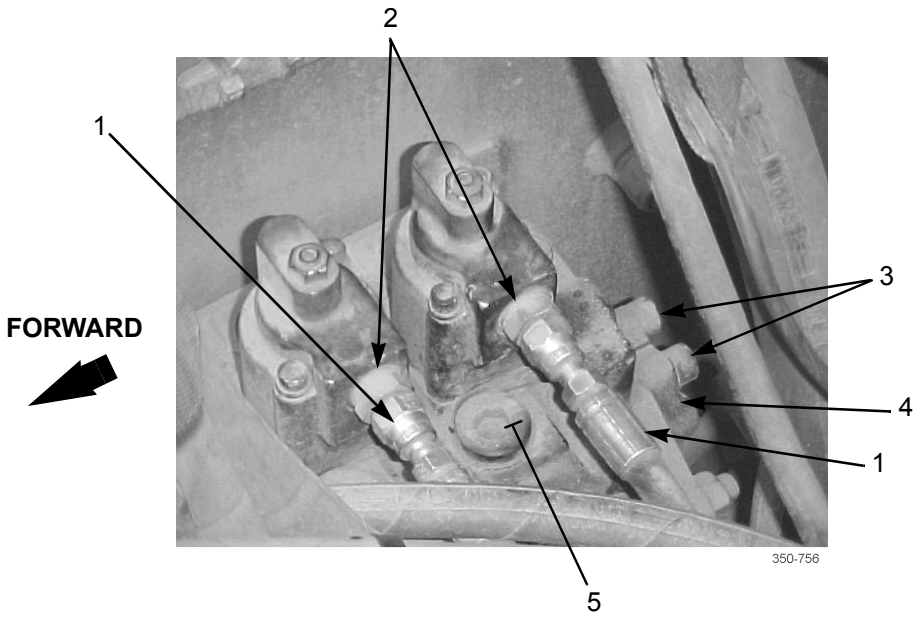
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Main control valve is located on right side of vehicle, on inner surface of frame.
- Tag all hydraulic lines.
- Remove nylon straps and clamp. Remove and discard tiedown straps as necessary to gain free movement in hydraulic hoses.

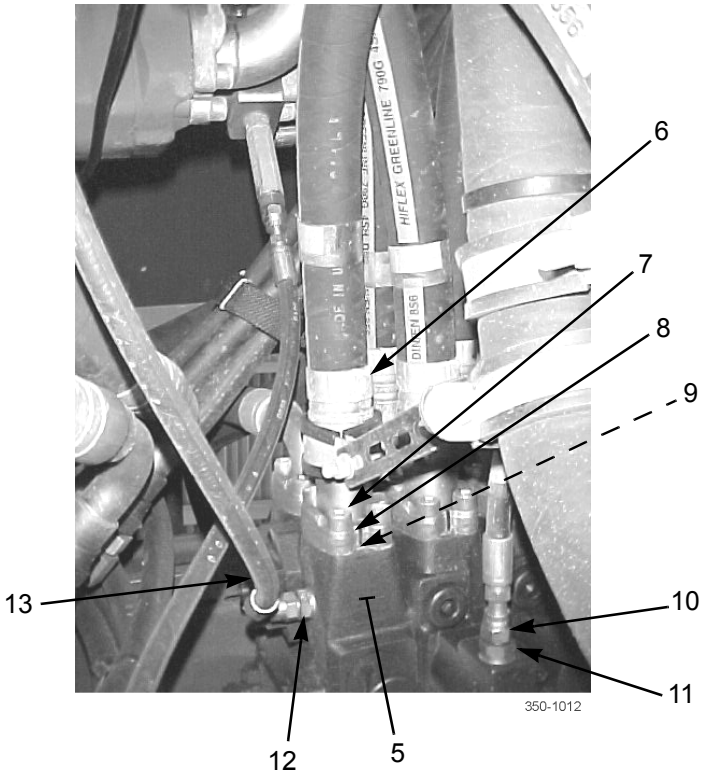
REMOVAL

1. Disconnect two hoses (1) from fittings (2) at top of control valve (5).
2. On rearward-facing surface of control valve (5), remove four screws (3) and flange (4) and disconnect hose from control valve. Remove and discard o-ring.



3. Disconnect two hoses (10) from fittings (11) on underside of control valve (5).
4. On forward-facing surface of control valve (5), disconnect hose (13) from fitting (12).
5. On left inner surface of control valve (5), disconnect each of six remaining hoses (6) as follows: Remove four screws (7), flange (8), and o-ring (9). Discard o-ring.

REMOVAL - CONTINUED



VIEW FROM UNDERSIDE

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Main control valve weighs approximately 100 lb (45 kg). Lifting device must have sufficient capacity to lift control valve. Failure to follow this warning may result in injury to personnel.

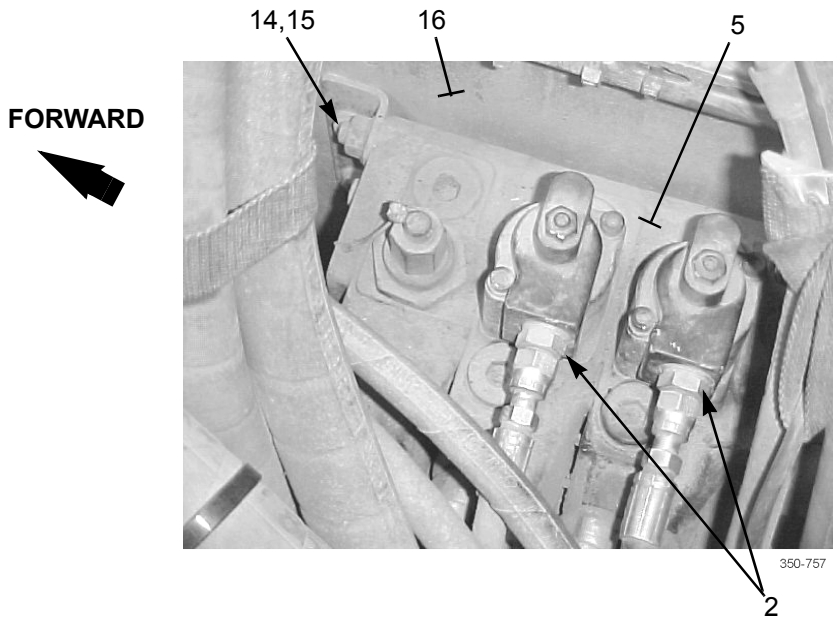
REMOVAL - CONTINUED

6. Wrap a nylon sling around control valve (5) and attach sling to a suitable lifting device.
7. Remove four screws (14), washers (15), and control valve (5) from frame (16) and lower from vehicle.

NOTE

Perform step 8 to remove fittings from control valve, if a new control valve is being installed.

8. Remove two fittings (2), two fittings (11), and fitting (12) from control valve (5).



INSTALLATION

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform step 1 to install fittings removed from old control valve, if a new control valve is being installed.

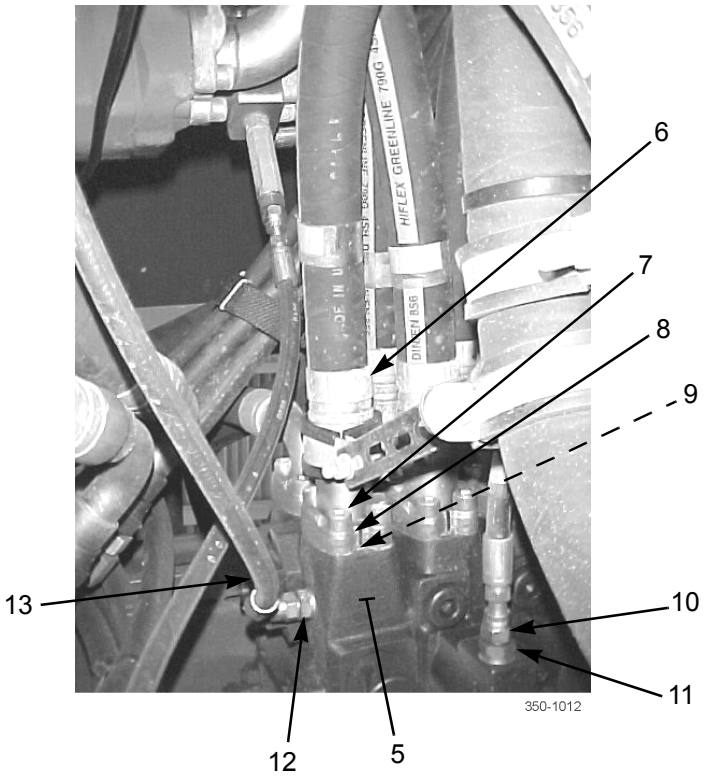
1. Install fitting (12), two fittings (11), and two fittings (2) to control valve (5).

INSTALLATION - CONTINUED

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Main control valve weighs approximately 100 lb (45 kg). Lifting device must have sufficient capacity to lift control valve. Failure to follow this warning may result in injury to personnel.

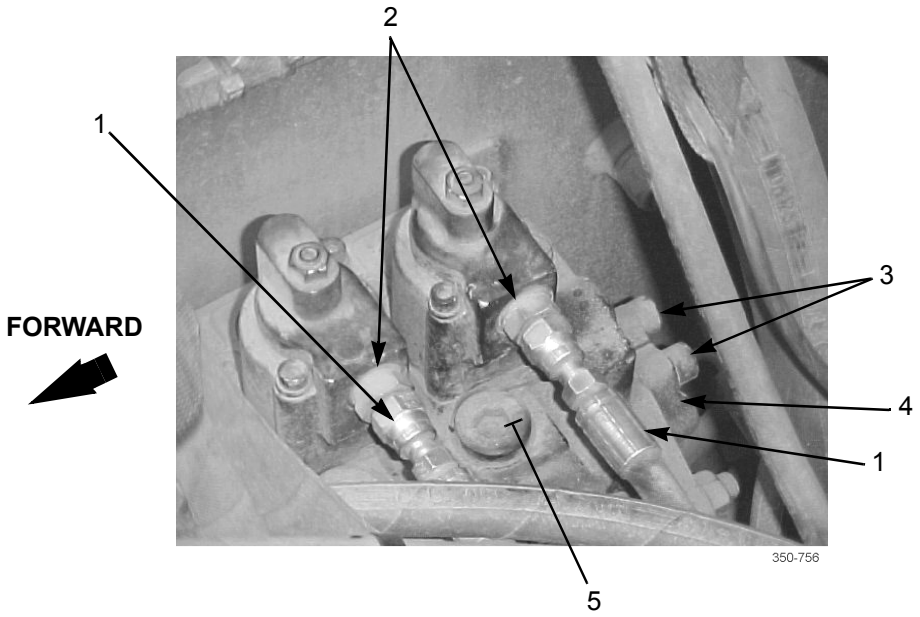
2. With a nylon sling wrapped around control valve (5) and sling supported by a suitable lifting device, position control valve against frame (16) and install four washers (15) and screws (14).
3. On left inner surface of control valve (5), connect each of six hoses (6) as follows: Install new o-ring (9) and hose with flange (8) and four screws (7).
4. On forward-facing surface of control valve (5), connect hose (13) to fitting (12).
5. Connect two hoses (10) to fittings (11) on underside of control valve (5).



VIEW FROM UNDERSIDE

INSTALLATION - CONTINUED

6. On rearward-facing surface of control valve (5), install new o-ring and hose with flange (4) and four screws (3).
7. Connect two hoses (1) to fittings (2) at top of control valve (5).



8. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
9. Start engine (TM 10-3930-675-10). Raise and lower boom and check for leaks.
10. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
11. Install nylon straps, clamp, and new tiedown straps as necessary to support hydraulic hoses.
12. Install transmission access covers and cab support frame (TM 10-3930-675-20).
13. Return cab to operational position (TM 10-3930-675-10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

SERVO CONTROL VALVE REPLACEMENT 0058 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

References

LO 10-3930-675-12

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Hydraulic system pressure relieved (TM 10-3930-675-20)

Transmission access covers removed (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Tag all hydraulic lines and electrical leads.
- Remove and discard tiedown straps as necessary to gain free movement in hydraulic hoses.

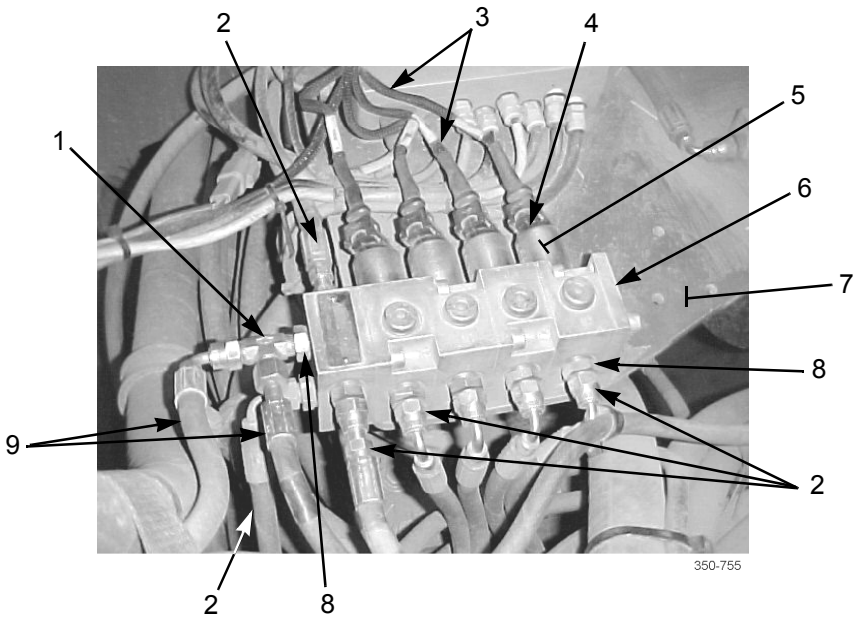
REMOVAL

1. Press in on four retaining clips (4) and disconnect four electrical leads (3) from solenoids (5).
2. Disconnect two hoses (9) from tee (1).
3. Disconnect seven hoses (2) from fittings (8) at control valve (6).
4. Remove two screws, washers, and control valve (6) from plate (7).

NOTE

Perform step 5 to remove fittings from control valve, if a new control valve is being installed.

5. Remove tee (1) and seven fittings (8) from control valve (6).



INSTALLATION

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform step 1 to install fittings removed from old control valve, if a new control valve is being installed.

1. Install seven fittings (8) and tee (1) to control valve (6).
2. Install control valve (6) to plate (7) with two washers and screws.
3. Connect seven hoses (2) to fittings (8) at control valve (6).
4. Connect two hoses (9) to tee (1).
5. Connect four electrical leads (3) to solenoids (5).
6. Check oil level in hydraulic reservoir (LO 10-3930-675-12).

INSTALLATION - CONTINUED

7. Start engine (TM 10-3930-675-10), operate systems, and check for leaks.
8. Install new tiedown straps, as necessary, to support hydraulic hoses.
9. Install transmission access covers (TM 10-3930-675-20).
10. Return cab to operational position (TM 10-3930-675-10).
11. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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TOPHANDLER CONTROL VALVE REPLACEMENT 0059 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Nut, lock (P/N 923828.0759) (4)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Cab and boom support in transport position (TM 10-3930-675-10)

Hydraulic system pressure relieved (TM 10-3930-675-20)

Master battery switch in OFF position

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Tag all electrical leads and hydraulic lines.
- Remove and discard tiedown straps as necessary to gain free movement in electrical leads and hydraulic hoses.

REMOVAL

1. Press in on retaining clips (8) and disconnect electrical leads (7) from solenoids (6). Secure electrical leads free from control valve (5).
2. Disconnect hydraulic hoses (9) from fittings (10) at control valve (5). Secure all hydraulic hoses free from control valve.

WARNING

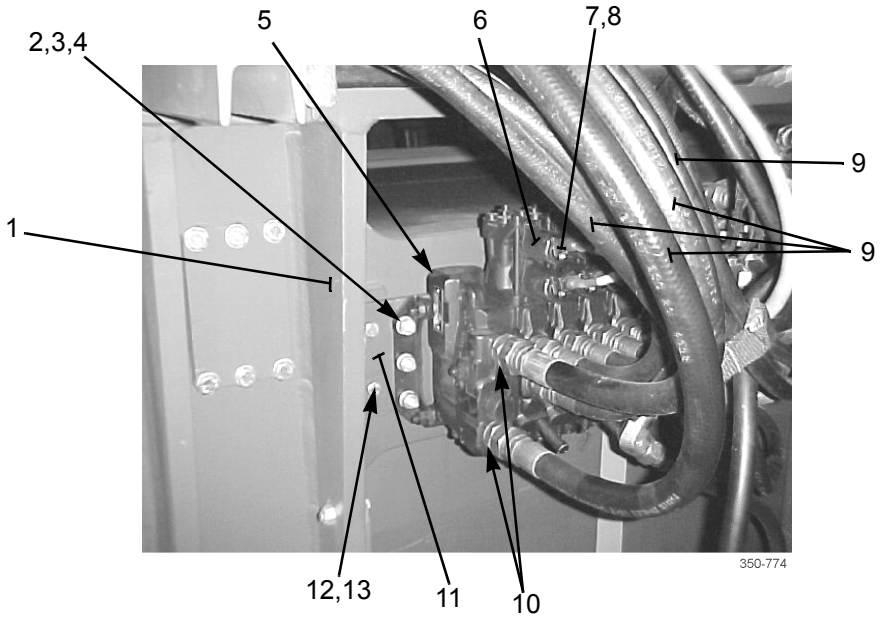
Use extreme caution when handling heavy parts. Tophandler control valve weighs approximately 150 lb (68 kg). Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

3. With assistance, remove four screws (12) and washers (13) securing mounting plate (11) with control valve (5) to tophandler (1). Remove control valve to work bench.
4. Remove four screws (2), washers (3), locknuts (4), and mounting plate (11) from control valve (5). Discard locknuts.

NOTE

Perform step 5 to remove fittings from control valve, if a new control valve is being installed.

5. Remove fittings (10) from control valve (5).



INSTALLATION

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform step 1 to install fittings removed from old control valve, if a new control valve is being installed.

1. Install fittings (10) on control valve (5).

WARNING

Use extreme caution when handling heavy parts. Tophandler control valve weighs approximately 150 lb (68 kg). Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

2. Position mounting plate (11) on control valve (5) and secure with four screws (2), washers (3), and new locknuts (4).
3. With assistance, position control valve (5) against tophandler (1) and secure with four washers (13) and screws (12).
4. Connect electrical leads (7) to solenoids (6).
5. Connect hydraulic hoses (9) to fittings (10) at control valve (5).
6. Install new tiedown straps, as necessary, to support electrical leads (7) and hydraulic hoses (9).
7. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
8. Start engine (TM 10-3930-675-10), operate tophandler, and check for leaks.
9. Return cab and boom support to operational position (TM 10-3930-675-10).
10. Check operation of tophandler (TM 10-3930-675-10).
11. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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BOOM LIFT CYLINDER REPLACEMENT 0060 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Jackscrew (2) (TM 10-3930-675-10, *Basic Issue Items*)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

O-ring (P/N 3503)

Materials/Parts - Continued

O-ring (P/N 3505)

Washer, lock (P/N 5398)

Washer, lock (P/N 923657.0001)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Tophandler fully lowered (TM 10-3930-675-10) and resting on cribbing

Boom hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake applied (TM 10-3930-675-10)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Boom lift cylinder weighs 885 lb (402 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

CAUTION

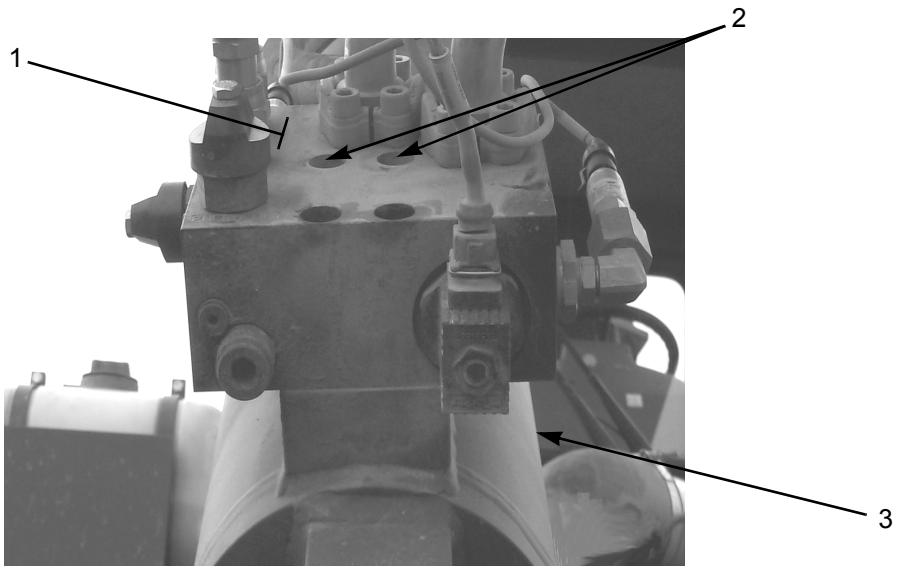
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

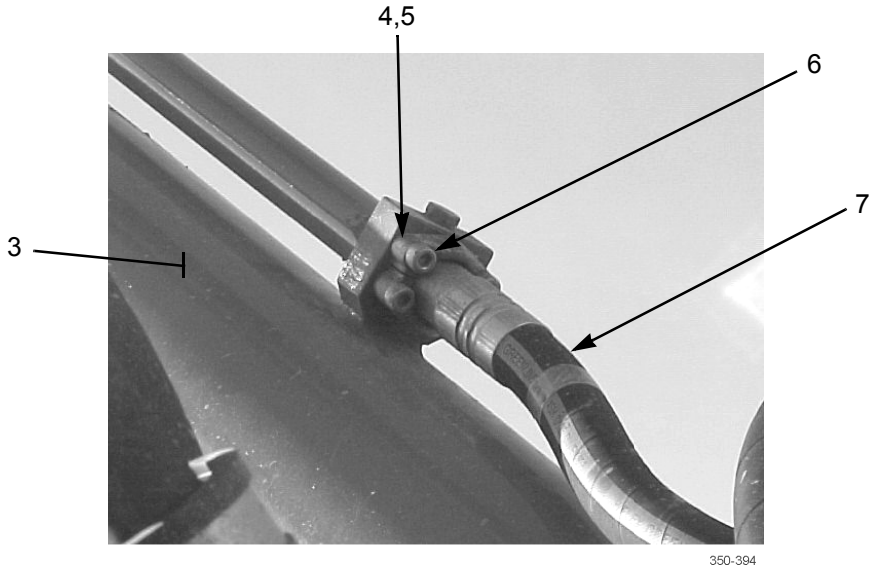
Boom lift cylinders are replaced in same manner.

REMOVAL

1. Open emergency lowering and float valves.
2. Remove four screws (2) securing valve (1) to cylinder (3). Set valve aside. Discard o-ring.



3. Remove four screws (6), flange (4), o-ring (5), and hose (7) from cylinder (3). Discard o-ring.

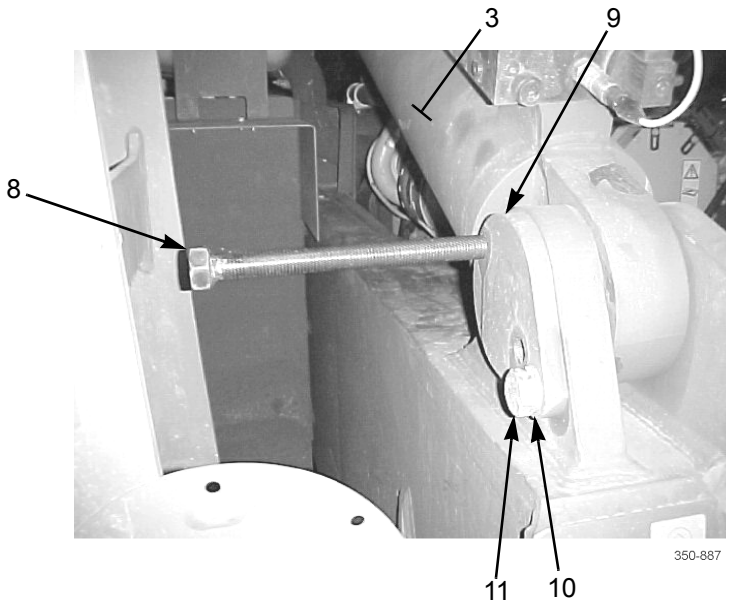


REMOVAL - CONTINUED

WARNING

Boom lift cylinder weighs 885 lb (402 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

4. Attach a nylon sling and suitable lifting device to cylinder (3).
5. At frame end of cylinder (3), remove screw (11) and lockwasher (10). Discard lockwasher.
6. Using two jackscrews (8), remove pin (9).

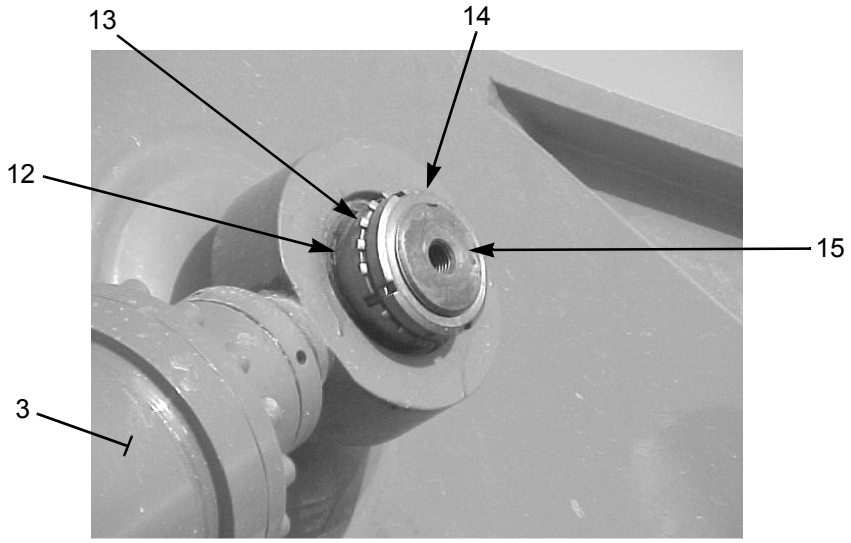


REMOVAL - CONTINUED

NOTE

Ensure sling is positioned so that cylinder is balanced and will not tilt when removed from vehicle.

7. Raise cylinder (3) until parallel with ground.
8. At boom end of cylinder (3), remove nut (14), lockwasher (13), and washer (12). Discard lockwasher.
9. Remove end of cylinder (3) from welded shaft (15) on boom.
10. Lower cylinder (3) to ground.



INSTALLATION

WARNING

Boom lift cylinder weighs 885 lb (402 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

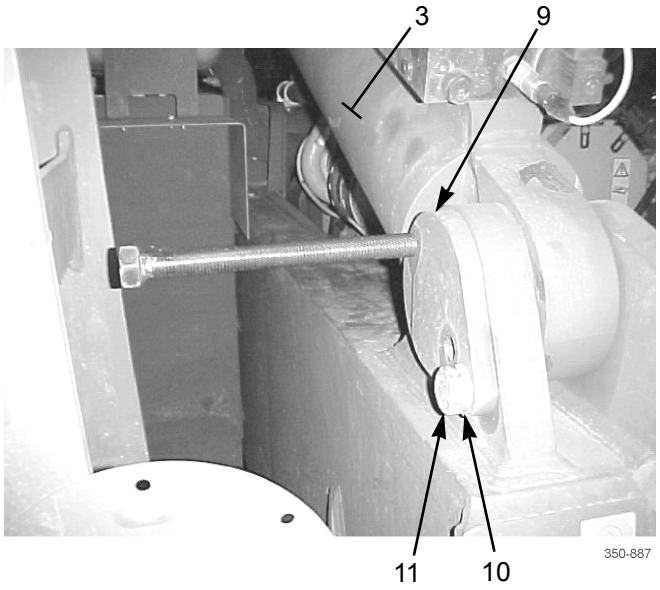
1. Using nylon sling and lifting device, raise cylinder (3) parallel to ground and position to slide boom end of cylinder on welded shaft (15).
2. Slide end of cylinder (3) onto welded shaft (15).
3. Install washer (12), new lockwasher (13), and nut (14). Bend tabs on lockwasher.
4. Lower frame end of cylinder (3) to mounting bracket on truck body.

INSTALLATION - CONTINUED

NOTE

- Ensure pin is clean and free of burrs.
- When installing pin, slot in pin for retaining screw must be alined with screw hole in mounting bracket.

5. Install pin (9).
6. Install new lockwasher (10) and screw (11).

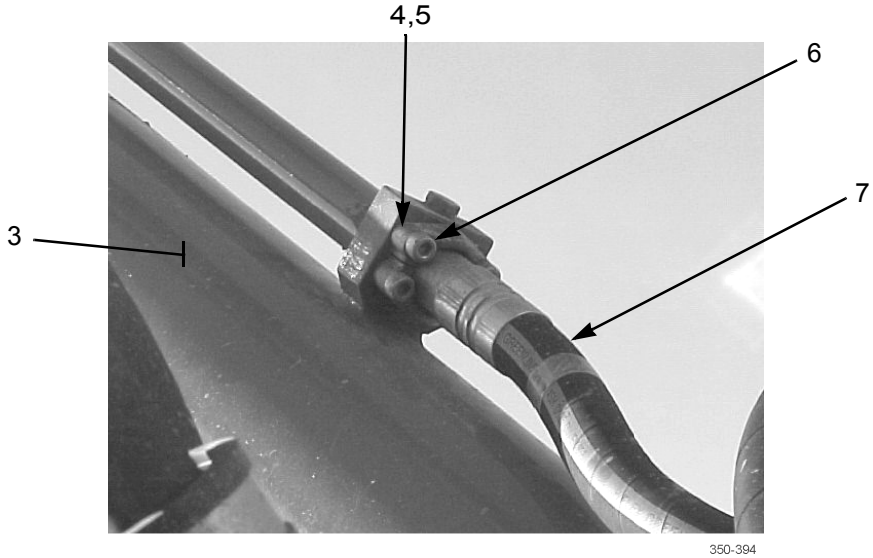


7. Remove sling and lifting device from cylinder (3).

NOTE

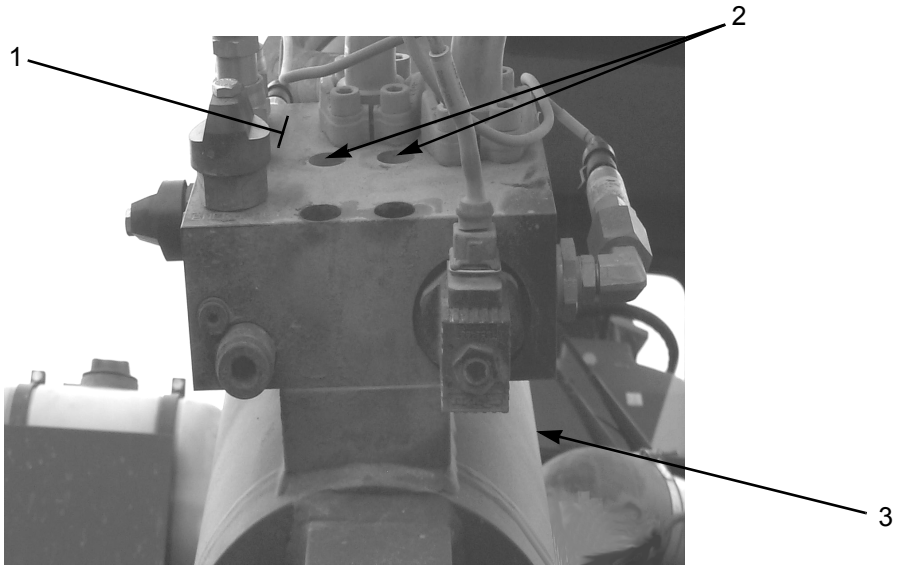
Lubricate new o-rings with lubricating oil.

8. Install new o-ring (5) and hose (7) to cylinder (3) with flange (4) and four screws (6).



INSTALLATION - CONTINUED

9. Position new o-ring and valve (1) and secure to cylinder (3) with four screws (2).



10. Close emergency lowering and float valves.
11. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
12. Start engine (TM 10-3930-675-10), operate lift cylinders, and check for leaks.
13. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

BOOM FOLDING CYLINDER REPLACEMENT 0061 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Goggles (Item 38, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Materials/Parts - Continued

Tag, marker (Item 31, WP 0089 00)

References

LO 10-3930-675-12

Personnel Required

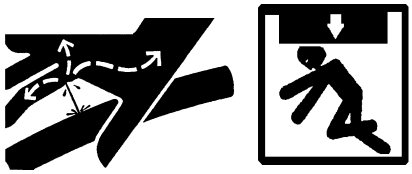
Two

Equipment Condition

Boom hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake applied (TM 10-3930-675-10)

WARNING



- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Boom folding cylinder weighs 132 lb (60 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Boom folding cylinders are replaced in same manner.
- Tag all hydraulic lines.
- Measure and record overall length of cylinder prior to removal. The recorded measurement will aid in cylinder adjustment procedures after installation.

REMOVAL

1. Remove hose clamp (7) from cylinder (8).

WARNING

Wear eye protection and have a rag handy when disconnecting hydraulic lines to boom folding cylinder. Failure to do so may result in eye injury due to residual hydraulic pressure in lines.

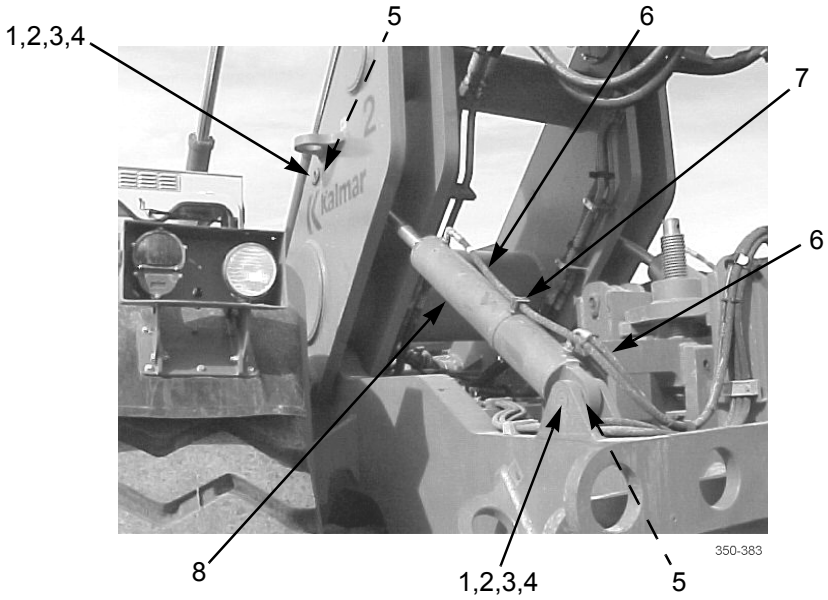
2. Disconnect two hydraulic hoses (6) from cylinder (8).

WARNING

Boom folding cylinder weighs 132 lb (60 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

3. Attach a nylon sling and suitable lifting device to cylinder (8).
4. At one end of cylinder (8), remove screw (1) and washer (2).
5. Remove pin (3). Remove grease fitting (4) from pin.
6. Remove and discard two o-rings (5) only if damaged.
7. Repeat steps 4 thru 6 for opposite end of cylinder (8).
8. Remove cylinder (8) from vehicle.

REMOVAL - CONTINUED



INSTALLATION

WARNING

Boom folding cylinder weighs 132 lb (60 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

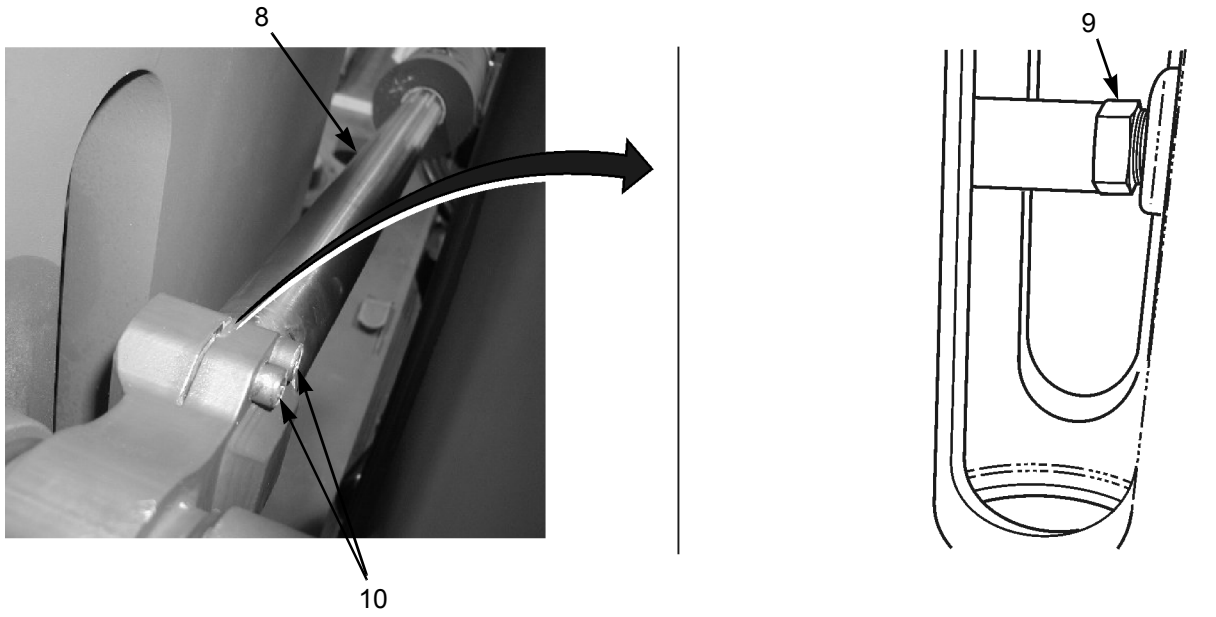
1. Using nylon sling and suitable lifting device, aline cylinder (8) to vehicle.
2. Lubricate two o-rings (5) with lubricating oil.
3. Position two o-rings (5) on cylinder (8) end.
4. Install grease fitting (4) to pin (3) and install pin.
5. Install washer (2) and screw (1).
6. Repeat steps 1 thru 5 for opposite end of cylinder (8).
7. Connect two hydraulic hoses (6) to cylinder (8).
8. Install hose clamp (7) to hydraulic hose (6) and cylinder (8).

INSTALLATION - CONTINUED

NOTE

- Ensure boom folding cylinders are adjusted to the full extended position. This will allow boom support locking pin cylinders to operate freely.
- After installing and adjusting boom folding cylinders, operate boom support locking pin cylinders to ensure locks will retract and extend properly (TM 10-3930-675-10).

9. Measure overall length of cylinder (8). If measurement is the same as recorded prior to removal, no adjustment is required. If measurement is not the same, cylinder adjustment is required; proceed to next step.
10. Adjust cylinder length by loosening two clevis clamping screws (10) at upper end of cylinder (8). Access cylinder piston rod adjusting nut (9) thru opening in boom supports. Turn adjusting nut to adjust overall length of cylinder. Tighten two clevis clamping screws.



11. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
12. Lubricate grease fittings (LO 10-3930-675-12).
13. Start engine (TM 10-3930-675-10).
14. Check for leaks and proper operation of boom folding cylinders (TM 10-3930-675-10).
15. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

BOOM SUPPORT LOCKING PIN CYLINDER REPLACEMENT 0062 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Pliers, retaining ring (Item 62, WP 0090 000)

Pliers, retaining ring (Item 63, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Materials/Parts - Continued

Tag, marker (Item 31, WP 0089 00)

Ring, retaining (P/N 5313) (2)

Ring, retaining (P/N 95088) (2)

References

LO 10-3930-675-12

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Boom locking pins in retracted position (TM 10-3930-675-10)

Hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake applied (TM 10-3930-675-10)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.

CAUTION

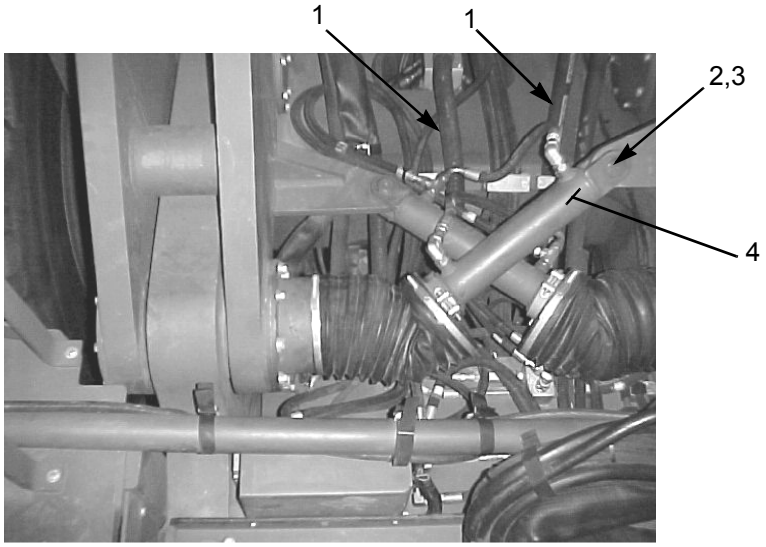
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Both boom locking pin cylinders are replaced in same manner.
- Tag all hydraulic lines.

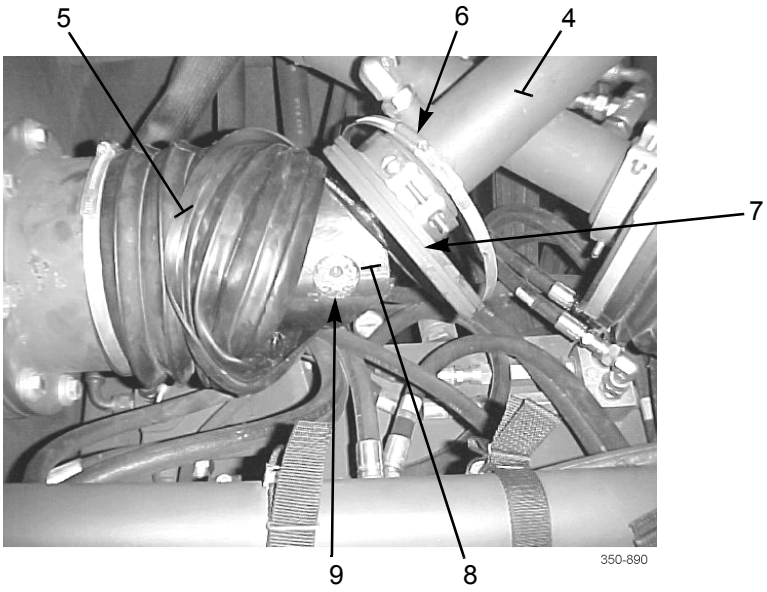
REMOVAL

1. Disconnect two hydraulic hoses (1) from cylinder (4).
2. Remove two retaining rings (2) and pin (3) securing cylinder (4) to vehicle. Discard retaining rings.



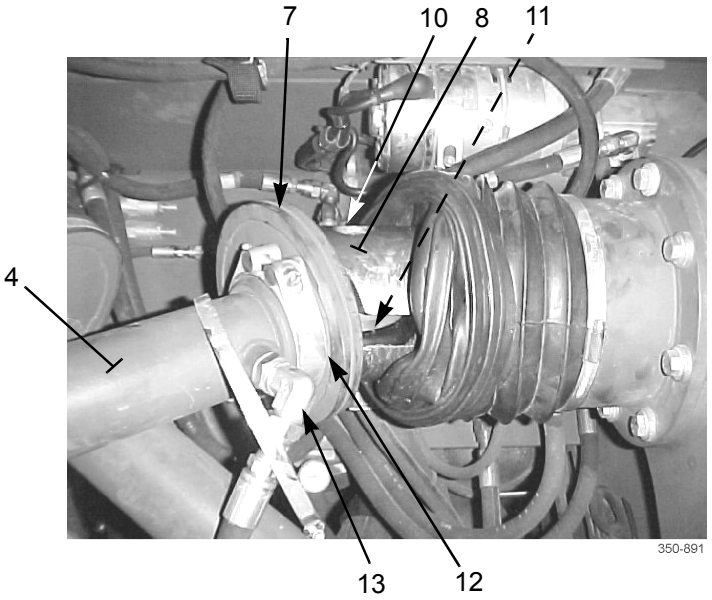
3. Loosen hose clamp (6) and slide rubber bellows (5) from bellows retaining plate (7) to expose end of cylinder (4) connected to locking pin (8).

Remove and discard retaining ring (9).



REMOVAL - CONTINUED

4. Pivot and rotate cylinder (4) to access retaining ring (10).
5. Remove retaining ring (10) and pin (11). Discard retaining ring.
6. Remove cylinder (4) from vehicle.
7. Loosen clamp (12) and remove bellows retaining plate (7) and two adapter fittings (13) from cylinder (4). Retain for installation.



INSTALLATION

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

1. Install two adapter fittings (13) on cylinder (4).
2. Install bellows retaining plate (7) and clamp (12) on cylinder (4).
3. Insert cylinder (4) into locking pin (8) and secure with pin (11) and new retaining ring (10).
4. Rotate and pivot cylinder (4) and insert new retaining ring (9).
5. Slide rubber bellows (5) over retaining plate (7) and secure with clamp (6).
6. Position cylinder (4) on vehicle mounting and secure with pin (3) and two new retaining rings (2).
7. Connect two hydraulic hoses (1) to cylinder (4).
8. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
9. Start engine (TM 10-3930-675-10), extend and retract boom support locking pins, and check for leaks.
10. Perform operational check of boom locking pins (TM 10-3930-675-10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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TOPHANDLER TILT CYLINDER REPLACEMENT 0063 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease (Item 13, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Washer, lock (P/N 923657.0004) (2)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Tophandler fully lowered (TM 10-3930-675-10) and resting on cribbing

Hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake applied (TM 10-3930-675-10)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Tophandler tilt cylinder weighs 115 lb (52 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Tophandler tilt cylinders are replaced in same manner.
- Tag all hydraulic lines.

REMOVAL

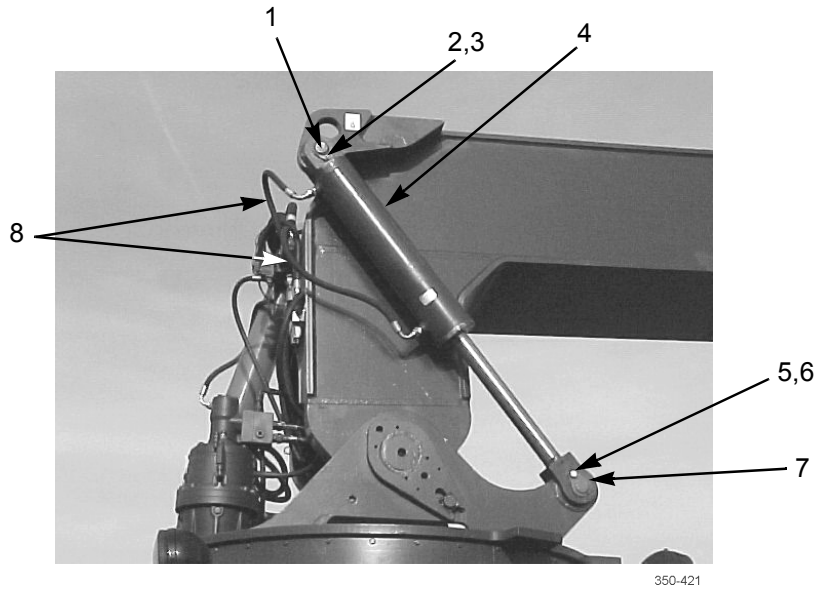
1. Disconnect two hydraulic hoses (8) from cylinder (4).

WARNING

Tophandler tilt cylinder weighs 115 lb (52 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

2. Attach a nylon sling and suitable lifting device to cylinder (4).
3. At lower end of cylinder (4), remove screw (5) and lockwasher (6). Discard lockwasher.
4. Remove pin (7).
5. Raise cylinder (4) to free lower end of cylinder from tophandler. Ensure sling is positioned so that cylinder will not tilt when removed.
6. At upper end of cylinder (4), remove screw (2) and lockwasher (3). Discard lockwasher.
7. Remove pin (1).
8. Remove upper end of cylinder (4) from boom.
9. Lower cylinder (4) to ground.

REMOVAL - CONTINUED



INSTALLATION

WARNING

Tophandler tilt cylinder weighs 115 lb (52 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Coat pins with grease before installation.

1. Using nylon sling and lifting device, position cylinder (4) so that upper end of cylinder can be attached to boom.
2. Install upper end of cylinder (4) to boom with pin (1).
3. Install new lockwasher (3) and screw (2).
4. Lower end of cylinder (4) to tophandler.
5. Install pin (7).
6. Install new lockwasher (6) and screw (5).
7. Remove sling and lifting device from cylinder (4).
8. Connect two hydraulic hoses (8) to cylinder (4).
9. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
10. Start engine (TM 10-3930-675-10), operate tilt cylinders, and check for leaks.

INSTALLATION - CONTINUED

11. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

TOPHANDLER SIDESHIFTING CYLINDER REPLACEMENT 0064 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Pliers, retaining ring (Item 62, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Materials/Parts - Continued

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake applied (TM 10-3930-675-10)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Tophandler sideshifting cylinder weighs 211 lb (96 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Tophandler sideshifting cylinders should be fully retracted to aid in replacement.
- Tophandler sideshifting cylinders are replaced in same manner.
- Tag all hydraulic lines.

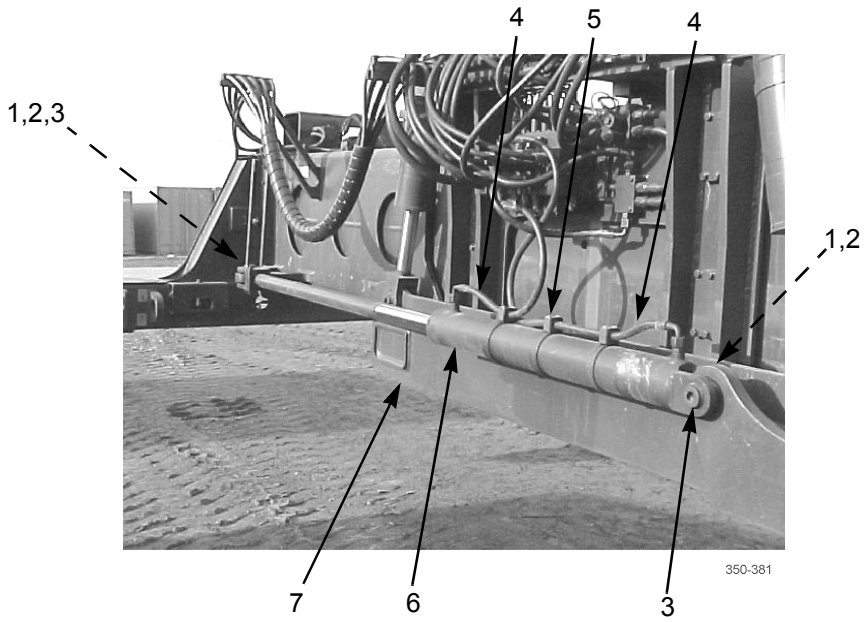
REMOVAL

1. Remove three hose clamps (5) from hydraulic hoses (4) and cylinder (6).
2. Place a container under cylinder (6) to catch any spillage. Disconnect two hydraulic hoses (4) from cylinder.

WARNING

Tophandler sideshifting cylinder weighs 211 lb (96 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

3. Attach nylon sling to cylinder (6) and attach sling to suitable lifting device.
4. Remove lock ring (1), spacer ring (2), and pin (3).
5. Repeat step 4 at opposite end of cylinder (6).
6. Remove cylinder (6) from tophandler (7).



INSTALLATION

WARNING

Tophandler sideshifting cylinder weighs 211 lb (96 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

1. Using suitable lifting device and nylon sling attached to cylinder (6), aline cylinder to tophandler (7).
2. Install pin (3), spacer ring (2), and lock ring (1).
3. Repeat step 2 at opposite end of cylinder (6).
4. Connect two hydraulic hoses (4) to cylinder (6).
5. Install three hose clamps (5) to hydraulic hoses (4) and cylinder (6).
6. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
7. Start engine (TM 10-3930-675-10), operate sideshifting cylinders, and check for leaks.
8. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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TOPHANDLER LEVELING CYLINDER REPLACEMENT 0065 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Pliers, retaining ring (Item 62, WP 0090 00)

Sling, nylon (Item 85, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Materials/Parts - Continued

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Personnel Required

Two

References

LO 10-3930-675-12

Equipment Condition

Tophandler supported with leveling cylinders fully collapsed

Hydraulic system pressure relieved (TM 10-3930-675-20)

Parking brake applied (TM 10-3930-675-10)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Tophandler leveling cylinder weighs 97 lb (44 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- All tophandler leveling cylinders are replaced in same manner.
- Tag all hydraulic lines.

REMOVAL

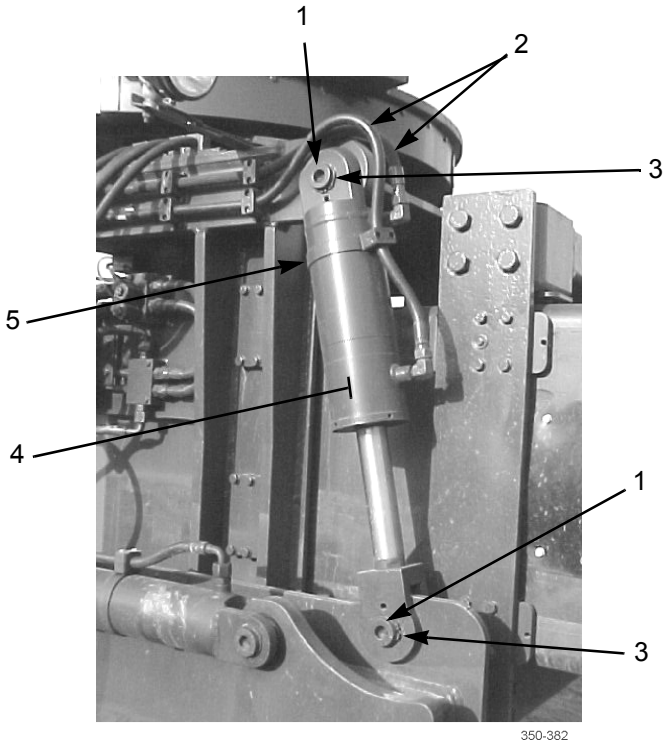
1. Remove hose clamp (5) from hydraulic hose (2) and cylinder (4).
2. Disconnect two hydraulic hoses (2) from cylinder (4).

WARNING

Tophandler leveling cylinder weighs 97 lb (44 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

3. Attach a nylon sling to cylinder (4) and attach sling to suitable lifting device.
4. Remove lockring (3) and pin (1).
5. Repeat step 4 at opposite end of cylinder (4).
6. Remove cylinder (4) from tophandler.

REMOVAL - CONTINUED



INSTALLATION

WARNING

Tophandler leveling cylinder weighs 97 lb (44 kg). Lifting device must have sufficient capacity to lift cylinder. Failure to follow this warning may result in death or injury to personnel.

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

1. Using a suitable lifting device and nylon sling, aline cylinder (4) to tophandler.
2. Install pin (1) and lockring (3).
3. Repeat step 2 at opposite end of cylinder (4).
4. Connect two hydraulic hoses (2) to cylinder (4).
5. Install hose clamp (5) to hydraulic hose (2) and cylinder (4).
6. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
7. Start engine (TM 10-3930-675-10), operate leveling cylinders, and check for leaks.

INSTALLATION - CONTINUED

8. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

FORKLIFT CYLINDER REPLACEMENT 0066 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Materials/Parts - Continued

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Personnel Required

Two

Equipment Condition

Forklift removed from tophandler

WARNING

- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

CAUTION

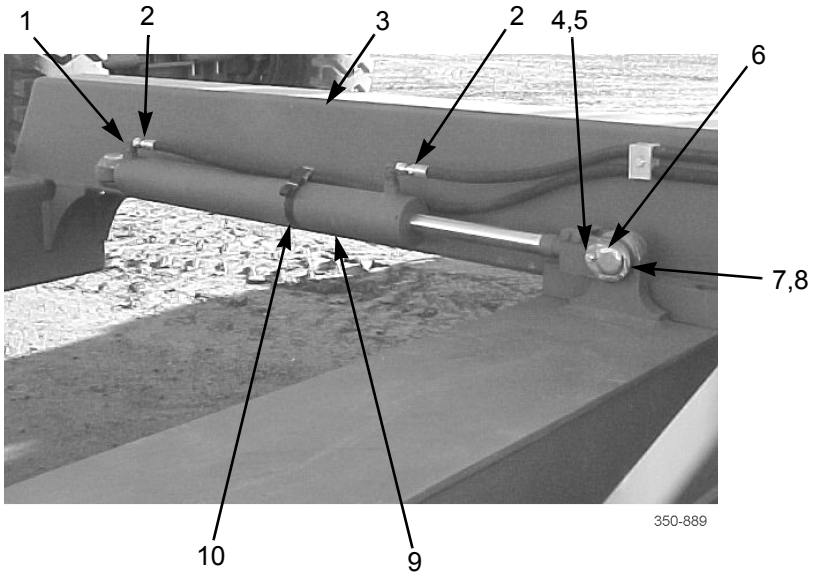
Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

NOTE

- Forklift cylinders are replaced in same manner.
- Tag all hydraulic lines.

REMOVAL

1. Loosen nylon strap (10) and disconnect two hydraulic hoses (2) from adapter fittings (1).
2. Remove two adapter fittings (1) from cylinder (9).
3. At one end of cylinder (9), remove screw (4) and spring washer (5).
4. Remove pin (6).
5. If damaged, remove two retaining rings (7) and guide bearing (8).
6. Repeat steps 4 thru 6 for opposite end of cylinder (9).
7. Remove cylinder (9) from forklift frame (3).



INSTALLATION

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

1. If removed, install guide bearing (8) and two retaining rings (7).
2. Position cylinder (9) to forklift frame (3) and install pin (6).
3. Install spring washer (5) and screw (4).
4. Repeat steps 1 thru 3 for opposite end of cylinder (9).
5. Install two adapter fittings (1) to cylinder (9).
6. Connect two hydraulic hoses (2) to cylinder (9). Tighten nylon strap (10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

HYDRAULIC RESERVOIR REPLACEMENT 0067 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pan, drain (Item 57, WP 0090 00)

Truck, forklift, 2000 lb capacity

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Seal, o-ring (P/N 1358)

Seal, o-ring (P/N 3503) (11)

Materials/Parts - Continued

Seal, o-ring (P/N 3505) (2)

Seal, o-ring (P/N 3507) (2)

Seal, o-ring (P/N 5252) (2)

Personnel Required

Two

Equipment Condition

Cab in transport position (TM 10-3930-675-10)

Transmission access covers removed (TM 10-3930-675-20)

Exhaust muffler removed (TM 10-3930-675-20)

Fuel tank removed (WP 0026 00)

Radiator splash shield removed (TM 10-3930-675-20)

Hydraulic reservoir drained (TM 10-3930-675-20)

Master battery switch in OFF position

Hydraulic reservoir pressure sensor removed (TM 10-3930-675-20)

WARNING

- DO NOT disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury.
- Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result.
- At operating temperature, hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulic lines. Failure to do so could result in injury.
- Hydraulic fluid is very slippery. Immediately wipe up any spills. Failure to follow this warning may result in injury to personnel.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Lifting device must have sufficient capacity to lift reservoir. Use a forklift truck with a 2000 lb capacity to remove reservoir. Failure to follow this warning may result in injury to personnel.

CAUTION

Wipe area clean around all hydraulic connections prior to disconnecting. Cap or plug all openings after disconnecting. Contamination of hydraulic system could result in equipment failure.

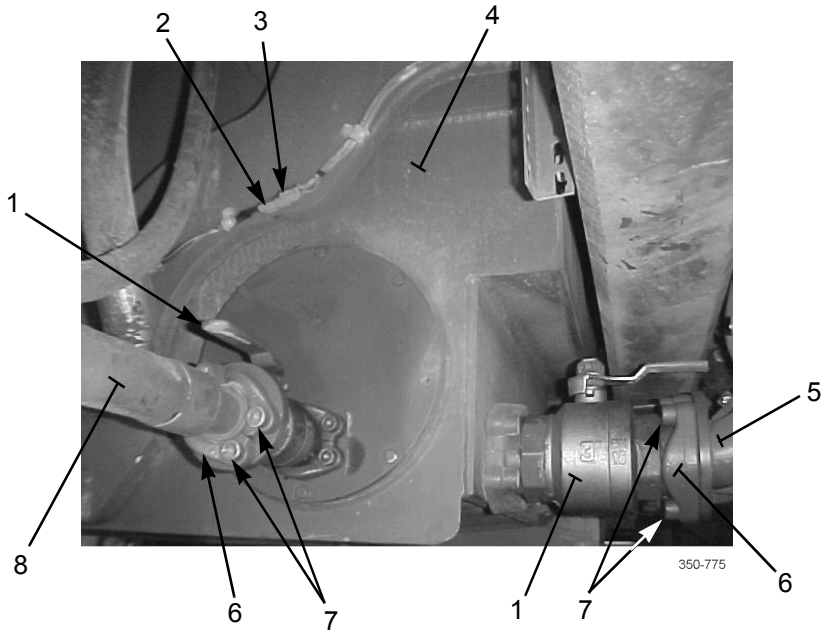
NOTE

- Tag all hydraulic lines and electrical leads.
- Remove nylon straps and cut and discard tiedown straps, as necessary, to gain free movement in hydraulic hoses and electrical leads.

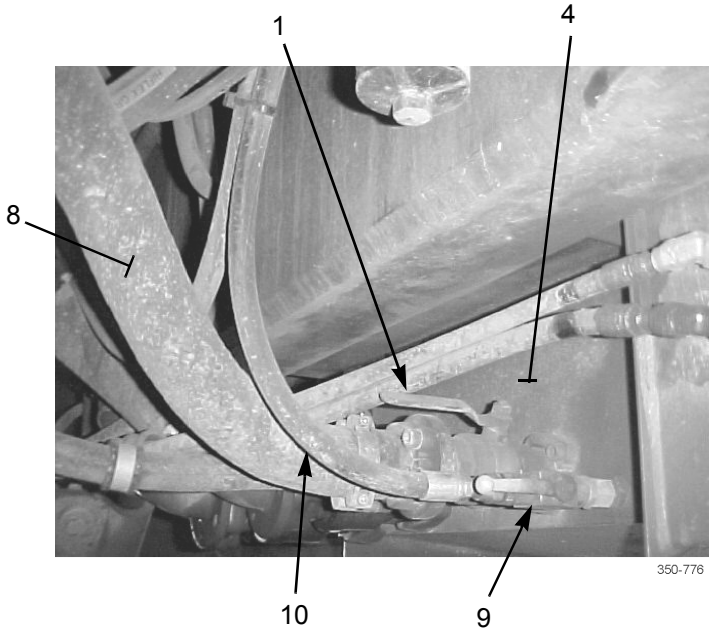
REMOVAL

1. Disconnect connector (2) from wiring harness connector (3).
2. Close five ball valves (1) at bottom of reservoir (4).
3. At five ball valves (1), remove four screws (7), flange (6), and disconnect hose (8) or pipe (5) from ball valve. Remove and discard o-ring.

REMOVAL - CONTINUED



4. Close ball valve (9) and disconnect hose (10) from ball valve.

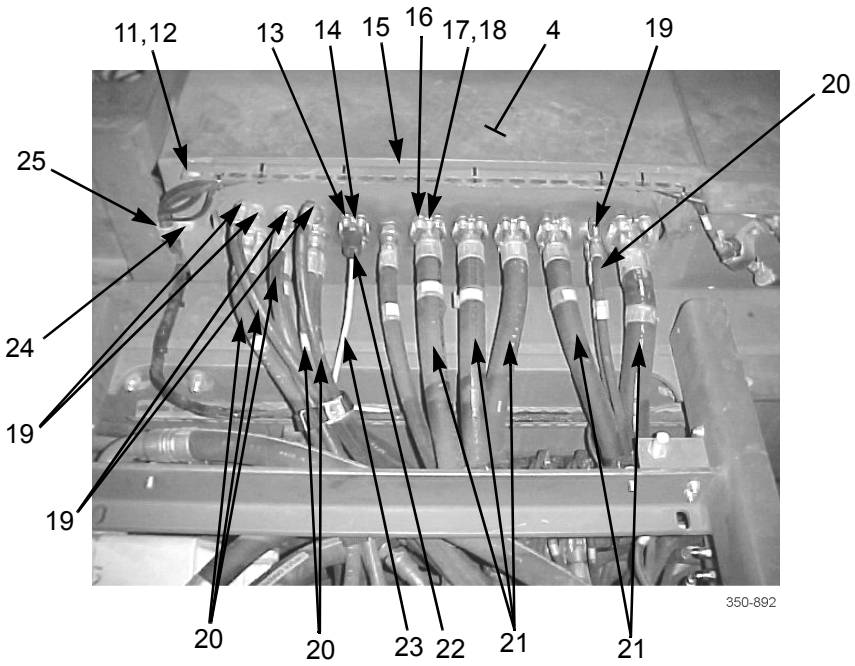


NOTE

If vehicle is equipped with arctic heater, perform steps 5 thru 7. If vehicle is not equipped with arctic heater, proceed to step 8.

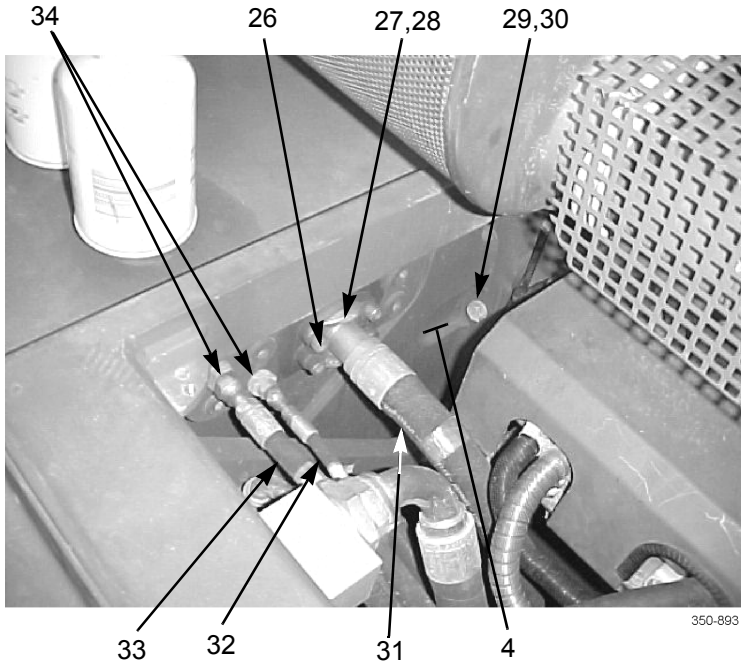
REMOVAL - CONTINUED

5. Remove two screws (11), washers (12), and arctic heater electrical and fuel lines (15) with support from hydraulic reservoir (4).
6. Remove screw (24) and hose clamp (25). Cut and discard tiedown straps as necessary.
7. Position arctic heater electrical and fuel lines (15) free of hydraulic reservoir (4).
8. At top left side of reservoir (4), disconnect hydraulic oil return hoses as follows:
   a. Remove four screws (16), flange (17), and o-ring (18) to disconnect each of five hoses (21). Discard o- rings.
   b. Disconnect ten remaining hoses (20) from fittings (19) at reservoir.
9. Remove four screws (13), flange (14), and sensor (22) with electrical lead (23) from hydraulic reservoir (4).



10. At top front of reservoir (4), remove three hydraulic hoses as follows:
    a. Remove four screws (26), flange (27), o-ring (28), and hose (31). Discard o-ring.
    b. Disconnect two hoses (32 and 33) from adapter fittings (34).

REMOVAL - CONTINUED



WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Lifting device must have sufficient capacity to lift reservoir. Use a forklift truck with a 2000 lb capacity to remove reservoir. Failure to follow this warning may result in injury to personnel.

NOTE

Ensure forklift truck is positioned with forks raised to support reservoir prior to removing attaching hardware.

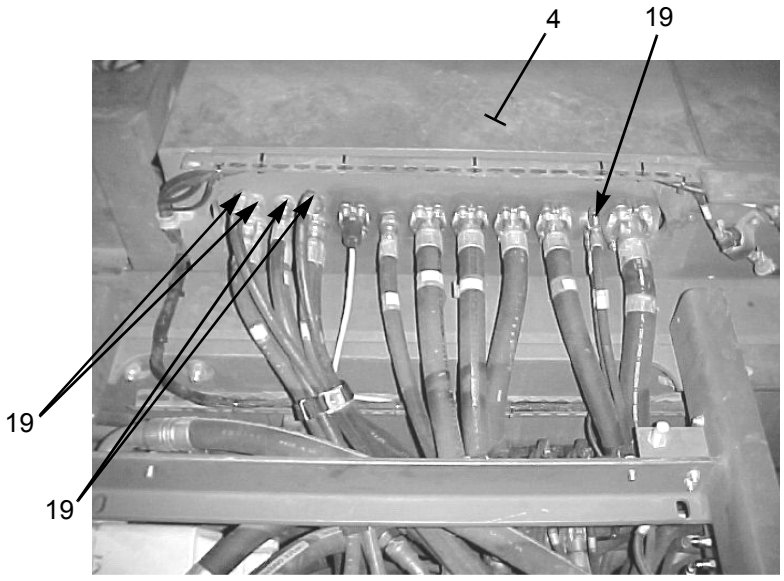
11. Remove six screws (29) and washers (30) securing hydraulic reservoir (4) to frame.

REMOVAL - CONTINUED

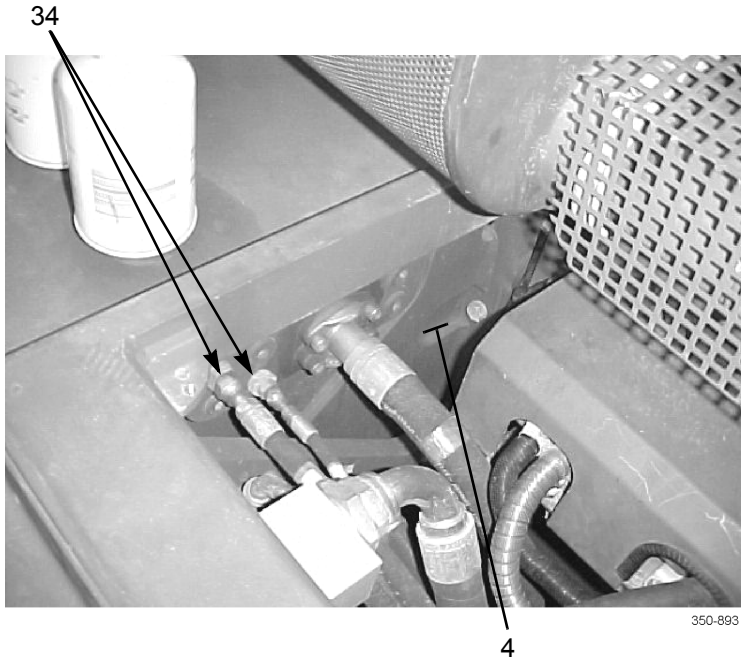
NOTE

Perform steps 12 thru 15 to remove fittings and ball valves from reservoir, if a new reservoir is being installed.

12. Remove 10 fittings (19) from top left side of reservoir (4).

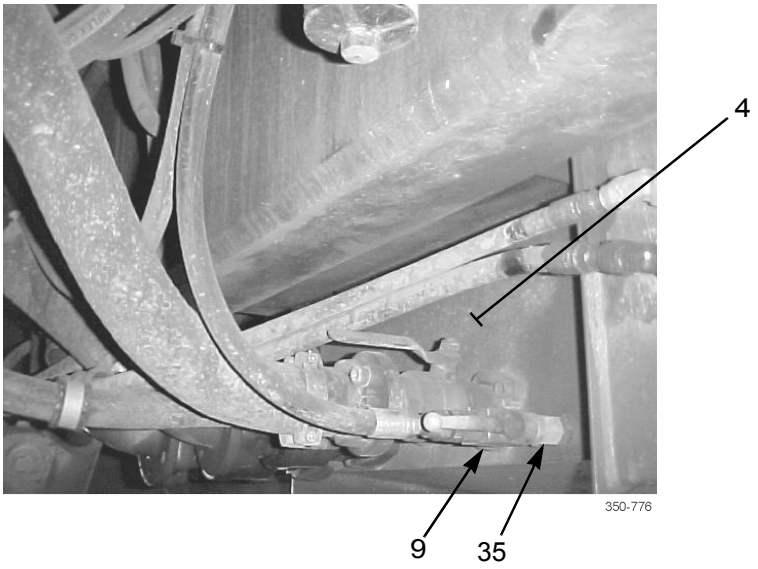


13. Remove two adapter fittings (34) from top front of reservoir (4).

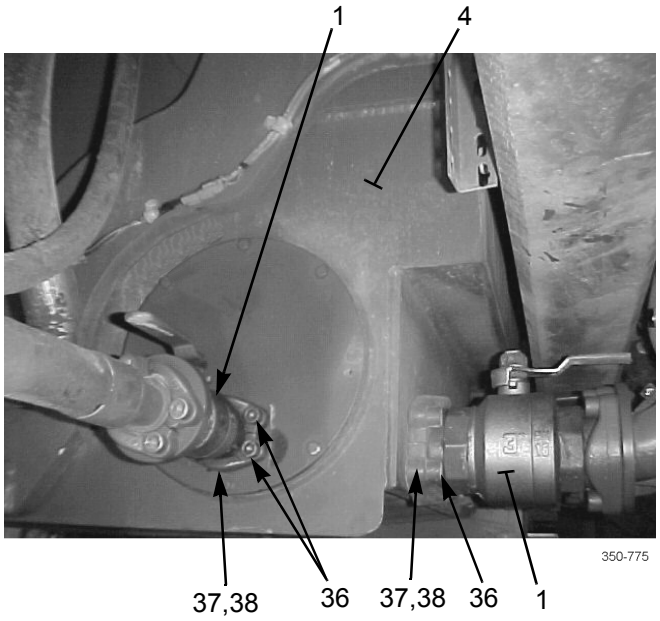


REMOVAL - CONTINUED

14. Remove ball valve (9) and fitting (35) from reservoir (4).



15. Remove each remaining ball valve (1) from reservoir (4) as follows:
    a. Remove four screws (36), flange (37), and ball valve (1).
    b. Remove and discard o-ring (38).

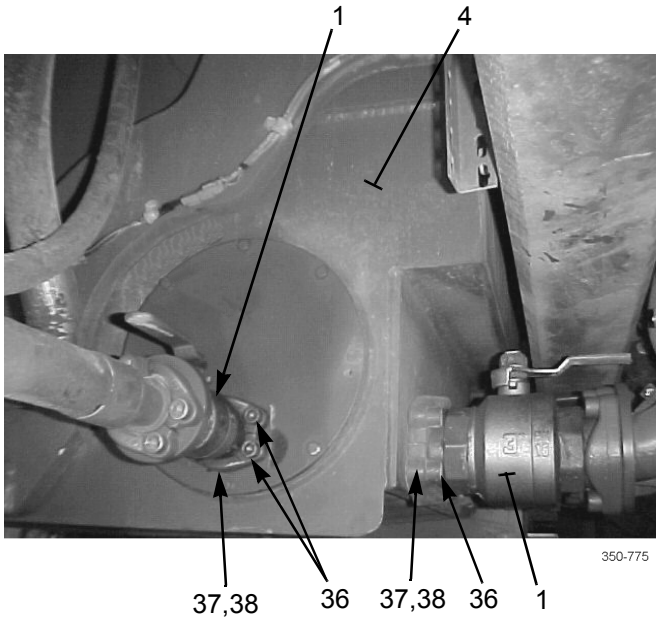


INSTALLATION

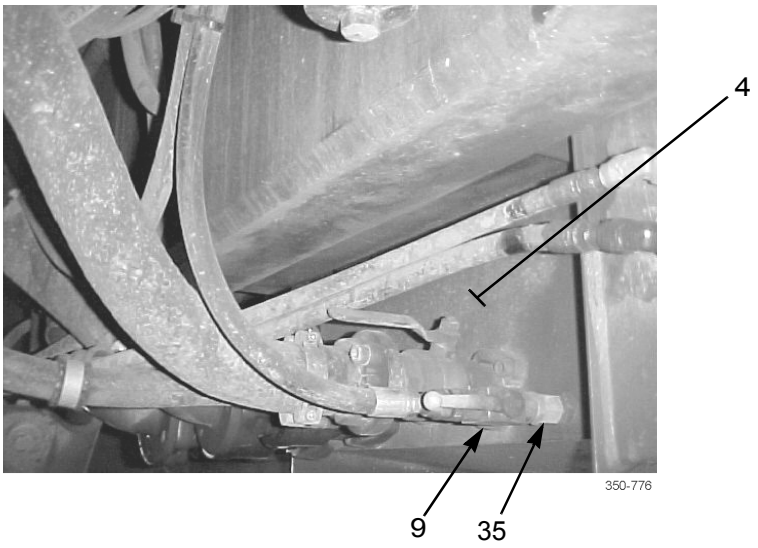
NOTE

- Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.
- Perform steps 1 thru 4 to install fittings removed from old reservoir, if a new reservoir is being installed.

1. Install each of five ball valves (1) at bottom of reservoir (4) as follows:
   a. Lubricate new o-ring (38).
   b. Install new o-ring (38) and ball valve (1) with flange (37) and four screws (36).

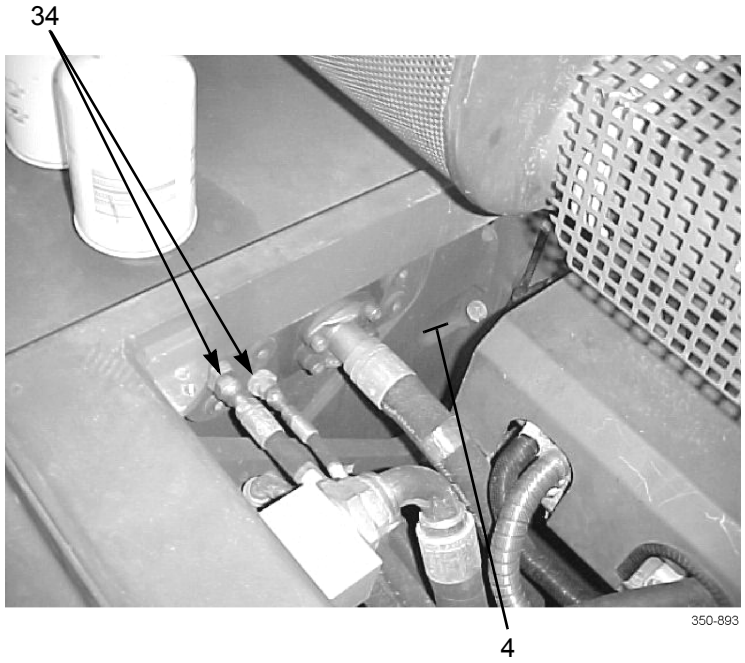


2. Install fitting (35) and ball valve (9) at bottom of reservoir (4).

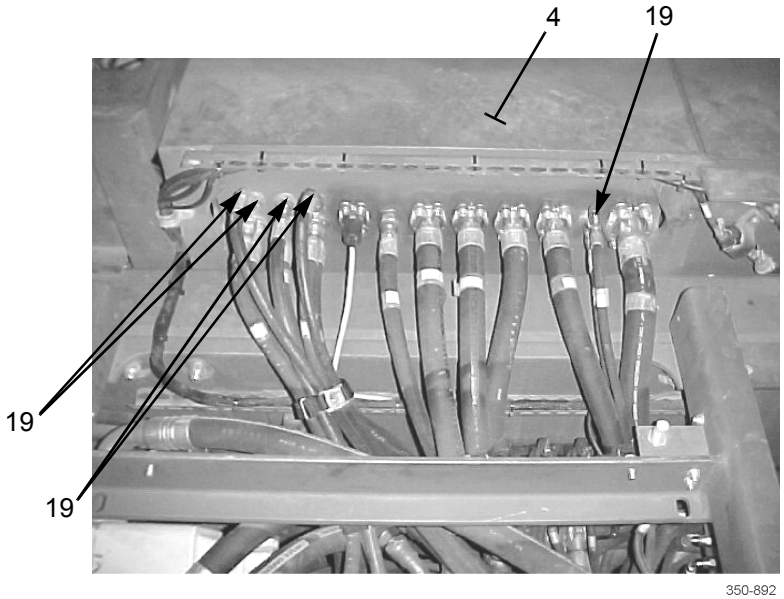


INSTALLATION - CONTINUED

3. Install two adapter fittings (34) to top front of reservoir (4).



4. Remove 10 fittings (19) from top left side of reservoir (4).

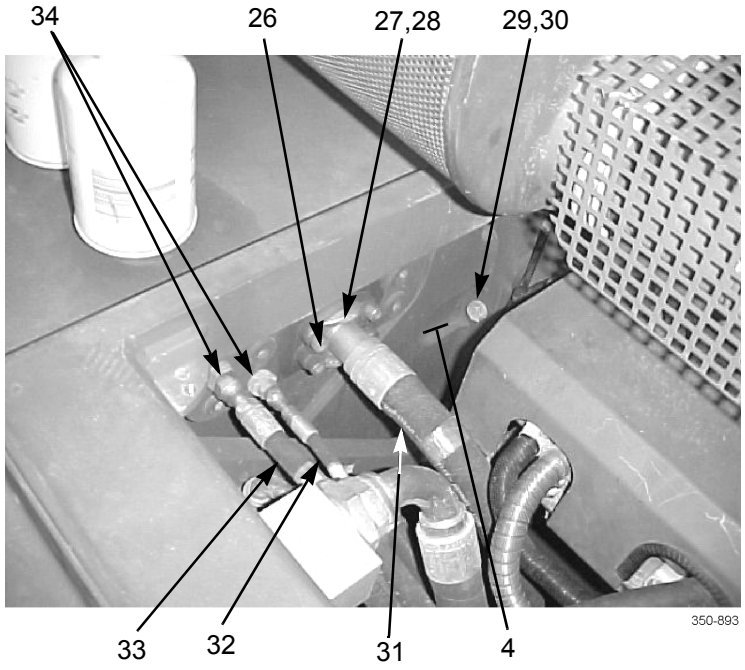


INSTALLATION - CONTINUED

WARNING

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.
- Lifting device must have sufficient capacity to lift reservoir. Use a forklift truck with a 2000 lb capacity to install reservoir. Failure to follow this warning may result in injury to personnel.

5. Using forklift truck, position reservoir (4) and secure to frame with six washers (30) and screws (29).
6. At top front of hydraulic reservoir (4), install three hydraulic hoses as follows:
   a. Lubricate new o-ring (28). Install new o-ring and hose (31) with flange (27) and four screws (26).
   b. Connect two hoses (32 and 33) to two adapter fittings (34).



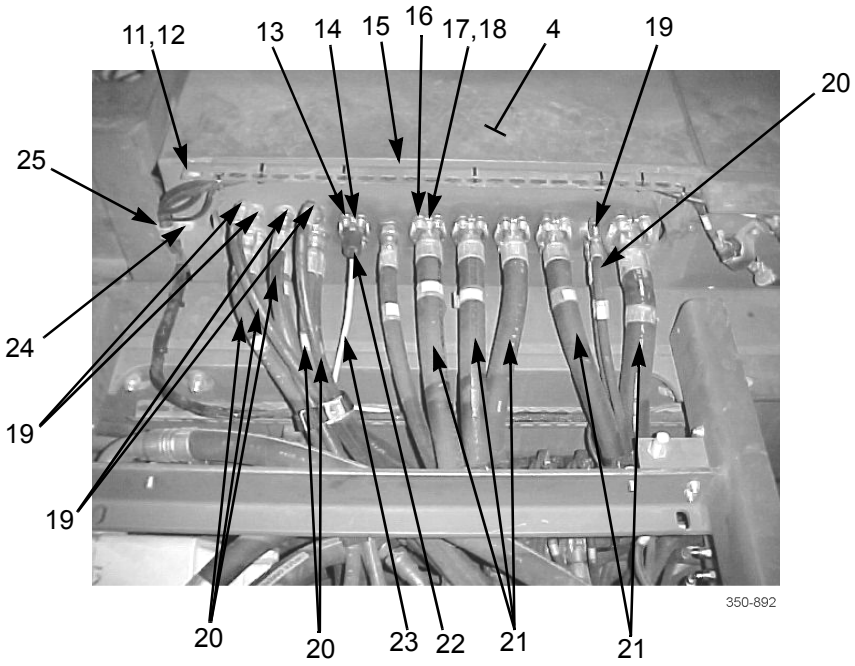
NOTE

If vehicle is equipped with arctic heater, perform steps 7 and 8. If vehicle is not equipped with arctic heater, proceed to step 9.

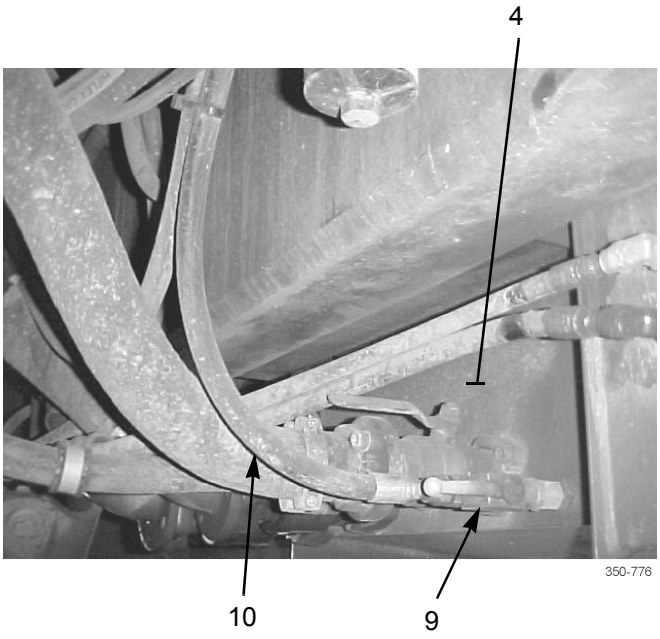
7. Position arctic heater electrical and fuel lines (15) with support on hydraulic reservoir (4) and secure with two screws (11) and washers (12).
8. Install screw (24) and hose clamp (25). Install new tiedown straps as necessary.
9. Install sensor (22) with electrical lead (23) and flange (14) with four screws (13).

INSTALLATION - CONTINUED

10. At top of reservoir (4), connect hydraulic oil return hoses as follows:
    a. Connect ten hoses (20) to fittings (19).
    b. Lubricate new o-ring (18). Install each of five hoses (21) with new o-ring, flange (17), and four screws (16).

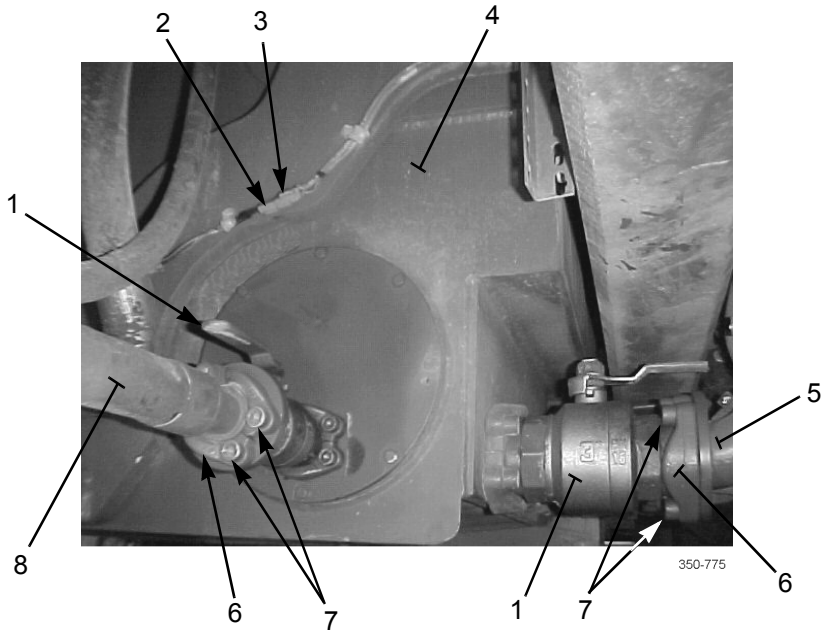


11. At bottom of reservoir (4), connect hose (10) to ball valve (9).

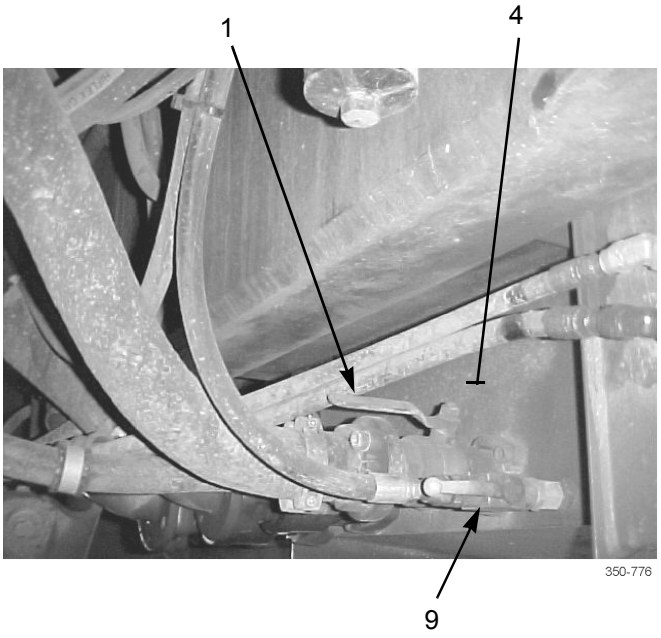


INSTALLATION - CONTINUED

12. At each of five ball valves (1), lubricate new o-ring. Install hose (8) or pipe (5) to ball valve with new o-ring, flange (6), and four screws (7).
13. Connect connector (2) to wiring harness connector (3).



14. Install hydraulic reservoir pressure sensor (TM 10-3930-675-20).
15. Fill hydraulic reservoir (TM 10-3930-675-20).
16. Open five ball valves (1) and ball valve (9) at bottom of reservoir (4).



INSTALLATION - CONTINUED

17. Install fuel tank (WP 0026 00).
18. Install nylon straps and new tiedown straps as necessary to support electrical leads and hydraulic hoses.
19. Install exhaust muffler (TM 10-3930-675-20).
20. Start engine (TM 10-3930-675-10) and check for leaks.
21. Perform operational check of all hydraulic systems (TM 10-3930-675-10).
22. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).
23. Install transmission access covers (TM 10-3930-675-20).
24. Install radiator splash shield (TM 10-3930-675-20).
25. Return cab to operational position (TM 10-3930-675-10).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

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AIR CONDITIONING SYSTEM MAINTENANCE 0068 00

THIS WORK PACKAGE COVERS

Recovery, Evacuating/Recycling, Purging, Flushing, Charging

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Gloves, rubber (Item 36, WP 0090 00)

Goggles, industrial (Item 38, WP 0090 00)

Reclaimer, refrigerant (Item 76, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Materials/Parts - Continued

Oil, refrigerant (Item 22, WP 0089 00)

Refrigerant, R-134a (Item 32, WP 0089 00)

References

TM 10-3930-675-10

WP 0069 00

WP 0072 00

Equipment Condition

Engine cover removed (TM 10-3930-675-20)

WARNING

- Use care to prevent refrigerant from touching your skin or eyes. Liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness may result if you come in contact with liquid refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in a fire or explosion, which could cause personnel injury or death.

RECOVERY

1. Remove caps from suction valve (5) and discharge valve (6) on AC compressor (7).
2. Wearing protective goggles and non-leather gloves, attach recovery/recycling station's hoses to valves (5 and 6).

NOTE

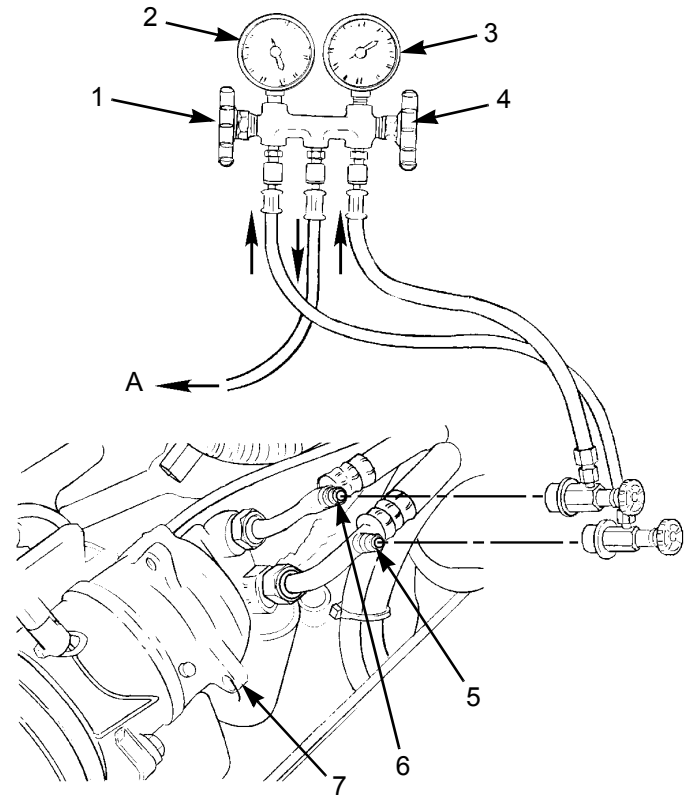
Push down firmly on hose connectors until a clicking sound is heard. This will ensure coupler is locked.

a. Ensure recovery/recycling station's valves are closed.

b. Connect red hose to discharge valve (6).

c. Connect blue hose to suction valve (5).

d. Turn knob clockwise on each coupler to open valves (5 and 6).



A	To Recovery Station
1	Manifold Suction Hand Valve (Open)
2	Low-Side Gage
3	High-Side Gage
4	Manifold Discharge Hand Valve (Open)
5	Suction Valve
6	Discharge Valve
7	AC Compressor

3. Follow recovery/recycling manufacturer's instructions and recover all refrigerant from system.

NOTE

- Always comply with all local regulations regarding refrigerant disposal. You may be subject to substantial penalties for improper disposal.
- Anytime air conditioning system refrigerant is evacuated, replace receiver-drier.

4. Replace receiver-drier (WP 0072 00).

RECOVERY - CONTINUED

NOTE

If system is contaminated with moisture, compressor oil must be replaced with clean oil. If system is heavily contaminated with desiccant or grit, replace compressor and expansion valve.

5. Replace air conditioner compressor (WP 0069 00).

EVACUATING/RECYCLING

NOTE

System must have been recovered and compressor filled with correct amount of refrigerant oil. Replace receiver-drier if system is opened.

1. Wearing protective goggles and rubber gloves, attach recovery/recycling station's hoses to valves.

NOTE

Push down firmly on hose connectors until a clicking sound is heard. This will ensure coupler is locked.

a. Ensure recovery/recycling station's valves are closed.
b. Connect red hose to discharge valve (6).
c. Connect blue hose to suction valve (5).
d. Turn knob clockwise on each coupler to open valves (5 and 6).

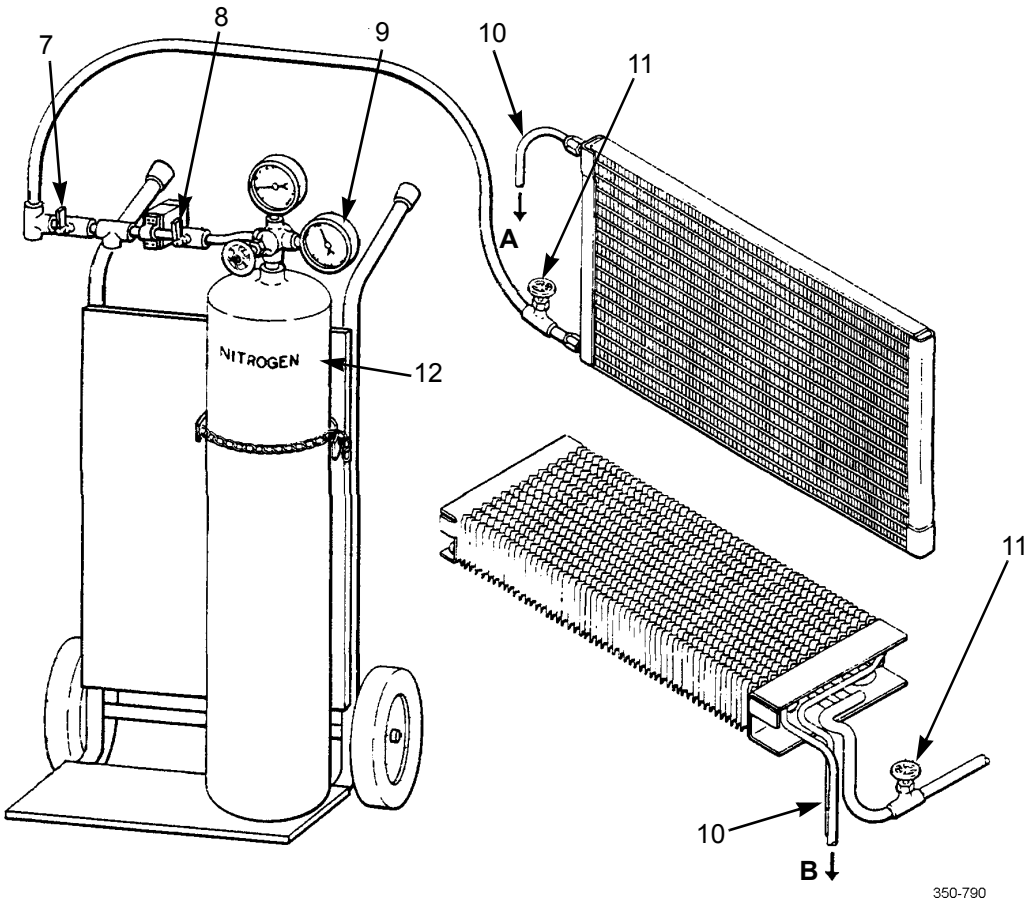
2. Follow recovery/recycling manufacturer's instructions and evacuate/recycle refrigerant system.

PURGING

NOTE

Dry nitrogen gas is recommended for purging. A pressure regulator is required to regulate between 0 to 200 psi (0-1379 kPa). Commercial cylinders of nitrogen contain pressures in excess of 2000 psi (13,780 kPa); this pressure must be reduced to 200 psi (1379 kPa) for purging.

1. Recover system refrigerant (refer to *Recovery*).
2. Disconnect both ends of line or part being purged. Tightly cap rest of system.
3. Ensure valves (8, 7, and 11) are closed.



A	**To Waste Container**	**B**	**To Recycling System Container**
7	Purging Control Valve	10	Drain Line
8	Nitrogen Bottle Control Valve	11	Supply Line Valve
9	Nitrogen Bottle Regulator/Gage	12	Nitrogen Bottle

4. Connect supply line valve (11) to outlet end of part or line.
5. Connect drain line (10) to inlet end of part or line.
6. Place outlet of drain line into a recycling system container.

PURGING - CONTINUED

7. Adjust nitrogen bottle regulator (9) to 200 psi (1379 kPa). Open nitrogen bottle control valve (8) and purging control valve (7). Then, slowly open supply line valve (11). Check drain line (10) for gas flow.
8. Let nitrogen flow at 200 psi (1379 kPa) and let it flow for 1 to 2 minutes. If part or line was very wet, allow it to flow until there is no trace of refrigerant oil or solid bits of dirt or grit flowing from drain tube.
9. Close nitrogen bottle control valve (8) and purging control valve (7) first, then close supply line valve (11).
10. Disconnect supply line valve (11) and drain line (10). Tightly cap both ends of part or line.

FLUSHING

1. Recover refrigerant system (refer to *Recovery*).
2. Disconnect both ends of part or line being flushed. Tightly cap lines to rest of system.
3. Heat R-134a refrigerant in a dial-a-charge or pressurize refrigerant in accordance with manufacturer's instructions provided with refrigerant reclaimer.
4. Connect dial-a-charge outlet hose to outlet side of system (this will ensure that R-134a will flow in reverse direction of normal flow).
5. Connect a line from inlet side of system to recovery/recycling station.

NOTE

If system is extremely contaminated, install a receiver-drier inline as a pre-filter for recovery/recycling station.

6. Turn on recovery/recycling station and open outlet valve for dial-a-charge. Allow about 2 pounds (1 kilogram) of R-134a to flow thru system.
7. Close supply line valve and wait for recovery station to shut off.
8. Disconnect supply line and drain line from dial-a-charge and recovery station. Connect lines to nitrogen bottle.
9. Purge system and check collection bottle for contaminants. Repeat process if needed.
10. Disconnect lines from part and tightly cap both ends of part.

CHARGING

NOTE

Before charging, system must be recovered and evacuated with recovery and recycling station connected to service and discharge port connections.

1. Obtain enough refrigerant to fully charge system. Set tank on a scale and weigh for correct amount of refrigerant to enter system. This prevents overcharging, which could cause damage to compressor.
2. Charge refrigerant system:

NOTE

If equipped with a recovery, recycling, and recharging system, charge system on high side following manufacturer's instructions. If charging from a bulk container, perform following steps:

a. Turn tank (bulk container) upside down. With engine off, open high side hand valve. DO NOT open low side hand valve.

b. Allow refrigerant to enter system until correct charge (by weight) has entered. Close high side hand valve.

CHARGING - CONTINUED

c. Start engine and run it at 1500 rpm. Set cab air conditioner controls at maximum cooling and fan speed; refrigerant compressor must engage.

d. If a charge did not enter system, place tank (bulk container) in upright position, then open LOW SIDE valve to draw vapor into system; leave valve open until correct weight of refrigerant has entered system, then close low side valve.

NOTE

If refrigerant is slow to enter system because of low outside temperatures, vaporization can be quickened by placing refrigerant tank in a tub of warm water, no warmer than 125°F (52°C).

3. Disconnect high side hose. With engine running, open low side and high side hose valves to recover refrigerant from lines.
4. Shut down engine.
5. Leak test air conditioning system (TM 10-3930-675-20).
6. Check operation of air conditioning system (TM 10-3630-675-10).
7. Install engine cover (TM 10-3930-675-20).

END OF WORK PACKAGE

AIR CONDITIONER COMPRESSOR REPLACEMENT 0069 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Nut, lock (P/N 5957) (2)

References

WP 0072 00

Equipment Condition

Master battery switch in OFF position

Air conditioning system refrigerant recovered (WP 0068 00)

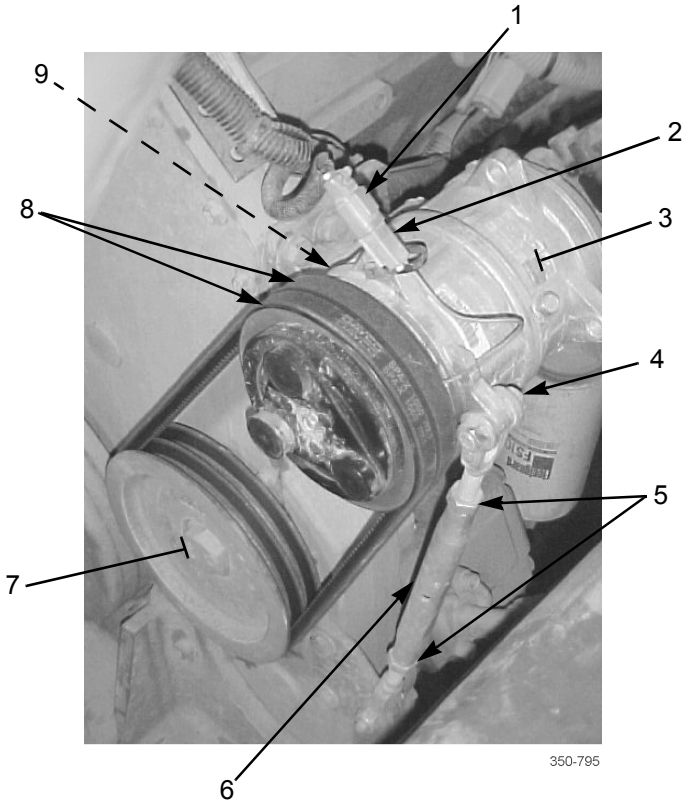
REMOVAL

NOTE

Remove and discard tiedown strap as necessary.

REMOVAL - CONTINUED

1. Disconnect connector (2) of air conditioner compressor (3) from engine wiring harness (1).
2. Loosen locknuts (4 and 9).
3. Loosen two jamnuts (5) and rotate support rod (6) to allow slack in two belts (8).
4. Remove two belts (8) from air conditioner compressor (3) and pulley (7).



5. Remove locknut (4) and screw (18) from yoke (17) of support rod (6). Discard locknut.

CAUTION

Water and dirt can damage refrigerant system. Refrigerant lines should be capped after disconnection to avoid contamination.

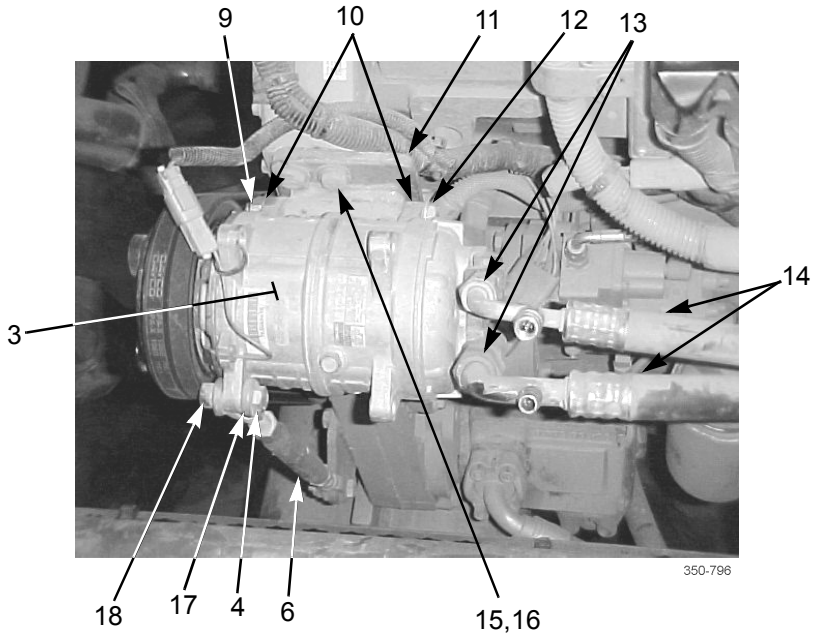
6. Loosen two fitting nuts (13) and disconnect two air conditioning hoses (14) from air conditioner compressor (3).
7. Remove locknut (9), bolt (12), two washers (10), and air conditioning compressor (3) from bracket (11). Discard locknut.

NOTE

Perform step 8 to remove bracket from engine.

8. Remove four screws (15), washers (16), and bracket (11) from left front of engine.

REMOVAL - CONTINUED



INSTALLATION

NOTE

Perform step 1 to install bracket to engine.

1. Install bracket (11) to left front of engine with four washers (16) and screws (15).
2. Install air conditioning compressor (3) to bracket (11) with two washers (10), bolt (12), and new locknut (9). Do not fully tighten locknut.
3. Connect two air conditioner hoses (14) to air conditioner compressor (3) and tighten two fitting nuts (13).
4. Position two belts (8) to air conditioner compressor (3) and pulley (7).
5. Install yoke (17) of support rod (6) to air conditioner compressor (3) with screw (18) and new locknut (4). Do not fully tighten locknut.
6. Rotate support rod (6) until belts (8) can be depressed no more than 1/2 in (12.7 mm) at center of belts. Tighten two jamnuts (5).
7. Tighten locknuts (4 and 9).

NOTE

Install new tiedown strap as necessary.

8. Connect connector (2) of air conditioner compressor (3) to engine wiring harness (1).

NOTE

Any time air conditioning system refrigerant is evacuated, replace receiver-drier.

INSTALLATION - CONTINUED

9. Replace receiver-drier (WP 0072 00).
10. Charge air conditioning system (WP 0068 00).

END OF WORK PACKAGE

AIR CONDITIONER HOSES REPLACEMENT 0070 00

THIS WORK PACKAGE COVERS

Chassis Air Conditioner Hoses: Removal, Installation

Cab Rear Air Conditioner Hose: Removal, Installation

Cab Interior Air Conditioner Hoses: Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

References

TM 10-3930-675-20

WP 0072 00

Equipment Condition

Air conditioning system refrigerant recovered (WP 0068 00)

CHASSIS AIR CONDITIONER HOSES REMOVAL

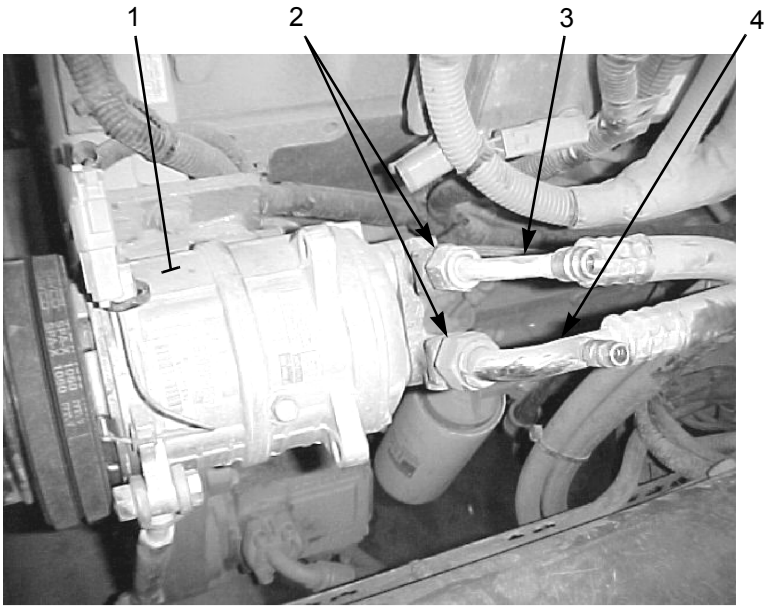
1. Remove transmission access covers (TM 10-3930-675-20).

CAUTION

Water and dirt can damage refrigerant system. Refrigerant lines and compressor should be capped after disconnection to avoid contamination.

CHASSIS AIR CONDITIONER HOSES REMOVAL - CONTINUED

2. Loosen two fitting nuts (2) and disconnect two air conditioner hoses (3 and 4) from air conditioner compressor (1).



350-816

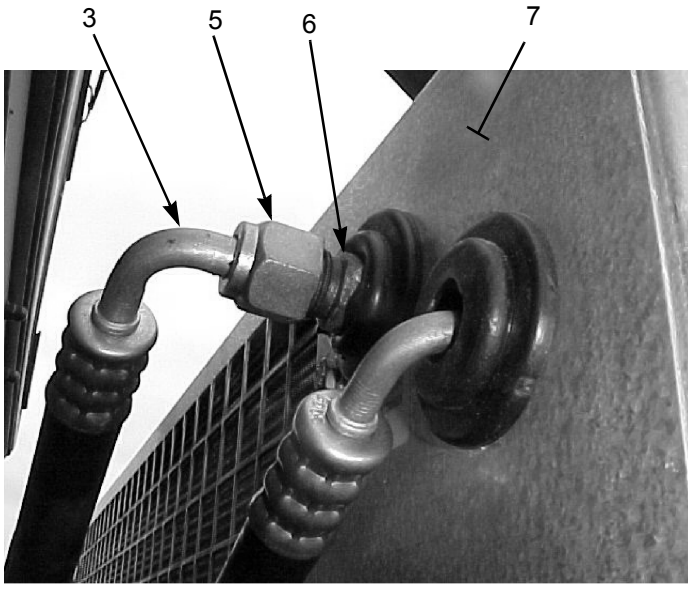
CAUTION

Use two wrenches when loosening fitting nut to avoid twisting tube of condenser.

NOTE

Remove nylon straps and remove and discard tiedown straps as necessary.

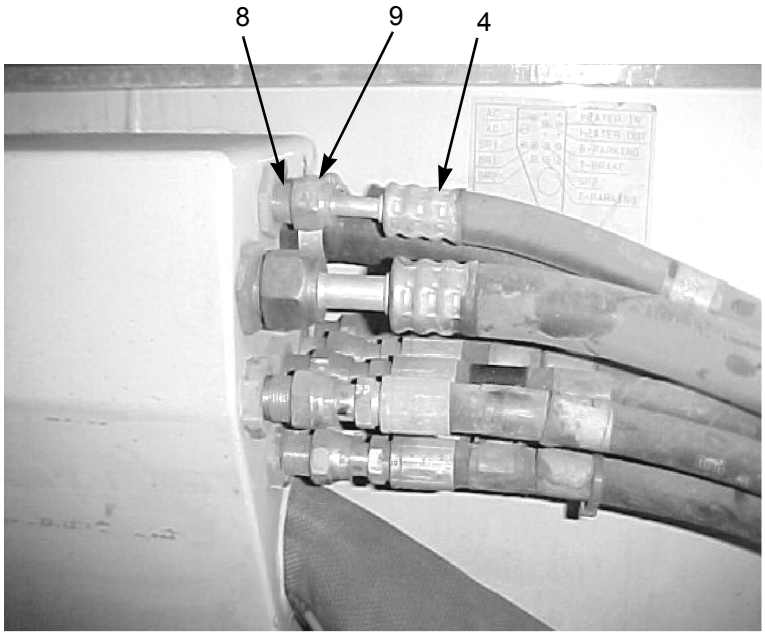
3. Behind cab, loosen fitting nut (5) and disconnect air conditioner hose (3) from condenser (6) at condenser fan box (7).



350-792

CHASSIS AIR CONDITIONER HOSES REMOVAL - CONTINUED

4. Loosen fitting nut (9) and disconnect air conditioner hose (4) from fitting (8) at cab interface at rear of cab.



350-818

5. Remove two air conditioner hoses (3 and 4) from vehicle.

CHASSIS AIR CONDITIONER HOSES INSTALLATION

1. Position two air conditioner hoses (3 and 4) to vehicle.
2. Connect air conditioner hose (4) to fitting (8) at cab interface at rear of cab and tighten fitting nut (9).

CAUTION

Use two wrenches when tightening fitting nut to avoid twisting tube of condenser.

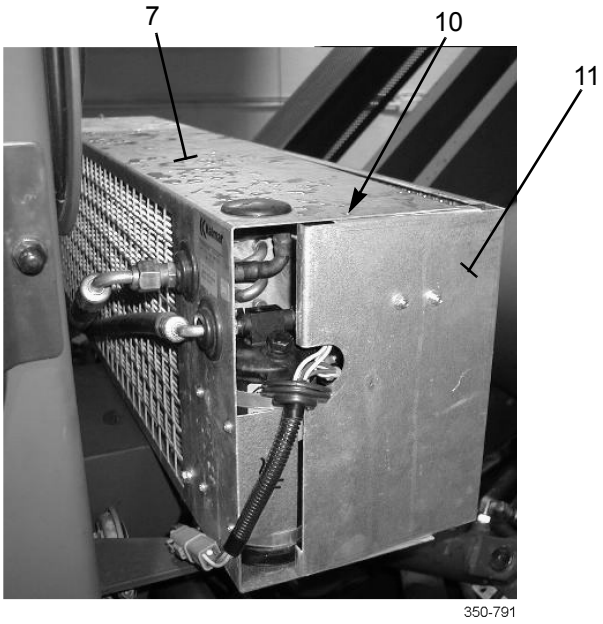
3. Connect air conditioner hose (3) to condenser (6) at condenser fan box (7) and tighten fitting nut (5).
4. Toward front of vehicle, connect two air conditioner hoses (3 and 4) to air conditioner compressor (1) and tighten two fitting nuts (2).
5. Replace receiver-drier (WP 0072 00).
6. Charge air conditioning system (WP 0068 00).
7. Install transmission access covers (TM 10-3930-675-20).

CAB REAR AIR CONDITIONER HOSE REMOVAL

NOTE

Perform following steps for short air conditioner hose at outside rear of cab.

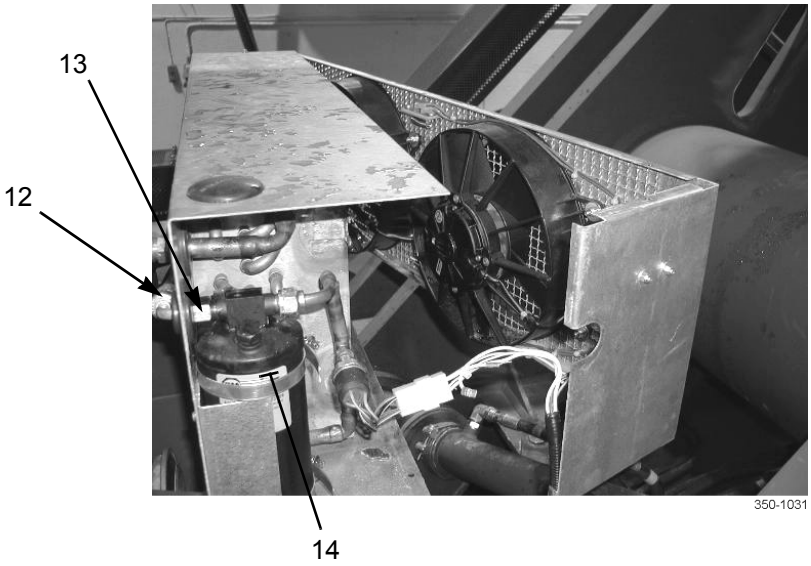
1. Remove ten screws (10) and separate cover (11) assembly from condenser fan box (7).



CAUTION

Water and dirt can damage refrigerant system. Refrigerant lines should be capped after disconnection to avoid contamination.

2. Loosen fitting nut (13) and disconnect air conditioner hose (12) from receiver-drier (14).

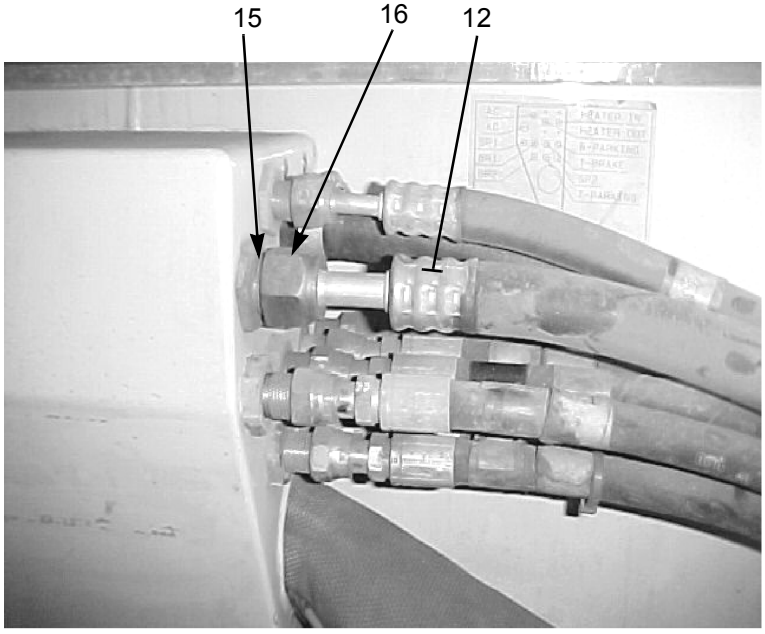


CAB REAR AIR CONDITIONER HOSE REMOVAL - CONTINUED

NOTE

Remove and discard tiedown straps as necessary.

3. Loosen fitting nut (16) and disconnect other end of air conditioner hose (12) from fitting (15) at cab interface at rear of cab.
4. Remove air conditioner hose (12) from rear of cab.



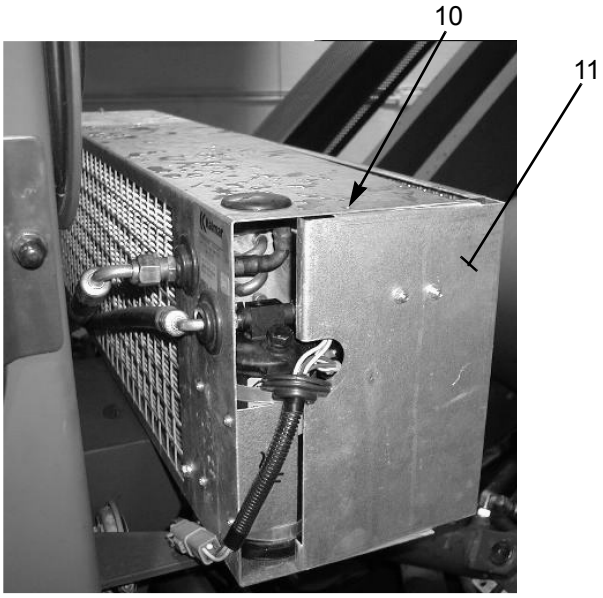
350-818

CAB REAR AIR CONDITIONER HOSE INSTALLATION

1. Position air conditioner hose (12) to rear of cab.
2. Connect air conditioner hose (12) to fitting (15) at cab interface at rear of cab and tighten fitting nut (16).
3. Replace receiver-drier (WP 0072 00).
4. Connect other end of air conditioner hose (12) to receiver-drier (14) and tighten fitting nut (13).

CAB REAR AIR CONDITIONER HOSE INSTALLATION - CONTINUED

5. Charge air conditioning system (WP 0068 00).
6. Close cover (11) assembly and install ten screws (10).



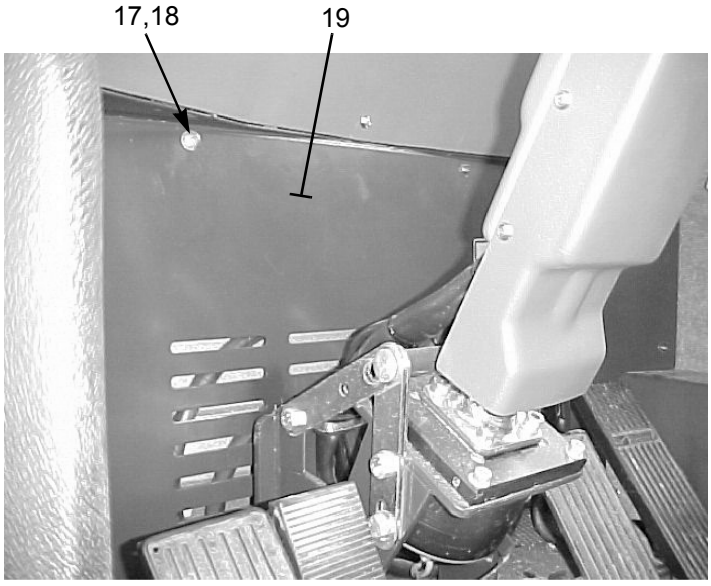
350-791

CAB INTERIOR AIR CONDITIONER HOSES REMOVAL

NOTE

Perform following steps to remove air conditioner hoses between cab heater/air conditioning unit and rear of cab.

1. Remove four screws (17), washers (18), and lower panel (19) from cab.



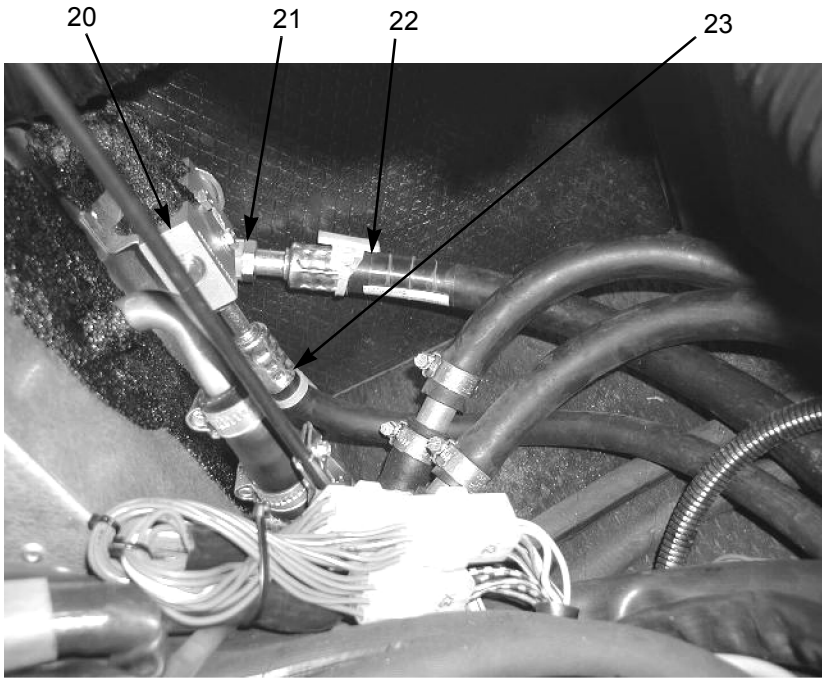
350-347

CAB INTERIOR AIR CONDITIONER HOSES REMOVAL - CONTINUED

CAUTION

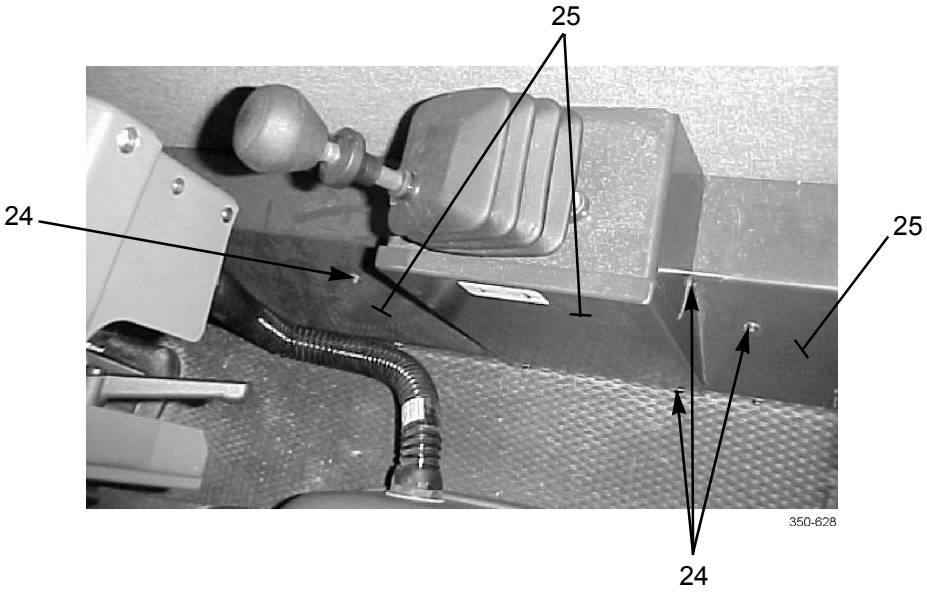
Water and dirt can damage refrigerant system. Refrigerant lines should be capped after disconnection to avoid contamination.

2. Loosen two fitting nuts (21) and disconnect two air conditioner hoses (22 and 23) from expansion valve (20).



350-783

3. Remove 14 screws (24) and three access covers (25) from right side of cab.



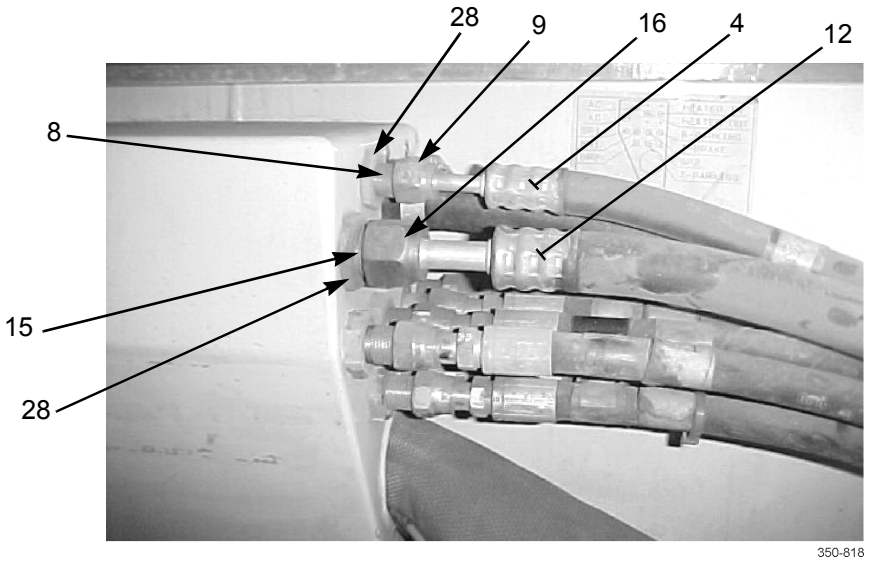
350-628

CAB INTERIOR AIR CONDITIONER HOSES REMOVAL - CONTINUED

4. Lift and remove right access cover (26) and middle access cover (27) from rear of cab.

350-737

5. At cab interface behind cab, loosen two fitting nuts (9 and 16) and disconnect two air conditioner hoses (4 and 12) from two fittings (8 and 15).
6. Remove two jamnuts (28) and push two fittings (8 and 15), with two air conditioner hoses (23 and 22) attached, into cab.



350-818

CAB INTERIOR AIR CONDITIONER HOSES REMOVAL - CONTINUED

7. At inside rear of cab, loosen two fitting nuts (29) and disconnect two air conditioner hoses (23 and 22) from two fittings (8 and 15). Set fittings aside.
8. Remove two air conditioner hoses (23 and 22) from cab.

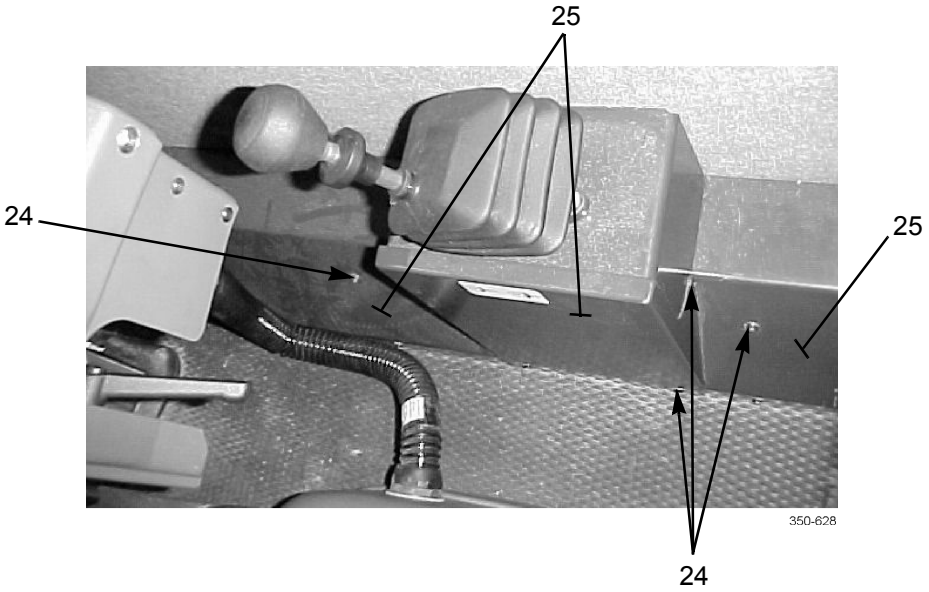
350-786

CAB INTERIOR AIR CONDITIONER HOSES INSTALLATION

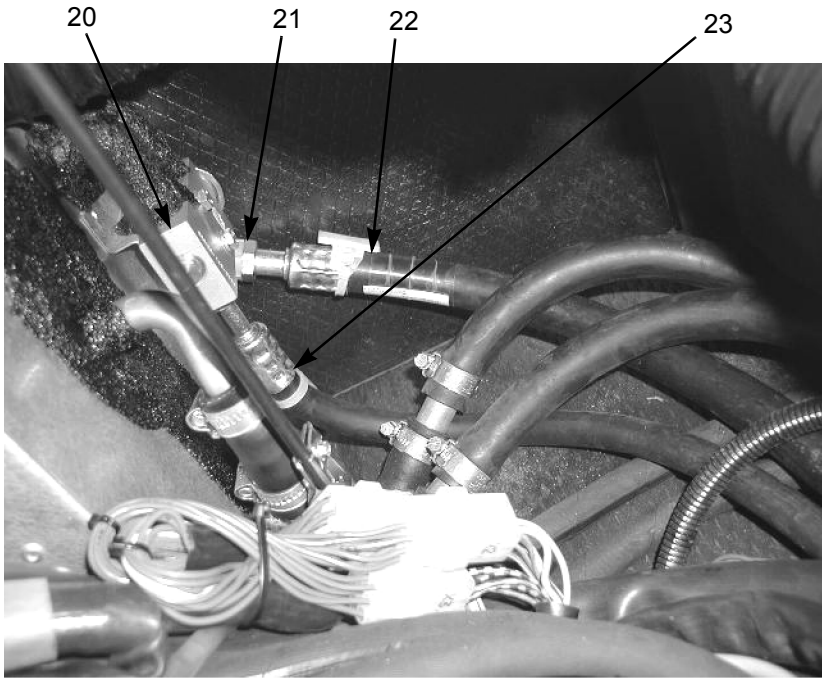
1. Position two air conditioner hoses (23 and 22) to cab.
2. At inside rear of cab, connect two air conditioning hoses (23 and 22) to two fittings (8 and 15) and tighten two fitting nuts (29).
3. Push two fittings (8 and 15), with two air conditioner hoses (23 and 22) attached, out of cab. Install two jamnuts (28).
4. Connect two air conditioner hoses (4 and 12) to two fittings (8 and 15) and tighten two fitting nuts (9 and 16).
5. Install middle access cover (27) and right access cover (26) to rear of cab.

CAB INTERIOR AIR CONDITIONER HOSES INSTALLATION - CONTINUED

6. Install three access covers (25) to right side of cab with 14 screws (24).

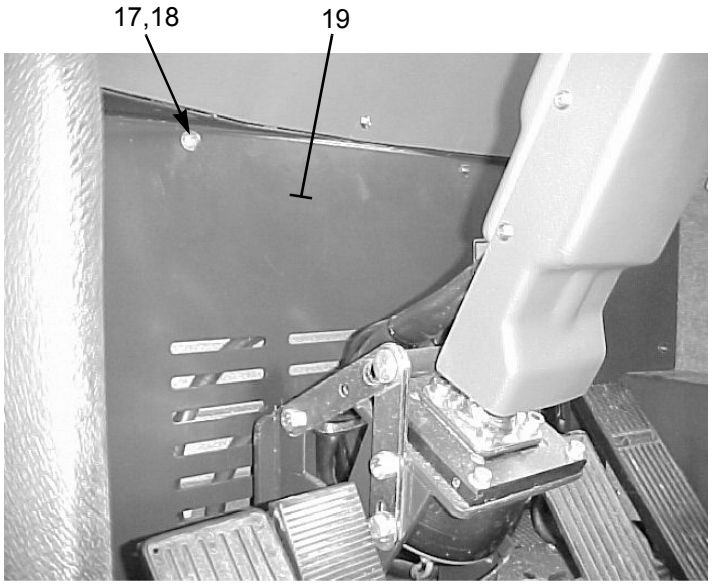


7. Connect two air conditioning hoses (23 and 22) to expansion valve (20) and tighten two fitting nuts (21).



CAB INTERIOR AIR CONDITIONER HOSES INSTALLATION - CONTINUED

8. Install lower panel (19) to cab with four washers (18) and screws (17).



350-347

9. Replace receiver-drier (WP 0072 00).
10. Charge air conditioning system (WP 0068 00).

END OF WORK PACKAGE

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AIR CONDITIONER CONDENSER REPLACEMENT 0071 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Washer, lock (P/N 5954) (4)

References

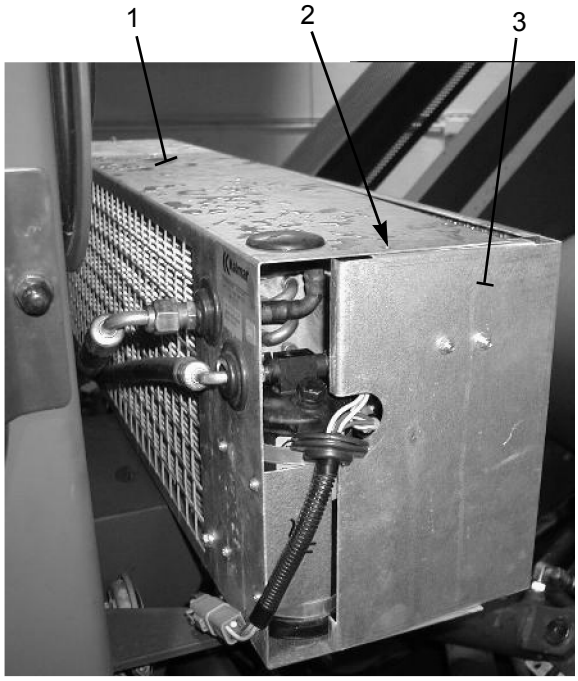
WP 0072 00

Equipment Condition

Air conditioning system refrigerant recovered (WP 0068 00)

REMOVAL

1. Remove ten screws (2) and separate cover (3) assembly from condenser fan box (1).



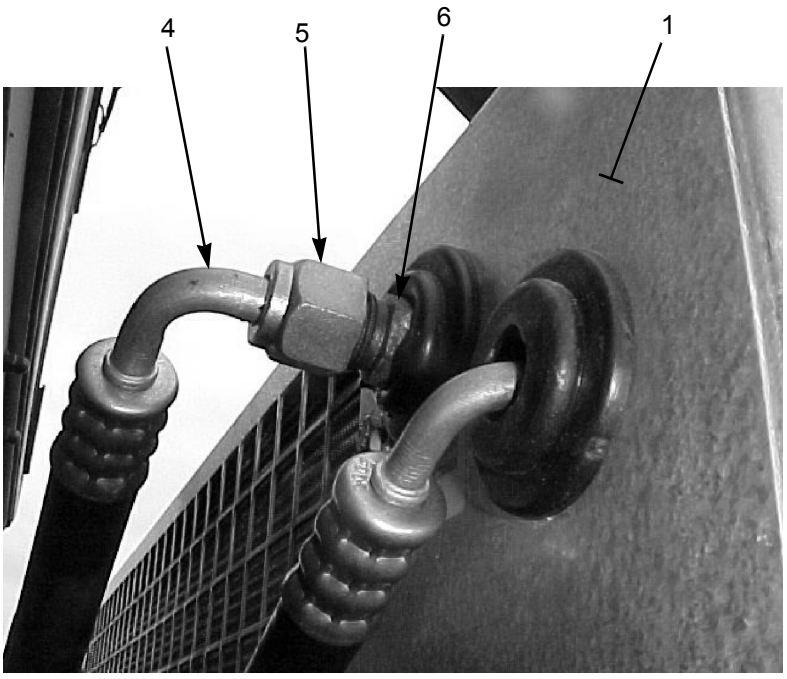
350-791

REMOVAL - CONTINUED

CAUTION

- Water and dirt can damage refrigerant system. Refrigerant lines should be capped after disconnection to avoid contamination.
- Use two wrenches when loosening fitting nut to avoid twisting tube of condenser.

2. From outside condenser fan box (1), loosen fitting nut (5) and disconnect air conditioning hose (4) from condenser (6).



350-792

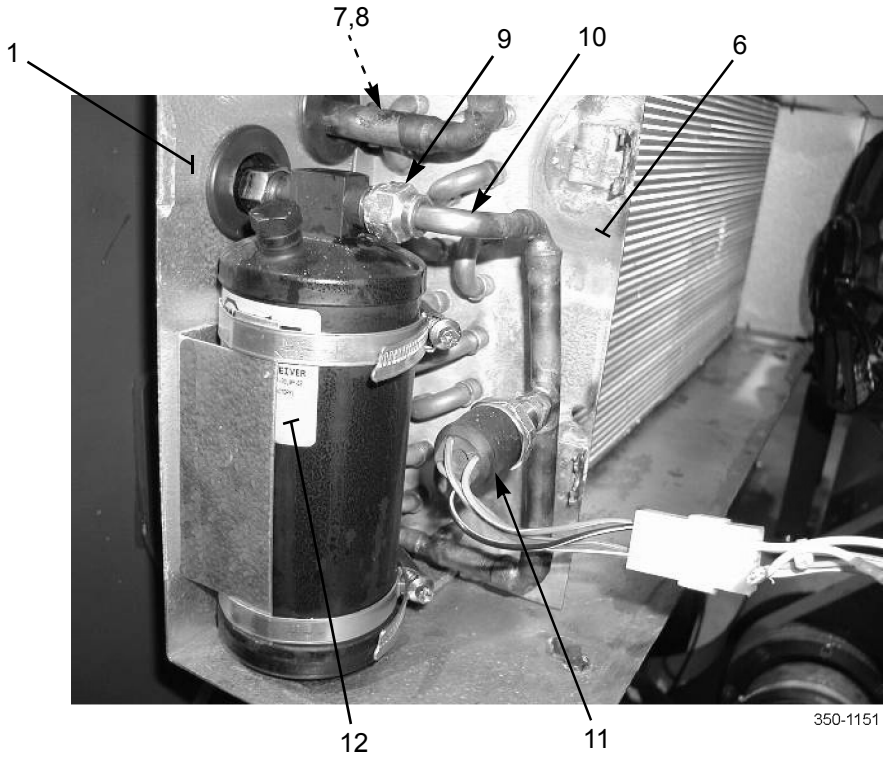
3. From inside condenser fan box (1), loosen fitting nut (9) and disconnect tube (10) from receiver-drier (12).
4. Remove pressure switch (11) from condenser (6).
5. Remove four screws (7), lockwashers (8), and condenser (6) from condenser fan box (1). Discard lockwashers.

NOTE

Any time air conditioning system refrigerant is evacuated, replace receiver-drier.

6. Remove receiver-drier (12) (WP 0072 00).

REMOVAL - CONTINUED



INSTALLATION

1. Install receiver-drier (12) (WP 0072 00).
2. Install condenser (6) to condenser fan box (1) with four screws (7) and new lockwashers (8).
3. Install pressure switch (11).
4. Connect tube (10) to receiver-drier (12) and tighten fitting nut (9).
5. Outside condenser fan box (1), connect air conditioner hose (4) to condenser (6) and tighten fitting nut (5).
6. Charge air conditioning system (WP 0068 00).

INSTALLATION - CONTINUED

7. Close cover (3) assembly and install ten screws (2).

350-791

END OF WORK PACKAGE

AIR CONDITIONER RECEIVER-DRIER REPLACEMENT 0072 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Materials/Parts

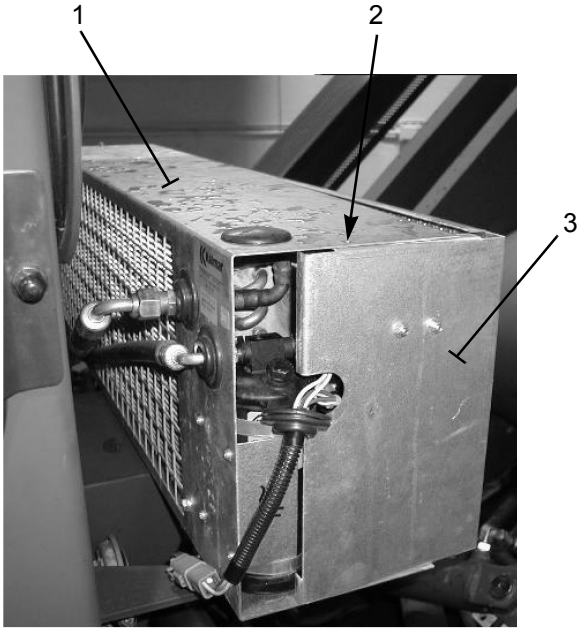
Cap set, protective (Item 3, WP 0089 00)

Equipment Condition

Air conditioning system refrigerant recovered (WP 0068 00)

REMOVAL

1. Remove ten screws (2) and separate cover (3) assembly from condenser fan box (1).



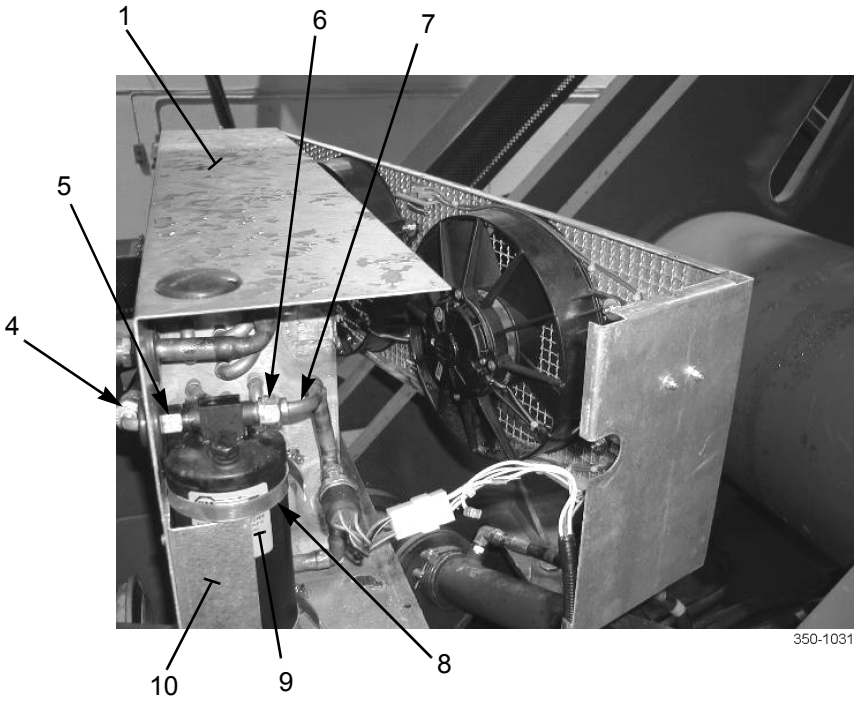
350-791

REMOVAL - CONTINUED

CAUTION

Water and dirt can damage refrigerant system. Refrigerant lines should be capped after disconnection to avoid contamination.

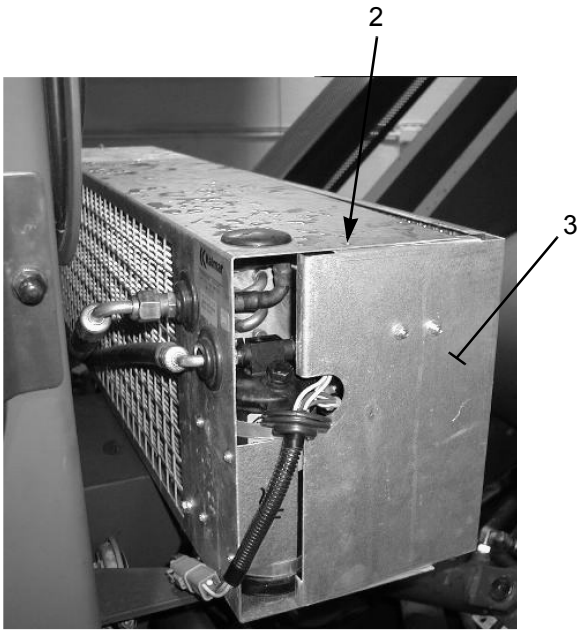
2. From inside condenser fan box (1), loosen fitting nut (5) and disconnect air conditioner hose (4) from receiver-drier (9).
3. Loosen fitting nut (6) to disconnect tube (7) from receiver-drier (9).
4. Remove two clamps (8) and receiver-drier (9) from bracket (10).



INSTALLATION

1. Install receiver-drier (9) to bracket (10) with two clamps (8). Do not fully tighten clamps.
2. Connect tube (7) to receiver-drier (9) and tighten fitting nut (6).
3. Connect air conditioner hose (4) to receiver-drier (9) and tighten fitting nut (5). Tighten two clamps (8).
4. Charge air conditioning system (WP 0068 00).
5. Close cover (3) assembly and install ten screws (2).

INSTALLATION - CONTINUED



350-791

END OF WORK PACKAGE

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BOOM ASSEMBLY REPLACEMENT 0073 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Direct Support

Tools and Special tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Jackscrew (2) (TM 10-3930-675-10, *Basic Issue Items*)

Screwdriver set, jeweler's (Item 79, WP 0090 00)

Wrench, adjustable (Item 99, WP 0090 00)

20-ton capacity crane or other suitable lifting device

Materials/Parts

Cap set, protective (Item 3, WP 0089 00)

Grease, GAA (Item 13, WP 0089 00)

Oil, lubricating (Item 19, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Strap, tiedown (Item 30, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Washer, lock (P/N 923657.0001) (2)

Personnel Required

Three

References

LO 10-3930-675-12

WP 0029 00

WP 0031 00

WP 0060 00

WP 0063 00

WP 0074 00

Equipment Condition

RTCH parked on level ground

Parking brake applied (TM 10-3930-675-10)

Wheels chocked

Tophandler removed (TM 10-3930-675-20)

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

NOTE

Boom assembly weighs 20,486 lb (9300 kg).

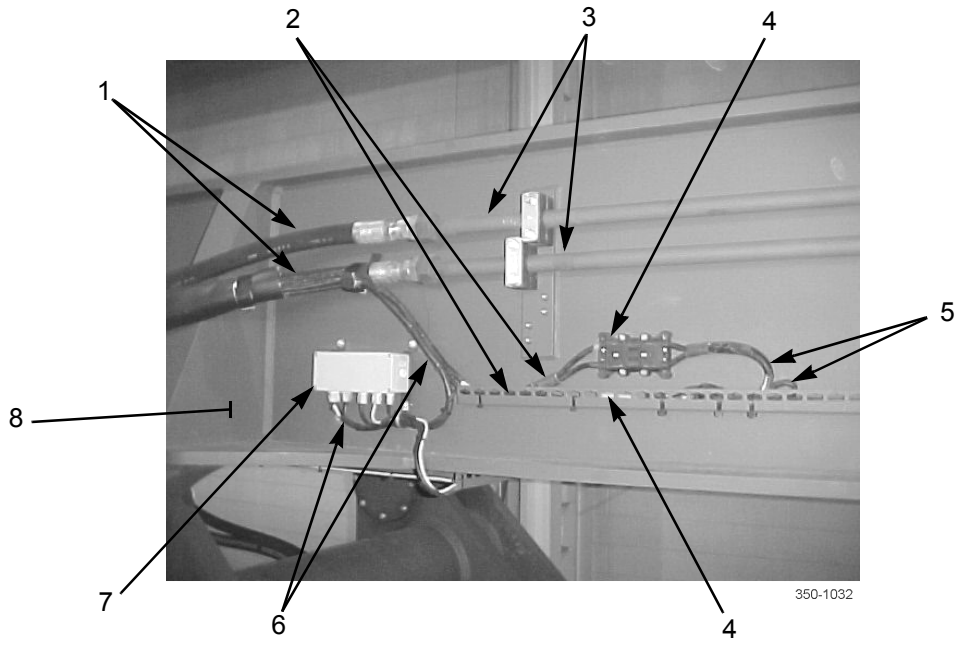
REMOVAL

1. Fully retract boom (TM 10-3930-675-10).

NOTE

Use a jeweler's screwdriver to disconnect electrical leads from boom junction box.

2. Remove boom angle sensor (TM 10-3930-675-20).
3. Remove boom extension sensor (TM 10-3930-675-20). Remove sensor cable from attachment to boom assembly (8) and from boom junction box (7). Discard tiedown straps removed.
4. Disconnect electrical leads of wiring harness (6) from boom junction box (7).
5. Disconnect boom wiring harnesses (5) from two connectors (4).
6. Remove wiring harnesses (2 and 6) from attachment to boom assembly (8). Discard tiedown straps removed.
7. Disconnect hydraulic hoses (1) from hydraulic pipes (3) (TM 10-3930-675-20). Remove hydraulic hoses from attachment to boom assembly (8).



8. Disconnect hydraulic hoses from extension cylinder (TM 10-3930-675-20).

NOTE

With boom fully retracted, center of gravity of boom assembly is 142 in (3606 mm), as measured forward from center of pivot shaft that attaches boom assembly to boom support.

9. Sling boom assembly, using a 20-ton crane or other suitable lifting device. Attach slings to lifting eyes at each end of boom assembly (8). Take up slack in slings.
10. Remove lift cylinders from boom assembly (8) and rest cylinders on blocks of wood on frame (WP 0060 00).
11. Remove screw (11) and lockwasher (12) from each side of boom support (9). Discard lockwashers.

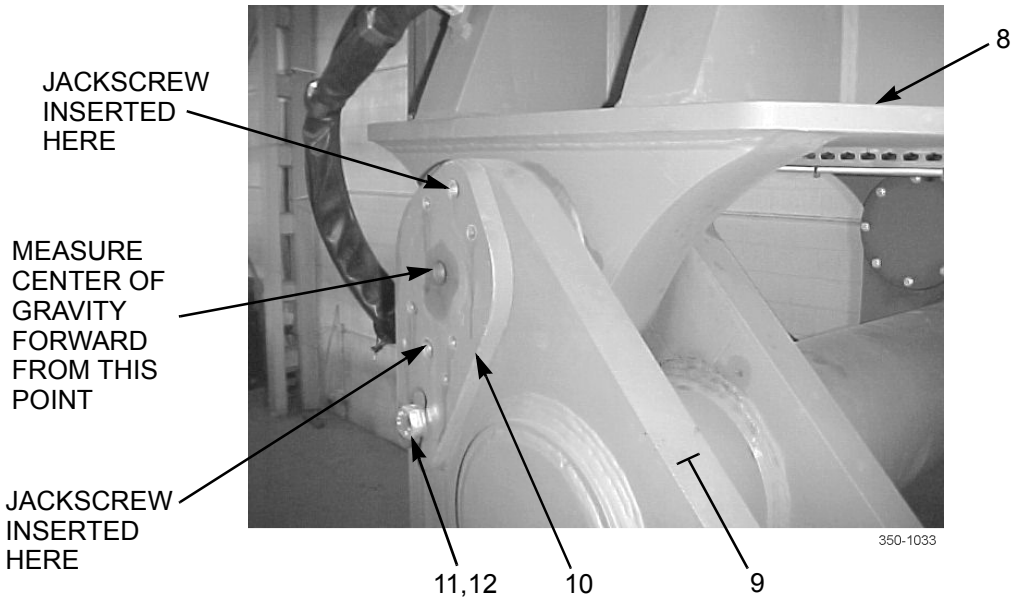
REMOVAL - CONTINUED

12. Lubricate two jackscrews with lubricating oil and install into ear of each pivot shaft (10).

NOTE

To avoid binding pivot shaft, screw in jackscrews equally and alternately.

13. Screw in jackscrews approximately 8 in (20.3 cm) to withdraw each pivot shaft (10) until boom assembly (8) is free of boom support (9).



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

CAUTION

Use caution when lifting boom assembly. Ensure boom assembly clears vehicle and does not contact electrical or hydraulic components. Failure to follow this caution may cause damage to components on boom assembly or damage to vehicle.

14. Ensure all disconnected electrical and hydraulic lines are secured out of the way. Lift boom assembly (8) from vehicle and remove. Place boom assembly on suitable cribbing as required.

REMOVAL - CONTINUED

15. As required, remove the following components from boom assembly (8), to be installed on replacement boom assembly:
    a. Work lights and IR lights (TM 10-3930-675-20)
    b. Boom wiring harnesses (WP 0029 00)
    c. Boom junction box (TM 10-3930-675-20)
    d. Hydraulic hoses, pipes, and fittings (TM 10-3930-675-20)
    e. Boom-to-boom extension flexible conveyer (TM 10-3930-675-20)
    f. Tophandler tilt cylinders (WP 0063 00)
    g. Tophandler junction box with twistlock indicator lights (WP 0031 00)
    h. Tophandler angle sensor (TM 10-3930-675-20)

INSTALLATION

NOTE

Refer to *General Maintenance Instructions* in TM 10-3930-675-20 for complete instructions on connecting hydraulic hoses and applying proper torque.

1. If removed, install the following components to replacement boom assembly (8):
    a. Work lights and IR lights (TM 10-3930-675-20)
    b. Boom wiring harnesses (WP 0029 00)
    c. Boom junction box (TM 10-3930-675-20)
    d. Hydraulic hoses, pipes, and fittings (TM 10-3930-675-20)
    e. Boom-to-boom extension flexible conveyer (TM 10-3930-675-20)
    f. Tophandler tilt cylinders (WP 0063 00)
    g. Tophandler junction box with twistlock indicator lights (WP 0031 00)
    h. Tophandler angle sensor (TM 10-3930-675-20)

NOTE

With boom fully retracted, center of gravity of boom assembly is 142 in (3606 mm), as measured forward from center of pivot shaft that attaches boom assembly to boom support.

2. Sling boom assembly, using a 20-ton crane or other suitable lifting device. Attach slings to lifting eyes at each end of boom assembly (8). Take up slack in slings.

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

INSTALLATION - CONTINUED

CAUTION

Use caution when lifting boom assembly. Ensure boom assembly clears vehicle and does not contact electrical or hydraulic components. Failure to follow this caution may cause damage to components on boom assembly or damage to vehicle.

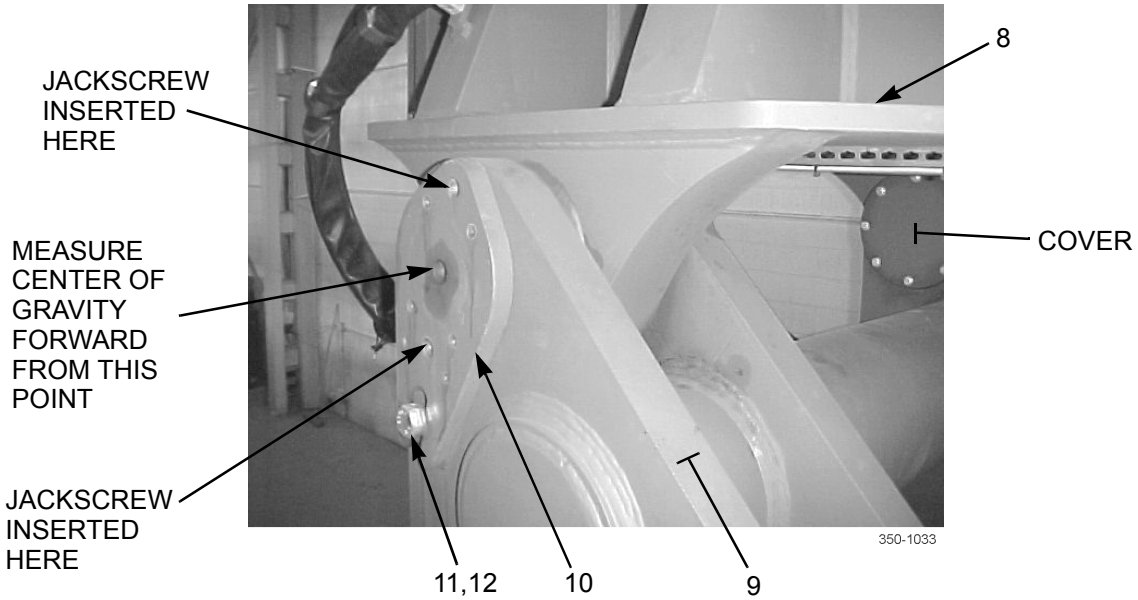
3. Lift boom assembly and position at vehicle.

4. Lower boom assembly (8) and position into boom support (9), while alining pivot shaft holes in boom assembly with holes in boom support.

NOTE

- Ensure pivot shafts are clean and free of burrs.
- When installing pivot shafts, slot in pivot shaft for retaining screw must be alined with screw hole in boom assembly.
- Covers may be removed to aid in alinement of pivot shafts.

5. Install pivot shaft (10) on each side of boom support (9). Secure with new lockwasher (12) and screw (11).



6. Connect lift cylinders to boom assembly (WP 0060 00).

7. Remove lifting device from boom assembly (8).

8. Connect hydraulic hoses to extension cylinder (TM 10-3930-675-20).

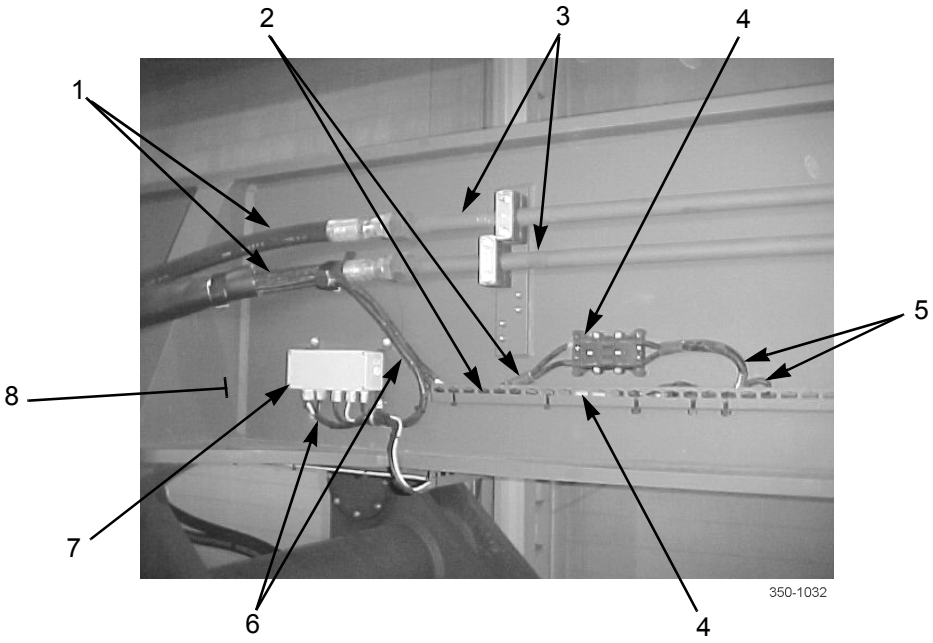
INSTALLATION - CONTINUED

9. Connect hydraulic hoses (1) to hydraulic pipes (3) (refer to *General Maintenance Instructions* in TM 10-3930-675-20). Secure hydraulic hoses to boom assembly (8).
10. Secure wiring harnesses (2 and 6) to boom assembly (8) with new tiedown straps.
11. Connect boom wiring harnesses (5) to two connectors (4).

NOTE

Use a jeweler's screwdriver to connect electrical leads to boom junction box.

12. Connect electrical leads of wiring harness (6) to boom junction box (7).



13. Install boom extension sensor (TM 10-3930-675-20). Connect sensor cable to boom junction box (7) and secure cable to boom assembly (8) with new tiedown straps.
14. Install boom angle sensor (TM 10-3930-675-20).
15. Lubricate pivot shafts (LO 10-3930-675-12).
16. Install tophandler (TM 10-3930-675-20).
17. Check oil level in hydraulic reservoir (LO 10-3930-675-12).
18. Perform *Boom and Tophandler Calibration* (WP 0074 00).
19. Check operation of boom assembly and tophandler (TM 10-3930-675-10).
20. Recheck oil level in hydraulic reservoir (LO 10-3930-675-12).

NOTE

Notify Organizational Maintenance to replace hydraulic reservoir return filters after 100 hours of operation.

END OF WORK PACKAGE

BOOM AND TOPHANDLER CALIBRATION 0074 00

THIS WORK PACKAGE COVERS

Calibration

INITIAL SETUP

References

TM 10-3930-675-10

NOTE

- RTCH must be parked on level ground with all wheels pointing straight ahead.
- When calibrating the boom and tophandler, perform all ten calibration steps in order. DO NOT skip or omit any steps.

CALIBRATION

1. **Access to Calibration Menus.**
   a. Turn master battery switch to ON position.
   b. Turn ignition switch ON and start truck.
   c. Select Kalmar service menu on driver's Electronic Control System (ECS) display screen and press "Enter".

NOTE

If boom or tophandler angle sensors have been removed or are being replaced, steps d-f must be performed prior to calibration.

   d. Ensure boom and tophandler are level with ground.
   e. Enter diagnostic menus, select DIAG SERVO menu, and scroll down to display 7 (13). Note angle sensor voltage reading.
   f. Loosen setscrew securing angle sensor lever to shaft. Rotate sensor shaft until voltage reading is between 7 and 8 volts (boom angle sensor) or 4 volts (tophandler angle sensor). Retighten setscrew and recheck voltage reading.
   g. Enter calibration program access number "13221" and press "Enter".
   h. Press right arrow button to locate "CALIBR SERVO" menu, then press "Enter".

CALIBRATION - CONTINUED

2. **Boom Calibration, Boom Angle, Lowered Position (Menu 1 of 10).**

   a. Lower boom to lowest position.

   b. Allow ECS display to stabilize, then press “Enter”.

   c. ECS display screen should look like the following:

CALIBR SERVO	1 (10)
LOWER MINIMUM BOOM ANGLE	 XXX XXX

Range 600-800

   d. Press right arrow button to advance thru remaining calibration menus.

3. **Boom Calibration, Tophandler Tilt Position (Menu 2 of 10).**

   a. Lower boom to lowest position.

   b. Level tophandler with the ground.

   c. Allow ECS display to stabilize, then press “Enter”.

   d. ECS display screen should look like the following:

CALIBR SERVO	2 (10)
LOWER MINIMUM TILT ANGLE	 XXX XXX

Range 200-400

   e. Press right arrow button to advance thru remaining calibration menus.

4. **Boom Calibration, Boom Angle, Raised Position (Menu 3 of 10).**

   a. Raise boom to maximum height and fully retract with tophandler level with ground.

   b. Allow ECS display to stabilize, then press “Enter”.

   c. ECS display screen should look like the following:

CALIBR SERVO	3 (10)
LIFT MAXIMUM BOOM ANGLE	 XXX XXX

Range 200-400

   d. Press right arrow button to advance thru remaining calibration menus.

CALIBRATION - CONTINUED

5. **Boom Calibration, Tophandler Tilt Angle (Boom in Raised Position) (Menu 4 of 10).**

   a. Raise boom to maximum height, fully retract, and level tophandler with ground.

   b. Allow ECS display to stabilize, then press “Enter”.

   c. ECS display screen should look like the following:

CALIBR SERVO	4 (10)
LIFT MAXIMUM TILT ANGLE	 XXX XXX

Range 600-800

   d. Press right arrow button to advance thru remaining calibration menus.

6. **Boom Calibration, Retracted Position (Menu 5 of 10).**

   a. Raise boom to maximum height and fully retract.

   b. Allow ECS display to stabilize, then press “Enter”.

   c. ECS display screen should look like the following:

CALIBR SERVO	5 (10)
BOOM MIN EXTENSION	XXX XXX

Range 35-150

   d. Press right arrow button to advance thru remaining calibration menus.

7. **Boom Calibration, Extended Position (Menu 6 of 10).**

   a. Fully extend boom.

   b. Allow ECS display to stabilize, then press “Enter”.

   c. ECS display screen should look like the following:

CALIBR SERVO	6 (10)
BOOM MAX EXTENSION	XXX XXX

Range 400-550

   d. Press right arrow button to advance thru remaining calibration menus.

CALIBRATION - CONTINUED

8. **Boom Calibration, Boom Cylinders (Retracted) (Menu 7 of 10).**
   a. Fully retract and lower boom.
   b. Raise boom 1/4 inch to pressurize boom cylinders, then release joystick. DO NOT reposition or move joystick again until procedure is completed.
   c. Allow system and ECS display to stabilize (10 to 20 seconds), then press “Enter”.
   d. ECS display screen should look like the following:

CALIBR SERVO	7 (10)
INIT BY MIN LOAD LE XXX XXX	RI XXX XXX

Range 500-650

   e. Press right arrow button to advance thru remaining calibration menus.

9. **Boom Calibration, Boom Cylinders (Extended) (Menu 8 of 10).**
   a. Fully extend and lower boom.
   b. Raise boom 1/4 inch to pressurize lift cylinders, then release joystick. DO NOT reposition or move joystick again until procedure is completed.
   c. Allow system and ECS display to stabilize (10 to 20 seconds), then press “Enter”.
   d. ECS display screen should look like the following:

CALIBR SERVO	8 (10)
INIT BY MAX LOAD LE XXX XXX	RI XXX XXX

Range 800-950

   e. Press right arrow button to advance thru remaining calibration menus.

10. **Boom Calibration, Load Check (Menu 9 of 10).**
   a. Fully retract boom and raise 1 in (2.5 cm).
   b. Check ECS display. Actual Load should read “0-100” lbs.
   c. Reposition boom. Actual Load reading should return to “0-100” lbs. after stabilizing.
   d. Reposition tophandler. Actual Load reading should return to “0-100” lbs. after stabilizing.
   e. ECS display screen should look like the following:

CALIBR SERVO	9 (10)
ALLOWED LOAD ACTUAL LOAD L-LC	Kg Kg M

   f. Press right arrow button to advance to remaining calibration menus.

CALIBRATION - CONTINUED

11. **Boom Calibration Completed (Menu 10 of 10).**
    a. With all calibration steps completed and corrections or adjustments made, press “Enter” to return to main menu.
    b. ECS display screen should look like the following:

CALIBR SERVO	10 (10)
CALIBRATION OF EL SERVO	DONE

END OF WORK PACKAGE

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TOPHANDLER TWISTLOCK REPLACEMENT 0075 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Pliers, retaining ring (Item 62, WP 0090 000)

Wrench set, socket, 1 in drive (Item 98, WP 0090 00)

Wrench, adjustable (Item 99, WP 0090 00)

Wrench, torque, 100-600 lb-ft capacity (Item 105, WP 0090 00)

Materials/Parts

Nut, lock (P/N 923828.0843)

Pin, cotter (P/N 923828.0837) (2)

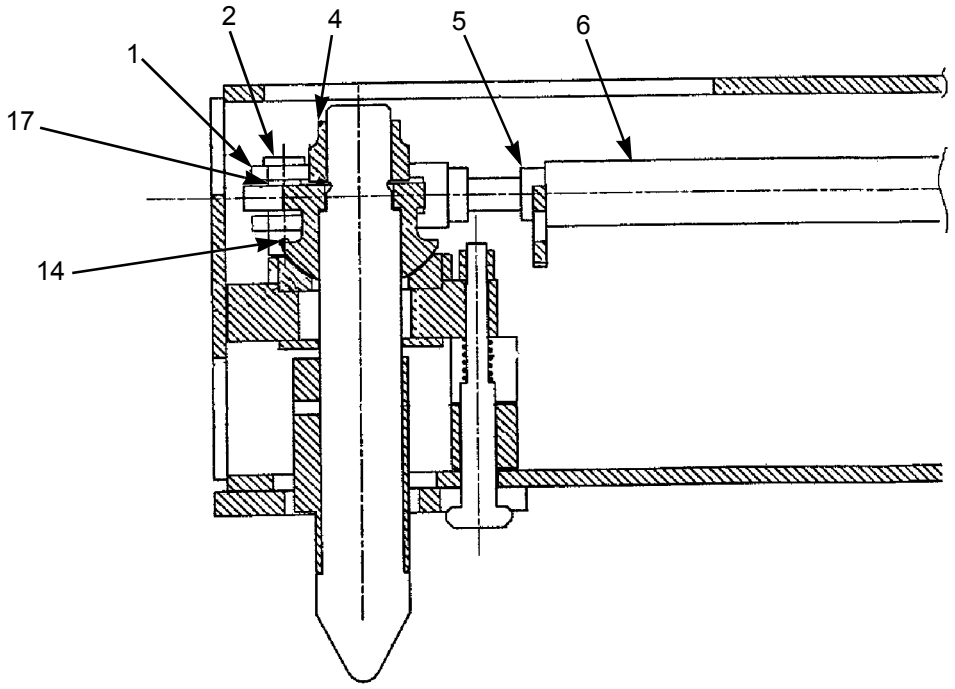
Set, washer, lock (P/N 923828.0842)

Personnel Required

Two

REMOVAL

1. Remove cotter pin (14), retaining ring (17), and shaft (2) from end bracket (1) of twistlock link (6). Discard cotter pin.
2. Loosen locknut (4) and nut (5).



350-543

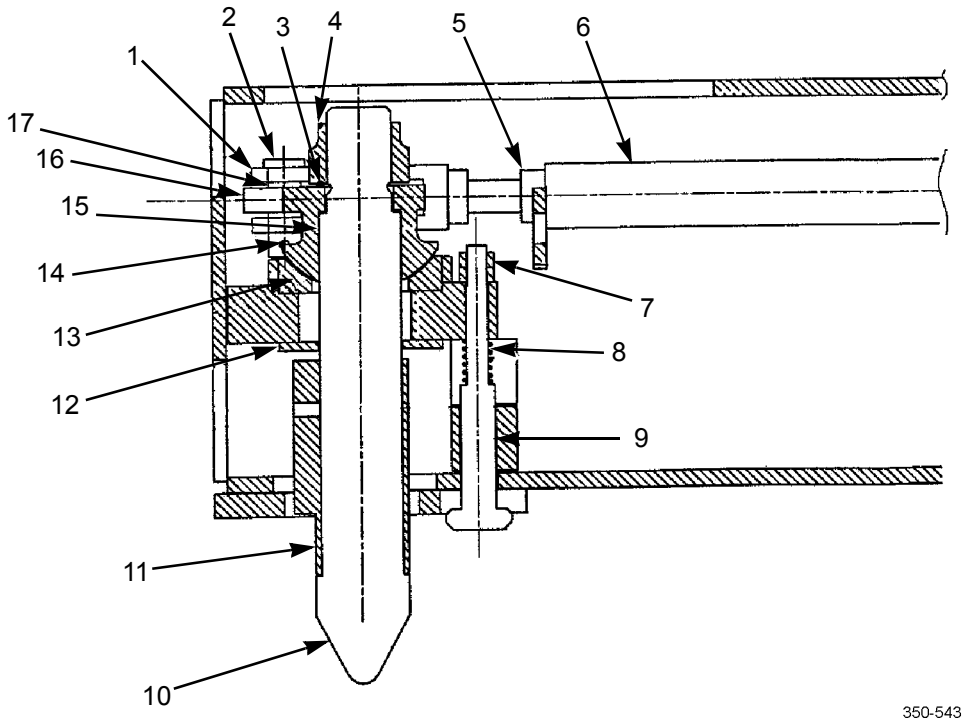
REMOVAL - CONTINUED

3. Remove twistlock link (6) assembly from tophandler.

NOTE

Note position and location of each of two end brackets for installation.

4. Remove end bracket (1) and nut (5) from twistlock link (6).
5. Remove locknut (4) and lockwasher set (3) from lifting pin (10). Discard locknut and lockwasher set.
6. Remove key (15), lever (16), bearing (13), lifting pin (10), and washer (12) from tophandler.
7. Remove guide pin (11) from lifting pin (10).
8. Remove two nuts (7), bar (9), and spring (8) from tophandler.



INSTALLATION

1. Install spring (8) and bar (9) to tophandler with two nuts (7).
2. Install guide pin (11) to lifting pin (10).
3. Install washer (12), lifting pin (10), bearing (13), lever (16), and key (15) to tophandler.
4. Loosely install new lockwasher set (3) and new locknut (4) to lifting pin (10).
5. Install nut (5) and end bracket (1) to twistlock link (6).
6. Position twistlock link (6) assembly to tophandler.
7. Tighten nut (5).

INSTALLATION - CONTINUED

8. Tighten locknut (4) to 221 lb-ft (300 Nm).
9. Install shaft (2) and retaining ring (17) to end bracket (1) of twistlock link (6) with new cotter pin (14).
10. Ensure bar (9) is adjusted so that its vertical movement alines with proximity switch.
11. Adjust proximity switch (TM 10-3930-675-20).

END OF WORK PACKAGE

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CHAPTER 4
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

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MOUNTING ENGINE ON REBUILD STAND 0076 00

THIS WORK PACKAGE COVERS

Installation, Removal

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Fixture, engine lifting (Item 27, WP 0090 00)

Pin, guide (Item 59, WP 0090 00)

Plate, adapter, engine stand (Item 61, WP 0090 00)

Stand, engine rebuild (Item 87, WP 0090 00)

Stand, engine support (Item 88, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Gasket, heater housing (P/N 3893690)

Gasket, thermostat housing support (P/N 3893692)

Materials/Parts - Continued

Gasket, water header plate (P/N 3899229)

Seal, o-ring (P/N 3819751) (2)

Personnel Required

Two

Equipment Condition

Engine removed and mounted on support stand (WP 0005 00)

Coolant filter removed (TM 10-3930-675-20)

Alternator drive belt removed (TM 10-3930-675-20)

Alternator removed (TM 10-3930-675-20)

Air ducts removed (TM 10-3930-675-20)

Water pump removed (TM 10-3930-675-20)

Thermostat and thermostat housing removed (TM 10-3930-675-20)

Intake manifold removed (WP 0019 00)

Exhaust manifold removed (WP 0018 00)

Engine oil cooler and oil filter head removed (WP 0017 00)

INSTALLATION

CAUTION

Care must be taken to ensure no surface scratches occur on water header plate or cylinder block mounting surfaces. Scratches on these surfaces will cause future leak paths.

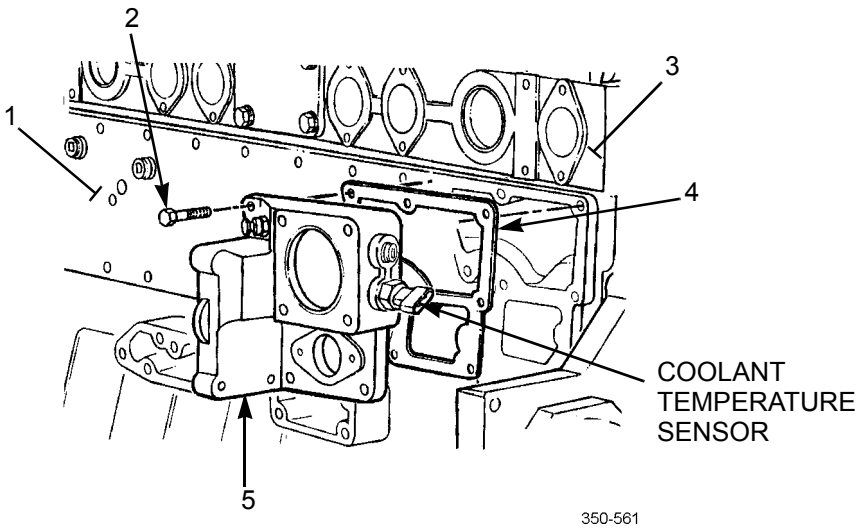
NOTE

- Tag wiring harness leads, connectors, and receptacles to ensure correct installation.
- Note size and location of attaching hardware during removal to ensure correct hardware is used during engine assembly.

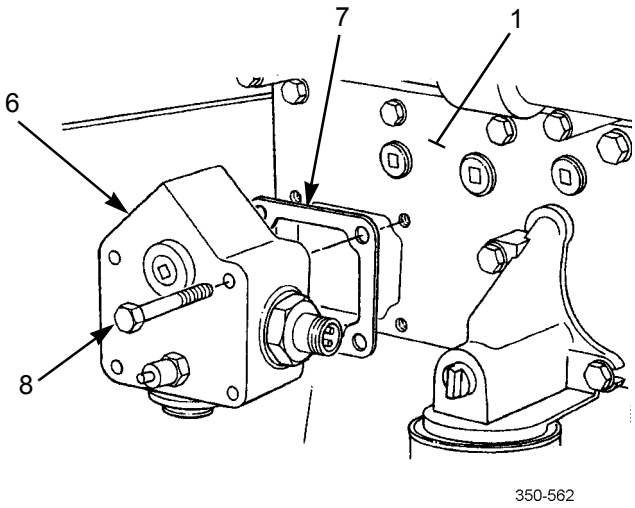
MOUNTING ENGINE ON REBUILD STAND - CONTINUED 0076 00

INSTALLATION - CONTINUED

1. Remove water header plate (1) from exhaust side of cylinder block (3) as follows:
   a. Disconnect wiring harness from coolant temperature sensor.
   b. Remove four screws (2), thermostat housing support (5), and gasket (4). Discard gasket.



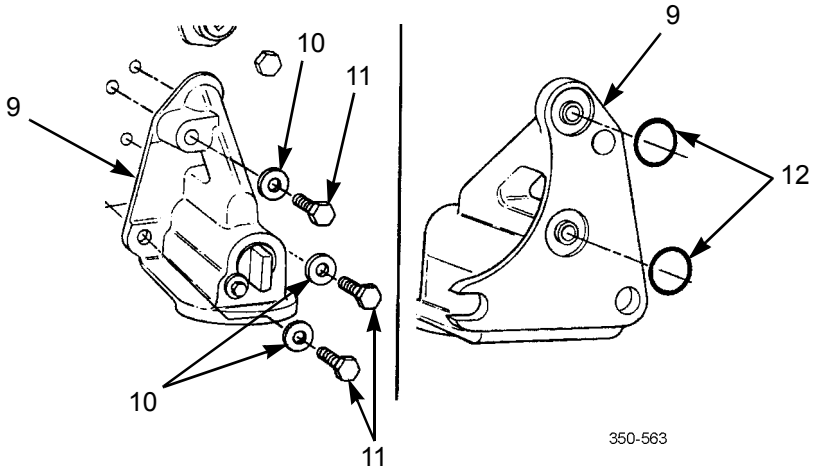
   c. Remove four screws (8), water heater housing (6), and gasket (7) from water header plate (1). Discard gasket.



MOUNTING ENGINE ON REBUILD STAND - CONTINUED **0076 00**

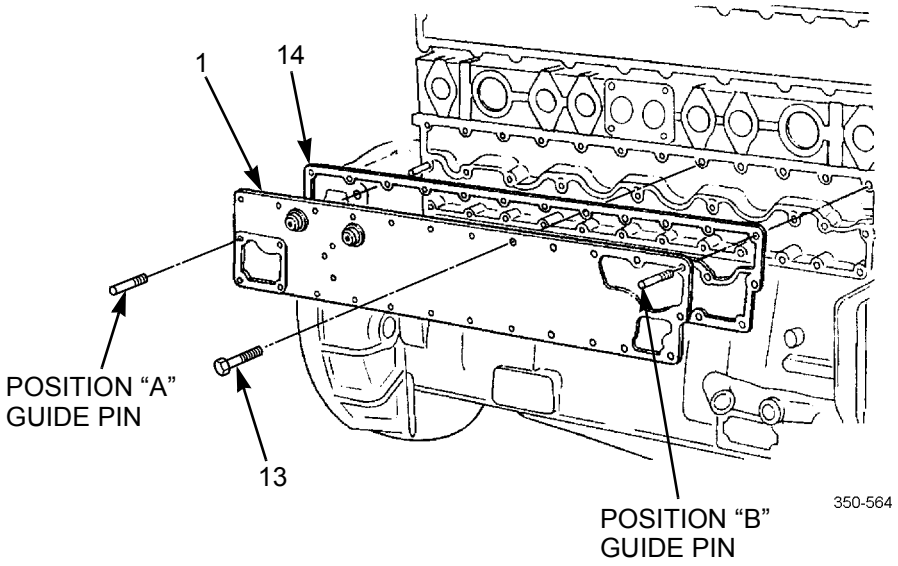
INSTALLATION - CONTINUED

d. Remove three screws (11), washers (10), two o-rings (12), and coolant filter head (9). Discard o-rings.



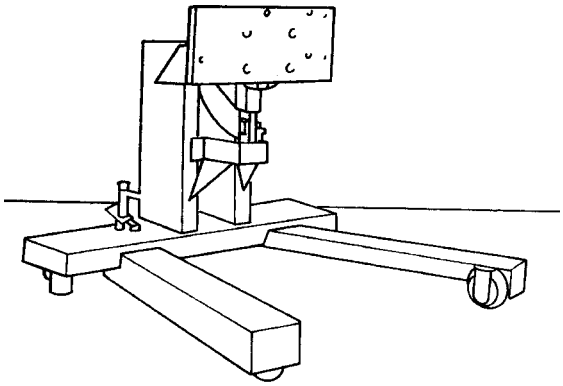
e. Remove two screws from position “A” and “B”. Replace screws with guide pins.

f. Remove 16 remaining screws (13), water header plate (1), gasket (14), and guide pins. Discard gasket.



INSTALLATION - CONTINUED

2. Install adapter plate to rebuild stand with five screws. Tighten screws to 135 lb-ft (183 Nm).



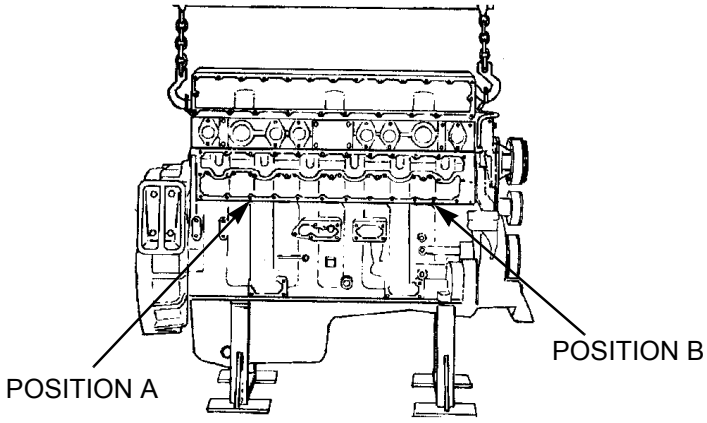
350-565

ENGINE REBUILD STAND WITH ADAPTER PLATE

NOTE

Ensure lifting brackets are installed on front and rear of engine.

3. Install guide pins in water header plate mounting screw holes at screw holes “A” and “B”.



350-566

WARNING

Engine weighs 2070 lb (940 kg). Lifting device must have sufficient capacity to lift engine. Failure to follow this warning may result in death or injury to personnel.

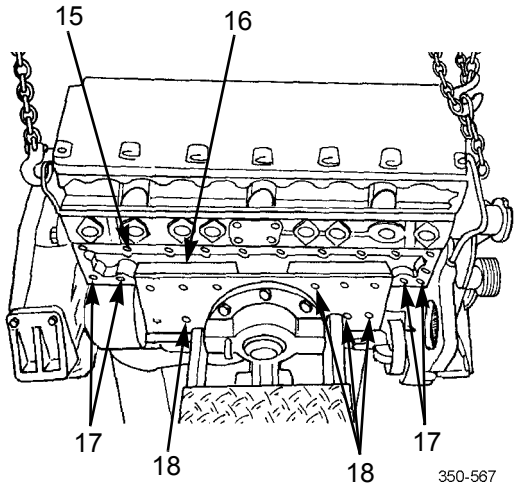
INSTALLATION - CONTINUED

4. Using engine lifting fixture, lift and install exhaust side of engine to rebuild stand as follows:
   a. Aline top of adapter plate (16) to top row of water header plate mounting screw holes (15).

NOTE

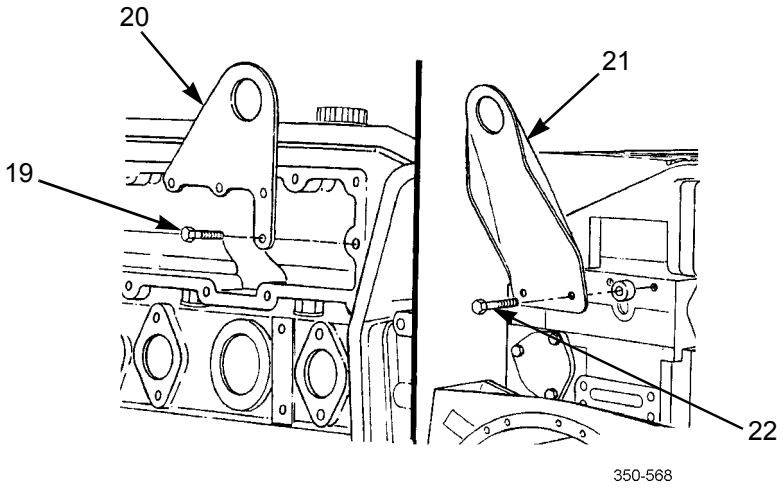
Cylinder block must be positioned so that two screw holes (17) in bottom row will show on each side of adapter plate.

   b. Aline guide pins with bottom row of adapter plate holes.
   c. Secure engine to rebuild stand with eight screws (18). Tighten screws to 35 lb-ft (47 Nm).
   d. Remove two guide pins and install remaining two screws (18). Tighten screws to 35 lb-ft (47 Nm).



REMOVAL

1. Install front lifting bracket (20) with four screws (19). Install rear lifting bracket (21) with two screws (22). Tighten screws to 55 lb-ft (75 Nm).

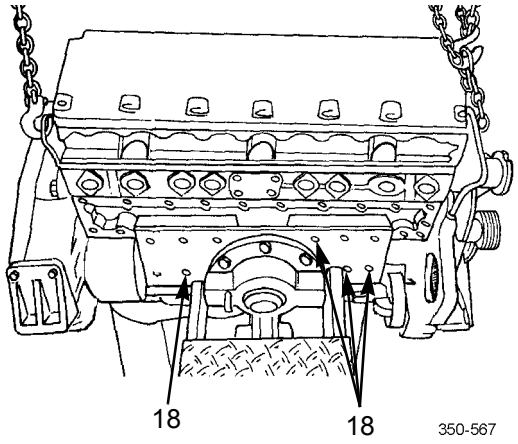


REMOVAL - CONTINUED

WARNING

Engine weighs 2070 lb (940 kg). Lifting device must have sufficient capacity to lift engine. Failure to follow this warning may result in death or injury to personnel.

2. Attach lifting fixture to engine and remove ten screws (18) securing engine to rebuild stand.



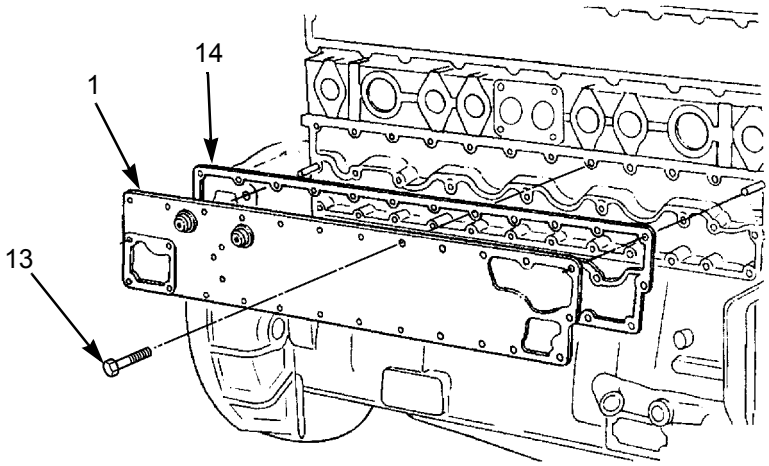
3. Place engine on support stand and disconnect lifting fixture.
4. Remove front lifting bracket and retain for future use.

NOTE

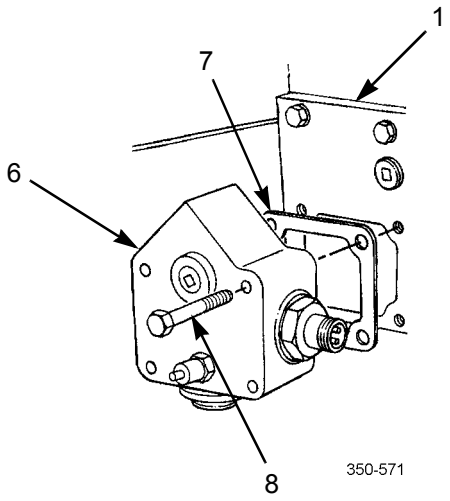
Ensure attaching hardware is used as was noted during installation of rebuild stand.

REMOVAL - CONTINUED

5. Install water header plate (1) with new gasket (14) and secure with 18 screws (13). Initial tighten screws to 15 lb-ft (20 Nm).



6. Position water heater housing (6) with new gasket (7) on water header plate (1). Install four screws (8) and initial tighten to 15 lb-ft (20 Nm).



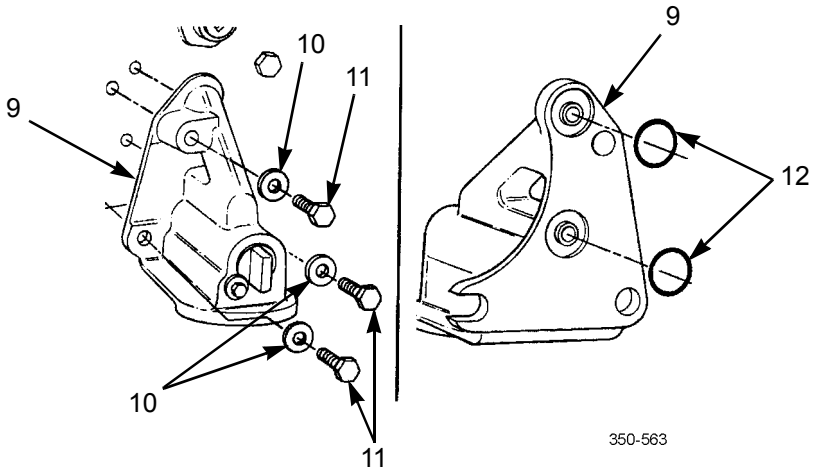
REMOVAL - CONTINUED

7. Apply lubricant to two new o-rings (12) and install on coolant filter head (9).

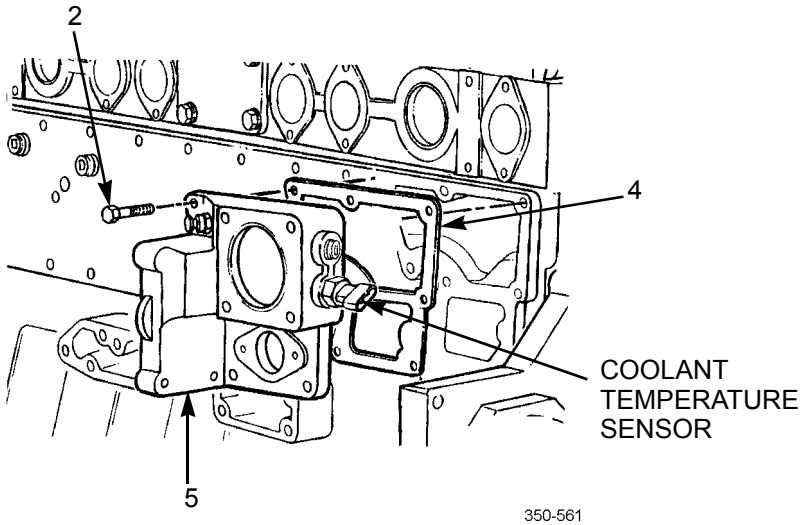
CAUTION

Ensure control valve on coolant filter head is in ON position. Possible engine damage may occur if valve is not in ON position.

8. Position coolant filter head (9) with new o-rings (12) on water header plate and install three washers (10) and screws (11). Initial tighten screws to 15 lb-ft (20 Nm).

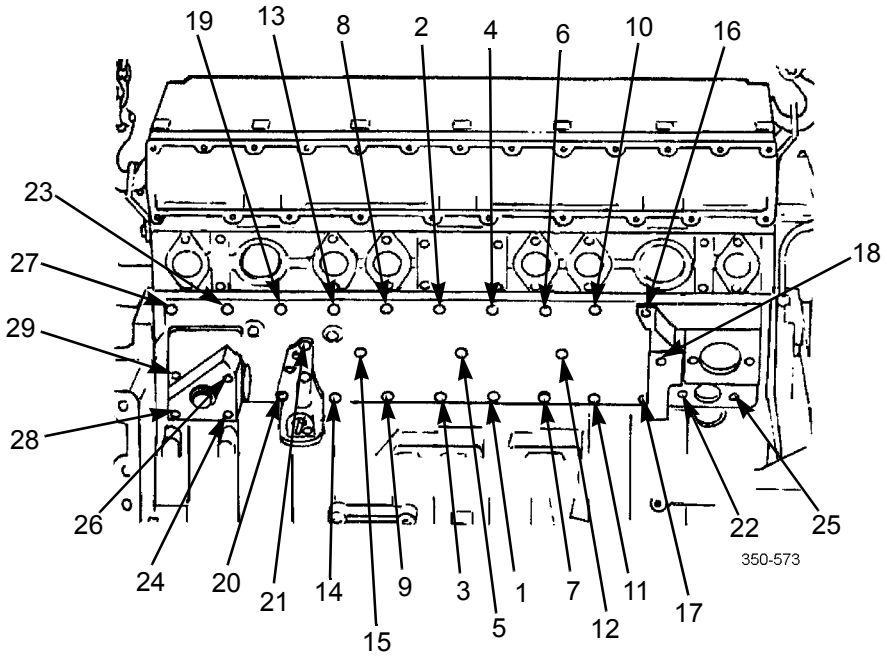


9. Position thermostat housing support (5) with new gasket (4) and install with four screws (2). Initial tighten screws to 15 lb-ft (20 Nm). Connect wiring harness to temperature sensor.



REMOVAL - CONTINUED

10. Final tighten screws securing water header plate to 40 lb-ft (55 Nm) in sequence shown.



TIGHTENING SEQUENCE

11. Install engine oil cooler and oil filter head (WP 0017 00).
12. Install exhaust manifold (WP 0018 00)
13. Install intake manifold (WP 0019 00).
14. Install thermostat and thermostat housing (TM 10-3930-675-20).
15. Install water pump (TM 10-3930-675-20).
16. Install alternator (TM 10-3930-675-20).
17. Install alternator drive belt (TM 10-3930-675-20).
18. Install air ducts (TM 10-3930-675-20).
19. Install coolant filter (TM 10-3930-675-20).

END OF WORK PACKAGE

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CYLINDER BLOCK REPAIR 0077 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)
Caliper, vernier (Item 11, WP 0090 00)
Driver (Item 18, WP 0090 00)
Driver, expansion plug (Item 19, WP 0090 00)
Driver, expansion plug (Item 20, WP 0090 00)
Extractor, dowel pin (Item 25, WP 0090 00)
Fixture, engine lifting (Item 27, WP 0090 00)
Gage, depth, dial indicating (Item 30, WP 0090 00)
Gage, master ring (Item 32, WP 0090 00)
Guide (Item 39, WP 0090 00)
Hammer, hand, plastic (Item 42, WP 0090 00)
Inserter, bearing and bushing (Item 47, WP 0090 00)
Liner/installation tool (Item 54, WP 0090 00)
Plate, adapter, engine stand (Item 61, WP 0090 00)
Puller, cylinder liner (Item 72, WP 0090 00)
Stand, engine rebuild (Item 87, WP 0090 00)
Stand, engine support (Item 88, WP 0090 00)
Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Materials/Parts

Abrasive pad (Item 1, WP 0089 00)
Oil, lubricating (Item 20, WP 0089 00)
Rag, wiping (Item 23, WP 0089 00)
Sealant, cup plug (Item 25, WP 0089 00)
Wipes, lint-free (Item 33, WP 0089 00)
Kit, cylinder liner (P/N 3803703) (6)
Pin, dowel (P/N 70550)
Pin, dowel (P/N 142207) (2)
Pin, dowel (P/N 3008446) (3)
Plug, expansion (P/N 3007632) (9)
Plug, expansion (P/N 3007635) (4)
Ring, dowel (P/N 3026231) (3)

Equipment Condition

Engine mounted on rebuild stand (WP 0076 00)
Cylinder head removed (WP 0007 00)
Crankshaft removed (WP 0078 00)

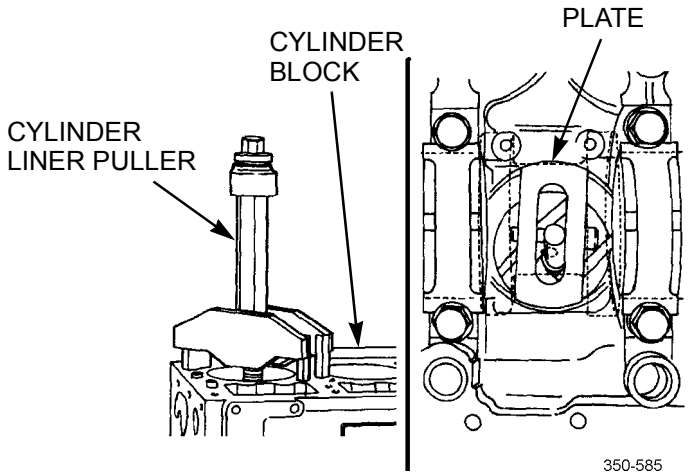
DISASSEMBLY

CAUTION

Cylinder liner puller must be installed and used as described to avoid damage to cylinder block. Puller plate must be parallel to main bearing saddles and must not overlap liner outside diameter.

DISASSEMBLY - CONTINUED

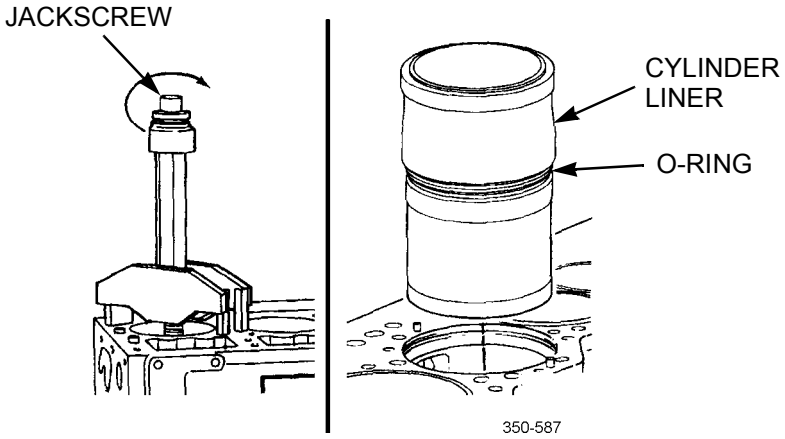
1. Install cylinder liner puller in top of cylinder block.



NOTE

Ensure liner puller is centered on top of cylinder liner being removed.

2. Turn puller jackscrew clockwise to loosen cylinder liner from cylinder block.
3. Use both hands to remove liner. Remove and discard o-ring.



NOTE

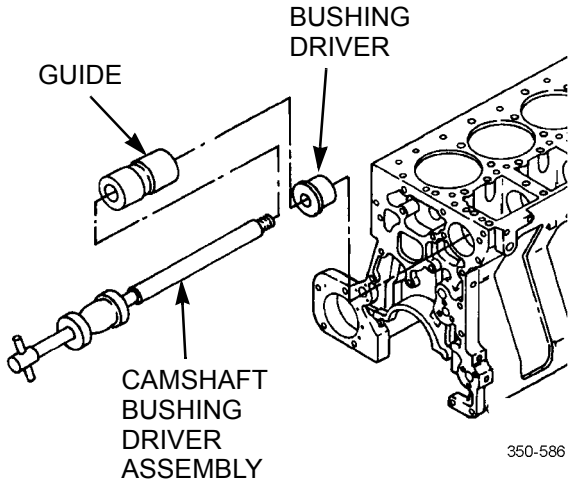
Cylinder liners must be reinstalled in cylinder from which they were removed.

4. Mark cylinder liner with cylinder number and place orientation mark on camshaft side.
5. Perform steps 1 thru 4 for each liner to be removed.

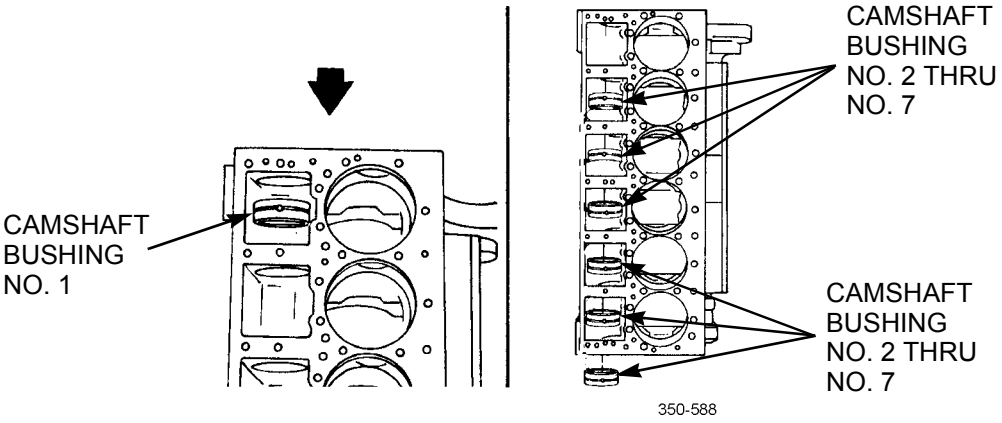
DISASSEMBLY - CONTINUED

6. Camshaft bushings are removed from cylinder block as follows:

   a. Using camshaft bushing driver, driver assembly, and guide, remove camshaft bushing number 1.

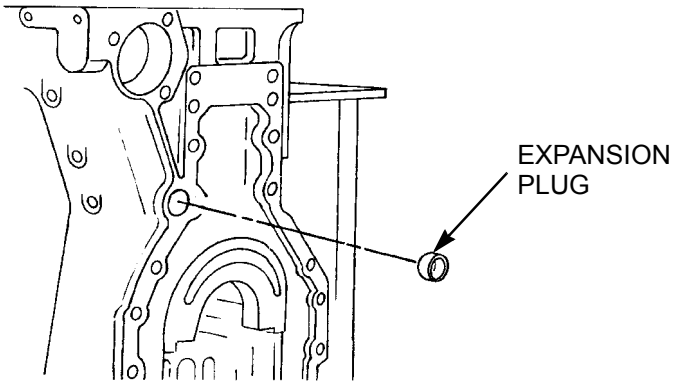


   b. Remove remaining camshaft bushing numbers 2 thru 7 in order.



DISASSEMBLY - CONTINUED

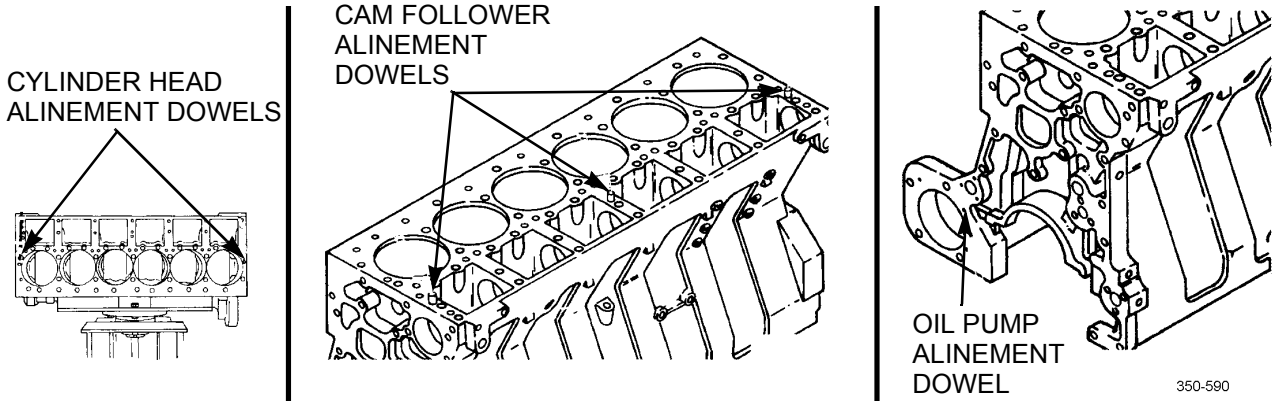
7. Remove and discard all expansion plugs.



NOTE

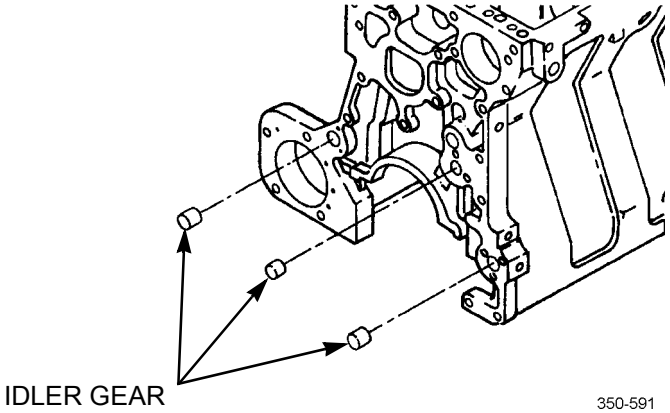
If guide dowels require replacement, perform steps below to remove appropriate dowel pins or dowel rings.

8. If necessary, use dowel pin extractor and remove two cylinder head alinement dowels, three cam follower alinement dowel pins, and oil pump alinement dowel pin. Discard all removed dowel pins.



DISASSEMBLY - CONTINUED

9. If necessary, use universal puller and remove three idler gear ring dowels. Discard dowels.



CLEANING

CAUTION

Do not damage machined surfaces when using wire brush or gasket scraper to clean cylinder block surfaces.

NOTE

If rust or corrosion cannot be removed with abrasive pad or bristle brush, cylinder block MUST be cleaned with chemical bath.

1. Use abrasive pad or bristle brush and clean following cylinder block areas:
   a. Gasket surfaces
   b. Cylinder liner bores
   c. Cylinder liner counterbores
   d. Cylinder head deck
   e. Cup plug bores
   f. Main bearing saddles and caps
   g. Water passages

NOTE

If cleaning with abrasive pad has not removed old gasket or sealant material, it may be necessary to steam clean cylinder block.

CLEANING - CONTINUED

2. Remove cylinder block from rebuild stand and place in cleaning tank as follows:
   a. Install main bearing caps numbers 3 and 5.

WARNING

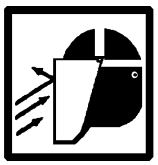
Cylinder block is heavy. Lifting device must have sufficient capacity to lift cylinder block. Failure to follow this warning may result in death or injury to personnel.

   b. Use lifting sling, remove cylinder block from rebuild stand and place in cleaning tank.

WARNING

- When using steam cleaner, wear protective clothing and eye protection. Hot steam will cause serious burns.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

   c. Ensure all oil passages and oil drillings are clean and free of foreign material. If cylinder block is NOT to be used immediately, coat with oil and cover to prevent rust.
   d. Remove cylinder block from cleaning tank, steam clean, and dry with compressed air.
3. Clean cylinder liners as follows:



WARNING

- When using steam cleaner, wear protective clothing and eye protection. Hot steam will cause serious burns.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

CAUTION

Do not use any abrasives in ring travel area of liner. Liner can be damaged.

   a. Remove scale and rust from liner using brush or abrasive pad.
   b. Lubricate inside of liner with clean engine oil and allow oil to soak in for 5 to 10 minutes.
   c. Wipe excess oil from inside liner with clean lint-free wipes.
   d. Continue to lubricate inside of liner and wipe clean until no gray or black residue shows on wipes.

INSPECTION

1. Visually inspect cylinder liners as follows:

NOTE

If conditions in steps a thru d below are found, replace liner.

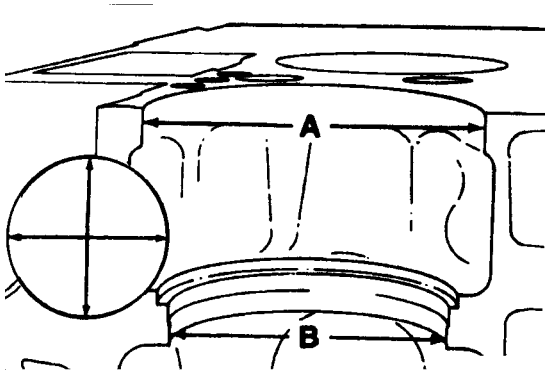
   a. Cracks on inside and outside diameters
   b. Cracks under liner flange
   c. Corrosion or pitting on outside diameter
   d. Scuffing or scoring on inside diameter
   e. Inspect inside diameter for vertical scratches. If fingernail catches in scratch, liner must be replaced.
   f. Inspect inside diameter for bore polishing. If a heavy polish is present over 20 percent of piston ring travel area, replace liner.

2. Visually inspect for cracks or damage in following areas of cylinder block:
   a. Cylinder head mounting surface
   b. Upper liner bore
   c. Liner counterbore
   d. Lower liner bore

NOTE

All measurements of cylinder block MUST be made when block is positioned on a flat surface. If block is mounted on engine stand, measurements can be wrong due to distortion. If any measurements are not as specified, cylinder block must be replaced.

3. Measure cylinder block upper liner bore inside diameter (ID). Measurement “A” must be 5.7441-5.7491 in (145.900-146.027 mm).
4. Measure liner seal bore inside diameter 0.32-0.53 in (8.0-13.5 mm) below counterbore. Measurement “B” must be 5.4355-5.4375 in (138.063-138.113 mm).



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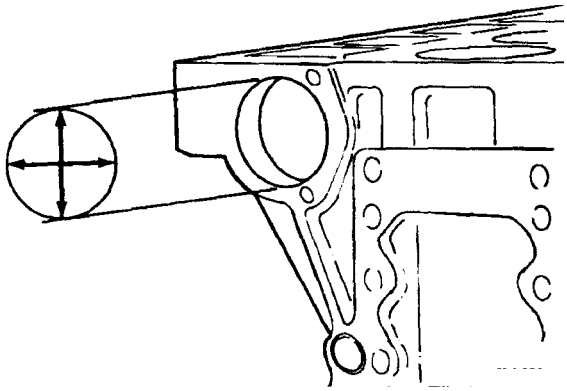
INSIDE DIAMETER, CYLINDER BLOCK UPPER LINER AND LINER SEAL BORE

INSPECTION - CONTINUED

5. Measure camshaft bushing bore inside diameter. Measurement must be 3.0310-3.0331 in (76.987-77.040 mm).



INSIDE DIAMETER, CAMSHAFT BUSHING BORE

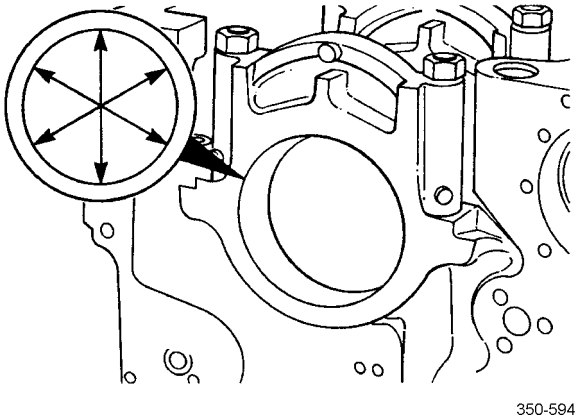
6. Measure main bearing bore inside diameter as follows:

   a. Position main bearing caps on cylinder block.

   b. Insert master ring gage in main bearing bore number 1 and tighten screws in same steps as installation of crankshaft (WP 0078 00).

   c. Remove master ring and perform step b one at a time for remaining main bearing bores.

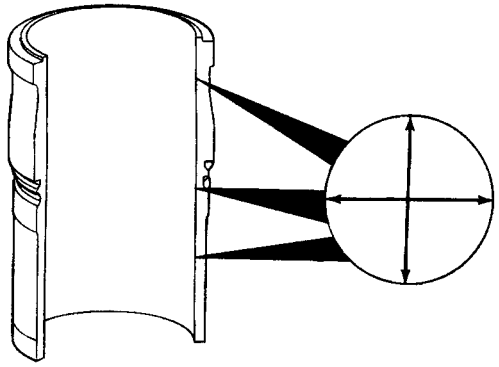
   d. Measure inside diameter in three places. Measurement must be 4.8028-4.8037 in (121.990-122.015 mm).



INSIDE DIAMETER, MAIN BEARING BORE

7. Measure cylinder liner inside diameter 90 degrees apart at top, middle, and bottom of piston travel. Measurement must be 4.9213-4.9250 in (125.000-125.095 mm). If not as specified, replace liner.

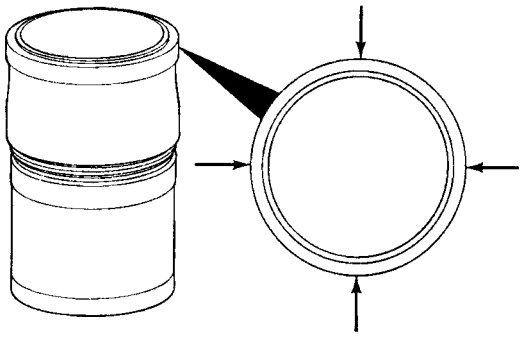
INSPECTION - CONTINUED



350-595

INSIDE DIAMETER, CYLINDER LINER

8. Measure cylinder liner top press fit outside diameter. Measurement must be 5.7456-5.7471 in (145.938-145.976 mm). If not as specified, replace liner.



350-596

OUTSIDE DIAMETER, CYLINDER LINER TOP PRESS FIT

ASSEMBLY

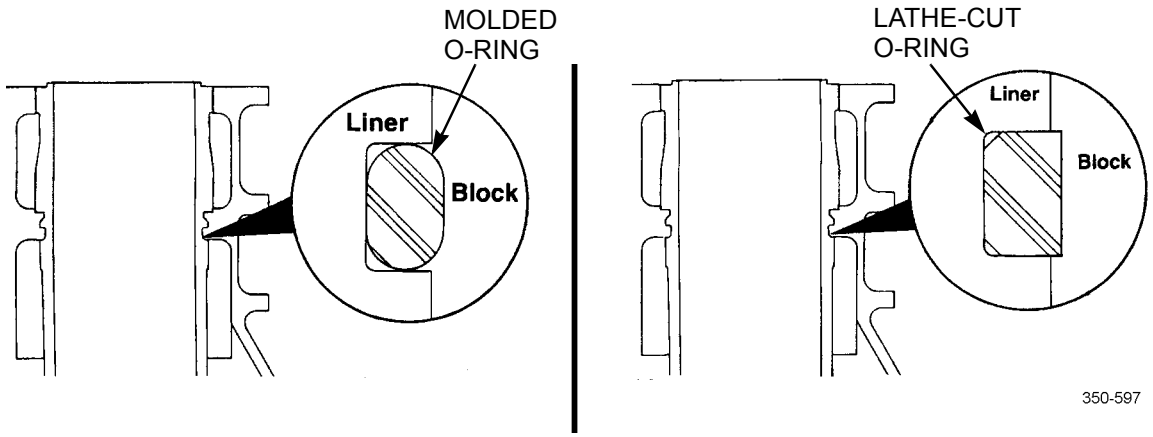
CAUTION

Cylinder liner o-rings are made by two different processes; molded or lathe-cut. Lathe-cut o-rings must be installed with straight side facing cylinder block.

NOTE

Ensure cylinder block is installed on rebuild stand for assembly.

1. Lubricate new o-ring with clean engine oil and install o-ring on cylinder liner as shown.



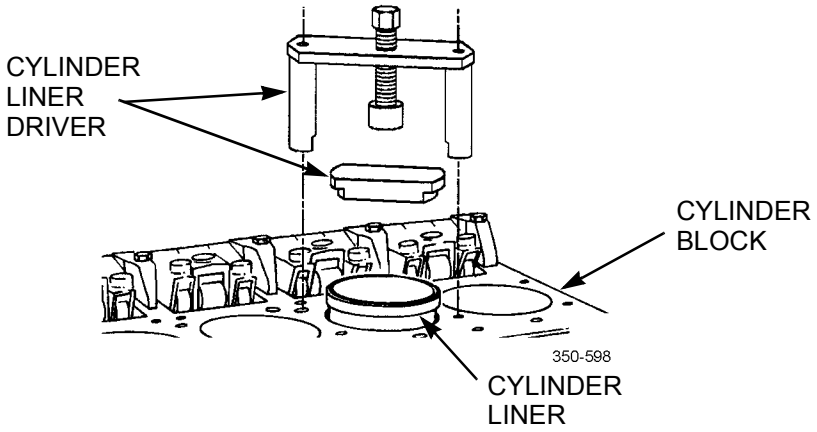
CAUTION

Liners must be installed within 30 seconds after being lubricated with oil. If liners are not installed within this time limit, o-ring will swell and be damaged when liner is installed.

NOTE

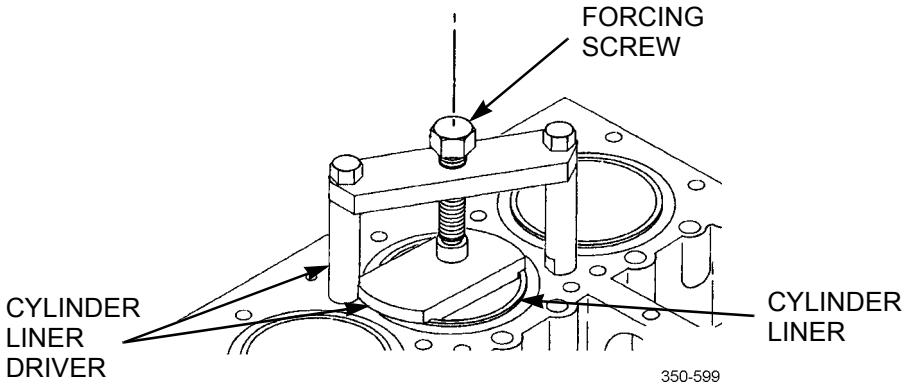
When acceptable reused liners are installed, rotate liner 90 degrees from original position in engine. Thrust and anti-thrust surfaces MUST face front and back of cylinder block.

2. Using cylinder liner driver and plastic-faced hammer, install cylinder liner into cylinder block bore.

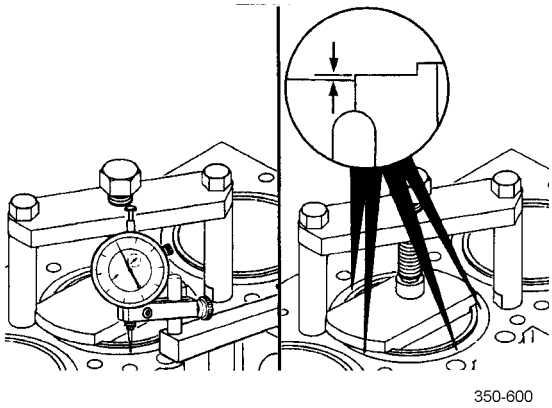


ASSEMBLY - CONTINUED

3. Cylinder liner protrusion MUST be checked for each replaced cylinder liner as follows:
   a. Install cylinder liner driver across liner and secure to cylinder. Tighten forcing screw to 100 lb-ft (136 Nm)



   b. Using dial indicating depth gage, measure liner protrusion at four points 90 degrees apart. Measurement must be 0.000-0.005 in (0.00-0.13 mm). If measurement varies more than 0.0010 in (0.025 mm) for each 180 degrees, replace liner.



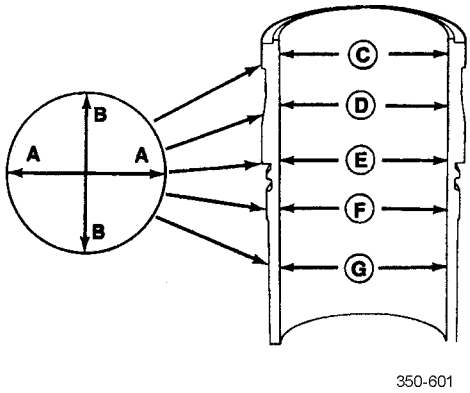
CYLINDER LINER PROTRUSION

NOTE

Each cylinder liner must be checked for out-of-roundness and cylinder liner-to-block clearance after installed in cylinder block.

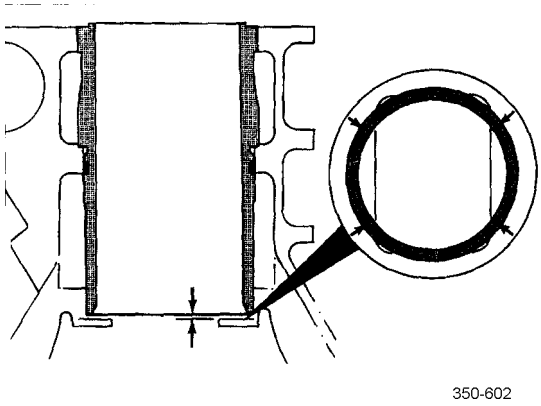
ASSEMBLY - CONTINUED

4. Measure cylinder liner out-of-roundness as follows:
   a. Measure cylinder liner at points “C”, “D”, “E”, “F”, and “G”.
   b. Measure each point in direction “AA” and “BB”.
   c. Bore MUST NOT be more than 0.004 in (0.10 mm) out-of-round.



CYLINDER LINER OUT-OF-ROUND

5. Using thickness gage, measure cylinder liner-to-block clearance. Measurement must be 0.10 in (0.25 mm). If measurement is less than specified, remove and reinstall liner.



CYLINDER LINER-TO-BLOCK CLEARANCE

NOTE

- Camshaft bushings are installed in following order: number 7, 6, 5, 4, 3, 2, and 1.
- Ensure oil hole in bushing is at 3 o’clock position as viewed from front of engine on installation.

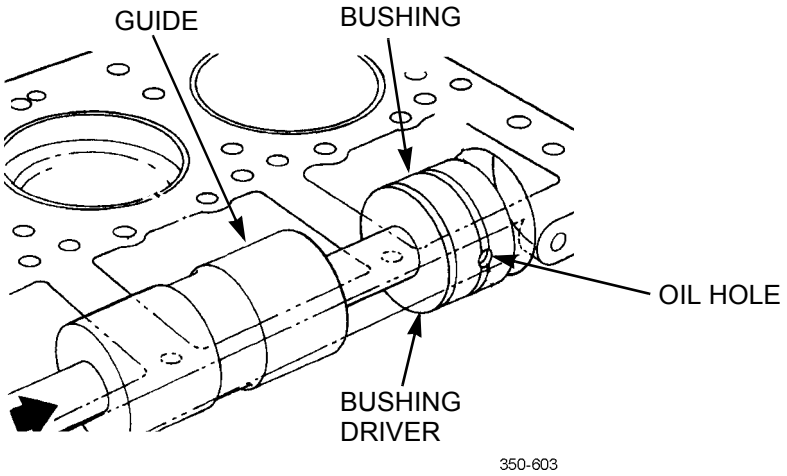
ASSEMBLY - CONTINUED

6. Install number 7 camshaft bushing as follows:

   a. Install guide between number 6 and 5 bores.

   b. Install bushing on driver with oil hole at 3 o'clock position as viewed from front of engine.

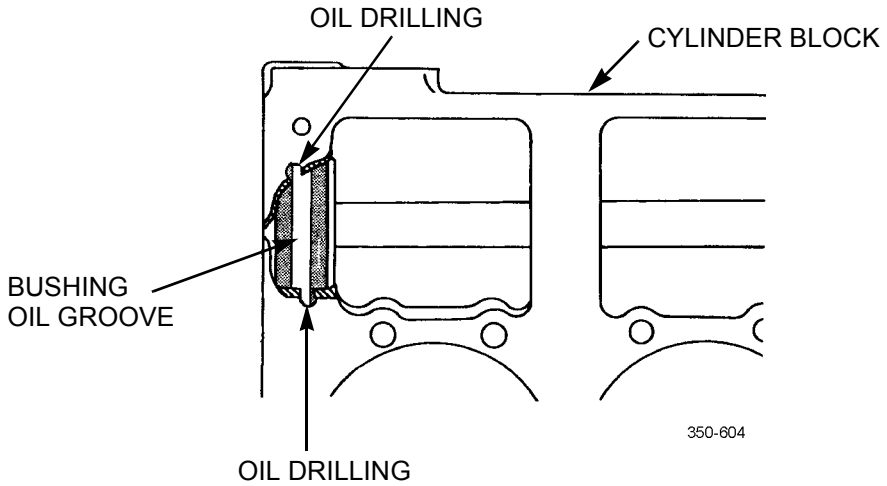
   c. Drive bushing in bore.



CAUTION

Bushing oil groove must be visible in both cylinder block oil drillings to prevent engine damage. Oil drillings are not in alinement with each other.

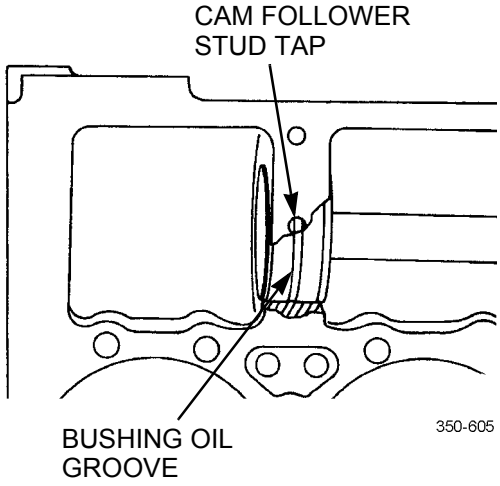
7. Visually inspect bushing oil groove alinement to ensure bushing is installed correctly.



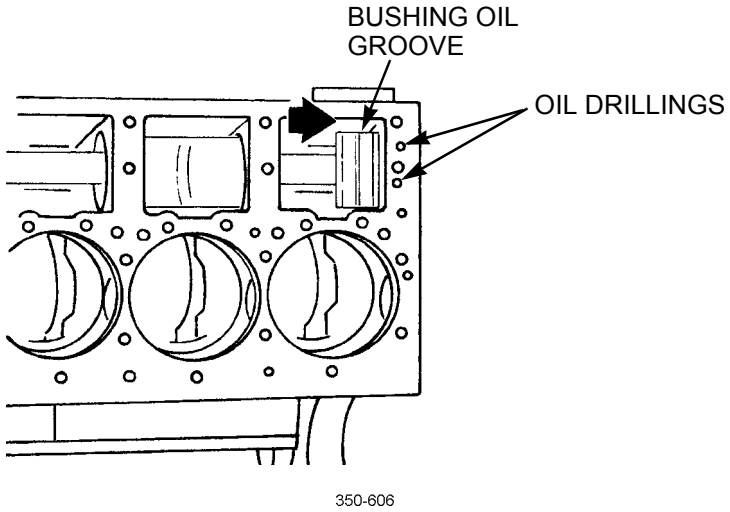
ASSEMBLY - CONTINUED

8. Install bushings in position 6, 5, 4, 3, and 2 in same manner.

9. Visually check thru cam follower stud taps for oil groove in camshaft bushing.



10. Follow procedures in step 6 to install number 1 camshaft bushing.



11. Visually check for oil groove alinement. Oil groove must be visible thru cylinder block oil drillings.

12. As necessary, apply sealant to new expansion plugs and, using expansion plug driver, install expansion plug.

13. Install crankshaft (WP 0078 00).

14. Install cylinder head (WP 0007 00).

END OF WORK PACKAGE

CRANKSHAFT REPLACEMENT 0078 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Indicator, dial (Item 45, WP 0090 00)

Plate, adapter, engine stand (Item 61, WP 0090 00)

Puller kit, universal (Item 70, WP 0090 00)

Puller, main bearing cap (Item 73, WP 0090 00)

Sling, endless (Item 82, WP 0090 00)

Stand, engine rebuild (Item 87, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Materials/Parts

Lubriplate (Item 15, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Personnel Required

Two

Equipment Condition

Engine mounted on rebuild stand (WP 0076 00)

Flywheel housing removed (WP 0013 00)

Front gear housing removed (WP 0084 00)

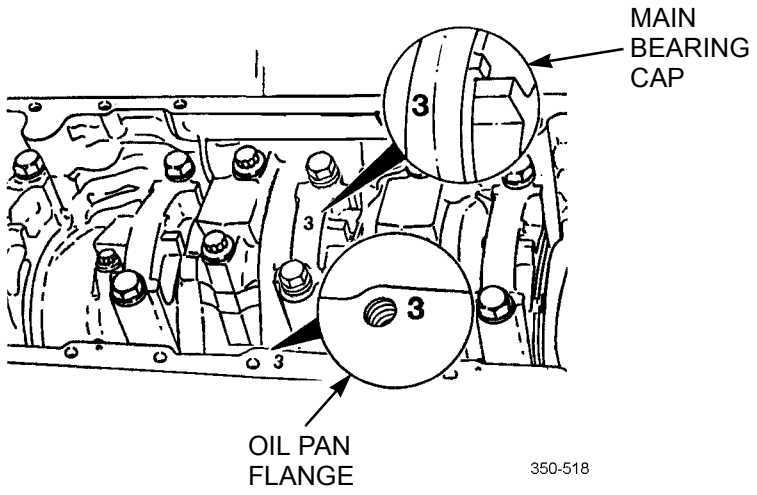
Pistons and connecting rods removed (WP 0079 00)

REMOVAL

NOTE

Position engine on stand with oil pan mounting flange facing up.

1. Verify stamped number on main bearing cap matches number stamped on oil pan flange. If not, stamp main bearing cap with number to match.



CAUTION

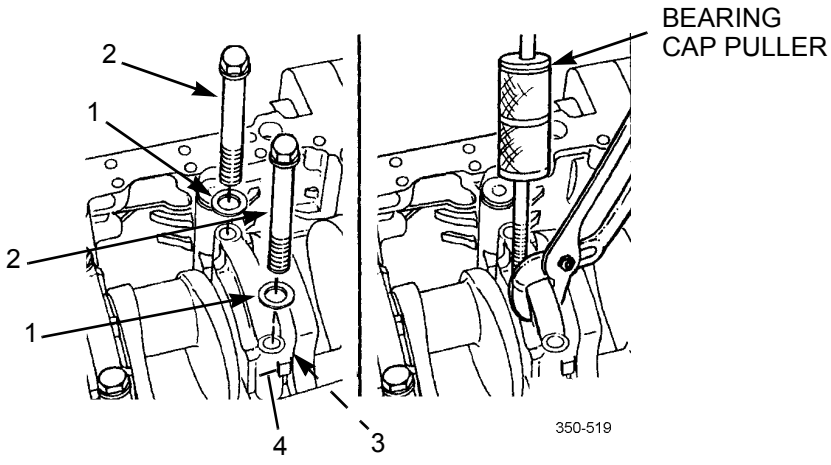
Number 4 main bearing cap is doweled to block. To avoid damage to cylinder block, DO NOT rock cap to remove.

2. Remove 14 main bearing capscrews (2) and washers (1).

NOTE

Main bearing cap puller must be centered on cap.

3. Remove seven main bearing caps (4) with lower bearing shells (3).

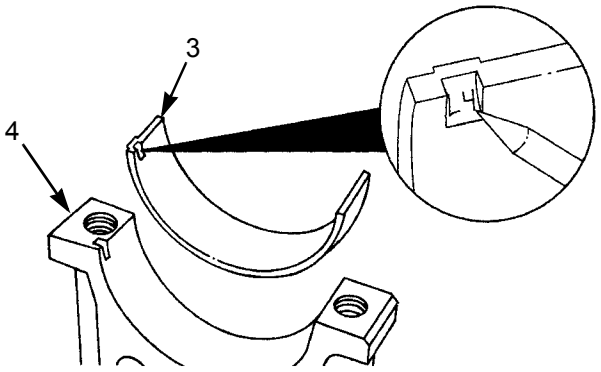


REMOVAL - CONTINUED

CAUTION

DO NOT mark main bearings on crankshaft mating surface. Possible damage to engine may occur if bearings are reused.

4. Remove seven lower bearing shells (3) from main bearing caps (4) and mark bearing for location.

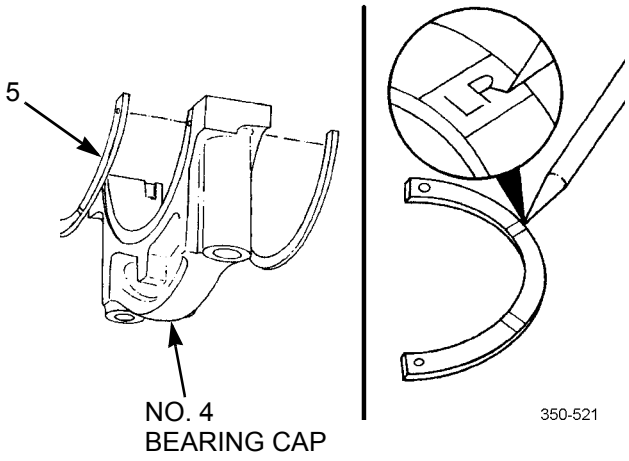


350-520

NOTE

Number 4 main bearing cap has four thrust bearings.

5. Remove and mark two lower thrust bearings (5) for location. Mark “L” for lower and “F” or “R” for front or rear.

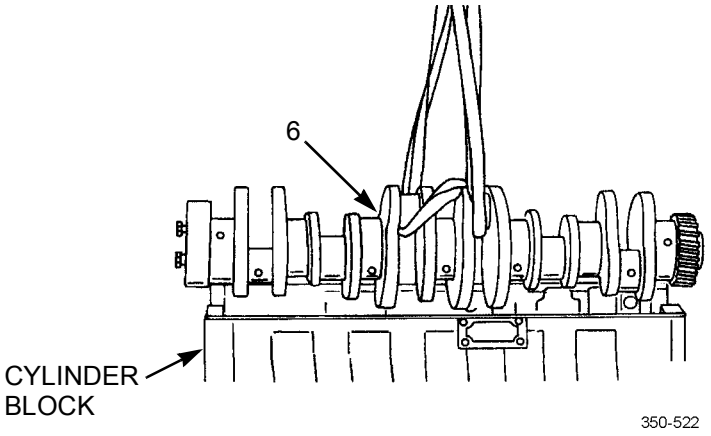


350-521

REMOVAL - CONTINUED

6. Remove and mark two upper thrust bearings (5) in same manner.

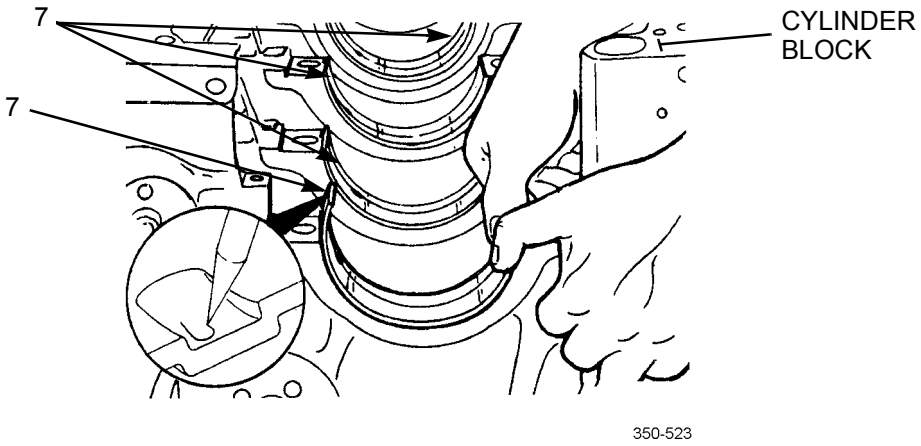
7. Using lifting sling and assistance, remove crankshaft (6) from cylinder block and place on work surface.



CAUTION

DO NOT mark main bearings on crankshaft mating surface. Possible damage to engine may occur if bearings are reused.

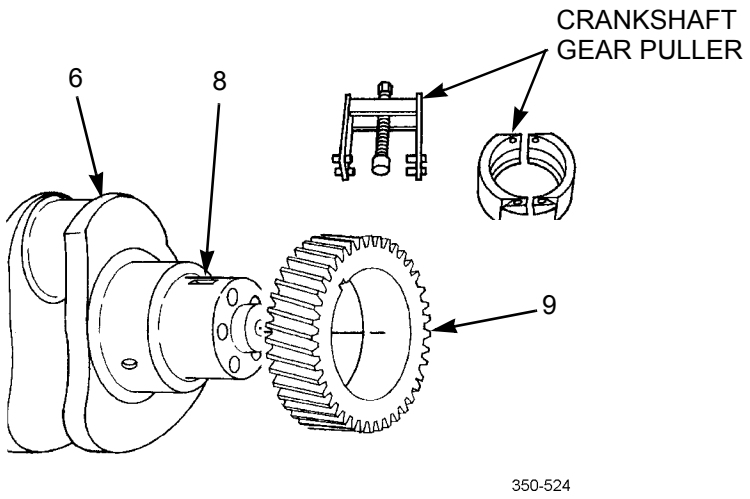
8. Remove seven upper main bearing shells (7) and mark for location.



9. Install gear puller and remove crankshaft gear (9).

10. Remove and retain crankshaft key (8).

REMOVAL - CONTINUED



CLEANING

- When using steam cleaner, wear protective clothing and eye protection. Hot steam will cause serious burns.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

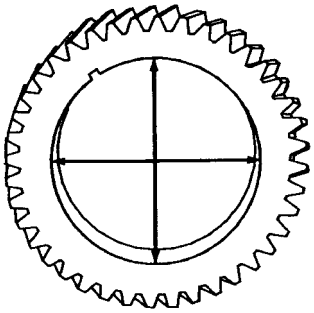
1. Steam clean crankshaft and dry with compressed air.
2. Clear out threaded holes for flywheel and vibration damper mounting in ends of crankshaft.
3. Clean crankshaft oil drilling passages of deposits.

Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.

4. Clean crankshaft gear with solvent and dry with compressed air.
5. Clean main bearing caps, capscrews and main bearings with solvent and dry with compressed air.
6. Apply clean engine oil to crankshaft and crankshaft gear to prevent rust.

INSPECTION

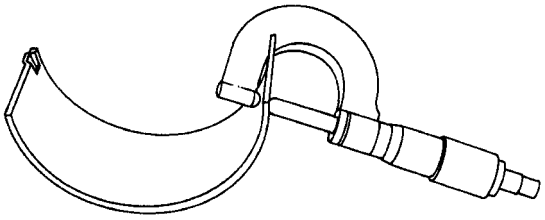
1. Visually inspect main bearing caps, capscrews, and washers for damage. If damaged, replace.
2. Visually inspect upper and lower main bearing shells for nicks, scratches or damage. If damaged, replace.
3. Visually inspect crankshaft machined surfaces for scratches or nicks. If scratches or nicks can be felt with fingernail after polishing, replace crankshaft.
4. Visually inspect threaded holes in both ends of crankshaft for damage. If more than three holes are damaged in one end, replace crankshaft.
5. Visually inspect crankshaft gear for cracks and broken or missing teeth. If damaged, replace gear.
6. Measure inside diameter of crankshaft gear bore. Measurement must be 3.3823-3.3833 in (85.910-85.935 mm). If not as specified, replace crankshaft gear.



350-525

INSIDE DIAMETER, CRANKSHAFT GEAR BORE

7. Measure main bearing shell thickness. Measurement must be 0.1533-0.1553 in (3.894-3.945 mm). If not as specified, replace bearing.

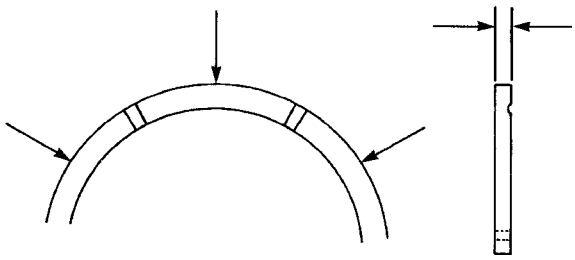


350-527

THICKNESS, MAIN BEARING SHELL

8. Measure thrust bearing thickness in three places. Measurement must be 0.1870-0.1925 in (4.75-4.89 mm). If not as specified, replace thrust bearing.

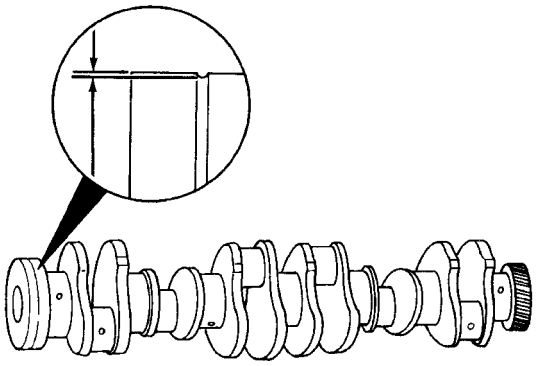
INSPECTION - CONTINUED



350-526

THICKNESS, THRUST BEARING

9. Measure crankshaft as follows. If crankshaft is not within specifications, replace crankshaft.
   a. Measure front and rear oil seal wear groove. Measurement must be 0.0098 in (0.25 mm).

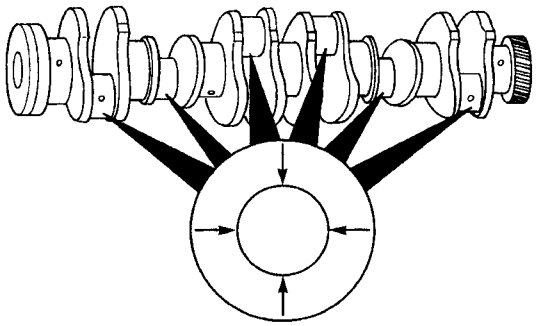


350-528

OIL SEAL WEAR GROOVE

INSPECTION - CONTINUED

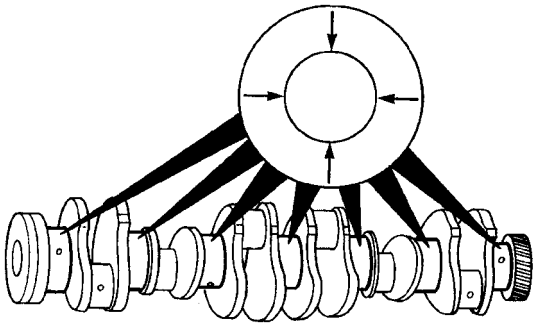
b. Measure connecting rod journals outside diameter. Measurement must be 3.1083-3.1107 in (78.950-79.013 mm).



350-529

OUTSIDE DIAMETER, CONNECTING ROD JOURNALS

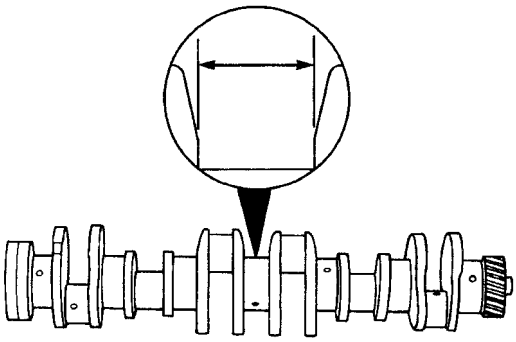
c. Measure main bearing journals outside diameter. Measurement must be 4.4888-4.4903 in (114.015-114.055 mm).



350-530

OUTSIDE DIAMETER, MAIN BEARING JOURNALS

d. Measure thrust face width. Measurement must be 1.9675-1.9724 in (49.975-50.100 mm).

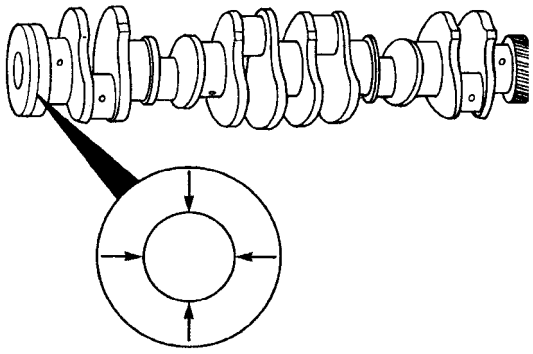


350-531

WIDTH, THRUST FACE

INSPECTION - CONTINUED

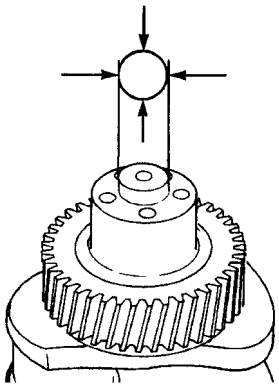
e. Measure crankshaft rear oil seal flange outside diameter. Measurement must be 6.4947-6.4974 in (164.965-165.035 mm).



350-532

OUTSIDE DIAMETER, REAR OIL SEAL FLANGE

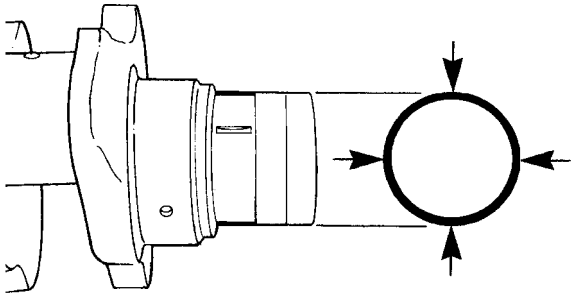
f. Measure damper pilot outside diameter. Measurement must be 1.2602-1.2614 in (32.01-32.04 mm).



350-533

OUTSIDE DIAMETER, DAMPER PILOT

g. Measure crankshaft gear journal outside diameter. Measurement must be 3.3848-3.3858 in (85.975-86.000 mm).



350-542

OUTSIDE DIAMETER, CRANKSHAFT GEAR JOURNAL

INSTALLATION

1. Using a plastic-faced hammer, install crankshaft key (8) in crankshaft keyway.

WARNING

Use protective clothing when handling heated or hot components. Failure to do so will cause serious burns.

CAUTION

DO NOT exceed specified heating time or temperature when heating crankshaft gear. Damage may be done to gear and teeth.

2. Heat crankshaft gear (9) to 350°F (177°C) for a minimum of 1.5 hours, but NOT more than 6 hours.

3. Apply a coating of lubriplate to crankshaft gear journal.

CAUTION

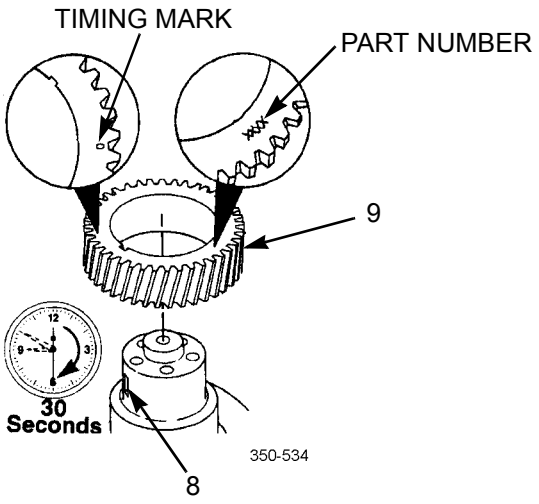
Ensure timing mark and part number on crankshaft gear face away from crankshaft when installed. Failure to orient gear prior to installation can result in damage to engine.

4. Orient crankshaft gear (9) with timing mark and part number facing away from crankshaft.

CAUTION

DO NOT use water or oil to reduce cooling time. Gear may crack. Allow gear to air cool.

5. Aline crankshaft gear keyway with crankshaft key (8) and install gear within 30 seconds. Allow gear to cool.

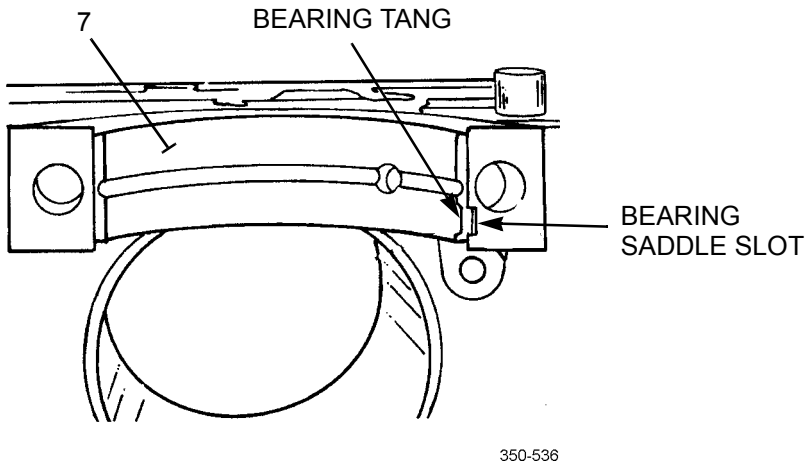


INSTALLATION - CONTINUED

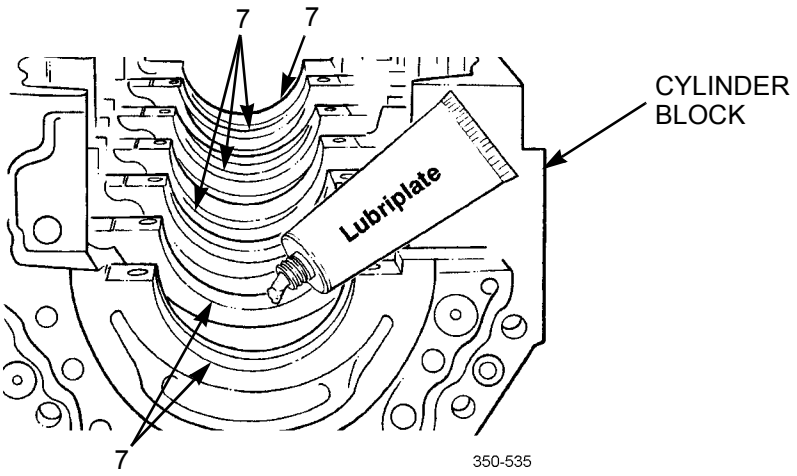
CAUTION

- Bearing shells are marked with words upper and lower. Each must be installed in correct location as marked during removal to prevent possible engine damage.
- Tang of bearing shell must be in slot of bearing saddle to correctly position bearing and prevent engine damage.

6. Install seven upper main bearing shells (7) in saddles on cylinder block.



7. Apply lubriplate to crankshaft mating surface of upper main bearing shells (7).



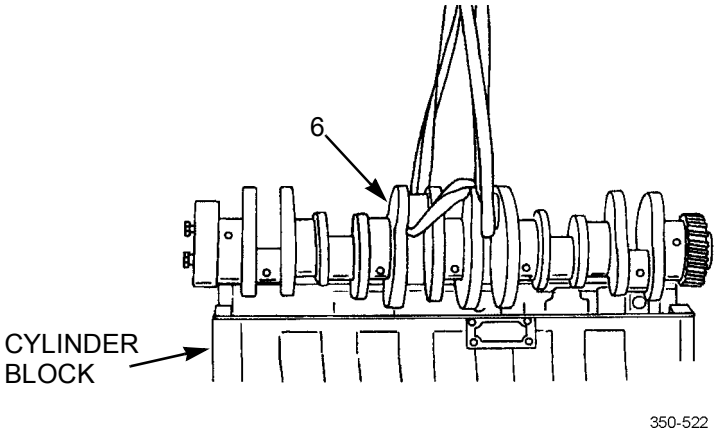
INSTALLATION - CONTINUED

8. Install lifting sling on crankshaft (6) number 3 and 4 rod bearing journals.

NOTE

Ensure upper main bearing shells DO NOT move when installing crankshaft.

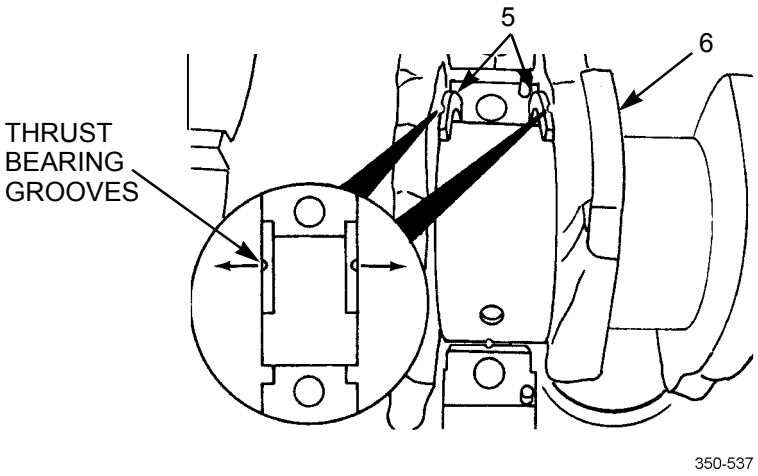
9. With assistance, lift crankshaft (6) and install in cylinder block.



NOTE

Thrust bearings must be installed with grooves facing crankshaft.

10. Apply lubriplate to two upper thrust bearings (5) and install in number 4 main bearing saddle as follows:
    a. Push crankshaft (6) toward rear of engine and install rear thrust bearing.
    b. Push crankshaft (6) toward front of engine and install front thrust bearing.

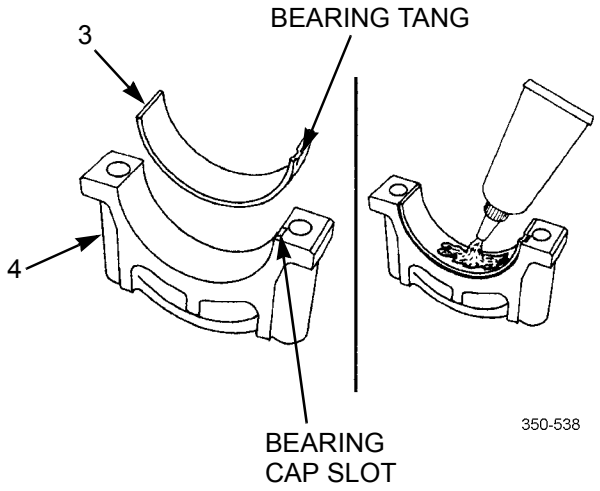


INSTALLATION - CONTINUED

NOTE

Ensure lower main bearing shells, if reused, are installed in same main bearing caps from which they were removed.

11. Install seven lower main bearing shells (3) with bearing tang in slot of main bearing cap (4). Apply lubriplate to bearing crankshaft mating surface.



INSTALLATION - CONTINUED

NOTE

Thrust bearings must be installed with grooves facing crankshaft.

12. Apply lubriplate to two lower thrust bearings (5) and install in number 4 main bearing cap (4).

NOTE

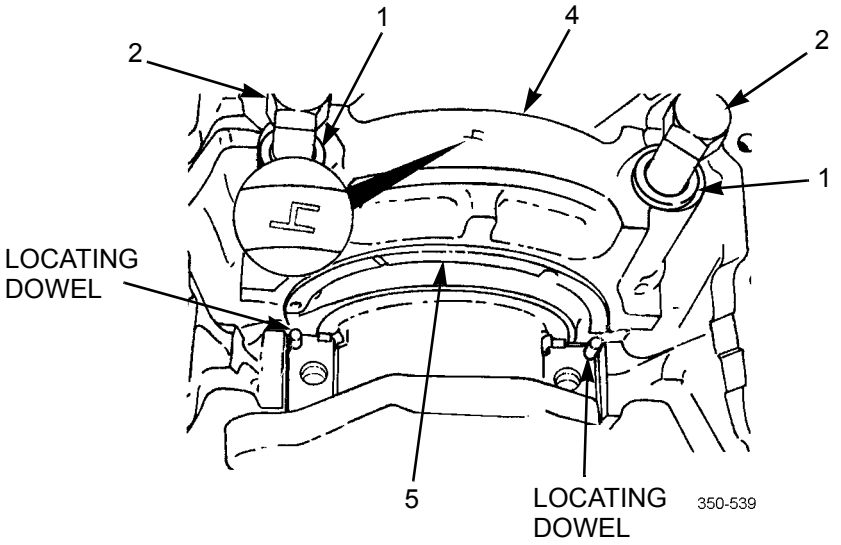
Ensure main bearing caps are installed on journal with stamped number of cap matching number on oil pan flange.

13. Apply clean engine oil to main bearing capscrews and washers and allow excess oil to drain off. Install main bearing caps number 1, 2, 3, 5, 6, and 7 with washers and capscrews. Hand tighten capscrews.

CAUTION

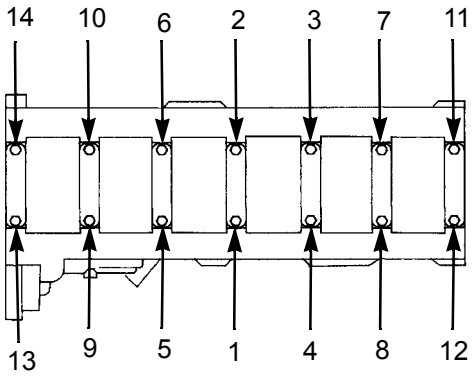
Number 4 main bearing cap is doweled and must be positioned to match locating dowels in cylinder block saddle. If main bearing cap and dowels are not alined, cylinder block and main bearing cap will be damaged when screws are tightened.

14. Install number 4 main bearing cap (4) with capscrews (2) and washers (1). Hand tighten capscrews.



15. Tighten main bearing capscrews in following steps and in sequence shown.
    a. Tighten capscrews to 50 lb-ft (68 Nm).
    b. Tighten capscrews to 105 lb-ft (142 Nm).
    c. Tighten to 155 lb-ft (210 Nm).
    d. Loosen capscrews completely.
    e. Tighten to 50 lb-ft (68 Nm).
    f. Tighten to 105 lb-ft (142 Nm).
    g. Tighten to 155 lb-ft (210 Nm).

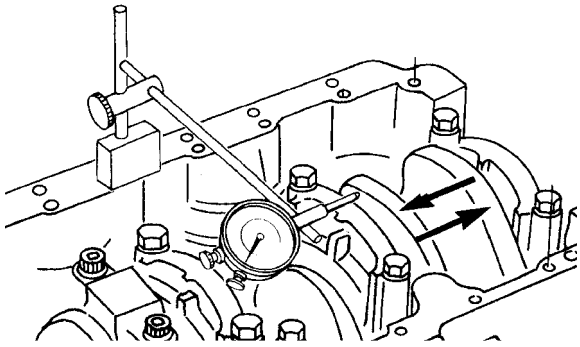
INSTALLATION - CONTINUED



350-540

TIGHTENING SEQUENCE

16. Turn crankshaft by hand. If crankshaft does not turn freely, loosen main bearing capscrews one at a time to locate tight bearing and replace if necessary.
17. Use dial indicator to measure crankshaft end clearance. Measurement must be 0.004-0.022 in (0.10-0.56 mm). If not as specified, replace thrust washers.



350-541

CRANKSHAFT END CLEARANCE

18. Install pistons and connecting rods (WP 0079 00).
19. Install flywheel housing (WP 0013 00).
20. Install front gear housing (WP 0084 00).

END OF WORK PACKAGE

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PISTON AND CONNECTING ROD MAINTENANCE 0079 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, micrometer, inside (Item 9, WP 0090 00)

Caliper, micrometer, outside (Item 10, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Compressor, piston ring (Item 13, WP 0090 00)

Expander, piston ring (Item 23, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Pins, guide, connecting rod (Item 60, WP 0090 00)

Plate, adapter, engine stand (Item 61, WP 0090 00)

Pliers, retaining ring, internal (Item 64, WP 0090 00)

Stand, engine rebuild (Item 87, WP 0090 00)

Wrench, torque, 50-250 lb-ft capacity (Item 104, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Abrasive pad (Item 1, WP 0089 00)

Detergent (Item 10, WP 0089 00)

Lubriplate (Item 15, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Piston kit, engine (P/N 3800470) (6)

Equipment Condition

Engine mounted on rebuild stand (WP 0076 00)

Oil pan removed (WP 0016 00)

Cylinder head removed (WP 0007 00)

Cam follower assembly removed (WP 0081 00)

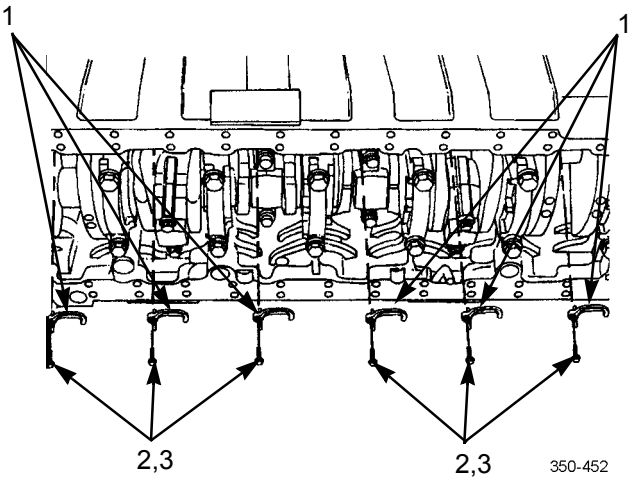
REMOVAL

NOTE

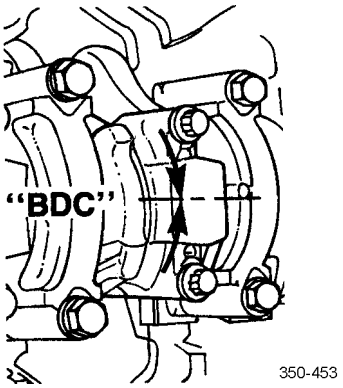
- Piston cooling nozzle MUST be removed prior to removing piston and connecting rod assembly. All cooling nozzles are removed and installed in the same manner.
- Crankshaft MUST be rotated to allow access to each piston cooling nozzle. Bar engine over using accessory drive for cooling nozzle access.

REMOVAL - CONTINUED

1. Remove piston cooling nozzle (1) as follows:
   a. Remove screw (2) and washer (3) securing cooling nozzle (1).
   b. Remove cooling nozzle (1). Retain for installation.
   c. Rotate crankshaft to access next cooling nozzle for removal.
   d. Perform step a thru c to remove remaining cooling nozzles.



2. Using accessory drive, bar engine over to position piston at bottom dead center (BDC).



BOTTOM DEAD CENTER POSITION

CAUTION

DO NOT use emery cloth or sandpaper to remove carbon from cylinder liners or cylinder block top deck surface. Aluminum oxide or silicon particles from emery cloth or sandpaper can cause serious engine damage.

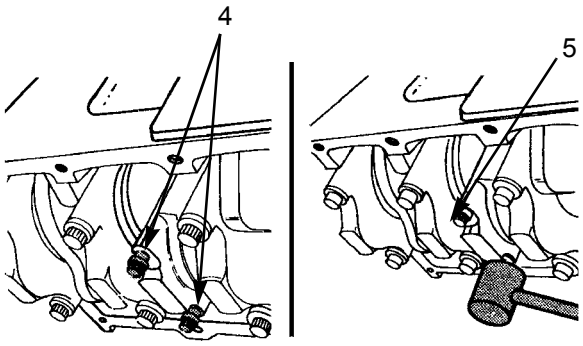
3. Using abrasive pad, clean carbon ridge from cylinder liner, above ring travel area, in cylinder liner of piston being removed.

REMOVAL - CONTINUED

NOTE

DO NOT remove connecting rod capscrews until caps have been loosened.

4. Loosen connecting rod capscrews (4) and tap heads of screws with plastic-faced hammer to loosen connecting rod cap (5) from dowel rings.



350-454

NOTE

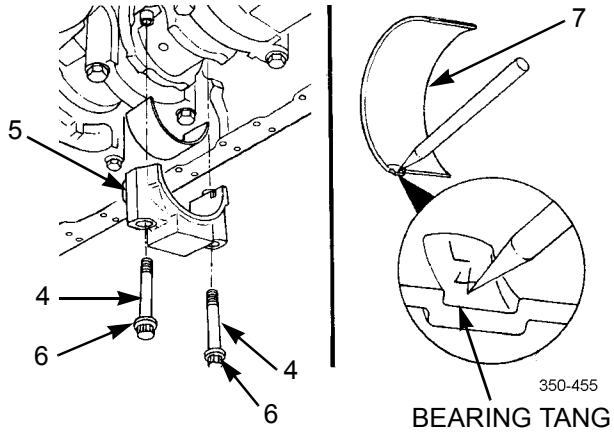
DO NOT drop bottom bearing when cap is removed.

5. Remove two capscrews (4) with captive washers (6) and connecting rod cap (5) with lower bearing (7).

CAUTION

DO NOT mark bearing on crankshaft mating surface. Damage to engine can occur if bearings are reinstalled.

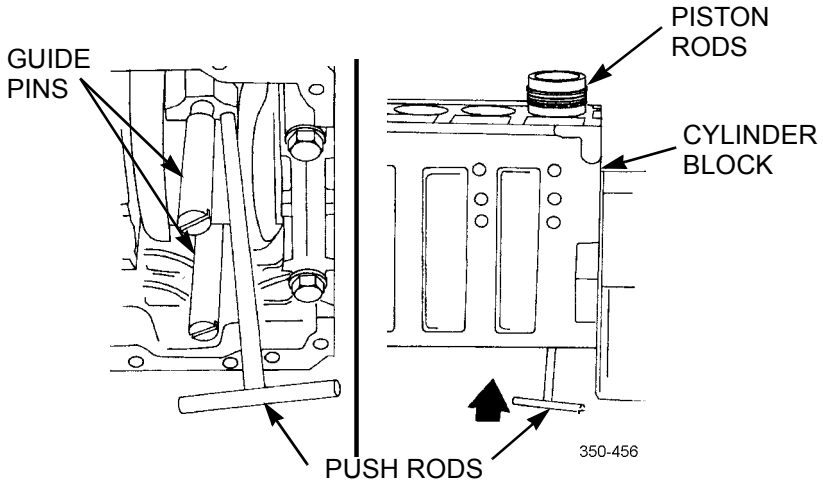
6. Mark cylinder number and letter “L” in flat surface of lower bearing (7) tang and connecting rod cap (5).



350-455

REMOVAL - CONTINUED

7. Install two connecting rod guide pins in connecting rod screw holes.
8. Using a nonmetallic push rod or hammer handle, push connecting rod away from crankshaft.
9. Push connecting rod until piston rings are outside cylinder block.
10. Using both hands, remove piston and connecting rod assembly from engine.

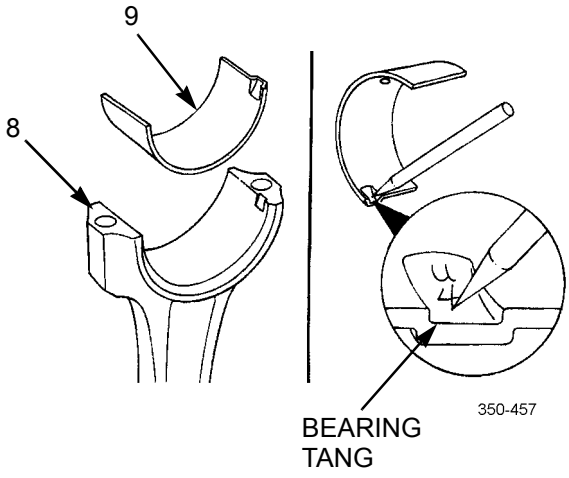


11. Remove upper bearing (9) from connecting rod (8).

CAUTION

DO NOT mark bearing on crankshaft mating surface. Damage to engine can occur if bearings are reinstalled.

12. Mark cylinder number and letter “U” in flat surface of upper bearing (9) tang.

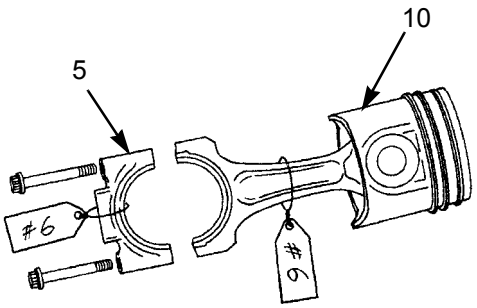


REMOVAL - CONTINUED

CAUTION

Piston, connecting rod, and connecting rod cap are matched sets to cylinder from which they were removed. Ensure they are tagged for identification with cylinder number and placed in a storage container or in a location to protect them from damage.

13. Tag piston and connecting rod assembly (10) and matching connecting rod cap (5) for cylinder location. Place in temporary storage container.



350-458

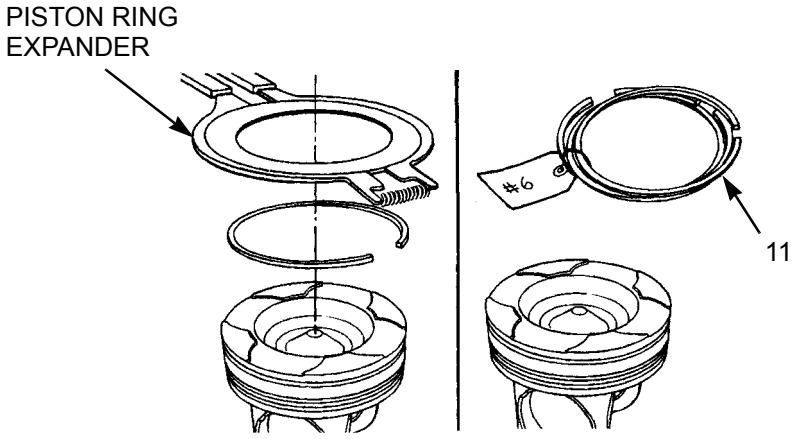
14. Repeat steps 2 thru 13 to remove each remaining piston and connecting rod assembly.

DISASSEMBLY

NOTE

- Ensure all component parts are tagged with cylinder number from which they were removed.
- Perform steps 1 thru 4 to disassemble each piston and connecting rod assembly.

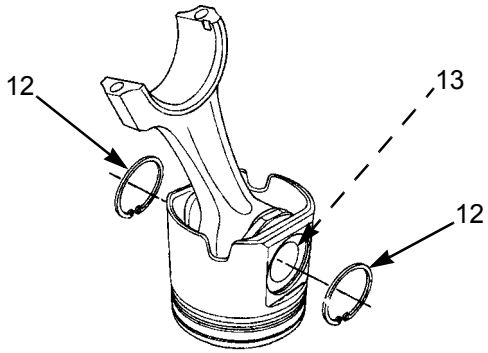
1. Using piston ring expander, remove and tag three piston rings (11).



350-459

DISASSEMBLY - CONTINUED

2. Remove two retaining rings (12) securing piston pin (13) in place. Discard retaining rings.



CAUTION

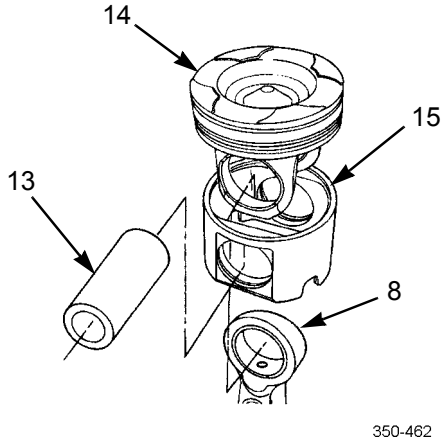
DO NOT use hammer to remove piston pin. Piston can distort, causing it to seize in cylinder.

3. If piston pin is not easily removed, perform the following:
   a. Heat container of water to 212° F (100° C).
   b. Insert piston and connecting rod assembly in container for 15 minutes.
   c. Use wood dowel stock to push piston pin from piston assembly.

NOTE

When piston pin is removed from articulated piston, skirt and crown will separate.

4. Tag piston pin (13), connecting rod (8), skirt (15), and crown (14) with cylinder number from which they were removed.



CLEANING

WARNING

Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200ºF (94ºC). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.

1. Soak pistons in solvent for a minimum of 30 minutes.
2. Remove carbon deposits with hot, soapy solution and nonmetallic brush.
3. Use solvent to clean connecting rods.

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

4. Dry all components with compressed air.

INSPECTION

1. Visually inspect connecting rod, connecting rod cap, and screws as follows:
   a. Inspect connecting rod for damage. If "I-beam" is nicked or damaged, replace connecting rod.
   b. Inspect connecting rod pin bore bushing for damage. If damaged, replace bushing.
   c. Inspect connecting rod cap for damage. If damaged, replace cap.
   d. Inspect capscrews for damaged threads. If damaged, replace capscrews.

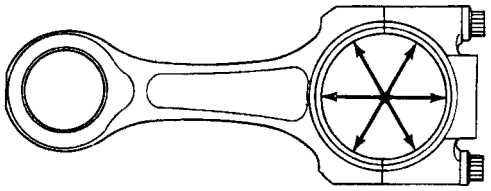
NOTE

Connecting rod cap and connecting rod are matched with a stamped number. When assembling connecting rod caps to connecting rods, stamped numbers MUST match and be on the same side.

2. Install connecting rod cap on connecting rod and secure with two capscrews with captive washers. Tighten as follows:
   a. Tighten capscrews to 50 lb-ft (68 Nm).
   b. Tighten to 105 lb-ft (142 Nm).
   c. Tighten to 155 lb-ft (210 Nm).
   d. Loosen capscrews completely.
   e. Repeat steps a thru c.

INSPECTION - CONTINUED

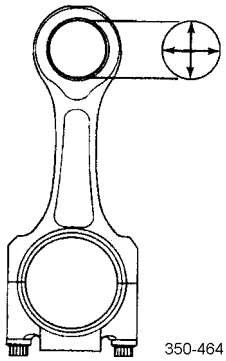
3. Measure connecting rod crankshaft bore inside diameter in three places as shown. Measurement should be 3.3061-3.3080 in (83.975-84.025 mm). If measurement is not within specification, replace connecting rod, connecting rod cap, and capscrews.



350-463

INSIDE DIAMETER, CONNECTING ROD CRANKSHAFT BORE

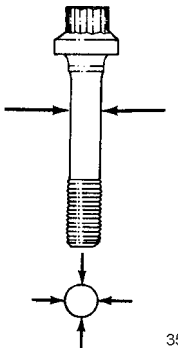
4. Measure piston pin bushing inside diameter in two places as shown. Measurement should be 2.1281-2.1299 in (54.054-54.099 mm). If measurement is not within specification, replace connecting rod, connecting rod cap, and capscrews.



350-464

INSIDE DIAMETER, PISTON PIN BUSHING BORE

5. Remove two capscrews and measure outside diameter in two places as shown. Measurement should be 0.496-0.504 in (12.60-12.80 mm). If measurement is not within specification, replace capscrews.

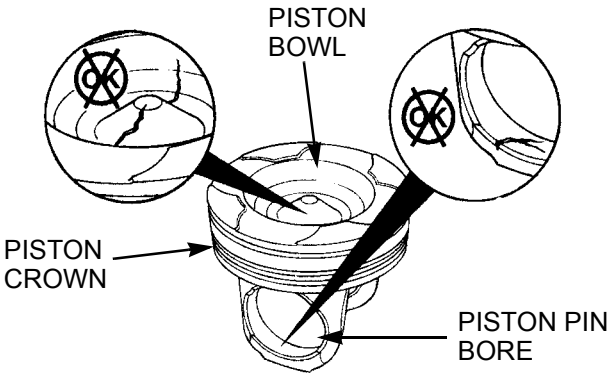


350-465

OUTSIDE DIAMETER, CONNECTING ROD CAPSCREWS

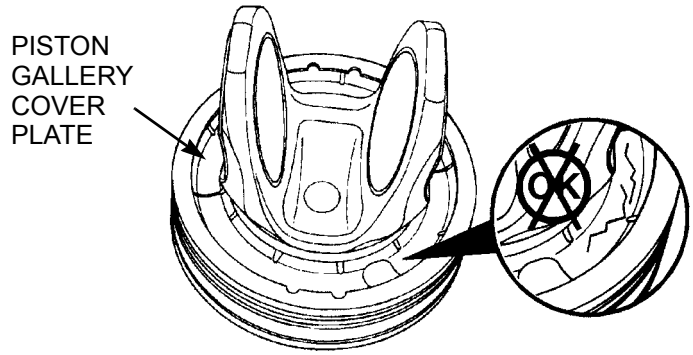
INSPECTION - CONTINUED

6. Visually inspect piston bowl and piston crown pin bore for cracks or damage. If noted, replace piston crown.



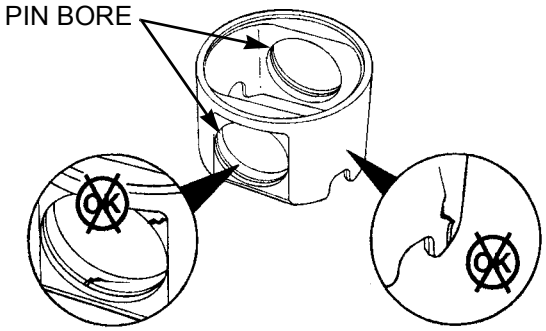
350-466

7. Inspect piston gallery cover plate for cracks or looseness. If noted, replace piston crown.



350-467

8. Visually inspect piston skirt pin bore and sides for cracks or damage. If noted, replace piston skirt.

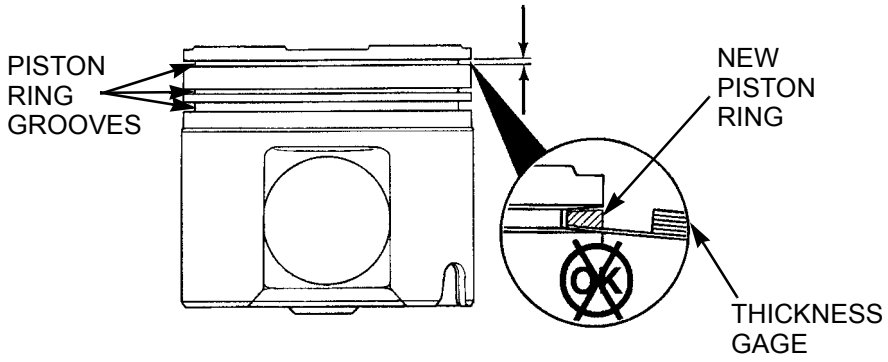


PISTON SKIRT

350-468

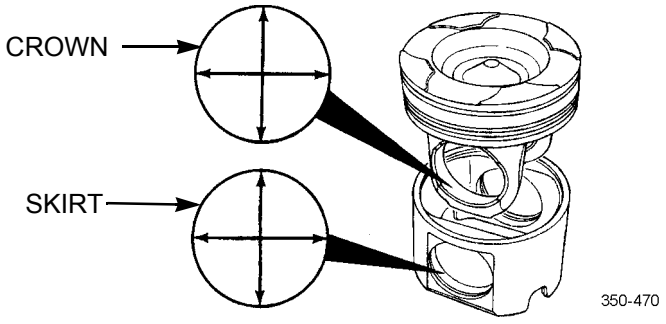
INSPECTION - CONTINUED

9. Using new piston ring and thickness gage. Inspect piston ring grooves for wear as follows:
   a. Hold new piston ring in ring groove.
   b. Insert 0.006 in (0.15 mm) thickness gage into ring groove. If thickness gage enters without resistance, there is too much wear. Replace piston.



PISTON CROWN 350-469

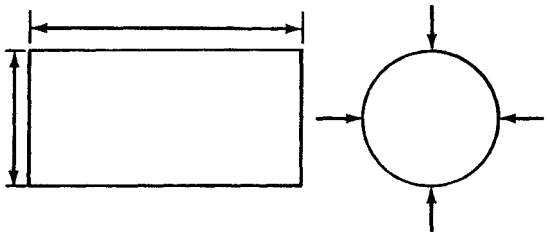
10. Measure piston pin bore inside diameter in both crown and skirt as shown. Measurement for crown should be 2.1276-2.1281 in (54.040-54.055 mm) and for skirt 2.1263-2.1266 in (54.007-54.015 mm). If measurement is not within specification, replace defective component.



INSIDE DIAMETER, PISTON PIN BORES

INSPECTION - CONTINUED

11. Measure piston pin outside diameter and length as shown. Length should be 4.0039-4.0157 in (101.70-102.00 mm). Outside diameter should be 2.1259-2.1261 in (53.997-54.003 mm). If piston pin is not within specification, replace piston pin.



350-471

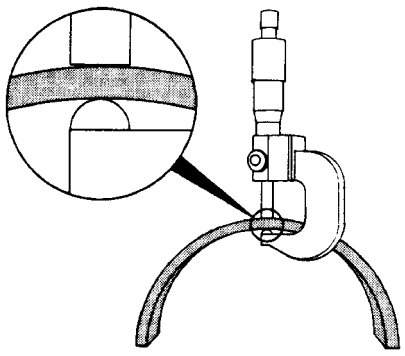
OUTSIDE DIAMETER AND LENGTH, PISTON PIN

12. Visually inspect piston cooling nozzle for damage and a nominal length of 1.752 in (44.5 mm). Replace if defective.

NOTE

Normal bearing wear produces a smooth finish which will wear into copper lining. Exposed copper does NOT always indicate worn bearings.

13. Visually inspect connecting rod bearings. Replace bearings with any of following conditions:
    a. Pitting
    b. Flaking
    c. Corrosion
    d. Lock tang damage
    e. Scratches (deep enough to be felt with a fingernail)
14. Measure connecting rod bearing thickness at three locations on each edge of bearing. Measurement should be 0.0957-0.974 in (2.430-2.473 mm). If not as specified, replace bearing.



350-461

THICKNESS, CONNECTING ROD BEARING

ASSEMBLY

CAUTION

Retaining ring must be seated completely in piston pin groove to prevent damage during engine operation.

NOTE

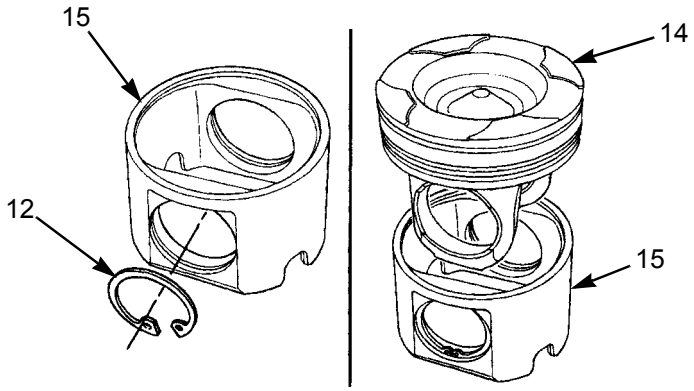
Perform step 1 thru 5 to assemble each piston and connecting rod assembly.

1. Install new retaining ring (12) in one piston pin bore of piston skirt (15).

NOTE

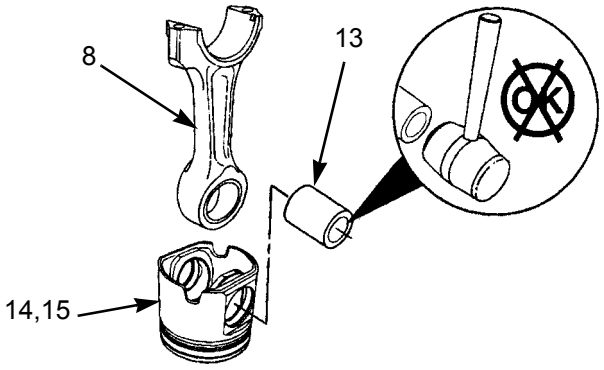
If piston is being reused, ensure crown, skirt, and pin are matched as noted in disassembly.

2. Position piston skirt (15) over piston crown (14).



350-472

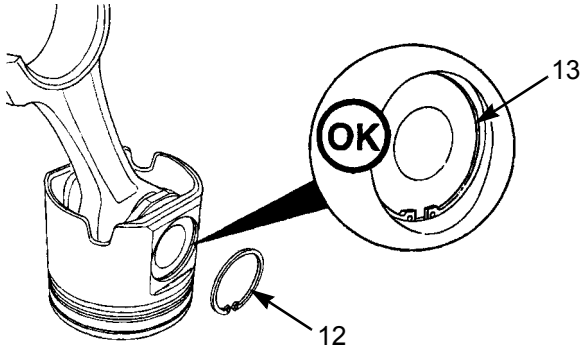
3. Aline pin bore of connecting rod (8) with pin bore of piston skirt (15) and crown (14). Install piston pin (13).



350-473

ASSEMBLY- CONTINUED

4. Install new retaining ring (12) in piston bore to secure piston pin (13).

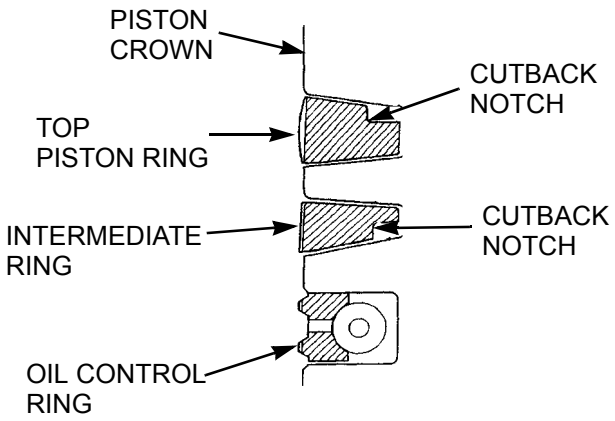


350-474

NOTE

Two-piece oil control ring MUST be installed with expander ring gap 180° from gap of oil ring. DO NOT overlap ends of expander ring.

5. Using piston ring expander, install piston rings in piston ring grooves as shown.



350-475

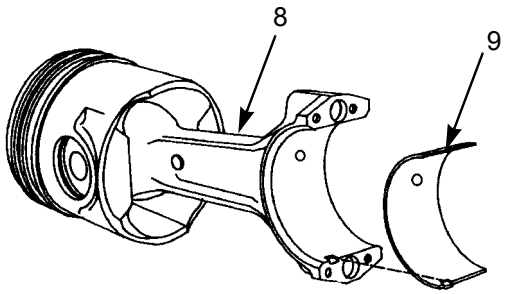
INSTALLATION

NOTE

- If new bearings are not being used, ensure bearings and connecting rod are matched as marked during removal and disassembly.
- Tang of bearing MUST be in slot of connecting rod and end of bearing MUST be even with cap mounting surface.

INSTALLATION - CONTINUED

1. Install upper bearing (9) in matching connecting rod (8).



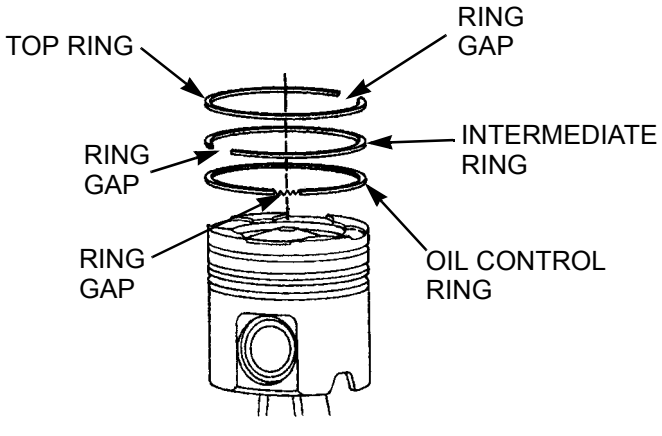
350-476

2. Apply a heavy film of clean engine oil to cylinder liner for piston and connecting rod assembly being installed.
3. To lubricate piston and connecting rod assembly, insert assembly in container of clean engine oil. Remove assembly allowing excess oil to drain into container.

NOTE

Ring gaps MUST NOT be alined with piston pin or any other ring gap.

4. Rotate piston rings to position ring gaps as shown.

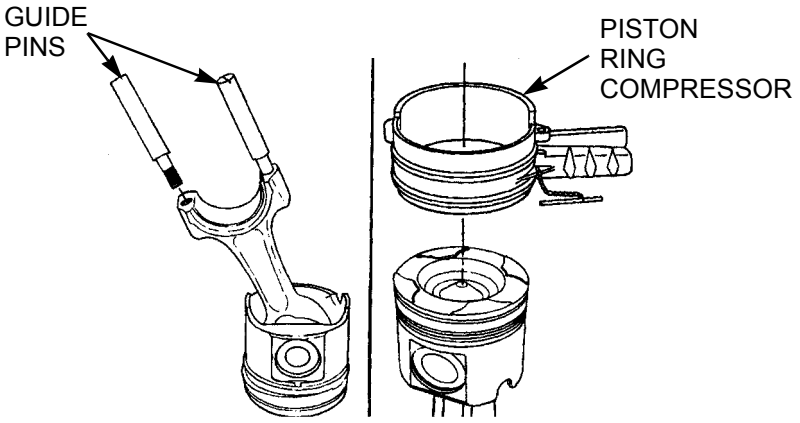


350-477

PISTON RING GAP ALINEMENT

INSTALLATION - CONTINUED

5. Install connecting rod guide pins.
6. Compress piston rings with piston ring compressor.



7. Using accessory drive, rotate crankshaft so connecting rod journal of piston rod assembly being installed is at BDC.
8. Insert piston and connecting rod assembly thru cylinder liner, with bearing tang toward camshaft side of engine, until ring compressor contacts top of liner.

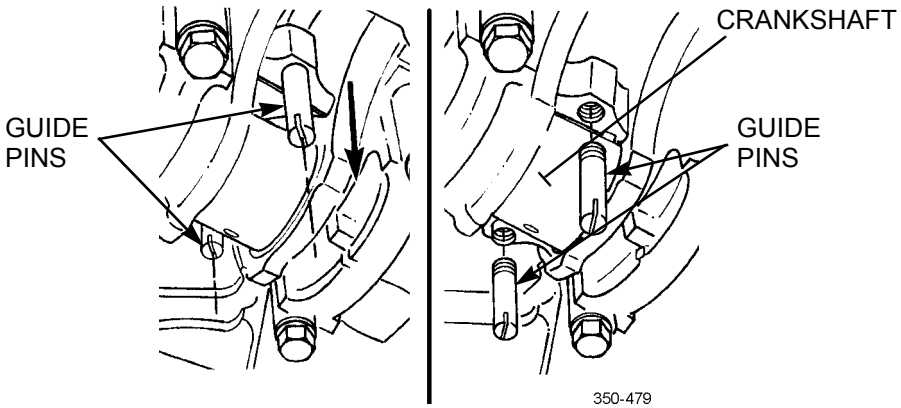
CAUTION

Do not use metal drift to push piston and connecting rod assembly into cylinder liner. Piston rings or cylinder liner may be damaged.

NOTE

If piston does not move freely, remove and inspect for broken or damaged rings.

9. Hold ring compressor against cylinder liner. Push piston thru ring compressor into cylinder liner until top ring is completely in cylinder liner.
10. Use guide pins to aline connecting rod with crankshaft while pushing piston and connecting rod assembly in place.
11. Remove guide pins.

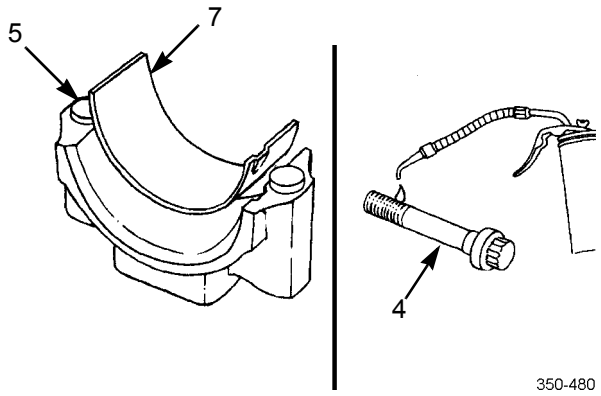


INSTALLATION - CONTINUED

NOTE

- If new bearings are not being used, ensure bearings and connecting rod cap are matched as marked during removal and disassembly.
- Tang of bearing MUST be in slot of connecting rod cap and end of bearing MUST be even with cap mounting surface.

12. Install lower bearing (7) in matching connecting rod cap (5).
13. Apply lubriplate to inside diameter of lower bearing (7).
14. Apply clean engine oil to threads of connecting rod capscrews (4).



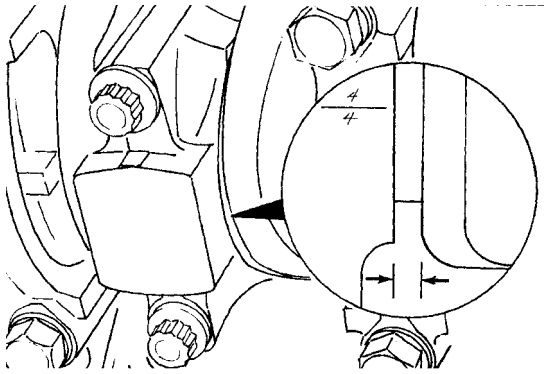
NOTE

- Connecting rod and rod cap MUST have same stamped number and be installed in same cylinder from which they were removed.
- Connecting rod and rod cap stamped number MUST be on same side.

15. Install connecting rod cap and two capscrews. Tighten as follows:
    a. Tighten capscrews to 50 lb-ft (68 Nm).
    b. Tighten to 105 lb-ft (142 Nm).
    c. Tighten to 155 lb-ft (210 Nm).
    d. Loosen capscrews completely.
    e. Repeat steps a thru c.

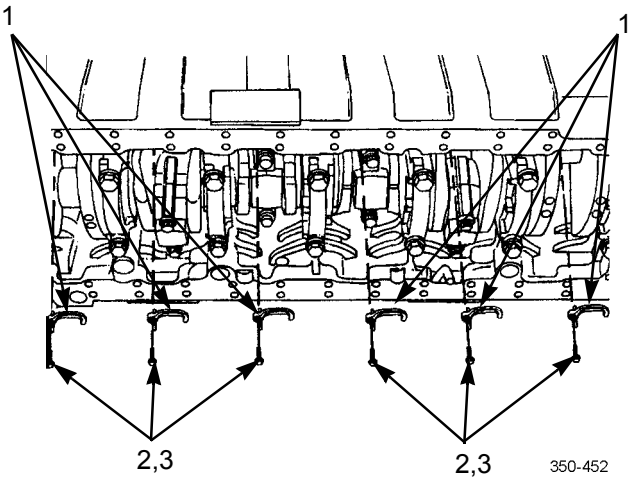
INSTALLATION - CONTINUED

16. Verify connecting rod side clearance as shown. Measurement should be 0.004-0.012 in (0.10-0.30 mm).



CONNECTING ROD SIDE CLEARANCE

17. Install piston cooling nozzle (1) and secure with screw (2) and washer (3). Tighten screw to 21 lb-ft (28 Nm).



18. Repeat steps 1 thru 17 to install each remaining piston and connecting rod assembly.
19. Install cam follower assembly (WP 0081 00).
20. Install cylinder head (WP 0007 00).
21. Install oil pan (WP 0016 00).

END OF WORK PACKAGE

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CAMSHAFT AND DRIVE GEAR REPLACEMENT 0080 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Guide, camshaft pilot (Item 40, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Indicator, dial (Item 45, WP 0090 00)

Puller kit, camshaft gear (Item 68, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Lubriplate (Item 15, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Gasket (P/N 3025296)

Equipment Condition

Engine removed and installed on stand (WP 0005 00)

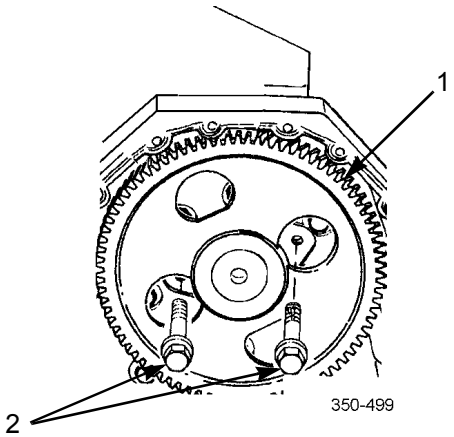
Cylinder head removed (WP 0007 00)

Cam follower assembly removed (WP 0081 00)

Camshaft idler gear removed (WP 0082 00)

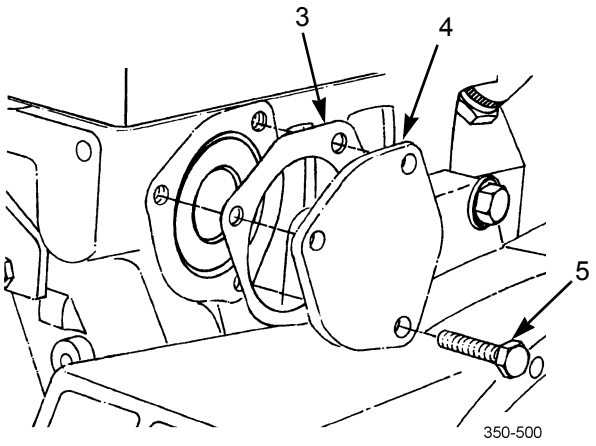
REMOVAL

1. Rotate camshaft to aline holes in camshaft drive gear (1) with thrust washer plate screws (2).
2. Remove two thrust plate mounting screws (2).

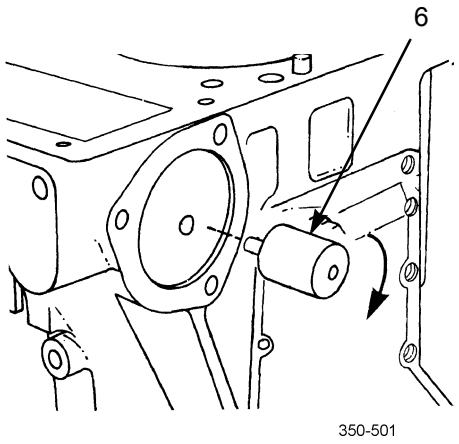


REMOVAL - CONTINUED

3. Remove three screws (5), gasket (3), and camshaft rear cover plate (4). Discard gasket.

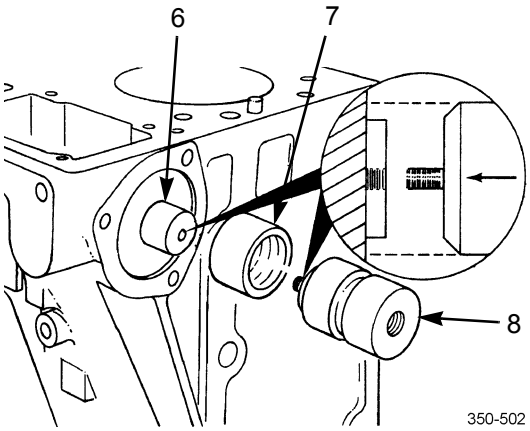


4. Install camshaft installation pilot guide as follows:
   a. Install expander (6) in camshaft thru rear cover plate opening.

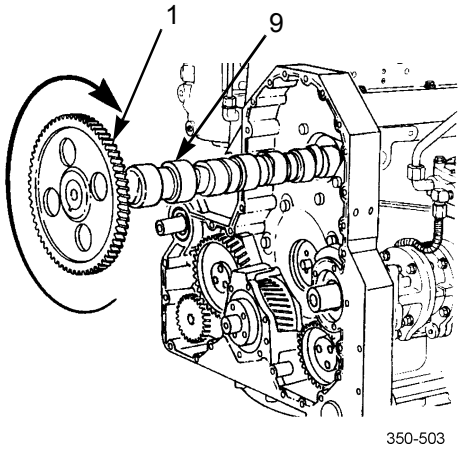


   b. Turn screw inside expander (6) clockwise to expand swell plug.
   c. Install arbor sleeve (7) over expander (6).
   d. Install locating pilot extensions (8) to expander (6).

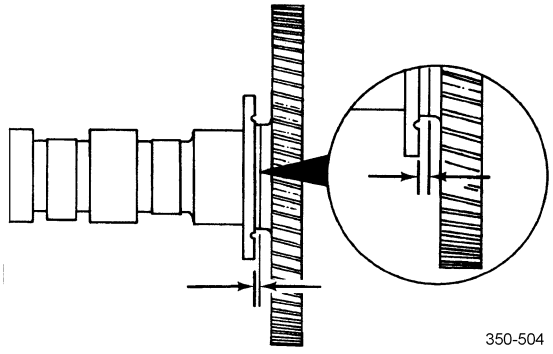
REMOVAL - CONTINUED



5. Rotate and pull camshaft (9) and drive gear (1) from cylinder block.
6. Remove camshaft installation pilot guide from rear of camshaft (9).



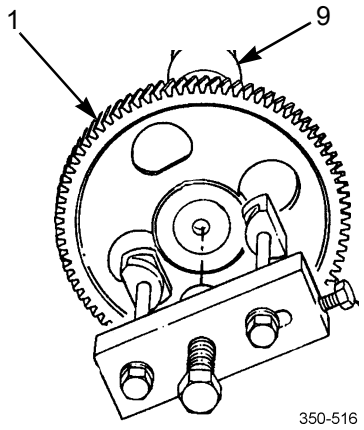
7. Measure and record clearance between camshaft gear hub and thrust washer plate. Measurement should be 0.005-0.013 in (0.13-0.33 mm).



GEAR HUB-TO-THRUST WASHER PLATE CLEARANCE

REMOVAL - CONTINUED

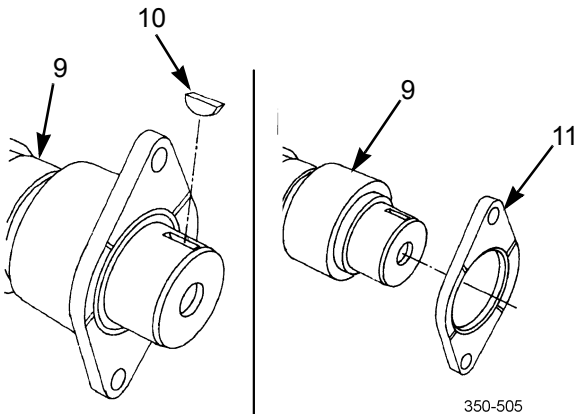
8. Using camshaft gear puller, remove camshaft drive gear (1) from camshaft (9).



NOTE

Record arrow direction on camshaft key and direction of offset for installation reference.

9. Remove and retain camshaft key (10).
10. Remove thrust washer plate (11) from camshaft (9).



CLEANING

1. Remove gasket material from camshaft rear cover plate and mating surface of cylinder block.

WARNING

- Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

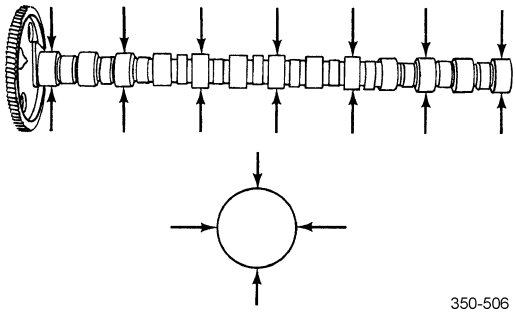
CAUTION

DO NOT touch machined surfaces of camshaft with bare hands after cleaning. This can cause rust to form, which will damage camshaft. Lubricate camshaft with clean engine oil before handling.

2. Clean camshaft in solvent and dry with compressed air.

INSPECTION

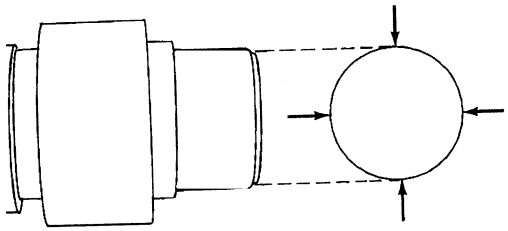
1. Visually inspect camshaft as follows. If above conditions are found, replace camshaft.
   a. Lobes: cracks, scratches or other damage.
   b. Nose: burrs.
2. Visually inspect camshaft drive gear as follows. If conditions are found, replace gear.
   a. Gear teeth: chipped, broken or cracked.
   b. Gear bore and keyway: burrs.
3. Measure camshaft as follows. If camshaft is not within specification, replace camshaft.
   a. Bushing journal outside diameter: 2.8331-2.8352 in (71.960-72.013 mm).



OUTSIDE DIAMETER, BUSHING JOURNALS

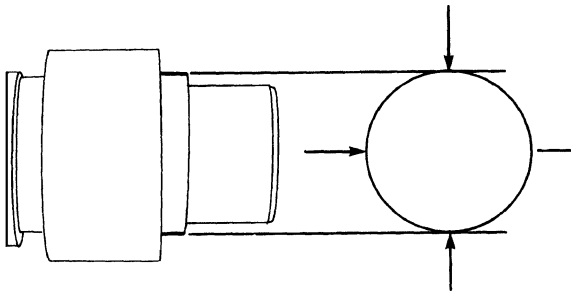
INSPECTION - CONTINUED

b. Gear mounting surface outside diameter: 1.8499-1.8509 in (46.987-47.013 mm).



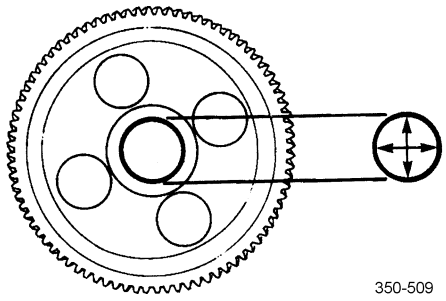
OUTSIDE DIAMETER, GEAR MOUNTING SURFACE

c. Thrust washer plate journal outside diameter: 2.1575-2.1732 in (54.800-55.200 mm).



OUTSIDE DIAMETER, THRUST WASHER PLATE JOURNAL

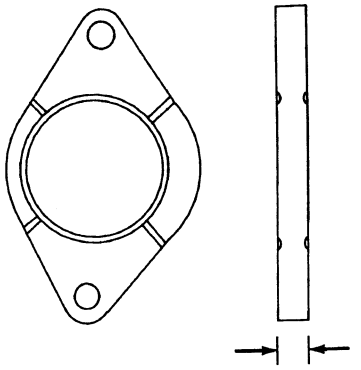
4. Measure camshaft drive gear bore inside diameter: Measurement should be 1.8469-1.8479 in (46.912-46.938 mm). If not as specified, replace camshaft drive gear.



INSIDE DIAMETER, CAMSHAFT DRIVE GEAR BORE

5. Measure thrust washer plate as follows. If not as specified, replace thrust washer plate.
   a. Thickness: 0.353-0.356 in (8.96-9.04 mm).

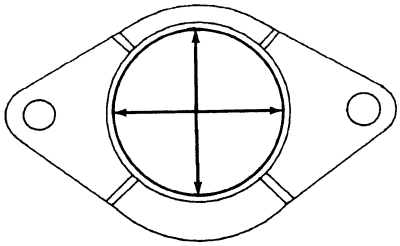
INSPECTION - CONTINUED



350-511

THICKNESS, THRUST WASHER PLATE

b. Bore inside diameter: 2.1890-2.2287 in (55.60-56.61 mm).



350-510

INSIDE DIAMETER, THRUST WASHER PLATE BORE

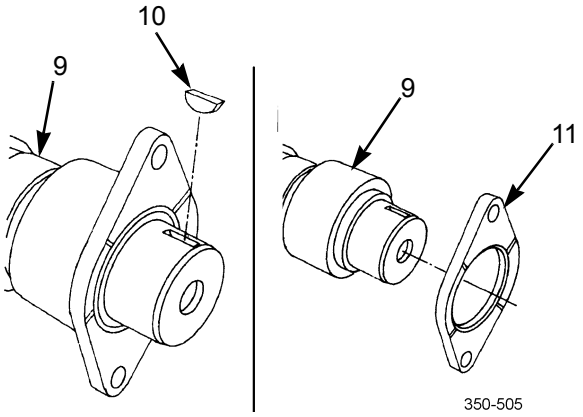
INSTALLATION

1. Install thrust washer plate (11) on camshaft (9).

NOTE

Ensure arrow on camshaft key is oriented as recorded in removal.

2. Install camshaft key (10) in camshaft (9). Tap with plastic-faced hammer as needed.



350-505

INSTALLATION - CONTINUED

WARNING

Use protective clothing when handling heated or hot components. Failure to do so will cause serious burns.

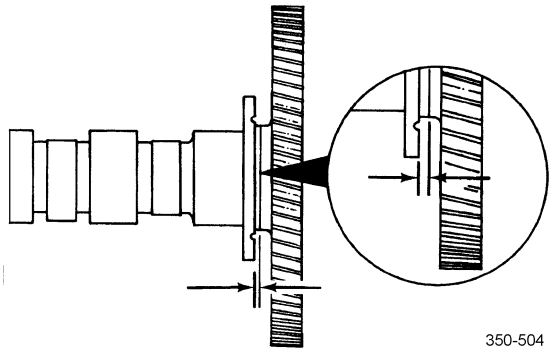
CAUTION

- Camshaft drive gear timing marks and part number MUST be facing away from camshaft when gear is installed.
- Maintain camshaft in a vertical position until gear has cooled and DO NOT use water to reduce cooling time; gear will crack.

NOTE

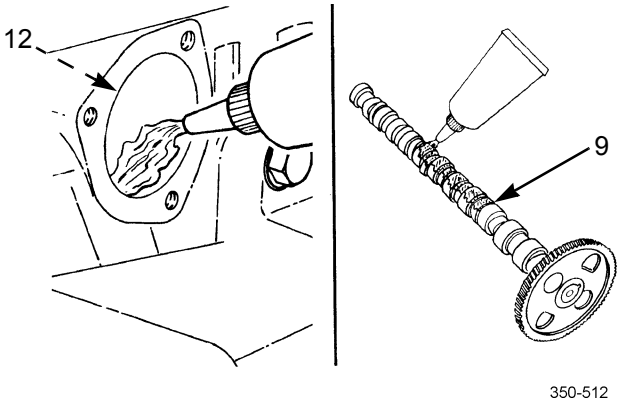
Camshaft drive gear MUST be heated to 450°F (235°C) for a minimum of one and not more than six hours. Installation must be accomplished within 30 seconds or gear may need to be reheated.

3. Apply lubriplate to camshaft drive gear journal.
4. Aline heated camshaft drive gear keyway with key in camshaft. Install camshaft drive gear on camshaft.
5. Measure camshaft thrust washer plate clearance. Measurement must be 0.005-0.013 in (0.13-0.33 mm).



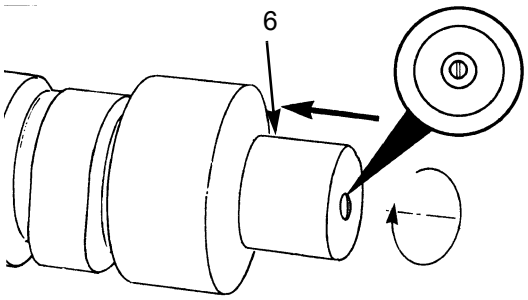
CLEARANCE, THRUST WASHER PLATE JOURNAL

6. Apply lubriplate to camshaft bushings (12) and camshaft (9).



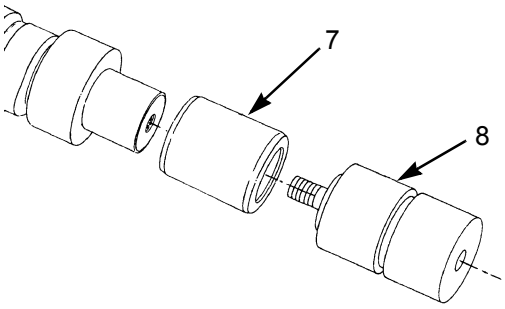
INSTALLATION - CONTINUED

7. Install camshaft installation pilot as follows:
   a. Install expander (6) in camshaft.



350-513

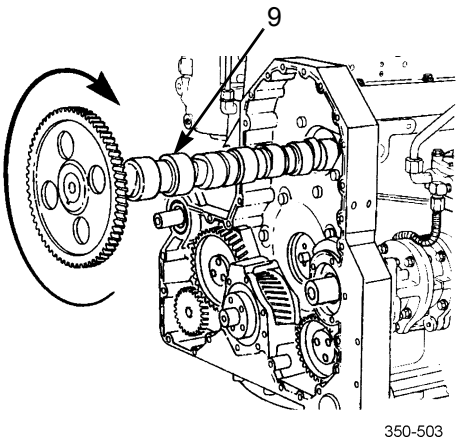
   b. Turn screw inside expander (6) clockwise to expand swell plug.
   c. Install arbor sleeve (7) over expander (6).
   d. Install locating pilot extensions (8) to expander (6).



350-514

INSTALLATION - CONTINUED

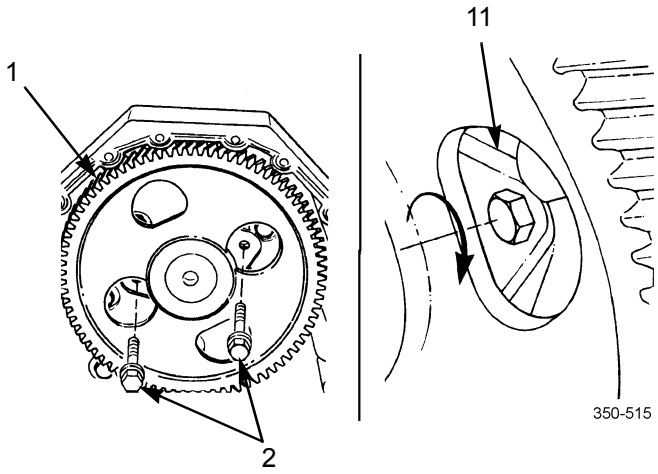
8. Rotate camshaft (9) slowly as it is being installed in cylinder block.



NOTE

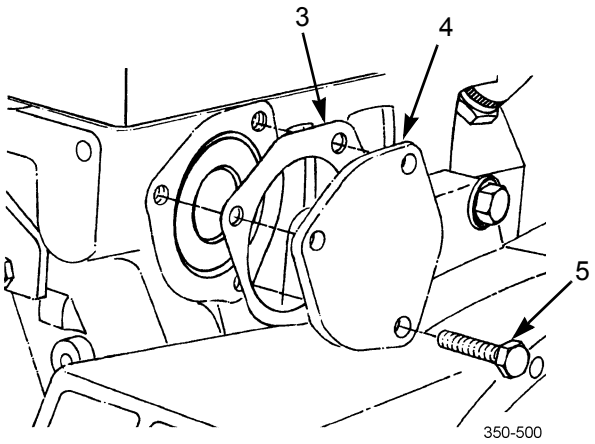
Camshaft installation pilot tool MUST be disassembled as it clears the number seven camshaft bushing to prevent interference with flywheel housing.

9. Remove camshaft installation pilot tool.
10. Rotate camshaft to aline holes in camshaft drive gear (1) with thrust washer plate screw holes.
11. Rotate thrust plate washer (11) to aline screw holes with cylinder block holes and install two screws (2). Tighten screws to 35 lb-ft (47 Nm).



INSTALLATION - CONTINUED

12. Position new gasket (3) and camshaft rear cover plate (4). Install three screws (5) and tighten to 35 lb-ft (47 Nm).



13. Measure camshaft drive gear end clearance. Measurement must be 0.005-0.013 in (0.13-0.33 mm). If not as specified, remove and check measurements.
14. Install camshaft idler gear (WP 0082 00).
15. Install cam follower assembly (WP 0081 00).
16. Install cylinder head (WP 0007 00).

END OF WORK PACKAGE

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CAM FOLLOWER ASSEMBLY MAINTENANCE 0081 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Installation/removal tool, cam follower (Item 50, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Equipment Condition

Engine removed and installed on stand (WP 0005 00)

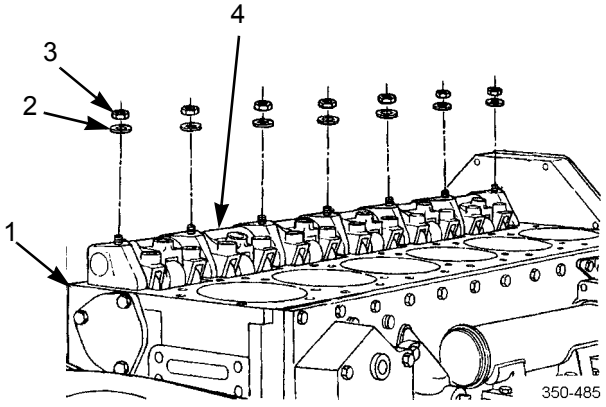
Cylinder head removed (WP 0007 00)

REMOVAL

CAUTION

Use care when removing attaching hardware securing cam follower assembly. Hardware can fall into engine causing internal damage.

1. Remove seven nuts (3) and washers (2) securing cam follower assembly (4) to cylinder block (1).



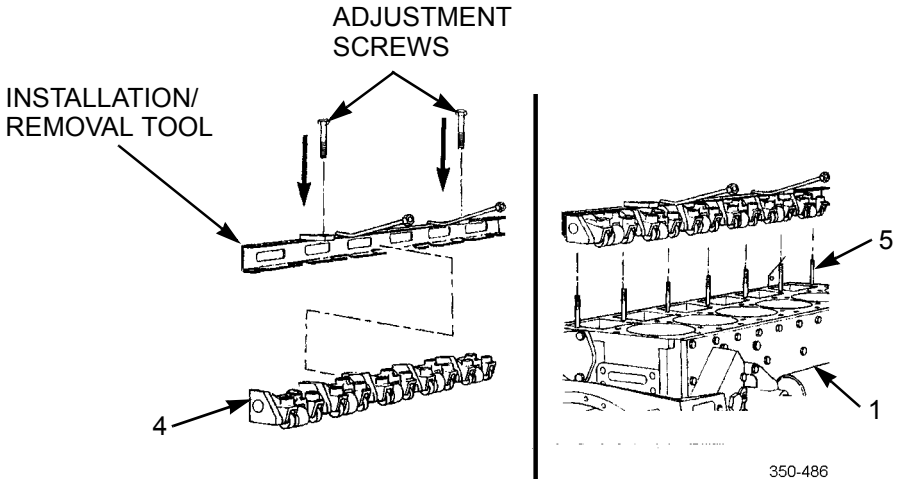
REMOVAL - CONTINUED

2. Attach cam follower installation/removal tool as follows:
   a. Slide tool under cam follower assembly (4) and around cam follower studs (5).
   b. If necessary, bump dowel supports to loosen.
   c. Slide tool forward until adjustment screws on top of tool can be finger tightened into socket of injector cam followers.

NOTE

Cam follower assembly consists of two shaft assemblies with a common center support.

3. Lift cam follower installation/removal tool and cam follower assembly (4) from cylinder block (1).



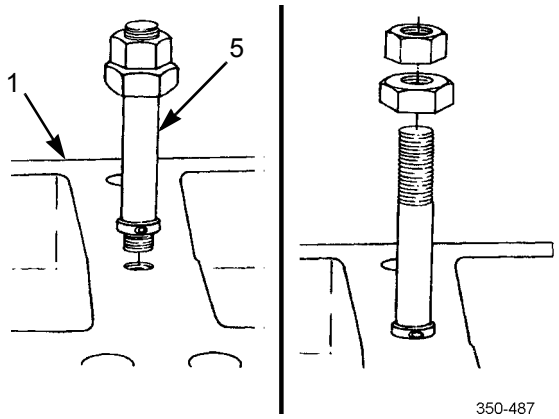
4. Place unit on work surface and remove cam follower installation/removal tool.

NOTE

Cam follower studs have an internal oil passage and must be removed for cleaning and inspection.

5. Remove seven cam follower studs (5) from cylinder block (1) as follows:
   a. Install two nuts together on cam follower stud (5).
   b. Turn bottom nut counterclockwise to remove cam follower stud (5).

REMOVAL - CONTINUED



DISASSEMBLY

NOTE

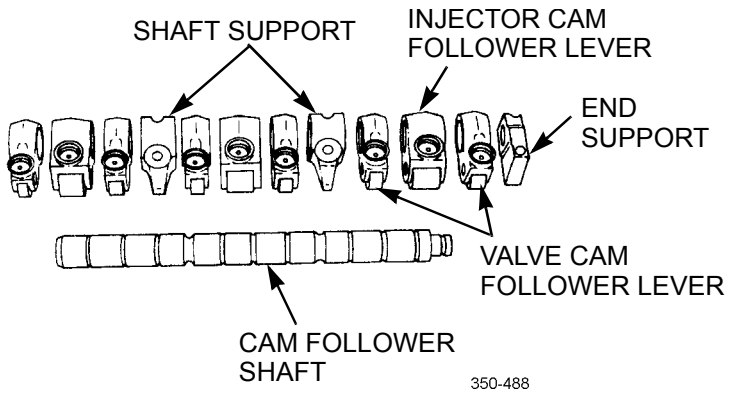
Cam follower levers have established wear patterns and MUST be installed in same position from which they were removed.

1. Mark end supports, internal supports, and all cam follower levers on front and rear sections to show location.

NOTE

Front and rear sections are disassembled and assembled in same manner.

2. Remove end support from shaft.
3. Remove intake valve cam follower lever, injector cam follower lever, exhaust valve cam follower lever, and shaft supports from cam follower shaft.
4. Repeat steps 2 and 3 to disassemble remaining section.



CLEANING

- Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

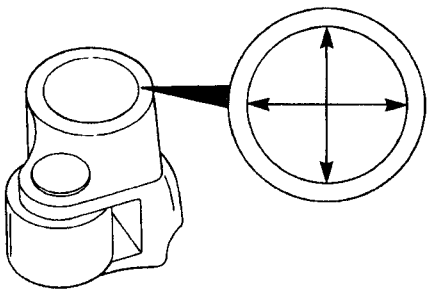
NOTE

Ensure all components are cleaned and oil passages free of debris.

1. Clean cam follower levers and shafts with solvent and dry with compressed air.
2. Clean cam follower studs and oil passages with solvent and dry with compressed air.

INSPECTION

1. Visually inspect components as follows:
   a. Visually inspect cam follower shafts for scoring or damage. If scoring or damage is found, replace.
   b. Visually inspect cam follower levers for cracks or damage. If cracks or damage is found, replace.
   c. Visually inspect cam follower shaft supports for cracks or damage. If found, replace supports
2. Measure outside diameter of cam follower shaft journals. Measurement must be 1.3382-1.3389 in (33.991-34.009 mm). If not as specified, replace shaft.
3. Measure inside diameter of cam follower lever shaft bore. Measurement must be 1.3420-1.3431 in (34.086-34.116 mm). If not as specified, replace cam follower lever.

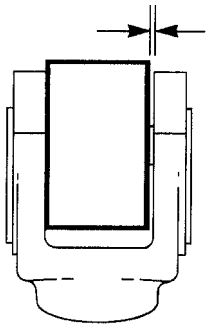


350-489

INSIDE DIAMETER, CAM FOLLOWER LEVER SHAFT BORE

4. Measure roller side clearance of cam follower lever. Measurement must be 0.007-0.026 in (0.19-0.65 mm). If not as specified, replace cam follower lever.

INSPECTION - CONTINUED



ROLLER SIDE CLEARANCE

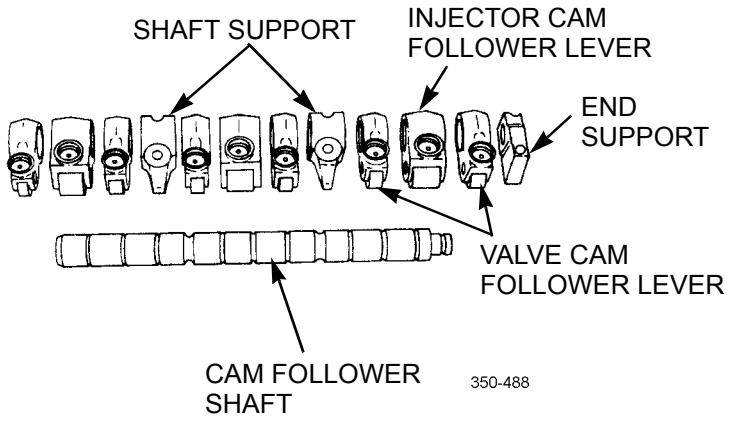
ASSEMBLY

1. Using clean engine oil, lubricate cam follower shaft and cam follower levers.

NOTE

Cam follower levers have established wear patterns and MUST be installed in same position from which they were removed.

2. Install end support on shaft
3. Install intake valve cam follower lever, injector cam follower lever, exhaust valve cam follower lever, and shaft support on shaft in same position as noted during disassembly.
4. Install remaining valve cam follower levers, injector cam follower levers, and supports as noted during disassembly.

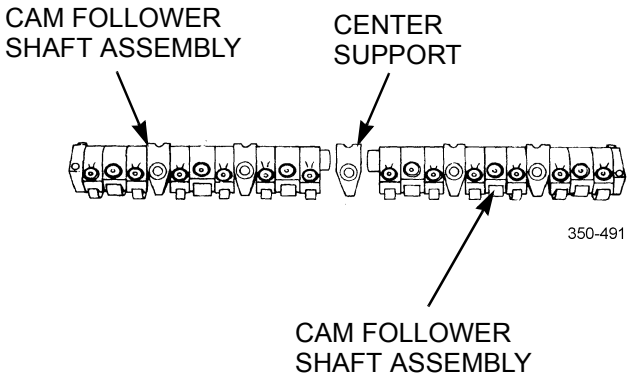


ASSEMBLY - CONTINUED

NOTE

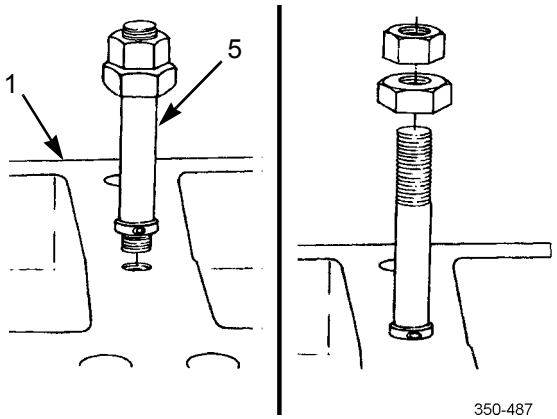
Common center support has a locating dowel hole. Other inner supports do not have this hole.

5. Install two cam follower shaft assemblies into common center support.



INSTALLATION

1. Install seven cam follower studs (5) to cylinder block (1) using two nuts tightened together. Tighten studs to 25 lb-ft (34 Nm).
2. Remove two nuts.



3. Install cam follower installation/removal tool on cam follower assembly.

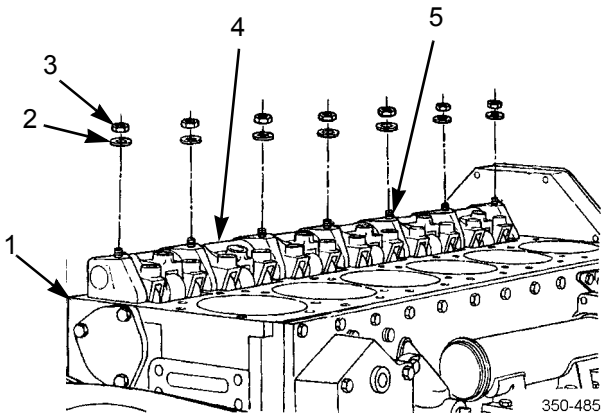
NOTE

Cam follower support numbers one, four, and seven are doweled and must aline with dowel pins in cylinder block.

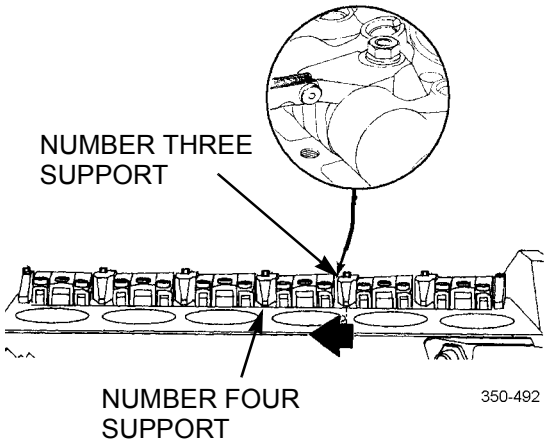
4. Position cam follower assembly (4) over cam follower studs (5) and on cylinder block (1). Remove installation/removal tool

INSTALLATION - CONTINUED

5. Install seven washers (2) and nuts (3). Tighten, at this time only, nuts for cam follower studs one, four, and seven to 35 lb-ft (47 Nm).

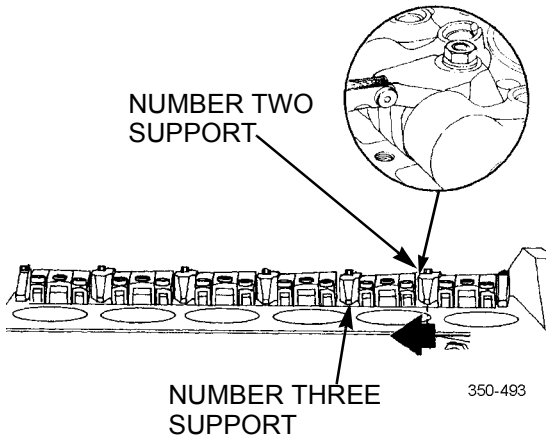


6. Install 0.030 in (0.76 mm) thickness gage between number three cam follower shaft support and exhaust lever for cylinder number three.
7. Push number three cam follower levers toward number four cam follower shaft support.
8. Tighten number three cam follower stud nut to 35 lb-ft (47 Nm).

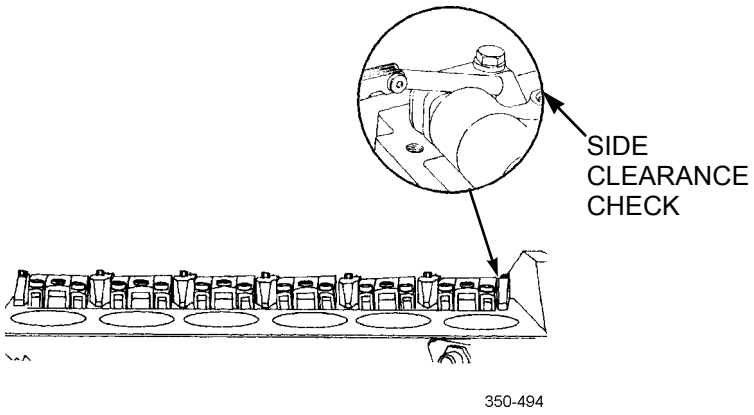


INSTALLATION - CONTINUED

9. Install 0.030 in (0.76 mm) thickness gage between number two cam follower shaft support and intake lever for cylinder number two.
10. Push number two cam follower levers toward number three cam follower shaft support.
11. Tighten number two cam follower stud nut to 35 lb-ft (47 Nm).

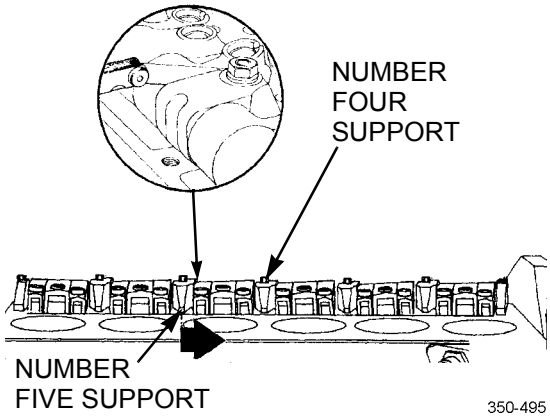


12. Measure side clearance between number one cam follower levers and end support. Measurement should be 0.030 in (0.76 mm).

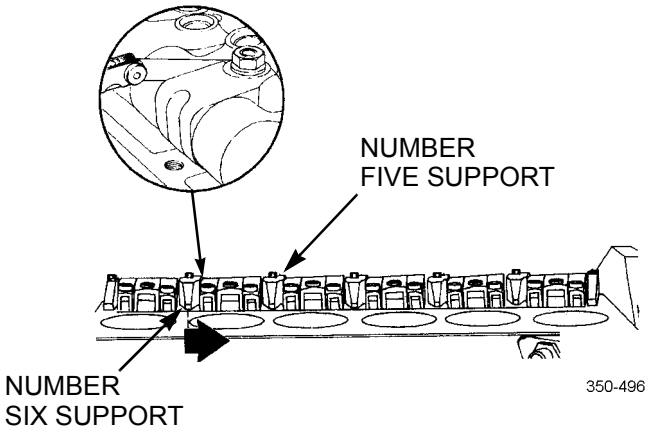


13. Install 0.030 in (0.76 mm) thickness gage between number five cam follower shaft support and exhaust lever for cylinder number four.
14. Push number five cam follower levers toward number four cam follower shaft support. Tighten number five cam follower stud nut to 35 lb-ft (47 Nm).

INSTALLATION - CONTINUED

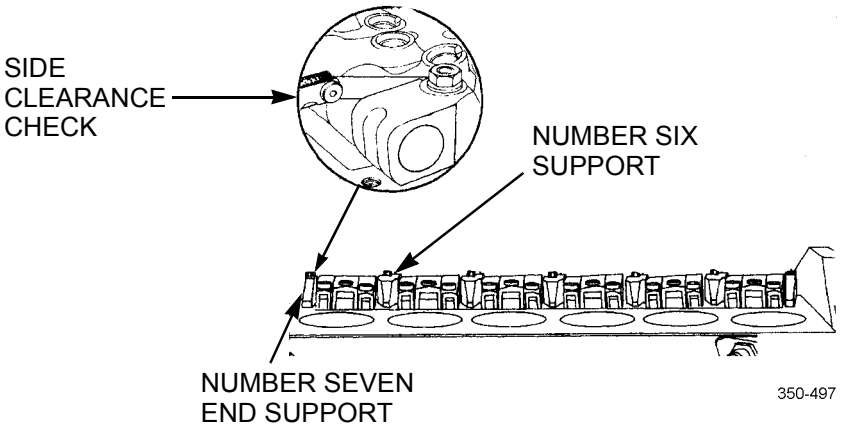


15. Install 0.030 in (0.76 mm) thickness gage between number six cam follower shaft support and intake lever for cylinder number five.
16. Push number six cam follower levers toward number five cam follower shaft support. Tighten number six cam follower stud nut to 35 lb-ft (47 Nm).



INSTALLATION - CONTINUED

17. Measure side clearance between number six cam follower levers and cam follower end support. Measurement should be 0.030 in (0.76 mm).



18. Install cylinder head (WP 0007 00).

END OF WORK PACKAGE

IDLER GEARS AND CAMSHAFT DRIVE GEAR REPLACEMENT 0082 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Hammer, hand, plastic (Item 42, WP 0090 00)

Indicator, dial (Item 45, WP 0090 00)

Installation tool, needle bearing (Item 48, WP 0090 00)

Puller kit, cam gear (Item 67, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Lubriplate (Item 15, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

Seal, rectangular (P/N 3883150)

Equipment Condition

Engine removed and installed on stand (WP 0005 00)

Alternator removed (TM 10-3930-675-20)

Cooling fan hydraulic pump removed (WP 0055 00)

Cooling fan hydraulic pump drive gear removed (WP 0022 00)

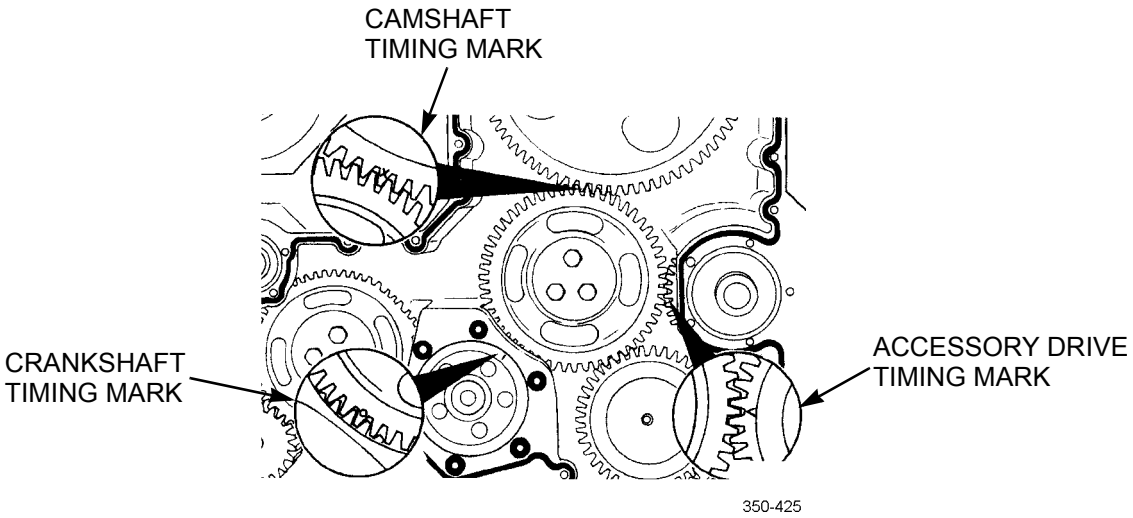
Front gear cover removed (WP 0020 00)

NOTE

Camshaft idler gear has more gear teeth than crankshaft gear; therefore camshaft idler gear timing marks will NOT aline with crankshaft, camshaft, and accessory drive gear timing marks on every crankshaft revolution.

REMOVAL

1. Use accessory driveshaft to rotate crankshaft until timing marks on crankshaft gear, camshaft gear, and accessory drive gear are completely engaged in camshaft idler gear as shown.



TIMING MARK POSITIONS

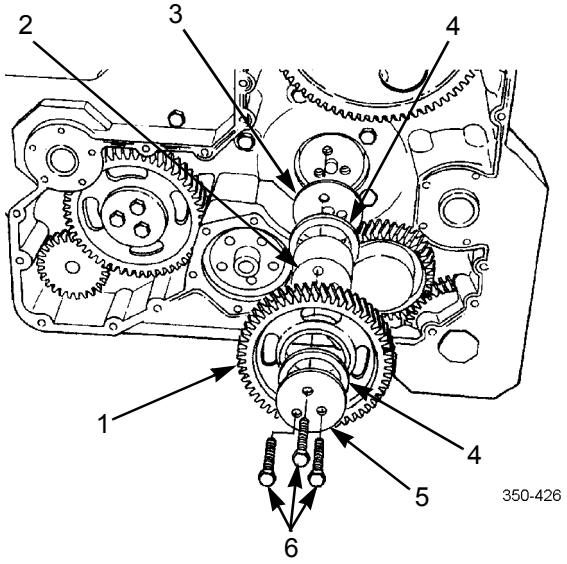
2. Remove camshaft idler gear as follows:

NOTE

- It may be necessary to tap camshaft idler gear with a plastic-faced hammer to loosen gear.
- Ensure all components are tagged for identification and location.

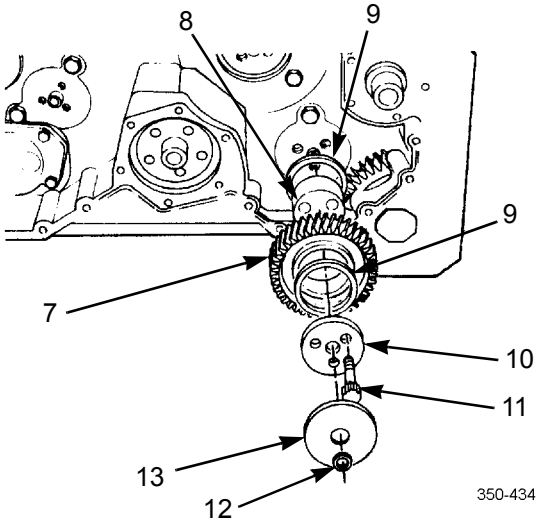
a. Remove three screws (6) securing cover plate (5) and front thrust bearing (4).

b. Remove camshaft idler gear (1), rear thrust bearing (4), idler gear shaft (2), and wear plate (3).

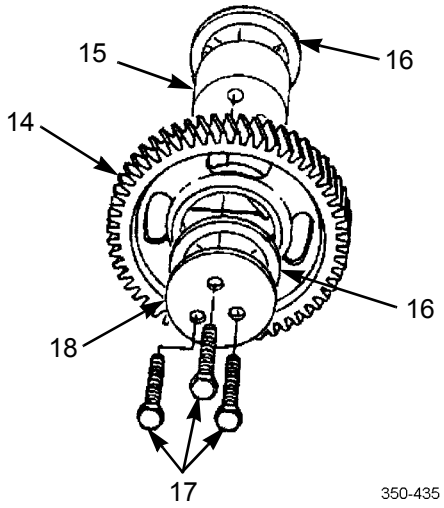


REMOVAL - CONTINUED

3. Remove hydraulic pump idler gear as follows:
   a. Remove and discard rectangular seal (12).
   b. Remove spacer (13), three screws (11), gear retainer (10), and front thrust bearing (9).
   c. Remove hydraulic pump idler gear (7), idler gear shaft (8), and rear thrust bearing (9).



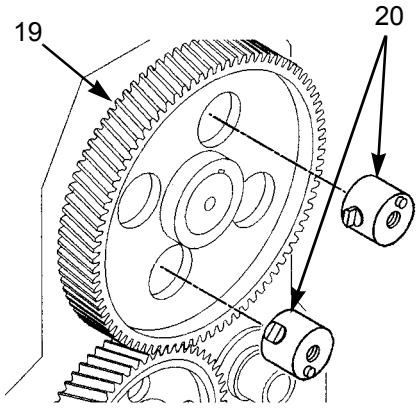
4. Remove water pump idler gear as follows:
   a. Remove three screws (17), cover plate (18), and front thrust bearing (16).
   b. Remove idler gear (14) with idler gear shaft (15) and rear thrust bearing (16).



REMOVAL - CONTINUED

5. Remove camshaft drive gear as follows:

   a. Install two puller adapters (20) in opposite holes in camshaft drive gear (19).

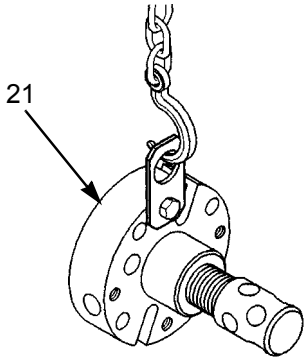


350-436

WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury to personnel.

   b. Attach camshaft gear puller assembly (21) to suitable lifting device.



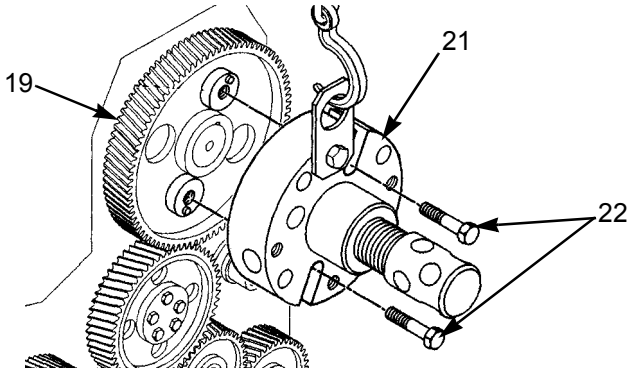
350-437

REMOVAL - CONTINUED

NOTE

Ensure forcing screw pilot is engaged with center of camshaft and puller adapter studs are properly seated in camshaft gear lifting device.

c. Install camshaft gear puller assembly (21) and lifting device to camshaft drive gear (19) with two screws (22). Tighten screws securely.

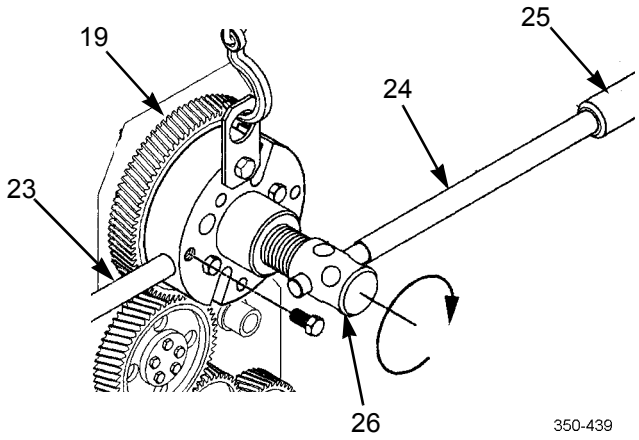


350-438

WARNING

Ensure lifting device remains attached to camshaft gear puller assembly. Camshaft gear and puller assembly may fall when released. Failure to follow this warning may cause serious injury to personnel.

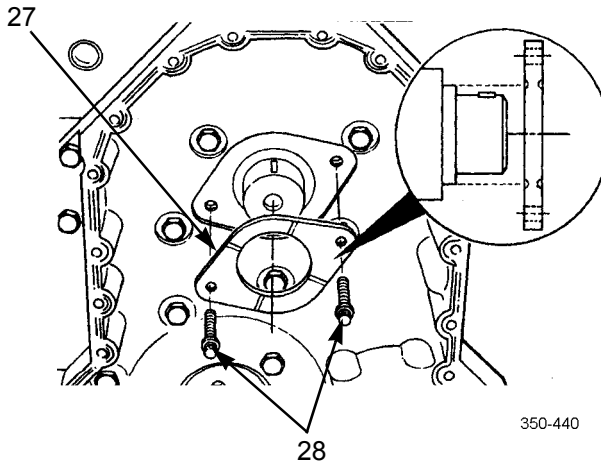
d. Using lever bar (24), extension bar (25), and torque reaction bar (23), turn forcing screw (26) clockwise to pull camshaft drive gear (19) from camshaft.



350-439

REMOVAL - CONTINUED

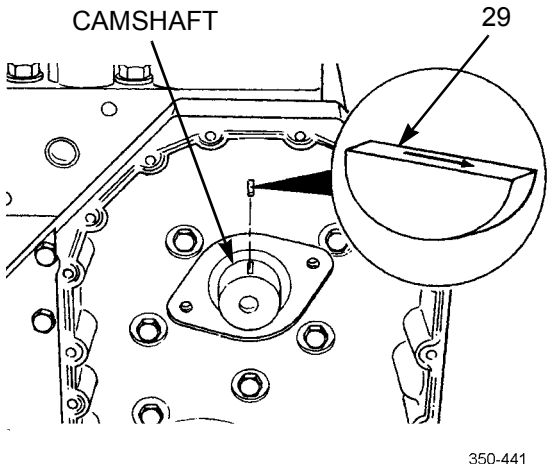
e. Remove two screws (28) and camshaft thrust plate (27).



NOTE

Make note of arrow direction on camshaft key to aid in installation.

f. Remove camshaft key (29). Retain for installation.



CLEANING

WARNING

- Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200ºF (94ºC). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

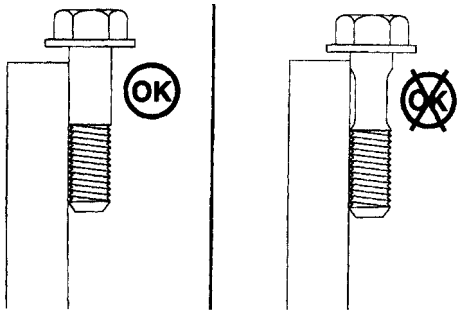
NOTE

- Cleaning procedures for camshaft idler gear are applicable to all idler gears and camshaft drive gear.
- Ensure all components have been tagged or marked for location and identification.

1. Clean all components of camshaft idler gear with solvent and dry with compressed air.
2. Use solvent and compressed air to clean oil drillings of gear shaft.

INSPECTION

1. Inspect all retaining screws with a straightedge for evidence of "necking". If necking is observed, retaining screws MUST be replaced.

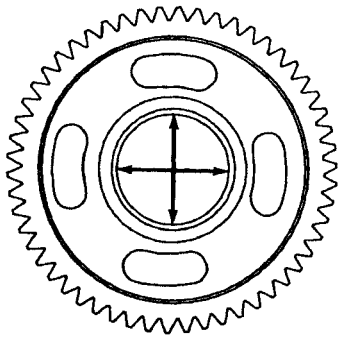


350-427

RETAINING SCREW "NECKING"

INSPECTION - CONTINUED

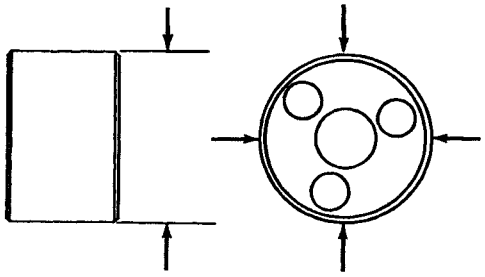
2. Visually inspect all idler gears and camshaft drive gear for chipped, broken or cracked teeth. If found, replace gear.
3. While flexing thrust bearings approximately 1/8 to ¼ in (3 to 6 mm), check for cracks. If found, replace thrust bearings.
4. Inspect camshaft, hydraulic pump, and water pump idler gears, shafts, thrust bearings, and ring dowels as follows. If indicated specifications are not met, replace defective gear or component.
   a. Measure inside diameter (ID) of idler gear bushing bore. Measurement must be 2.3640-2.3661 in (60.045-60.100 mm).



350-428

INSIDE DIAMETER, IDLER GEAR BUSHING BORE

   b. Measure outside diameter (OD) of idler gear shaft. Measurement must be 2.3612-2.3625 in (59.975-60.008 mm).

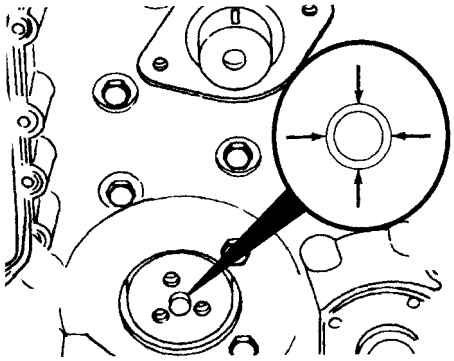


350-429

OUTSIDE DIAMETER, IDLER GEAR SHAFT

INSPECTION - CONTINUED

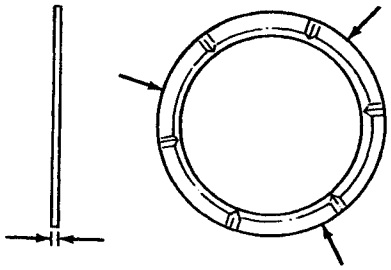
c. Measure OD of idler gear ring dowel. Measurement must be 0.7566-0.7576 in (19.217-19.243 mm).



350-430

OUTSIDE DIAMETER, IDLER GEAR RING DOWEL

5. Measure thickness of all thrust bearings in three places 120 degrees apart. Measurement must be 0.0945-0.0972 in (2.400-2.470 mm).



350-431

THICKNESS, THRUST WASHER

6. Inspect camshaft drive gear and thrust plate as follows:

   a. Visually inspect camshaft drive gear for cracks, chips or broken teeth. Inspect bore of gear and keyway for burrs or frets. If burrs or frets cannot be removed, or other damage is present, replace camshaft drive gear.

   b. Measure inside diameter of gear bore. Measurement must be 1.8469-1.8479 in (46.912-46.938 mm). If measurement is not within specification, replace camshaft drive gear.

   c. Measure camshaft thrust plate inside diameter. Measurement must be 2.1890-2.2287 in (55.60-56.61 mm). If measurement is not as specified, replace thrust plate.

   d. Measure camshaft thrust plate thickness. Measurement must be 0.3528-0.3559 in (8.960-9.040 mm). If measurement is not as specified, replace thrust plate.

INSTALLATION

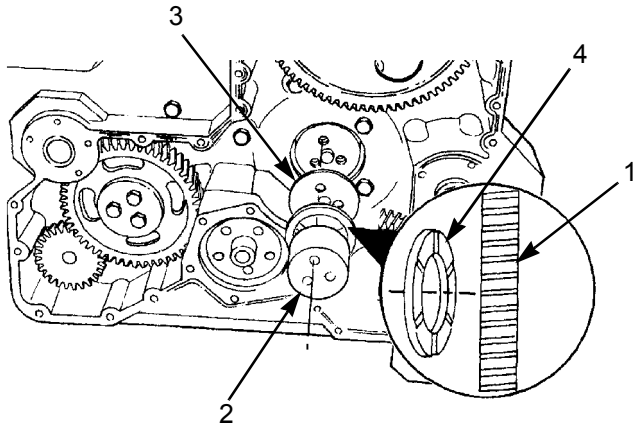
1. Install camshaft idler gear as follows:

CAUTION

To prevent damage to gear and engine during operation, position rear thrust bearing with grooved side toward idler gear.

a. Apply a light coating of lubriplate to wear plate (3), rear thrust bearing (4), and camshaft idler gear (1).

b. Install wear plate (3), rear thrust bearing (4), and idler gear shaft (2).

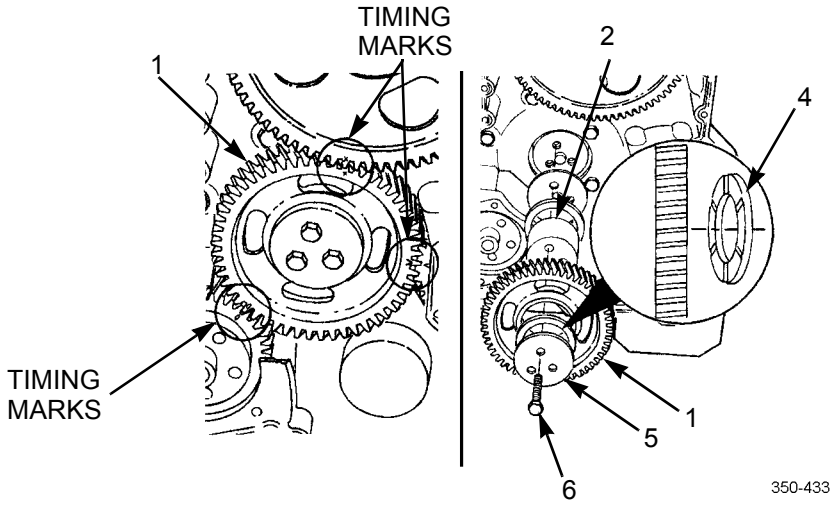


c. Aline camshaft idler gear (1) and position on idler gear shaft (2) so that timing marks on idler gear match same marks on other gears as shown.

CAUTION

To prevent damage to gear and engine during operation, position front thrust bearing with grooved side toward idler gear.

d. Install front thrust bearing (4) and cover plate (5). Secure with three screws (6). Tighten screws to 45 lb-ft (61 Nm).



INSTALLATION - CONTINUED

2. Install hydraulic pump idler gear as follows:

CAUTION

To prevent damage to gear and engine during operation, position rear thrust bearing with grooved side toward idler gear.

a. Apply a light coating of lubriplate to rear thrust bearing (9) and hydraulic pump idler gear (7).

b. Install rear thrust bearing (9) and idler gear shaft (8).

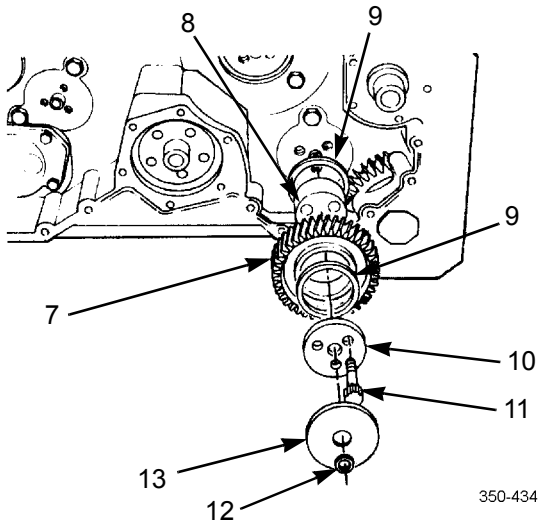
CAUTION

To prevent damage to gear and engine during operation, position front thrust bearing with grooved side toward idler gear.

c. Install hydraulic pump idler gear (7) and front thrust bearing (9) on idler gear shaft (8).

d. Install gear retainer (10) and three screws (11). Tighten screws to 45 lb-ft (61 Nm).

e. Insert spacer (13) and new rectangular seal (12).



3. Install water pump idler gear as follows:

CAUTION

To prevent damage to gear and engine during operation, position rear thrust bearing with grooved side toward idler gear.

INSTALLATION - CONTINUED

a. Apply a light coating of lubriplate to rear thrust bearing (16) and idler gear shaft (15).

b. Install rear thrust bearing (16) and water pump idler gear (14) without idler gear shaft (15).

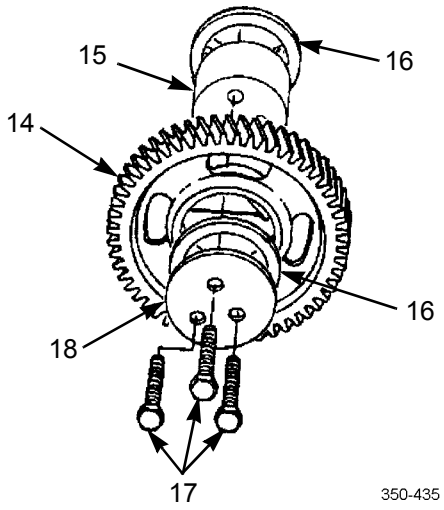
c. Aline bore of idler gear (14) with bore of rear thrust bearing (16).

d. Install idler gear shaft (15) thru idler gear (14) and rear thrust bearing (16) bores.

CAUTION

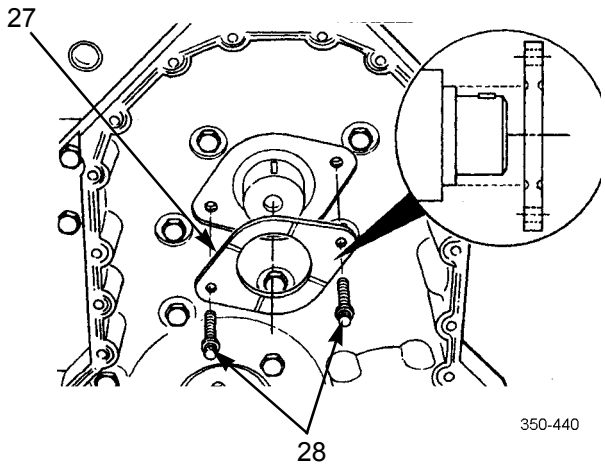
To prevent damage to gear and engine during operation, position front thrust bearing with grooved side toward idler gear.

e. Install front thrust bearing (16), cover plate (18), and three screws (17). Tighten screws to 45 lb-ft (61 Nm).



4. Install camshaft drive gear as follows:

a. Install camshaft thrust plate (27) and secure with two screws (28). Tighten screws to 35 lb-ft (47 Nm).

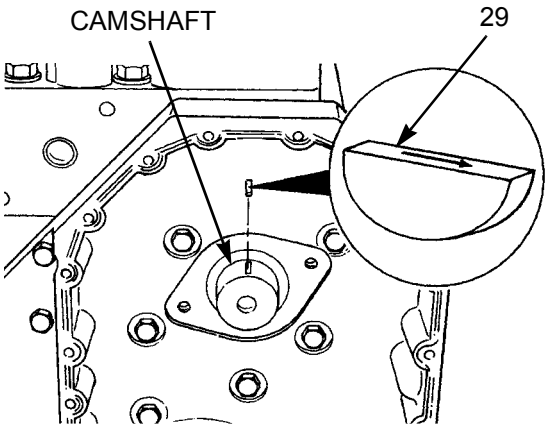


INSTALLATION - CONTINUED

NOTE

Ensure direction of arrow on camshaft key is the same as noted during removal.

b. Install camshaft key (29) in slot on camshaft. Seat key by tapping with a plastic-faced hammer.



c. Apply a coating of lubriplate to nose of camshaft.

WARNING

Use protective clothing when handling heated or hot components. Failure to use protective clothing to handle heated or hot components will cause serious burns.

CAUTION

Camshaft drive gear timing marks and part number MUST be facing away from camshaft when gear is installed.

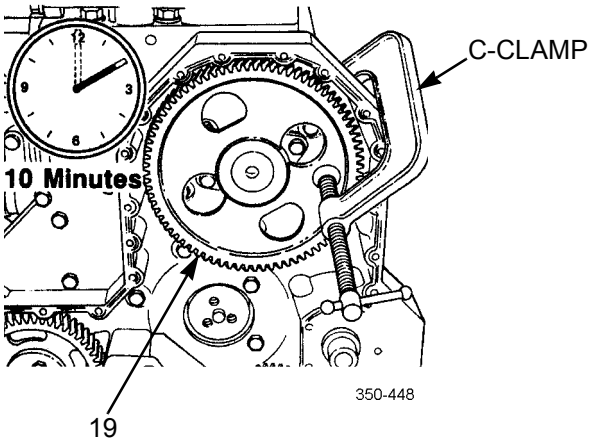
NOTE

Camshaft drive gear MUST be heated to 450°F (235°C) for a minimum of one and not more than six hours. Installation must be accomplished within 30 seconds or gear may need to be reheated.

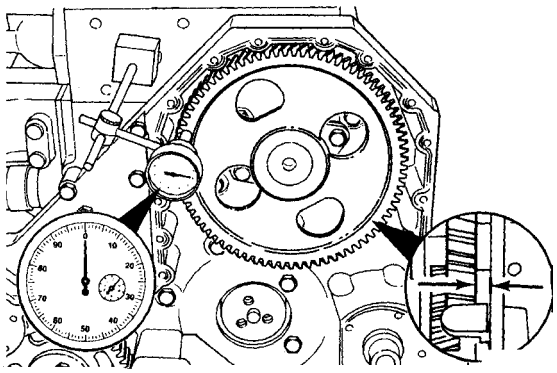
INSTALLATION - CONTINUED

d. Aline heated camshaft gear keyway with key in camshaft. Install camshaft drive gear (19) on camshaft.

e. Install C-clamp to hold camshaft drive gear (19) in place and allow it to cool. Remove C-clamp only after camshaft drive gear has cooled to room temperature.



f. Using dial indicator, verify camshaft drive gear end clearance is within specification of 0.005-0.013 in (0.13-0.33 mm).



CAMSHAFT GEAR END CLEARANCE

INSTALLATION - CONTINUED

NOTE

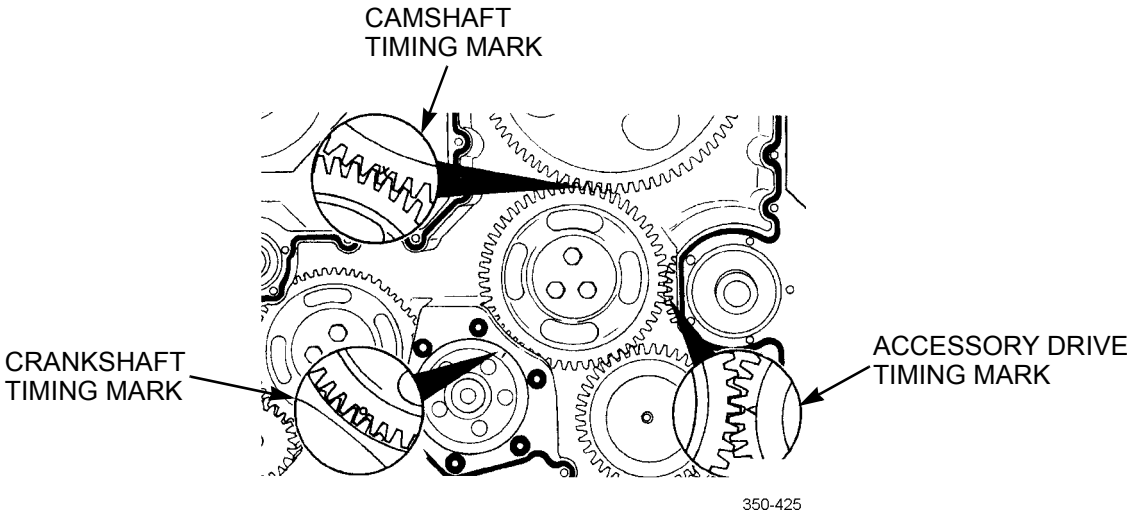
Specifications listed below apply to all idler gears.

5. Measure camshaft, hydraulic pump, and water pump idler gear end clearance and backlash. End clearance measurement must be 0.012-0.021 in (0.30-0.53 mm). Backlash measurement must be 0.003-0.015 in (0.08-0.38 mm).

CAUTION

Failure to check engine timing can cause severe engine damage.

6. Check engine timing marks on gear train. Marks should be as shown.



TIMING MARK POSITIONS

7. Install cooling fan hydraulic pump drive gear (WP 0022 00).
8. Install cooling fan hydraulic pump (WP 0055 00).
9. Install front gear cover (WP 0020 00).
10. Install alternator (TM 10-3930-657-20).

END OF WORK PACKAGE

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OIL PUMP ASSEMBLY MAINTENANCE 0083 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Disassembly, Assembly, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Indicator, dial (Item 45, WP 0090 00)

Puller, mechanical (Item 74, WP 0090 00)

Wrench, torque 0-300 lb-in capacity (Item 107, WP 0090 00)

Wrench, torque 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Grease, GAA (Item 13, WP 0089 00)

Lubriplate (Item 15, WP 0089 00)

Oil, lubricating (Item 20, WP 0089 00)

Rag, wiping (Item 23, WP 0089 00)

Sealant (Item 24, WP 0089 00)

Tag, marker (Item 31, WP 0089 00)

O-ring (P/N 3033247)

O-ring (P/N 3033248)

Equipment Condition

Engine removed and installed on stand (WP 0005 00)

Water pump removed (TM 10-3930-675-20)

Front gear cover removed (WP 0020 00)

REMOVAL

NOTE

Water pump idler gear MUST be removed for access prior to removing oil pump.

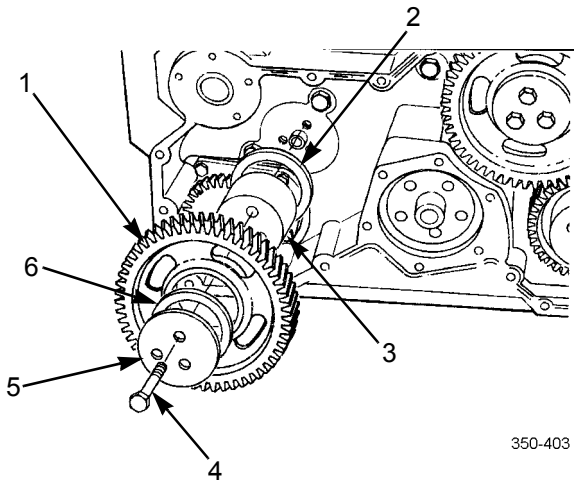
REMOVAL - CONTINUED

1. Remove three screws (4) securing water pump idler gear assembly in place.

NOTE

Ensure all items are tagged for identification and location prior to removal.

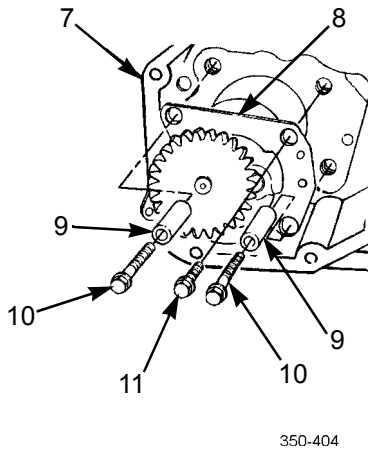
2. Remove cover plate (5), front thrust bearing (6), idler gear (1), rear thrust bearing (2), and idler gear shaft (3).



CAUTION

DO NOT pry on oil pump gear or mounting flange. Failure to follow this caution may result in damage to oil pump.

3. Remove two long screws (10), two spacers (9), and one short screw (11) securing oil pump assembly (8) to engine (7).
4. Remove oil pump assembly (8) from engine by hand.



REMOVAL - CONTINUED

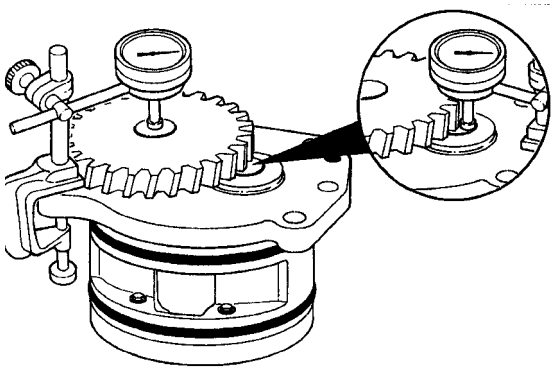
5. Remove and discard two o-rings from oil pump.

INSPECTION

NOTE

Ensure oil pump and component parts have been cleaned prior to inspection.

1. Perform following to determine if disassembly is required. If any of these conditions are noted, disassembly and further inspection is required.
   a. Turn main drive gear by hand to check gears for freedom of movement.
   b. Visually inspect drive gear for cracked, worn or broken teeth.
   c. Visually inspect rear cover plate shaft bores for excessive wear or discoloration.
   d. Measure drive shaft end clearance in two locations 90° apart. Clearance must be 0.0025-0.0106 in (0.064-0.269 mm).



350-405

DRIVE SHAFT END CLEARANCE

NOTE

Perform following inspections on component parts of oil pump.

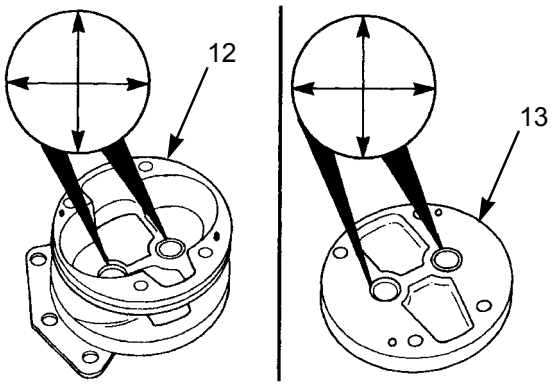
2. Visually inspect gear pockets in pump body for excessive wear or scoring. If excessive wear or scoring is found, oil pump MUST be replaced.
3. Visually inspect internal oil pump gears for cracked or broken teeth or excessive wear. If found, replace gears.

CAUTION

DO NOT drill or ream oil pump body and cover plate shaft bores. Failure to follow this caution will cause damage to oil pump machined components.

INSPECTION - CONTINUED

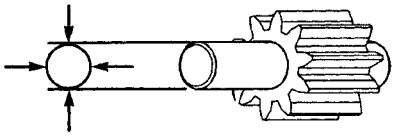
4. Measure inside diameter of shaft bores in oil pump body (12) and rear cover plate (13). Shaft bore IDs must be 0.7370-0.7380 in (18.720-18.746 mm).



350-406

INSIDE DIAMETER, OIL PUMP AND COVER PLATE

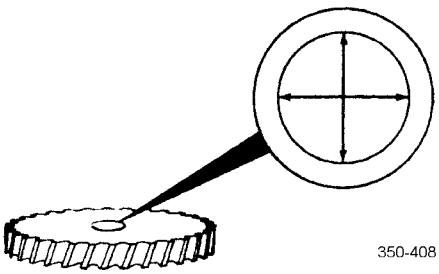
5. Measure outside diameter of oil pump gear shafts. Shaft ODs must be 0.7350-0.7355 in (18.669-18.625 mm). If shafts are worn past limits, replace gear shafts.



350-407

OUTSIDE DIAMETER, GEAR SHAFT

6. Measure inside diameter of drive gear bore. Gear bore ID must be 0.7323-07.333 in (18.600-18.625 mm). If worn past limits, replace gear.

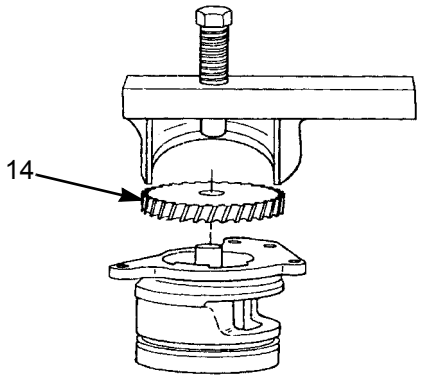


350-408

INSIDE DIAMETER, DRIVE GEAR BORE

DISASSEMBLY

1. Use oil pump gear puller and remove main drive gear (14).

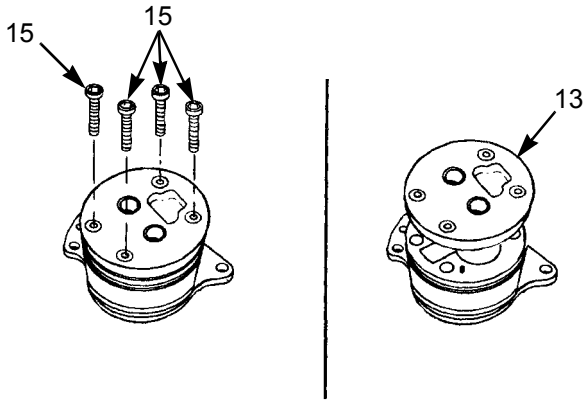


350-409

NOTE

Rear cover plate is located with dowel pins. Use care not to damage or break dowels.

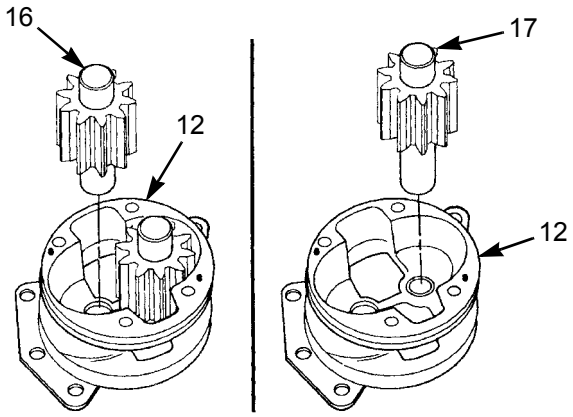
2. Remove four screws (15) and remove rear cover plate (13).



350-410

DISASSEMBLY - CONTINUED

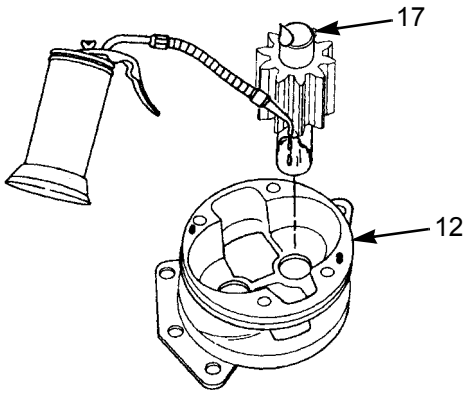
3. Remove driven gear and shaft (16) from oil pump body (12).
4. Remove drive gear and shaft (17) from oil pump body (12).



350-411

ASSEMBLY

1. Apply clean lubricating oil to drive gear and shaft (17) and install in oil pump body (12).



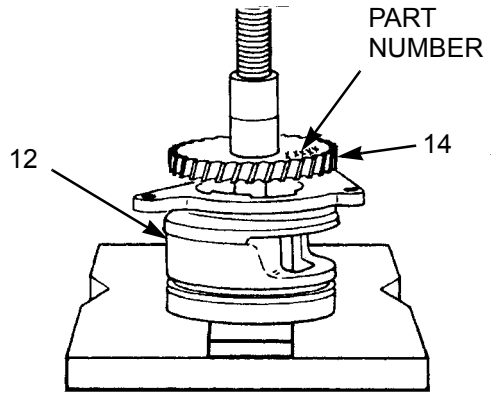
350-412

CAUTION

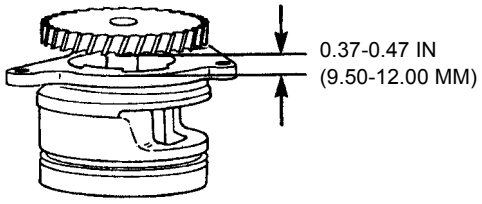
Ensure flat face of oil pump body, and not dowel pins, is resting against press table. Damage to dowel pins may occur when installing drive gear.

2. Place oil pump body (12) in press with front facing up and support drive shaft.
3. Position drive gear (14) on shaft with part number facing up.
4. Press drive gear (14) on shaft far enough to leave specified clearance. Gear-to-body clearance must be 0.37-0.47 in (9.50-12.00 mm).

ASSEMBLY - CONTINUED



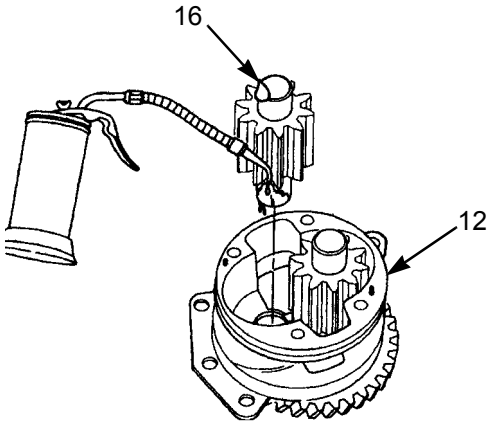
350-413



350-414

GEAR-TO-BODY CLEARANCE

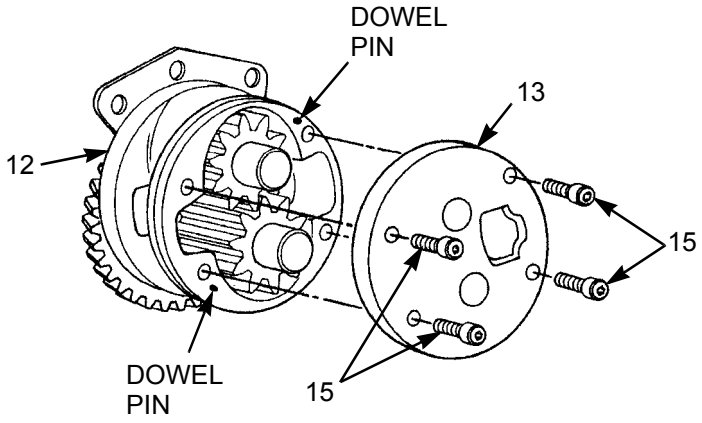
5. Apply clean lubricating oil to driven gear and shaft (16) and install into oil pump body (12).



350-415

ASSEMBLY - CONTINUED

6. Aline dowel pins in oil pump body (12) with locating holes in rear cover plate (13) and secure rear cover plate with four screws (15). Alternately tighten screws to 216 lb-in (20 Nm).



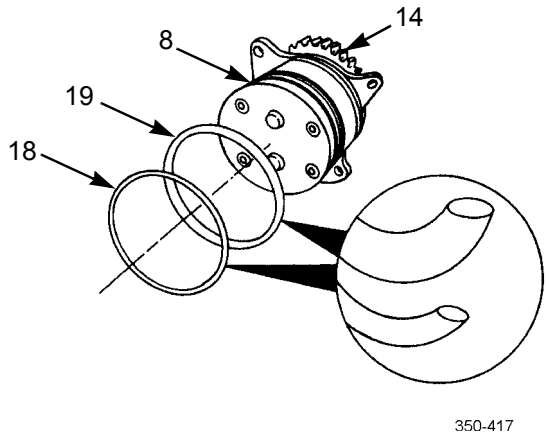
7. Verify drive gear turns freely and shaft end clearance is within specifications (refer to *Inspection*).

INSTALLATION

NOTE

- Ensure cylinder block mounting holes and screws have been cleaned and all residue removed.
- DO NOT lubricate new o-rings. O-rings will swell and pump cannot be installed.

1. Install two new o-rings (18 and 19) on oil pump assembly (8) with thickest o-ring in groove nearest drive gear (14).



2. Apply clean lubricating oil to oil pump gears.
3. Apply a thin film of grease to oil pump bore in cylinder block.

INSTALLATION - CONTINUED

CAUTION

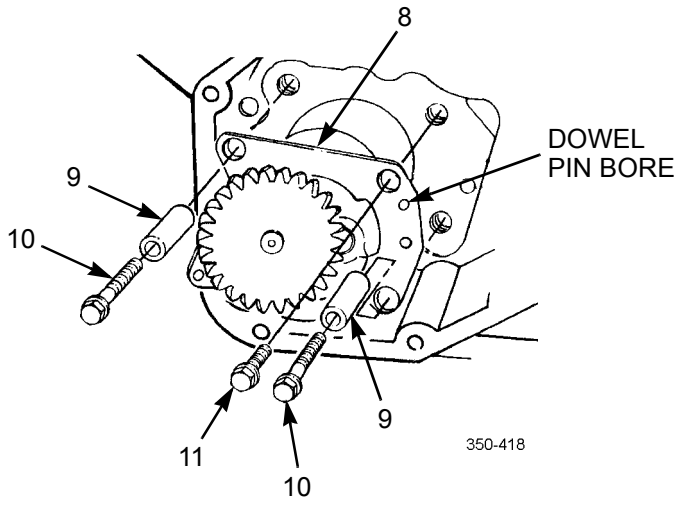
Dowel pin bore in oil pump flange must be alined with dowel pin in cylinder block to prevent damage to oil pump flange during installation. DO NOT use mounting screws to pull oil pump into bore. This will cause damage to oil pump mounting flange.

4. Install oil pump assembly (8) by hand.

NOTE

Sealant MUST be used to coat threads of mounting screws to prevent air from being drawn past screws during operation.

5. Apply sealant to mounting screw threads. Install short screw (11) in upper right mounting location, and two longer screws (10) with spacers (9) in remaining two locations. Tighten screws to 30 lb-ft (41 Nm).



INSTALLATION - CONTINUED

CAUTION

Grooved side of rear thrust bearing must face toward gear to prevent damage to gear and engine.

6. Apply lubriplate to rear thrust bearing (2) and idler gear shaft (3).
7. Install rear thrust bearing (2) without idler gear shaft (3).
8. Aline inside diameter of rear thrust bearing (2) and inside diameter of idler gear (1).

NOTE

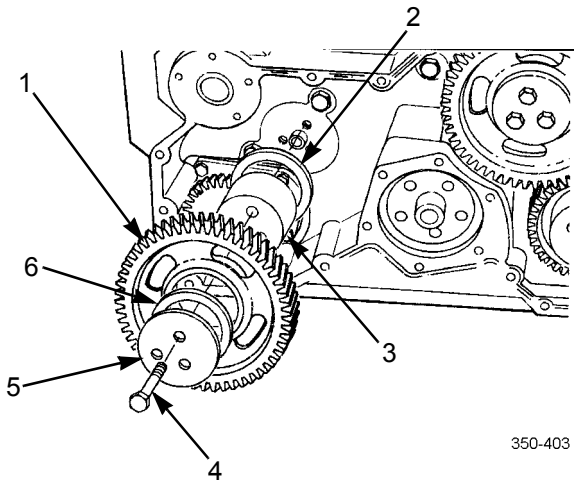
Shaft MUST pass thru gear and pilot into rear thrust bearing. After installation, shaft MUST protrude from idler gear only slightly more than thickness of front thrust bearing.

9. Install idler gear shaft (3) into idler gear (1) bore.

CAUTION

Grooved side of front thrust bearing must face gear to prevent damage to gear and engine

10. Apply lubriplate to front thrust bearing (6) and install bearing.
11. Install cover plate (5) and secure with three screws (4). Tighten screws to 45 lb-ft (61 Nm). Rotate 60° and check torque.



12. Install water pump (TM 10-3930-675-20).
13. Using dial indicator, verify idler gear end clearance is 0.012-0.021 in (0.30-0.53 mm) and backlash is 0.003-0.015 in (0.08-0.38 mm).
14. Install front gear cover (WP 0020 00).

END OF WORK PACKAGE

FRONT GEAR HOUSING REPLACEMENT 0084 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Maintenance Level

General Support

Tools and Special Tools

Tool kit, general mechanic's (Item 93, WP 0090 00)

Bearing kit, needle (Item 6, WP 0090 00)

Caliper, vernier (Item 11, WP 0090 00)

Pin, guide (Item 59, WP 0090 00)

Puller kit, universal (Item 69, WP 0090 00)

Wrench, torque, 15-75 lb-ft capacity (Item 108, WP 0090 00)

Materials/Parts

Rag, wiping (Item 23, WP 0089 00)

Sealant, silicone (Item 27, WP 0089 00)

Solvent, dry cleaning, type III (Item 29, WP 0089 00)

Bearing, needle (P/N 3025354)

Materials/Parts - Continued

Bearing, needle (P/N 3893919)

Seal, o-ring (P/N 3883150)

Seal, rectangular ring (P/N 3201659) (6)

Seal, rectangular ring (P/N 3820945)

Seal, rectangular ring (P/N 3820946)

Personnel Required

Two

Equipment Condition

Engine removed (WP 0005 00)

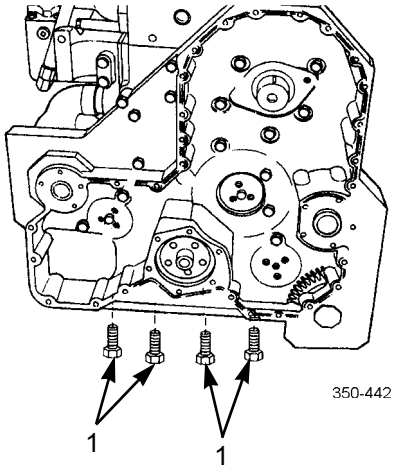
Engine position sensor removed (TM 10-3930-675-20)

Water pump removed (TM 10-3930-675-20)

Idler and camshaft drive gears removed (WP 0082 00)

REMOVAL

1. Remove four oil pan-to-gear housing screws (1).



REMOVAL - CONTINUED

NOTE

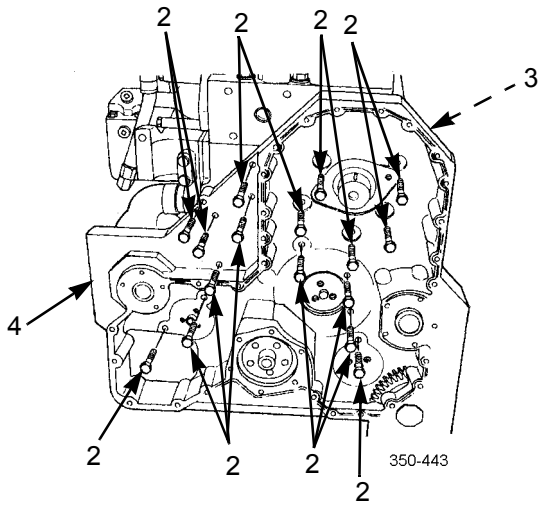
Note location and length of screws during removal to aid in installation.

2. Remove 16 flange head screws (2) securing front gear housing (4) to cylinder block (3).

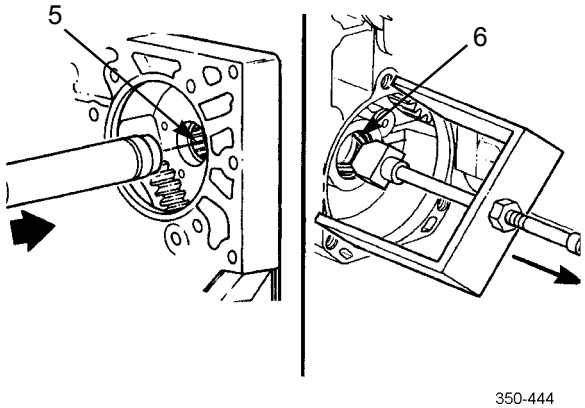
CAUTION

Use care when removing front gear housing not to damage oil pan gasket. If oil pan gasket is damaged, oil pan must be removed and gasket replaced.

3. Remove front gear housing (4) from cylinder block (3).

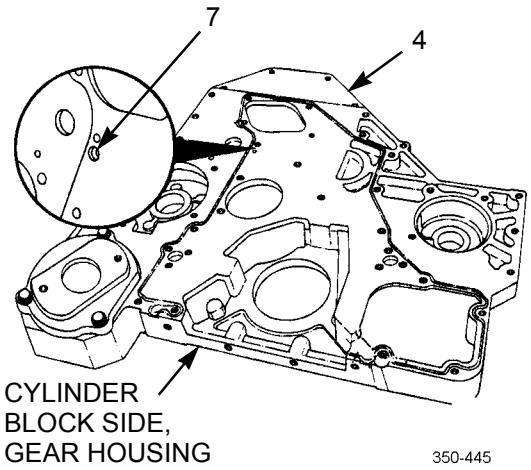


4. Use needle bearing tool to remove water pump drive needle bearing (5). Discard bearing.
5. Use needle bearing tool to remove hydraulic pump drive needle bearing (6). Discard bearing.



REMOVAL - CONTINUED

6. Remove one o-ring seal (7) and eight rectangular seals from front and back surfaces of front gear housing (4). Discard o-ring seal and rectangular seals.



CLEANING

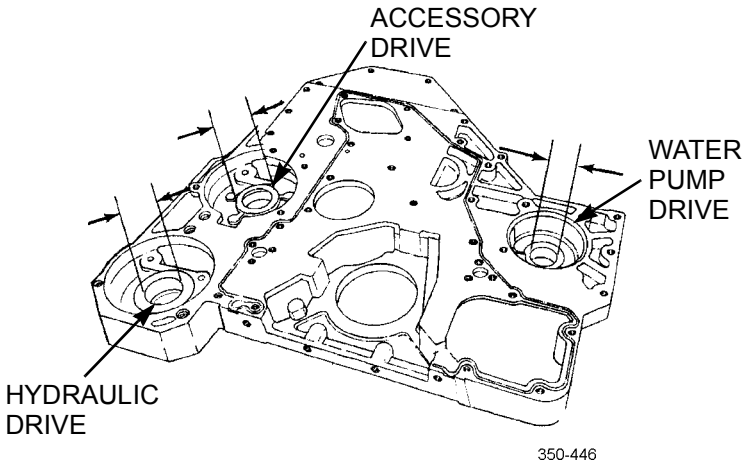
1. Remove gasket-forming material from all mating surfaces.
2. Remove seal residue from grooves on front surface of front gear housing.

- Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flames or excessive heat. The solvent's flash point is 200ºF (94ºC). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If solvent contacts eyes, wash your eyes and get medical aid immediately.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Use protective equipment and exercise caution to avoid injury to personnel.

3. Clean front gear housing with solvent and dry with compressed air.
4. Use compressed air to clear oil jumper gallery of any obstructions.

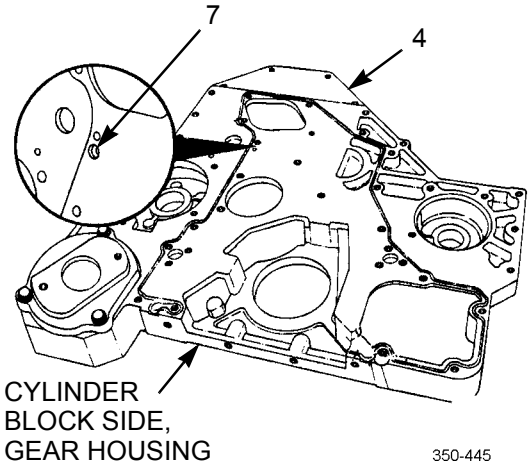
INSPECTION

1. Visually inspect front gear housing for cracks or other damage.
2. Inspect seal grooves on both sides for debris or damage.
3. Inspect o-ring groove at accessory drive oil jumper gallery for cracks or damage.
4. Measure inside diameter of bearing bores. Measurements should be as listed below; if not, replace front gear housing.
   a. Hydraulic drive: 1.6522-1.6532 in (41.967-41.992 mm)
   b. Water pump drive: 1.4553-1.4564 in (36.967-36.992 mm)
   c. Accessory drive: 1.7756-1.7766 in (45.100-45.125 mm)



INSTALLATION

1. Install new o-ring seal (7) into rear of front gear housing (4) at oil jumper gallery for accessory drive support. Install eight new rectangular seals into front surface of front gear housing.



INSTALLATION - CONTINUED

2. Install two guide pins in front gear housing end of cylinder block.

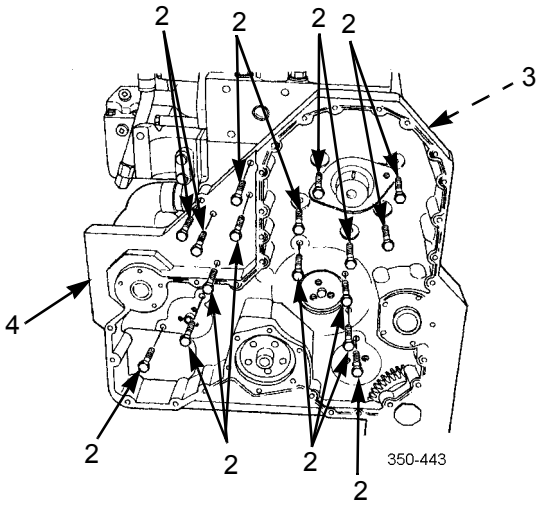
CAUTION

Avoid use of excessive amounts of sealant, which could result in blocked oil passages in engine.

NOTE

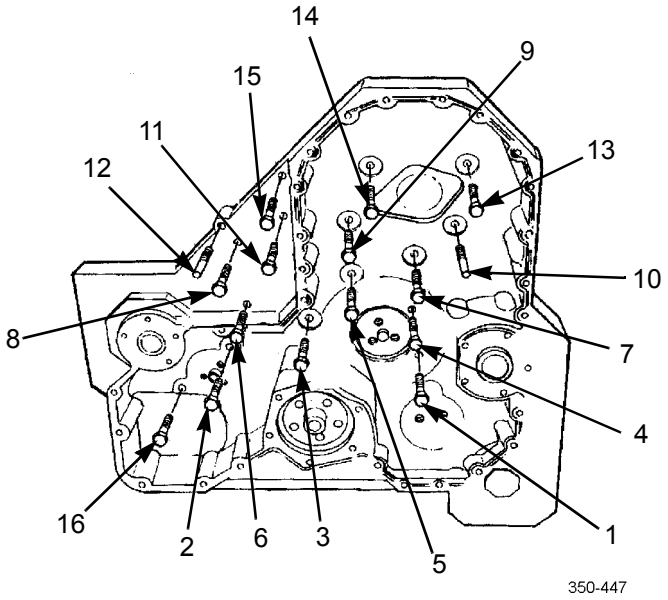
Sealant requires installation in ten minutes or less. It is best to apply sealant and immediately install front gear housing.

3. Apply sealant to areas of front gear housing (4) as follows:
   a. Apply sealant to rear of gear housing, filling groove so that 1/16-1/8 in (1.6-3.2 mm) is above block mounting surface.
   b. Apply a 1/16 in (1.6 mm) bead of sealant to oil pan and cylinder block gear housing joint.
   c. Apply additional sealant to area by camshaft opening.
4. Install front gear housing (4) over guide pins to cylinder block (3) and install 14 flange head screws (2) as noted during removal.
5. Remove two guide pins and install two remaining flange head screws (2).



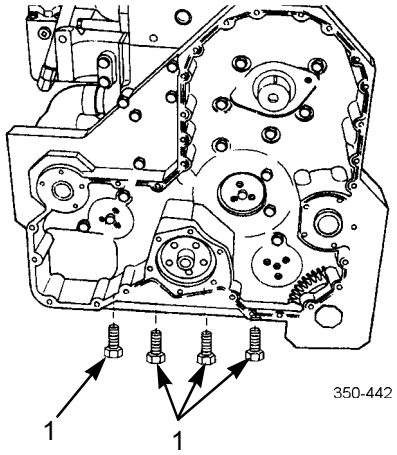
INSTALLATION - CONTINUED

6. Tighten all flange head screws (2) in sequence shown.
   a. 15 lb-ft (20 Nm)
   b. 50 lb-ft (68 Nm)



TIGHTENING SEQUENCE

7. Install four oil pan-to-gear housing screws (1). Tighten screws to 35 ft-lb (47 Nm).

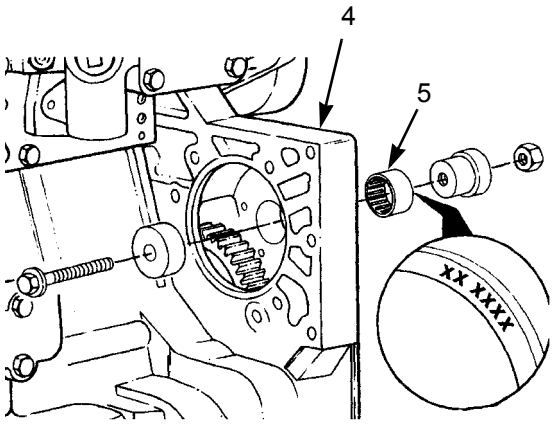


NOTE

Needle bearing MUST be installed with part number side of bearing against installation tool.

INSTALLATION - CONTINUED

8. Install new water pump drive needle bearing (5) from front side of front gear housing (4) until needle bearing is flush with front edge of housing bore.

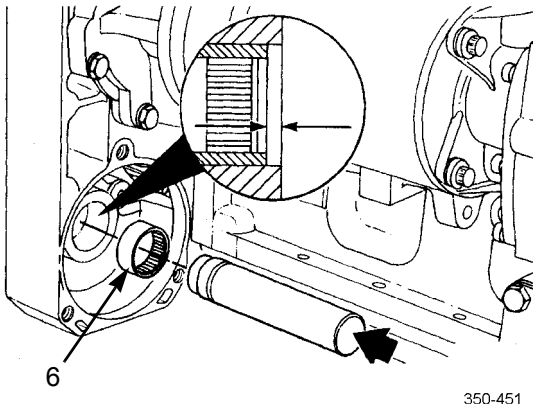


350-450

NOTE

Hydraulic pump drive needle bearing MUST be 0.010-0.030 in (0.25-0.76 mm) past outside edge of front gear housing bore surface.

9. Using installation tool, gently tap new hydraulic pump drive needle bearing (6) until it comes in contact with shoulder in front gear housing.



350-451

10. Install idler gears and camshaft drive gear (WP 0082 00).
11. Install water pump (TM 10-3930-675-20).
12. Install engine position sensor (TM 10-3930-675-20).

END OF WORK PACKAGE

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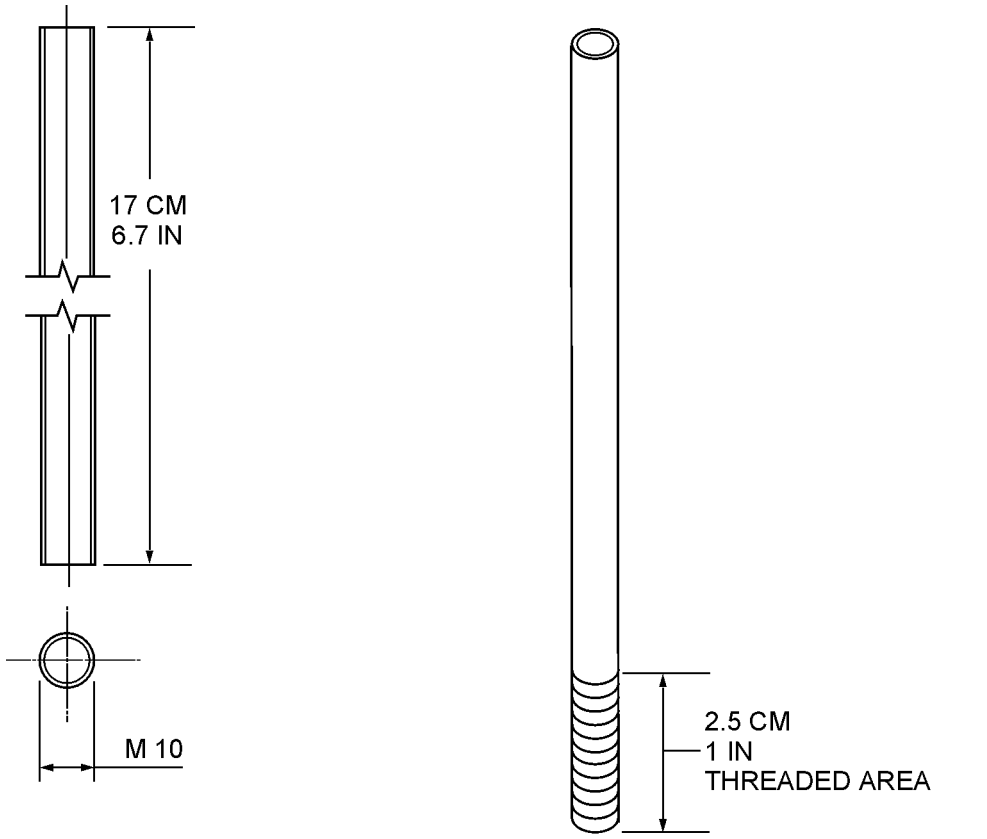
ILLUSTRATED LIST OF MANUFACTURED ITEMS 0085 00

SCOPE

1. This work package includes complete instructions for making items authorized to be manufactured or fabricated at Direct or General Support Maintenance.
2. All bulk materials needed for manufacture of an item are listed by part number or specification number.

MANUFACTURED ITEMS

Table 1. Manufactured Items.



NOTES:
1. Material: Steel Bar
2. Remove all sharp edges.

STUD, GUIDE, P/N A27255.0500 01

END OF WORK PACKAGE

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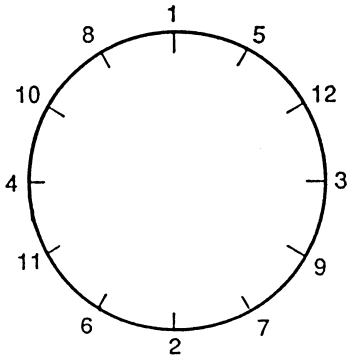
TORQUE LIMITS 0086 00

SCOPE

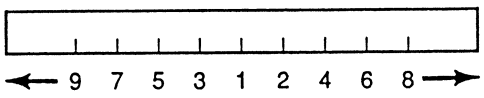
This work package lists standard torque values and provides general information for applying torque. Special torque values and tightening sequences are indicated in the maintenance procedures for applicable components.

GENERAL

1. Always use torque values listed in Table 1 when a maintenance procedure does not give a specific torque value.
2. Unless otherwise indicated, standard torque tolerance shall be ±10%.
3. Torque values listed are based on clean, dry threads. Reduce torque by 10% when engine oil is used as a lubricant. Reduce torque by 20% if new plated capscrews are used.
4. If the maintenance procedures do not specify a tightening order, use the following guides:
   a. Unless otherwise specified, lubricate threads of fasteners with oil (OE/HDO-10 or OEA).
   b. When tightening fasteners above 30 lb-ft (41 Nm), use the torque pattern but only tighten to 70 percent of final value (multiply final value by 0.7). Repeat pattern until final value is reached.
   c. Tighten circular patterns using circular torque pattern and tighten straight patterns using straight torque pattern.



CIRCULAR TORQUE PATTERN

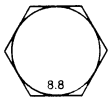
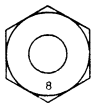
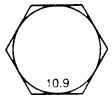
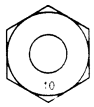


STRAIGHT TORQUE PATTERN

CAUTION

If replacement capscrews are of higher grade than originally supplied, use torque specifications for the original. This will prevent equipment damage due to overtorquing.

Table 1. Torque Limits.

TORQUE VALUES FOR METRIC THREAD FASTENERS WITH LUBRICATED* OR PLATED THREADS†				
Thread Diameter-Pitch	 **Class 8.8 Bolt**	 **Class 8 Nut**	 **Class 10.9 Bolt**	 **Class 10 Nut**
	Torque: lb-ft (Nm)		**Torque: lb-ft (Nm)**	
M6	5 (7)		7 (9)	
M8	12 (16)		17 (23)	
M8 x 1	13 (18)		18 (24)	
M10	24 (33)		34 (46)	
M10 x 1.25	27 (37)		38 (52)	
M12	42 (57)		60 (81)	
M12 x 1.5	43 (58)		62 (84)	
M14	66 (89)		95 (129)	
M14 x 1.5	72 (98)		103 (140)	
M16	103 (140)		148 (201)	
M16 x 1.5	110 (149)		157 (213)	
M18	147 (199)		203 (275)	
M18 x 1.5	165 (224)		229 (310)	
M20	208 (282)		288 (390)	
M20 x 1.5	213 (313)		320 (434)	
M22	283 (384)		392 (531)	
M22 x 1.5	315 (427)		431 (584)	
M24	360 (488)		498 (675)	
M24 x 2	392 (531)		542 (735)	
M27	527 (715)		729 (988)	
M27 x 2	569 (771)		788 (1068)	
M30	715 (969)		990 (1342)	
M30 x 2	792 (1074)		1096 (1486)	

* Kalmar recommends that all plated and unplated fasteners be coated with oil before installation.

† Use these torque values if either the bolt or nut is lubricated or plated (zinc-phosphate conversion-coated, cadmium-plated, or waxed).

DIAGRAMS **0087 00**

Electrical Schematics

Figure 1. ECS Display/CAN-BUS (A34647.0200) 0087 00-2
Figure 2. ECS Electrical Servo (A34648.0200) 0087 00-5
Figure 3. ECS Engine (A34649.0200) 0087 00-10
Figure 4. ECU Transmission (A34650.0200) 0087 00-12
Figure 5. ECS Steering (A34651.0200) 0087 00-16
Figure 6. ECS Attachment (A34652.0200) 0087 00-23
Figure 7. ECS Hydraulics (A34654.0200) 0087 00-29
Figure 8. Current Supply (A34738.0200) 0087 00-31
Figure 9. Shifting (A34739.0200) 0087 00-35
Figure 10. Sender (A34740.0200) 0087 00-36
Figure 11. Wipers (A34741.0200) 0087 00-38
Figure 12. AC and Fan (A34742.0200) 0087 00-39
Figure 13. Cab (A34743.0200) 0087 00-40
Figure 14. Lights (A34744.0200) 0087 00-41
Figure 15. Worklights (A34745.0200) 0087 00-46
Figure 16. Auxiliary Pump (A34746.0200) 0087 00-47
Figure 17. Information (A34749.0200) 0087 00-48

Hydraulic Diagrams

Figure 18. Steering System 0087 00-50
Figure 19. Brake System 0087 00-51
Figure 20. Main System 0087 00-52
Figure 21. Spreader System 0087 00-53

Symbol Legends

Figure 22. Electrical Symbols 0087 00-54
Figure 23. Hydraulic Symbols 0087 00-55

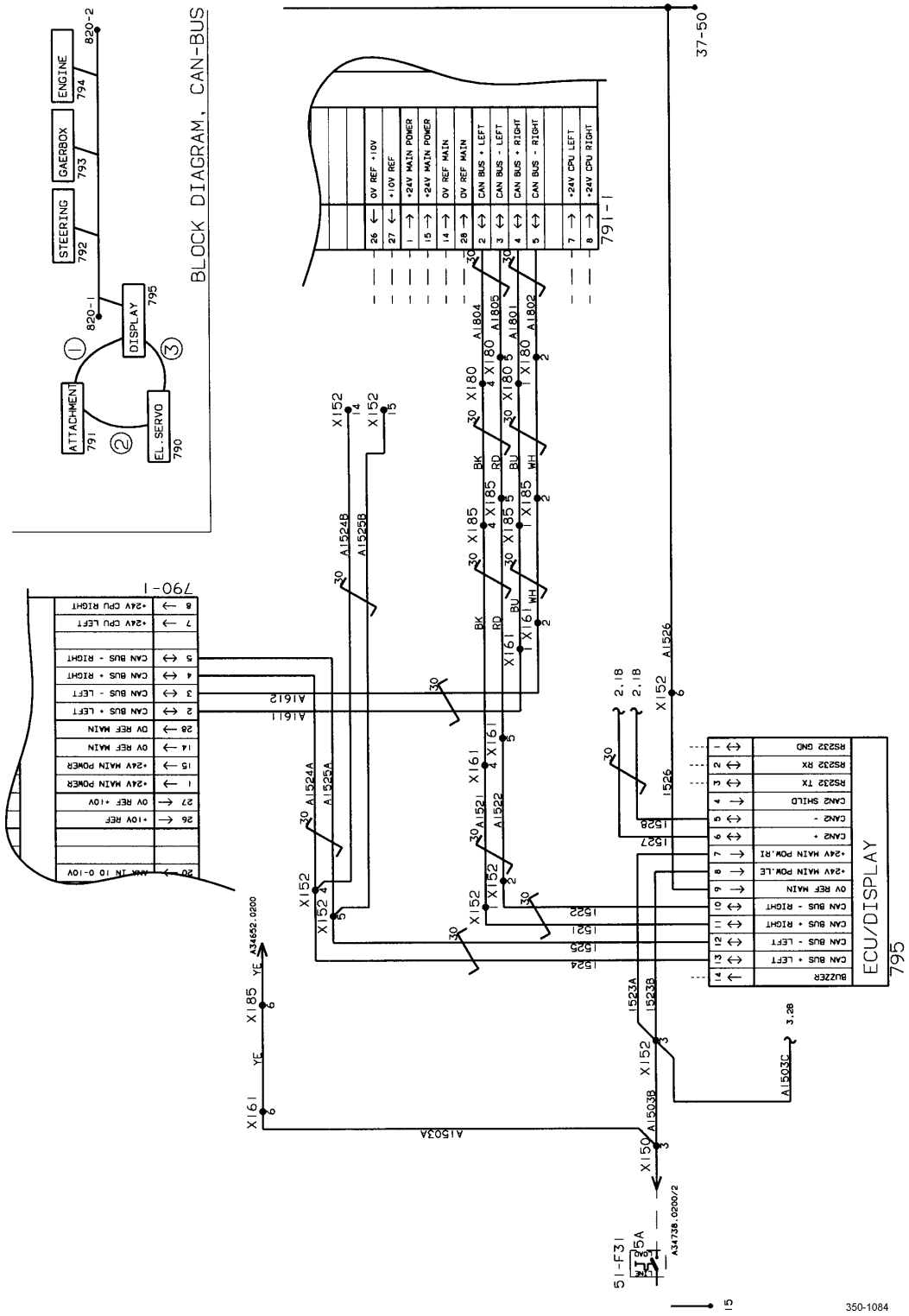


Figure 1. ECS Display/CAN-BUS (A34647.0200).

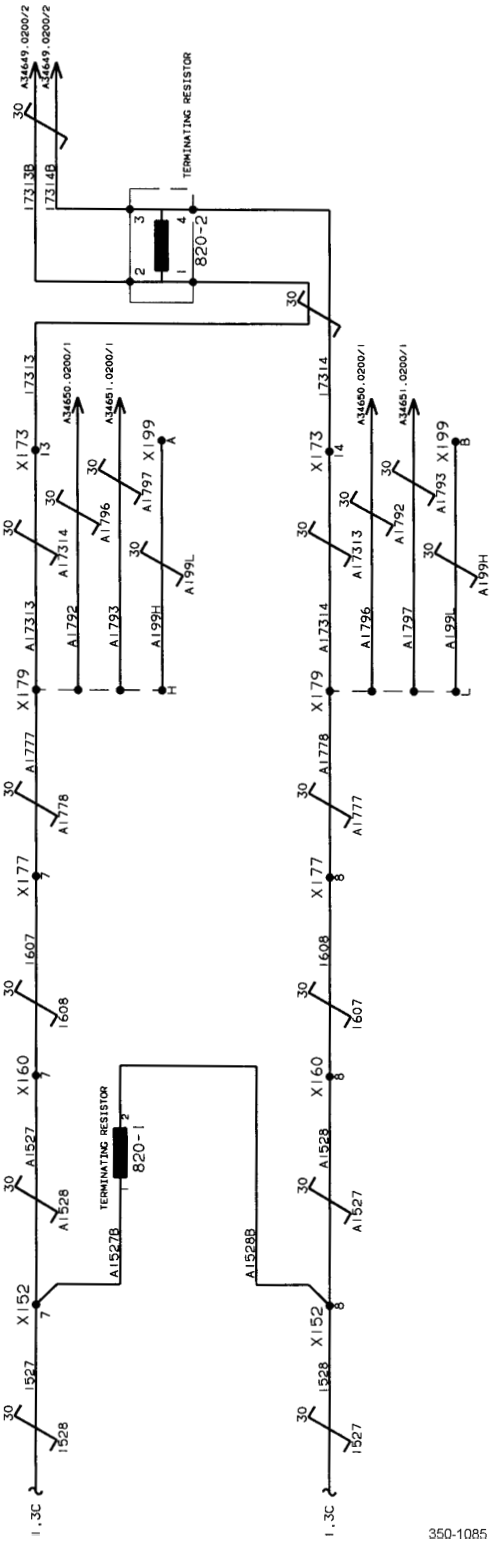


Figure 1. ECS Display/CAN-BUS (A34647.0200) - Continued.

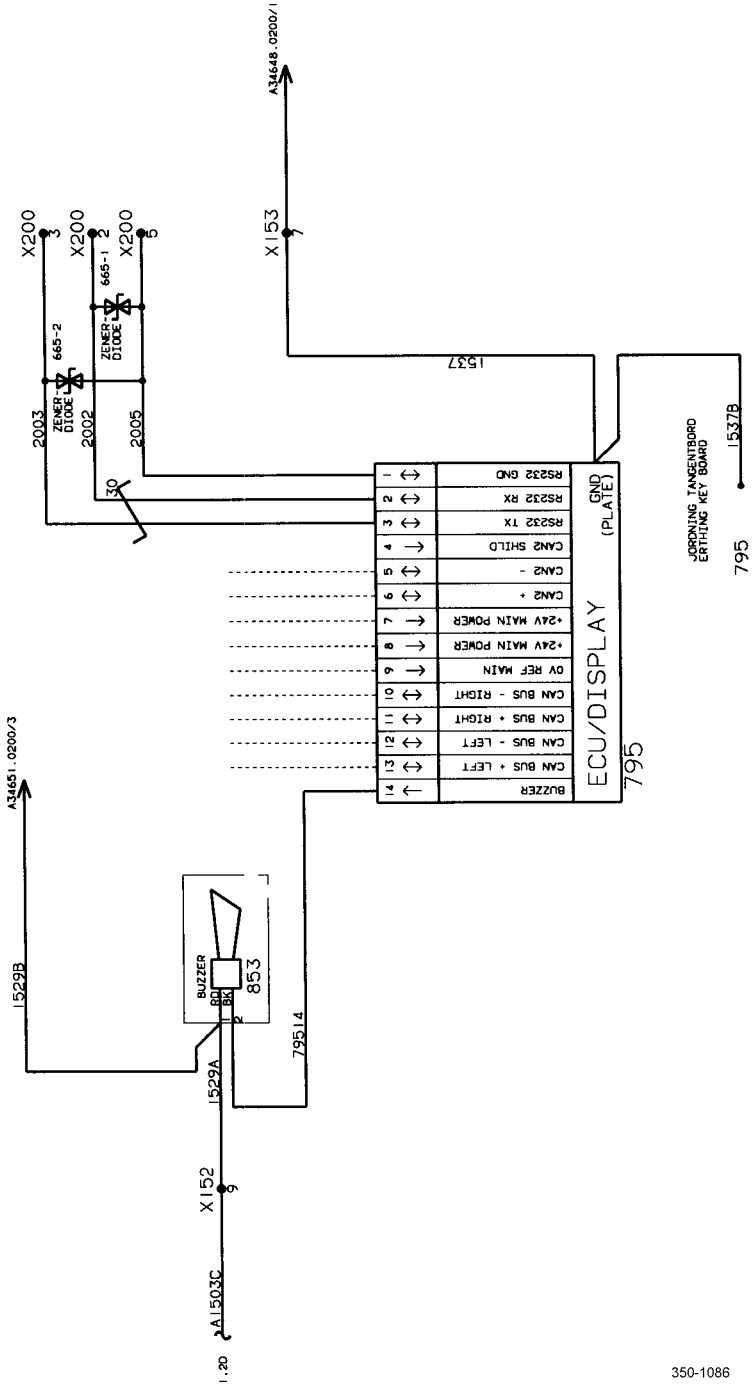


Figure 1. ECS Display/CAN-BUS (A34647.0200) - Continued.

DIAGRAMS - CONTINUED **0087 00**

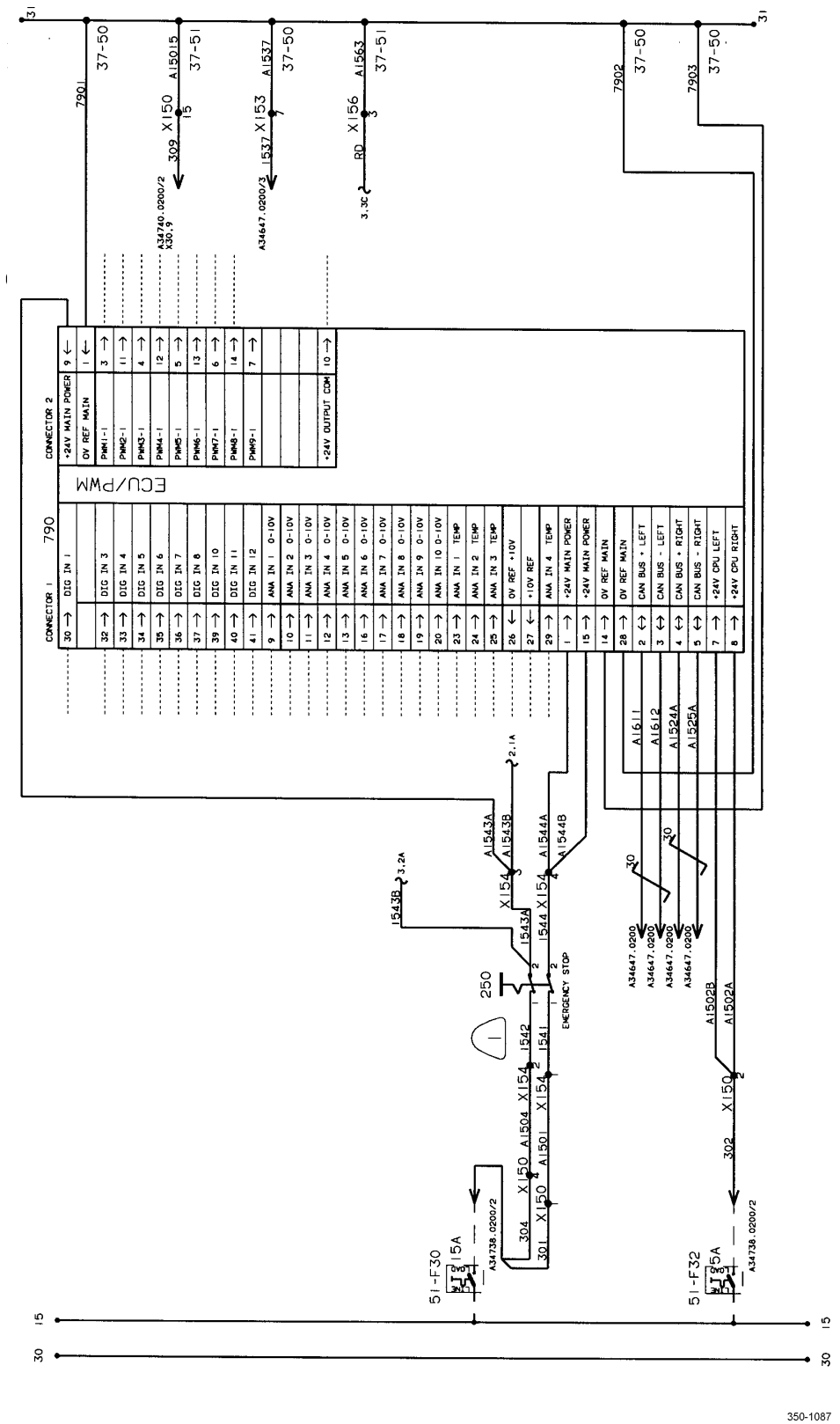


Figure 2. ECS Electrical Servo (A34648.0200).

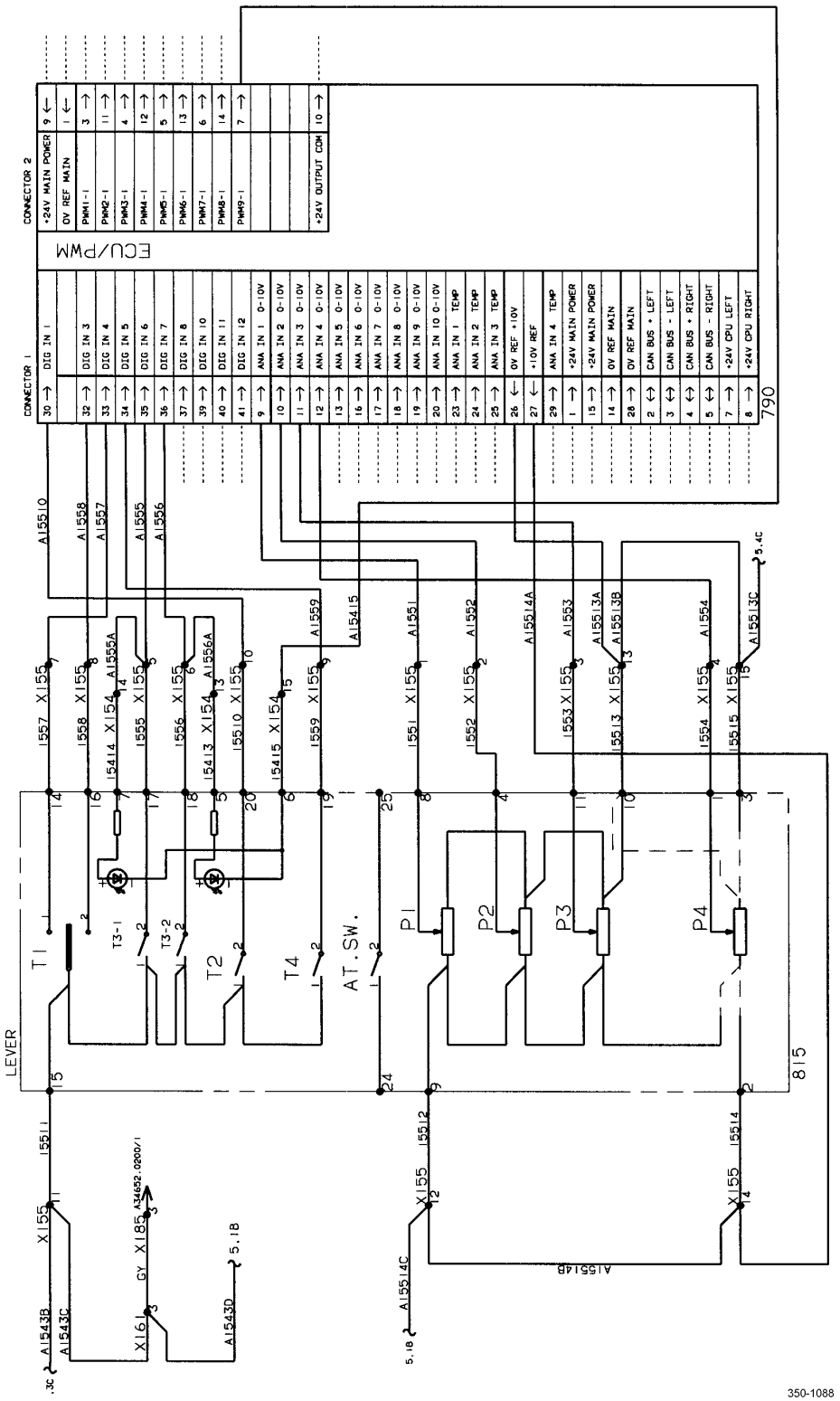


Figure 2. ECS Electrical Servo (A34648.0200) - Continued.

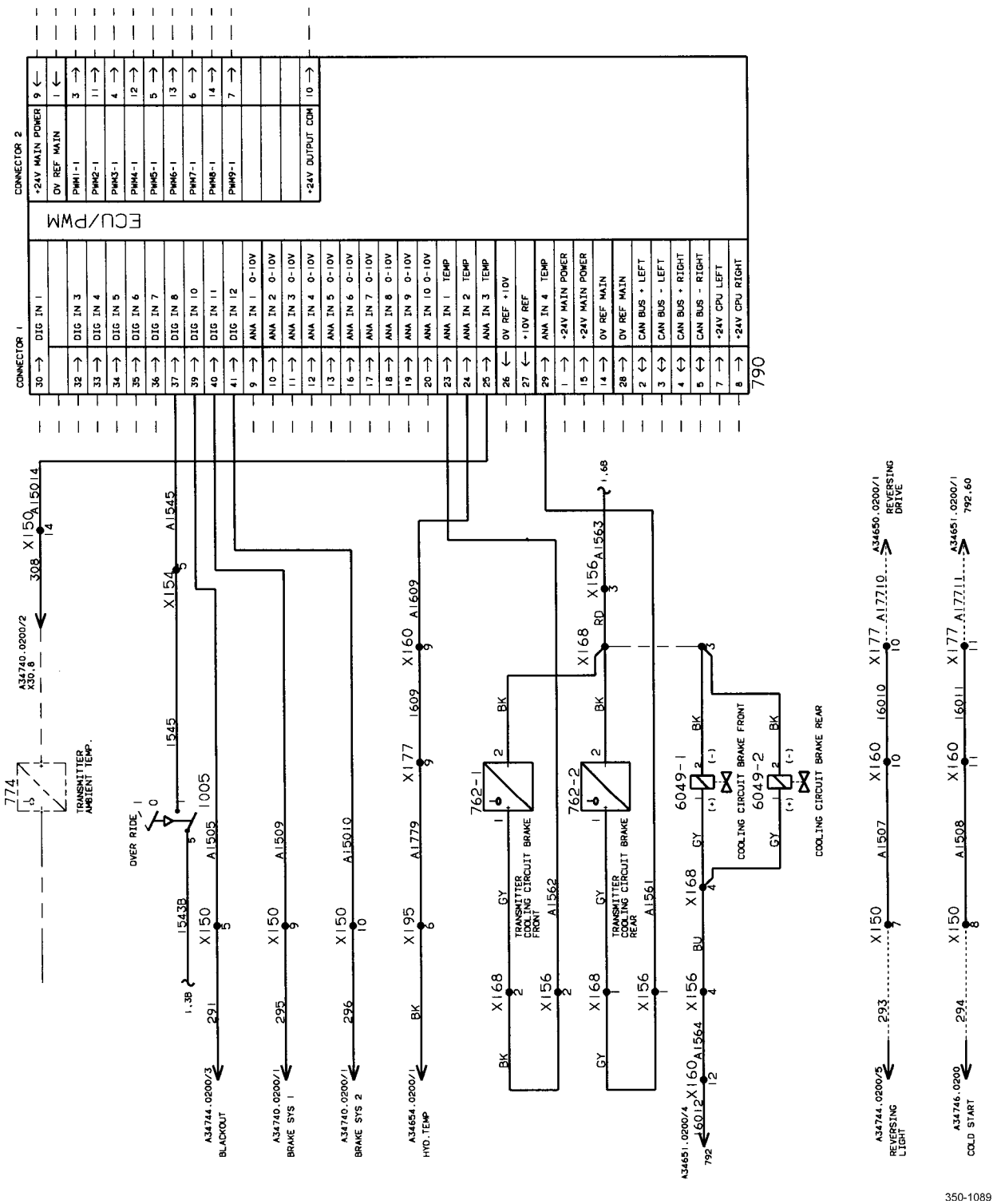


Figure 2. ECS Electrical Servo (A34648.0200) - Continued.

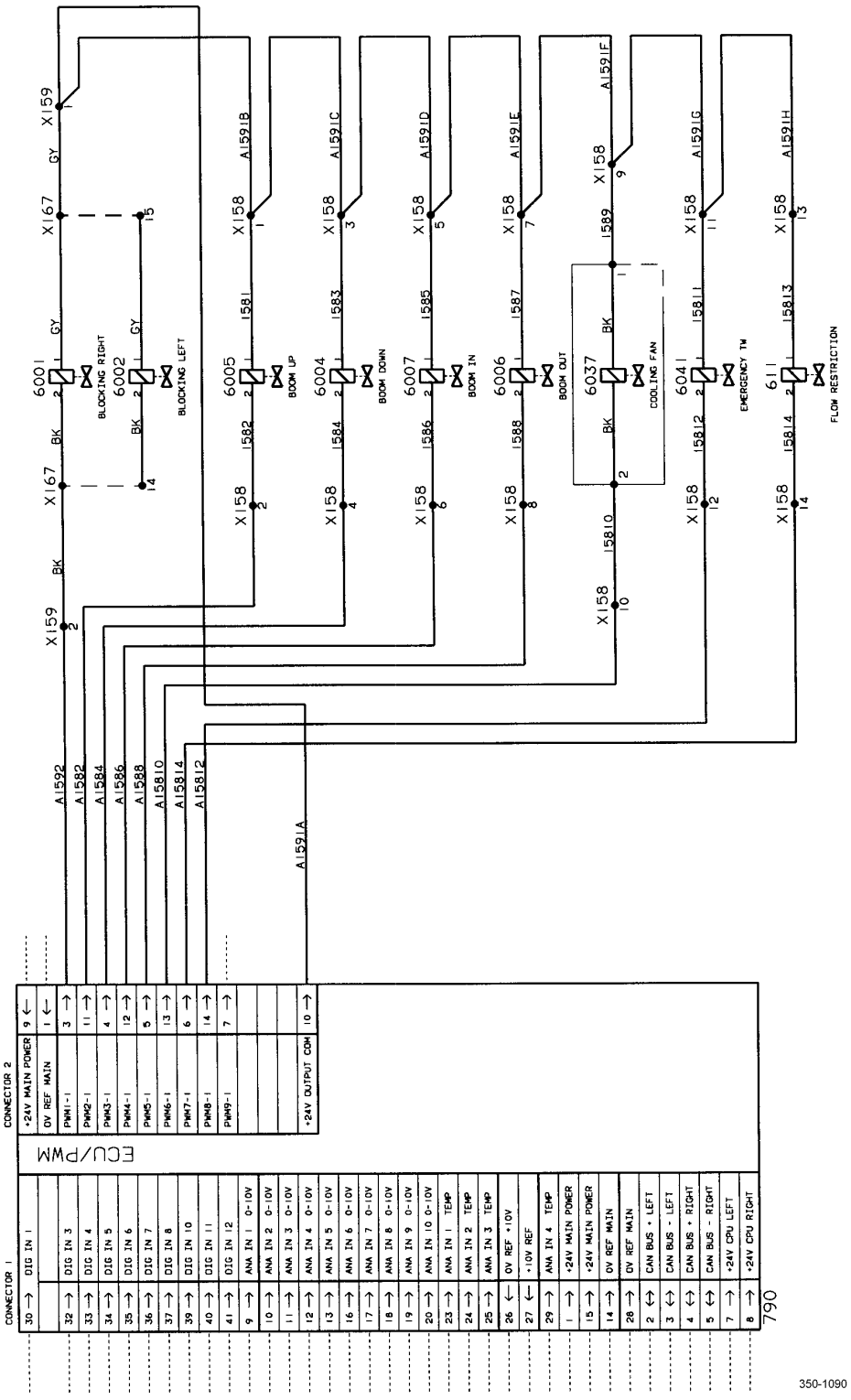


Figure 2. ECS Electrical Servo (A34648.0200) - Continued.

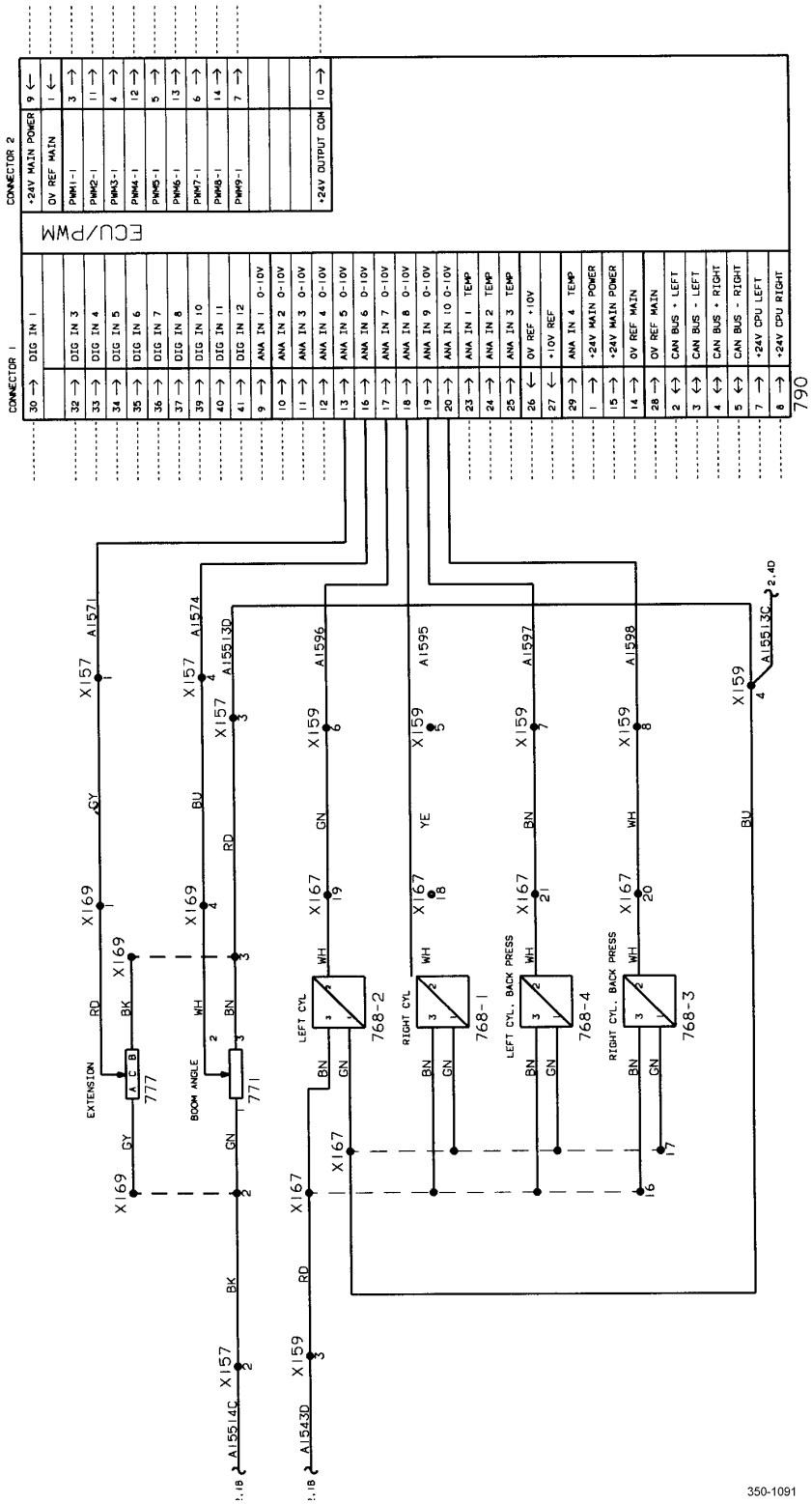


Figure 2. ECS Electrical Servo (A34648.0200) - Continued.

DIAGRAMS - CONTINUED **0087 00**

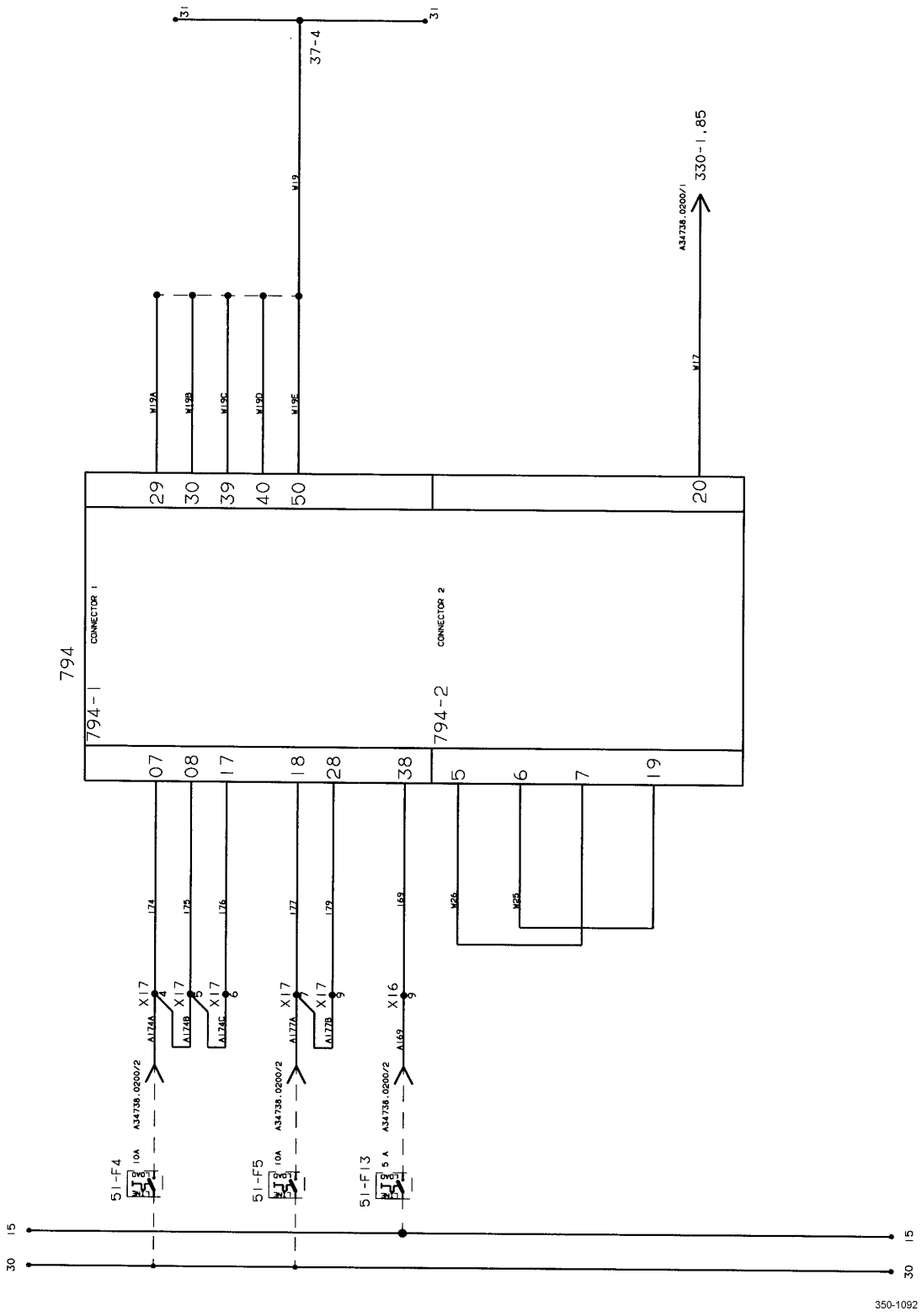


Figure 3. ECS Engine (A34649.0200).

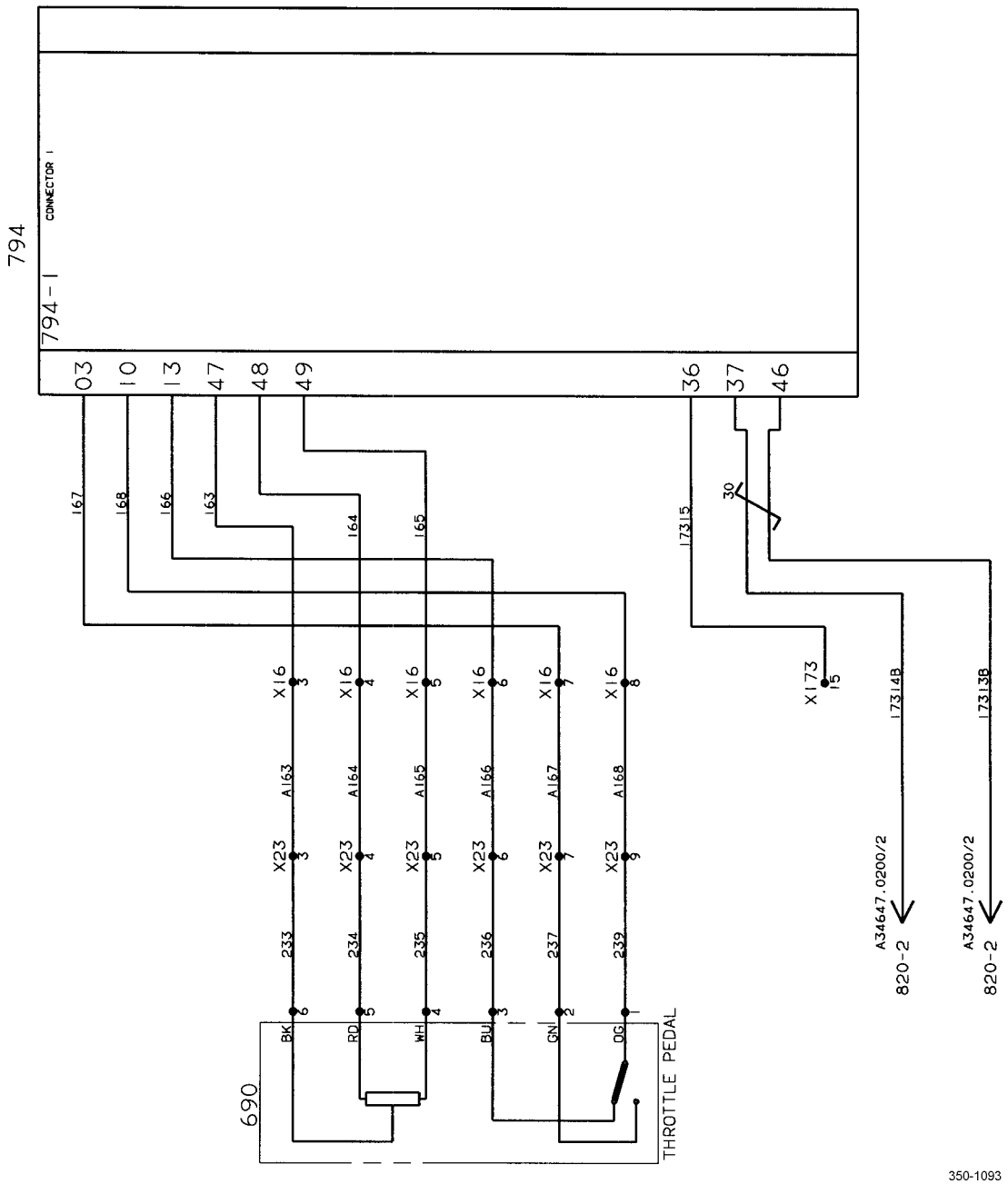


Figure 3. ECS Engine (A34649.0200) - Continued.

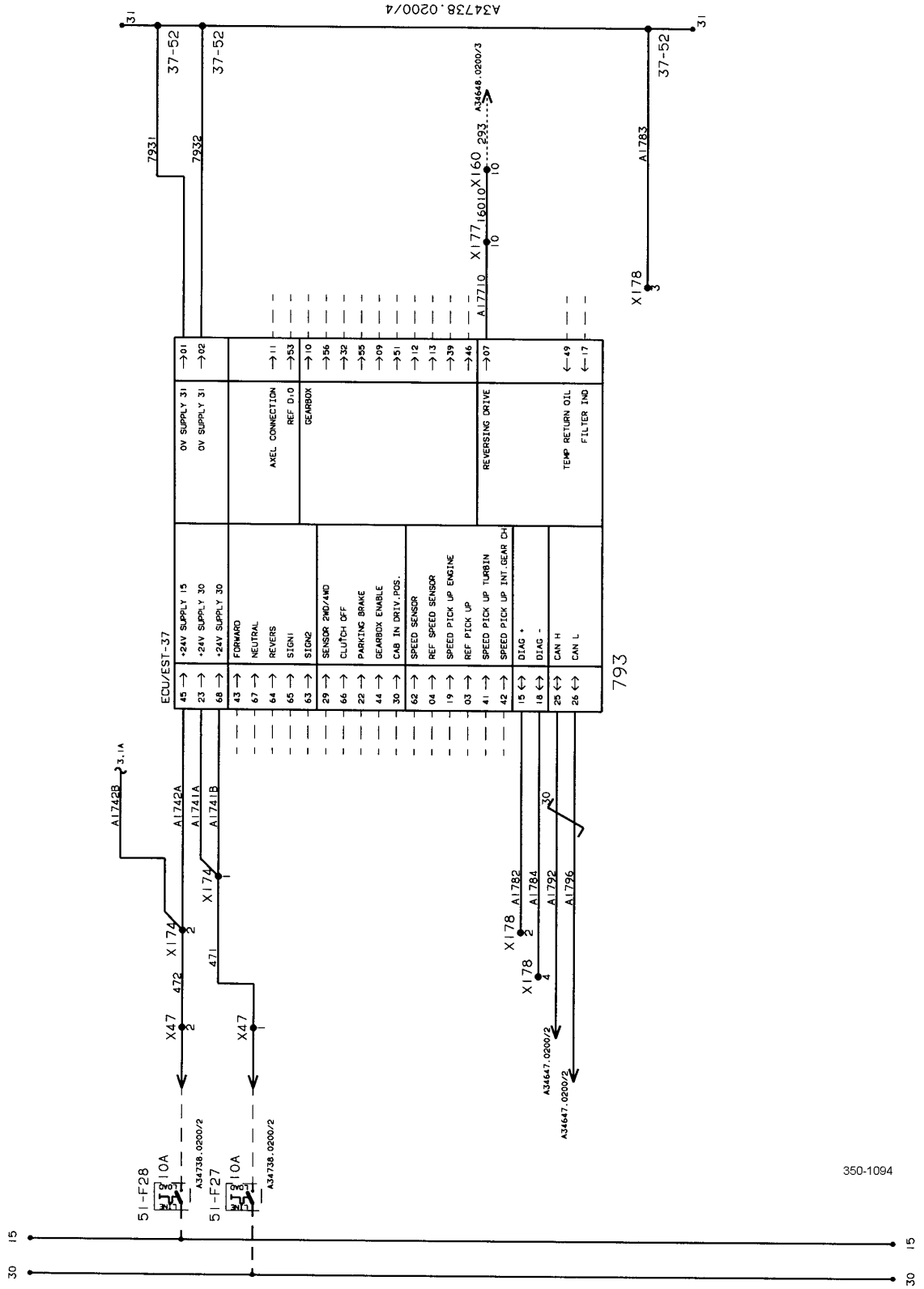


Figure 4. ECS Transmission (A34650.0200).

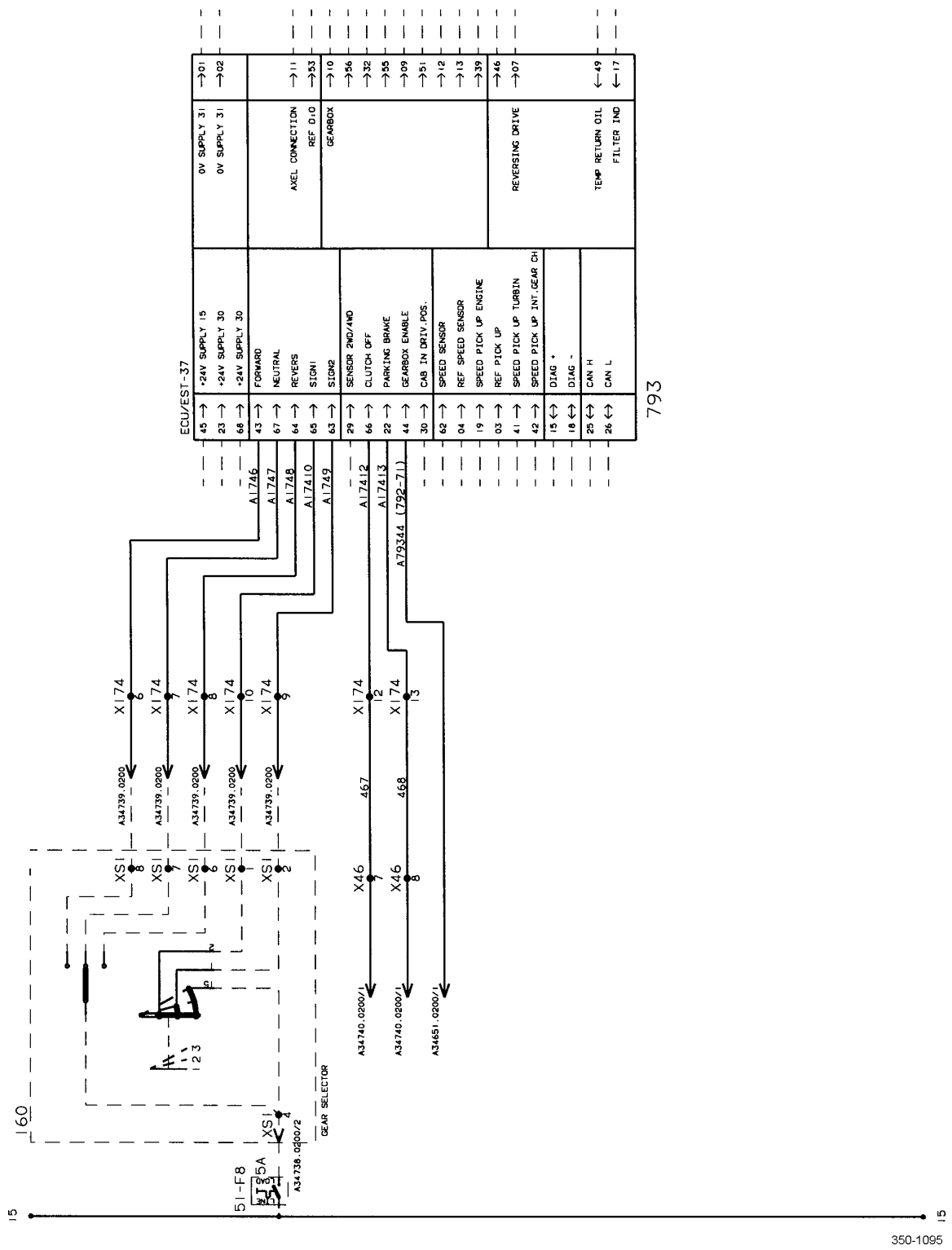


Figure 4. ECS Transmission (A34650.0200) - Continued.

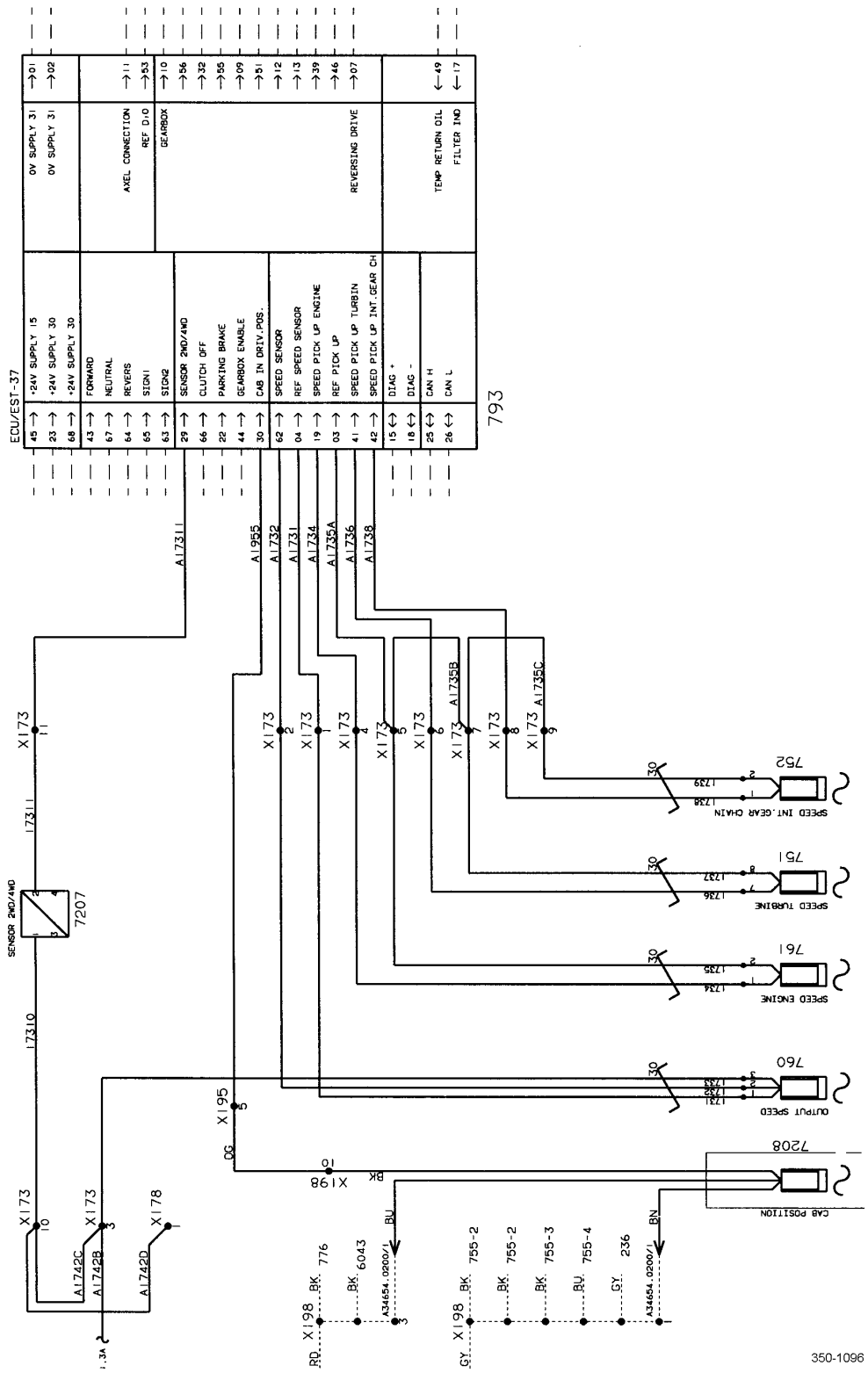


Figure 4. ECS Transmission (A34650.0200) - Continued.

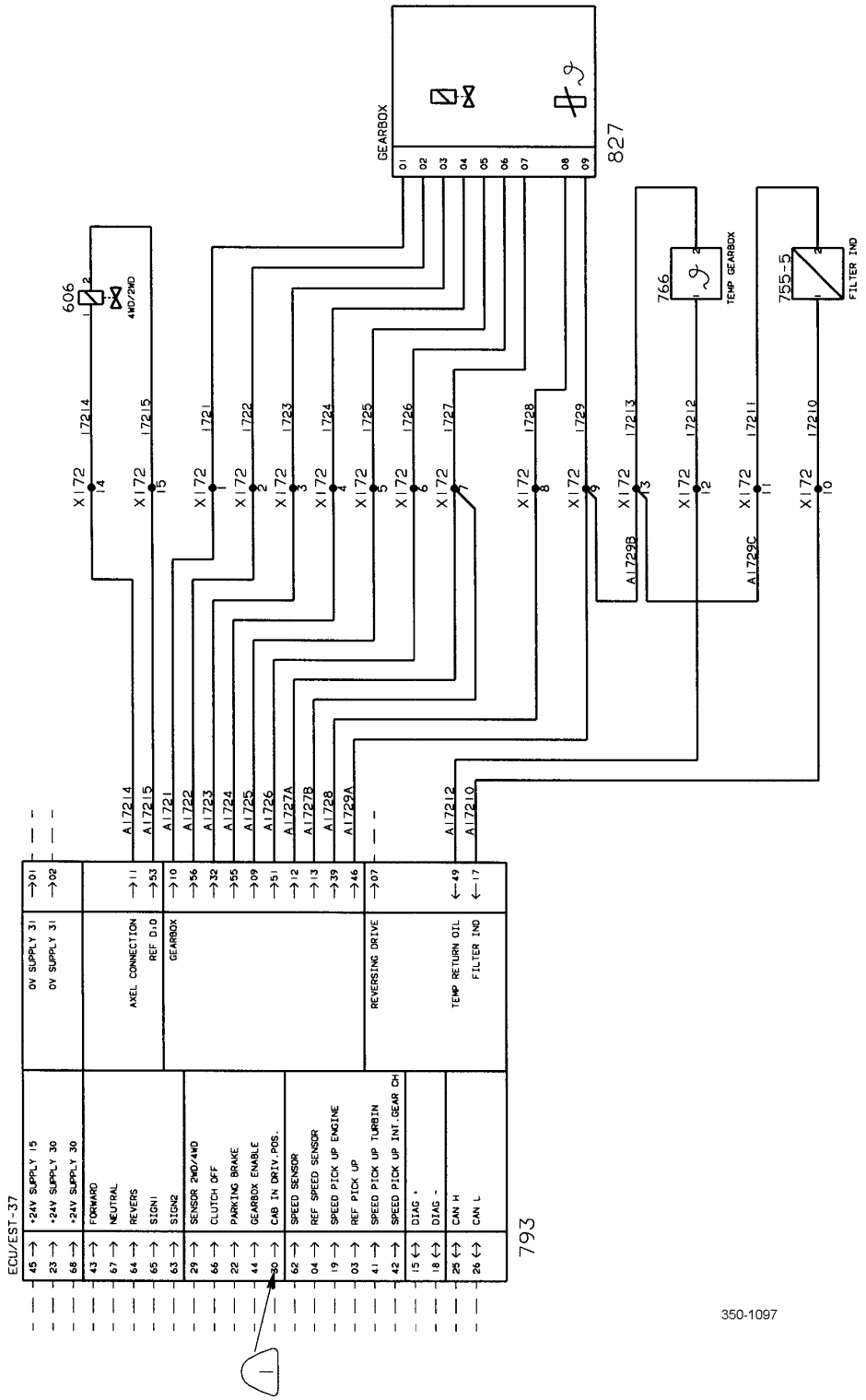


Figure 4. ECS Transmission (A34650.0200) - Continued.

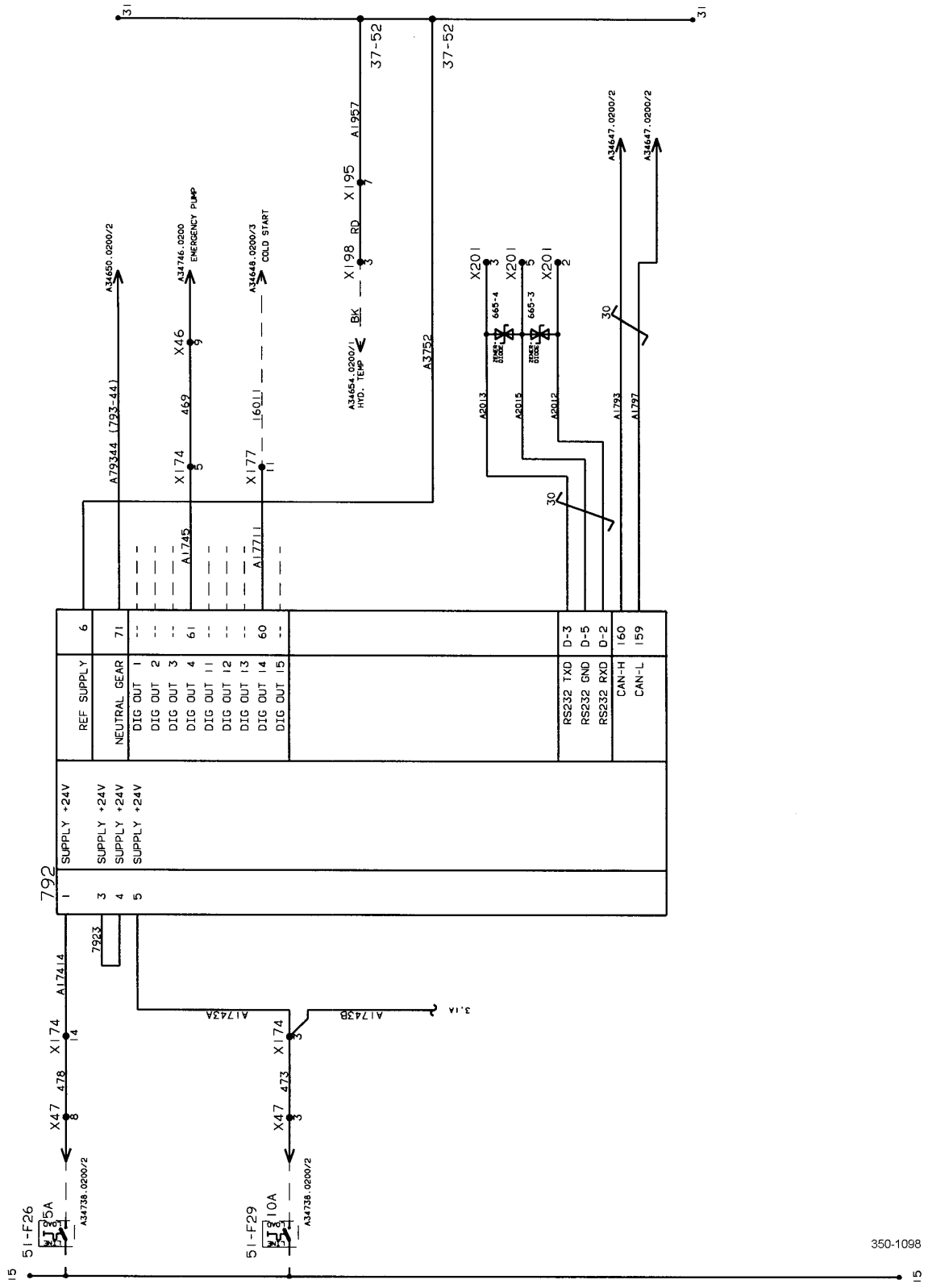


Figure 5. ECS Steering (A34651.0200).

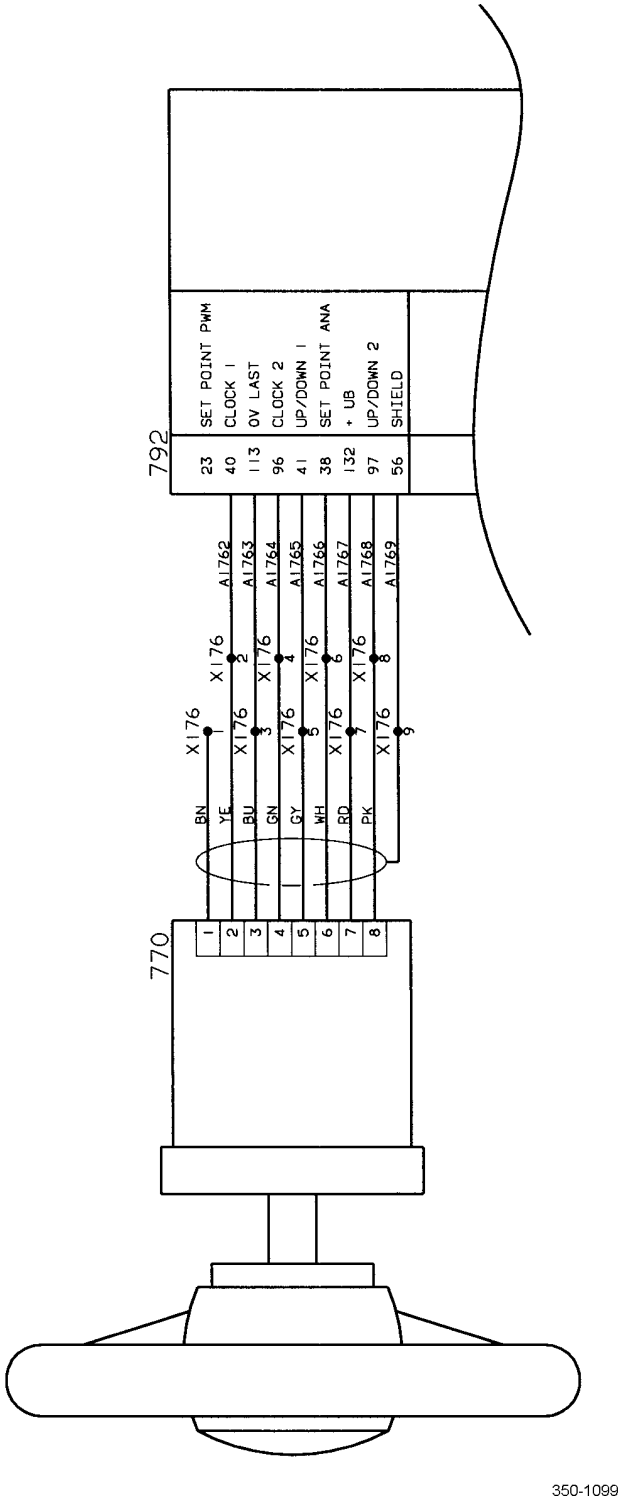


Figure 5. ECS Steering (A34651.0200) - Continued.

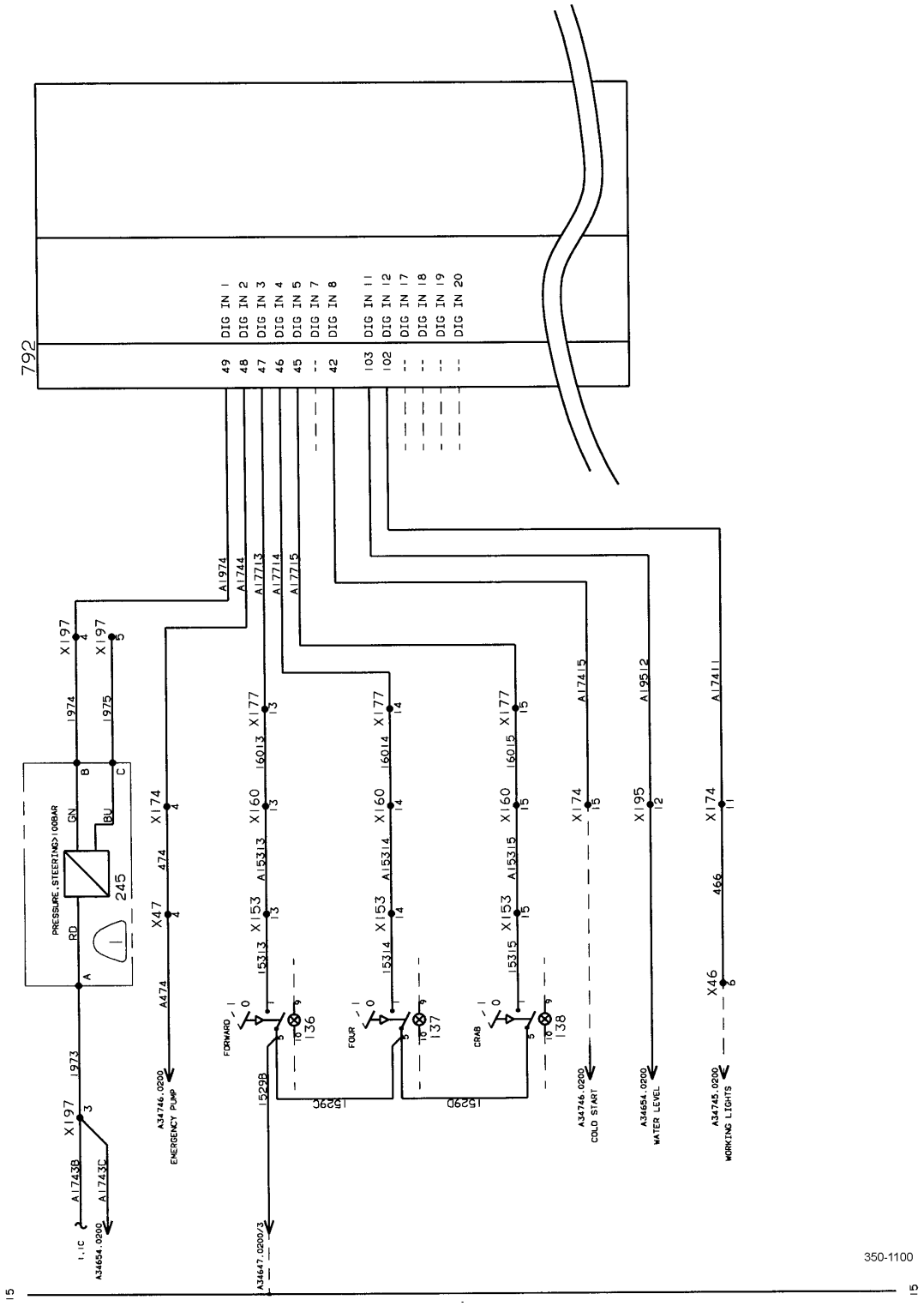


Figure 5. ECS Steering (A34651.0200) - Continued.

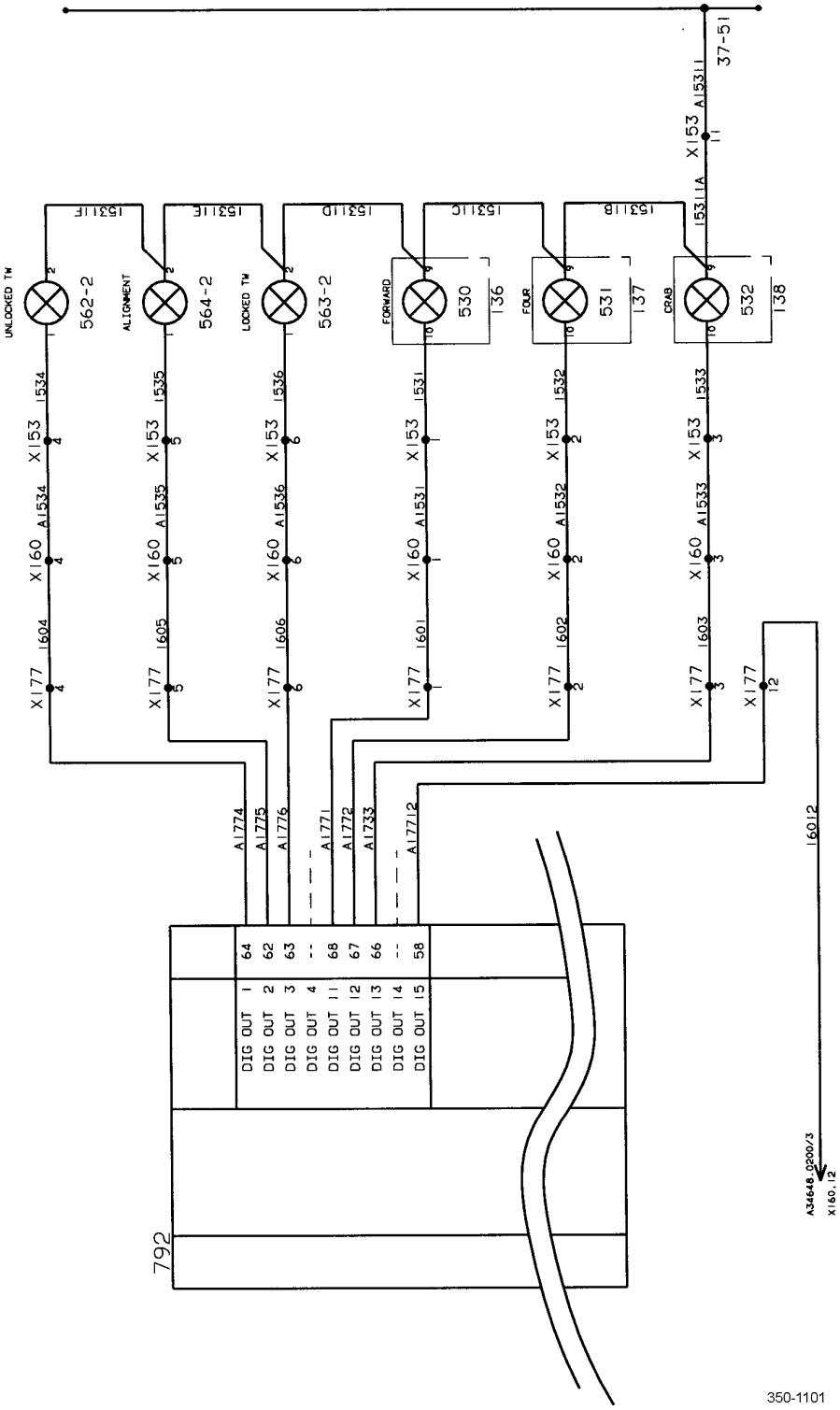


Figure 5. ECS Steering (A34651.0200) - Continued.

DIAGRAMS - CONTINUED **0087 00**

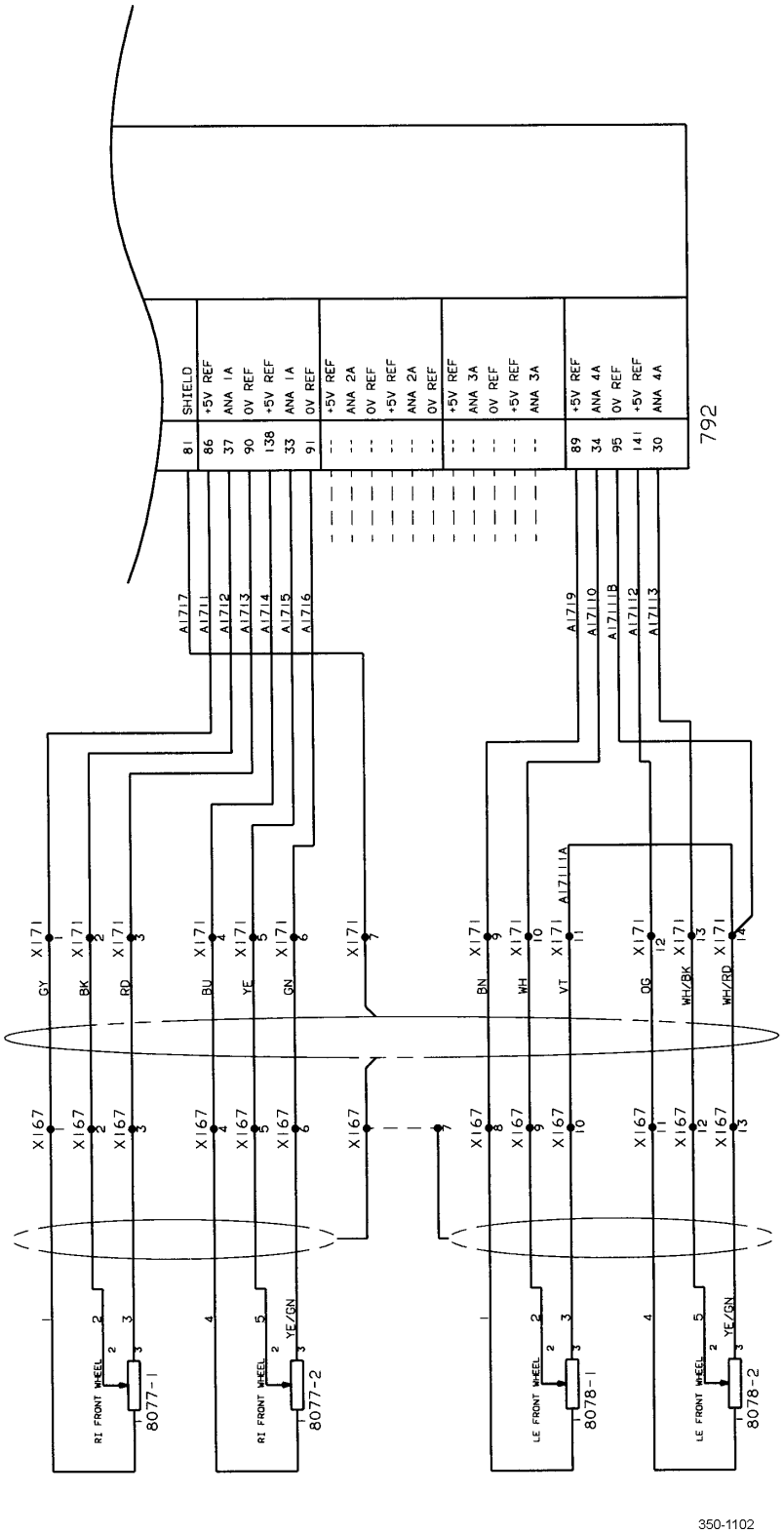


Figure 5. ECS Steering (A34651.0200) - Continued.

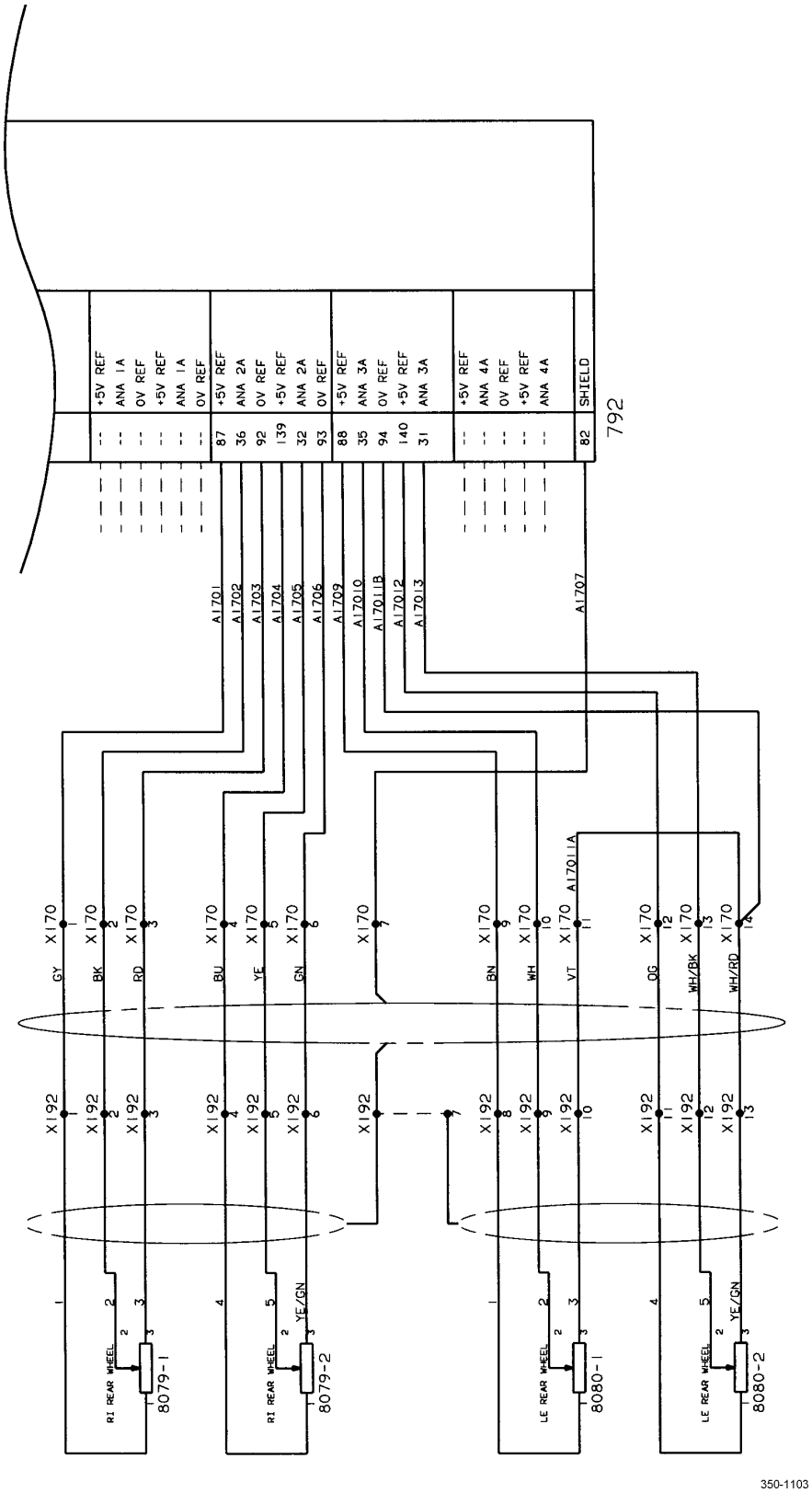


Figure 5. ECS Steering (A34651.0200) - Continued.

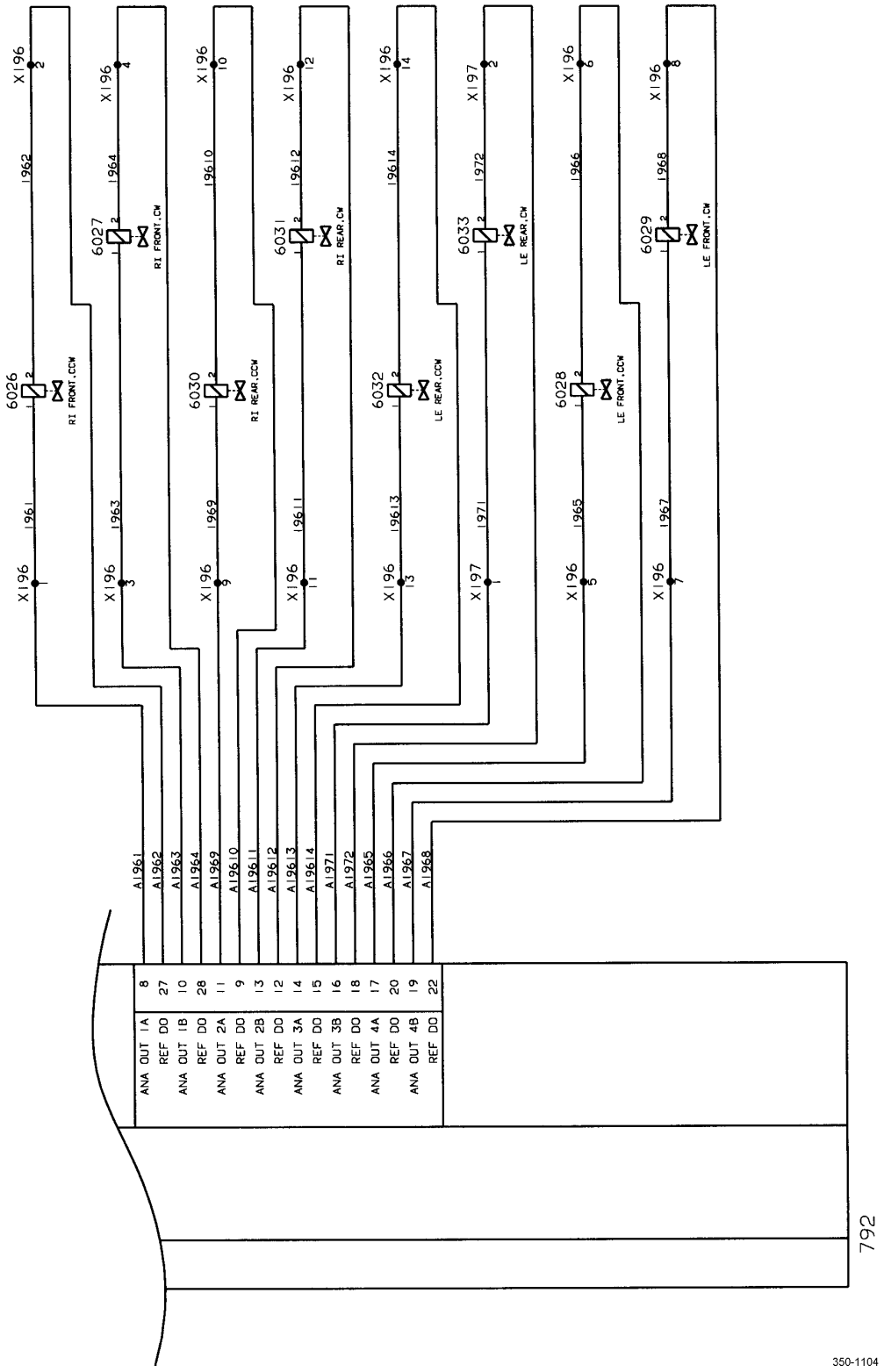


Figure 5. ECS Steering (A34651.0200) - Continued.

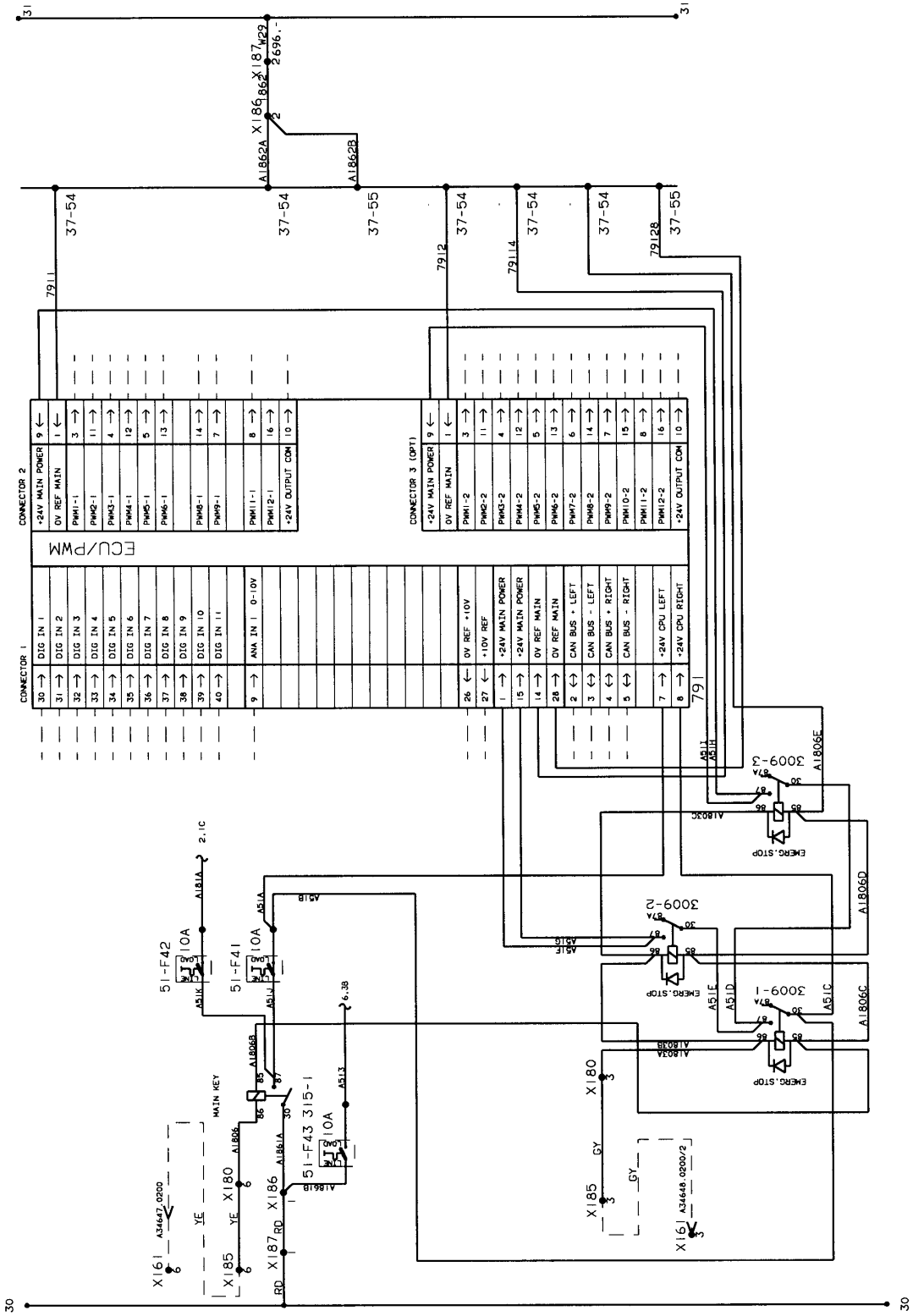


Figure 6. ECS Attachment (A34652.0200).

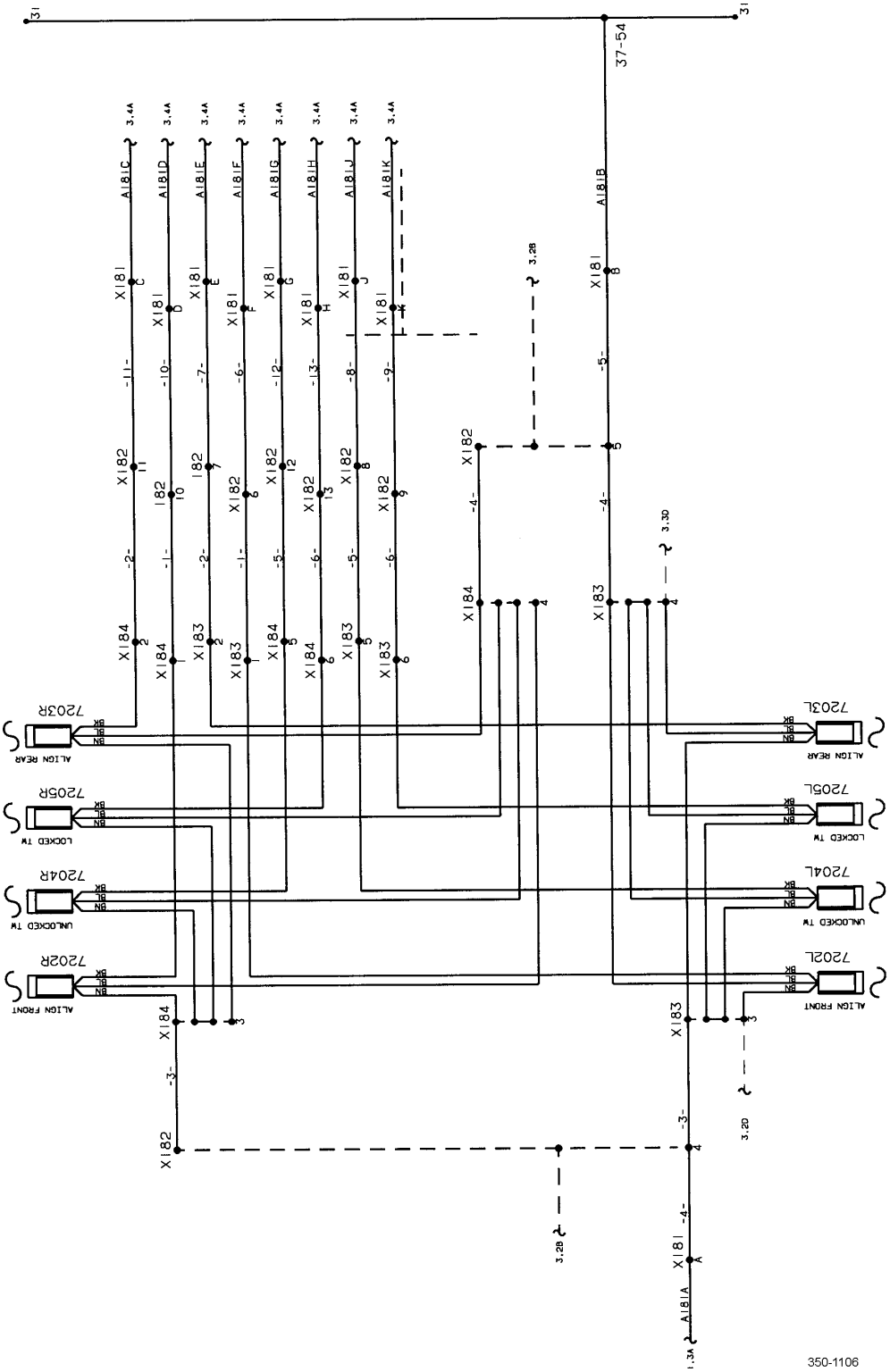


Figure 6. ECS Attachment (A34652.0200) - Continued.

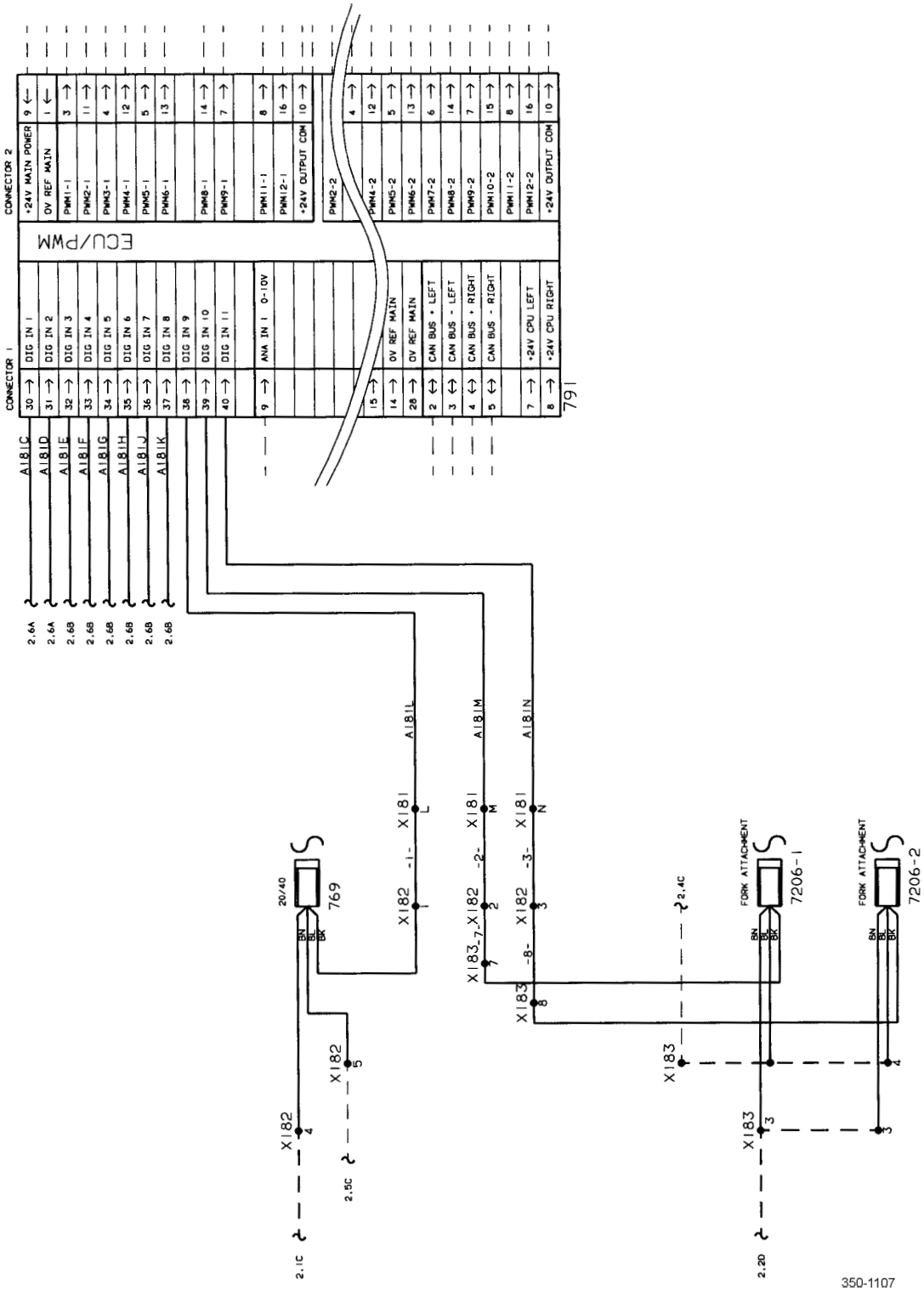


Figure 6. ECS Attachment (A34652.0200) - Continued.

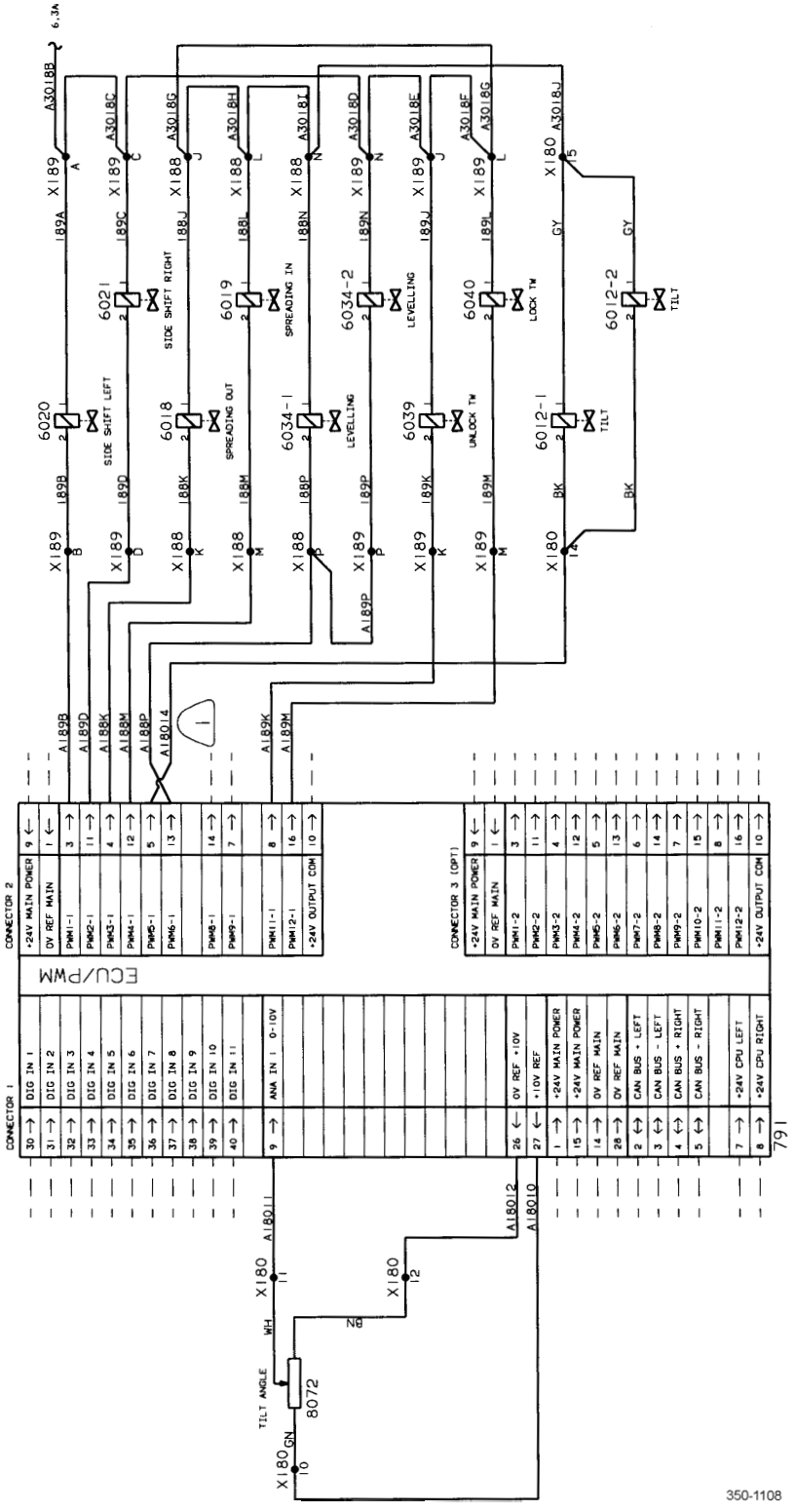


Figure 6. ECS Attachment (A34652.0200) - Continued.

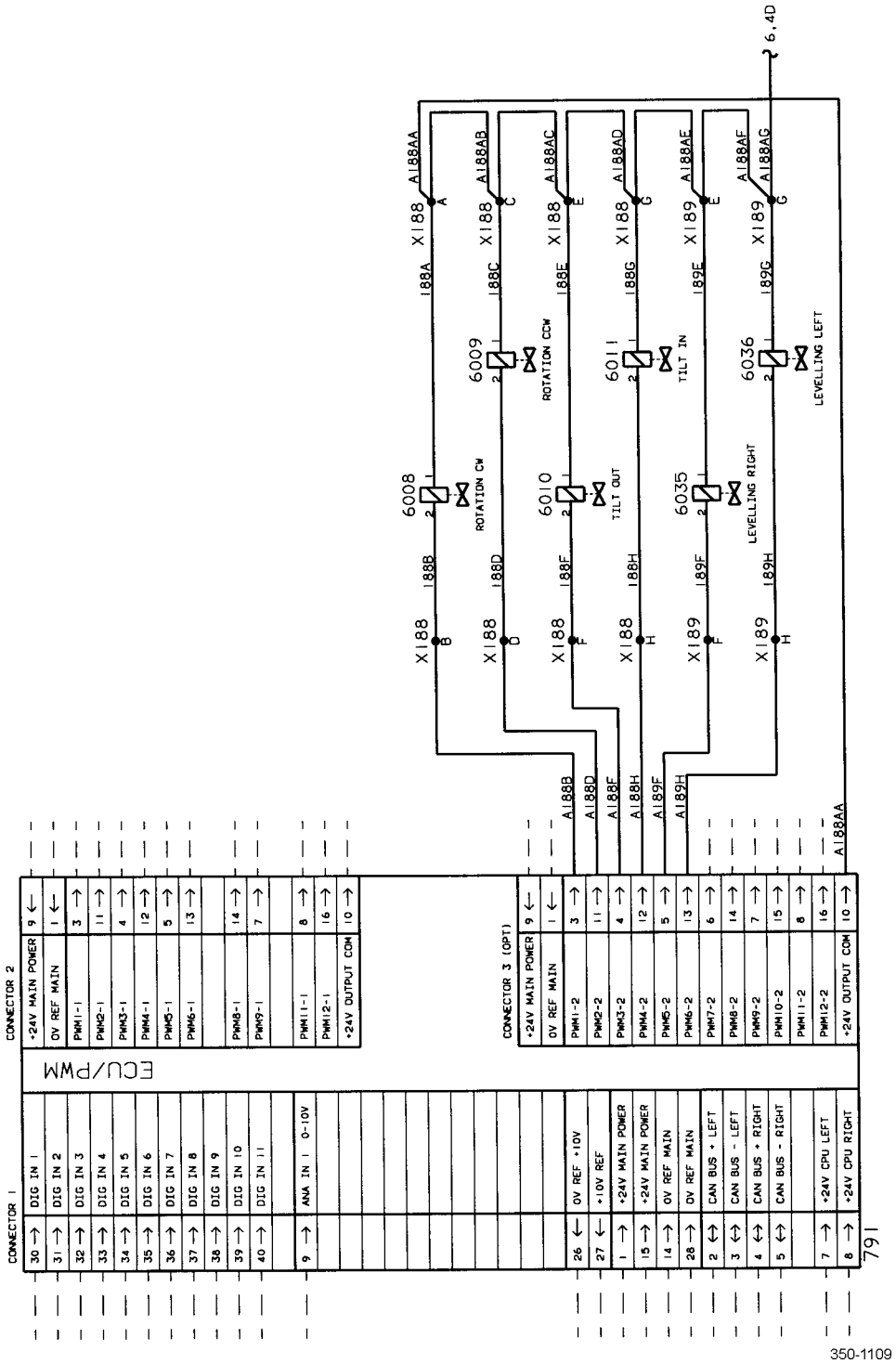


Figure 6. ECS Attachment (A34652.0200) - Continued.

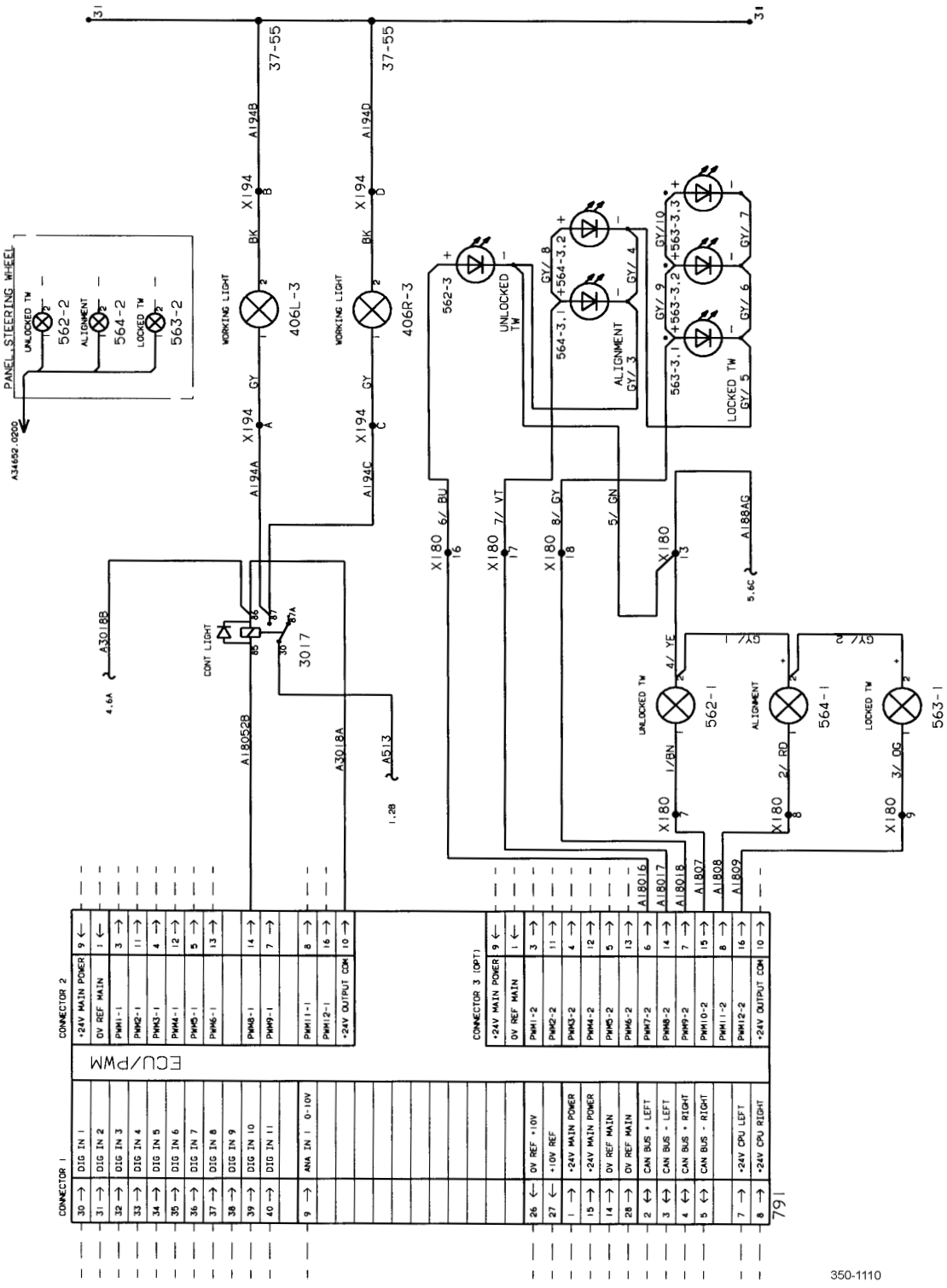


Figure 6. ECS Attachment (A34652.0200) - Continued.

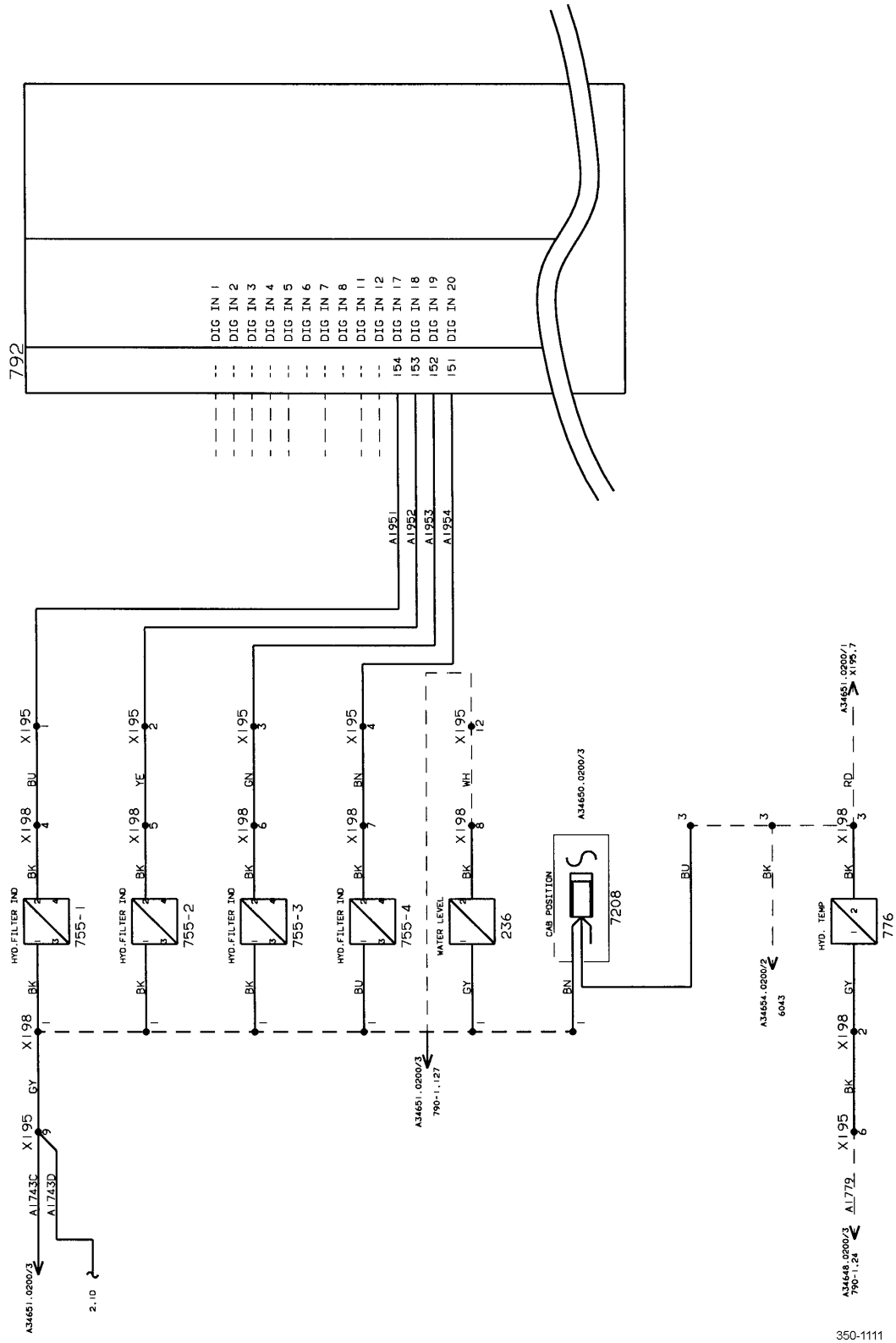


Figure 7. ECS Hydraulics (A34654.0200).

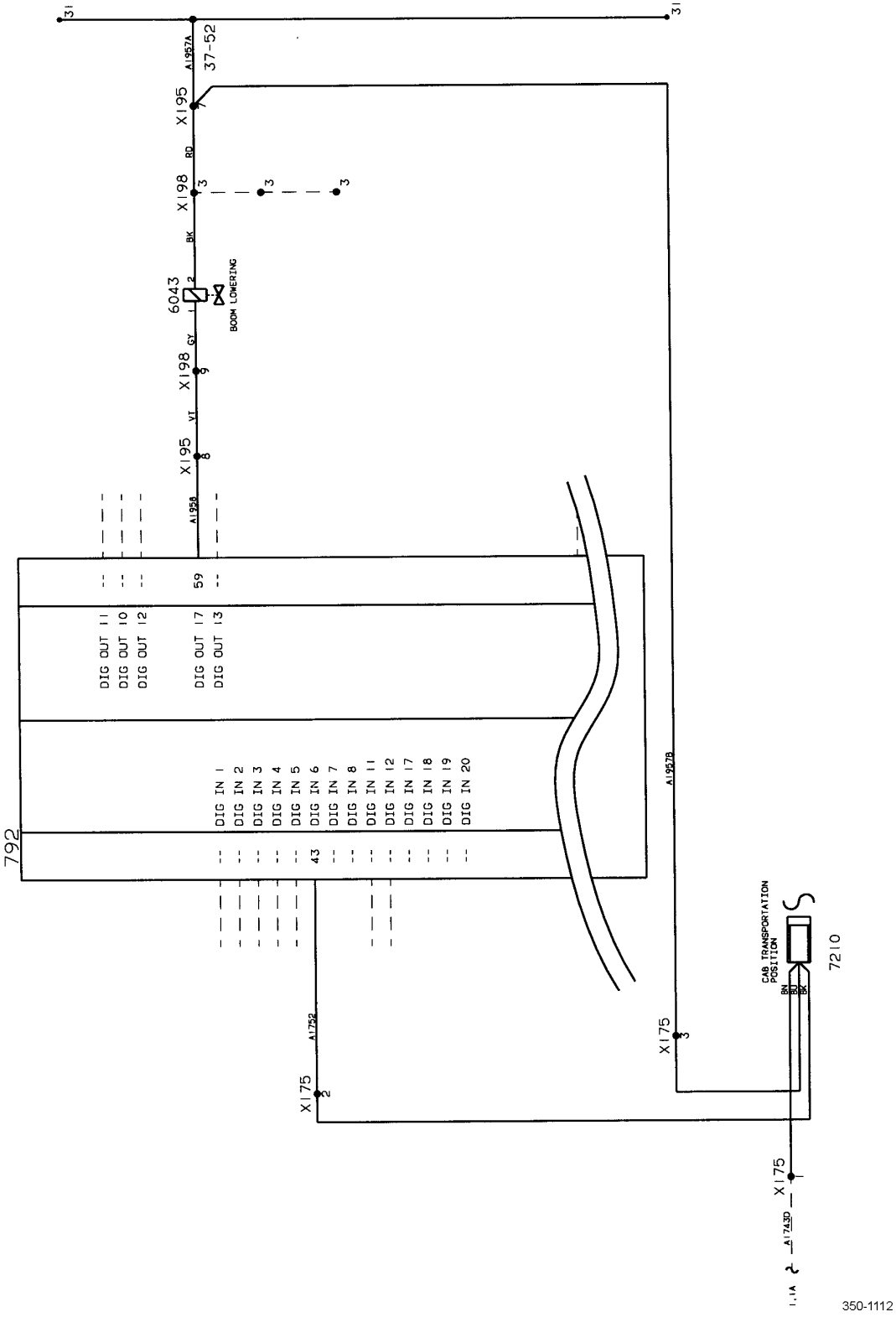


Figure 7. ECS Hydraulics (A34654.0200) - Continued.

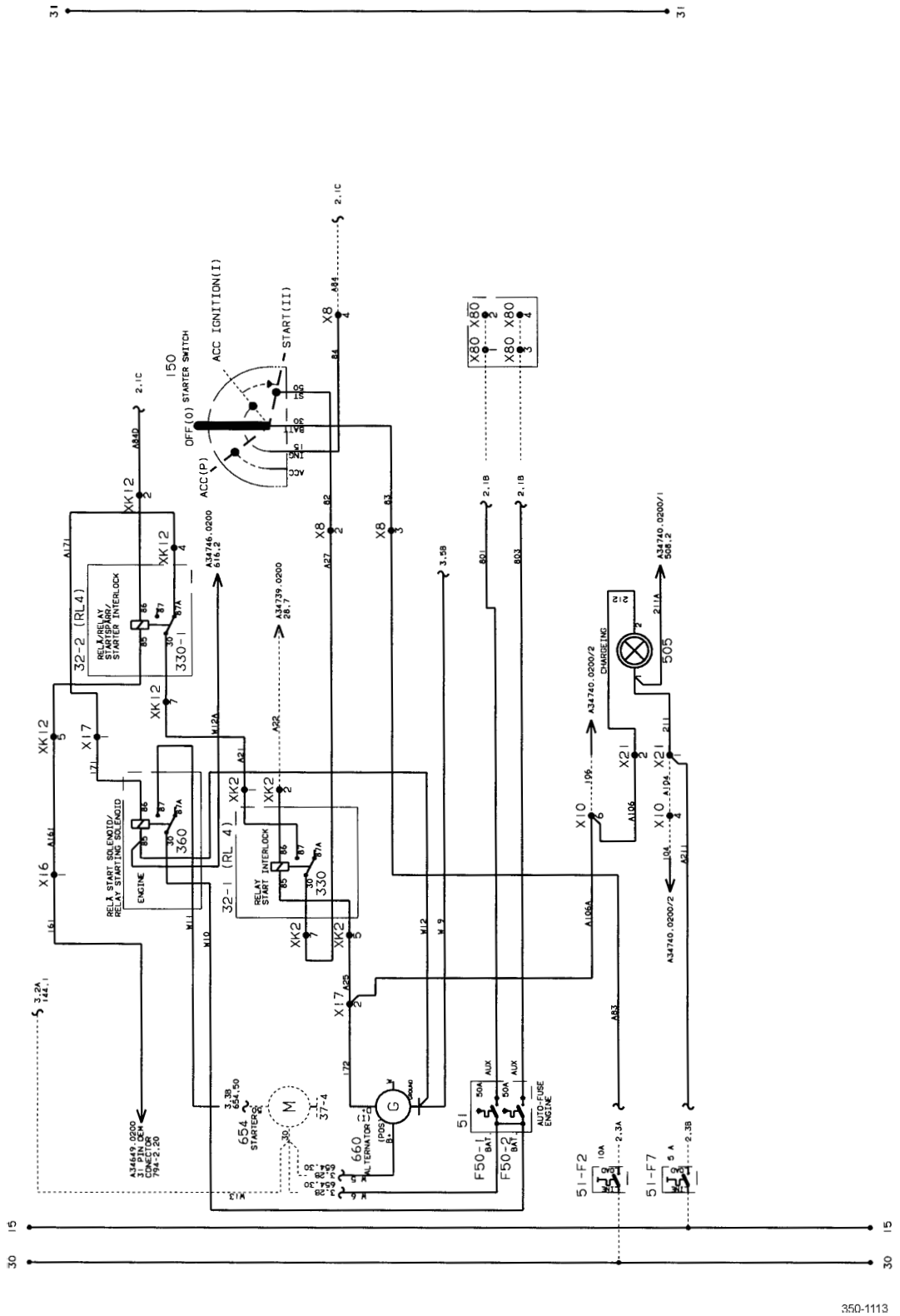


Figure 8. Current Supply (A34738.0200).

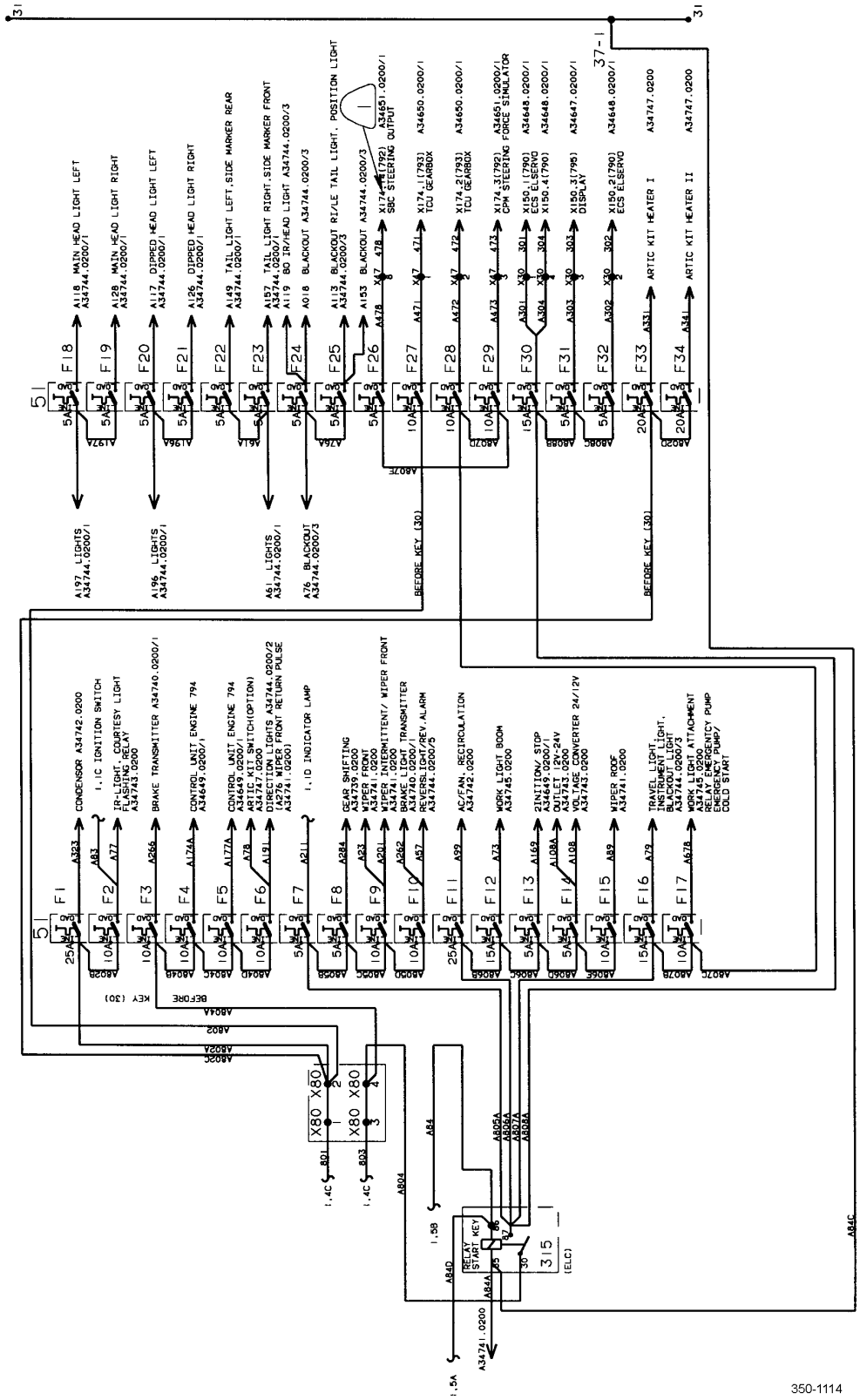


Figure 8. Current Supply (A34738.0200) - Continued.

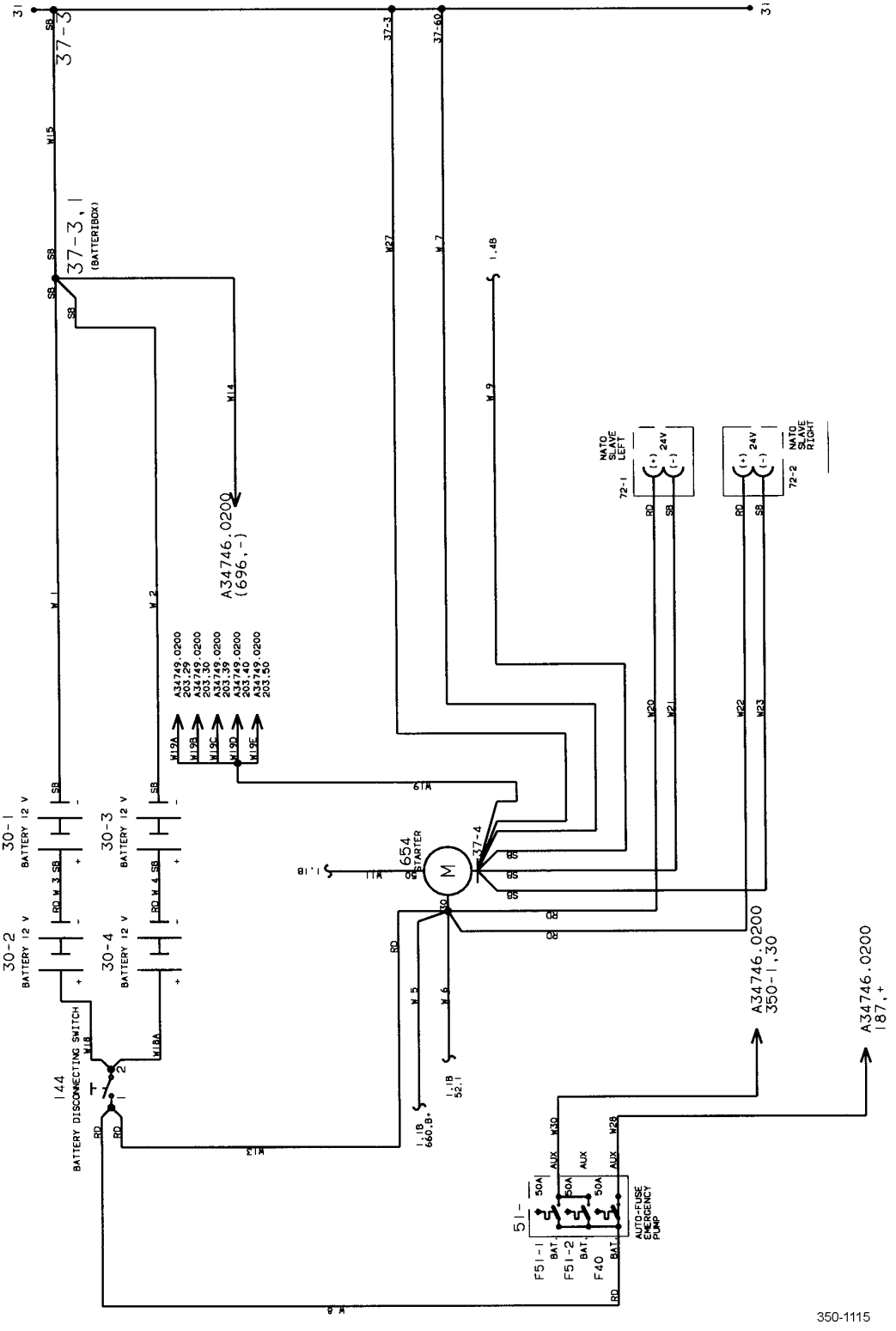


Figure 8. Current Supply (A34738.0200) - Continued.

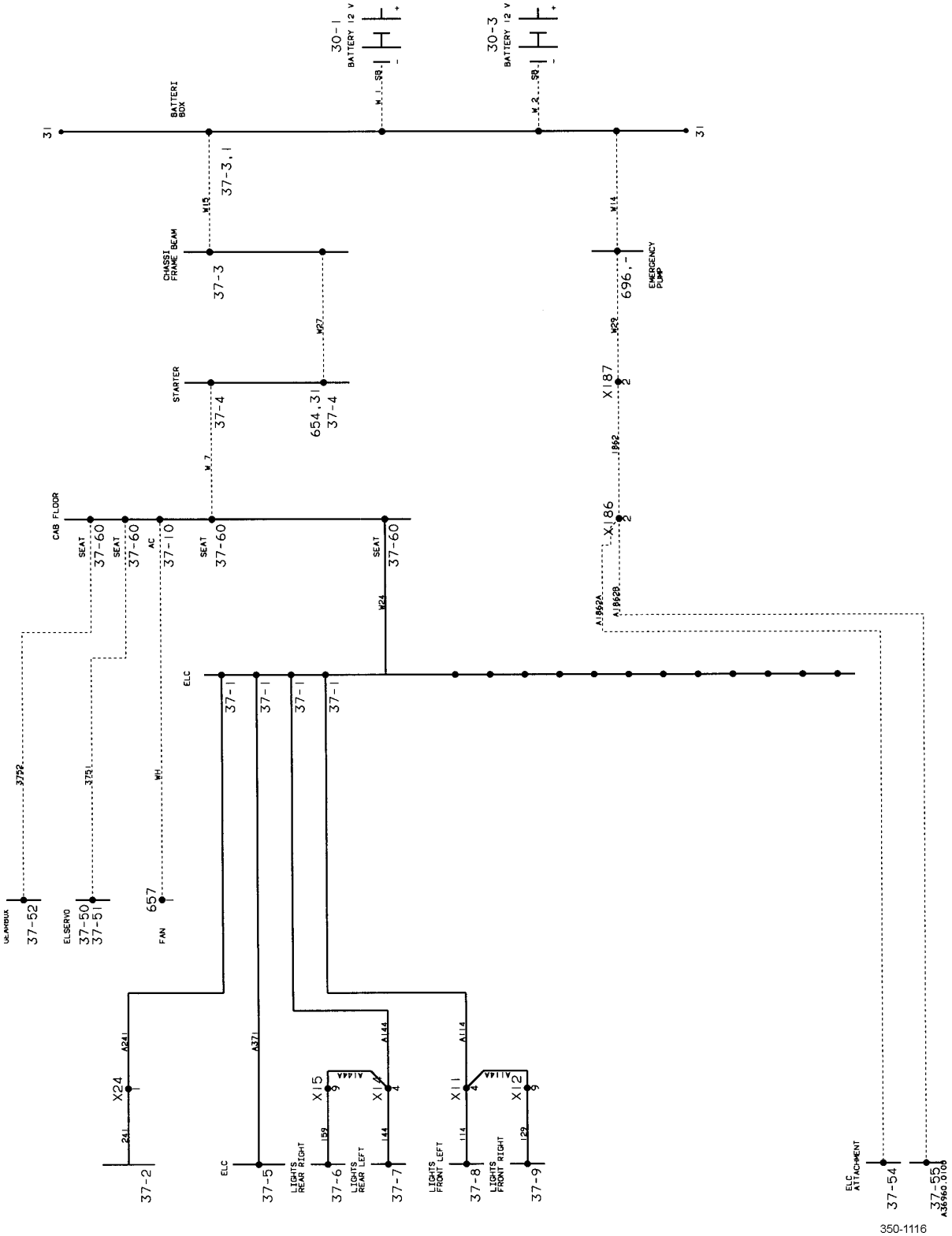


Figure 8. Current Supply (A34738.0200) - Continued.

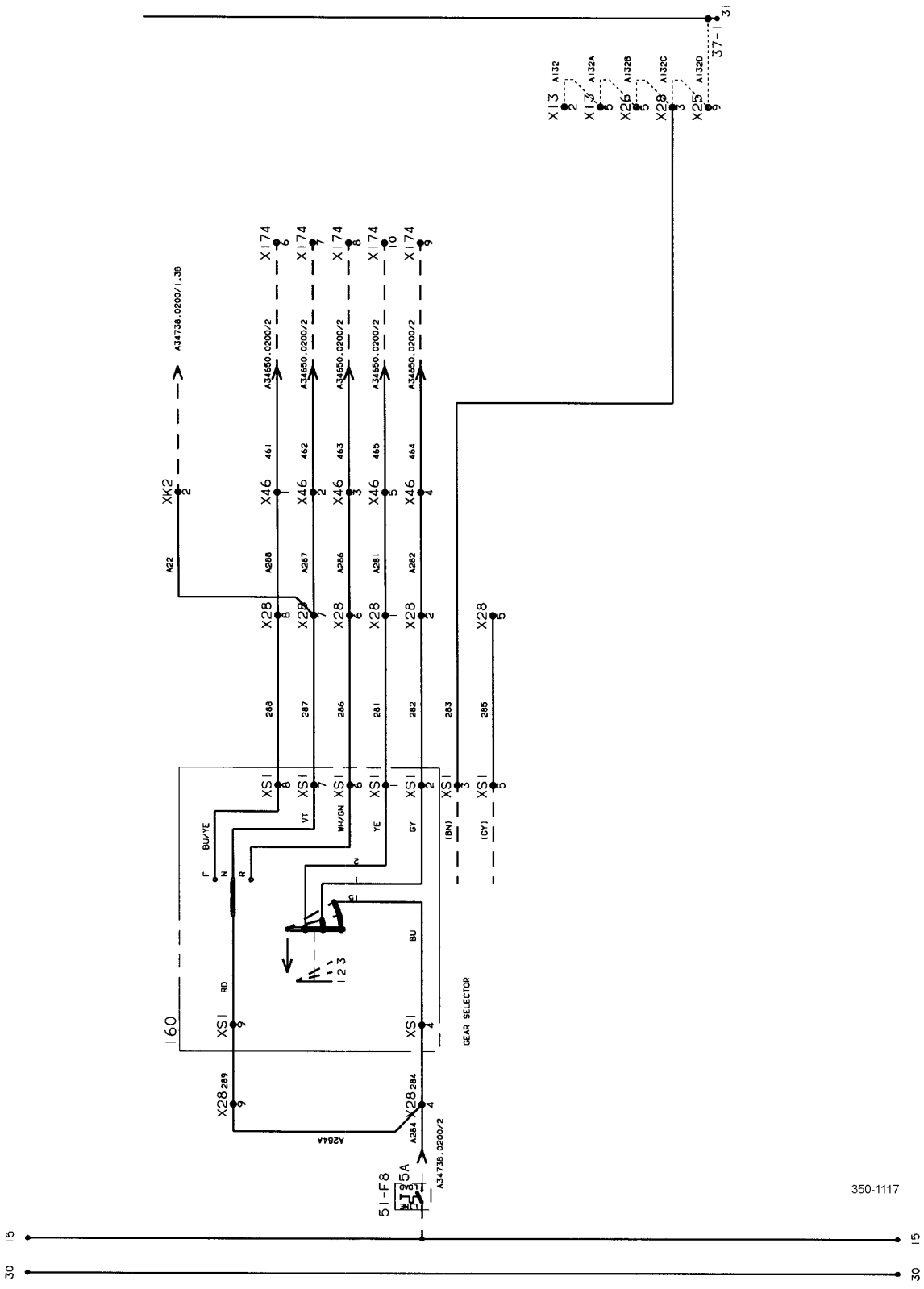


Figure 9. Shifting (A34739.0200).

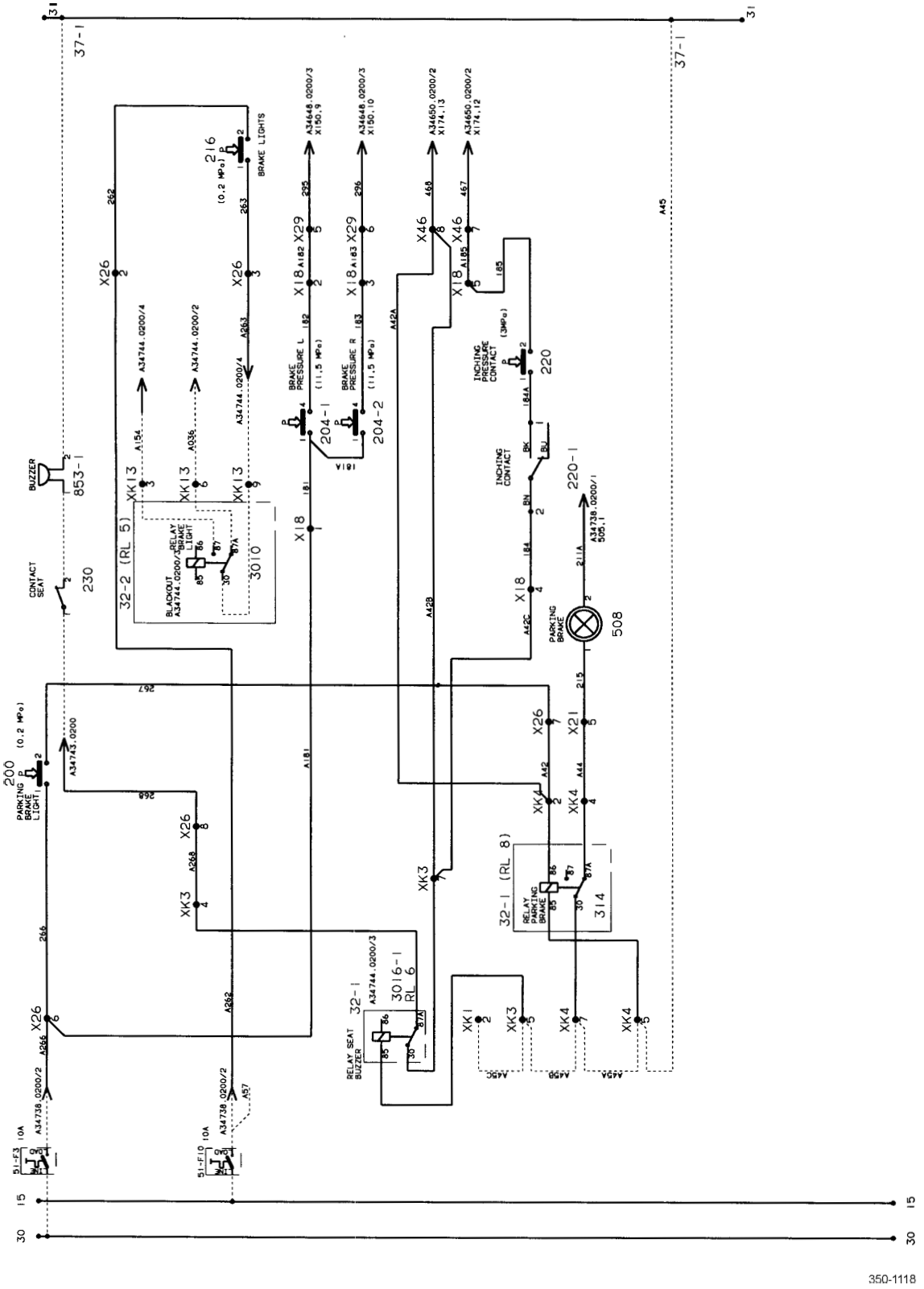


Figure 10. Sender (A34740.0200).

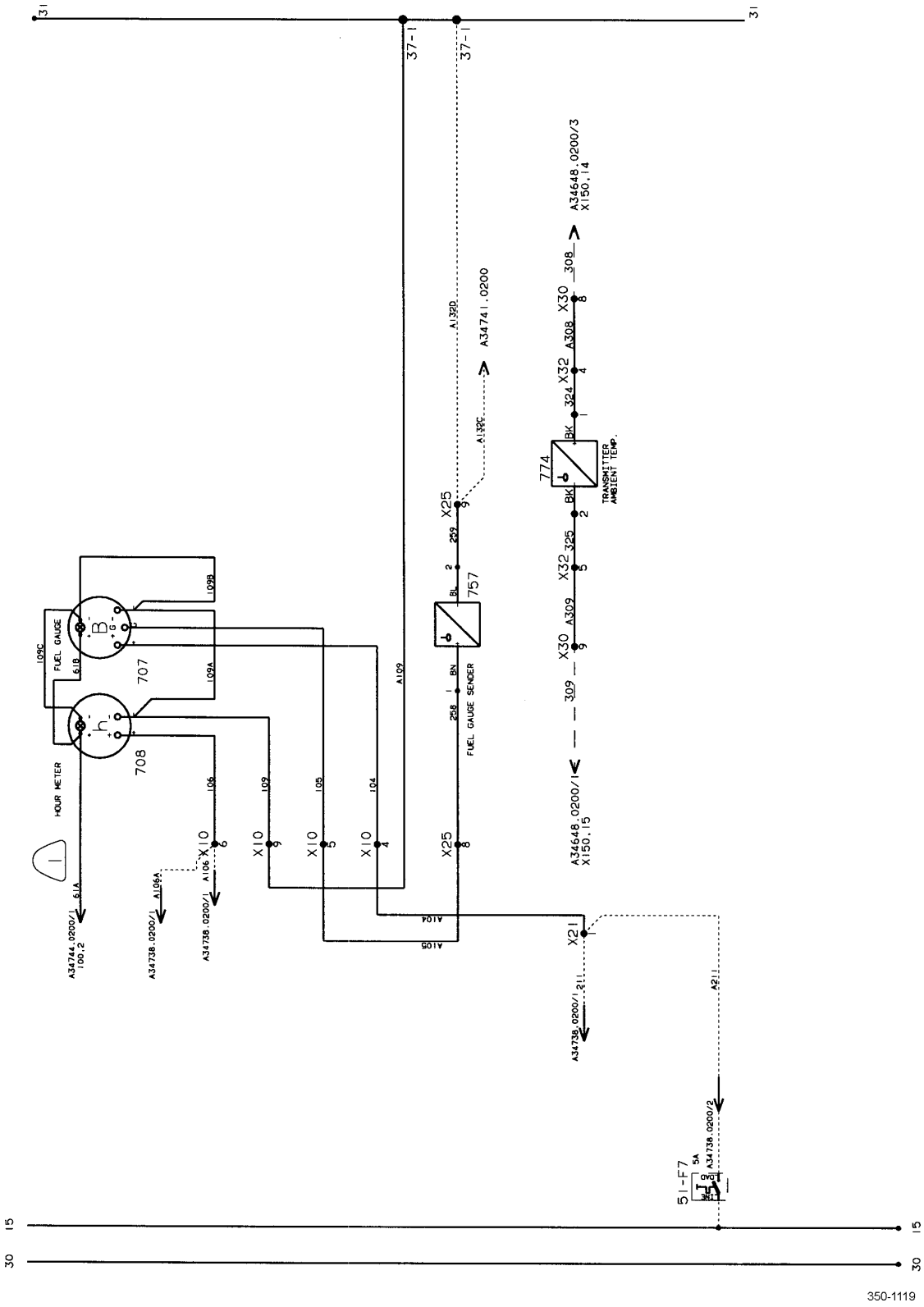


Figure 10. Sender (A34740.0200) - Continued.

DIAGRAMS - CONTINUED **0087 00**

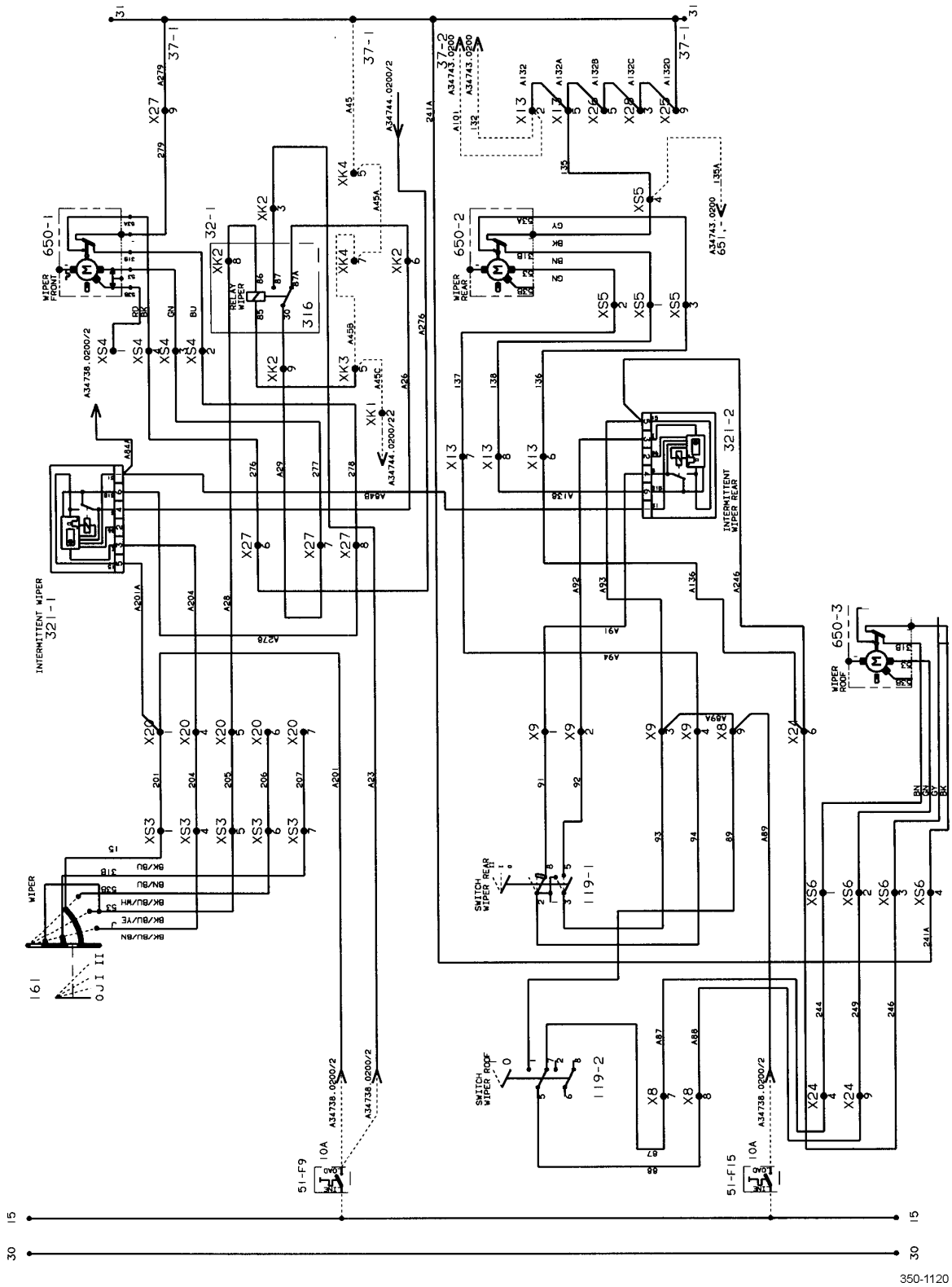
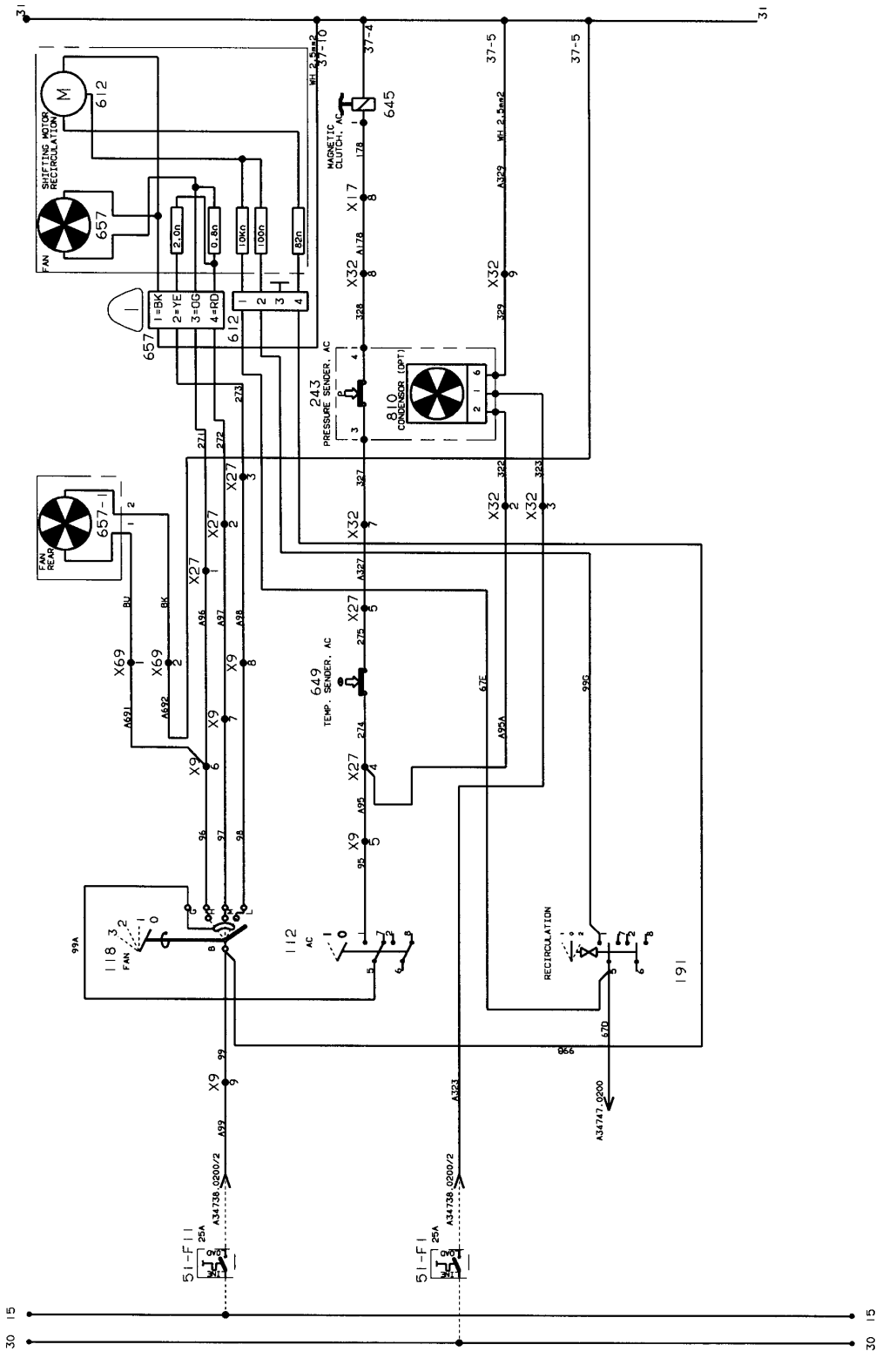


Figure 11. Wipers (A34741.0200).



350-1121

Figure 12. AC and Fan (A34742.0200).

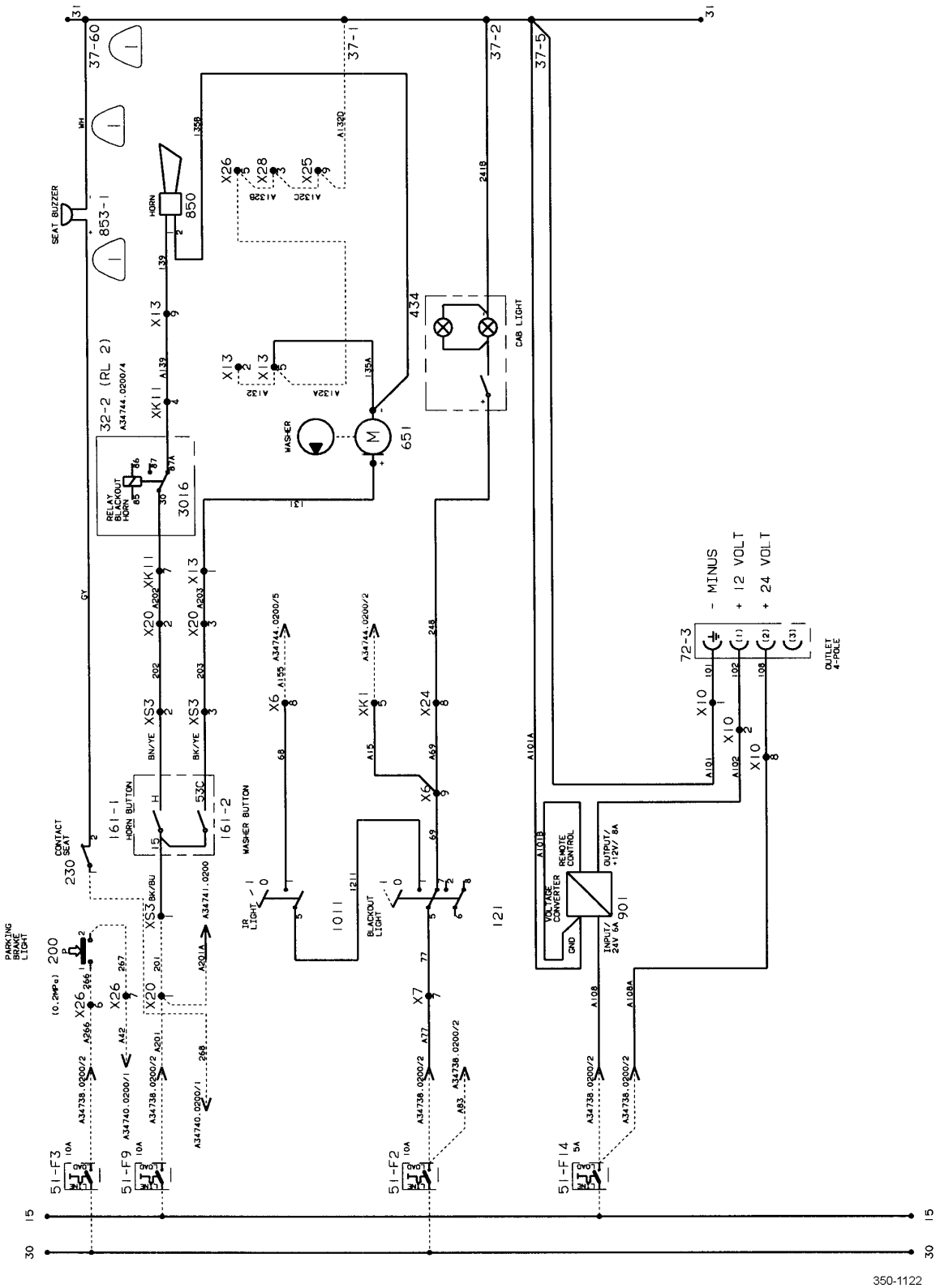


Figure 13. Cab (A34743.0200).

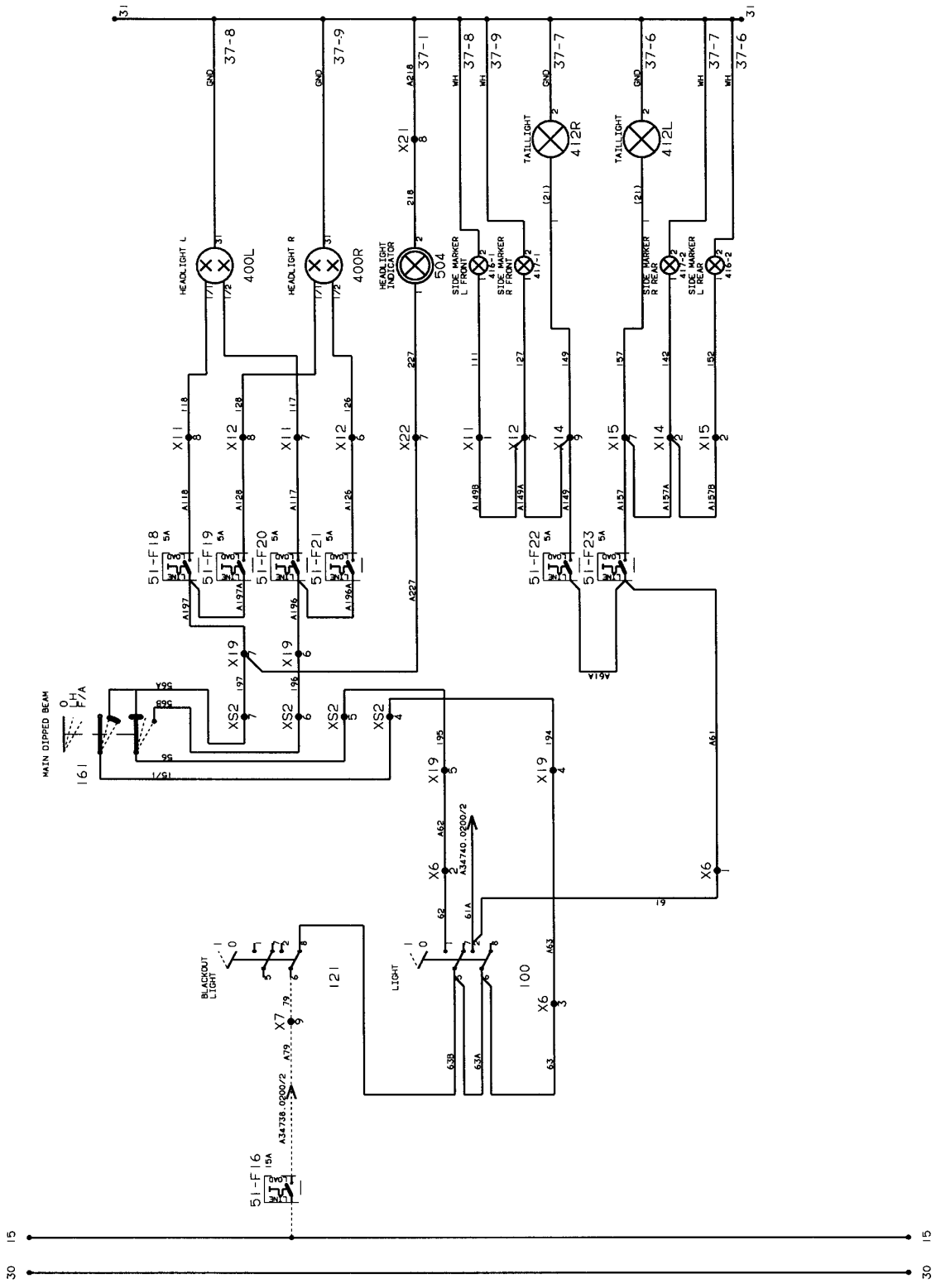
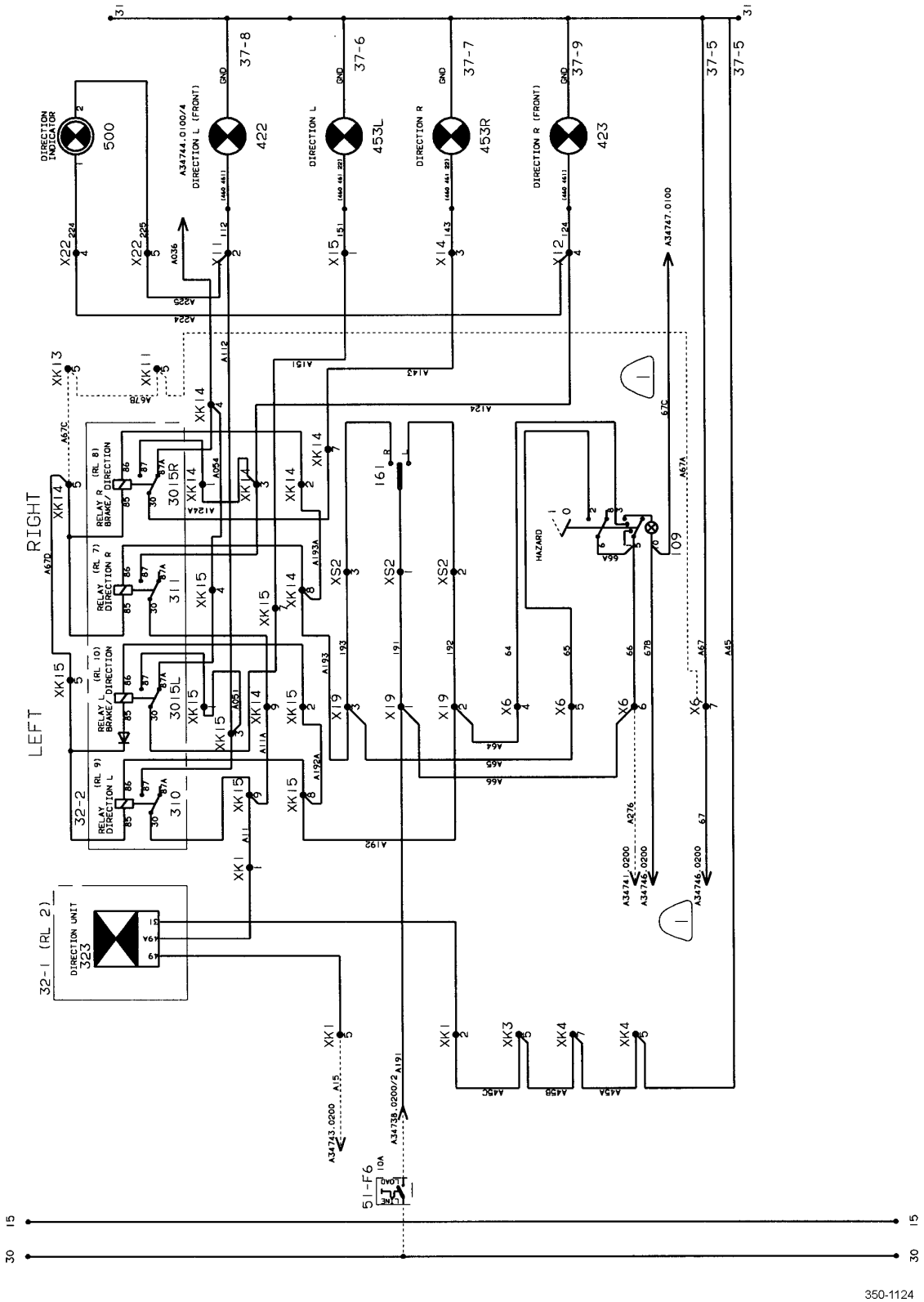


Figure 14. Lights (A34744.0200).



350-1124

Figure 14. Lights (A34744.0200) - Continued.

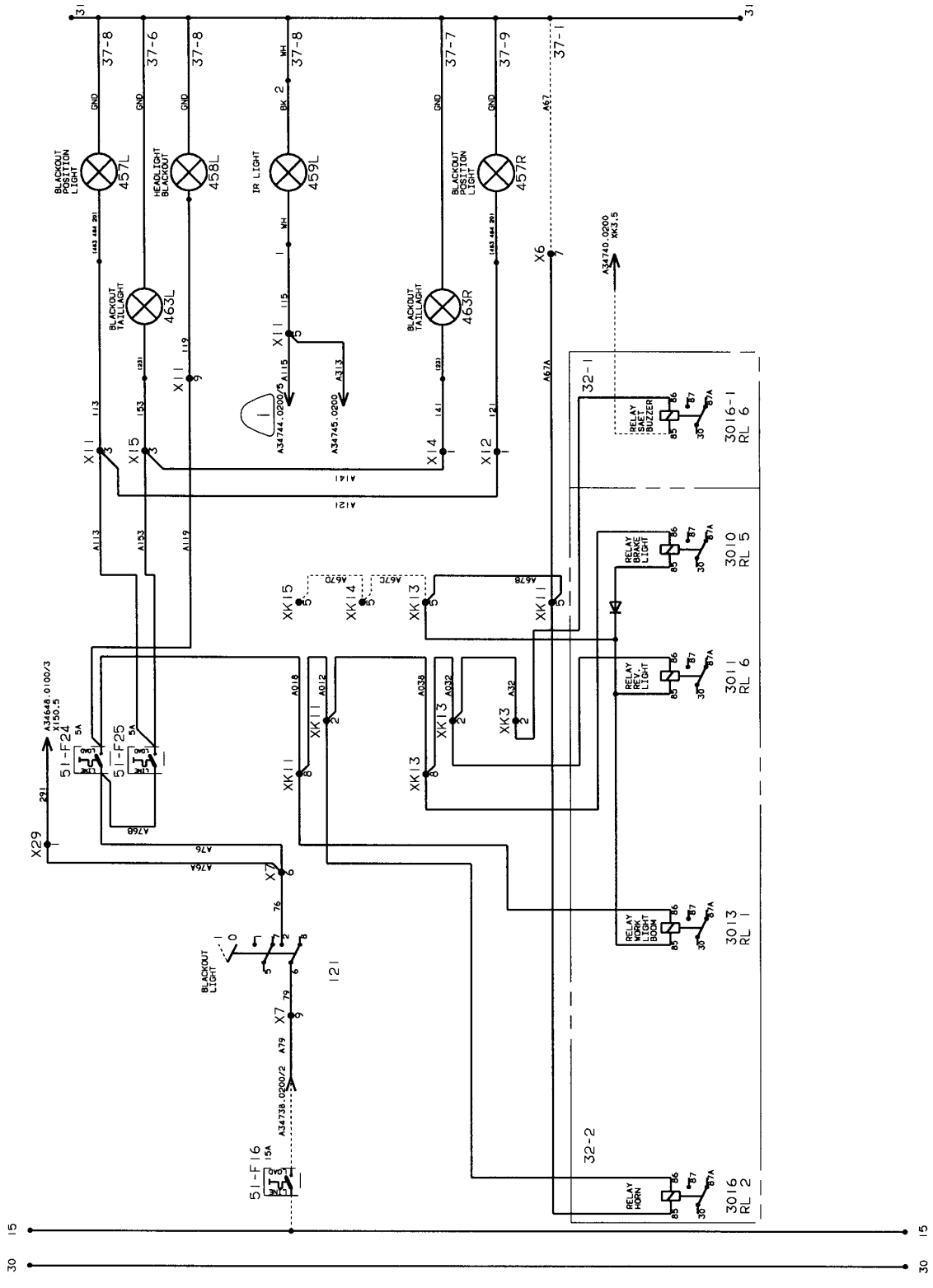
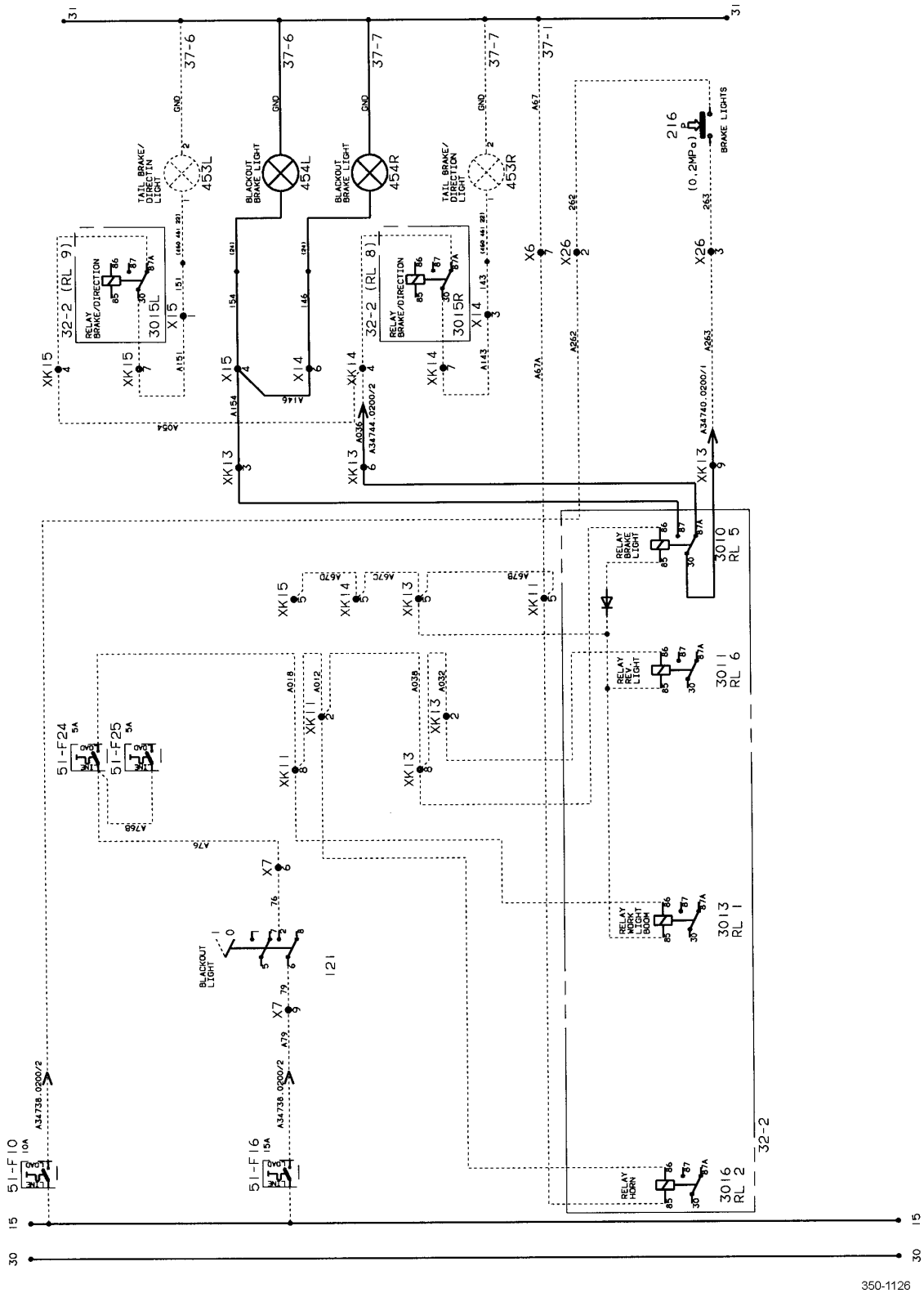
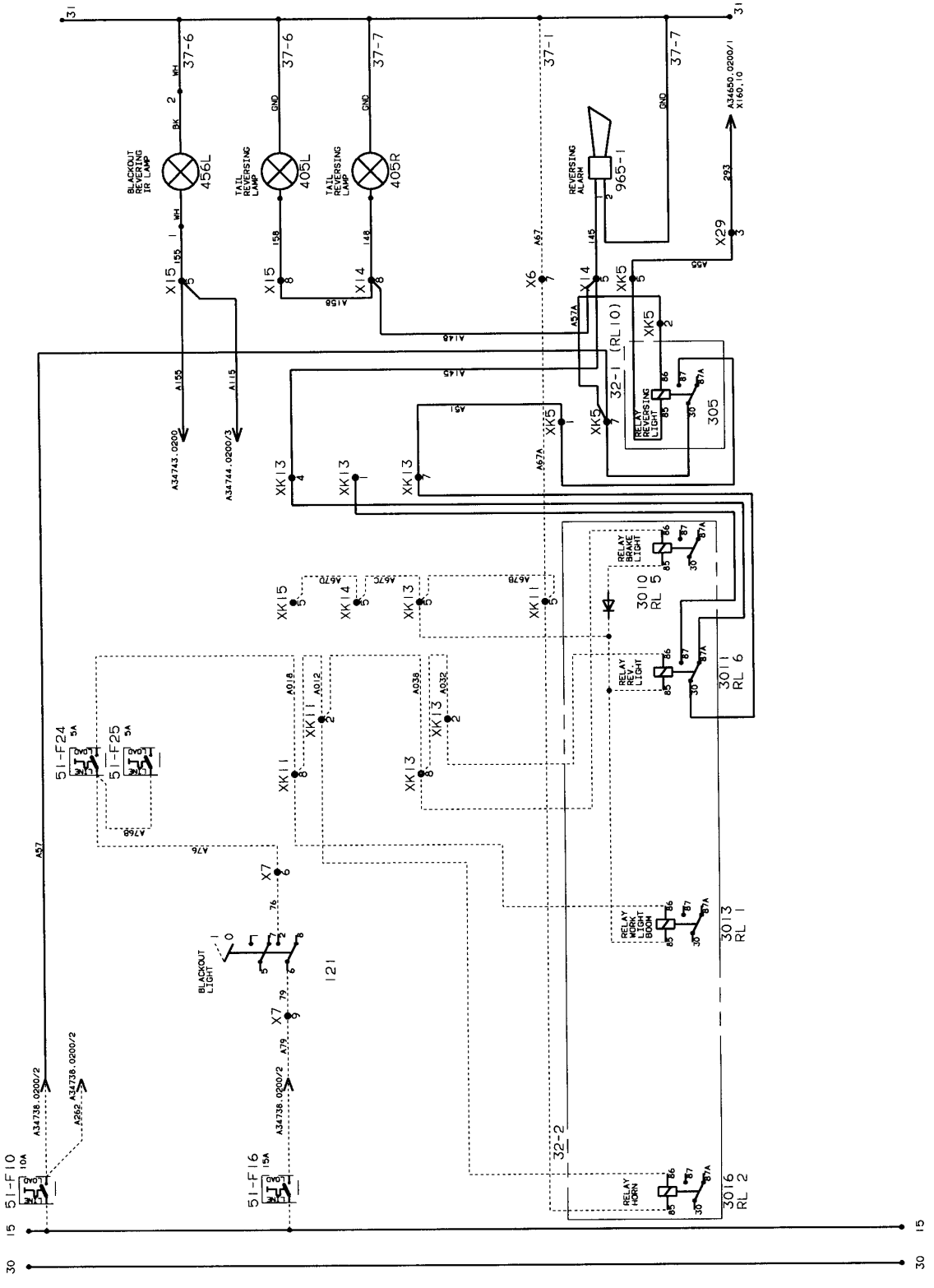


Figure 14. Lights (A34744.0200) - Continued.



350-1126

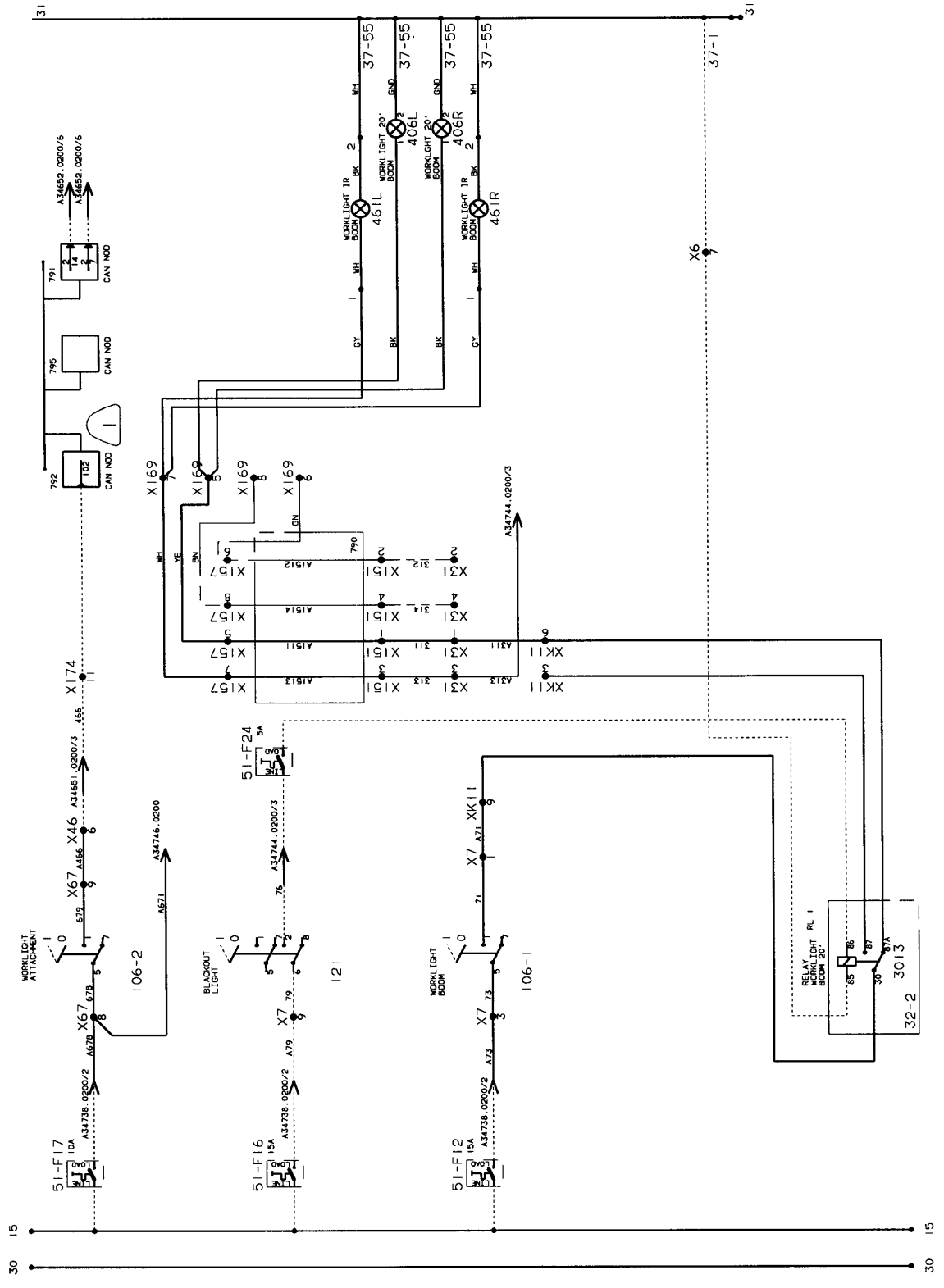
Figure 14. Lights (A34744.0200) - Continued.



350-1127

Figure 14. Lights (A34744.0200) - Continued.

DIAGRAMS - CONTINUED **0087 00**



350-1128

Figure 15. Worklights (A34745.0200).

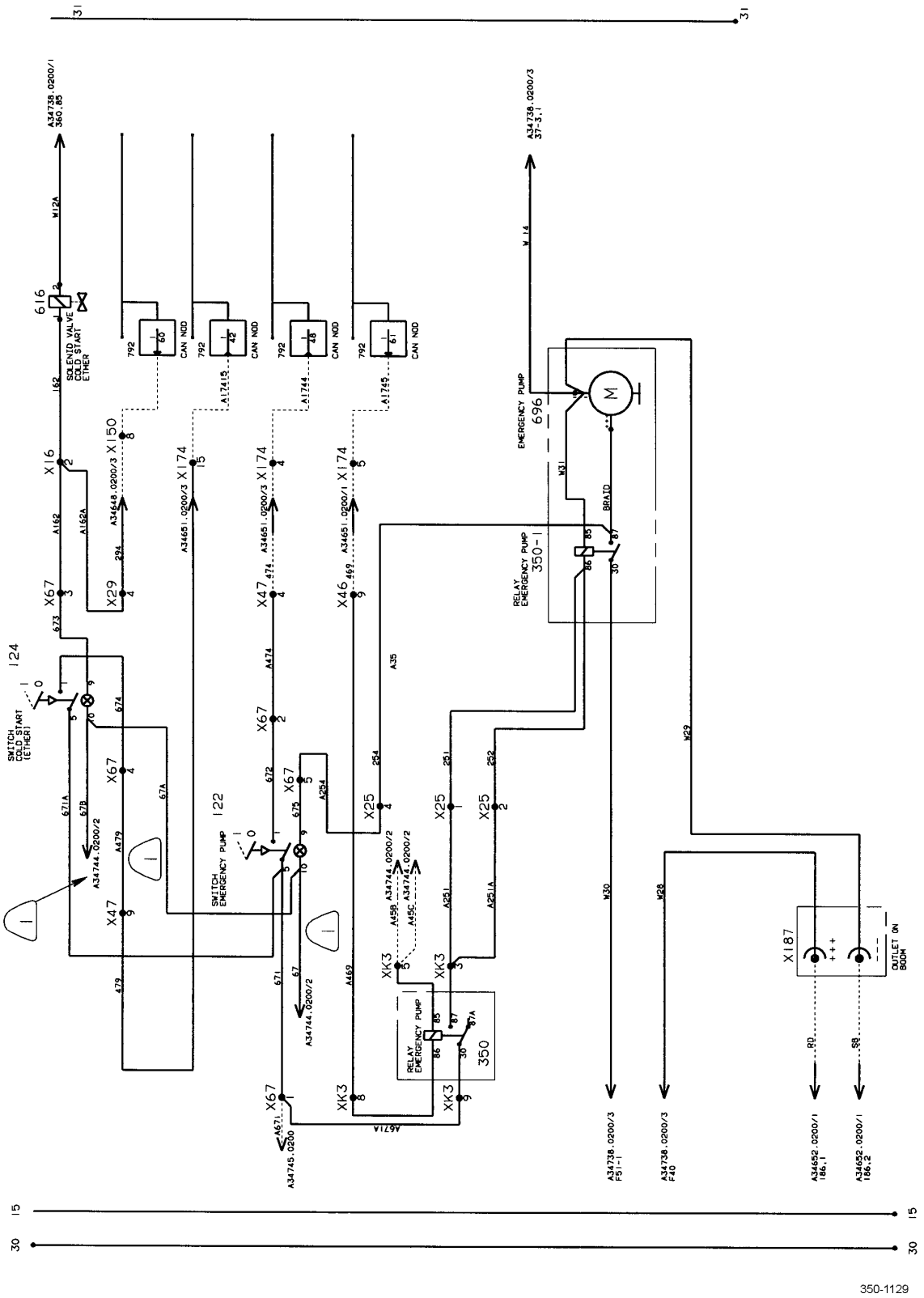


Figure 16. Auxiliary Pump (A34746.0200).

	51-F	Fuses	
Before Key	F1	25A	Condenser
	F2	10A	Courtesy Light, Flashing Relay, IR-Light
	F3	10A	Brake Pressure Sensor, Park-Brake Relay, Seat Buzzer, Inching
	F4	10A	Control Unit Engine
	F5	10A	Control Unit Engine
	F6	10A	Direction Indicator, Wiper Front Return Pulse, Arctic Switch Kit (Option)
After Key	F7	5A	Charging Indicator Lamp, Parking Brake Indicator Lamp, Fuel Gage
	F8	5A	Gear Shifting
	F9	10A	Intermittent Wiper Front, Wiper Front
	F10	10A	Brake Light Sensor, Reversing Light, Reversing Alarm
	F11	25A	AC Fan, Recirculation
	F12	15A	Worklight Boom
	F13	5A	Engine Brake - Down
	F14	5A	Voltage Converter 24V - 12V, Outlet 12V and 24V
	F15	10A	Wiper Motor Roof, Wiper Motor Rear, Interval Wiper
	F16	15A	Headlights, Blackout Lights, Instrument Lights
	F17	10A	Working Lights Attachment, Aux Elec Hydr Pump, Coldstart (Ether)
	F18	5A	Main Headlight Left
	F19	5A	Main Headlight Right
	F20	5A	Dipped Headlight Left
	F21	5A	Dipped Headlight Right
	F22	5A	Taillight Right, Side Marker Front
	F23	5A	Taillight Left, Side Marker Rear
	F24	5A	Blackout Relay, Blackout Left Front
	F25	5A	Blackout Right/Left Taillight and Blackout, Position, Light Front
	F26	5A	Control Unit Steering Output
Before Key	F27	10A	Control Unit Gearbox ECU
After Key	F28	10A	Control Unit Gearbox ECU
	F29	10A	Control Unit Steering SBC, Filter Indication, Water Level, Sensor Cab
	F30	15A	Control Unit El Servo ECS
	F31	5A	Display
	F32	5A	Control Unit El Servo ECS
Before Key	F33	20A	Arctic Kit (Option)
	F34	20A	Arctic Kit (Option)
	F41	10A	Control Unit Attachment (Tophandler)
	F42	10A	Transmitter
	F43	10A	Worklight Attachment (Tophandler)
	F50-1	50A	To Cab Fuse
	F50-2	50A	To Cab Main Relay
	F51-1	50A	Aux Elec. Hydraulic Pump
	F51-2	50A	Aux Elec. Hydraulic Pump
	F40	50A	Feeding Attachment (Tophandler)

Pos	Electric Circuit Name	ANT/No	RITN. Number
1	Circuit Current Supply	1-4	A34738.0200
2	Circuit Gear Shifting, Throttle	1	A34739.0200
3	Circuit, Sender Gage	1-2	A34740.0200
4	Wiper	1	A34741.0200
5	Circuit AC & Fan	1	A34742.0200
6	Circuit Cab	1	A34743.0200
7	Circuit, Light, Blackout	1-5	A34744.0200
8	Circuit, Worklight	1	A34745.0200
9	Circuit, Aux Hydr Pump, Coldstart	1	A34746.0200
10	Circuit, ECS Display-CAN-BU	1-3	A34647.0200
11	Circuit, ECS El Servo	1-5	A34648.0200
12	Circuit ECS Engine	1-2	A34649.0200
13	Circuit, Gearbox	1-4	A34650.0200
14	Circuit, Steering	1-7	A34651.0200
15	Circuit, ECS Attachment	1-6	A34652.0200
16	Circuit, Hydraulic	1-2	A34654.0200
17	Arctic Kit, Option	1	A34747.0200

	Number	Relay
32-1	RL 1	Reserved
	323	Turn Signal
	316	Wiper
	330	Starter Interlock
	350	Pump Control
	3016-1	Seat Buzzer
	RL 7	Reserved
	314	Parking Brake
	RL 9	Reserved
	305	Taillight
32-2	3013	Worklight Boom, STD B/O
	3016	Horn
	RL 3	Reserved
	330-1	Starter Interlock
	3010	Brake Light Changing STD B/O
	3011	Reversing, STD B/O
	311	Right Direction
	3015R	Turn Signal - Brake Lgt,Right
	3015L	Turn Signal - Brake Lgt, Left
	310	Left Direction
ELC	321-1	Intermittent Wiper
	321-2	Intermittent Wiper, Rear
	315	Ignition
ENG	360	Starting Solenoid
	Number	**Relay**
ELC Attachment	3009-1	Emergency Stop
	3009-2	Emergency Stop
	3009-3	Emergency Stop
	3017	Worklight Tophandler
	315-1	Starting Key
	350-1	Aux Ele Hydraulic Pump

350-1130

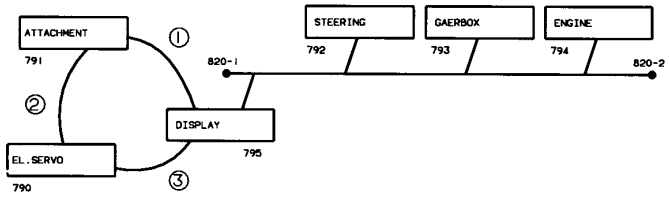
Figure 17. Information (A34749.0200).

DIAGRAMS - CONTINUED 0087 00

Number	Socket	No. of Pins
XK1-XK5	Sockets Printed Circuit Board	9
XK11-XK15	Sockets Printed Circuit Board	9
X6	Lamp Switch	9
X7	Lamp Switch	9
X8	Ignition Lock	9
X9	Wiper Switch	9
X10	Gauge, Voltage Converter 21-12V	9
X11	Lights, Left Front	9
X12	Lights, Right Front	9
X13	Horn, Washer, Wiper Rear	9
X14	Lights, Right Rear	9
X15	Lights, Left Front	9
X16	Throttle Pedal	9
X17	Alternator, AC Compressor, Starter	9
X18	Sender, Inching, Brake Pressure R-L	9
X19	Switch, Direction, Main Dipped	9
X20	Switch, Washer, Front Wiper, Horn	9
X21	Indicator Lamp	9
X22	Indicator Lamp	9
X23	Throttle Pedal	9
X24	Wiper, Roof Interior Light	9
X25	Fuel Transmitter, Relay Emergency Pump	9
X26	Seat Buzzer, Transmission, Parking Brake	9
X27	Fan, Wiper Motor, Front	9
X28	Gear Changing	9
X29	EI Servo X150	9
X30	EI Servo X150	9
X31	EI Servo X151	9
X32	Condenser, Temp Out	9
X33	Arctic Kit (Option)	9
X34	Arctic Kit (Option)	9
X46	Control Unit Gearbox X174	9
X47	Control Unit Gearbox X174	9
X67	Emergency Pump, Coldstart, W-Light Boom	9
X69	Rear Fan	9
X150	Distribution Unit	15
X151	Distribution Unit	15
X152	Display	15
X153	Steering Wheel Panel	15
X154	Emergency Stop	15
X155	Joystick Panel	15
X156	Temp Steering/Brake Cooling	15
X157	Boom	15
X158	Valves Boom	15
X159	Transmitter Cylinder	15
X160	Gear Changing	15
X161	CAN-BUS Attachment (Tophandler)	15
X170	Steering Rear Wheel	15
X171	Steering Front Wheel	15
X172	Gearbox	15
X173	Gearbox	15
X174	Distribution Unit	15
X175	Transmitter Cab	15
X176	Steering Force Simulator	15
X177	EI Servo	15
X178	Diagnose ZF	15
X179	CAN-BUS	15
X180	ECU Attachment	15
X181	Transmitter	14
X186-1	Current Supply	1
X186-2	Current Supply	1
X188	Valve Solenoid	14
X189	Valve Solenoid	14
X194	Worklight Attachment (Tophandler)	14
X195	Hydraulic Filter Indication	15
X196	Valve Solenoid Steering	15
X197	Valve Solenoid Steering	15
X198	Filter Indicator, Sensor Cab, Water Level, Temp Hyd, Valve Tilting Tower	15
X199	CAN - J1939	3
X200	Communication PC-ME	9
X201	Communication PC-ME	9

A37314.0200	Install Chassis
A37311.0200	Install Chassis ECS
A37313.0200	Install Cab ECS
A37312.0200	Install Boom ECS
A32685.0400	Install ELC
A36980.0200	Install ELC Attachment
A37401.0200	Install EL Servo
A37727.0200	Install Steering ECS
A38389.0200	Install Engine, TRA

Number	Earth Connections
37-1	Distribution Unit
37-2	Cab Roof
37-3	Frame, Batteries
37-4	Engine
37-5	Computers
37-6	Lights, Left Rear
37-7	Lights, Right Rear
37-8	Lights, Left Rear
37-9	Lights, Right Rear
37-10	Cab Floor AC
37-50-51	Servo
37-52	Steering ECS
37-54-55	Distribution Unit Attachment
37-60	Cab Floor Seat



BLOCK DIAGRAM, CAN-BUS

350-1142

Figure 17. Information (A34749.0200) - Continued.

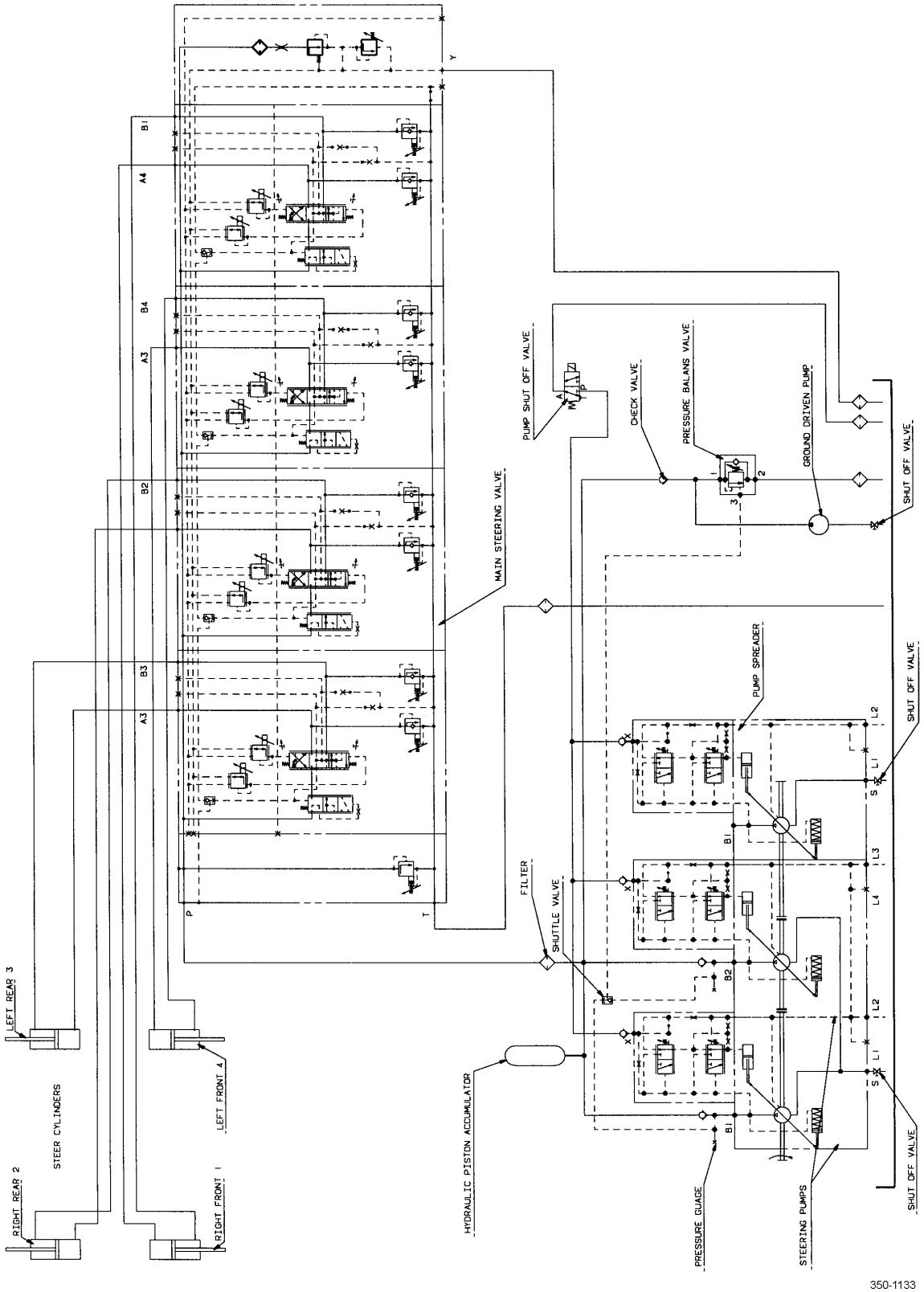


Figure 18. Steering System.

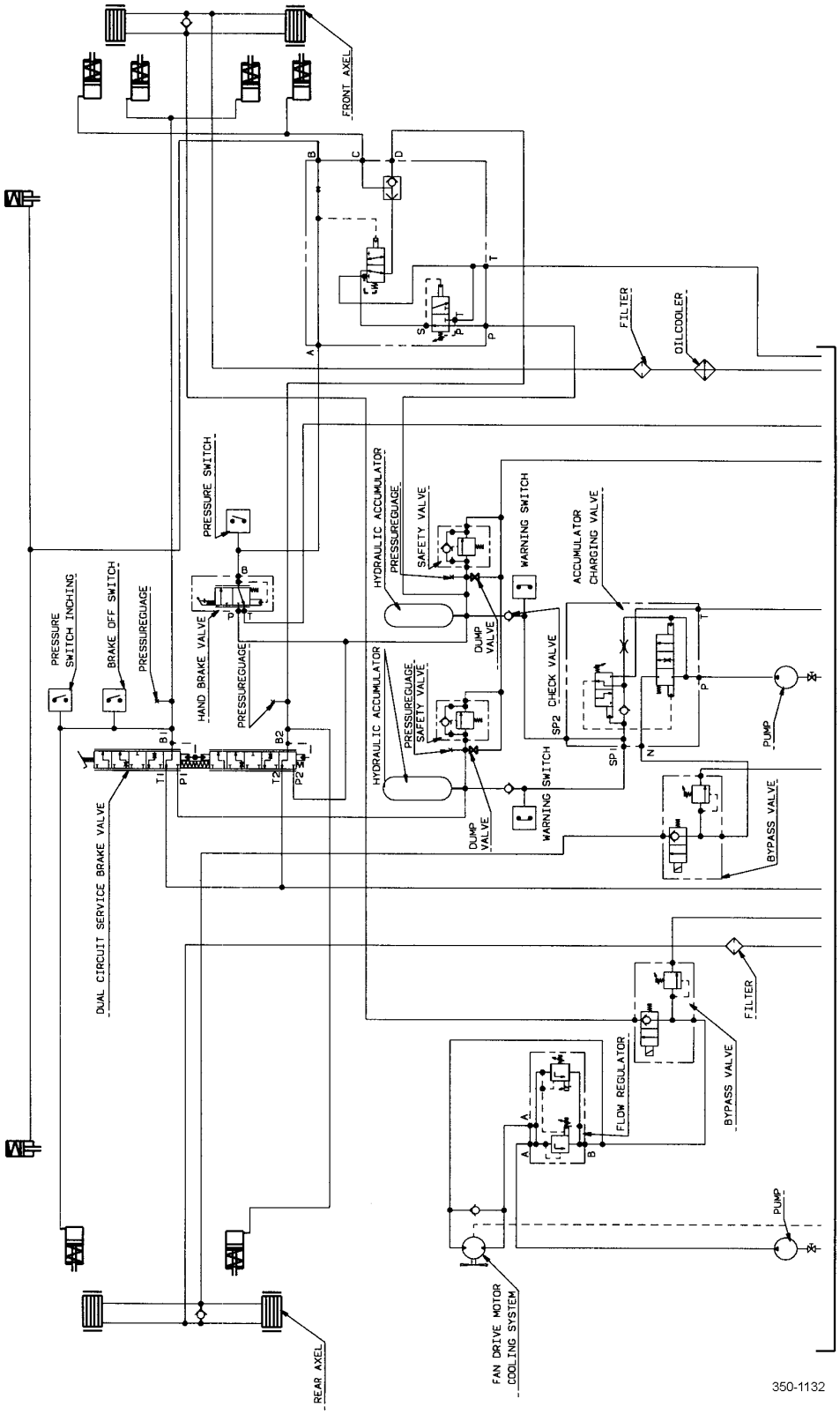


Figure 19. Brake System.

DIAGRAMS - CONTINUED **0087 00**

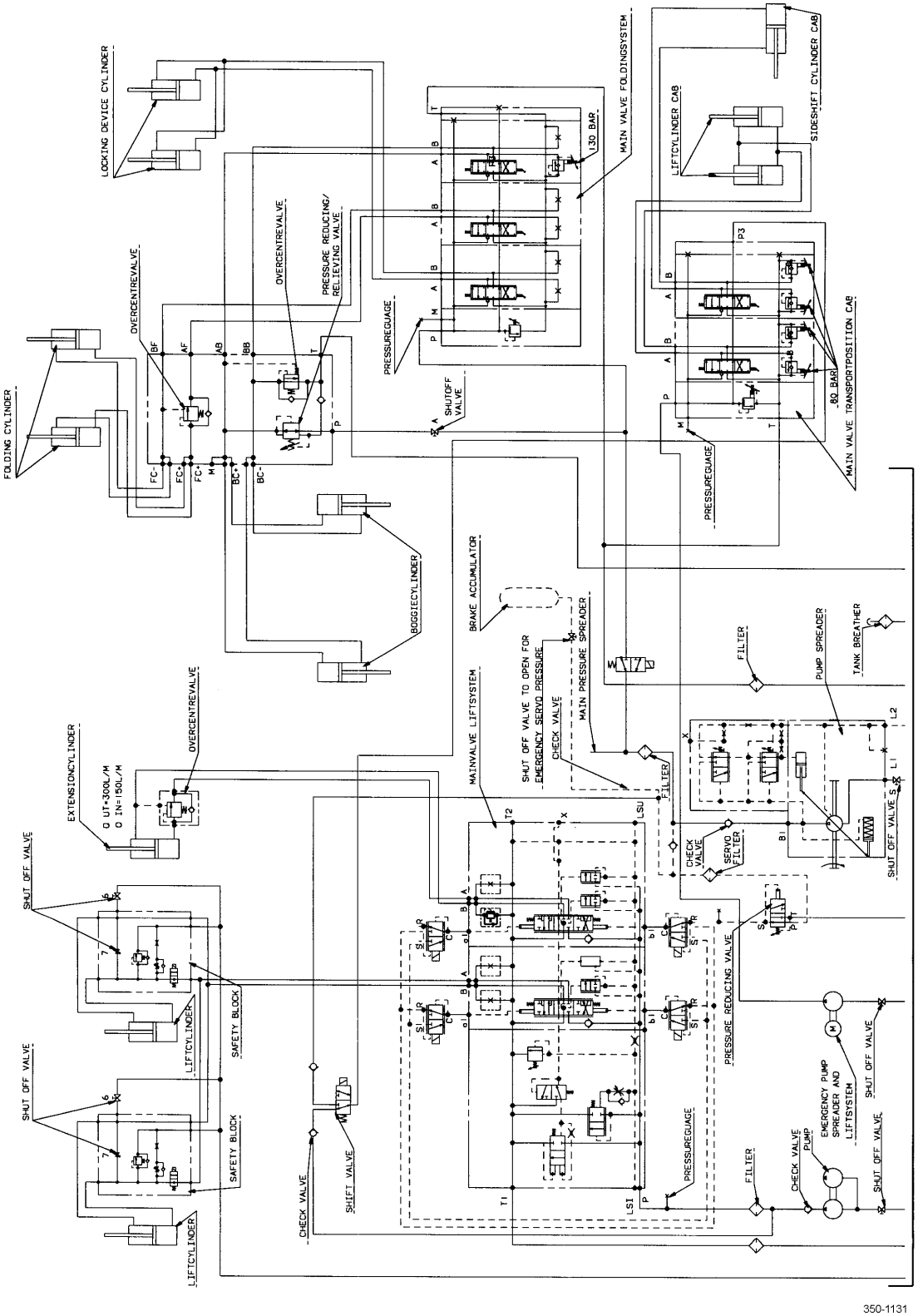


Figure 20. Main System.

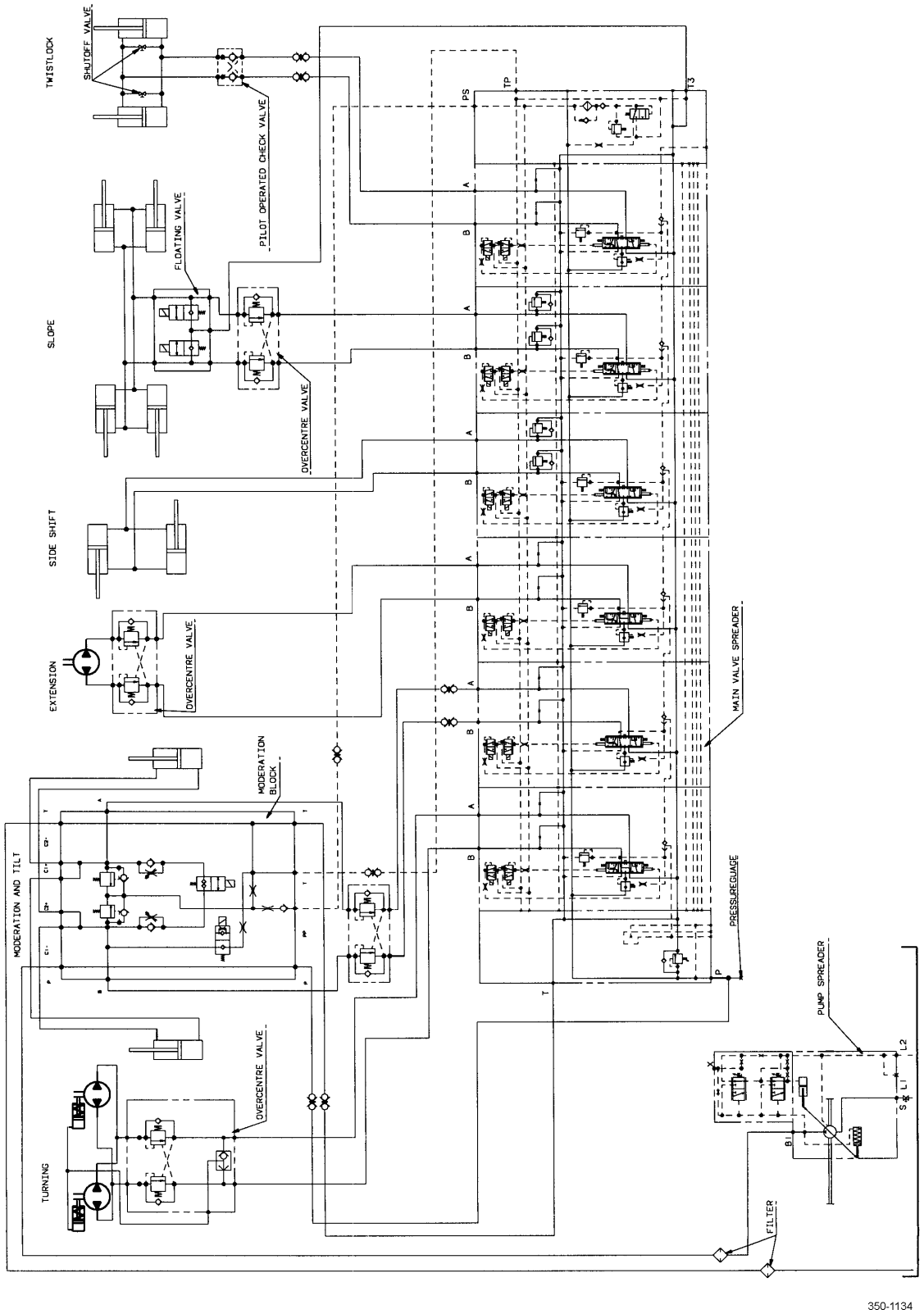


Figure 21. Spreader System.

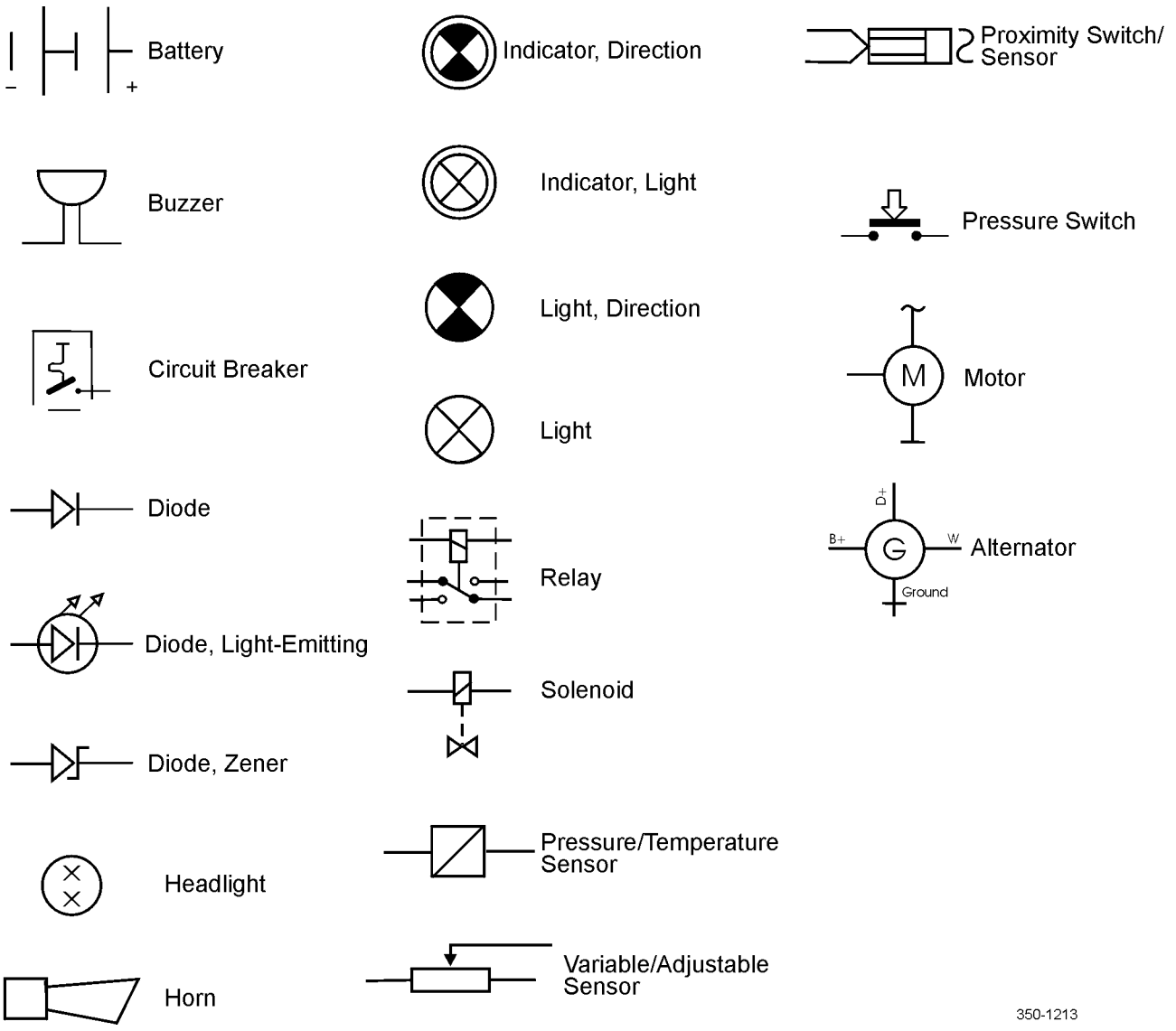


Figure 22. Electrical Symbols.

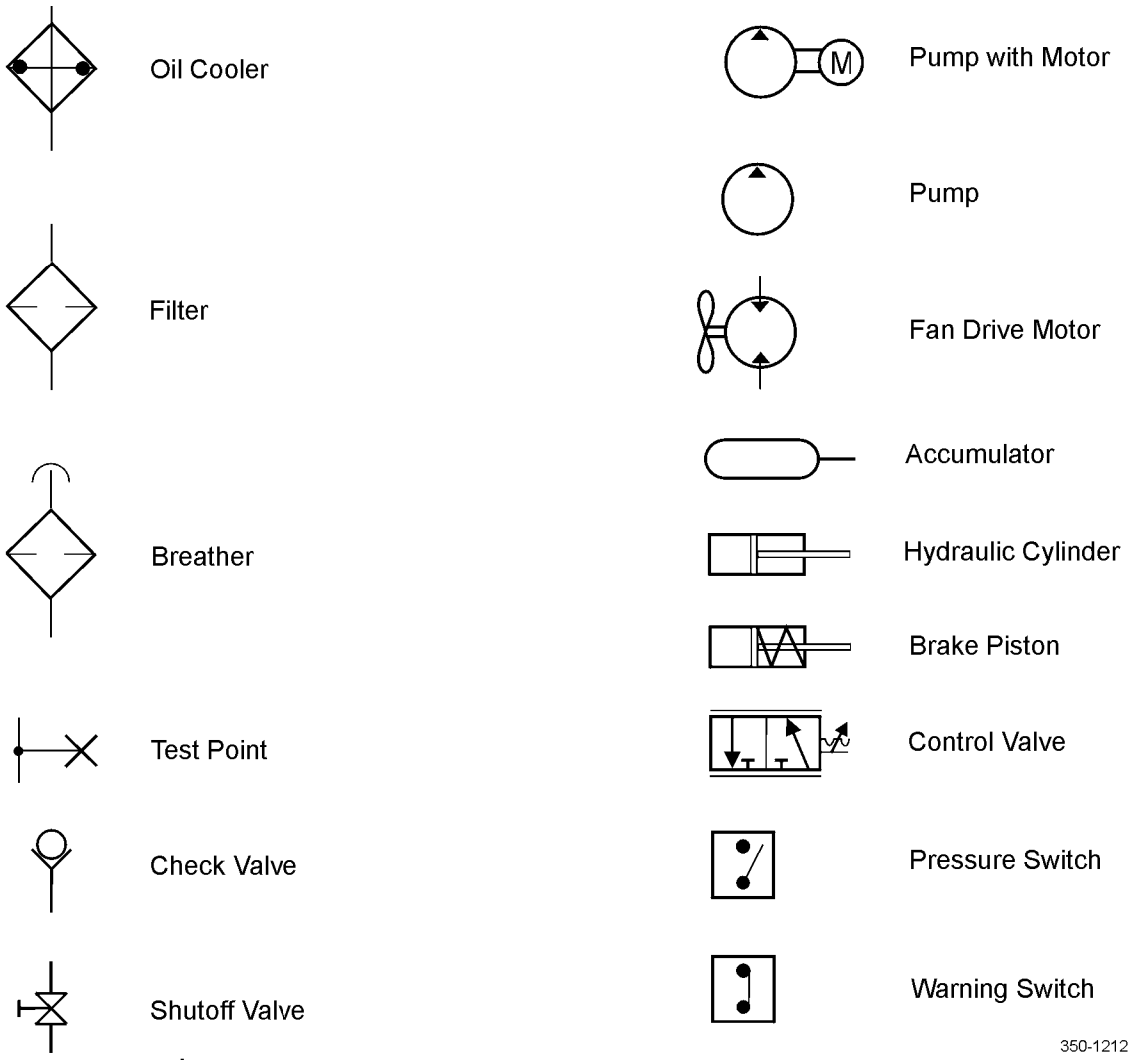


Figure 23. Hydraulic Symbols.

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CHAPTER 5
SUPPORTING INFORMATION

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REFERENCES 0088 00

SCOPE

This work package lists all forms, field manuals, technical bulletins, technical manuals, and other publications referenced in this manual and which apply to Direct and General Support Maintenance of the RTCH-RT 240.

PUBLICATIONS INDEXES

The following indexes should be consulted frequently for latest changes or revisions and for new publications relating to material covered in this technical manual.

Consolidated Index of Army Publications and Blank Forms . . . . . .DA Pam 25-30
Functional User's Manual for the Army Maintenance Management System . . . . . .DA Pam 738-750
U.S. Army Equipment Index of Modification Work Orders . . . . . .DA Pam 750-10

FORMS

Refer to DA Pam 738-750, *The Army Maintenance Management System (TAMMS)*, for instructions on the use of maintenance forms.

Equipment Inspection and Maintenance Worksheet . . . . . .DA Form 5988-E
Equipment Log Assembly (Records) . . . . . DA Form 2408
Maintenance Request Form . . . . . .DA Form 5990-E
Preventive Maintenance Schedule and Record . . . . . .DA Form 5986-E
Processing and Deprocessing Record for Shipment, Storage and Issue of Vehicles and Spare Engines . . . . . DD Form 1397
Product Quality Deficiency Report . . . . . SF Form 368
Recommended Changes to Equipment Technical Publications . . . . . DA Form 2028-2
Recommended Changes to Publications and Blank Forms . . . . . DA Form 2028
Report of Discrepancy (ROD) . . . . . SF Form 364
Request for AOAP . . . . . DD Form 2026, DA Form 5991-E

FIELD MANUALS

Basic Cold Weather Manual . . . . . .FM 31-70
Camouflage . . . . . .FM 5-20
Chemical, Biological, Radiological, and Nuclear Defense . . . . . .FM 21-40
First Aid for Soldiers . . . . . .FM 21-11
Northern Operations . . . . . .FM 31-71
Operation and Maintenance of Ordnance Material in Extreme Cold Weather (0°F to -65°F) . . . . . .FM 9-207

TECHNICAL BULLETINS AND SUPPLY BULLETINS

Color, Marking, and Camouflage Painting of Military Vehicles, Construction Equipment, and Materials Handling Equipment . . . . . TB 43-0209
Solder and Soldering . . . . . TB SIG 222
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems . . . . . TB 750-651
Warranty Bulletin for RT 240 RTCH . . . . . .TB 10-3930-675-14

TECHNICAL MANUALS

Chemical, Biological, Radiological, and Nuclear Defense . . . . . TM 3-220
Cooling Systems: Tactical Vehicles . . . . . TM 750-254
Inspection, Care, and Maintenance of Antifriction Bearings . . . . . TM 9-214

REFERENCES - CONTINUED 0088 00

TECHNICAL MANUALS - CONTINUED

Materials Used for Cleaning, Preserving, Abrading and Cementing Ordnance Materiel and Related Materials, Including Chemicals . . . . . TM 9-247

Operator's, Unit, Direct Support and General Maintenance Manual for Care, Maintenance, Repair and Inspection of Pneumatic Tires and Inner Tubes . . . . . TM 9-2610-200-14

Operator's, Organizational, Direct Support, and General Support Maintenance Manual for Lead-Acid Storage Batteries . . . . . TM 9-6140-200-14

Operator's Manual for RT 240 RTCH. . . . . TM 10-3930-675-10

Operator's Manual for Welding Theory and Application . . . . . TM 9-237

Organizational Maintenance Manual for RT 240 RTCH . . . . . TM 10-3930-675-20

Painting Instruction for Field Use . . . . . TM 43-0139

Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use. . . . . TM 750-244-6

Repair Parts and Special Tools Lists for RT 240 RTCH . . . . . TM 9-2320-302-24P

OTHER PUBLICATIONS

Abbreviations and Acronyms . . . . . ASME Y14.38-1999

Army Medical Department Expendable/Durable Items . . . . . CTA 8-100

Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items . . . . . CTA 50-970

Lubrication Order for RT 240 RTCH . . . . . LO 10-3930-675-12

EXPENDABLE AND DURABLE ITEMS LIST 0089 00

SCOPE

This work package lists expendable and durable items you will need to maintain the M412 RTCH. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, *Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items)*, or CTA 8-100, *Army Medical Department Expendable/Durable Items*.

EXPLANATION OF COLUMNS

1. **Column (1) - Item Number.** This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item [e.g., Use abrasive pad (Item 1, WP 0089 00)].
2. **Column (2) - Level.** This column identifies the lowest level of maintenance that requires the listed item.

   F- Direct Support Maintenance

   H- General Support Maintenance
3. **Column (3) - National Stock Number (NSN).** This is the NSN assigned to the item which you can use to requisition it.
4. **Column (4) - Description, Item Name, Commercial and Government Entity Code (CAGEC), and Part Number (P/N).** This provides the other information you need to identify the item.
5. **Column (5) - Unit of Measure (U/M).** This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Table 1. Expendable and Durable Items List.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
1	F		ABRASIVE PAD (15434) 3823258	EA
2	F		ANTIFREEZE: Permanent, Ethylene Glycol, Inhibited (81349) MILA46153	
		6850-00-181-7929	1 Gallon Bottle	GA
		6850-00-181-7933	5 Gallon Can	GAL
		6850-00-181-7940	55 Gallon Drum	GAL
3	F	5340-00-450-5718	CAP SET, PROTECTIVE: Dust and Moisture Seal (19207) 10935405	EA
4	F		COMPOUND: Antiseize (05972) 76764	
		8030-00-251-3980	1 Pound Can	LB
5	F		COMPOUND: Antiseize, High Temperature (73165) 51008	
		8030-00-597-5367	2.5 Pound Can	LB
6	F		COMPOUND: Gasket Forming, Silicone, 13 Oz Cartridge (05972) 77C	OZ
7	F		COMPOUND: Gasket Forming, High Tack (77247) 98D	
		5330-00-151-6659	1 Pint Can	
8	F		COMPOUND: Sealing (81349) MIL-S-46163	
		8030-00-111-2763	10 cc Bottle, Box of 10 Bottles	CC
		8030-00-111-2762	50 cc Bottle	CC
9	F		COMPOUND: Sealing, Dissimilar Metal Protection (71961) 6099	
		8030-01-392-3276	1 Gallon Can	GAL
10	F		DETERGENT: General Purpose, Liquid (81348) P-D-220	
		7930-00-282-9699	1 Gallon Can	GAL
11	F		FLUX: Soldering (58536) A-A-51145TY1 FORM A	
		3439-00-255-9935	1 Pound Can	LB

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
12	F		FUEL: Diesel, DF-2 Grade (81346) ASTM D 975	
		9140-00-286-5294	Bulk	GAL
		9140-00-286-5295	5 Gallon Can	GAL
		9140-00-286-5296	55 Gallon Drum	GAL
13	F		GREASE: Automotive and Artillery, GAA	
		9150-01-197-7688	(81349) M-10924-A 1-1/4 Ounce Tube	OZ
		9150-01-197-7693	(81349) M-10924-B 14 Ounce Cartridge	OZ
		9150-01-197-7690	(81349) M-10924-C 2-1/4 Pound Can	LB
		9150-01-197-7692	(81349) M-10924-E 35 Pound Can	LB
14	F	9150-01-361-8919	GREASE: Electrically Conductive (47224) 5190179	OZ
15	F	7050-00-961-7663	LUBRIPLATE: Lubricant (90536) ST40334	OZ
16	F		OIL: Cutting (77247) 22F	
		9150-00-825-6131	1 Gallon Can	GAL
17	F		OIL: Lubricating, GO 80W/90 (81349) MIL-PRF-2105	
		9150-01-035-5392	1 Quart Can	QT
		9150-01-313-2191	1 Gallon Can	GAL
		9150-00-001-9395	5 Gallon Can	GAL
		9150-01-035-5394	55 Gallon Drum	GAL
18	F		OIL: Lubricating, GO 85W/140 (81349) MIL-PRF-2105	
		9150-01-048-4591	1 Quart Can	QT
		9150-01-035-5395	5 Gallon Can	GAL
		9150-01-035-5396	55 Gallon Drum	GAL
19	F		OIL: Lubricating, OE/HDO 10 (81349) MIL-L-2104	
		9150-00-189-6727	1 Quart Can	QT
		9150-00-186-6668	5 Gallon Can	GAL
		9150-00-191-2772	55 Gallon Drum	GAL

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
20	F		OIL: Lubricating, OE/HDO 15/40 (81349) MIL-L-2104	
		9150-01-152-4117	1 Quart Can	QT
		9150-01-152-4118	5 Gallon Can	GAL
		9150-01-152-4119	55 Gallon Drum	GAL
21	F		OIL: Lubricating, OEA, Arctic (81349) MIL-L-46167	
		9150-00-402-4478	1 Quart Can	QT
		9150-00-402-2372	5 Gallon Can	GAL
		9150-00-491-7197	55 Gallon Drum	GAL
22	F	9150-01-410-8972	OIL: Lubricating, Refrigerant Compressor, Synthetic Ester (59595) CAPELLA HFG-68NA	
		9150-01-410-8972	1 Quart Can	QT
23	F		RAG: Wiping (64067) 7920-00-205-1711	
		7920-00-205-1711	50 Pound Bale	LB
24	F		SEALANT (15434) 3824038	OZ
25	F		SEALANT: Cup Plug (15434) 3375068	OZ
26	F		SEALANT: Pipe (15434) 3375066	OZ
27	F		SEALANT: Silicone (15434) 3823494	OZ
28	F		SOLDER: Lead-Tin Alloy, Rosin Core (15434) 3823494	
		3439-00-555-4629	1 Pound Spool	LB
29	F		SOLVENT: Dry Cleaning, Type III (81348) P-D-680	
		6850-01-377-1808	1 Quart Container	QT
		6850-01-331-3349	5 Gallon Can	GAL
		6850-01-331-3350	55 Gallon Drum	GAL

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
30	F		STRAP: Tiedown, Electrical	
		5975-00-903-2284	(96906) MS3367-4-0 4 Inch Length, Black Package of 100	EA
		5975-00-984-6582	(96906) MS3367-1-0 6 Inch Length, Black Package of 100	EA
		5975-00-935-5946	(96906) MS3367-2-1 13 Inch Length, Brown Package of 100	EA
31	F		TAG: Marker (64067) 9905-00-537-8954	
		9905-00-537-8954	Pack of 50	EA
32	F		TETRAFLUOROETHANE: Technical Refrigerant, R-134A (4V886) R134A	
		6830-01-439-0614	43 Pound Cylinder	LB
33	F	8305-01-301-1031	WIPES: Lint-Free (28480) 92193W	EA
34	F		WIRE: Nonelectrical (81346) ASTM A641	
		9905-00-596-0191	5 Pound Coil	LB

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TOOL IDENTIFICATION LIST 0090 00

SCOPE

This work package lists all common tools and supplements and special tools/fixtures needed to maintain the RT 240 RTCH.

EXPLANATION OF COLUMNS IN THE TOOL IDENTIFICATION LIST

1. **Column (1) - Item Number (No.).** This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., Tool kit, general mechanic's, Item 93, WP 0090 00).
2. **Column (2) - Item Name.** This column lists the item by noun nomenclature and other descriptive features (e.g., Barring tool, engine).
3. **Column (3) - National Stock Number.** This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.
4. **Column (4) - Part Number/CAGEC.** Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. The manufacturer's Commercial and Government Entity Code (CAGEC) is also included.
5. **Column (5) - Reference.** This column identifies the authorizing supply catalog or RPSTL for items listed in this work package.

TOOL IDENTIFICATION LIST

Table 1. Tool Identification List.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
1	Adapter, Wrench, Torque		3163196 (15434)	TM 10-3930-675-24P
2	Adjustment Kit, Injector	4910-00-548-7984	3823610 (15434)	TM 10-3930-675-24P
3	Alinement Plate, Flywheel Housing		3376606 (15434)	TM 10-3930-675-24P
4	Attachment, Dial	4910-01-097-6972	ST-1325 (15434)	TM 10-3930-675-24P
5	Barring Tool, Engine		3824270 (15434)	TM 10-3930-675-24P
6	Bearing Kit, Needle		3823774 (15434)	TM 10-3930-675-24P
7	Bracket, Lifting, Cylinder Head		3822479 (15434)	TM 10-3930-675-24P
8	Caliper, Inside: Firm joint, 12 in size	5210-00-189-9640	27-12 (57163)	
9	Caliper, Micrometer, Inside: 2-12 in range	5210-00-221-1921	124BZ (57163)	SC 4910-95-A31
10	Caliper, Micrometer, Outside: 0-1 in range	5210-00-540-2973	T230RL (57163)	
11	Caliper, Vernier: English and metric measurements, 0-6 in and 1-150 mm	5210-01-113-1548	GGG-C-111 (81348)	SC 4910-95-A31
12	Chain Assembly, Single Leg: 14 feet long	4010-00-171-4426	R-R-C-271 (81348)	
13	Compressor, Piston Ring		3823309 (15434)	TM 10-3930-675-24P
14	Compressor, Valve Spring	5120-01-145-7293	ST-448 (15434)	TM 10-3930-675-24P
15	Dispenser, Sealant	5120-00-061-1283	45RCT (88736)	SC 4910-95-A31
16	Drill Set, Twist	5133-00-293-0983	800434 (19203)	SC 4910-95-A31
17	Drill, Electric, Portable: 3/8 in size	5130-00-935-7354	6635 (55111)	SC 4910-95-A31
18	Driver		3376070 (15434)	TM 10-3930-675-24P
19	Driver, Expansion Plug	4910-01-143-3337	3376816 (15434)	TM 10-3930-675-24P
20	Driver, Expansion Plug		3822372 (15434)	TM 10-3930-675-24P
21	Driver, Gear, Fuel Pump		3823581 (15434)	TM 10-3930-675-24P
22	Driver, Injector Sleeve	5120-00-981-3108	ST-1227 (15434)	TM 10-3930-675-24P
23	Expander, Piston Ring		ST-821 (15434)	TM 10-3930-675-24P
24	Expander, Tube	3441-00-922-6699	ST880 (15434)	TM 10-3930-675-24P
25	Extractor, Dowel Pin		ST1134 (15434)	TM 10-3930-675-24P
26	Extractor, Valve Seat		3376146 (15434)	TM 10-3930-675-24P
27	Fixture, Engine Lifting		3162871 (15434)	TM 10-3930-675-24P

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
28	Gage, Capscrew, Cylinder Head		3823546 (15434)	TM 10-3930-675-24P
29	Gage, Depth	4910-00-238-9957	ST-537 (15434)	TM 10-3930-675-24P
30	Gage, Depth, Dial Indicating	5210-01-157-3091	3823495 (15434)	TM 10-3930-675-24P
31	Gage, Depth, Micrometer: 0-6 in range	5210-00-619-4045	52-225-015 (1E258)	
32	Gage, Master Ring		3376576 (15434)	TM 10-3930-675-24P
33	Gage, Pressure, Dial Indicating	6620-01-382-1206	3375275 (15434)	TM 10-3930-675-24P
34	Gage, Thickness: 0.051-1.00 mm	5210-01-045-3526	66MA (57163)	SC 4910-95-A31
35	Gage, Tire Pressure	4910-00-204-3170	7188BH (27783)	SC 4910-95-A31
36	Gloves, Chemical and Oil Protective: Rubber	8415-00-641-4601	ZZ-G-381 (81348)	SC 4910-95-A31
37	Gloves, Welders': Leather	8415-00-268-7859	A-A-50022 (58536)	SC 4910-95-A31
38	Goggles, Industrial	4240-00-816-3819	WA60-5H0746-0315 (74936)	SC 4910-95-A31
39	Guide		3376069 (15434)	TM 10-3930-675-24P
40	Guide, Camshaft Pilot		3376388 (15434)	TM 10-3930-675-24P
41	Handle, Socket Wrench	5120-00-709-4072	L52BH (55719)	SC 4910-95-A31
42	Hammer, Hand, Plastic	5120-01-065-2211	57-534 (61711)	SC 4910-95-A31
43	Hammer, Slide, Mechanical	5120-00-313-9498	4056H (93389)	SC 4910-95-A31
44	Holding Tool, Injector Sleeve	5120-00-104-1795	ST1179 (15434)	TM 10-3930-675-24P
45	Indicator, Dial	5210-01-157-2291	3376050 (15434)	TM 10-3930-675-24P
46	Insert Kit, Valve Seat	4910-00-345-3708	ST-257 (15434)	TM 10-3930-675-24P
47	Inserter, Bearing and Bushing	5120-01-156-6186	3376637 (15434)	TM 10-3930-675-24P
48	Installation Tool, Needle Bearing		3824117 (15434)	TM 10-3930-675-24P
49	Installation Tool, Seal, Valve		3823946 (15434)	TM 10-3930-675-24P
50	Installation/Removal Tool, Cam Follower		3824519 (15434)	TM 10-3930-675-24P
51	Jack Kit, Hydraulic, Hand: 20 ton capacity	5120-00-595-8387	A-A-312 (58536)	SC 4910-95-A31
52	Kit, Dye	4820-01-446-7489	3376891 (15434)	TM 10-3930-675-24P
53	Kit, Nitrogen Charging	1025-01-070-3200	8449334 (19200)	TM 10-3930-675-24P
54	Liner/Installation Tool		3824272 (15434)	TM 10-3930-675-24P
55	Multimeter, Digital	6625-01-265-6000	27FM W/ACCE (89536)	SC 4910-95-A31
56	Multiplier, Torque Wrench	5120-00-169-2986	PD1201 (92059)	SC 4910-95-A31

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
57	Pan, Drain: 4 gallon capacity	4910-00-387-9592	450 (05463)	SC 4910-95-A31
58	Pin Kit, Guide		3376695 (15434)	TM 10-3930-675-24P
59	Pin, Guide		3376488 (15434)	TM 10-3930-675-24P
60	Pins, Guide, Connecting Rod		3376038 (15434)	TM 10-3930-675-24P
61	Plate, Adapter, Engine Stand		3376432 (15434)	TM 10-3930-675-24P
62	Pliers, Retaining Ring: External, 0.038-1.000 in diameter	5120-00-288-9717	0200 (79136)	SC 4910-95-A31
63	Pliers, Retaining Ring: Internal, 1.02-1.37 ring size	5120-00-293-0048	0100 (79136)	SC 4910-95-A31
64	Pliers, Retaining Ring: Internal, 1.75-2 in ring size	5120-00-293-0045	0300 (79136)	SC 4910-95-A31
65	Press, Arbor: Hand operated	3444-00-449-7295	A-A-51194 (80244)	SC 4910-95-A31
66	Puller and Driver, Injector		3823579 (15434)	TM 10-3930-675-24P
67	Puller Kit, Cam Gear		3162895 (15434)	TM 10-3930-675-24P
68	Puller Kit, Camshaft Gear		3824106 (15434)	TM 10-3930-675-24P
69	Puller Kit, Universal	5180-01-104-2762	3375784 (15434)	TM 10-3930-675-24P
70	Puller Kit, Universal	5180-01-178-5332	3375840 (15434)	TM 10-3930-675-24P
71	Puller Kit, Universal	5180-00-313-9496	1178 (45225)	SC 4910-95-A31
72	Puller, Cylinder Liner		3375629 (15434)	TM 10-3930-675-24P
73	Puller, Main Bearing Cap	5120-01-141-5779	ST-1178 (15434)	TM 10-3930-675-24P
74	Puller, Mechanical	5120-01-331-6468	3375082 (15434)	TM 10-3930-675-24P
75	Puller, Mechanical	5120-00-113-5271	3377079 (15434)	TM 10-3930-675-24P
76	Reclaimer, Refrigerant, R134A	4250-01-396-8928	EEEAC304A (55719)	
77	Removal Tool, Valve Guide		3376398 (15434)	TM 10-3930-675-24P
78	Riveter, Blind, Hand: 3/32 in, 1/8 in, 5/32 in, and 3/16 in diameters	5120-00-017-2849	98 (54402)	
79	Screwdriver Set, Jeweler's	5120-00-288-8739	250 (33164)	
80	Separator Tool, Bearing	5120-01-128-2674	3375326 (15434)	TM 10-3930-675-24P
81	Shackle, Lifting	4030-00-169-9298	358T1 1-2 (39428)	
82	Sling, Endless	3940-01-183-9412	3375957 (15434)	TM 10-3930-675-24P
83	Sling, Engine and Transmission	4910-01-243-5556	DFP-188 (59678)	SC 4910-95-A31
84	Sling, Eye	3940-01-334-0749	EE1-202 (23755)	
85	Sling, Nylon	2835-01-078-2081	4-8FTX2IN (91796)	

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
86	Socket, Socket Wrench: 46 mm	5130-01-113-1565	IMM462 (55719)	SC 4910-95-A31
87	Stand, Engine Rebuild	4910-01-128-2686	3375194 (15434)	TM 10-3930-675-24P
88	Stand, Engine Support		3376057 (15434)	TM 10-3930-675-24P
89	Tape, Measuring: 50 feet long	5210-00-234-6745	C213 (37163)	SC 4910-95-A31
90	Test Kit, Pressure, Lubricating Oil Cooler		3376861 (15434)	TM 10-3930-675-24P
91	Tester, Valve Spring	4910-01-142-4929	3375182 (15434)	TM 10-3930-675-24P
92	Tool Kit, Electrical Connector Repair	5180-00-876-9336	7550526 (19204)	SC 4910-95-A31
93	Tool Kit, General Mechanic's: Automotive	5180-00-177-7033	SC5180-90-N26 (50980)	SC 5180-95-N26
94	Trestle, Hoist, Portable: 7 ton capacity	3950-00-251-8013	306 (79805)	SC 4910-95-A31
95	Wrench Set, Socket Attachment: Screwdriver, torx, 1/4 and 1/8 in drive	5120-01-178-6342	J29843 (33287)	
96	Wrench Set, Socket, Impact	5130-00-357-5136	B107.2 (80204)	
97	Wrench Set, Socket: 3/4 in drive	5120-00-204-1999	FEDSTD353 (06542)	SC 4910-95-A31
98	Wrench Set, Socket: 1 in drive	5120-00-081-2309	A-A-1392 (58536)	SC 4910-95-A31
99	Wrench, Adjustable: 3-5/8 in jaw, 15 in long	5120-00-264-3793	2117080 (24617)	
100	Wrench, Impact, Pneumatic	5130-00-542-3230	5130-00-542-3230 (18426)	
101	Wrench, Pipe, Strap	5120-00-242-3249	D170X (50893)	
102	Wrench, Strap, Oil Filter	5120-00-020-2947	2432097 (10001)	SC 4910-95-A31
103	Wrench, Torque	5120-01-348-0959	3376592 (15434)	TM 10-3930-675-24P
104	Wrench, Torque: 50-250 lb-ft capacity	5120-01-042-0982	VB-2503MFR (27464)	SC 4910-95-A31
105	Wrench, Torque: 3/4 in drive, 100-600 lb-ft capacity	5120-01-113-9564	7379 (45225)	SC 4910-95-A31
106	Wrench, Torque: 3/8 in drive, 0-200 lb-in capacity	5120-00-853-4538	F2001 (90947)	
107	Wrench, Torque: 3/8 in drive, 0-300 lb-in capacity	5120-00-776-1841	2163993 (10001)	SC 4910-95-A31
108	Wrench, Torque: 3/8 in drive, 15-75 lb-ft capacity	5120-01-355-1739	QC2FR75 (55719)	SC 4910-95-A31

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By Order of the Secretary of the Army:

ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0108507

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1 Rock Island Arsenal
Rock Island, IL 61299-7630

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125th Transportation Company
ATTN: Motor SGT (SGT Wilson)
Ft. Riley, KA 78665-4000

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 10-3930-675-34	1 July 2001	Direct and General Support Maintenance Manual for the Rough Terrain Container Handler (RTCH-RT 240)

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
	0035 00-1	Initial Setup				Item number for Oil, lubricating is not correct

SAMPLE

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Johnny Wilson, E-5, MOTOR SGT	DSN 867-7967	

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Rock Island, IL 61299-7630

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

Weights

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Pounds
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

Liquid Measure

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

Square Measure

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.0386 Sq Miles

Cubic Measure

1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

Temperature

5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 C° +32 = F°

APPROXIMATE CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Sq Inches	Sq Centimeters	6.451
Sq Feet	Sq Meters	0.093
Sq Yards	Sq Meters	0.836
Sq Miles	Sq Kilometers	2.590
Acres	Sq Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Sq Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

To Change	To	Multiply By
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Sq Inches	0.155
Sq Meters	Sq Feet	10.764
Sq Meters	Sq Yards	1.196
Sq Kilometers	Sq Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Sq Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

PIN: 078949-000