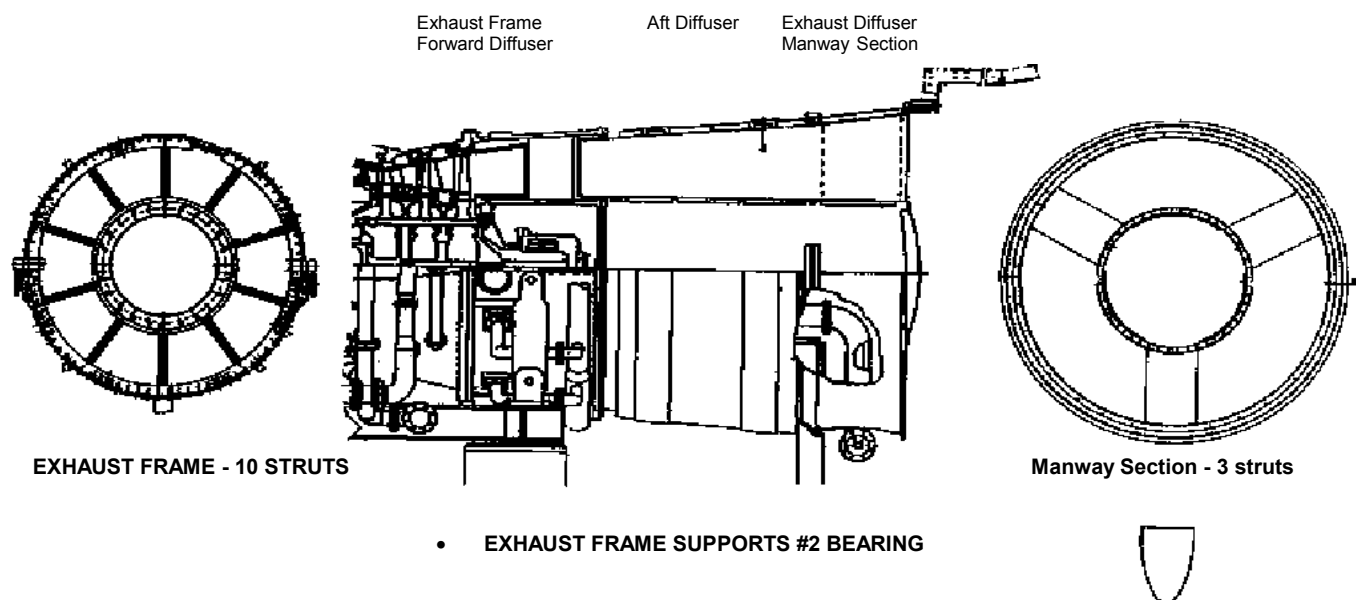


## 7F/9F EXHAUST FRAME AND DIFFUSER ASSEMBLY



### **Introduction:**

The exhaust diffuser consists of three components:

- 1.) Forward diffuser (Exhaust Frame)
- 2.) Aft Diffuser (includes radiation shields)
- 3.) Diffuser Manway section

Enclosed in this tab are conditions that have appeared as the F Units continue to accrue operating starts/hours and helpful maintenance practices to maintain the exhaust diffuser in operating condition.

1. Exhaust Diffuser Cracking
2. Weld Repair Procedure for 7/9 F/FA 347 Stainless Steel Exhaust Diffusers
3. Forward to Aft Diffuser Vertical Joint Bolting
4. 7/9 F/FA Exhaust Frame Flex Seals
5. 7F and 9F Exhaust Frame Horizontal Joint Gasket

## **1. Exhaust Diffuser Cracking**

### **BackGround**

Exhaust Diffuser cracking is considered a normal maintenance activity for incorporation into site maintenance activity as required. The exhaust diffusers of 7F/FA and 9F/FA have experience heavy cracking as a result of thermal life cycle fatigue. This cracking has been considered a result of the uneven heating and cooling of the diffuser at the stiffened areas on the diffuser. Many if not all units effected by this cracking have been modified to remove the axial stiffeners, reduce the box channels to a single flange arrangement and had lifting lugs removed. Cracking in the areas of the manways and struts is normal. Some of the enclosed sketches may not currently apply following modification to the reader's unit/s.

### **Crack Repair Limits:**

The following guidelines are provided for determining when weld repair of Exhaust diffuser cracks is required. When crack length reaches the limit provided, weld repair shall be initiated.

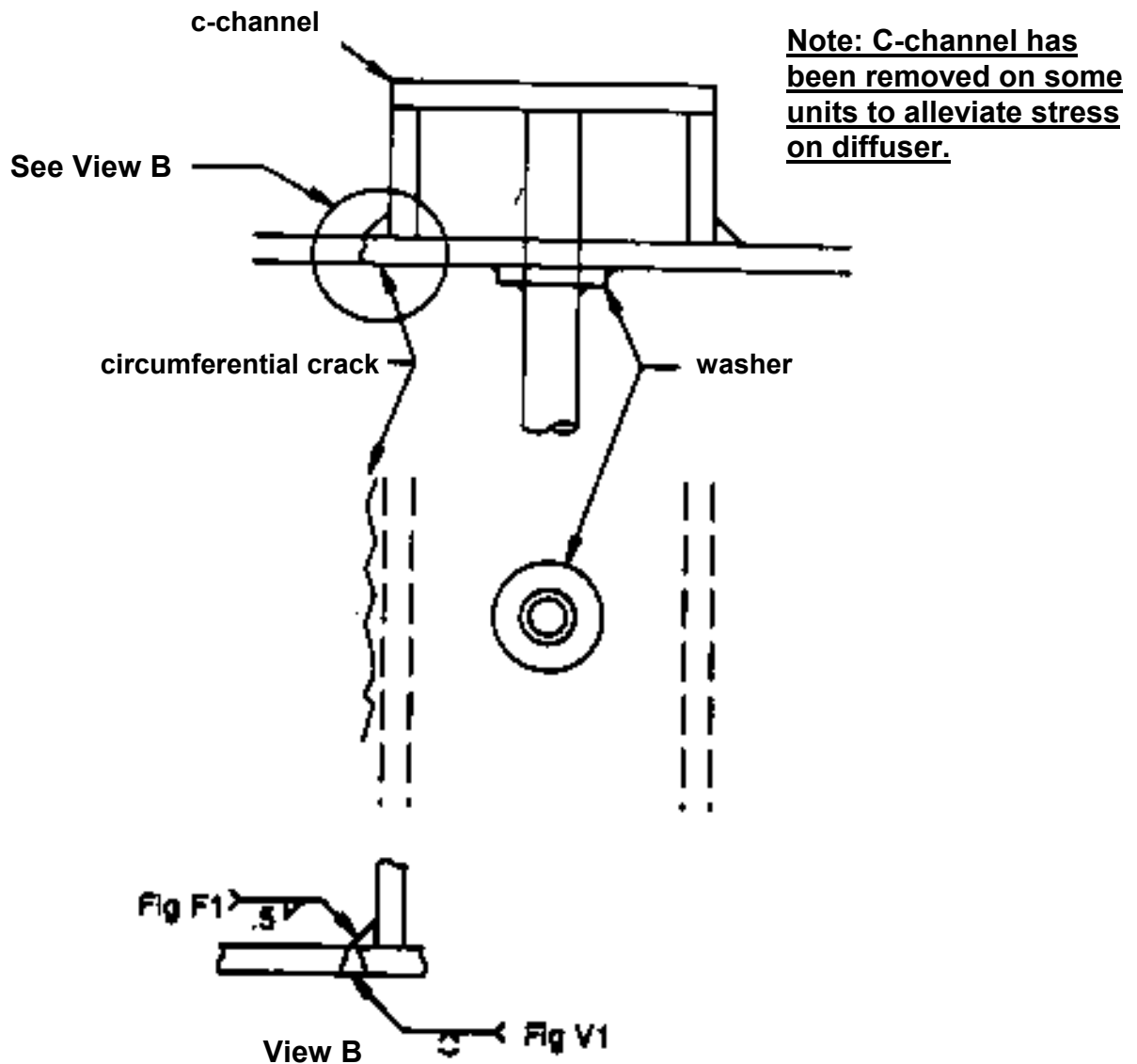
<b><u>Crack location</u></b>	<b><u>Crack length limits (inches)</u></b>
Aft Diffuser Outer Barrel - Axial Cracks at Radiation Shield	4.0 (per side)
Aft Diffuser Manway Fillet Weld	6.0
Fwd Diffuser Strut	
Leading or Trailing Edge	4.0
Fillet at Barrel	4.0
Fwd Diffuser Horizontal Joint	3.0
Circumferential Cracking at Stiffening Rings or Flanges	20.0
Aft Diffuser Outer Barrel - Axial	8.0
Aft Diffuser Axial Stiffener Ends	4.0

Weld repair can be performed at any outage opportunity regardless of crack length.

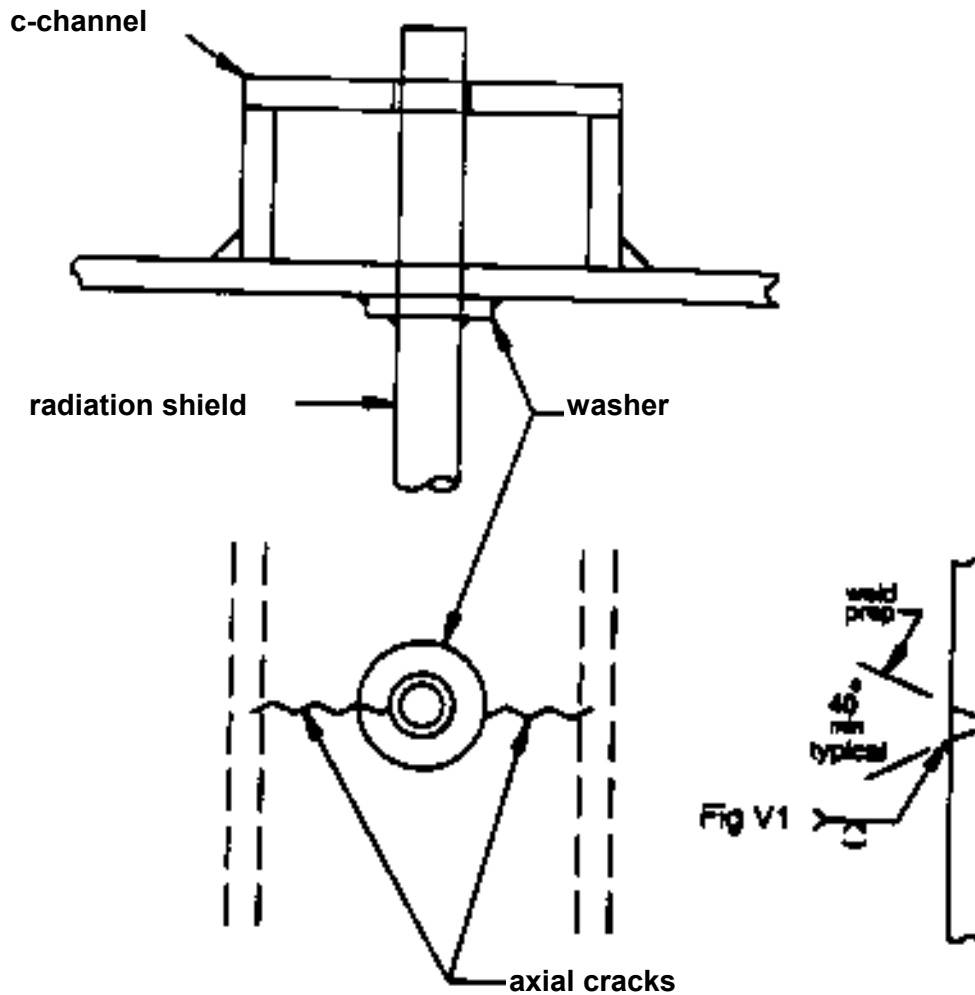
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F/FA INSPECTION LIMITS MANUAL

Exhaust Diffuser

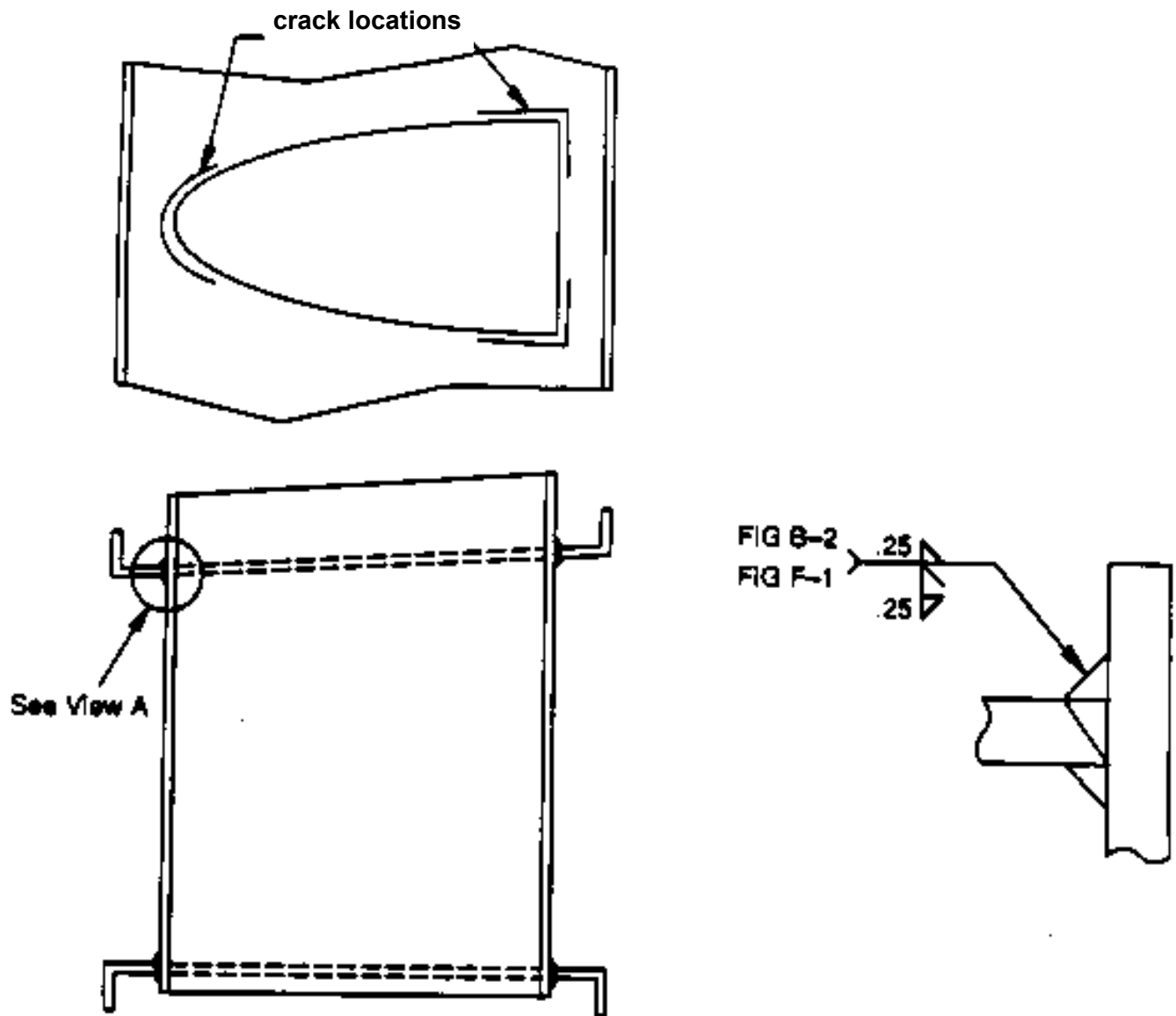
**Circumferential Cracking at Stiffening Rings or Flanges**



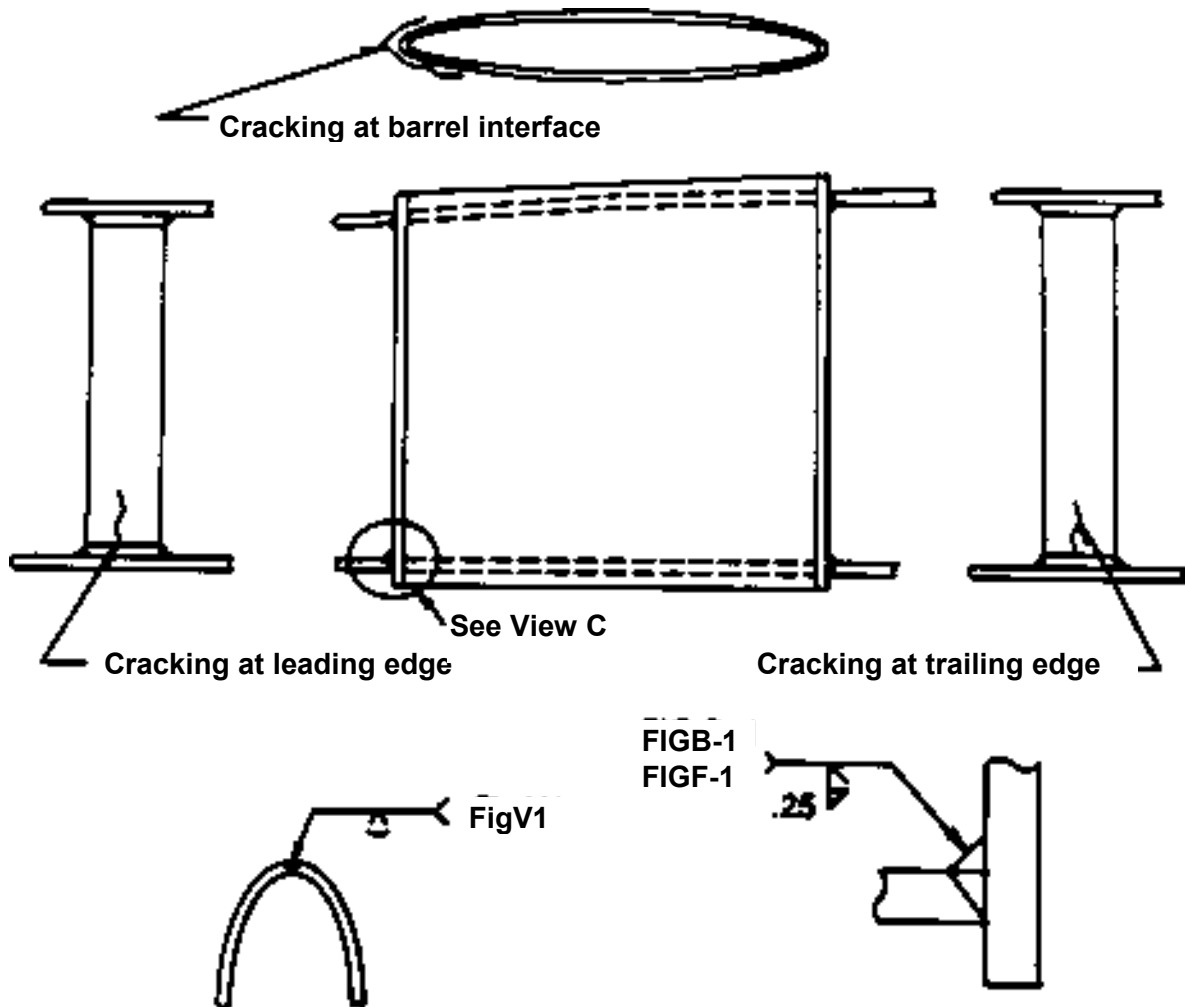
### Radiation Shield Weld Cracks



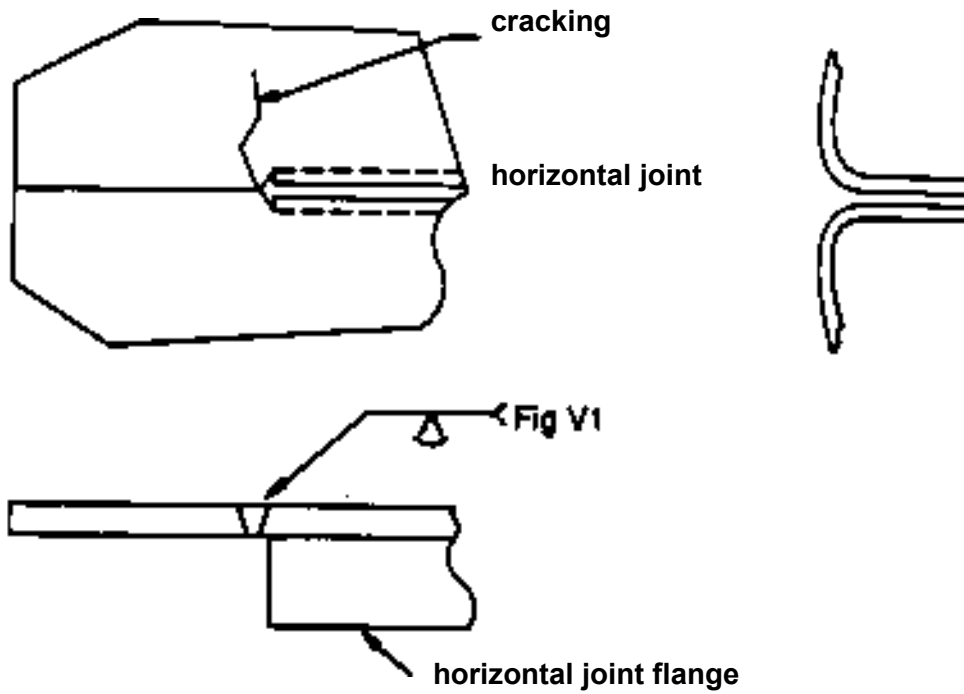
**Manway Weld Crack**



### Fwd Diffuser Airfoil Cracking



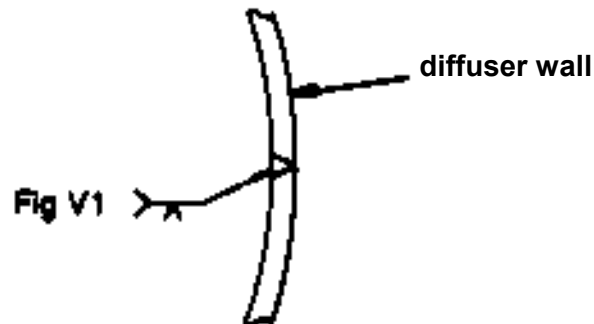
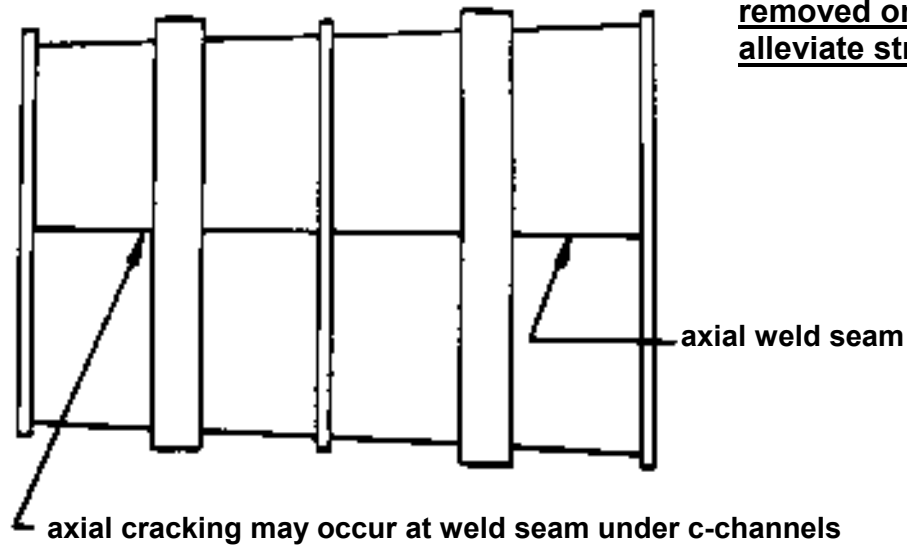
**Fwd Diffuser Horizontal Joint Cracking**





**Aft Diffuser Axial Cracking in Outer Barrel**

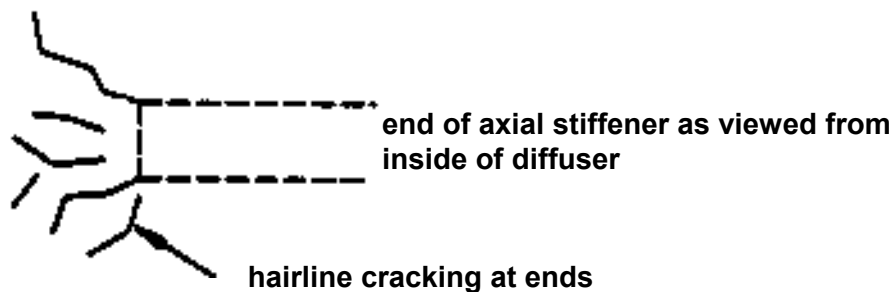
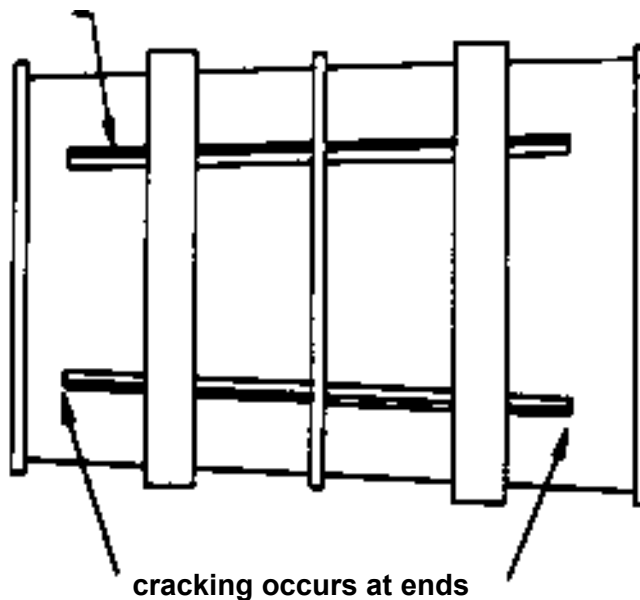
**Note: CChannels have been removed on some units to alleviate stress on diffuser**



### Aft Diffuser Cracking at Axial Stiffener Ends

**Note** Axial stiffeners have been removed on some units to alleviate stress on diffuser.

axial stiffener



These cracks tend to stop growing and may not require repair. If any crack exceeds 4 inches in length or if several cracks appear to be connecting in such a manner as to possibly allow a panel segment to come out, then the cracks should be ground out and welded with a full penetration groove weld.

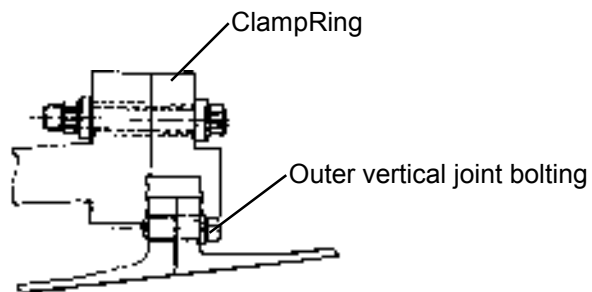
### 3. Forward to Aft Diffuser Outer Vertical Joint Bolting

#### Background:

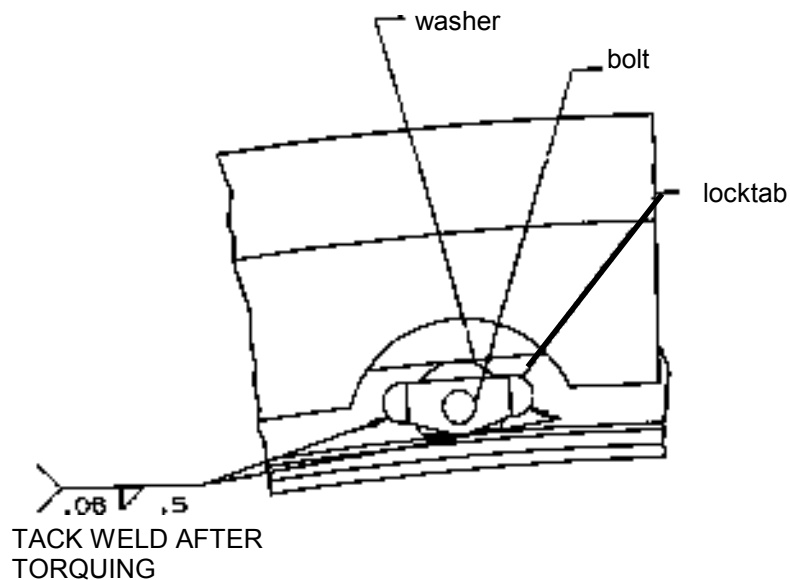
Units in the field have experienced a condition where the forward to aft outer vertical joint bolting loosen and back out. It is believed this condition resulted from the bolts losing tension due to effects of operational heat treatment and subsequent loss of tension. If this condition exists, a higher temperature bolt is currently used. In some cases washers have been added to increase the clamping force and anti-rotation locktabs have been used.

The following configurations are currently used in various applications:

#### 1. Original Design



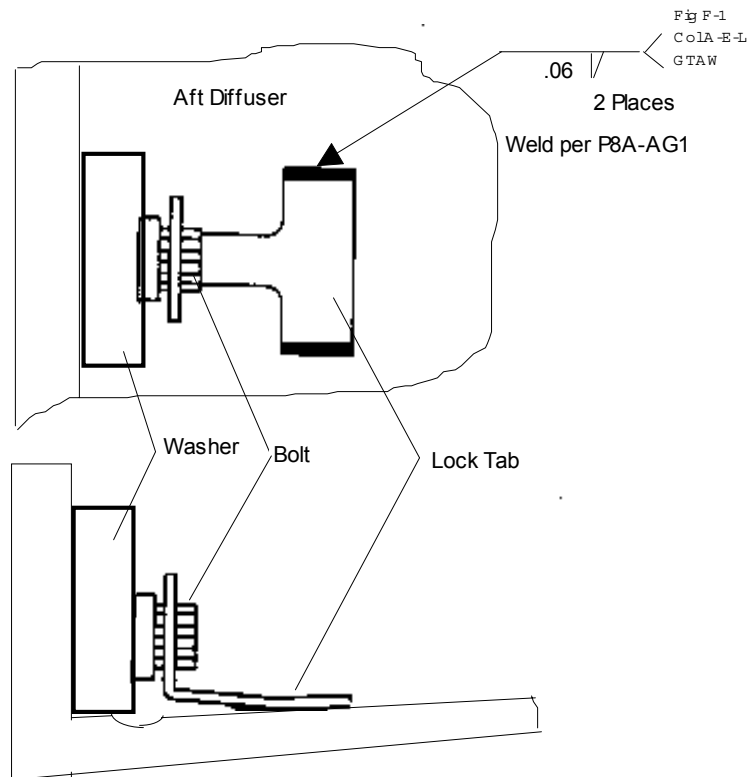
#### 2. With washer, longer bolt, and anti-rotation clip.



# g F/FA INSPECTION LIMITS MANUAL

Exhaust Diffuser

## 3. With washer, longer bolt, and redesign anti-rotation clip. (Current Design)



It should be realized that with the locktabs installed, during the scheduled major Inspection, new loacktabs will have to be installed and welded.

## 4. 7/9 F/FA Exhaust Frame Flex Seals

### Inspection Criteria

The flex seals as describe below are to be visually inspected at every Hot Gas Path Inspection. It is recommended that the flex seals be replaced at the major inspection. With the upper half of the turbine casing removed, a visual inspection is to be made of all accessible flex seals. If the flex seals currently installed are not of the latest design as noted, they should be replaced with the new design to prevent any possibility of shingling.

<u>INSPECT</u>	<u>Disposition</u>
Cracks, tears	Replace
Missing Pieces	Replace
Deposits	Clean
Hot Spots	Determine cause
Broken Anti-Rotation Tabs	Replace
Shingling	Replace with new design

### BACKGROUND:

The flex seals are a series of flat plate seals located at the forward end of the Exhaust Frame and Forward Diffuser. The seals are mounted in a split pipe on the Fwd Diffuser and engage a slot on the ID of the Exhaust Frame Outer Barrel. The flex seals provide closure for the cooling circuit air that passes between the Exhaust Frame and Diffuser. The flex seals must provide sealing while accommodating axial and radial thermal expansion between the Frame and Diffuser. The seals consist of two layers of 30 degree arc segments with layers offset by 15 degrees.

A problem known as “shingling” has occurred on some units with original design flex seals as installed on early 7F/FA Units. “Shingling” is when the flex seal segments slide past each other and create openings to the cooling circuit. A new flex seal design is now used that has tabs at the end of each seal segment to prevent this “shingling” condition. The preferred field fix for “shingling” is to replace the old style flex seals with the new seal design. This requires removal of the upper half of the Exhaust Frame which would only be an option during a major outage. Two field fix options are also presently used. One which can be performed with the upper half of the turbine case removed and a second approach which is installed from the flow path of the exhaust frame with no unit disassembly. Contact your GE representative for information.

### New Parts Information:

If “shingling” occurs on old design seals, the following are current recommended replacement parts:

7F Units:       177D9526P001  
                      177D9526P002  
                      177D9526P003

9F Units:       167D3277G001

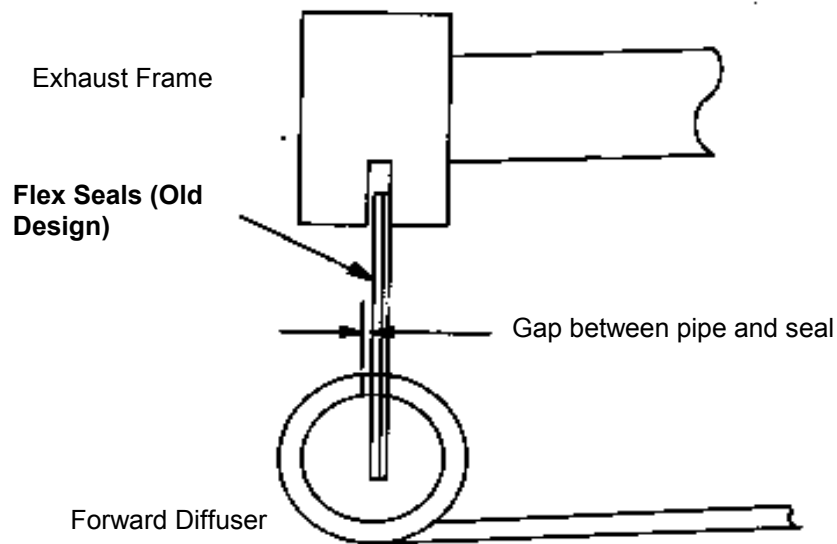


Figure 27-1. Original Flex Seal Design

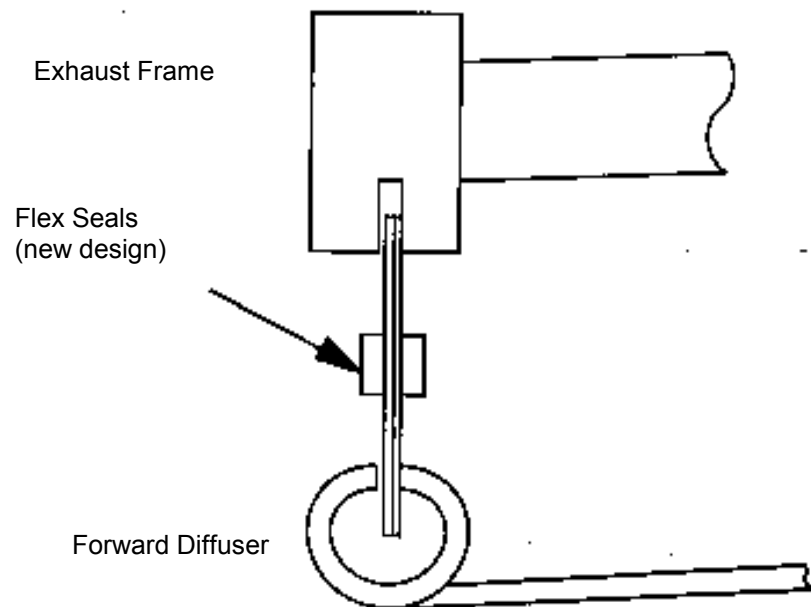


Figure 27-2. Current Flex Seal Design

## 5. 7F and 9F Exhaust Frame Horizontal Joint Gasket

### Inspection Criteria

The forward diffuser horizontal joint gaskets are to be replaced at each major inspection. When the exhaust diffuser is entered at other times the following criteria is to be used.

#### INSPECT

Missing

#### Disposition

Replace when diffuser next removed

### BACKGROUND

The original forward exhaust diffuser horizontal joint gasket on the 7F and 9F machines, 344A9720, has had durability problems. The gasket contained some material that had deteriorated in operation. As a result, some F machines in the fleet are operating without gaskets. While the loss of the gasket will allow the loss of some cooling air from the cooling circuit, the blower system design curves were based on the assumption of no gasket and therefore the cooling system should not be compromised by the loss of gaskets. However, the current production design is now available for field replacement at outage opportunities.

The new Exhaust Frame Horizontal Joint gasket, 351A9259, is made of Inconel wire mesh and should handle operating temperatures. To install the new gaskets, the Exhaust Frame upper half must be removed. Refer to the Field Maintenance Manual for removal instructions. The Forward Diffuser must be adequately secured with welded bracing prior to removal of the upper half of the Exhaust Frame. The new gaskets are installed at both the Inner and Outer Barrels of the Fwd Diffuser halves.

The gasket part numbers for the 7 and 9F machines are:

351A9259P01	7F Outer Barrel
351A9259P02	7F Inner Barrel
351A9259P03	9F Outer Barrel
351A9259P04	9F Inner Barrel

For each machine, a quantity of 2 each of the gaskets are required for both the Outer and Inner Barrel horizontal joints. (For example, a 7F machine requires 2 each of P01 and P02).

### INSTALLATION INSTRUCTIONS:

1. Position gasket over the horizontal joint pins with the bulb opposite the gas path side so that the bulb fits snugly against the diffuser horizontal joint flange edge. See Sketch 1. The forward end of the gasket should be located forward of the first horizontal joint pin as listed below:

P01	5.0"	(7F Outer)
P02	2.75:	(7F Inner)
P03	6.3"	(9F Outer)
P04	3.0"	(9F Inner)

**Note:** On gaskets P01 and P03 for the Outer Barrels, position the section where the bulb is removed over the Outer Barrel retaining strap near the fwd end.

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## F/FA INSPECTION LIMITS MANUAL

Exhaust Diffuser

2. Using a sharp pointed, .75 diameter insert the pin through the gasket wire mesh above each horizontal joint alignment pin and twist open a hole for each horizontal joint pin.

**Note:** Do NOT attempt to fabricate holes using any machining operation such as drilling or punching. The Inconel wires must not be cut in order to prevent gasket fraying.

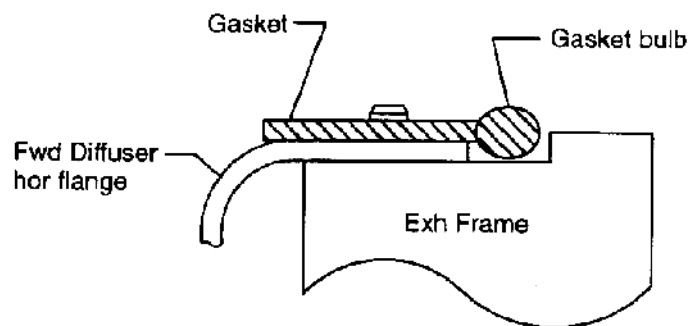


Figure 27-3