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CHAPTER 72 - ENGINE TURBINE/TURBO PROP DUCTED FAN/ UNDUCTED FAN

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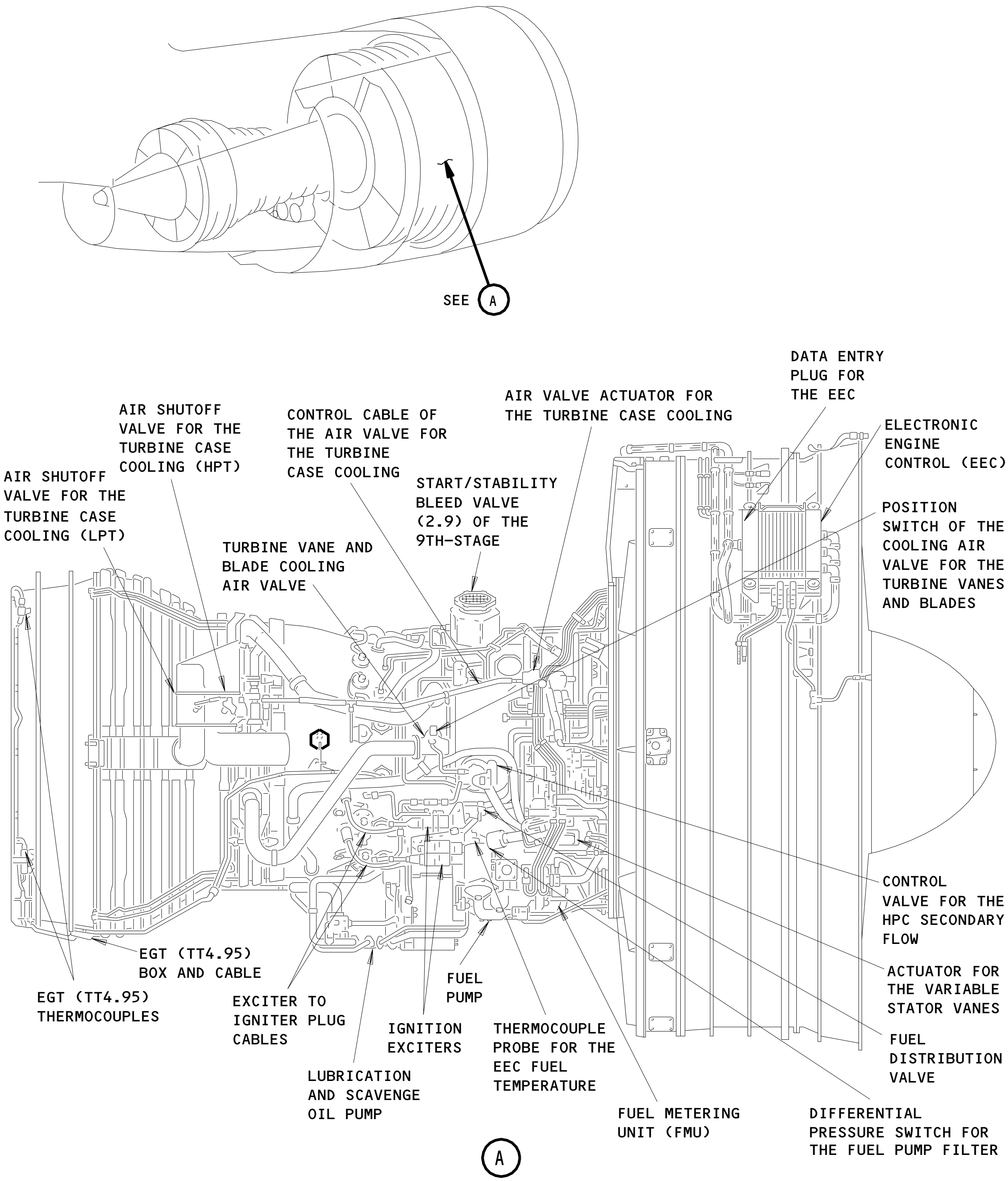
ENGINE - DESCRIPTION AND OPERATION

1. General
   A. This section includes the general description of the basic PW4000 engine sections and components. Detailed description of these areas can be found in the Compressor Section (AMM 72-30-00), Diffuser and Combustion Section (AMM 72-40-00), Turbine and Exhaust Section (AMM 72-50-00), and Accessory Drives (AMM 72-60-00).
   B. The PW4000 series engines have incorporated technology which provides significant advantages in fuel consumption and engine weight. The improved engine performance of the basic engine is achieved with a single-stage fan, low pressure compressor with 5 stages, high pressure compressor with 11 stages, a burner that employs low emissions features, a high pressure turbine with 2 stages, and a low pressure turbine with 4 stages. Improved components include a wide-chord, single-shroud fan blade, single-crystal blades of the high pressure turbine, carbon seals in all bearing compartments and a full authority system for the electronic engine control.
   C. Engine General (Fig. 1)
      (1) The PW4000 engine is a 2-spool axial flow turbofan engine of high compression and bypass ratio, having 16 compressor stages, an annular combustion chamber, and 6 turbine stages. The low pressure system consists of a low pressure compressor with 5 stages (LPC) and a low pressure turbine with 4 stages (LPT) and is mechanically independent of the high pressure system consisting of the high pressure compressor with 11 stages (HPC) and high pressure turbine (HPT) with 2 stages. The engine cases, when bolted together, form a structurally rigid support for the engine, with internal parts supported through struts and bearings. The engine mounts are located at the 12 o'clock positions on the intermediate case and turbine exhaust case.
      (2) The 1st-stage compressor rotor of the front compressor section is much larger in diameter than the other stages and is called the fan. The fan provides two separate airstreams. The primary (or inner) airstream traveling through the engine, operates internal devices to generate pressures and gases in the exhaust nozzle and thereby provide a propulsive force. The secondary (or outer) airstream is mechanically compressed by the fan when entering the engine and is ducted to the outside of the engine a short distance from the fan at the fan discharge duct. This secondary airstream adds to the propulsive force and increases the efficiency of the engine. The engine cases are bolted together, and support the inner parts of the engine through struts and bearings.



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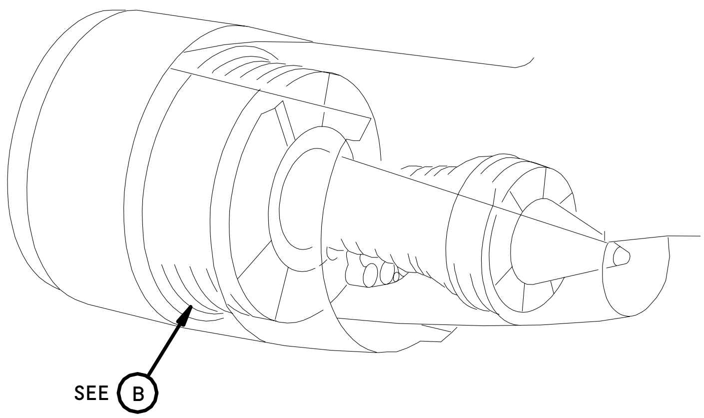
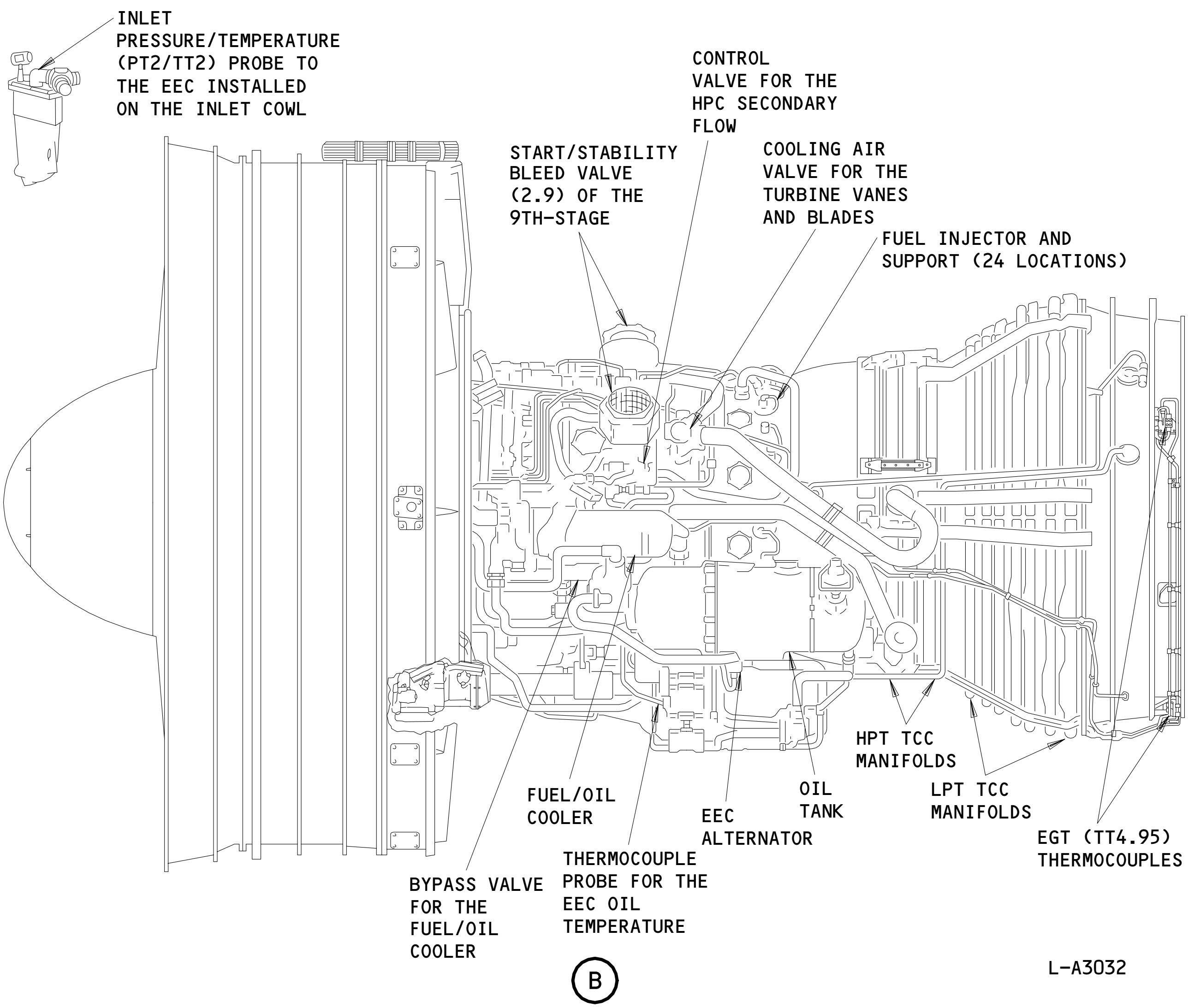
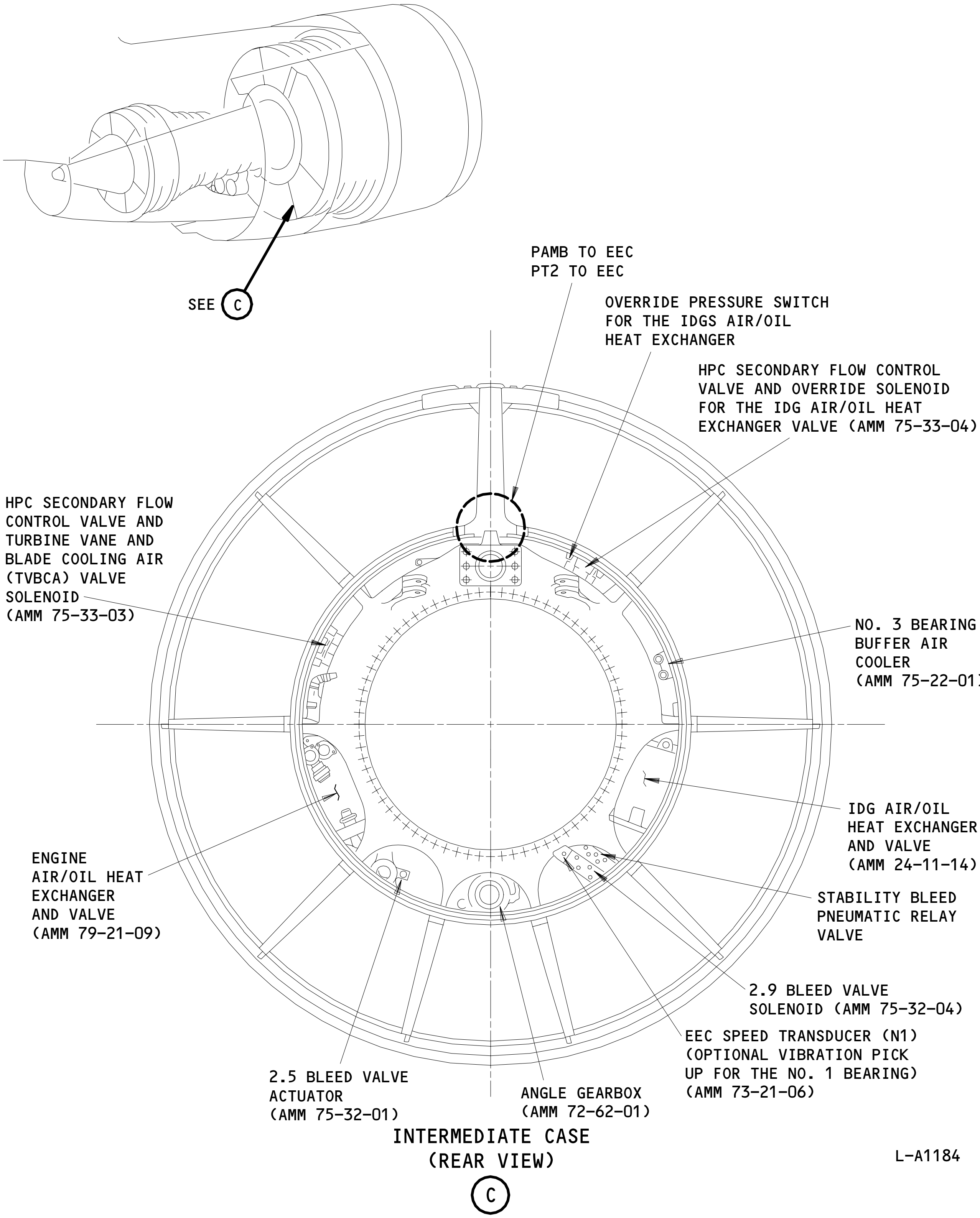
Engine External Components (Right Side)
Figure 1 (Sheet 1)

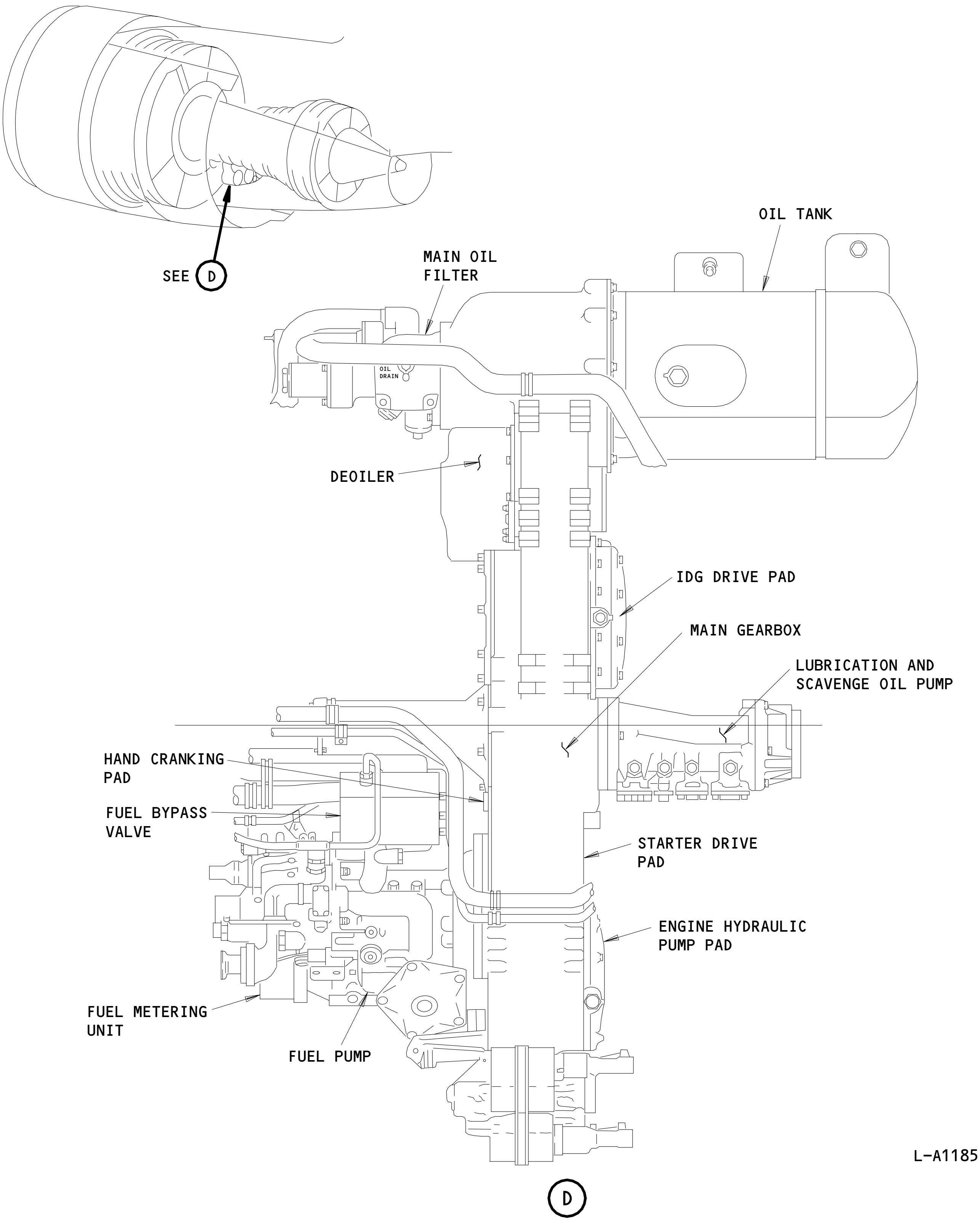




Engine External Components (Left Side)
Figure 1 (Sheet 2)



Engine External Components (Intermediate Case View)
Figure 1 (Sheet 3)



Engine External Components (Bottom View)
Figure 1 (Sheet 4)

(3) The high pressure system consists of the rear compressor rotor and drive turbine rotor for the 1st- and 2nd-stage rear compressor. The engine front mount is located at the 12 o'clock position of the intermediate case and carries thrust, vertical and side loads. The rear mount is located at the 12 o'clock position of the turbine exhaust case and carries vertical, side and torsional loads. Ground handling provision is provided by pads at six locations on the fan exit case plus locations on the turbine exhaust case.

D. Engine Flange Identification (Fig. 2)

(1) Engine flanges are identified in alphabetical sequence from front to rear.

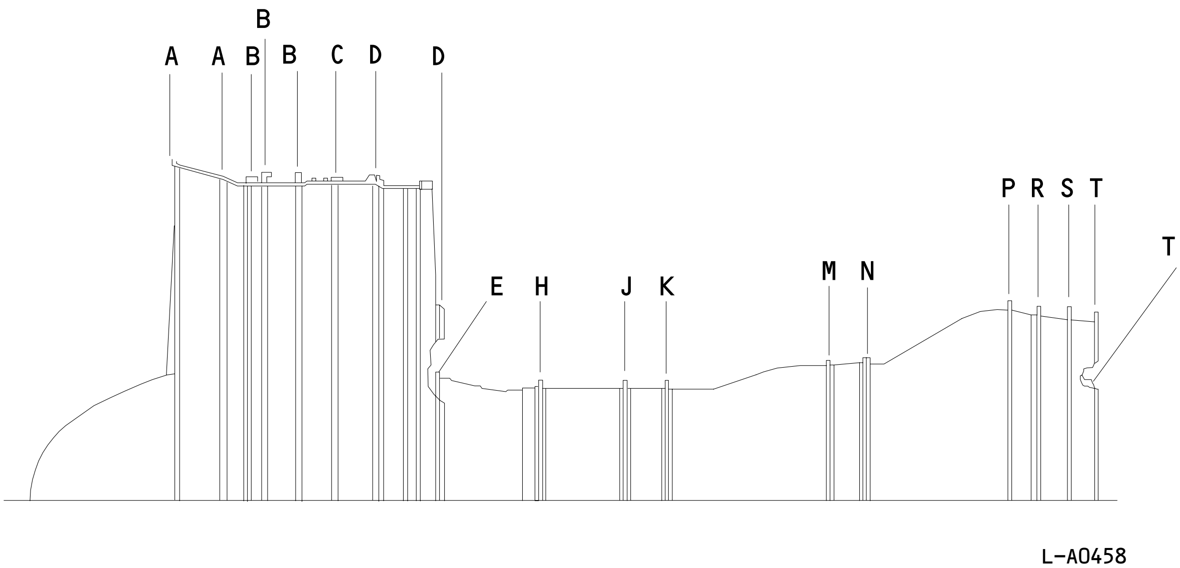
E. Borescope Ports (Fig. 3)

(1) Inspection of internal areas of the engine is facilitated by 16 borescope access ports (AP-11 optional) at specific locations around the engine. These ports permit visual analysis of part condition in areas not otherwise accessible without engine disassembly.

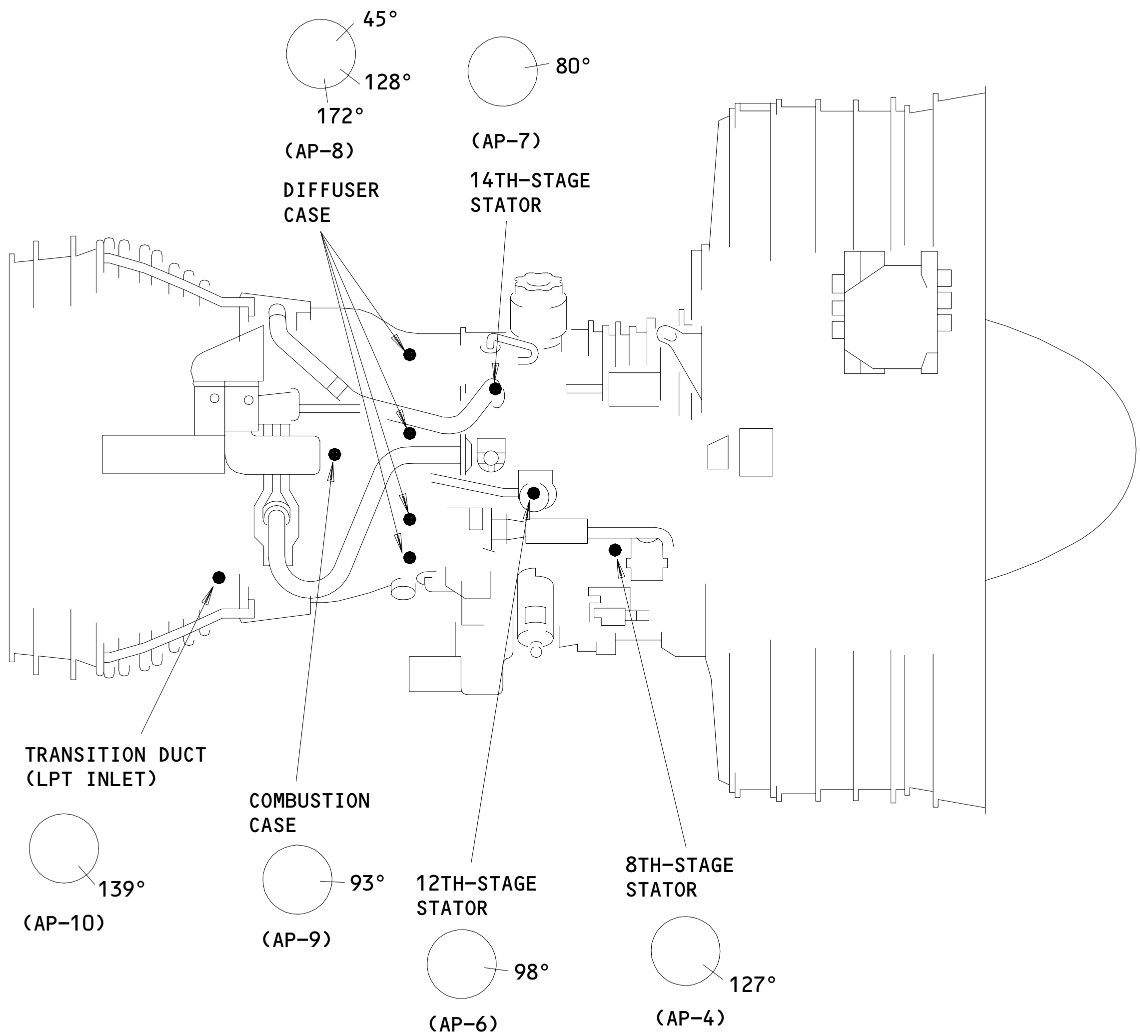
F. Specifications are tabulated as follows:

ITEM	SPECIFICATION
General	
Type.	Axial-Flow, gas turbine turbofan
Number of Combustion Chambers . . .	One
Type of Combustion Chamber.	Annular
Type of Compressor.	2-spool, 16-stage compressor, consisting of a 5-stage low pressure front compressor (includes 1st-stage fan) and an 11-stage high pressure compressor.
Type of Turbine	6-stage, split, having a 2-stage high pressure turbine and a 4-stage low pressure turbine.

ITEM	WEIGHT	LENGTH	DIAMETER
Basic Engine	9200lbs. (4173kg) (approx.)	133 in. (3378 mm)	97 in. (2464 mm)
Turbine Exhaust Sleeve	TO BE FURNISHED	TO BE FURNISHED	TO BE FURNISHED
Turbine Exhaust Plug			
Inlet Cowl	TO BE FURNISHED		
Demountable Powerplant	TO BE FURNISHED	TO BE FURNISHED	

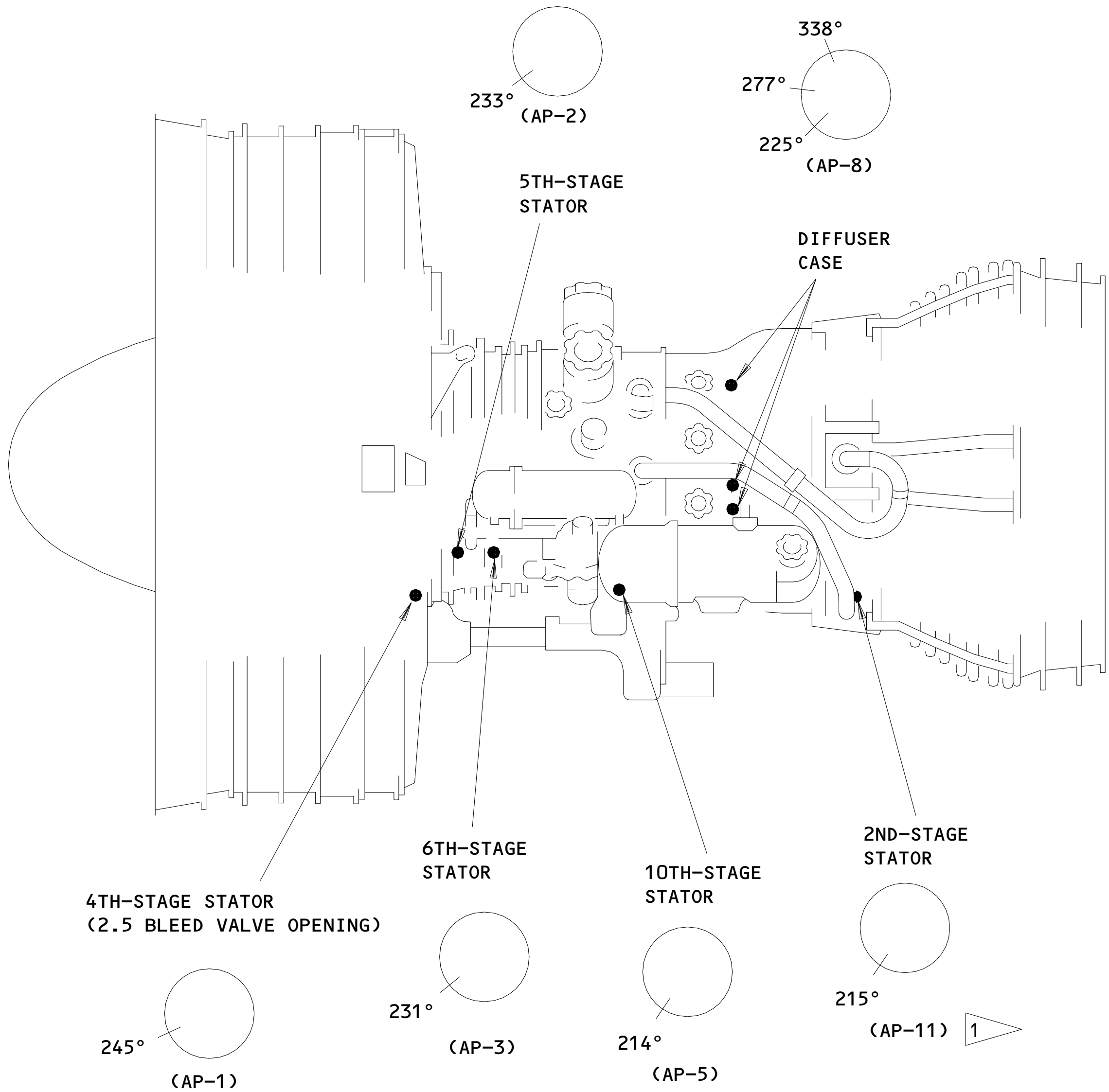


Engine FLange Identification
Figure 2



AP-4	8TH- AND 9TH-STAGE BLADES
AP-6	12TH- AND 13TH-STAGE BLADES
AP-7	14TH- AND 15TH-STAGE BLADES
AP-8	COMBUSTION LINER AND FUEL NOZZLES
AP-9	1ST-STAGE HPT BLADES
AP-10	2ND-STAGE HPT BLADES AND 3RD-STAGE LPT VANES

Borescope Port Locations (Right Side)
Figure 3 (Sheet 1)



AP-1 4TH-STAGE BLADES
AP-2 5TH AND 6TH-STAGE BLADES
AP-3 6TH AND 7TH-STAGE BLADES
AP-5 10TH AND 11TH-STAGE BLADES
AP-8 COMBUSTION LINER AND FUEL NOZZLES
AP-11 REAR OF 1ST BLADES
FRONT OF 2ND BLADES

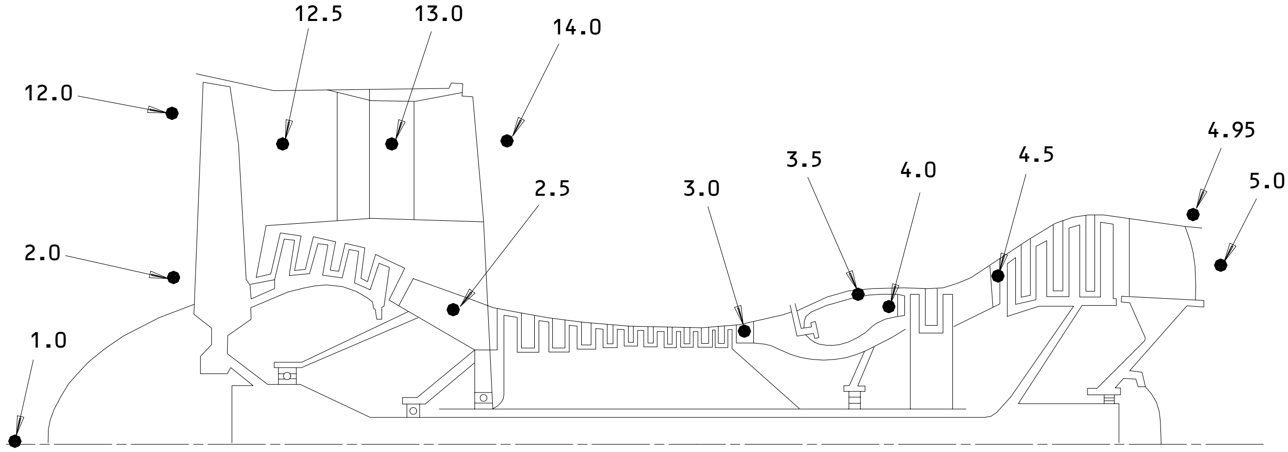
1 OPTIONAL PORT LOCATION

Borescope Port Locations (Left Side)
Figure 3 (Sheet 2)

G. Ignition, Oil, Fuel and Air System specifications are tabulated as follows:

ITEM	SPECIFICATION
Ignition System	
Ignition Exciter.	Bendix
Igniter Plugs	Champion, Auburn
Exciter-to-Igniter Plug Cables. . .	Bendix
Oil System	
Oil Specification	PWA-521 Type II (Ref P&WA Service Bulletin No. 238 for approved oils)
Oil Tank Capacity (U.S. Gallons) Engines 1 and 2	Refer to 79-11-00, Description and Operation
Oil Pump.	Sundstrand
Fuel/Oil Heat Exchange.	Serck
Air/Oil Heat Exchanger.	Serck, Hughes Treitor, Hamilton Standard
Fuel System	
Fuel Specification.	PWA-522D (Refer to PWA Service Bulletin No. 2016 for approved fuel)
Electronic Engine Control (EEC) . .	Hamilton Standard
Fuel Control.	Hamilton Standard
Fuel Pump	TRW
Fuel Injector and Support	Pratt & Whitney
Air System	
Stator Vane Actuator.	Hamilton-Standard
Intercompressor (2.5) Bleed Actuator.	Hamilton-Standard

2. Component Details
   A. Designation of Engine Stations (Fig. 4)
      (1) Certain specific points along the engine axial profile are identified by station name to provide ease of reference for items such as component locations, test taps, and sensor locations.
   B. Compressor Section
      (1) Low Pressure Compressor (LPC) (Fig. 5)
         (a) The LPC is a 5 stage rotor and stator assembly. This assembly provides the initial compression of the ambient (inlet) air which is then ducted through the intermediate case to the high pressure compressor (HPC). The compressor inlet cone mounted on the front compressor hub provides a smooth aerodynamic fairing at the inlet of the LPC.



1.0 AMBIENT
2.0 FAN INLET ID
2.5 LOW COMPRESSOR EXIT
3.0 DIFFUSER INLET - UPSTREAM OF THE DIFFUSER BLEED PORTS AND DIVERGENT NOZZLE
3.5 COMBUSTOR
4.0 COMBUSTOR EXIT
4.5 HPT EXIT, LPT INLET TRANSITION DUCT
4.95 TURBINE EXHAUST CASE, TEMPERATURE AND PRESSURE MEASURING PROBE LOCATION
5.0 TURBINE EXIT GUIDE VANE EXIT
12.0 FAN INLET OD
12.5 FAN EXIT - ROTOR TRAILING EDGE
13.0 FAN EXIT - UPSTREAM OF FAN EXIT GUIDE VANE
14.0 FAN EXIT GUIDE VANE EXIT

Designation of Engine Stations
Figure 4

(b) The LPC rotor is driven by the low pressure turbine (LPT). Structural support for the rotor is provided by the No. 1 ball bearing which is mounted on the front compressor hub. The 1st stage of the rotor is commonly referred to as the fan stage. Fan blades are replaceable in balanced pairs on installed engines.

(c) The LPC (1.6th-, 2nd-, and 3rd-stage) stator assembly is structurally supported by the inner case assembly of the fan exit. The 1st-stage of the stator assembly, attached to the forward flange of the LPC stator assembly, is located immediately aft of the fan blades at the entrance to the primary gaspath. Surrounding the front half of the stator assembly is a fan exit fairing which acts as an aerodynamic splitter separating the primary (main gas generator) airstream from the secondary (fan discharge) airstream.

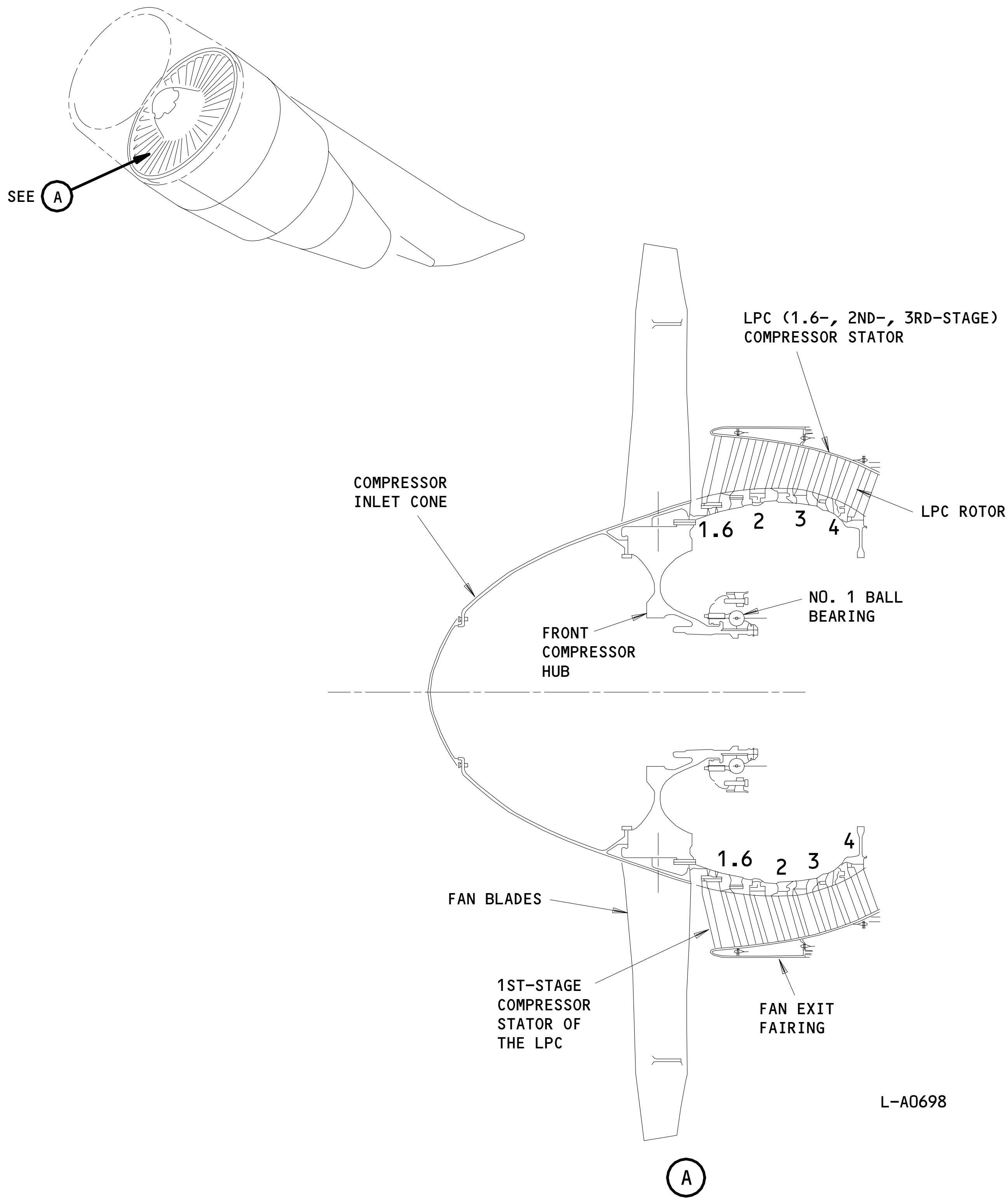
(2) LPC/LPT Coupling (Fig. 6)

(a) The LPC/LPT coupling (section) consists of those interface parts that attach and secure the LPC rotor to the shaft of the low pressure turbine (LPT). The main feature of this section is a turbine shaft coupling which is splined to both the front compressor hub and the LPT shaft. This coupling is supported structurally through the No. 1.5 roller bearing to the intermediate case. Mounted on the coupling is a motional pickup wheel from which the low rotor speed (N1) is determined.

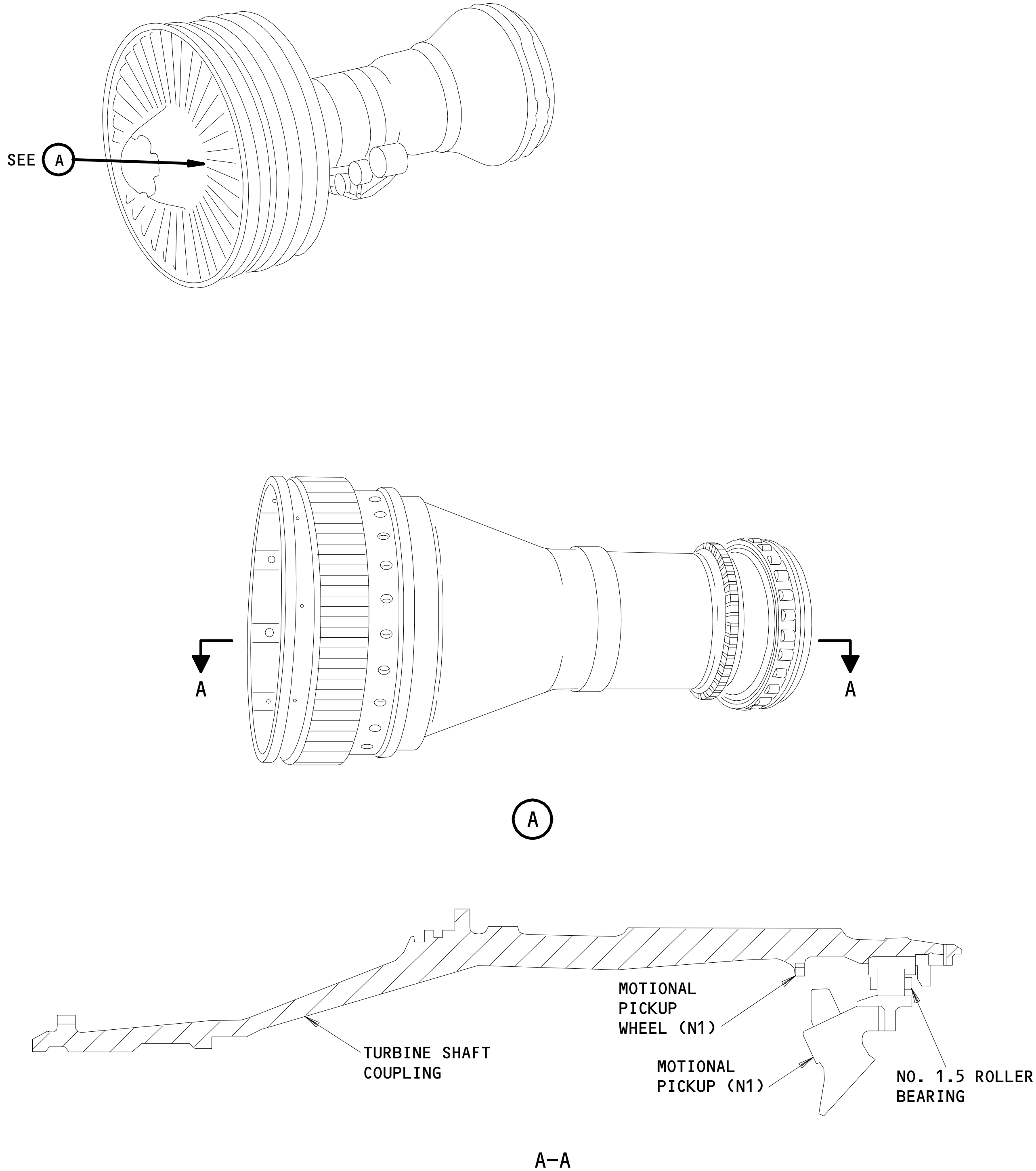
(3) Fan Case (Fig. 7)

(a) Between the inlet cowl and the airframe supplied fan exhaust hardware are separate fan cases whose purpose is to contain the fan discharge airstream and to provide the structural link between the airplane and the core engine. The fan case assembly supports the inlet cowl and provides for containment of the fan blades. The fan exit case and vane assembly straightens the fan discharge airstream prior to the air entering the fan exhaust.

(b) The assembly for the 2.5 bleed valve attached to the inner case assembly of the fan exit at the LPC exit ensures stable operation at low power levels and increases stall margin during starting and when required at other operating conditions.



Low Pressure Compressor (LPC)
Figure 5



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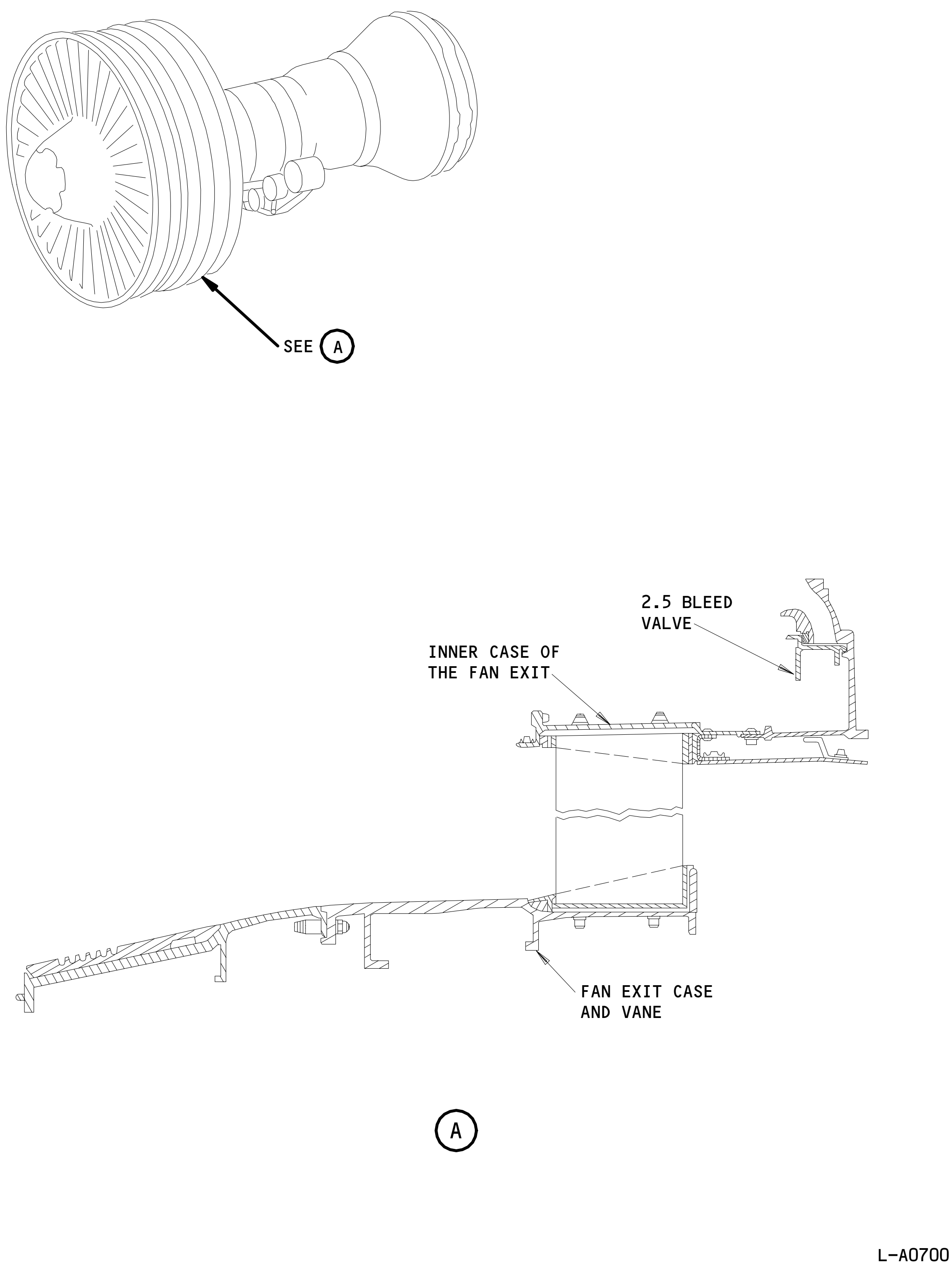
LPC/LPT Coupling
Figure 6



Fan Case
Figure 7

(4) Intermediate Case (Fig. 8)

(a) The intermediate case contains the supporting structure for thrust bearings at the front (LPC) of the front and rear (HPC) compressors in addition to the power train for the gearbox. Bearing loads are transmitted to engine outer cases through eight struts.

(b) Two mount brackets are located on the intermediate case for transmission of thrust directly to the airplane structure. A puck arrangement on the upper rear face of the intermediate case provides for an airplane structure connection to carry engine vertical and side loads.

(c) For additional description of the intermediate case, refer to AMM 72-30-00.

(5) High Pressure Compressor (HPC) (Fig. 9)

(a) The HPC consists of an stator assembly for the inlet guide vanes (IGV) and an 11 stage rotor and stator assembly. The purpose of the HPC is to further compress air delivered by the LPC and to direct this highly compressed air to the diffuser and combustor area. Bleed connections are provided at the 8th-stage to satisfy airplane pneumatic requirements.

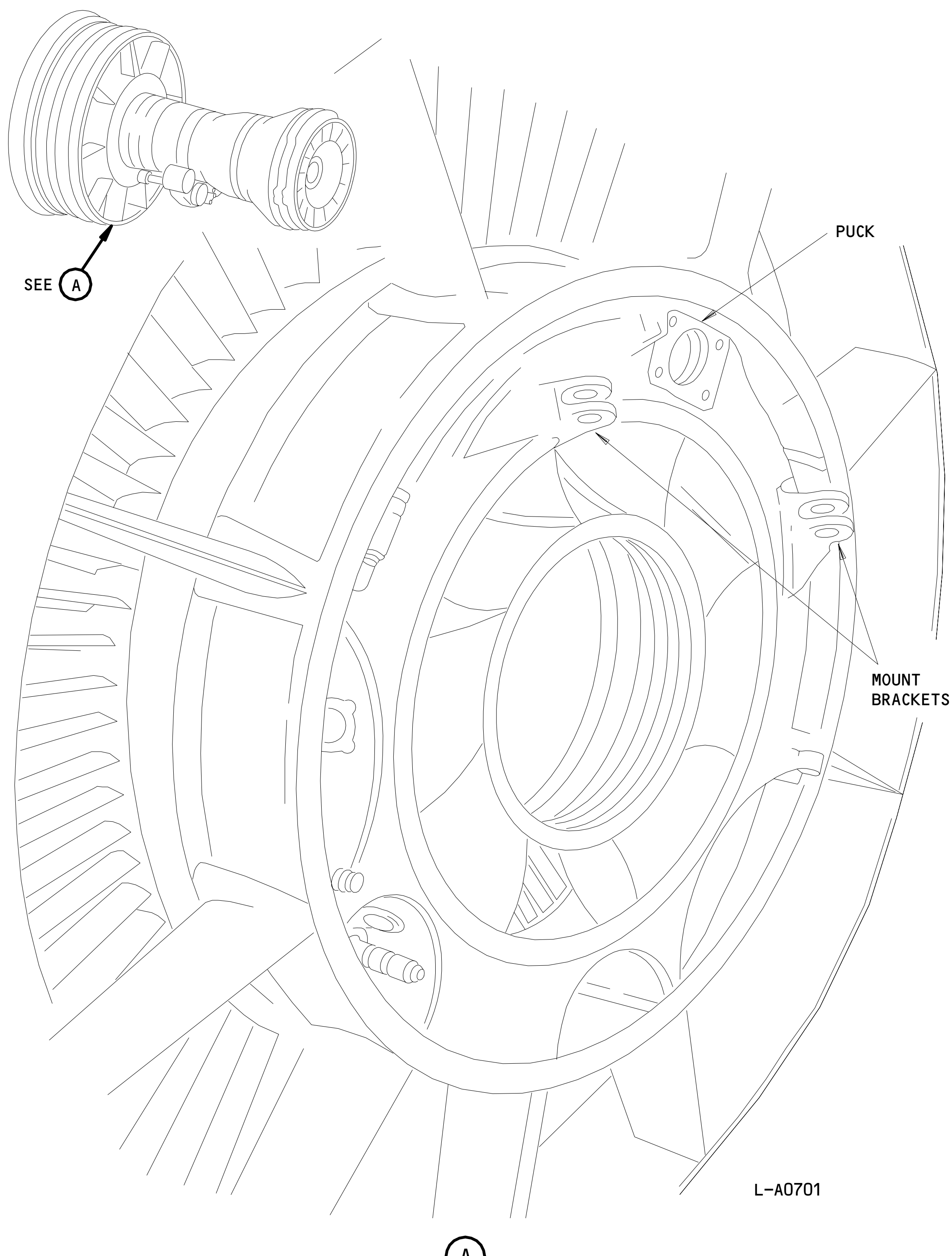
(b) The HPC rotor is driven by the high pressure turbine (HPT). The HPC rotor is supported at the front by the No. 2 ball bearing and at the rear by the No. 3 roller bearing.

(c) The HPC static structure consists of stator vane stages that are variable and fixed. Each of the 4 stages of the variable stator vanes is attached to a synchronizing ring assembly. The 4 synchronizing ring assemblies are linked to a stator vane actuator controlled by the electronic engine control (EEC) which automatically adjusts the variable stator vanes to provide adequate stall margin for engine starting, acceleration and part power operation.

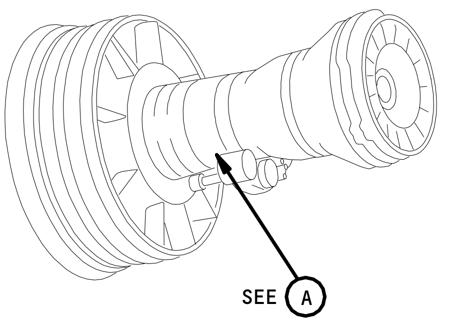
C. Combustion Section

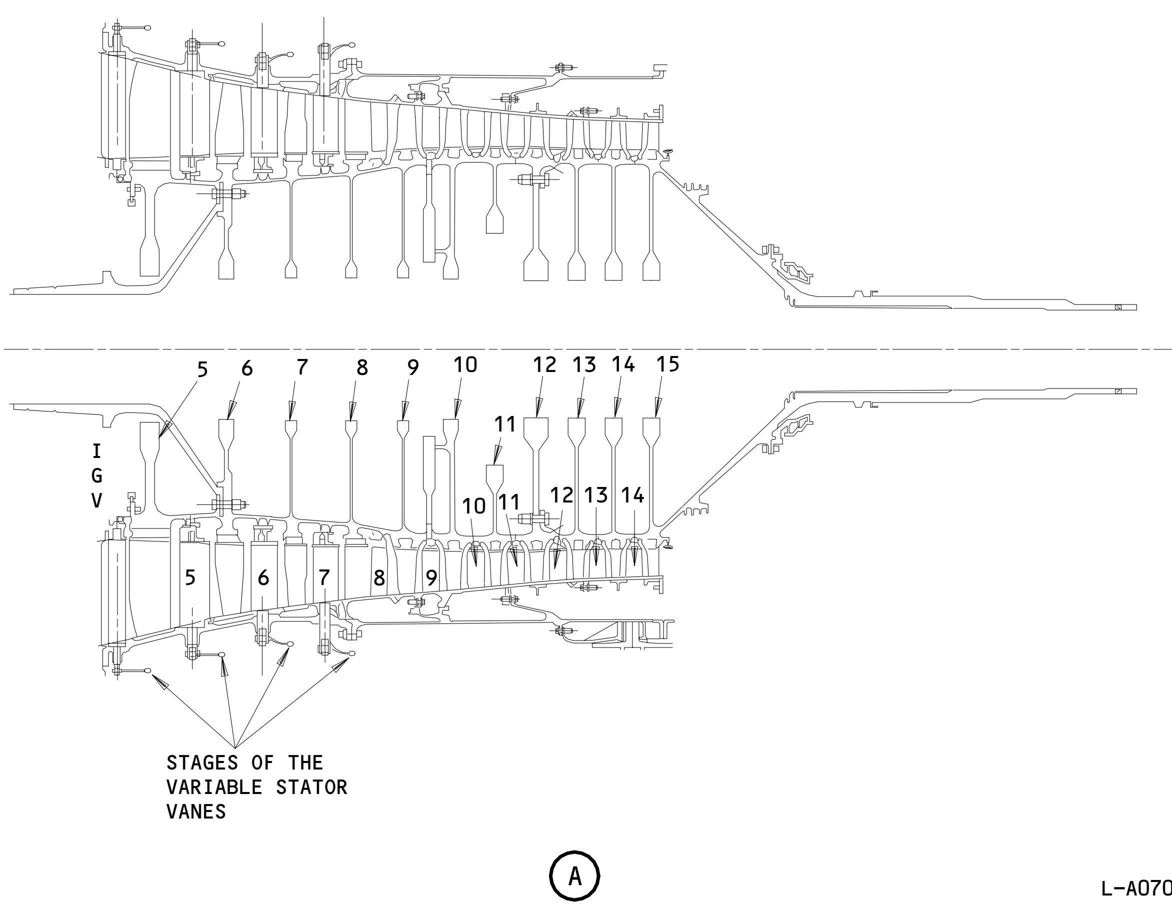
(1) Diffuser And Combustor (Fig. 10)

(a) The diffuser and combustor is attached to the rear case of the high pressure compressor (HPC). The compressed air flows from the exit of the HPT into the diffuser and combustor section. The airflow is straightened and diffused (allowed to expand) which reduces the velocity and raises the pressure of the airflow prior to entering the combustion chamber. Metered fuel is provided to the combustion chamber through 24 fuel injectors. The fuel and air mixture is burned within the combustion chamber. The heat resulting from the combustion process causes the airflow to expand and accelerate rearward to drive the turbines and produce thrust at the exhaust (jet) nozzle.

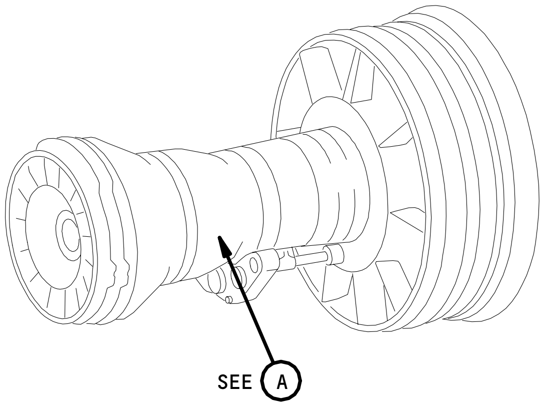


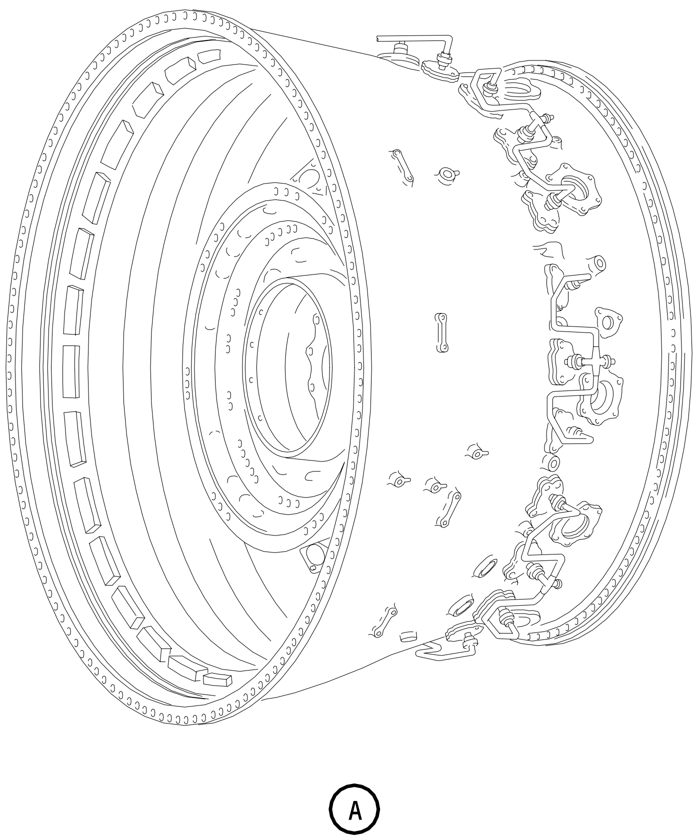
Intermediate Case
Figure 8





High Pressure Compressor (HPC)
Figure 9





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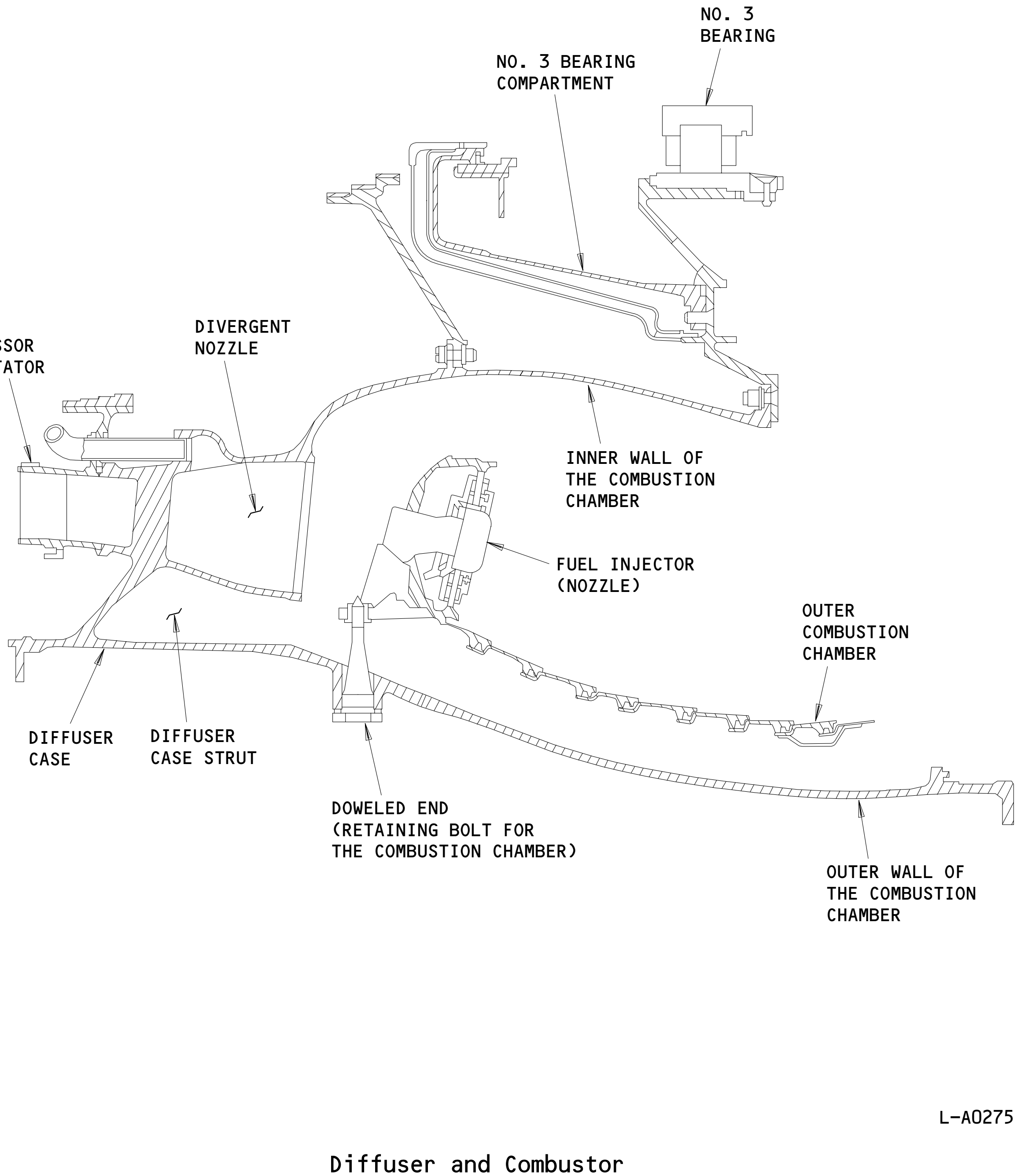
Diffuser and Combustor
Figure 10 (Sheet 1)



Diffuser and Combustor
Figure 10 (Sheet 2)

D. Turbine Section

(1) General

(a) The turbine section contains the turbine nozzle, the high pressure turbine (HPT), the low pressure turbine (LPT), and the turbine exhaust case.

(2) Turbine Nozzle (Fig. 11)

(a) The turbine nozzle contains the inner combustion chamber, the cooling air duct of the 1st-stage HPT (blade) and the vane cluster assemblies of the 1st-stage HPT (nozzle guide). The turbine nozzle is located at the rear internal portion of the diffuser case.

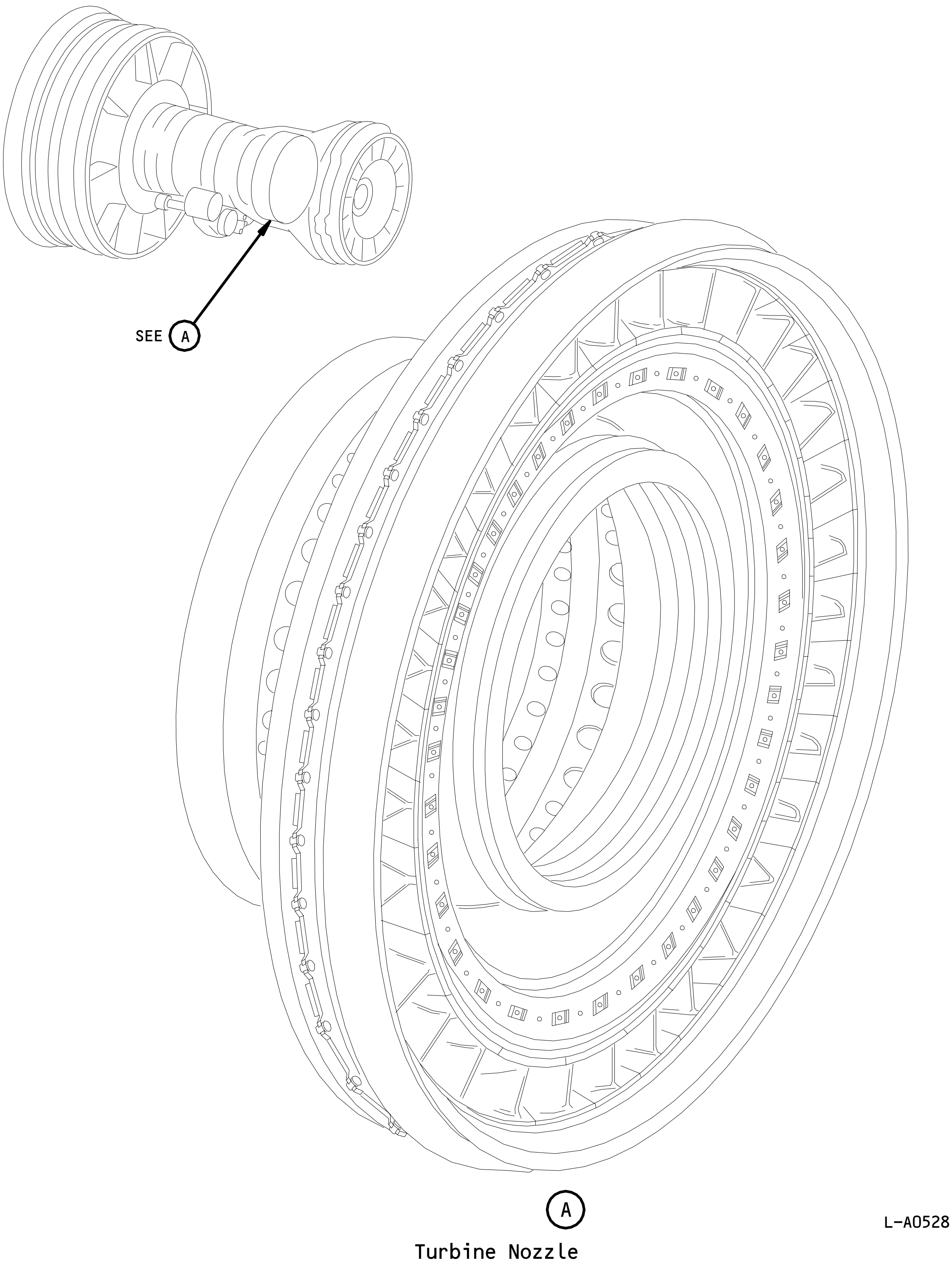
(b) The assembly for the inner combustion chamber (liner) forms the inner half of the annular combustion chamber (burner). The combustion chamber design is commonly referred to as a double pass type burner. The cooling air which is used to insulate the liner from the heat of combustion enters the liner through several small holes at each liner ring into a circumferential groove. This air is then introduced to the inner surface of each liner segment as a uniform cooling film.

(c) The turbine nozzle is formed by 17 vane clusters secured to the cooling air duct of the 1st-stage HPT (blade) and inner combustion chamber. The vanes are air cooled. Cooling air enters the internal passages of each vane. Air exits the vane through a specific pattern of holes to provide a protective film over the gaspath surfaces of the vane. The nozzles formed by the ring of vanes increase the velocity of the hot gasses exiting the combustion chamber and direct these gasses to provide the optimum angle, pressure and flow to the 1st-stage turbine blades.

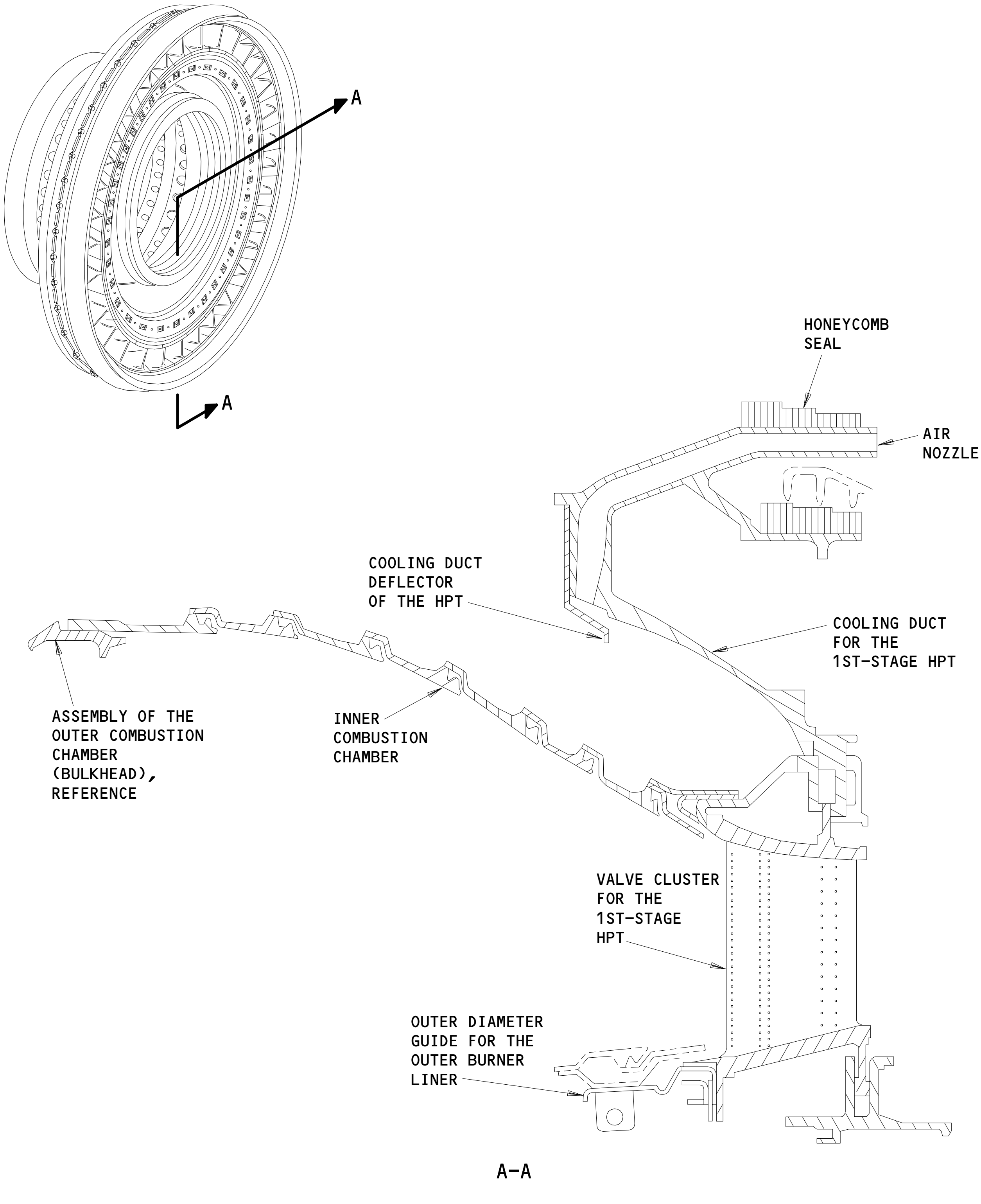
(d) The cooling duct assembly of the 1st-stage HPT, directs cooling air from the inner combusiton chamber area of the diffuser case, through a metering nozzle and directs or impinges the air on the turbine rotor for cooling the 1st-stage turbine blades. The cooling duct case contour also forms the rear inner portion of the combustion chamber. Honeycomb seal lands are provided at the interfaces with the 1st-stage rotor to reduce leakage of the cooling air of the 1st-stage blades.

(3) High Pressure Turbine (HPT) (Fig. 12)

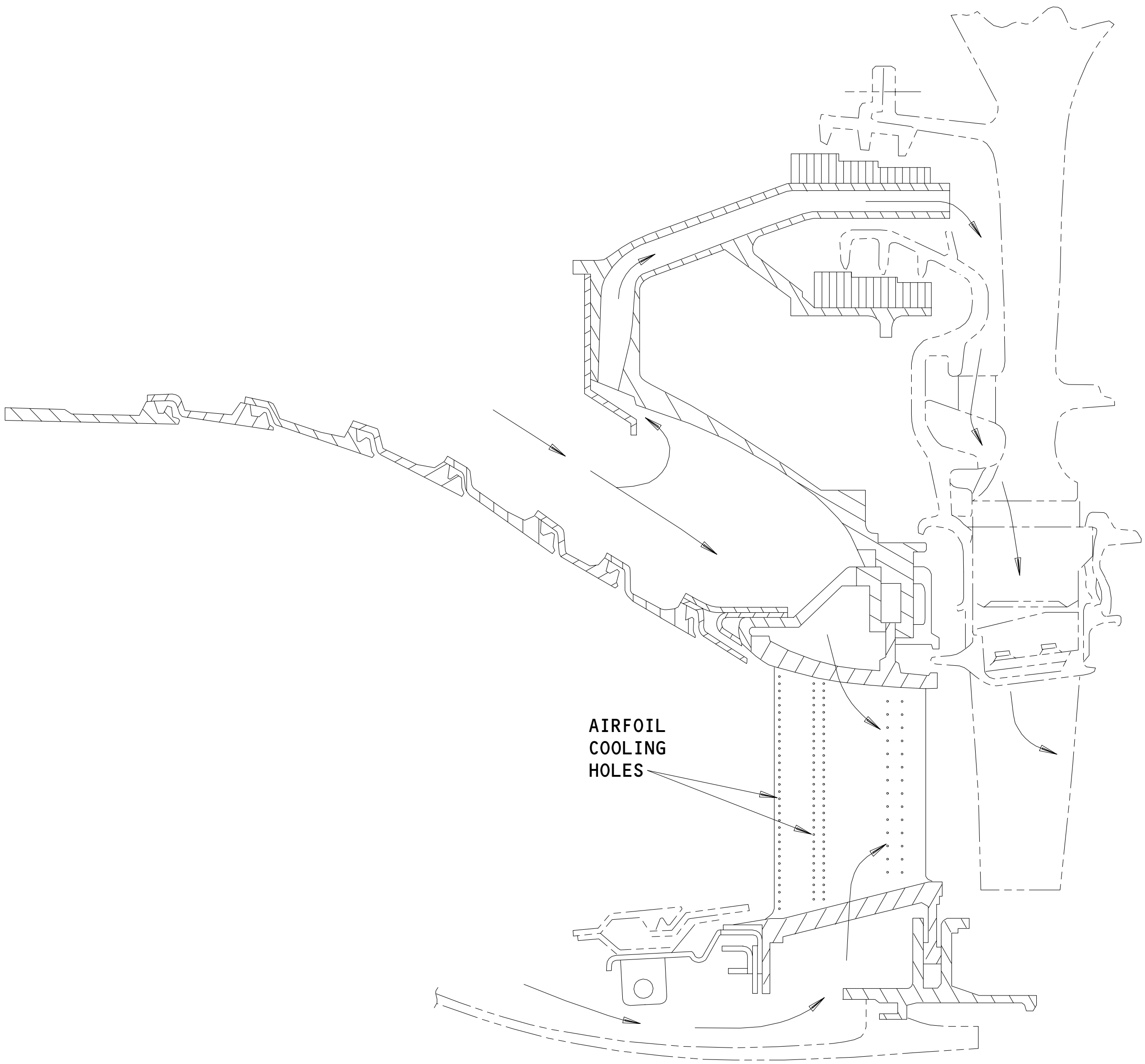
(a) The high pressure turbine (HPT) provides the driving force for the high pressure compressor (HPC). The high pressure turbine is located at the rear of the diffuser and combustor and forward of the low pressure turbine (LPT). The high pressure turbine consists of 2 turbine rotor stages, case and vane assembly and a rotating inner airseal. The turbine rotor assemblies, 2nd-stage vanes and inner airseal are air cooled. The turbine case assembly is also air cooled as part of the automatic control system for turbine rotor clearance.



Turbine Nozzle
Figure 11 (Sheet 1)



Turbine Nozzle
Figure 11 (Sheet 2)



Turbine Nozzle
Figure 11 (Sheet 3)

(b) The 1st-stage turbine rotor employs single crystal material blades, which are cooled by air from the diffuser. The nozzles for the cooling air duct in the turbine nozzle meters cooling air to the blades. The blades are internally air cooled and externally film cooled.

(c) The assembly for the 2nd-stage turbine rotor employs directionally solidified blades which are internally cooled by modulated 12th-stage compressor air and diffuser air. Cooling air is reduced at cruise for increased performance.

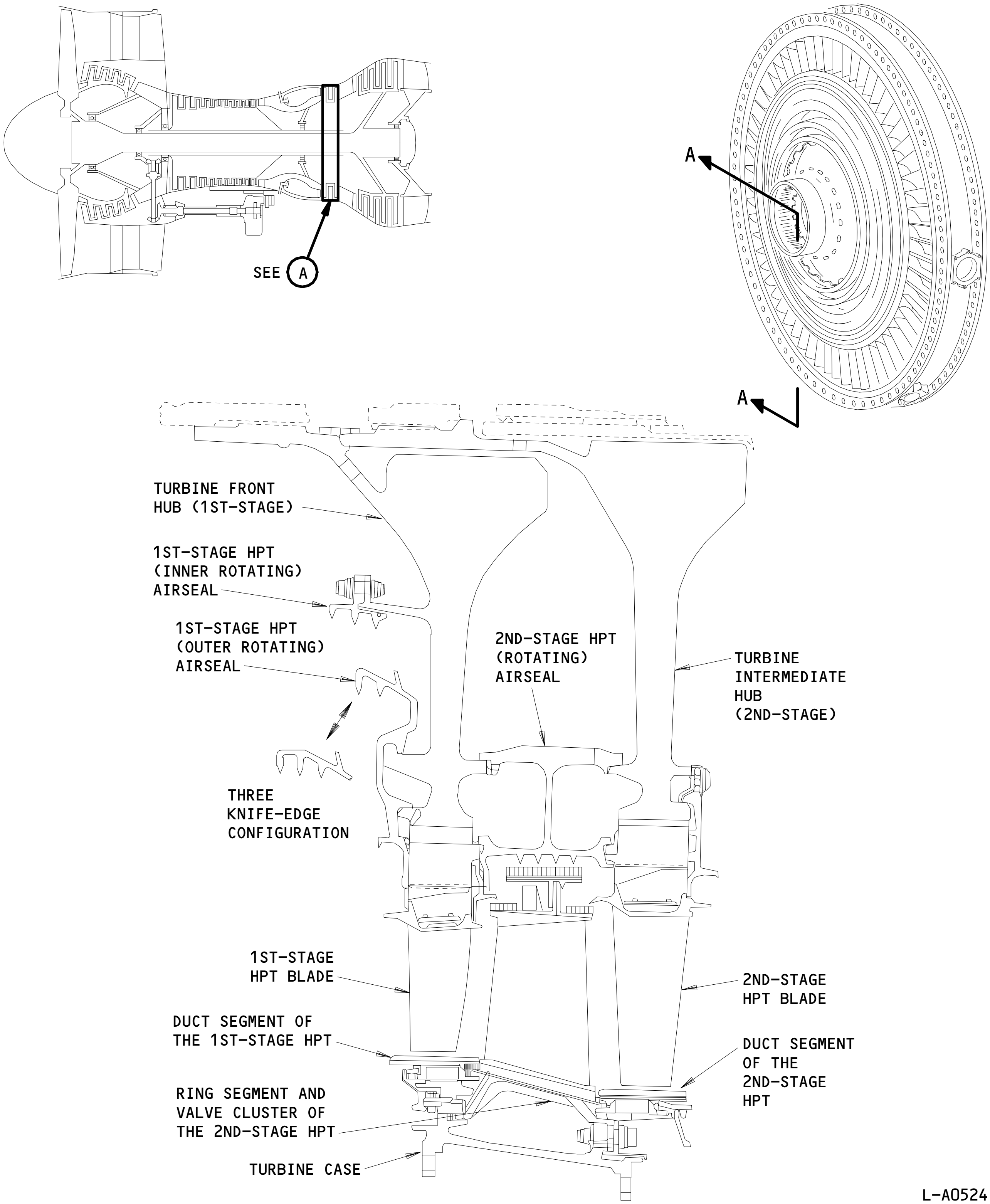
(d) The 2nd-stage vanes are internally air cooled with modulated compressor air. Cooling air is supplied through four external tubes from the 12th-stage compressor bleed location. Two of these tubes contain valves which are closed to reduce cooling air flow at cruise conditions to improve performance. An inner land for an air seal is located on the ID of the 2nd-stage vane clusters and is part of the inner seal of the 2nd-stage vanes. This seal is cooled by nozzles, mounted on the ID of the vanes.

(e) The tubes of the automatic control system for the turbine rotor clearance are mounted to brackets on the outside of the turbine case. These tubes supply fan discharge air to cool the surface of the turbine case during cruise operation. The case cooling results in shrinkage of the turbine case and the segments of the outer airseal duct which decreases the blade tip clearances. The resulting reduced tip clearance provides improved turbine efficiency.

(4) Low Pressure Turbine (LPT) (Fig. 13)

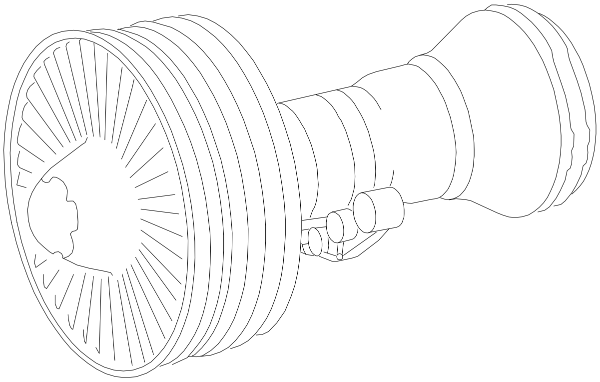
(a) The low pressure turbine provides the rotational driving force for the low pressure compressor. This rotational force is transmitted through a shaft at the center of the engine and coupled to the low pressure compressor. The operating speeds, pressures and temperatures are lower than that of the high pressure turbine as the combustion gasses expand and energy is extracted.

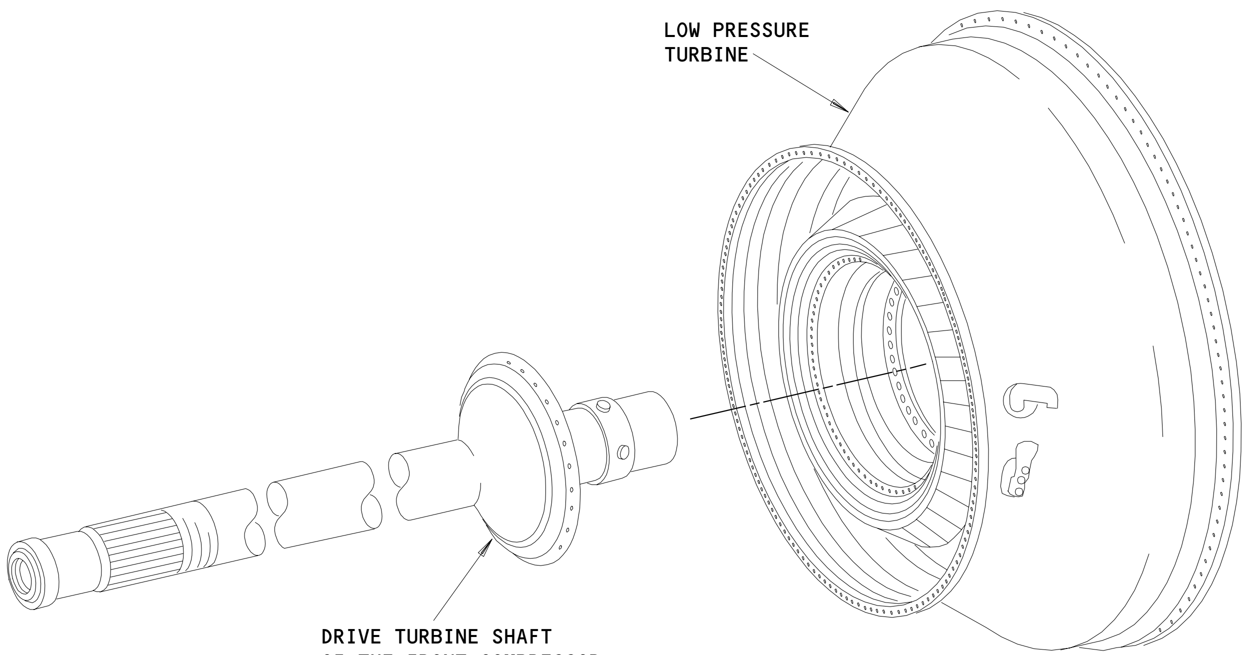
(b) The low pressure turbine is a 4 stage turbine mounted onto the rear of the high pressure turbine and is located forward of the turbine exhaust case. The 3rd- and 4th-stage turbine rotors are each cantilevered and attached to the forward side of the hub of the 5th-stage rear turbine. The 6th-stage turbine rotor is also attached to the 5th-stage rear hub and is cantilevered to the rearward side. Knife-edge seals are positioned between each of the rotating stages, near the ID to seal the stator vanes from gaspath leakage around the vanes.



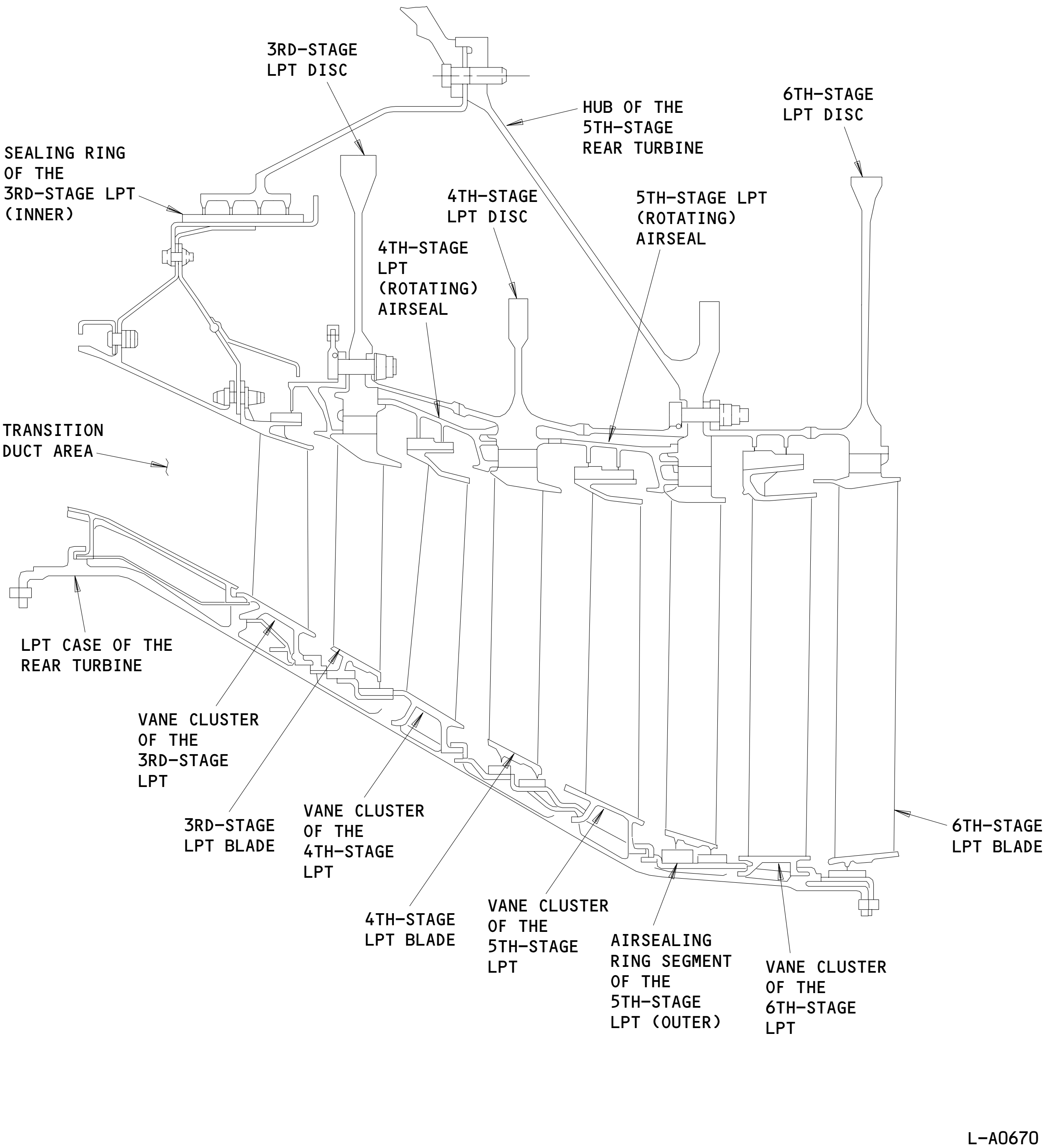
A-A

High Pressure Turbine (HPT)
Figure 12

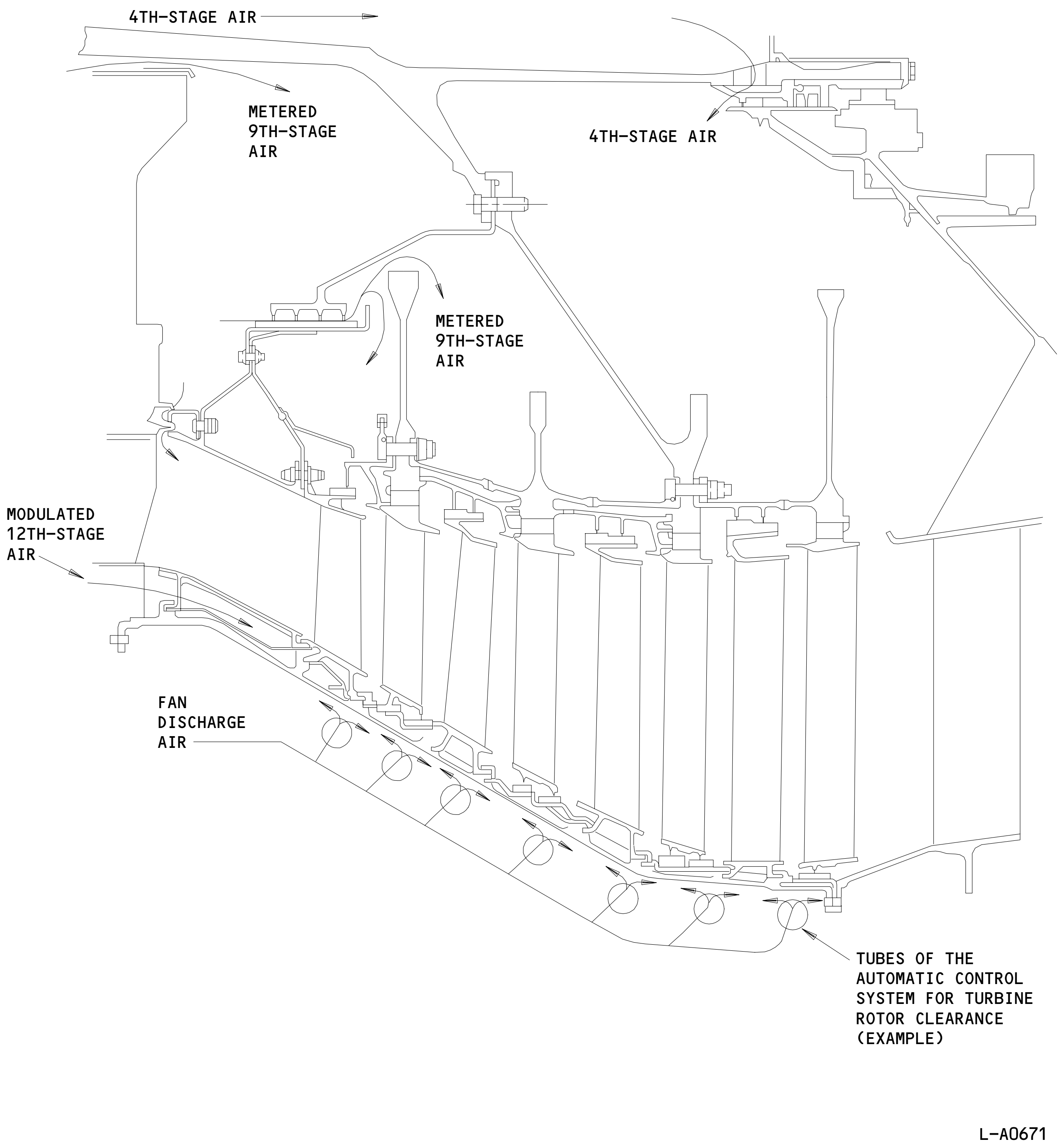




Low Pressure Turbine
Figure 13 (Sheet 1)



Low Pressure Turbine
Figure 13 (Sheet 2)



Low Pressure Turbine
Figure 13 (Sheet 3)

(c) The low pressure turbine case is designed to permit installation of stator vane clusters, at each stage, directly to the case at OD buttresses. The ID of the vane clusters in each stage incorporate a honeycomb seal segment which forms a seal land ring. This seal land ring is the static member of the inner vane seal.

(d) Cooling air is provided to the low pressure turbine to reduce and regulate temperatures in the transition duct OD area, the ID of the rotors, inner cavity areas and the stator seal areas. Air from the high pressure compressor is used to cool the 3rd through 5th-stage inner and outer areas and 4th-stage air from the low pressure compressor is used to cool the 6th-stage inner cavity.

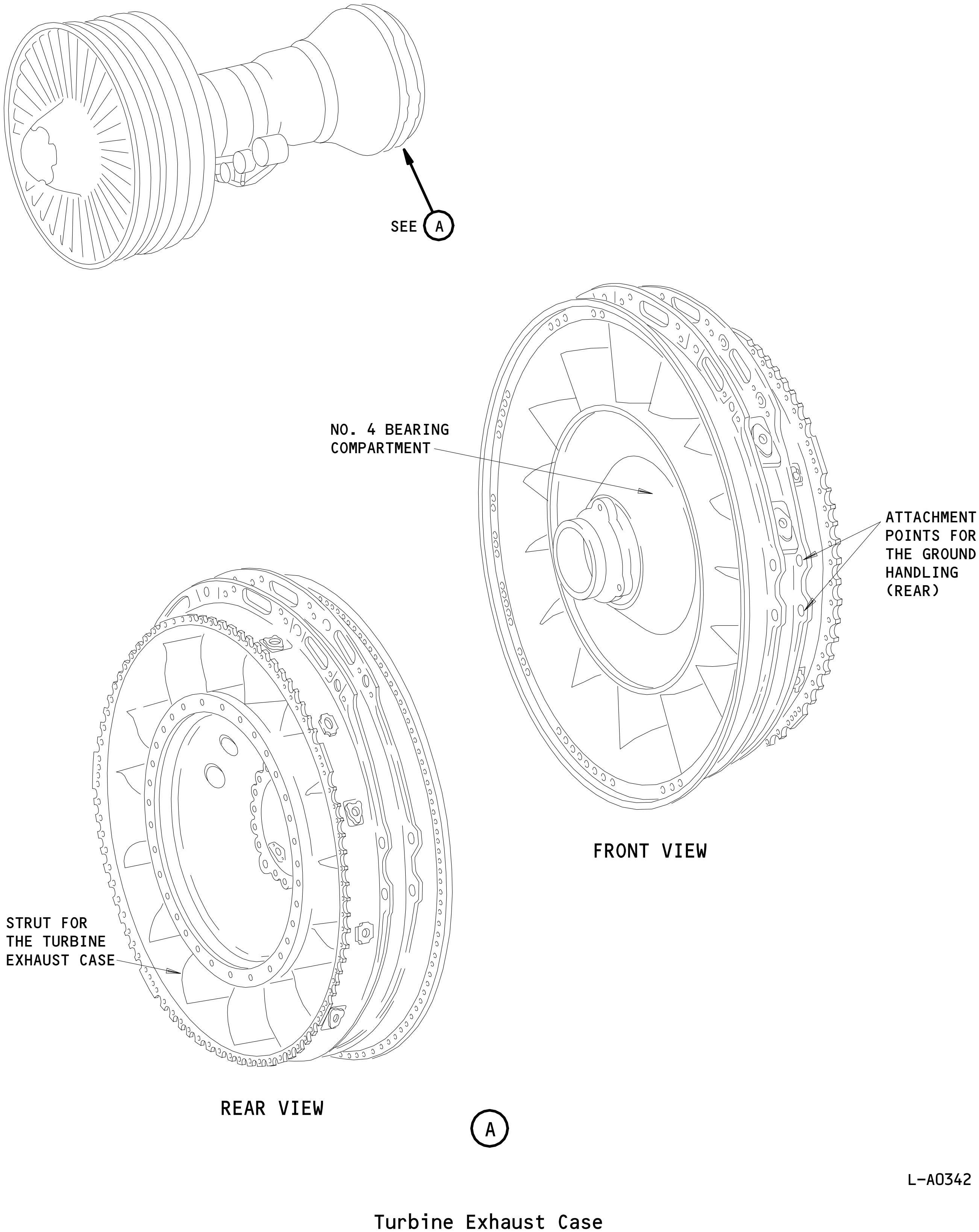
(e) An autotmatic control system for the turbine rotor clearance is incorporated to increase the efficiency of the low pressure turbine at cruise conditions. This system bleeds fan air onto the external surfaces of the case of the low pressure turbine through tubes mounted close to the case, thus shrinking the case and decreasing the clearances of the turbine blade tips.

(f) Vanes of the low pressure turbine are constructed of nickel alloy and are assembled as cast clusters of three vanes. The 3rd-stage stator incorporates aluminide-coated airfoils, with an aerodynamic transition duct directing gas flow exiting the high pressure turbine. The 3rd-stage airseal land is bolted to the inner transition duct shroud and incorporates an abradable honeycomb airseal land in alignment with the four knife-edges of the 3rd-stage airseal (inner rotating) for thrust balance. The 4th- thru 6th-stage stators incorporate uncoated airfoils with integral, abradable honeycomb airseal lands on the ID. These seal lands are in alignment with the knife-edges of the 4th- and 5th-stage (rotating) airseals and the 6th-stage disk to form the inner vane seals.

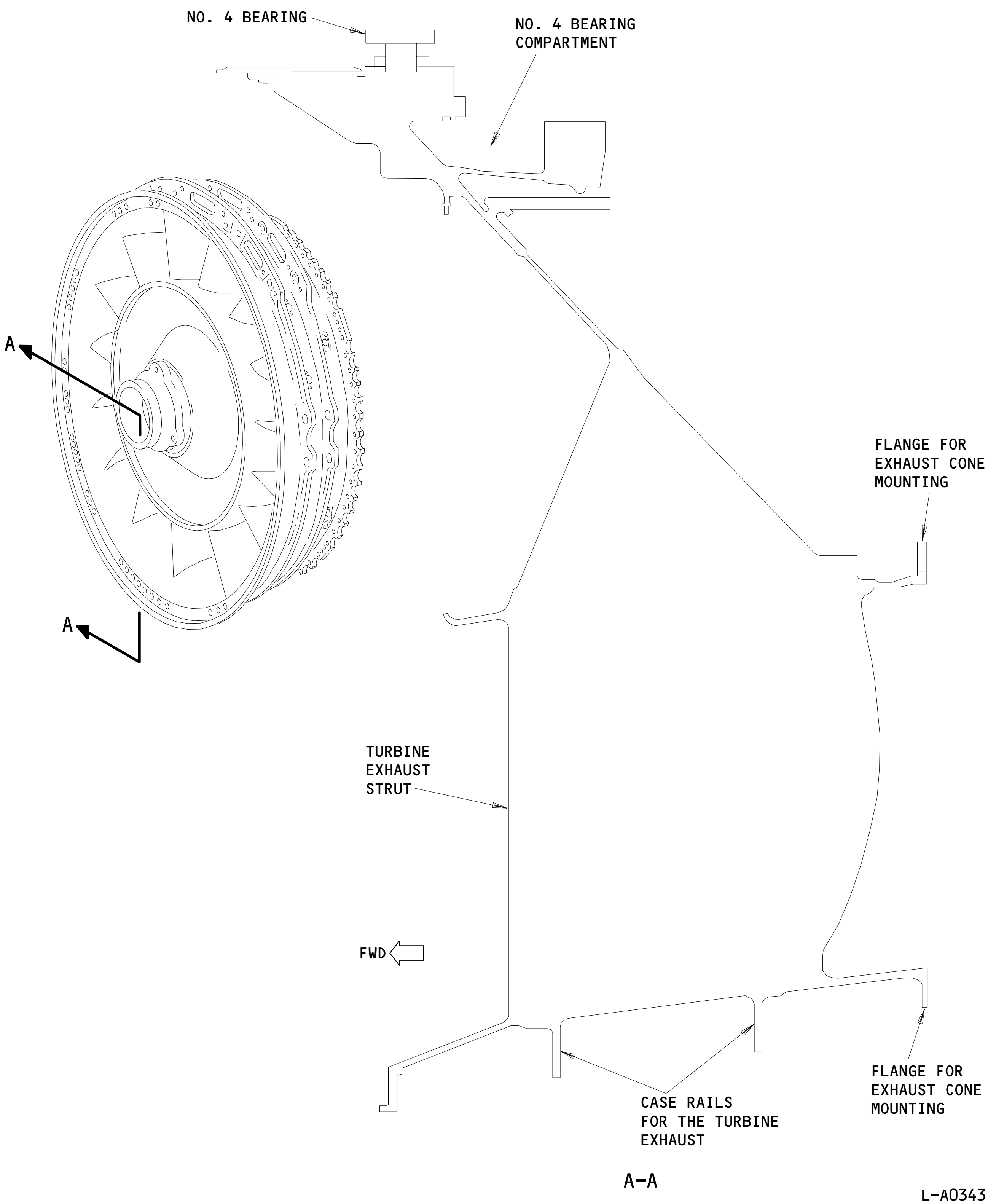
(g) The case for the low pressure turbine is a single piece, machined weldment of six nickel alloy forgings. Internal slotted supports provide hooked engagement with stator vane feet and with segments of the outer airseal shroud positioned behind each of the four vane stages. The segments of the outer airseal shroud incorporate abradable honeycomb rubstrips which align with knife-edge seals on the outer shrouds of the turbine blades.

(h) The tubes of the automatic control system for the turbine rotor clearance surround the external surfaces of the case of the low pressure turbine, and impinge fan discharge air on the surface of the case to cool the case during cruise power operation. Cooling the case surface results in shrinkage of the case, with decreased tip clearances between the blade tips and airseal lands, resulting in improved turbine efficiency.

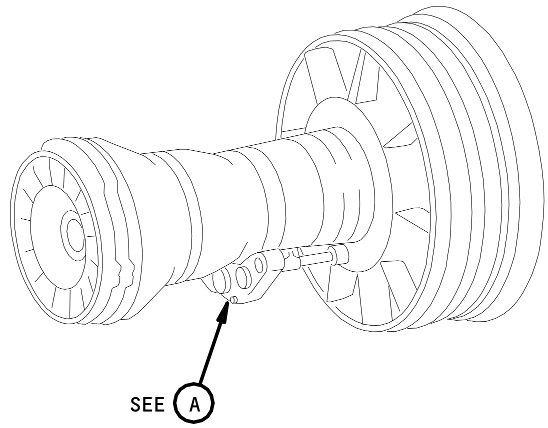
(5) Turbine Exhaust Case (Fig. 14)

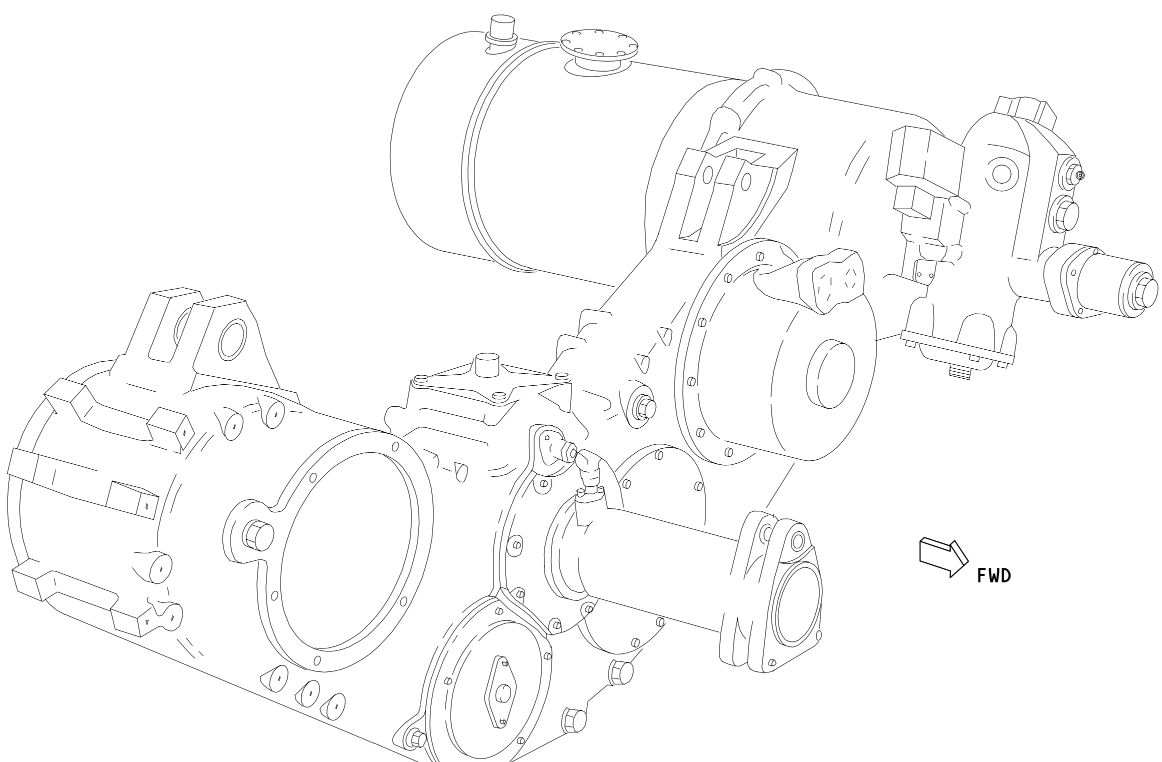


Turbine Exhaust Case
Figure 14 (Sheet 1)



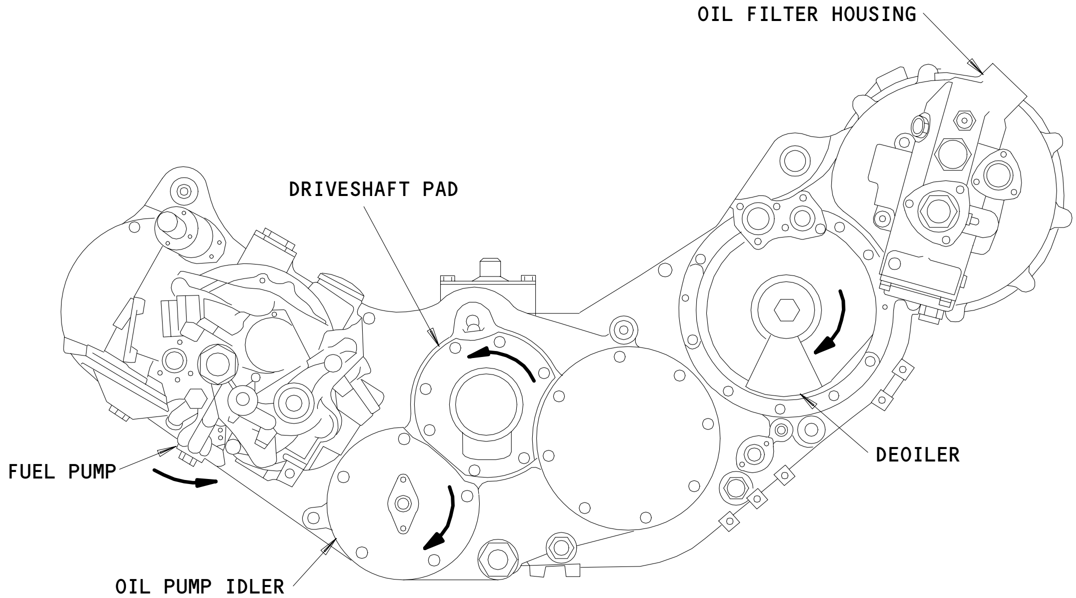
Turbine Exhaust Case
Figure 14 (Sheet 2)



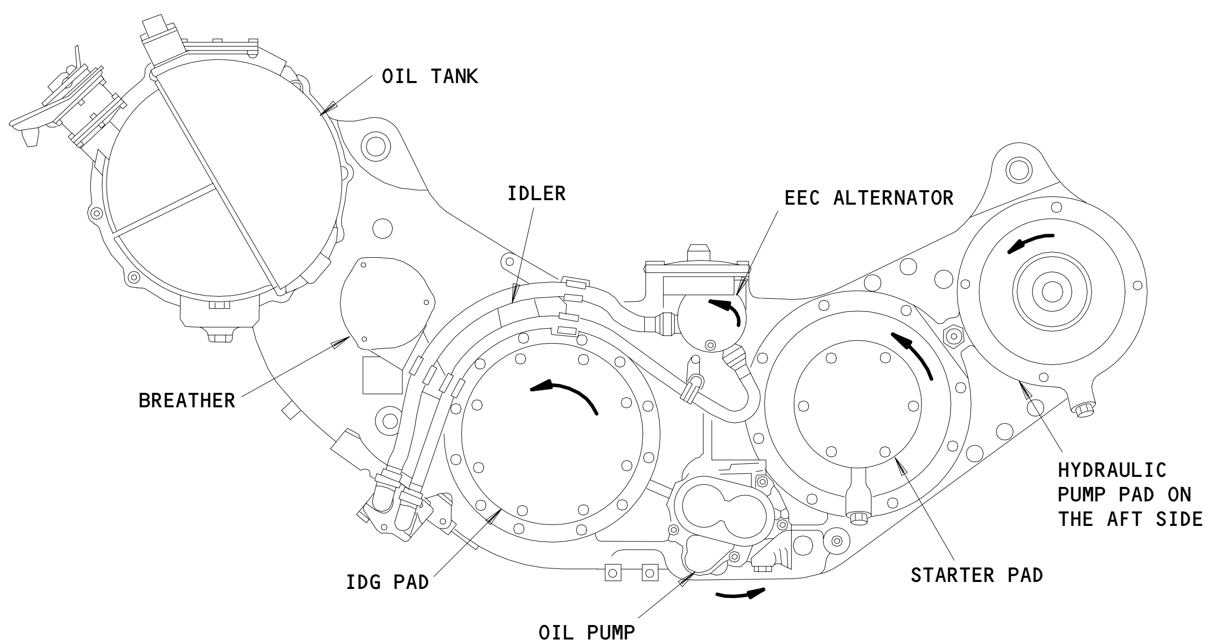


A

Main Gearbox
Figure 15 (Sheet 1)



FRONT VIEW



REAR VIEW

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Main Gearbox
Figure 15 (Sheet 2)

(a) The assembly for the turbine exhaust case is a main structural support member of the engine and provides a housing for the rear (LPT) shaft bearing (No. 4 Bearing). This structural case provides the aft attachment point for the power plant to the airplane strut. Rear attachment point for a ground handling tool are also located on this case.

(b) The turbine exhaust case is the transition duct for the exhaust gas flow from divergent (through the turbines) to convergent (through the exhaust nozzle).

(c) Provisions are made in the rear mount rails for the attachment of the engine (lower) aft mount links to carry engine vertical, side and torsional loads to the airplane structure. Then engine rear ground handling provisions consist of 2 holes through the rear mount rail on the horizontal centerline.

(d) Probes are installed between the exhaust case struts at 4 locations. At two locations probes measure gaspath total temperature (T4.95). At the other 2 locations, probes measure gaspath total temperature and total gaspath pressure.

E. Accessory Drives

(1) Main Gearbox (Fig. 15)

(a) Main gearbox power to drive the engine and airplane supplied accessories is obtained from the rotor for the high pressure compressor (HPC). A vertical (radial) driveshaft in the intermediate case is geared to the front of the rotor.

(b) The vertical driveshaft drives the bevel gear set for the angle gearbox which transmits power to the main gearbox through the gearbox driveshaft assembly. The angle gearbox is located in the intermediate case completely enclosed between the rear case of the fan exit and the OD wall of the intermediate case.

(c) The main gearbox incorporates drive pads for the engine fuel pump and fuel metering unit (tandem mounted), engine hydraulic pump, the starter, the integrated drive generator. Provisions are also incorporated to permit hand cranking of the compressor rotor to allow more complete inspection through the borescope ports.

(d) The gearbox engine accessories include an alternator for the electronic engine control (EEC), a module for the lubrication and scavenge oil pump and a main oil filter.

(e) For additional description of the accessory gearboxes, refer to AMM 72-60-00.

F. Main Bearings (Fig. 16)

(1) Main bearing locations are commonly referred to by number. Table 1 provides information on bearing location and type.

Main Bearing Identification
Table 1

Bearing No.	Location	Type
1	Low Pressure Compressor; Turbine Shaft Coupling	Ball
1.5	Intermediate Case; Turbine Shaft Coupling	Roller
2	Intermediate Case; Front Hub of the Rear Compressor	Ball
3	Diffuser Case; Rear Hub of the Rear Compressor	Roller
4	Turbine Exhaust Case; Drive Turbine Shaft of the Front Compressor	Roller

(a) The No. 1 bearing is a thrust bearing for the low pressure compressor (LPC) and consists of a split inner race, angular contact ball bearing mounted aft of the fan rotor in a relatively cool area. Lubrication and cooling oil is supplied under the inner race and introduced to the bearing through the inner race split.

(b) The No. 1.5 bearing is a standard non-preloaded cylindrical roller bearing which radially supports the coupling of the drive turbine shaft for the low compressor. It is mounted at the forward end of the intermediate case. Lubrication for the front seal and the bearing is provided by a single jet directed at the front of the seal plate. Lubrication for the rear seal plate is provided by use of an axial scoop.

(c) The No. 2 bearing is a thrust bearing for the high pressure compressor (HPC) and consists of a split inner race, angular contact ball bearing mounted forward of the rear compressor rotor. Lubrication and cooling oil is supplied under the inner race and carried to the bearing through the inner race split.

(d) The No. 3 bearing is a preloaded cylindrical roller bearing mounted forward of the high pressure turbine. The preload to prevent skidding is mechanically applied by grinding the outer surface of the outer race elliptical, and grinding the inner surface of the outer race round. Mounting this race in a round housing then forces the inner surface to assume an elliptical shape, thus creating a two-point preload of the bearing. The retainer is a balanced, silver plated, one-piece inner land riding cage. Lubrication is provided by splash oil from the seal plates and scoop.

(e) The No. 4 bearing is a standard non-preloaded cylindrical roller bearing which radially supports the rear of the drive shaft for the low pressure compressor. It is mounted aft of the drive turbine for the front compressor. The retainer is a balanced, silver plated, one-piece inner land riding cage. Lubrication is provided by splash oil from the seal and scoop.

G. Bearing Supports

(1) The engine incorporates three support structures for the main bearings; both the low pressure and high pressure rotors are supported at the front by the intermediate case structure. The high pressure compressor and high pressure turbine are supported by the diffuser case structure, and the low pressure turbine is supported by the structure for the turbine exhaust case.

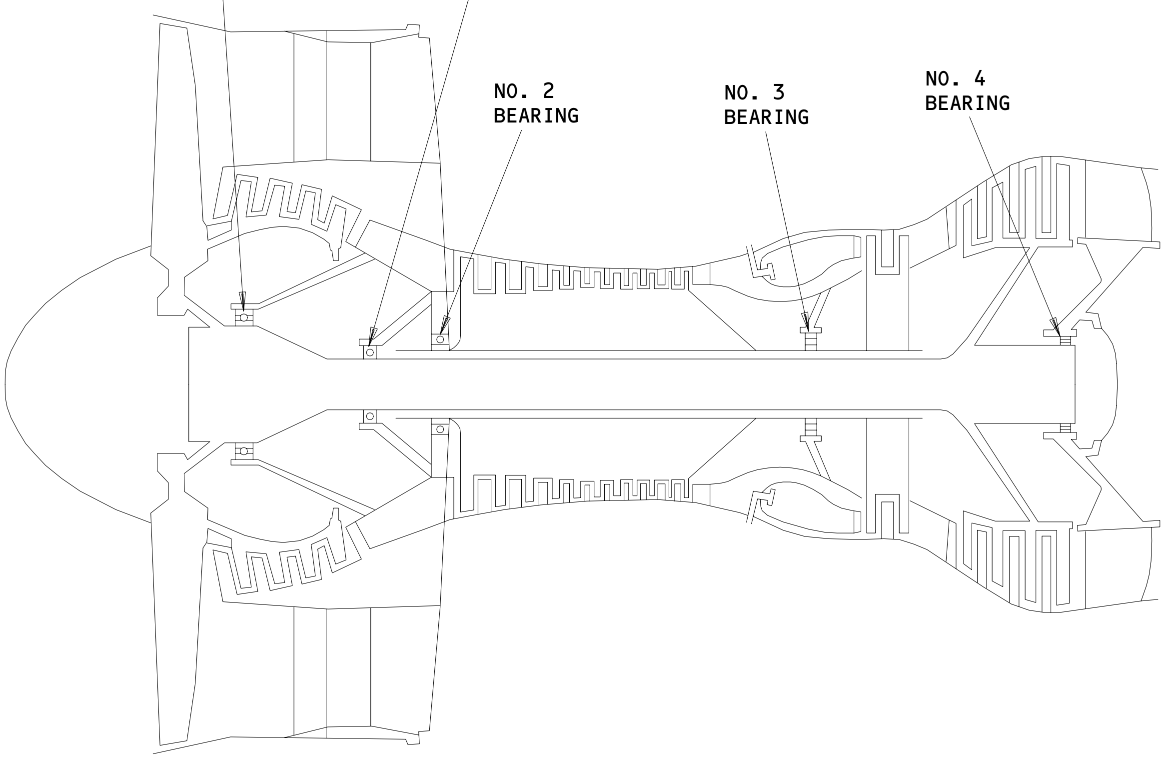
(2) All bearing support structures consist of a system of inner and outer cones or rings connected through the flow path by airfoil shaped struts.

(a) Intermediate Case Support

1) The loads from the No. 1, No. 1.5, and No. 2 bearings are carried through the compressor intermediate case across the engine flow path to the fan exit case.

(b) Diffuser and Combustion Case Support

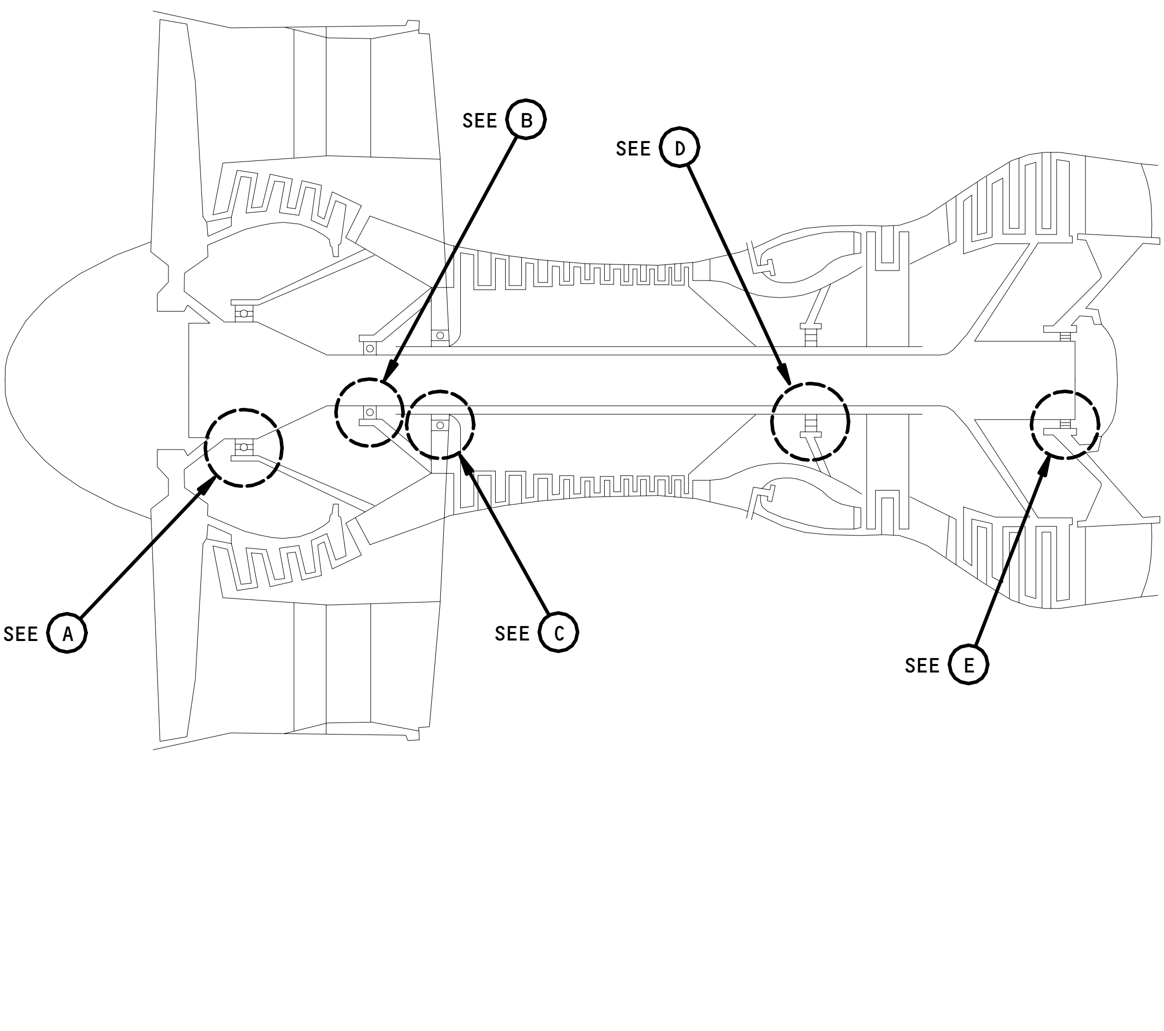
1) The inner section of the diffuser case provides structural support for the No. 3 bearing compartment and is connected radially to the outer section by 24 struts. Bearing loads are carried from the inner case through the struts to the outer case.



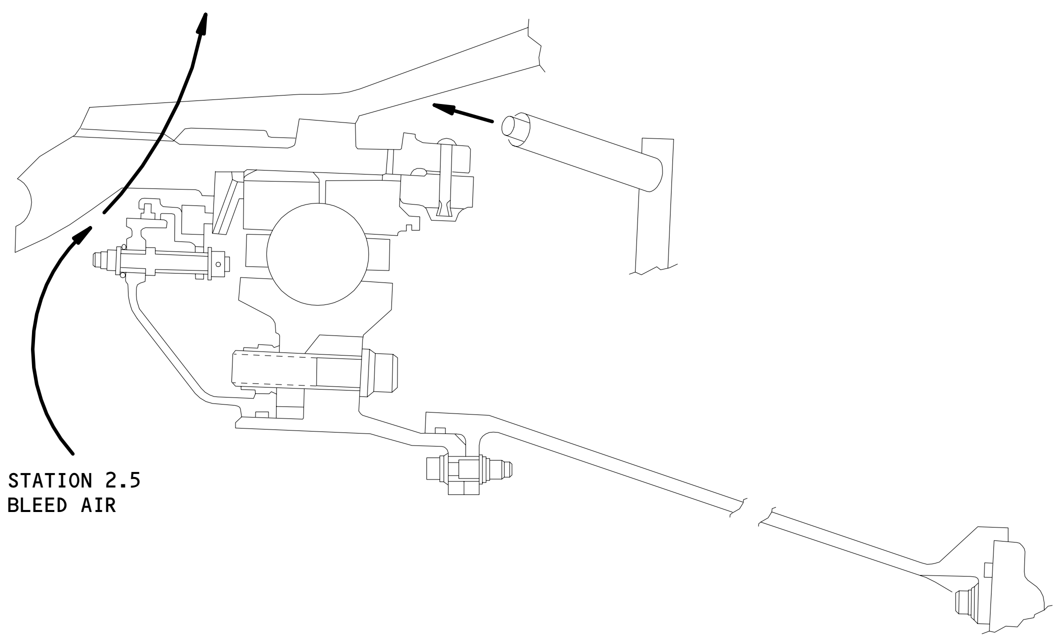
Main Bearing Numbering/Location
Figure 16

(c) Support for the Turbine Exhaust Case
   1) The inner cone section of the turbine exhaust case provides structural support for the No. 4 bearing compartment, and transfers bearing loads to the outer case section through 15 radial struts.

H. Seal Pressurization of the Bearing Compartment
(1) The carbon seals for the main bearing are pressurized by compressor air to ensure that oil is not permitted to enter the airstream as follows:
   (a) No. 1, No. 1.5, and No. 2 Bearing Compartments
      1) The No. 1, No. 1.5, and No. 2 carbon seals are dry face spring loaded seals.
      2) Carbon seals for the No. 1 bearing and No. 2 bearing are pressurized by station 2.5 bleed air for the low pressure compressor.
      3) The No. 1.5 bearing seals are pressurized by 9th-stage bleed air from the high pressure compressor (HPC).
   (b) No. 3 Bearing Compartment
      1) The No. 3 seals are spring-loaded wet face carbon seals, and are located forward and to the rear of the No. 3 bearing.
      2) The seals are pressurized by 12th-stage bleed air from the HPC that has passed through an air/air heat exchanger located in the fan exit/intermediate case.
   (c) No. 4 Bearing Compartment
      1) The carbon seal for the The No. 4 bearing is a dry face ring seal.
      2) This seal is pressurized by LPC station 2.5 air that enters the shaft of the low pressure turbine forward of the No. 1 bearing.



Bearing Compartment Locations
Figure 17 (Sheet 1)

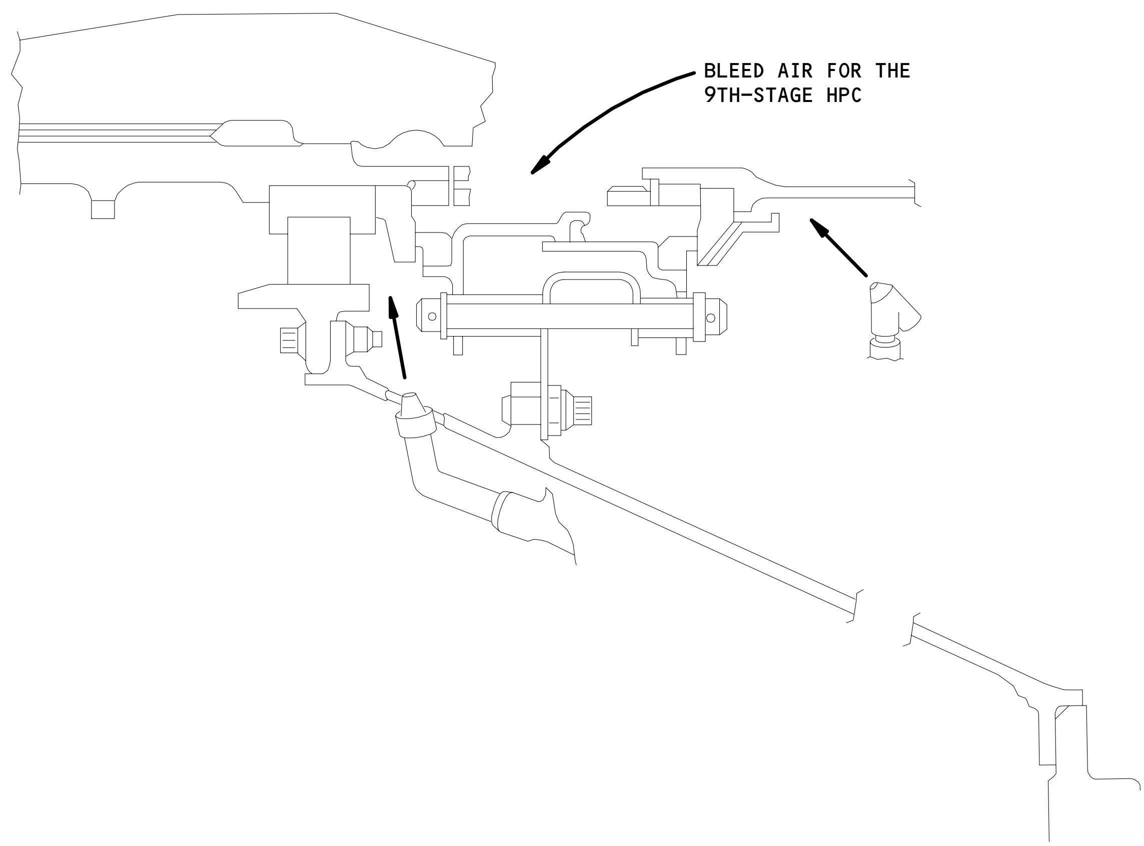


NO. 1 BEARING AREA

A

L-A0462

Bearing Compartment Locations
Figure 17 (Sheet 2)

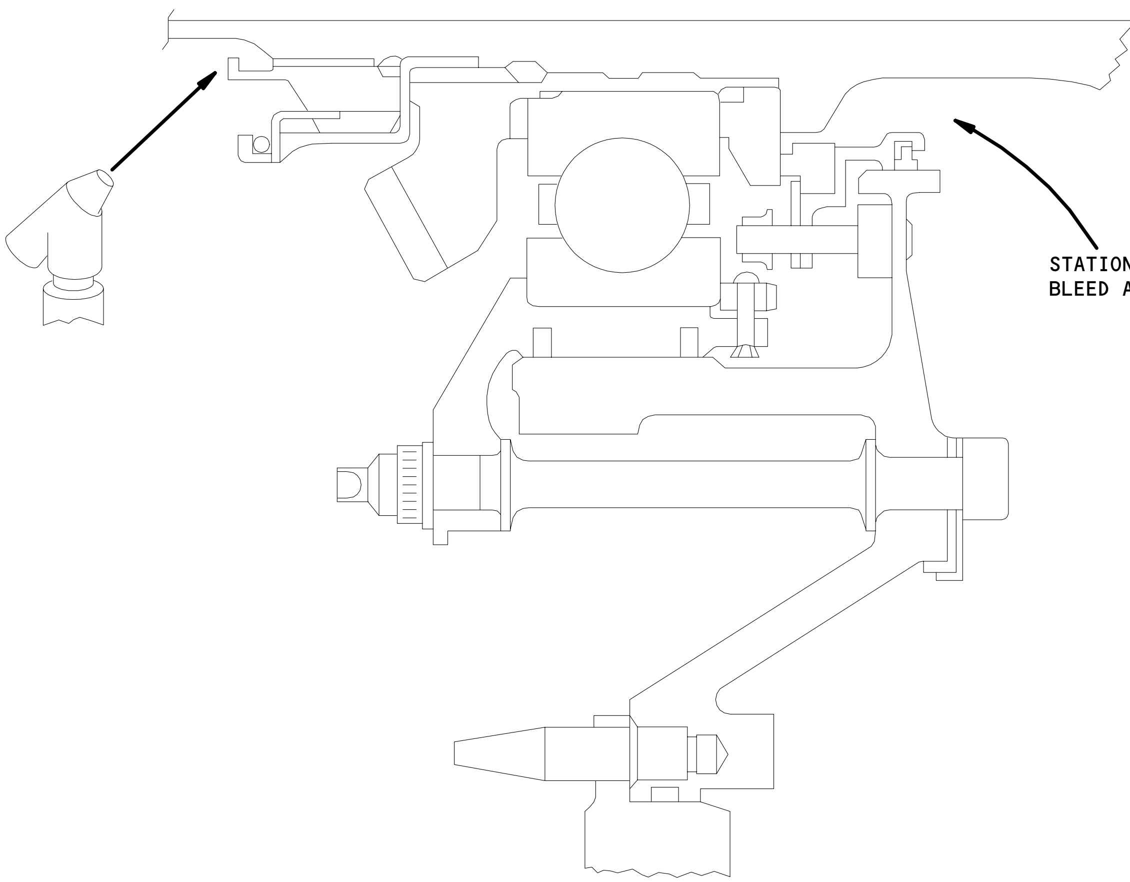


NO. 1.5 BEARING AREA

B

L-A0463

Bearing Compartment Locations
Figure 17 (Sheet 3)

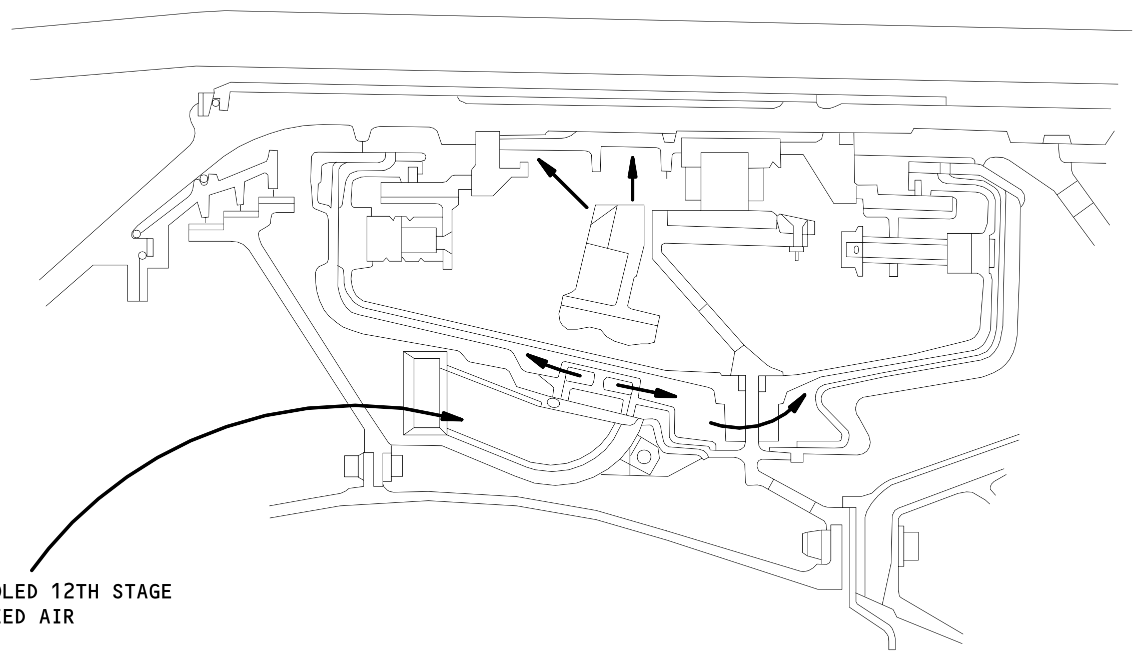


NO. 2 BEARING AREA

C

L-A0464

Bearing Compartment Locations
Figure 17 (Sheet 4)

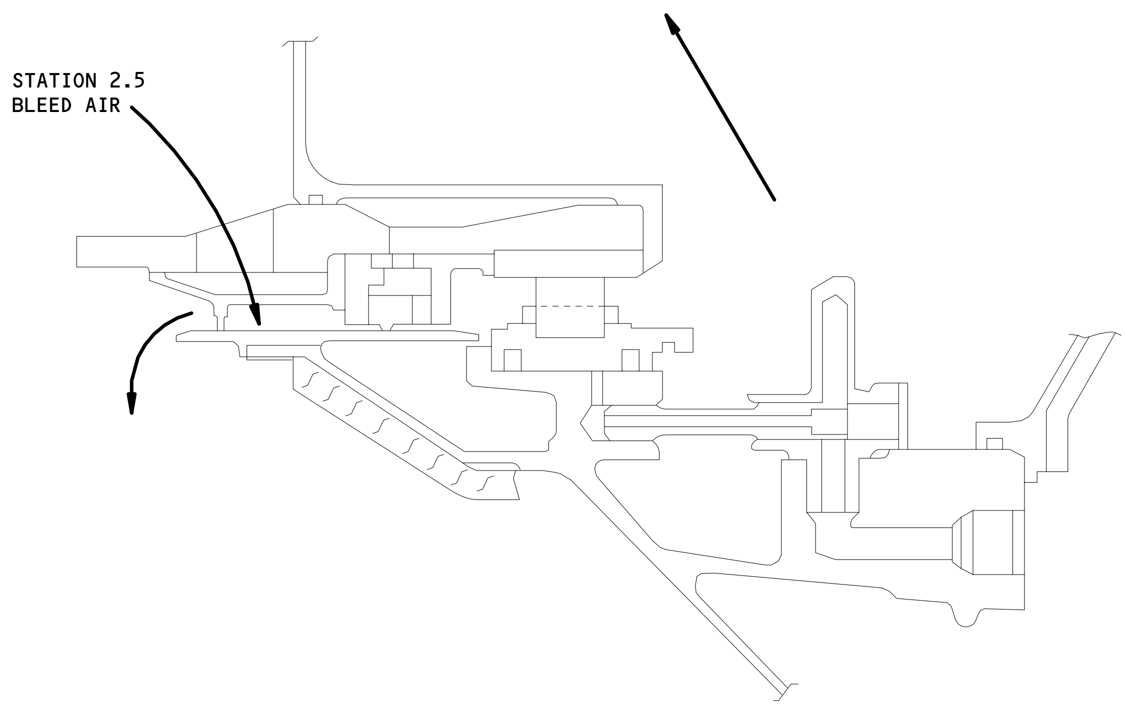


NO. 3 BEARING AREA

D

L-A0465

Bearing Compartment Locations
Figure 17 (Sheet 5)



NO. 4 BEARING AREA

E

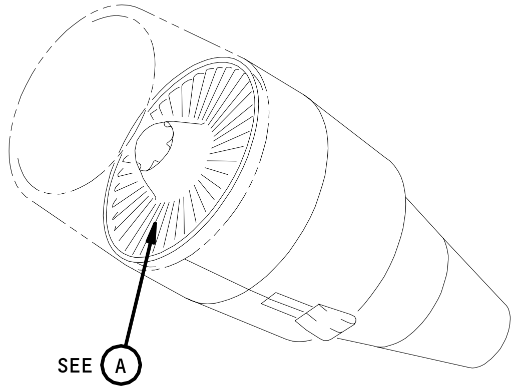
L-A0466

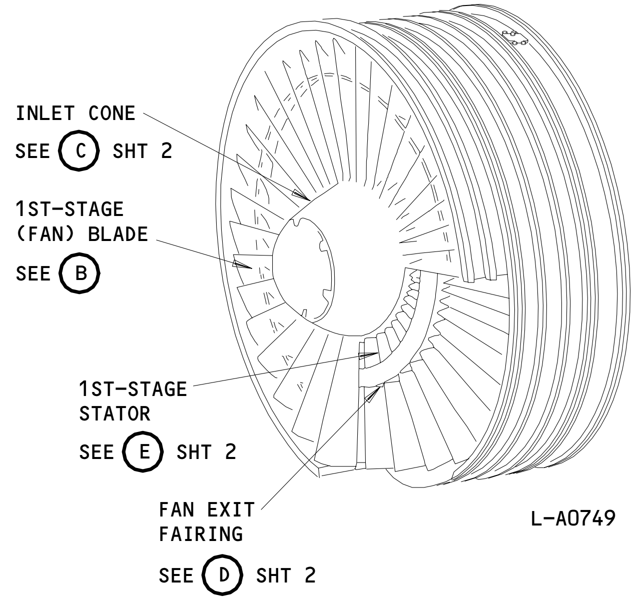
Bearing Compartment Locations
Figure 17 (Sheet 6)

ENGINE

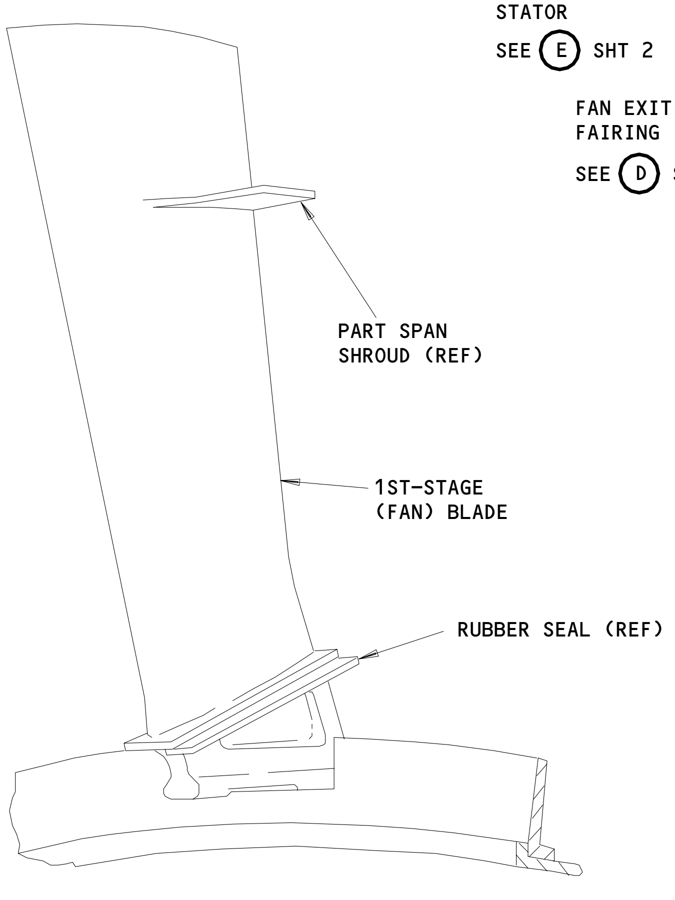
COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
BLADES - 1ST-STAGE (FAN), LEFT ENG	1	38	LPC HUB	72-31-02
BLADES - 1ST-STAGE (FAN), RIGHT ENG	1	38	LPC HUB	72-31-02
CASE - FRONT FAN, LEFT ENG	3	1	413,414, FAN COWL PANELS	72-33-01
CASE - FRONT FAN, RIGHT ENG	3	1	423,424, FAN COWL PANELS	72-33-01
CONE - INLET, LEFT ENG	2	1	LPC HUB	72-31-01
CONE - INLET, RIGHT ENG	2	1	LPC HUB	72-31-01
COUPLING - STARTER DRIVE, LEFT ENG	6,8	1	415,416, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-09
COUPLING - STARTER DRIVE, RIGHT ENG	6,8	1	425,426, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-09
COVER - NO. 4 BEARING COMPARTMENT, LEFT ENG	9	1	419, TURBINE EXHAUST SLEEVE, TURBINE EXHAUST CASE, AFT FACE	72-54-04
COVER - NO. 4 BEARING COMPARTMENT, RIGHT ENG	9	1	429, TURBINE EXHAUST SLEEVE, TURBINE EXHAUST CASE, AFT FACE	72-54-04
FAIRING - FAN EXIT, LEFT ENG	2	1	LPC	72-31-03
FAIRING - FAN EXIT, RIGHT ENG	2	1	LPC	72-31-03
GEARBOX - ANGLE, LEFT ENG	5	1	415,416, THRUST REVERSER HALVES, INTERMEDIATE CASE	72-62-01
GEARBOX - ANGLE, RIGHT ENG	5	1	425,426, THRUST REVERSER HALVES, INTERMEDIATE CASE	72-62-01
GEARBOX - ANGLE, LEFT ENG	5	1	435,436, THRUST REVERSER HALVES, INTERMEDIATE CASE	72-62-01
GEARBOX - ANGLE, RIGHT ENG	5	1	445,446, THRUST REVERSER HALVES, INTERMEDIATE CASE	72-62-01
HOUSING - MAIN OIL FILTER, LEFT ENG	5	1	415,416, THRUST REVERSER HALVES, MAIN GEARBOX, FWD FACE	72-61-11
HOUSING - MAIN OIL FILTER, RIGHT ENG	5	1	425,426, THRUST REVERSER HALVES, MAIN GEARBOX, FWD FACE	72-61-11
SEAL - DEOILER DRIVE OIL, LEFT ENG	6,7	1	415, LEFT THRUST REVERSER HALF, MAIN GEARBOX, AFT FACE	72-61-02
SEAL - DEOILER DRIVE OIL, RIGHT ENG	6,7	1	425, LEFT THRUST REVERSER HALF, MAIN GEARBOX, AFT FACE	72-61-02
SEAL - EEC ALTERNATOR DRIVE OIL, LEFT ENG	6,7	1	415,416, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-05
SEAL - EEC ALTERNATOR DRIVE OIL, RIGHT ENG	6,7	1	425,426, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-05
SEAL - FUEL PUMP DRIVE OIL, LEFT ENG	6,7	1	416, RIGHT THRUST REVERSER HALF, MAIN GEARBOX, FWD FACE	72-61-06
SEAL - FUEL PUMP DRIVE OIL, RIGHT ENG	6,7	1	426, RIGHT THRUST REVERSER HALF, MAIN GEARBOX, FWD FACE	72-61-06
SEAL - HYDRAULIC PUMP DRIVE OIL, LEFT ENG	6,7	1	416, RIGHT THRUST REVERSER HALF, MAIN GEARBOX, AFT FACE	72-61-07
SEAL - HYDRAULIC PUMP DRIVE OIL, RIGHT ENG	6,7	1	426, RIGHT THRUST REVERSER HALF, MAIN GEARBOX, AFT FACE	72-61-07
SEAL - INTEGRATED DRIVE GENERATOR (IDG) DRIVE OIL, LEFT ENG	6,8	1	415,416, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-04
SEAL - INTEGRATED DRIVE GENERATOR (IDG) DRIVE OIL, RIGHT ENG	6,8	1	425,426, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-04
SEAL - STARTER DRIVE OIL, LEFT ENG	6,8	1	415,416, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-03
SEAL - STARTER DRIVE OIL, RIGHT ENG	6,8	1	425,426, THRUST REVERSER HALVES, MAIN GEARBOX, AFT FACE	72-61-03
SEGMENT - FAN EXIT LINER, LEFT ENG	4	8	415,416, THRUST REVERSER HALVES, INTERMEDIATE CASE	72-34-03
SEGMENT - FAN EXIT LINER, RIGHT ENG	4	8	425,426, THRUST REVERSER HALVES, INTERMEDIATE CASE	72-34-03
STATOR - 1ST-STAGE, LEFT ENG	2	1	LPC	72-31-04
STATOR - 1ST-STAGE, RIGHT ENG	2	1	LPC	72-31-04

Component Index
Figure 101





A

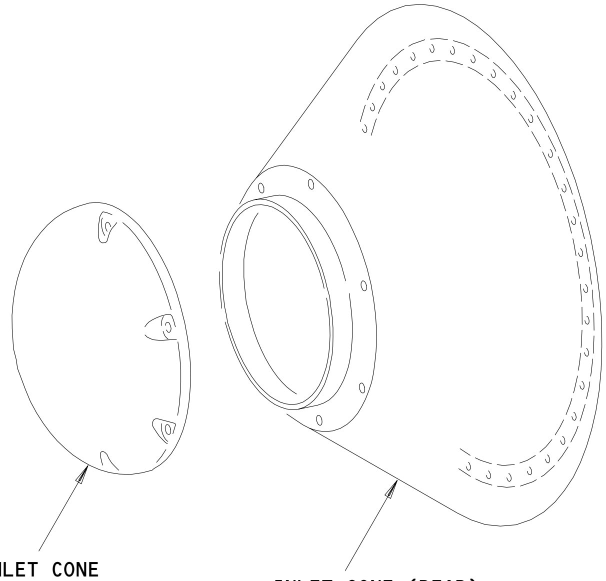


1ST-STAGE (FAN) BLADE

B

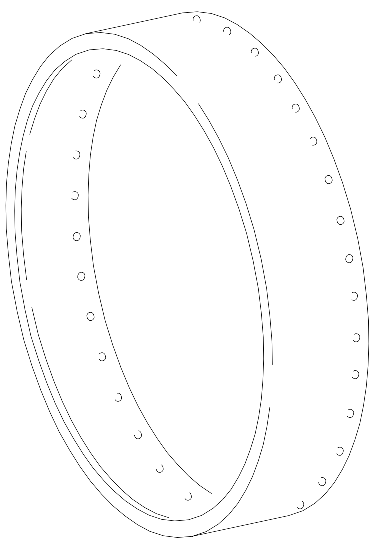
L-A2005

Component Location
Figure 102 (Sheet 1)



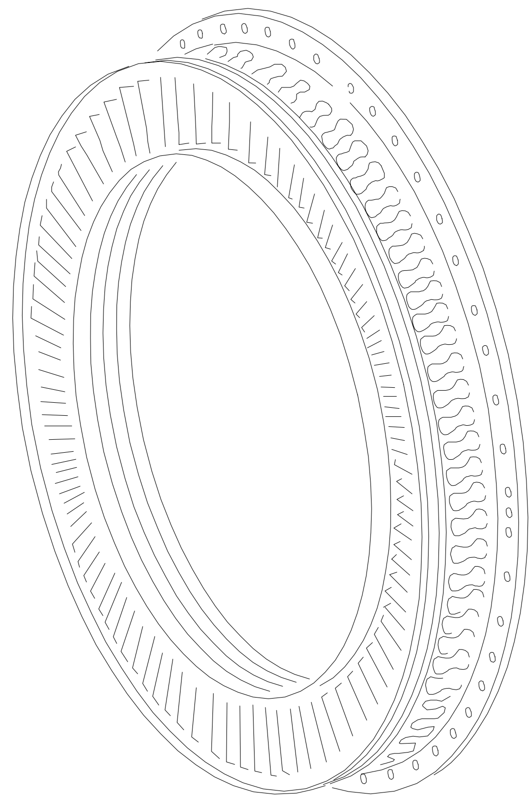
C

L-A0035



FAN EXIT FAIRING

D

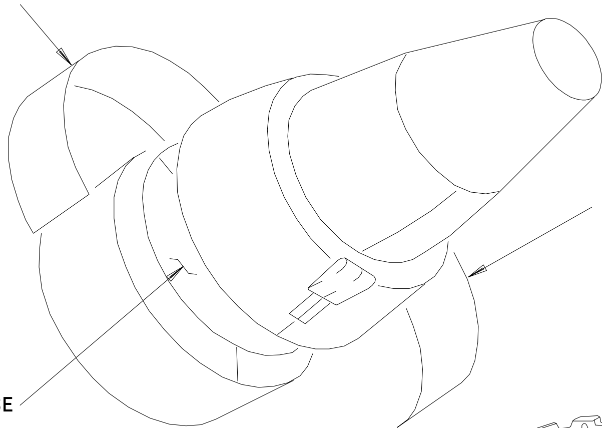


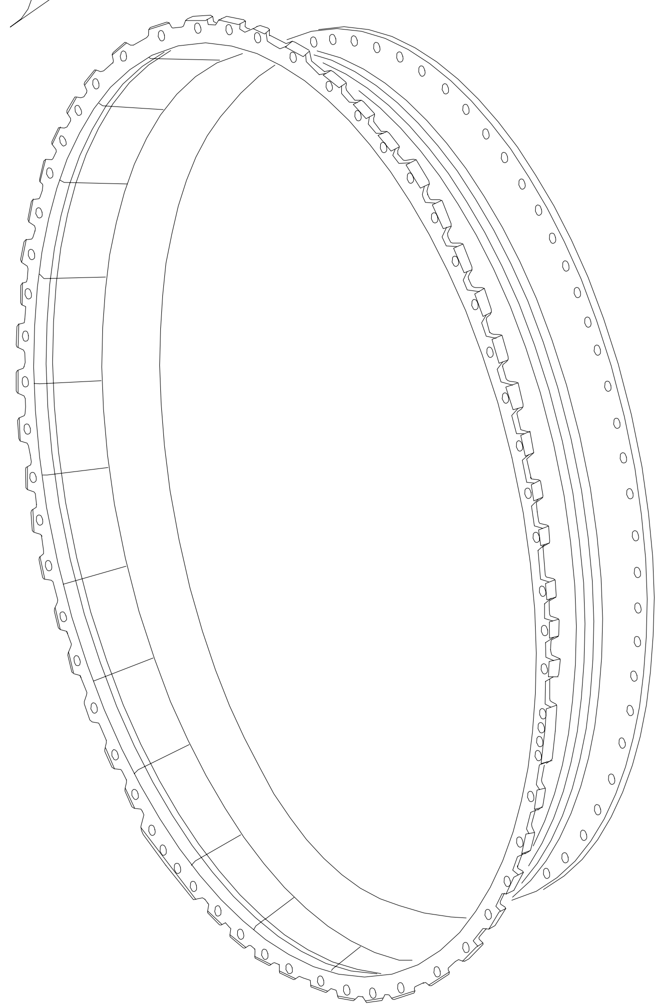
L-A0731
0887

1ST-STAGE STATOR

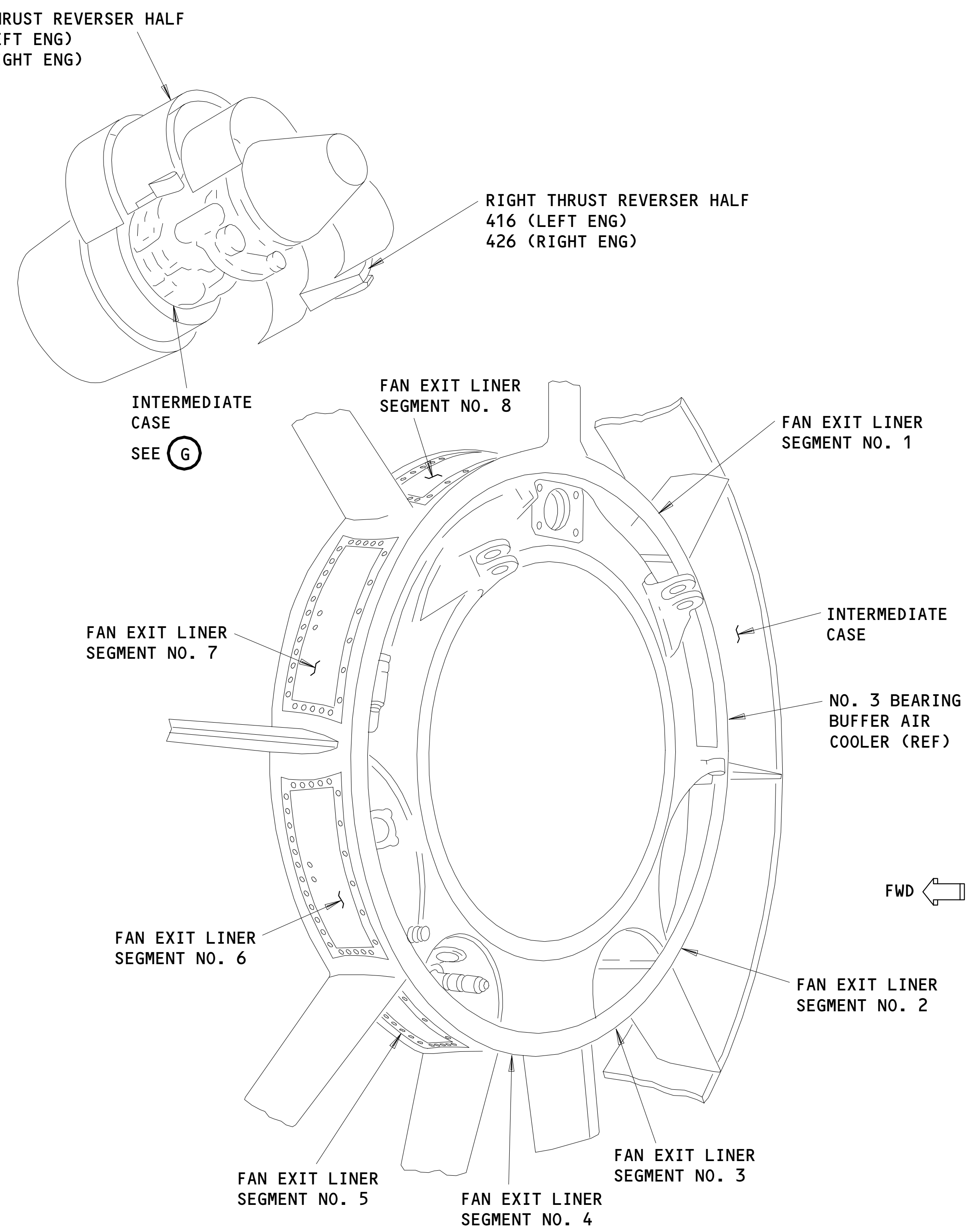
E

Component Location (Details from Sht 1)
Figure 102 (Sheet 2)





Component Location
Figure 102 (Sheet 3)

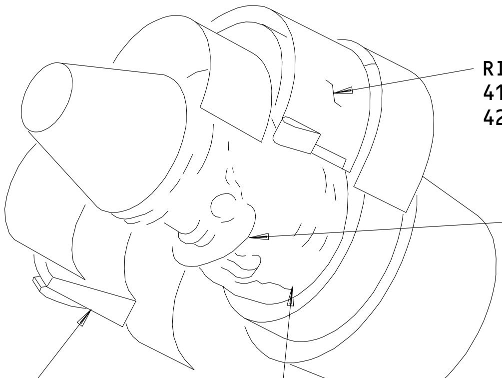


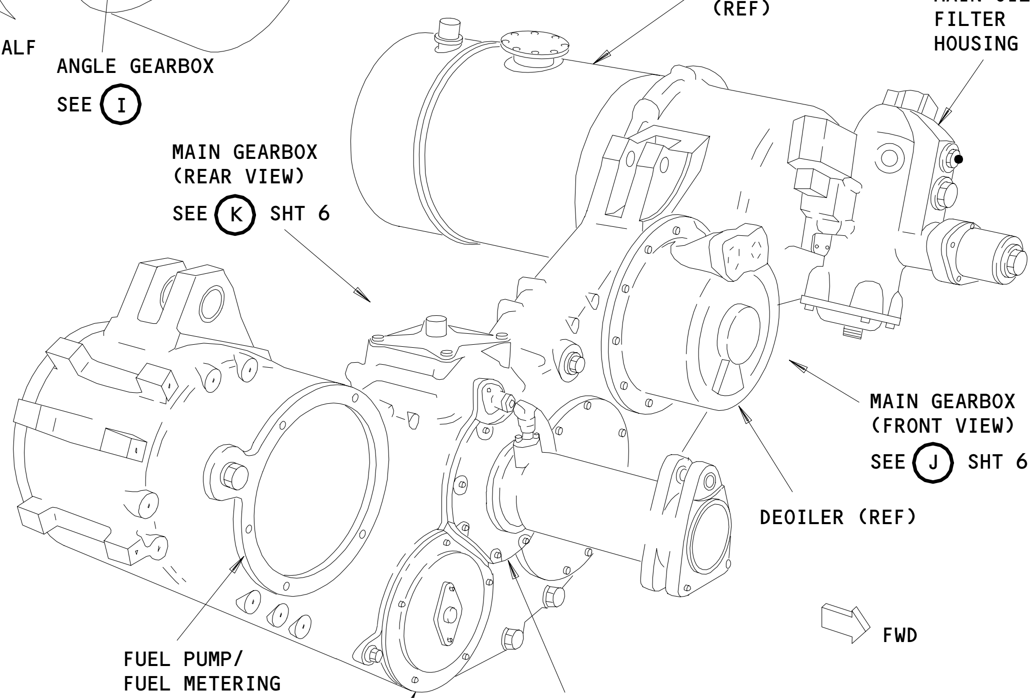
INTERMEDIATE CASE

G

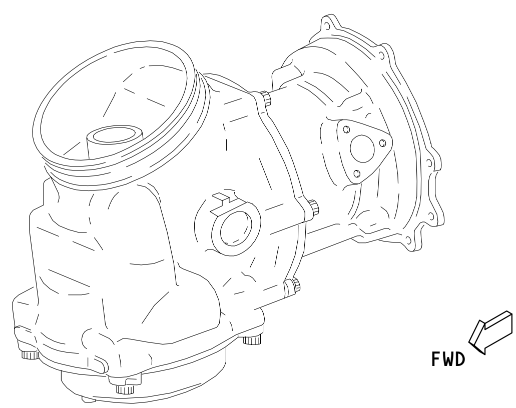
L-A2768

Component Location
Figure 102 (Sheet 4)





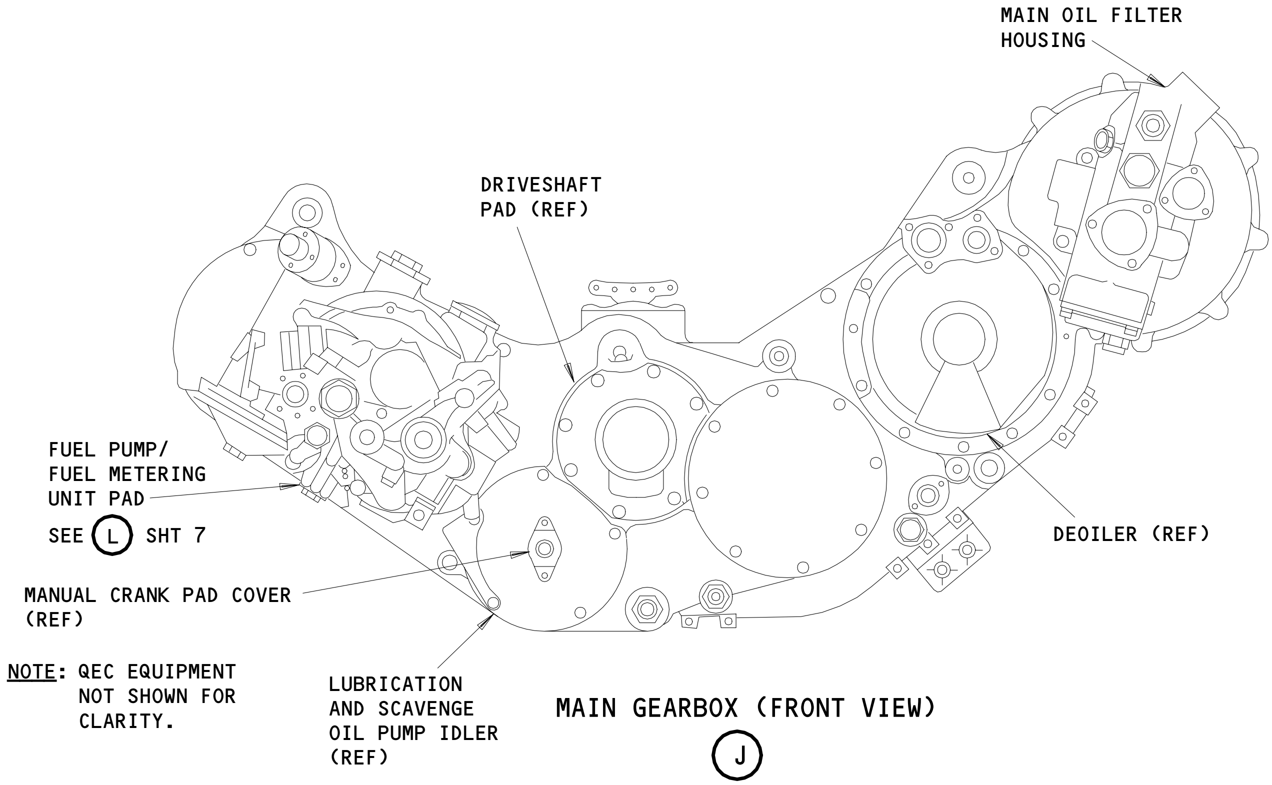
MAIN GEARBOX
H



ANGLE GEARBOX
I

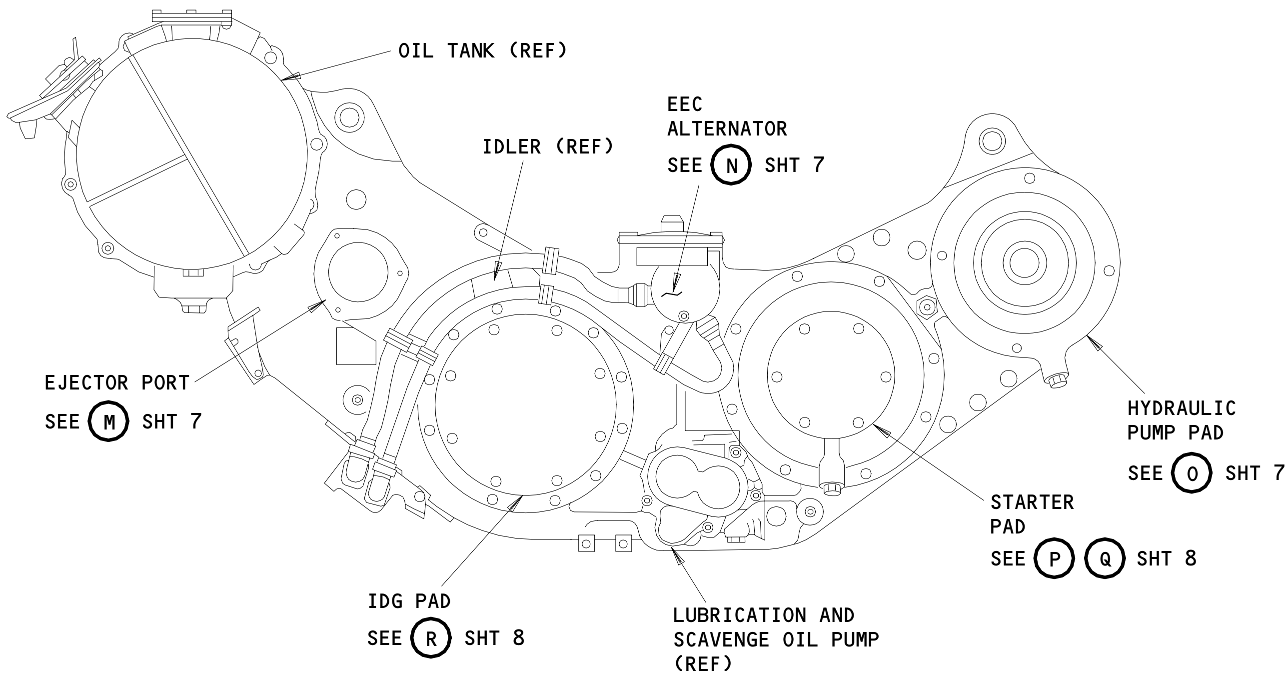
L-A0531

Component Location
Figure 102 (Sheet 5)



MAIN GEARBOX (FRONT VIEW)

J

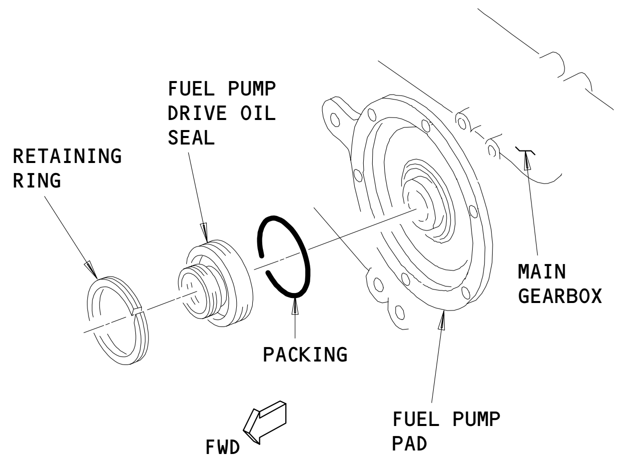


MAIN GEARBOX (REAR VIEW)

K

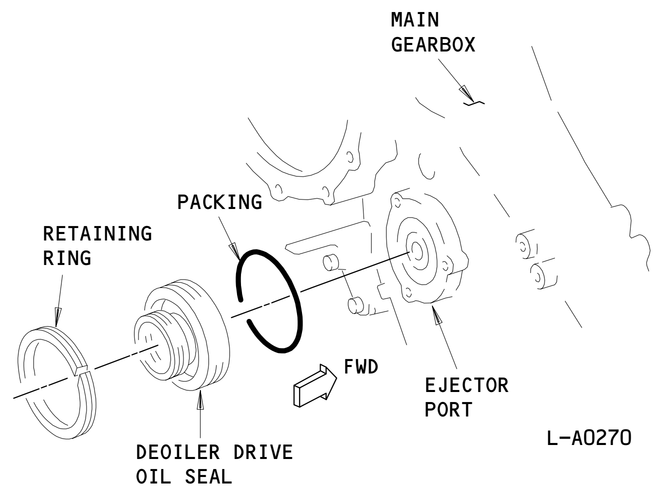
L-A2742

Component Location (Details from Sht 5)
Figure 102 (Sheet 6)



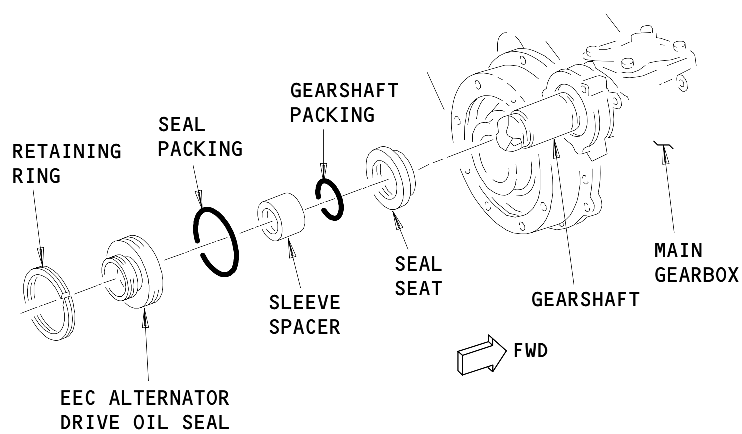
FUEL PUMP/FUEL METERING UNIT PAD

L



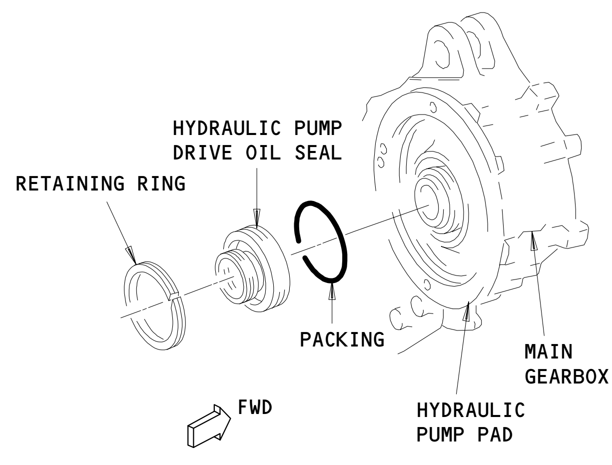
EJECTOR PORT

M



NOTE: EEC ALTERNATOR SHOWN REMOVED.

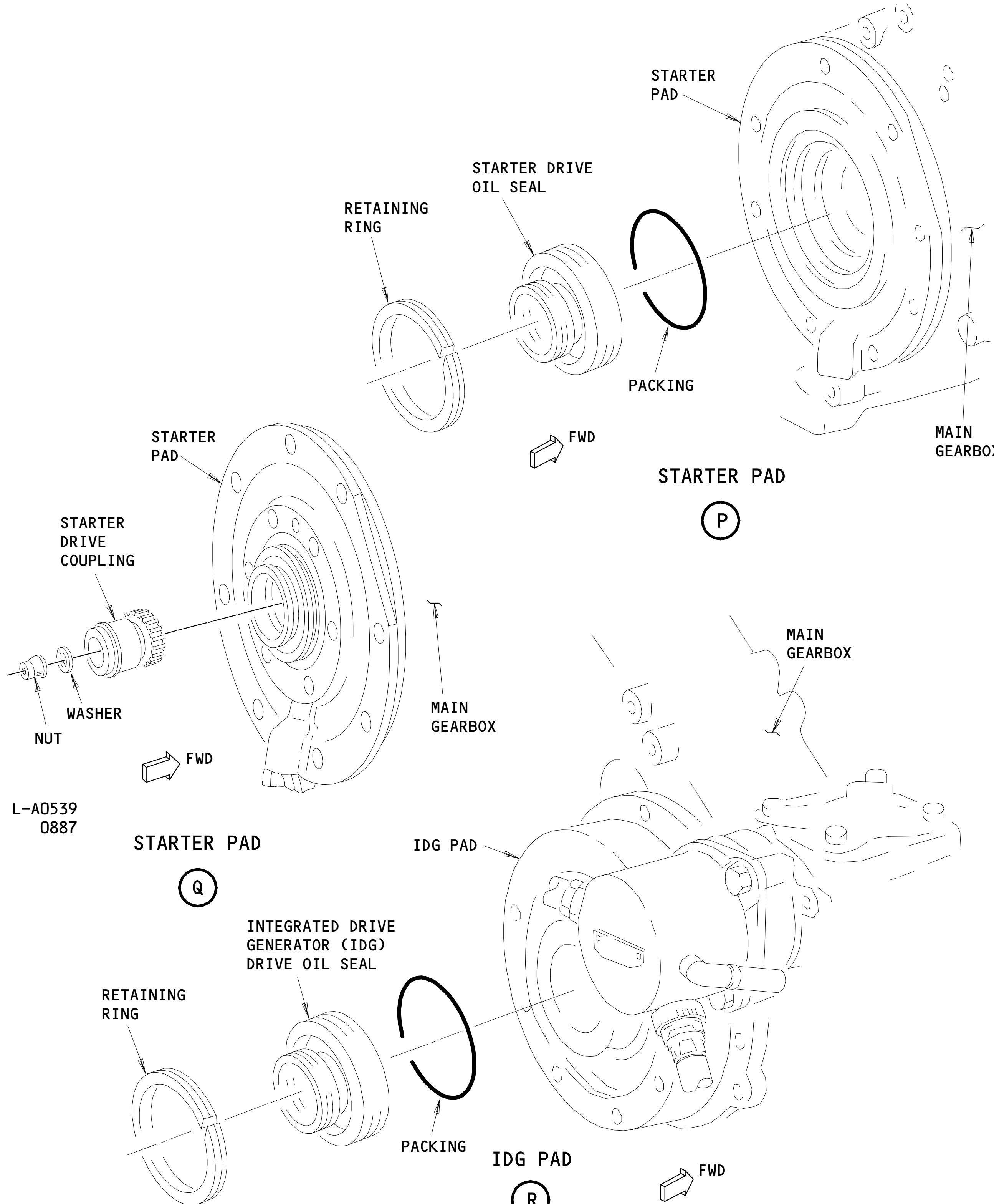
N



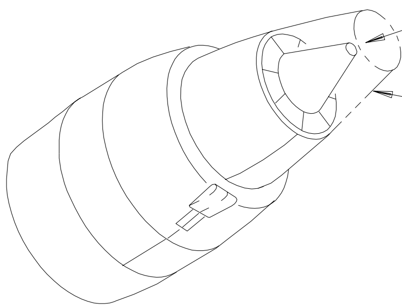
HYDRAULIC PUMP PAD

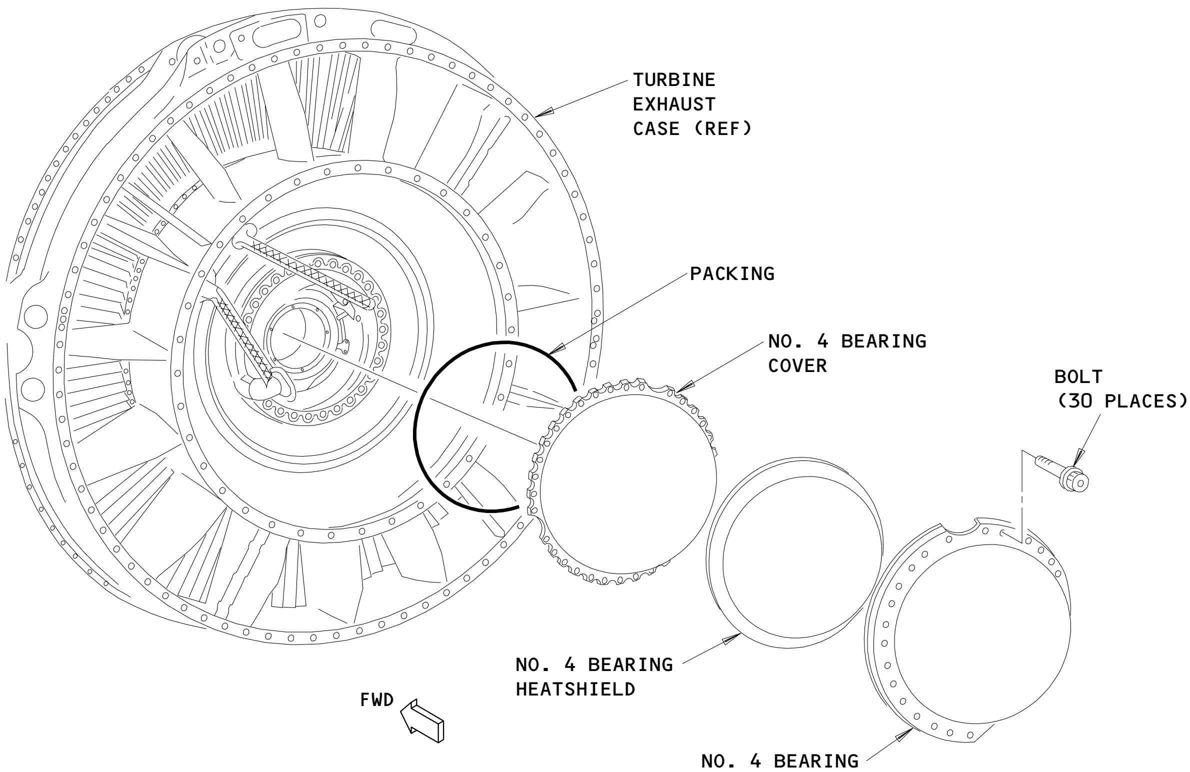
O

Component Location (Details from Sht 6)
Figure 102 (Sheet 7)



Component Location (Details from Sht 6)
Figure 102 (Sheet 8)





NOTE: EXHAUST SLEEVE AND EXHAUST PLUG REMOVED.

NO. 4 BEARING COMPARTMENT COVER

S

L-A4493

Component Location
Figure 102 (Sheet 9)

ENGINE - MAINTENANCE PRACTICES

1. General
   A. This procedure gives the applicable torques for the replacemnt of conical seat connectors on tube fittings. This task will stop leaks of conical seats on tube fittings. Tube fittings are in many different locations on the engine.

TASK 72-00-00-902-001-N00

2. Replacement of Damaged Conical Seat Connectors
   A. General
      (1) This task gives the steps to replace damaged seals in conical seat connectors.
      (2) You can get the correct seal part number for each hose size and thread size from Table 201 or the Voi-Shan catalogue.
   B. Consumable Materials
      (1) D00390 Oil - Engine
      (2) A00456 Compound - Antigalling, Hi-T650, PWA 550
      (3) D00247 Compound - Antigalling, PWA 586
   C. Access
      (1) Location Zones
          411 No. 1 Power Plant
          421 No. 2 Power Plant

   D. Procedure

      S 902-002-N00
      (1) Do the steps that follow to replace a Voi-Shan seal (Refer to Table 201).
          (a) Loosen the applicable tube nut.
          (b) Disconnect the tube.
          (c) Clean the mating surfaces of the conical seat.
          (d) Refer to Table 201 to find the correct Voi-Shan seal size.

              NOTE: The letter "C" in the part number refers to a copper seals, and the "N" refers to nickel seals. For a mixed material assembly (a steel connector with a titanium nut or a titanium connector with a steel nut) use the torque for antigalling lubricated titanium fittings.

TABLE 201
37 DEGREES CONE SEAT CONNECTORS WITH NICKEL GASKETS

HOSE SIZE	TUBING OUTER DIAMETER /THREAD SIZE	SEAL PN (SEAL MATERIAL)	TORQUE IN POUND-INCHES (NEWTON-METERS)	
			1) OIL LUBRICATED STEEL FITTINGS OR 2) ANTIGALLING LUBRICATED TITANIUM FITTINGS	ANTIGALLING LUBRICATED STEEL FITTINGS
-3	0.1875/ 0.375-24	VSF1015C-3 VSF1015N-3	50-60 (5.649-6.779)	40-45 (4.519-5.084)
-4	0.250/ 0.4375-20	VSF1015C-4 VSF1015N-4	90-100 (10.169-11.298)	65-75 (7.344-8.474)
-5	0.3125/ 0.500-20	VSF1015C-5 VSF1015N-5	1) 135-150 (15.253-16.948) 2) 120-135 (13.558-15.253)	100-110 (11.298-12.428)
-6	0.375/ 0.5625-18	VSF1015C-6 VSF1015N-6	1) 200-220 (22.597-24.857) 2) 135-150 (15.253-16.948)	150-165 (16.948-18.642)
	0.4375/ 0.625-18	VSF1015C-7 VSF1015N-7	250-270 (28.246-30.506)	185-200 (20.902-22.597)
-8	0.500/ 0.750-16	VSF1015C-8 VSF1015N-8	350-400 (39.545-45.194)	270-300 (30.506-33.895)
	0.562/ 0.8125-16	VSF1015C-9 VSF1015N-9	400-450 (45.492-50.843)	300-350 (33.985-39.545)
-10	0.625/ 0.875-14	VSF1015C-10 VSF1015N-10	500-550 (56.492-62.142)	360-400 (40.675-45.194)
	0.656/ 0.9375-12	VSF1015C-10.5 VSF1015N-10.5	550-600 (62.142-67.791)	420-460 (47.454-51.973)
	0.688/ 1.000-12	VSF1015C-11 VSF1015N-11	600-700 (67.791-79.809)	480-530 (54.233-59.882)

TABLE 201 (CONTINUED)
37 DEGREES CONE SEAT CONNECTORS WITH NICKEL GASKETS

HOSE SIZE	TUBING OUTER DIAMETER /THREAD SIZE	SEAL PN (SEAL MATERIAL)	TORQUE IN POUND-INCHES (NEWTON-METERS)	
			OIL LUBRICATED STEEL FITTINGS OR ANTIGALLING LUBRICATED TITANIUM FITTINGS	ANTIGALLING LUBRICATED STEEL FITTINGS
-12	0.750/ 1.0625-12	VSF1015C-12 VSF1015N-12	700-800 (79.089-90.388)	540-600 (67.012-67.791)
	0.875/ 1.1875-12	VSF1015C-14 VSF1015N-14	800-900 (90.388-101.686)	600-675 (67.791-76.265)
-16	1.000/ 1.3125-12	VSF1015C-14 VSF1015N-14	1000-1100 (112.985-124.283)	750-825 (101.686-112.985)
	1.125/ 1.500-12	VSF1015C-18 VSF1015N-18	1300-1400 (146.880-158.179)	900-1000 (101.686-112.985)
-20	1.250 1.625-12	VSF1015C-20 VSF1015N-20	1400-1500 (158.179-169.477)	1000-1100 (112.985-124.283)
-24	1.500 1.875-12	VSF1015C-24 VSF1015N-24	1600-1700 (180.776-192.074)	1200-1300 (135.582-146.880)

(e) Lubricate the threads on the fittings with the oil, or the antigalling compound (PWA 586 or PWA 550).
(f) Put the correct size Voi-Shan seal on the male conical seat.
(g) Connect the tubes.
(h) Torque the tube nut to the correct torque for the tube size and lubrication as shown in Table 201.

ENGINE GASPATH - INSPECTION/CHECK

1. General
   A. This procedure contains the sections that follow:
      (1) General
      (2) Inlet, Exhaust, and Externals Inspection
      (3) Birdstrike (Foreign Object Damage) Inspection
      (4) Engine Overtemperature Inspection
      (5) Engine Overspeed Inspection
      (6) Engine Windmilling Inspection/Check
      (7) Oil Overtemperature Inspection/Check
      (8) Oil System Contamination Inspection
      (9) Volcanic Ash/Sand Ingestion Inspection/Check
      (10) Prepare for the Borescope Inspection
      (11) LPC Blade and Vane (1st thru 4th-Stage) - Inspection
      (12) HPC Vane and Blade (5th thru 15th-Stage) - Inspection
      (13) Combustion Chamber Inspection
      (14) HPT (1st and 2nd-Stage) Blade and (1st-Stage) Vane Inspection
      (15) LPT Vanes (3rd-Stage) - Inspection
      (16) LPT Blades (3rd-Stage) - Inspection
      (17) Put the Airplane Back to its Usual Condition
      (18) N2 Rotor - Manual Turn Procedure
   B. These procedures give the instructions for the borescope inspections of the engine gaspath and for the unusual condition inspections.
   C. The engine gaspath inspections have borescope inspections through different access ports on the engine case. These access ports are from the 4th-stage low pressure compressor (LPC) thru the 3rd-stage of the low pressure turbine (LPT). You can also put the borescope through the fan and through an optional access port in the cooling air duct of the turbine vane.
   D. To get access to the engine gaspath for the inspection, open the applicable cowls and look through the different access ports.
      (1) Table 601A gives the number of blades in each of the gaspath stages for reference.

TABLE 601A			
LPC	HPC	HPT	LPT
Stage - No. of Blades	Stage - No. of Blades	Stage - No. of Blades	Stage - No. of Blades
1.6 - 94	5 - 40 *[2]	1 - 60	3 - 128
2 - 88	6 - 51	2 - 82	4 - 130
3 - 72	7 - 56		5 - 118 *[1]
4 - 66	8 - 53		
	9 - 66		6 - 128
	10 - 62		
	11 - 68		
	12 - 72		
	13 - 78		
	14 - 76		
	15 - 70		

*[1] ON NEW ENGINES OR ENGINES POST-PW-SB 72-256;
There are 126 blades in the 5th-stage.
*[2] ON ENGINES POST-PW-SB 72-786;
There are 41 blades in the 5th-stage.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

TASK 72-00-00-206-231-N00

2. Inlet, Exhaust, and Externals Inspection/Check

A. General
   (1) This procedure gives you the general checks of the fan air path, turbine exhaust area, and the external components.

B. References
   (1) AMM 71-00-02/401, Power Plant
   (2) AMM 71-11-04/201, Fan Cowl Panels
   (3) AMM 71-11-06/201, Core Cowl Panels
   (4) AMM 72-31-01/601, Inlet Cone
   (5) AMM 72-31-02/601, 1st-Stage (Fan) Blade
   (6) AMM 72-31-03/601, Fan Exit Fairing
   (7) AMM 72-31-04/601, 1st-Stage Stator
   (8) AMM 72-31-05/601, 1.6-Stage Blades
   (9) AMM 72-31-08/601, 1.6th-Stage LPC Stator Rubstrip
   (10) AMM 72-33-01/601, Fan Case Section
   (11) AMM 72-33-02/601, Fan Exit Case and Vane
   (12) AMM 72-34-01/601, Fan Exit Liner Segments (Outer)
   (13) AMM 72-34-03/601, Fan Exit Liner Segments (Inner Rear)
   (14) AMM 72-34-04/601, Fan Exit (Bifurcation) Fairing
   (15) AMM 72-34-05/601, Compressor Intermediate Case Fairings
   (16) AMM 72-34-06/601, Fan Exit Liner Segments (Inner Front)
   (17) AMM 72-53-01/601, 6th-Stage Low Pressure Turbine Blade
   (18) AMM 72-54-01/201, Turbine Exhaust Case
   (19) AMM 72-54-01/601, Turbine Exhaust Case
   (20) AMM 75-24-00/601, Turbine Cooling System

C. Access
   (1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

D. Prepare for the Inlet, Exhaust, and Externals Inspection/Check.

S 496-461-N00

WARNING: DO NOT GO INTO THE ENGINE INLET TO DO AN INSPECTION IF THE FAN BLADES ARE WINDMILLING. THE AIR FROM THE WIND THAT FLOWS THROUGH THE ENGINE CAN CAUSE THE FAN BLADES TO TURN. TO MAKE THE ENGINE SAFE, YOU MUST DO THE STEPS THAT FOLLOW TO STOP THE AIR FLOW THROUGH THE ENGINE. IF YOU DO NOT OBEY THESE INSTRUCTIONS, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

   (1) If the engine is windmilling because of high ground winds, do one of the steps that follow to stop the engine:
      (a) Move the airplane into the hangar, out of the wind, to do the inspection.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(b) Turn the airplane heading 90 degrees to the wind heading.

NOTE: When you turn the airplane, the wind will hit the side of the airplane, and will not flow through the engine.

CAUTION: WHEN YOU PUT ON THE ENGINE COVERS IN THE STEPS THAT FOLLOW, DO NOT INSTALL THE ENGINE INLET COVER FIRST. THE SUCTION OF THE WINDMILLING ENGINE CAN PULL THE ENGINE INLET COVER INTO THE ENGINE. THIS CAN CAUSE DAMAGE TO THE 1ST-STAGE FAN BLADES AND STATOR VANES.

(c) Install the turbine exhaust cover and the fan reverser plug covers into the rear openings of each engine.

NOTE: When the rear engine covers stop the air flow through the engine, the fan blades will slowly come to a stop.

(d) When the fan stops windmilling, install the engine inlet cover on the engine inlet.
1) When you do the inspection of the front area of the engine, temporarily remove only the engine inlet cover (keep the rear engine covers installed to stop the air flow through the engine).
2) When you do the inspection of the rear area of the engine, temporarily remove only the rear engine covers (keep the engine inlet cover installed to stop the air flow through the engine).

S 016-233-N00

(2) Open the fan cowl panel (AMM 71-11-04/201).

S 046-232-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-234-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 016-235-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

S 866-462-N00

(6) Make sure that the fuel control switches are in the CUTOFF position, and attach the DO-NOT-OPERATE tags.

S 496-463-N00

CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF EACH MAT TOUCH THE ADJACENT MAT, OR ARE ATTACHED WITH TAPE. IF YOU DO NOT DO THIS, THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

(7) Put the protective mat on the lower, inner half of the inlet cowl.

E. Do the Inlet, Exhaust, and Externals Inspection.

S 216-236-N00

(1) Do these steps to examine the inlet and fan air path.
  (a) Examine the fan blades for these types of FOD: Part span shrouds that are not there, part span shrouds that have cracks, cracks in other areas, tears, sharp nicks that are not repaired, bends in the leading edge or tip, and sharp dents (AMM 72-31-02/601).
  (b) Examine the inlet cone for cracks, delaminations, dents, and cut areas (AMM 72-31-01/601).
  (c) Examine the fan rubstrip for areas that are gone, not bonded, or are worn (AMM 72-33-01/601).
  (d) Examine the 1st-stage stator vanes for FOD (AMM 72-31-04/601).
  (e) With a fluorescent light or other applicable tools, examine the 1.6-stage blades for FOD (AMM 72-31-05/601).

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(f) With a fluorescent light or other applicable tools, examine the 1.6-stage rubstrip for damage (AMM 72-31-08/601).
(g) Examine the fan exit case and vane assembly for cracks, delamination, or vanes that are missing (AMM 72-33-02/601).
(h) Examine the fan exit fairing for FOD, cracks, dents, and attached screws that are missing (AMM 72-31-03/601).
(i) Examine the linings and fairings of the intermediate case assembly and fan case for these defects (AMM 72-34-01/601, 72-34-03/601, 72-34-04/601, 72-34-05/601, 72-34-06/601):
1) Loose parts
a) Parts that are not there
2) Nicks, Dents, and Gouges
3) Punctures, and Holes
4) Delamination
5) Cracks
6) Areas with broken or fraying fibers
7) Loose patches
8) Erosion.

NOTE: It is not necessary to examine the Compressor Intermediate Case Fairings or the Fan Exit Liner Segments (Outer) for erosion.

S 216-237-N00
(2) Do these steps to examine the turbine exhaust area.
(a) Examine the external rails and mount bushings of the turbine exhaust case for bent rails, cracks, dents, and nicks (AMM 72-54-01/601).
(b) Examine the struts of the turbine exhaust case for cracks, dents, and nicks (AMM 72-54-01/601).
(c) Examine the outer duct for oil that is on the inner bottom or outer bottom of the duct (AMM 72-54-01/201).
(d) Examine the turbine exhaust case, tailpipe, and tail cone area for metal particles.
1) If you find too many particles, do the applicable procedures in the Engine Gaspath Inspection/Check (AMM 72-00-00/601).
(e) Examine the 6th-stage LPT blades for nicks, dents, tears, and cracks (AMM 72-53-01/601).

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

S 216-238-N00

(3) Do these steps to examine the external components.

CAUTION: REPAIR OR REPLACE THE CRACKED OR BROKEN COOLING AIR TUBES IN THE TURBINE. THESE DAMAGED COOLING AIR TUBES CAN CAUSE DAMAGE TO THE HIGH PRESSURE TURBINE.

(a) Examine the cooling air tubes in the turbine for cracks (AMM 75-24-00/601).

CAUTION: CORRECT EACH DEFECT IN THE COOLING SYSTEM OF THE LPT TURBINE CASE. THIS SYSTEM IS NECESSARY TO KEEP THE STRUCTURE COOL. IF THE ENGINE IS CONTINUOUSLY OPERATED WITH A DEFECTIVE COOLING SYSTEM, THIS CAN CAUSE STRUCTURAL DAMAGE.

(b) Examine the cooling system tubes, valves and cable of the LPT turbine case (AMM 75-24-00/601).

(c) Examine all of the other tubes for cracks, erosion, blockage, and fretting with other tubes.

(d) Examine the tubes and nuts for looseness, leaks, and corrosion.

NOTE: When looking for leaks, it's possible to see small amounts of oil near the area of the spinner, the bottom of the fan case, or the HPC variable vane attach bolts at the bottom of the engine. The source of this oil is the No. 1 or/and the No. 2 bearing carbon seal assembly.

After the engine windmills or after a long start, the difference in pressure between the carbon seal assemblies and their environment is very high. This high difference in pressure can cause small amounts of oil to leak through the carbon seals and onto external engine parts. This condition is allowable.

Do not remove the engine for this condition. All other conditions of the inspection must be met. A limit for the allowable amount of oil on external engine parts is not known. The limit for the quantity of oil is the oil consumption level.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(e) Examine the tube and wire bundle clips, clamps, and bolts for loose fits.
(f) Examine the electrical harness for damage or corrosion.
(g) Examine the brackets for cracks that you can see, damage, and loose fits.
(h) Examine for broken or loose lockwires.
(i) Make sure the mounting clamps for the accessory component are attached correctly and have no damage.

S 216-239-N00

(4) Examine each external fuel hydraulic tube.
(a) Examine the tubes for nicks, worn areas, scratches, and pitting.

NOTE: Pitting is a concentration of corrosion at a point.

1) Damage that is no more than 0.002 inch (0.051 mm) in depth is permitted all along the tube length; this includes the tube bend area.

(b) Examine the tubes for dents.
1) Dents that are less than 0.250 inch (6.350 mm) from the ferrules are not permitted.
2) Tube dents without sharp edges are permitted if the inner diameter of the tube is decreased by less than 10 percent.

NOTE: To do this check, use a ball that has a diameter that is 90 percent of the inner diameter of the tube. Try to put this ball through the tube. Tubes in which the ball gets caught are not permitted.

(c) Examine the tubes for corrosion and stains.
1) Corrosion and stain are permitted if you can lightly polish the damaged area with a crocus cloth and remove the damage.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(d) Do a pressure test on the tubes.
1) Pressurize the tubes to 1500 psi (10342.1 kPa); Refer to the Standard Practices Manual.
2) If the tube has leaks, replace it.

S 226-240-N00
(5) Examine each external tube of the oil system.
(a) Examine the tubes for nicks, worn areas, scratches, and pitting.

NOTE: Pitting is a concentration of corrosion at a point.

1) Damage that is no more than 0.003 inch (0.076 mm) in depth is permitted all along the tube length; this includes the tube bend area.
(b) Examine the tube for dents.
1) Dents that are less than 0.250 inch (6.350 mm) from the ferrules are not permitted.
2) Tube dents without sharp edges are permitted if the inner diameter of the tube is decreased by less than 20 percent.

NOTE: To do this check, use a ball that has a diameter that is 80 percent of the inner diameter of the tube. Try to put this ball through the tube. Tubes in which the ball gets caught are not permitted.

(c) Examine the tubes for corrosion and stains.
1) Corrosion and stains are permitted if you can lightly polish the damaged area with a crocus cloth and remove the damage.

S 226-241-N00
(6) Examine each external tube of the fuel system.
(a) Examine the tubes for nicks, worn areas, scratches, and pitting.

NOTE: Pitting is a concentration of corrosion at a point.

1) Damage that is no more than 0.002 inch (0.051 mm) in depth is permitted all along the tube length; this includes the tube bend area.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(b) Examine the tubes for dents.
   1) Dents that are less than 0.250 in. (6.350 mm) from the ferrules are not permitted.
   2) Tube dents without sharp edges are permitted if the inner diameter of the tube is decreased by less than 10 percent.

   NOTE: To do this check, use a ball that has a diameter that is 90 percent of the inner diameter of the tube. Try to put this ball through the tube. Tubes in which the ball gets caught are not permitted.

(c) Examine the tubes for corrosion and stains.
   1) Corrosion and stains are permitted if you can lightly polish the damaged area with a crocus cloth and remove the damage.
(d) Do a pressure test on the tubes.
   1) Pressurize the tubes to 1500 psi (10342.1 kPa); Refer to the Standard Practices Manual.
   2) If the tube has leaks, replace it.

S 226-242-N00
(7) Examine each external tube of the air system.
(a) Examine the tubes for nicks, worn areas, scratches, and pitting.

   NOTE: Pitting is a concentration of corrosion at a point.

   1) Damage that is no more than 0.003 inch (0.076 mm) in depth is permitted all along the tube length; this includes the tube bend area.
(b) Examine the tubes for dents.
   1) Dents that are less than 0.250 inch (6.350 mm) from the ferrules are not permitted.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

2) Tube dents without sharp edges are permitted if the inner diameter of the tube is decreased by less than 20 percent.

NOTE: To do this check, use a ball that has a diameter that is 80 percent of the inner diameter of the tube. Try to put this ball through the tube. Tubes in which the ball gets caught are not permitted.

(c) Examine the tubes for corrosion and stains.
1) Corrosion and stains are permitted if you can lightly polish the damaged area with a crocus cloth and remove the damage.
(d) Do a pressure test of the tubes.
1) Pressurize the tubes to 200 psi (1379.0 kPa); Refer to the Standard Practices Manual.
2) If the test tube has leaks, replace it.

S 216-395-N00
(8) ENGINES PRE-PW-SB 72-432;
Examine the variable vane arms.
(a) Examine the Inlet Guide Vanes (IGV), and the 5th- thru 7th-stage vanes for correct installation, and for loose or disengaged vane arms.
1) If you find a loose vane arm, replace the synchronizing unison ring for that stage.
2) If you find a disengaded vane arm (the rivet pin is gone), remove the engine (AMM 71-00-02/401).

NOTE: A disengaged vane arm is a loss of a rivet pin attachment to the synchronizing unison ring, an incorrect assembly of the vane trunnion, or a separation from the vane trunnion. Refer to PW Alert SB A72-419.

a) Refer to the PWA Engine CIR Manual for the applicable inspections.

S 216-396-N00
(9) Examine the VSV (variable stator vane) actuating system for continue-in-service limits for worn or loose areas.
(a) If the damage you find is worse than the continue-in-service limits, replace or repair the area within 250 hours.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

CONTINUE-IN-SERVICE LIMITS FOR THE VARIABLE STATOR VANE ACTUATING SYSTEM	
Examine	Continue-in-Service Limits
Clevis Attachments: Examine the lever set connecting rod to the VSV unison ring for IGV, 5th-, 6th- and 7th-stages for loose connections.	Loose connections are not permitted.
Upper Mounting Attachments of the Actuator Support Bracket: Examine the attachments for radial play.	A Maximum play of 0.040 inch (1.016 mm) is permitted.
Lower Mounting Attachments of the Actuator Support Bracket: Examine the attachments for radial play.	A Maximum play of 0.050 inch (1.270 mm) is permitted.
Lever set Assembly: Examine the assembly for axial play.	A Maximum play of 0.040 inch (1.016 mm) is permitted.
Lever set Assembly: Examine the assembly for radial play.	A Maximum play of 0.030 inch (0.762 mm) is permitted.

S 206-481-N00

(10) Examine the HPC front case split flange for fractured or missing bolts (Fig. 601).
   (a) If only one bolt or nut on each side is fractured or missing, at any of the 11 positions, the bolt or nut must be replaced within 25 flight cycles.
   (b) If more than one bolt or nut is fractured on the same side of the engine, the bolts or nuts at the fractured locations must be replaced.

No. 2 - Inlet, Exhaust, and Externals Inspection/Check

(c) If the 11th position bolt is fractured or is missing, the bolt must be replaced.
   1) In addition, torque the 10th position bolt to 200 pound-inches (22.6 newton-meters) to make sure the 10th position bolt is not fractured.

(d) If any bolts or nuts are found fractured or missing, you must inspect the synchronizing ring system to find the liberated bolt or nut pieces or bolts or nuts to prevent interference with the variable vane system operation.
   1) If bolt or nut sections are found to obstruct the operation of the synchronizing rings, the engine must be removed for HPC 5th, 6th and 7th stage blade replacements.

S 096-466-N00

(11) If it is necessary, remove the engine inlet cover, turbine exhaust cover, and fan reverser plug covers from each engine.

S 096-464-N00

(12) Remove the protective mats from the inlet cowl.

S 866-465-N00

(13) Remove the DO-NOT-OPERATE tags from the fuel control switches.

S 416-243-N00

(14) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 3 - Birdstrike (Foreign Object Damage) Inspection

TASK 72-00-00-206-244-N00

3. Birdstrike (Foreign Object Damage) Inspection

A. General

(1) The FIM gives you the steps that you follow after unwanted objects go into the engine, when there is foreign object ingestion. The damage that is caused is referred to as foreign object damage or FOD.

(2) Signs of a birdstrike, when a bird goes into the engine, are not always easy to find. Much time, and some weather conditions, causes the signs to decrease. A small quantity of organic material in the inlet is a strong sign of a birdstrike.

(3) When a birdstrike occurs, remaining pieces of the bird can be found in these areas: the inner surfaces of the shrouds in the middle of the fan blades, the outer ends of the guide vanes of the fan exit or the LPC inlet, the 2.5 bleed screens, and in the thrust reverser linkage.

(4) When you examine the inlet area, look at the path of the remaining bird pieces to help you find the possibly damaged areas.

B. References

(1) 71-00-02/401, Power Plant

(2) AMM 71-11-04/201, Fan Cowl Panels

(3) AMM 71-11-06/201, Core Cowl Panels

(4) AMM 78-31-00/201, Thrust Reversers

C. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

D. Examine the Engine for Birdstrike Damage, and FOD.

No. 3 - Birdstrike (Foreign Object Damage) Inspection

S 216-518-N00

WARNING: THERE IS A POSSIBLE HEALTH RISK TO PERSONNEL WHO DO MAINTENANCE TASKS AFTER A BIRDSTRIKE. USE DISPOSABLE PLASTIC POLYETHYLENE GLOVES. IF IT IS NOT POSSIBLE TO KEEP AWAY FROM THE BIRD REMAINS, USE DISPOSABLE COVERALLS. DO NOT USE AIR PRESSURE OR WATER PRESSURE TO CLEAN THE PART OF THE ENGINE HIT BY THE BIRD. IF YOU DO NOT OBEY THESE INSTRUCTIONS, INJURY TO PERSONNEL CAN OCCUR.

WARNING: THERE IS A POSSIBLE HEALTH RISK TO PERSONNEL WHO DO MAINTENANCE TASKS AFTER A BIRDSTRIKE. REMOVE THE BIRD REMAINS AND PUT THEM IN A PLASTIC BAG. DO NOT TOUCH THE FACE, EYES, NOSE, OR OTHER PARTS OF YOUR BODY WITH YOUR GLOVES. IF YOU USED DISPOSABLE GLOVES AND DISPOSABLE COVERALLS PUT THEM IN THE SAME PLASTIC BAG AS THE REMAINS. SEAL AND DISCARD THE BAG AND FULLY CLEAN HANDS WITH SOAP AND WATER. IF YOU DO NOT OBEY THESE INSTRUCTIONS, INJURY TO PERSONNEL CAN OCCUR.

(1) Examine these inlet areas for damage:
  (a) The inlet cowl
  (b) The inlet cone
  (c) The fan blades
  (d) The inlet guide vanes of the LPC
  (e) The 1.6-stage blades in the LPC
  (f) The guide vanes of the fan exit
  (g) The linings that absorb sound.

S 016-247-N00

(2) Open the fan cowl panel (AMM 71-11-04/201).

S 046-246-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-248-N00

(4) Open the core cowl panel (AMM 71-11-06/201).

No. 3 - Birdstrike (Foreign Object Damage) Inspection

S 016-249-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reverser (AMM 78-31-00/201).

S 216-250-N00

(6) Examine the turbine exhaust area and the 2.9 bleed valves for metal particles.
  (a) If metal particles are found, remove the engine (AMM 71-00-02/401) and replace it.

S 226-251-N00

(7) Do the gaspath inspection of the high pressure compressor (AMM 72-00-00/601) if you find one or more of these conditions (within serviceable limits):

NOTE: These conditions are an indication that an object went through the core of the engine.

  (a) Damage to the fan blades, adjacent to the engine core inlet
  (b) Remaining bird pieces or FOD on the LPC inlet vanes or on the 2.5 bleed screens.
  (c) There was damage to the 1.6th stage stator rubstrip.
  (d) The flight crew made a report that they smelled a bird in the flight compartment after the incident.
  (e) The incident caused an engine surge followed by an unusual operation of the engine.

NOTE: When there is engine core FOD or bird ingestion, some damage to the HPC 5th and 6th stage blades can possibly occur. Signs of blade tip cracks or fracture are possible. You can more easily examine for this damage to the 5th stage blades with a flexible borescope with a direct vision deflecting tip. To do this, get access through the engine core inlet or the 2.5 bleed ports in the 4th-stage LPC. You can examine the 6th-stage blades through the borescope access port, AP-2.

No. 3 - Birdstrike (Foreign Object Damage) Inspection

S 226-520-N00

(8) Do a borescope inspection of the HPC stages 5, 6 and 10 (AMM 72-00-00/601). If damage is found, do a borescope inspection of all the HPC stages 5 through 15.

S 226-252-N00

(9) If the gaspath inspection shows that there is damage within serviceable limits to the rear HPC stages, do the gaspath inspection of the HPT vanes and blades (AMM 72-00-00/601).

NOTE: The damage to look for is possible blade tip cracking or tip fracture of the 5th and 6th-stage blades. The engine must be removed if this type of damage is found.

S 226-519-N00

(10) If there are no signs of engine core ingestion or a surge followed by unusual engine operations, borescope inspection of the HPC is not necessary.

S 416-253-N00

(11) Do this procedure: Put the Airplane Back to its Usual Condition.

S 216-482-N00

(12) After you do a visual inspection, refer to the FIM 71-Fault Code Diagram, Bird Strike/FOD - Fault Codes.

No. 4 - Engine Overtemperature Inspection

TASK 72-00-00-206-254-N00

4. Engine Overtemperature Inspection

A. General

(1) This procedure gives you the steps that you follow after the EGT goes higher than the limits.

(2) When you remove or repair the engine because of an overtemperature condition, the steps that follow must be done:

(a) The engine or the section of the engine that you will replace must be tagged with the data that follows:

1) The maximum temperature that occurred

2) The time during which the overtemperature occurred

3) If the overtemperature occurred at steady state or at surge conditions

4) All other data that you think is important.

(b) All hot section repairs that are necessary to make the engine serviceable must be done.

NOTE: The PW4000 Engine Manual has the specifications for what is serviceable.

1) The high pressure turbine rotors must be removed and disassembled to do an analysis of the metal of the 1st- and 2nd-stage turbine blades.

2) All other inspections that you think are necessary to make all the parts serviceable must be done.

(c) You can Disassemble the Diffuser and Combustor Group and the Low Pressure Turbine Assembly, but this is not necessary unless defects are found. Visual and borescope inspections must be done in these areas and in the high and low pressure compressor groups. This will make sure that there are no defects in the engine gaspath.

(d) Visual and borescope inspections must be done in these areas and in the high and low pressure compressor groups.

NOTE: This will make sure that there are no defects in the engine.

B. References

(1) AMM 71-11-04/201, Fan Cowl Panels

(2) AMM 71-11-06/201, Core Cowl Panels

(3) AMM 74-21-01/601, Exciter-to-Igniter Plug Cable

(4) AMM 78-31-00/201, Thrust Reverser System

C. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

No. 4 - Engine Overtemperature Inspection

D. Examine the engine for overtemperature damage.

S 216-255-N00

(1) Do a visual check of the engine.
   (a) Visually examine these areas for burned areas, distortion, metal particles, or signs of upstream blade or vane damage: the turbine exhaust sleeve and plug, and the area immediately aft of the 6th-stage turbine blades.

S 226-256-N00

(2) Do the hot section check.
   (a) Open the fan cowl panel (AMM 71-11-04/201).

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

   (b) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).
   (c) Open the core cowl panel (AMM 71-11-06/201).

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

   (d) Open the thrust reversers (AMM 78-31-00/201).
   (e) Examine the high tension leads of the igniter plug (AMM 74-21-01/601).

NOTE: When the operation of the engine is stopped too quickly, sufficient cooling air is kept from the igniters. The heat goes through the igniter plug and the high tension leads. That condition can cause deterioration of the rubber insulation, which can then make arcs at the terminal area.

   (f) Do the borescope inspections that follow (AMM 72-00-00/601, Engine Gaspath - Inspection/Check).
      1) Examine the combustion lining for signs of cracks, burned areas, too much heat, erosion, distortion, and areas that are not correctly aligned.
      2) Examine also for worn pins and for worn areas at the nozzles and the mounts.
      3) Examine the fuel nozzles for coke, cracks, distortion, worn areas, broken open areas, and burned holes.
      4) Examine the 1st-stage HPT vanes for cracks, FOD, erosion, corrosion, burned marks, and distortion.

No. 4 - Engine Overtemperature Inspection

5) Examine the 1st-stage HPT blades for cracks, FOD, tip rub, erosion, and corrosion.
6) Examine the 1st-stage HPT blades for discoloration that has the shape of concentric circles on the airfoil surface.
7) Examine each 2nd-stage HPT blade for cracks, tip rub, erosion, FOD, and blade extension.

NOTE: A sign of airfoil extension is when the length of the blade is increased and the perimeter of the middle is decreased.

8) Examine the 3rd-stage LPT blades and vanes for cracks, FOD, tip rub, and erosion.
   a) If there has been a sudden increase in EGT, check for a possible missing or liberated LPT 3rd-stage outer transition duct segment.
   b) No missing or liberated outer transition duct segments are permitted.

S 416-257-N00
(3) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 5 - Engine Overspeed Inspection

TASK 72-00-00-206-258-N00

5. Engine Overspeed Inspection

A. General

(1) This procedure tells you the steps to do after the low pressure rotor (N1) or the high pressure rotor (N2) operates at a speed above its redline.

NOTE: When the speed of a rotor is above its redline, this condition is referred to as overspeed.

B. References

(1) AMM 71-00-00/501, Power Plant

(2) AMM 71-00-02/401, Power Plant

(3) AMM 77-12-00/501, Engine Tachometer System

(4) FIM 71-PIMU MESSAGE INDEX

C. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

D. Examine the engine for overspeed damage.

S 286-259-N00

(1) Find the speed that the rotor was above its redline and the length of time of the overspeed:

(a) Press the ENG EXCD switch on the EICAS maintenance panel.

(b) Look at the ENG EXCD page to find the maximum N1 and N2 speed that occurred and the length of time the speed was above the redline.

NOTE: The EICAS will not make an overspeed record if the speed of N1 or N2 did not go above its redline by more than 1.0% for less than 5 seconds.

No action is required when the speed of N1 or N2 goes between its redline and redline transient for less than 5 seconds.

(c) If the overspeed record shows that N1 and N2 did not go above the redline by more than 1.0%, do the step that follows.

1) To calculate the correct length of time, add five seconds to the overspeed record from the display.

No. 5 - Engine Overspeed Inspection

S 216-420-N00

(2) Look at Figure 601A to find the area that the N1 was above its redline.

(a) If the overspeed occurred in Area A, do the steps that follow.

NOTE: No action is required when the speed of N1 is between its redline and redline transient for less than 5 seconds.

1) Make sure the rotor turns freely.
2) Inspect the inlet and the exhaust ducts for unwanted materials.
   a) If unwanted materials are found, remove them.
3) Make sure the tachometer system operates correctly (AMM 77-12-00/501).
4) Do the PIMU BITE procedure (FIM 71-PIMU MESSAGE INDEX).
5) Inspect the inlet and the exhaust ducts for damage.
6) If no damage is found, do the steps that follow.
   a) Correct the cause of the overspeed.
   b) Do the Test No. 3 - Ground Test - Idle Power (AMM 71-00-00/501) to make sure the engine operates correctly.
7) If damage is found, do the borescope inspections in the Engine Gaspath Inspection/Check (AMM 72-00-00/601).

(b) If the overspeed occurred in Area B, do the steps that follow.

1) Do the steps for an N1 overspeed that occurred in Area A.
2) If the engine operates correctly, it may remain in service for 60 hours. After 60 hours, the engine must be replaced (AMM 71-00-02/401).

NOTE: Make sure the N1 indicating system operates correctly before you remove the engine (AMM 77-12-00/501).

   a) Do a full inspection of the removed engine (PW4000 Engine Manual).

No. 5 - Engine Overspeed Inspection

(c) If the overspeed occurred in Area C, replace the engine (AMM 71-00-02/401).

NOTE: Make sure that the N1 indicating system operates correctly before you remove the engine (AMM 77-12-00/501).

1) Do a full inspection of the removed engine (PW4000 Engine Manual). A full inspection includes the inspections that follow.
   a) Remove the LPC and do a full overhaul inspection on the N1 rotor.
   b) Examine the LPT blades for extension and for worn knife edge seals.
   c) Examine all of the LPT disks for extension.
   d) Examine the LPC drive shaft for extension.
   e) Examine all of the LPT disks and blades by the fluorescent penetrant procedure.

S 216-421-N00

(3) Look at Figure 601A to find the area that the N2 operated at above its redline.

(a) If the overspeed occurred in Area A, do the steps that follow.

NOTE: No action is required when the speed of N2 is between its redline and redline transient for less than 5 seconds.

1) Make sure the rotor turns freely.
2) Inspect the inlet and the exhaust ducts for unwanted materials.
   a) If unwanted materials are found, remove them.
3) Make sure the tachometer system operates correctly (AMM 77-12-00/501).
4) Do the PIMU BITE procedure (FIM 71-PIMU MESSAGE INDEX).
5) Inspect the inlet and the exhaust ducts for damage.
6) If no damage is found, do the steps that follow.
   a) Correct the cause of the overspeed.
   b) Do the Test No. 3 - Ground Test - Idle Power (AMM 71-00-00/501) to make sure the engine operates correctly.
7) If damage is found, do the borescope inspections in the Engine Gaspath Inspection/Check (AMM 72-00-00/601).

(b) If the overspeed occurred in Area B, do the steps that follow.

1) Do the steps for an N2 overspeed that occurred in Area A.

No. 5 - Engine Overspeed Inspection

2) If the engine operates correctly, it may remain in service for 60 hours. After 60 hours the engine must be replaced (AMM 71-00-02/401).
3) Do a full inspection of the removed engine (PW4000 Engine Manual).

(c) If the overspeed occurred in Area C, replace the engine (AMM 71-00-02/401).

NOTE: Make sure the N2 indicating system operates correctly before you remove the engine (AMM 77-12-00/501).

1) Do a full inspection of the removed engine (PW4000 Engine Manual). A full inspection includes the inspections that follow.
   a) Remove the HPC and do a full overhaul inspection on the N2 rotor.
   b) Examine the HPT blades for extention and for worn knife edge seals.
   c) Examine all of the HPT disks for extension.
   d) Examine all of the HPT disks and blades by the flourescent penetrant procedure.

S 866-273-N00

(4) Do the steps that follow to erase the overspeed indications.
(a) Push the MAX IND RESET switch on the pilot's display select panel, P9, to erase the overspeed indication from the EICAS primary display.
(b) Do these steps to erase the EICAS EXCD page.
   1) Push the ENG EXCD switch on the EICAS maintenance panel, P61.
   2) Push and hold the ERASE switch for 3 seconds.
(c) Do these steps to erase the PERF/APU AUTO-EVENT page.
   1) Push the PERF/APU switch on the EICAS maintenance panel, P61.
   2) Push the AUTO-EVENT READ switch.
   3) Push and hold the ERASE switch for 3 seconds.

No. 6 - Engine Windmilling Inspection/Check

TASK 72-00-00-206-274-N00

6. Engine Windmilling Inspection/Check

A. General

(1) This procedure gives you the steps to do after an engine stops during a flight which caused engine windmilling. When an engine stops during a flight, this is referred to as an inflight shutdown or an IFSD.

(2) A record of the engine operation conditions before the IFSD and during the windmilling must be kept to refer to subsequently.

B. References

(1) AMM 71-00-00/201, Power Plant
(2) AMM 71-00-02/401, Power Plant
(3) AMM 71-11-04/201, Fan Cowl Panels
(4) AMM 71-11-06/201, Core Cowl Panels
(5) AMM 78-31-00/201, Thrust Reversers
(6) AMM 79-21-05/401, Main Oil Filter
(7) AMM 79-21-10/401, Magnetic Chip Detectors

C. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

D. Prepare for the Engine Windmilling Inspection/Check

S 016-487-N00

CAUTION: BEFORE YOU START THIS PROCEDURE, EXAMINE AND CORRECT ALL ENGINE MALFUNCTIONS THAT CAUSED THE ENGINE TO STOP DURING A FLIGHT. STEPS FROM THIS PROCEDURE CAN CAUSE DAMAGE TO THE ENGINE IF SOME MALFUNCTIONS ARE NOT CORRECTED.

(1) Open the fan cowl panel (AMM 71-11-04/201).

S 046-275-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-277-N00

(3) Open the core cowl panel (AMM 71-11-06/201).

No. 6 - Engine Windmilling Inspection/Check

S 016-278-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reverser (AMM 78-31-00/201).

E. Do the Engine Windmilling Inspection/Check

S 026-279-N00

(1) If the engine had an IFSD at power because of one or more of the causes that follow, remove the engine (AMM 71-00-02/401) and examine it.

NOTE: Refer to the PW4000 Engine Manual to perform a complete inspection of all bearing compartments.

NOTE: Engine operating conditions recorded before and after and during windmilling are required for this inspection, and must be kept for future reference.

(a) Oil pressure reading below 40 psi (276.0 kPa)
(b) High oil temperature reading (AMM 71-00-00/201: Engine Operating Limits).

NOTE: Do the Oil Overtemperature Inspection (AMM 72-00-00/601).

(c) Interrupted oil supply for more than 10 seconds.
(d) Engine operated or windmilled without oil (i.e., no oil in system, or oil pump shaft failure).

No. 6 - Engine Windmilling Inspection/Check

S 026-479-N00

(2) If the oil pressure was continously more than zero, during the engine shutdown and during windmilling (an indication that the pump was producing pressure, i.e., pump did not fail, oil lines did not fracture, or rotor/gearbox did not seize etc.), do the inspections that follow:

NOTE: During windmilling, the oil pressure indications can be low or unreadable, (below 40 psi (276.0 kPa) which is permissible if oil temperature conditions are within limits (AMM 71-00-00/201: Engine Operating Limits)).

(a) Remove the main oil filter and six magnetic chip detectors, and examine for metal contamination chips as necessary.
   1) If you find metal contamination chips, it may be an indication of bearing distress and more inspection is required before the next flight.
   2) If you do not find metal contamination chips, do these steps:
      a) Install the main oil filter (AMM 79-21-05/401).
      b) Install the six magnetic chip detector probes (AMM 79-21-10/401).

(b) Do the engine oil servicing procedure (AMM 12-13-01/301).

(c) Operate the engine at the minimum idle run for five minutes (AMM 71-00-00/201).

(d) Examine the oil filter and magnetic chip detectors for metal contamination again.
   1) If you do not find metal contamination chips during inspection, the engine may continue-in-service but do the check for the main oil filter and magnetic chip detectors again at these times.
      a) After the first flight.
      b) After 50 hours of operation.
      c) After 100 hours of operation.

S 206-503-N00

(3) If the engine had an in-flight shutdown (IFSD) at power because of one or more of the following conditions, you must remove the engine and do a complete inspection of all bearing compartments.
   (a) Oil pressure reading below 40.0 psi (276.0 kPa).
   (b) High oil temperature reading (AMM 71-00-00/201).
   (c) Oil supply is interrupted for more than 10 seconds.
   (d) Engine operated or windmilled without oil (i.e., no oil in system, or oil pump shaft failure).

S 416-504-N00

(4) Close the thrust reverser (AMM 78-31-00/201).

No. 6 - Engine Windmilling Inspection/Check

S 416-505-N00

(5) Close the core cowl panel (AMM 71-11-06/201).

S 416-506-N00

(6) Close the fan cowl panel (AMM 71-11-04/201).

S 416-507-N00

(7) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 7 - Oil Overtemperature Inspection/Check

TASK 72-00-00-206-292-N00

7. Oil Overtemperature Inspection/Check

A. General

(1) This procedure examines the oil system afer the oil temperature goes higher than the permitted limits (Fig. 602).

B. Special Tools and Equipment

(1) PWA 86018 - Adapter, Oil Sample, Pratt & Whitney

(2) PWA 85507 - Puller, Jackscrew

(3) PWA 85518 - Puller

C. Standard Tools and Equipment

(1) Container - 5 gallon (20 liter)

(2) M303, M305 or M307 Bergen Mechanical Crimper
Bergen Cable Technologies Inc
170 Gregg St
P. O. Box 1300
Lodi, NJ 07644-9982

D. Consumable Materials

(1) D50124 Anti-seize paste - PWA 36246 (P06-054)

(2) D00137 Engine Oil - PWA 521B

(a) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) - AS3214-02

(b) G02335 Cable, Safety (P05-291)

(c) G02332 Ferrule, Safety Cable (P05-292)

E. References

(1) AMM 12-13-01/301, Engine Oil Servicing

(2) AMM 71-00-02/401, Power Plant

(3) AMM 71-11-06/201, Core Cowl Panels

(4) AMM 72-54-04/401, No. 4 Bearing

(5) AMM 72-62-01/401, Angle Gearbox

(6) AMM 78-31-00/201, Thrust Reverser System

(7) AMM 79-11-00/301, Engine Oil Storage

(8) AMM 79-21-05/601, Main Oil Filter

(9) AMM 79-21-10/601, Magnetic Chip Detectors

(10) AMM 79-21-16/601, Last Chance Oil Strainers

(11) AMM 79-34-00/501, Oil Temperature Indicating System

F. Access

(1) Location Zones

411 No. 1 Power Plant
421 No. 2 Power Plant

G. Prepare for the Overtemperature Inspections

S 016-294-N00

(1) Open the fan cowl panel (AMM 71-11-04/201).

No. 7 - Oil Overtemperature Inspection/Check

S 046-293-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-295-N00

(3) Open the core cowl panel (AMM 71-11-06/201).

S 016-296-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reverser (AMM 78-31-00/201).

H. Do the Moderately High Oil Temperature inspection.

S 216-509-N00

(1) Examine the data from the aircraft indicating system that is related to:
   (a) The engine oil system.
   (b) The integrated-drive generator system (IDGS).

S 216-300-N00

(2) Examine the instruments for correct operation.

S 706-510-N00

(3) Do the Electronic Engine Control (EEC) Static Test No. 7 (AMM 71-00-00/501).
   (a) Examine the results for EEC/fuel/oil system defects.

S 216-511-N00

(4) Do a check for the fuel/oil-cooler bypass valve.
   (a) Remove the old fuel/oil-cooler bypass valve (AMM 79-21-01/401).
   (b) Install the fuel/oil-cooler bypass valve (AMM 79-21-01/401).
   (c) Do the Electronic Engine Control (EEC) Test No. 4 for the Engine Power Acceleration/Deceleration Test (AMM 71-00-00/501).
      1) Do not do the engine acceleration/deceleration test.
      2) Write down the new oil temperature data.
   (d) Compare the new oil temperature data.
      1) Check the new data with the old data before you replace the new valve.

No. 7 - Oil Overtemperature Inspection/Check

2) Check the new engine data with an old engine data which has correct temperature.

(e) If the oil temperature data from the test are satisfactory, the removed bypass valve was defective.

S 216-512-N00

(5) Examine the engine air/oil heat exchanger and valve for satisfactory operation (Figure 602A).

(a) Disconnect W3P17.

NOTE: When W3P17 is disconnected, the valve is in the "OPEN" position.

(b) Do the Electronic Engine Control (EEC) Test No. 4 Engine Power Acceleration/Deceleration Test (AMM 71-00-00/501).

1) Do not do the engine acceleration/deceleration test.

2) Write down the new oil temperature data.

(c) Compare the new oil temperature data.

1) Check the new data with the old data before you disconnect W3P17.

2) Check the new engine data with the old engine data which has correct temperature.

(d) If the oil temperature data from the test are better than the old data, then the valve that you removed was defective (AMM 79-21-09/401).

S 216-305-N00

(6) Examine the oil system for contamination (AMM 72-00-00/601).

(a) Do not do the "Hydraulic Fluid Contamination Inspection".

NOTE: The inspection procedures to drain and flush are in Oil System Contamination AMM 72-00-00/601, and also in the procedures that follow. You will want to schedule operations to keep to a minimum the number of times you do the same operations.

S 606-513-N00

(7) Get a sample of oil.

(a) Use PWA 86018 Adapter as follows:

1) Remove the magnetic chip detector probes in the oil tank (AMM 79-21-10/401).

2) Install PWA 86018 adapter in the hole for the magnetic chip detector probe.

3) Get a sample of oil.

(b) Examine the oil.

1) If the answer to the three questions that follow is "No", do not continue the inspection.

No. 7 - Oil Overtemperature Inspection/Check

2) If the answer to any of the questions is "Yes", do all the inspections in this section (Refer to PW-SB-PW4ENG 238 for oil quantity limits.
   a) Look at the color, is the oil darker than usual?
   b) Is the oil more viscous?
   c) Has the Total Acid Number (TAN) increased?

(c) Examine the main gearbox for discoloration, distortion, and burned areas.
   1) None is permitted.
   2) If there are any indication of this type of damage, remove and repair the engine.

(d) Drain the engine oil (AMM 12-13-01/301).

NOTE: The procedures that follow will let you examine the engine for coke and deterioration of packings. Coke and packings with deterioration are possible indications of clogged oil nozzles or defective carbon seal assemblies. These two conditions can cause high oil temperature.

(e) Look in the angle gearbox (Figure 602A).
   1) Open the angle gearbox.
      a) Remove the fan exit liner segment (inner rear) that is below the angle gearbox at 6 o'clock position.
      b) Remove the retaining ring that keeps the plug in the angle-gearbox cover assembly installed.
      c) Remove the plug with PWA 85518 puller.
   2) Examine the internal part of the angle gearbox.
      a) Examine the packing that is on the plug for deterioration.
      b) Examine the gears for coke.
   3) If you find coke, the No. 1, 1.5, and 2 bearing compartment carbon seal and/or oil nozzles are possibly damaged.
      a) Remove and repair the engine.
   4) If you do not find coke, close the angle gearbox and do these steps.
      a) Lubricate a new packing for the plug with Engine Oil (P03-001).
      b) Install the packing on the plug.
      c) Install the plug in the angle-gearbox cover assembly.
      d) Install the retaining ring.
      e) Install the fan exit liner segment (inner rear) that you removed at 6 o'clock position.

(f) Look in the No. 4 bearing compartment (Figure 602A).
   1) Open the No. 4 bearing compartment.
      a) Remove the bolts that attach the No. 4 bearing shield to the rear inner flange of the turbine exhaust case.
      b) Remove the shield.
      c) Remove the No. 4 bearing heat shield.

No. 7 - Oil Overtemperature Inspection/Check

2) ENGINES PRE-SB-PW4ENG 72-385;
The No. 4 bearing cover that has six small threads holes.
    a) Install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case.
    b) Attach with two bolts, washers and nut details.
    c) Install the small plate of the puller to the six threads holes in the cover.
    d) Attach with six knurled screw details.
    e) Turn the jackscrew to disengage the cover from the exhaust case.
    f) Remove the puller and the cover from the exhaust case.
    g) Remove the cover from the puller.
    h) Discard the packing.

3) ENGINES POST-SB-PW4ENG 72-385;
The No. 4 bearing cover that has eight jackscrew holes.
    a) Install and evenly tighten eight 0.190 - 32 jackscrews to remove the cover.
    b) Discard the packing.

(g) Examine the internal part of the No. 4 bearing compartment.
    1) Examine the packing for signs of deterioration.
    2) Examine the cover for signs of coke.
    3) Look in the compartment for signs of coke.

CAUTION: REMOVE THE PROTECTION COVERS FROM ALL OPENINGS. DAMAGE TO THE ENGINE CAN OCCUR.

CAUTION: YOU MUST APPLY ENGINE OIL P03-001 FULLY TO THE COVER PACKING, OR YOU WILL CUT THE PACKING DURING THE INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE IN-FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION WITH FOUR WORK BOLTS AT EQUAL DISTANCES AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO ITS POSITION EQUALLY. MONITOR THE COVER WHILE IT ENGAGES TO MAKE SURE THAT IT DOES NOT CUT THE PACKING DURING THE INSTALLATION. OIL LEAK WILL OCCUR IF THERE IS A CUT IN THE PACKING. THIS CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(h) If you find coke, the No. 4 bearing carbon seal and/or oil nozzles is possibly damaged.
    1) Remove and repair the engine.

(i) If you do not find coke, close the No. 4 bearing compartment.
    1) Apply Engine Oil (P03-001) to the new packing (PN AS3209-378).
    2) Install the new packing PN AS3209-378 into the groove at the rear flange of the No. 4 bearing cover.
    3) Install the cover into the rear inner flange of the exhaust case.

No. 7 - Oil Overtemperature Inspection/Check

4) Install the four work bolts equally spaced around the cover.
5) Tighten the bolts equally in small increments to pull the cover into position equally.
6) Monitor the engagement of the cover to make sure the packing is not cut.
7) Remove the four work bolts.
8) Put the heat shield in the recess in the shield.
9) Lubricate the threads of bolts with Engine Oil (P003-001).
10) Attach the shield with the bolts.
    a) Tighten the bolts to 85 - 95 pound-inches (9.604 - 10.734 Newton-meters).

(j) Examine the No. 3 bearing oil scavenge manifold assembly (LR04) for coke and other deterioration as follows (Figure 603).
1) Remove the No. 3 bearing oil scavenge manifold (LR04) assembly as follows.
    a) Disconnect W5P13 harness connector from the thermocouple probe that is on the manifold.
    b) Remove the lockwire.
    c) Disconnect the nut from the manifold elbow that is on the diffuser case.
    d) Remove the bolts that attach the manifold to the oil pump port.
    e) Remove the clamp bolt and nut that attach the manifold.
    f) Remove the manifold.
    g) Discard the packing.
2) Look for coke in the manifold and in the diffuser case internal tube.
3) If you find coke in the manifold, the No. 3 bearing carbon seals or oil nozzles are possibly damaged.
    a) Remove and repair the engine.
4) If you do not find coke in the manifold, install the No. 3 bearing oil scavenge manifold as follows.
    a) Lubricate the threads of the bolts that will go into the oil pump with anti-seize paste (P06-054).
    b) Lubricate the threads of all other bolts with the Engine Oil (P03-001).
    c) Lubricate the packing with the Engine Oil (P03-001).
    d) Lubricate the threads of the manifold elbow with Engine Oil (P03-001).
5) Install the packing in the packing groove near the flange of the manifold.
6) Install the manifold at one end, to the tube nut of the diffuser case internal tube.
    a) Tighten the tube nut by hand.
7) Attach the manifold at the other end, to the oil pump port with bolts.
    a) Tighten the bolts by hand.

No. 7 - Oil Overtemperature Inspection/Check

8) Attach the tube (LR05) and No. 3 bearing oil scavenge manifold (LR04) to the oil pump bracket with clamps, a bolt, and a nut.
9) ENGINES POST-SB-PW4ENG 79-46;
   Attach the No. 3 bearing oil scavenge manifold (LR04) to the tube (LR05) with the clamps, bolt, and nut.
   a) Make sure the loop clamp grommet halves (clip-on) are on the No. 3 bearing oil scavenge manifold (LR04) and the tube (LR05), at this clamping location.
10) Tighten the bolts and nuts to these torque values as follows.
   a) Tighten the clamp bolts to 36 - 40 pound-inches (4.067 - 4.519 Newton-meters).
   b) Tighten the tube nut to 650 - 700 pound-inches (73.440 - 79.089 Newton-meters).
   c) Tighten other bolts to 62 - 72 pound-inches (7.005 - 8.135 Newton-meters).
   d) Install the lockwire (P05-289) or safety cable (P05-291), and safety cable ferrule (P05-292) in the tube nut and the manifold oil pump bolts.

(k) ENGINES PRE-SB-PW4ENG 73-84;
Connect the W5P13 harness connector to the thermocouple probe as follows.
1) Remove the protector covers.
2) Examine the harness connector and the mating receptacle for bent pins and contamination.
3) If necessary, carefully straighten the bent pins.
4) If necessary, clean the connector and receptacle with Denatured Ethyl Alcohol (P11-009).
   a) Let it dry.
5) Align the connector keyways and engage the connector to the mating receptacle.
   a) Tighten the connector coupling nut by hand until you cover the witness (color) band, and the connector coupling nut is handtight.

      NOTE: The witness (color) band is the first band on the receptacle that you cover when you tighten the connector coupling nut.

No. 7 - Oil Overtemperature Inspection/Check

CAUTION: USE THE CORRECT ASSEMBLY TOOLS. IF YOU USE THE INCORRECT ASSEMBLY TOOLS, DAMAGE TO THE CONNECTOR, OR A LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR INCREASES VIBRATION. THIS DECREASES THE LIFE OF THE CONTACT, AND ALSO DECREASES LIGHTING PROTECTION.

6) Use the Glenair TG-70 strap wrench or the Glenair TG-69 soft-jawed pliers, and make sure that you use sufficient force as follows.
   a) Tighten the connector coupling nut.
   b) The connector fits tightly against the receptacle (metal-to-metal).
   c) This procedure will make sure the contacts are sufficiently engaged and the connector is tight.

      NOTE: If you use too much force, the tools (above) will turn around on the connector coupling nut. This will prevent too much torque.

      NOTE: See the instructions given with the strap wrench for correct use of the tool.

CAUTION: TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE PROBE NUTS CAN LOOSEN THEM. IF TOO MUCH TORQUE IS APPLIED, DAMAGE TO THE THERMOCOUPLE STUDS CAN OCCUR.

(l) ENGINES POST-SB-PW4ENG 73-84;
   Connect the W5P13 harness connector to the thermocouple probe as follows:
   1) Remove the nuts from the thermocouple terminal studs.
      a) Make sure that the nuts (round collar end inboard) are tight.
      b) Align the leads so that they are parallel to one another.
   2) Tighten the alumel nuts (larger terminal studs) to 18 - 22 pound-inches (2.034 - 2.486 Newton-meters).
   3) Tighten the chromel nuts (smaller terminal studs) to 15 - 18 pound-inches (1.695 - 2.034 Newton-meters).
(m) Examine the No. 3 bearing breather tube assemblies (LB03 and LB04) for coke (Figure. 604).
   1) Remove the upper tube (LB03) as follows:
      a) Remove the lockwire from the upper and lower tube nuts of the upper tube.
      b) Disconnect the tube from the diffuser case internal tube nut at approximately 1 o'clock position.

No. 7 - Oil Overtemperature Inspection/Check

c) Disconnect the tube from the lower tube nut at approximately 10 o'clock position.
d) Remove the clamp bolts and nuts that attach the tube to the brackets.
e) Remove the tube.

2) Remove the lower tube (LB04) as follows:
a) Remove the three bolts that attach the tube to the gearbox deoiler.
b) Remove the clamp bolt that attaches the tube to the bracket.
c) Disengage the tube.
d) Discard the packing.

(n) Examine the breather tubes and in the diffuser case internal tube for coke.

(o) If you find coke, the No. 3 bearing carbon seals and/or oil nozzles are possibly damaged.
1) Remove and repair the engine.

(p) If you do not find coke in the tubes, install the lower tube (LB04) as follows.
1) Lubricate the packing with the Engine Oil (P03-001).
2) Lubricate the threads of the bolts with Engine Oil (P03-001).
3) Install the new packing in the groove at the flanged end of the tube.
4) Attach the tube to the gearbox pad with three bolts.
a) Tighten the bolts by hand.
5) Attach the clamp to the bracket with one bolt.
6) Tighten the clamp bolt to 36 - 40 pound-inches (4.067 - 4.519 Newton-meters).
7) Tighten other bolts to 85 - 95 pound-inches (9.604 - 10.734 Newton-meters).
8) Install the lockwire (P05-289) or safety cable (P05-291), and safety cable ferrule (P05-292) to the gearbox pad bolts.

(q) If you do not find coke in the tubes, install the upper tube (LB03).
1) Lubricate the threads of the lower tube nut with anti-seize paste (P06-054).
2) Lubricate the threads of the tube nut (internal tube of the diffuser case) with Engine Oil (P03-001).
3) Install the tube to the tube nut.
a) Tighten the tube nuts by hand.
4) Attach the clamps to the brackets with bolts and nuts.
5) Tighten the clamp bolts to 36 - 40 pound-inches (4.067-4.519 newton-meters).
6) Tighten the tube nut (internal tube of the diffuser case) to 650 - 700 pound-inches (73.440 - 79.089 Newton-meters).
7) Tighten the tube nut (lower) to 675 - 750 pound-inches (76.265 - 84.739 Newton-meters).

No. 7 - Oil Overtemperature Inspection/Check

8) Install the lockwire (P05-289) or safety cable (P05-291) and safety cable ferrule (P05-292) in the tube nuts.

(r) If you do not find coke.

1) Flush the oil system (AMM 79-11-00/301).
2) Do the Engine Vacuum Test No. 12 (AMM 71-00-00/501).
3) Do the Ground Test - Idle Power Test No. 3 (AMM 71-00-00/501).
4) Examine the oil color, viscosity, and acidity of the oil after 50 hours of service.
5) If you find these properties are not correct, remove the engine and do the inspections for Very High Temperature.

I. Do the Overtemperature Inspection for Very High Temperature

S 026-309-N00

(1) Remove the engine (AMM 71-00-02/401).

(a) Get access to all main and accessory drive bearings, seals and nozzles.
(b) Examine all main bearings, seals, seal seats and nozzles.
(c) Examine all accessory drive bearings, seals, seal seats and nozzles.
(d) Repair or replace the damaged parts.

S 416-310-N00

(2) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 8 - Oil System Contamination Inspection

TASK 72-00-00-206-311-N00

8. Oil System Contamination Inspection

A. General

(1) The detection and identification of the four most usual kinds of oil system contamination are as follows:

(a) Unwanted material that is in the engine from the time of its assembly (called build debris) and pieces from a repair.

1) Remaining material from repairs are, for example, small pieces of gaskets or preformed packing, sealing compound, or pieces of metal seal rings. This contamination is usually caught in the oil filter after the first engine operation after the repair.

2) These pieces are frequently not metallic.

3) If the pieces are metallic, they are frequently larger than the particles that come from a bearing or gear.

(b) Metal particles from a bearing or gear.

1) Metal particle contamination is a bad problem that is caused, for example, by bearings and gears that are worn too much.

2) The particle source must be found and the condition must be corrected before the subsequent flight.

CAUTION: IF THE OIL IS BLACK, IT CAN BE THE RESULT OF OIL TEMPERATURES THAT WERE HIGHER THAN THE USUAL OIL TEMPERATURES (SEE FIM 71-00-00, HIGH OIL TEMPERATURE). BLACK OIL CAN ALSO BE A SIGN OF OTHER DAMAGE OR CONTAMINATION. IF HIGH OIL TEMPERATURE HAS NOT OCCURRED, CONTINUE WITH THE STEPS BELOW.

(c) Hydraulic fluid (Skydrol is an example)

1) Hydraulic fluid contamination can cause bad problems in the oil system. During usual engine operation temperatures, hydraulic fluid makes the synthetic engine oils become black, thick, and tacky.

2) This oil stops or badly decreases the oil flow through the jets, the nozzles, and the small-mesh screens.

3) Oil that has hydraulic fluid in it can cause damage to packings. The quantity of damage is in proportion to the quantity, temperature, and length of time of contamination. If packings have damage, leaks and corrosion of oil system parts are possible.

4) Hydraulic fluid can get into the oil system through a hydraulic pump seal failure or when hydraulic fluid is accidentally added to the oil tank.

(d) Jet Fuel.

1) Jet fuel contamination can cause bad problems in the oil system.

No. 8 - Oil System Contamination Inspection

2) If oil has jet fuel in it, you can smell the fuel. Also, the viscosity of oil that has jet fuel in it is less than for oil without fuel in it.
3) Signs of Jet Fuel contamination are high oil temperature and too much oil in the oil tank.
4) Oil with jet fuel contamination causes damage to packings. Damaged packings cause oil leaks in the gearbox accesory seals. The quantity of damage to the bearings is in proportion to the quantity, and length of time of contamination.
5) It is possible that an internal leak in the fuel-oil cooler is the cause or fuel contamination.

B. Equipment
(1) PWA 86018 - Adapter, Oil Sample, Pratt & Whitney, Commercial Products Division, 400 Main Street, East Hartford, CT 06108

C. Consumable Materials
(1) B00192 Solvent - PWA P11-027

D. References
(1) AMM 12-13-01/301, Engine Oil Servicing
(2) AMM 29-11-05/401, Engine-Driven Pump (EDP)
(3) AMM 71-00-00/201, Power Plant
(4) AMM 71-11-04/201, Fan Cowl Panels
(5) AMM 71-11-06/201, Core Cowl Panels
(6) AMM 72-34-03/401, Fan Exit Liner Segments (Inner Rear)
(7) AMM 72-61-07/401, Rear Hydraulic Pump Drive Oil Seal Assembly
(8) AMM 78-31-00/201, Thrust Reverser System
(9) AMM 79-21-05/401, Main Oil Filter
(10) AMM 79-21-10/401, Magnetic Chip Detectors
(11) AMM 79-21-10/601, Magnetic Chip Detector
(12) AMM 79-21-16/401, Last Chance Oil Strainers
(13) AMM 79-21-16/601, Last Chance Oil Strainers
(14) AMM 79-21-16/701, Last Chance Oil Strainers

E. Prepare for the Oil System Contamination Inspection

S 016-313-N00
(1) Open the fan cowl panel (AMM 71-11-04/201).

S 046-312-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

No. 8 - Oil System Contamination Inspection

S 016-314-N00
(3) Open the core cowl panel (AMM 71-11-06/201).

S 016-315-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reverser (AMM 78-31-00/201).

F. Examine the Oil for Contamination from Solids (Build Debris, Pieces from a Repair, Bearing, or Gear).

S 246-501-N00
(1) Examine for contamination as follows:

NOTE: You must adjust the frequency of filter checks and replacements. This will keep to a minimum the number of incidents where the delta-P warning light for the main oil filter comes on.

(a) Remove the main oil filter (AMM 79-21-05/401) and the magnetic chip detectors (AMM 79-21-10/401).

CAUTION: IF YOU FIND METAL PARTICLES, YOU MUST FIND THE SOURCE OF THE PARTICLES AND CORRECT THE CONDITION BEFORE SUBSEQUENT FLIGHTS. MORE DAMAGE CAN POSSIBLY OCCUR IF THE ENGINE IS OPERATED WITH A PROBLEM THAT IS NOT CORRECTED.

(b) Flush the main oil filter with solvent.
(c) Put the solvent through filter paper or a clean cloth to examine the particles from the oil filter.
1) Keep the contamination.
(d) Install the clean oil filter (AMM 79-21-05/401).
(e) Remove all the last chance oil strainers (AMM 79-21-16/401).

No. 8 - Oil System Contamination Inspection

(f) Examine the last chance oil strainers for contamination (AMM 79-21-16/601).
  1) Keep the contamination that you find.
(g) Clean the last chance oil strainers if you find contamination (AMM 79-21-16/701).
(h) Install the last chance oil strainers.
(i) Put the solvent through filter paper or a clean cloth to collect the contamination.
(j) Examine the magnetic chip detectors (AMM 79-21-10/601).

S 286-397-N00

(2) If you find contamination, do the steps that follow to do an analysis of the contamination.
  (a) Examine the contamination.

NOTE: Data collected by persons shows that the inspection of the magnetic chip detectors is very sensitive. The start of bearing and gear deterioration will release very small particles which will go through the oil system to the magnetic chip detector. You must be very careful when you try to find what parts the particles came from. A high power, 30 to 50X, magnification will help you do the analysis.

  (b) Look for the chip properties.

NOTE: Particles that are made by spalling usually are shiny rounded chips with one surface that is different from the opposite surface. The outer surface is highly polished and can have parallel dents, but the other surface will be rougher, or granular, or have waves. Particles are thin with thinner edges and open cracks. When the surface layer becomes fully worn, the layer below starts to break. This layer below is rougher, not as bright, and has many sharp cracks. Thin chips that are made by spalling are usually harder and less easily bent than other contamination.

No. 8 - Oil System Contamination Inspection

(c) If you cannot find the source of a chip, do a spectrographic analysis to help you find which elements are in the chip, the chip composition.

(d) Refer to the Chip Composition Table which shows the percent of elements in parts which can make chips.

Chip Composition Table				
SOURCE	MAIN OIL PUMP GEARS	OTHER GEARS	BEARINGS	
SPECIFICATION	AISI H-13	AMS 6265	AMS 6441 AISI 52100 PWA - 723	AMS 6490 PWA - 725 PWA - 793
COMPOSITION (PERCENT)	MIN - MAX	MIN - MAX	MIN - MAX	MIN - MAX
CARBON	0.32 - 0.45	0.07 - 0.13	0.95 - 1.10	0.77 - 0.85
MANGANESE	0.20 - 0.50	0.40 - 0.70	0.25 - 0.45	-- 0.35
SILICON	0.80 - 1.20	0.20 - 0.35	0.20 - 0.35	-- 0.25
PHOSPHOROUS	-- 0.30	-- 0.025	-- 0.025	-- 0.015
SULPHUR	-- 0.30	-- 0.025	-- 0.025	-- 0.015
CHROMIUM	4.75 - 5.50	1.00 - 1.40	1.30 - 1.60	3.75 - 4.25
NICKEL	-- --	3.00 - 3.50	-- 0.15	-- 0.15
MOLYBDENUM	1.10 - 1.75	0.08 - 0.15	-- 0.10	4.00 - 4.50
COPPER	-- --	-- 0.35	-- 0.15	-- 0.10
VANADIUM	0.80 - 1.20	-- --	-- --	0.90 - 1.10
COBALT	-- --	-- --	-- --	-- 0.25
TUNGSTEN	-- --	-- --	-- --	-- 0.25
IRON	REMAINDER	REMAINDER	REMAINDER	REMAINDER

No. 8 - Oil System Contamination Inspection

S 816-398-N00

(3) If you know the source of the contamination, do the steps that follow to find if there is more contamination:

(a) If the particles you found are from the gears or bearings, do the steps that follow.
1) Remove the engine (AMM 71-00-02/401).
2) Examine the bearings and gears.

(b) If the particles are from a repair, operate the engine as follows:
1) Flush the oil system (AMM 12-13-01/301).
2) Fill the oil system (AMM 12-13-01/301).
3) Start the engine and operate it at minimum power until the temperature of the oil is more than 150°F (65.6°C) (AMM 71-00-00/201).
4) Increase the speed to 1.35 to 1.40 EPR and then operate the engine at minimum power. Do this four more times.
5) Operate the engine at 1.35-1.40 EPR for 10 minutes.
6) Do the engine shutdown procedure (AMM 71-00-00/201).
7) Examine again the main oil filter and the magnetic chip detectors for contamination.
8) If you do not find contamination, install the oil filter and the chip detectors.
a) Continue the operation of the engine, but examine the chip detectors again at 50 hours of service.
9) If you find contamination, do the particle analysis, and the steps to find if there is more contamination.

NOTE: It is not necessary to examine the last chance oil strainers a second time.

a) If you find contamination after the second engine operation, immediately remove the engine, find the source of the contamination, and correct the problem.

No. 8 - Oil System Contamination Inspection

G. Examine For Black Oil.

NOTE: Dark oil can be an indication of a serious problem or it can be a condition that requires no maintenance action. The dark oil condition "black oil" is the result of some additives in the oil that oxidize as the oil ages. This can cause very fine carbon particulate which darkens the oil without an effect on the properties which lubricate and cool (Total acid number and viscosity are not changed).

S 286-472-N00

(1) Perform the maintenance below if one or more of the items that follows is true:
   (a) The oil has an unusual smell (burnt or equivalent to fuel or hydraulic fluid).
   (b) The oil is thick or gummy.
   (c) An engine oil overtemperature occurred.

S 286-473-N00

(2) If one or more of the items above is true, you must do the procedures that follow:
   (a) Examine the oil for contamination from hydraulic fluid.
   (b) Do the Oil Overtemperature Inspection (AMM 72-00-00/601).

S 286-474-N00

(3) If none of the items above are true, the engine can continue in service.

H. Examine the Oil for Contamination from Hydraulic Fluid.

S 286-459-N00

CAUTION: IF THE OIL IS BLACK, IT CAN BE THE RESULT OF OIL TEMPERATURES THAT WERE HIGHER THAN THE USUAL OIL TEMPERATURES (SEE FIM 71-00-00, HIGH OIL TEMPERATURE). BLACK OIL CAN ALSO BE A SIGN OF OTHER DAMAGE OR CONTAMINATION. IF HIGH OIL TEMPERATURE HAS NOT OCCURRED, CONTINUE WITH THE STEPS BELOW.

(1) Examine for contamination from hydraulic fluid if one or more of the items that follows is true.
   (a) There was a failure of a hydraulic pump, and it is possible that hydraulic fluid went in the gearbox drain.

No. 8 - Oil System Contamination Inspection

(b) There is corrosion of metal adjacent to the gearbox in the open space in the hydraulic pump drive pad.
(c) There is hydraulic fluid in the open space of the hydraulic pump drive pad.
(d) The engine oil is black, thick, and gummy.

S 286-401-N00

(2) Examine the oil for contamination from hydraulic fluid as follows.
(a) Examine the viscosity of the oil.
1) Compare the viscosity of the oil sample with the viscosity of a sample of the same type of oil that has no contamination (Refer to the P&W SB 238 for the oil quality limits).

NOTE: If the viscosities are very different, the oil will possibly have contamination by hydraulic fluid or jet fuel.

(b) Do a check of the phosphorus content of the oil.
1) Measure the phosphorus content of the oil, with the wet chemical test (ASTM-D-1091-64) or by spectrographic oil analysis (AMM 72-00-00/601, Oil System Contamination).

NOTE: The best indication of contamination by hydraulic fluid is a phosphorous content that is higher than the usual content.

S 366-405-N00

(3) If you found contamination from hydraulic fluid or if you think the hydraulic pump is damaged, repair the damaged engine parts as follows:
(a) Remove the engine driven (hydraulic fluid) pump that is referred to as the EDP (AMM 29-11-05/401).

No. 8 - Oil System Contamination Inspection

(b) Remove the fluid from the empty space between the EDP and the gearbox pad.
(c) Remove the EDP drive oil seal from the drive pad in the gearbox (AMM 72-61-07/401).
1) Examine the condition of the EDP drive oil seal.
2) Examine the condition of the packing which seals the support of the EDP drive oil seal to the gearbox.

NOTE: Deterioration of these packing seals is a sign that the engine oil can have contamination by hydraulic fluid.

3) With radial and axial movements of the drive spline, examine the drive shaft bearings.

NOTE: A loose drive spline is a sign that there is a bearing problem which must be corrected before subsequent flights.

4) Install the drive oil seal for the EDP with a new packing (AMM 72-61-07/401).

NOTE: Use new a drive oil seal if the original one had corrosion.

5) Install the EDP (AMM 29-11-05/401).

NOTE: If the EDP is damaged, you must replace the EDP.

6) Do the subsequent steps to put to the oil system back to a serviceable condition.

S 216-500-N00
(4) Get a sample of oil.
(a) Use PWA 86018 Adapter as follows:
1) Remove the magnetic chip detector probe from the oil tank (AMM 79-21-10/401).

No. 8 - Oil System Contamination Inspection

2) Install PWA 86018 Adapater in the hole for the magnetic chip probe.
3) Get a sample of oil.

(b) Examine the oil.
1) If the answer to the three questions that follow is "no", do not continue the inspections.
2) If the answer to any of the questions is "yes", do all the inspections in this section (Refer to P&W SB PW4ENG 238 for oil quantity limits).
a) Look at the color, is the oil darker than usual?
b) Is the oil more viscous?
c) Has the Total Acid Number (TAN) increased?

(c) Examine the main gearbox for discoloration, distortion, and burned areas.
1) None is permitted.
2) If there are any indications of this type of damage, remove and repair the engine.

(d) Drain the engine oil.

NOTE: The procedures that follow will let you examine for coke and deterioration of packings. Coke and packings with deterioration are possible indications of clogged oil nozzles or detective carbon seal assemblies. These two conditions can cause high oil temperature.

(e) Look in the angle gearbox.
1) Open the angle gearbox.
a) Remove the fan exit liner segment (inner rear) that is at 6 o'clock position (AMM 72-34-03/401).
b) Remove the retaining ring that keeps the plug in the angle-gearbox cover-assembly installed.
c) Remove the plug with PWA 85518 Puller.
2) Examine the internal part of the angle gearbox.
a) Examine the packing that is on the plug for deterioration.
b) Examine the gears for coke.
3) If you find coke, the No. 1, 1.5, and 2 bearing-compartment carbon seals and/or oil nozzles are possibly damaged.
a) Remove and repair the engine.
4) If you do not find coke, close the angle gearbox.
a) Lubricate a new packing for the plug with engine oil (P03-001).
b) Install the packing on the plug.

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c) Install the plug in the angle-gearbox cover assembly.
d) Install the retaining ring.
e) Install the fan exit liner segment (inner rear) that you removed (AMM 72-34-03/401).

(f) Look in the No. 4 bearing compartment.
1) Open the No. 4 bearing compartment.
a) Remove the bolts that attach the No. 4 bearing shield to the rear inner flange of the turbine exhaust case.
b) Remove the shield.
c) Remove the No. 4 bearing heat shield.
2) ENGINES WITHOUT PW-SB PW4ENG 72-385;

The No. 4 bearing cover that has six small threads holes.
a) Install the PWA 85307 Jackscrew Puller to the rear inner bolt hole flange (Flange T1) of the exhaust case.
b) Attach with two bolts, washers and nut details.
c) Install the small plate of the puller to the six threads holes in the cover.
d) Attach with six knurled screw details.
e) Turn the jackscrew to disengage the cover from the exhaust case.
f) Remove the puller and the cover from the exhaust case.
g) Remove the cover from the puller.
h) Discard the packing.
3) ENGINES WITH PW-SB PW4ENG 72-385;

The No. 4 bearing cover that has eight jackscrew holes.
a) Install and evenly tighten eight jackscrews to remove the cover.
b) Discard the packing.
4) Examine the internal part of the No. 4 bearing compartment.
a) Check the packing for signs of deterioration.
b) Check the cover for signs of coke.

No. 8 - Oil System Contamination Inspection

c) Look in the compartment for signs of coke.

CAUTION: REMOVE THE PROTECTION COVERS FROM ALL OPENINGS. IF YOU DO NOT, DAMAGE TO THE ENGINE CAN OCCUR.

CAUTION: APPLY ENGINE OIL P01-003 FULLY TO THE COVER PACKING. WITHOUT OIL, YOU WILL CUT THE PACKING DURING THE INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LEAKS. THIS CAN CAUSE AN IN-FLIGHT SHUTDOWN.

CAUTION: PUT THE FOUR WORK BOLTS AT EQUAL DISTANCES AROUND THE COVER TO INSTALL THE COVER INTO ITS POSITION. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO ITS POSITION EQUALLY. MONITOR THE COVER WHILE IT ENGAGES TO MAKE SURE THAT IT DOES NOT CUT THE PACKING DURING THE INSTALLATION. OIL LEAKS WILL OCCUR IF THERE IS A CUT IN THE PACKING. THIS CAN CAUSE AN IN-FLIGHT SHUTDOWN.

5) If you find coke, the No. 4 bearing carbon seal and/or oil nozzle is possibly damaged.
   a) Remove and repair the engine.
6) If you do not find coke, close the No. 4 bearing compartment.
   a) Apply engine oil (P03-001) fully to the new packing.
   b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover.
   c) Install the cover into the near inner flange of the exhaust case.
   d) Install four work bolts equally in small increments to pull the cover into position equally.
   e) Monitor the engagement of the cover to make sure the packing is not cut.
   f) Remove the four work bolts.
   g) Put the heat shield in the recess in the shield.
   h) Lubricate the threads of 30 bolts with engine oil (P03-001).
   i) Attach the shield with the bolts.
   j) Tighten the bolts to 85-95 Pound-inches (9.604-10.734 Newton-meters).

No. 8 - Oil System Contamination Inspection

I. Examine the Oil for Contamination from Jet Fuel.

S 286-402-N00

(1) Examine for contamination from jet fuel if one or more of the items that follows is true.
   (a) You smell jet fuel in the oil.
   (b) There was too much oil in the oil tank.
   (c) There is an indication of high oil temperature.

S 286-403-N00

(2) Examine the oil for contamination from jet fuel as follows.
   (a) Examine the viscocity of the oil.
      1) Compare the viscosity of the oil sample with the viscosity of a sample of the same type of oil that has no contamination (Refer to the PW SB 79-238 for the oil quality limits).

         NOTE: If the viscosities are very different, the oil will possibly have contamination by jet fuel or hydraulic fluid.

S 366-404-N00

(3) If you found contamination from jet fuel, do as follows:
   (a) Remove the fuel/oil cooler (AMM 79-21-01/401).
   (b) Examine the fuel/oil cooler.
   (c) Repair or replace the fuel/oil cooler as necessary.
   (d) Do the subsequent steps to put to the oil system back to a serviceable condition.

J. Put the Oil System Back to a Serviceable Condition.

S 616-400-N00

(1) Do the steps that follow to put the oil system back to the usual condition.
   (a) Drain the oil system (AMM 79-00-00/201).

No. 8 - Oil System Contamination Inspection

(b) Flush the oil system (AMM 79-00-00/201).
(c) Fill the oil system (AMM 12-13-01/301).
(d) Start the engine and operate it at minimum power until the temperature of the oil is more than 150°F (65.5°C) (AMM 71-00-00/201).
(e) Increase the speed to 1.35-1.40 EPR and then operate the engine at minimum power.
  1) Do that step four more times.
(f) Operate the engine at 1.35 to 1.40 EPR for 10 minutes.
(g) Do the engine shutdown procedure (AMM 71-00-00/201).
(h) Get a sample of oil as follows:
  1) Remove the magnetic chip detector from the engine oil tank (AMM 79-21-10/401).
  2) Install the PWA 86018 adapter in the hole from which the chip detector was removed.
  3) Get a sample of the engine oil.
  4) Remove the PWA 86018 adapter.
  5) Install the magnetic chip detector (AMM 79-21-10/401).
(i) Examine the viscosity and phosphorus content of the oil.

NOTE: The engine may continue-in-service, as you wait for the results of the analysis for contamination.

(j) If this analysis shows contamination, examine the oil for contamination from hydraulic fluid or jet fuel again.

S 416-318-N00
(2) Do this procedure: Put the Airplane Back to its Usual Condition.

TASK 72-00-00-206-319-N00

9. Volcanic Ash/Sand Ingestion Inspection/Check

A. General

(1) This procedure gives you the steps that you do after a high concentration of volcanic ash or sand goes into the engine. This is referred to as ash or sand ingestion.

(2) Ingestion of high concentrations of volcanic ash or sand can cause engine operation problems such as a decrease in power. Ash or sand contamination in the engine systems can cause performance deterioration, blocked cooling air holes, abrasive damage and other problems. This procedure must be done after each time there is ash or sand ingestion, if there are problems or if there are not.

B. References

(1) AMM 12-13-01/301, Engine Oil Servicing
(2) AMM 71-00-00/501, Power Plant
(3) AMM 71-00-02/401, Power PLant
(4) AMM 71-11-04/201, Fan Cowl Panels
(5) AMM 71-11-06/201, Core Cowl Panels
(6) AMM 73-11-02/601, Fuel Pump Filter
(7) AMM 73-11-04/601, Fuel Distribution Valve Strainer
(8) AMM 75-33-05/201, PS3 Air Filter Element
(9) AMM 75-33-05/401, PS3 Air Filter Element
(10) AMM 78-31-00/201, Thrust Reverser System
(11) AMM 79-00-00/201, Oil
(12) AMM 79-11-00/301, Engine Oil Storage
(13) AMM 79-21-05/601, Main Oil Filter
(14) AMM 79-21-10/601, Magnetic Chip Detectors
(15) AMM 79-21-16/601, Last Chance Oil Strainer

C. Access

(1) Location Zones

411 No. 1 Power Plant
421 No. 2 Power Plant

D. Prepare for the Volcanic Ash/Sand Ingestion Inspection/Check

S 016-321-N00

(1) Open the fan cowl panel (AMM 71-11-04/201).

No. 9 - Volcaninc Ash/Sand Ingestion Inspection/Check

S 046-320-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-322-N00

(3) Open the core cowl panel (AMM 71-11-06/201).

S 016-323-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reverser (AMM 78-31-00/201).

E. Do the Volcanic Ash/Sand Ingestion Inspection/Check.

S 216-324-N00

(1) If the ash or sand ingestion caused engine operation problems, do the steps that follow.
   (a) Remove the engine (AMM 71-00-02/401).
   (b) Do these steps, if they are necessary: disassemble, examine, and repair the engine.
      1) Make sure the oil system, air supplied components, turbine cooling system, and fuel system operate correctly.
   (c) For engines operating under the requirements of PW-SB-PW4ENG 72-731, to avoid the Fan Thrust Deterioration Mode (FTDM), recountour the fan blade leading edges using any of the procedures in PW-SB-PW4ENG 72-731.

S 216-325-N00

(2) If the ash or sand ingestion did not cause engine operation problems, do the steps that follow.
   (a) Visually examine the engine inlet and exhaust areas for signs of damage or too much erosion (AMM 72-00-00/601, Inlet/Exhaust Check).
   (b) With a borecope, examine the high pressure compressor and the high pressure turbine for these conditions for the borescope inspection and its inspection limits.
      1) Too much erosion.

No. 9 - Volcaninc Ash/Sand Ingestion Inspection/Check

2) Foreign object damage (FOD).
3) Cooling hole blockage in the high pressure turbine airfoils.
4) Build-up of ash or sand particles.

(c) Do an inspection of the magnetic chip detectors and the oil, as follows:
1) Examine the magnetic plugs for contamination (AMM 79-21-10/401).
2) Do a spectroscopic analysis of the oil, as follows:
a) With the magnetic probe removed from the oil tank, install the PWA 86018 adapter in that location.
b) Get a sample of the engine oil.
c) Do a spectroscopic analysis of the oil and find out if there is engine damage (AMM 79-21-10/601).
3) If the oil has contamination, Flush the oil system (AMM 79-11-00/301).
a) Do the check for oil system contamination again.
4) Install the magnetic chip detector (AMM 79-21-10/401).

(d) If it is necessary, remove and clean or replace as follows:
1) The main oil filter.
2) The fuel filter element.
3) The air filter element.
4) If you still find the contamination, keep the sample for analysis.

(e) Examine the engine oil system for contamination.
1) Examine the main oil filter.
2) Clean or replace the main filter as necessary.

(f) Remove the No. 1, 1.5 and 2 bearing bearing oil pressure last chance strainer (AMM 79-21-16/401).
1) Examine the bearing oil elements.
2) Clean or replace the last chance oil strainer as necessary.

(g) Remove the No. 3 bearing oil pressure last chance strainer (AMM 79-21-16/401),
1) Examine the bearing oil elements.
2) Change or replace the last chance oil strainer as necessary.

No. 9 - Volcaninc Ash/Sand Ingestion Inspection/Check

(h) Remove the No.4 bearing oil pressure last chance strainer (AMM 79-21-16/401).
   1) Examine the bearing oil element.
   2) Clean or replace the oil last chance strainer as necessary.
(i) Remove the main gearbox and angle gearbox last chance strainer (AMM 79-21-16/401).
   1) Examine the main and angle gearbox elements.
   2) Clean or replace the main and angle gearbox last chance strainer as necessary.
(j) Examine the fuel system for contamination.
   1) Remove the fuel pump filter (AMM 73-11-02/401).
   2) Examine the fuel pump filter for contamination (AMM 73-11-02/601).

      NOTE: Keep the particles you find to do an analysis of them.

   3) Clean or replace the fuel pump filter as it is necessary (AMM 73-11-02/401).
   4) If the flight deck, fuel filter, or bypass light was on during or after ash or sand ingestion, do these steps.
      a) Remove the strainer for the fuel distribution valve (AMM 73-11-04/401).
      b) Examine the strainer for the fuel distribution valve inlet screen (AMM 73-11-04/601).

         NOTE: Keep the particles you find to do an analysis of them.

      c) Clean or replace the strainer for the fuel distribution valve as necessary (AMM 73-11-04/401).
(k) Examine the air system for contamination.
   1) Remove the cooling air valve filter of the turbine blade and vane, and the control valve filter of the HPC secondary flow (AMM 75-33-05/201, AMM 75-33-05/401).
   2) Examine the valves for damage (AMM 75-33-05/201, AMM 75-33-05/401).

      NOTE: Keep the particles you find to do an analysis of them.

   3) Clean or replace the valves as necessary (AMM 75-33-05/201, AMM 75-33-05/401).

(l) For engines operating under the PW-SB-PW4ENG 72-731, to avoid Fan Thrust Deterioration Mode (FTDM), recontour the fan blade leading edges using any of the procedures in PW-SB-PW4ENG 72-731 at the next station that capable of performing this procedure

1) This procedures must be performed within the next 10 cycles of engines operation.

(m) Do the engine test to determine if a shift in performance parameters has occurred.

1) If the parameters are incorrect, replace the engine (refer to Test No. 9 - Performance Test AMM 71-00-00/501).

F. Put the airplane back to its usual condition.

S 416-326-N00

(1) Do this procedure: Put the Airplane Back to its Usual Condition.

S 726-327-N00

(2) Do Test No. 9 - Performance Test (AMM 71-00-00/501).

No. 10 - Fire/Fire Extinguishing Agent Exposure Inspection/Check

TASK 72-00-00-206-484-N00

10. Fire/Fire Extinguishing Agent Exposure Inspection/Check

A. General

(1) This procedure gives you the steps that you do after an engine has been exposed to fire or fire extinguishing agents.

B. References

(1) AMM 72-00-00/701, Power Plant

C. Do the Fire/Fire Extinguishing Agent Exposure Inspection/Check

S 286-485-N00

(1) If the engine was damaged by fire it will require special inspection which exceed the normal inspection requirements. For special instruction for relative engine parts, contact your Pratt & Whitney representative.

S 206-486-N00

(2) If the engine was exposed to fire extinguishing agents (without a fire) on it's external or internal surfaces, clean the engine (AMM 72-00-00/701).

No. 11 - Prepare for the Borescope Inspection

TASK 72-00-00-846-328-N00

11. Prepare for the Borescope Inspection

A. General

(1) This procedure gives the equipment and steps that are necessary to prepare for the borescope inspections.

(2) Refer to Fig. 605A for installation data on each borescope access port.

B. Equipment

(1) Borescope Inspection Equipment - Specification CTE 6181, Support Equipment Engineering, Pratt & Whitney Commercial Products Division, 400 Main Street, East Hartford, CT 06108, USA MS 11803

NOTE: Specification CTE 6181 gives the equipment and related hardware, such as power source, light cables, adapter, that is required during borescope inspections. This specification sets the quality and functional standards for this equipment. This borescope equipment is recommended:

(a) Low magnification rigid borescope. . . . . AP2-7, 9 (optional for THRU FAN) (0.270 inch/6.8 mm barrel dia max)

(b) High magnification rigid borescope. . . . . AP8, 11 (0.444 inch/11.3 mm barrel dia max)

(c) Flexible borescope . . . . AP-1, THRU FAN (optional for AP2-7) (0.270 inch/6.8 mm cable dia max)

(2) Optional borescope equipment and sizes that make the operation of the borescope better and easier are also shown in CTE 6181. This equipment includes clamps that hold the borescope in position and optical video equipment. This video equipment helps you see and make a videotape record of the borescope procedure for a second, more full, examination.

(a) Borescope equipment is available with rigid or flexible probes that have different operation lengths and fields of vision. You can use closed circuit television with some borescopes.

No. 11 - Prepare for the Borescope Inspection

(b) The equipment that follows is from Olympus Corp., IFD 4 Nevada Drive, Lake Success, NY 11042, and agrees with specification CTE 7181. You can get equivalent equipment from American Cystoscope Makers Inc., Industrial Division, 300 Stillwater Ave., Stamford, CT 06902, or Richard Wolf Medical Instruments Corp., 7046 Lydon Ave., Rosemont, IL 60018.
1) Rigid Borescope - Olympus Model C080-048-090-50, 8 mm diameter, 48 cm operation length, lateral view, 50-degree field of view
2) Rigid Borescope - Olympus Model C100-037-090-50, 10 mm diameter, 37 cm operation length, lateral view, 50-degree field of view
3) Eyepiece, right angle adapter - Olympus Model KMR-90/4
4) Flexible Borescope - Olympus Model IF8D3-15, 8 mm diameter, 125 cm operation length, direct view, 40-degree field of view
5) Distal right angle adapter - Olympus Model IF8D3-A40S, 40-degree field of view
6) Light Source - Olympus Model ILK-4, 150 Watt Halogen
7) Light Cable - Olympus Model 2950B High Intensity Light Cable, 6 mm diameter, 72 inch length
8) Flexible Borescope - Olympus Model PF27-7, 6.8 mm (0.27 inch) diameter, 130 cm operation length, direct view, 70-degree field of view, Articulating Tip
9) Flexible Borescope - Olympus Model IF6D3-20, 6 mm diameter, 180 cm operation length, direct view, 65-degree field of view, Articulating Tip

No. 11 - Prepare for the Borescope Inspection

(c) This television system is available from Westinghouse Electronic Tube Division, P.O. Box 284, Elmira, New York 14902
1) Mobile Video Inspection Equipment - Model No. M616W, closed circuit television camera system.

NOTE: This video inspection equipment is used with Richard Wolf Corp. Borescope Models FIB 750, and FIB 760.

C. Reference
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System

D. Access
(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

E. Prepare for the Borescope Inspection.

S 846-329-N00
(1) Get the applicable borescope equipment.

S 046-521-N00
(2) For the left engine, open this circuit breaker on the overhead circuit breaker panel, P11, and attach a DO-NOT-CLOSE tag:
(a) 11D19, ENGINE START CONT L

S 046-522-N00
(3) For the right engine, open this circuit breaker on the overhead circuit breaker panel, P11, and attach a DO-NOT-CLOSE tag:
(a) 11D20, ENGINE START CONT R

S 016-331-N00
(4) Open the fan cowl panel (AMM 71-11-04/201).

S 046-330-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(5) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

No. 11 - Prepare for the Borescope Inspection

S 016-332-N00

(6) Open the core cowl panel (AMM 71-11-06/201).

S 016-333-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(7) Open the thrust reverser (AMM 78-31-00/201).

No. 12 - LPC Blade and Vane (1st thru 4th-Stage) - Inspection

TASK 72-00-00-206-334-N00

12. LPC Blade and Vane (1st thru 4th-Stage) Inspection

A. General

(1) This inspection is the visual check of the primary gaspath of the LPC (the 1st-stage vanes, the 1.6-stage blades and vanes, and the 4th-stage blades and vanes).

(2) The limits given in this section will help you know if the engine can continue to operate or if you must remove and repair it.

(3) No data is given in Figure 601 to examine the LPC airfoils between the 1.6 and 4th-stage blades. But, if you can see damage through the fan inlet, the permitted damage limit given for the 4th-stage vanes will apply to the LPC stages 1.6, 2, and 3 vanes. And, the damage limits given for the 4th-stage blades will apply to the 2nd and 3rd-stage LPC blades.

B. Equipment

(1) Packing - Preform AS3209-121

(2) PWA 102757 - Wedge, Block - Fan Blade (3 are necessary during windy conditions), Pratt & Whitney

C. Consumable Materials

(1) D00137 Engine Oil - PWA 521B

D. References

(1) AMM 72-31-04/601, 1st-Stage Stator

(2) AMM 72-31-05/601, 1.6-Stage Blades

(3) AMM 72-34-03/401, Fan Exit Liner Segments

E. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

F. Do the LPC Rotor and Stator Inspection.

S 846-335-N00

(1) Do this procedure: Prepare for the Borescope Inspection.

No. 12 - LPC Blade and Vane (1st thru 4th-Stage) - Inspection

S 406-471-N00

WARNING: DO NOT DO A BORESCOPE INSPECTION IF THE WIND IS MORE THAN 3 - 5 MPH (4.8 - 8 KPH). DURING WINDY CONDITIONS, THE N1 ROTOR CAN TURN (WINDMILL). THIS CAN CAUSE INJURY TO INSPECTION PERSONNEL AND DAMAGE TO BORESCOPE EQUIPMENT.

(2) Do this procedure: If there are mild wind conditions, less than 3 - 5 miles per hour (4.8 - 8 kph), install PWA 102757 Wedges as follows:

WARNING: INSTALL PWA PWA 102757 WEDGES BETWEEN THE FAN BLADES DURING MILD WIND, LESS THAN 3 - 5 MPH (4.8 - 8 KPH). IF YOU DO NOT INSTALL THE WEDGES DURING MILD WIND CONDITIONS, THE N1 ROTOR CAN TURN (WINDMILL). THIS CAN CAUSE INJURY TO INSPECTION PERSONNEL AND DAMAGE TO BORESCOPE EQUIPMENT.

(a) Install two or three PWA 102757 Wedges between several fan blades and the fan case at approximately the 6 o'clock location.
(b) Make sure the wedge is installed tight enough to prevent the fan blades from turning but they must not raise the fan blades up.
(c) The red warning streamer must go towards the front of the engine inlet.
(d) If it is necessary to turn the N1 rotor to complete the borescope inspection, you will have to remove the wedges, turn the fan rotor by and install the wedges again. Do this procedure again until the borescope inspection is complete.

No. 12 - LPC Blade and Vane (1st thru 4th-Stage) - Inspection

S 226-525-N00

CAUTION: WHEN YOU EXAMINE THE BLADES AND VANES, FIND THE CAUSE OF ALL OF THE FOD TO MAKE SURE THAT THE LOW PRESSURE COMPRESSOR (LPC) IS SERVICEABLE. DAMAGE IN THIS AREA CAN BE AN INDICATION OF A MORE DANGEROUS PROBLEM. OTHER COMPONENTS CAN POSSIBLY BE DAMAGED.

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHEN THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

(3) To examine the 1st-stage vanes, do this procedure: 1st-Stage Stator Inspection (AMM 72-31-04/601).

NOTE: It is not necessary to remove the fan blades if you use a borescope through the fan, in the Thru Fan AP.

S 226-337-N00

(4) To examine the 1.6-stage blades, do this procedure: 1.6-Stage Blades Inspection (AMM 72-31-05/601).

NOTE: It is not necessary to remove the 1st-stage stator if you use a borescope through the fan, in the Thru Fan AP.

S 016-338-N00

(5) Examine the 4.5-stage vanes and blades through one of the fourteen AP-1 access port locations (the flow path of the 2.5 bleed Air) (Fig. 607, sheet 1).

NOTE: The flow path of the 2.5 bleed air is through one of the fourteen openings in the fan exit liner segments (inner rear) and an open 2.5 bleed air valve. The top eight openings have screens which must be removed before you put the borescope in the exit ducts. The remaining six openings across the bottom of the engine do not have screens and the borescope access is direct.

No. 12 - LPC Blade and Vane (1st thru 4th-Stage) - Inspection

S 016-405-N00

(6) If you will use one of the top eight AP-1 access ports, remove the screens as follows:

(a) Remove the screws from the applicable inner, front, lining segments of the fan exit.

NOTE: The removal of these inner, front lining segments of the fan exit gives access to the bolts of the bleed screens.

(b) Remove the lining segments.

(c) Remove the bolts and the washers from the bleed valve ducts and screens.

(d) Remove the ducts and the screens.

S 296-408-N00

WARNING: DO NOT USE THE POWER CABLE OF THE BORESCOPE IF YOU FIND CIRCUMFERENTIAL CUT HOLES, FRAYING, OR BROKEN HOLES IN THE EXTERNAL RUBBER COVERING ON THE CABLE. POWER CABLES WITH THOSE CONDITIONS CAN CAUSE INJURY TO PERSONS.

CAUTION: MAKE SURE THE TEMPERATURE OF THE INSPECTION AREAS ARE BELOW 150°F (65.6°C) BEFORE YOU USE THE BORESCOPE. IF THE CASES ADJACENT TO THE INSPECTION AREAS ARE TOO HOT TO KEEP YOUR HAND ON, YOU CAN CAUSE DAMAGE TO THE BORESCOPE.

(7) Put a flexible borescope along the flow path of the 2.5 Bleed Air to examine the condition of the 4th-stage LPC vanes and blades. Refer to Fig. 605 and 607 for the AP-1 access port locations and borescope data.

S 216-340-N00

(8) If you find damage that is worse than the limits, examine it to find if the area is a defect or a blend repair.

NOTE: Repaired areas have a 4 to 1 length to depth ratio and have smooth round corners. This is important because a repaired area can possibly be worse than the continue-in-service limits that follow. The limits apply only to defects and not to areas that are repaired.

S 226-341-N00

(9) Compare the defects with the continue-in-service limits in Fig. 607.

(a) The continue-in-service limits for the 4th-stage LPC vane are as follows:

1) Nicks or dents that are on a leading or a trailing edge must be less than 0.050 inch (1.270 mm) in depth.

No. 12 - LPC Blade and Vane (1st thru 4th-Stage) - Inspection

2) The minimum distance between damaged areas that are on the same edge is 0.500 inch (12.700 mm).
3) Damage on one edge must not be directly opposite the damage on the other edge.
4) The distance from damage on one edge to damage on the opposite edge must be more than the vane width average.
5) Dents on the concave or the convex surfaces must be less than 0.010 inch (0.254 mm) in depth.
6) The distance between dents on the surfaces must be least 1.000 inch (25.400 mm).
7) Tears are not permitted in this area.

(b) The continue-in-service limits for the 4th-stage LPC blade are as follows:
1) Damage that is in area A must be less than 0.0312 inch (0.792 mm) in depth.
2) The minimum distance between damaged areas that are on the same edge is 1.000 inch (25.400 mm).
3) Damage on one edge must not be directly opposite the damage on the other edge.
4) The distance from damage on one edge to damage on the opposite edge must be more than the vane width average.
5) Rounded dents in area B must be less than 0.0312 inch (0.792 mm) in depth.
6) Tears are not permitted in area B.
7) Defects are not permitted in area C, but the perimeters of blend repairs are permitted.

S 416-342-N00
(10) Install the bleed screens in the exit ducts of the 2.5 Bleed Air (Fig. 607, sheet 1) as follows:
(a) Install the bleed screens on the exit ducts of the 2.5 bleed air with bolts, lubricated with oil, and washers.
(b) Tighten the bolts on the bleed screens to 36-40 pound-inches (4.067-4.519 newton-meters).
(c) Install the lining segments adjacent to the vane inner fairing at the inner case assembly of the fan exit.
(d) Install the screws on the lining segments.
(e) Tighten and lock the screws on the lining segments to a maximum torque of 40 pound-inches (4.519 newton-meters).

S 416-343-N00
(11) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

TASK 72-00-00-206-344-N00

13. HPC Vane and Blade (5th thru 15th-Stage) - Inspection

A. General

(1) This inspection is the visual check of the primary gaspath of the HPC, the 5th-stage thru the 15th-stage blades and vanes.

(2) The limits given in this section will help you know if the engine can continue to operate or if you must remove and repair it.

B. Equipment

(1) AP-5, AP-7 Inner Plug Wrench - PWA 75250

(2) AP-5, AP-7 Inner Plug Driver - PWA 86580

(3) AP-5, AP-7 Outer Plug Keywasher - PWA MS9582-19 (2 required)

(4) Mechanical Crimper - PWA 101674 (AP-2, AP-3, AP-5, AND AP-7 Borescope Plugs)

(5) Packing - Preform AS3209-121

C. Consumable Materials

(1) D50124 - Anti-seize paste (P06-054)

(2) Silver Goop (P06-023)

(3) D00137 Engine Oil - PWA 521B

D. References

(1) AMM 72-35-01/801, Helical Coil Inserts

(2) AMM 72-35-02/801, Stage 5, 6, And 7 Rotor Blades - Repairs

(3) IPC 72-35-51-05, Plugs-Instrumentation HPC Front Case

(4) IPC 72-35-53-01, Plugs-Borescope HPC Rear Case

E. Access

(1) Location Zones

411 No. 1 Power Plant

421 No. 2 Power Plant

F. Prepare for the HPC Vanes and Blades Inspection

S 846-345-N00

(1) Do this procedure: Prepare for the Borescope Inspection.

S 846-442-N00

(2) Do this procedure: N2 Rotor - Manual Turn Procedure.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

CAUTION: WHEN YOU EXAMINE THE BLADES AND VANES, FIND THE CAUSE OF ALL OF THE FOD TO MAKE SURE THAT THE LPC IS SERVICEABLE. DAMAGE IN THIS AREA CAN BE AN INDICATION OF A MORE DANGEROUS PROBLEM. OTHER COMPONENTS CAN POSSIBLY BE DAMAGED.

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHILE THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

G. Do the HPC Vane and Blade Inspection.

S 016-349-N00

(1) Remove the plugs from the HPC access ports AP-2, AP-3, AP-4, AP-5, AP-6, and AP-7. Refer to Fig. 605 and 608 for the access port locations and the borescope data.

NOTE: The Access ports AP-5 and AP-7 have two plugs each. A PWA 75250 wrench and 86580 driver is necessary to remove the inner plugs.

NOTE: POST SB PW4ENG 72-755 the AP-5 and AP-7 do not have inner plugs.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

S 016-494-N00

CAUTION: IF NECESSARY, TURN THE SYNCHRONIZING RINGS FOR ACCESS TO THE AP-2 AND AP-3 PLUGS. DO NOT PUT FORCE AGAINST THE RING LEVERS. USE A STANDARD CROWSFOOT WRENCH AND TURN THE BELLCRANK. IF YOU DO NOT DO THIS, IT CAN CAUSE DAMAGE TO THE ENGINE.

CAUTION: FOR THE AP-2 AND AP-3 PLUGS, THE 6TH STAGE SYNCHRONIZING RING MUST BE IN ITS REARMOST POSITION TO PROVIDE SUFFICIENT CLEARANCE TO REMOVE THE PLUGS OR DAMAGE TO THE SYNCHRONIZING RING CAN OCCUR. WHEN THE SYNCHRONIZING RING IS IN ITS REARMOST POSITION, THE VANE ARMS WILL BE APPROXIMATELY AXIAL TO THE ENGINE. OTHER POSITIONS OF THE SYNCHRONIZING RING CAN CAUSE DAMAGE TO THE SYNCHRONIZING RING.

(2) If it is necessary, do the steps that follow to turn the synchronizing ring which moves the synchronizing ring arms and the variable vanes during the borescope inspection.

NOTE: These steps are possibly necessary to get acces to the AP-2 or AP-3 access port plugs. These steps will also help you to get a better view of the blades and vanes during the inspection.

(a) Install a standard Crows Foot wrench of the SVA Bellcrank (flats), adjacent to the 5th-stage adjustor.
(b) Push on the wrench in the applicable (up or down) direction to turn the synchronizing ring arm.
(c) This turns the synchronizing ring and moves the ring arms and variable vanes.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

S 296-495-N00

CAUTION: MAKE SURE THAT THE TEMPERATURE OF THE INSPECTION AREAS ARE LESS THAN 150°F (65.6°C) BEFORE YOU USE THE BORESCOPE. IF THE CASES ADJACENT TO THE INSPECTION AREAS ARE TOO HOT TO KEEP YOUR HAND ON, YOU CAN CAUSE DAMAGE TO THE BORESCOPE.

(3) Insert the borescope through the applicable port (AP-2 through AP-7), you can do the inspection of the HPC blades and vanes.

NOTE: You can accomplish a full 360 degree of inspection of the HPC rotor using the manual cranking provision on the main gearbox.

NOTE: It is possible to view outer airseal rubstrip areas during the borescope inspection of the HPC rotor, but it is not necessary to do the inspection of the rubstrip. If you do the inspection of the rubstrip, follow the steps below.

(a) For the 6th- and 7th-stage areas, all quantities of feltmetel can be broken off, not bonded, or gone, if the conditions that follow occur:
1) All airfoil damage is not worse than the continue-in-service limits.
2) The engine shows no signs that it operated unsatisfactorily or that it was not stable.

(b) For the 8th- thru 15-stage areas, the limits for feltmetel that broken off, not bonded, or gone is as follows:
1) No more than four areas of material can be gone from each stage.
2) No more than a total of 3.00 square inches (1935 square mm) of feltmetal can be broken off, not bonded, or gone from each stage.

S 296-496-N00

(4) Examine the 5th- thru 7th stages of the HPC blades for curled leading edge and blade tip with the continue-in-service limits (Fig. 608).
(a) A curled blade has these conditions:
1) A three sided corner of the blade material with a bend line that goes from the leading edge to the tip.
2) The bend makes an angle of between 20 and 90 degrees from the usual concave blade contour (toward the convex blade side).
(b) A maximum of six curled blades.
(c) The curled blades must be seperated by at least three non-curled blades.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

(d) The borescope inspection limits for the blade surface damage are allowed in all areas except index 5 (Fig 609).

S 296-497-N00

(5) Examine the 5th- thru 7th stages of the HPC blades for bend on the leading edge (Fig. 609).
   (a) No bends are permitted on the adjacent blades.
   (b) No bends are permitted on more than six blades on each stage.
   (c) No tears or cracks are permitted.
      1) Bends must be smooth and continuous.
   (d) No more than one bend per blade is permitted on each blade.

S 296-516-N00

(6) Examine the 9th- thru 15th-stage of the HPC for tangential blade locks that are loose or incorrectly installed.
   (a) If those blade seals are loose or gone, the engine can stay in operation with up to two loose stage 9 through 15 blade locks (each stage) until the next regularly scheduled HPC disassembly.

S 296-410-N00

(7) While you do the HPC borescope inspection, examine the 9th- thru 15th-stage of the HPC for blade seals that are loose or gone.
   (a) If those blade seals are loose or gone, the engine can stay in operation until the next regularly scheduled HPC disassembly.

S 296-351-N00

WARNING: THE FOLLOWING BLADE NICK LIMITS FOR FOREIGN OBJECT DAMAGE THAT YOU COULD SEE THROUGH THE BORESCOPE INSPECTION PORTS ARE INTENDED AS A GUIDE TO DETERMINE WHETHER THE ENGINE MAY REMAIN IN SERVICE OR REPAIR IS NECESSARY. IT IS IMPORTANT THAT THE CAUSE OF THE FOREIGN OBJECT DAMAGE BE DETERMINED TO ENSURE COMPRESSOR INTEGRITY SINCE IT MAY BE AN INDICATION OF A MORE SERIOUS PROBLEM. IF YOU ARE NOT SURE OF THE COMPRESSOR INTEGRITY, REPLACE THE COMPRESSOR AS NECESSARY.

(8) Do the borescope inspection of the 5th- thru 15th stages of the HPC compressor blade for nicks and dents (Fig. 608).
   (a) If the nicks and dents defects appears to exceed the allowable damage limits, examine the area closely to determine if the condition is a defect or previously blended damage.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

(b) The blend areas have 4 - 1 length to depth ratio and have smooth corners.

NOTE: This is important because a repaired area can possibly be worse than the continue-in-service limits. The limits apply only to defects and not to repaired areas.

(c) The 12th and 13th stages of HPC blades cannot be in-situ blended for an engine that has incorporated the HPC ring case since it prevents the ability to insert blending tool through the AP-6 borescope port.

(d) The HPC continue-in-service and repair limits are shown in Table 601B and Table 601C (Fig. 609).

1) The borescope ports for each stage are as follows:

STAGE (BLADE)	AP PLUG
Stage 5	AP-2
Stage 6	AP2 and AP-3
Stage 7	AP-3
Stage 8	AP-4
Stage 9	AP-4
Stage 10	AP-5
Stage 11	AP-5
Stage 12	AP-6
Stage 13	AP-6
Stage 14	AP-7
Stage 15	AP-7

(e) For the in-situ (assembled engine) blend, repairs are permitted if the damage is within the limits shown in Table 601C and as follows:

NOTE: The limit shown in the Table 601C are the maximum size that can be repaired by in-situ repair. The in-situ repair will remove additional material. The final repair depth is control by the in-situ repair procedure (AMM 72-35-02/801).

NOTE: Repairs are allowed for the leading and trailing edges except as noted.

1) The blend repairs are only allowed where shown.
2) The multiple blends are permitted to a maximum depth of the limits shown in Table 601B.
3) One blend on each blade is permitted.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

4) All blends must be separated by a minimum of 0.125 inch (3.175 mm).
5) Blends on both edges must not be directly opposite to one another.
6) Blends must be separated diagonally by a minimum distance equal to the mean chordal length of the blade.

(f) There is no limit to the number of blades in a single stage or for all nine stages that can be blended by this repair.

(g) The damage in area C that is adjacent to area A can be repaired on the leading and trailing edge only.
1) It may not be possible to repair the blend damage on the blade tips due to the tooling clearance with the outer ducts.
2) If the repair cannot be accomplished and the damage exceeds the continue-in-service limits, you must replace the HPC blade.

(h) Replace the in-situ blend repaired blades at the next repair service, if the blend repairs are greater than the overhaul repair limits specified for that blade.

S 296-499-N00

WARNING: THE FOLLOWING BLADE NICK LIMITS FOR FOREIGN OBJECT DAMAGE THAT YOU COULD SEE THROUGH THE BORESCOPE INSPECTION PORTS ARE INTENDED AS A GUIDE TO DETERMINE WHETHER THE ENGINE MAY REMAIN IN SERVICE OR REPAIR IS NECESSARY. IT IS IMPORTANT THAT THE CAUSE OF THE FOREIGN OBJECT DAMAGE BE DETERMINED TO ENSURE COMPRESSOR INTEGRITY SINCE IT MAY BE AN INDICATION OF MORE SERIOUS PROBLEM. IF YOU ARE NOT SURE OF THE COMPRESSOR INTEGRITY, REPLACE THE COMPRESSOR AS NECESSARY.

(9) Do the HPC borescope inspection (service limits) compressor stator vanes (IGV and 5th- thru 15th stages).

(a) When you do the borescope inspection, and if you find the defect appears to exceed the allowable damage limits, examine the area closely to determine if the condition is damage or previously blended damage.

(b) The blended areas have 4 - 1 length to depth ratio and have smooth and round corners.

NOTE: This is important because a repaired area can possibly be worse than the continue-in-service limits.

(c) Examine the HPC vane service limits for nicks.
1) These conditions are for maximum depth nicks that are on opposite edges:
a) The distance between the nicks must be greater than the vane width average.

No. 13 - HPC Vane and Blade (5th thru 15th-Stage) - Inspection

b) The nick on one edge must not be directly opposite the nick on the other edge.
c) The nick depth limits are acceptable only if combined nicked leading edge depth and nicked trailing edge does not exceed above single nick limit.

2) No more than two nicks at the maximum depth are permitted on each vane.
3) The total nick length on a vane edge cannot be more than 1/8 of the total length.
4) No cracks are permitted.

(d) Examine the HPC vane service limits for missing braze.

1) The missing braze can only occur on the 14th-stage stator.
2) Missing braze is permitted at the vane to shroud OD fillet radius for the two 14th-stage vanes adjacent to the AP-7 borescope port.

S 296-411-N00

(10) Examine the 9th- thru 15th-stage of the HPC for tangential blade locks that are loose or incorrectly installed.

(a) The engine cannot stay in operation if there are more than two loose tangential blade locks on each stage.

1) If there are two or less, repair them during the regularly scheduled time to disassemble the HPC.

S 226-353-N00

(11) Compare the defects on the blades and vanes with the continue-in-service limits.

(a) The steps that follow and Tables 601B thru 601D are the continue-in-service limits for the HPC blades in Fig. 609.

NOTE: You can blend the leading edges of the blades that are damaged in the 5th, 6th, and 7th stage of the HPC (AMM 72-35-02/801).

HPC Borescope and Access Plug Installation Data
Table 601B

ACCESS PORT	ENGINE LOCATION	PLUG PACKING	LOCKING METHOD	PLUG LUBRICANT	TORQUE VALUE LB-IN. (N.M)
AP-2	HPC 5TH-STAGE VANE	NO	SELF LOCKING INSERT FOR EARLIER PLUG, KEY WASHER (53H027) FOR LATER PLUG	ANTI-SEIZE PASTE (P06-054)	175-190 (19.772-21.467)
AP-3	HPC 6TH-STAGE VANE	NO	SELF LOCKING INSERT FOR EARLIER PLUG, KEY WASHER (53H028) FOR LATER PLUG	ANTI-SIEZE PASTE (P06-054)	175-190 (19.772-21.467)
AP-4	HPC 8TH-STAGE VANE	NO	SELF LOCKING INSERT	ANTI-SEIZE PASTE (P06-054)	175-190 (19.772-21.467)
AP-5 (OUTER)	HPC 10TH-STAGE VANE	NO	KEY WASHER (MS 9582-19) (PRE-SB-PW4ENG 72-708), 58H216 (POST-SB-PW4ENG 72-708), (POST-SB-PW4ENG 72-755)	ANTI-SEIZE PASTE (P06-054) (NO INNER PLUG)	175-190 (19.772-21.467)
AP-5 (INNER)	HPC 10TH-STAGE VANE	NO	PLUG ASSY. WITH INTEGRAL LOCK WASHER (PRE-SB-PW4ENG 72-675)	ANTI-SEIZE PASTE (P06-054)	175-190 (19.772-21.467)
AP-5 (INNER)	HPC 10TH-STAGE VANE	NO	PLUG ASSY. WITH INTEGRAL LOCK WASHER (POST-SB-PW4ENG 72-675)	DO NOT APPLY ANY ANTIGAL-LING COMPOU-ND (This plug has baked on antigalling compound)	175-190 (19.772-21.467)
AP-6	HPC 12TH-STAGE VANE	NO	SELF LOCKING INSERT	ANTI-SEIZE PASTE (P06-054)	175-190 (19.772-21.467)

HPC Borescope and Access Plug Installation Data
Table 601B

ACCESS PORT	ENGINE LOCATION	PLUG PACKING	LOCKING METHOD	PLUG LUBRICANT	TORQUE VALUE LB-IN. (N.M)
AP-7 (OUTER)	HPC 14TH-STAGE VANE	NO	KEY WASHER (MS 9582-19) (PRE-SB-PW4ENG 72-708), 58H216 (POST-SB-PW4ENG 72-708), (POST-SB-PW4ENG 72-755)	ANTI-SEIZE PASTE (P06-054) NO INNER PLUG	175-190 (19.772-21.467)
AP-7 (INNER)	HPC 14TH-STAGE VANE	NO	SELF LOCKING INSERT (POST-SB-PW4ENG 72-675)	ANTI-SEIZE PASTE (P06-054)	175-190 (19.772-21.467)
AP-7 (INNER)	HPC 14TH-STAGE VANE	NO	PLUG ASSY. WITH INTEGRAL LOCKWASHER (POST-SB-PW4ENG 72-675)	DO NOT APPLY ANY ANTIGAL-LING COMPOU-ND (This plug has baked on antigalling compound)	175-190 (19.772-21.467)
AP-8 (INNER)	1:30 O'CLOCK POSITION	YES PART# 673049	LOCKWIRE (AS3214-02)	SILVER GOOP (P06-023)	40 - 50 (4.519 - 5.649)
AP-8 (INNER)	4:30 O'CLOCK POSITION	YES PART# 673049	LOCKWIRE (AS3214-02)	SILVER GOOP (P06-023)	40 - 50 (4.519 - 5.649)
AP-8 (INNER)	6:00 O'CLOCK POSITION	YES PART# 673049	LOCKWIRE (AS3214-02)	SILVER GOOP (P06-023)	40 - 50 (4.519 - 5.649)
AP-8 (INNER)	7:30 O'CLOCK POSITION	YES PART# 673049	LOCKWIRE (AS3214-02)	SILVER GOOP (P06-023)	40 - 50 (4.519 - 5.649)
AP-8 (INNER)	9:00 O'CLOCK POSITION	YES PART# 673049	LOCKWIRE (AS3214-02)	SILVER GOOP (P06-023)	40 - 50 (4.519 - 5.649)

HPC 5th- thru 15th-Stage Blade Continue-In-Service Limits
Table 601B (Continue)

STAGE	AREA A	AREA B (AIRFOIL ONLY)	AREA C DEPTH VALUE IN. (MM)	AREA D	AREA E DEPTH VALUE IN. (MM)	INDEX 1 VALUE IN. (MM)
5	SEE THE LIMITS BELOW	SEE THE LIMITS BELOW	0.030 (0.794)	NONE ALLOWED	0.020 (0.397)	0.50 (12.70)
6-8	SEE THE LIMITS BELOW	SEE THE LIMITS BELOW	0.030 (0.794)	SEE THE LIMITS BELOW	0.020 (0.397)	0.50 (12.70)
9-12	SEE THE LIMITS BELOW	SEE THE LIMITS BELOW	0.030 (0.974)	SEE THE LIMITS BELOW	0.030 (0.974)	0.50 (12.70)
13-15	SEE THE LIMITS BELOW	SEE THE LIMITS BELOW	0.030 (0.974)	SEE THE LIMITS BELOW	0.030 (0.974)	0.38 (9.652)

HPC 5th- thru 15th-Stage Blade Continue-In-Service Limits
Table 601B (Continue)

BLADE AREA	CONTINUE-IN-SERVICE LIMITS	NOTES
Airfoil Surfaces Both Sides	Airfoil discoloration and shiny surfaces are permitted.	Discoloration or shiny surfaces are not cause for engine removal.
A	Not more than 0.25 inch (6.350 mm) of a corner can be fully broken off. Curled, different shape, or impact damaged material is permitted.	Nicks and dents near the leading and trailing edge corners are not important.
B	All dents are permitted. Pushed out areas on the opposite side of the airfoil are permitted if there are no cracks.	Pushed out areas are caused by dents on the opposite side of the airfoil surface.
C	Multiple damage on the same blade edge that is not more than 0.031 inch (0.794 mm) in depth is permitted. There is no separation requirement for damage on the same edge. Damage that is not more than 0.031 inch (0.794 mm) in depth on both leading and trailing edges is acceptable. There is no separation requirement for damage on opposite blade edges.	Nicks in the leading and trailing edges are important when they are near the blade root. Damage with small radii or sharp edges are very important.

HPC 5th- thru 15th-Stage Blade Continue-In-Service Limits
Table 601B (Continue)

BLADE AREA	CONTINUE-IN-SERVICE LIMITS	NOTES
D	Stage 5 No damage is permitted except small surface imperfections caused by erosion.	The small surface erosion will look larger because of the borescope magnification.
D	Stages 6 through 8 No damage is permitted except small surface imperfections caused by erosion or smooth round bottom indentations. A maximum of 0.006 inch (0.152 mm) depth imperfections are permitted and a maximum of 0.003 inch (0.076 mm) depth imperfections are permitted in fillet provided there is no raised material, no sharp discontinuities, and no multiple overlapping indentations. No cracks are permitted.	The small surface erosion will look larger because of the borescope magnification.

HPC 5th- thru 15th-Stage Blade Continue-In-Service Limits Table 601B (Continue)		
BLADE AREA	CONTINUE-IN-SERVICE LIMITS	NOTES
D	Stage 9 through 15 No damage is permitted except small surface imperfections caused by erosion or smooth round bottom indentations. A maximum of 0.006 inch (0.152 mm) depth imperfections are permitted and a maximum of 0.003 inch (0.076 mm) depth imperfections are permitted in fillet provided there is no raised material, no sharp discontinuities, and no multiple overlapping indentations. No cracks are permitted. Signs of overheating (blueing) are permitted on the tip of the airfoil, but cannot extend down onto the concave or convex surfaces of the airfoil.	The small surface erosion will look larger because of the borescope magnification.

HPC 5th- thru 15th-Stage Blade Continue-In-Service Limits Table 601B (Continue)		
BLADE AREA	CONTINUE-IN-SERVICE LIMITS	NOTES
E	Stage 5 through 8 Multiple damage on the same blade edge that is not more than 0.020 inch (0.397 mm) deep is permitted. There is no separation requirement for damage on the same edge. Damage that is not more than 0.020 inch (0.397 mm) in depth on both leading and trailing edges is acceptable. There is no separation requirement for damage on opposite blade edges.	Nicks in leading edge and trailing edge become critical closer to blade root. Damage with small radii or ragged edges are especially critical.
E	Stage 9 through 15 Multiple damage on the same blade edge that is not more than 0.031 inch (0.794 mm) in depth is permitted. There is no separation requirement for damage on the same edge. Damage that is not more than 0.031 inch (0.794 mm) in depth on both leading and trailing edges is acceptable. There is no separation requirement for damage on opposite blade edges.	Nicks in leading edge and trailing edge become critical closer to blade root. Damage with small radii or ragged edges are especially critical.

HPC Blade In-Situ Continue-In-Service Limits
Table 601C

STAGE	AREA C Midspan to 0.250 In. (6.350 mm) From Tip (Max. Depth)	AREA E 0.250 In. (6.350 mm) Above Root Platform To Midspan (Max. Depth)	AREA F 0.190 - 0.250 In. (4.83 - 6.35 mm) Above Root Platform (Max. Depth)	AREA G 0.150 - 0.190 In. (3.81 - 4.83 mm) above Root Platform (Max. Depth)
5	0.144 Inch (3.66 mm)	NONE	NONE	NONE
6-7	0.144 Inch (3.66 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
8	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
9 Leading Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
10 Trailing Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
11 Leading Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
12 Trailing Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
13-14	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)
15 Leading Edge Only	0.082 Inch (2.08 mm)	0.048 Inch (1.22 mm)	0.023 Inch (0.58 mm)	0.007 Inch (0.18 mm)

1) Examine the 5th- thru 7th stages blades for curled blade on the leading edge.
   a) A three sided corner of blade material with a bend line that goes from the leading edge to the tip
   b) The bend makes an angle of between 20 and 90 degrees from the usual concave blade contour.
   c) Curled blades are not permitted on more than six blades on each stage.
   d) Curled blades must be separated by at least three non-curled blades.
2) The continue-in-service limits that are given are for all areas of the curled blade, but not for the bend line.
   a) No dents, gouges, cracks, or scratches are permitted on the bend line.
   b) Nicks and dents that are near the leading or trailing edge corners do not change the condition of the engine too much.
   c) Nicks on the leading or trailing edge change the condition os the engine more when they are closer to the bottom of the blade.
   d) Damage which has a small radius or ragged edges changes the condition of the engine very much.
   e) Dents on the airfoil surface of the blade can cause pushed out areas on the opposite surface.
3) Examine the 5th- thru 7th-stage blades for bends on the leading edge (Fig. 609, Sheet 2).
   a) No bends are permitted on adjacent blades.
   b) Bends are not permitted on more than six (6) blades on each stage.
   c) Bends must be smooth and continuous without tears or cracks.
   d) No more than one bend is permitted on each blade.

(b) The steps that follow are about nicks on the HPC vanes (stages 5 thru 15) (Fig. 610).
1) When performing the borescope inspection, if you see a defect that exceeds the allowable "damage limits", do the step below.
   a) Examine the area closely to find out if it is a defect or previously blended damage.
   b) Blend areas can be recognize by a 4 to 1 length to depth blend ratio and smooth round corners.

      <u>NOTE</u>: This determination is very important because a blended area could exceed the "damage limits" allowed for a defect.

2) The conditions that follow are for nicks that are at the maximum depth on opposite edges:
   a) The distance between the nicks must be greater than the vane width average.

b) The nick on one edge must not be directly opposite the nick on the other edge.

3) The condition that follows is for nicks that are not at the maximum depth and are on opposite edges:

a) Nicks can be directly opposite if the sum of the depths is less than the depth limit for one nick.

4) No more than two nicks that are at the maximum depth are permitted on each vane.

5) The total nick length on a vane edge cannot be more than 1/8 of the total edge length.

6) No cracks are permitted.

(c) Examine the 14th-stage stator for missing braze.

1) Missing braze is permitted at the vane to shroud OD fillet radius for the two 14th-stage vanes adjacent to the AP-7 borescope port.

S 416-483-N00

CAUTION: MAKE SURE YOU OBEY THE PROCEDURES IN THE STANDARD PRACTICES MANUAL (AMM 70-41-01/201) WHEN YOU INSTALL BORESCOPE PLUG WASHERS. INCORRECT INSTALLATION OF THE KEY WASHERS CAN CAUSE THE BORESCOPE PLUG TO COME OUT. IF AN AP-5 OR AP-7 BORESCOPE PLUG IS NOT THERE, HOT GASES FROM THE PLUG HOLE CAN CAUSE DAMAGE TO THE THRUST REVERSER.

(12) Install the access port plugs for the high pressure compressor (HPC (HPC) and where removed, a new key washer) (Fig. 605A):

(a) ENGINES PRE-PW-SB 72-675;
Install all AP-2, AP-3, AP-4, AP-5, AP-6 and AP-7 borescope plugs (Fig. 605A and 608).

1) With a nylon brush, remove the unwanted heat dried (excess baked) compound from the threads of the plugs.

CAUTION: DO NOT APPLY THE ANTI-SEIZE PASTE (P06-054) TO THE THREADS AND WASHER FACE OF POST SB PW4ENG 72-765 PLUGS. THESE PLUGS HAVE BAKED ON THE ANTIGALLING COMPOUND.

a) Put some anti-seize paste on the threads and on the mating surface of the plug head washer.

NOTE: Use the anti-seize paste and do not use engine oil.

b) Wipe off unwanted heat dried (excess baked) compound on the contact surface area.
c) Do not use the engine oil.
d) Run in the borescope plug and make sure the borescope plug is seated.
e) Tighten the borescope plug (Fig. 605A).
f) Torque the plugs and use the PWA 101674 Mechanical Crimper (Fig. 623) to bend the tabs of the key washer as follows:
g) Put the end of the crimper onto the end of the plug.
   - Turn the crimper so that the jaw is under a key.
   - Squeeze the crimper handle to bend the key washer tab until the tab makes contact with the hex head of the plug.
h) Release the handle and reposition the jaw so that it makes contact again at the base of the tab.
i) Squeeze the crimper handle to final bend the key washer tab until the tab makes contact with the hex head of the plug and maintains less than a 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.
j) Crimp all 5 key washer tabs with the same method.

NOTE: All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug. If a tab overlaps two different faces of the hex head, the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and the hex head face that has the larger surface area covered by the tab.

k) All tabs of the key washer must be bent; examine the tabs for the following conditions:

NOTE: The tab washer PN 58H216 uses five tabs as an alternate to two tabs. The additional tabs allow some deviation from the standard practices section requirements, but it is necessary that all five tabs meet these relaxed requirements.

The variations to the standard practices section procedure for this key washer are as follows:

l) All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug.

m) If a tab overlaps two different faces of the hex head, the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and whichever face of the hex head has the larger surface area coverage with the tab.

NOTE: It is good practice to bend the tab against the remaining surface.

n) It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.

o) It is not necessary that the key washer tabs be pulled away from the axis of the plug before you torque the plug.

(b) ENGINES POST-PW-SB 72-675;
Install the AP-5 and AP-7 inner plugs into the compressor case (Fig. 605A and 608).

NOTE: Do not use the anit-seize paste and do not use engine oil. The plugs have baked on antigalling compound.

1) Do not use antigalling compound or engine oil.
2) Run in the borescope plug and make sure the plug is seated.
3) Tighten the borescope plug (Fig. 605A).

(c) ENGINES POST-PW-SB 72-708;
Install the AP-5 and AP-7 inner plugs into the compressor case (Fig. 608).

NOTE: Do not use the anti-seize paste and do not use engine oil.

1) Do not use antigalling compound or engine oil.
2) Run in the borescope plug to be sure the plug is seated.
3) Tighten the borescope plug (Fig. 605A).
4) Torque the plugs and use the PWA 101674 Mechanical Crimper (Fig. 623) to bend the tabs of the key washer as follows:

5) Put the end of the crimper on the end of the plug.
   a) Turn the crimper so the jaw is under a key washer tab.
   b) Squeeze the crimper handle to bend the washer tab until the tab makes contact with the hex head of the plug.
6) Release the handle and reposition the jaw so that it makes contact again at the base of the tab.
7) Squeeze the crimper handle to bend the key washer tab until the tab makes contact with the hex head of the plug and maintains less than 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.
8) Crimp all 5 key washer tabs with the same method.

   NOTE: All five tabs must be within 0.020 inches (0.508 mm) maximum of the hex head of the plug. If a tab overlaps two different faces of the hex head, the 0.020 inch (0.508 mm) gap must be between the tab and the hex head face that has the larger surface area covered by the tab.

9) All tabs of the key washer must be bent, and examine the tabs for the following conditions:

   NOTE: The tab washer PN 58H216 uses five tabs as an alternate to two tabs. The additional tabs allow some deviation from the standard practices section requirements, but it is necessary that all five tabs meet these requirements.

   The variation to the standard practices section procedure for this key washer are as follows.

   a) All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug.
   b) If a tab overlaps onto two different faces of the hex head 0.002 inch (0.508 mm) gap requirement must be kept between the tab and face of the hex head that have the larger surface area coverage with the tab.

      NOTE: It is good practice to bend the tab against the remaining surface.

   c) It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.
   d) It is not necessary that the key washer tab base be pulled away from the axis of the plug before you tighten the plug.

(d) ENGINES POST-PW-SB 72-755;
Install the AP-5 and AP-7 inner plugs (Fig. 608).

NOTE: Apply anti-seize paste to the threads and the plug head washer contact surface. Wipe off excess compound.

1) Run in the borescope plug to be sure the plug is seated.
2) Tighten the borescope plug (Fig. 605A).
3) Torque the plugs and use the PWA 101674 Mechanical Crimper (Fig. 623) to bend the tabs of the key washer as follows:
   a) Put the end of the crimper on the end of the plug.
   b) Turn the crimper so the jaw is under a key washer tab.
   c) Squeeze the crimper handle to bend the washer tab until the tab makes contact with the hex head of the plug.
   d) Release the handle and reposition the jaw so that it makes contact again at the base of the tab.
   e) Squeeze the crimper handle to final bend the key washer tab until the tab makes contact with the hex head of the plug and maintain less than a 0.020 inch (0.508 mm) gap everywhere between the tab and the hex head of the plug.
   f) Crimp all 5 of the key washers with the same method.
   g) All tabs of the key washer must be bent, and examine the tabs for the following condition.

      NOTE: The tab washer PN 58H216 uses five tabs as an alternate to two tabs. These additional tabs allow some deviation from the Standard Practices section requirements, but it is necessary that all five tabs meet this requirements.

   h) All five tabs must be within 0.020 inch (0.508 mm) maximum of the hex head of the plug.
   i) If a tab overlaps two different faces of the hex head, the 0.020 inch (0.508 mm) gap requirement must be kept between the tab and which ever face of the hex head has the larger surface area covered by the tab.
   j) It is not necessary that 75 percent of the base of the tab make contact with the hex head of the plug.
   k) It is not necessary that the key washer tabs be pulled away from the axis of the plug before you tighten the plug.
4) You can replace damaged threaded inserts (AP-2 through AP-7) on the HPC rear case borescope access ports (AMM 72-35-01/801).

(e) Put some antigalling compound on the threads and on the mating surface of the plug head washer.

NOTE: Use the antigalling compound and do not use engine oil.

(f) Install the AP-4 and AP-6 plugs (Fig. 605A).
(g) Install the AP-5 and AP-7 outer plugs (Fig. 605A).

NOTE: Use the PWA MS9582-19 key washers for the AP-5 and the AP-7 plug installations.

(h) Install the AP-2 and AP-3 plugs (Fig. 605A).
1) For engines with the self-locking helicoil inserts, use them to lock the plugs to the case.
2) For engines with key washers which lock the plugs to the case, install new key washers.

NOTE: For AP-2 plugs, use the PN53H027 key washers and for the AP-3 plugs, use the PN53H028 key washers.

CAUTION: MAKE SURE YOU INSTALL THE AP-2 AND AP-3 ACCESS PORT PLUGS IN THE CORRECT PORT. IF THE AP-3 PLUG IS INSTALLED IN THE AP-2 ACCESS PORT, THE 5TH-STAGE VARIABLE VANE CAN CATCH ON IT, WHICH CAN CAUSE AN ENGINE SURGE.

(i) Be careful to install the plugs correctly.
(j) Tighten the plugs, AP-2 thru AP-7 (Fig. 605A and 608).

NOTE: You can replace damaged threaded inserts (AP-4 through AP-7) in the borescope access ports on the HPC rear case (AMM 72-35-01/801).

H. Put the Airplane Back to its Usual Condition.

S 416-443-N00
(1) Install the crank pad cover.
(a) Use this procedure: N2 Rotor - Manual Turn Procedure.

S 416-356-N00
(2) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 14 - Combustion Chamber Inspection

TASK 72-00-00-206-357-N00

14. Combustion Chamber Inspection

A. General
   (1) This inspection is the visual check of the Combustion Chamber: the inner and outer combustion chamber assemblies, the bulkhead, and the heatshield of the fuel injector guide.
   (2) The limits given in this section will help you know if the engine can continue to operate or if you must remove and repair it.

B. Equipment
   (1) AP-8 Gasket - PWA 673049 (6 are necessary)

C. Consumable Materials
   (1) D00137 Engine Oil - PWA 521B
   (2) D00244 Antiseize compound, high temperature - Silver Goop

D. Access
   (1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

E. Do the Combustion Chamber Inspection

S 846-526-N00

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHILE THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

   (1) Do this procedure: Prepare for the Borescope Inspection.

S 016-359-N00

   (2) Remove the plugs from the AP-8 access ports of the combustion chamber; refer to Fig. 605 and 611 for access port locations and borescope data.

   NOTE: Six AP-8 plugs are on the diffuser case at 45, 128, 172, 225, 277, and 338 degrees clockwise from top center of engine when you look forward.

No. 14 - Combustion Chamber Inspection

S 296-360-N00

WARNING: DO NOT USE THE POWER CABLE OF THE BORESCOPE IF YOU FIND CIRCUMFERENTIAL CUT HOLES, FRAYING OR BROKEN HOLES IN THE EXTERNAL RUBBER COVERING ON THE CABLE. POWER CABLES WITH THOSE CONDITIONS CAN CAUSE INJURY TO PERSONS.

CAUTION: MAKE SURE THE TEMPERATURE OF THE INSPECTION AREAS ARE BELOW 150°F (65.6°C) BEFORE YOU USE THE BORESCOPE. IF THE CASES ADJACENT TO THE INSPECTION AREAS ARE TOO HOT TO KEEP YOUR HAND ON, YOU CAN CAUSE DAMAGE TO THE BORESCOPE.

(3) Put the borescope through each access port to examine the condition of the combustion chamber.

NOTE: The borescope goes into the combustion chamber through the dilution air holes.

No. 14 - Combustion Chamber Inspection

S 226-361-N00

(4) Compare the damage as identified in Figs. 612, 613, and 614 with the continue-in-service limits shown in Table 602A and Table 602B.

NOTE: The frequency of the regular time inspection that is referred to in the tables is from our Maintenance Planning Document. The frequency of the decreased time inspection is two times the frequency of the regular time inspection. In other words, the interval between decreased time inspections is half the interval of regular time inspections.

NOTE: The maximum limits for the regular time and decreased time inspections were calculated to have the qualities that follow:
- During usual conditions of operation, permitted damage will not become unsatisfactory before the time for the subsequent applicable inspection.
- Usually, higher damage limits are permitted for the decreased time inspection because that inspection is done more frequently.
- Damage and deterioration in some areas change the performance of the engine very quickly, which makes a higher limit (for the decreased time inspection) not possible. For damage in these areas, the limits for the decreased and regular time inspections are equal.

(a) These conditions of damage occur in the inner and outer combustion chamber assembly:
   1) The conditions that follow are examples of burned or released material:
      a) Discolored or distorted areas on the louver
      b) Areas where louver lip material is gone because of too much heat.
   2) An axial series of damaged louvers, in which each louver has burned or released material, is an example of a burned stripe.
   3) A hole is because of too much heat and goes fully through the combustion chamber wall; holes frequently occur in burned stripes.

(b) Refer to Figs. 615, 616, and 617 to help you keep a record of the damage in the combustion chamber assembly.

   NOTE: You can write on copies of these figures to keep a record of the damage.

(c) If damage is worse than the decreased time inspection limits, remove the engine before the 6th cycle.

Table 602A		
CONDITION FOUND	INNER AND OUTER COMBUSTION CHAMBER ASSSEMBLY (Except Bulkhead) CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Open Holes that are Burned Through	Four open holes in each assembly.	Six open holes in each assembly.
	The maximum diameter of each hole is 0.500 inch (12.700 mm) 0.19 square inch (123 square mm). There must be at least 6 inches (152.400 mm) of material without damage, between each hole.	
Burned Marks, Distortion, Louver Lip Material that is gone, or Burned Stripes	All quantities of burned marks, distortion, or louver lip material that is gone Damage that is on no more than three adjacent louvers. This is the indication of the start of a burned stripe.	Axial burned stripes that are on more than three adjacent louvers. Refer to the applicable condition found in this table for limits for opened hole size, crack length, and the connection of cracks.
Burned Areas, Areas where Material is Gone, or a Deterioration of the Surface Layer.	All quantities. NOTE: If you find much damage or many areas where the material is gone, examine the turbine airfoils for damage. This is most important for the last louver.	
Nicks in the Surface Layer, Thermal Barrier Ceramic Layer that is Gone.	All quantities. NOTE: When the surface layer is gone, the rate of the Combustion Chamber deterioration will increase.	
Louver Gap Decrease and and Burned Marks	All quantities. NOTE: Too much of a Gap decrease will increase the rate of downstream deterioration in the Combustion Chamber.	

Table 602A		
CONDITION FOUND	INNER AND OUTER COMBUSTION CHAMBER ASSSEMBLY (Except Bulkhead) CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Bends, Buckles, or Distortion on the Louvers	All quantities.	
Axial Cracks that are confined to one louver	NOTE: For axial cracks that enter a combustor, dilution, or ignition hole, the diameter of the manufactured hole does not need to be added to determine the crack length until the crack is seen exiting from the opposite side of the hole. All cracks that are not more than 0.75 inch (19.050 mm) in length. Cracks that go completely across the No.9 louver of the Outer Burner Lining, if there is not less than 2.5 inches (63.5 mm) circumferentially between each one. Cracks can completely traverse one louver, but must be separated circumferentially by 6.0 inches (152.40 mm) minimum.	Maximum of 2 cracks every 6.0 inch (152.040 mm) of louver material. Cracks must be separated circumferentially by 0.75 inch (19.05 mm). Maximum of 3 cracks every 6.0 inches (152.40 mm) of louver material. Cracks must be separated circumferentially by 1.5 inches (38.10 mm).

Table 602A

CONDITION FOUND	INNER AND OUTER COMBUSTION CHAMBER ASSSEMBLY (Except Bulkhead) CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
	NOTE: If these limits are exceeded, contact Pratt & Whitney for recommendation. Cracks can completely traverse on Outer Burner Lining No. 9 (rear most) louver, but must be separated circumferentially by 2.5 inches (63.5 mm) minimum. On the Outer Burner Lining (rear most), the minimum separation of cracks must be 2.5 inches (63.5 mm). NOTE: An individual crack is a crack only to one louver.	

<table>
<tr><td colspan="3">Table 602A</td></tr>
<tr><td rowspan="2">CONDITION FOUND</td><td colspan="2">INNER AND OUTER COMBUSTION CHAMBER ASSSEMBLY (Except Bulkhead)
CONTINUE-IN-SERVICE LIMITS</td></tr>
<tr><td>PERMITTED WITH REGULAR TIME INSPECTION</td><td>PERMITTED WITH DECREASED TIME INSPECTION</td></tr>
<tr><td rowspan="2">Continuous Axial Cracks that go completely through one or more louvers</td><td>Axial cracks which go completely through more than one louver must be inspected with the decreased time inspection.</td><td>Axial cracks which go completely through more than three adjacent louvers are not permitted.</td></tr>
<tr><td colspan="2">If you can do an inspection of the outside diameter (OD) (cold side) of the louver, and the cracks do not go through the edge which overlaps the adjacent louver, the limits for axial cracks that are confined to one louver are applicable. If you cannot do an inspection of the OD (cold side) of the louver, the limits for continuous axial cracks that go through one or more louvers are applicable.

<u>NOTE</u>: If the outer (cold side) inspection shows that the cracks do not go through the louver knuckle area, the cracks are classified as individual axial cracks. Use the individual axial crack limits. Without the outer side (cold side) inspection, the cracks must be classified as continous cracks.

Examine the continuous axial cracks with decreased distance as follows:
1. Two louver crack, if the measured crack width on each of the adjacent louver is more than 0.060 inch (1.524 mm) wide and/or louver wall deformation or surface mismatch is more than 0.060 inch (1.524 mm). Individual crack separation limits apply for two louver cracks.
2. Three louver crack, if the measured crack width on each of the three adjacent louvers is more than 0.060 inch (1.524 mm) wide and/or louver wall deformation, or surface mismatch is more than 0.060 inch (1.524 mm). Three louver cracks must be apart circumferentially by 20.0 inches (508.0 mm) minimum.
3. Four louver crack, if the measured crack width on each of the three adjacent louvers is more than 0.060 inch (1.524 mm) wide but less than 0.150 inch (3.810 mm), and/or louver wall deformation surface mismatch is more than 0.060 inch (1.524 mm) but less than 0.150 inch (3.810 mm). Engine must be removed off from the wing within 40 hours.</td></tr>
</table>

Table 602A

<table>
<tr><td rowspan="2">CONDITION FOUND</td><td colspan="2">INNER AND OUTER COMBUSTION CHAMBER ASSSEMBLY (Except Bulkhead)
CONTINUE-IN-SERVICE LIMITS</td></tr>
<tr><td>PERMITTED WITH REGULAR TIME INSPECTION</td><td>PERMITTED WITH DECREASED TIME INSPECTION</td></tr>
<tr><td></td><td colspan="2">4. More than three louver crack, engine must be removed immediately if the crack is greater than 0.150 inch (3.810 mm) wide, and/or louver wall deformation or surface mis-match is greater than 0.150 inch (3.810 mm).

NOTE: Use the hot side inspection only if the cold side inspection is not easy to access. This inspection is used to find if a knuckle between two louvers is cracked by looking through a borescope at the inner (hot side) surface of the burner rather than the outer (cold side) surface.

To use the inner surface inspection method, all cra-cked surfaces in the continuous axial crack must be inspected for crack width. If all louver cracks are less than 0.060 inch (1.524 mm), it must be classi-fied as individual cracks. If one after the other have crack width more than 0.060 inch (1.524 mm), it should be classified as a three louver crack.

Cracks are classified as an individual axial cracks, if they do not go through the louver knuckle area. An outer (cold side) inspection is an optional to check, if the cracks go through the louver knuckle area. If the outer (cold side) inspection shows that the cracks do not go through the louver knuckle area, then the cracks are classified as individual axial cracks.

NOTE: As a burn streak becomes longer, the louver metal can burn, twist and fall away from the surface of the louver. This can cause axial cracks on one louver to continue to burn onto the adjacent louvers, but they are not always easily seen. That is why it is best to do an OD (cold side) inspection, if you can.</td></tr>
<tr><td>Circumferen-tial Cracks</td><td colspan="2">Only ones in the lip area are permitted. The maximum length for the lip cracks is 2.0 inches (50.800 mm).</td></tr>
</table>

Table 602A

CONDITION FOUND	INNER AND OUTER COMBUSTION CHAMBER ASSSEMBLY (Except Bulkhead) CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Connection of Axial and Circumferen- tial Cracks	The only ones permitted are in the lip area. Louver lip material that is gone because of the connection of axial and cicumferential cracks is permitted. The maximum length of circumferential crack in lip area is 2 inches (50.8 mm).	
Connection of Axial Cracks and Burned Holes	Refer to the limits for Burn-Through (Open Holes) and Axial Cracks. Include width of burn hole as part of overall crack length.	

Table 602B

CONDITION FOUND	COMBUSTION CHAMBER ASSEMBLY BULKHEAD AND FUEL INJECTOR GUIDE HEATSHEILD CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Cracks in the Heatshield Face	All quantities of cracks that are not more than 0.25 inch (6.350 mm) in length are permitted. Cracks that go through other cracks are not permitted.	
	No more than two cracks that are longer than 0.25 inch (6.350 mm) are permitted. Two cracks on each face are permitted to go across each face, but must be apart by at least 45°.	No more than four cracks that are longer that 0.25 inch (6.350 mm) are permitted. Four cracks on each face are permitted to go across each face, but must be apart by at least 30°.
Erosion of the Inner Heatshield Face (Material that is Gone)	All quantities of erosion of the Inner Heatshield Face are permitted. But, the impingment holes must not be open to view from the rear.	All quantities of erosion of the Inner Heatshield Face are permitted. But, no more than four impingment holes on each Heatshield are permitted to be open to view from the rear.
Erosion of the Outer Heat-shield Face (Material that is Gone)	Outer Heatshield Face Erosion must not extend more than 0.200 inch (5.080 mm) from the perimeter of the Outer Heatshield Face.	Erosion which extends from the perimeter of the Outer Heat-shield Face must be more than 0.025 inch (0.635 mm) away from the Inner Heatshield Face
Burned Marks and Distortion in the Heat-shield Face	Heatshield burned marks and distortion are permitted if the Heatshield face erosion and cracks are in the limits. The damage that results to the Bulkhead must not be worse than the given limits.	
Heatshield Surface Layer that is Gone	All quantities. NOTE: When the surface layer is gone, the rate of the Heatshield deterioration will increase.	
Fuel Injector Endcap Segments	All quantities of Cracks or endcap segments that are gone are permitted. If pieces of the endcap segments are not there, examine the 1st- and 2nd-stage HPT blades for FOD.	

Table 602B

CONDITION FOUND	COMBUSTION CHAMBER ASSEMBLY BULKHEAD AND FUEL INJECTOR GUIDE HEATSHEILD CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Radial Cracks in the Fuel Injector End Cap/Tip Heatshield	All quantities are permitted. See Figure 614.	
Circumferential Cracks along the OD of the Fuel Injector End Cap/Tip Heatshield	All quantities are permitted. See Figure 614.	
End Cap Material Liberation of the Fuel Injector End Cap/Tip Heatshield	All quantities are permitted. See Figure 614. NOTE: Liberation is segments broken away.	
Burned Marks, Erosion, Distortion, or Holes in the Bulkhead	None are permitted. IMMEDIATELY REMOVE THE ENGINE	

Table 602B

CONDITION FOUND	COMBUSTION CHAMBER ASSEMBLY BULKHEAD AND FUEL INJECTOR GUIDE HEATSHEILD CONTINUE-IN-SERVICE LIMITS	
	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Radial or Circumferential Bulkhead Cracks	Individual radial or circumferential cracks that are less than 0.50 inch (12.7 mm) in length are permitted. Cracks must be separated circumferentially by 6.00 inches (152.40 mm) of sound material. No cracks running under a fuel injector heat shield are permitted.	All quantities that are less than 0.50 inch (12.700 mm) in length are permitted. Cracks must be separated circumferentially by 6.00 inches (152.40 mm) of sound material. Multiple cracks with less than 6.00 inches (152.40 mm) circumferential separation are permitted, if the sum of crack lengths is not greater than 2.00 inches (50.80 mm) and the maximum individual crack legnth is not greater than 0.75 inch (19.05 mm). No cracks running under a fuel injector heat shield are permitted. Cracks which can connect and become a semicircle are not permitted.

No. 14 - Combustion Chamber Inspection

S 416-362-N00

(5) Install the access port plugs AP-8 (Fig. 605A):
   (a) Apply some Silver Goop to the plug threads.
   (b) Install the plugs with new AP-8 Gaskets.
   (c) Tighten the AP-8 plugs to 40-50 pound-inches (4.519-5.649 newton-meter).
   (d) Install lockwire on the AP-8 plug.

S 416-363-N00

(6) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

TASK 72-00-00-206-364-N00

15. HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

A. General

(1) This inspection is the visual check of the HPT Blades, Duct Segments and Vanes (the 1st-stage blades, duct segments and vanes and the 2nd-stage blades).

(2) The limits given in this section will help you know if the engine can continue to operate or if you must remove and repair it.

B. Equipment

(1) AP-8 Gasket - PWA 673049 (6 are necessary)
(2) AP-9 Washer - PWA 584977
(3) AP-10 Gasket - PWA ST1146-08
(4) AP-11 Gasket - PWA ST1142-012
(5) Puller - PWA 86081 (For removal of the AP-10 Plug Assembly)
(6) Packing - Preform AS3209-121
(7) Guide Tube - PWA 86411, AP-8 Port (for the flexible borescope)

C. Consumable Materials

(1) D50124 Anti-seize paste (P06-054)
(2) B00299 Petroleum Solvent P-D-680, Type I
(3) D00244 Antiseize compound, high temperature - Silver Goop

D. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

E. Do the HPT Blade and Vane Inspection.

S 846-527-N00

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHILE THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

(1) Do this procedure: Prepare for the Borescope Inspection.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

S 016-366-N00

(2) Remove the plugs from the access ports AP-8 and AP-9 of the combustion chamber; refer to Fig. 605 and 611 for the access port locations and borescope data.

NOTE: The six AP-8 plugs are found on the diffuser case at 45, 128, 172, 225, 277, and 338 degrees clockwise from the top center of the engine from the rear view.

(a) Measure the shaft diameter of the AP-9 borescope plug.
(b) If the minimum dimension of the shaft diameter is less than 0.100 inch (2.54 mm), you must replace the AP-9 borescope plug.

S 016-367-N00

(3) Do the steps that follow to install the PWA Guide Tube:
(a) Put the PWA 86411 Guide Tube through the diffuser case access port at the AP-8 location with the tip pointed forward (in the direction of the front of the engine).
(b) Turn and adjust the tube until the flexible borescope, when it is installed, will point in the direction of the 1st-stage NGV (nozzle guide vanes).
(c) Lock the Guide Tube in the correct position with the compression nut.

S 016-369-N00

(4) Remove the plugs from the access ports AP-10 of the HPT LPT transition duct, and the optional AP-11 for the HPT; refer to Fig. 605 and Fig. 618 for the access port locations and borescope data.
(a) Remove the two bolts which attach the AP-10 plug assembly to the case (Fig. 618).
(b) Use a PWA 86081 Puller to remove, as an assembly, the AP-10 plug, the plug stop, the spring washer, and the cotter pin.

NOTE: Do not remove the cotter pin.

(c) Discard the gasket.
(d) ENGINES WITH BORESCOPE PLUG AP-11 (POST-PW-SB 72-157); remove the borescope plug and gasket from the No. 3 TVBCA (turbine vane cooling air) duct AP-11 as follows:
1) Remove the bolts that attach the borescope plug to the aft elbow of the No. 3 TVBCA duct.
2) Remove the plug with two jackscrews, if it is necessary.
3) Discard the packing.

<u>No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection</u>

S 296-370-N00

<u>WARNING</u>: DO NOT USE THE POWER CABLE OF THE BORESCOPE IF YOU FIND CIRCUMFERENTIAL CUT HOLES, FRAYING, OR BROKEN HOLES IN THE EXTERNAL RUBBER COVERING ON THE CABLE. POWER CABLES WITH THOSE CONDITIONS CAN CAUSE INJURY TO PERSONS.

<u>CAUTION</u>: MAKE SURE THE TEMPERATURE OF THE INSPECTION AREAS ARE BELOW 150°F (65.6°C) BEFORE YOU USE THE BORESCOPE. IF THE CASES ADJACENT TO THE INSPECTION AREAS ARE TOO HOT TO KEEP YOUR HAND ON, YOU CAN CAUSE DAMAGE TO THE BORESCOPE.

(5) Put the borescope through each access port to examine the condition of the HPT blades and vanes.

<u>NOTE</u>: It is possible that you will find local cracks and spalling on the HPT duct segments during the borescope inspection. These local cracks and spalling are permitted, if the engine is within EGT limits.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

S 226-371-N00

(6) Compare the damage as identified in Figs. 619, 620, and 621 with the continue-in-service limits shown in Tables 603, 604 and 605.

NOTE: The frequency of the regular time inspection that is referred to in the tables is from our Maintenance Planning Document. The frequency of the decreased time inspection is two times the frequency of the regular time inspection. In other words, the interval between decreased time inspections is half the interval of regular time inspections.

NOTE: The maximum limits for the regular time and decreased time inspections were calculated to have the qualities that follow:
- During usual conditions of operation, permitted damage will not become unsatisfactory before the time for the subsequent applicable inspection.
- Usually, higher damage limits are permitted for the decreased time inspection because that inspection is done more frequently.
- Damage and deterioration in some areas change the performance of the engine very quickly, which makes a higher limit (for the decreased time inspection) not possible. For damage in these areas, the limits for the decreased and regular time inspections are equal.

(a) Use these limits when you examine the 1st-stage HPT vanes:
  1) If damage is worse than the decreased time inspection limits, remove the engine before the 6th cycle.
  2) If these conditions will quickly occur, immediately remove the engine: part failure, or areas where material will break off.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619) Table 603			
CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Nicks and Dents	Leading Edge, Concave and Convex Airfoils, ID and OD Platforms	Nicks and rounded bottom dents that are not more than 0.125 inch (3.175 mm) in length or diameter. NOTE: If the view angle is such that depth can be determined, the maximum nick and round bottom dent depth is 0.0312 inch (0.792 mm).	
	Trailing Edge	No more than two nicks or dents that are apart by at least 0.750 inch (19.050 mm). Five Vanes Maximum on each engine. If more than the above interval inspection limits.	Remove engine in 5 cycles or less.
Damaged or Missing Thermal Barrier Coating	Leading Edge, Concave and Convex Airfoils, ID and OD Platforms, Trailing Edge	No limit on the quantity of chipped coating, coating loss, checking, crazed or cracked thermal barrier coating. NOTE: If a large quantity of thermal barrier coating is missing, (gone), and the vane is operated for a long time, it is possible that the vane cannot be repaired at overhaul. The vane base metal can become burned and eroded.	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Burned Areas, Erosion	Leading Edge, Concave and Convex Airfoils, ID and OD Platforms, Trailing Edge	No limit on the quantity of burning and erosion as long as it is not burned completely through the wall.	
Material Break-through or Burn-through	Leading Edge, Concave and Convex Airfoils, ID and OD Platforms	One material breakthrough or burnthrough with an open area (material that is not there) up to but not more than 0.157 inch (3.988 mm) diameter or 0.019 sq-in. (12.258 sq-mm).	
		One material breakthrough or burnthrough and with an open area (material that is not there) more than 0.157 inch (3.988 mm) but less than 0.300 inch (7.620 mm) diameter or up to 0.070 sq-in. (45.161 sq-mm) maximum.	Permitted for 300 cycle reduced inspection interval.
		A maximum of five vanes for each engine with one material breakthrough or burnthrough, and more than 0.300 inch (7.620 mm) but less than 0.500 inch (12.700 mm) diameter or 0.196 sq-inch (126.451 mm) into the internal cavity.	Permitted for 300 cycle reduced inspection interval.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619) Table 603			
CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		More than 5 vanes with one material breakthrough or burnthrough and more than 0.300 inch (7.620 mm) but less than 0.500 inch (12.700 mm) diameter or up to 0.196 sq-inch (126.451 sq-mm) maximum.	Permitted for 150 cycle reduced inspection interval.
		For leading edge burn-through more than 0.500 inch (12.700 mm) diameter: No limit on the number of vanes with leading edge burnthrough up to 1.614 inch (40.996 mm) maximum radial length that does not go axially more than the first row of concave side cooling holes and does not go axially more than the second row of convex side cooling holes is permitted if there is no burning on the internal baffle.	Permitted for 50 cycle reduced inspection interval.
		Vane baffle burned through.	Not permitted. Remove and Replace.
		More than the above internal inspection limits.	Remove engine in 5 cycles maximum or less.
Material Break-through or Burn-through	Concave Side Trailing Edge	Burnthrough less than 75 percent span of axial length from the trailing edge to the rear cooling holes and up to 1.575 inches (40.005 mm) maximum width.	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619) Table 603			
CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		Burnthrough more than 75 percent span of axial length from the trailing edge to the rear cooling holes and up to 1.575 inches (40.005 mm) maximum width.	Permitted for 300 cycle reduced inspection interval.
		Burnthrough up to 0.512 inch (13.005 mm) forward of the rear two rows of cooling holes and up to 1.575 inches (40.005 mm) maximum width.	Permitted for 150 cycle reduced inspection interval.
		Burnthrough more than 0.511 inch (12.979 mm) forward of the rear two rows of cooling holes, or is more than 1.575 inches (40.005 mm) in width, or if the internal baffle is burned through.	Remove engine in 5 cycles maximum or less.
	Convex Side Trailing Edge	Burnthrough less than 50 percent span from the trailing edge to the rear cooling holes.	
		Burnthrough more than 50 percent span from the trailing edge to the rear cooling holes.	Permitted for 150 cycle reduced inspection interval.
		Burnthrough is forward of the rear cooling holes.	Remove engine in 5 cycles or less.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Cracks, (Axial and Radial)	Leading Edge Surface	No limit on the quantity of tight cracks. Closed loop cracks are not permitted.	
		One crack in each vane starting at the ID or OD platform, to a maximum height of 0.500 inch (12.700 mm).	
		A maximum of 3 cracks in each vane which go to a concave or convex airfoil cooling hole. Closed loop cracks are not permitted.	
		Two cracks in each vane starting at the ID or OD platforms, to a maximum height of 0.750 inch (19.050 mm).	Permitted for 300 cycle reduced inspection interval.
		More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.
	Concave Airfoil Surface	No limit on the quantity of axial or radial cracks less than 0.157 inch (3.988 mm) are permitted. Closed loop cracks are not permitted. NOTE: A crack or part length of a crack that has burned or eroded to a width more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		A maximum of three axial cracks that go from one cooling hole group to the next cooling hole group or from the trailing edge to the rear cooling hole group are permitted.	
		One of the above three axial cracks can go forward or rearward to the next cooling hole group or from the trailing edge through the rear cooling hole group to the next cooling hole group.	
		No limit on the quantity of axial cracks that go from one cooling hole group to the next cooling hole group or from the trailing edge to the rear cooling hole group if the cracks do not form a closed loop.	Permitted for 300 cycle reduced inspection interval.
		Radial cracks that go from the ID or OD platform to the concave airfoil are permitted. The maximum crack length on the airfoil from the platform is 0.500 inch (12.700 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		Radial cracks that go from the ID or OD platform to the concave airfoil surface more than 0.500 inch (12.700 mm) but less than 0.800 inch (20.320 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for 300 cycle reduced inspection interval.
		Three radial cracks maximum to 0.500 inch (12.700 mm) maximum length are permitted.	
		No limit on the quantity of radial cracks to 0.800 inch (20.320 mm) length.	Permitted for 300 cycle reduced inspection interval.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619) Table 603			
CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		A crack can intersect with another crack except for cracks that start at the ID or OD platform. The maximum length for either crack leg is 0.400 inch (10.160 mm). The intersection of platform cracks with airfoil cracks is not permitted.	
		An intersecting crack with a leg more than 0.400 inch (10.160 mm) and less than 0.800 inch (20.320 mm) except for cracks that start at the the ID or OD platform. The intersection of platform cracks with airfoil cracks is not permitted. length.	Permitted for 300 cycle reduced inspection interval.
		More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
	Convex Airfoil Surface	No limit on the quantity of axial or radial cracks less than 0.157 inch (3.988 mm) are permitted. Closed loop cracks are not permitted.	
		NOTE: A crack or part length of a crack that has burned or eroded to a width more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.	
		Three axial cracks maximum to 0.500 inch (12.700 mm) maximum length except as follows: One of the three axial cracks can traverse from the trailing edge for a maximum distance of 0.750 inch (19.050).	
		Six axial cracks maximum to 0.800 inch (20.320 mm) maximum length except as follows: One of the six axial cracks can traverse from the trailing edge for a maximum distance of 1.300 inches (33.020 mm), or to the last row of cooling holes.	Permitted for 300 cycle reduced inspection interval.
		One axial crack from the trailing edge to a maximum of 1.181 inches (29.997 mm).	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		One axial crack from the trailing edge more than 1.181 inches (29.997 mm) to 2.362 inches (59.995 mm) maximum is permitted.	Permitted for 300 cycle reduced inspection interval.
		Three radial cracks to 0.500 inch (12.700 mm) length.	
		No limit on the quantity of radial cracks to 0.800 inch (20.320 mm) maximum.	Permitted for 300 cycle reduced inspection interval.
		A crack can intersect with another crack except for cracks that start at the ID or OD platforms. The maximum length for either crack leg is 0.500 inch (12.700 mm). Intersection of platform cracks with airfoil cracks is not permitted.	
		An intersecting crack with a leg more than 0.500 inch (12.700 mm) and less than 0.800 inch (20.320 mm) except for cracks that start at the ID or OD platform. Intersection of platform cracks is not permitted.	Permitted for 300 cycle reduced inspection interval.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619) Table 603			
CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		Radial cracks that go from the ID or OD plat- forms to the convex air- foil are permitted. The maximum crack length on the airfoil from the platform is 0.500 inch (12.700 mm). Cracks from a platform that go to the airfoil surface cannot intersect other cracks on the airfoil surface.	
		Radial cracks that go from the ID or OD plat- form to the convex air- foil surface more than 0.500 inch (12.700 mm) but less than 0.800 inch (20.320 mm) are permit- ted. Cracks from a plat- form that go to the air- airfoil surface cannot intersect other cracks on the airfoil surface.	Permitted for 300 cycle reduced inspection interval.
		More than the above interval inspection limits.	Remove engine in 5 cycles maximum or less.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619) Table 603			
CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
	ID and OD Platform Surfaces (Buttresses)	No limit on the quantity of cracks less than 0.250 inch (6.350 mm) in length on the platform surfaces are permitted. Intersecting cracks are permitted if no closed loop is formed. Closed loop cracks are not permitted. NOTE: A crack or part length of a crack that has burned or eroded to a width of more than 0.050 inch (1.270 mm) must be identified as a hole. The breakthrough or burnthrough limits apply.	
		Four cracks maximum more than 0.250 inch (6.350 mm) long are permitted on the OD platform concave airfoil side. Three of the cracks can be up to 0.700 inch (17.780 mm) long, and one crack can be of any length. These cracks can go to the airfoil concave surface to a height of 0.500 inch (12.70 mm).	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		Six cracks maximum more than 0.250 inch (6.350 mm) long are permitted on the OD platform concave airfoil side. Four of the cracks can be up to 0.700 inch (17.780 mm) long, and two of the cracks can be of any length. These cracks can go to the airfoil concave surface to a height of 0.800 inch (20.320 mm).	Permitted for 300 cycle reduced interval.
		Two cracks more than 0.250 inch (6.350 mm) long are permitted on the OD platform convex airfoil side from the airfoil fillet to platform edge.	
		Four cracks more than 0.250 inch (6.350 mm) long are permitted on the OD platform convex airfoil side from the airfoil fillet to platform edge.	Permitted for 300 cycle reduced inspection interval.

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		Two cracks maximum more than 0.250 inch (6.350 mm) long are permitted on the ID platform concave or convex airfoil side from the airfoil fillet to platform edge.	
		Four cracks more than 0.250 inch (6.350 mm) long are permitted on the ID platform concave or convex airfoil side from the airfoil fillet to platform edge.	Permitted for 300 cycle reduced inspection interval.
		One crack maximum for each side and two cracks total for each vane in the ID or OD fillet radius that goes parallel or axially along the fillet radius surface. The maximum length is 0.600 inch (15.240 mm). Airfoil/platform fillet radius cracks can inter-sect other cracks if the total length is less than 1.0 inch (25.400 mm). No circumferential cracks in the leading edge fillet.	

1ST-STAGE HPT VANES CONTINUE-IN-SERVICE LIMITS (Figure 619)
Table 603

CONDITION FOUND	VANE AREA	PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
		One crack maximum for each side and two cracks total for each vane in the ID or OD fillet radius that goes parallel or axially along the fillet radius surface. The maximum length is 1.000 inch (25.400 mm). Airfoil/platform fillet radius cracks can inter- sect other cracks if the total length is less than 1.750 inches (44.450 mm).	Permitted for 300 cycle reduced inspection interval.
		One crack maximum in the ID or OD leading edge fillet radius surface that goes circumferen- tially around the leading edge to a length of 0.400 inch)10.160 mm) maximum.	Permitted for 300 cycle reduced inspection interval.
		More than the above in- terval inspection limits.	Remove engine in 5 cycles maximum or less.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

(b) Use these limits when you examine the 1st-stage HPT blades:

NOTE: The first sign of corrosion on a blade is a circular stain or mark on the outer surface of the blade. A green to white and blue color stain is a sign of sulfidation corrosion.

NOTE: Blade erosion removes the surface layer which is for protection. This will quickly cause deterioration of the inner alloy.

NOTE: A sign of airfoil growth is when the length of the blade is increased and the perimeter of the middle is decreased.

1) If damage is worse than the decreased time inspection limits, remove the engine before the 6th cycle.
2) If these conditions will quickly occur, immediately remove the engine: part failure, or areas where material will break off.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 604

CONDITION FOUND	BLADE AREA	1ST-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS	
		PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Nicks and Dents NOTE: No crack that is with a nick or dent is permitted, unless it is, in the limits for Axial or Radial Cracks.	A	None	On each blade, one nick or dent that is no more than 0.08 inch (2.032 mm) in length or diameter.
	B	All Nicks or dents that are not more than 0.08 inch (2.032 mm) in length or diameter.	All nicks or dent that are not more than 0.125 inch (3.175 mm) in length or diameter.
Burned Areas NOTE: Burned areas that cause a decrease in the flow of cooling air is not permitted.	A, B, and C	Burned areas are not permitted.	Burned areas to a maximum of 0.750 inch (19.050 mm) in diameter or 0.422 square inch (285.0 square mm) in area. Leading edge burned areas to a maximum of 0.40 inch (10.160 mm) in diameter Or 0.126 square inch (81.0 square mm) in area.
Erosion damage on the surface layer.	A, B, and C	All amounts are Permitted.	All amounts are permitted.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 604

CONDITION FOUND	BLADE AREA	1ST-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Axial or Radial Cracks NOTE: See the subsequent limits for open cracks. Material tears are the same as cracks.	A	None	One hole to hole crack on the leading edge only. No airfoil cracks. NOTE: REMOVE ENGINE IMMEDIATELY IF THERE IS IMMINENT PART FAILURE OR IMMINENT MATERIAL LIBERATION. REMOVE ENGINE WITHIN 5 CYCLES IF ANY REDUCED INTERVAL INSPECTION LIMITS ARE EXCEEDED.
	B	All axial or radial cracks or hole to hole cracks at the tip or leading edge are permitted. No breakthrough or open areas. No intersecting cracks or imminent material liberation. NOTE: REMOVE ENGINE IMMEDIATELY IF THERE IS IMMINENT PART FAILURE OR IMMINENT MATERIAL LIBERATION.	Axial or radial cracks on the leading edge, airfoil or tip area are permitted. Breakthrough to internal cavity with open area to breakthrough limit is permitted. NOTE: REMOVE ENGINE IMMEDIATELY IF THERE IS IMMINENT PART FAILURE OR IMMINENT MATERIAL LIBERATION. REMOVE ENGINE WITHIN 5 CYCLES IF ANY REDUCED INTERVAL INSPECTION LIMITS ARE EXCEEDED.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 604

CONDITION FOUND	BLADE AREA	1ST-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS	
		PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Axial or Radial Cracks NOTE: See the subsequent cracks. Material tears are the same as cracks.	C	All quantities of platform edge cracks that do not go into the platform to airfoil fillet radius and do not have signs of platform curling.	All quantities of platform edge cracks that go into the platform to airfoil fillet radius UP TO 0.250 INCH (6.350 mm) RADIALLY PAST THE RADIUS INTO THE AIRFOIL. NOTE: REMOVE ENGINE WITHIN 5 CYCLES IF ANY REDUCED INTERVAL INSPECTION LIMITS ARE EXCEEDED. PLATFORM CURL (BEND) IS NOT PERMITTED.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 604

CONDITION FOUND	BLADE AREA	1ST-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH REGULAR TIME INSPECTION	1ST-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH DECREASED TIME INSPECTION
Holes that are Broken or Burned through to the Internal Cavity	A	None is permitted. IMMEDIATELY REMOVE THE ENGINE.	
	B	None	On each blade, one piece that is gone from the tip or one hole that is less than 0.125 square inch (81.0 square mm) in area. No more than five blades with these holes on each rotor. NOTE: If the hole is more than the decreased time limits, but fully in area B, remove the engine within 50 cycles. If the hole goes outside of area B, remove the engine within 5 cycles or immediately.
Bent Tip	B	A bent tip is permitted if the damage is not worse than other damage limits.	
Leading Edge Holes and Blocked Cooling Air Exit Slots in the Trailing Edge	A and B	Two leading edge holes (not adjacent) and two blocked trailing edge exit slots on each blade.	
Blocked Cooling Air Exit Holes in the Tip	B	Two blocked holes on each blade.	All blocked holes if the damage is not worse than other damage limits.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 604

CONDITION FOUND	BLADE AREA	1ST-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS	
		PERMITTED WITH REGULAR TIME INSPECTION	PERMITTED WITH DECREASED TIME INSPECTION
Tip Rub or Plasma Spray Deterioration	B	All quantities, if it is not worn through to the internal cavity.	
Areas where the Blade Parent Material is Gone	A and B	None	None, but that which is in the limits for Broken or Burned Hole.
Airfoil Growth	A and B	None IMMEDIATELY REMOVE THE ENGINE.	

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

(c) PW4056 ENGINES PRE-PW-SB 72-466;
Examine the 1st-Stage HPT blades for airfoil bulges as follows (Fig. 622):

NOTE: Refer to PW SB 72-422 for data about how to point the borescope through the AP-8 and AP-11 access ports.

1) If you use AP-11, examine the 1st-stage HPT blades for bulges (which cause the blade tip to curve) as follows:
   a) Examine the blades for bulges after the first 2,000 cycles and after each 250 cycles or each subsequent "A check".
   b) If you find a bulge, remove the engine within 25 cycles.
2) If you use a flexible borescope with a guide tube through AP-8, examine the concave side of the 1st-stage HPT blades for dark spots as follows:

   NOTE: The 1st-stage HPT blades with airfoil bulging usually have a large dark spot or shadow near the bulge. A dark spot that goes forward of the fifth tip cooling hole is a sign that the blade was too hot, which can cause bulging.

   a) Examine the blades for dark spots after the first 2,000 cycles and after each 250 cycles or each subsequent "A check".
   b) If you find a bulge or a white spot in a dark spot, remove the engine within 25 cycles.

      NOTE: A white spot within a dark spot can be a sign of spalled coating which is caused by a bulge.

   c) If you find more than 30 blades with dark spots that go forward of the fifth tip cooling air hole, examine the engine each 20 cycles and remove the engine within 100 cycles.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

(d) PW4060 ENGINES PRE-PW-SB 72-466;
Examine the 1st-Stage HPT blades for airfoil bulges as follows (Fig. 622):

NOTE: Refer to PW SB 72-422 for data about how to point the borescope through the AP-8 and AP-11 access ports.

1) If you use AP-11, examine the 1st-stage HPT blades for bulges (which cause the blade tip to curve) as follows:
   a) Examine the blades for bulges after the first 1,000 cycles and after each 250 cycles or each subsequent "A check" until the 1,900th cycle.
   b) After the 1,900th cycle, examine the blades for bulges each 125 cycles.
   c) If you find a bulge before the 1,500th cycle, examine the engine for worse damage each 50 cycles.
   d) If you find a bulge after the 1,500th cycle, remove the engine within 25 cycles.
2) If you use a flexible borescope with a guide tube through AP-8, examine the concave side of the 1st-stage HPT blades for dark spots as follows:

   NOTE: The 1st-stage HPT blades with airfoil bulging usually have a large dark spot or shadow near the bulge. A dark spot that goes forward of the fifth tip cooling hole is a sign that the blade was too hot, which can cause bulging.

   a) Examine the blades for dark spots after the first 1,000 cycles and after each 250 cycles or each subsequent "A check" until the 1,900th cycle.
   b) If you find a white spot in a dark spot after the 1,500th cycle, remove the engine within 25 cycles.

      NOTE: A white spot within a dark spot can be a sign of spalled coating which is caused by a bulge.

   c) After the 1,900th cycle, examine the blades for bulges each 125 cycles.
   d) If you find more than 30 blades with dark spots that go forward of the fifth tip cooling air hole, remove the engine within 25 cycles.
   e) If you find a bulge remove the engine within 10 cycles.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

(e) Insert the borescope through the port and examine the HPT 2nd-stage blades as follows.
   1) Look for signs of nicks, dents, cracks, tip damage, erosion, coating loss, liberated materials, bent tip, tip rub, airfoil growth, blocked cooling holes, sulfidation and damage caused by passage of foreign object metarials.
   2) You must examine each blade, and rotate the high rotor using hand or foot operated equipment.

(f) Use these limits when you examine the 2nd-stage HPT blades:

NOTE: The first sign of corrosion on a blade is a circular stain or mark on the outer surface of the Blade. A green to white and blue color stain is a sign of sulfidation corrosion.

NOTE: Blade erosion removes the surface layer which is for protection. This will quickly cause deterioration of the inner alloy.

NOTE: A sign of airfoil growth is when the length of the blade is increased and the perimeter of the middle is decreased.

NOTE: The loss of the blade coating can possibly result in decreased life of the base alloy. This condition, as well as hot corrosion that attach (sulfidation), can affect the blade reliability.

   1) If damage is worse than the decreased time inspection limits, remove the engine from operation before the 6th cycle.
   2) If these conditions will quickly occur, immediately remove the engine from operation: part failure, or areas where material will break off.

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(7) Examine the HPT 1st stage duct segments for spalling (ceramic coating which is missing).
   (a) All quantities of spalling are permitted.
   (b) Ceramic spalling causes the conditions that follow:
      1) Increase in tip clearance of the HPT 1st stage blade.
      2) Increase in EGT.
      3) Increase in fuel consumption.
      4) Possible damage to the tip of the HPT 1st stage blades.
      5) Possible damage to the HPT 2nd stage blades.
   (c) If the HPT 1st stage duct segments are spalled, do the inspection of the HPT 1st and 2nd stage blades for damage.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

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(8) Examine the HPT 2nd stage duct segments for spalling (ceramic coating which is missing).
   (a) All quantities of spalling are permitted.
   (b) Ceramic spalling causes the conditions that follow:
      1) Increase in tip clearance of the HPT 2nd stage blade.
      2) Increase in EGT.
      3) Increase in fuel consumption.
      4) Possible damage to the tip of the HPT 2nd stage blades.
   (c) If the HPT 2nd stage duct segments are spalled, do the inspection of the HPT 1st and 2nd stage blades for damage.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 605 (Figure 621)

CONDITION FOUND	BLADE AREA	2ND-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH REGULAR TIME INSPECTIONS	PERMITTED WITH DECREASED TIME INSPECTIONS	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
Nicks and Dents	A	None	On each blade, one nick or dent that is not more than 0.025 inch (0.635 mm) in length or diameter.	For imminent material liberation, remove engine immediately.
NOTE: No crack that is with a nick or dent is permitted, unless it is in the limits for Axial or Radial Cracks.	B	All nicks or dents that are not more than 0.130 inch (3.302 mm) in length or diameter.	All nicks or dents that are not more than 0.250 inch (6.350 mm) in length or diameter.	
	C	All nicks or dents that are not more than 0.130 inch (3.302 mm) in length or diameter.	All nicks or dents that are not more than 0.300 inch (7.620 mm) in length or diameter.	

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 605 (Figure 621)

CONDITION FOUND	BLADE AREA	2ND-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH REGULAR TIME INSPECTIONS	PERMITTED WITH DECREASED TIME INSPECTIONS	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
Surface Layer Deterior-ation, Burned Areas Erosion	A, B	One defect on each blade, in these limits: 1) Surface layer deterioration on the airfoil no more than 0.750 inch (19.050 mm) in diameter, 0.442 square inch (285 square mm) in area, or 2) Leading edge burned areas no more than 0.400 inch (10.160 mm) in diameter, 0.126 square inch (81 square mm) in area.		
	C	Same as A, B	One defect on each blade if it is in the burned or broken hole limits.	

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 605 (Figure 621)

CONDITION FOUND	BLADE AREA	2ND-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH REGULAR TIME INSPECTIONS	PERMITTED WITH DECREASED TIME INSPECTIONS	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
Axial or Radial Cracks NOTE: If there are holes, see "Holes that are Burned through to the Internal Space", below. Material tears are the same as cracks.	A	None. IMMEDIATELY REMOVE THE ENGINE.		
	B	None	All cracks that are less than 0.130 inch (3.3mm) in length and not with broken holes and do not connect with other cracks.	For imminent material liberation, remove engine immediately.
	C	All cracks are permitted provided that there are no open areas. No intersecting cracks or immnent material liberation are permitted.	All cracks on the leading edge or airfoil at tip are permitted. Break-through to internal cavity with open area to breakthrough limit is permitted.	For imminent material liberation, remove engine immediately.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 605 (Figure 621)

CONDITION FOUND	BLADE AREA	2ND-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS: PERMITTED WITH REGULAR TIME INSPECTIONS	PERMITTED WITH DECREASED TIME INSPECTIONS	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
Holes that Broken or Burned thr to the Int Space	A, B	None. IMMEDIATELY REMOVE THE ENGINE.		
	C	None	On each blade, one piece that is gone from the lip or one hole that is less than 0.125 square inch (81 square mm) in area. No more than five blades with these holes on each rotor.	For imminent material liberation, remove engine immediately.
Bent Tip	C	Permitted if other conditions are not exceeded.		Remove Engine Immediately
Trailing Edge Cooling Air Slots Blockage	A	A maximum of one trailing edge cooling air slot blocked per blade is permitted.		Remove engine immediately
	B, C	A maximum of two non-adjacent trailing edge cooling air slots blocked per blade is permitted.		Remove engine immediately
Tip Rub or Plasma Spray Loss	C	Any amount is acceptable if not rubbed into the internal cavity.		Remove engine immediately

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 605 (Figure 621)

CONDITION FOUND	BLADE AREA	2ND-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS		
		PERMITTED WITH REGULAR TIME INSPECTIONS	PERMITTED WITH DECREASED TIME INSPECTIONS	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
Liberated Blade Parent Material	A, B and C	None	None except as defined for "Material breakthrough into internal cavity" observed condition	Remove engine immediately
Airfoil Growth (as evid-enced by: bent or displaced 2nd stage blade(s) relative to adjcent blades in rotor Abnormal/ excessive tip rub	A, B and C	None See Fig. 621A	None See Fig. 621A	Remove engine immediately

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

Table 605 (Figure 621)				
		2ND-STAGE HPT BLADE CONTINUE-IN-SERVICE LIMITS		
CONDITION FOUND	BLADE AREA	PERMITTED WITH REGULAR TIME INSPECTIONS	PERMITTED WITH DECREASED TIME INSPECTIONS	IF THE LIMIT IS EXCEEDED, REMOVE ENGINE WITHIN 5 CYCLES OR AS NOTED BELOW
Wavy/ deformed trailing edge				
Necking or thinning of airfoil profile at midspan region				
Cracks in the midspan trailing edge cooling hole openings				

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(9) Install the access port plugs AP-8 (Fig. 605A):
   (a) Remove the PWA 86441 guide tube from the AP-8 ports.
   (b) Apply Silver Goop to the plug threads.
   (c) Install the plug with a new AP-8 gasket.
   (d) Tighten the AP-8 plugs.
   (e) Install lockwire on the AP-8 plug.

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(10) Install the access port plug AP-9 (Fig. 605A):
   (a) Apply silver goop to the plug threads.
   (b) Install the plugs with new AP-9 washers.
   (c) Tighten the AP-9 plugs.
   (d) Install lockwire on the AP-9 plug.

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(11) Install the access port AP-10 (Fig. 605A):
   (a) If the access port AP-10 is disassembled, assemble it for the installation.

      NOTE: The plug assembly is not usually disassembled. If you will examine the 3rd-Stage LPT vanes and blades , do not install the AP-10 access plug.

      1) When you install the spring tension washer in the cover recess, make sure these conditions occur: the outer diameter of the washer touches the cover, and the concave surface of the washer is adjacent to the cover.
      2) From the washer side, put the plug in the assembled washer and cover.
      3) Push the cotter pin in the plug until the cotter pin head is tightly against the flat side of the plug.
   (b) With the split side to the inside, install the plug with a new AP-10 gasket.

      NOTE: The plug will be in the case boss and the spring washer will push the plug to the inside.

   (c) Attach the plug stop cover to the plug (AP-10).
   (d) Fully clean the bolt threads and the plug threads with petroleum solvent.

      NOTE: This removes unwanted carbon and all the used anti-seize paste (P06-054).

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(e) Apply a layer of Silver Goop to the threads of the bolts and remove the unwanted compound.
(f) With the bolts, attach the plug stop to the access port boss (Fig. 618).
(g) Tighten the bolts (See Table 605A).
(h) Install lockwire on the AP-10 plug.

S 416-375-N00

(12) ENGINES WITH BORESCOPE PLUG AP-11 (POST-PW-SB 72-157); Install the AP-11 plug in the No. 3 TVBCA duct (Fig. 605A).
(a) Install the gasket in the borescope plug groove.
(b) Install the AP-11 plug at the aft elbow of the No. 3 TVBCA duct.
(c) Engage the AP-11 plug end in the inner hole of the HPT to seat it.
(d) Install the bolts, threads lubricated with engine oil.
(e) Tighten the bolts, in a sequence that is not circular (See Table 605A).
1) Install lockwire on the plug.

No. 15 - HPT (1st and 2nd-Stage) Blade and Duct Segments, and (1st-Stage) Vane Inspection

AP-10 and AP-11 Borescope Plug Installation Data
Table 605A

AP Number And Location	Gasket Required	Bolt Locking Method	Bolt Replacement Lubricant	Bolt Torque Value lb-in (N.m)
AP-10 HPT 2nd-Stage	Yes ST1146-08	Lockwire (MS9226-04)	P06-023 Silver Goop	54.000 - 60.000 (6.101 - 6.779)
AP-11 Lower TCA Tube	Yes PN ST1142-011 (Gasket)	Self-locking	P03-001 Engine Oil	75.000 - 85.000 (8.474 - 9.604)

S 416-376-N00
(13) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 16 - LPT Vanes (3rd-Stage) - Inspection

TASK 72-00-00-206-377-N00

16. LPT Vanes (3rd-Stage)-Inspection

A. General

(1) This inspection is the visual check of the 3rd-stage vanes in the primary gaspath of the LPT.

(2) The limits in this section will help you know if the engine can continue to operate or if you must remove and repair it.

B. Equipment

(1) AP-10 Gasket - PWA ST1146-08

(2) Puller - PWA 86081 (For removal of the AP-10 Plug Assembly)

(3) Wedge (Block - Fan Blade) - PWA 102757 (3 are required during windy conditions)

(4) Packing - Preform AS3209-121

(5) Crank Pad Cover Packing - PWA AS3204-121

C. Consumable Materials

(1) D50124 Anti-seize paste (P06-054)

(2) G00966 Kerosene - VV-K-211

(3) B00776 Petroleum Solvent P-D-680, Type I

(4) D00244 - Antiseize compound, high temperature - Silver Goop

D. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

E. Do the LPT Vane Inspection.

S 846-528-N00

CAUTION: WHEN YOU EXAMINE THE VANES, FIND THE CAUSE OF ALL OF THE FOD TO MAKE SURE THAT THE LPC IS SERVICEABLE. DAMAGE IN THIS AREA CAN BE AN INDICATION OF A MORE DANGEROUS PROBLEM. OTHER COMPONENTS CAN POSSIBLY BE DAMAGED.

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHILE THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

(1) Do this procedure: Prepare for the Borescope Inspection.

No. 16 - LPT Vanes (3rd-Stage) - Inspection

S 416-490-N00

WARNING: DO NOT DO A BORESCOPE INSPECTION IF THE WIND IS MORE THAN 3 - 5 MPH (4.8 - 8 KPH). DURING WINDY CONDITIONS, THE N1 ROTOR CAN TURN (WINDMILL). THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE BORESCOPE EQUIPMENT.

WARNING: INSTALL THE PWA 102757 WEDGES BETWEEN THE FAN BLADES WHEN THE WIND IS LESS THAN 3 - 5 MPH (4.8 - 8 KPH). IF YOU DO NOT INSTALL THE WEDGES DURING MILD WIND CONDITIONS, THE N1 CAN TURN (WINDMILL). THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE BORESCOPE EQUIPMENT.

(2) If the wind condition is less than 3 - 5 MPH (4.8 - 8 KPH), install the wedges as follows.
   (a) Do not install the wedge if the wind condition is more than 3 - 5 MPH (4.8 - 8 KPH).
   (b) Install two or three wedges between the fan blades and the fan case at approximately the 6 o'clock position.
   (c) Make sure the wedge is installed tight enough to prevent the fan blades from turning, but it must not raise the fan blades up.
   (d) The red warning streamer must go towards the front of the engine inlet.
   (e) If it is necessary to turn the N1 rotor to complete the borescope inspection, do the steps as follow.
      1) Remove the wedges.
      2) Turn the N1 rotor by hand and install the wedges again.
      3) Do this procedure again until the borescope inspection is complete.

S 016-379-N00

(3) Remove the plug from the LPT HPT access port AP-10; refer to Fig. 605 and 618 for the access port location and the borescope data.
   (a) Remove the two bolts that attach the plug stop to the case (Fig. 618).
   (b) Use a PWA 86081 Puller to remove, as an assembly, the plug, the plug stop, the spring washer, and the cotter pin; discard the gasket.

      NOTE: Do not remove the cotter pin.

No. 16 - LPT Vanes (3rd-Stage) - Inspection

S 296-380-N00

WARNING: DO NOT USE THE POWER CABLE OF THE BORESCOPE IF YOU FIND CIRCUMFERENTIAL CUT HOLES, FRAYING, OR BROKEN HOLES IN THE EXTERNAL RUBBER COVERING ON THE CABLE. POWER CABLES WITH THOSE CONDITIONS CAN CAUSE INJURY TO PERSONS.

CAUTION: MAKE SURE THE TEMPERATURE OF THE INSPECTION AREAS ARE BELOW 150°F (65.6°C) BEFORE YOU USE THE BORESCOPE. IF THE CASES ADJACENT TO THE INSPECTION AREAS ARE TOO HOT TO KEEP YOUR HAND ON, YOU CAN CAUSE DAMAGE TO THE BORESCOPE.

(4) Put the borescope through the access port to examine the 3rd-stage LPT vanes for nicks, dents, cracks, and other FOD.

S 226-413-N00

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHILE THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

CAUTION: IF YOU FIND DAMAGE THAT IS WORSE THAN THE CONTINUE-IN-SERVICE LIMITS, OR PIECES OF THE VANE WILL FALL OFF, REMOVE THE ENGINE IMMEDIATELY. THIS TYPE OF DAMAGE CAN CAUSE MORE DAMAGE TO THE ENGINE IF IT IS NOT REPAIRED.

(5) Compare the damage you find with the continue-in-service limits shown in Fig. 622 (sheet 1).
   (a) If there has been a sudden increase in EGT, check for a possible missing or liberated LPT 3rd-stage outer transition duct segment.
   (b) No missing or liberated outer transition duct segments are permitted.

No. 16 - LPT Vanes (3rd-Stage) - Inspection

S 416-382-N00

(6) Install the access port AP-10 (Fig. 605A):

NOTE: If you will do an inspection of the LPT 3rd-stage blades, do not install the access port AP-10.

(a) If the access port AP-10 is disassembled, assemble it for the installation.

NOTE: The plug assembly is not usually disassembled.

1) When you install the spring tension washer in the cover recess, make sure these conditions occur: the outer diameter of the washer touches the cover, and the concave surface of the washer is adjacent to the cover.
2) From the washer side, put the plug in the assembled washer and cover.
3) Push the cotter pin in the plug until the cotter pin head is tightly against the flat side of the plug.

(b) With the split side to the inside, install the plug with a new AP-10 gasket.

NOTE: The plug will be in the case boss and the spring washer will push the plug to the inner side.

(c) Attach the plug stop cover to the plug (AP-10).
(d) Fully clean the bolt threads and the plug threads with petroleum solvent.

NOTE: This removes unwanted carbon and all used anti-seize paste.

(e) Apply a layer of Silver Goop to the threads of the bolts and remove the unwanted compound.
(f) Attach the plug stop to the access port boss with the bolts (Fig. 618).
1) Tighten the bolts.
(g) Install lockwire on the AP-10 plug.

S 016-491-N00

CAUTION: YOU MUST REMOVE ALL THE WEDGES AFTER THE BORESCOPE INSPECTION IS COMPLETE. IF THE WEDGES ARE NOT REMOVED, THE ENGINE WILL BE BE DAMAGED WHEN THE ENGINE IS STARTED.

(7) Remove all the wedges after you complete all of the borescope inspections.

No. 16 - LPT Vanes (3rd-Stage) - Inspection

S 416-383-N00

(8) Do this procedure: Put the Airplane Back to its Usual Condition.

TASK 72-00-00-206-384-N00

17. LPT Blades (3rd-Stage) - Inspection

A. General

(1) This inspection is the visual check of the 3rd-stage blades in the primary gaspath of the LPT.

(2) The limits in this section will help you know if the engine can continue to operate or if you must remove and repair it.

B. Equipment

(1) AP-10 Gasket - PWA ST1146-08

(2) Puller - PWA 86081 (For removal of the AP-10 Plug Assembly)

(3) Wedge (Block - Fan Blade) - PWA 102757 (3 are required during windy conditions)

(4) Packing - Preform AS3209-121

(5) Crank Pad Cover Packing - PWA AS3204-121

C. Consumable Materials

(1) D50124 Anti-seize paste (P06-054)

(2) D00776 Petroleum Solvent P-D-680, Type I

(3) D00244 Antiseize compound, high temperature - Silver Goop

D. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

E. Do the LPT Blade Inspection.

S 846-529-N00

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE BORESCOPE INSPECTION LIMITS ARE A RESULT OF TESTS AND STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHILE THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

(1) Do this procedure: Prepare for the Borescope Inspection.

No. 17 - LPT Blades (3rd-Stage) - Inspection

S 416-492-N00

WARNING: DO NOT DO A BORESCOPE INSPECTION IF THE WIND IS MORE THAN 3 - 5 MHP (4.8 - 8 KPH). DURING WINDY CONDITIONS, THE N1 ROTOR CAN TURN (WINDMILL). THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE BORESCOPE EQUIPMENT.

WARNING: INSTALL THE PWA 102757 WEDGES BETWEEN THE FAN BLADES WHEN THE WIND IS LESS THAN 3 - 5 MPH (4.8 - 8 KPH). IF YOU DO NOT INSTALL THE WEDGES DURING MILD WIND CONDITIONS, THE N1 CAN TURN (WINDMILL). THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE BORESCOPE EQUIPMENT.

(2) If the wind condition is less than 3 - 5 MPH (4.8 - 8 KPH), install the wedges as follows.
   (a) Do not install the wedges if the wind condition is more than 3 - 5 MPH (4.8 - 8 KPH).
   (b) Install two or three wedges between the fan blades and the fan case at approximately the 6 o'clock position.
   (c) Make sure the wedge is installed tight enough to prevent the fan blades from turning, but it must not raise the fan blades up.
   (d) The red warning streamer must go towards the front of the engine inlet.
   (e) If it is necessary to turn the N1 rotor to complete the borescope inspection, do the steps as follow.
      1) Remove the wedges.
      2) Turn the N1 rotor by hand and install the wedges again.
      3) Do this procedure again until the borescope inspection is complete.

S 016-386-N00

(3) Remove the plug from the LPT HPT access port AP-10; refer to Fig. 605 and 618 for the access port location and the borescope data.
   (a) Remove the two bolts that attach the plug stop to the case (Fig. 618).
   (b) Use a PWA 86081 Puller to remove, as an assembly, the plug, the plug stop, the spring washer, and the cotter pin; discard the gasket.

      NOTE: Do not remove the cotter pin.

No. 17 - LPT Blades (3rd-Stage) - Inspection

S 296-387-N00

WARNING: DO NOT USE THE POWER CABLE OF THE BORESCOPE IF YOU FIND CIRCUMFERENTIAL CUT HOLES, FRAYING, OR BROKEN HOLES IN THE EXTERNAL RUBBER COVERING ON THE CABLE. POWER CABLES WITH THOSE CONDITIONS CAN CAUSE INJURY TO PERSONS.

CAUTION: MAKE SURE THE TEMPERATURE OF THE INSPECTION AREAS ARE BELOW 150°F (65.6°C) BEFORE YOU USE THE BORESCOPE. IF THE CASES ADJACENT TO THE INSPECTION AREAS ARE TOO HOT TO KEEP YOUR HAND ON, YOU CAN CAUSE DAMAGE TO THE BORESCOPE.

(4) Put the borescope through the access port to examine the 3rd-stage LPT blades for nicks, dents, cracks, and other FOD.

S 226-480-N00

(5) If there has been a sudden increase in EGT, check for a possible missing or liberated LPT 3rd-stage outer transition duct segment.
   (a) No missing or liberated outer transition duct segments are permitted.

S 226-388-N00

(6) Compare the damage as identified in Fig. 622 with the continue-in-service limits shown in Fig. 622 and Table 606.

   CAUTION: IF YOU FIND DAMAGE THAT IS WORSE THAN THE CONTINUE-IN-SERVICE LIMITS, OR PIECES OF THE BLADE WILL FALL OFF, REMOVE THE ENGINE IMMEDIATELY. THIS TYPE OF DAMAGE CAN CAUSE MORE DAMAGE TO THE ENGINE IF IT IS NOT REPAIRED.

   (a) Refer to Fig. 622 and Table 606 for the LPT Blade continue-in-service limits.

No. 17 - LPT Blades (3rd-Stage) - Inspection

Table 606

CONDITION FOUND	BLADE AREA	3RD-STAGE LPT BLADE CONTINUE-IN-SERVICE LIMITS	
		SERVICEABLE LIMITS	REMOVE THE ENGINE BEFORE THE 6TH CYCLE
Cracks and Tears	A,B,C,E	No cracks or tears are permitted	No cracks or tears are permitted
	D	No cracks or tears are permitted	A tight radial crack or tear that is no more than 0.100 inch (2.54 mm) in length. .
Nicks	A,C,D,E	All nicks that are no more than 0.015 inch (0.381mm) in depth.	All nicks that are no more than 0.050 inch (1.27 mm) in depth.
	B	No nicks are permitted	All nicks that are no more than 0.030 inch (0.762 mm) in depth.

No. 17 - LPT Blades (3rd-Stage) - Inspection

Table 606

CONDITION FOUND	BLADE AREA	3RD-STAGE LPT BLADE CONTINUE-IN-SERVICE LIMITS: SERVICEABLE LIMITS	3RD-STAGE LPT BLADE CONTINUE-IN-SERVICE LIMITS: REMOVE THE ENGINE BEFORE THE 6TH CYCLE
Rounded Bottom Dents	A,C,D	All dents that are no more than 0.020 inch (0.508 mm) in depth and no more than 0.125 inch (3.175 mm) in diameter.	All dents that are no more than 0.050 inch (1.270 mm) in depth.
	B	All dents that are no more than 0.020 inch (0.508 mm) in depth and no more than 0.125 inch (3.175 mm) in diameter.	All dents that are no more than 0.030 inch (0.762 mm) in depth.
	E	All dents that are less than 0.020 inch (0.508 mm) in depth and less than 0.100 inch (2.540 mm) in diameter, or one dent that is 0.020-0.030 inch (0.508-0.762 mm) in depth and 0.100-0.50 (2.54-12.7 mm) in diameter.	All dents that are worse than the SERVICEABLE LIMITS.
Deterioration of the Surface Layer	A,B,C,D AND E	All decreases in the surface layer are permitted.	All decreases in the surface layer are permitted.

No. 17 - LPT Blades (3rd-Stage) - Inspection

Table 606

CONDITION FOUND	BLADE AREA	3RD-STAGE LPT BLADE CONTINUE-IN-SERVICE LIMITS: SERVICEABLE LIMITS	REMOVE THE ENGINE BEFORE THE 6TH CYCLE
Burned Areas or Erosion	A,C,D	All burned areas or erosion that is no more than 0.020 inch (0.508 mm) in depth and 0.300 inch (7.620 mm) in diameter.	All burned areas or erosion that is no more than 0.020 inch (0.508 mm) in depth and 0.300 inch (7.620 mm) in diameter.
	B	All burned areas or erosion that is no more than 0.010 inch (0.254 mm) in depth and 0.300 inch (7.620 mm) in diameter.	All burned areas or erosion that is no more than 0.010 inch (0.254 mm) in depth and 0.300 inch (7.620 mm) in diameter.
	E	All burned areas or erosion that is no more than 0.020 inch (0.508 mm) in depth and 0.300 inch (7.620 mm) in diameter.	All damage that is worse than the SERVICEABLE LIMITS
Sulfidation	A,B,C,D and E	No sulfidation is permitted.	On each blade, one area that is no more than 0.200 square inch (5.080 square mm) in area and no meterial that is gone. On each rotor, no more than five blades with sulfidation.
Blade Growth	A	No blade growth is permitted.	No blade growth is permitted.
		NOTE: A sign of blade growth is an increase in the length and a decrease in the perimeter.	

No. 17 - LPT Blades (3rd-Stage)-Inspection

S 416-389-N00

(7) Install the access port AP-10 (Fig. 605A):

(a) If the access port AP-10 is disassembled, assemble it for the installation.

NOTE: The plug assembly is not usually disassembled. If you will examine the 3rd-Stage LPT vanes and blades, do not install the AP-10 access plug.

1) When you install the spring tension washer in the cover recess, make sure these conditions occur: the outer diameter of the washer touches the cover, and the concave surface of the washer is adjacent to the cover.

2) From the washer side, put the plug in the assembled washer and cover.

3) Push the cotter pin in the plug until the cotter pin head is tightly against the flat side of the plug.

(b) With the split side to the inside, install the plug with a new AP-10 gasket.

NOTE: The plug will be in the case boss and the spring washer will push the plug to the inner side.

(c) Attach the plug stop cover to the plug (AP-10).

(d) Fully clean the bolt threads and the plug threads with petroleum solvent.

NOTE: This removes unwanted carbon and all used anti-seize paste.

(e) Apply a layer of Silver Goop to the threads of the bolts and remove the unwanted compound.

(f) Attach the plug stop to the access port boss with the bolts (Fig. 618).

1) Tighten the bolts.

(g) Install lockwire on the AP-10 plug.

S 016-493-N00

CAUTION: YOU MUST REMOVE ALL THE WEDGES AFTER THE BORESCOPE INSPECTION IS COMPLETE. IF THE WEDGES ARE NOT REMOVED, THE ENGINE WILL BE BE DAMAGED WHEN THE ENGINE IS STARTED.

(8) Remove all the wedges after you complete all of the borescope inspections.

S 416-390-N00

(9) Do this procedure: Put the Airplane Back to its Usual Condition.

No. 17 - LPT Blades (3rd-Stage)-Inspection

No. 18 - Put the Airplane Back to its Usual Condition

TASK 72-00-00-846-423-N00

18. Put The Airplane Back to its Usual Condition

A. General

(1) This procedure gives the steps to put the airplane back to its usual condition after the gaspath and unusual condition inspections.

B. References

(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System

C. Access

(1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

D. Put the Airplane Back to its Usual Condition

S 416-228-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reverser (AMM 78-31-00/201).

S 416-229-N00

(2) Close the core cowl panel (AMM 71-11-06/201).

S 416-230-N00

(3) Close the fan cowl panel (AMM 71-11-04/201).

S 446-523-N00

(4) For the left engine, remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
(a) 11D19, ENGINE START CONT L

No. 18 - Put the Airplane Back to its Usual Condition

S 446-524-N00

(5) For the right engine, remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
   (a) 11D20, ENGINE START CONT R

S 446-231-N00

(6) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

No. 19 - N2 Rotor - Manual Turn Procedure

TASK 72-00-00-986-445-N00

19. N2 Rotor - Manual Turn Procedure

A. General

(1) This procedure gives instructions how to turn the N2 rotor, without starter operation, during a borescope inspection or a N2 rotor rotation check.

B. Special Tools and Equipment

(1) PWA 85572-1 - Foot Operated Rotator, Pratt & Whitney, Commercial Products Division, 400 Main Street, East Hartford, CT 06108

NOTE: PWA 85572-1 foot operated rotator is an alternative to these tools:

PWA 85572-2 Hand Operated Rotator, the
PWA 49058 Hand Ratchet Rotor, the
PWA 76271 Engine Turning Control Kit and the
PWA 102089 Engine Turning Control Kit.

(2) PWA 85572-2 - Hand Operated Rotator, Pratt & Whitney

NOTE: PWA 85572-2 hand operated rotator is an alternative to these tools:

PWA 85572-1 Foot Operated Rotator, the
PWA 49058 Hand Ratchet Rotor, the
PWA 76271 Engine Turning Control Kit and the
PWA 102089 Engine Turning Control Kit.

(3) PWA 49058 - Rotator, Hand Ratchet, Pratt & Whitney

NOTE: PWA 49058 hand ratchet rotator is an alternative to these tools:

PWA 85572-1 Foot Operated Rotator, the
PWA 85572-2 Hand Operated Rotator, the
PWA 76271 Engine Turning Control Kit and the
PWA 102089 Engine Turning Control Kit.

(4) PWA 86441 - Drive Unit

NOTE: PWA 86441 drive unit is used with PWA 76271 Engine Turning Control Kit.

No. 19 - N2 Rotor - Manual Turn Procedure

(5) PWA 102093 - Drive Adapter, Engine Turning

NOTE: PWA 102093 Engine Turning Drive Adapter is used with the PWA 102089 Engine Turning Control Kit.

PWA 102093 Engine Turing Drive Adapter is an alternative to the PWA 102090 Engine Turning Drive Adapter.

(6) PWA 102090 - Drive Adapter, Engine Turning

NOTE: PWA 102090 Engine Turning Drive Adapter is used with the PWA 102089 Engine Turning Control Kit.

PWA 102090 Engine Turing Drive Adapter is an alternative to the PWA 102093 Engine Turning Drive Adapter.

(7) PWA 76271 - Control Kit, Engine Turning

NOTE: PWA 76271 Engine Turning Drive is used with the PWA 86441 Drive Unit.

PWA 76271 Engine Turing Control Kit is an alternative to these tools:

PWA 85572-1 Foot Operated Rotator, the
PWA 85572-2 Hand Operated Rotator, the
PWA 49058 Hand Ratchet Rotor, and the
PWA 102089 Engine Turning Control Kit.

(8) PWA 85768 - Knocker Puller, Pratt & Whitney

C. Equipment
   (1) Wrench - Equipped with 9/16-inch drive
   (2) Air Source - Compressed, filtered, dry (for connection to pneumatic motor of hand or foot operated rotator)
   (3) Container - 1 gallon (4 liter) capacity, applicable to collect oil
   (4) Crank Pad Cover Packing - PWA AS3209-121

D. Consumable Materials
   (1) D00390 Oil - Engine
   (2) D50124 Anti-seize paste (P06-054)

E. References
   (1) AMM 71-00-00/501, Power Plant
   (2) AMM 71-11-04/201, Fan Cowl Panels
   (3) AMM 71-11-06/201, Core Cowl Panels
   (4) AMM 78-31-00/201, Thrust Reverser System

No. 19 - N2 Rotor - Manual Turn Procedure

F. Access

(1) Location Zone

412	Engine 1 - Main Gearbox Fwd Face 5:30 o'clock
422	Engine 2 - Main Gearbox Fwd Face 5:30 o'clock
432	Engine 3 - Main Gearbox Fwd Face 5:30 o'clock
442	Engine 4 - Main Gearbox Fwd Face 5:30 o'clock

(2) Access Panel

415 and 416	Thrust Reverser Halves - Engine 1
425 and 426	Thrust Reverser Halves - Engine 2
435 and 436	Thrust Reverser Halves - Engine 3
445 and 446	Thrust Reverser Halves - Engine 4

G. Prepare the Aircraft

S 046-446-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(1) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-447-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 016-448-N00

(3) Open the core cowl panels (AMM 71-11-06/201).

S 016-449-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open each half of the thrust reverser (AMM 78-31-00/201).

H. Procedure

S 016-450-N00

(1) Find and remove the cover from the manual crank pad on the bearing housing of the scavenge pump drive (Fig. 606, View A).

(a) Put the container below the main gearbox to catch the oil.

No. 19 - N2 Rotor - Manual Turn Procedure

CAUTION: DO NOT REMOVE THE BEARING HOUSING OF THE SCAVENGE PUMP. THE INSTALLATION OF THE BEARING HOUSING IS DIFFICULT AND AN INCORRECT INSTALLATION WILL CAUSE DAMAGE TO THE BEARING.

(b) Remove the two bolts and the washers that hold the cover on the manual crank pad.
(c) Use the puller to remove the cover.
(d) Remove and discard the packing from the cover.

NOTE: If the engine has sat for over 2 hours since shutdown, oil leakage can be found when the manual crank pad cover is removed. Oil accumulation behind this cover can occur due to leak-back from the oil tank through the oil pump. This condition is considered normal so no maintenance action is required.

S 986-451-N00

CAUTION: DO NOT MANUALLY TURN THE N2 ROTOR UNTIL THE ENGINE IS COOL. THE FORCE NECESSARY TO TURN THE N2 ROTOR WHEN THE ENGINE IS HOT CAN BREAK THE SHEAR PIN IN THE TOOL.

(2) Do the steps that follow to install and use the pneumatic N2 rotator (Fig. 606):
(a) Install one of the tools that follow into the opening of the manual crank pad:

NOTE: Make sure the socket aligns correctly with the hexagonal end of the idler gear of the scavenge pump.

1) Wrench
2) PWA 85572-2
3) PWA 85572-1.

(b) If you use the hand or the foot operated rotator, do these steps:
1) Attach the rotator to the manual crank pad with two cap screws that come in the rotator kit.
2) Tighten the screws.
3) Connect the air source to the pneumatic motor of the rotator.

(c) Manually turn the N2 rotor until it is in the necessary position.
(d) After operation of the N2 rotor rotator, disconnect the air source and remove the rotator if applicable.

No. 19 - N2 Rotor - Manual Turn Procedure

S 986-452-N00

(3) Alternatively, do the steps that follow to install and use the electronic N2 rotator (Fig. 606, Views B through F):

(a) Engage the PWA 86441 drive unit to the hexagonal end of the idler gear of the oil pump.
(b) Attach the drive unit to the manual crank pad with the two cap screws that come in the rotator kit.
(c) Tighten the screws.
(d) Attach the drive unit to the power unit with the drive unit cable (PWA 76271 control kit).
(e) Use the remaining three cables to connect the controller and the AC power source to the power unit, and the foot switch to the controller.
(f) Set the controller to have the correct program for the engine.
(g) To operate the electronic N2 rotator, refer to the Manufacturer's Instruction Manual that is included in the control kit.
(h) After operation of the N2 rotor rotator, remove the control cables and remove the drive unit from the manual crank pad.

S 986-469-N00

(4) Alternatively, do the steps that follow to install and use the hand N2 rotator:

(a) Attach the detail socket and adapter to the ratchet assembly.
(b) Attach the PWA 49058 Hand Rotator to the manual crank pad with the two nuts that come in the rotator kit.

NOTE: Make sure the socket aligns correctly with the hexagonal end of the idler gear of the oil pump.

(c) Manually turn the N2 rotor until it is in the necessary position.
(d) Remove the hand rotator from the manual crank pad.

S 986-470-N00

(5) Alternately, do the steps that follow to install the PWA 102089 Controller Kit:

NOTE: The PWA 102089 is the Rhinesthal Corporation Engine Turning Controller Kit.

(a) Attach one of the following drive adapters to the N2 rotator pad:

NOTE: Make sure the socket aligns correctly with the hexagonal end of the idler gear of the oil pump.

1) Drive Adapter - PWA 102093, PWA 102390.

No. 19 - N2 Rotor - Manual Turn Procedure

(b) Attach the drive unit to the drive adapter.
(c) Refer to the manufacturer's instructions for assembly of the rotator kit.
(d) Connect the electrical power cable to the AC power source.
(e) Turn the N2 rotor until it is in the necessary position.
(f) Remove the power cable from the power unit or remove the air supply to the pneumatic motor.
(g) Remove the cables from the rotator and the controller.
(h) Remove the two rotator attachment bolts.
(i) Remove the rotator from the gearbox.

S 416-453-N00
(6) Install the cover of the manual crank pad:
(a) Lubricate a new packing with engine oil.
(b) Install the new packing on the cover.

CAUTION: MAKE SURE YOU INSTALL THE PACKING AND THE COVER CORRECTLY. AN INCORRECT INSTALLATION CAN CAUSE OIL PRESSURE TO GO TO ZERO DURING ENGINE OPERATION AND CAUSE SUBSEQUENT DAMAGE TO THE ENGINE.

(c) Lubricate the threads of the two bolts with anti-seize paste.
(d) Install the crank pad cover with the two bolts and washers.
(e) Tighten the bolts to 62-72 pound-inches (7.0-8.1 newton-meters).
(f) Do a test of the manual crank pad cover that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

I. Return the Aircraft to its usual condition

S 416-454-N00

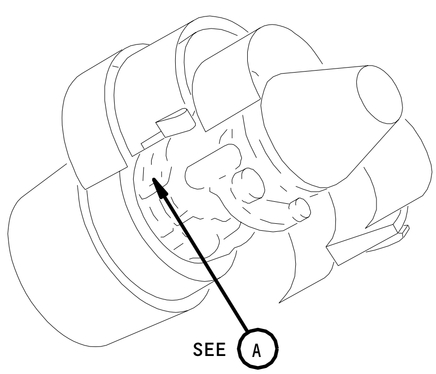
WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

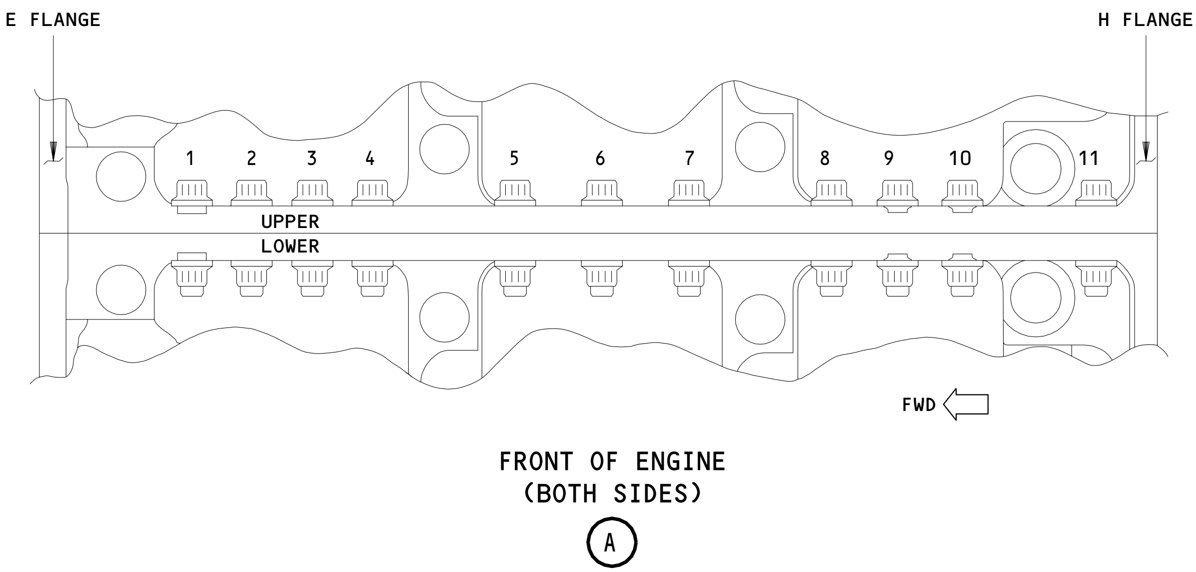
(1) Close the thrust reverser (AMM 78-31-00/201).

S 416-455-N00
(2) Close the core cowl panel (AMM 71-11-06/201).

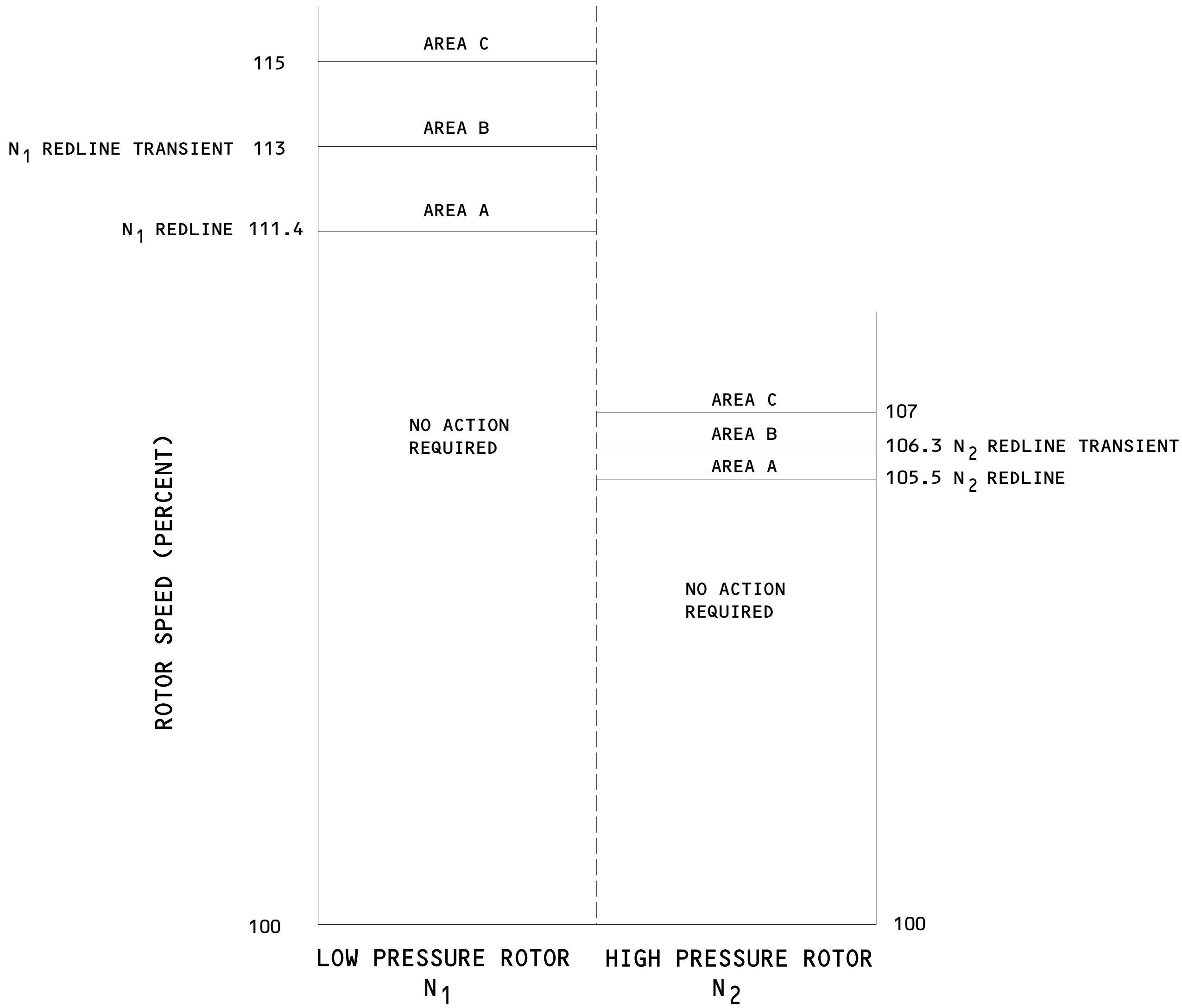
S 416-456-N00
(3) Close the fan cowl panel (AMM 71-11-04/201).

S 446-457-N00
(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).





HPC Front Case Split Flange Bolts
Figure 601



Rotor Overspeed Maintenance Actions
Figure 601A

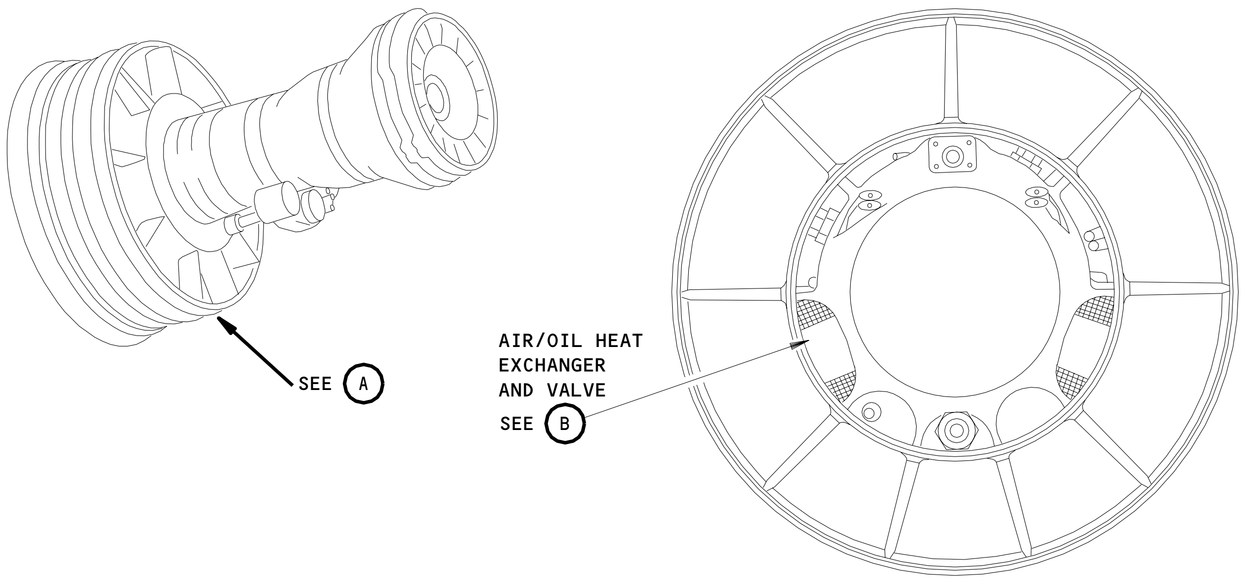
OIL TEMPERATURE	LENGTH OF TIME AT OVERTEMPERATURE	NECESSARY PROCEDURE
325-350°F (163-177°C)	LESS THAN 20 MIN 1	NONE
	MORE THAN 20 MIN 2	SEE OVERTEMPERATURE INSPECTION
351-400°F (178-204°C)	ALL LENGTHS OF TIME 3	
401°F (205°C)+	ALL LENGTHS OF TIME 3	SEE OVERTEMPERATURE INSPECTION FOR VERY HIGH TEMPERATURE

1 WHILE AT A CHANGE FROM HIGH POWER (HIGH OIL TEMP, LOW FUEL FLOW)

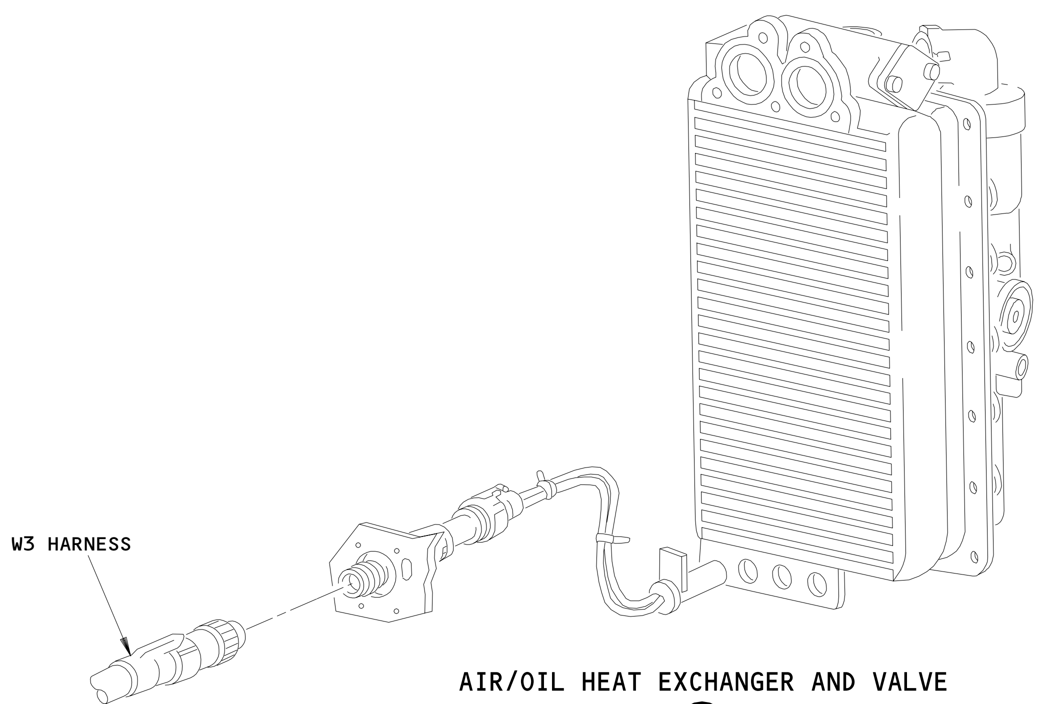
2 AT STEADY STATE OPERATION

3 AT ALL CONDITIONS OF OPERATION

Oil System Overtemperature
Figure 602



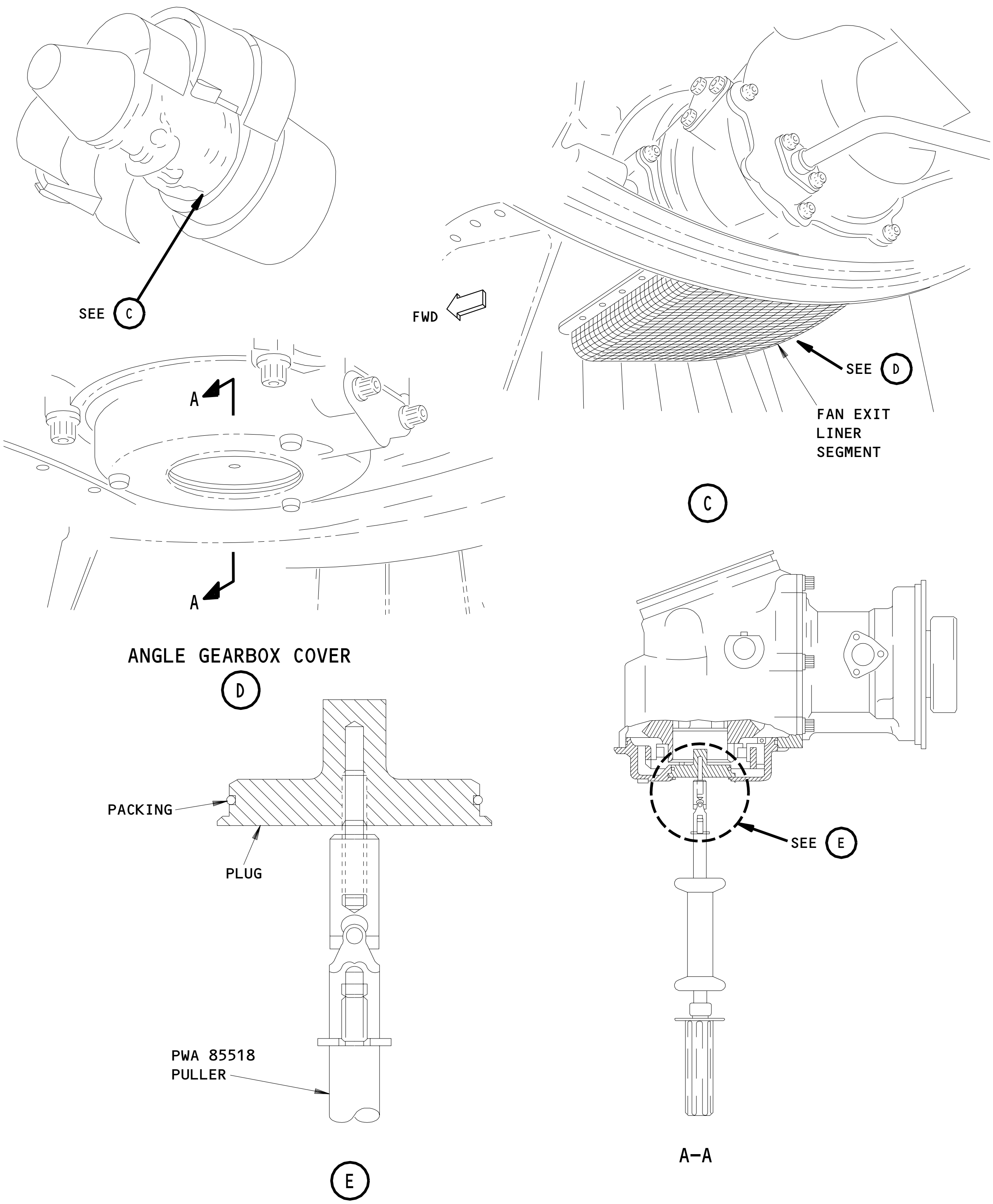
INTERMEDIATE CASE
(VIEW IN THE FORWARD DIRECTION)
A



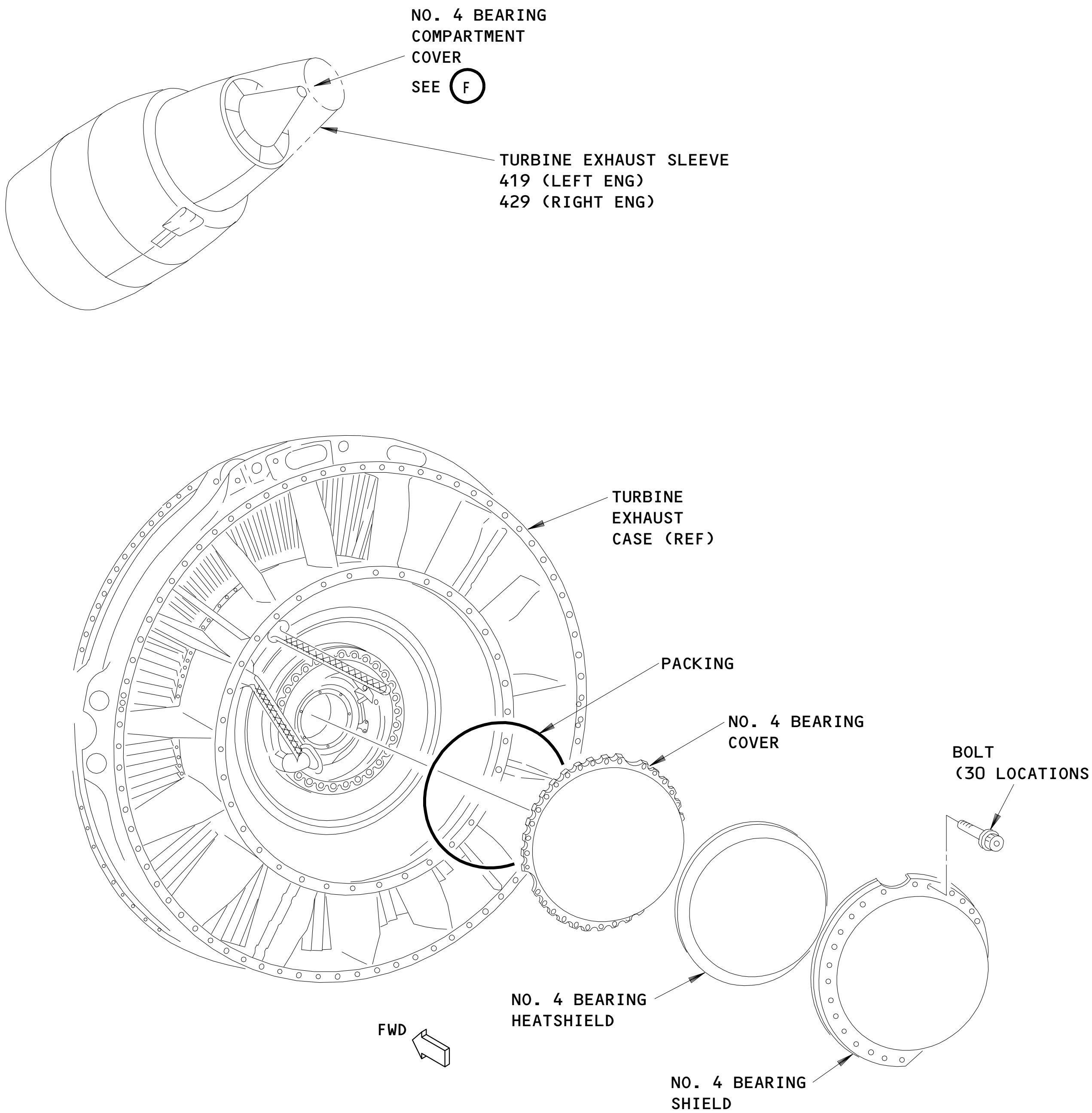
AIR/OIL HEAT EXCHANGER AND VALVE
B

L-A4834

Air/Oil Heat Exchanger and Valve Inspection
Figure 602A (Sheet 1)



Air/Oil Heat Exchanger and Valve Inspection
Figure 602A (Sheet 2)



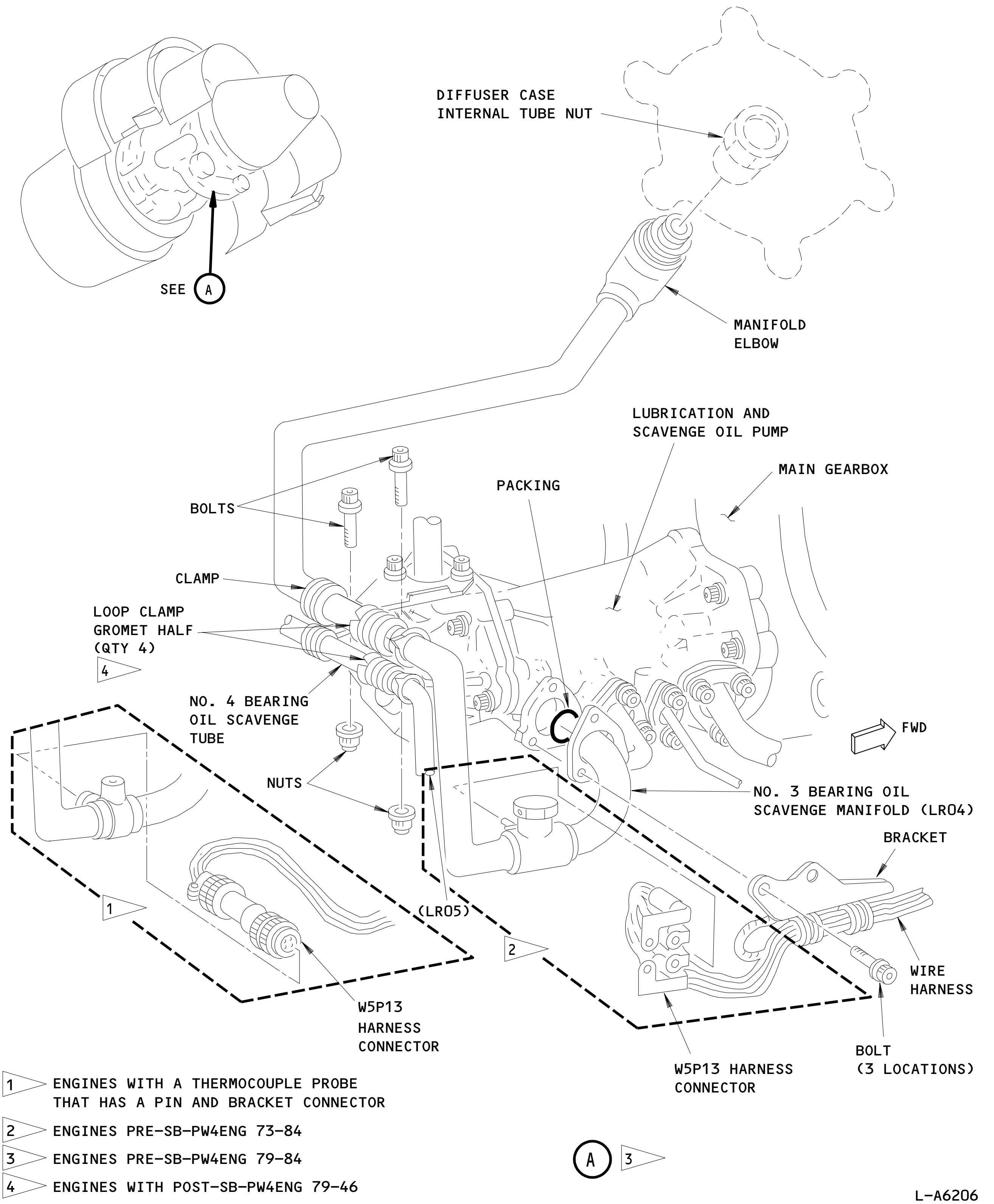
NOTE: EXHAUST SLEEVE AND EXHAUST PLUG REMOVED.

NO. 4 BEARING COMPARTMENT COVER

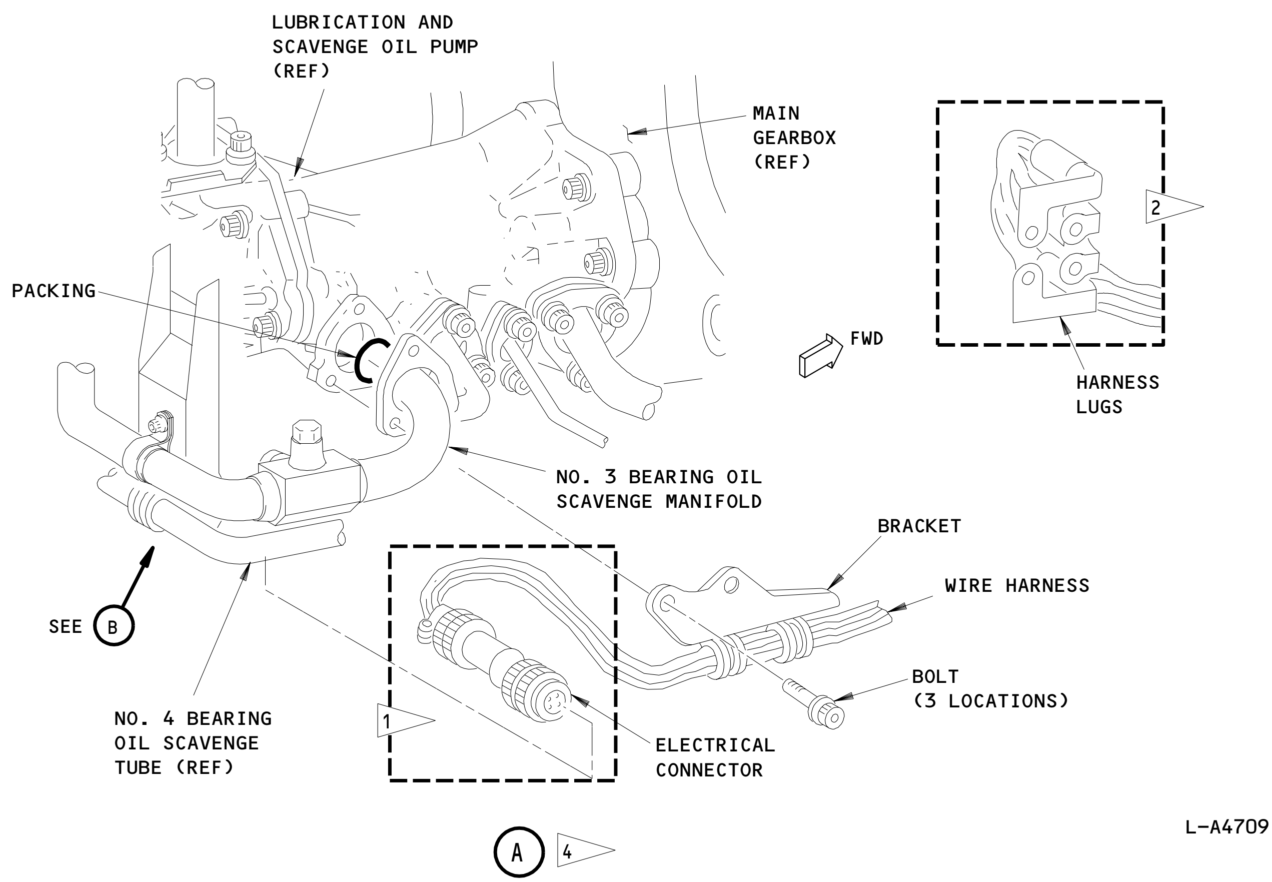
F

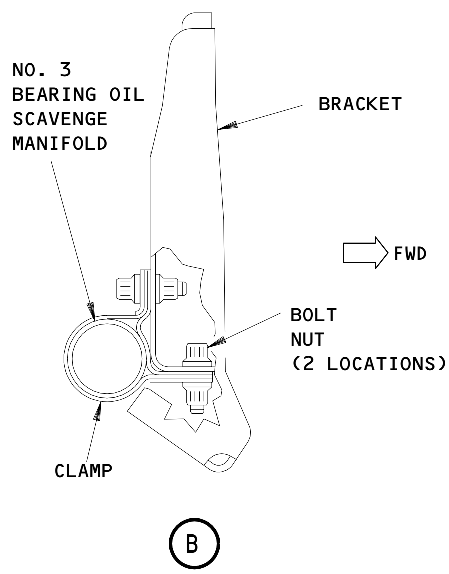
L-A4493

Air/Oil Heat Exchanger and Valve Inspection
Figure 602A (Sheet 3)

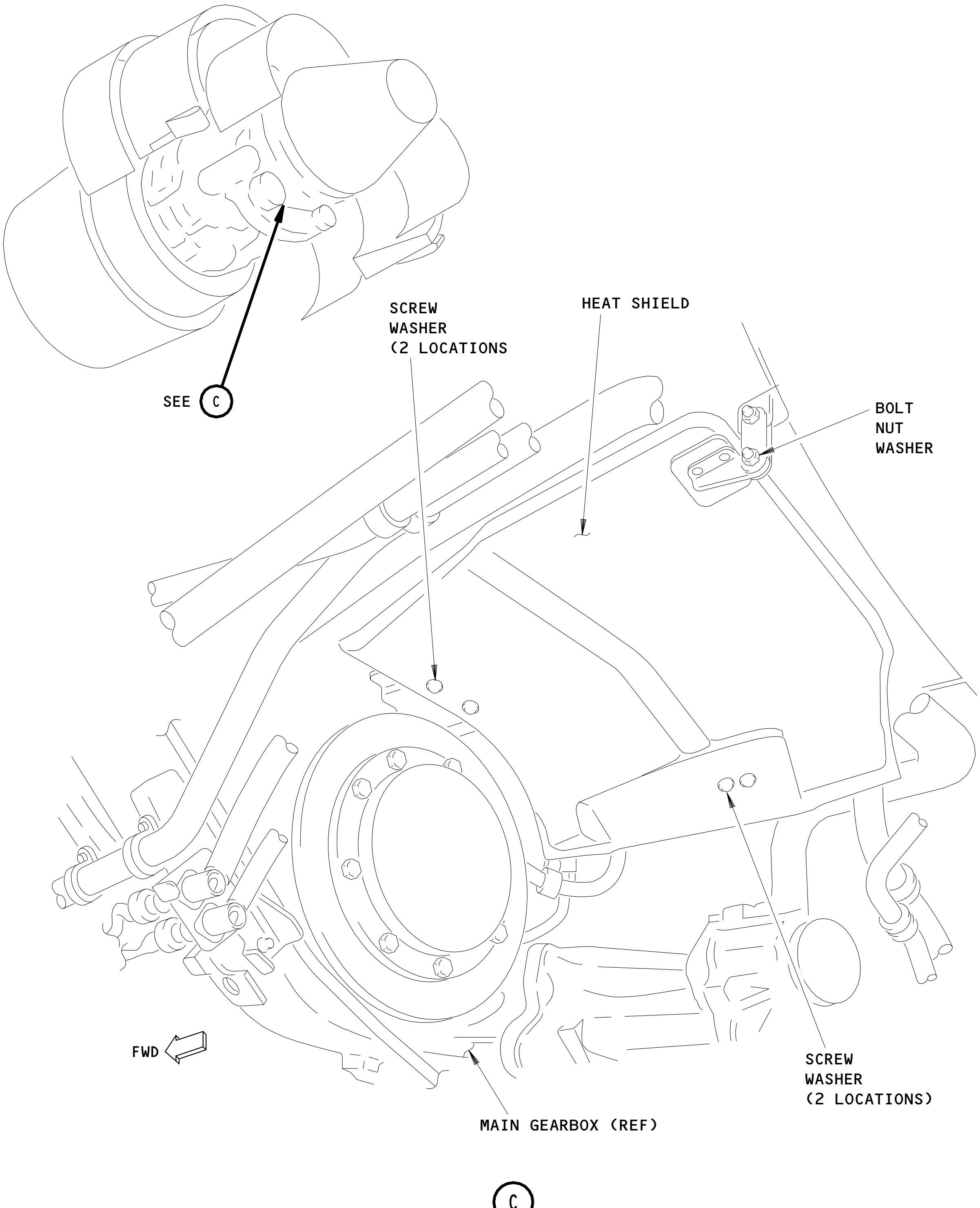


No. 3 Bearing Oil Scavenge Manifold Inspection
Figure 603 (Sheet 1)



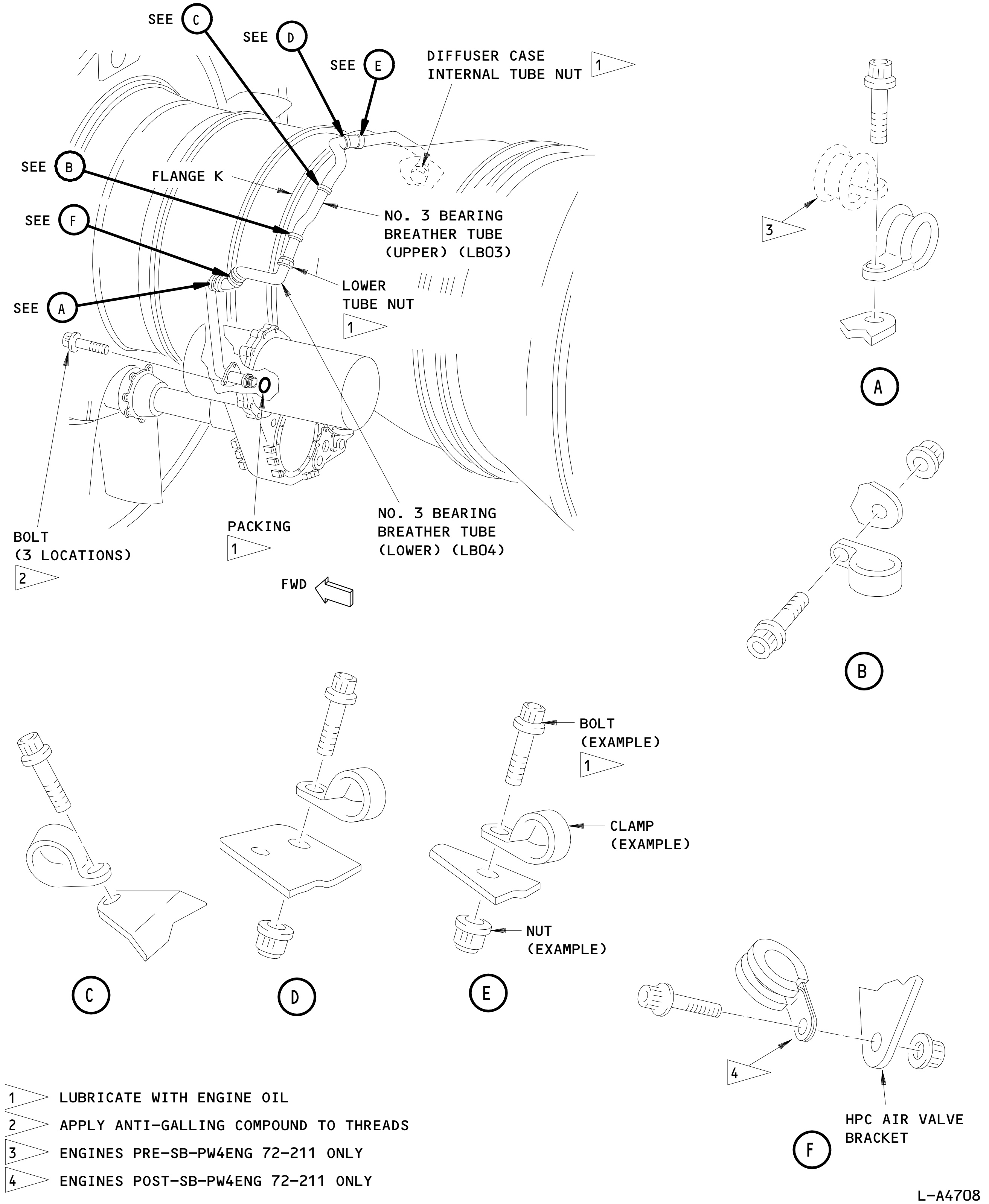


No. 3 Bearing Oil Scavenge Manifold Inspection
Figure 603 (Sheet 2)



NOTE: IDG SHOWN REMOVED.

No. 3 Bearing Oil Scavenge Manifold Inspection
Figure 603 (Sheet 3)



1 LUBRICATE WITH ENGINE OIL

2 APPLY ANTI-GALLING COMPOUND TO THREADS

3 ENGINES PRE-SB-PW4ENG 72-211 ONLY

4 ENGINES POST-SB-PW4ENG 72-211 ONLY

L-A4708

No. 3 Bearing Breather Tube
Figure 604

ACCESS PORT	ANGULAR POSITION CLOCKWISE FROM REAR	GASPATH LOCATION	PART(S) IN VIEW FOR INSPECTION	RECOMMENDED MAXIMUM PROBE DIAMETER IN/mm
THRU FAN	ALL	LPC COMPRESSOR INLET	1ST C-VANE 1ST C-BLADE	--
AP-1	245°	4TH-STAGE COMPRESSOR VANE	REAR OF 4TH C-BLADE FRONT OF 4TH C-VANE	--
AP-2	233°	5TH-STAGE COMPRESSOR VANE	REAR OF 5TH C-BLADE FRONT OF 6TH C-BLADE	0.270/6.8
AP-3	231°	6TH-STAGE COMPRESSOR VANE	REAR OF 6TH C-BLADE FRONT OF 7TH C-BLADE	0.270/6.8
AP-4	127°	8TH-STAGE COMPRESSOR VANE	REAR OF 8TH C-BLADE FRONT OF 9TH C-BLADE	0.270/6.8
AP-5	214°	10TH-STAGE COMPRESSOR VANE	REAR OF 10TH C-BLADE FRONT OF 11TH C-BLADE	0.270/6.8
AP-6	98°	12TH-STAGE COMPRESSOR VANE	REAR OF 12TH C-BLADE FRONT OF 13TH C-BLADE	0.270/6.8
AP-7	80°	14TH-STAGE COMPRESSOR VANE	REAR OF 14TH C-BLADE FRONT OF 15TH C-BLADE	0.270/6.8
AP-8	45°, 128°, 172°, 225°, 277°, 338°	COMBUSTION CHAMBER	FUEL NOZZLE COMBUSTION CHAMBER 1ST TURBINE VANE	0.444/11.3
AP-9	93°	COMBUSTION CHAMBER	FRONT OF 1ST T-VANE FRONT OF 1ST T-BLADE	0.270/6.8
AP-10	139°	TRANSITION DUCT	REAR OF 2ND T-BLADE FRONT OF 3RD T-VANE	0.270/6.8
AP-11	215°	STAGE 2 TURBINE BLADE	REAR OF 1ST T-BLADE FRONT OF 2ND T-BLADE	0.444/11.3
THRU EXHAUST CASE STRUTS	ALL		6TH T-BLADE 6TH T-VANE	

Borescope Access Port Data
Figure 605 (Sheet 1)

ACCESS PORT	NOTES
THRU FAN	
AP-1	1 7
AP-2	
AP-3	
AP-4	
AP-5	2
AP-6	3
AP-7	
AP-8, 45°	5
AP-8, 128°	5
AP-8, 172°	5 9
AP-8, 225°	5
AP-8, 277°	4
AP-8, 338°	5 6
AP-9	
AP-10	
AP-11	8

1 ACCESS IS THROUGH FOURTEEN 2.5 BLEED VALVE OPENINGS IN THE INNER LINING OF THE FAN EXIT CASE. A FLEXIBLE PROBE IS NECESSARY AT THIS ACCESS PORT.

2 BORESCOPE MUST BE ANGLED 5° AFT OF THE PLANE THAT IS AT 90° TO THE ENGINE CENTERLINE TO INSERT PROBE.

3 BORESCOPE MUST BE ANGLED 15° AFT OF PLANE THAT IS AT 90° TO ENGINE CENTERLINE TO INSERT PROBE.

4 BORESCOPE MUST BE ANGLED 21° FORWARD OF PLANE THAT IS AT 90° TO ENGINE CENTERLINE TO INSERT PROBE.

5 BORESCOPE MUST BE ANGLED 7.5° FORWARD OF PLANE THAT IS AT 90° TO ENGINE CENTERLINE TO INSERT PROBE.

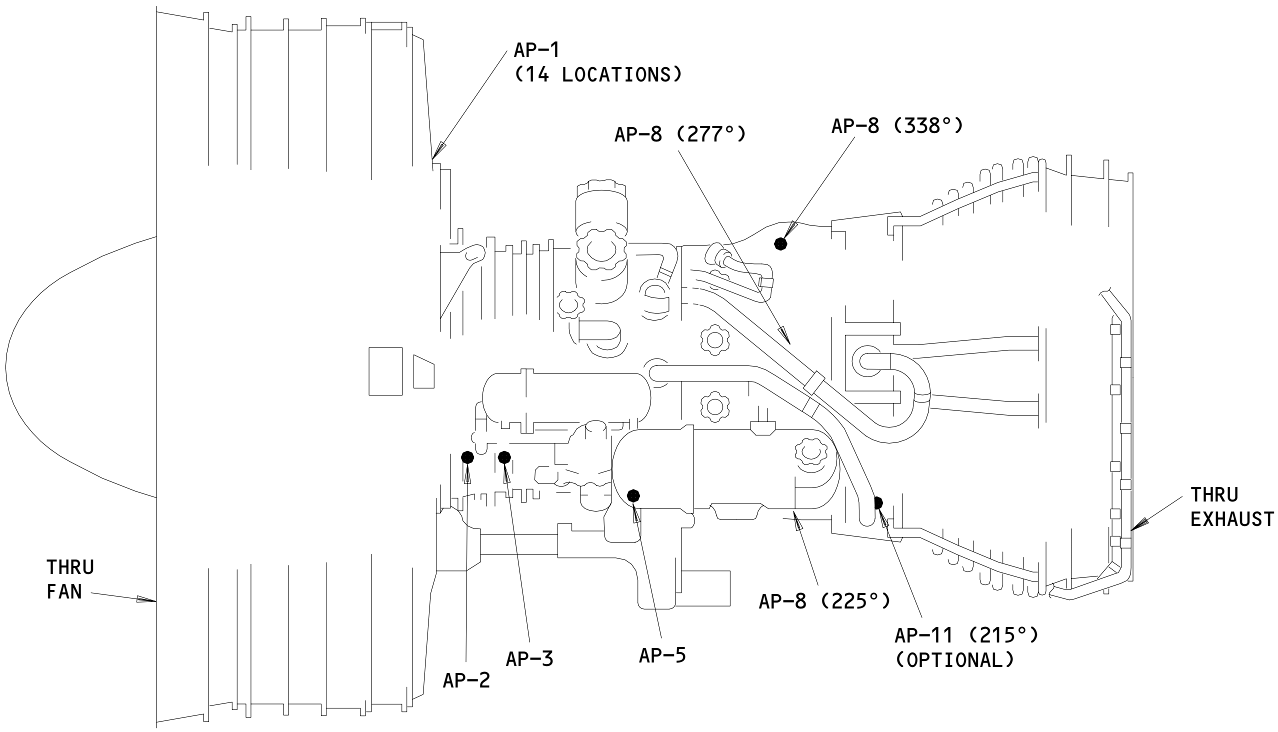
6 RIGHT ANGLE EYEPIECE RECOMMENDED.

7 ALLOW 3-4 INCHES (76-102 mm) FOR THE EYEPIECE LENGTH.

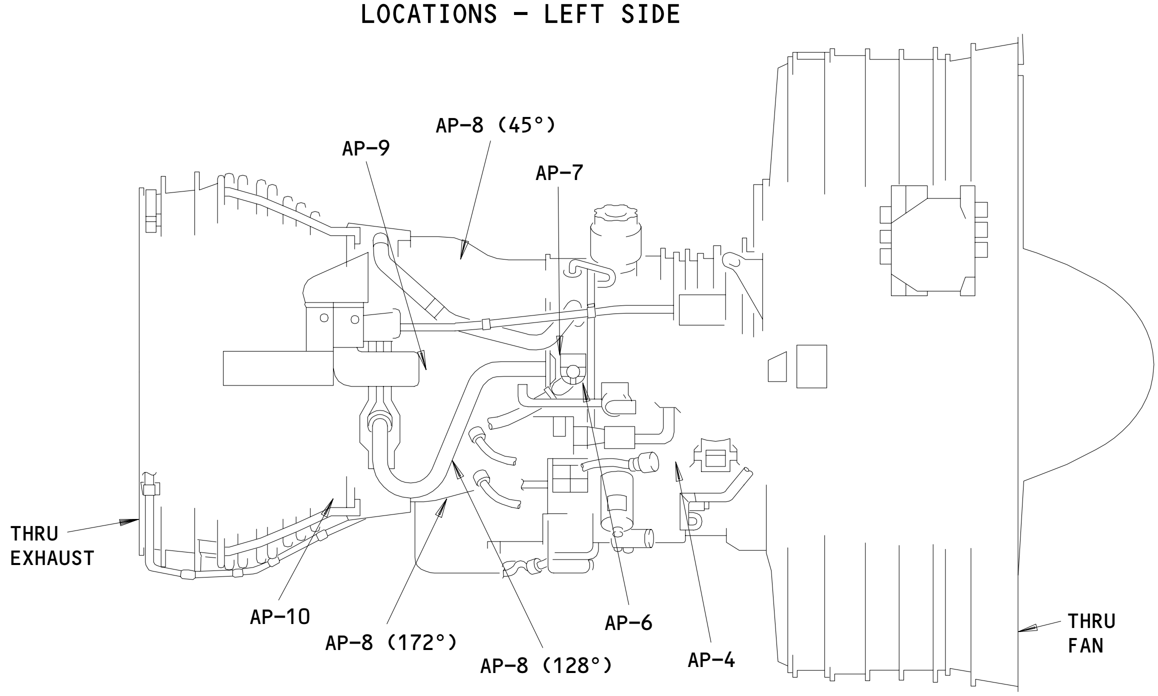
8 OPTIONAL BORESCOPE PORT LOCATION

9 RIGHT ANGLE EYEPIECE IS NECESSARY.

Borescope Access Port Data
Figure 605 (Sheet 2)

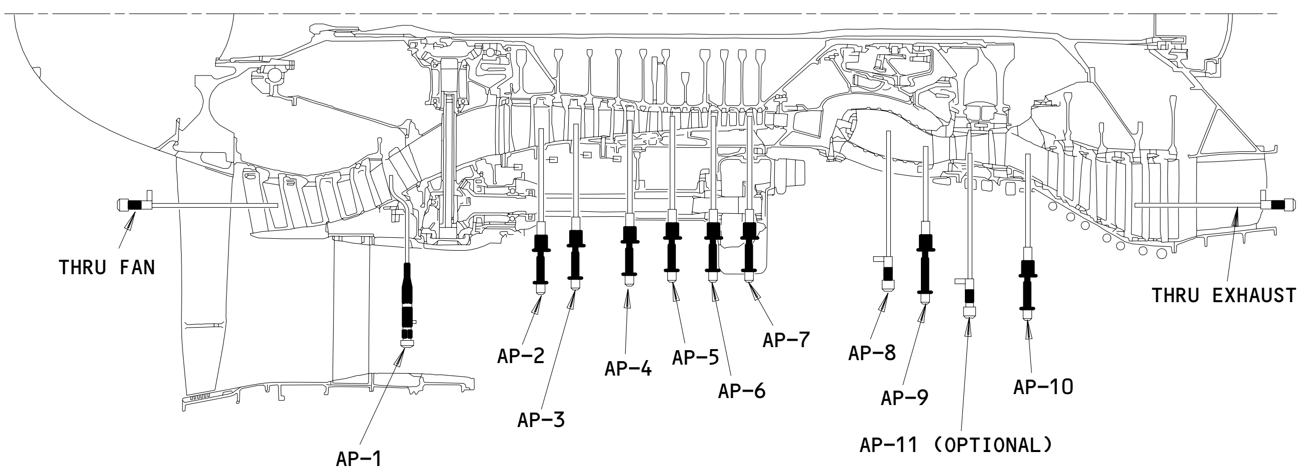


BORESCOPE ACCESS PORT
LOCATIONS - LEFT SIDE



BORESCOPE ACCESS PORT
LOCATIONS - RIGHT SIDE

Borescope Access Port Data
Figure 605 (Sheet 3)



ACCESS PORT GASPATH LOCATION

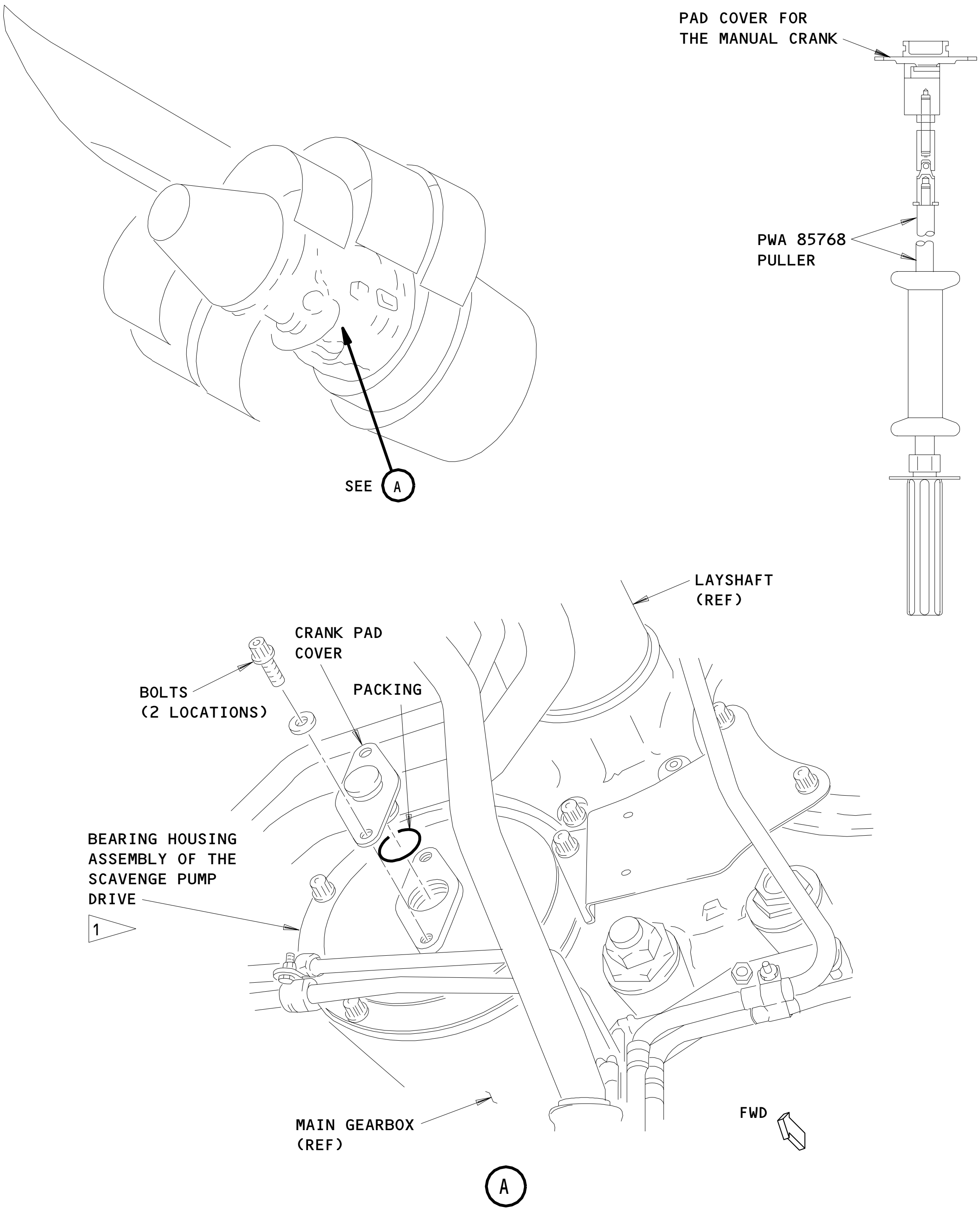
L-A0640
0688

Borescope Access Port Data
Figure 605 (Sheet 4)

ACCESS PORT	ENGINE LOCATION	PACKING/ GASKET	LOCKING METHOD	PLUG LUBRICANT	TORQUE VALUE INCH-POUNDS (NEWTON-METERS)
AP-2	HPC 5TH-STAGE VANE	NO	SELF-LOCKING INSERT FOR EARLIER PLUG KEY WASHER (PN 53H027) FOR LATER PLUG	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-3	HPC 6TH-STAGE VANE	NO	SELF-LOCKING INSERT FOR EARLIER PLUG KEY WASHER (PN 53H028) FOR LATER PLUG	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-4	HPC 8TH-STAGE VANE	NO	SELF-LOCKING INSERT	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-5 (OUTER)	HPC 10TH-STAGE VANE	NO	[3] KEY WASHER (MS 9582-19)	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-5 (OUTER)	HPC 10TH-STAGE VANE	NO	[4] KEY WASHER (58H216)	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-5 (INNER)	HPC 10TH-STAGE VANE	NO	PLUG ASSEMBLY WITH INTEGRAL LOCK WASHER	ANTIGALLING COMPOUND [1]	175-190 (19.8-21.5)
AP-5 (INNER)	HPC 10TH-STAGE VANE	NO	PLUG ASSEMBLY WITH INTEGRAL LOCK WASHER	[2] [4] [6]	175-190 (19.8-21.5)
AP-6	HPC 12TH-STAGE VANE	NO	SELF-LOCKING INSERT	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-7 (OUTER)	HPC 14TH-STAGE VANE	NO	[3] KEY WASHER (MS 9582-19)	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-7 (OUTER)	HPC 14TH-STAGE VANE	NO	[4] KEY WASHER (58H216)	ANTIGALLING COMPOUND	175-190 (19.8-21.5)
AP-7 (INNER)	HPC 10TH-STAGE VANE	NO	SELF-LOCKING INSERT	ANTIGALLING COMPOUND [1]	175-190 (19.8-21.5)
AP-7 (INNER)	HPC 10TH-STAGE VANE	NO	SELF-LOCKING INSERT	[2] [4] [6]	175-190 (19.8-21.5)
AP-8 (45)	DIFFUSER CASE	GASKET	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-8 (128)	DIFFUSER CASE	GASKET	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-8 (172)	DIFFUSER CASE	GASKET	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-8 (225)	DIFFUSER CASE	GASKET	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-8 (277)	DIFFUSER CASE	GASKET	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-8 (338)	DIFFUSER CASE	GASKET	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-9	REAR OF DIFFUSER CASE	WASHER	LOCKWIRE	SILVER GOOP	40-50 (4.5-5.6)
AP-10	2ND-STAGE HPT BLADE	GASKET	LOCKWIRE	SILVER GOOP	54-60 (6.1-6.8)
AP-11 [5]	1ST-STAGE HPT BLADE	GASKET	LOCKWIRE	ENGINE OIL ON BOLT THREADS	75-85 (8.5-9.6)

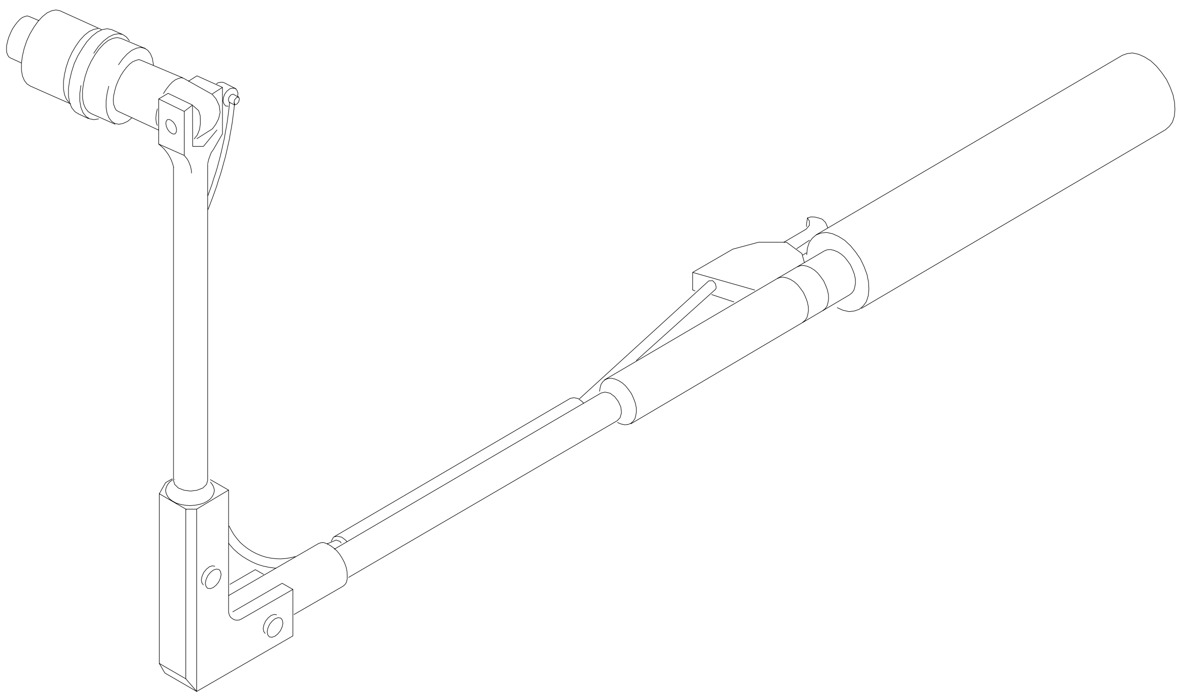
[1] ENGINES PRE-PW-SB 72-675
[2] ENGINES POST-PW-SB 72-675
[3] ENGINES PRE-PW-SB 72-708
[4] ENGINES POST-PW-SB 72-708
[5] ENGINES POST-PW-SB 72-157
[6] ENGINES POST-PW-SB 72-755

Borescope Access Port Installation Data
Figure 605A



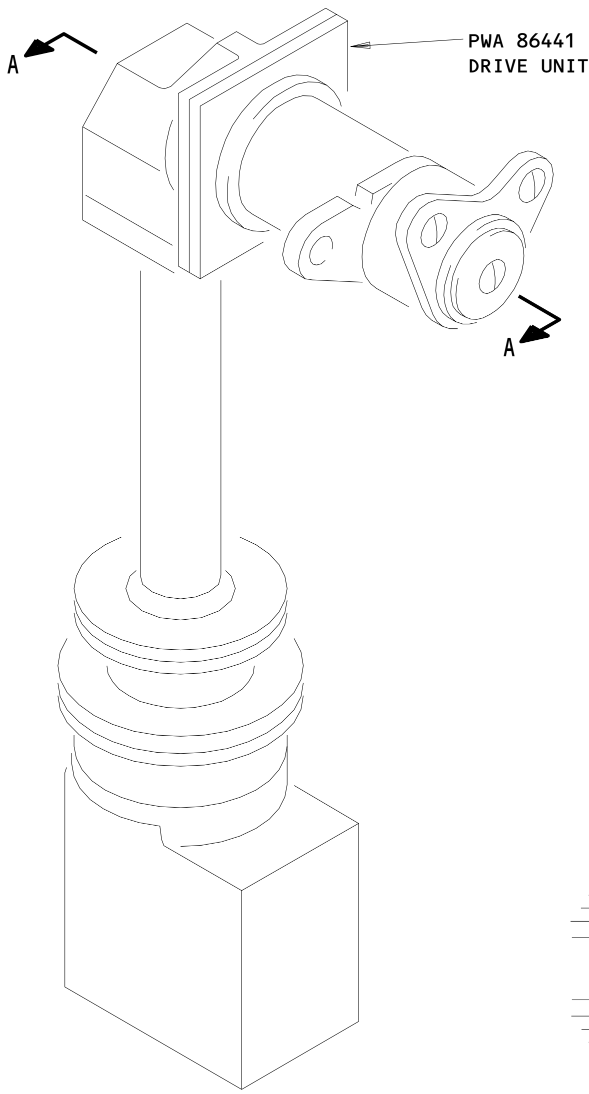
1 DO NOT REMOVE. THE INSTALLATION IS NOT EASY. INCORRECT INSTALLATION WILL DAMAGE THE BEARING.

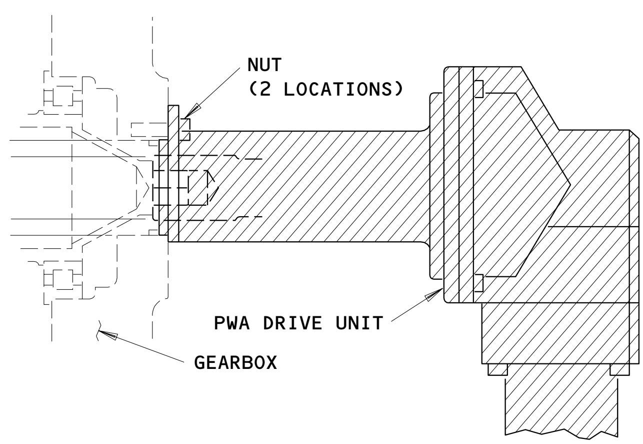
High Pressure Rotor Rotator
Figure 606 (Sheet 1)



N2 ROTOR MANUAL CRANKING

High Pressure Rotor Rotator
Figure 606 (Sheet 2)

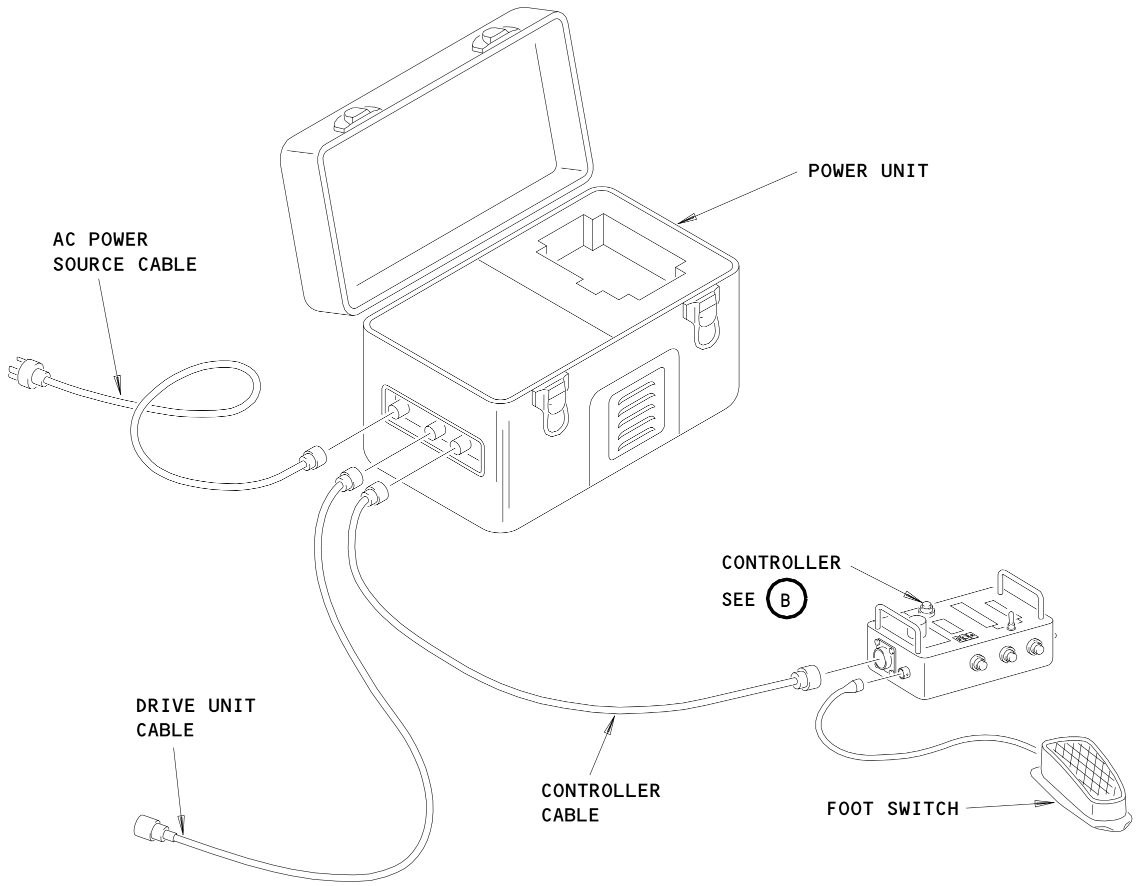




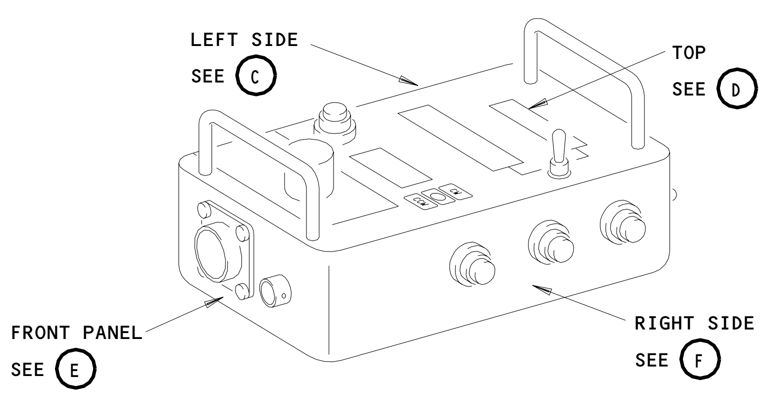
PWA 86441 DRIVE UNIT SHOWN
INSTALLED ON THE GEARBOX
A-A

L-96830(0000)

High pressure Rotor Rotator
Figure 606 (Sheet 3)



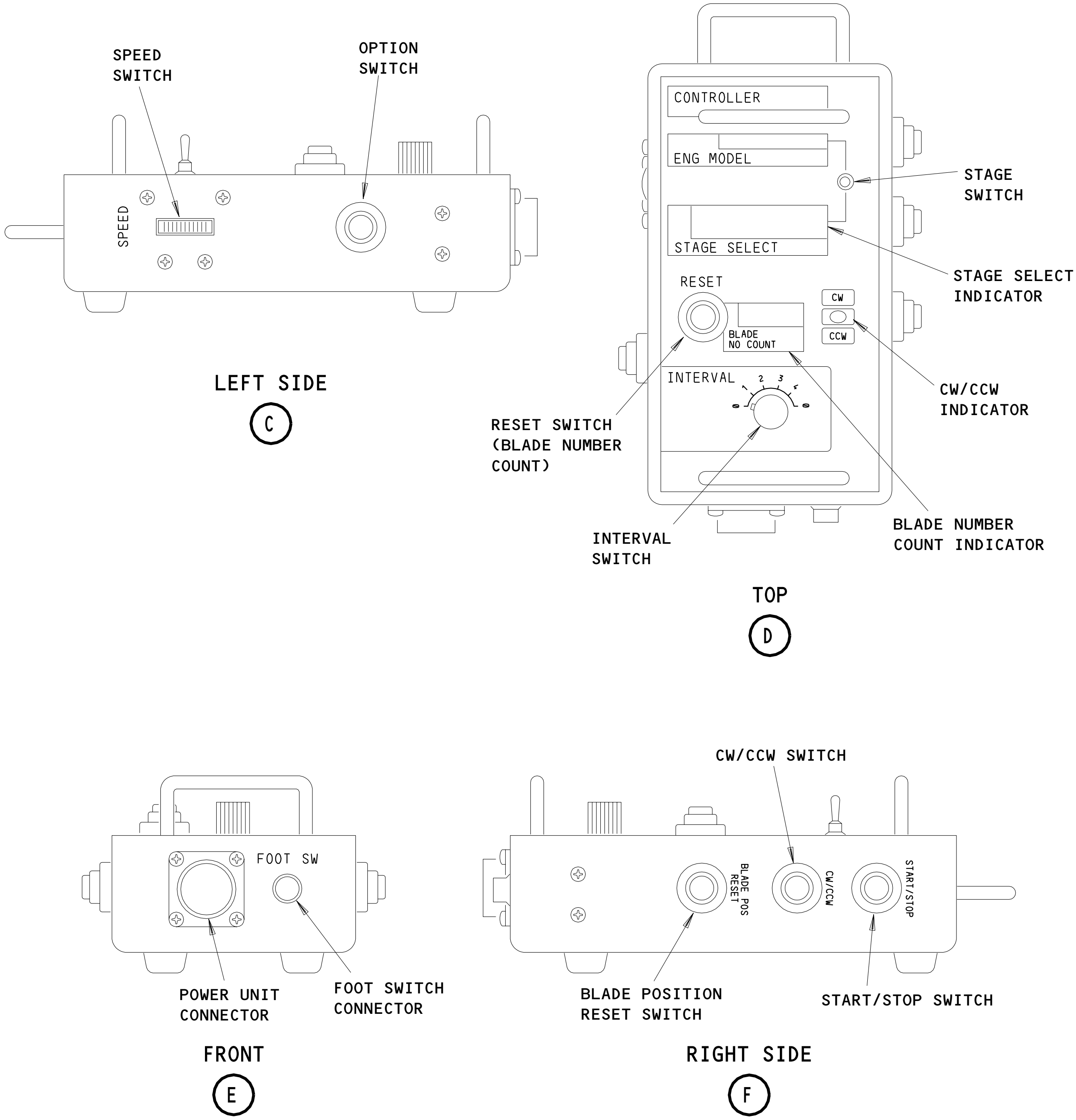
PWA 76271 ENGINE TURNING CONTROL KIT



CONTROLLER
B

L-96831(0000)

High Pressure Rotor Rotator
Figure 606 (Sheet 4)



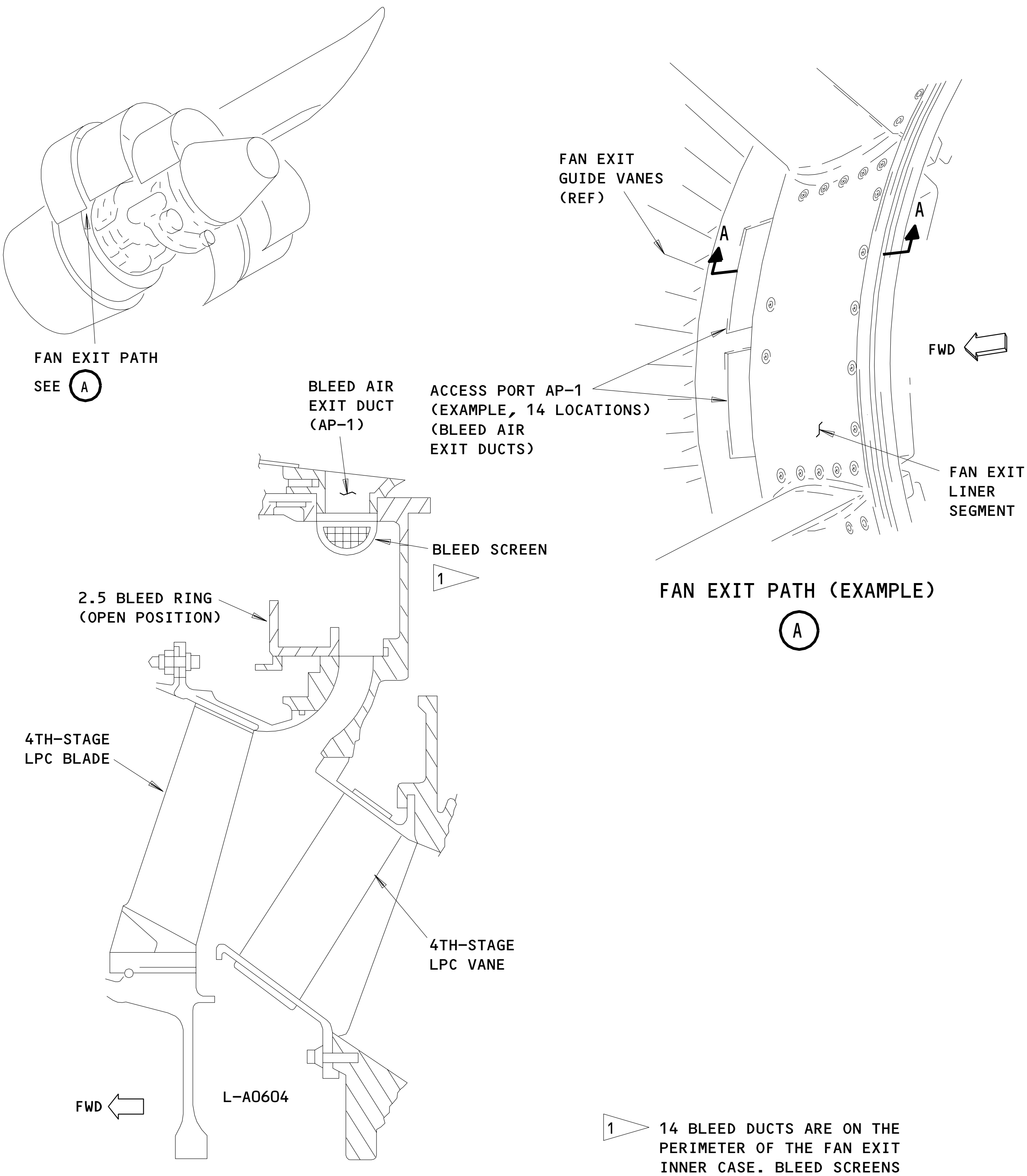
NOTE: REFER TO THE TABLE ON SHEET 5 FOR THE SWITCH FUNCTIONS.

L-96828(0000)

High Pressure Rotor Rotator
Figure 606 (Sheet 5)

DESCRIPTION OF THE CONTROLLER SWITCHES		
SWITCH NAME	LOCATION	FUNCTION
SPEED SWITCH	LEFT SIDE	SETS THE ROTOR DRIVE SPEED.
OPTION SWITCH	LEFT SIDE	SPARE
STAGE SWITCH	TOP	SETS THE STAGE NUMBER YOU WILL EXAMINE.
STAGE SELECT INDICATOR	TOP	SHOWS THE COMPRESSOR OR TURBINE STAGE NUMBER.
RESET SWITCH (BLADE NUMBER COUNT)	TOP	RESETS THE BLADE NUMBER INDICATION WHEN IT IS PUSHED.
CW/CCW INDICATOR	TOP	SHOWS THE DIRECTION THAT THE ROTOR TURNS. THE RED LIGHT COMES ON WHEN THE CENTER OF EACH BLADE IS SET TO EXAMINE.
BLADE NUMBER COUNT INDICATOR	TOP	A. WITH THE CW/CCW SWITCH SET TO CW, IT COUNTS THE BLADES UP FROM "1". IT STOPS WHEN ALL THE BLADES ON THE STAGE HAVE BEEN COUNTED. B. WITH THE CW/CCW SWITCH SET TO CCW, IT COUNTS THE BLADES DOWN FROM THE SELECTED BLADE. IT STOPS WHEN IT GETS TO "1".
INTERVAL SWITCH	TOP	SET THE INTERVAL TO VIEW EACH BLADE: • "0" POSITION - NO STOP • "1,2,3,4, OR 5" - THE ROTOR STOPS FOR 1,2,3,4, OR 5 SECONDS AT EACH BLADE.
START/STOP SWITCH	RIGHT SIDE	THE ROTOR DRIVE ON OR OFF SWITCHES
CW/CCW SWITCH	RIGHT SIDE	SETS THE DIRECTION THAT THE ROTOR TURNS.
BLADE POSITION RESET SWITCH	RIGHT SIDE	SETS THE INSPECTION POSITION OF THE BLADE. WHEN IT IS SET, EACH BLADE WILL STOP AT THE SAME POSITION.
FOOT SWITCH CONNECTOR	FRONT	CONNECTION FOR THE OPTIONAL FOOT SWITCH
POWER UNIT CONNECTOR	FRONT	CONNECTION FOR THE POWER UNIT

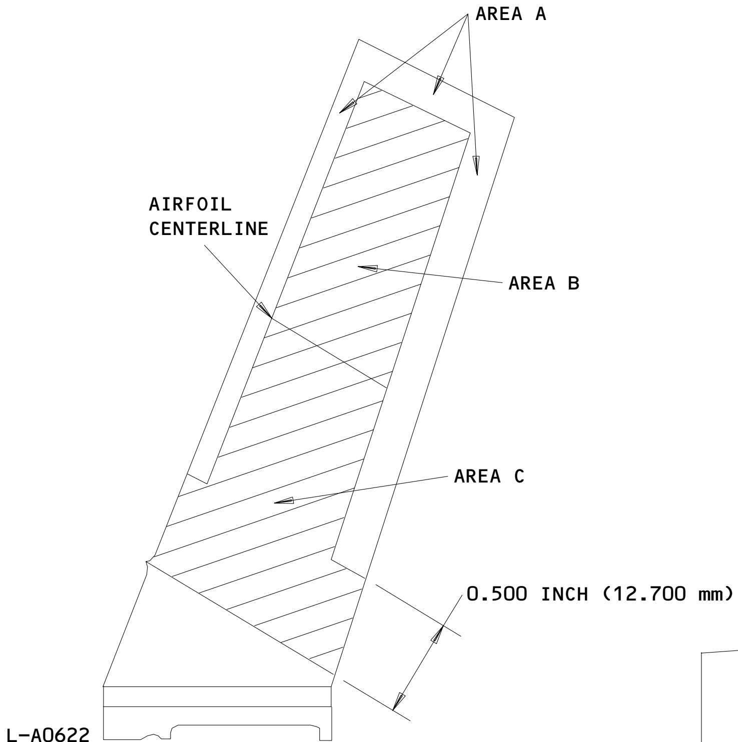
High Pressure Rotor Rotator
Figure 606 (Sheet 6)



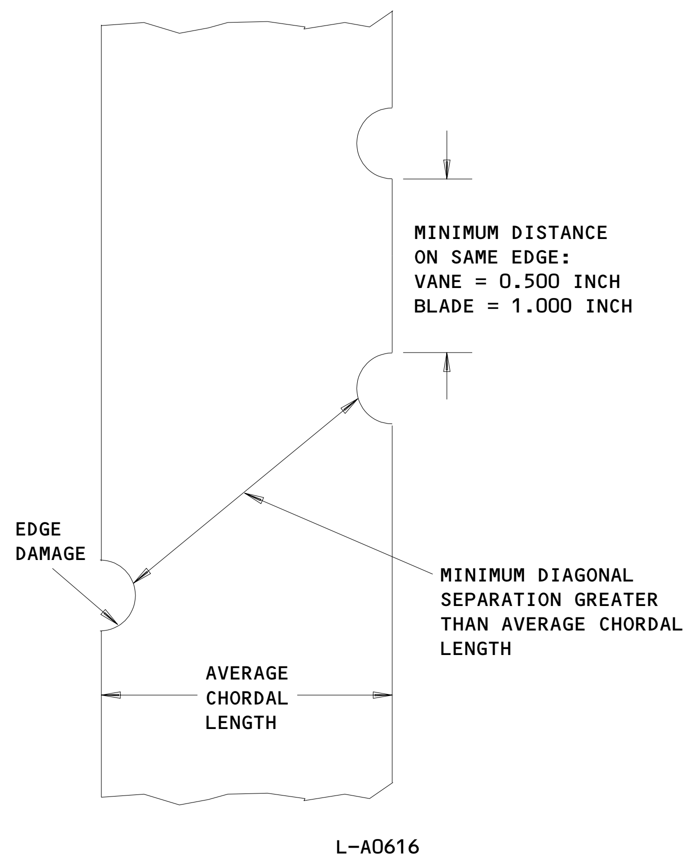
2.5 BLEED AIR
INTERNAL FLOWPATH
A-A

1 14 BLEED DUCTS ARE ON THE PERIMETER OF THE FAN EXIT INNER CASE. BLEED SCREENS ARE INSTALLED IN THE UPPER 8 DUCTS.

4th-Stage LPC Blade and Vane Wear Limits
Figure 607 (Sheet 1)

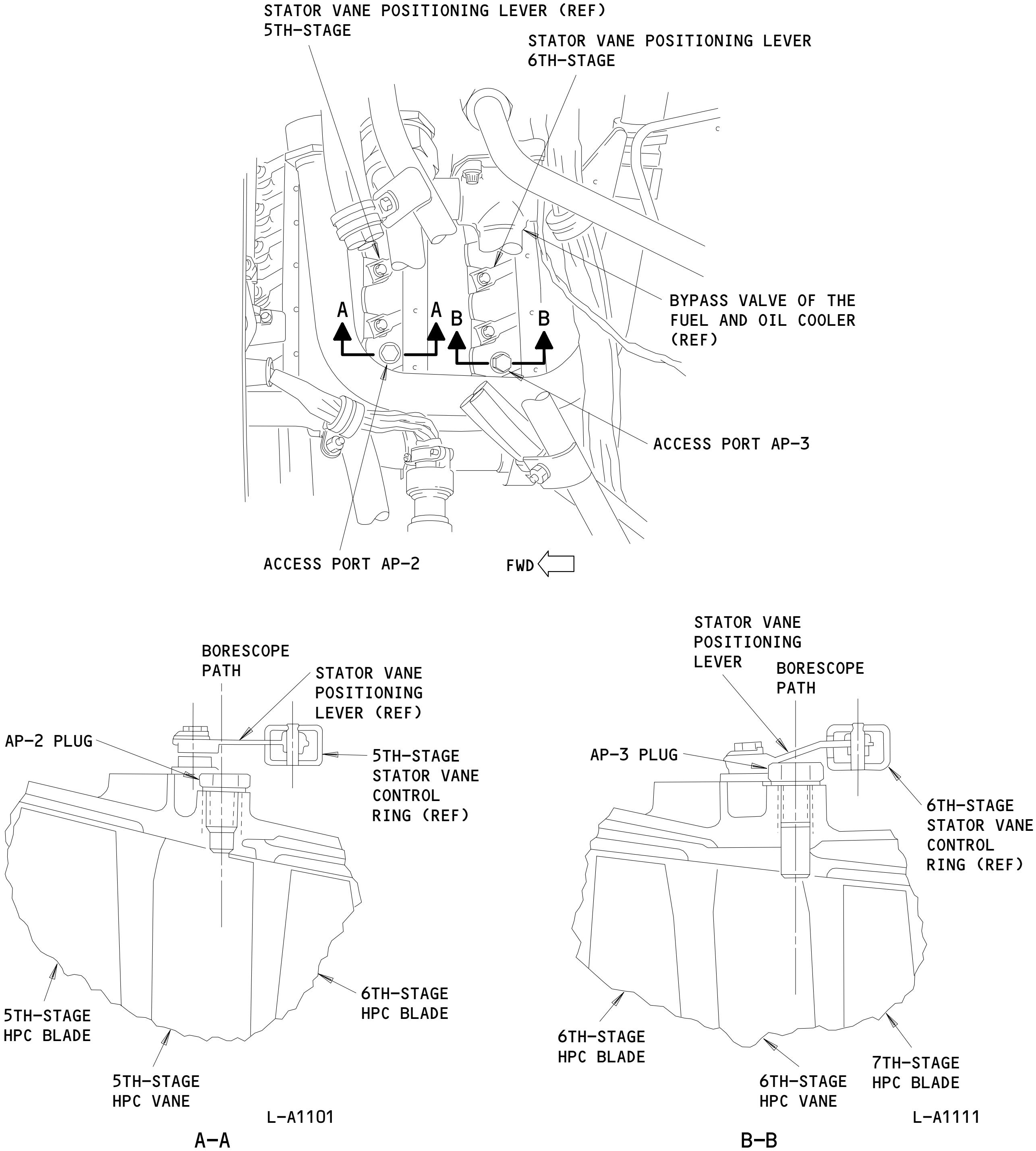


4TH-STAGE LPC BLADE

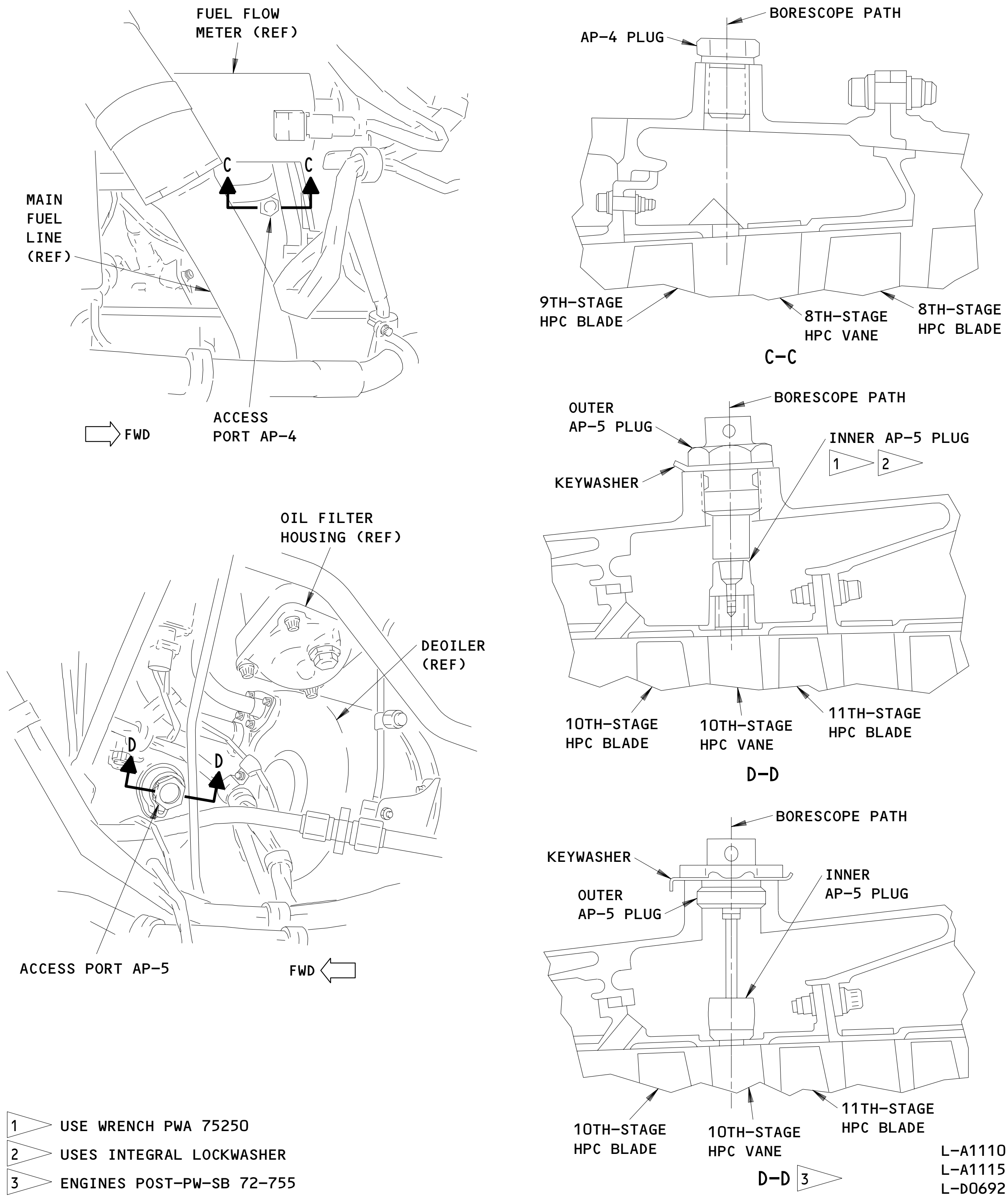


BLADE OR VANE EDGE DAMAGE LIMITS

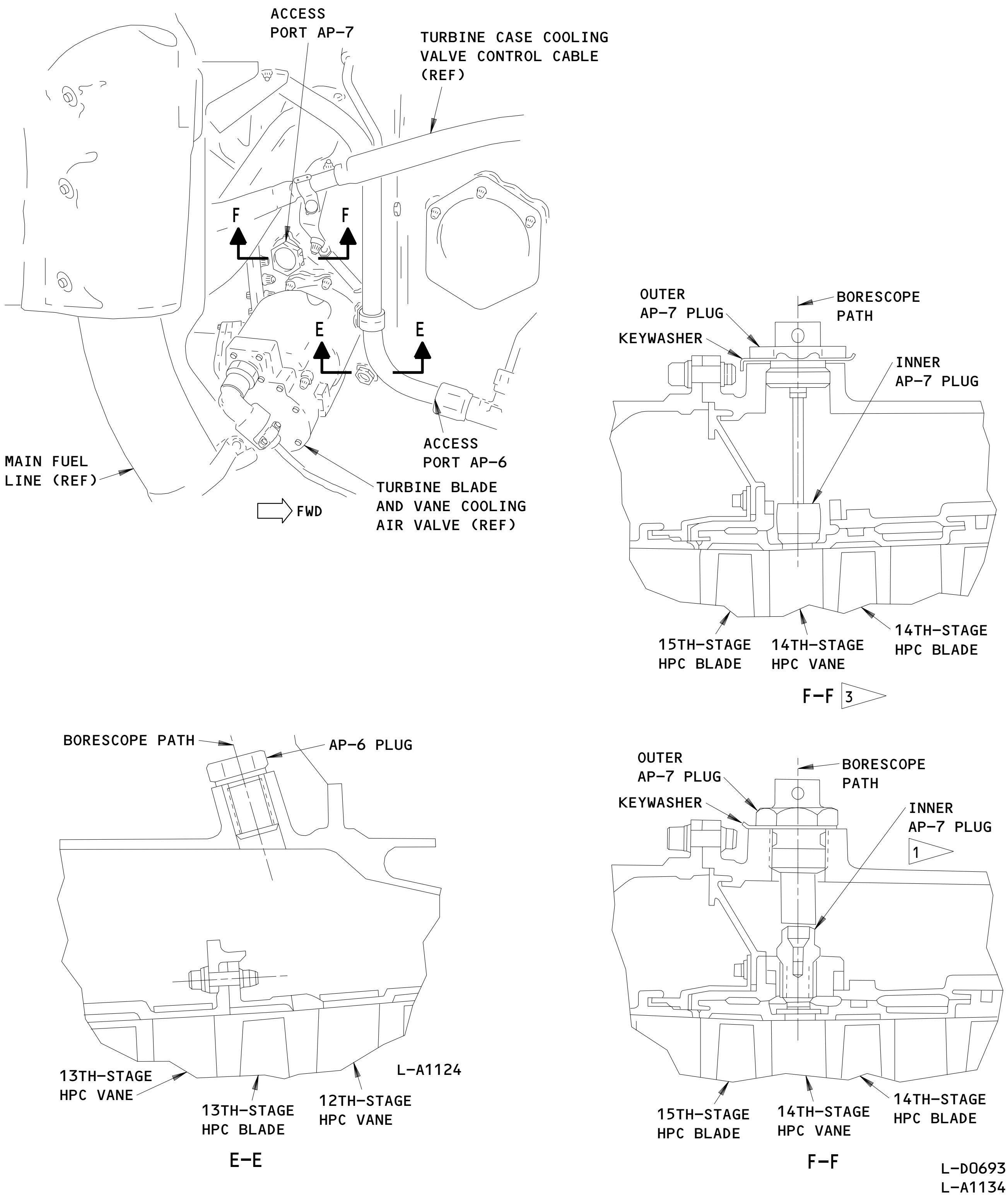
4th-Stage LPC Blade/Vane Wear Limits
Figure 607 (Sheet 2)



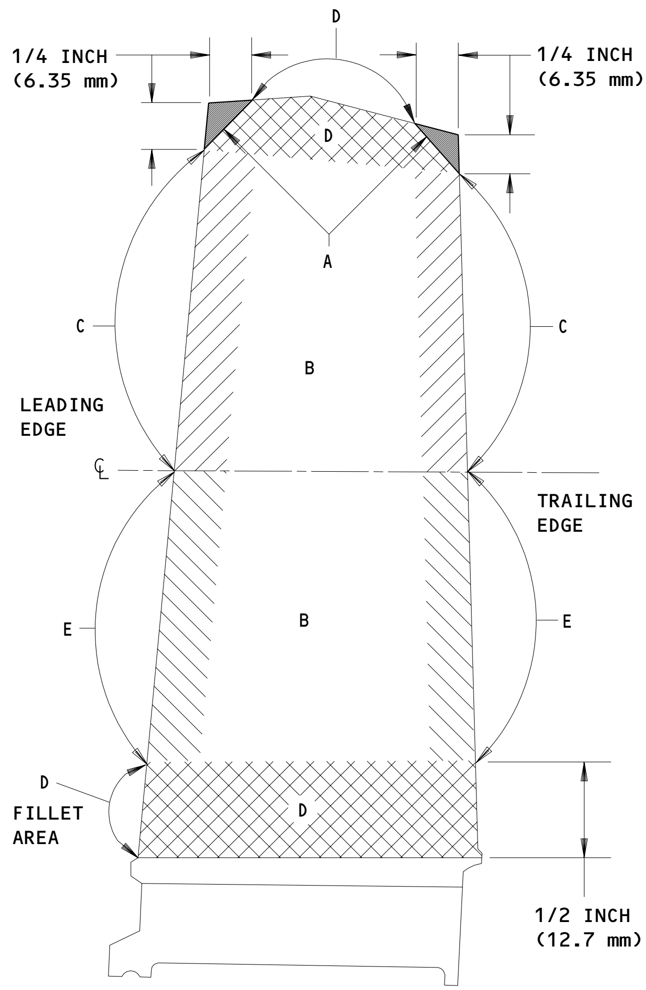
HPC Access Ports
Figure 608 (Sheet 1)



HPC Access Ports
Figure 608 (Sheet 2)



HPC Access Ports
Figure 608 (Sheet 3)



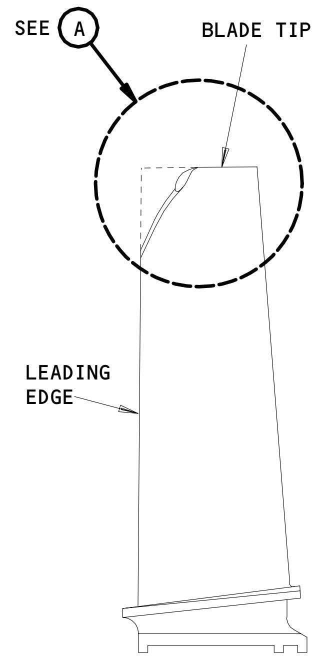
5TH-15TH STAGES HPC BLADE

L-D286

HPC Blade Continue-In-Service Limits
Figure 609 (Sheet 1)

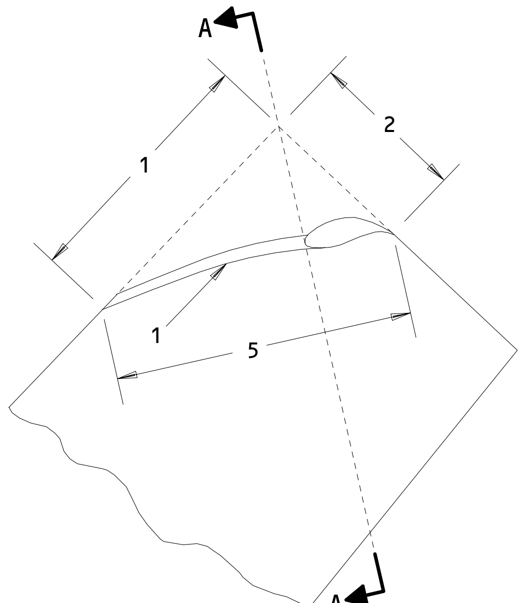
INDEX	CURLED BLADE CONTINUE-IN-SERVICE LIMITS
1 - LEADING EDGE	0.500 INCH (12.700 mm) MAXIMUM. EDGE MUST BE SMOOTH AND CONTINUOUS
2 - TIP	0.250 INCH (6.350 mm) MAXIMUM
3 - BEND ANGLE	90° MAXIMUM
4 - BEND LINE	NO DENTS, GOUGES, CRACKS, OR SCRATCHES ARE PERMITTED ON THE FULL LENGTH OF THE BEND LINE, INDEX 5.

CURLED BLADES MUST BE APART BY AT LEAST 3 STRAIGHT BLADES, WITH NO MORE THAN 6 CURLED BLADES ON EACH STAGE.



L-A2696

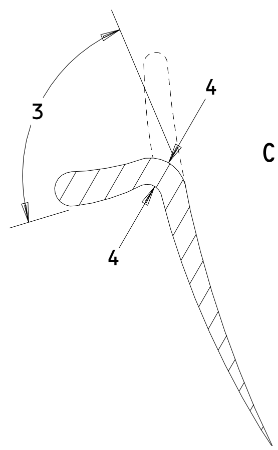
CURLED 5TH- THRU 7TH-STAGE BLADE (EXAMPLE)



L-A2696

CURLED LEADING EDGE TIP DETAIL

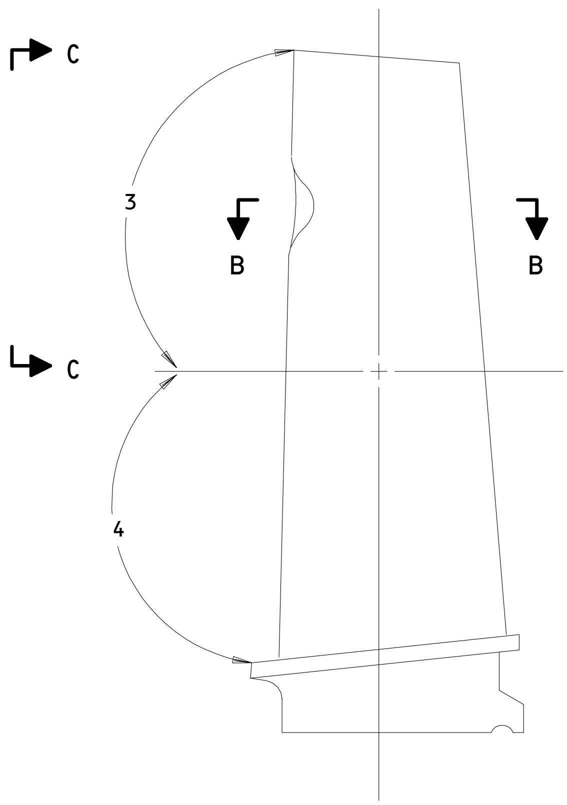
A



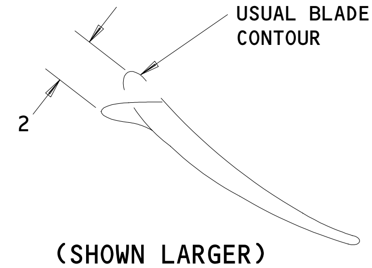
L-A2696

A-A

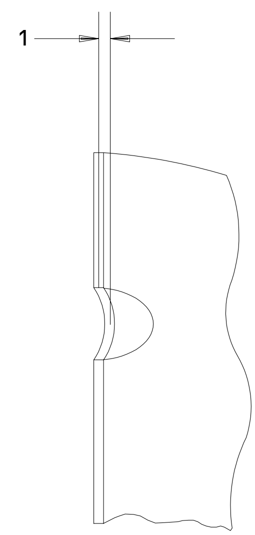
HPC Blade Continue-in-Service Limits
Figure 609 (Sheet 2)



BENT LEADING EDGE
ON 5TH- THRU 7TH-STAGE BLADES



(SHOWN LARGER)
B-B

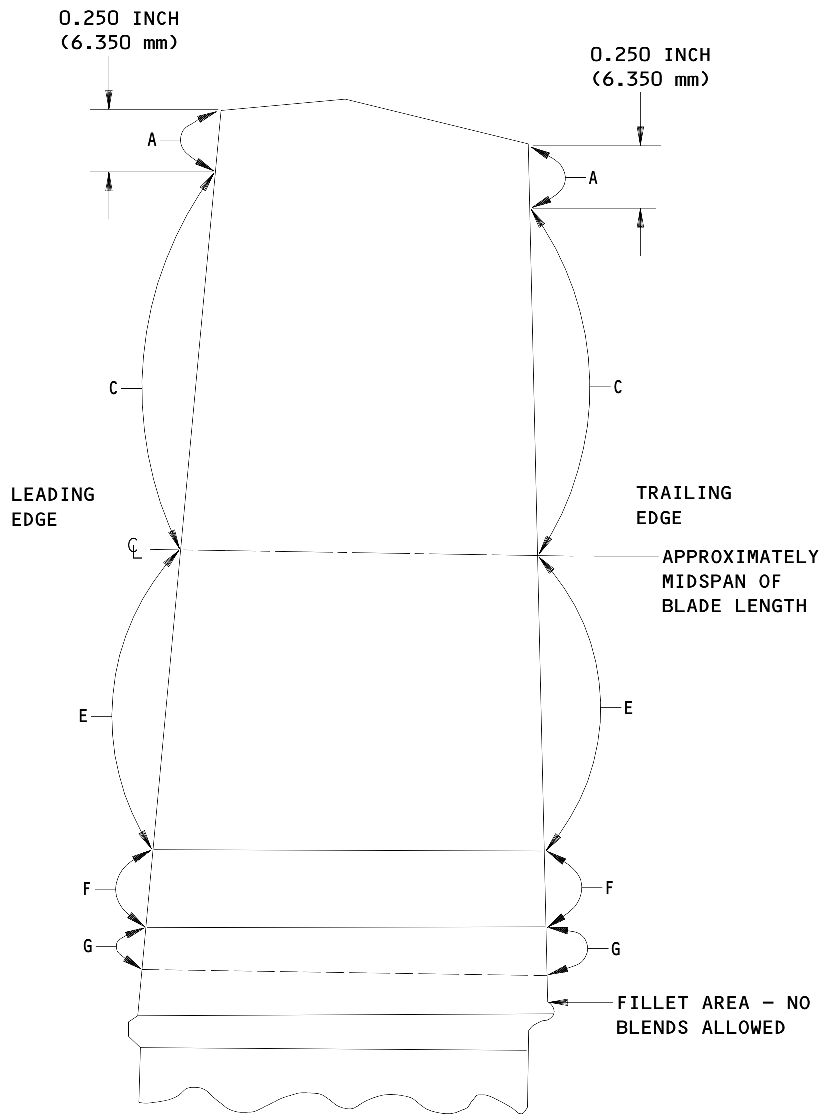


(SHOWN LARGER)
C-C

1. HPC 5TH-STAGE BLADES - 0.045 INCH (1.143 mm) MAXIMUM.
   HPC 6TH-AND 7TH-STAGE BLADES - 0.030 INCH (0.762 mm) MAXIMUM.
2. MAXIMUM DISTANCE, IN ALL DIRECTIONS, FROM THE USUAL BLADE CONTOUR:
   HPC 5TH-STAGE BLADES - 0.045 INCH (1.143 mm) MAXIMUM.
   HPC 6TH-AND 7TH-STAGE BLADES - 0.030 INCH (0.762 mm) MAXIMUM.
3. BENDS THAT ARE LESS THAN INDICES 1. AND 2. ARE PERMITTED IN THIS AREA
4. NO BENDS ARE PERMITTED IN THIS AREA

L-A7170

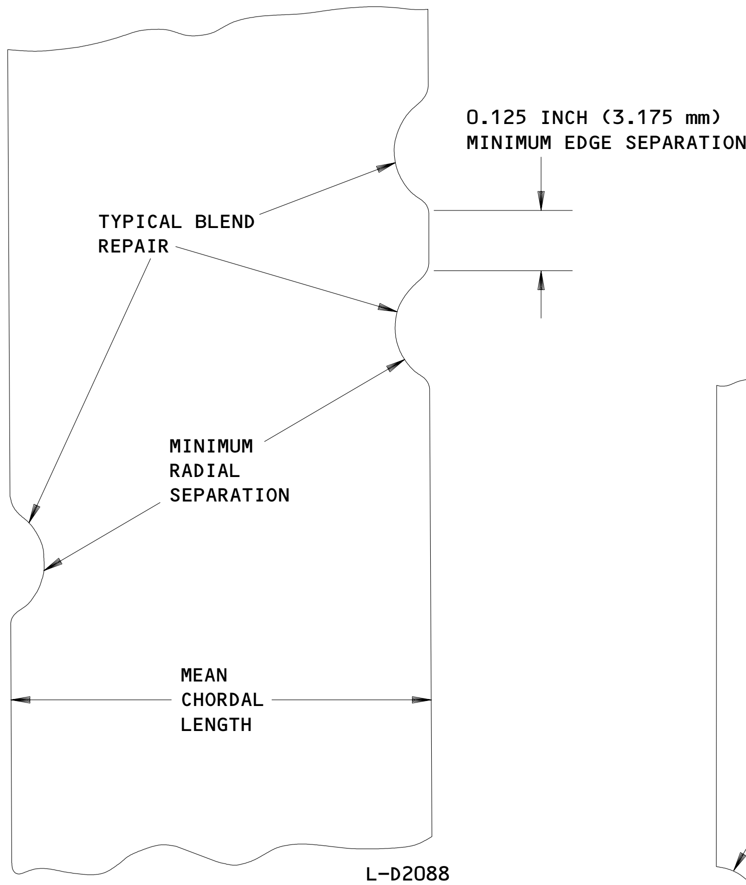
HPC Blade Continue-In-Service Limits
Figure 609 (Sheet 3)



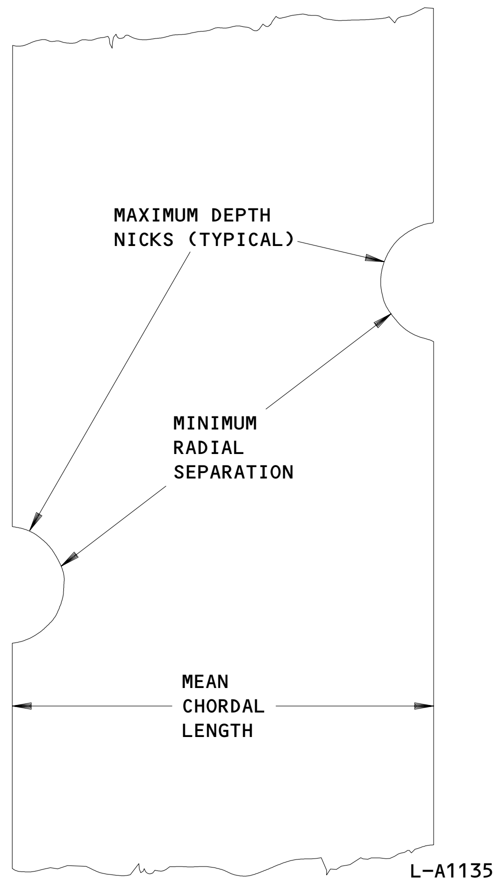
HPC BLADE IN-SITU REPAIR LIMITS

L-D2087

HPC Blade Continue-In-Service Limits
Figure 609 (Sheet 4)

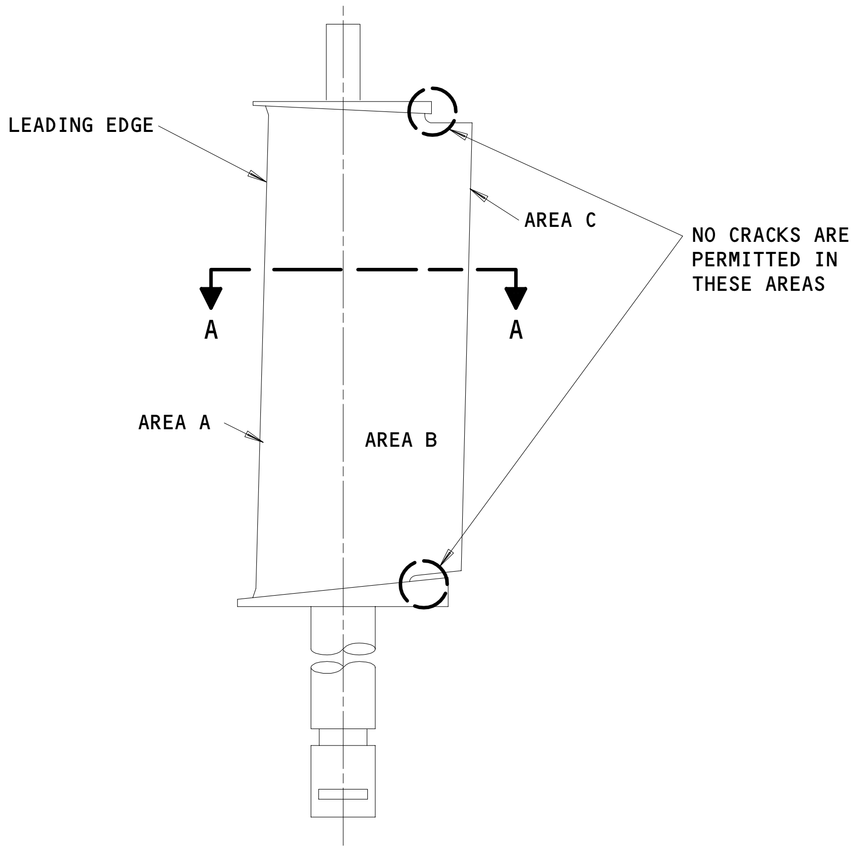


5TH-15TH STAGES BLEND
SEPARATION LIMITS



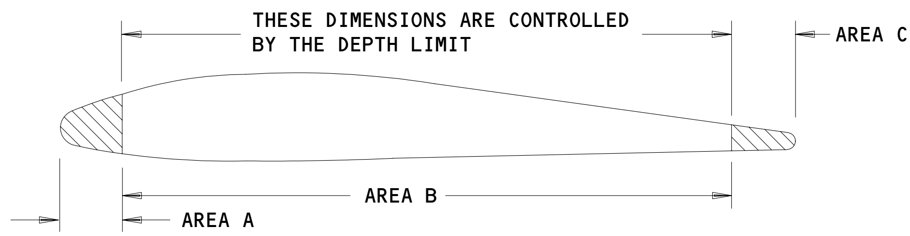
COMPRESSOR BLADES PROXIMITY OF NICKS
BETWEEN LEADING AND TRAILING EDGE

HPC Blade Continue-In-Service Limits
Figure 609 (Sheet 5)



5TH- THRU 7TH-STAGE HPC VANE

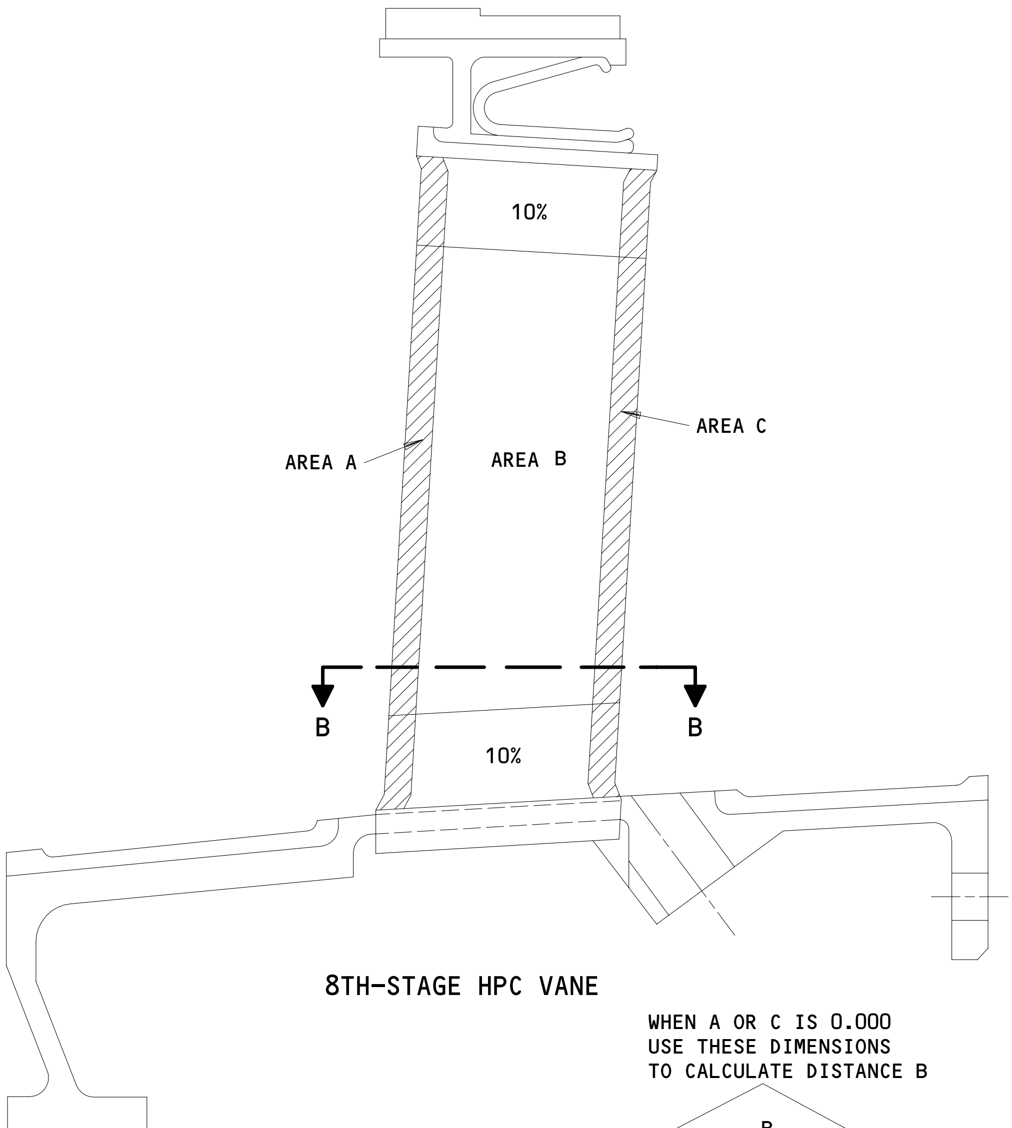
VANE AREA	MAXIMUM DEPTH CONTINUE-IN-SERVICE LIMITS
A	0.030 INCH (0.762 mm)
B	0.010 INCH (0.254 mm)
C	0.030 INCH (0.762 mm)

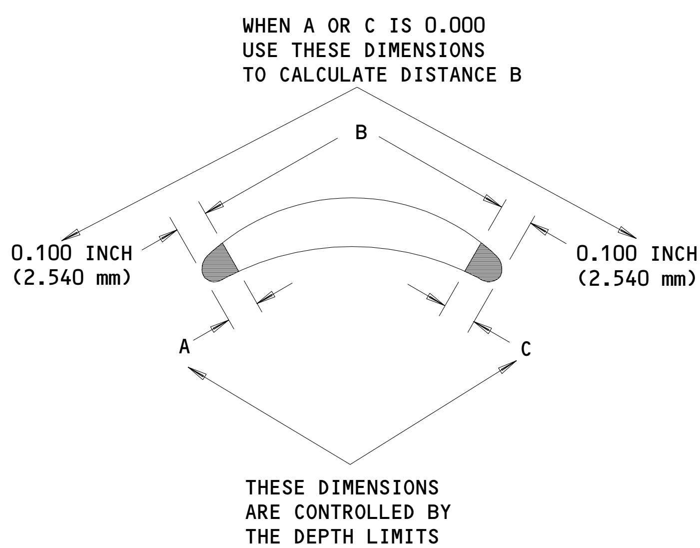


EXAMPLE AT ANY RADIAL LOCATION
A-A

L-A5172

HPC Vane Continue-In-Service Limits
Figure 610 (Sheet 1)



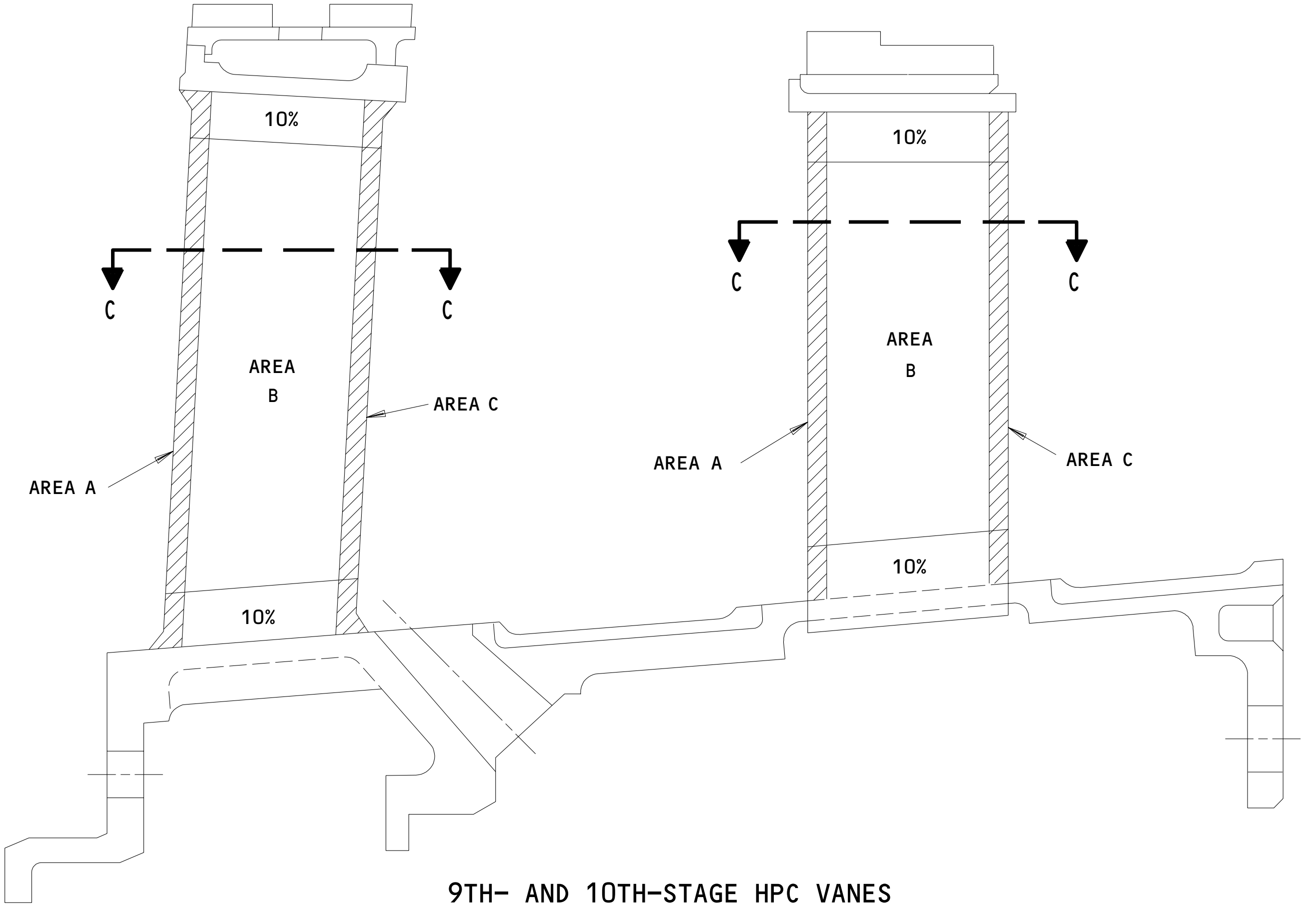


B-B

VANE AREA		MAXIMUM DEPTH CONTINUE-IN-SERVICE LIMITS		
		A	B	C
8	10%	0.000 INCH (0.000 mm)	0.010 INCH (0.254 mm)	0.000 INCH (0.000 mm)
	80%	0.030 INCH (0.762 mm)	0.010 INCH (0.254 mm)	0.030 INCH (0.762 mm)

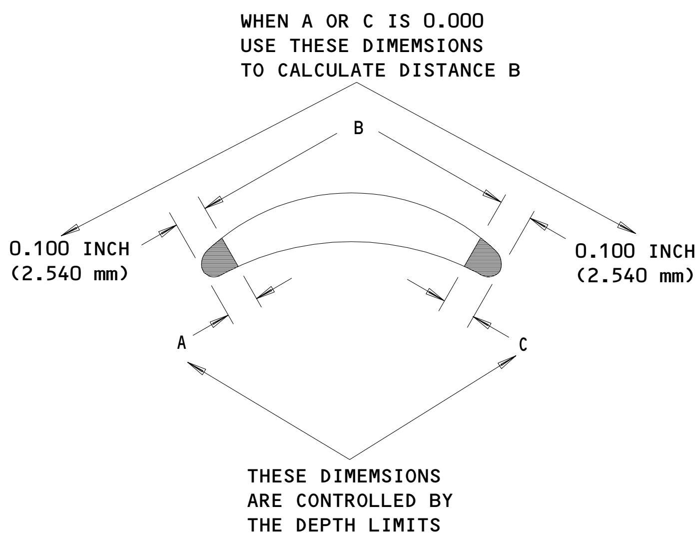
L-A5178

HPC Vane Continue-In-Service Limits
Figure 610 (Sheet 2)



9TH- AND 10TH-STAGE HPC VANES

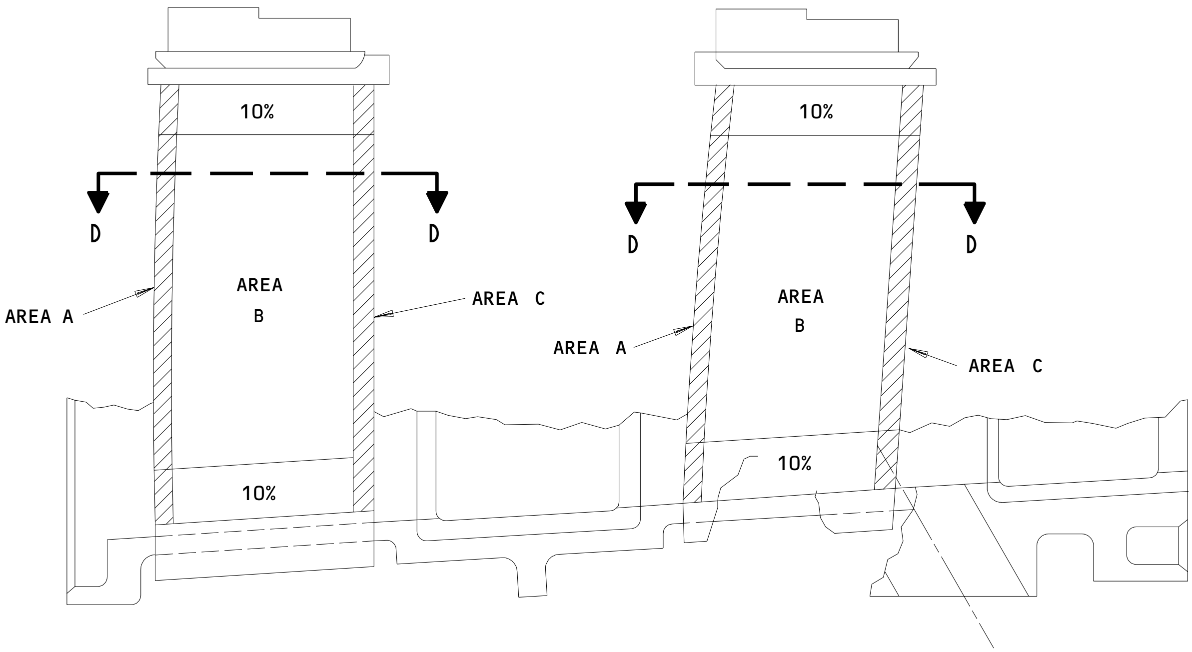
VANE AREA		MAXIMUM DEPTH CONTINUE-IN-SERVICE LIMITS		
		A	B	C
9	10%	0.030 INCH (0.762 mm)	0.000 INCH (0.000 mm)	0.030 INCH (0.762 mm)
	80%	0.030 INCH (0.762 mm)	0.000 INCH (0.000 mm)	0.030 INCH (0.762 mm)
10	10%	0.000 INCH (0.000 mm)	0.010 INCH (0.254 mm)	0.000 INCH (0.000 mm)
	80%	0.030 INCH (0.762 mm)	0.010 INCH (0.254 mm)	0.30 INCH (0.762 mm)



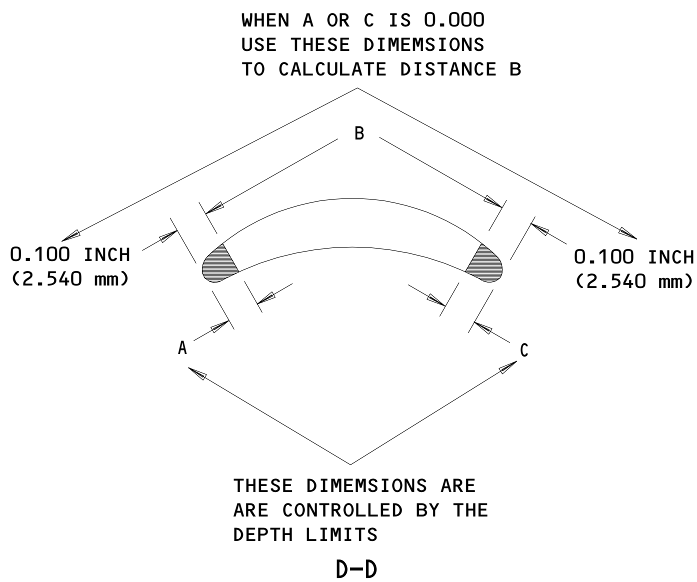
C-C

L-A5192

HPC VANE Continue-In-Service Limits
Figure 610 (Sheet 3)

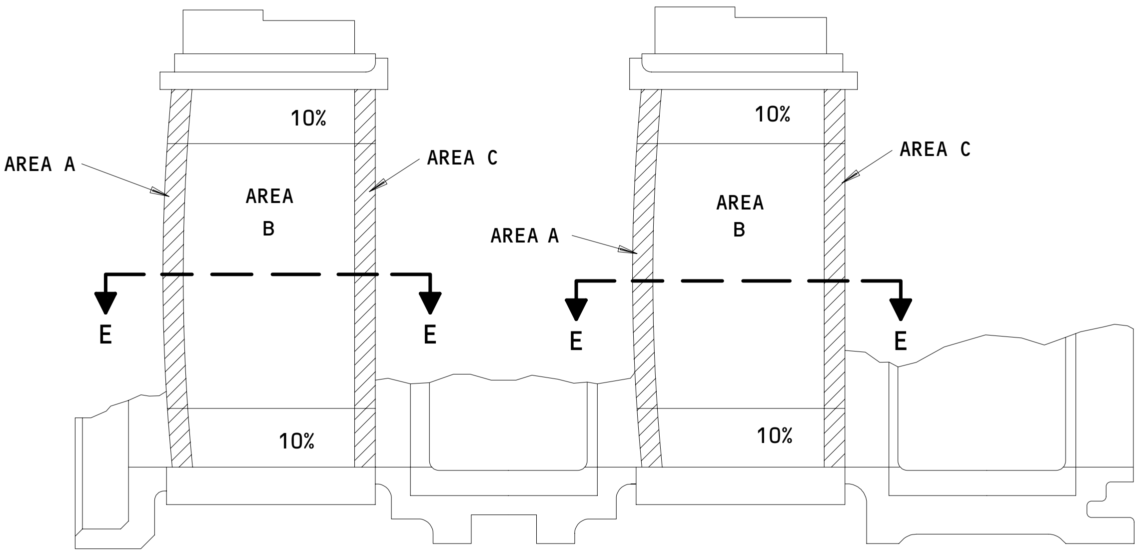


11TH- AND 12TH-STAGE HPC VANES



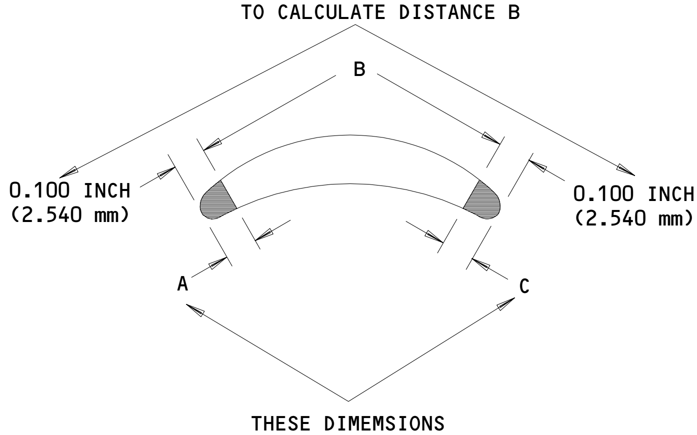
VANE AREA		MAXIMUM DEPTH CONTINUE-IN-SERVICE LIMITS		
		A	B	C
11	10%	0.000 INCH (0.000 mm)	0.010 INCH (0.254 mm)	0.000 INCH (0.000 mm)
12	80%	0.030 INCH (0.762 mm)	0.010 INCH (0.254 mm)	0.030 INCH (0.762 mm)

HPC Vane Continue-In-Service Limits
Figure 610 (Sheet 4)



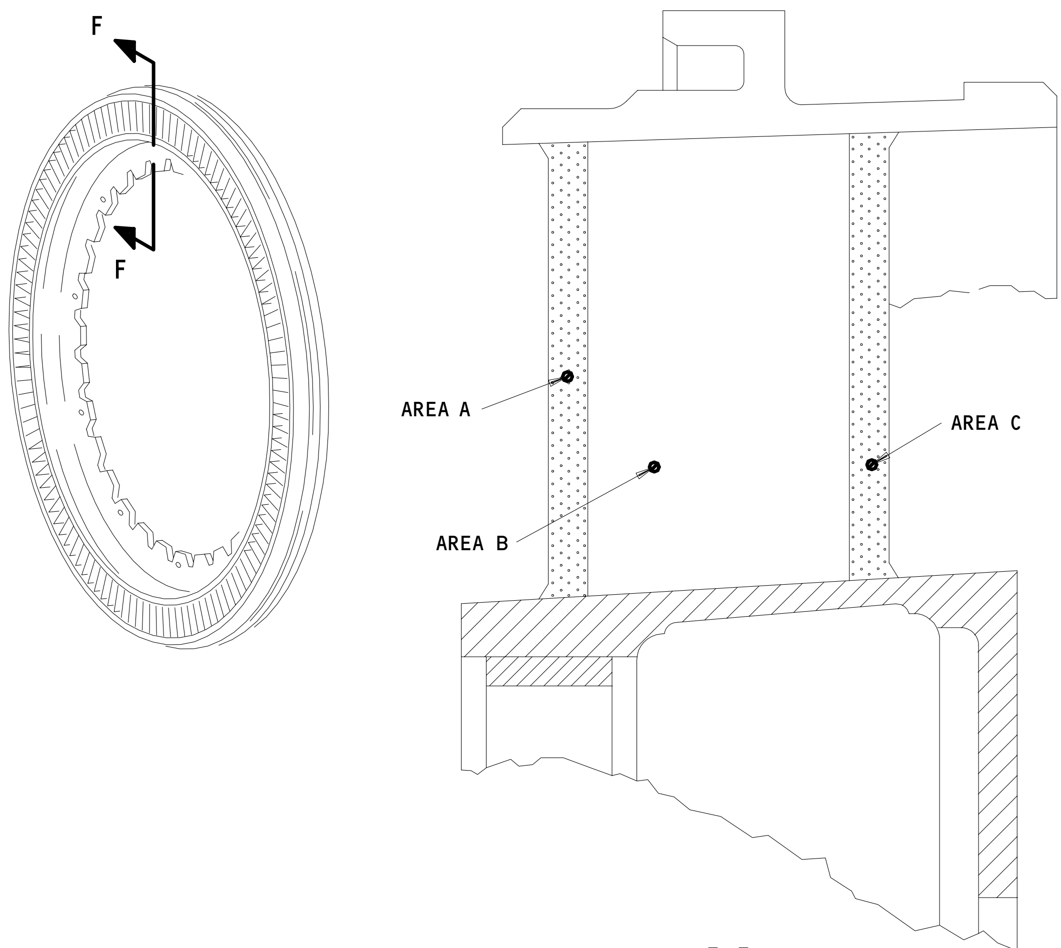
13TH- AND 14TH-STAGE HPC VANES

L-A5185



VANE AREA		MAXIMUM DEPTH CONTINUE-IN-SERVICE LIMITS		
		A	B	C
13	10%	0.000 INCH (0.000 mm)	0.010 INCH (0.254 mm)	0.000 INCH (0.000 mm)
14	80%	0.030 INCH (0.762 mm)	0.010 INCH (0.254 mm)	0.030 INCH (0.762 mm)

HPC Vane Continue-In-Service Limits
Figure 610 (Sheet 5)

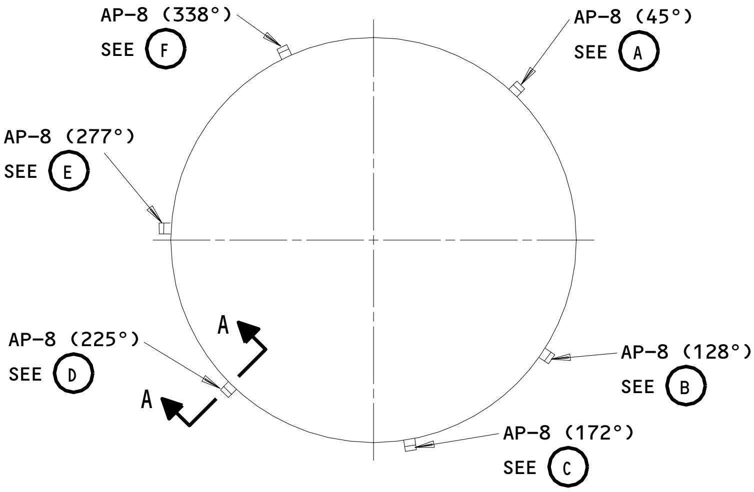


15TH-STAGE HPC EXIT STATOR VANE

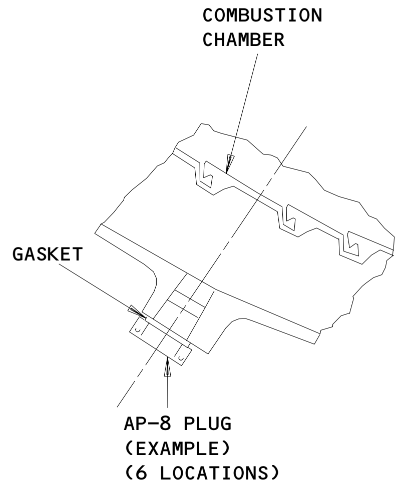
VANE AREA	MAXIMUM DEPTH CONTINUE-IN-SERVICE LIMITS
A	0.030 INCH (0.762 mm)
B	0.010 INCH (0.254 mm)
C	0.030 INCH (0.762 mm)

L-A5199
0790

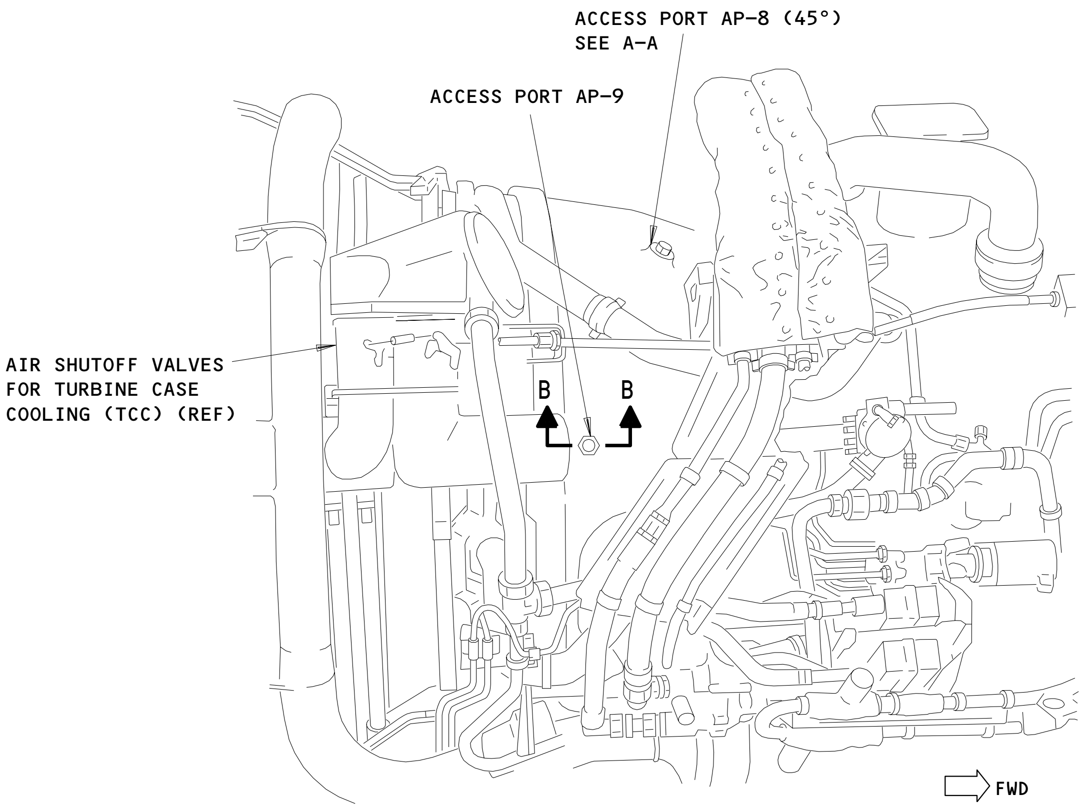
HPC Vane Continue-In-Service Limits
Figure 610 (Sheet 6)



AP-8 PORT LOCATIONS
(VIEW IN THE FORWARD DIRECTION)

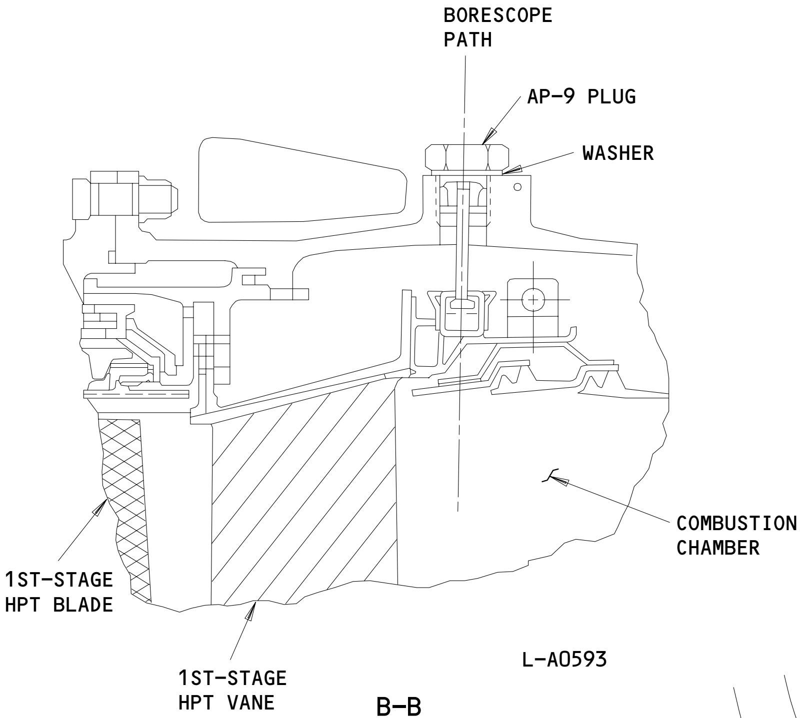


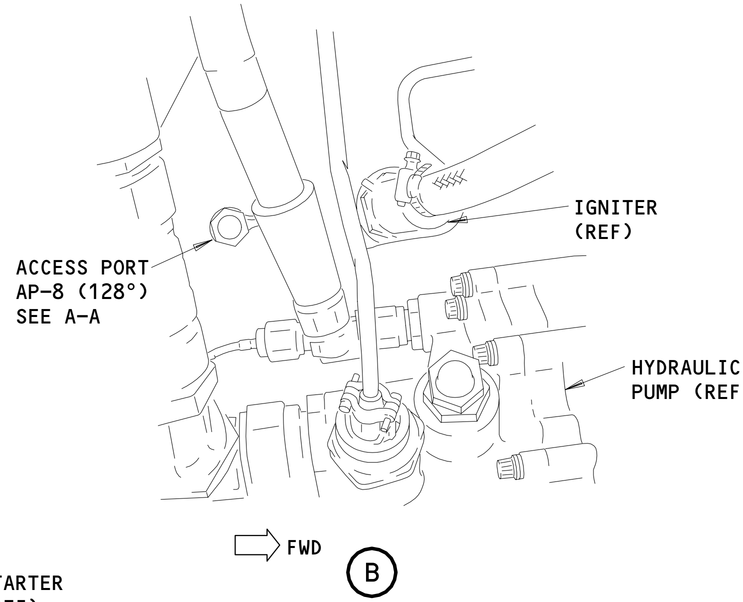
A-A

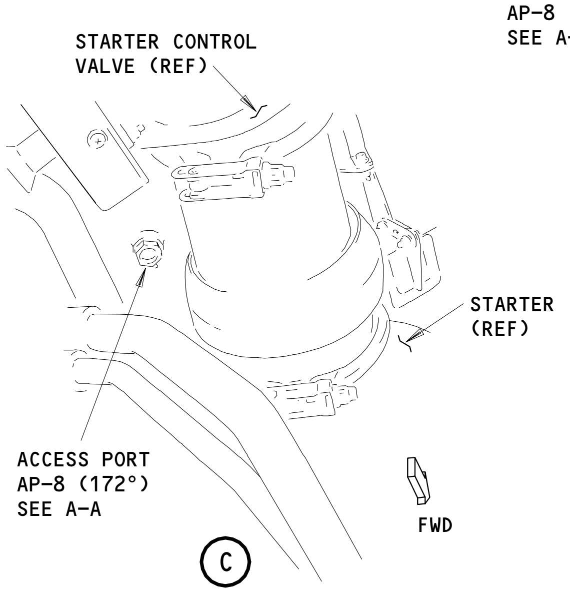


DIFFUSER CASE
A

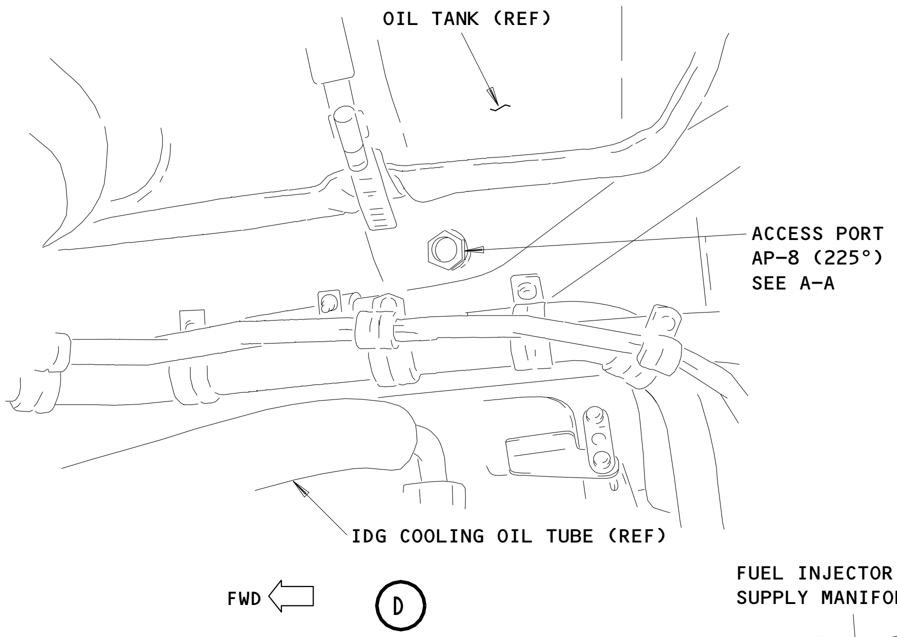
Combustion Chamber Access Ports
Figure 611 (Sheet 1)

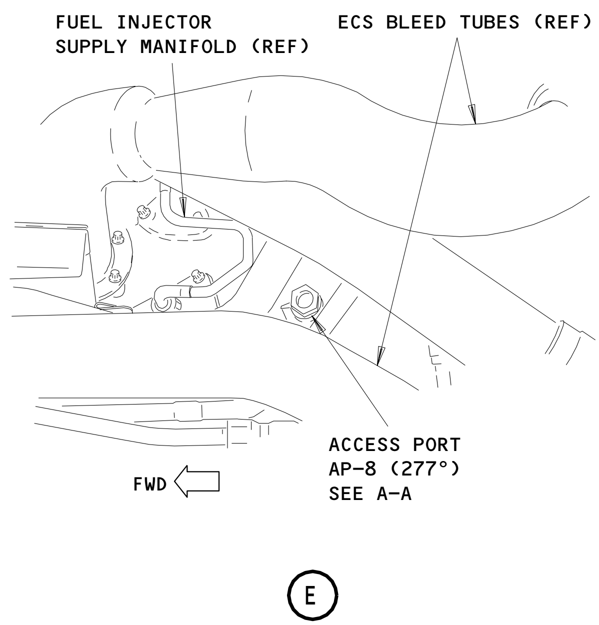


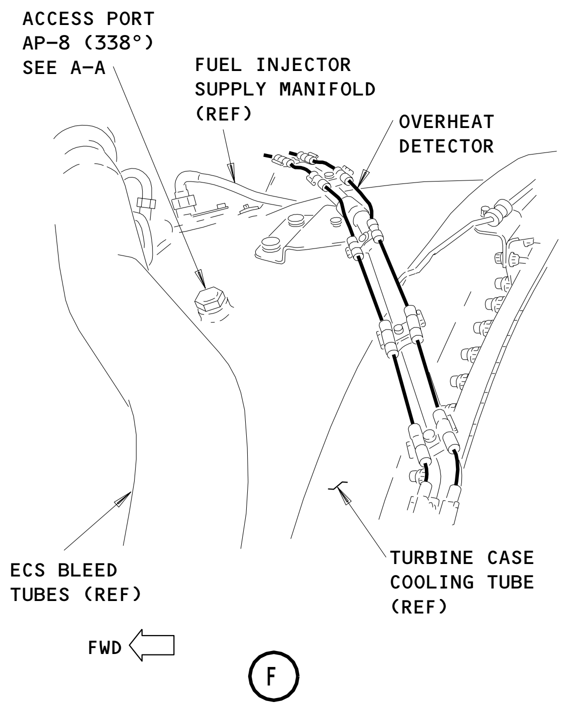




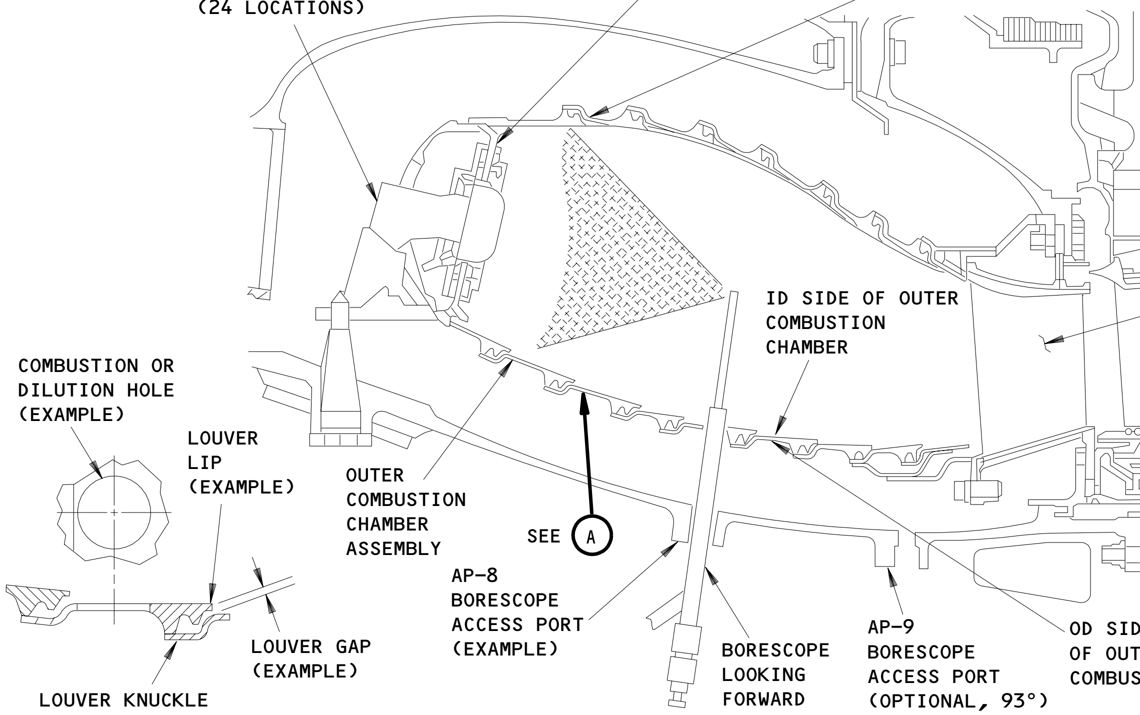
Combustion Chamber Access Ports
Figure 611 (Sheet 2)



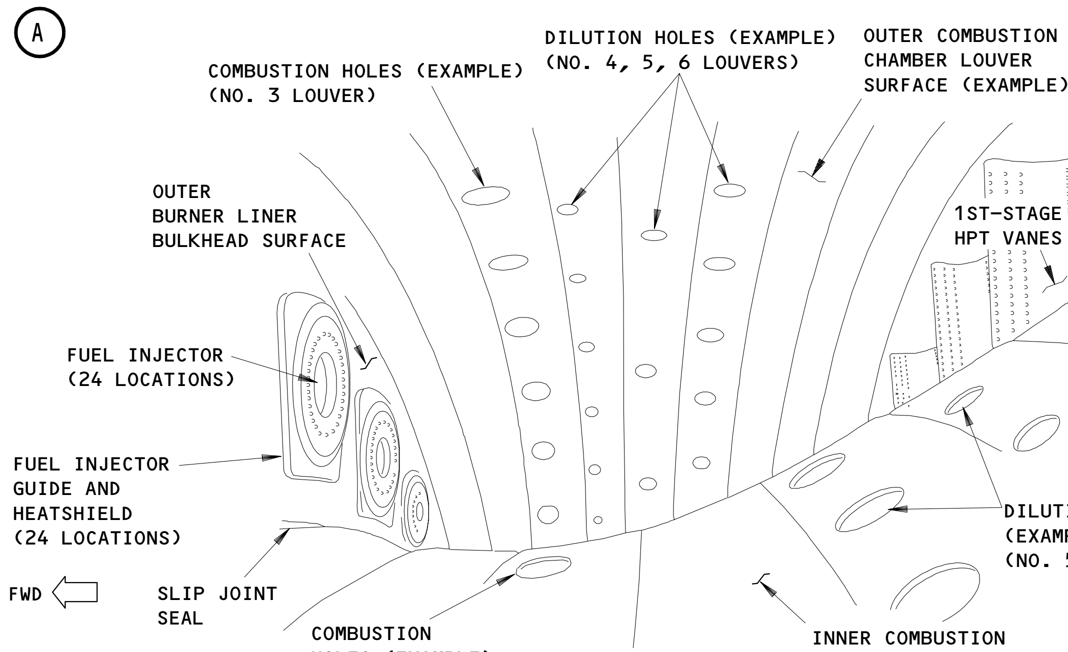




Combustion Chamber Access Ports
Figure 611 (Sheet 3)

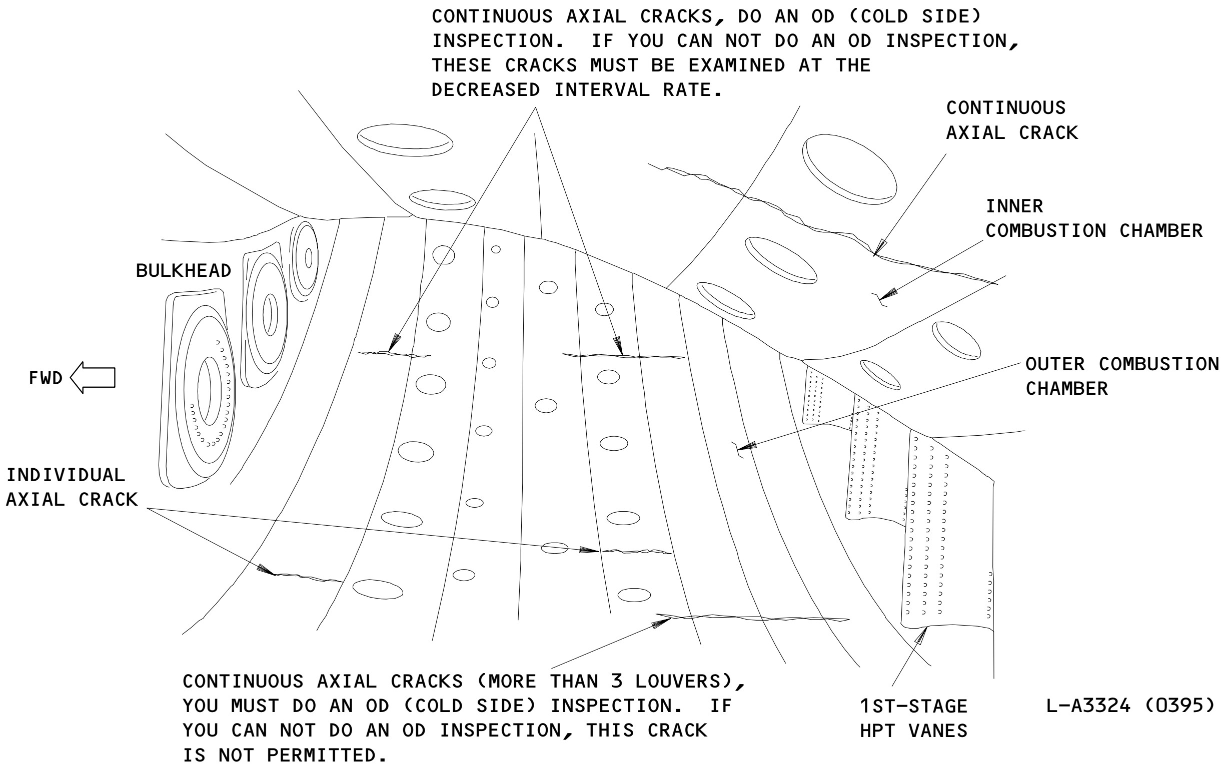


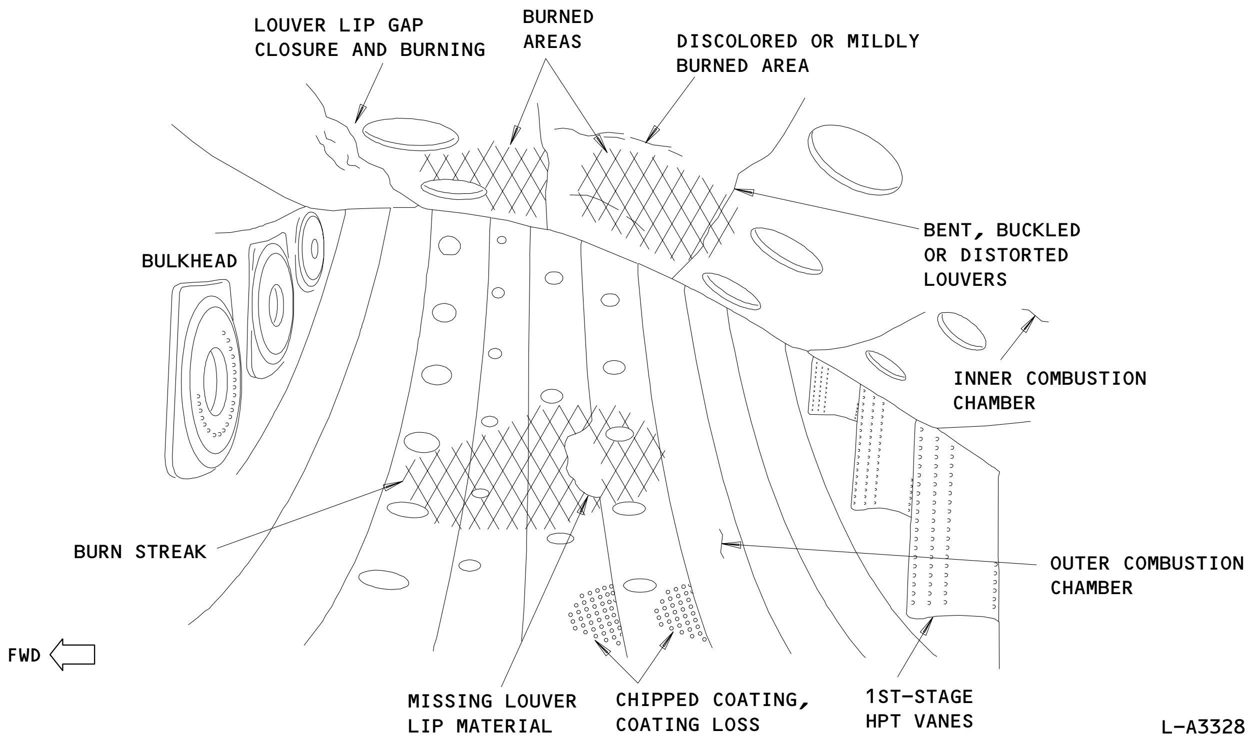
COMBUSTION CHAMBER CROSS-SECTION



COMBUSTION CHAMBER INTERNALS
VIEW LOOKING CIRCUMFERENTIALLY

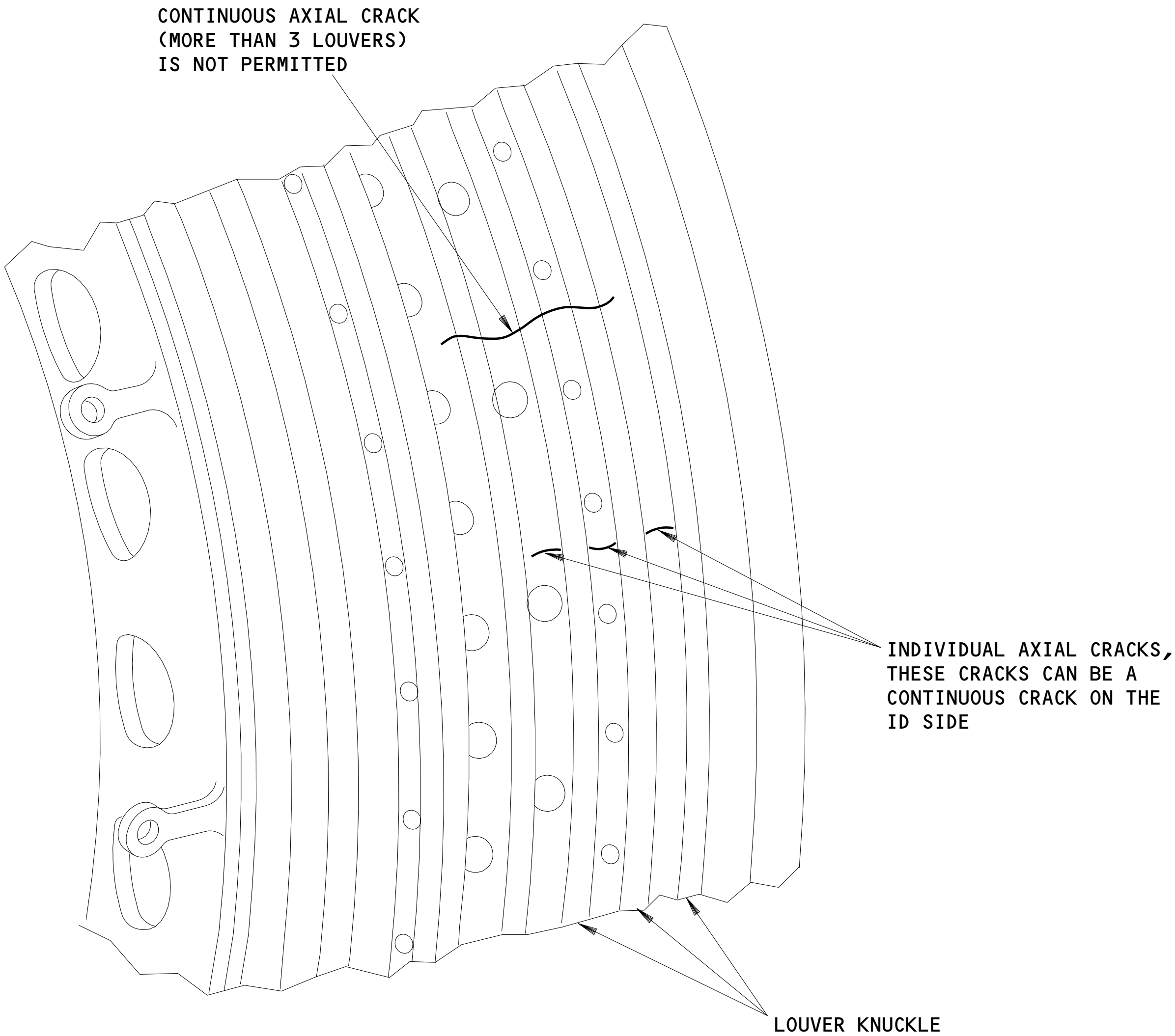
Combustion Chamber Components
Figure 612





VIEW IN THE CIRCUMFERENTIAL DIRECTION

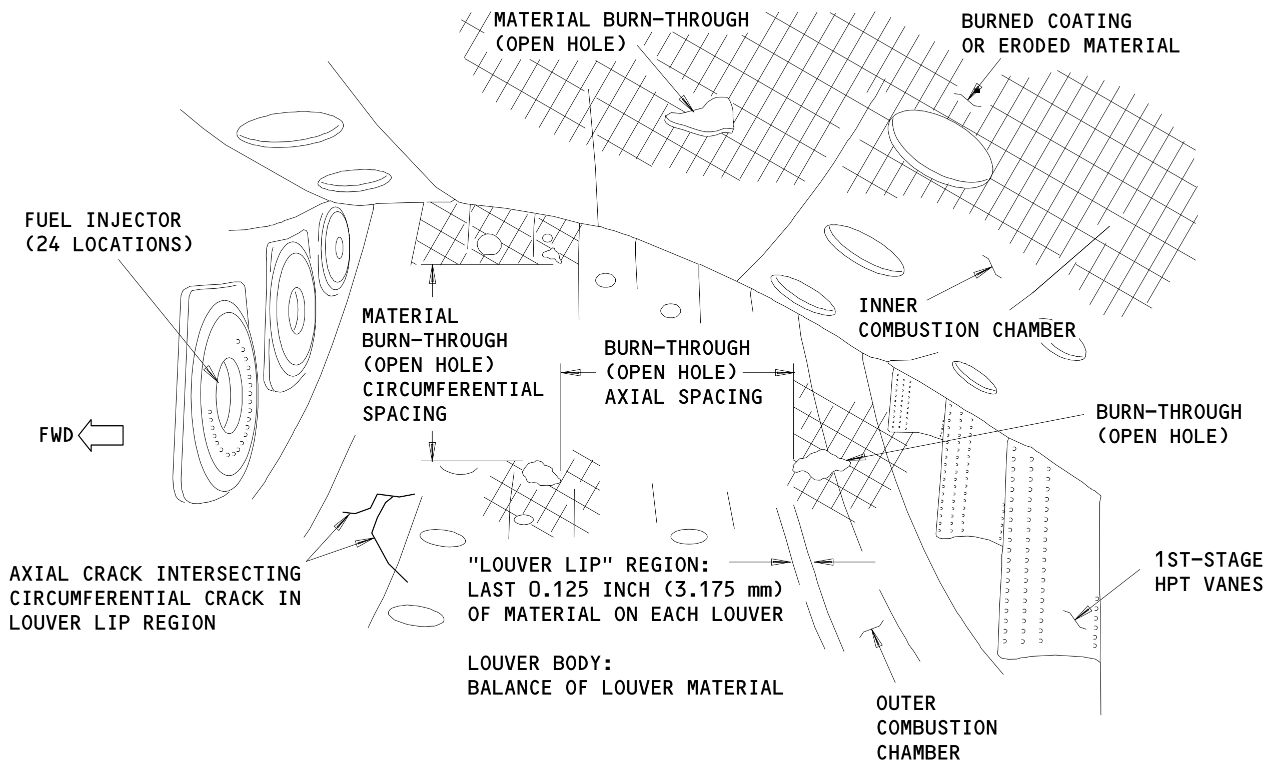
Inner and Outer Combustion Chamber Distress
Figure 613 (Sheet 1)



OD (COLD SIDE) VIEW OF OUTER
COMBUSTION CHAMBER

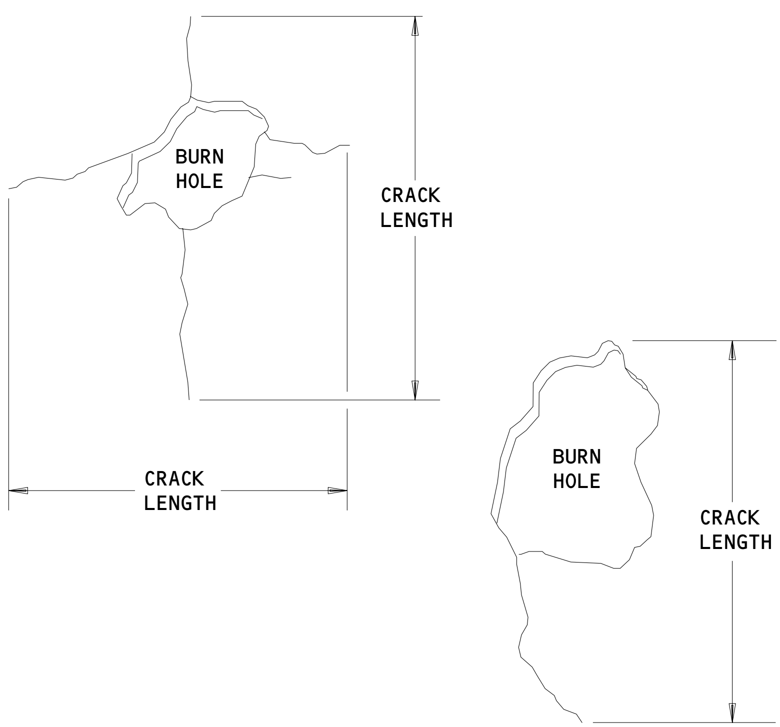
L-B0742 (0000)
PW V

Inner and Outer Combustion Chamber Distress
Figure 613 (Sheet 2)



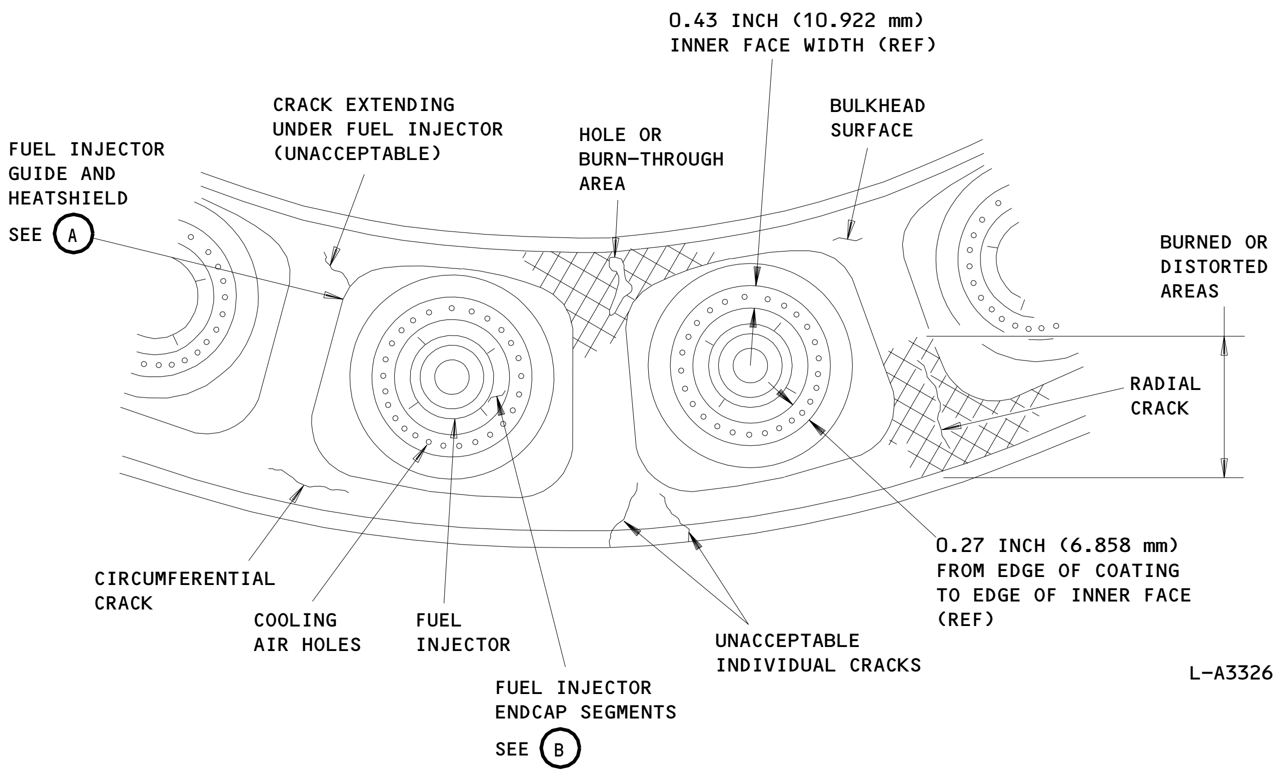
VIEW LOOKING CIRCUMFERENTIALLY

L-A3325



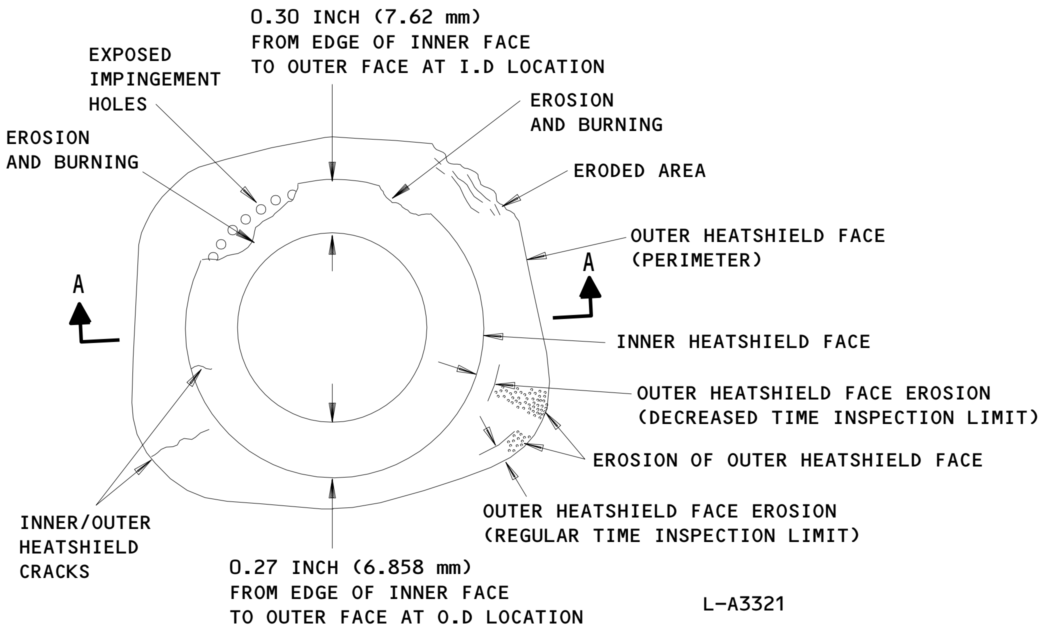
L-A3327

Inner and Outer Combustion Chamber Distress
Figure 613 (Sheet 3)



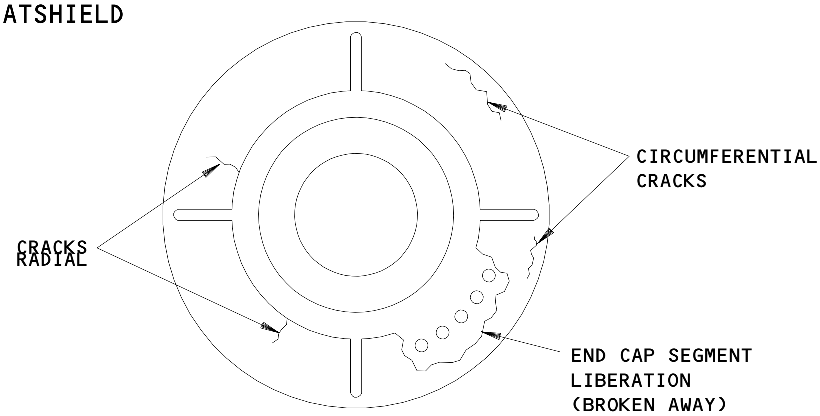
COMBUSTION CHAMBER BULKHEAD

Combustion Chamber Bulkhead and Fuel Injector Guide Heatshield Distress
Figure 614 (Sheet 1)



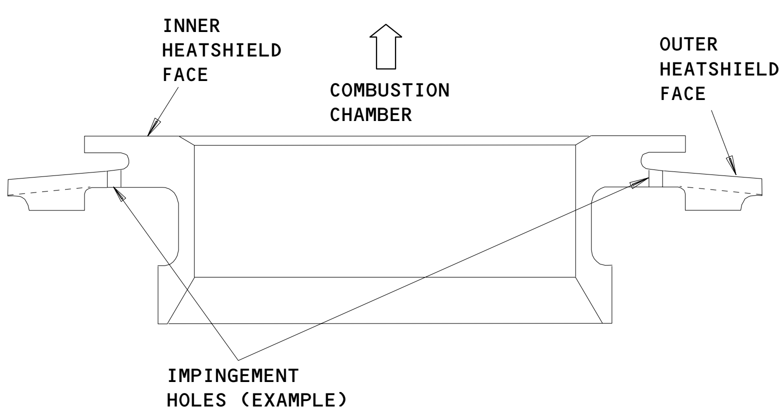
FUEL INJECTOR GUIDE HEATSHIELD

A



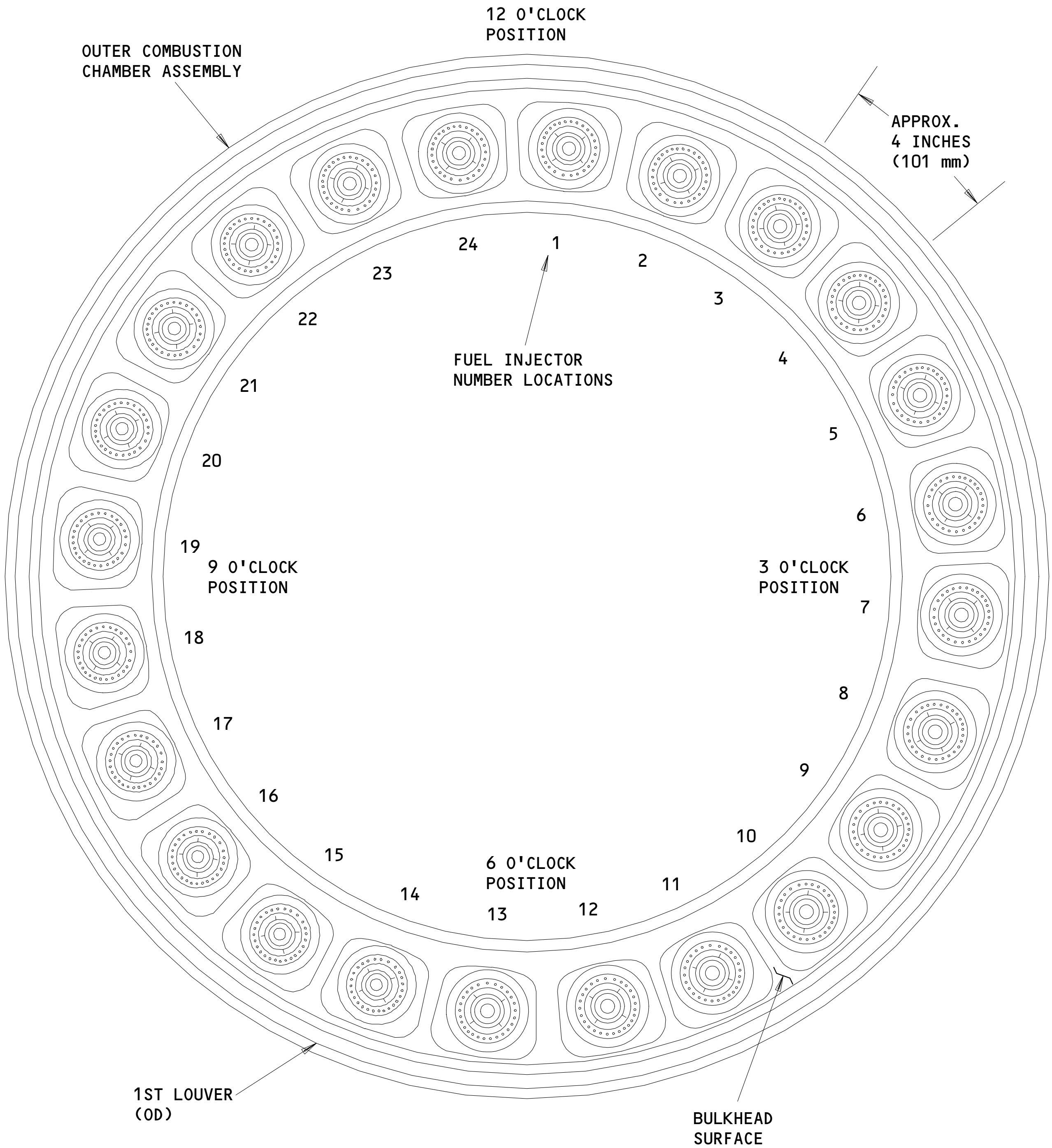
FUEL INJECTOR ENDCAP SEGMENTS

B



A-A

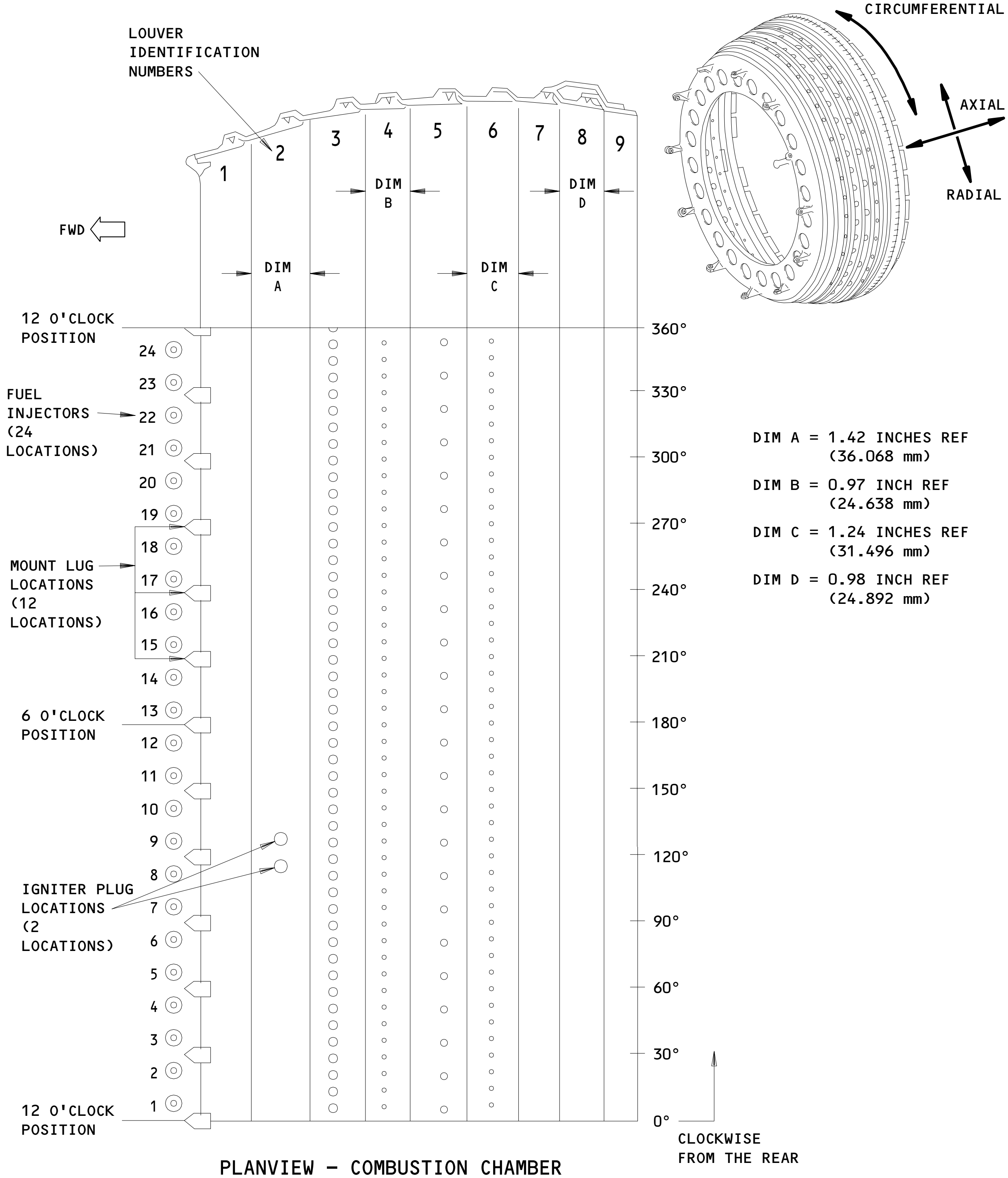
Combustion Chamber Bulkhead and Fuel Injector Guide Heatshield Distress
Figure 614 (Sheet 2)



VIEW IN THE FORWARD DIRECTION

L-A3334

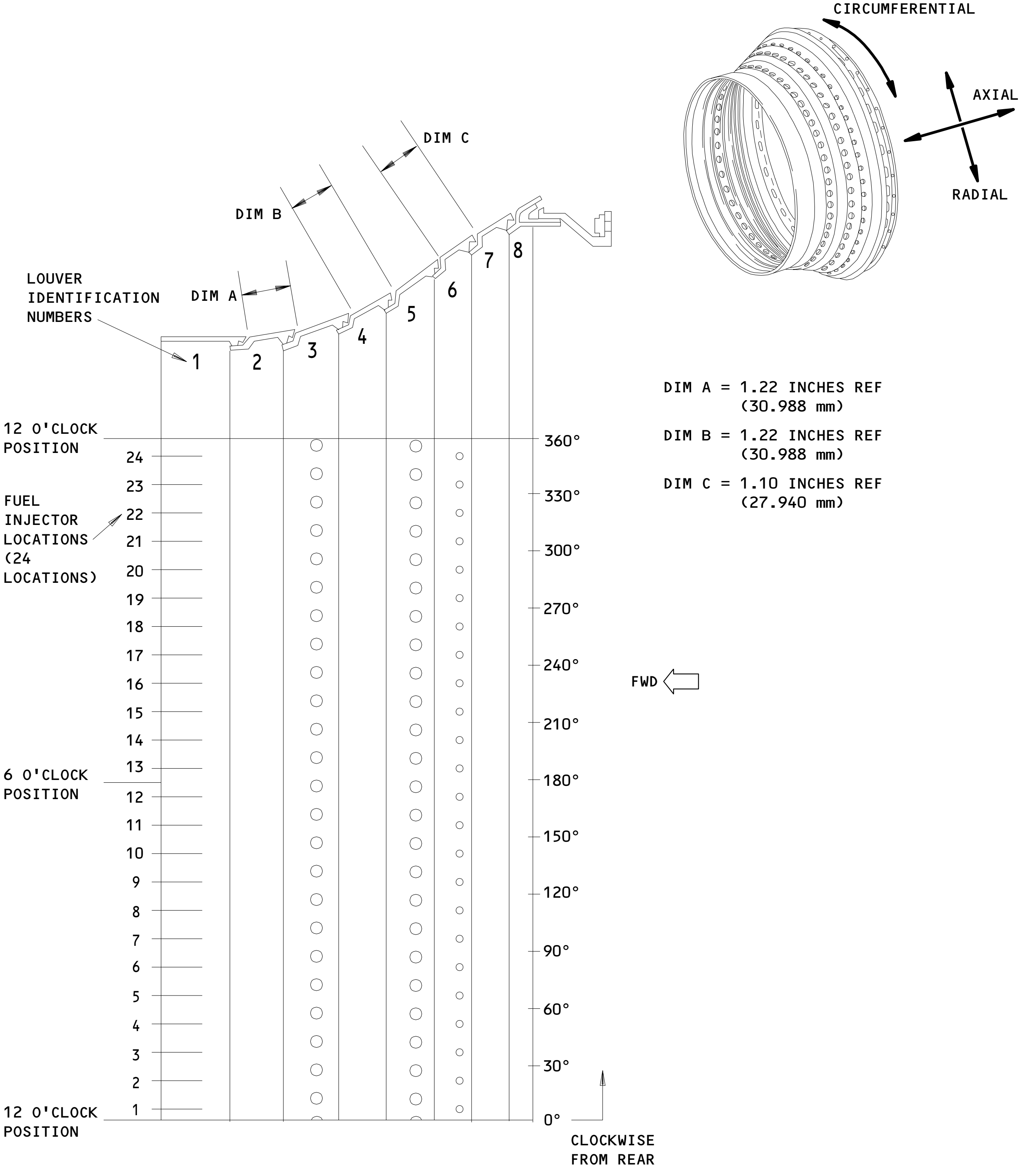
Outer Burner Liner Bulkhead and Fuel Injectors
Figure 615



PLANVIEW - COMBUSTION CHAMBER
INTERNAL SURFACE

L-A3337
(0597)

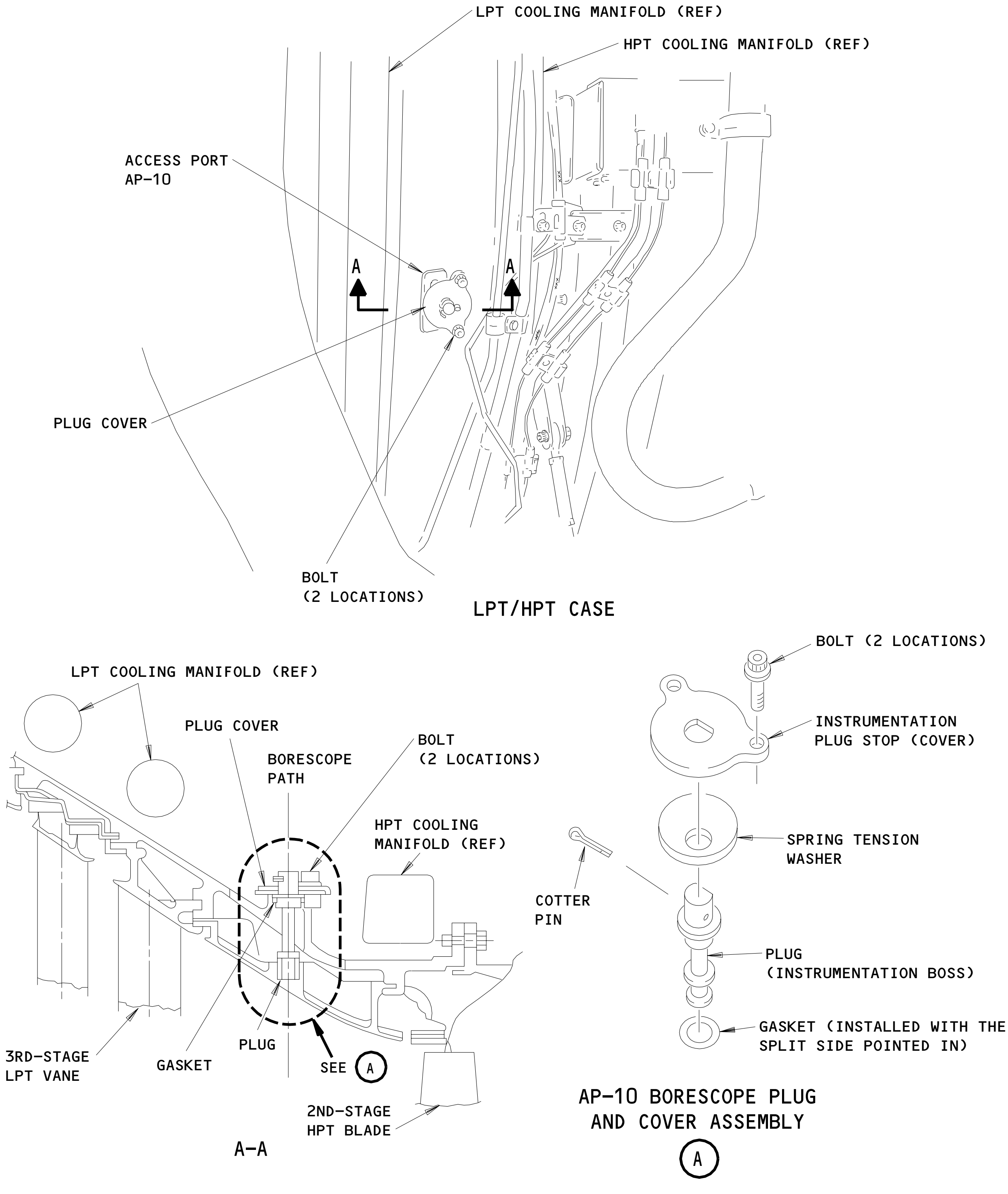
Outer Combustion Chamber
Figure 616



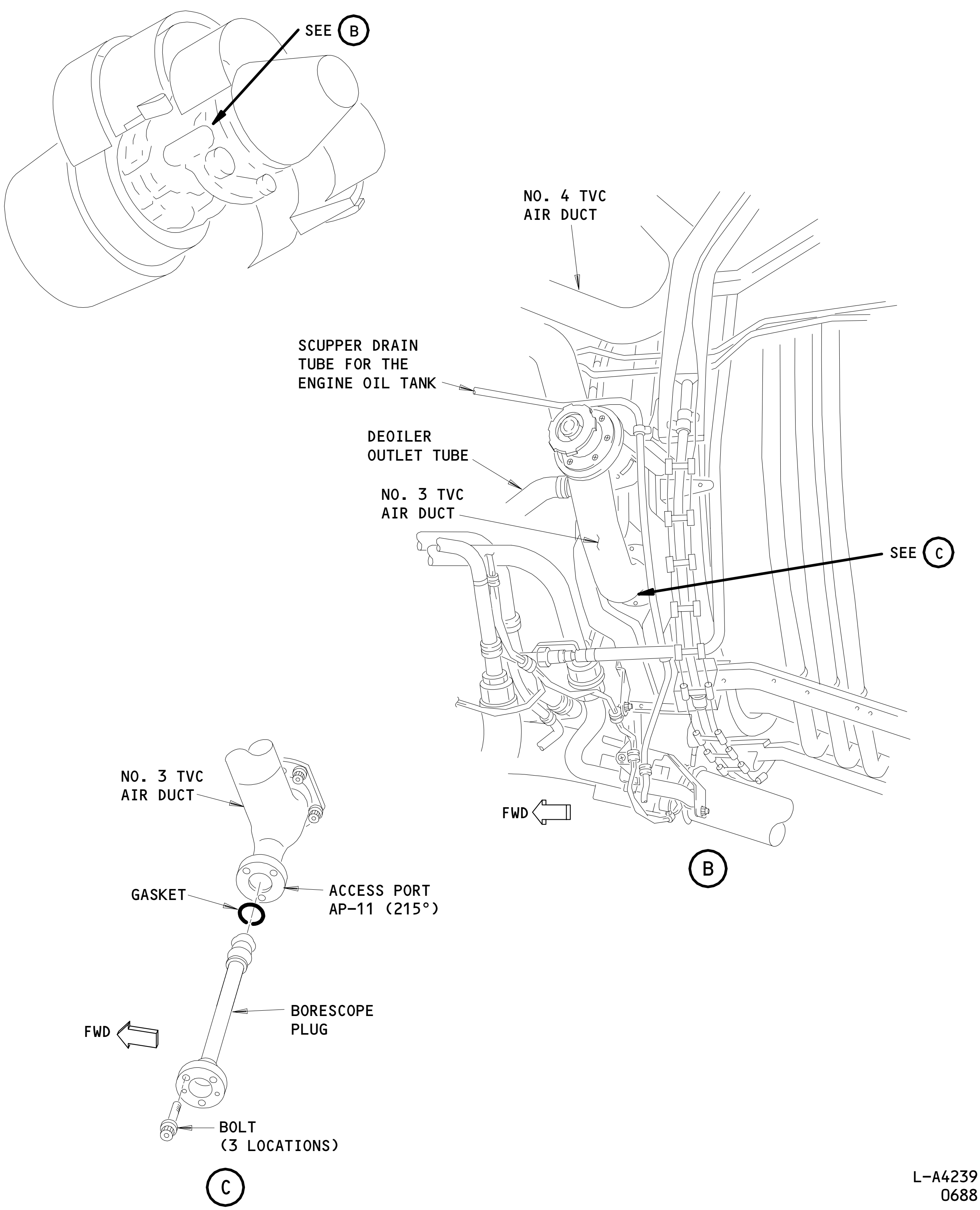
PLANVIEW - COMBUSTION CHAMBER
INTERNAL SURFACE

L-A3331
(0597)

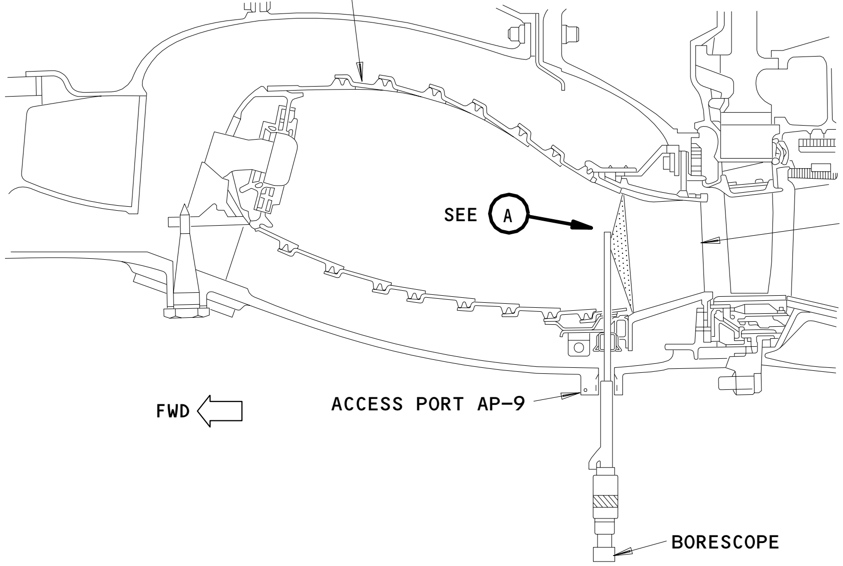
Inner Combustion Chamber
Figure 617

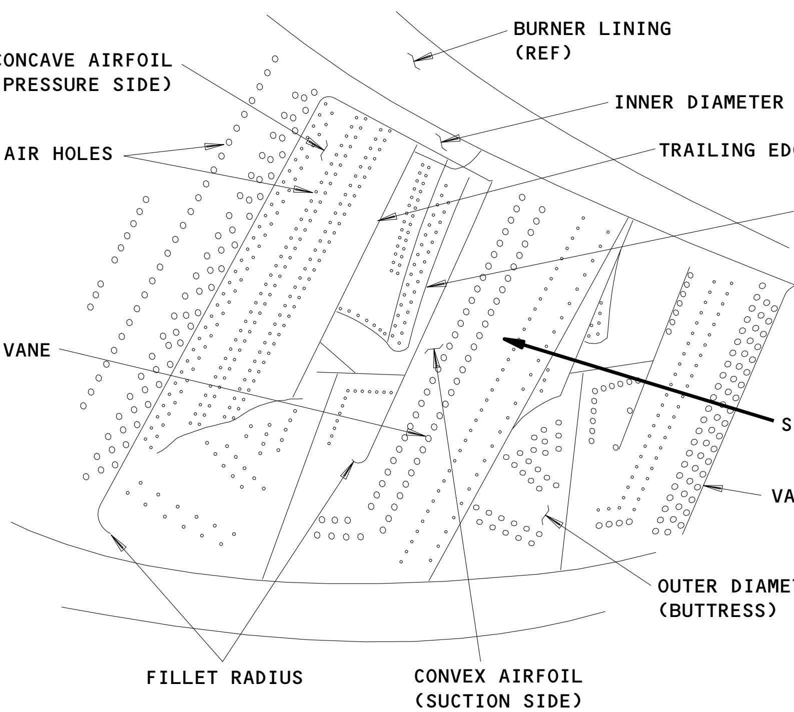


HPT/LPT Access Port Locations
Figure 618 (Sheet 1)



HPT/LPT Access Port Locations
Figure 618 (Sheet 2)

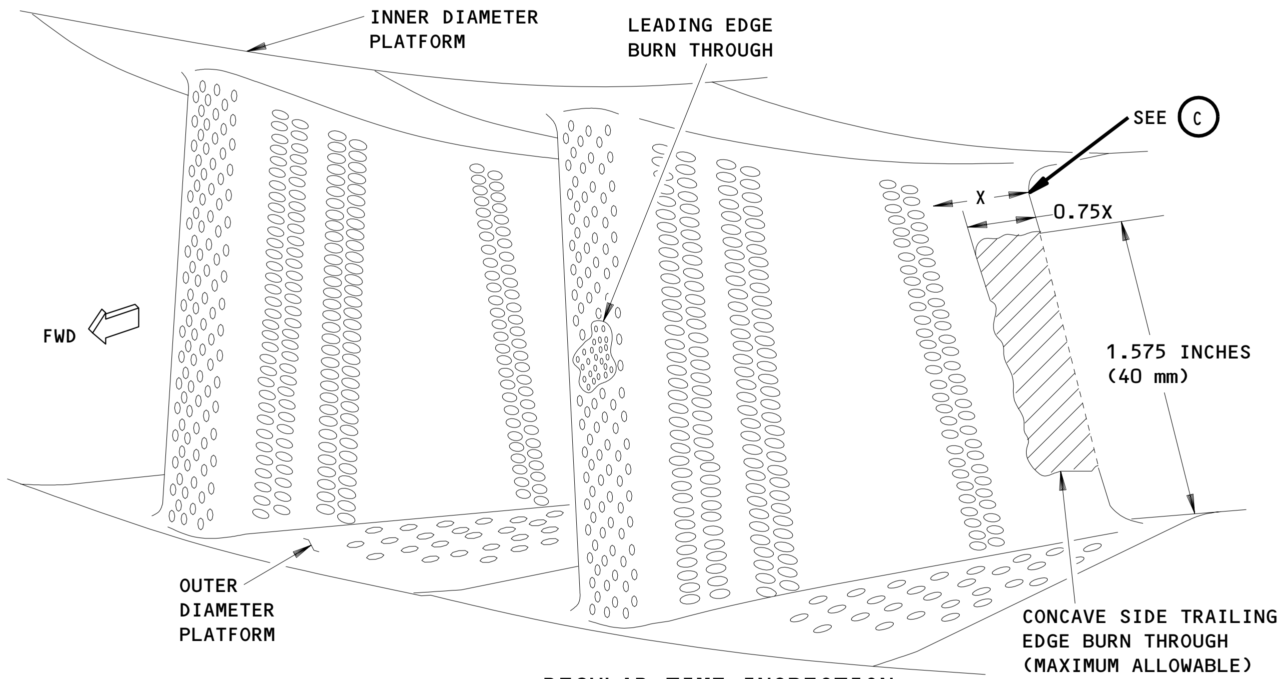




VIEW OF 1ST-STAGE HPT VANES THROUGH BORESCOPE
A

L-A1729 (0192)

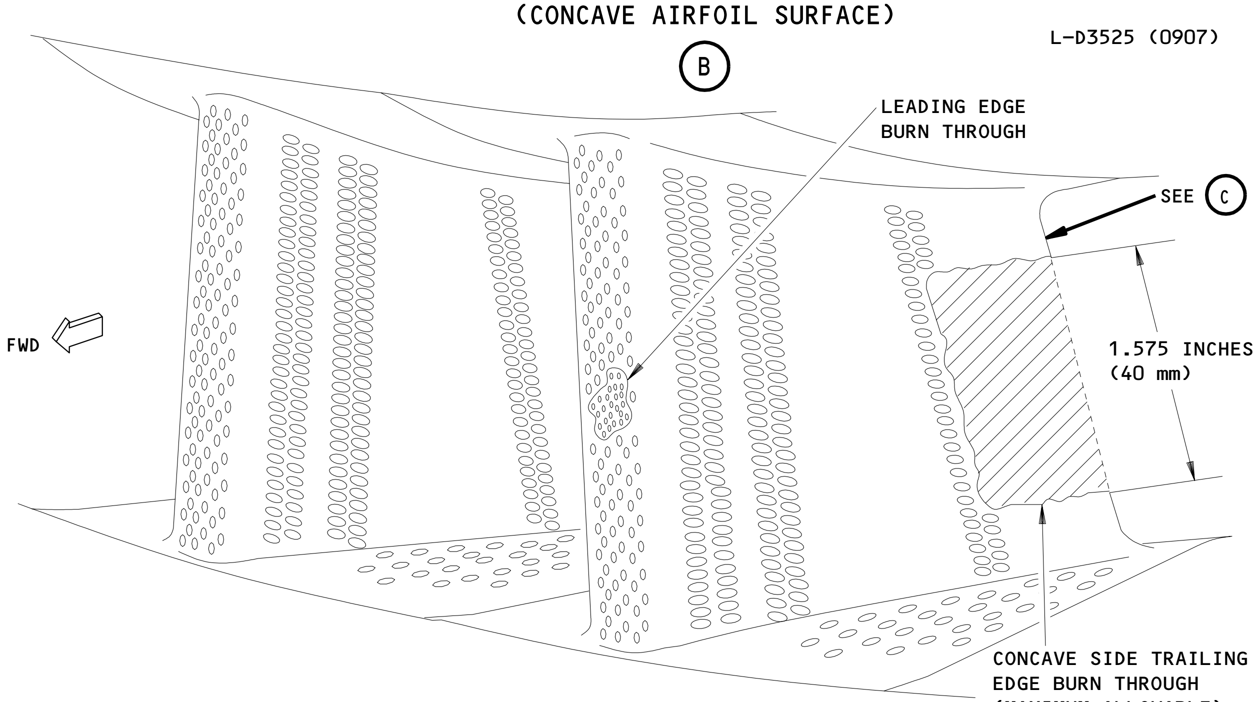
1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 1)



REGULAR TIME INSPECTION
(CONCAVE AIRFOIL SURFACE)

B

L-D3525 (0907)

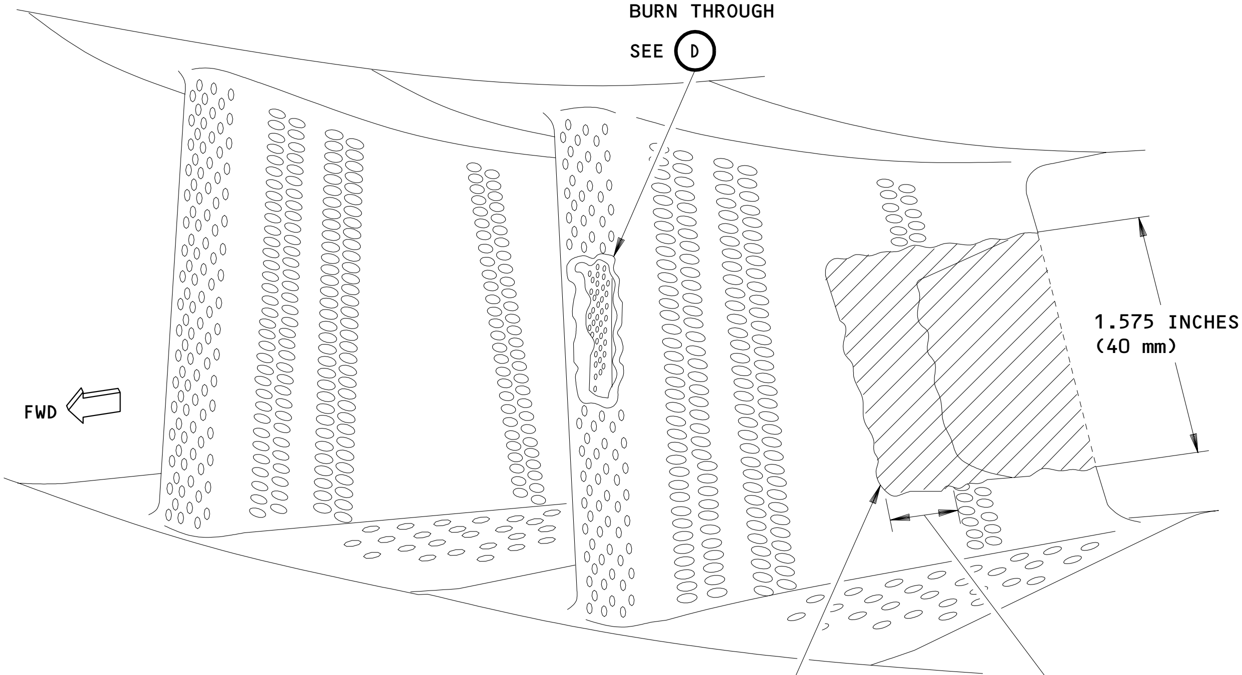


300 CYCLE DECREASED TIME INSPECTION
(CONCAVE AIRFOIL SURFACE)

B

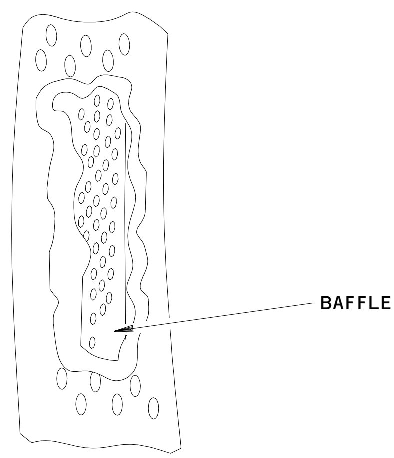
L-D3526 (0907)

1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 2)



150 CYCLE DECREASED TIME INSPECTION
(CONCAVE AIRFOIL SURFACE)

B

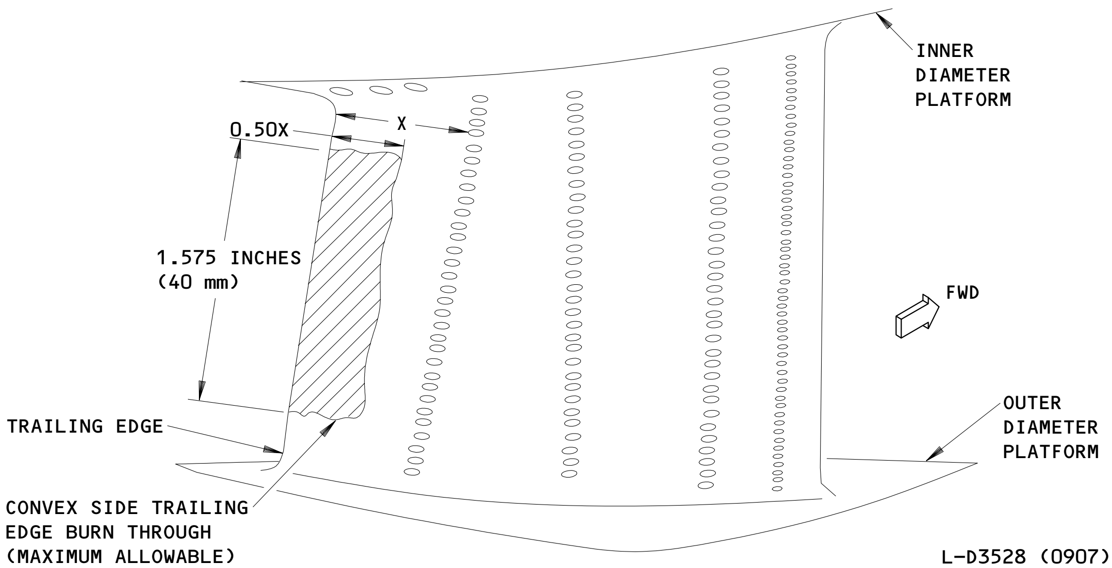


LEADING EDGE BURN THROUGH

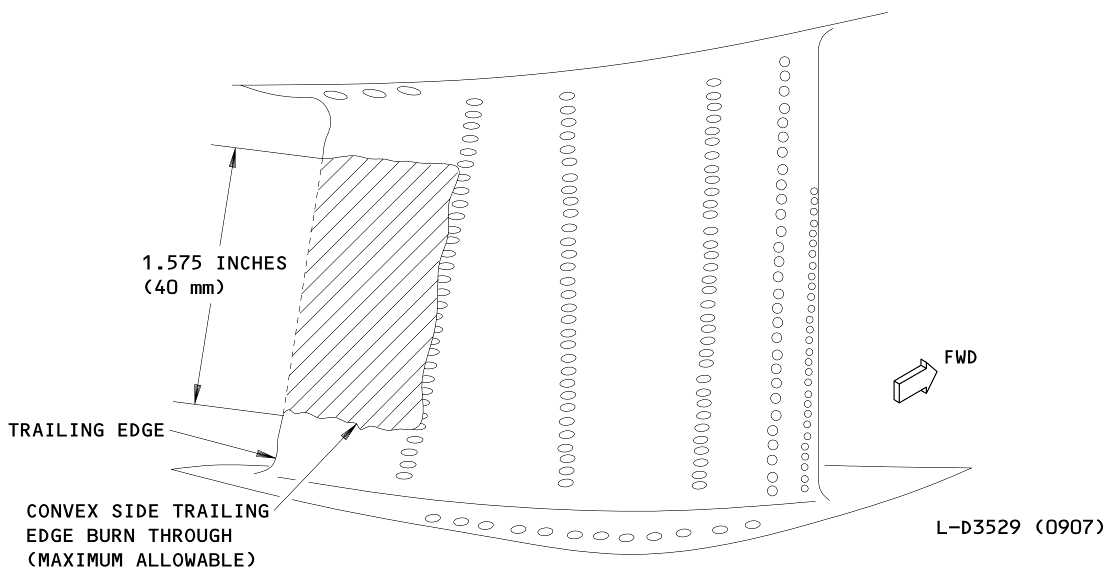
D

L-D3527 (0907) PWV

1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 3)

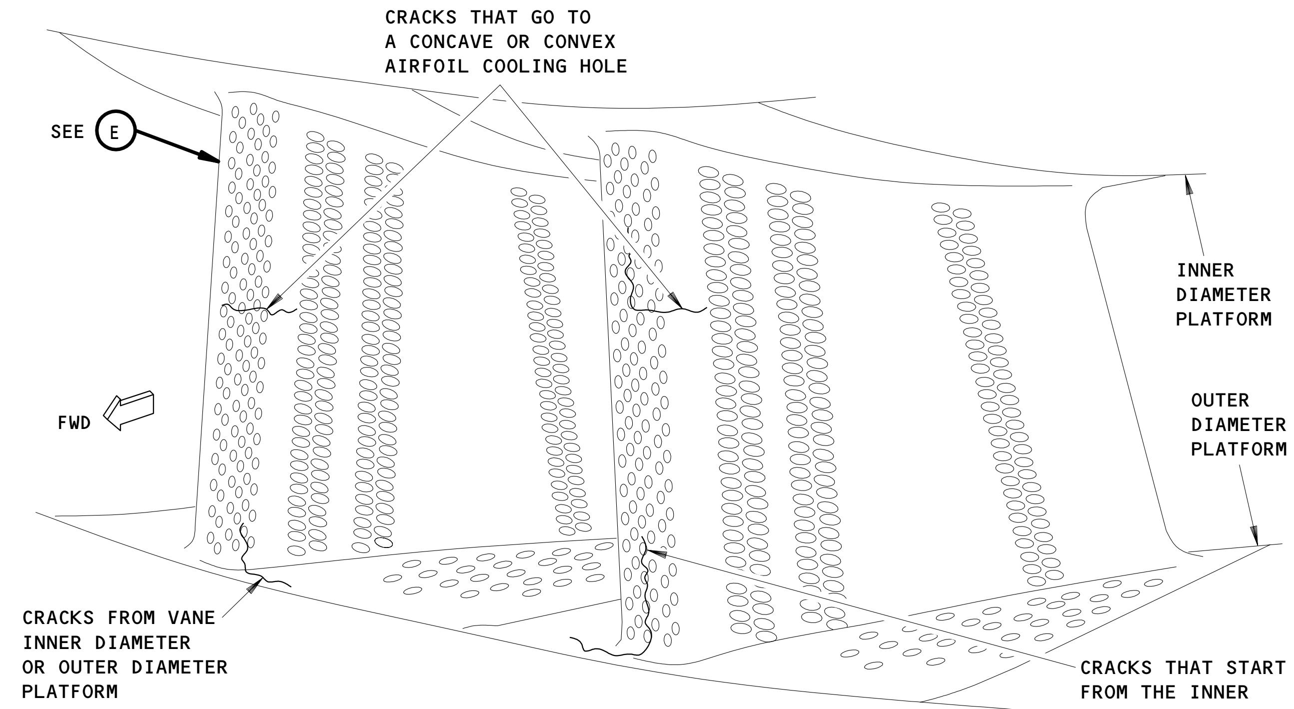


RETURN TIME INSPECTION
(CONVEX AIRFOIL SURFACE)
C



150 CYCLE DECREASED TIME INSPECTION
(CONVEX AIRFOIL SURFACE)
C

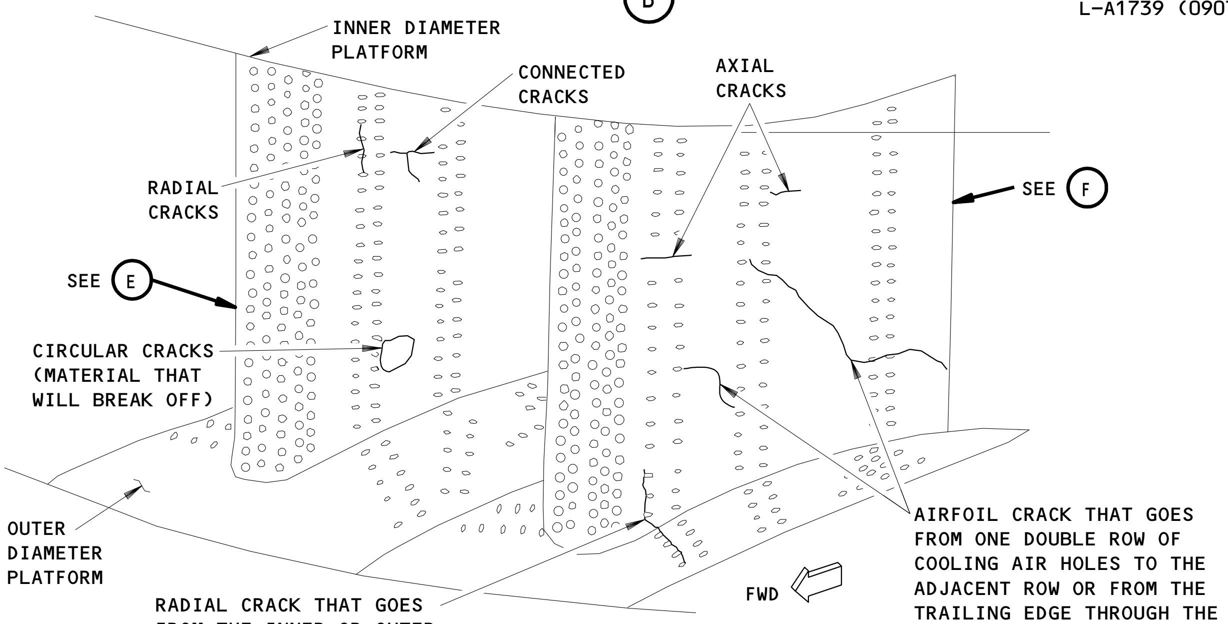
1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 4)



LEADING EDGE CRACKS

B

L-A1739 (0907) PWV

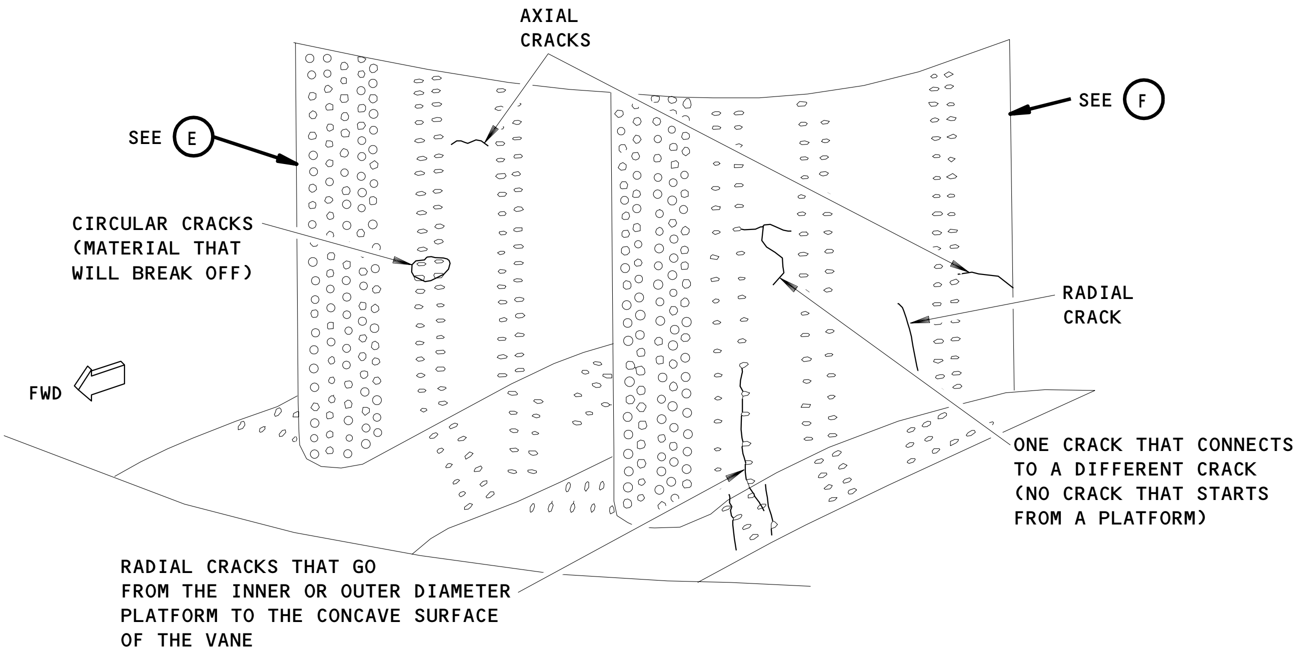


REGULAR TIME INSPECTION (CONCAVE AIRFOIL SURFACE)

B

L-A1740 (0907)

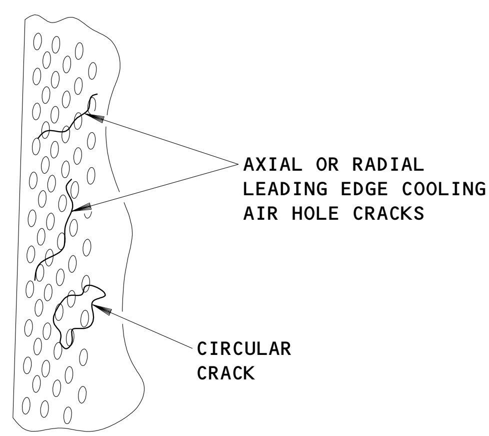
1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 5)



300 CYCLE DECREASED TIME INSPECTION
(CONCAVE AIRFOIL SURFACE)

L-A1743 (0907)

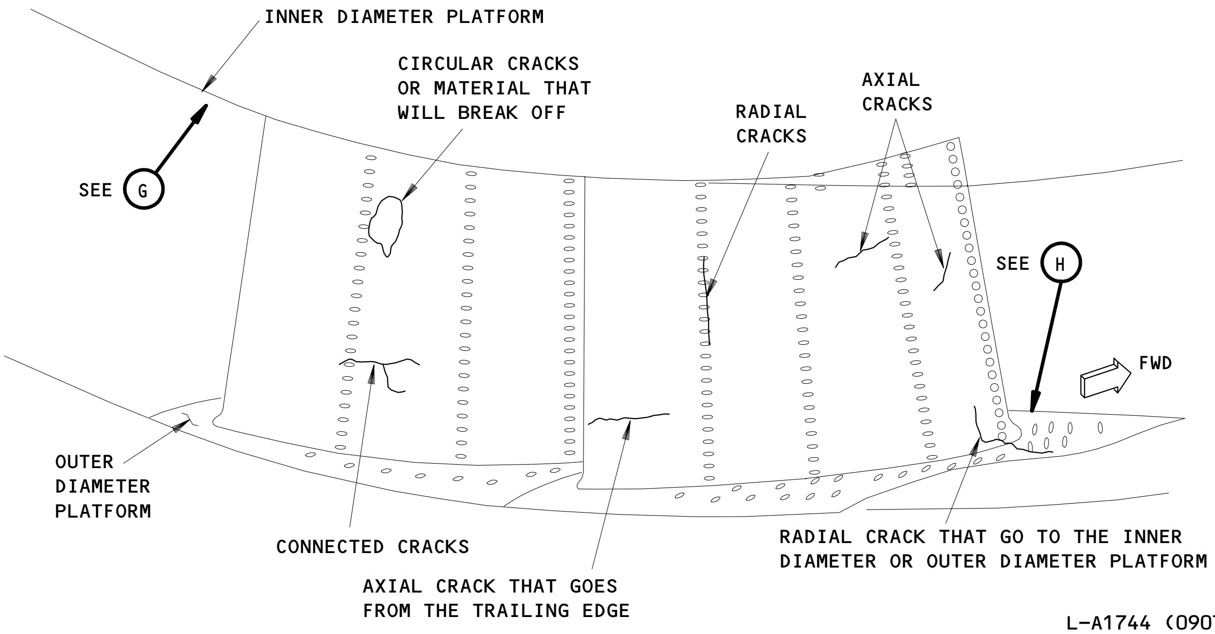
B



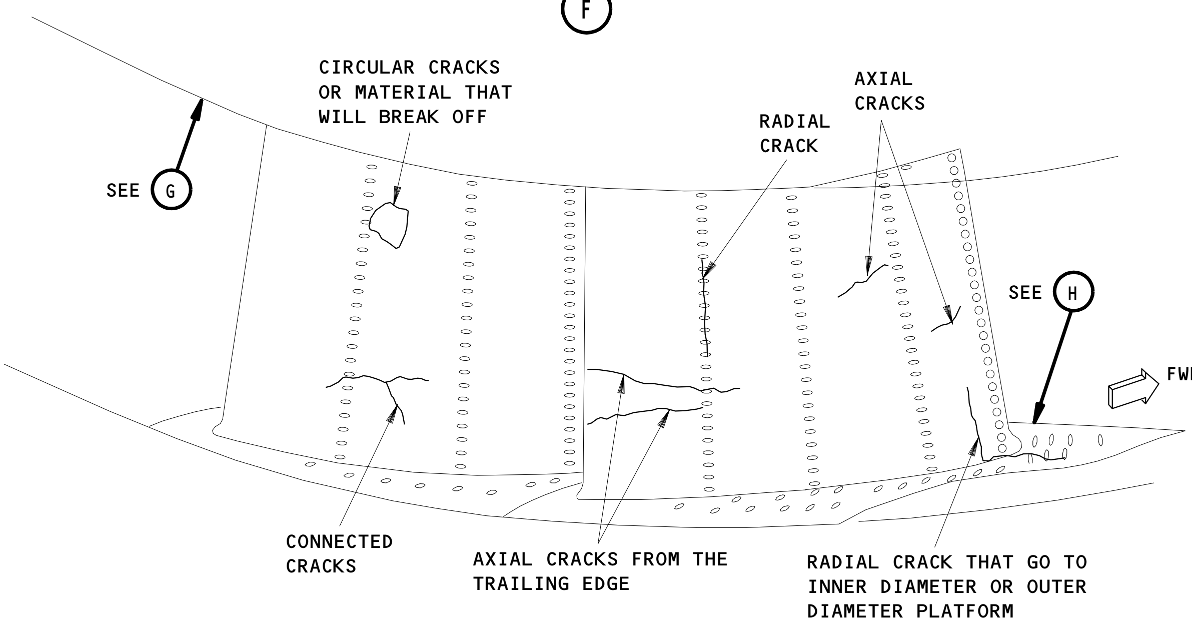
L-A1739 (0907)

E

1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 6)



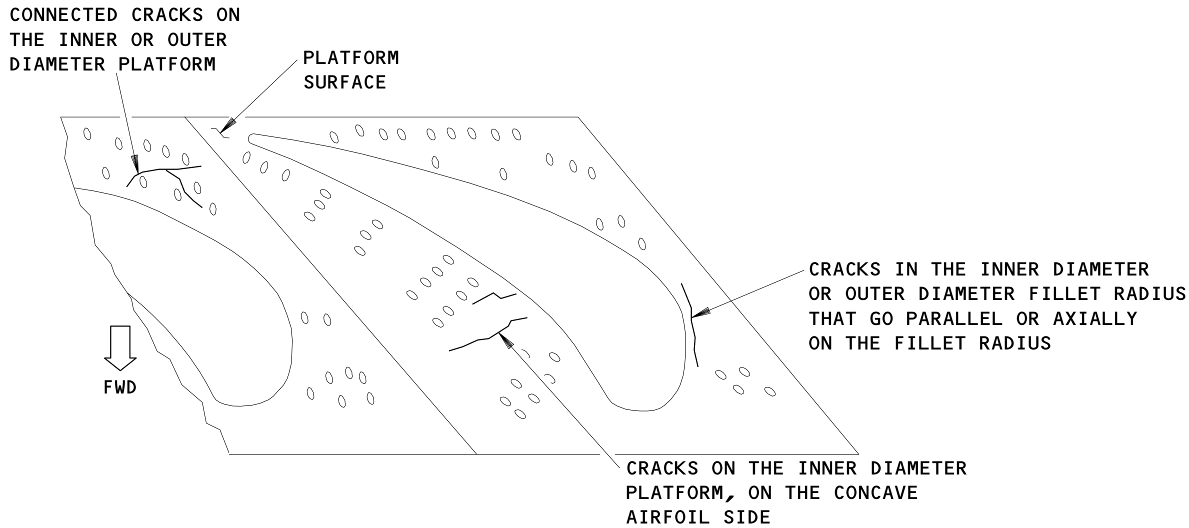
REGULAR TIME INSPECTION
(CONVEX AIRFOIL SURFACE)
F



300 CYCLE DECREASED TIME INSPECTION
(CONVEX AIRFOIL SURFACE)
F

L-A1745 (0907)

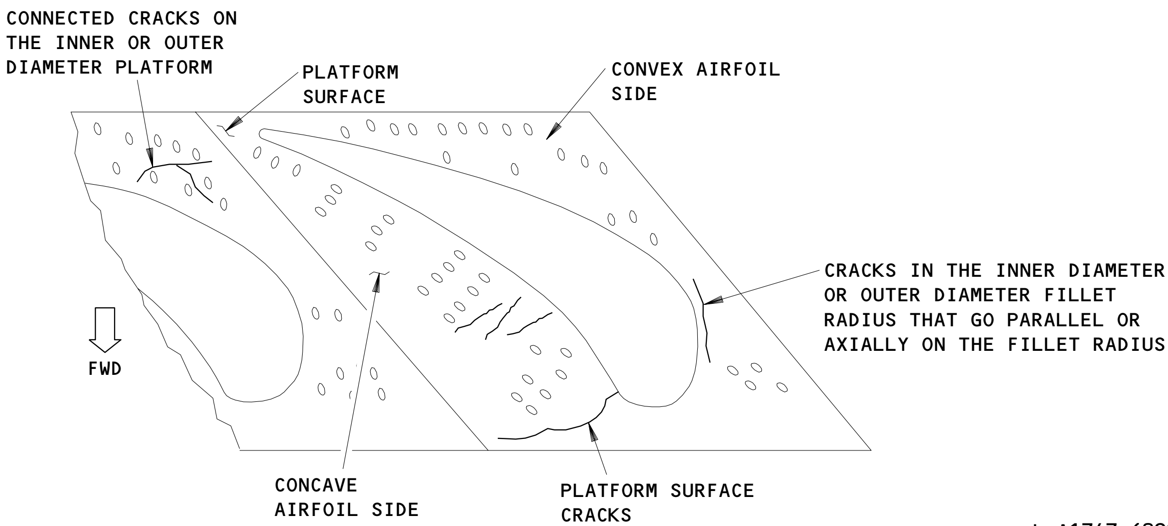
1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 7)



REGULAR TIME INSPECTION
(INNER DIAMETER PLATFORM)

G

L-A1746 (0907)

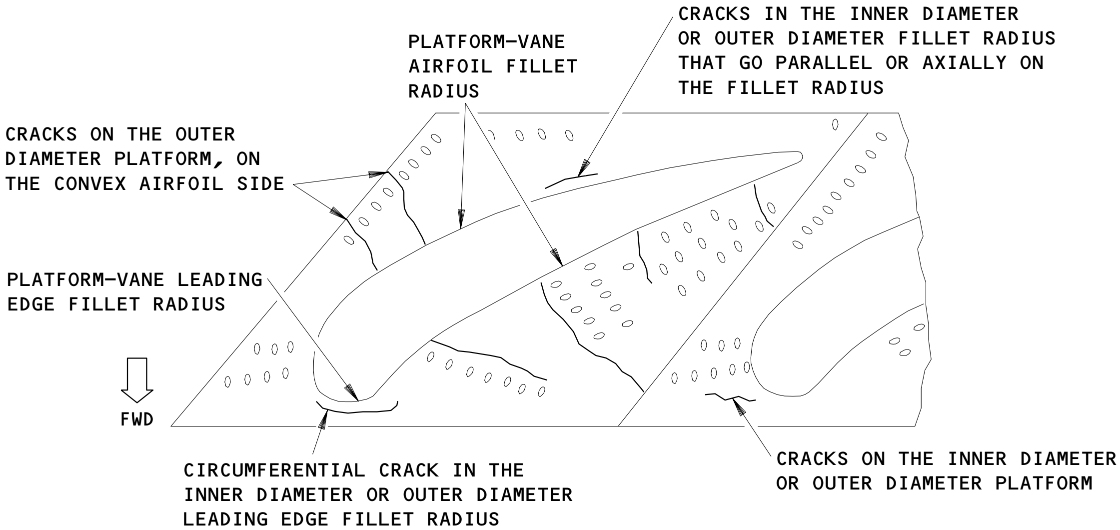


L-A1747 (0907)

300 CYCLE DECREASED TIME INSPECTION
(INNER DIAMETER PLATFORM)

G

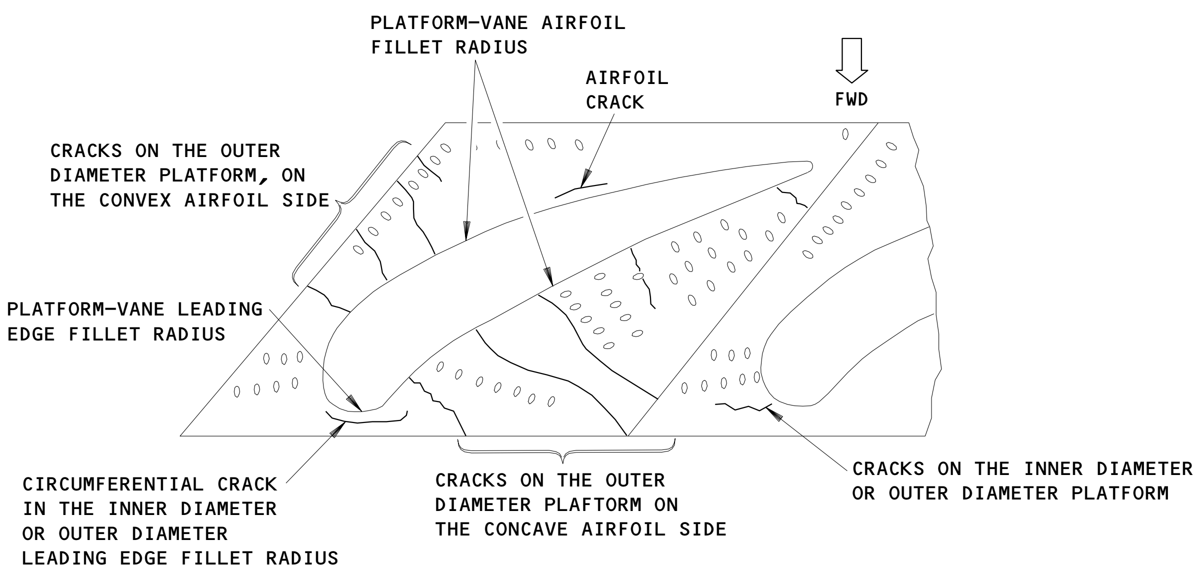
1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 8)



REGULAR TIME INSPECTION
(OUTER DIAMETER PLATFORM)

L-A1746 (0907)

H

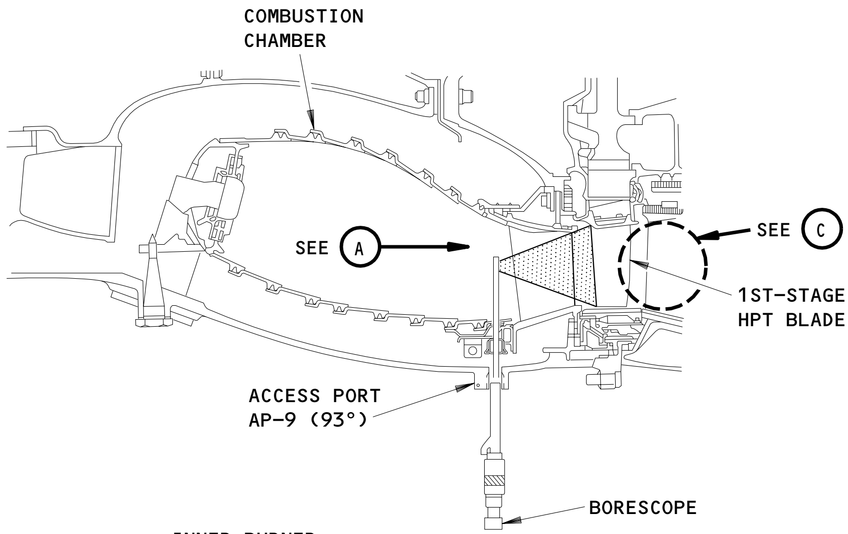


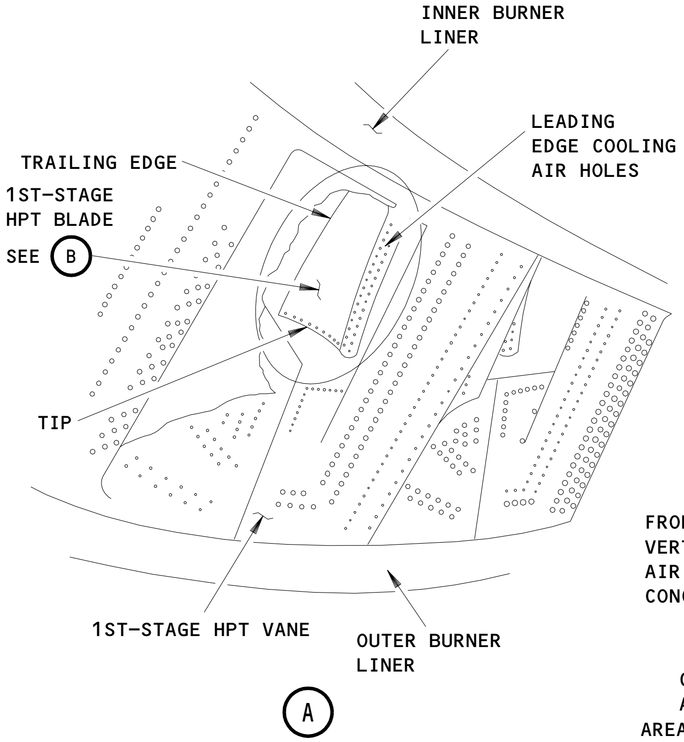
300 CYCLE DECREASED TIME INSPECTION
(OUTER DIAMETER PLATFORM)

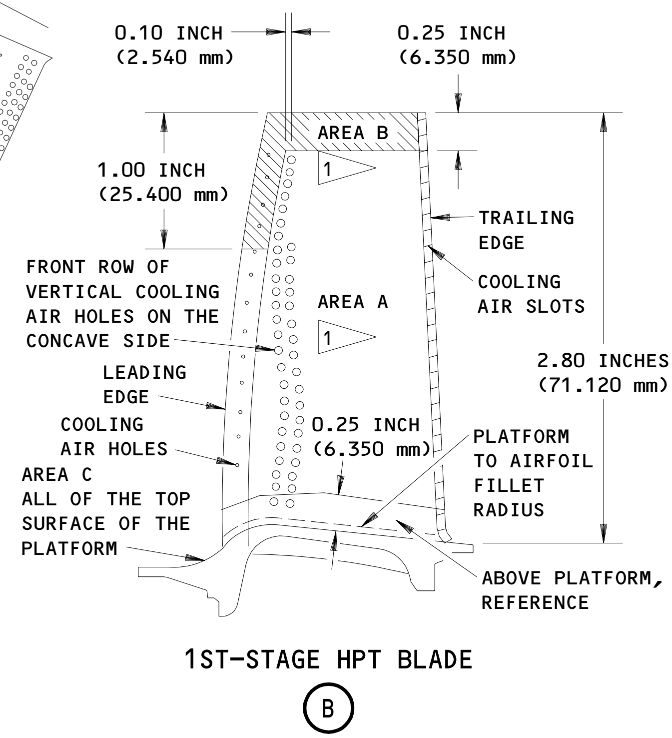
L-A1747 (0907)

H

1st-Stage HPT Vane Continue-In-Service Limits
Figure 619 (Sheet 9)

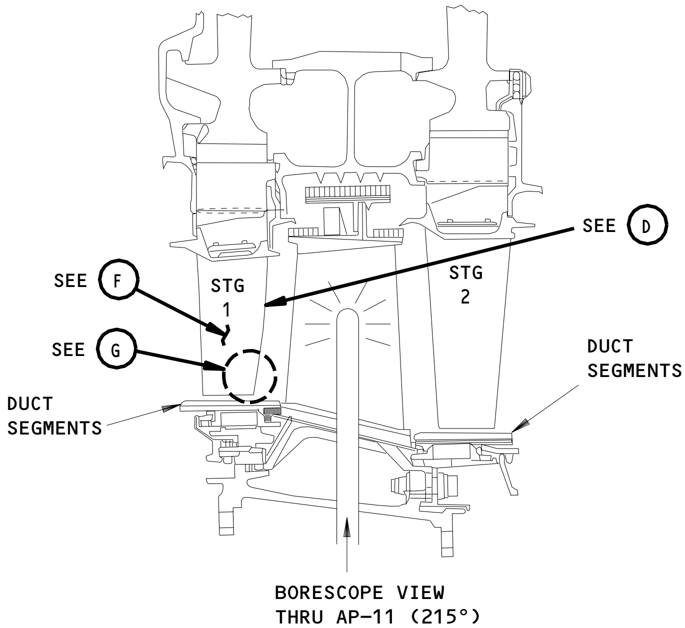


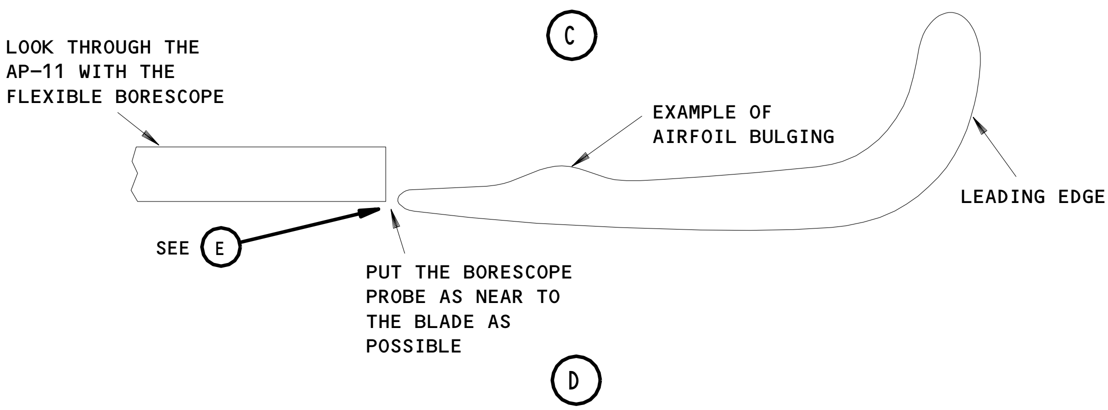


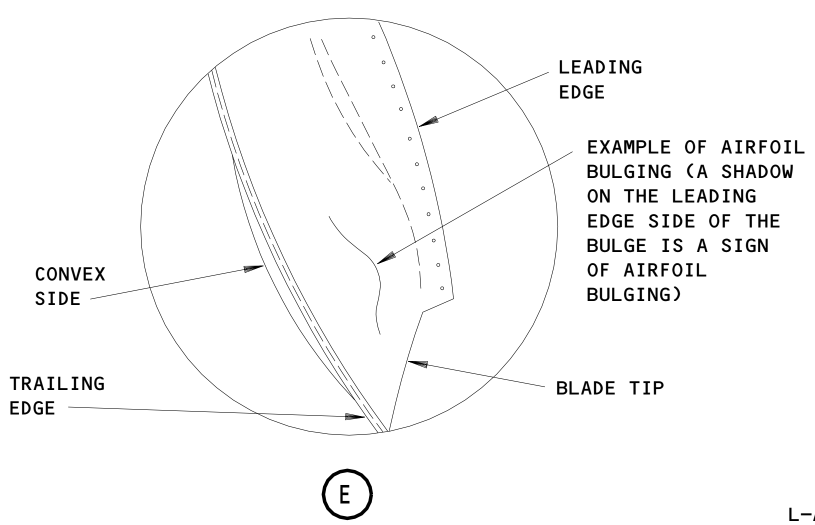


1 AREAS A AND B ARE ON THE CONVEX AND CONCAVE SIDE OF THE BLADE

1st-Stage HPT Blade Continue-In-Service Limits
Figure 620 (Sheet 1)

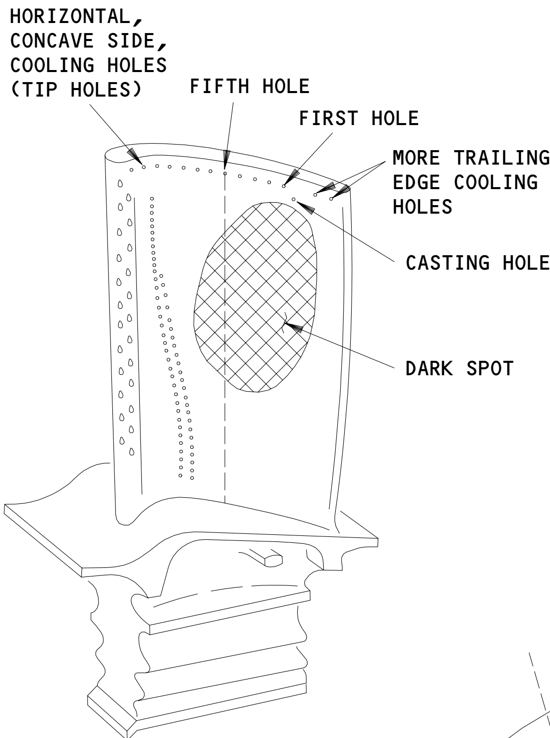






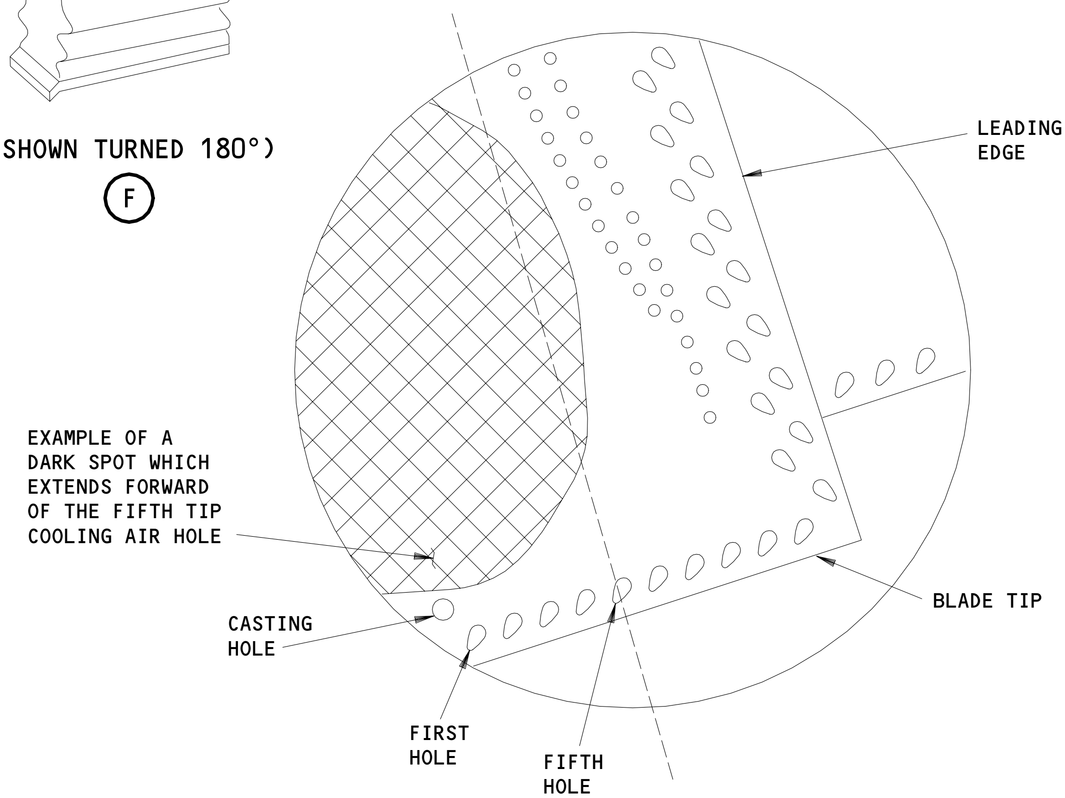
L-A7731 (0000)

1st-Stage HPT Blade Continue-In-Service Limits
Figure 620 (Sheet 2)



(SHOWN TURNED 180°)

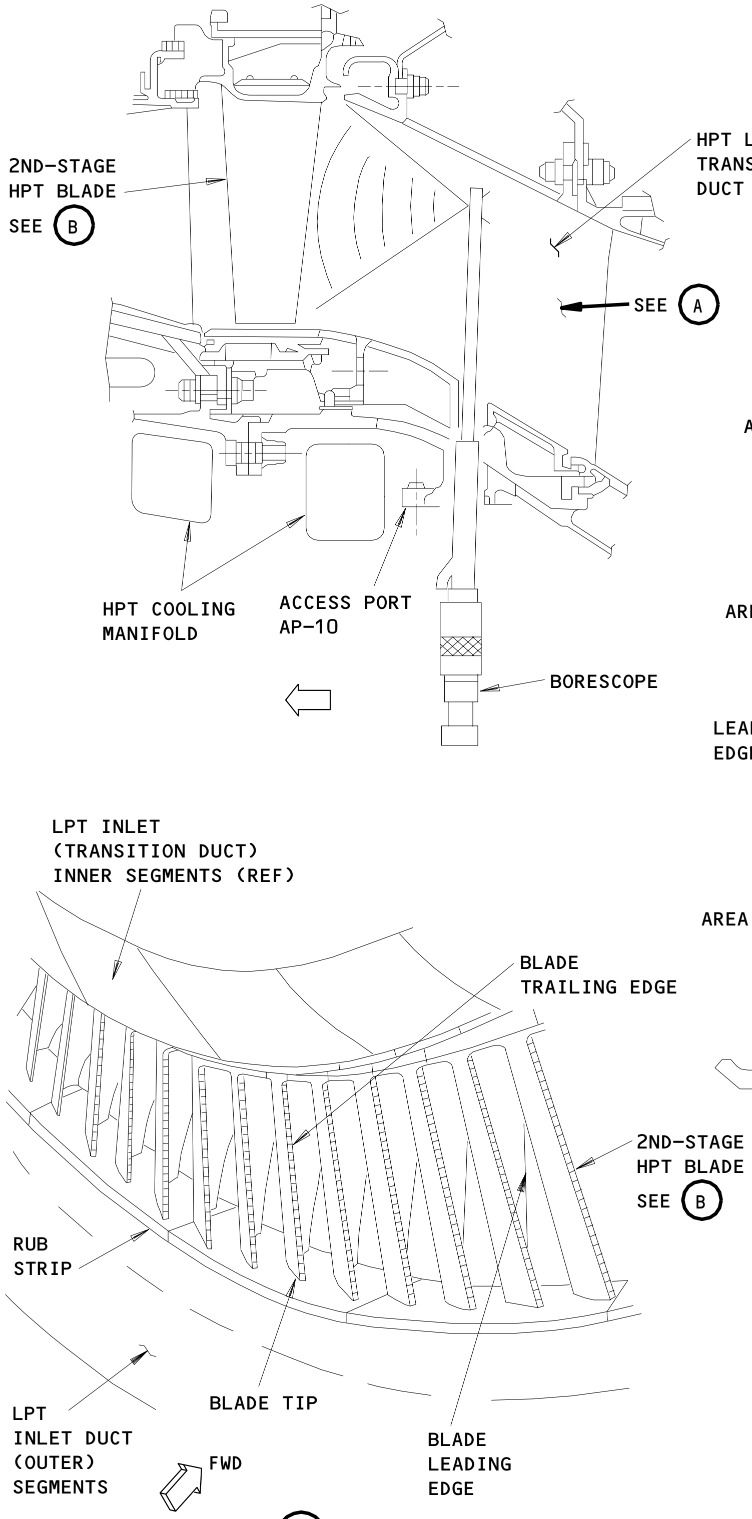
F

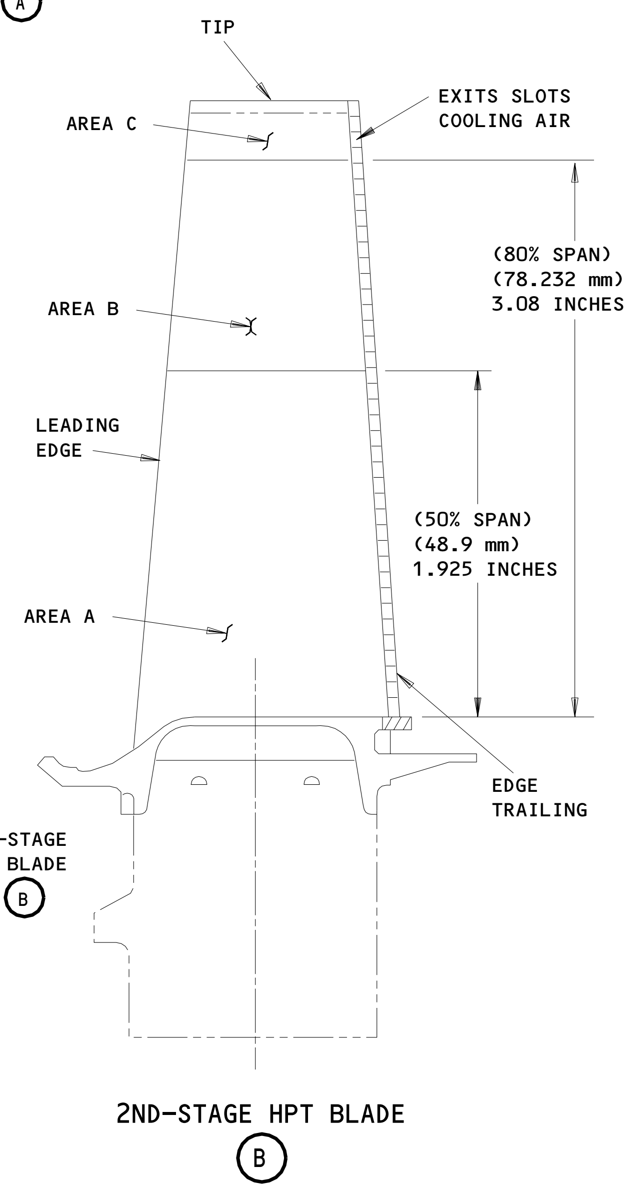


G

L-A7732 (0000)

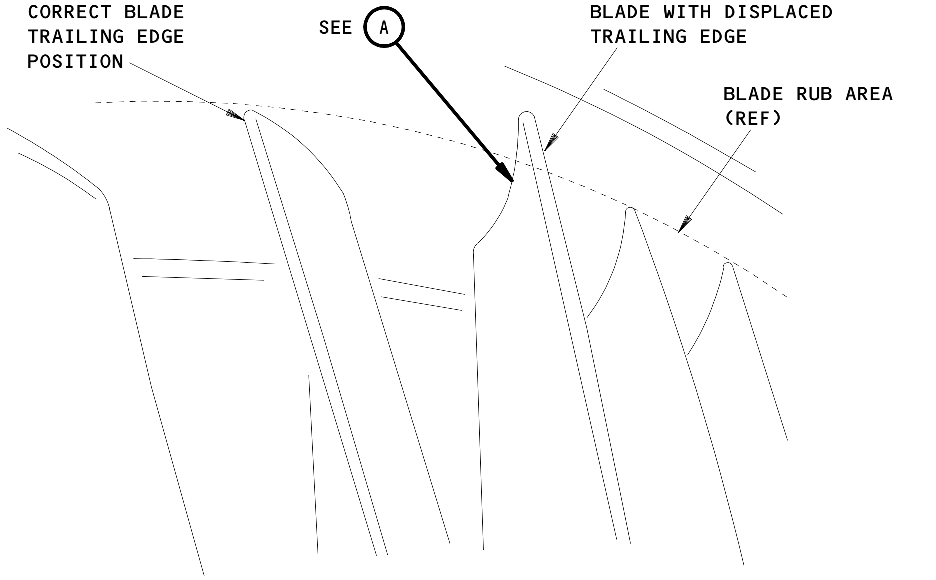
1st-Stage HPT Blade Continue-In-Service Limits
figure 620 (Sheet 3)



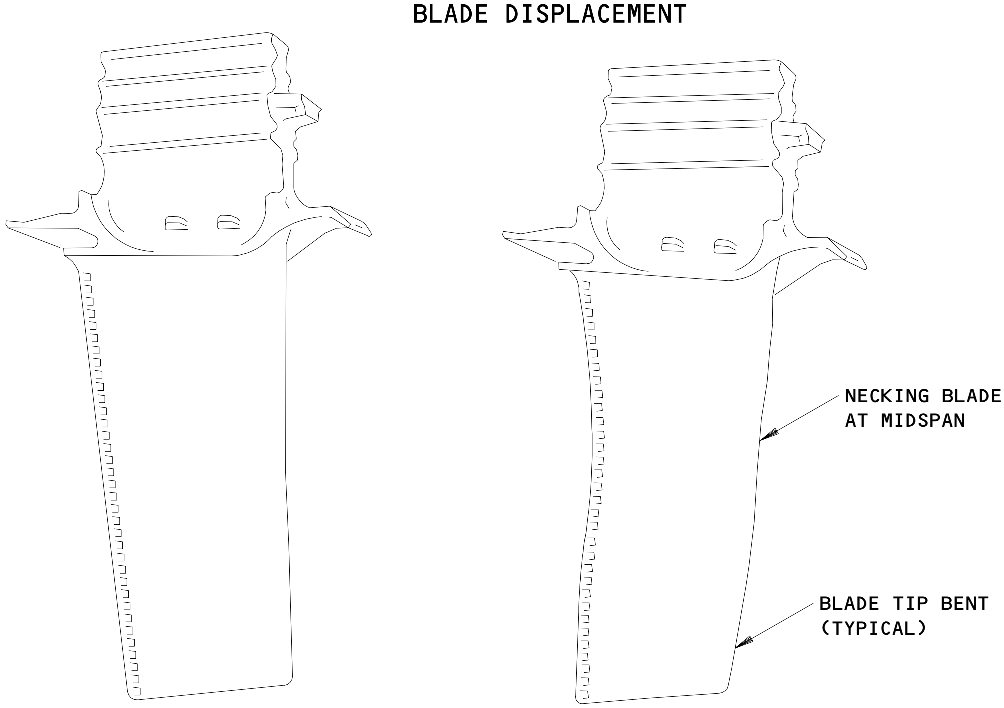


L-A0603
L-A0660

2nd-Stage HPT Blade Continue-In-Service Limits
Figure 621



BORESCOPE VIEW AS SEEN THROUGH AP-10 PORT SHOWING 2ND-STAGE BLADE DISPLACEMENT

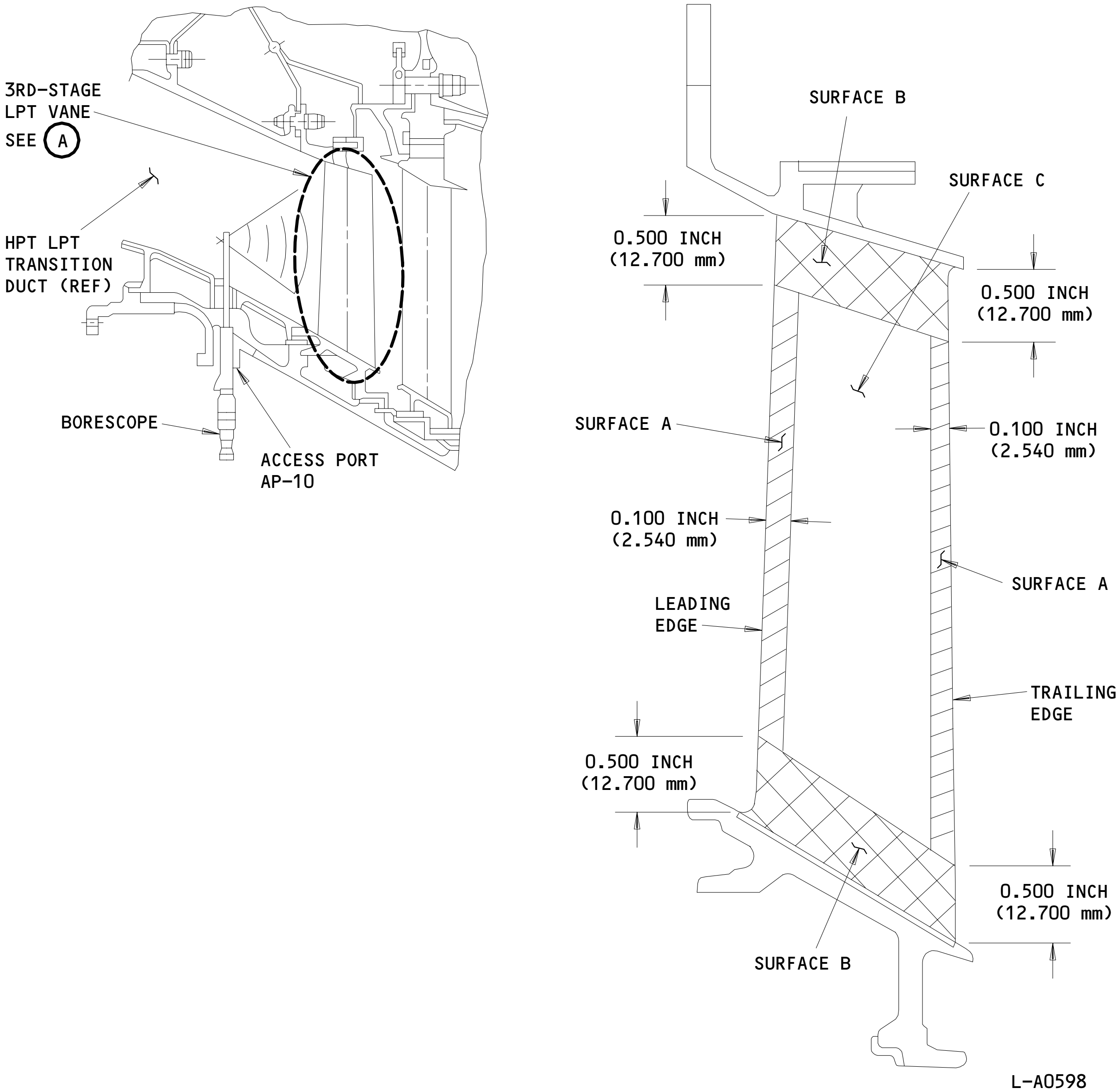


HPT 2nd-STAGE CAUSED BY AIRFOIL GROWTH (ACCEPTABLE BLADE)
A

HPT 2nd-STAGE CAUSED BY AIRFOIL GROWTH (UNACCEPTABLE BLADE)
A

G-11959 (0105)
PWV

2nd-Stage HPT Blade Continue-In-Service Limits
Figure 621A

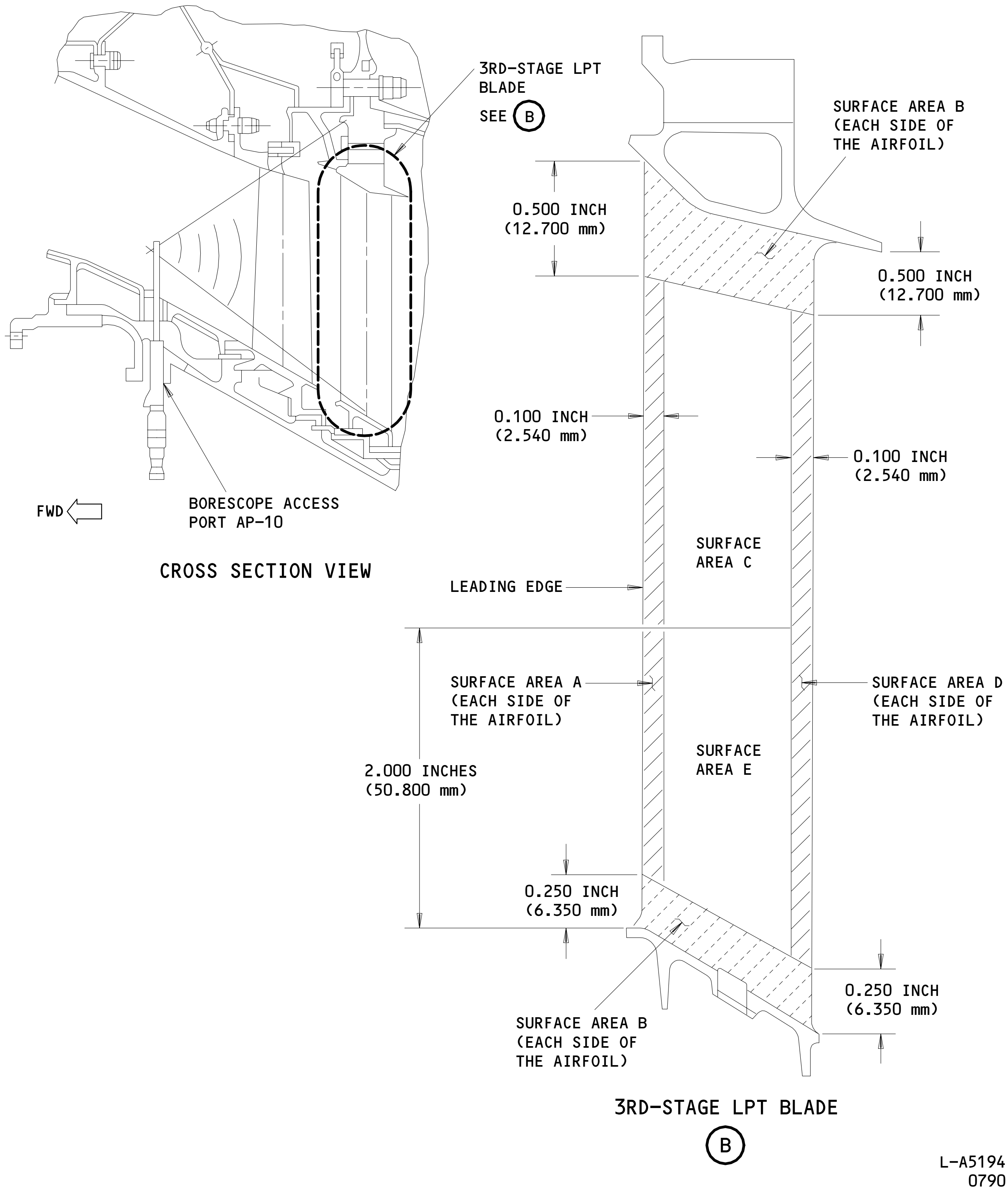


3RD-STAGE LPT VANE

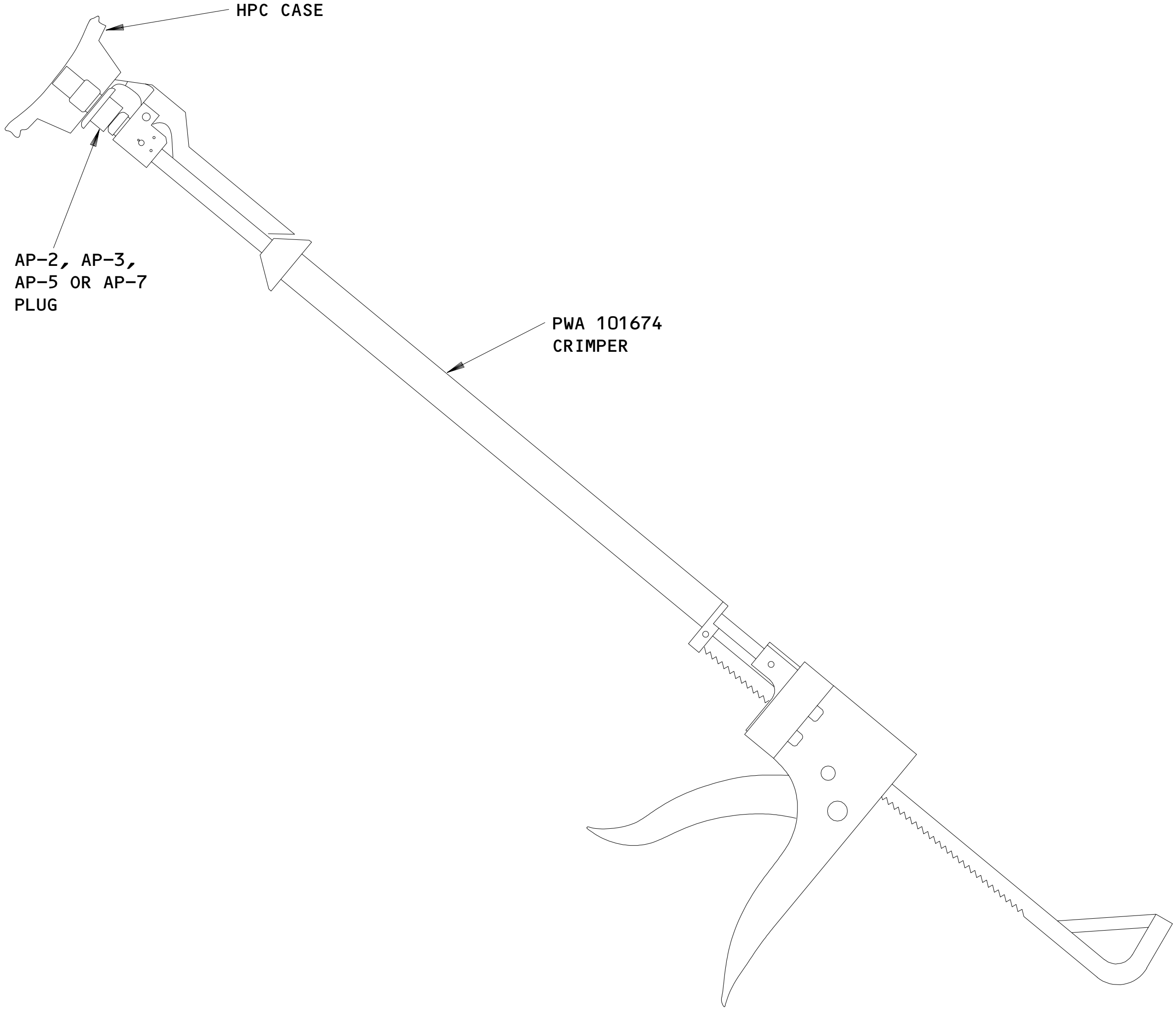
A

SURFACE A	DENTS OR MOVED METAL NOT MORE THAN 0.030 INCH. (0.762 mm). NO CRACKS ARE PERMITTED.
SURFACE B	NO DAMAGE IS PERMITTED.
SURFACE C	DENTS NO MORE THAN 0.020 INCH. (0.508 mm) IN DEPTH ARE PERMITTED. NO CRACKS ARE PERMITTED.

3rd-Stage LPT Continue-In-Service Limits
Figure 622 (Sheet 1)



3rd-Stage LPT Continue-In-Service Limits
Figure 622 (Sheet 2)



L-D3534 (0906)
PW V

Mechanical Crimper
Figure 623

ENGINE - CLEANING/PAINTING

1. General
    A. This procedure has these tasks:
        (1) A task to clean the engine gaspath using water with or without detergent (wet) for regular maintenance.
        (2) A task to clean the engine after the fire extinguishing agents are used (dry) and the engine will continue to operate.
        (3) A task to clean the engine after the fire extinguishing agents are used (dry) and the engine will be removed.
        (4) A task to clean the EPR (Engine Pressure Ratio) PT4.95 probes (pressure sensing holes).
    B. A large quantity of airflow in the engine can cause contamination to collect on the compressor blades. This contamination can decrease the engine performance. Clean the contamination off the compressor blades to increase the engine performance.
    C. A regular maintenance (wet) cleaning procedure of the engine internal gaspath does an engine motor operation with the starter. This is done while you apply water or a water and Gaspath cleaner mixture into the low pressure compressor inlet. Alcohol is added to the water when the temperature is below 0° C. The internal engine areas are made dry when the engine is operated.
    D. After the fire extinguishing agents are used, the (dry) cleaning procedure for the engine internal gaspath does an engine motor operation with the starter. This procedure blows out as much of the fire extinguishing agent as possible.

TASK 72-00-00-107-357-N00

2. Preparation of Gaspath and Compressor Cleaner Solution (SPS 87)
    A. General
        (1) This procedure shows the preparation of cleaner solution before you perform the gaspath/compressor clean.
    B. Reference
        (1) 70-00-00/201 - Potable Water Quality Specifications
    C. Consumable Materials
        (1) Solvent - Cleaner Gaspath (SPMC 87-4) (P11-021)

(2) Solvent - Cleaner Gaspath (SPMC 87-5) (P11-021)
(3) Solvent - Cleaner Gaspath (SPMC 87-6) (P11-021)
(4) Solvent - Cleaner Gaspath (SPMC 87-7) (P11-021)
(5) Solvent - Cleaner Gaspath (SPMC 87-9A) (P11-021)
(6) Solvent - Cleaner Gaspath (SPMC 87-9B) (P11-021)
(7) Solvent - Cleaner Gaspath (SPMC 87-10A) (P11-021)
(8) Solvent - Cleaner Gaspath (SPMC 87-10B) (P11-021)
(9) Solvent - Cleaner Gaspath (SPMC 87-11A) (P11-021)
(10) Solvent - Cleaner Gaspath (SPMC 87-11B) (P11-021)
(11) Solvent - Cleaner Gaspath (SPMC 87-11C) (P11-021)
(12) Solvent - Cleaner Gaspath (SPMC 87-12) (P11-021)
(13) Solvent - Cleaner Gaspath (SPMC 87-13) (P11-021)
(14) Solvent - Cleaner Gaspath (SPMC 87-14) (P11-021)

D. Procedure

S 917-358-N00

(1) You must obey the procedures and limits in the applicable AMM maintenance tasks.

S 917-359-N00

(2) Do the potable water quality specifications (Ref to 70-00-00/201).
   (a) Mix the gaspath solvent cleaner as specified in the applicable gaspath/compressor cleaning cart as follows:

      NOTE: SPMC 87-1 thru 87-3 and 87-8 are not available. There are no replacements.

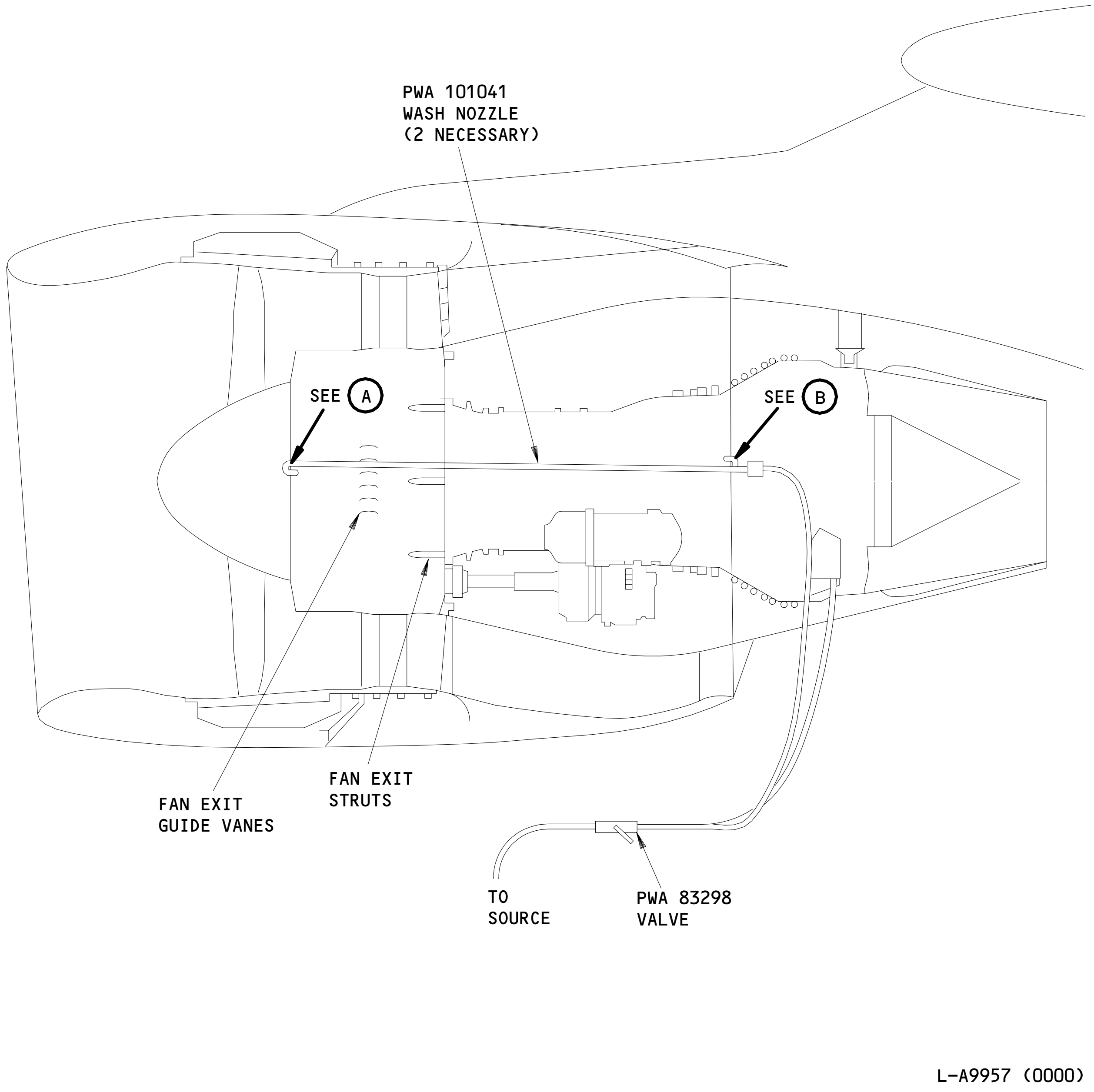
      1) SPMC 87-4, -6, -7, -10A, -11C, -12, -13, or -14 at 20% by volume with potable water.
      2) SPMC 87-5, -9A, -10B, or -11B at 100% by volume.
      3) SPMC 87-9B at 15% by volume with potable water.
      4) SPMC 87-11A at 10% by volume with potable water.
   (b) Use the solution at ambient temperature unless the manufacturer's instructions specify differently.

TASK 72-00-00-107-243-N00

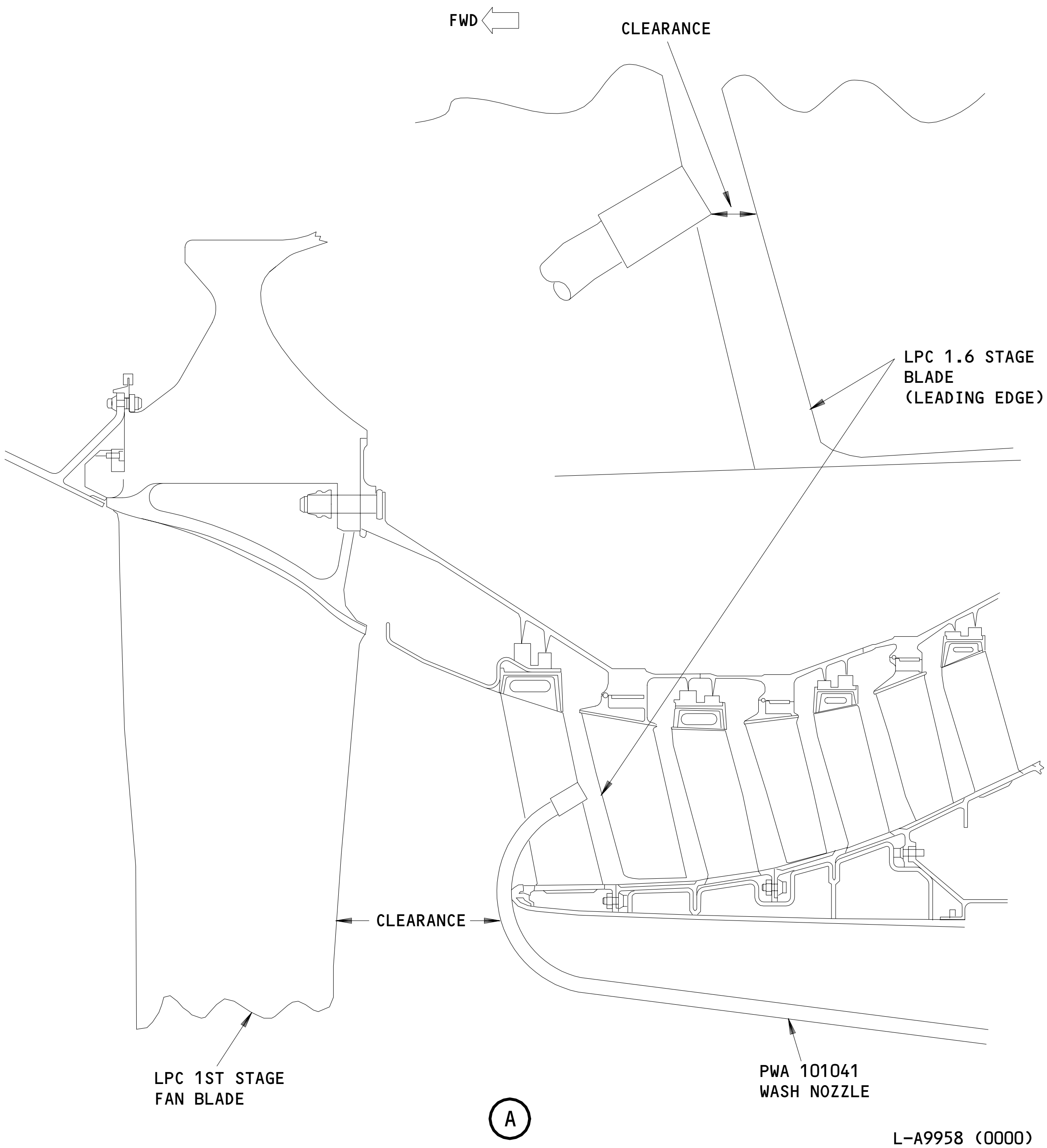
3. Clean Engine Gaspath (Water Wash With Or Without Cleaning Solution)

A. General

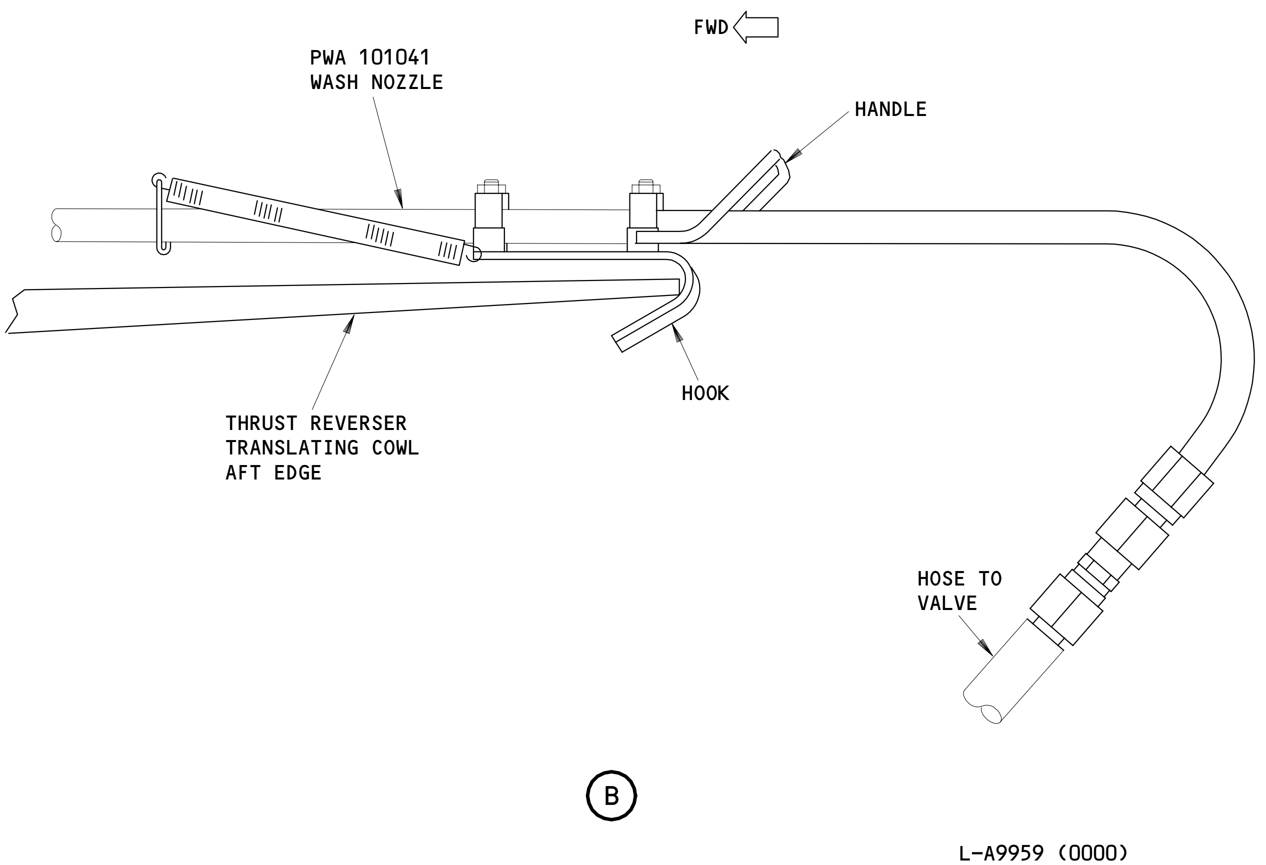
(1) This procedure is not reccomended on more than one engine during the same maintenance visit.



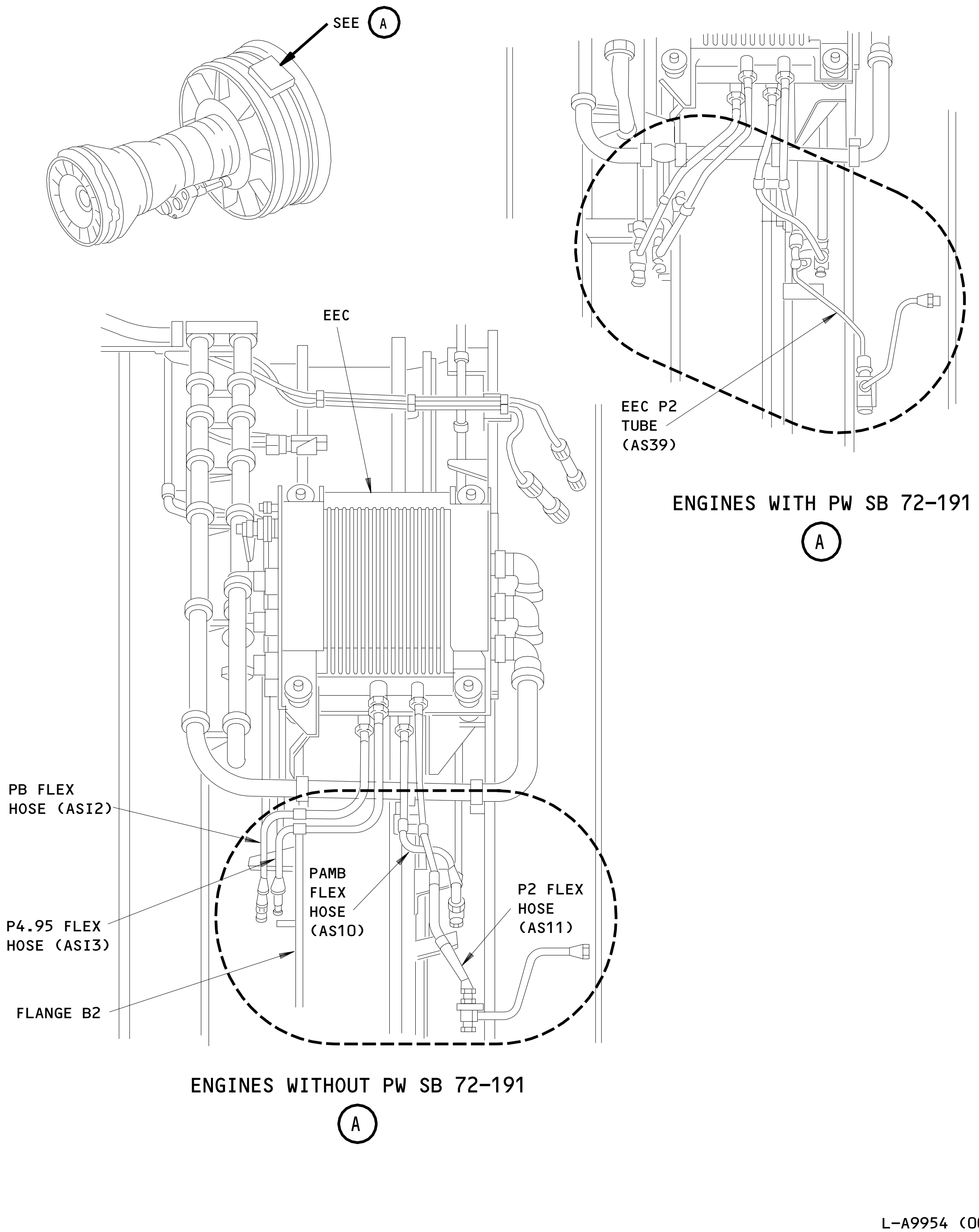
Water Wash Equipment Installation
Figure 701 (Sheet 1)



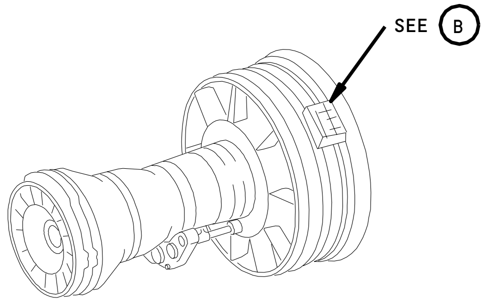
Water Wash Equipment Installation
Figure 701 (Sheet 2)

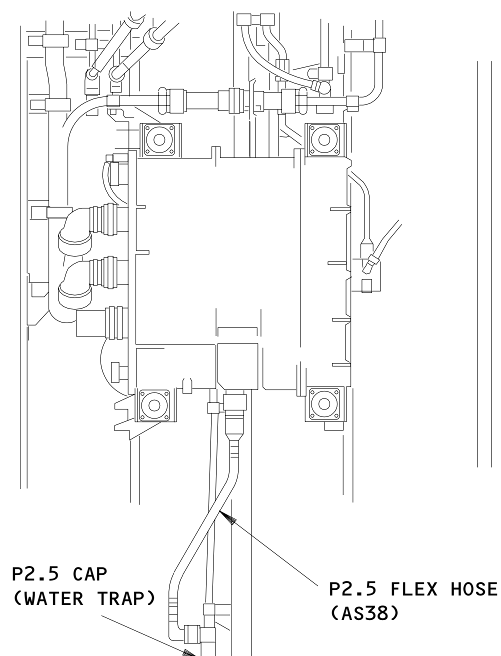


Water Wash Equipment Installation
Figure 701 (Sheet 3)



Electronic Engine Control Sensing Lines
Figure 702 (Sheet 1)



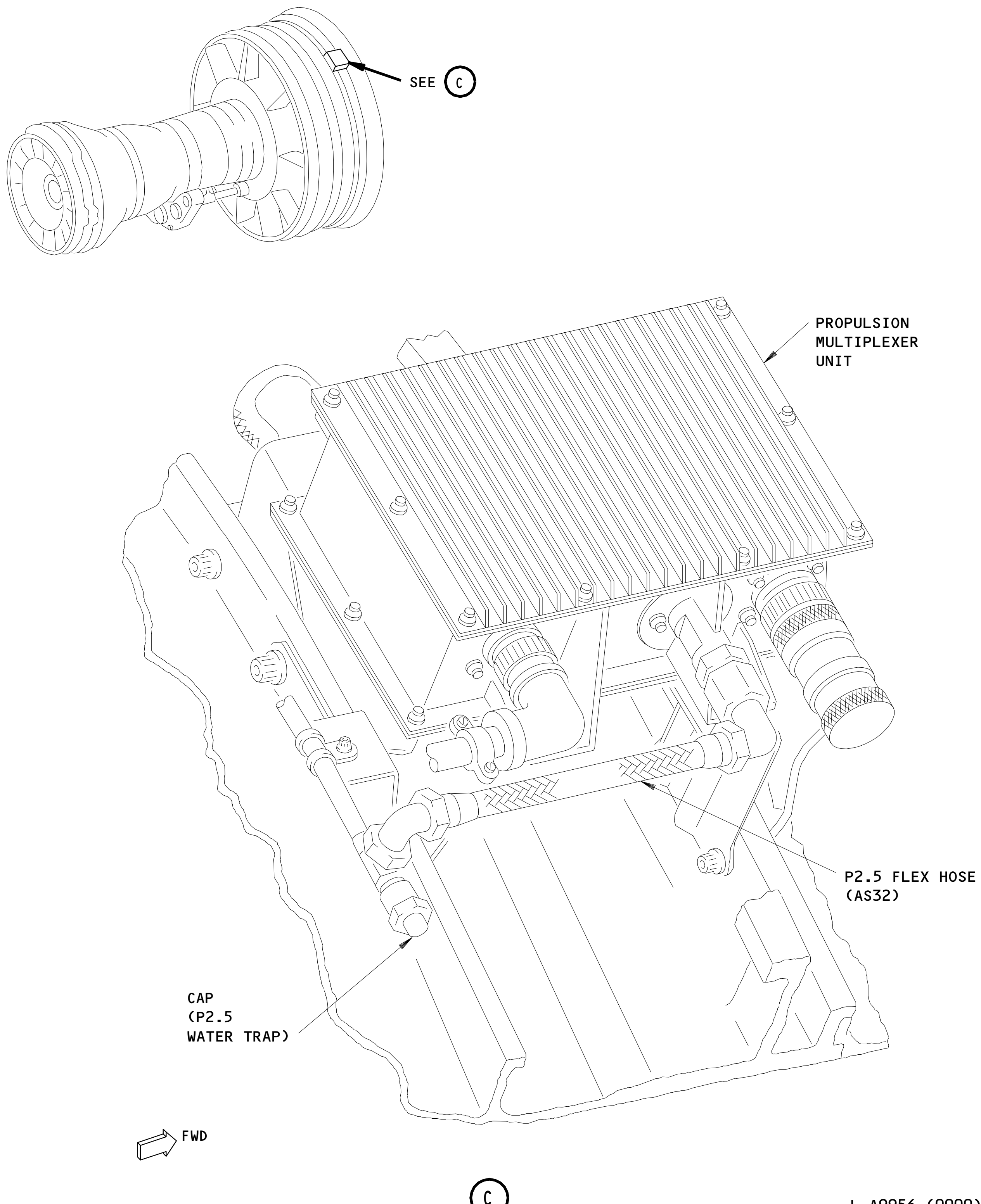


ENGINES WITH SCU WITH MULTIPLEXING

B

L-A9955 (0000)

Supplemental Control Unit (With Multiplexing) Sense Line
Figure 702 (Sheet 2)



Propulsion Multiplexer Unit (PMUX) Sense Lines
Figure 702 (Sheet 3)

B. Equipment

(1) Hoses - Water, and Suitable Nozzles, capable of providing a flow of 160 gpm (606 liters/min)

NOTE: Tests have shown that two 7/8 inch (22.2 mm) nozzles with applicable size hoses and pressure will supply this flow.

(2) Tank - Water (optional to a water source), with approximately a 250 U.S. gallon (946 liter) capacity, and with a pump that can supply a pressure of 50-100 psi (345-690 kPa).

(3) Air Source - (optional to nitrogen gas) Compressed, Clean, Filtered, Dry, 50 psi (345 kPa) discharge pressure.

(4) These tools are optional to the potable water (G00000), clean shop air (G00018) or nitrogen gas (G00960), hoses, and nozzles:

(a) Cart with a pump that is powered by gasoline - PWA 86516

(b) Cart with a pump that is powered by electricity - PWA 86517

(c) Cart with a pump that is powered by gasoline and has a system that supplies nitrogen - PWA 86527

(d) Cart with a pump that is powered by electricity and has a system that supplies nitrogen - PWA 86528

(e) Nozzles (2) - PWA 101041

NOTE: Test has shown that local water supply pressure will give enough flow. You must use one of the optional carts if:
- You use a cleaning solution or
- You use alcohol for antifreeze or
- There is no clean tap water source at the wash site.

(f) Valve with hoses that have a flow capacity of at least 15 gallons/minute (57 liters/minute) - PWA 83298

(5) M303, M305 or M307 Bergen Mechanical Crimper
Bergen Cable Technologies Inc
170 Gregg St.
P.O. BOX 1300
Lodi, NJ 07644-9982

C. Consumable Materials
   (1) G00018 Air - Clean Shop (Optional To The Nitrogen Gas)
   (2) B00400 Cleaner - Gaspath
   (3) B00649 Cleaner - Wipe
   (4) B00651 Cleaner - Wipe
   (5) G00834 Cloth - Cotton And Lint Free
   (6) G00960 Gas - Nitrogen
   (7) B00105 Pad - Scotch Brite
   (8) Lockwire, (P05-289) 0.032 inch (0.813 mm) AS3214-02
   (9) Cable, Safety (P05-291)
   (10) Ferrule, Safety Cable (P05-292)
   (11) G00000 Water - Potable (AMM 70-00-00/201)
   You can use either the clean water from a permanent source or the clean water from a container.

D. References
   (1) AMM 71-00-00/201, Power Plant
   (2) AMM 71-11-04/201, Fan Cowl Panels
   (3) AMM 71-11-06/201, Core Cowl Panels
   (4) AMM 73-21-04/601, Electronic Engine Control (EEC)
   (5) AMM 75-33-05/201, Filter Element - Air
   (6) AMM 70-11-10/201, Fire Extinguishing Agents Hydraulic Fluid, Or Oil Or Fuel (SPOP 425) - Engine Contamination
   (7) AMM 78-31-00/201, Thrust Reverser System

E. Access
   (1) Location Zone

411	Left Engine
412	Right Engine

   (2) Access Panel

415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)

F. Prepare the Engine for the Procedure

S 447-361-N00

CAUTION: IT IS NOT RECOMMENDED THAT YOU CLEAN AN ENGINE WITH WATER, IF A FIRE EXTINGUISHING AGENT MADE OF A DRY CHEMICAL POWDER WAS USED IN THE GASPATH. WATER WILL CAUSE THE DRY CHEMICAL POWDER TO BECOME TACKY AND BOND TO THE ENGINE PARTS.

THE DRY CHEMICAL POWDER MUST BE MADE NEUTRAL AND REMOVED FROM ALL ENGINE PARTS AT THE FIRST AVAILABLE TIME. THE DRY CHEMICAL POWDER CAN CAUSE CORROSION DAMAGE TO THE COMPRESSORS, HOT SECTION, AND TURBINE AREA PARTS. IT CAN ALSO CAUSE ENGINE OIL CONTAMINATION.

CAUTION: DO NOT DO THIS PROCEDURE ON BOTH ENGINES DURING THE SAME MAINTENANCE VISIT IF AT ALL POSSIBLE. HOWEVER, IF IT IS NOT POSSIBLE TO AVOID MAINTENANCE ON MORE THAN ONE ENGINE AT THE SAME TIME, IT IS RECOMMENDED THAT DIFFERENT TEAMS SERVICE EACH ENGINE.

(1) It is not reccomended that you do this procedure on more than one engine during the same maintenance visit.

S 447-244-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 107-347-N00

CAUTION: FOR ENGINES WITH DRY CHEMICAL POWDER FIRE EXTINGUISHING AGENTS IN THE GASPATH, DO NOT DO THIS WATER WASH WITH OR WITHOUT A CLEANING SOLUTION. THESE AGENTS ARE NOT WATER SOLUBLE. IF YOU WATER WASH WITH THESE AGENTS IN THE ENGINE GASPATH PARTS, THE AGENTS WILL STICK OR CAKE ON THE ENGINE GASPATH PARTS. MAKE SURE YOU LOOK AT CLEAN THE ENGINE WITH FIRE EXTINGUISHING AGENTS BY SPOP 429 (AMM 70-11-10/201) FOR THE CORRECT CLEANING REQUIREMENT FOR EACH TYPE OF CHEMICAL CONTAMINATION.

CAUTION: TO PREVENT THE FORMATION OF ICE, WATER WASH SHOULD NOT BE DONE WHEN AMBIENT TEMPERATURE IS LESS THAN 40°F (4.4°C) UNLESS YOU ADD ALCOHOL TYPE ANTIFREEZE TO THE WATER.

NOTE: Use your past experience to determine if you use a cleaning solution to wash the engine gaspath.

(3) To prevent the formation of ice, do not do this water wash procedure when the ambient temperature is less than 40°F (4.4°C) unless you add isopropyl alcohol to the water.

S 107-351-N00

(4) For an option, collect a pre water wash oil sample as follows.
   (a) Use a clear drain bottle, glass jar, or equivalent to collect a 4 ounce (100 ml) sample of oil.
   (b) Collect a sample from a low point on the engine.
   (c) Make a label of the sample as "Pre water wash".

S 727-245-N00

(5) Calibrate and install the wash equipment as follows:
   (a) Connect the hoses, adapters, valve (PWA 83298), and two nozzles (PWA 101041) to the source of the water.
   (b) Turn on the water source.
   (c) Adjust the PWA 83298 flow valve for approximately 15 US gallons (57 liters) per minute total flow (7.5 US gallons (28.5 liters) per minute from each nozzle).

      NOTE: Use a container of known volume and a stop watch to calculate the flow rate.

(d) Make a mark on the valve and valve handle for the correct position.
(e) Turn off the source.

S 487-246-N00

(6) Install the equipment to the engine as follows:
(a) Use two persons to carefully put the two nozzles (PWA 101041) into the rear part of the thrust reverser's fan exit area at approximately the 3 o'clock and 9 o'clock positions (Fig. 701).
(b) Put the nozzles over the forward lip of the fan exit fairing (spliter) just aft of the fan blades (Fig. 701).
(c) Make sure the flow will go into the engine core gaspath at approximately the 3 and 9 o'clock positions.
(d) Put the nozzles in position as not to touch the fan exit guide vanes.
(e) Carefully, attach the nozzle hooks to the thrust reverser translating cowl as follows:
1) Pull the hook handle aft
2) Engage the hook over the aft edge of the thrust reverser translating cowl to hold the wash nozzle in position (Fig. 701).
3) Check that the four detail bolts on the clamp assembly are tight to hold the clamp in the correct position.
4) Attach the hoses and valve to an adjacent structure so that they do not move while you clean the gaspath of the engine.

S 827-247-N00

(7) Examine the equipment installation as follows:
(a) If necessary, change the position of the wash nozzles for better attachment.
(b) Make sure there is enough clearance between the nozzles and the LPC 1st stage fan blades for safe engine motoring.
(c) Make sure you can turn the LPC freely.
(d) Make sure there is enough clearence between the nozzles and the LPC 1.6 stage blades for safe engine motoring.

(e) Make sure the hose and valve are not in the fan airstream and are correctly attached before you motor the engine with the starter.

(f) Make sure that the hoses and valve are correctly attached to an adjacent structure so that they do not move while you clean the gaspath of the engine.

S 117-248-N00

(8) For optional water wash with detergent, prepare 30 US gallons (113.56 liter) of detergent solution as follows:

Gaspath Cleaner (P11-021)	Make-up
SPMC 87-1, -2, -3, -4, -6, -7, -10A, -11C, -12, -13, or -14	20 percent cleaner by volume with potable water
SPMC 87-5, -9A, -10B, or -11B	100 percent cleaner
SPMC 87-9B	15 percent cleaner
SPMC 87-11A	10 percent cleaner

(a) Use the solution at ambient temperature unless the manufacturer's instructions specify differently.

(b) The solution must be completely mixed and you must start the water wash within one hour after you mix the solution.

S 117-249-N00

(9) For outside ambient temperatures less than 40°F (4.4°C), mix Isopropyl Alcohol to the water as follows.

Outside Air Temperature (OAT): Volume	Percent Alcohol By
39°F (3.9°C)	05
36°F (2.7°C)	09
33°F (0.6°C)	14
31°F (-0.6°C)	17
28°F (-2.2°C)	20
26°F (-3.3°C)	22
25°F (-3.9°C)	23
20°F (-6.7°C)	27
15°F (-9.4°C)	32
10°F (-12.2°C)	36
05°F (-15°C)	39
0°F (-17.8°C)	43

Minimum Required Alcohol/Water Mixtures
Table 701

NOTE: At 40°F (4.4°C) and below, be careful when you do the water wash. Make sure no ice forms which could cause damage to the engine. Use Table 701 for the correct mixture.

S 107-352-N00

(10) For an option, measure the Pre water wash oil quantity.
  (a) Do the dry motor engine with the starter to get an oil quantity measurement check before you do the water flow into the engine.
  (b) Motor the engine at least 30 seconds.
    1) Make a record of the oil quantity measurement.
    2) Make a record of the %N2 speed when you do the dry motor engine (AMM 71-00-00/501).

S 867-250-N00

(11) Dry motor the engine with the starter until N2 is at 18 - 22 percent (AMM 71-00-00/201).
  (a) Make sure that N2 stays in this range while you clean the gaspath of the engine.

NOTE: N2 decreases as water flows into the gaspath of the engine.

S 177-251-N00

CAUTION: DO NOT START THE WATER FLOW INTO THE GASPATH IF EGT IS ABOVE 150°F (66°C). IF YOU DO NOT OBEY THIS INSTRUCTION, YOU CAN CAUSE DAMAGE (THERMAL SHOCK) TO THE ENGINE GASPATH PARTS.

(12) With the EGT less than 150°F (66°C), start the flow of water (or solution) into the gaspath at approximately 15 US gallons (57 liters) total flow.

S 107-252-N00

(13) After approximately 45 seconds, stop the flow of the water and stop the starter (AMM 71-00-00/201).

S 107-253-N00

(14) Wait approximately five minutes.

S 177-254-N00

(15) Do this wash procedure three times or until the water (or solution) from the tailpipe is clear.

NOTE: If water flow from the tail pipe is dirty, benefit can be increased if you do the wash procedure again. The operator can do the wash procedure again at their discretion.

S 177-255-N00
(16) If you used detergent cleaning solution, do the wash procedure two more times with water only.

NOTE: This is necessary to rinse all the detergent from the gaspath.

The engine speed will decrease as water is flowed into the gaspath.

S 087-256-N00

CAUTION: REMOVE THE WATER WASH EQUIPMENT AS SOON AS POSSIBLE AND BEFORE YOU OPEN THE THRUST REVERSER. IF YOU TRY TO OPEN THE THRUST REVERSER WITH THE EQUIPMENT INSTALLED, YOU WILL CAUSE DAMAGE TO THE ENGINE AND/OR THRUST REVERSER.

(17) Remove the wash nozzles from the engine as follows:
(a) Remove hoses, adapters, and valve.
(b) Loosen the four bolts on the clamp assembly.
(c) Pull the hook handles aft.
(d) Carefully remove the wash hooks.

S 217-257-N00
(18) Examine the LPC 1st stage (fan) blades, fairing, fan exit guide vanes and 1.6 stage blades for any damage from the cleaning procedure.

S 167-258-N00
(19) Hand clean the stage 1 fan blades:
(a) Make a clean Lint Free Cotton Cloth or fine or medium Scotch Brite Pad moist with Gaspath Cleaner.
(b) Wipe both sides of the fan blades until clean.
(c) Flush the fan blades with clean water.

NOTE: The wipe cleaner (B00649) and the wipe cleaner (B00651) are both optional to the gaspath cleaner (B00400) to clean the fan blades. If you use either the wipe cleaner (B00649) or the wipe cleaner (B00651) to clean the fan blades, you do not need to flush the fan blades with clean water.

S 167-259-N00

(20) Hand clean the vanes that are in the stator of the stage 1 LPC:

(a) Make a clean, lint free, cotton cloth (G00834) or a fine or medium Scotch Brite pad (B00105) moist with the gaspath cleaner (B00400).

NOTE: The wipe cleaner (B00649) and the wipe cleaner (B00651) are both optional to the gaspath cleaner (B00400).

(b) Clean both sides of each vane.

(c) Flush the vanes with clean water.

NOTE: If you use either the wipe cleaner (B00649) or the wipe cleaner (B00651) to clean the vanes, you do not need to flush the vanes with clean water.

S 017-260-N00

CAUTION: MAKE SURE YOU REMOVE THE WATER WASH EQUIPMENT BEFORE YOU OPEN THE THRUST REVERSER. IF YOU TRY TO OPEN THE THRUST REVERSER WITH THE EQUIPMENT INSTALLED, YOU WILL CAUSE DAMAGE TO THE ENGINE AND/OR THRUST REVERSER.

(21) Open the fan cowl panels (AMM 71-11-04/201).

S 017-328-N00

(22) Open the core cowl panels (AMM 71-11-06/201).

S 017-329-N00

(23) Open the thrust reversers (AMM 78-31-00/201).

S 217-261-N00

(24) Do an inspection and drain the EEC P2, P2.5 (with SCU), PAMB, and P4.95 condensation traps (AMM 73-21-04/601).

S 167-263-N00

(25) Remove any water from the EEC sensing system by the steps that follow.

(a) Hold the adapters with a wrench and disconnect the sensing P2, P2.5, PAMB, P4.95, and PB hoses from the EEC, and SCU (if installed) (Fig. 702).

(b) Install the necessary adapters and fittings to attach shop air or Nitrogen to each sensing hose.

(c) Use 20 psi (137.9 kPa) shop air or Nitrogen and remove any water from each sensing system.

(d) Remove the adapters and fittings.

S 427-264-N00

CAUTION: DO NOT USE LUBRICANTS ON EEC OR SCU SENSING TUBES, ADAPTERS, OR PACKINGS. IF YOU DO, CONTAMINATION CAN OCCUR TO THESE COMPONENTS.

(26) Connect the EEC, SCU or PMUX (if installed) sensing hoses as follows:
   (a) Do not apply lubricant to the hoses or adapters.
   (b) Attach the rear PB flex hose (AS12) to the adapter in the port marked PB.
      1) Hold the adapter with a wrench and torque the flex hose nut to 270 - 300 pound-inches (30.506 - 33.895 newton-meters).
         a) If the hose nuts have lockwire holes, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.
   (c) Attach the P4.95 flex hose (AS13) to the adapter in the port marked P5.
      1) Hold the adapter with a wrench and torque the flex hose nut to 450 - 500 pound-inches (50.843 - 56.492 newton-meters).
         a) If the hose nuts have lockwire holes, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.
   (d) Attach the PAMB flex hose (AS10) to the adapter in the port marked PAMB.
      1) Hold the adapter with a wrench and torque the flex hose nut to 135 - 150 pound-inches (15.253 - 16.948 newton-meters).
         a) If the hose nuts have lockwire holes, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.
   (e) Attach the P2 flex hose (AS11) to the adapter marked P2.
      1) Hold the adapter with a wrench and torque the flex hose nut to 90 - 100 pound-inches (10.169 - 11.298 newton-meters).
         a) If the hose nuts have lockwire holes, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.
   (f) If the supplemental control unit has the multiplexing option, attach the P2.5 flex hose (AS38) to the adapter at the bottom side of the supplemental control unit.
      1) Hold the adapter with a wrench and torque the flex hose nut to 270 - 300 pound-inches (30.506 - 33.895 newton-meters).
         a) If the hose nuts have lockwire holes, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.

S 107-353-N00

(27) For an option, examine the "Post water wash" oil quantity.

(a) Do the dry motor engine with the starter to get an oil quantity measurement before you do the water flow into the engine.

(b) Dry-motor the engine for a minimum 30 seconds.

(c) Record the oil quantity and %N2 speed during the this dry motoring procedure.

NOTE: The oil quantity can change. If the %N2 speed does not agree within +/-2% of the %N2 speed that was recorded for the "Pre water wash" of the oil quantity procedure.

S 417-265-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(28) Close the thrust reverser (AMM 78-31-00/201).

S 417-266-N00

(29) Close the core cowl panels (AMM 71-11-06/201).

S 417-267-N00

(30) Close the fan cowl panels (AMM 71-11-04/201).

S 717-349-N00

CAUTION: ALL ENGINE MONITORING OPENINGS MUST BE FREE OF WATER AND PROTECTION COVERS. IF THESE OPENINGS ARE BLOCKED, DAMAGE TO THE ENGINE CAN OCCUR AND AFFECT THE OPERATION OF THE AIRCRAFT.

(31) Do a check of the Environmental Control System for odors:

(a) Start the engine by the Engine Starting Procedure (Normal) (AMM 71-00-00/201).

(b) Run the engine at sufficient power to allow the main oil temperature to reach 220°F (104.4°C) minimum for a minimum of two minutes.

(c) Operate the air conditioning packs and insure there is no odor.

NOTE: If there is odor, continue to operate engine until you do not notice the odor.

S 107-354-N00

(32) For an option, collect a post water wash oil sample.

(a) Use a clear drain bottle, glass jar, or equivalent to collect a 4 ounce (100 ml) sample of oil.

(b) Make a label of the container as "Post water wash".

S 107-355-N00

(33) For an option, examine if you think that the oil is contain water.

(a) Compare the oil quantity measured that you have labeled as "Pre water wash" with the labeled as "Post water wash".

(b) Compare the "Post water wash" oil sample to the "Pre water wash" oil sample.

(c) Hold the oil samples collected with the "Pre water wash" and the "Post water wash", side by side against the light source.

(d) Compare the color of the oil samples.

1) Look for a lighter color (perhaps milky appearance) in the "Post water" oil sample, or beading of water in the oil.

NOTE: These indications show that there can be water contamination of the oil system.

2) If the oil sample color is not changed between the two samples.

a) Examine the "Post water wash" oil sample again after 30 minutes.

b) If you see a separation of oil and water, then there is water contamination in the oil system.

(e) If the oil quantity increases by 2 quarts (2 liters) or more, and if you see change in color between the "Pre water wash" and "Post water wash" oil samples, then the oil system is contaminated with water.

1) Do a check of the P2.5, PB, and P4.95 condensation traps again.

(f) If the oil quantity increases by 2 quarts (2 liters) or more, or you see change in color between the "Pre water wash" and "Post water wash" oil samples, then the oil system is contaminated with water.

1) If it is possible, the water contamination in the oil because the oil quantity increase, but the oil sample comparison is in limits, you can take a second oil sample after 10 minutes of the engine operation at idle speed.

2) If you find the oil to be in limits, do the check for the P2.5, PB, and P4.95 condensation traps again.

(g) For the engines you think that have water contamination in the oil system, do these steps:

1) Drain the engine oil system (Ref to 12-22-01/301).

2) Fiil the engine oil system again.

S 107-356-N00

(34) For an option, do the ground idle power test (Test No. 3) (Ref to 71-00-00/501) .

(a) Do the leak inspection of the oil system.

(b) Do the "Post water wash" oil sample from the low point on the engine.

S 217-269-N00

(35) Examine the P2, P2.5 (with SCU), PAMB, PB, and P4.95 condensation traps again (AMM 73-21-04/601).

NOTE: You must remove all water from the sense lines before you continue in service.

S 217-271-N00

(36) Do an inspection of the turbine vane and blade cooling air valve air (PS3) filter elements (AMM 75-33-05/201).

S 447-272-N00

(37) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

TASK 72-00-00-107-273-N00

4. Engine Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425)

A. General

(1) This procedure gives the general instructions and the approved materials for cleaning the engine after chemical contact with fire extinguishing agents, hydraulic fluid, oil, or fuel.

(2) This task gives data to clean and disassemble engines as necessary if they have come into contact with fire extiguishing agents, hydraulic fluid, oils, or fuel (AMM 70-11-10/201, Figure 201). If the fire has been contained to the burner or gaspath areas, the operator must find if overtemperature limits were more than the permitted limits.

NOTE: For those operators who use the fire extinguishing agents that are not specified in AMM 70-11-10/201, Figure 201, but are used at airport, in test cells and in hangars should provide their local Pratt & Whitney representative technical data and Material Safety Data Sheets for forwarding to Pratt & Whitney Customer Service in East Hartford, CT 06108 USA.

(3) The most important problem with the introduction of dry powder or foam chemicals into the engine is corrosion during subsequent engine operation. These materials can be very harmful to cold and hot section parts. These dry powder chemicals cause chemical reactions during engine operation.

(4) The test results show as follows:

(a) The stainless steel alloys, nickel base alloys (coated or uncoated), and cobalt base alloys show high degree of susceptability to chemical corrosion, even at temperatures below the engine operating range.

(b) The titanium, aluminum, magnesium, cadmium plated and nickel-cadmium plated low alloy steels show no signs of corrosion from bicarbonate compounds (dry powder) at engine operating temperatures.

(c) The titanium in the high compressor can experience stress corrosion from foam chemicals at service operation temperatures. However, overspray on the fan blades can be removed by hand wipe cleaning with aqueous cleaner (SPMC 148).

(5) The Halon 1301 fire extinguishing agent, products of decomposition will include certain acids which can have a small corrosive effect on gaspath materials when exposed to high temperatures. The turbine airfoil coatings can degrade from Halon 1301 contact at 1800°F (982°C) for short exposure if discharged directly into the core of the engine from the ground unit. However, onboard nacelle fire extiguisher systems (Halon 1301) on the turbofan engines, do not discharge directly into the core but rather into the nacelle compartment which would not result in contact with the turbine airfoils.

(6) Although no specific testing has been done relative to the effects of these agents on oil systems, the oil system should be analyzed for the contamination because agents could enter the oil system for those engine models which use labyrinth seals.

B. Consumable Materials

(1) Cleaner - Aqueous (SPMC 148) (P11-049)

C. References

(1) AMM 70-11-10/201, Engine Contamination (SPOP 425)

(2) AMM 70-11-12/201, Degreasing Of Engine External (SPOP 1)

D. Procedure

S 297-341-N00

(1) Perform borescope inspection (On-Wing or Off-Wing).
   (a) Perform an exterior inspection and an interior borescope inspection and find out which parts are contaminated by the chemical fire extinguishing agent.
   (b) Perform the borescope inspection of the engine nacelle and look for the fire damage.
      1) An internal or external wash is not necessary after engine has been contacted with Halon 1310 (CFC), typically used in the nacelle fire extiguishing systems.

S 207-342-N00

(2) Perform the freedom of movement check.
   (a) Rotate the rotor and listen for the mechanical damage or interference.

S 107-343-N00

(3) Perform an external and internal wash (On-Wing or Off-Wing).
   (a) Remove and clean the parts as soon as possible to minimize possible corrosion of engine parts by the agents (AMM 70-11-10/201, Figure 201).
      1) Do not operate the engine after contamination.
   (b) When the engine gaspath is exposed to foam chemical agents, remove and clean the engine parts as soon as possible.
      1) Do not wash the gaspath before disassembly and clean the affected parts.
      2) It is not possible to remove all remaining foam agent and chemical residue from the engine by a water or detergent wash of the gaspath.
   (c) Do not wash engine gaspath after engine is expose to dry chemical powder fire extiguishing agents.
      1) These agents are not fully cleaned by water.

2) A water wash on the dry chemical powder fire extiguishing agents causes caking, sticking of these materials on engine parts, and clogging of air holes and cavities.

(d) When dry chemical powder fire extinguishing agents get into the engine gaspath, these materials at service operation temperatures can cause severe corrosion damage to the compressor, the hot section, and the turbine areas.

1) It is possible that they can also enter and cause contamination to the engine oil system.
2) Do not start the engine.
3) Remove the engine from on-wing.
   a) Remove the contaminated parts and clean immediately.
   b) Look for the signs and amount of the contamination, mechanical or fire damage.

(e) If the exterior of the engine had chemical contact:

1) Clean the external parts of the engine by SPOP 1 (AMM 70-11-12/201).

(f) If engine part had contact with any dry chemicals listed in AMM 70-11-10/201 Table 201, only an external wash by SPOP 1 is permitted for cleaning (AMM 70-11-12/201).

1) Do not compressor wash the engine.

S 207-344-N00

(4) Engine disassemble inspection (after engine disassemble in shop).

(a) Clean all the engine parts by the applicable Maintenance Manual instructions.

(b) Do a visual inspection of all parts that you think might come in contact with the chemical.

1) Use the applicable inspection limits.

NOTE: Do an inspection to determine the contamination parts, then remove the part that came in contact with chemical.

TASK 72-00-00-107-302-N00

5. Engine Gaspath Cleaning After the Fire Extinguishing Agents are Used (Before the Engine Removal)

A. General

(1) This procedure gives the steps to prepare for the removal of the engine after fire extinguishing agents were used. The engine will be disassembled and cleaned after the removal. If you will continue to use the engine and will not remove it, do this procedure: Engine Gaspath Cleaning After the Fire Extinguishing Agents are Used (Continue-In-Service).

(2) This procedure is not recommended on more than one engine during the same maintenance visit.

B. References

(1) AMM 70-11-10/201, Engine Contamination (SPOP 425)

C. Remove the Remaining Fire Extinguishing Powder from the Engine

S 167-362-N00

CAUTION: IT IS NOT RECOMMENDED THAT YOU CLEAN AN ENGINE WITH WATER, IF A FIRE EXTINGUISHING AGENT MADE OF A DRY CHEMICAL POWDER WAS USED IN THE GASPATH. WATER WILL CAUSE THE DRY CHEMICAL POWDER TO BECOME TACKY AND BOND TO THE ENGINE PARTS.

THE DRY CHEMICAL POWDER MUST BE MADE NEUTRAL AND REMOVED FROM ALL ENGINE PARTS AT THE FIRST AVAILABLE TIME. THE DRY CHEMICAL POWDER CAN CAUSE CORROSION DAMAGE TO THE COMPRESSORS, HOT SECTION, AND TURBINE AREA PARTS. IT CAN ALSO CAUSE ENGINE OIL CONTAMINATION.

CAUTION: DO NOT DO THIS PROCEDURE ON BOTH ENGINES DURING THE SAME MAINTENANCE VISIT IF AT ALL POSSIBLE. HOWEVER, IF IT IS NOT POSSIBLE TO AVOID MAINTENANCE ON MORE THAN ONE ENGINE AT THE SAME TIME, IT IS RECOMMENDED THAT DIFFERENT TEAMS SERVICE EACH ENGINE.

(1) If necessary, clean the engine to remove fire extinguishing agents by SPOP 425. See AMM 70-11-10/201.

TASK 72-00-00-107-324-N00

6. Clean the Engine Pressure Ratio (EPR) PT4.95 Probes (Pressure Sensing Holes).

A. General

(1) In this procedure the Engine Pressure Ratio (EPR) PT4.95 Probes (Pressure Sensing Holes) will be referred to as the EPR PT4.95 probes.

(2) This procedure is not recommended on more than one engine during the same maintenance visit.

B. Equipment
   (1) Pump - PWA 86453
   (2) Adapter - Pump, PWA 86457
   (3) Adapter - Pump, PWA 86458
   (4) M303, M305 or M307 Bergen Mechanical Crimper
       Bergen Cable Technologies Inc
       170 Gregg St
       P. O. 1300
       Lodi, NJ 07644-9982

C. Consumable Materials
   (1) B00130 Alcohol - Isopropyl
   (2) Lockwire, (P05-289) 0.032 inch (0.813 mm) AS3214-02
   (3) Cable, Safety (P05-291)
   (4) Ferrule, Safety Cable (P05-292)
   (5) B00000 Cleaner - Alkali

       NOTE: You can get the alkali cleaner from these companies:
       Blue Gold Spray Wash (low foam) from -
       Modern Chemical Inc.
       P.O. Box 368
       Jacksonville, AR 72076 USA

       Ardrox 6333 (low foam) from -
       Ardrox Inc.
       16961 Knott Avenue
       La Mirada, CA 90638-06015 USA
       or -
       Brent Chemicals International PLC
       Brent Europe Ltd. (Formerly Ardrox Div.)
       Ridgeway
       Iver
       Bucks SL0 9JJ
       England

D. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 78-31-00/201, Thrust Reverser System

E. Access
   (1) Location Zone

411	Left Engine
412	Right Engine

   (2) Access Panel

415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)

F. Clean the EPR PT4.95 Probes.

S 017-363-N00

CAUTION: IT IS NOT RECOMMENDED THAT YOU CLEAN AN ENGINE WITH WATER, IF A FIRE EXTINGUISHING AGENT MADE OF A DRY CHEMICAL POWDER WAS USED IN THE GASPATH. WATER WILL CAUSE THE DRY CHEMICAL POWDER TO BECOME TACKY AND BOND TO THE ENGINE PARTS.

THE DRY CHEMICAL POWDER MUST BE MADE NEUTRAL AND REMOVED FROM ALL ENGINE PARTS AT THE FIRST AVAILABLE TIME. THE DRY CHEMICAL POWDER CAN CAUSE CORROSION DAMAGE TO THE COMPRESSORS, HOT SECTION, AND TURBINE AREA PARTS. IT CAN ALSO CAUSE ENGINE OIL CONTAMINATION.

CAUTION: DO NOT DO THIS PROCEDURE ON BOTH ENGINES DURING THE SAME MAINTENANCE VISIT IF AT ALL POSSIBLE. HOWEVER, IF IT IS NOT POSSIBLE TO AVOID MAINTENANCE ON MORE THAN ONE ENGINE AT THE SAME TIME, IT IS RECOMMENDED THAT DIFFERENT TEAMS SERVICE EACH ENGINE.

(1) Do the steps that follow to prepare to clean the EPR PT4.95 probes.

CAUTION: DO THIS PROCEDURE AT LEAST SIX HOURS AFTER THE LAST OPERATION OF THE ENGINE. THIS WILL MAKE SURE THE EGT IS LESS THAN 175 °F (79.4 °C). IF THE EGT IS NOT SUFFICIENTLY COOL, DAMAGE TO THE ENGINE CAN OCCUR.

(a) Open the fan cowl panels (AMM 71-11-04/201).

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(b) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

(c) Open the core cowl panels (AMM 71-11-06/201).

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(d) Open the thrust reversers (AMM 78-31-00/201).

CAUTION: IF THE ENGINE WILL BE IN AN AMBIENT TEMPERATURE OF 40°F (4.4°C) OR LESS BEFORE THE YOU OPERATE THE ENGINE AGAIN, MIX ANTIFREEZE WITH THE POTABLE WATER. THE ANTIFREEZE WILL MAKE SURE THAT THE WATER WILL NOT MAKE ICE IN THE EXHAUST CASE. ICE OR FROZEN LIQUIDS IN THE TURBINE EXHAUST CASE CAN CAUSE THE N1 ROTOR TO CATCH OR CAN CAUSE DAMAGE TO THE 6TH-STAGE LPT (LOW PRESSURE TURBINE) ROTOR.

(e) If the ambient temperature is 45°F (4.4°C) or less, refer to Table 702 to add sufficient isopropyl alcohol to the potable water as follows.

NOTE: Table 702 gives the minimum quantity of alcohol that can be added for each temperature. A maximum of 50% alcohol can be used.

Outside Air Temperature (OAT): Volume	Percent Alcohol By
39°F (3.9°C)	05
36°F (2.7°C)	09
33°F (0.6°C)	14
31°F (-0.6°C)	17
28°F (-2.2°C)	20
26°F (-3.3°C)	22
25°F (-3.9°C)	23
20°F (-6.7°C)	27
15°F (-9.4°C)	32
10°F (-12.2°C)	36
05°F (-15°C)	39
0°F (-17.8°C)	43

Minimum Required Alcohol/Water Mixtures
Table 702

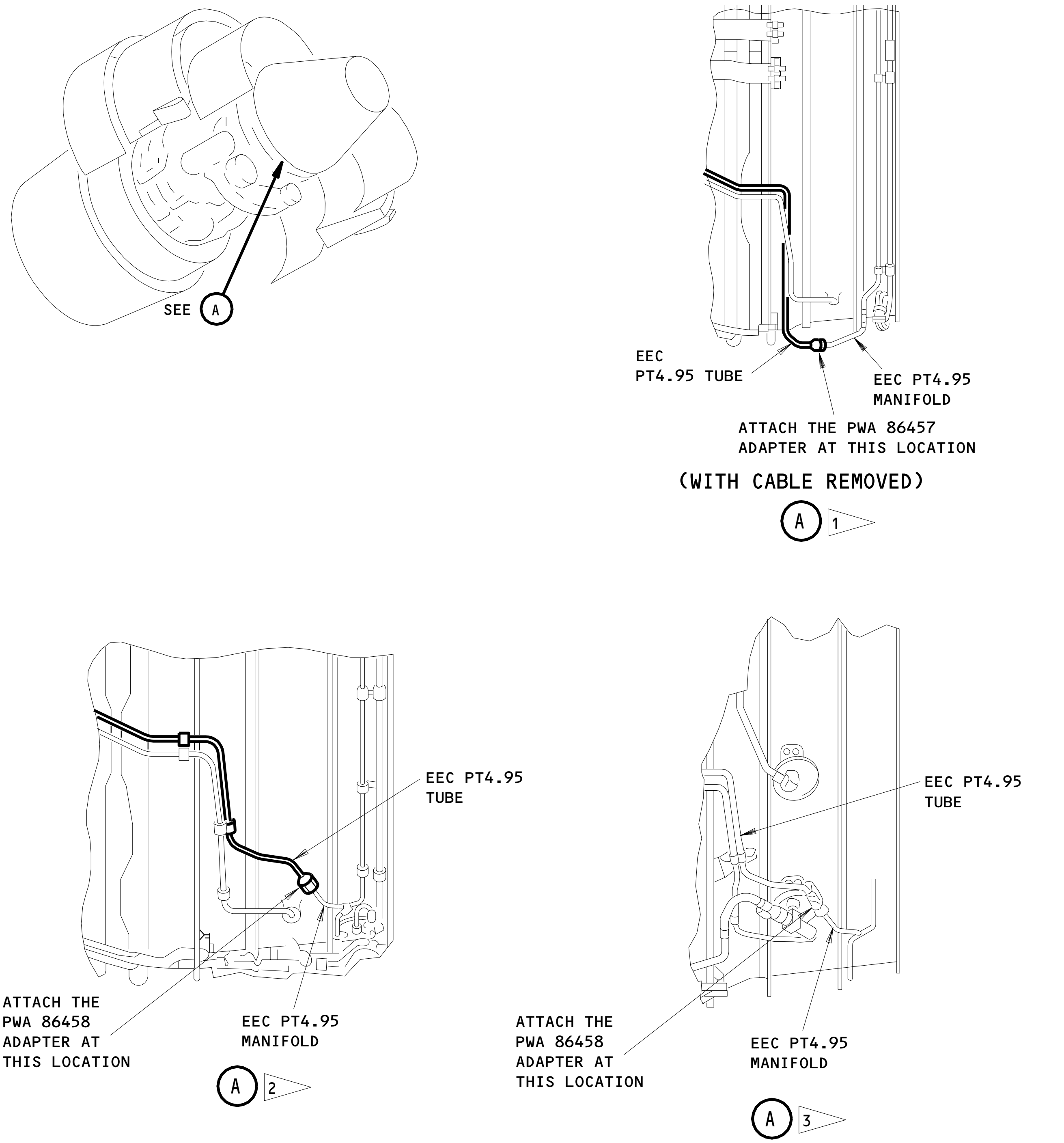
NOTE: At 40°F (4.4°C) and below, be careful when you do the water wash. Make sure no ice forms which could cause damage to the engine. Use Table 702 for the correct mixture.

(f) Mix 12.8 ounces (0.379 liters) of alkali cleaner with 115.2 ounces (3.411 liters) of potable water to make one gallon of cleaning solution.

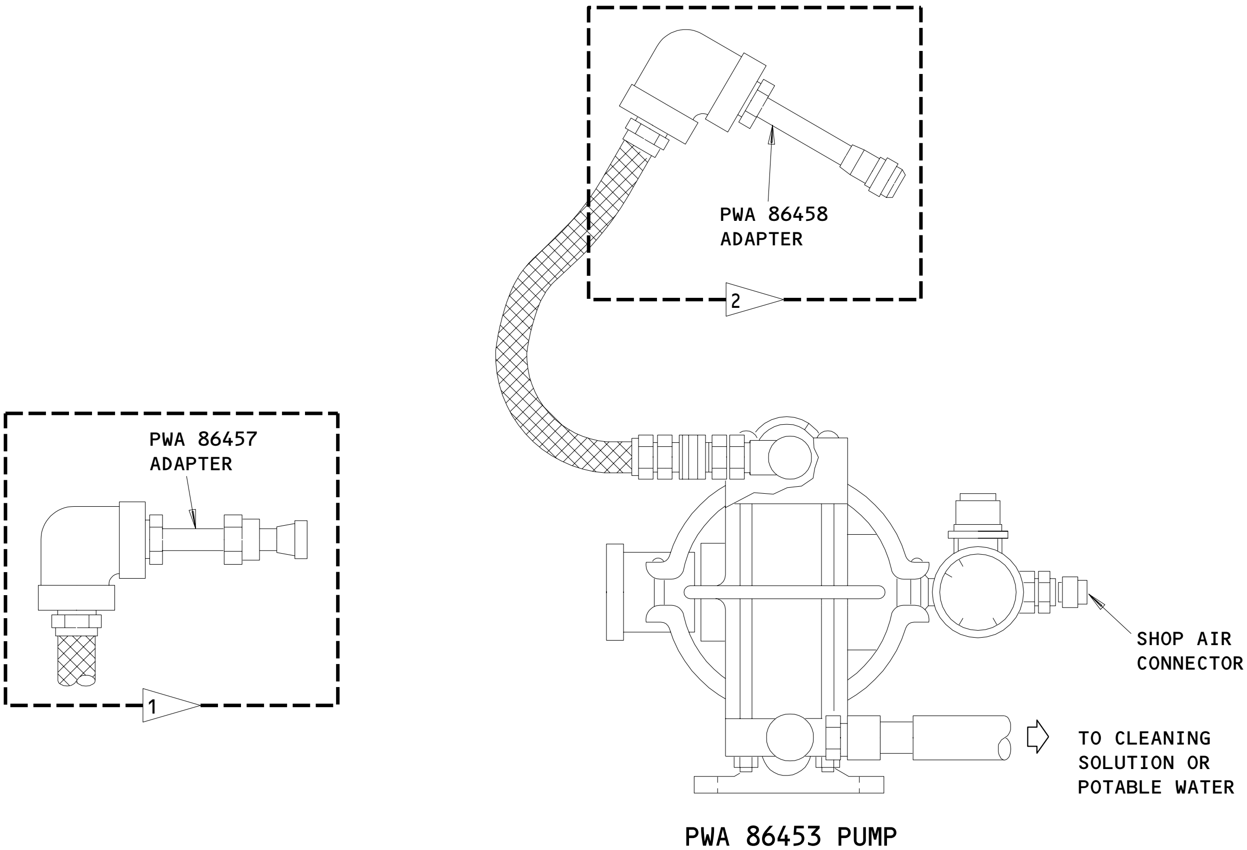
NOTE: This is 10% alkali cleaner and 90% potable water.

(g) Remove all the clamps which are necessary to move the EEC PT4.95 tube away from the EEC PT4.95 manifold.

NOTE: This will make a space for the installation of the cleaning adapters.



Adapter Installation
Figure 703 (Sheet 1)



1 ENGINES WITHOUT PW SB 72-134
2 ENGINES WITH SB 72-134
3 ENGINES WITH SB 79-76

L-A7905 (0000)

Adapter Installation
Figure 703 (Sheet 2)

CAUTION: CONNECT THE CLEANING ADAPTER ONLY TO THE EEC PT4.95 MANIFOLD. THIS WILL PREVENT DAMAGE TO THE ELECTRONIC ENGINE CONTROL.

(h) Install the applicable cleaning adapter to the EEC PT4.95 manifold (Fig. 703).
 1) ENGINES PRE-PW-SB 72-134;
 Install the PWA 86457 Adapter to the EEC PT4.95 manifold.
 2) ENGINES POST-PW-SB 72-134;
 Install the PWA 86458 Adapter to the EEC PT4.95 manifold.
(i) Attach the PWA 86453 Pump to the adapter on the EEC PT4.95 manifold with the hose that is part of the pump.
(j) Connect the PWA 86453 Pump to a shop air source and to a container of cleaning solution.
(k) Put a container with a minimum capacity of 2 gallons (7.57 liters) under the engine, directly under Flange P, between the LPT (low pressure turbine) and the exhaust case.

 NOTE: This will collect the cleaning solution so it will not drain on the ground or on the area under the engine.

S 177-326-N00
(2) Do the steps that follow to clean the EPR PT4.95 probes.
 (a) Set the inlet air pressure to the PWA 86453 Pump to 75-105 psig (517.1-723.9 kPa).
 (b) Make the one gallon (3.79 liters) of cleaning solution flow through the PT4.95 manifold and the PT4.95 probes.

 NOTE: The cleaning solution will come directly into the gaspath area of the duct of the turbine exhaust case. The cleaning solution will probably also come through Flange P under the engine.

CAUTION: IF THE ENGINE WILL BE IN AN AMBIENT TEMPERATURE OF 40°F (4.4°C) OR LESS BEFORE THE YOU OPERATE THE ENGINE AGAIN, MIX ANTIFREEZE WITH THE POTABLE WATER. THE ANTIFREEZE WILL MAKE SURE THAT THE WATER WILL NOT MAKE ICE IN THE EXHAUST CASE. ICE OR FROZEN LIQUIDS IN THE TURBINE EXHAUST CASE CAN CAUSE THE N1 ROTOR TO CATCH OR CAN CAUSE DAMAGE TO THE 6TH-STAGE LPT (LOW PRESSURE TURBINE) ROTOR.

 (c) Set the inlet air pressure to the PWA 86453 Pump to 75-105 psig (517.1-723.9 kPa).
 (d) Make the one gallon (3.79 liters) of potable water flow through the PT4.95 manifold and the PT4.95 probes.
 (e) Disconnect the pump at the quick disconnect fitting.
 (f) Attach a source of dry compressed air.

(g) Make compressed air at 75-105 psig (517.1-723.9 kPa) flow through the EEC PT4.95 manifold and the probes for 2 (two) minutes.

S 867-327-N00

(3) Do the steps that follow to put the airplane back to its usual condition.
   (a) Remove the adapter from the manifold.
   (b) Connect the EEC PT4.95 tube to the EEC PT4.95 manifold as follows.
      1) Remove the protective cover.
      2) Install the rear EEC PT4.95 tube to the EEC PT4.95 manifold.
      3) Tighten the tube nut with your hand.
      4) Install all the clamps that you removed.
         a) Make sure all the clamps are tight.
      5) Torque the tube nut to 270-300 pound-inches (30.506-33.895 newton meters).
      6) Install lockwire or the safety cable and safety cable ferrule on the tube nut.

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

   (c) Close the thrust reversers (AMM 78-31-00/201).
   (d) Close the core cowl panels (AMM 71-11-06/201).
   (e) Close the fan cowl panels (AMM 71-11-04/201).
   (f) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

ENGINE - APPROVED REPAIR

TASK 72-00-00-308-001-N00

1. In-situ HPC Blade Blend Repair (Stages 5 through 15)

   A. General

      (1) This task provides the sources identified to do the in-situ blade blend repair.

   B. Procedure

      S 898-002-N00

      CAUTION: EXCEPT FOR WORK OR SUPPLIES TO BE PERFORMED OR FURNISHED BY PRATT & WHITNEY, PRATT & WHITNEY DOES NOT ENDORSE THE WORK PERFORMED BY THE COMPANY OR COMPANIES IDENTIFIED HEREIN OR ANY OTHER COMPANY AND DOES NOT ACCEPT RESPONSIBILITY TO ANY DEGREE FOR THE SELECTION OF SUCH COMPANY OR COMPANIES FOR THE PERFORMANCE OF ANY WORK OR PROCUREMENT OF SUPPLIES. IF YOU DO NOT OBEY THESE INSTRUCTIONS, DAMAGE TO EQUIPMENT CAN OCCUR.

      (1) The source identified below is approved to do this repair.

Pratt & Whitney Services, Inc.
d.b.a. Dallas Aviations Field Service
400 Main Street East
East Hartford, CT 06108-0969 USA
TEL: (860) 565-0140
FAX: (860) 565-5442

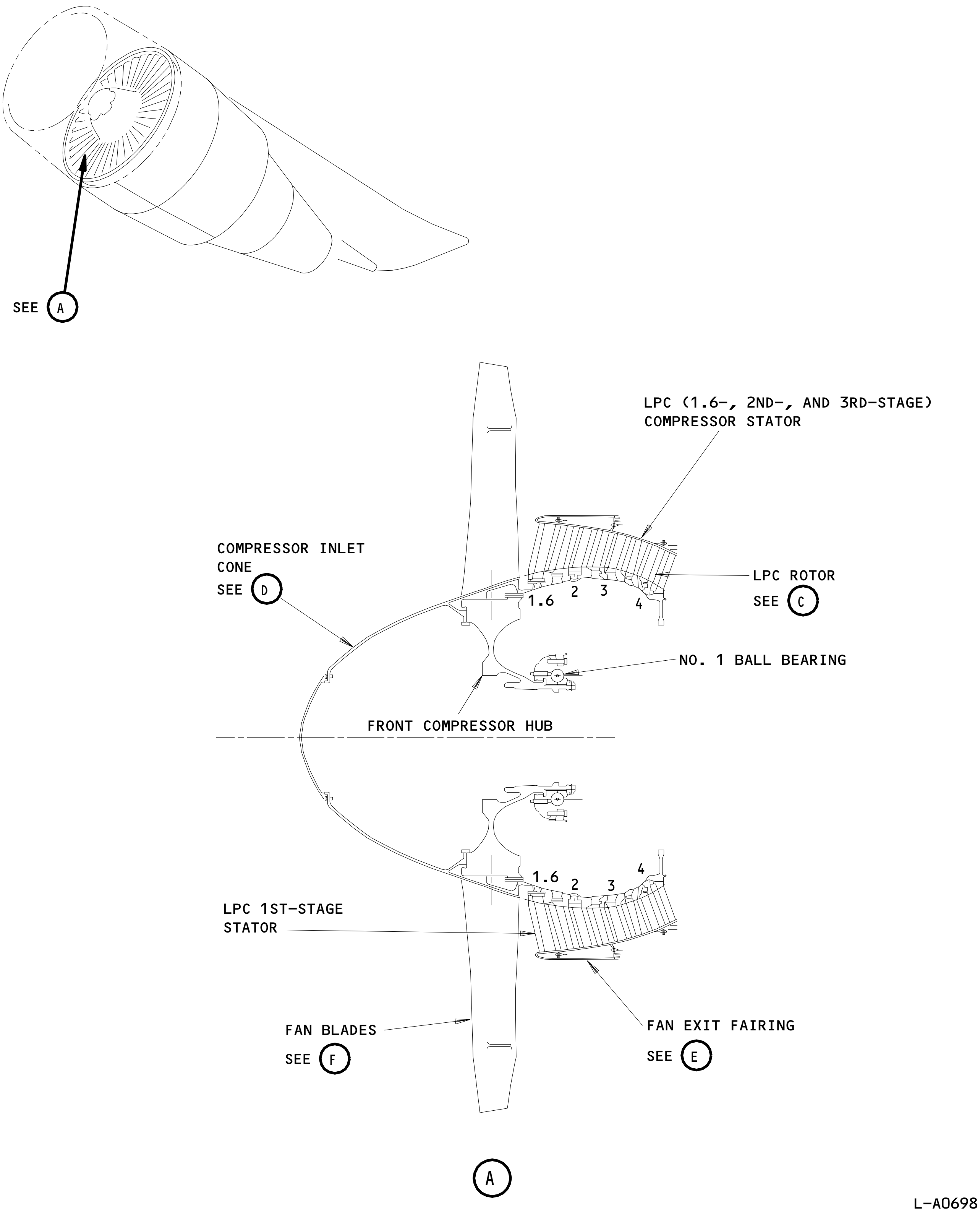
      S 898-003-N00

      (2) Due to the critical nature of this repair, repair sources must demonstrate to Pratt & Whitney their capabilities to perform this repair and be licensed by Pratt & Whitney. Write to the address below for the qualification program to become an approved and licensed source.

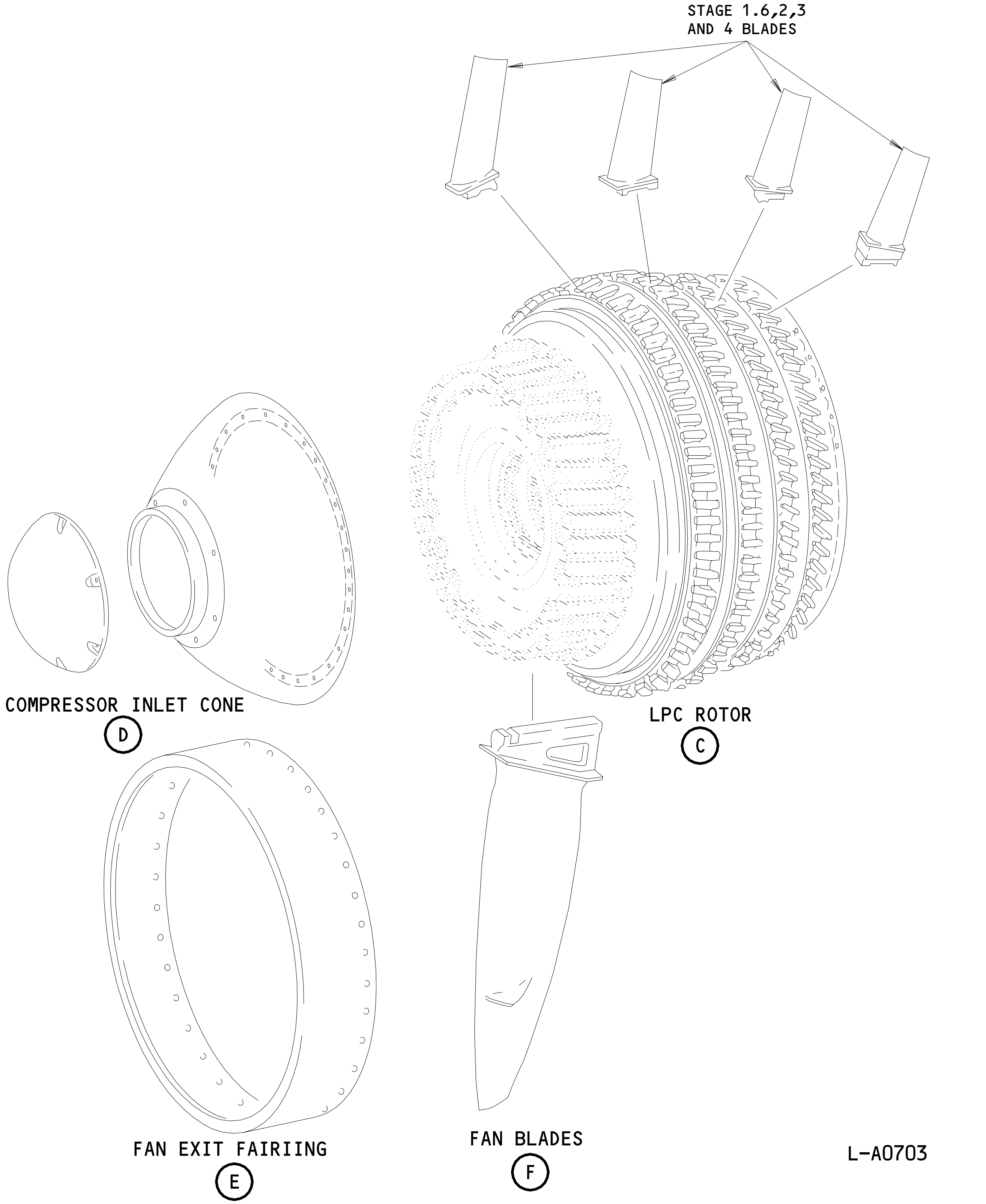
Pratt & Whitney, A United Technologies Company
Manager, Joint Ventures, Partnerships and Licensing
400 Main Street, Mail Stop 133-58
East Hartford, CT 06108 USA
E-Mail: gppwlicng@pw.utc.com
Fax: (860) 557-7197

COMPRESSOR SECTION - DESCRIPTION AND OPERATION

1. General
   A. The compressor contains five individual sections. The stator for the low pressure compressor (LPC) is attached to the inner case of the fan exit and the rotor is supported through the intermediate case. The LPC/LPT coupling is attached to the ID of the LPC fan hub and the OD of the shaft for the low pressure turbine (LPT). The fan case is attached to the intermediate case OD at Flange C and the ID through the 2.5 bleed duct. The intermediate case is attached to the forward end of the high pressure compressor (HPC). The high pressure compressor (HPC) is attached to the intermediate case at the front and the diffuser case at the rear.
2. Component Details (Fig. 1)
   A. Section of the Low Pressure Compressor (LPC)
      (1) The low pressure compressor (LPC) is a 5-stage rotor and stator assembly whose purpose is to provide the initial compression of ambient air that will eventually be used to generate heated gases which will provide propulsive force. The LPC group consists of a 5-stage (Stages 1, 1.6, 2, 3 and 4) rotor and four stages (Stages 1, 1.6, 2 and 3) of stator assemblies.
      (2) Rotor of the Low Pressure Compressor (LPC)
         (a) The LPC rotor consists of a titanium hub (Stage 1) mechanically attached to a 4-stage (Stages 1.6, 2, 3 and 4) titanium drum rotor. Titanium blades are installed in all five stages. The 1st stage of the rotor, commonly referred to as the fan stage, consists of 38 wide chord blade assemblies which are installed in slots 12 degrees from axial in the front compressor hub. The fan blades are retained at the rear by the drum rotor and at the front by a circumferential blade lock installed in aligned slots in the hub. Each fan blade has a single aft positioned part span shroud for added strength. Fan blades are replaceable in balanced pairs on installed engines. The blades in the remaining four stages of the rotor are installed in axial slots in the drum rotor and are retained by wire blade locks. Four pairs of knife-edge seals are integral to the drum rotor and are in axial alignment with each of the inner shrouds of the 1st-, 1.6th-, 2nd-, and 3rd-stage stators.
         (b) The rotor is driven by the low pressure turbine (LPT). The front compressor hub is splined to a titanium turbine shaft coupling which in turn is splined to the LPT shaft. Structural support for the rotor is provided by the No. 1 ball bearing which is mounted on the front compressor hub.

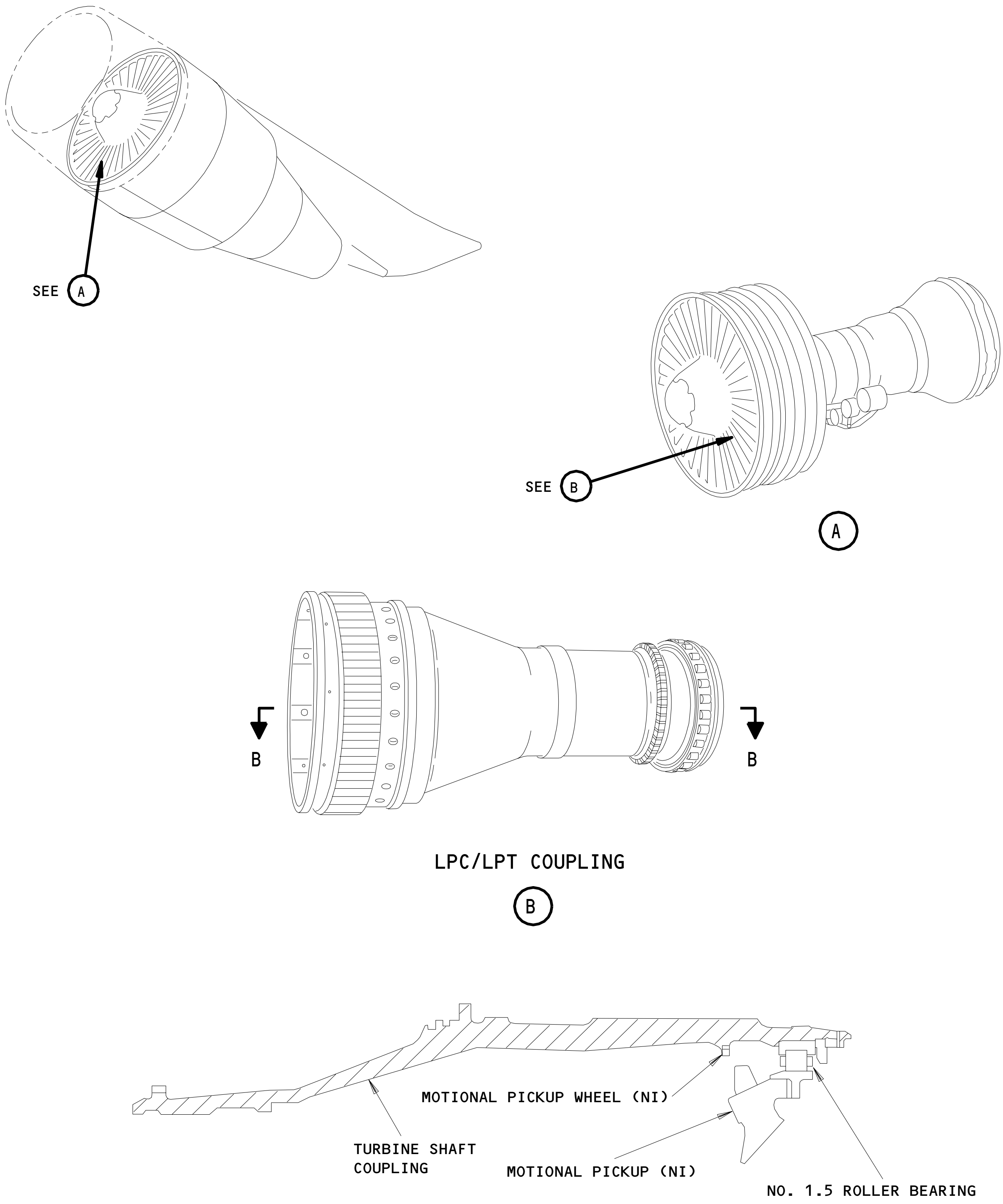


Low Pressure Compressor (LPC)
Figure 1 (Sheet 1)



Low Pressure Compressor (LPC)
Figure 1 (Sheet 2)

(3) Stator for the Low Pressure Compressor (LPC)
   (a) The LPC stator assembly consists of a single stage (assembly for the 1st-stage compressor stator) full hoop aluminum case with titanium stator vanes mechanically attached to a 3-stage (assembly for the 1.6th-, 2nd-, and 3rd-stage compressor stators) split case aluminum stator assembly with titanium vanes installed in all three stages. The 1st-stage stator consists of 88 solid vanes and is located immediately aft of the 1st-stage LPC blades at the entrance to the primary gaspath. At the inner shroud of the 1st-stage stator are a pair of PWA 407 abradable seal lands axially aligned with a pair of knife-edge seals on the drum rotor. The 3-stage (1.6th-, 2nd-, and 3rd-stage) stator assembly also contains solid vanes and incorporates three PWA 407 abradable rubstrips at outer shroud locations in axial alignment with blades (1.6th-, 2nd-, and 3rd-stage). At inner shroud locations are three pairs of PWA 407 abradable seal lands in axial alignment with pairs of knife-edge seals on the drum rotor. An aluminum LPC stage duct which incorporates a PWA 407 abradable rubstrip in axial alignment with the 4th-stage LPC blades is mechanically attached to the rear outer flange of the assembly for the LPC stators.
   (b) The assembly for the LPC compressor stators is supported structurally by mechanical attachment to the inner case of the fan exit.
(4) Compressor Inlet Cone
   (a) The segment assembly of the compressor inlet cone is mounted on the front compressor hub and provides a smooth aerodynamic fairing at the inlet of the LPC. The segment assembly consists of a front segment which is bolted to an rear segment assembly which is bolted in turn to the front flange of the front compressor hub. Both inlet cone segments are fabricated from Kevlar fabric impregnated with epoxy resin.
(5) Fan Exit Fairing
   (a) Surrounding the front half of the stator assembly is a composite (Kevlar coated with polyurethane) fan exit fairing which acts as an aerodynamic splitter separating the primary (main gas generator) airstream from the secondary (fan discharge) airstream.
(6) LPC/LPT Coupling (Fig. 2)
   (a) The rotor of the low pressure compressor (LPC) is driven by the low pressure turbine (LPT). The LPC/LPT coupling consists of those interface parts that attach and secure the front compressor hub of the LPC rotor to the shaft of the low pressure turbine (LPT).



Low Pressure Compressor/Low Pressure Turbine (LPC/LPT) Coupling
Figure 2

(b) The main feature of the LPC/LPT coupling is a titanium turbine shaft coupling which at the front is splined to the front compressor hub and at the rear is splined to the LPT shaft. A steel retaining nut secures the front compressor hub to the turbine shaft coupling while a titanium retaining nut secures the coupling to the LPT shaft. The turbine shaft coupling is supported structurally through the No. 1.5 roller bearing to the intermediate case.

(c) Mounted on the turbine shaft coupling is a steel motional pickup wheel from which the low rotor speed (N1) is determined.

B. Fan Cases

(1) General (Fig. 3)

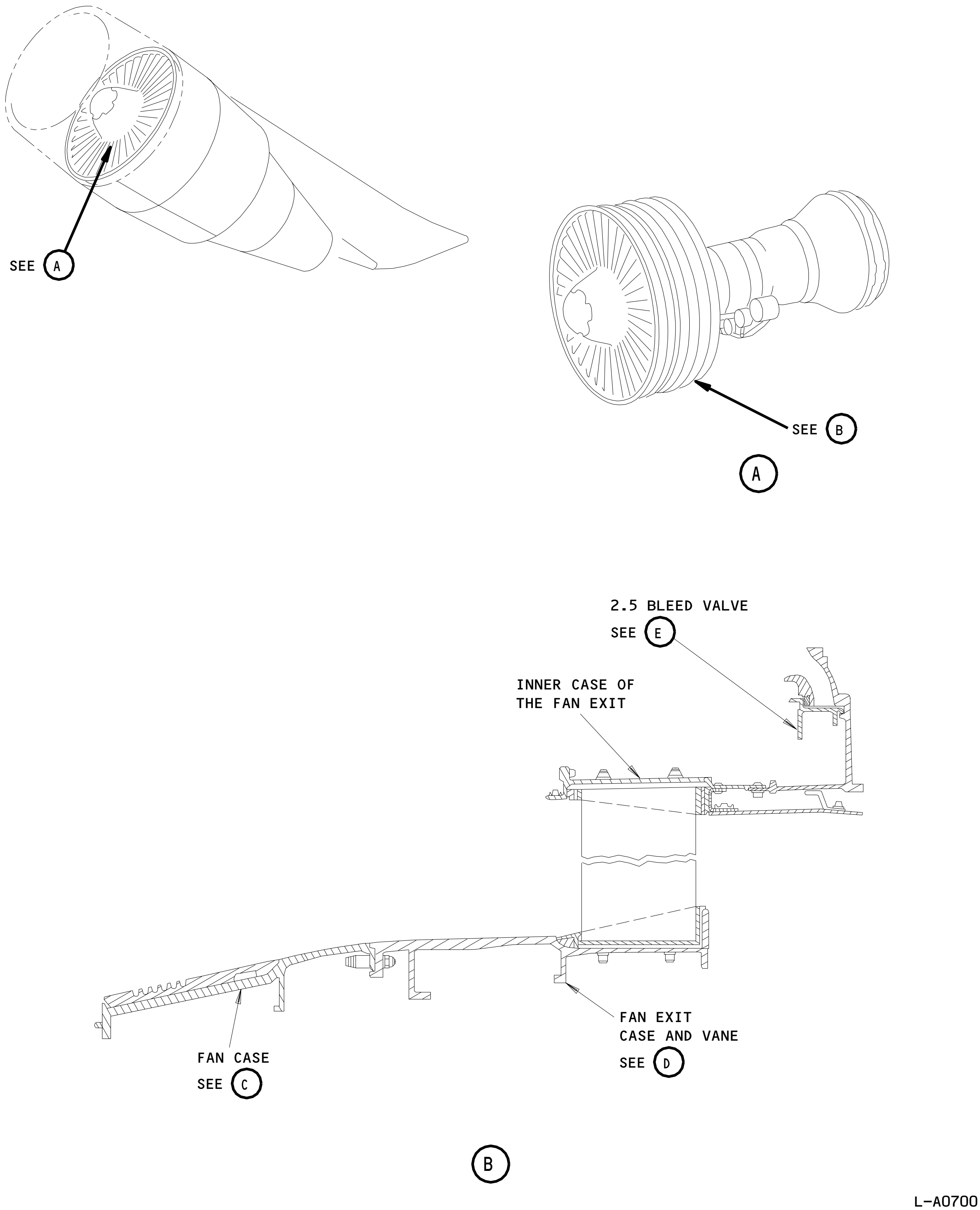
Between the inlet cowl and the fan exhaust hardware are three separate fan cases whose purpose is to contain and direct the fan discharge airstream and to provide the structural link between the airplane and the core engine. They are the fan case assembly, the fan exit case and vane assembly, and the rear case of the fan exit. The fan case assembly and the fan exit case and vane assembly, including the 2.5 bleed valve and linkage, comprise the fan cases and are addressed here. The rear case of the fan exit is integral to the intermediate case and is addressed in the intermediate case section.

(2) Fan Case Assembly

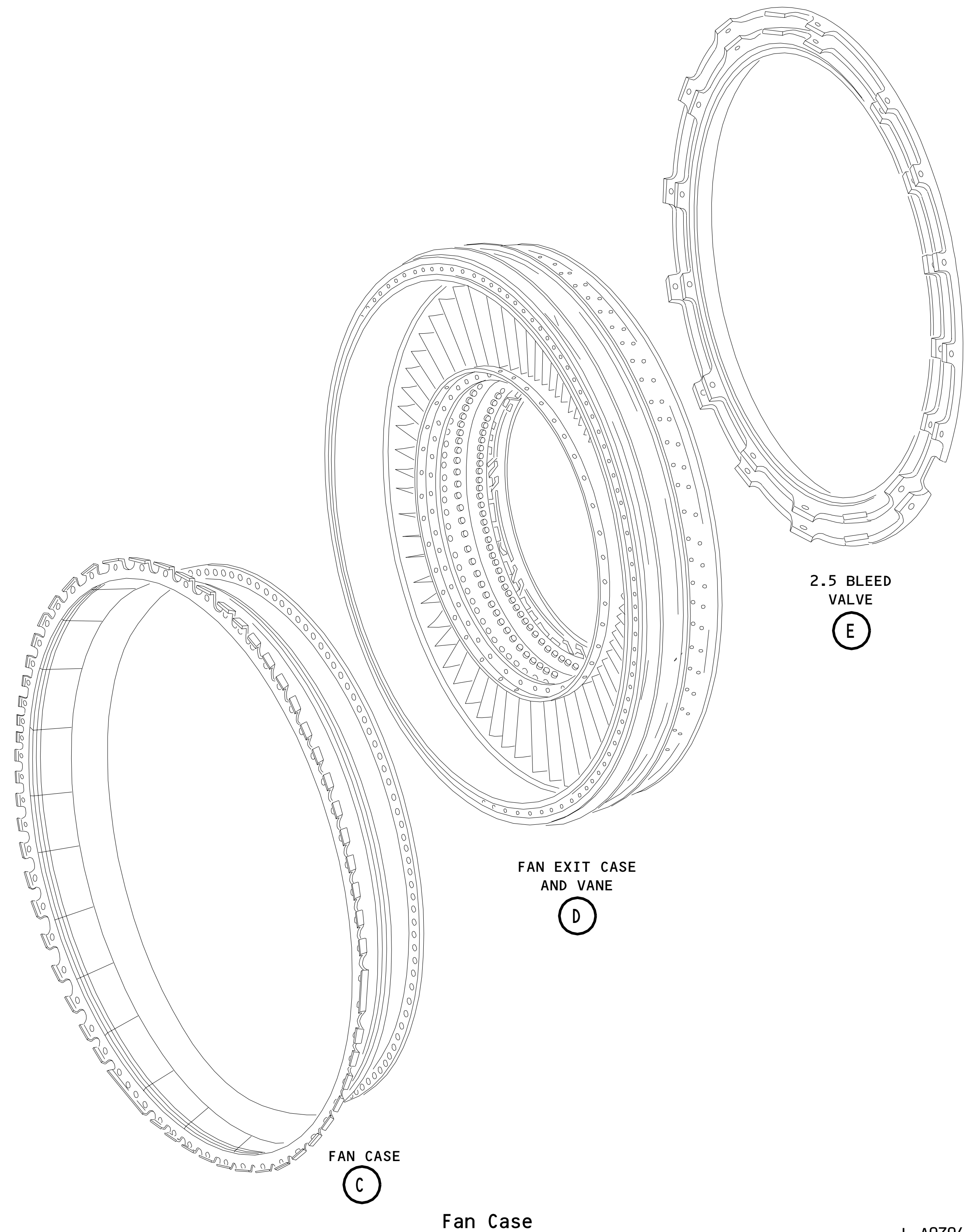
(a) The strengthened stainless steel fan case assembly supports the inlet cowl and provides for containment of the fan blades. Abradable rubstrip segments for the fan blades, which are made by an injection molding process that requires no finish machining, are secured to the ID of the fan case assembly with adhesive and mechanical retention. The fan case assembly is supported by mechanical attachment to the outer case of the fan exit.

(3) Fan Exit Case and Vane Assembly

(a) The fan exit case and vane assembly consists of an aluminum outer case, an aluminum inner case assembly and 84 fan exit vanes that span the two cases. At the front the outer case supports the fan case assembly while at the rear the outer case itself is supported by mechanical attachment to the rear case of the fan exit. The inner case assembly supports the LPC stator assembly at the front while itself being supported at the rear by mechanical attachment to the intermediate case. The fan exit vanes, made of a composite material are designed to straighten the fan discharge airstream prior to the air entering the fan exhaust.



Fan Case
Figure 3 (Sheet 1)



Fan Case
Figure 3 (Sheet 2)

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(4) 2.5 Bleed Valve Assembly

(a) The 2.5 bleed valve assembly is attached to the inner case assembly of the LPC fan exit. The purpose of this bleed valve is to ensure stable operation at low power levels and to increase stall margin during starting and when required at other operating conditions. The bleed system is actuated through linkages by a hydraulic cylinder mounted on the intermediate case. Bleed air is exhausted through the inner case assembly of the fan exit into the fan discharge airstream to provide maximum diffusion of the bleed air and minimum effect on the fan discharge airstream.

(5) Intermediate Case (Fig. 4)

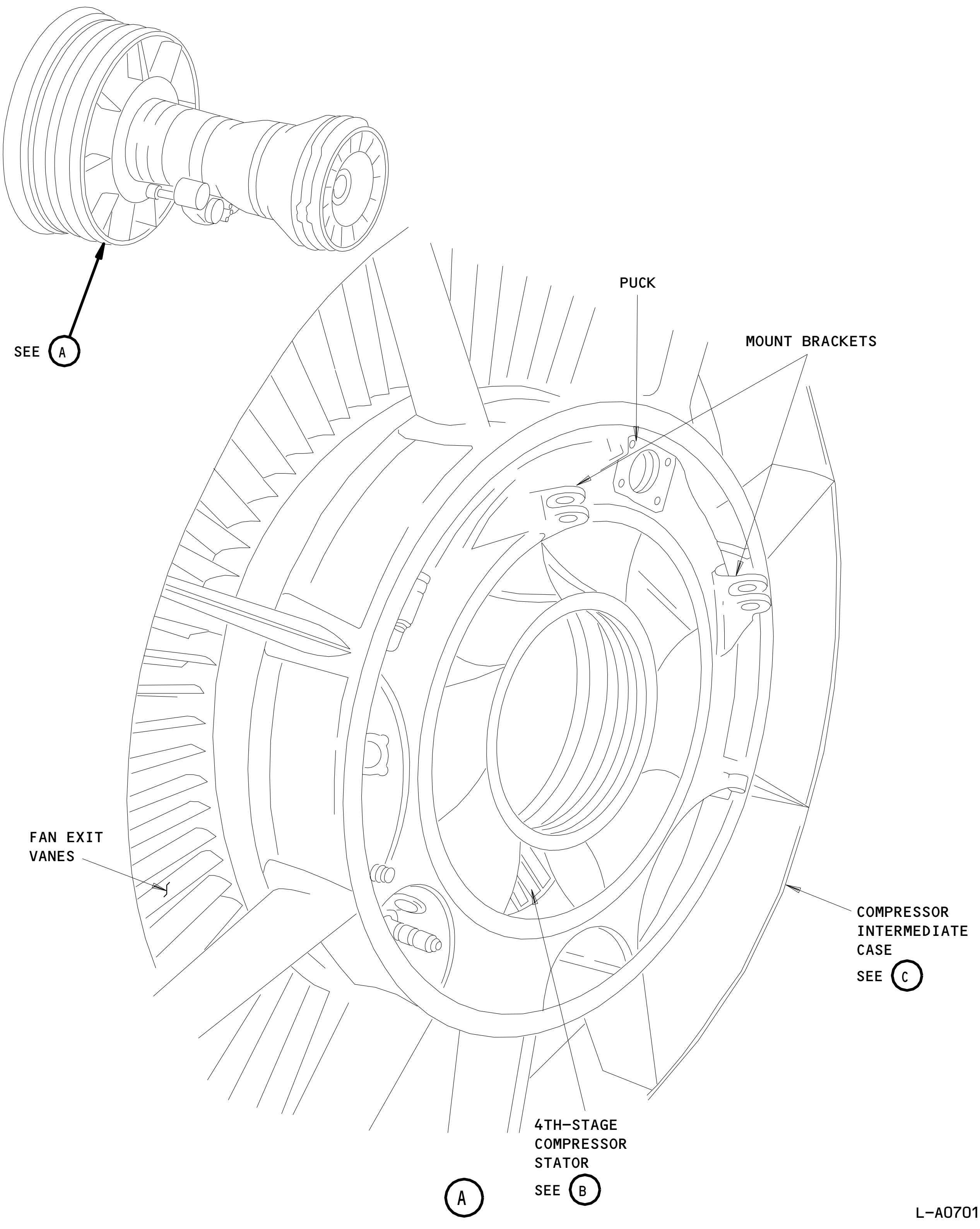
(a) The intermediate case is a major structural member of the engine that supports the thrust bearings for both the LPC and HPC rotors. The No. 1 ball bearing is supported by a cone support attached to the inner front flange of the compressor intermediate case. The No. 2 ball bearing is supported by the inner rear flange of the compressor intermediate case. Two mount brackets located on the rear of the compressor intermediate case transmit the thrust generated by both rotors directly to the airplane structure. A puck arrangement on the upper rear face of the compressor intermediate case provides for an airplane structure connection to carry engine vertical and side loads.

(b) In addition to the assembly for the compressor intermediate case, the intermediate case group consists of the 4th-stage compressor stator, the angle gearbox and bevel gear, gearshaft and driveshaft assembly which transmit power from the HPC rotor (N2) to the gearbox group.

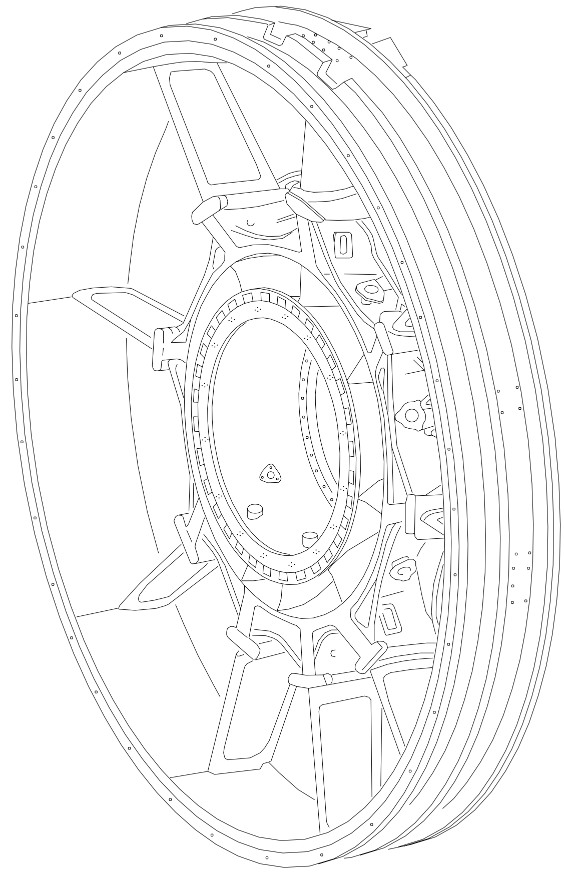
(6) Assembly for the Compressor Intermediate Case

(a) A steel compressor intermediate case and an aluminum rear case of the fan exit are attached through nine steel struts to form the assembly for the compressor intermediate case, the main structural element of the intermediate case group.

(b) The compressor intermediate case is a large investment casting which supports the No. 1, 1.5 and 2 bearings and transmits the thrust loads generated by the LPC and HPC rotors to the airplane structure through two mount brackets. The primary (main gas generator) airstream passes through the compressor intermediate case on its way from the LPC to the HPC. Aerodynamic panels attached to the OD provide the inner containment for the secondary (fan discharge) airstream.

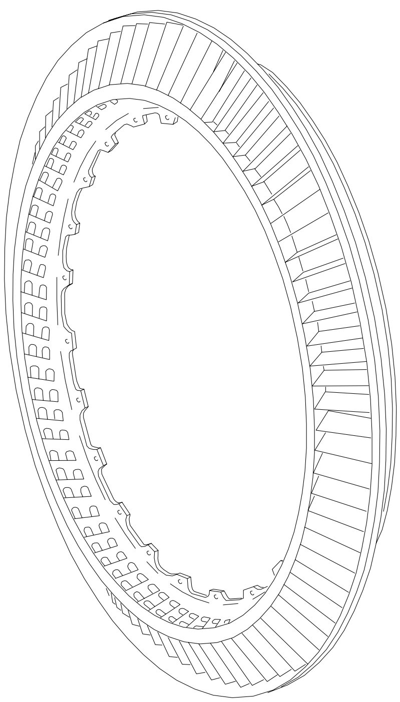


Intermediate Case
Figure 4 (Sheet 1)



COMPRESSOR INTERMEDIATE
CASE

C



FOURTH STAGE COMPRESSOR
STATOR

B

L-A0705

Intermediate Case
Figure 4 (Sheet 2)

(c) The rear case of the fan exit is an aluminum weldment which at the front attaches to the fan exit case and vane assembly and at the rear to the fan exhaust. Aerodynamic panels attached to the ID of the rear case of the fan exit provides the outer containment for the secondary (fan discharge) airstream.

(d) The nine struts that span the secondary (fan discharge) airstream are welded to the compressor intermediate case and are attached to the rear case of the fan exit by pin rivets to provide the stiffness required of this assembly.

(7) Assembly of the 4th-Stage Compressor Stator

(a) The 4th-stage compressor stator consists of the 80 aluminum vanes retained in aluminum inner and outer shroud rings. The stator is bolted to the inner front flange of the compressor intermediate case. The vanes serve to direct the primary (main gas generator) airflow as it exits the LPC.

C. Section of the High Pressure Compressor (HPC)

(1) HPC - General (Fig. 5)

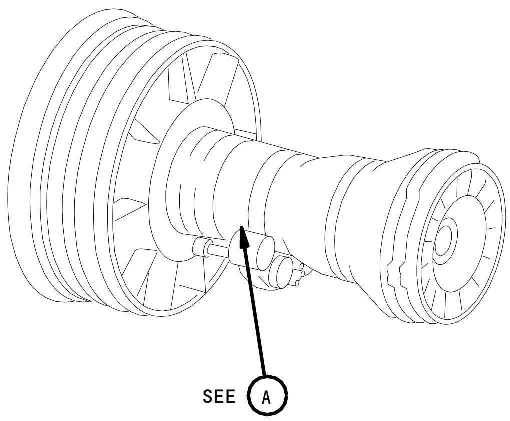
(a) The high pressure compressor (HPC) consists of a stator assembly for the inlet guide vanes (IGV) and an 11-stage rotor and stator assembly. The HPC is connected to the rear flange of the compressor intermediate case and to the front flange of the diffuser case. The purpose of the HPC is to further compress air delivered by th LPC and to direct this highly compressed air to the diffuser and combustor area.

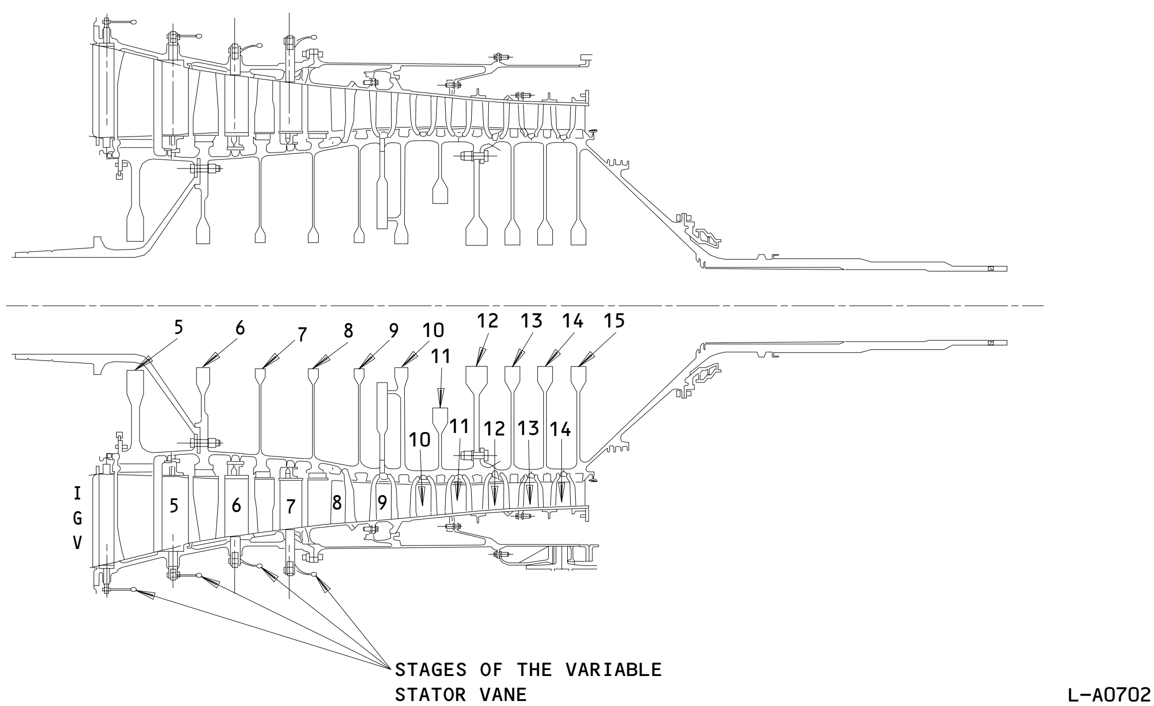
(b) Bleed connections are provided at the 8th-stage to satisfy airplane pneumatic requirements. 12th-stage air is delivered to a heat exchanger in the fan duct where the air is cooled prior to being delivered to the No. 3 bearing compartment to maintain a cool environment in that area. 12th-stage air is also delivered to the high pressure turbine (HPT) to provide cooling for the 2nd-stage turbine vanes and 2nd-stage turbine blades.

(c) The HPC consists of an 11th-stage (Stages 5 thru 15) rotor assembly, 11 stages (IGV and Stages 5 thru 14) of stator assemblies, the HPC cases and their externally mounted accessories. The 15th-stage HPC (compressor exit) stator is addressed as part of the diffuser and combustion build group.

(2) HPC Stators and Cases

(a) The stators in the HPC consists of 4 stages (IGV and 5th-, 6th-, and 7th-stages) of variable stator vanes and 7 stages (8th- thru 14th-stages) of fixed stator vanes. All HPC stator vanes are made of nickel alloy. The 9th-stage stator vanes are hollow while the other HPC stator vanes are solid.





High Pressure Compressor (HPC)
Figure 5

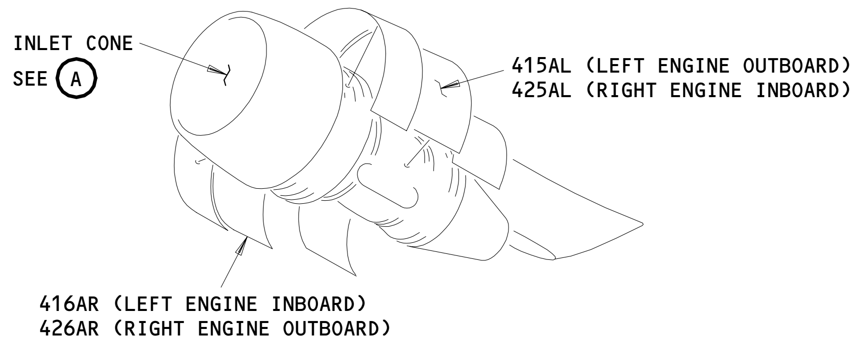
(b) The 4 variable vane stages are contained in the split HPC front case that is bolted together during assembly. The case is made of titanium and has a steel fire liner at the 6th- and 7th-stages. The outer trunnion of each vane is mechanically attached through the HPC front case to a synchronizing ring assembly for each stage. The 4 synchronizing ring assemblies are then linked to a stator vane actuator controlled by the electronic engine control (EEC). The vanes are automatically adjusted to provide adequate stall margin for engine starting, acceleration and part power operation. Attached to the ID of the vanes are abradable rubstrips axially aligned with knife-edge seals on the drum rotor. Attached to the ID of the HPC front case are abradable rubstrips axially aligned with the 5th-, 6th-, and 7th-stage blade tips.

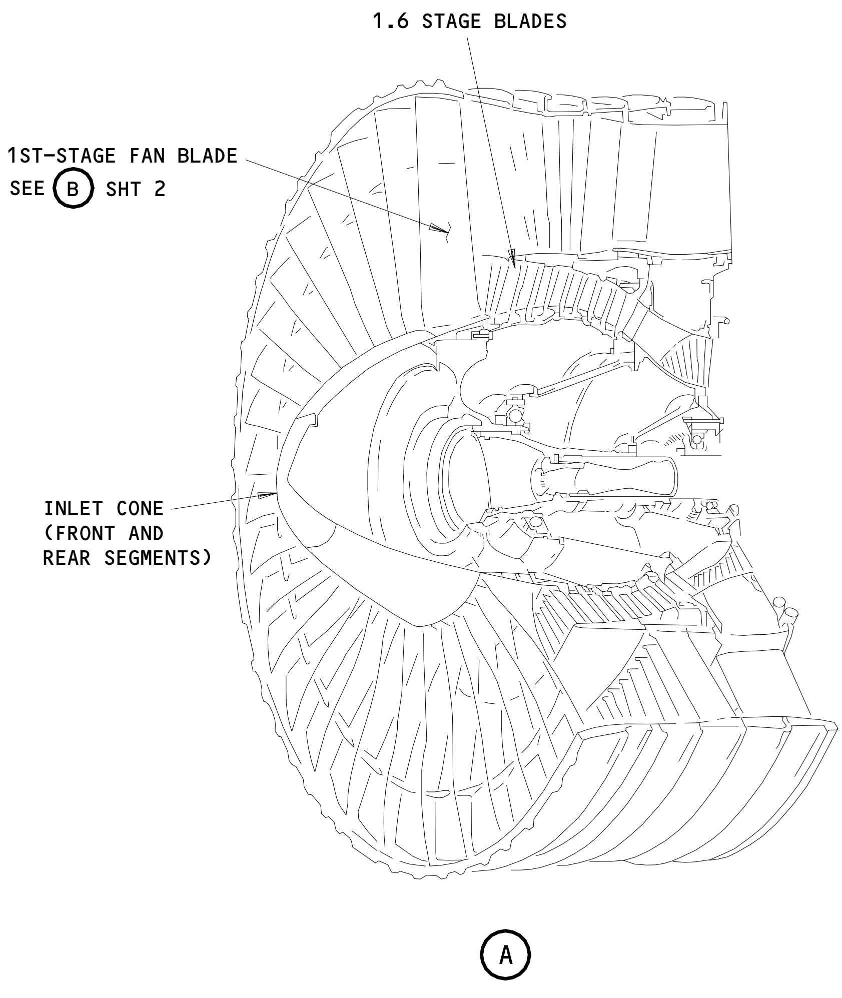
(c) The 7 fixed vane stages are mounted in the non-split titanium HPC rear case. A single stage split case stator assembly (8th-stage) is bolted to a 2-stage split case stator assembly (9th- and 10th-stages). This assembly is bolted to an inner support case containing two sets of 2-stage stator quadrants (four 90-degree segments making up the 11th- and 12th-stages and four 90-degree segments making up the 13th and 14th-stages). On the ID shroud of each stator assembly are seal rings axially aligned with knife-edge seals on the drum rotor. On the OD shroud of each stator assembly are seal rings axially aligned with the rotor blade tips.

COMPRESSOR SECTION

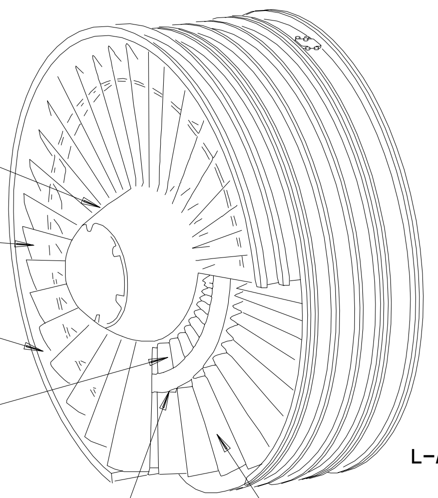
COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
BLADES - 1ST-STAGE FAN	1	40	LEFT ENGINE, 1ST-STAGE FAN	72-31-02
BLADES - 1ST-STAGE FAN	1	40	RIGHT ENGINE, 1ST-STAGE FAN	72-31-02
BLADES - 1.6-STAGE	2	108	LEFT ENGINE	72-31-05
BLADES - 1.6-STAGE	2	108	RIGHT ENGINE	72-31-05
CASE - FRONT FAN	2	1	416AR, LEFT ENGINE	72-33-01
CASE - FRONT FAN	2	1	426AR, RIGHT ENGINE	72-33-01
CASE AND VANE - FAN EXIT	3	1	415AL,416AR, LEFT ENGINE	72-33-02
CASE AND VANE - FAN EXIT	3	1	425AL,426AR, RIGHT ENGINE	72-33-02
CONE - INLET	1,2	1	LEFT ENGINE	72-31-01
CONE - INLET	1,2	1	RIGHT ENGINE	72-31-01
FAIRING - FAN EXIT	2	1	LEFT ENGINE	72-31-03
FAIRING - FAN EXIT	2	1	RIGHT ENGINE	72-31-03
LINER SEGMENTS - FAN EXIT (REAR INNER)	3	8	415AL,416AR, LEFT ENGINE	72-34-03
LINER SEGMENTS - FAN EXIT (REAR INNER)	3	8	425AL,426AR, RIGHT ENGINE	72-34-03
LINER SEGMENTS - FAN EXIT (REAR OUTER)	3	9	415AL,416AR, LEFT ENGINE	72-34-01
LINER SEGMENTS - FAN EXIT (REAR OUTER)	3	9	425AL,426AR, RIGHT ENGINE	72-34-01
STATOR - 1ST-STAGE	2	1	LEFT ENGINE	72-31-04
STATOR - 1ST-STAGE	2	1	RIGHT ENGINE	72-31-04
STRUT AND FAIRINGS - INTERMEDIATE CASE	3	8	415AL,416AR, LEFT ENGINE	72-34-05
STRUT AND FAIRINGS - INTERMEDIATE CASE	3	8	425AL,426AR, RIGHT ENGINE	72-34-05

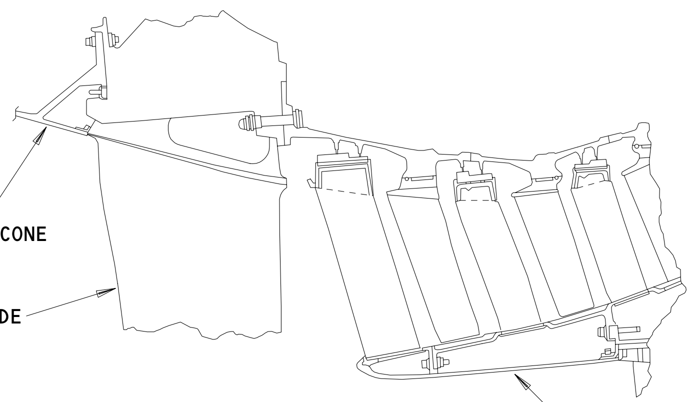
Compressor Section - Component Index
Figure 101





Compressor Section - Component Location
Figure 102 (Sheet 1)

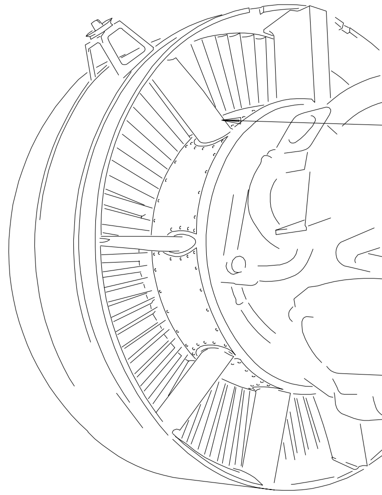


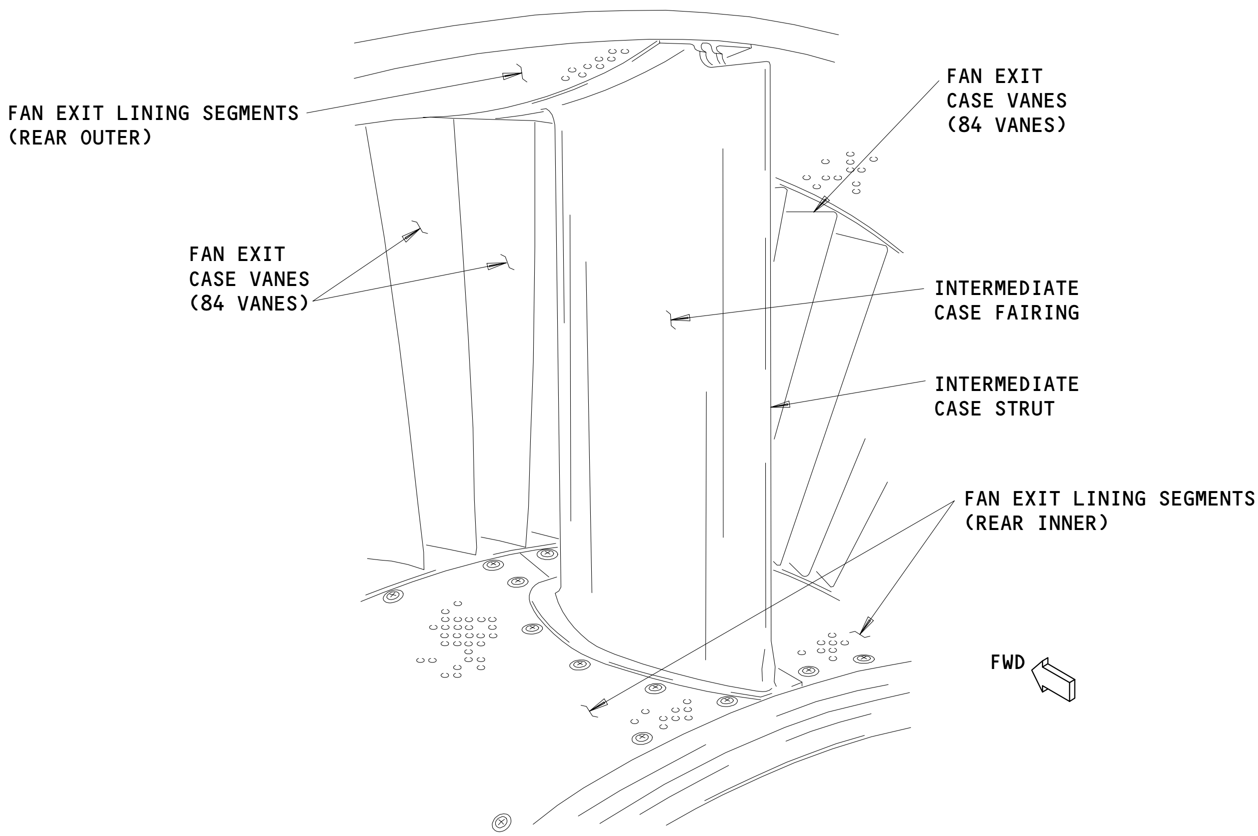


B FROM SHT 1

C

Compressor Section - Component Location
Figure 102 (Sheet 2)





INTERMEDIATE CASE STRUT
D

Compressor Section - Component Location
Figure 102 (Sheet 3)

LOW PRESSURE COMPRESSOR - ADJUSTMENT/TEST

TASK 72-31-00-725-137-N00

1. Balance the Front and Rear Balance Plane (Trim Balance - PBS-4100 Dual Pick-Up Procedure)

A. General

CAUTION: DO NOT USE THE TRIM BALANCE TO CORRECT THE VIBRATION CAUSED BY MECHANICAL PROBLEMS. REPAIR THE PART DAMAGE BEFORE YOU DO THE ENGINE TRIM BALANCE. IF YOU DO NOT REPAIR THE PART DAMAGE FIRST, MORE DAMAGE TO THE ENGINE CAN OCCUR.

(1) This trim-balance procedure includes the instructions to decrease the low rotor vibration levels in the engine with the PBS-4100 portable trim balance system.
    (a) Do the trim balance procedure to decrease the vibration levels of the low (N1) rotor to a satisfactory level.
(2) If the vibration occurred after the replacement of a fan blade, the replaced blades must be examined to make sure the moment weight pairs are not more than 1.0 ounce-inch in difference. The moment weight is written on the mid-span shroud. If it is necessary, the pair can be replaced with a different set of fan blades that have more equal moment weights.
(3) Use the trim balance to correct the stable vibration of the N1 rotor.
(4) The LPC Trim Balance - PBS-4100 Dual Pick-Up procedure uses the PBS-4100 Trim-balance system that collects engine vibration data from two engine installed vibration pick-ups; one on "A" flange and one on "P" flange. The PBS-4100 also calculates the balance solution. This is the preferred method because it will produce the lowest engine vibration levels. This method can stop vibration in the front balance plane of the LPC and the rear balance plane of the LPT. This method must be used when reductions in cabin noise is necessary.
(5) Engines that have a stable total vibration level can be trim balanced more to decrease the N1 rotor vibration.
    (a) A stable vibration has a peak amplitude that does not change more than 0.5 units (1.0 mils DA) after 30 seconds of engine operation.
(6) It is recommended that this trim balance procedure be done by personnel that are trained in the use and operation of the PBS-4100 portable trim balancing system and have experience with engine trim balance.
(7) This procedure uses the Mechanical Technologies Portable Balancing System (PBS-4100) to find the quantity and the angular location of the correct weight(s) necessary to trim balance the engine. The weight is added to stop vibration in the front balance plane of the LPC and the rear balance plane of the LPT.

(8) The weights for the engine trim balance are installed on the compressor (front balance plane) and the turbine (rear balance plane).

(9) A fan plane balance will affect the low rotor vibration levels on both the vibration pick-ups ("A" and "P" Flanges). Also, fan plane trim balance counter-weights are easier to install. Therefore, it is recommended you try a fan plane balance first.

(10) Trim balance can decrease engine vibration. The trim balance procedure adds a small amount of weight to correct the unbalance. The weight(s) are installed on the compressor front balance plane and the turbine rear balance plane. The trim balance procedure can be done on the engine while it is on the airplane.

(11) Trim balance is only used to correct stable low rotor related (1EL) vibration.

(12) The total vector sum of the trim balance weights and the weights installed for component (LPC) balance must not be more than the limits that follow:

Fan Plane: 50 oz-inches (36,000 g.mm)
LPT: 48 oz-inches (34,560 g.mm)

NOTE: If more correction weight than permitted is necessary, you must examine the engine for incorrect assembly and part damage.

(13) Identify all the trim balance weights permanently with the letters "TB".

NOTE: The balance weights installed on the fan hub during LPC balance are not identified with the letters "TB".

(14) This procedure includes instructions for these subtasks:
(a) Installation of engine equipment and external cables.
(b) Listing of available fan and turbine plane counterweights.
(c) Instruction of the installation of the counterweights.
(d) Engine test requirements.
(e) Supplemental PBS-4100 operation and setup information.

(15) Definitions:
(a) Once Per Revolution N1 Speed Reference: Once every revolution a signal is received by the N1 speed transducer. The short tooth of the tachometer gear on the turbine shaft coupling makes the signal.
(b) N1 Reference Mark: Ink mark on a fan blade or the hub which identifies the short tooth location.
(c) 1EL: The vibration of the low pressure rotor.
(d) Vibration Units: Vibration should be in mils (mm) and vibration velocity in inches per second (mm per second).

1 mil = 0.001 inch (0.025 mm)

(e) Phase Angle Lag: If the low pressure rotor is not balanced, the vibration analyzer will give its angular location. The phase angle lag is the angle between the actual location of the unbalance and the location the analyzer shows.

NOTE: This procedure uses phase measurement equipment that measures from the N1 speed pulse to the vibration pulse (maximum). Measure positive angles, in this coordinate system, in the opposite direction from the direction in which the engine turns. Some phase measurement equipment, such as the MTI equipment, measure positive angles in the direction in which the engine turns (lead angle).

(f) Phase Angle: The angle between the signal from the vibration transducer and the signal from the N1 speed reference. The speed reference is given once per revolution.
(g) Sensitivity: The moment weight that causes 1.0 mil (0.025 mm) of vibration.
(h) Once Per Revolution N1 Speed Reference: Once every revolution a signal is received by the N1 speed transducer. The short tooth of the tachometer gear on the turbine shaft coupling makes the signal. As an alternative procedure, use an optical tachometer for the once per revolution N1 speed reference.
(i) N1 Reference Blade: Fan blade with an ink mark to identify the short tooth location.
(j) Stable Vibration: A Stable Vibration is a vibration of which the vibration maximum does not change by more than one-fourth of the average vibration during 30 seconds of the engine operation.
(k) Vibration Survey: To do a test and write the engine vibration data against the rotational speed during an engine acceleration or deceleration. This finds which engine speeds give the maximum vibration levels which are not permitted.
(l) Trim Balance Survey: To do a test and write the vibration amplitude and phase angle data of the low rotor. The vibration amplitude is measured while the engine is stable at the peak vibration level. You can then calculate the correct weight.

B. Equipment
(1) MTI 2825-4045 Bracket - "A" Flange Vibration Pick-up,
Mechanical Technology Inc.,
968 Albany-Shaker Road,
Latham, NY 12110
(2) MTI 2825-4044 Bracket - "P" Flange Vibration Pick-up, Mechanical Technology
(3) MTI 5500-4001 Accelerometer - (quantity 2), Mechanical Technology
(4) MTI 8218-5201 Cable - "A" Flange Vibration Pick up, Mechanical Technology
(5) MTI 8218-5202 Cable - "P" Flange Vibration Pick-up, Mechanical Technology

(6) MTI 8218-5203 Harness - N1 Breakout Cable, Mechanical Technology
(7) MTI 8900-5036 Amplifier - Engine Jumper Cable, Mechanical Technology
(8) MTI 8000-4225 Amplifier - Charge, Mechanical Technology
(9) MTI 8900-5034 Harness - Engine Interface Cable, Mechanical Technology
(10) MTI 8900-5035 Jumper - PBS, Mechanical Technology
(11) MTI 7000-4133 Portable Balancing System - PBS-4100 (This includes a Computer and Data Acquisition Unit (DAU)), Mechanical Technology
(12) PWA 76855 Pump - Hydraulic, (use with PWA 86302)
Pratt & Whitney
Commercial Products Division
400 Main Street
East Hartford, CT 06108 US
(13) PWA 85306 Puller - (For Turbine Shaft Plug), Pratt & Whitney
(14) PWA 86302 Bender - Hydraulic (Turbine Clip Crimping Tool), (Optional to PWA 102335), Pratt & Whitney
(15) PWA 102335 Bender - Mechanical (Optional to PWA 86302), Pratt & Whitney
(16) PWA 85234 Riveter - (Flaring Pliers, for Fan Weight Rivets), Pratt & Whitney
(17) ENGINES POST-PW-SB 72-385;
0.190-32 Jackscrews - 8 are necessary

C. Consumable Materials
(1) G00846 Pencil - Silver
(2) D00504 Petrolatum - White
(3) G00949 Ink

D. References
(1) AMM 71-00-00/201, Power Plant
(2) AMM 71-00-00/501, Power Plant
(3) AMM 71-11-04/201, Fan Cowl Panels
(4) AMM 71-11-06/201, Core Cowl Panels
(5) AMM 72-31-01/401, Inlet Cone
(6) AMM 78-11-02/401, Turbine Exhaust Plug
(7) AMM 78-31-00/201, Thrust Reverser System

E. Access
(1) Location Zone
411 Left Engine
421 Right Engine

F. Prepare for the Trim Balance Procedure.

S 485-129-N00
(1) Do the steps that follow to install the accelerometers (Fig. 501, Fig. 502):

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(a) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).
(b) Open the fan cowl panels (AMM 71-11-04/201).

NOTE: It is necessary to open the left and right fan cowl panels if all other cowlings are opened.

(c) Open the core cowl panels (AMM 71-11-06/201).

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(d) Open the thrust reversers (AMM 78-31-00/201).
(e) Install the MTI 2825-4045 bracket and the MTI 5500-4001 accelerometer assembly on Flange A.
(f) Connect the Turbine Pick-up Jumper with a routing down, near the drain mast.
(g) Install the MTI 2825-4044 bracket and the MTI 5500-4001 accelerometer assembly on Flange P at the 9 o'clock position.

NOTE: The recommended location for the "P" flange accelerometer is the 9 o'clock position (Fig. 502). It is not always possible to install the accelerometer bracket at the 9 o'clock position if the engine has an oil system tubing modification. If you cannot install the "P" flange accelerometer bracket at the 9 o'clock position, install the bracket at the 1:30 o'clock position as shown in (Fig. 502). The pick-up bracket can be installed on the forward or rearward side of "P" flange.

S 485-130-N00
(2) Do the steps that follow to install the trim balance equipment:
(a) Disconnect the N1 probe cable from the N1 probe.
(b) Connect the MTI 8218-5203 N1 breakout cable to the N1 probe.
(c) Connect the MTI 8218-5203 N1 breakout cable to the wiring harness.
(d) Route the MTI 8218-5203 N1 breakout cable as necessary so that the connector will exit the reverser doors at the overboard drain access door.
(e) Install the MTI 8218-5202 "P" Flange vibration pick-up cable as necessary so that the connectors will exit the reverser doors at the overboard drain access door.

(f) Install the MTI 8218-5201 "A" Flange vibration pick-up cable as necessary so that the connector will exit between the cowling at the 6 o'clock position.

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 TO CLOSE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

CAUTION: MAKE SURE THAT THE CABLES DO NOT GET CAUGHT TIGHTLY IN THE COWLING, THRUST REVERSER OR LATCHES. TIGHT BENDS CAN CAUSE DAMAGE TO THE CABLES.

(g) Close the thrust reversers (AMM 78-31-00/201).
(h) Close the core cowl panels (AMM 71-11-06/201).
(i) Use tie raps to the MTI 8000-4225 Charge Amplifier tightly to the drain mast grating on the overboard drain access door.
(j) Close the fan cowl panels (AMM 71-11-04/201).
(k) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).
(l) Connect the MTI 8218-5201 "A" Flange vibration pick-up cable to the channel 1 connector on the MTI 8000-4225 Charge Amplifier.
(m) Connect the MTI 8218-5202 "P" Flange vibration pick-up cable to the channel 2 connector on the MTI 8000-4225 Charge Amplifier.
(n) Connect the MTI 8218-5203 N1 breakout cable to the MTI 8900-5035 Engine Jumper Cable.
(o) Connect the MTI 8900-5035 Engine Jumper Cable to the MTI 8000-4225 Charge Amplifier.
(p) Connect the MTI 8900-5034 Engine Interface Cable to the MTI 8900-5035 Engine Jumper Cable.
(q) Use tape to attach the Engine Interface Cable up the side of the cowl and pylon to the wing.
(r) Attach the Engine Interface Cable along the wing, and into the leading edge door on the aircraft's wing, or above the wing door.

CAUTION: DO NOT CLOSE THE DOOR FULLY. IF YOU CLOSE THE DOOR FULLY, THE DOOR CAN CAUSE DAMAGE AND FAILURE TO THE CABLE.

(s) Put the MTI 7000-4133 PBS-4100 laptop computer, and the Data Acquisition Unit (DAU) near the cockpit.
(t) With the extension cord and adapter, connect the DAU, and the laptop computer to 115V 400HZ power in the cockpit.
(u) Connect the MTI 8900-5034 Engine Interface Cable to the MTI 8900-5035 Jumper Cable.
(v) Connect the MTI 8900-5035 Jumper Cable to the PBS-4100.

NOTE: Refer to the PBS-4100 equipment manual for installation instructions of the PBS-4100.

S 975-131-N00

(3) Make a record of the date, airplane, and engine date, airplane, and engine that will be balanced.

G. As-Is Trim Balance Survey.

S 975-132-N00

(1) Do the steps that follow to do the As-Is Trim Balance Survey:

(a) Thermally stabilize the engine:

NOTE: You must have a thermally stable engine before you do the vibration survey.

WARNING: USE AMM 71-00-00/201 TO OPERATE THE POWER PLANT. IF YOU DO NOT USE THIS PROCEDURE, YOU CAN CAUSE DAMAGE TO EQUIPMENT OR INJURIES TO PERSONS.

1) Use the Power Plant Operation (Normal) procedure to start the engine (AMM 71-00-00/201).
2) Operate the engine at minimum power for five minutes.
3) Do a slow acceleration to 1.3 EPR power, then stay at 1.3 EPR for three minutes.
4) Decrease the power to IDLE, then stay at IDLE for six minutes.

NOTE: You now have a thermally stable engine.

(b) To do the trim balance survey, stop at the N1 speeds that follow and take trim balance data during the slow accel (90-120 seconds) to 90% N1 (3250 RPM).

63% N1 (2250 RPM) speed
68% N1 (2450 RPM) speed
82% N1 (2950 RPM) speed
90% N1 (3250 RPM) speed

NOTE: Refer to the PBS-4100 operation manual for instructions on computer operations.

NOTE: PBS-4100 software V2.21 and higher will let you take the trim balance data during the vibration survey. If the software is pre V2.21, the vibration survey and the trim balance can be done separately.

(c) Do a slow decel (90-120 seconds) to IDLE.

NOTE: Trim balance data is only taken during the accel vibration survey.

(d) Operate the engine at IDLE for five minutes to let the engine become cool.
(e) Use the Power Plant Operation (Normal) procedure to do the engine shutdown (AMM 71-00-00/201).
(f) Remove the inlet cone (AMM 72-31-01/401).
(g) Examine the hub flange for installed counter-weights (See Figure 503).
(h) If weights are installed, do these steps:
  1) Examine the fan blades and fan hub for an N1 Reference Mark.
  2) If there is no N1 Reference Mark on a fan blade or the fan hub, do the steps that follow to make an N1 Reference Mark (See Figure 504).
    a) Remove the retaining ring of the key washer and the key washer.

       NOTE: The key washer holds the turbine shaft plug in position.

    b) Use a PWA 85306 Puller to remove the plug.
    c) Discard the packing.
    d) Find the small recess on the end of the coupling assembly of the turbine shaft.

       NOTE: This recess gives the location of the short tooth which makes the signal for the N1 speed transducer.

    e) Make a mark with ink in a location which you can easily see on the fan blade which is aligned with the recess.
    f) Lubricate a new packing with the petrolatum.
    g) Install the packing to the turbine shaft plug.
    h) Install the turbine shaft plug to the coupling ID.
    i) Install the key washer and the retainer ring.
    j) Make sure that the retainer ring is fully installed all around the groove in the retainer nut.

       NOTE: The clearance between the ends of the retainer ring will be 0.10 inch (0.254 mm) when it is correctly installed.

  3) Make a mark with a Silver Pencil on the fan blade rubstrip at the 12 o'clock position.
  4) To index the fan, rotate the fan until the mark on the fan blade is aligned with the mark on the fan rubstrip.
    a) Lubricate a new packing with the petrolatum.
    b) Install the packing to the turbine shaft plug.
    c) Install the turbine shaft plug to the coupling ID.
    d) Install the key washer and the retainer ring.

e) Make sure that the retainer ring is fully installed all around the groove in the retainer nut.

NOTE: The clearance between the ends of the retainer ring will be 0.10 inch (0.254 mm) when it is correctly installed.

f) Examine the hub flange for installed counterweights.
g) Examine each counterweight for the letters "TB" marked on the inner diameter face.
h) Make a record of the part number and tang location of all counterweights.

NOTE: After the fan is indexed, the tang at the 12 o'clock position is the No. 1 tang. The tangs are numbered 1 through 19 in the clockwise direction.

5) Input their weight (PBS class number) and location (tang number) into the PBS-4100 computer.

NOTE: The PBS class number must be input as a negative (-) number.

6) Remove all of the counterweights on the fan.
7) Install the inlet cone (AMM 72-31-01/401).
8) Do a Check Run as given later in this procedure.

(i) If counterweights are not installed, do these steps:

1) Install counter-weights No. 1 (CW1) trial weights to the fan balance ring (See Table 503 and Figure 503).

NOTE: Use assembled phase angle and sensitivity data to find the CW1 trial weight location.

2) Temporarily install the correction weights in the fan with cotter pins (See Table 501).

3) If necessary, install correction weights in the turbine by one of these two methods (See Table 502 and Figure 505):

NOTE: Low turbine plane counterweights are installed to the 6th-stage turbine blades.

There are 128 6th-stage turbine blades. With the fan indexed, the No. 1 turbine will be the blade at 12 o'clock position. The blades are numbered 1 through 128 in the clockwise direction.

A clip-on counterweight (50N401) is provided for the LPT 6th-stage blade shroud. Use as necessary with a maximum number of 10 clip-on weights per engine.

a) Attach the counterweights with a PWA 86302 Hydraulic Bender and a PWA 76855 Hydraulic Pump.

CAUTION: DO NOT BEND THE COUNTER-WEIGHT TABS WHEN YOU HOLD THE COUNTER-WEIGHT IN THE MECHANICAL BENDER. IF YOU BEND THE TABS, YOU WILL NOT BE ABLE TO INSTALL THE COUNTERWEIGHT ON THE 6TH-STAGE TURBINE BLADE.

b) Attach the counter-weights with a PWS 102335 Mechanical Bender:
1. Put the counter-weight on the counter-weight holder of the PWA 102335 Mechanical Bender.
2. Operate the quick grip handle to lightly hold the counter-weight. Do not squeeze the quick grip handle too much so that you bend the counter-weight tabs.
3. Put the PWA 102335 Mechanical Bender with the counter-weight on the airfoil section of the designated 6th-stage turbine blade(s).
4. With the counter-weight still installed in the bender, slide the counter-weight along the airfoil onto the blade outer shroud.

NOTE: Make sure the counter-weight hook goes around the leading edge of the blade.

5. To attach the counter-weight to the blade, operate the quick grip handle until it hits the bar stop to bend the tab.
6. Release the quick grip handle and remove the PWA 102335 Mechanical Bender from the engine.

4) Install the inlet cone (AMM 72-31-01/401).
5) Do a Check Run as given later in this procedure.

TABLE 501 TRIM BALANCE COUNTERWEIGHTS FOR THE FAN PLANE			
CLS	CNTRWGHT PN 534493	CNTRWGHT PN 534495	CNTRWGHT PN 1B4294
1	2.0 oz-in (1440 g.mm)	4.9 oz-in (3528 g.mm)	12.8 oz-in (9216 g.mm)
2	2.4 oz-in (1728 g.mm)	5.3 oz-in (3816 g.mm)	
3	2.8 oz-in (2016 g.mm)	5.7 oz-in (4104 g.mm)	
4		6.1 oz-in (4392 g.mm)	
5		6.5 oz-in (4680 g.mm)	

TABLE 502 TRIM BALANCE COUNTERWEIGHT FOR THE TURBINE PLANE
COUNTERWEIGHT PN 50N401
4.3 oz-in (3096 g.mm)

H. Check Run.

S 975-133-N00

(1) Do a Check Run as follows:

(a) Thermally stabilize the engine with the steps given earlier in this procedure.

(b) Do the trim balance survey by stopping at the same N1 speeds used during the As-Is Trim Balance Survey and make a record of the data.

NOTE: Refer to PBS-4100 operation manual for instructions on computer operations.

NOTE: PBS-4100 software V2.21 and higher will let you take the trim balance data during the vibration survey. If the software is pre V2.21, the vibration survey and the trim balance can be done separately.

(c) Do a slow decel (90-120 seconds) to IDLE.

NOTE: Trim balance data is only taken during the accel vibration survey.

(d) Operate the engine at IDLE for five minutes to let the engine become cool.
(e) Use the Power Plant Operation (Normal) procedure to do the engine shutdown (AMM 71-00-00/201).
(f) If the vibration levels are satisfactory, do these steps:
1) Return the airplane to service with the steps given later in this procedure.
(g) If the vibration levels are not satisfactory, do the steps that follow:
1) Use the "PREDICT" feature of the PBS-4100 to find if there is a balance solution that will decrease the vibration to satisfactory levels.
2) If there is a satisfactory balance solution, Do a Re-Balance with the steps given later in this procedure.
3) If there are no satisfactory balance solutions, remove the engine (AMM 71-00-02/401).

I. Re-Balance (Repeat Shot).

S 975-134-N00

(1) Do the Re-Balance (Repeat Shot) as follows:
(a) Remove the inlet cone (AMM 72-31-01/401).
(b) Using the "BALANCE WGTS" feature of the PBS-4100, find which weights to remove and to install.
(c) Temporarily install the correction weights in the fan with the cotter pins.
(d) If necessary, bend the tab on the clip about 50 percent to install the counterweights to the turbine.

<u>NOTE</u>: Low turbine plane counterweights are installed to the 6th-stage turbine blades.

There are 128 6th-stage turbine blades. With the fan indexed, the No. 1 turbine will be the blade at 12 o'clock position. The blades are numbered 1 through 128 in the clockwise direction.

1) A clip-on counterweight (50N401) is given for the LPT 6th-stage blade shroud. Use as necessary with a maximum number of 10 clip-on weights per engine.
2) Attach the counterweights with a PWA 86302 Hydraulic Bender and a PWA 76855 Hydraulic Pump (Fig. 505).

(e) Obey the computer instructions to make sure the weights you installed are the same as the solution.
1) If you installed weights that are different from the balance solution, make sure you change the data in the computer.
(f) Install the inlet cone (AMM 72-31-01/401).
(g) Do a Check Run with the steps given earlier in this procedure.

J. Return the Airplane to Service.

S 825-135-N00

(1) Remove the trial balance weights and install the permanent counterweight(s).
  (a) Install the permanent fan weights as follows:
    1) Remove the front segment of the inlet cone (AMM 72-31-01/401).
    2) Vibro peen the letters "TB" on the inner diameter face of all the trim balance counterweight(s).
    3) Install each permanent fan weight with a rivet.
      a) Use the riveter to make a 0.125 inch (3.175 mm) diameter head on the rivet.
    4) Install the front segment of the inlet cone (AMM 72-31-01/401).
  (b) Operate the engine with the counterweights installed to make sure that the engine vibration is within limits.

S 085-136-N00

(2) Remove the trim balance equipment as follows:

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSON AND DAMAGE TO EQUIPMENT.

  (a) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).
  (b) Open the right fan cowl panel (AMM 71-11-04/201).
  (c) Open the core cowl panels (AMM 71-11-06/201).
  (d) After you disconnect the N1 Sensor Pickup Jumper, connect the flight N1 sensor harness to the N1 sensor.
  (e) Remove the PWA 85774 bracket and the PWA 85703 accelerometer assembly from Flange P at the 9 o'clock position.
  (f) After you disconnect the N1 Sensor Pickup Jumper, connect the flight N1 sensor harness to the N1 sensor.
  (g) Close the core cowl panels (AMM 71-11-06/201).
  (h) Close the right fan cowl panel (AMM 71-11-04/201).
  (i) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).
  (j) Make sure all equipment that was installed for the trim balance procedure was removed.

TASK 72-31-00-725-164-N00

2. Balance the Front Balance Plane (Trim Balance - PBS-4100 / AVM Procedure)

A. General

(1) It is recommended that this trim balance procedure be done by personnel that are trained in the use and operation of the PBS-4100 portable trim balancing system and have experience with engine trim balance.

(2) This method uses the aircraft AVM and the Mechanical Technologies Portable Balancing System (PBS-4100). The PBS-4100 is plugged into the AVM signal conditioner. The PBS-4100 collects the vibration data and calculates a balance solution. This method is used to lower fan ("A" flange) vibration levels only. This procedure should not be used to correct cabin noise problems.

CAUTION: TRIM BALANCE SHOULD NOT BE USED TO CORRECT VIBRATION CAUSED BY MECHANICAL PROBLEMS. EXAMPLES OF THIS TYPE OF PROBLEM ARE:

INCORRECT ASSEMBLY - INCORRECT ASSEMBLY DURING ENGINE OVERHAUL OR REPAIR CAN BE SHOWN BY VIBRATION LEVELS LARGER THAN TWICE THE VIBRATION LIMIT.

DAMAGE TO ROTOR PARTS - PART DAMAGE MUST BE REPAIRED BEFORE ENGINE TRIM BALANCE.

(3) Trim balance can decrease engine vibration. The trim balance procedure adds a small amount of weight to correct unbalance. The weight(s) are installed on the compressor front balance plane and the turbine rear balance plane. The trim balance procedure can be done on the engine while it is on the airplane.

NOTE: If vibration occurred after fan blade replacement, the replaced blades should be inspected to make sure that the moment weight pairs do not exceed 1.0 oz-in. (720 g.mm) difference. The moment weight is marked on the concave airfoil surface inboard of the mid-span shroud. If necessary, replace with a different set of moment weight fan blade pair.

(4) A fan plane balance will affect the low rotor vibration levels on both the fan ("A" flange) and turbine ("P" flange) cases. Because the AVM only has vibration pick-ups on the fan case, the affect of a fan plane balance on the turbine case will not be known. Therefore, this procedure has a limit of the quantity of weight that can be installed to the fan balance flange. A turbine plane balance cannot be done with this procedure.

(5) Trim balance is only used to correct stable low rotor related (1EL) vibration.

(6) The total vector sum of the trim balance weights and the weights installed for component (LPC) balance must not be more than the limits that follow:

Fan plane: 20 oz-in. (14400. g.mm)

NOTE: Engines that require more correction weight than allowed must be trim balanced using the PBS-4100 Dual Pick-up Procedure.

(7) Identify all the trim balance weights permanently with the letters "TB".

NOTE: The balance weights installed on the fan hub during LPC balance are not identified with the letters "TB".

(8) If the sum of the low rotor and the high rotor vibration does not equal the total vibration, then some N1 or N2 related vibration harmonics or noise caused by the equipment (leads and pick-ups) can be present. The total vibration limit applies to the square root of the sum of the N1 vibration squared plus the N2 vibration squared.

(9) The first trial balance weights are identified as CW1, the second weights CW2, the third weights as CW3, etc.

(10) This task gives the instructions for these subtasks:
- (a) Installation of engine equipment and external cables.
- (b) Listing of available fan and turbine plane counterweights.
- (c) Instruction for the installation of the counterweights.
- (d) Engine test requirements.
- (e) Supplemental PBS-4100 operation and setup information.

(11) Definitions:
- (a) 1EL: The low rotor related vibration.
- (b) Vibration Units: Vibration should be in mils (mm) and vibration velocity in inches per second (mm per second).

  1 mil = 0.001 inch (0.025 mm)

(c) Phase Angle: The angle between the signal from the vibration transducer and the signal from the once per revolution N1 speed reference.

NOTE: This procedure uses phase measurement equipment that measures from the N1 speed pulse to the vibration pulse (maximum). Measure positive angles, in this coordinate system, in the opposite direction from the direction in which the engine turns (lag angle). Some phase measurement equipment, such as the MTI PBS-4000, measure positive angles in the direction in which the engine turns (lead angle). The PBS-4100 can be set to either lead or lag angle.

(d) Phase Angle Lag: The angle the low rotor turns during the time the "heavy point" goes by the vibration transducer and the effect of this is shown.
(e) Sensitivity: The moment weight that causes 1.0 mil (0.025 mm) of vibration.
(f) Once Per Revolution N1 Speed Reference: The short tooth of the tachometer gear on the turbine shaft coupling makes a signal to the N1 speed transducer once each revolution. As an alternative procedure, use an optical tachometer for the once per revolution N1 speed reference.
(g) N1 Reference Blade: Fan blade with an ink mark to identify the short tooth location.
(h) Stable Vibration: A Stable Vibration is a vibration of which the vibration maximum does not change by more than one-fourth of the average vibration during 30 seconds of the engine operation.
(i) Vibration Survey: The process to get and record engine vibration data versus rotational speed during an engine acceleration/deceleration. This is used to document that an engine is within vibration limits. It is also used to identify peak vibration levels at certain engine speeds which are not within vibration limits.
(j) Trim Balance Survey: This survey is done after or during the Vibration Survey. The engine is tested at predetermined N1 speeds. The (1EL) low rotor engine vibration amplitude and phase angle data are recorded at each of the predetermined N1 speeds.

B. Equipment
(1) MTI 8900-6714 Engine Selector Switch Box,
Mechanical Technology Inc.,
968 Albany-Shaker Road,
Latham, NY 12110
(2) MTI 8115-6713 PBS Jumper Cable,
Mechanical Technology Inc.
(3) MTI 8900-5065 AVM Interface Cable, Mechanical Technology Inc.

(4) MTI 7000-4133 Portable Balancing System - PBS-4100 (This includes a Computer and Data Acquisition Unit (DAU), Mechanical Technology Inc.
(5) PWA 85306 Puller - Pratt & Whitney
(6) PWA 85307 Puller - Knocker, Pratt & Whitney
(7) PWA 85234 Riveter - (Flaring Pliers, for Fan Weight Rivets) Pratt & Whitney

C. Consumable Materials
(1) G00846 Pencil - Silver
(2) D00504 Petrolatum - White
(3) D00390 Oil - Engine
(4) G00949 Ink

D. References
(1) AMM 71-00-00/201, Power Plant
(2) AMM 71-00-00/501, Power Plant
(3) AMM 72-31-01/401, Inlet Cone
(4) AMM 78-11-02/401, Turbine Exhaust Plug

E. Access
(1) Location Zone

411	Left Engine
421	Right Engine
119/120	Main Equipment Center

(2) Access Panel
119AL Main Equipment Center

F. Prepare for the Trim Balance Procedure.

S 485-165-N00
(1) Do the steps that follow to install the trim balance equipment (See Figure 506).
(a) Locate the AVM Signal Conditioner.
(b) Connect the MTI 8900-5065 Interface Cable to AVM front panel maintenance connector.
(c) Route the MTI 8900-5065 Interface Cable to PBS-4100 location in the aircraft.
(d) Connect the MTI 8900-5065 Interface Cable to Switch Box (8115-6714).

(e) Connect Jumper Cable (8115-6713) to Switch Box (8115-6714) and to the PBS-4100 Data Acquisition Unit.
(f) Connect PBS-4100 Data Acquisition Unit to the PBS-4100 Computer.

NOTE: Refer to the PBS-4100 equipment manual for installation instructions of the PBS-4100.

(g) With the extension cord and adapter, connect the DAU, and the laptop computer to 115V 400HZ power in the cockpit.

S 975-166-N00
(2) Make a record of the date, airplane, and engine that will be balanced.

S 935-172-N00
(3) Find the mark (recess) that refers to the once per revolution N1 speed signal as follows:
(a) Use a Silver Pencil and mark the inlet cone front segment and the inlet cone (rear) segment for alignment during installation.
(b) Remove the compressor inlet cone front segment (AMM 72-31-01/401).
(c) Remove the key washer retaining ring and the retaining nut key washer which holds the turbine shaft plug, at the front of the coupling. Use the PWA 85306 Puller to remove the plug. Discard the packing. (See Figure 504)
(d) Find the small recess on the end of the turbine shaft coupling assembly. This recess shows the location of the short tooth which makes the signal for the N1 speed transducer. Mark the fan blade which is aligned with this recess, using ink, in an easily seen location.
(e) Lubricate a new packing with the petrolatum.
(f) Install the packing to the turbine shaft plug.
(g) Install the turbine shaft plug to the coupling ID.
(h) Install the key washer and the retainer ring.
1) Make sure that the retainer ring is fully installed all around the groove in the retainer nut.

NOTE: The clearance between the ends of the retainer ring will be 0.10 inch (0.254 mm) when it is correctly installed.

(i) Make a mark with Silver Pencil on the fan blade rubstrip at the 12:00 o'clock position.

(j) To index the fan, turn the fan until the mark on the fan blade is aligned with the mark on the fan rubstrip.

(k) Examine the hub flange for installed counterweights. Check each counterweight for the letters "TB" marked on the inner diameter face.

(l) Make a record of the part number and tang location of all counterweights marked "TB".

<u>NOTE</u>: After the fan is indexed, the tang at the 12 o'clock position is the No. 1 tang. The tangs are numbered 1 through 19 in the clockwise direction.

(m) If weights marked "TB" are installed, use the "Trial Weight Balancing" option on the computer.

(n) If weights marked "TB" are not installed, use the "Stored Influence Coefficient Balancing" option on the computer.

(o) Install the compressor inlet cone (AMM 72-31-01/401).

G. Vibration/Trim Balance Survey.

S 975-167-N00

(1) Do the steps that follow to do the Vibration/Trim Balance Survey:

(a) Thermally stabilize the engine as follows:

<u>NOTE</u>: You must have a thermally stable engine before you do the vibration survey.

<u>WARNING</u>: USE AMM 71-00-00/201 TO OPERATE THE POWER PLANT. IF YOU DO NOT USE THIS PROCEDURE, YOU CAN CAUSE DAMAGE TO EQUIPMENT OR INJURIES TO PERSONS.

1) Use the Power Plant Operation (Normal) procedure to start the engine (AMM 71-00-00/201).

2) Operate the engine at minimum power for five minutes.
3) Do a slow acceleration to 1.3 EPR power, then stay at 1.3 EPR for three minutes.
4) Decrease the power to IDLE, then stay at IDLE for six minutes.

NOTE: You now have a thermally stable engine.

(b) To do the vibration survey, stop at these N1 speeds and take trim balance data during the slow accel (90-120 seconds) to 90% N1 (3250 RPM).

82% N1 (2950 RPM) speed
90% N1 (3250 RPM) speed

NOTE: Refer to PBS-4100 operation manual for instructions on computer operations.

NOTE: PBS-4100 software V2.21 and higher will let you take the trim balance data during the vibration survey. If the software is PRE V2.21, the vibration survey and the trim balance must be done separately.

(c) After the accel vibration survey, do a decel vibration survey during a slow decel (90-120 seconds) to IDLE.

NOTE: Trim balance data is only taken during the accel vibration survey.

(d) Operate the engine at IDLE for five minutes to let the engine become cool.
(e) Use the Power Plant Operation (Normal) procedure to do the engine shutdown (AMM 71-00-00/201).

S 285-171-N00
(2) Procedures necessary after the first vibration/trim balance survey.
(a) Remove the compressor inlet cone front segment (AMM 72-31-01/401).

(b) Index the fan by aligning the marked fan blade with the mark on the fan rubstrip at the 12:00 o'clock position.

NOTE: After the fan is indexed, the tang at the 12:00 o'clock position is the No. 1 tang. The tangs are numbered 1 through 19 in the clockwise direction.

(c) Examine the hub flange for installed counterweights. Check each counterweight for the letters "TB" marked on the inner diameter face. Record the part number and tang location of all counterweights marked "TB". Remove all the counterweights marked "TB".

(d) If weights marked "TB" were removed, input their weight (PBS class number) and location (tang number) into the PBS-4100 computer. The PBS class number must be input as a negative (-) number.

(e) If "TB" weights were removed go to the next step. If counterweights marked "TB" are not present, install counterweights No. 1 (CW1) trial weights to the fan balance ring as directed by the PBS-4100 computer.

NOTE: Use "Stored Influence Coefficient Balancing" option to determine CW1 weight location.

Fan counterweights can be temporarily installed by using a cotter pin (MS 9245-45).

(f) Install the compressor inlet cone (AMM 72-31-01/401).

(g) Perform the vibration/trim balance survey (See step 1).

S 085-173-N00

(3) If the vibration levels are satisfactory, remove the trim balance equipment.

S 755-174-N00

(4) If the vibration levels are not satisfactory, do the steps that follow:

(a) Using the "PREDICT" feature of the PBS-4100 determine if the PBS-4100 fan plane balance solution will reduce the vibration to satisfactory levels.

(b) If changing the amount and location of the fan plane counterweights will reduce the vibration to satisfactory levels, then use a cotter pin (MS9245-45) and install the counterweight(s) to the fan balance hub as directed by the PBS-4100 computer (Table 502A)

1) Repeat the vibration/trim balance survey.
2) If the vibration levels are reduced to satisfactory levels permanently install the fan counterweights.

NOTE: Using a cotter pin to secure a counterweight is a temporary installation.

TABLE 502A
TRIM BALANCE COUNTERWEIGHTS FOR THE FAN PLANE

CLS	CNTRWGHT PN 534493	CNTRWGHT PN 534495	CNTRWGHT PN 1B4294
1	2.0 oz–in (1440 g.mm)	4.9 oz-in (3528 g.mm)	12.8 oz-in (9216 g.mm)
2	2.4 oz–in (1728 g.mm)	5.3 oz-in (3816 g.mm)	
3	2.8 oz–in (2016 g.mm)	5.7 oz-in (4104 g.mm)	
4		6.1 oz-in (4392 g.mm)	
5		6.5 oz-in (4680 g.mm)	

3) If the vibration levels are not satisfactory, use the "PREDICT" feature of the PBS 4100 to find out if the "A" flange vibration values can be reduced to satisfactory levels by adding less than 50 oz-in. (36000 g.mm). If the answer is yes, install the PBS 4100 equipment and do the PBS-4100 Dual Pick-Up Trim Balance Procedure. This procedure will add counterweights to the fan plane and the LPT 6th stage blades and do the vibration/trim balance survey again. If the answer is no, replace the engine.

S 825-170-N00

(5) Remove the trial balance weights and install the permanent counterweight(s).

(a) Install the permanent fan weights as follows:

1) Remove the front segment of the inlet cone. (AMM 72-31-01/401)

2) Record the location and the moment weight of all the trial balance weights.

3) Vibro peen the letters "TB" on the inner diameter face of all the trim balance counterweight(s).

4) Install each permanent fan counterweight with a rivet. (See Table 502A)

a) Use the riveter to make a 0.125 inch (3.175 mm) diameter head on the rivet.

5) Align the pencil mark on the inlet cone front segment with the pencil mark on the inlet cone (rear) segment.

6) Install the front segment of the inlet cone (AMM 72-31-01/401).

(b) Operate the engine with the counterweights installed to make sure that the engine vibration is within limits.

(c) Remove the test equipment including the MTI interface cable, jumper cable and engine selector switch box.

TASK 72-31-00-725-138-N00

3. <u>Engine Trim Balance with the Universal Airborne Vibration Monitor (AVM) (P/N S362A001)</u>

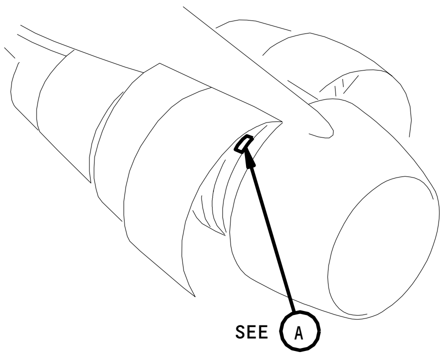
A. General

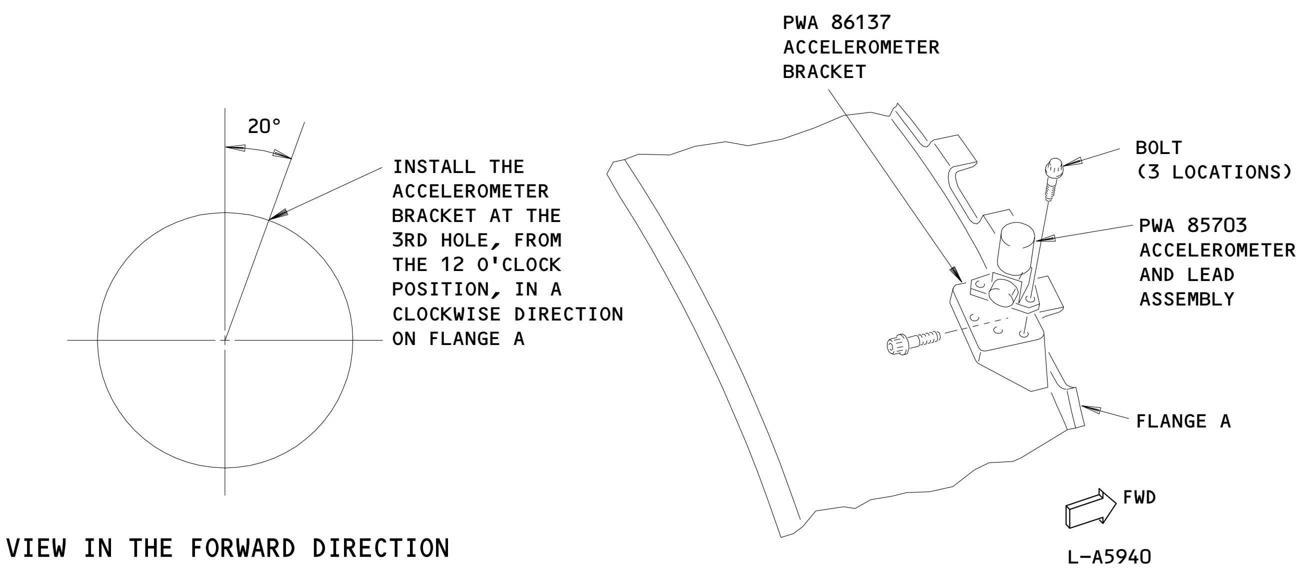
(1) These procedures are included in this section:

(a) Trim balance of the engine using the Vibro-Meter Universal Airborne Vibration Monitor (AVM) S362A001-10.

1) Using vibration data recorded during flight, on ground runs and Vibrations Surveys this system calculates the best balance solution for the fan, 1 plane solution.

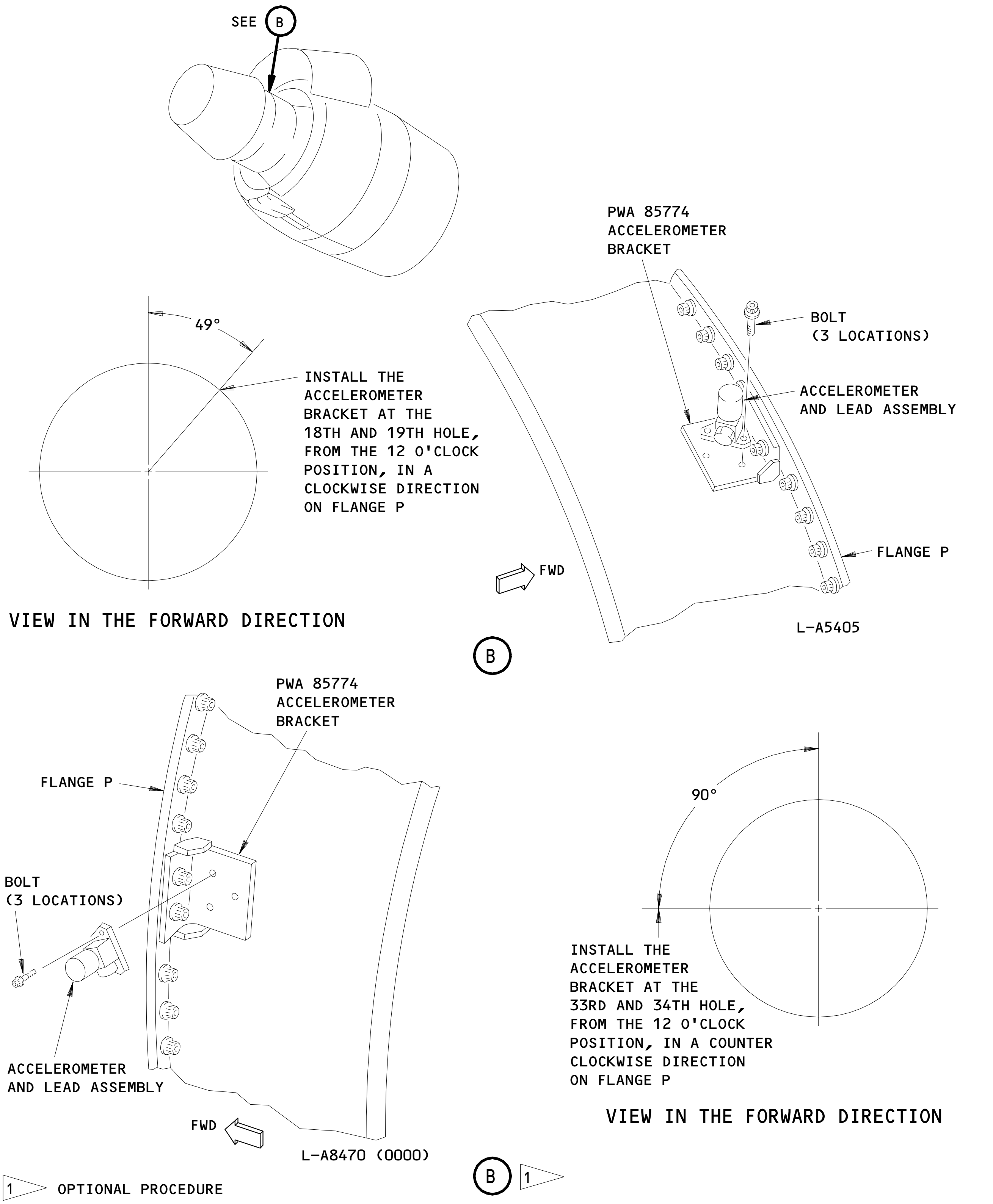
2) The results are given as a direction in degrees from the index mark and a balance weight in in-oz.



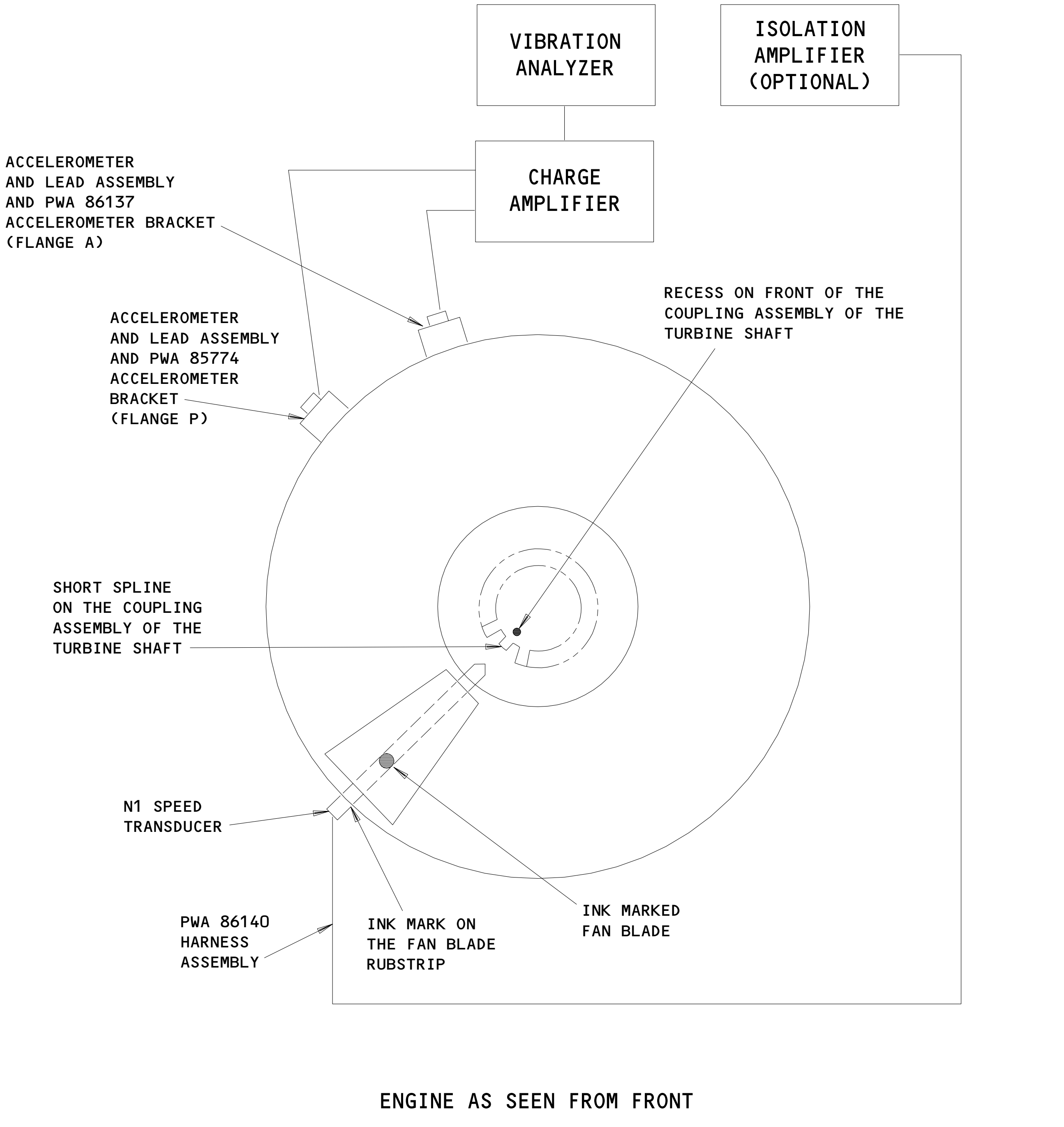


A

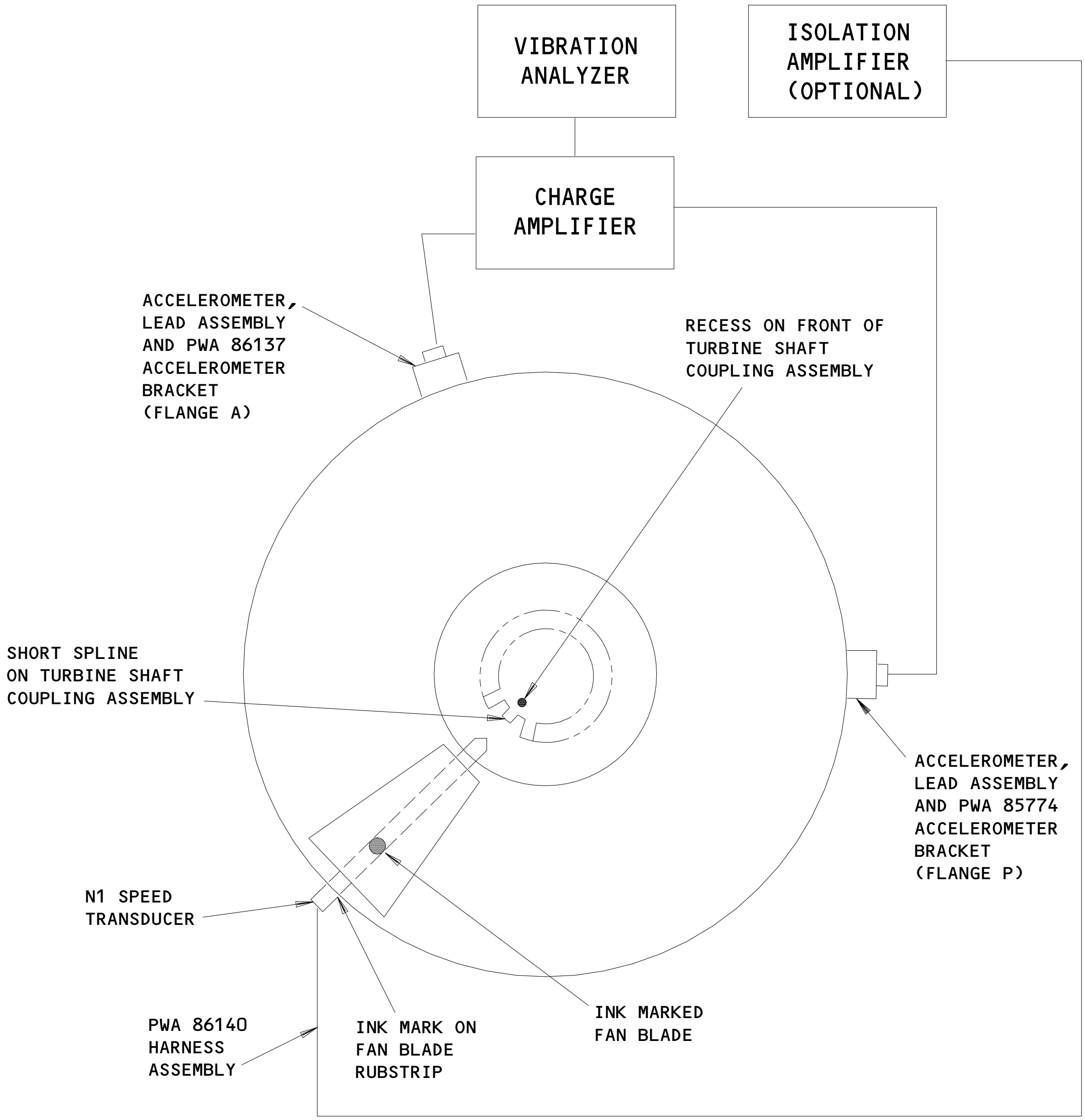
Accelerometer Installation on Flanges A and P
Figure 501 (Sheet 1)



Accelerometer Installation on Flanges A and P
Figure 501 (Sheet 2)



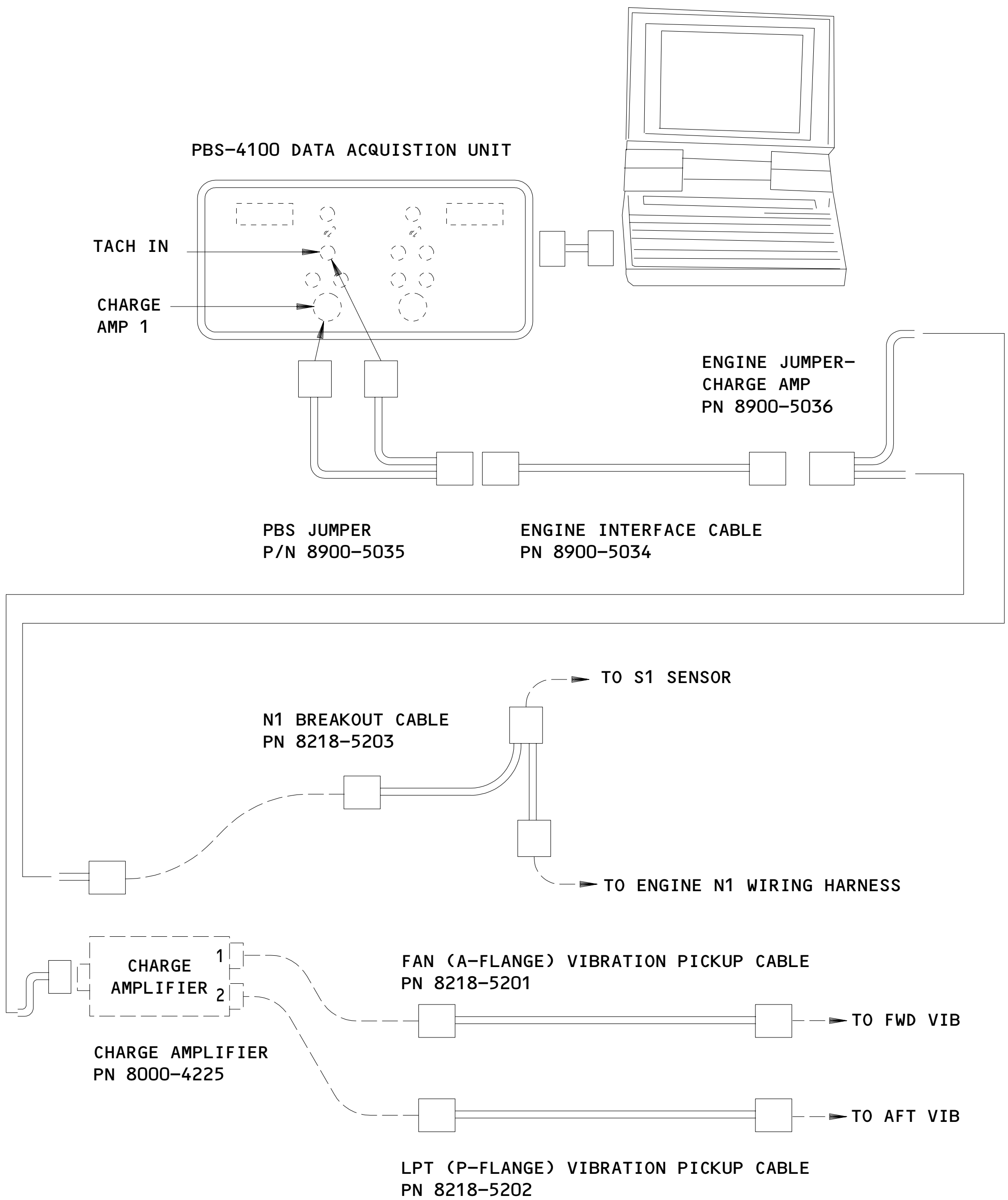
Trim Balance Equipment Installation Schematic
Figure 502 (Sheet 1)



ENGINE AS SEEN FROM FRONT
(OPTIONAL PROCEDURE)

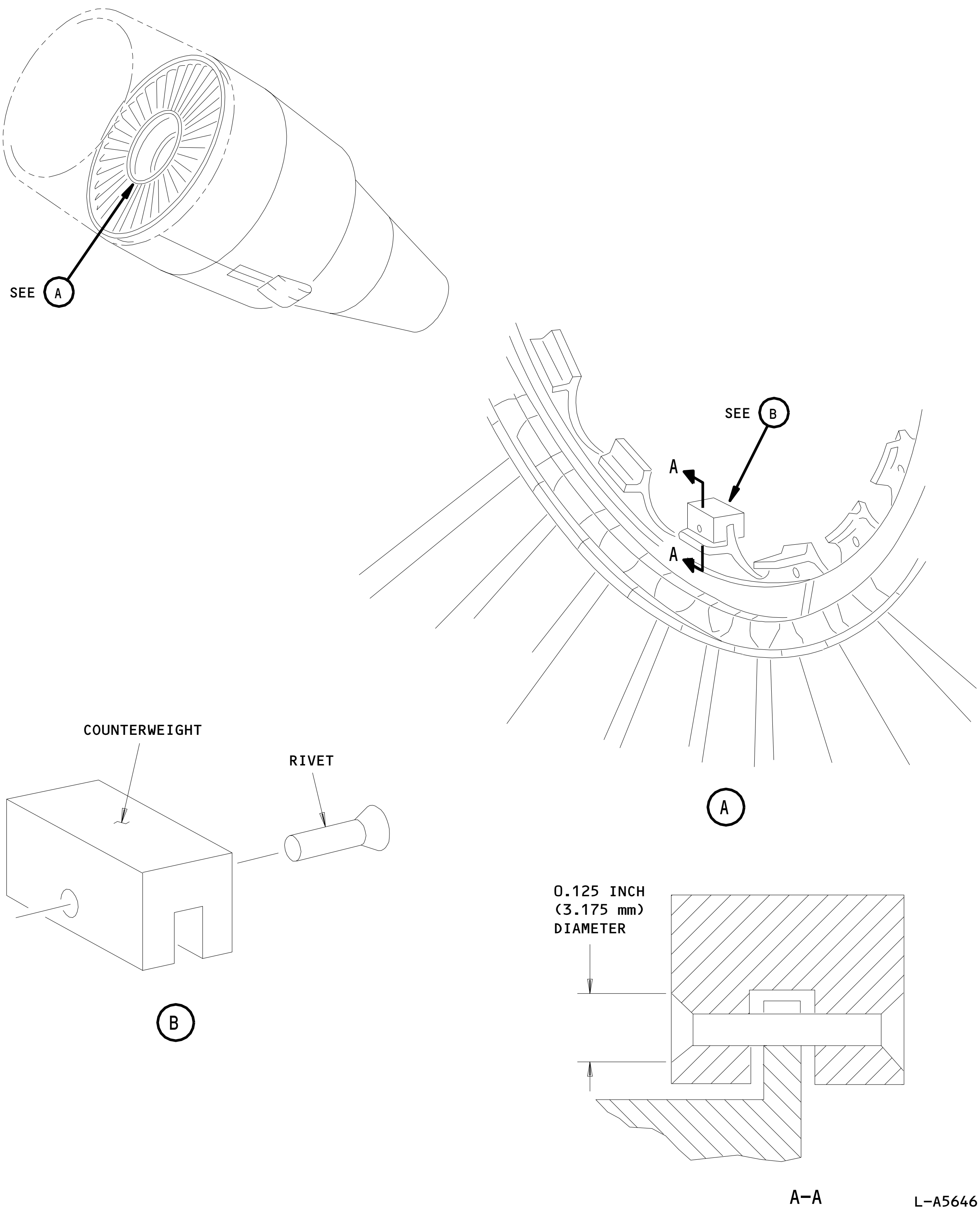
L-A4871

Trim Balance Equipment Installation Schematic
Figure 502 (Sheet 2)

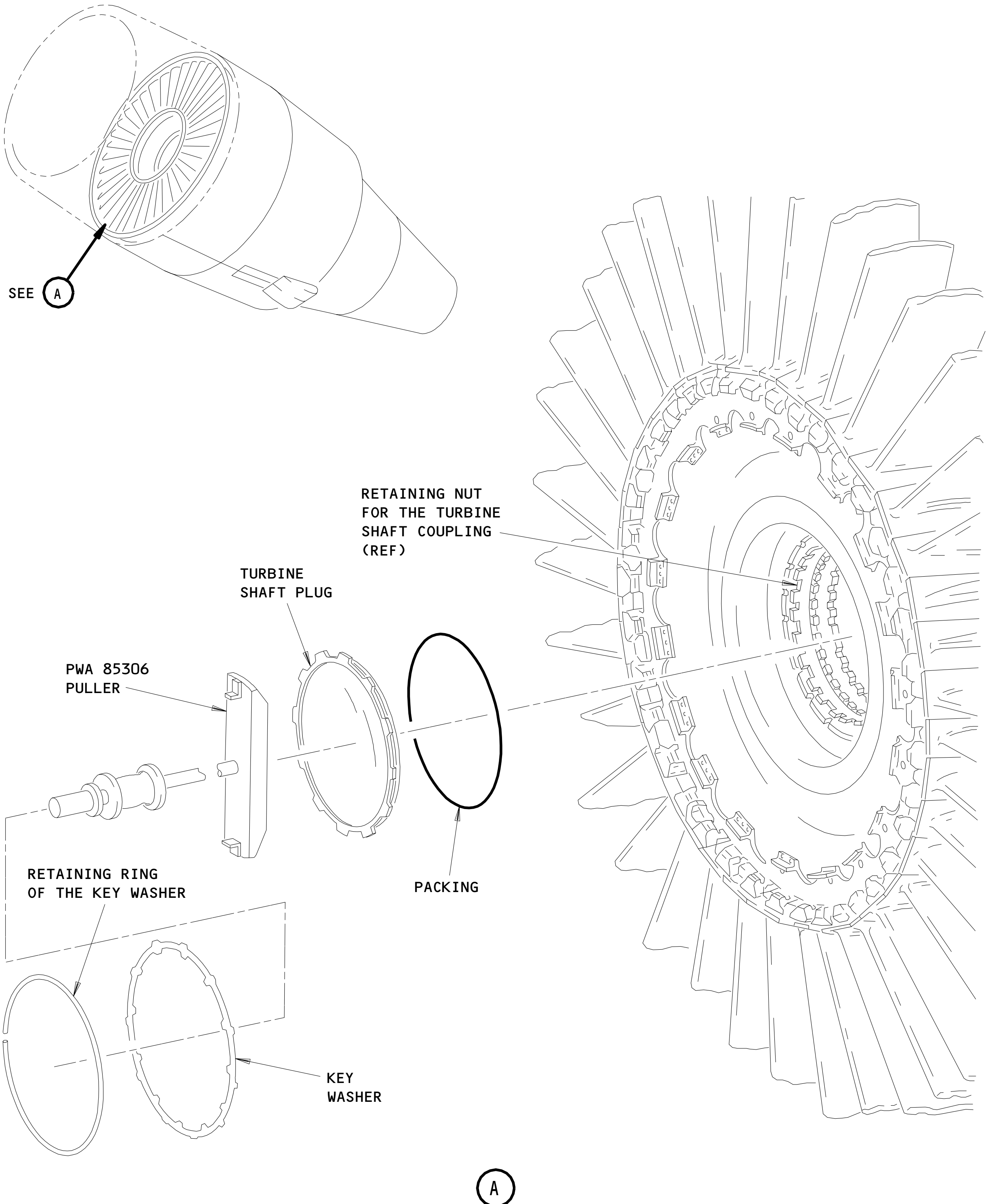


L-A9015 (0000)

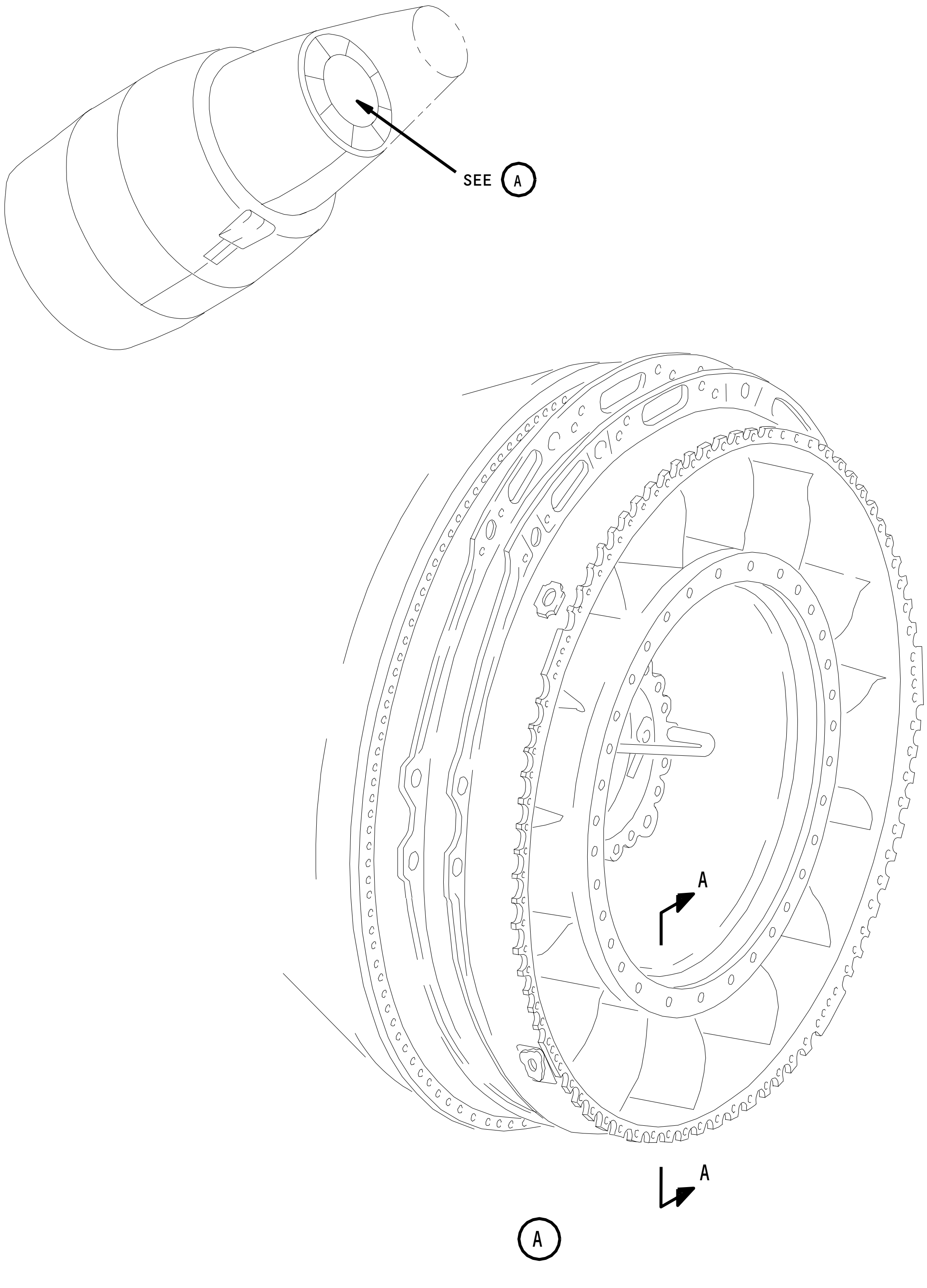
Trim Balance Equipment Installation Schematic
Figure 502 (Sheet 3)



Counter Weight Installation on Fan Plane
Figure 503



Turbine Shaft Plug Installation
Figure 504



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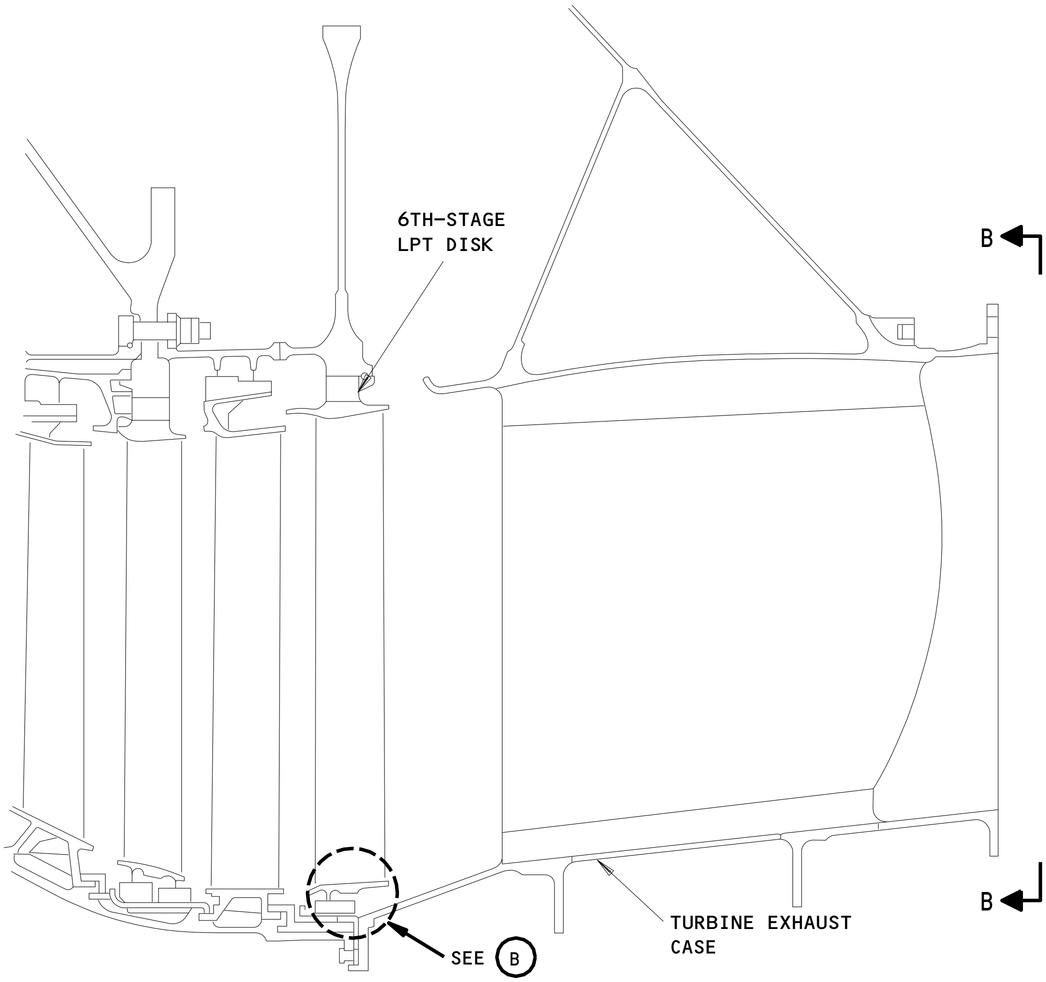
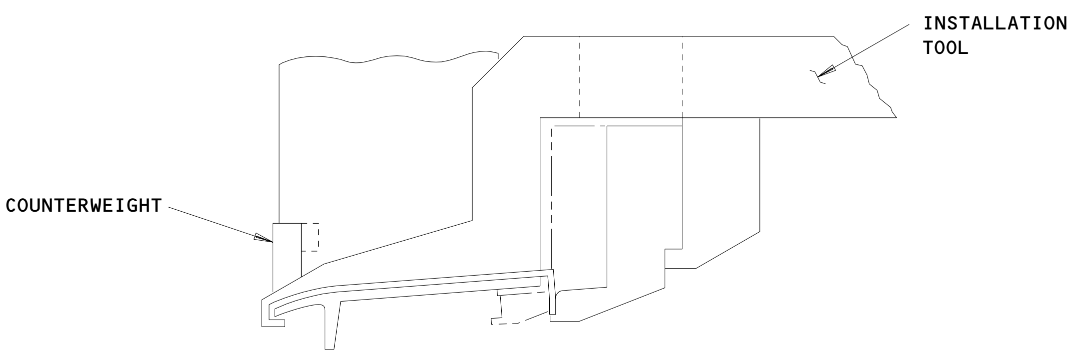
Counterweight Installation on the LPT Plane
Figure 505 (Sheet 1)



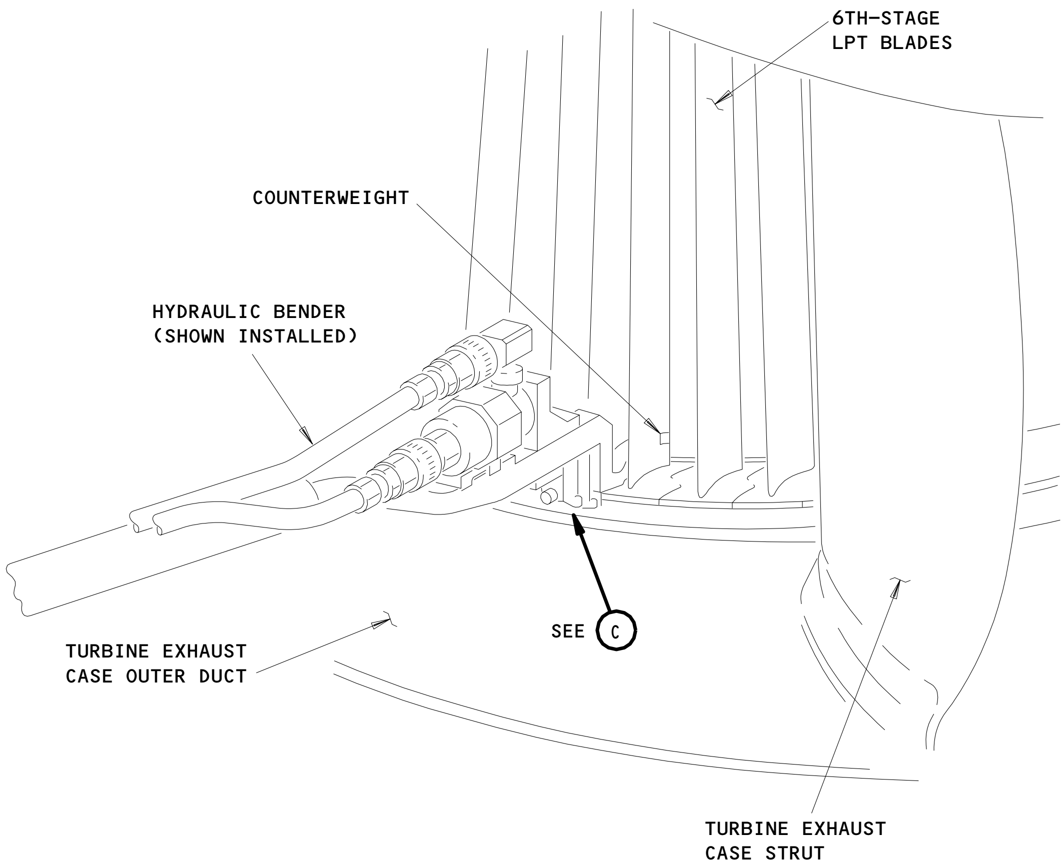
A-A



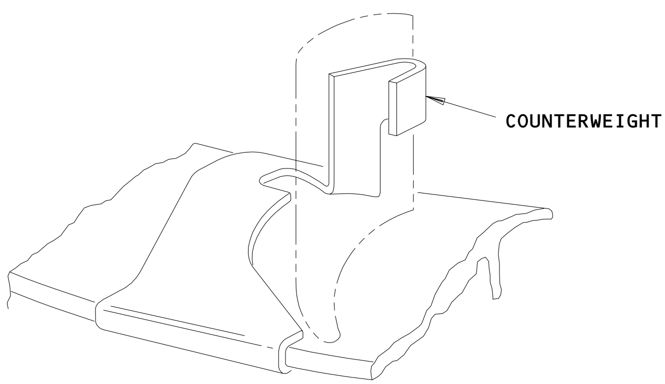
B

L-A6315

Counterweight Installation on the LPT Plane
Figure 505 (Sheet 2)



B-B

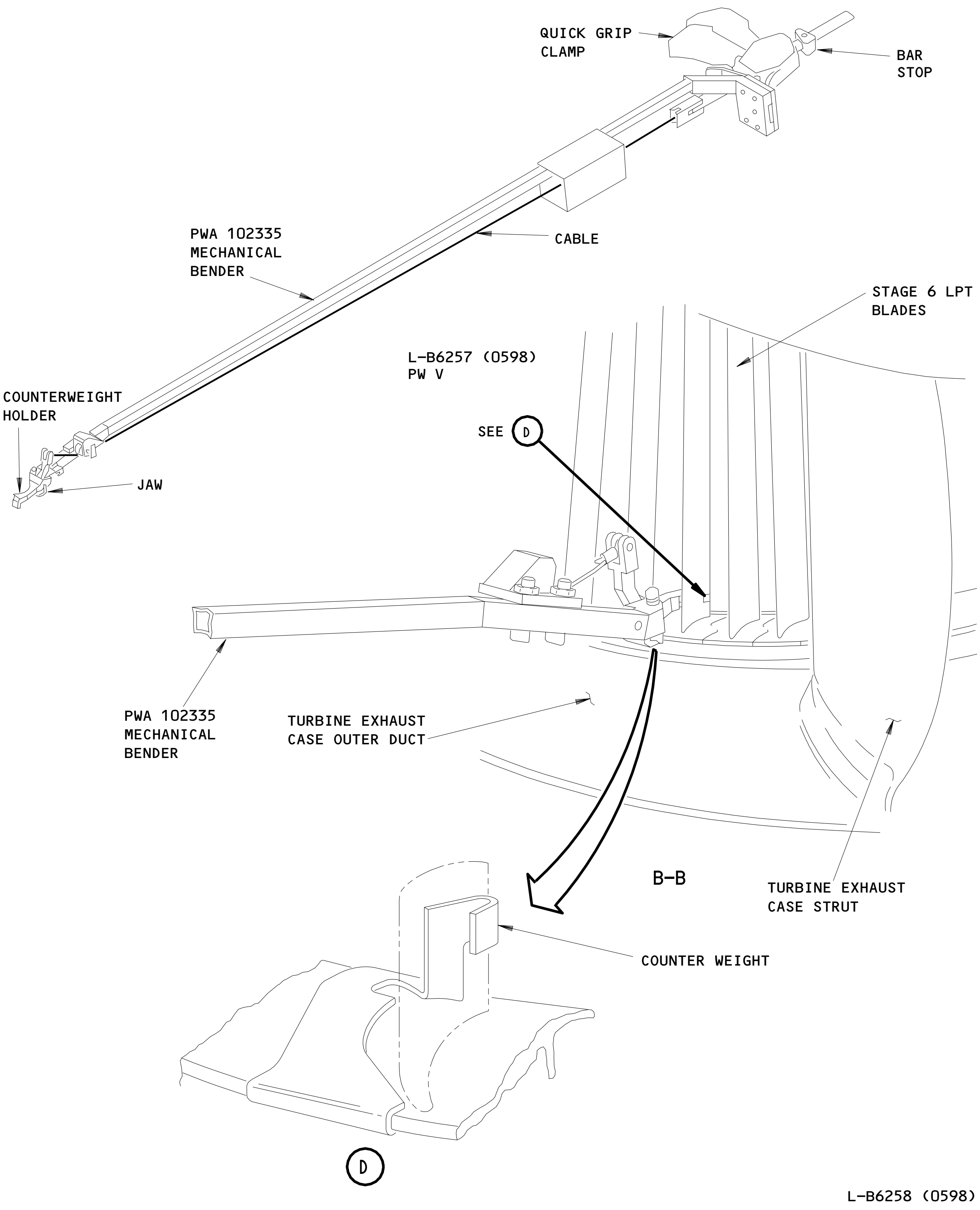


(OPTIONAL)
C

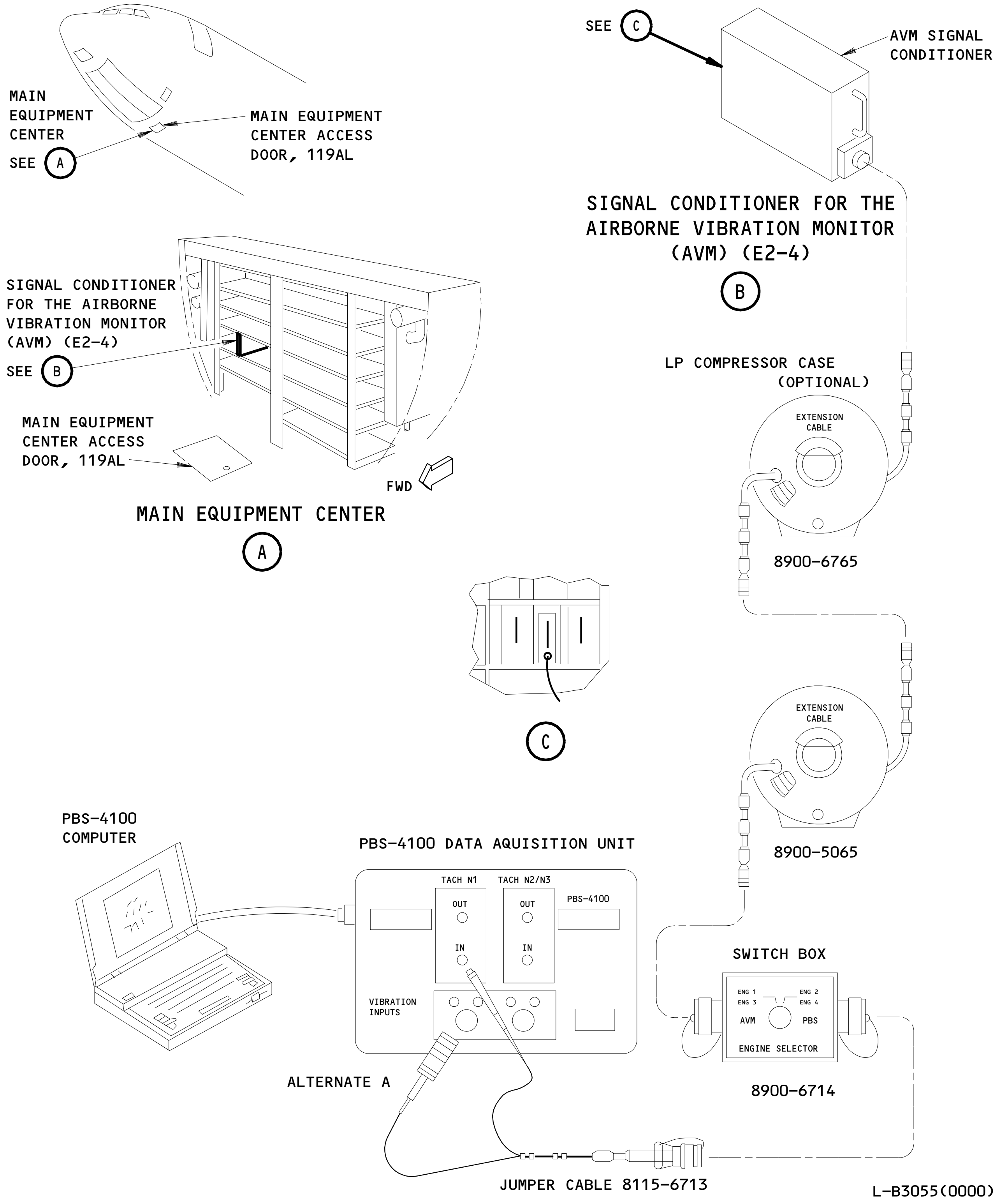
L-A6316

Counterweight Installation on the LPT Plane
Figure 505 (Sheet 3)

K11831



Counterweight Installation on the 6th Stage LPT Plane
Figure 505 (Sheet 4)



Trim Balance Equipment Installation
Figure 506

(b) Vibration Survey of the fan using the Univerasl AVM.

(2) The trim balance procedures should decrease the vibration levels of the fan and LPT.

(3) This trim balance procedure uses the imbalance data from one of the last 6 flights or ground runs.

(4) From the front panel display of the AVM you can get this data:

(a) The current imbalance data.

(b) The balance weights configuration currently installed on the engine fan.

(c) The results of a calculation of a 1-plane balance (fan).

1) The results are given as a direction in degrees from the index mark and a balance weight in in-oz.

B. References

(1) AMM 71-00-00/201, Power Plant - General

(2) AMM 72-31-01/401, Inlet Cone

C. Equipment

(1) Mat - Protective, 3/8 Inch Minimum Thickness, Minimum 42 Inches by 60 Inches With Warning Streamers (commercially available)

(2) Riveter - PWA 81550

(3) Balance Weights - P&W P/N 534495CL1
P&W P/N 534495CL2
P&W P/N 534495CL3
P&W P/N 534495CL4
P&W P/N 534495CL5
P&W P/N 1B4294

D. Consumable Material

(1) G02061 Marker-Felt tip

E. Access

(1) Location Zones
411 Left Engine
421 Right Engine

(2) Access Panel
119 Main Equipment center
120 Main Equipment center

F. Prepare for the Trim Balance Procedure

S 865-139-N00

(1) Make sure that this circuit breaker is closed:
   (a) Circuit Breaker Panel, P11:
      1) 11K1, ENGINE VIB MONITOR

G. Trim Balance Procedure

S 845-140-N00

(1) Remove the inlet cone segment of the front compressor (fan nose cone) (AMM 72-31-01/401).

S 985-141-N00

(2) Find the short tooth of the tachometer gear on the turbine shaft coupling at the front end of the low pressure compressor. This represents the radial marking for zero degrees.
The location on the balance flange radially out from the short tooth is location 1.

NOTE: If the radial from the short tooth points to a space between two locations, location 1 is the first location clockwise from the radial.
The locations are counted clockwise when facing aft and looking at the engine.

   (a) Record the part number and location of any balance weights that you find.

   NOTE: If the engine has any balance weights with P/N 534493CL1 534493CL2 or 534493CL3 installed, it is recommended that you to remove these weights and run a Vibration Survey (AMM 71-00-00/501).

   NOTE: If there are 2 weights installed on the same location, it is recommeded that you move one of them to an adjecent location.

S 745-142-N00

(3) Do these steps to get to the fan (1-plane) balance menu on the AVM front panel:

(a) Push and release one of the four buttons to show SELF TEST? on the front panel display.

NOTE: The front panel display will turn off if the buttons are not pushed for five minutes or if an engine starts running.

(b) Push and release the NO button three times until the BALANCE? option shows.

(c) Push and release the YES button to go to the balance menu. This causes the BALANCE ENGINE 1? screen to show.

(d) To get the balance data for engine 1, push and release the YES button. This causes the IMBAL DATA READ? screen to show.

NOTE: It is recommended to look at the imbalance data before doing the Balance 1 Plane Compute.

1) To get the balance data for engine 2, do these steps:

a) From the BALANCE ENGINE 1? screen push and release the NO button. This causes the BAL ENGINE 2? screen to show.

b) Push and release the YES button. This causes the IMBAL DATA READ? screen to show.

NOTE: The Enigne 2 balance procedure is the same as Engine 1 except the Ex code on all of the screens will read E2 instead of E1.

S 745-143-N00

(4) Do these steps at the IMBAL DATA READ? menu to read the balance data:

NOTE: It is recommended to look at the imbalance data for other flights or trim balance runs.

NOTE: The AVM gathers data from six N1% speed ranges for each engine and stores this data from the previous six flights or engine ground runs. A balance calculation can be performed on the data from any of these six flights or engine ground runs. This calculation can be performed as long as the flight or ground run has imbalance data recorded in one or more of the N1% speed ranges. Better balances are obtained when the flight or ground run has captured data in several N1% speed ranges, and when the data has been obtained in flight rather than a ground run.

(a) Push and release the YES button. This causes the X FLIGHTS DISPLAY? screen to show. If you don't want to look at the imbalance, data push and release the NO button, the BALANCE 1 PLANE COMPUTE? screen will show.

NOTE: The X refers to the total number of flights in memory, and can be 1 through 6.

NOTE: If NO IMBAL DATA shows, there is no stored balance data in the AVM. The fan trim balance cannot be performed until after a flight or ground trim run is performed. (AMM 71-00-00/501 Vibration Survey)

(b) Push and release the YES button to show the highest imbalance data for the selected flight that was recorded (TABLE 503).

NOTE: The definitions of the screen are given below.

NOTE: There are six separate imbalance data screens for each flight.

NOTE: Use the UP and DOWN ARROW buttons to get each of the five other imbalance data screens that were recorded during each flight.

NOTE: If no data was recorded for a particular screen then the screen will appear as:

E1 --.-%
-.--/---
-:--/---

Use the UP and DOWN ARROW buttons to view the next imbalance data screen.

NOTE: Each data screen contains vibration information at a different engine N1 speed. Typically, the six screens show vibration information for 100-88.1% N1, 88.0-85.0% N1, 84.9-81.1% N1, 81.0-75.0% N1, 74.9-70.0% N1, and 69.0-60.0% N1.

AVM FRONT PANEL DISPLAY TABLE 503
E 1 x x . x %
n . n n / y y y
m . m m / z z z

1) xxx - N1 rotor speed in percent
2) nnn - the fan displacement in mils DA
3) mmm - the LPT displacement in mils DA

NOTE: DA is double amplitude

4) yyy - the phase angle for the fan in degrees
5) zzz - the phase angle for the LPT in degrees

(c) From the FLIGHT X ? screen, push and release the NO button. This causes the BALANCE 1 PLANE COMPUTE? screen to show.

S 745-144-N00

(5) From the IMBAL DATA READ? or FLIGHT x? screen, push and release the NO button. This causes the BALANCE 1 PLANE COMPUTE? screen to show.

S 745-147-N00

(6) Do these steps at the BALANCE 1 PLANE COMPUTE? menu to calculate a 1-plane (fan only) balance solution:

(a) To do a 1-plane (fan) balance solution Push and release the YES button, then Push and release the NO button. The display will read xxxxxxxx SPECIFIC COEFFS.?

NOTE: xxxxxxxxx is the Specific Coeff. Set Identification.

(b) Push and release the Yes button. The display will temporarily read COMPUTE IN PROGRESS.

(c) After the computation is completed the Display Panel will read: NO BALANCE DATA or X FLIGHTS DISPLAY?. Where x is the number of flights or ground runs from 1 to 6.

1) If the display reads NO BALANCE DATA, push and release the NO button 2 times to go to the Engine 2 balance menu.

(d) Push and release the YES button. The display will read FLIGHT 0.

NOTE: FLIGHT 0 is the last flight or ground run. Use the UP and DOWN ARROW buttons to get to the data recorded for each of the other 5 flights or ground runs.

(e) Push and release the YES button to get the balance data for the flight or ground run you have selected (TABLE 506).

NOTE: This is a raw data solution. The data for all of the flights or ground runs should be looked at to determine which flight (Fx) should be used for the specific balance solution.

NOTE: The definitions of the screen are given below.

(f) To go back and select another flight or ground run from a solution screen, push and release the No button.

AVM FRONT PANEL DISPLAY TABLE 506		
n n n n /	y y y	
x / 6	Fx	?

1) nnnn - Fan balance weight solution (g-mm).
2) yyy - the Fan balance weight position in degrees.
3) x/6 - the number of speed ranges with valid data (0 to 6).
4) Fx - the flight number (0 to 5, where 0 is the last fight).

TRIM BALANCE WEIGHTS		
P/N 534495		P/N 1B4294
534495CL1	3.7 oz-in.	10.0 oz-in.
534495CL2	4.0 oz-in.	
534495CL3	4.3 oz-in.	
534495CL4	4.6 oz-in.	
534495CL5	4.9 oz-in.	

S 745-151-N00

(7) If you are not going to balance Engine 2, push and release the NO button 2 times. The TURN OFF DISPLAY? screen will show. Push and release the NO button to turn off the display or the display will automatically turn off after 5 minutes of no activity.

S 025-152-N00

(8) Do the following steps to apply the balance solution and install balance weights on the fan.

(a) Do the balance solution by removing, attaching and/or moving balance weights on the balance weight location flanges on the fan.

NOTE: The maximum correction at the fan shall not exceed a total vector sum of 20 oz-in. The maximum vector sum of all trim balance weights and all previously installed weights on the fan hub shall not exceed 30 oz-in.

1) Attach balance weights by flareing the rivet(s) to 0.125 inch (3.175 mm) in diameter.

2) If you can not do the balance solution without exceeding the correction limits, you must remove the attached weights and do a Vibration Survey (AMM 72-31-00/501).

S 025-162-N00

(9) Install the inlet cone segment of the front compressor (AMM 72-31-01/401).

H. Vibration Survey with the Universal Airborne Vibration Monitor (AVM) (P/N S362A001)

S 775-163-N00

(1) Do the steps that follow to do the Vibration Survey:

WARNING: USE AMM 71-00-00/201 TO OPERATE THE POWER PLANT. IF YOU DO NOT USE THIS PROCEDURE, YOU CAN CAUSE DAMAGE TO EQUIPMENT OR INJURIES TO PERSONS.

(a) Use the Power Plant Operation (Normal) procedure to start the engine (AMM 71-00-00/201).

(b) Operate the engine at minimum power for five minutes.

(c) Thermally stabilize the engine:

NOTE: You must have a thermally stable engine before you do the vibration survey.

1) Do a slow acceleration to 1.3 EPR power, then stay at 1.3 EPR for three minutes.
2) Decrease the power to IDLE, then stay at IDLE for six minutes.

NOTE: You now have a thermally stable engine.

(d) To do the vibration survey, stop at the N1 speeds that follow during the slow accel (90-120 seconds) to 90% N1 (3250 RPM).

63% N1 (2250 RPM) speed
68% N1 (2450 RPM) speed
82% N1 (2950 RPM) speed
90% N1 (3250 RPM) speed

(e) Do a slow decel (90-120 seconds) to IDLE.
(f) Operate the engine at IDLE for five minutes to let the engine become cool.
(g) Use the Power Plant Operation (Normal) procedure to do the engine shutdown (AMM 71-00-00/201).

INLET CONE - REMOVAL/INSTALLATION

1. General
   A. The inlet cone is located forward of the front compressor hub. Access is through the air inlet cowl.
   B. Equipment
      (1) Torque Wrench - Commercially Available
      (2) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).
      (3) Puller, Knocker - PWA 86122
   C. Consumable Materials
   D. Access
      (1) Location Zones

410	Left Power Plant Nacelle
420	Right Power Plant Nacelle

TASK 72-31-01-024-001-N00

2. Remove the Inlet Cone
   A. Remove the Inlet Cone (Fig. 401)

      S 864-002-N00

      (1) Attach the DO-NOT-OPERATE tag to the ENG START switch on the pilot's P5 overhead panel.

      S 494-003-N00

      CAUTION: IF A PROTECTIVE MAT IS NOT USED, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INNER COWL.

      (2) Position the protective mat on the inner surface of the inlet cowl.

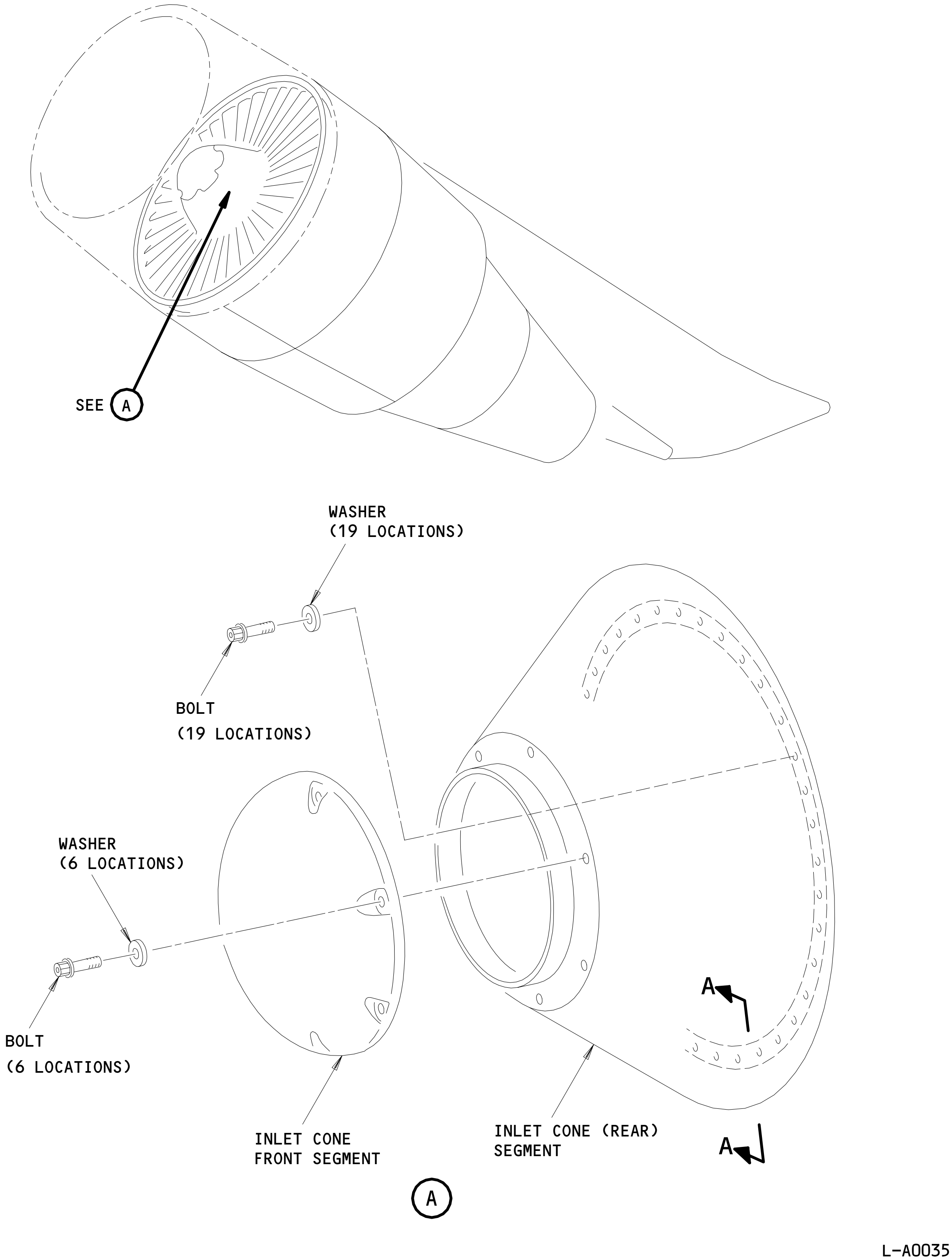
      S 934-005-N00

      WARNING: DO NOT LET THE INLET CONE FALL FROM THE ENGINE AS INJURY TO PERSONS AND/OR DAMAGE TO INLET CONE MAY RESULT.

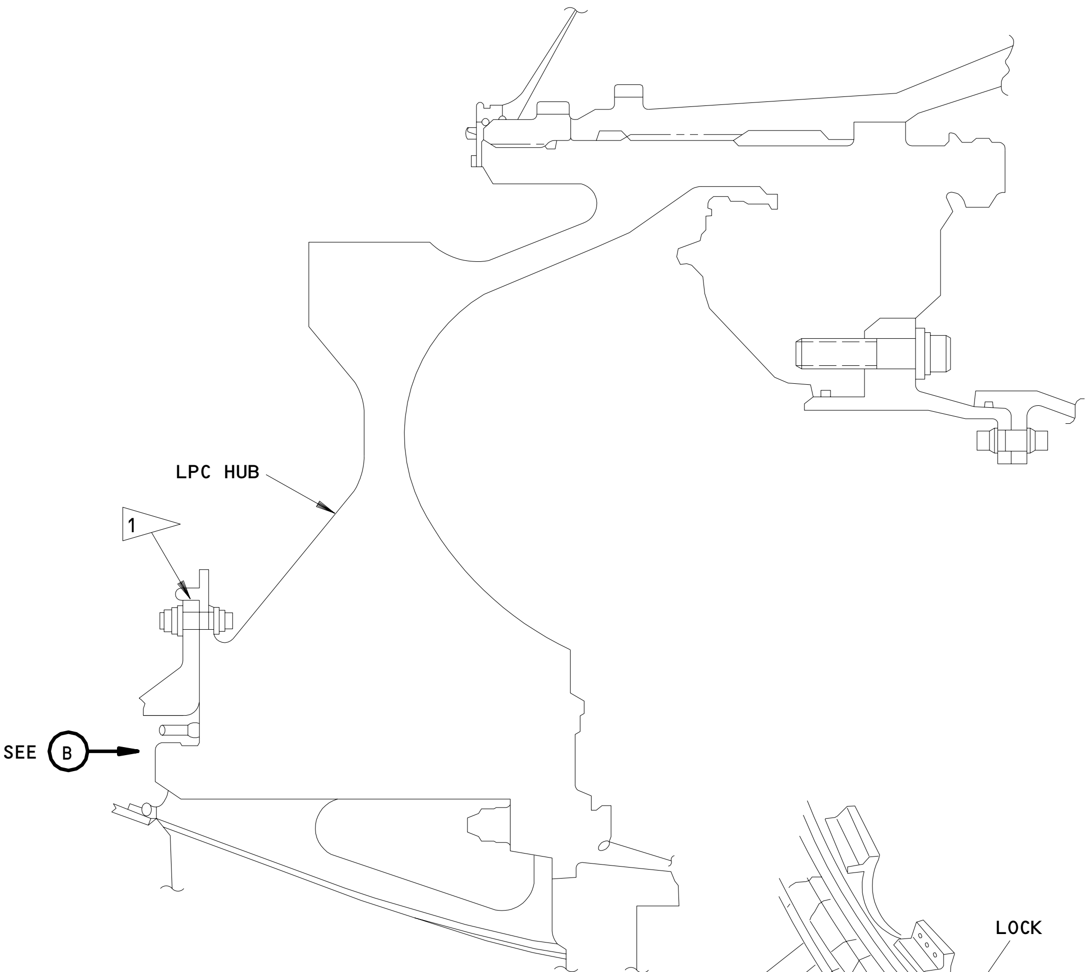
      (3) Use a marking pen to mark the front segment of the inlet cone, the (rear) segment of the inlet cone, and the front compressor hub to make sure the parts are aligned correctly during installation.

      S 024-006-N00

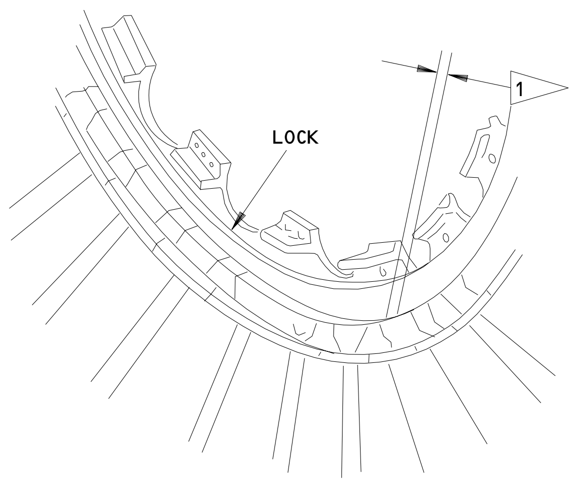
      (4) Remove the bolts and washers which secure the front section of the inlet cowl to the rear segment of the inlet cowl and remove the front segment.



Inlet Cone Installation
Figure 401 (Sheet 1)



A-A

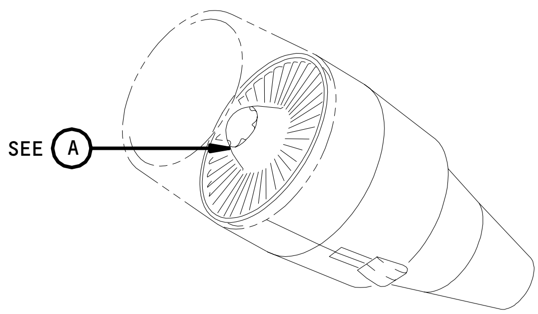


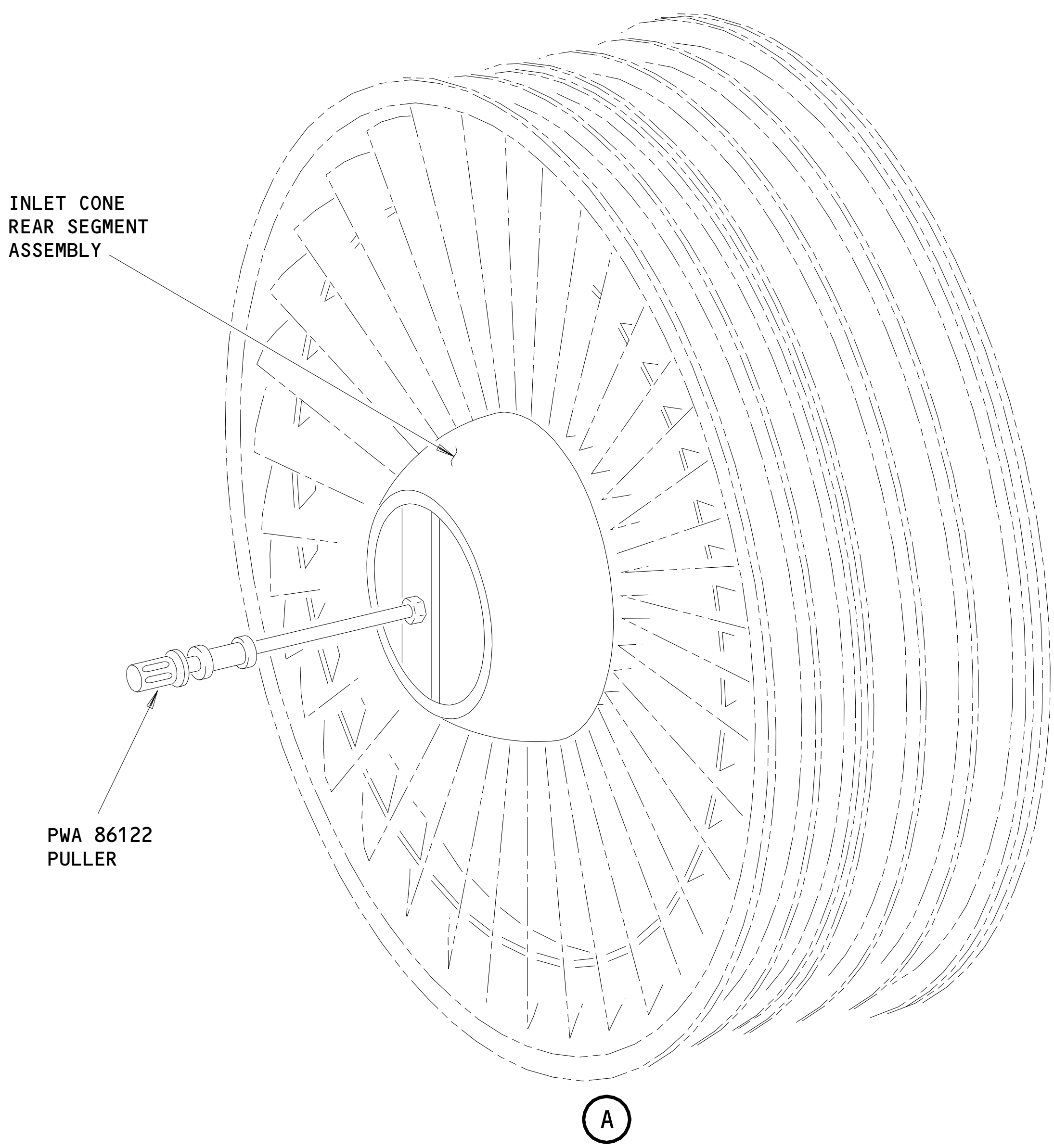
COMPRESSOR INLET CONE
(REAR) SEGMENT REMOVED
B

1 CHECK DIMENSION BEFORE ASSEMBLY
(SEE TABLE 401)

L-A3302 (0697)

Inlet Cone Installation
Figure 401 (Sheet 2)





L-A6157

Inlet Cone Puller Installation
Figure 402

S 024-007-N00

(5) Remove the bolts and washers which secure the rear segment of the inlet cone to the front compressor hub.

S 494-017-N00

CAUTION: DAMAGE TO THE NUT PLATES AND/OR INLET CONE CAN OCCUR IS THE PWA 86122 PULLER IS NOT INSTALLED BETWEEN THE INLET-CONE NUT PLATES.

(6) Install the puller to the inner side of the inlet cone (Fig. 402).

S 024-009-N00

(7) Remove the rear segment of the inlet cone and put on a pallet or workbench.

TASK 72-31-01-424-010-N00

3. Install the Inlet Cone (Fig. 401)

A. Equipment
   (1) Torque Wrench - Commercially Available
   (2) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).
   (3) Puller, Knocker - PWA 86122

B. Consumable Materials
   (1) ENGINES PRE-SB-PW4ENG 72-792;
       Oil - PWA 521
   (2) ENGINES POST-SB-PW4ENG 72-792;
       Oil, Engine - PWA 521B
   (3) ENGINES PRE-SB-PW4ENG 72-792;
       Pen, Marking - Cado Marker
   (4) ENGINES POST-SB-PW4ENG 72-792;
       Pen, Marking

C. Access
   (1) Location Zones
       410 Left Power Plant Nacelle
       420 Right Power Plant Nacelle

D. ENGINES PRE-SB-PW4ENG 72-792;
Install the Inlet Cone (Rear) Segment to the Front Compressor Hub.

S 644-049-N00

WARNING: DO NOT LET THE INLET CONE FALL FROM THE ENGINE BECAUSE IT CAN CAUSE INJURY.

CAUTION: DO NOT LET THE INLET CONE FALL FROM THE ENGINE BECAUSE IT CAN CAUSE DAMAGE TO THE CONE.

(1) Apply Engine Oil (P03-001) to the threads of the 19 bolts you will use to install the inlet cone (rear) segment.

S 424-032-N00

(2) Align the pen mark on the inlet cone (rear) segment with the pen mark on the front compressor hub.

NOTE: It is not necessary to align marks during an installation of a new inlet cone or one that has been repaired and balanced. New or repaired inlet cones are balanced to less than 1.0 ounce inch (720 gram millimeters) and it is not necessary to be aligned at installation.

S 984-012-N00

(3) Install the cone segment to the hub with 19 washers and lubricated bolts.

(a) Make sure that the seal is installed below the leading edge (fan blade platform) before you tighten the bolts.

NOTE: A non-metal blunt object (plastic scraper or equivalent) is used to install the seal.

S 424-021-N00

(4) Tighten the bolts to 85-95 pound inches (9.604-10.734 newton meters).

E. ENGINES POST-SB-PW4ENG 72-792;
Install the Inlet Cone (Rear) Segment to the Front Compressor Hub.

S 644-050-N00

WARNING: DO NOT LET THE INLET CONE FALL FROM THE ENGINE BECAUSE IT CAN CAUSE INJURY.

CAUTION: DO NOT LET THE INLET CONE FALL FROM THE ENGINE BECAUSE IT CAN CAUSE DAMAGE TO THE CONE.

(1) Apply engine oil (P03-001) to threads of the 19 bolts you will use to install the inlet cone (rear) segment.

S 424-047-N00

(2) Align the pen mark on the inlet cone (rear) segment with the pen mark on the front compressor hub.

NOTE: It is not necessary to align marks during an installation of a new inlet cone or one that has been repaired and balanced. New or repaired inlet cones are balanced to less than 1.0 ounce inch (720 gram millimeter) and it is not necessary to be aligned at installation.

S 424-034-N00

(3) Put the inlet cone (rear) segment on the front compressor hub.

S 424-045-N00

(4) Loosely install four washers and lubricated bolts.

S 424-044-N00

(5) Install the bolts with an equal distance between them (if possible).

S 424-035-N00

WARNING: DO NOT USE YOUR FINGERS TO PUSH THE SEAL BULBS. YOU CAN CAUSE INJURY TO YOUR FINGERS.

(6) Push the inlet cone front opening.
(a) Tighten the four bolts with your fingers.

S 424-036-N00

CAUTION: MAKE SURE THAT THE PLATFORM SEALS (FAN BLADE) AND THE CONE SEAL DO NOT TOUCH. PUT THE CONE SEAL (RADIAL ATTITUDE) INBOARD TO THE PLATFORM SEALS FOR THE CORRECT INSTALLATION OF THE CONE. SOME OF THE PLATFORM SEALS CAN LOOSEN AND TOUCH THE CONE SEAL. IF YOU DO NOT FOLLOW THIS PROCEDURE DAMAGE TO EQUIPMENT CAN OCCUR.

(7) Push the seal bulb at each location inboard (radial attitude) to the platform seals (fan blade) with the tool that follows.
    (a) A thin flat blade tool made of plastic or wood (made local) that measures approximately 1.250 inches (31.750 mm) wide.

S 424-037-N00
(8) Tighten the four bolts with your fingers again.

S 424-038-N00
(9) Install the remaining bolts and washers.

S 424-039-N00
(10) Tighten the bolts to 85-95 pound inches (9.604-10.734 newton meters).

F. Install the Inlet Cone Front Segment.

S 644-040-N00
(1) Apply Engine Oil (P03-001) to the threads of the six bolts used to install the inlet cone (front) segment.

S 424-041-N00
(2) Do the step that follows if there are alignment marks.
    (a) Align the pen mark on the inlet cone (front) segment with the pen mark on the inlet cone (rear) segment.

S 424-042-N00
(3) Install the cone front segment with six washers and lubricated bolts.

S 424-043-N00
(4) Tighten the bolts to 45-50 pound inches (5.084-5.649 newton meters).

S 094-015-N00
(5) Remove the protective mat from the inner surface of the inlet cowl.

S 864-016-N00
(6) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's P5 overhead panel.

INLET CONE - INSPECTION/CHECK

1. General
   A. This procedure inspects the inner and outer surfaces of the inlet cone. Items to be checked are chipping cracks or delaminations and their severity. Continue-In-Service limits are also included.

      NOTE: Chipping is an area with erosion where small particles of surface material are gone. Chipping is pitting that was not caused by corrosion.

TASK 72-31-01-206-008-N00

2. Inlet Cone-Inspection/Check
   A. Equipment
      (1) Protective mat - Rubber Manufactures Association, Grade SC43 Neoprene Sponge 1 in. thick, approximately 5x6 ft with warning streamer attached (3 required)
   B. Consumable Materials
      (1) G01077, Emery paper (Aluminum oxide) 200-325 Grit - PWA P05-055
   C. References
      (1) AMM 72-31-01/401, Inlet Cone
      (2) AMM 72-31-01/801, Inlet Cone
   D. Access
      (1) Location Zones
          410 Left Power Plant Nacelle
          420 Right Power Plant Nacelle

   E. Inspect The Inlet Cone (Fig. 601)

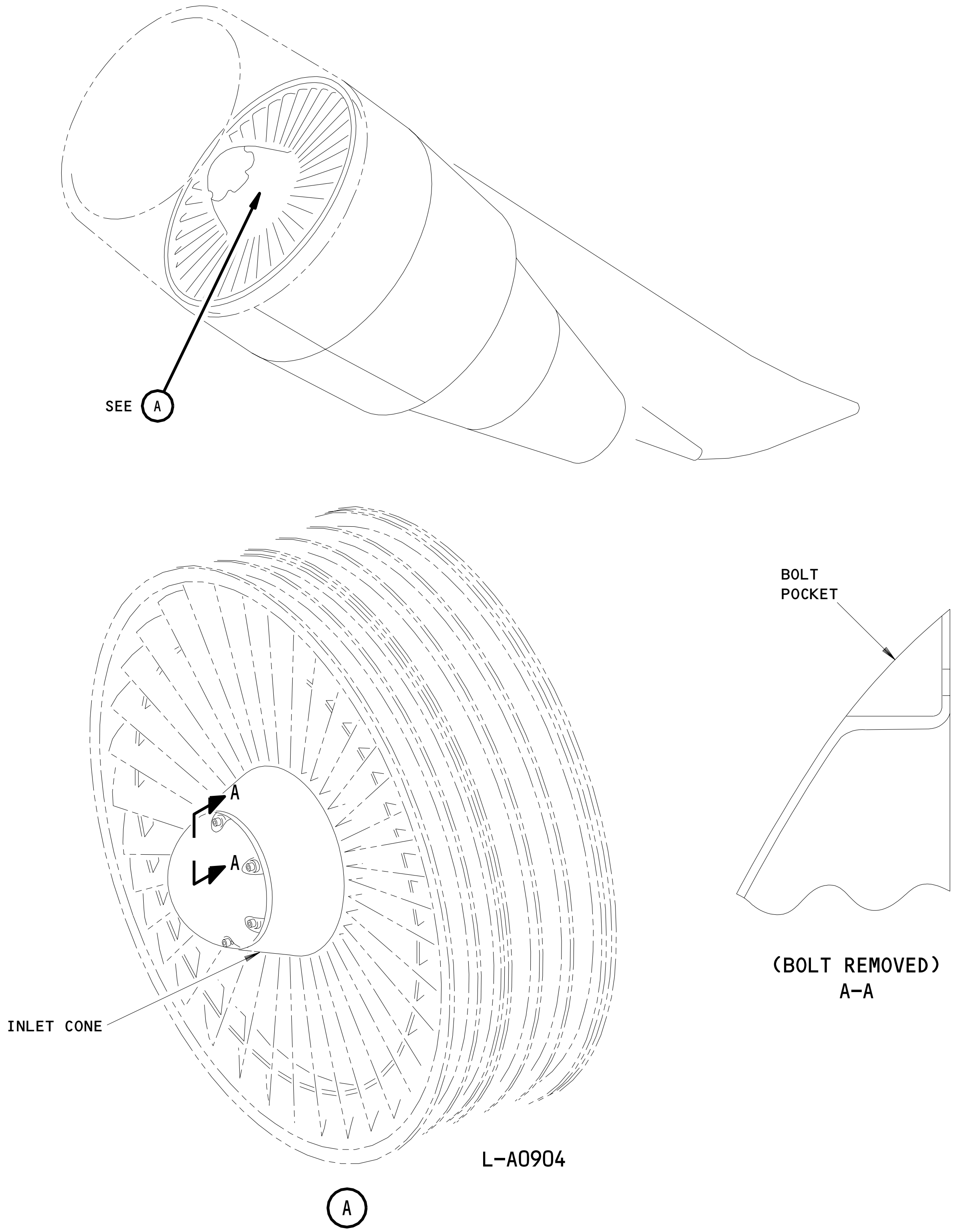
      S 866-001-N00
      (1) Attach the DO-NOT-OPERATE tag to the ENG START switch on the P5 overhead panel.

      S 496-002-N00

      CAUTION: USE A PROTECTIVE MAT WHEN WORKING INSIDE THE INLET OR DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET CONE.

      (2) Position the protective mat in the lower ID of the inlet cone.

         NOTE: Length to depth (L/D) ratio is equal to five noted differently. Limits apply to damaged area after blending and not to quantity of damage measured before blending.



Inlet Cone Inspection
Figure 601

S 216-003-N00

(3) Inspect the inlet cone for chipping, cracks and delamination caused by damage from a bird, ice, or other object.

(a) Inspect the exterior surface of the inlet cone. Look for any signs of chipping, cracks and delamination which are caused by foriegn object damage (FOD).

(b) Inspect the interior surface of the inlet cone for any visible signs of cracking or delamination. Impact damage to the outer surface of the cone segment which causes visible cracking or delamination of the inner surface indicates major structural damage. In this case, the cone segment must be removed from service (AMM 72-31-01/401).

<u>NOTE</u>: Inlet cones which have been subjected to damage which was caused by a bird, ice or by the use of impact tool are very susceptible to this type of damage.

S 096-004-N00

(4) Remove the protective mat from the inlet cowl.

S 216-005-N00

(5) The checks that follow are the Continue-In-Service Limits.

(a) The visual limits of the external cone surface FOD are as follows:

1) Minor paint chipping, dents or scratches which do not cause crazing with a primary path to inside surface of cone are permitted without restriction.

2) After the initial inspection, if any indication of cracks on any surface location are found, and these cracks go through the composite material, remove the part.

3) Cracks are permitted in the black protective paint but must not progress into the composite material and must be within the limits that follow:

a) The maximum crack length is 12.0 in. (304.8 mm) for each crack.

b) A maximum of 10 cracks are permitted for each inlet cone.
c) The cracks must be in the resin rich areas and must not go into the composite material. Find the correct crack depth by lightly sanding the surface with Emery Paper (P05-055).
d) The cracks must not cause delamination.
e) The end of the crack must be at least 2.0 in. (50.8 mm) away from the trailing edge.

(b) The visible chipping and delamination limits of the external cone surface are as follows:
1) No delamination or peeling is permitted on composite material surface.
2) FOR ENGINES WITH PN 749629;
Erosion or peeling of the black protective paint on the cone (front) segment is permitted up to 50% of the surface area, but the part must be replaced at the next scheduled maintenance action. If the area of erosion or peeling is more than 50%, the cone (front) segment must be replaced within 50 hours maximum (AMM 72-31-01/401).
3) FOR ENGINES WITH PN 51A681 AND 51A760;
Erosion, peeling ot flaking of the flouroelastomer coating on the cone (front) segment is not permitted except in the bolt pocket corners. Replace the cone (front) segment within 50 hours if there is any erosion, peeling or flaking of the flouroelastomer coating (AMM 72-31-01/401). Repair the flouroelastomer coating in bolt pocket corner if there is any erosion, peeling or flaking (AMM 72-31-01/801).

<u>NOTE</u>: This is a temporary repair and the part must be replaced at the next scheduled maintenance interval.

4) For cone (rear) segment, erosion or peeling of the black protective paint is permitted up to 10% of the surface area, but the part must be replaced at the next scheduled maintenance action. If the area of erosion or peeling is more than 10% of the surface area the cone (rear) segment must be replaced within 50 hours (AMM 72-31-01/401).

(c) The visable crack limits of the internal flange area are as follows.
1) Minor chipping, dents, scratches or discontinuous crazing at resin rich areas in front flange or minor discontinuous crazing in resin rich areas at rear flange are permitted without restriction.

<u>NOTE</u>: The front and rear flange cannot be easily seen. Therefore, if inlet cone is thought to have damage, the front segment must be removed and the inside of the inlet cone inspected.

S 216-010-N00

(6) Inlet cone rear segment seal damage limits are as follows:
   (a) Remove any portion of the seal that is loose, hanging into, or protruding into the gaspath by trimming as close to the inlet cone external surface as possible.
   (b) Any amount of seal is permitted to be missing, but the seal must be replaced at the next scheduled maintenance opportunity or at the next C Check.

S 216-006-N00

(7) The checks that follow are the Flyback Limits.
   (a) Flyback limits are for a maximum of 50 hours.
   (b) The conditions that are permitted only for flyback are:
      - Composite material delamination or peeling.
      - Paint erosion or peeling.
      - Indentations not more than 0.060 in. (1.524 mm) in depth or 1.500 in. (38.100 mm) in diameter.
      - Local cracks which after inspection of the inside of the inlet cone are not longer than 0.500 in. (12.700 mm) are permitted for flyback limit only.
      1) Any through cracks, indentations or surface ply peeling which is more than the flyback limits requires that the part, assembly, or engine be removed.

         NOTE: The front segment of the inlet cone can be used if the through cracks are evident as long as it is secured to the rear segment.

      2) Crazing with a primary path (indicating a crack) which does not exceed 0.500 in. (12.700 mm) in length is permitted.
      3) Any crack that ends less than 2.0 in. (50.0 mm) away from the traling edge is permitted for the flybacklimit only.
      4) If any damage occurs which is more than the flyback limit, the part must be removed (AMM 72-31-01/401).

S 866-007-N00

(8) Remove the DO-NOT-OPERATE tags from the ENG START switch on P5 overhead panel.

INLET CONE - APPROVED REPAIRS

1. General
   A. This procedure has four repairs for the inlet cone:
      (1) The installation of the replacement seal,
      (2) The repair of the polyurethane finish,
      (3) The repair of damage on the surface.
      (4) The repair of damage to the bolt pocket corner on the front cone segment.
   B. The inlet cone is forward of the front compressor hub.
   C. You can go through the air inlet cowl to get acces to the inlet cone.

TASK 72-31-01-308-012-N00

2. Inlet Cone Seal Repair
   A. General
      (1) The inlet cone seal will be referred to as the seal.
   B. Equipment
      (1) Mat - Protective, Rubber
          Manufacturer's Association, Grade 5C43 neoprene
          sponge, 1 inch thick, approximately 5x6 feet
          with warning streamers attached (3 required).
   C. Consumable Materials
      (1) G00834 Cloth - Cotton, Lintfree
      (2) G01104 Cloth - Nonmetallic (No. 90 Grit)
      (3) A00482 Sealant - Silicone Rubber, RTV 159
      (4) B00740 Alcohol - Isopropyl (PMC 9094)
   D. References
      (1) AMM 72-31-01/401, Inlet Cone
   E. Access
      (1) Location Zones
          410 Left Power Plant Nacelle
          420 Right Power Plant Nacelle

   F. Replace the Seal

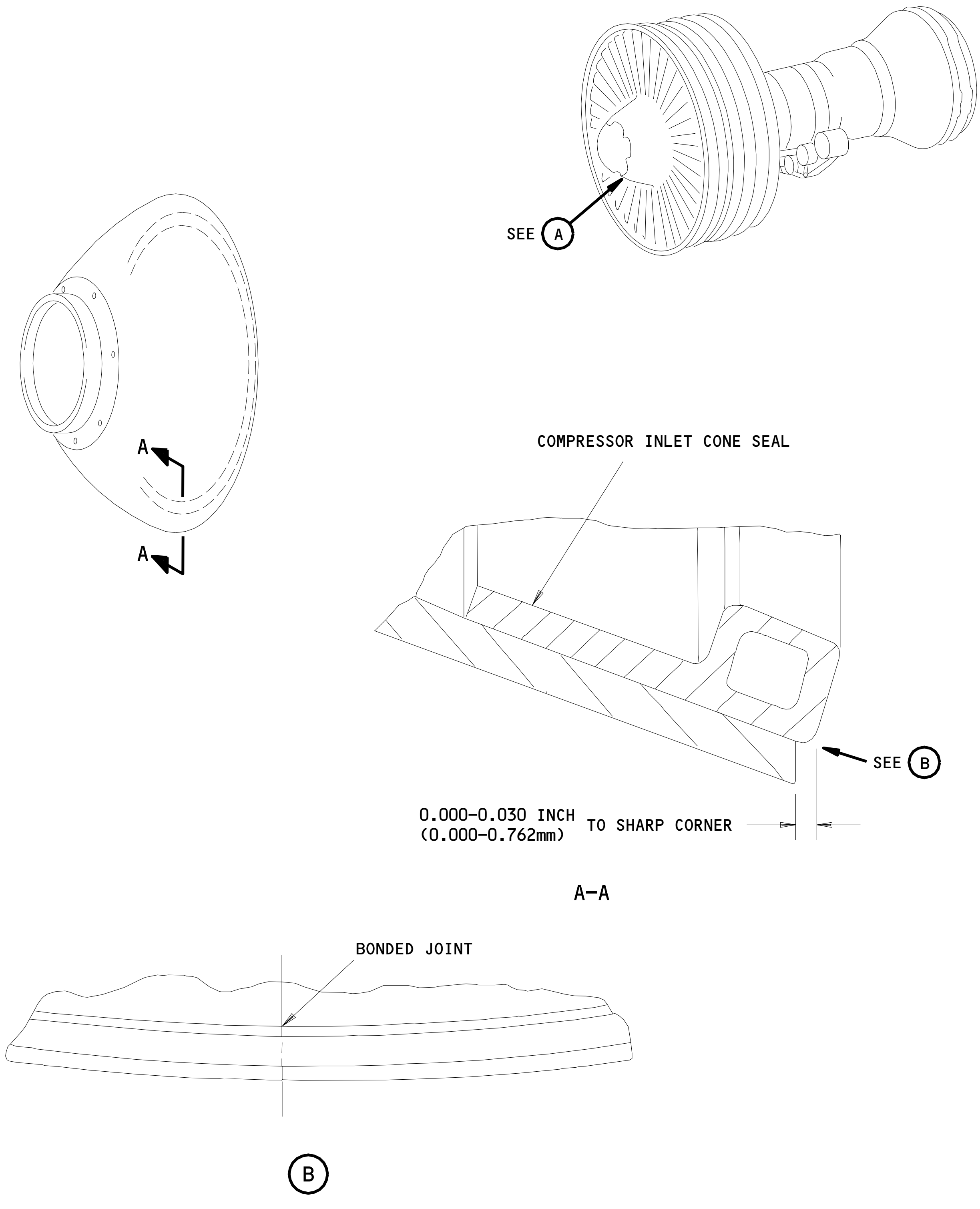
      S 868-010-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

      S 498-001-N00

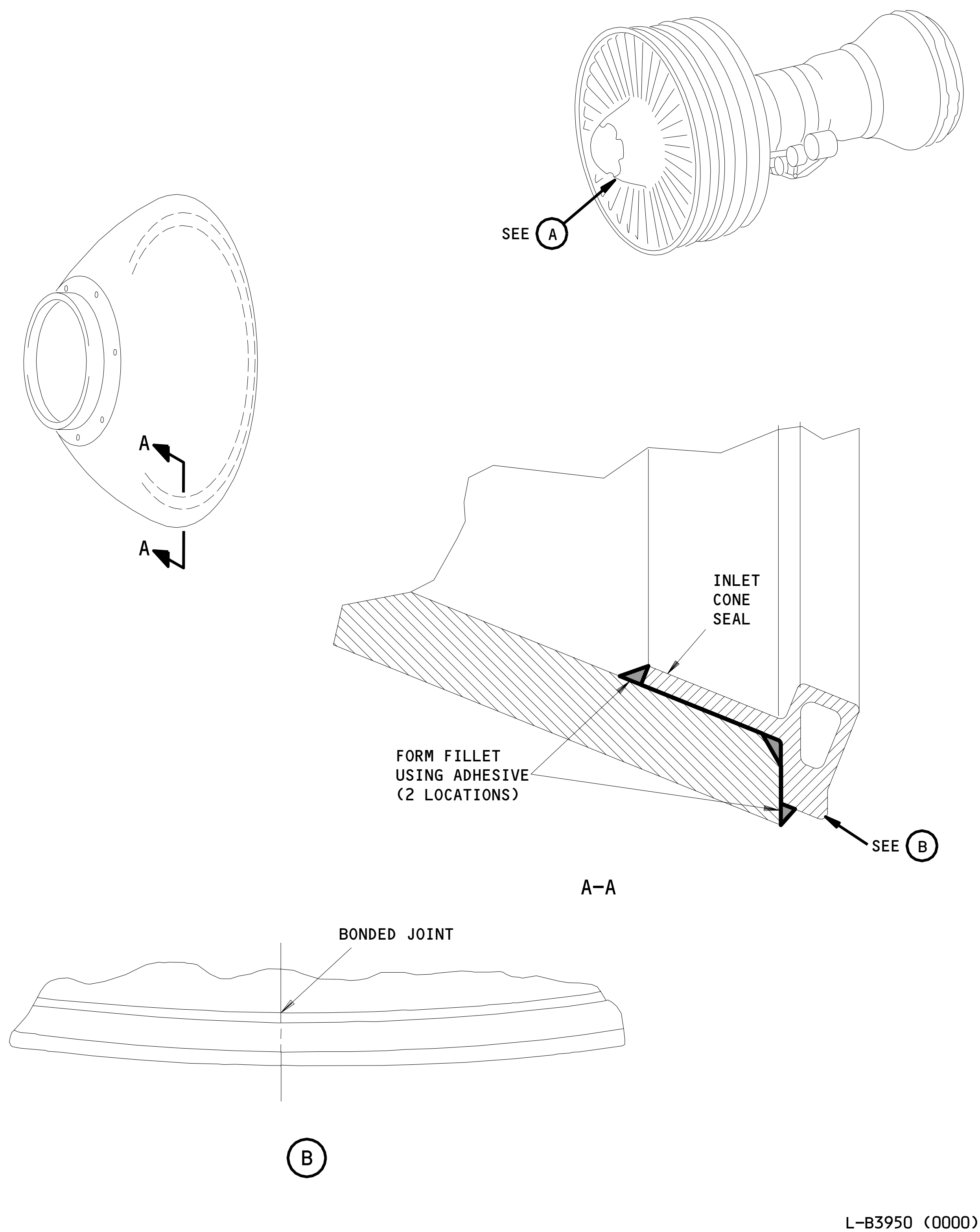
      CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

      (2) Put the protective mat on the inner, lower half of the inlet cowl.

      S 018-002-N00
      (3) Remove the inlet cone (AMM 72-31-01/401).



Compressor Inlet Cone - Seal Replacement
Figure 801 (Sheet 1)



Compressor Inlet Cone - Seal Replacement
Figure 801 (Sheet 2)

S 968-004-N00

(4) Do the steps that follow to replace the seal.

(a) With a scraper, remove the seal.

(b) Clean the surface with a cotton lintfree cloth that is wet with Alcohol.

1) Let the surface become dry.

(c) Install a new seal around and in the space on the inlet cone support.

(d) Cut the seal to the correct length as shown in Fig. 801.

(e) Clean the cut ends of the seal with a clean cotton lintfree cloth that is wet with alcohol.

1) Let the cut ends of the seal become dry.

(f) Apply a continuous layer of the silicone rubber sealant, approximately 0.010 inch (0.254 mm) in thickness, on the cut ends of the new seal.

(g) Bond the ends of the seal together to make a continuous circle.

(h) Let the sealant cure as follows:

1) In air at a temperature of 70-95°F (21-35°C), and a relative humidity of not less than 50 percent,

2) A minimum of 24 hours,

3) In an area that is free of oil, fumes, spray, and other unwanted material.

NOTE: To make a good bond, materials, tools, fixtures and equipment must also be free of unwanted materials.

(i) With a non-metallic grit cloth, make the bonding joints of the seal rough until it has a continuous matt finish.

1) Clean this area with a clean cotton lintfree cloth that is wet with Alcohol.

a) Let the area become dry.

(j) Apply a continuous thin layer of the silicone rubber sealant on the bonding joints of the seal and the inlet cone support.

1) Bond the seal to the inlet cone.

(k) Let the sealant cure in air at ambient temperature, a minimum of 24 hours.

S 418-005-N00

(5) Install the inlet cone (AMM 72-31-01/401).

S 098-006-N00

(6) Remove the protective mat from the inlet cowl.

S 868-007-N00

(7) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

TASK 72-31-01-308-017-N00

3. Inlet Cone Polyurethane Finish Repair (Fig. 802)

A. General

(1) This procedure gives the steps to apply a new polyurethane finish to the inlet cone.

B. Consumable Materials

(1) G00834 Cloth - Cotton, Lintfree
(2) C00672 Coating - Polyurethane, PWA 36013
(3) C00690 Coating - Polyurethane, PWA 36014
(4) G01077 Paper - Emery (No. 250 Grit)
(5) B00740 Alcohol - Isopropyl (PMC 9094)

C. References

(1) AMM 72-31-01/401, Inlet Cone

D. Access

(1) Location Zones

410	Left Power Plant Nacelle
420	Right Power Plant Nacelle

E. Repair the Polyurethane Finish on the Inlet Cone.

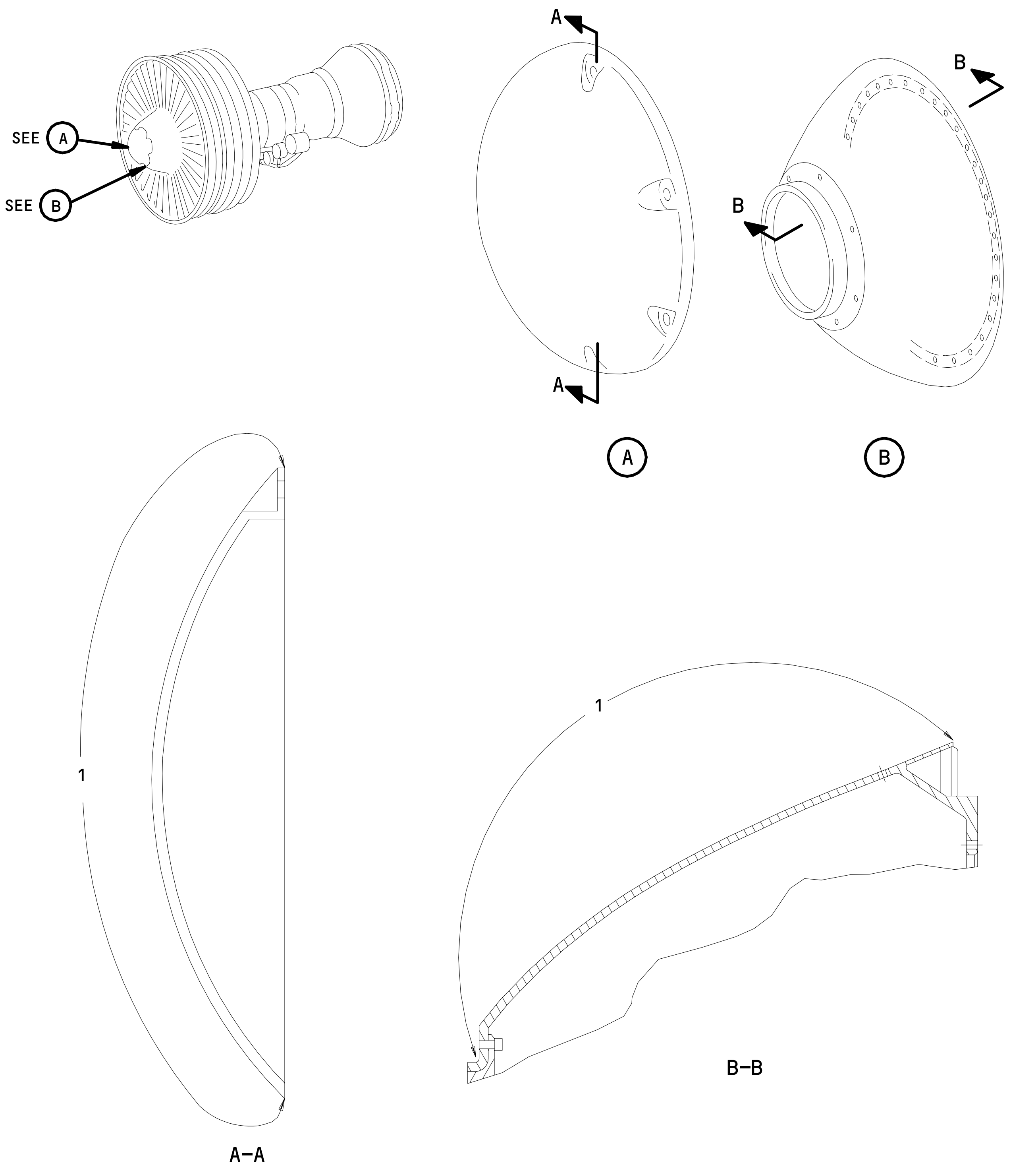
S 868-008-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 498-011-N00

CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH TAPE. IF THE EDGES ARE NOT, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

(2) Put the protective mat on the lower, inner half of the inlet cowl.



1. PROTECTIVE POLYURETHANE COATING

L-A3778

Compressor Inlet Cone - Protective Finish Restoration
Figure 802

S 018-013-N00

(3) Remove the front segment of the inlet cone (AMM 72-31-01/401).

S 348-014-N00

(4) Do the steps that follow to repair the polyurethane finish.
   (a) With the emery paper, remove the polyurethane finish from the fiberglass in the damaged area.

      NOTE: Small flakes and scratches can be made smooth, but it is not necessary to completeley remove all of the remaining finish.

   (b) Clean the surface with a cotton lintfree cloth that is wet with alcohol.
      1) Let the surface become dry.

   WARNING: MIX THE POLYURETHANE IN AN AREA THAT HAS A GOOD FLOW OF AIR. DO NOT GET THE POLYURETHANE IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE POLYURETHANE . PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE THE POLYURETHANE. THE POLYURETHANE CAN CAUSE INJURY TO PERSONS.

   (c) Paint one layer of the polyurethane coating (PWA 36014) in the area shown on Fig. 802.
      1) Let the surface become dry.
   (d) Do the steps that follow to make a new finish on the inlet cone.
      1) Paint one layer of the polyurethane coating (PWA 36013) in the area that is shown.
      2) Let the surface become dry.
      3) Paint one more layer of the polyurethane coating (PWA 36013) in a direction that is different from the direction of the top layer.
      4) Do these steps again until you have a total of five new layers of the polyurethane coating (PWA 30613).

S 418-015-N00

(5) Install the outer segment of the inlet cone (Ref 72-31-01/401).

S 098-016-N00

(6) Remove the protective mat from the inlet cone.

S 868-009-N00

(7) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

TASK 72-31-01-308-018-N00

4. Inlet Cone Surface Damage Repair

A. General

(1) This procedure gives the steps to repair the fiberglass surface of the inlet cone.

B. Consumable Materials

(1) G00834 Cloth - Cotton, Lintfree
(2) G01099 Paper - Emery (No. 60 Grit)
(3) A00940 Resin - Liquid Epoxy (PWA 421-2)
(4) C00691 Agent - Curing, Epoxy Resin (PWA 422-1)
(5) B00740 Alcohol - Isopropyl (PMC 9094)

C. References

(1) AMM 72-31-01/401, Inlet Cone

D. Access

(1) Location Zones

410	Left Power Plant Nacelle
420	Right Power Plant Nacelle

E. Repair the Damage on the Surface of the Inlet Cone (Fig. 803).

S 868-019-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

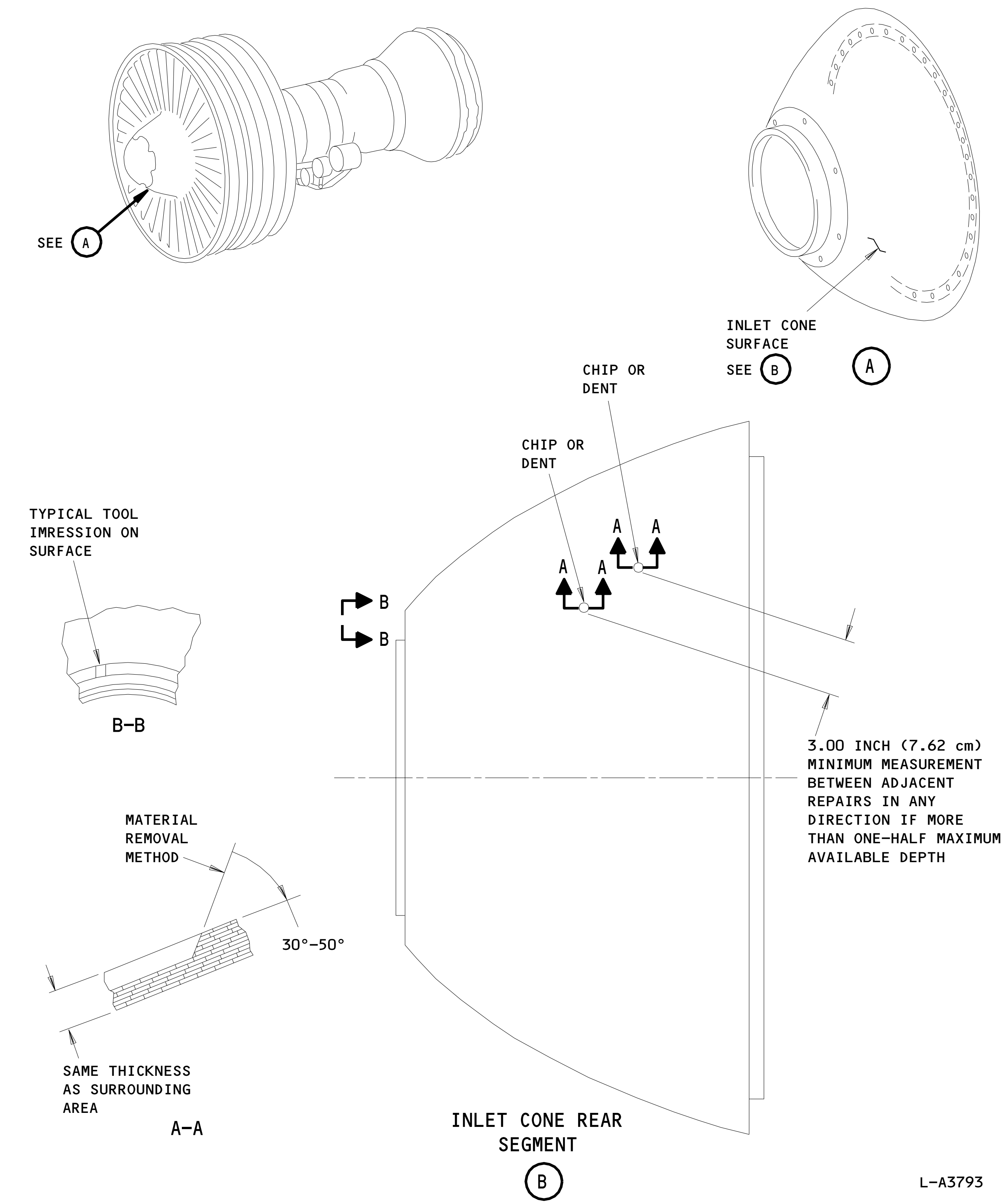
S 498-020-N00

CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

(2) Put the protective mat on the lower inner half of the inlet cowl.

S 018-021-N00

(3) Remove the inlet cone (AMM 72-31-01/401).



Compressor Inlet Cone - Surface Damage Repair
Figure 803

S 348-022-N00

(4) Do the steps that follow to repair the fiberglass surface of the inlet cone.

(a) Prepare the repair area with the emery paper (View A-A, Fig. 803).

(b) Clean the surface with a cotton lintfree cloth that is wet with Alcohol.

1) Let the surface become dry.

(c) Mix the applicable quantity of filler compound as follows:

1) Mix 100 parts (by weight) of Liquid Epoxy Resin with 25 parts (by weight) of Epoxy Curing Agent.

NOTE: The pot life of the compound is 20-30 minutes at ambient temperature.

(d) Fill the damaged area with the prepared resin compound.

1) Make the outer surface of the filled area a small quantity higher than the adjacent surfaces.

(e) Make the contour the same as the usual contour.

(f) Let the surface have a cure time of 4 hours, at a temperature of 175°F (79.4°C).

(g) Apply a new polyurethane finish on the surface (Ref par. 3).

S 418-023-N00

(5) Install the inlet cone (AMM 72-31-01/401).

S 098-024-N00

(6) Remove the protective mat from the inlet cone.

S 868-025-N00

(7) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

TASK 72-31-01-728-027-N00

5. Front Cone Segment Bolt Pocket Corner Repair

A. General

(1) This procedure gives the steps to repair the bolt pocket corner of the front inlet cone segment.

(2) This repair is temporary and the part must be repaired at the next schedule maintenance interval.

B. Standard Tools and Equipment
(1) Mat - Protective Rubber
Manufacturer's Association, Grade 5C43 neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

C. Consumable Materials
(1) Cloth - Cotton, Lint Free (P05-005)
(2) Paper - Aluminum Oxide (P05-094)
(3) Paper - Abrasive, Silicone Carbide (P05-153)
(4) Paper - Abrasive (P05-253)
(5) Coating - Polyurethane (PWA 36013) (P05-053)
(6) Coating - Polyurethane (PWA 36014) (P05-054)
(7) Coating - Fluoroelastomer (PWA 36516-1) (P05-370)
(8) Coating - Fluoroelastomer (PWA 36516-2) (P05-371)
(9) Coating - Fluoroelastomer (PWA 36516-4) (P05-372)
(10) Alcohol - Isopropyl (PMC 9016) (P11-014A)

D. References
(1) AMM 70-11-16/201, Degreasing of Parts by Aqueous Cleaner (No Rinse) (SPOP 209)
(2) AMM 72-31-01/401, Inlet Cone

E. Access
(1) Location Zones

410	Left Power Plant Nacelle
420	Right Power Plant Nacelle

F. Repair the Inlet Cone Front Segment

S 868-037-N00
(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

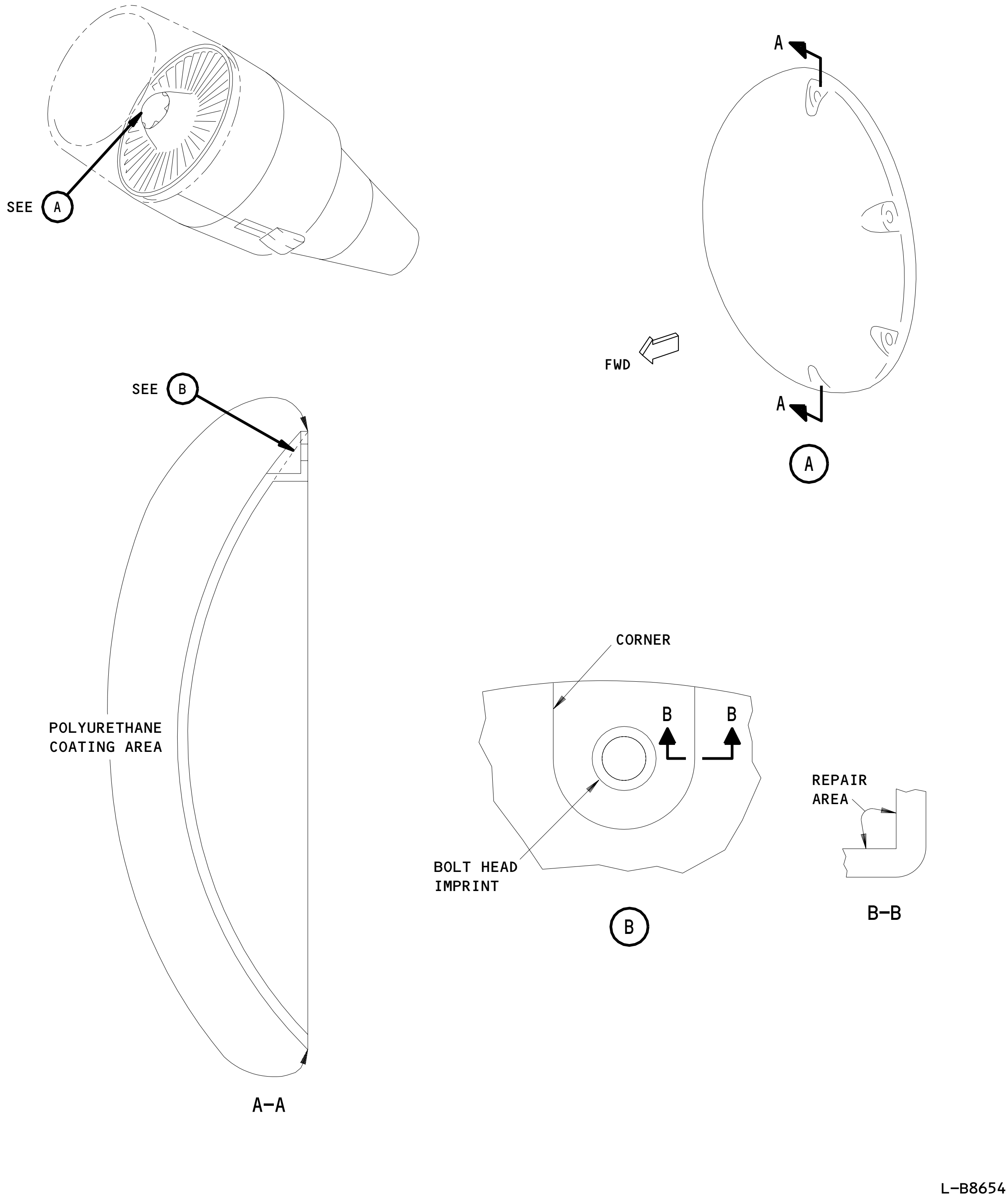
S 488-039-N00

CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

(2) Put the protective mat on the lower, inner half of the inlet cowl.

S 028-030-N00
(3) Remove the front segment of the inlet cone (AMM 72-31-01/401).

S 028-031-N00
(4) Do the steps that follow to repair the bolt pocket of the front segment of the inlet cone.
(a) Clean the damage area by SPOP 209.
(b) If necessary, use a soft non-metallic brush or pad.



Compressor Inlet Cone (Front) - Bolt Pocket Corner Damage Repair
Figure 804

(c) Dry with clean cotton cloth.

S 358-032-N00

(5) Lightly abrade the repair area with #108 grit paper or #240 grit abrasive paper, and be careful not to damage the kevlar layers under the fiberglass.
(a) Clean by SPOP 208 using Isopropyl Alcohol (AMM 70-00-00/201).
(b) Let air dry for 30 minutes minimum.

NOTE: Alcohol which has not completely dried prevents proper coating cure.

S 398-033-N00

(6) Apply the urethane coating to the repair area as follows:

NOTE: Keep the coating away from the bolt head imprint.

(a) Paint with the polyurethane coating (P05-054).
1) Apply one coat to the required areas.
2) Allow to dry between 5 - 6 minutes.
(b) Paint with the polyurethane coating (P05-053).
1) Apply five coats minimum in the required areas.
2) Allow to dry 5 - 6 minutes between coats.
(c) Apply sufficient layers of coating to make the damaged area flush to 0.010 inch (0.254 mm) above the adjacent undamaged coating.

S 168-044-N00

(7) Mix the fluoroelastomer protective coating (P05-370) or fluoroelastomer protective coating (P05-371) by the manufacturers recommended directions.
(a) Be careful not to cause air bubbles in the mixed coating.
(b) Let the mixture stay for a minimum of 10 minutes before you use the coating.
(c) Use MIBK to recrease the mixture application.

NOTE: The fluoeroelastomer protective coating (P05-372) is paste and can be used in place of fluoroelastomer protective coating (P05-370), or fluoroelastomer protective coating (P05-371). The fluoroelastomer protective coating (P05-372) accumulates the thickness quickly (the thickness will occur when applied less number of times).

S 168-041-N00

(8) Use a brush to apply the coating by the manufacturers recommended directions.

S 168-042-N00

(9) Apply sufficient layers of coating to make the damaged area flush to 0.010 inch (0.254 mm) above the adjacent undamaged coating.
   (a) Allow to dry for 5 minutes minimum between each coat.

S 168-043-N00

(10) Let air dry for 2 hours minimum at the room temperature 60 - 90 F (16 - 32 C), and to let the release of the volatiles.
   (a) Increase the temperature to 150 - 170 F (66 - 77 C) for 2 hours minimum.

S 418-035-N00

(11) Install the front segment of the inlet cone (AMM 72-31-01/401).

S 088-036-N00

(12) Remove the protective mat from the inlet cowl.

S 868-038-N00

(13) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

1ST-STAGE (FAN) BLADE - REMOVAL/INSTALLATION

1. General
   A. This procedure has two pairs of tasks for the removal and installation of the fan blades.
      (1) The first pair of tasks is for damaged fan blades. You can replace one blade that has the same moment as the one you remove. You can also replace two blades, a matched moment set, that are 180° apart.

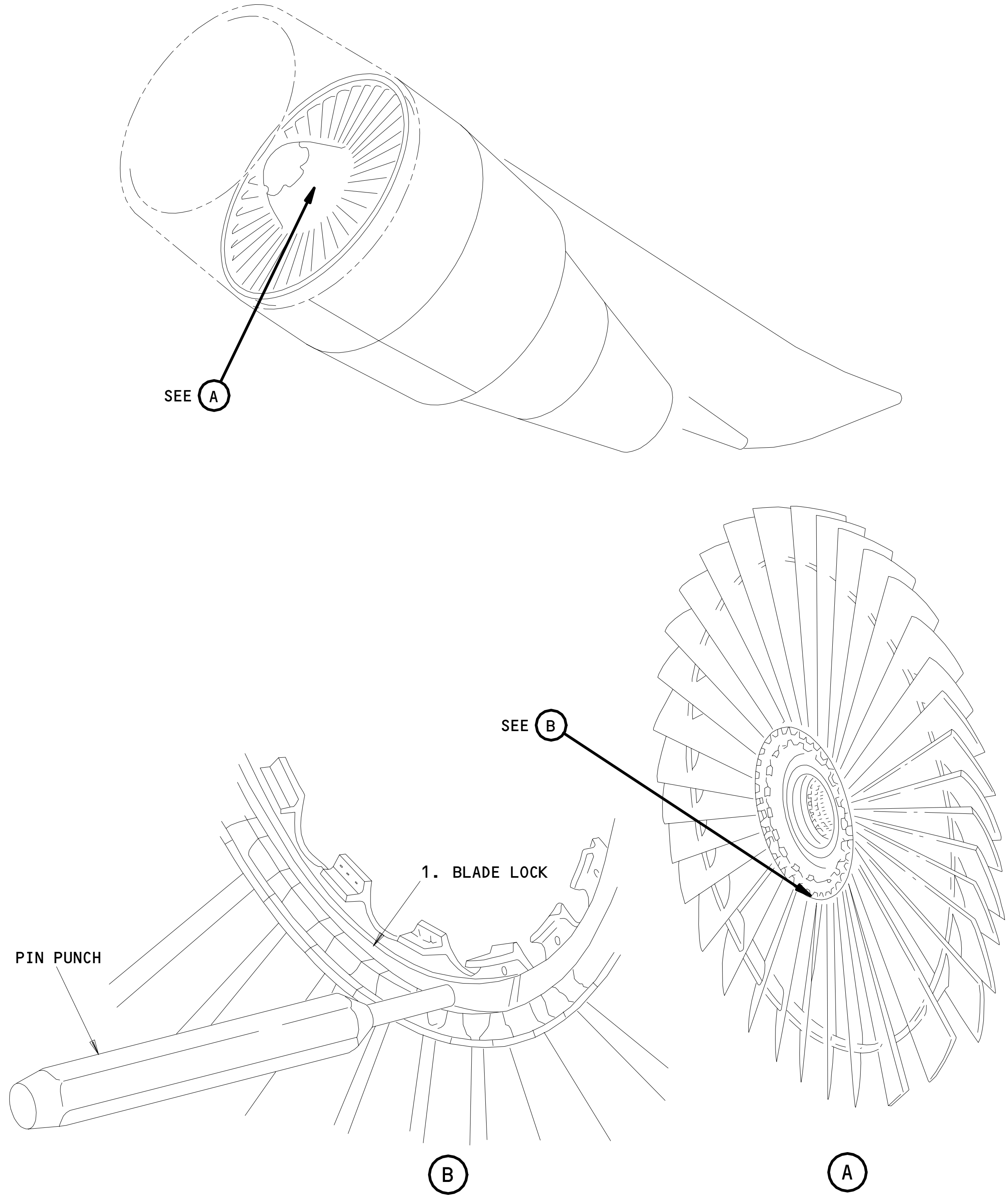
          NOTE: A matched moment set is a pair of blades that have the same moment weight (moment of inertia).

      (2) The second pair of tasks is for maintenance. You can remove all of the fan blades as a full set.
   B. The 1st-stage (fan) blades are the first stage of the low pressure compressor (LPC).
   C. You can go into the inlet cowl to get access to the 1st-stage fan blades.

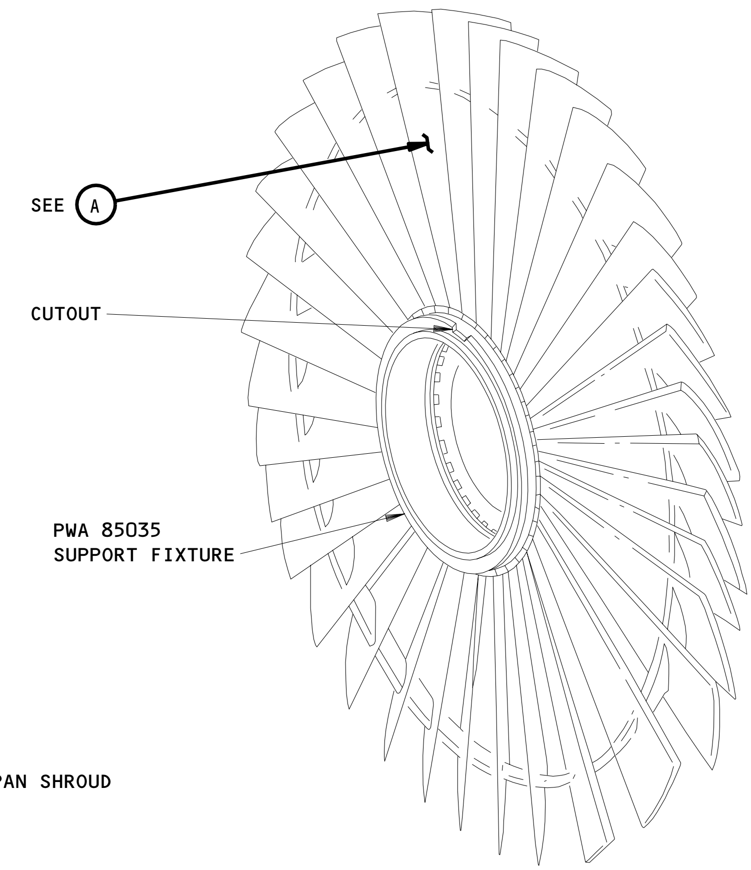
TASK 72-31-02-004-001-N00

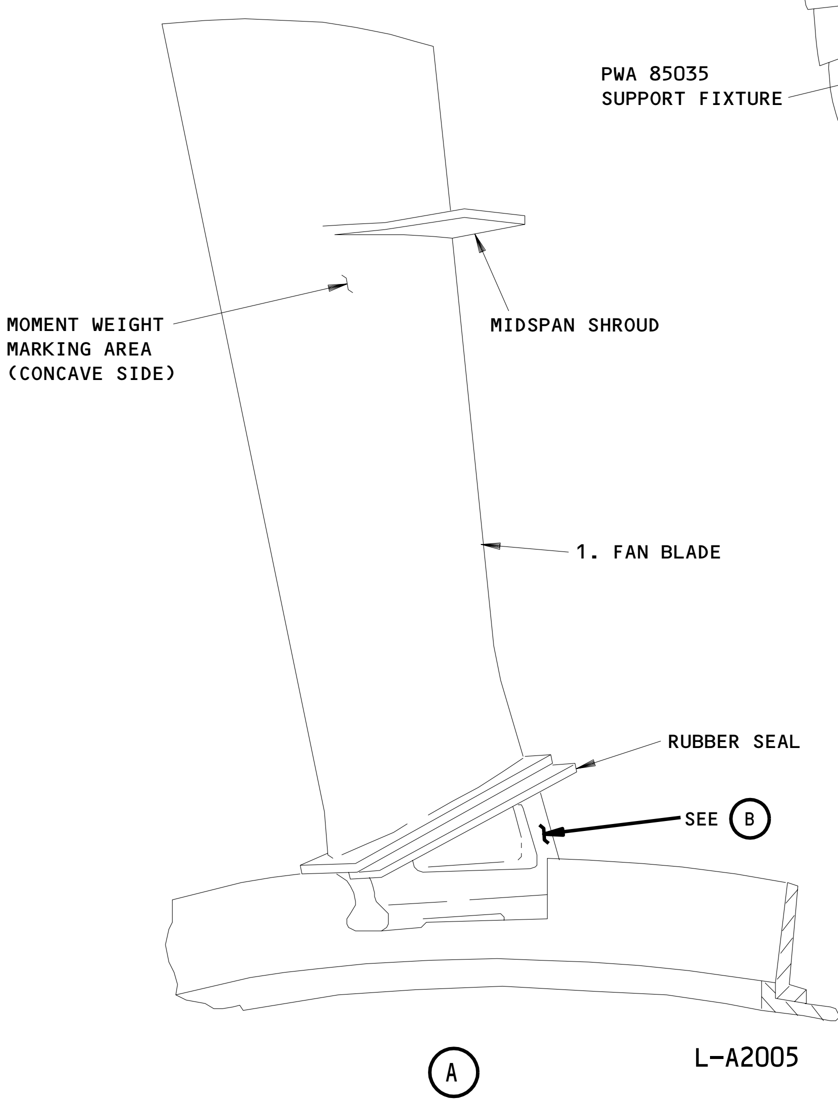
2. Fan Blade Removal (One or Two)
   A. General
      (1) This procedure is for the removal of damaged blades.
   B. Equipment
      (1) Mat - Protective, rubber
          Manufacturer's Association, Grade SC43,
          neoprene sponge, 1 inch thick, approximately
          5 x 6 feet with warning streamer attached
          (3 required)
      (2) Fixture - Support, PWA 85035, Pratt & Whitney
      (3) Pin Punch - locally available
   C. Consumable Materials
      (1) G01306 Gloves - locally available
   D. Parts

AMM		NOMENCLATURE	AIPC		
FIG	ITEM		SUBJECT	FIG	ITEM
402	1	Blade Assembly - Compressor Blade (Fan Blade)	72-31-02	10	15

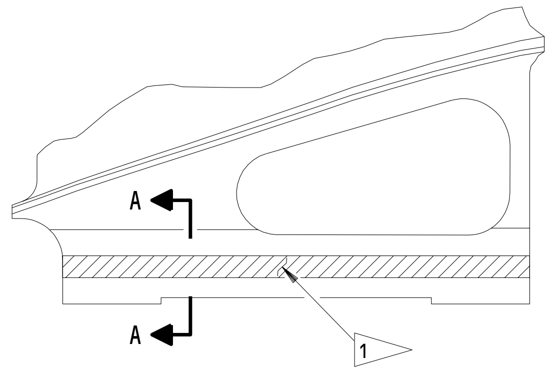


Blade Lock Installation
Figure 401





1st-Stage (Fan) Blade Installation
Figure 402 (Sheet 1)



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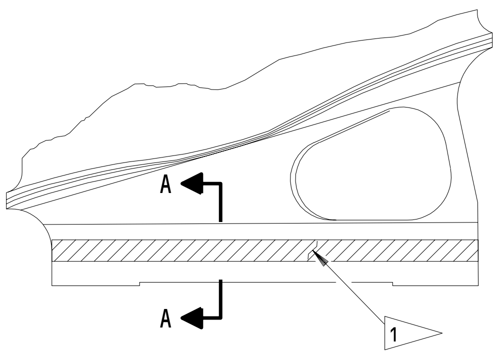

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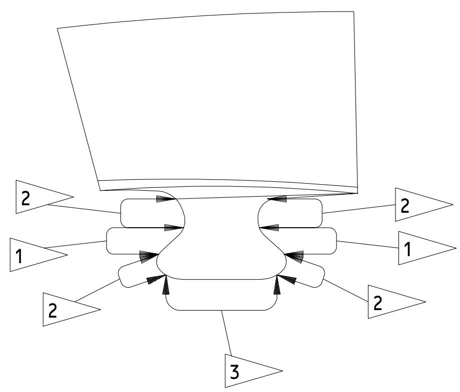


A-A

1 BLADE ROOT APPLICATION AREA

2 A SMALL QUANTITY OF LUBRICATION IS ACCEPTABLE IN THIS AREA.

3 NO LUBRICATION APPLIED TO THIS AREA

4 TYPICAL FOR P/N: 52A121, 52A121-001, 53A321, 56A511, 56A821, 52A121-002, 52A121-003, 53A321-001

5 TYPICAL FOR P/N: 54A821, 56A621

L-D3257(0406)

1st-Stage (Fan) Blade Installation
Figure 402 (Sheet 2)

E. References
(1) AMM 72-31-01/401, Inlet Cone

F. Access
(1) Location Zones
410 Left Power Plant Nacelle
420 Right Power Plant Nacelle

G. Prepare for the removal

S 864-002-N00
(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 494-003-N00

CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

(2) Put the protective mats on the inner lower half of the inlet cowl.

S 414-004-N00
(3) Remove the inlet cone (AMM 72-31-01/401).

S 034-005-N00

WARNING: ALWAYS WEAR GLOVES WHEN YOU TOUCH THE FAN BLADES. THE FAN BLADES ARE SHARP AND CAN CAUSE INJURY TO YOUR HANDS.

CAUTION: MAKE SURE YOU INSTALL THE BLADE LOCK IF YOU MUST GO AWAY FROM THE ENGINE. IF THERE IS ENGINE WINDMILLING WHEN THE FAN BLADES ARE IN THE FORWARD POSITION, THE BLADES CAN BECOME DAMAGED.

(4) Use a small pin punch, in the hole that is near the lock joint, to remove the fan blade lock (1) (Fig. 401).

S 984-006-N00
(5) Turn the fan blades until the blade you will remove is at the 12 o'clock position.

S 494-007-N00
(6) Install the (PWA 85035) support fixture to the front LPC hub.
(a) Attach the (PWA 85035) support fixture to the front LPC hub with the bolts (Fig. 402).

S 014-008-N00
(7) Align the cutout with the blade you will remove (Fig. 402).

H. Remove One or Two Fan Blades

S 024-010-N00

CAUTION: BE CAREFUL WITH THE FAN BLADE WHEN YOU REMOVE IT. YOU CAN EASILY CAUSE DAMAGE TO THE SEAL THAT IS BONDED TO THE BOTTOM OF THE FAN BLADE PLATFORM.

(1) Do the steps that follow to keep the blade shroud and root free to move during the blade removal:
(a) Before you move each fan blade, put it at the 12 o'clock position.
(b) Carefully pull the fan blade forward a small increment, in the hub slot.
(c) Go counterclockwise, as seen from the front, to the adjacent fan blade.
(d) Continue to move all of the blades forward, one at a time, until each blade is stopped by the fixture.
(e) The blade at the 12 o'clock position will then be free to move fully out of the slot.
(f) Turn the cutout in the fixture until it aligns with the blade that you will remove at the 12 o'clock position.

S 024-011-N00

(2) If you will replace a matched moment set of blades, do the steps that follow:
(a) Put the opposite fan blade at the 12 o'clock position.
(b) Align the cutout with the blade you will remove.
(c) Remove the fan blade that is 180 degrees from the first fan blade you removed.

TASK 72-31-02-004-012-N00

3. Fan Blade Removal (Full Set)

A. General
(1) This procedure is for maintenance tasks.

B. Equipment
(1) Mat - Protective, rubber
Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately
5 x 6 feet with warning streamer attached
(3 required)
(2) Fixture - Support, PWA 85035, Pratt & Whitney
(3) Cart Storage - PWA 86651, Pratt & Whitney

C. Consumable Materials
(1) G00758 Pen - Marking, Cado Marker
(2) G01306 Gloves - locally available

D. References
(1) AMM 72-31-01/401, Inlet Cone

E. Access
  (1) Location Zones
    410 Left Power Plant Nacelle
    420 Right Power Plant Nacelle

F. Prepare for the removal

S 864-013-N00
  (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 494-014-N00

CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER HALF OF THE INLET COWL SURFACE. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

  (2) Put the protective mats on the inner lower half of the inlet cowl.

S 014-015-N00
  (3) Remove the inlet cone (AMM 72-31-01/401).

S 014-016-N00

WARNING: ALWAYS WEAR GLOVES WHEN YOU TOUCH THE FAN BLADES. THE FAN BLADES ARE SHARP AND CAN CAUSE INJURY TO YOUR HANDS.

CAUTION: MAKE SURE YOU INSTALL THE BLADE LOCK IF YOU MUST GO AWAY FROM THE ENGINE. IF THERE IS ENGINE WINDMILLING WHEN THE FAN BLADES ARE IN THE FORWARD POSITION, THE BLADES CAN BECOME DAMAGED.

  (4) Use a small pin punch, in the hole that is near the lock joint, to remove the fan blade lock (1) (Fig. 401).

S 494-017-N00
  (5) Install the (PWA 85035) support fixture to the front LPC hub.
    (a) Attach the (PWA 85035) support fixture to the front LPC hub with the bolts (Fig. 402).

S 014-018-N00
  (6) Align the cutout with the blade you will remove (Fig. 402).

G. Remove the Full Set of Fan Blades (Fig. 402).

S 934-050-N00
  (1) Do the steps that follow to make a record of the fan blade sequence.
    (a) With a marking pen, write the number 1 on the fan blade and the adjacent hub slot.
    (b) Go clockwise, as seen from the front, to the adjacent fan blade.

(c) Continue to write the numbers until all 38 of the fan blades have numbers.

S 024-020-N00

CAUTION: BE CAREFUL WITH THE FAN BLADES WHEN YOU REMOVE THEM. YOU CAN EASILY CAUSE DAMAGE TO THE SEAL THAT IS BONDED TO THE BOTTOM OF THE FAN BLADE PLATFORM.

(2) Do the steps that follow to keep the blade shroud and root free to move during the blade removal:
(a) Before you move each fan blade, put it at the 12 o'clock position.
(b) Carefully pull the fan blade a small increment forward in the hub slot.
(c) Go counterclockwise, as seen from the front, to the adjacent fan blade.
(d) Continue to move all of the blades forward, one at a time, until each blade is stopped by the fixture.
(e) The blade at the 12 o'clock position will then be free to move fully out of the slot.
(f) Turn the cutout in the fixture until it aligns with the blade that you will remove at the 12 o'clock position.
(g) After you remove each fan blade (1) through the cutout, put it in the PWA 86651 storage cart to make sure the blade will not get damaged.

NOTE: After you have removed the fan blade, do a check for fan blade moment weights that are missing. Any number of missing fan blade moment weights, on any number of fan blades, may continue in service until the next shop visit, provided the engine vibration levels during the prior engine operation were within acceptable limits, and the fan blades are reinstalled in the same fan hub positions. If the engine operation prior to the fan blade removal was not within acceptable limits, the missing fan blade moment weights may be the cause of the vibration.

(h) Turn the cutout counterclockwise, as seen from the front, and remove one more fan blade (1).
(i) Continue to turn the cutout and remove the fan blades until all of the fan blades are in the PWA 86651 storage cart.

CAUTION: DO NOT REMOVE THE MOMENT WEIGHTS WITH NO VIBRO-PEENED LABEL, OR WEIGHTS LABELED "HUB". THESE WEIGHTS BELONG WITH THE LPC DRUM AND BLADES AND THE HUB Z-PLANE SLOT RADIUS RESPECTIVELY. IF THESE WEIGHTS ARE REMOVED, THE LPC WILL HAVE TO BE BALANCED.

(j) If you are to replace all the fan blades with a different set, remove the moment weights from the hub that have been labeled "FAN".

NOTE: The moment weights that have been labeled "TB" can be left on the hub. These weights may have been used to trim balance the hub and should not be removed unless the engine is to be balanced again.

TASK 72-31-02-404-021-N00

4. Fan Blade Installation (One or Two Fan Blades)

A. General
   (1) This procedure is for the installation of one or a pair of replacement fan blades.
B. Equipment
   (1) Mat - Protective, rubber
       Manufacturer's Association, Grade SC43,
       neoprene sponge, 1 inch thick, approximately
       5 x 6 feet with warning streamer attached
       (3 required)
   (2) Fixture - Support, PWA 85035, Pratt & Whitney
C. Consumable Materials
   (1) D00651 Lubricant - Paste, PWA 587, G-N Metal Assembly (P06-005)
   (2) G01306 Gloves - locally available
   (3) G00758 Pen - Marking, Cado Marker
D. Parts

AMM			AIPC		
FIG	ITEM	NOMENCLATURE	SUBJECT	FIG	ITEM
402	1	Blade Assembly - Compressor Blade (Fan Blade)	72-31-02	10	15

E. References
   (1) AMM 72-31-01/401, Inlet Cone
F. Access
   (1) Location Zones
       410 Left Power Plant Nacelle
       420 Right Power Plant Nacelle

G. Install One or a Pair of Fan Blades (Fig. 402).

S 974-023-N00

WARNING: ALWAYS WEAR GLOVES WHEN YOU TOUCH THE FAN BLADES. THE FAN BLADES ARE SHARP AND CAN CAUSE INJURY TO YOUR HANDS.

CAUTION: MAKE SURE YOU INSTALL THE BLADE LOCK IF YOU MUST GO AWAY FROM THE ENGINE. IF THERE IS ENGINE WINDMILLING WHEN THE FAN BLADES ARE IN THE FORWARD POSITION, THE BLADES CAN BECOME DAMAGED.

CAUTION: DO NOT USE THE PHASE III FAN BLADES WITHOUT THE APPLICABLE EEC PROGRAMING PLUG (EPP) AND EEC SOFTWARE, PW SCN 9A/AG. IF YOU DO NOT USE THE CORRECT EPP AND EEC SOFTWARE, DAMAGE CAN OCCUR TO THE ENGINE.

CAUTION: DO NOT MIX THE PHASE III FAN BLADES WITH OTHER FAN BLADES. THIS CAN CAUSE DAMAGE TO THE ENGINE.

(1) Use the correct fan blade or blades for the installation.

NOTE: To follow service bulletin PW4ENG 72-132, fan blades (not PHASE III) that have different part numbers are interchangeable. But, matched moment sets with the same parts numbers must be kept together. It is better to keep the mixture of different part numbers at a minimum. It is best if all of the fan blades, that you install, have the same part numbers.

S 974-024-N00

(2) Refer to figure 402 for the location of the moment weight marks.

NOTE: You can replace each damaged blade with a blade that has the same moment weight or you can replace the blades with matched moment sets. If you use a matched moment set, the rotor must be assembled with matched moment sets.

When you replace a matched moment set of fan blades, install the fan blades 180 degrees apart. Two matched moment blades must have moment weights that are not more than 1.0 ounce-inch (720 gram-millimeters) apart.

When you replace one blade in a full rotor set, the moment of the replacement blade must not be more than 1.0 ounce-inch (720 gram-millimeter) from the blade that is 180 degrees opposite.

S 934-080-N00

(3) Make a temporary mark with a marker (G00758, Cado Marker Pen). See Identification of Engine Components with Marks (Standard Practices, AMM 70-11-07/201).

NOTE: Blade moment weight markings are found on concave side of blade airfoil section.

NOTE: If two or more blended blades are grouped together, then blended blades and their matching blades should be evenly distributed around hub. Unless this process can be successfully completed, a vibration check is recommended.

S 644-047-N00

WARNING: DO NOT PERMIT THE LUBRICANT TO TOUCH YOUR SKIN. IF IT DOES, WASH YOUR SKIN IMMEDIATELY WITH SOAP AND WATER. THE LUBRICANT CAN CAUSE INJURY TO YOUR SKIN.

(4) Lubricate the mid-span shrouds and blade roots of the blades with the method that follows.
   (a) With a brush, apply lubricant PWA 587 G-N Metal Assembly Paste (P06-005) to the mating surfaces of the mid-span shrouds of the blades.
   (b) With a brush, apply lubricant PWA 587 G-N Metal Assembly Paste (P06-005) to the dove tail area of the fan blades.

   NOTE: Do not apply lubricant to the fan hub slots or bottom face of the fan blade root. Some lubricant is permitted on the area between the dove tail area and platform.

S 424-025-N00

(5) Do the steps that follow to install one blade.
   (a) Put the empty blade slot at the 12 o'clock position.
   (b) Align the cutout with the empty blade slot.
   (c) Make sure that all of the blades are moved forward until they are stopped by the support fixture.
   (d) Install the replacement blade (1) (Fig. 402) through the cutout.

S 424-026-N00

(6) If you will replace a matched moment set of blades, do the steps that follow.
   (a) Put the opposite empty blade slot at the 12 o'clock position.
   (b) Align the cutout with the empty blade slot.
   (c) Install the fan blade (1) (Fig. 402) through the cutout.

S 424-028-N00

CAUTION: BE CAREFUL WITH THE FAN BLADE WHEN YOU INSTALL IT. YOU CAN EASILY CAUSE DAMAGE TO THE SEAL THAT IS BONDED TO THE BOTTOM OF THE FAN BLADE PLATFORM.

(7) Do the steps that follow to keep the blade shroud and root free to move during the blade installation:
   (a) Before you move each fan blade, put it at the 12 o'clock position.
   (b) Carefully push the fan blade rearward a small increment, in the hub slot.
   (c) Go clockwise, as seen from the front, to the adjacent fan blade.
   (d) Continue to move all of the blades rearward, one at a time, at the 12 o'clock position, until each blade is fully installed.

H. Put the Airplane Back to its Usual Condition

S 094-029-N00

(1) Remove the PWA 85035 support fixture (Fig. 402).

S 434-030-N00

(2) Install the blade lock (1) as follows (Fig. 401):
   (a) Put the anti-rotation pin of the blade lock with the slot in the hub.
   (b) With a fiber drift, start at the lock joint to fully install the blade lock.
   (c) Make sure the lock is correctly installed by measurement of the gap between the lock ends. The gap must be 0.010 - 0.060 inch (0.25mm - 1.52mm). If the gap measurement is not correct, you must make sure the lock is fully seated.

S 414-031-N00

(3) Install the inlet cone (AMM 72-31-01/401).

S 094-032-N00

(4) Remove the protective mat from the inner surface of the inlet cowl.

S 864-033-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

S 754-054-N00

(6) Do a vibration survey.

TASK 72-31-02-404-034-N00

5. Fan Blade Installation (Full Set)

A. General
   (1) This procedure is for the installation of the complete set of fan blades.

B. Equipment
   (1) Mat - Protective, rubber
       Manufacturer's Association, Grade SC43,
       neoprene sponge, 1 inch thick, approximately
       5 x 6 feet with warning streamer attached
       (3 required)
   (2) Fixture - Support, PWA 85035, Pratt & Whitney
   (3) Cart Storage - PWA 86651, Pratt & Whitney
C. Consumable Materials
   (1) G00758 Pen - Marking, Cado Marker
   (2) D00651 Lubricant - Paste, PWA 587, G-N Metal Assembly (P06-005)
   (3) G01306 Gloves - locally available
D. Parts

AMM			AIPC		
FIG	ITEM	NOMENCLATURE	SUBJECT	FIG	ITEM
402	1	Blade Assembly - Compressor Blade (Fan Blade)	72-31-02	10	15

E. References
   (1) AMM 72-31-01/401, Inlet Cone
F. Access
   (1) Location Zones
       410 Left Power Plant Nacelle
       420 Right Power Plant Nacelle

G. Install the Full Set of Fan Blades.

S 974-049-N00

CAUTION: DO NOT USE THE PHASE III FAN BLADES WITHOUT THE APPLICABLE EEC PROGRAMING PLUG (EPP) AND EEC SOFTWARE, PW SCN94/AG. IF YOU DO NOT USE THE CORRECT EPP AND EEC SOFTWARE, DAMAGE CAN OCCUR TO THE ENGINE.

CAUTION: DO NOT MIX THE PHASE III FAN BLADES WITH OTHER FAN BLADES. THIS CAN CAUSE DAMAGE TO THE ENGINE.

(1) Put the fan blades, from the storage cart, in a sequence with one of the two procedures that follow.
   (a) Put the fan blades in the same sequence as removed.
   (b) An optional procedure is to put the fan blades in a sequence of matched moment sets.
      1) With a temporary marker (G00758, Cado Marker Pen), write the numbers 1 and 20 on the heaviest pair of blades. See Identification of Engine Components with Marks (Standard Practices, AMM 70-11-07/201).

2) Write the numbers 2 and 21 on the heaviest matched moment set of remaining fan blades.
3) Write the numbers 3 and 22 on the heaviest matched moment set of remaining fan blades.
4) Continue to write these numbers until you mark the lightest matched moment set with 19 and 38.

S 644-052-N00

(2) Lubricate the mid-span shrouds and blade roots of the blades with the method that follows.

WARNING: DO NOT LET THE LUBRICANT TOUCH YOUR SKIN. IF YOU TOUCH THE LUBRICANT, CLEAN YOUR SKIN WITH SOAP AND WATER IMMEDIATELY. THE LUBRICANT CAN CAUSE INJURY TO YOUR SKIN.

(a) With a brush, apply lubricant PWA 587 G-N Metal Assembly Paste (P06-005) to the contact faces of the mid-span shrouds of the blades.
(b) With a brush, apply lubricant PWA 587 G-N Metal Assembly Paste (P06-005) to the dove tail area of the fan blade roots.

NOTE: Do not apply lubricant to the fan hub slots or bottom face of the fan blade roots. Some lubricant is permitted on the area between the dove tail area and platform.

S 424-040-N00

(3) Do the steps that follow to install the fan blades in the correct position.

WARNING: DO NOT LET THE LUBRICANT TOUCH YOUR SKIN. IF YOU TOUCH THE LUBRICANT, CLEAN YOUR SKIN WITH SOAP AND WATER IMMEDIATELY. THE LUBRICANT CAN CAUSE INJURY TO YOUR SKIN.

(a) Apply the lubricant on the mating surface of the midspan shroud of the fan blades.

(b) Go clockwise while you install the fan blades (1), in the correct sequence, in the hub slot with the applicable number.
(c) Continue to install the fan blades, but do not install the last blade.
(d) Put the empty blade slot at the 12 o'clock position.
(e) Align the cutout with the empty blade slot.
(f) Install the last fan blade.

S 424-048-N00

CAUTION: BE CAREFUL WITH THE FAN BLADE WHEN YOU INSTALL IT. YOU CAN EASILY CAUSE DAMAGE TO THE SEAL THAT IS BONDED TO THE BOTTOM OF THE FAN BLADE PLATFORM.

(4) While you complete the fan blade installation, do the steps that follow to keep the blade shroud and root free to move.
  (a) Put the fan blades in their position.
  (b) Put each fan blade at the 12 o'clock position.
  (c) Go clockwise, as seen from the front, and carefully push each blade rearward, in the hub slot, in small increments.
  (d) Continue to move each fan blade rearward, at the 12 o'clock position, until all of the fan blades are fully installed.

H. Put the Airplane Back to its Usual Condition.

S 094-042-N00

(1) Remove the PWA 85035 support fixture (Fig. 402).

S 434-043-N00

(2) Install the blade lock (1) as follows (Fig. 401):
  (a) Put the anti-rotation pin of the blade lock with the slot in the hub.
  (b) With a fiber drift, start at the lock joint to fully install the blade lock.
  (c) Make sure the lock is correctly installed by measurement of the gap between the lock ends. The gap must be 0.010 - 0.060 inch (0.25mm - 1.52mm). If the gap measurement is not correct, you must make sure the lock is fully seated.

S 414-044-N00

(3) Install the inlet cone (AMM 72-31-01/401).

S 094-045-N00

(4) Remove the protective mat from the inner surface of the inlet cowl.

S 864-046-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

S 754-079-N00

(6) Do the test for the replacement of the fan blades (vibration survey) that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

LPC 1ST-STAGE FAN BLADE - INSPECTION/CHECK

1. General
   A. This procedure contains information on the inspection of the blades for the LPC 1st-stage fan. These blades are the first stage of the front compressor and can be seen from the front of the engine.
   B. The instructions that follow are standard inspection conditions which apply during all the inspection tasks.

      NOTE: Fan Blades must be cleaned with a clean cloth before the blades are visually inspected.

      (1) Blend limits are made to give blades the most satisfactory structural strength. The use of a large number of blades repaired to or near the maximum limits, or the use of blades which have many repaired areas, can decrease compressor efficiency and thus decrease the performance of the engine. Refer to AMM 72-31-02/801 for the limits on the quantity and size of the repaired areas.
      (2) All blade surfaces must be smooth. All signs of leading and trailing edge repairs must be smooth and rounded. Refer to AMM 72-31-02/801 for the minimum edge thickness limits.
      (3) To know the depth of a blend at the leading or trailing edge, you must measure from the initial edge contour (the edge contour when the blade was manufactured).

          NOTE: A blend is an area where damage was repaired and made smooth. To find the initial edge contour, use a straight edge.

          (a) You must add together the depth of each blend that is at the same position.
          (b) If the total depth of the blend is at its maximum limit from the initial edge contour, no more blends are permitted.
          (c) Do not measure from a raised material surface.
      (4) Blends directly opposite each other on leading and trailing edges are also added together and must not be more than the maximum depth of one leading or trailing edge blend.

(5) Maximum depth blends which are on the leading and trailing edges must be separated by a minimum distance equal to the mean chordal length of the blade. Refer to AMM 72-31-02/801 for the mean chordal limits.

(6) If two heavily repaired blades are adjacent, move the blades and their matched moment blades such that the damaged blades are installed symmetrically around the rotor. This will keep the engine vibration to a minimum.

(7) These blending procedures given here will make sure that damage at the surface and below the surface is removed. It is very important that the blending procedures are followed carefully when the repairs are done in the shop or on the wing. It is necessary to examine the repaired areas with Eddy Current or Flourescent Penetrant Inspection to make sure all surface damage has been removed.

(8) If there is damage on the fan blades, adjacent to the engine core inlet, it is necessary to examine the engine for Birdstrike (Foreign Object Damage) (AMM 72-00-00/601).

C. This procedure for the inspection of the 1st-stage fan blades is divided into the tasks that follow:

(1) General (this part of the procedure).
(2) 1st-Stage Fan Blade Airfoil Inspection of Surface Damage and Cracks.
(3) 1st-Stage Fan Blade Part Span Shroud Inspection for Damage.
(4) 1st-Stage Fan Blade Airfoil Inspection for Bends and Curl.
(5) 1st-Stage Fan Blade Platform Inspection for Damage.
(6) 1st-Stage Fan Blade Root Inspection for Damage.
(7) Fluorescent Penetrant Inspection of the Airfoil and Shroud for Cracks.
(8) Eddy Current Inspection of the Leading and Trailing Edges for Cracks.

TASK 72-31-02-206-066-N00

2. 1st-Stage Fan Blade Airfoil Inspection of Surface Damage and Cracks (Fig. 601)

A. General

(1) This inspection is done when it is necessary for a detailed inspection during a regular engine inspection check, such as made necessary by the Maintenance Review Board, or when you think there is foreign object damage.

B. Equipment

(1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

(2) Light source

(3) Mirror

(4) Gloves or a lint free cloth

C. Access

(1) Location Zones

411	Left Engine
422	Right Engine

D. Examine the Fan Blade Airfoil for Surface Damage and Cracks (Fig. 602).

S 866-071-N00

(1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 946-057-N00

CAUTION: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

(2) Put the protective mat on the inner surface of the inlet cowl.

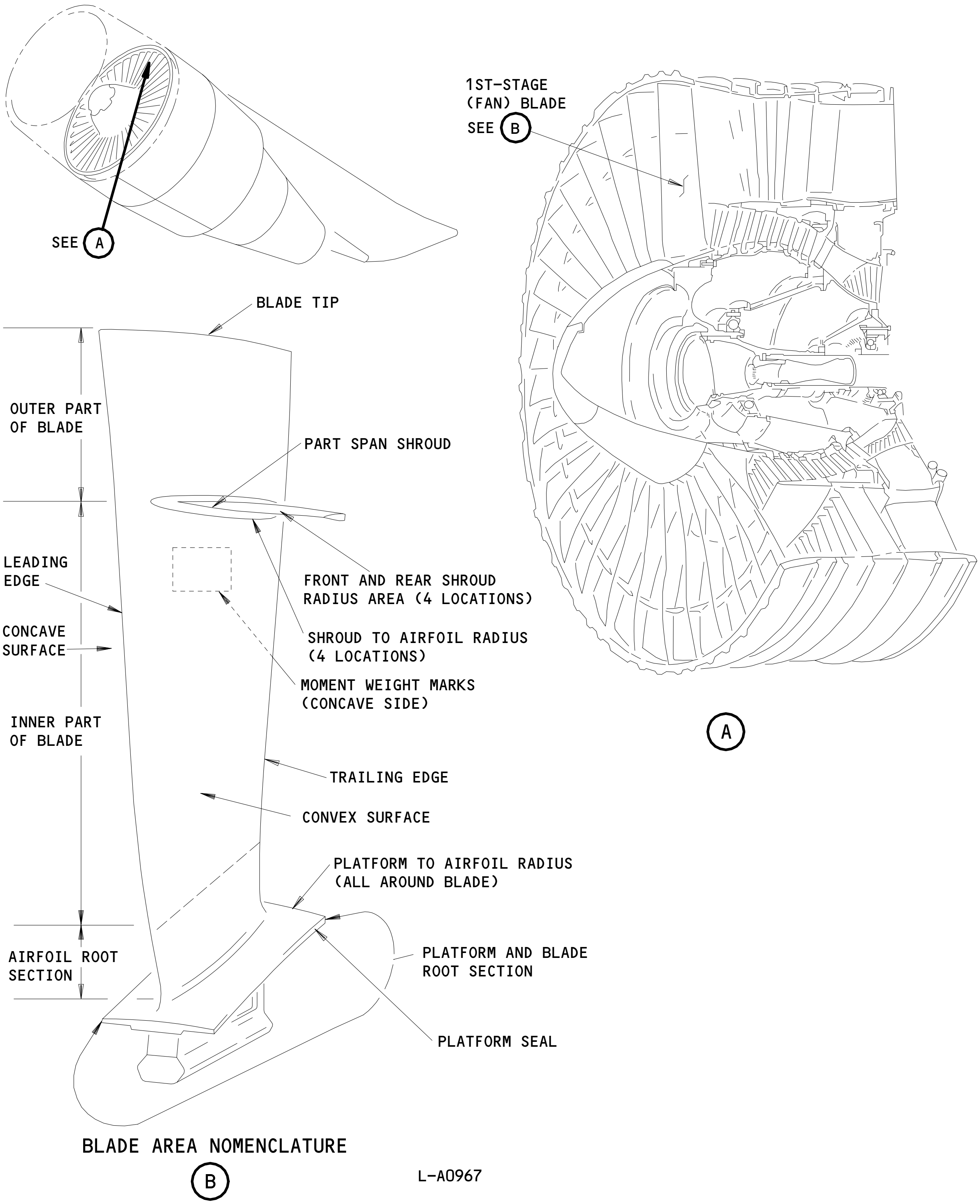
S 216-112-N00

WARNING: TO PREVENT INJURY TO YOUR HANDS, GLOVES SHOULD BE WORN WHEN YOU HANDLE THE BLADES.

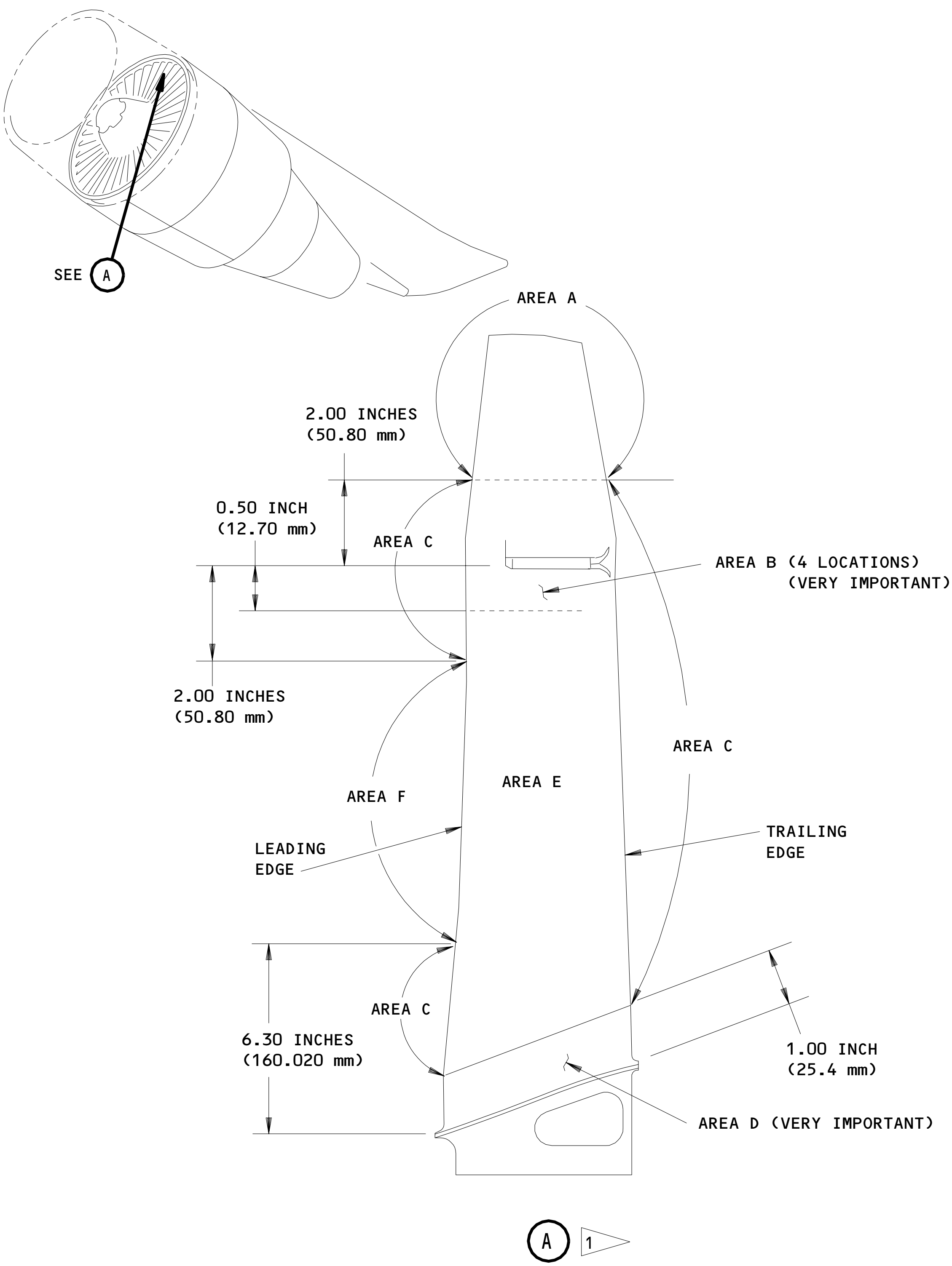
CAUTION: USE CAUTION WITH ANY ELECTRICAL EQUIPMENT USED NEAR THE BLADES. IF ANY ELECTRICAL SOURCE TOUCHES THE BLADE, CURRENT MAY PASS THROUGH TO THE BLADE AND CAUSE AN ARC BURN. THIS COULD RESULT IN A DECREASE IN THE MATERIAL STRENGTH OF THE BLADE. THIS COULD ALSO CAUSE CRACKS TO APPEAR IN THE BLADE.

(3) Use the equipment as follows to help find damage.

(a) Use a strong light and mirror.



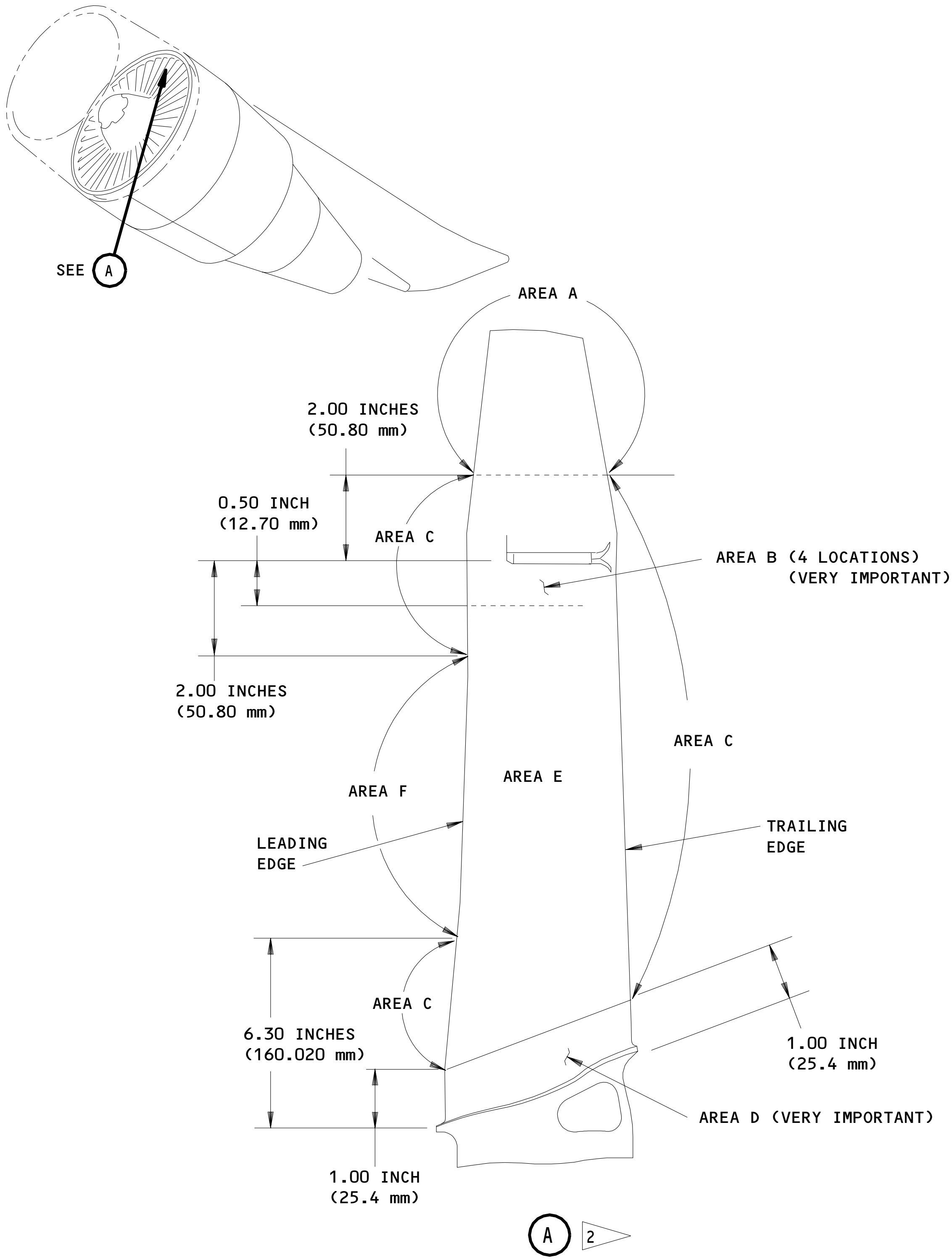
Name of 1st-Stage Blade Areas
Figure 601



1 ENGINES PRE-PHASE III

L-A8821 (0896)

1st-Stage Fan Blade Damage Limits
Figure 602 (Sheet 1)



2 ENGINES POST-PHASE III

L-A8821 (0896)

1st-Stage Fan Blade Damage Limits
Figure 602 (Sheet 2)

(b) Lightly rub the blade edge with gloves or a cloth (Which will catch on lifted material) to help find damage.

(c) Use your fingernails and fingertips to help find the size and condition of the damage.

EXAMPLE: Your fingernails can help you find if the damage has a sharp or rounded bottom.

S 216-059-N00

(4) Examine the tip (Area A) of the blade.

(a) Examine the tip for tears, which are not permitted.

(b) Examine the tip for nicks, dents and other damage.

(c) Blade tip color change (for example, a light blue color) is permitted.

S 216-106-N00

CAUTION: VERY CAREFULLY EXAMINE ALL DAMAGE TO THE LEADING AND TRAILING EDGES THAT IS IN THE AREA BETWEEN THE PART SPAN SHROUD AND THE PLATFORM. NICKS IN THE LEADING AND TRAILING EDGE BECOME MORE IMPORTANT THE CLOSER THEY ARE TO THE ROOT OF THE BLADE.

(5) Examine the leading and trailing edges and airfoil surfaces for nicks, dents and other damage.

(a) Examine the leading and trailing edges and airfoil surfaces for local damage such as lifted edges or compressed material.

(b) You must repair areas of lifted edges and compressed material which have small radii or rough edges (AMM 72-31-02/801).

NOTE: Use your fingernail to help identify a local, sharp nick or dent.

(c) It is permitted for blades with erosion to continue in service.

NOTE: Erosion is where a layer of the surface is gone. Signs of erosion are many, very small dents that feel like sand paper. Erosion limits are given at shop overhaul.

(d) Do not blend blades that have damage which is more than the limits in Table 601.

1) Keep the fan blades that were removed for possible subsequent repair, as specified by an approved repair source.

Table 601
Airfoil Damage Limits

EXAMINE THESE AIRFOIL AREAS	MAXIMUM DEPTH OF DAMAGE ON THE AIRFOIL		
	PERMITTED WITHOUT REPAIRS	PERMITTED AFTER REPAIRS	PERMITTED FOR 50 HOURS OF SERVICE AFTER REPAIRS
Area A The Tip	0.020 inch (0.508 mm)	0.750 inch (19.050 mm)	1.000 inch (25.400 mm)
Area B Shroud to Airfoil Radius	No Damage is Permitted	No Damage is Permitted	No Damage is Permitted
Area C Leading and Trailing Edges	0.005 inch (0.127 mm)	0.250 inch (6.350 mm)	0.300 inch (7.629 mm)
Area D Platform to Airfoil Radius	No Damage is Permitted	No Damage is Permitted	No Damage is Permitted
Leading and Trailing Edges	0.005 inch (0.127 mm)	0.150 inch (3.810 mm)	None (See Permitted After Repairs)
Area E Other Surfaces	0.020 inch (0.508 mm)	0.030 inch (0.762 mm)	0.060 inch (1.524 mm)
Area F Other Surfaces	0.005 inch (0.127 mm)	0.250 inch (6.350 mm) See *[1]	0.300 inch (7.629 mm) See *[1]

*[1] This limit may be found to be 0.500 inch (12.7 mm) maximum in the CRI Manual. The higher limit is allowed for necessary bead peen and ECI at overhaul facility.

S 216-060-N00

(6) Examine the airfoil for arc burn.

NOTE: Signs of arc burn are small circular or semicircular heat damaged areas on the blade surface that can have very small rounded dents, cracks, burned or melted areas.

(a) Arc burn is not permitted.

S 216-061-N00

(7) Examine the airfoil for cracks.
   (a) You must repair all cracks (AMM 72-31-02/801).

S 866-091-N00

(8) If you are done with the fan blade inspections, do the steps that follow:
   (a) Remove the protective mat from the inlet cowl.
   (b) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.

TASK 72-31-02-206-065-N00

3. 1st-Stage Fan Blade Part Span Shroud Inspection for Damage (Fig. 603)

A. General

(1) The part span shrouds will be called the shrouds in this task.

(2) This inspection is done when it is necessary for a detailed inspection during a regular engine inspection check, such as made necessary by the Maintenance Review Board, or when you think there is foreign object damage.

B. Equipment

(1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

C. Consumable Materials

(1) D00059 Lubricant - PWA 587 (P06-005)

D. Access

(1) Location Zones

411	Left Engine
422	Right Engine

E. Procedure

S 866-076-N00

(1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 866-077-N00

CAUTION: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

(2) Put the protective mat on the inner surface of the inlet cowl.

S 826-107-N00

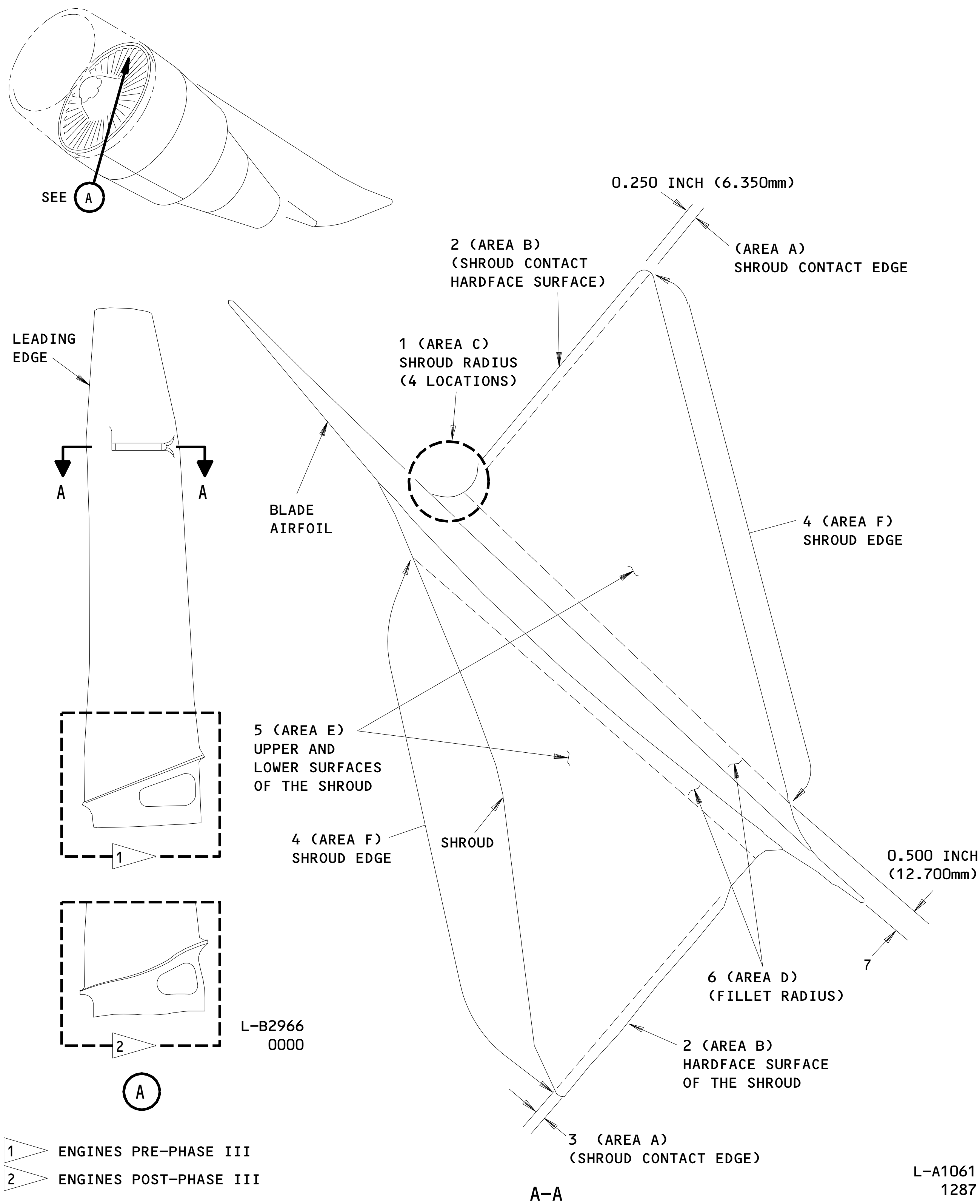
WARNING: USE GLOVES ON YOUR HANDS WHEN YOU HANDLE THE BLADES. THE BLADES ARE SHARP AND CAN CAUSE INJURY TO YOUR HANDS.

(3) Loosen all of the 1st-stage fan blades, if necessary, to make sure they are free to move at the shroud face at the 12 o'clock location.

S 216-064-N00

(4) Examine the fan blades for shrouds that are broken, fractured, have cracks, or are not there.

(a) A fan blade with a shroud that is broken, fractured, has cracks, or is not there is not permitted.



Names of the Fan Blade Shroud Areas
Figure 603

(b) If you find a shroud(s) that has cracks do the steps that follow:

1) Examine the shrouds of all the fan blades for cracks.

a) Carefully examine the shroud radius (Area C) that is on the concave side of the airfoil.

NOTE: It is very important to examine the side of Area C that is nearest to the root of the blade.

2) Remove the damaged fan blade(s), the blades that are on each side of it, and the matched moment blade of each removed blade.

NOTE: For each fan blade that has a shroud(s) that has cracks, you must remove six fan blades.

(c) If you find a shroud(s) that is broken (fractured) or not there do the steps that follow:

1) Remove and replace the damaged blade and two adjacent blades along with their three moment weighed pairs. Report the serial numbers of the adjacent blades.
2) Lubricate the shrouds and dispatch the aircraft.
3) Obey a 25 hour flyback limit until you do a NDI inspection of all concave shrouds per PW4ENG 72-478.
4) NDI reinspect all concave shrouds per SB PW4ENG 72-478 within 40 cycle.
5) Visually inspect at every 1/2 A-check (lubrication interval).

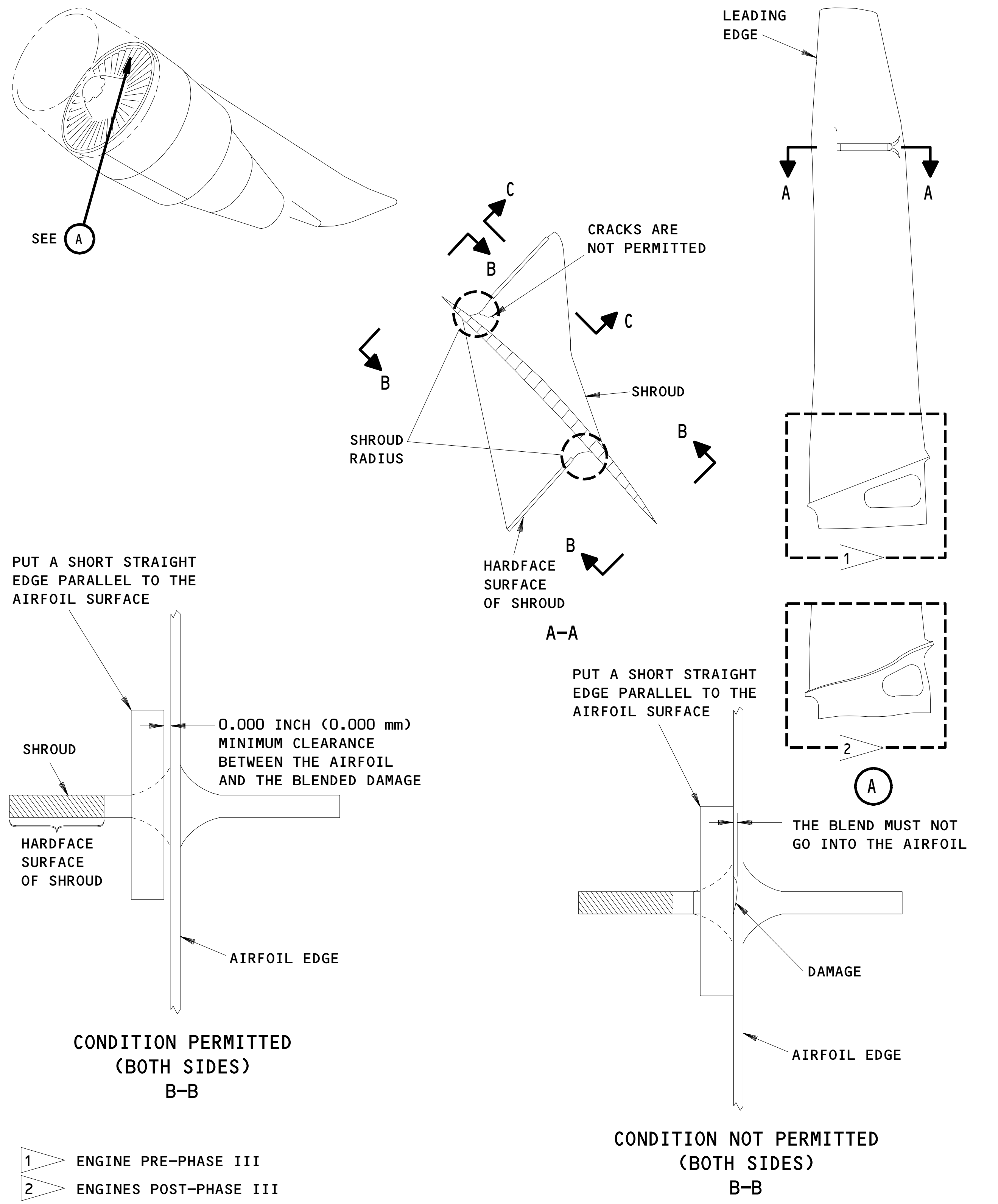
NOTE: This applies to the pre SB PW4ENG 72-536 fan rotors only. Inspect all phase III and post SB PW4ENG 72-536 fan rotors at every A-check.

6) NDI reinspect at next C-check.
7) NDI reinspect at all overhauls.
8) Notify P&W of any cracked fan blades found reporting:
- Total time
- Total cycles
- Part number and change letter
- Part serial number and heat code
- Engine serial number
- Cycles since last inspection.

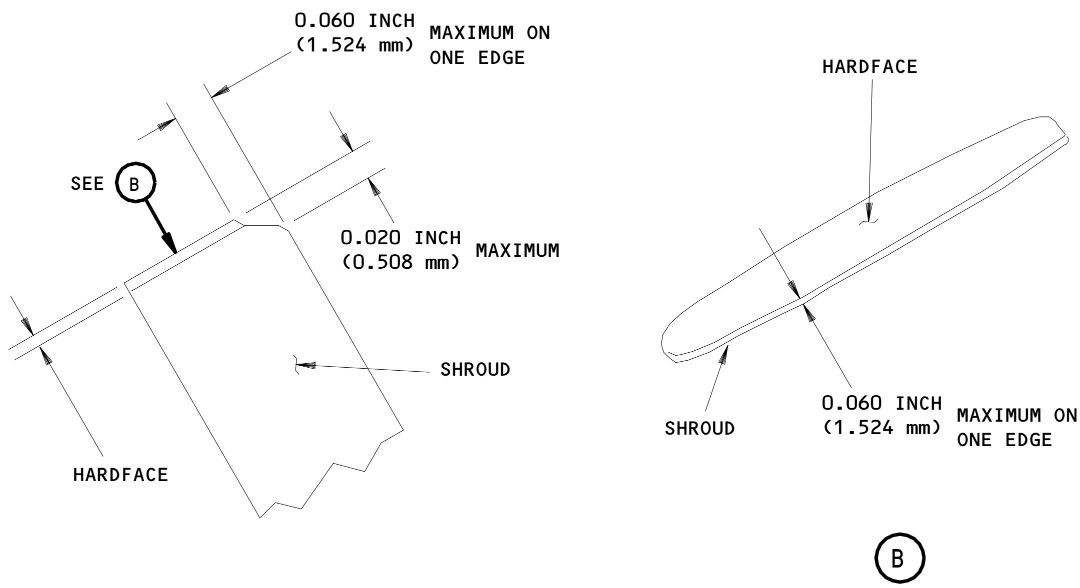
S 216-067-N00

(5) Examine Area A (shroud contact edge) for damage.

(a) No damage or blends are permitted in Area A.



Fan Blade Shroud Damage Limits
Figure 604 (Sheet 1)



CONDITIONS PERMITTED
(ONE EDGE AND ONE SIDE
OF THE SHROUD ONLY)
C-C

L-B2611 (0000)
PWV

Fan Blade Shroud Damage Limits
Figure 604 (Sheet 2)

G71870

S 216-068-N00

(6) Examine Area B (hardface surface of the shroud) for cracks, worn areas or damage on the hardface.

(a) With the rotor stopped and not held, manually push one blade rearward in the blade slot at the 12 o'clock position and pull the adjacent blade forward.

NOTE: You can hit the thick part of the shroud with your hand or with a soft rubber mallet to release the blades.

(b) Examine the shrouds for worn areas on the mating surfaces.

1) If there are areas where the hardface is worn through, do not use the fan blade.

NOTE: If the hardface is worn through, the operation of the engine can distort and peen the titanium shroud.

(c) Erosion, mismatch or coverage that is not complete on the shroud hardface surface is permitted if it meets the conditions below (Fig. 604).

1) A maximimum of 0.060 inch (1.524 mm) is permitted on one edge and on one side of the shroud only.

2) The surface must be well rounded with no sharp edges.

3) The depth must not be more than 0.020 inch (0.508 mm).

(d) Chips in the hardface surface which are larger than 0.060 inch (1.524 mm) are not permitted.

(e) If you think there is a crack, do a fluorescent penetrant inspection.

1) Cracks are not permitted.

S 216-069-N00

(7) Examine Area C (shroud radius) for damage (Fig. 604).

(a) Repair all damage that is not more than the repair limits (AMM 72-31-02/801).

1) The repairs must not go below the airfoil surface.

(b) Sharp edges are not permitted (AMM 72-31-02/801).

(c) If the damage is more than the blend limits, do not use the fan blade.

S 216-074-N00

(8) Examine Area D (fillet radius) for damage (Fig. 603).

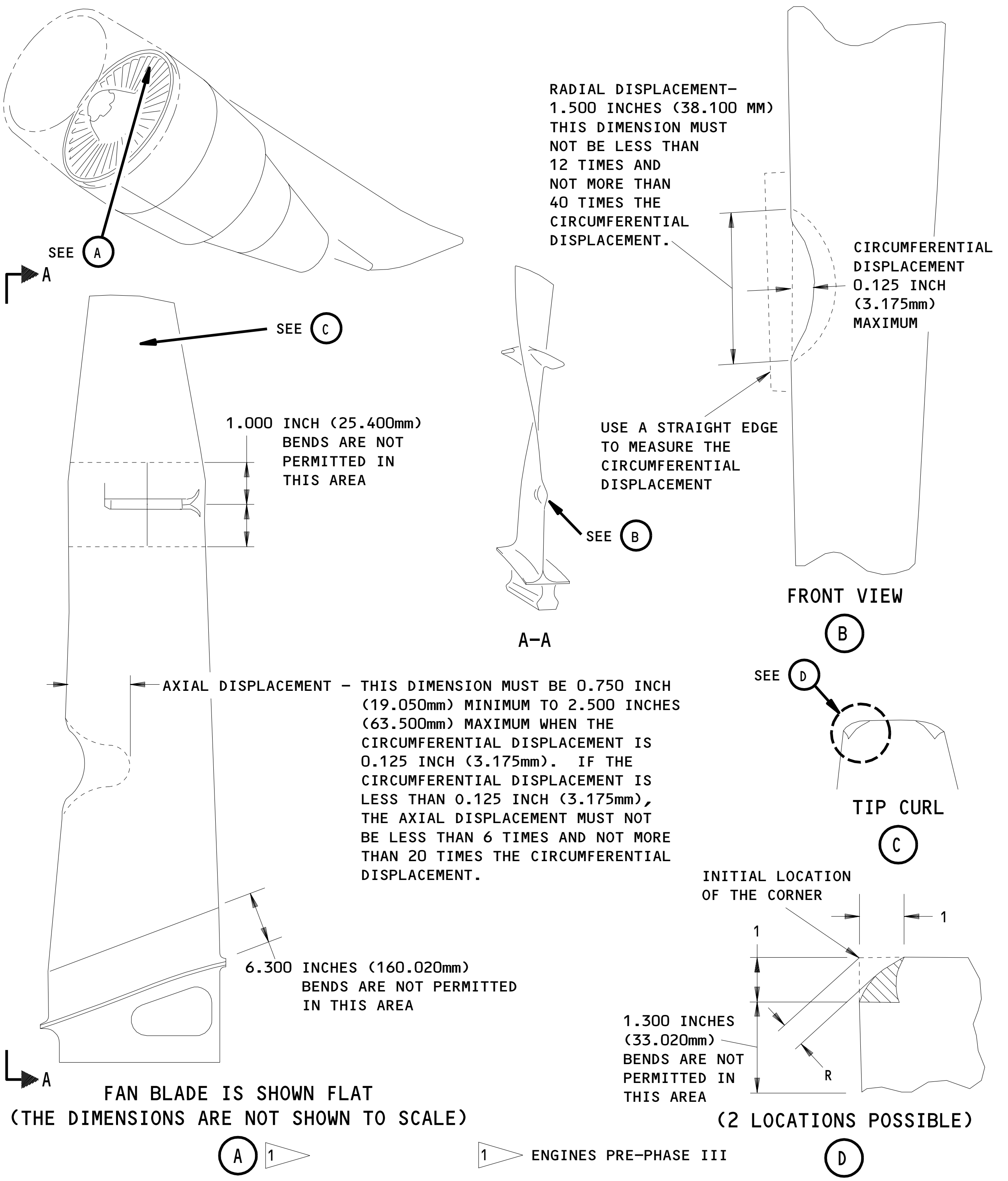
(a) Isolated damage with rounded bottoms that is less than 0.005 inch (0.127 mm) in depth is serviceable.

(b) No other damage is permitted.

S 216-075-N00

(9) Examine Area E (shroud upper and lower surfaces) for damage (Fig. 603).

(a) No damage is permitted.



1st-Stage Blade Airfoil Bend and Curl Limits
Figure 605 (Sheet 1)

(b) You must repair all damage that is less than the repair limits (AMM 72-31-02/801).
1) The maximum depth of a blend is 0.010 inch (0.254 mm).
(c) Fan blades that have shrouds that are broken, have cracks or are not there, are not permitted.

S 216-092-N00
(10) Examine Area F (shroud edges) for damage (Fig. 603).
(a) No damage is permitted.
(b) You must repair all damage that is less than the repair limits (AMM 72-31-02/801).
1) The maximum blend depth is 0.060 inch (1.524 mm).

S 646-111-N00

WARNING: DO NOT PERMIT THE LUBRICANT TO TOUCH YOUR SKIN. IF IT DOES, WASH YOUR SKIN IMMEDIATELY WITH SOAP AND WATER. THE LUBRICANT CAN CAUSE INJURY TO YOUR SKIN

(11) If there is not sufficient lubricant on the hardface surface of the shroud, do the steps that follow.
(a) With a brush, apply a layer of lubricant to area B, the hardface surface of the shroud.

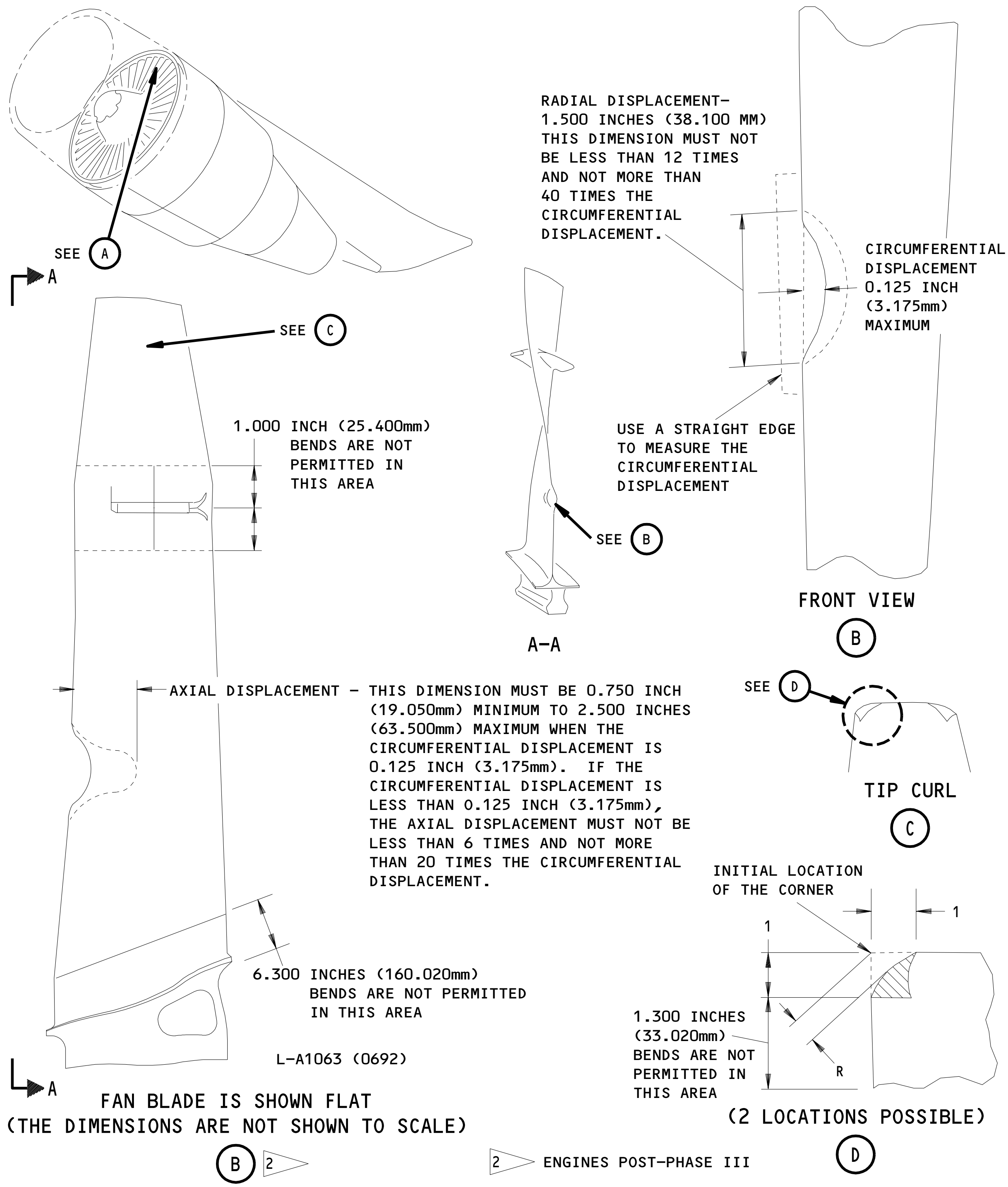
NOTE: The liquid-paste Molykote type G-N lubricant is easier to apply, and lubricates a longer time than the spray type Molykote.

(b) Remove the unwanted lubricant from the outer surfaces of the shroud and the blade airfoil.

S 986-080-N00
(12) Turn the rotor to put the adjacent two blades at the 12 o'clock position.

S 216-078-N00
(13) Do this inspection procedure again until you examine all the fan blades.

S 866-079-N00
(14) If you are done with the fan blade inspections, do the steps that follow:
(a) Remove the protective mat from the inlet cowl.
(b) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.



1st-Stage Blade Airfoil Bend and Curl Limits
Figure 605 (Sheet 2)

TASK 72-31-02-206-070-N00

4. 1st-Stage Fan Blade Airfoil Inspection for Bends and Curl (Fig. 605)

A. General
(1) This inspection is done when you think there is foreign object damage (FOD).

B. Equipment
(1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

C. Access
(1) Location Zones

411	Left Engine
422	Right Engine

D. Procedure (Fig. 605)

S 866-108-N00

(1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 866-093-N00

CAUTION: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

(2) Put the protective mat on the inner surface of the inlet cowl.

S 216-094-N00

WARNING: TO PREVENT INJURY TO YOUR HANDS, GLOVES SHOULD BE WORN WHEN YOU HANDLE THE BLADES.

(3) Examine the tip of the blade for bends and curl.

NOTE: A curl is a small bend.

(a) Tip curl is permitted as follows:
1) Index 1 must not be more than 0.200 inch (5.080 mm).
2) No more than three adjacent blades with tip curl are permitted.
3) No more than a total of five blades with tip curl are permitted.
4) Tip curl with cracks or tears is not permitted.

(b) A blade with the conditions that follow can continue in service without repair for 50 hours.
1) Index 1 must not be more than 2.000 inches (50.800 mm).
2) Index R must not be more than 0.500 inch (12.700 mm).

S 216-072-N00

(4) Examine the leading and trailing edges for bends.

S 216-073-N00

(5) If the bends are more than the limits, remove the fan blade and keep it for a possible subsequent repair.

S 866-095-N00

(6) If you are done with the fan blade inspections, do the steps that follow:
   (a) Remove the protective mat from the inlet cowl.
   (b) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.

TASK 72-31-02-206-081-N00

5. 1st-Stage Fan Blade Platform Inspection for Damage (Fig. 606)

A. General

(1) This inspection is done when you think there is foreign object damage (FOD).

B. Equipment

(1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

C. Access

(1) Location Zones

411	Left Engine
422	Right Engine

D. Procedure

S 866-085-N00

(1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 866-109-N00

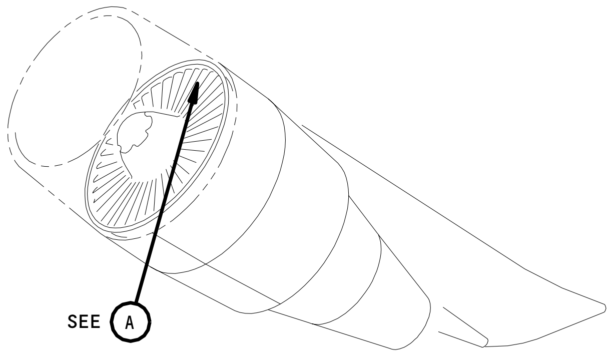
CAUTION: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

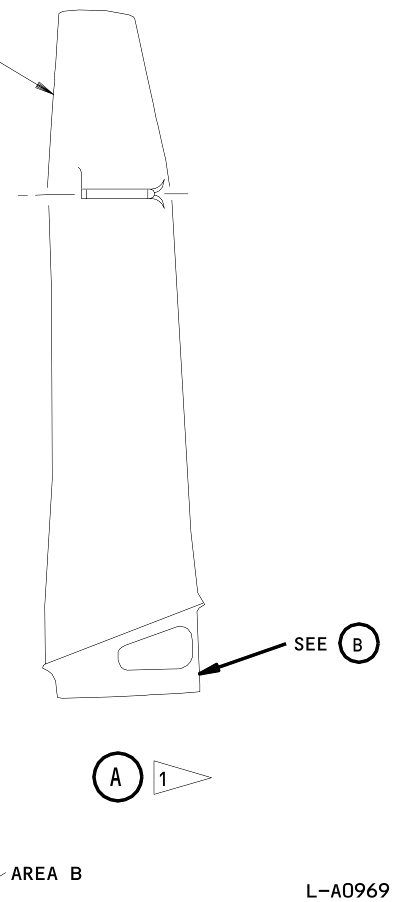
(2) Put the protective mat on the inner surface of the inlet cowl.

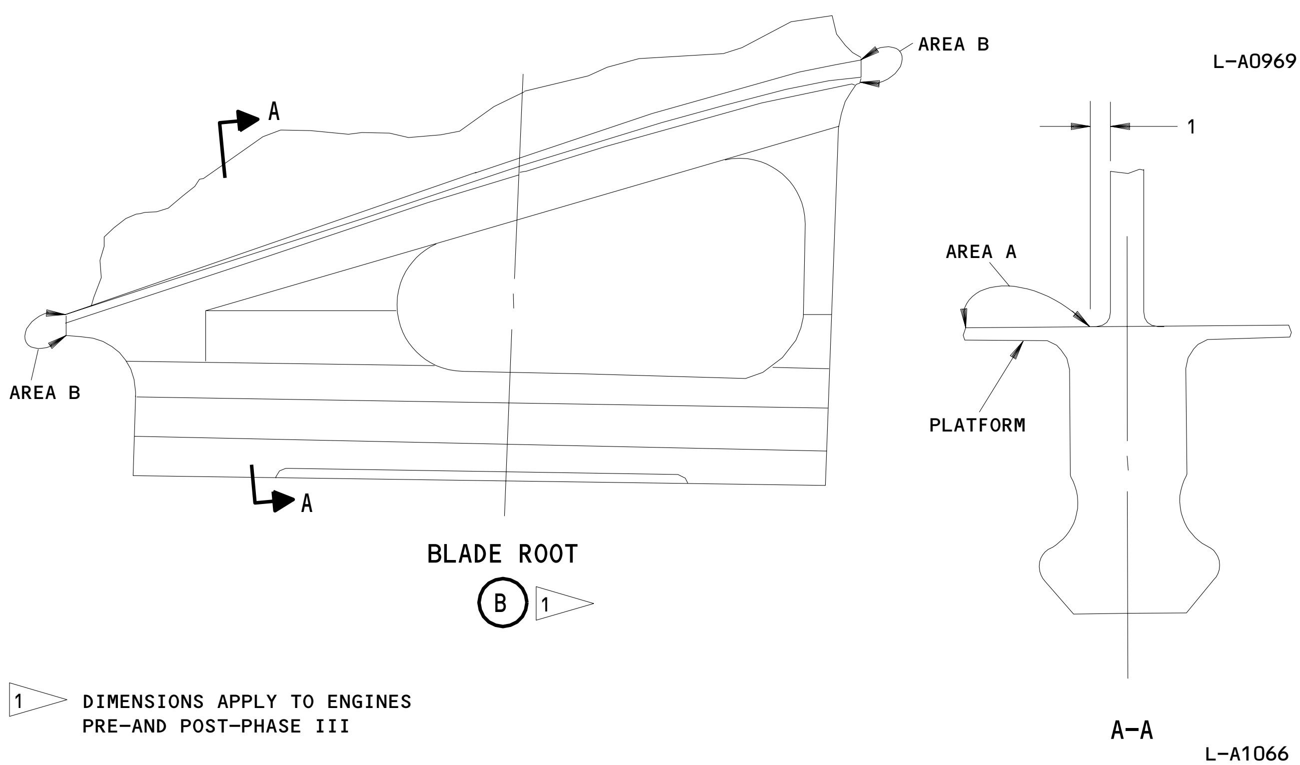
S 216-110-N00

WARNING: TO PREVENT INJURY TO YOUR HANDS, GLOVES SHOULD BE WORN WHEN YOU HANDLE THE BLADES.

(3) Examine the platform surfaces for nicks, dents, and scratches (Fig. 606, and Table 602).
   (a) Use 10X magnification.
   (b) Repair the blades that have damage (AMM 72-31-02/801).

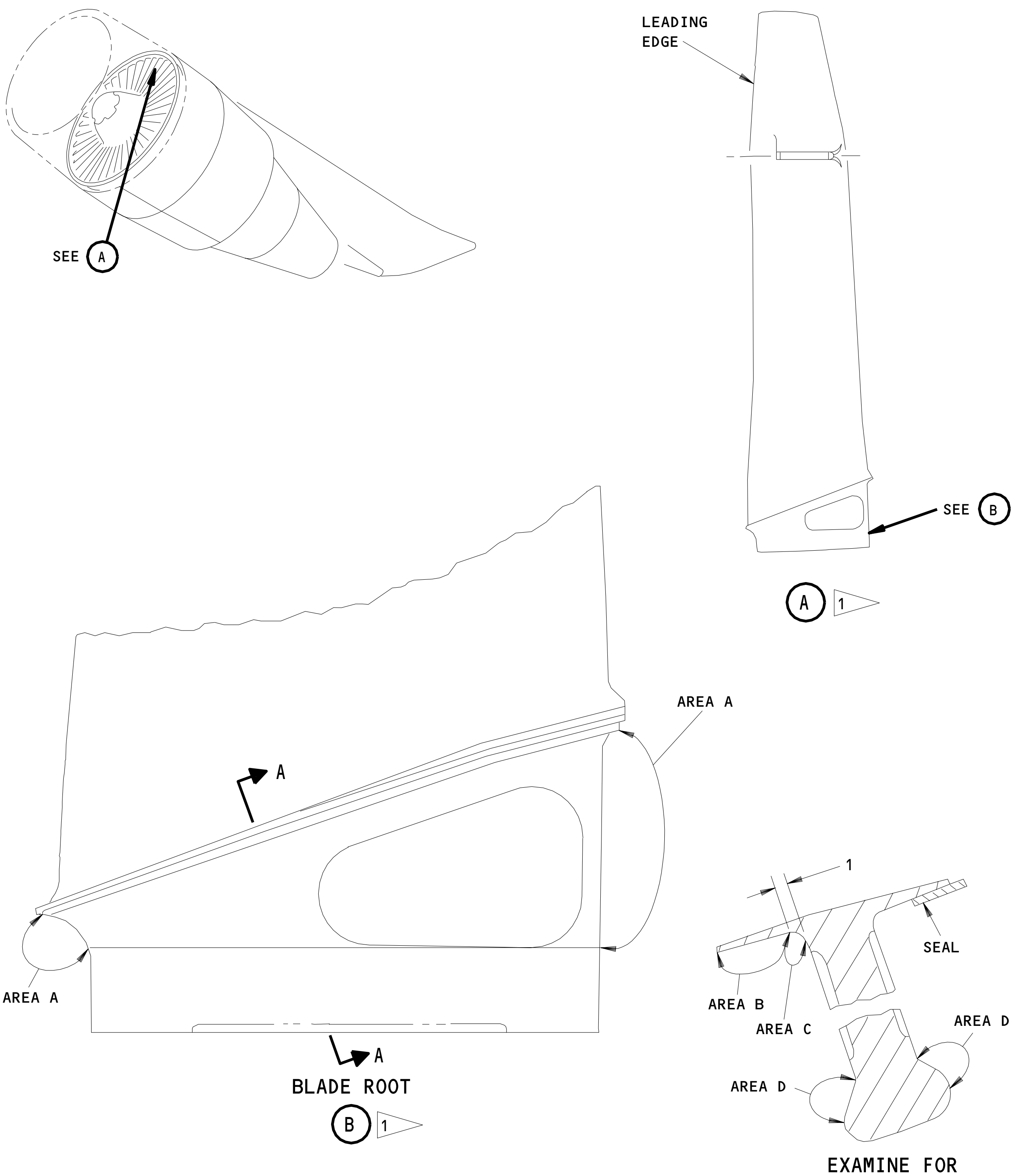






1 DIMENSIONS APPLY TO ENGINES PRE-AND POST-PHASE III

1st-Stage Blade Platform Inspection Limits
Figure 606



1 DIMENSIONS APPLY TO ENGINES PRE-AND POST-PHASE III

L-A1326(0692)

1st-Stage Blade Leading and Trailing Edge Root Blend Limits
Figure 607

TABLE 602
PLATFORM INSPECTION LIMITS

EXAMINE THESE AREAS	MAXIMUM DEPTH OF DAMAGE ON THE PLATFORM	
	PERMITTED WITHOUT REPAIRS	PERMITTED IF REPAIRED
Dimension 1 (For Reference)	0.300 Inch (7.620 mm) minimum	
Area A Platform Surface	0.005 Inch (0.127 mm)	0.020 inch (0.508 mm)
Area B Root Face	0.005 Inch (0.127 mm)	0.040 inch (1.016 mm)

S 216-083-N00

(4) Examine the platform for cracks.
   (a) Remove fan blades that have cracks in the platform, because cracks are not permitted in the platform and you cannot repair cracks.

S 866-084-N00

(5) If you are done with the fan blade inspections, do the steps that follow:
   (a) Remove the protective mat from the inlet cowl.
   (b) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.

TASK 72-31-02-206-086-N00

6. <u>1st-Stage Fan Blade Root Inspection for Damage</u> (Fig. 607)

A. General

(1) This inspection is done when the blade root is open to view.

B. Equipment

(1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

C. Access

(1) Location Zones

411	Left Engine
422	Right Engine

D. Procedure

S 866-101-N00

(1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 866-102-N00

<u>CAUTION</u>: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

(2) Put the protective mat on the inner surface of the inlet cowl.

S 016-103-N00

(3) Remove the inlet cone (AMM 72-31-01/401).

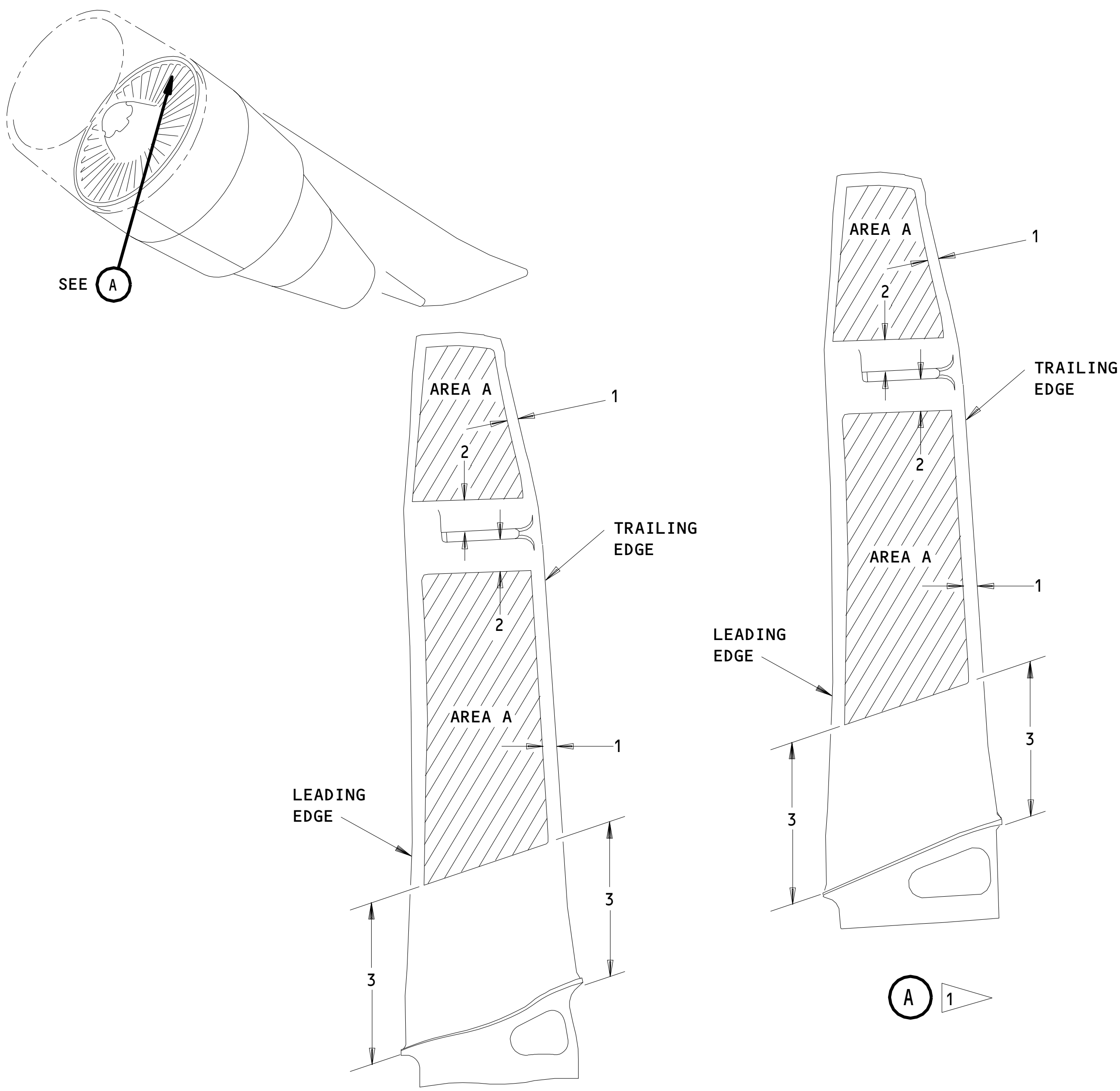
S 216-104-N00

<u>WARNING</u>: TO PREVENT INJURY TO YOUR HANDS, GLOVES SHOULD BE WORN WHEN YOU HANDLE THE BLADES.

(4) Examine the platform for loose rubber seals or for rubber seals that have damage or are not there.

(a) Replace rubber seals that are loose, have damage or are not there (AMM 72-31-02/801).

<u>NOTE</u>: Partially unbounded or raised seals must be trimmed so they do not protrude into the airstream. A trimmed seal counts as a missing seal.



1. 0.500 INCH (12.700 mm) ALL AROUND
2. 0.500 INCH (12.700 mm)
3. 6.300 INCHES (16.020 cm)

NOTE: INSPECTION IS NOT NECESSARY IN AREA A.

1 ENGINES PRE-PHASE III
2 ENGINES POST-PHASE III

L-A0970

1st-Stage Blade Fluorescent Penetrant Inspection Areas
Figure 608

(b) A maximum of 19 seals in any location can be partially or completely missing until the next C check.
(c) At the next C check, you must replace all of the missing seals, or you must install fan blade pairs with properly bonded seals to replace all fan blades with missing seals.
(d) For an option, it is permitted to continue service operation without restriction with a maximum of 6 missing seals in any location.

S 216-105-N00
(5) Examine Areas A, B, and C for worn areas, nicks, dents and other damage (Fig. 607, and Table 603).
(a) Repair blades that have damage that is more than the limits.

TABLE 603
BLADE ROOT INSPECTION LIMITS

EXAMINE THESE AREAS	MAXIMUM DEPTH OF DAMAGE ON THE BLADE ROOT	
	PERMITTED WITHOUT REPAIRS	PERMITTED IF REPAIRED
Dimension 1 (For Reference)	0.200 Inch (5.080 mm) Minimum	
Area A Root Edge	0.005 Inch (0.127 mm)	0.040 inch (1.016 mm)
Area B Platform Surface	0.005 Inch (0.127 mm)	0.020 inch (0.508 mm)
Area C Radius Under Platform	0.000 Inch (0.000 mm)	0.005 inch (0.127 mm)

S 216-088-N00
(6) Examine Area D for galling.
(a) If you find much galling, you must use the visual inspection that is in the Engine Manual to Examine the Fan Blade.

S 216-089-N00
(7) Examine all areas of the blade root for cracks.
(a) Remove fan blades that have cracks in the blade root, because you cannot repair cracks in the blade root.

S 866-090-N00
(8) If you are done with the fan blade inspections, do the steps that follow:
(a) Install the inlet cone (AMM 72-31-01/401).
(b) Remove the protective mat from the inlet cowl.

(c) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.

TASK 72-31-02-206-087-N00

7. Fluorescent Penetrant Inspection of the Airfoil and Shroud for Cracks (Fig. 608)

A. General
   (1) Do this inspection (or an eddy current inspection) if you think there are cracks and after you repair damage.

B. Equipment
   (1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

C. References
   (1) AMM 70-11-06/201, Fluorescent Penetrant Inspection

D. Access
   (1) Location Zones

411	Left Engine
422	Right Engine

E. Procedure

S 866-096-N00

   (1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 866-099-N00

CAUTION: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

   (2) Put the protective mat on the inner surface of the inlet cowl.

S 216-097-N00

WARNING: TO PREVENT INJURY TO YOUR HANDS, GLOVES SHOULD BE WORN WHEN YOU HANDLE THE BLADES.

   (3) With ultra high sensitivity penetrant, examine the areas of the blade where you think there are cracks (AMM 70-11-06/201).
      (a) Cracks are not permitted.

S 026-113-N00

   (4) If you are done with the fan blade inspections, do the steps that follow:
      (a) Remove the protective mat from the inlet cowl.
      (b) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.

TASK 72-31-02-206-100-N00

8. Eddy Current Inspection of the Leading and Trailing Edges for Cracks.

A. General

(1) Do this inspection (or a fluorescent penetrant inspection) if you think there are cracks and after you repair damage.

B. Equipment

(1) Protective mat - Rubber Manufacturer's Association, Grade SC43, neoprene sponge, 1 inch thick, approximately 5x6 feet with warning streamers attached (3 required).

(2) Standard - Crack, PWA 28403

(3) Probe - Leading Edge, PWA 28404, (Optional to PWA 75909)

(4) Probe - Trailing Edge, PWA 28443 (Optional to PWA 75909)

(5) Probe - PWA 75909, Pratt & Whitney Aircraft

(6) Eddy Current Instrument - Model ED 1500, Magnaflux Corporation, 7300 W. Lawrence Ave., Chicago, Ill. 60656 (Recommended), or Commercially Available (Alternative)

(7) Eddy Current Instrument, Foerster Defectometer - Model H 2.835 or equivalent model available from: Foerster Instruments Inc. 140 Insustry Drive, RIDC Park West, Pittsburg, PA 14275 U.S.A R or Institute Dr. Friedrich Forster, Prufgeratebau Gmbh & Co. KG, In Laisen 70, D7410 Reutlingen FRG (Recommended), or Commercially Available (Alternative)

(8) Detectometer - 2.154 or 2.164 Krauthromer - Branson Inc., 76 Progress Drive, Standford, Conn. 06904 or Institute Doctor Forster, D-7410 Reutlingen, Grathwohl STR-4, West Germany (Recommended), or Commercially Available (Alternative)

(9) Signal Recorder, Soltec High Speed, Model 6214 Mainframe with 6200-0654 Single Pen Input Module available from: Soltec Corporation R Sol Vista Park R 12977 Arroyo Street San Fernando, CA 91340-1597 U.S.A

(10) Signal Recorder (Optional) - Models 135X, 7034A, 7044, or 680, (International) Hewlett-Packard 3200 Hillview Ave., Palo Alto, CA 94304 or (Domestic) Hewlett Pa ckard, 1501 Page Hill Road, Palo Alto, CA 94306 (Recommended), or Commercially Available (Alternative)

(11) Patch Cord, RS232 - Foerster Defectometer to Soltec High Speed Signal Recorder. Purchased from any of the respective manufacturers.

C. Consumable Materials
   (1) B00666 - Solvent, Methyl Propyl Ketone (MPK)
   (2) G02187 Tape - MISC 148 Teflon Adhesive, Type T
   (3) G02188 Cloth, Abrasive - MISC 114, 240 Grit, Aluminum Oxide

D. References
   (1) AMM 72-31-01/401, Inlet Cone
   (2) AMM 72-31-02/801, LPC 1st-Stage Fan Blades

E. Access
   (1) Location Zones

411	Left Engine
422	Right Engine

F. Prepare for Inspection

S 866-001-N00

(1) Attach the DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead P5.

S 946-028-N00

CAUTION: MAKE SURE YOU USE A PROTECTIVE MAT. IF YOU DO NOT, DAMAGE MAY RESULT TO THE INNER SURFACE OF THE INLET COWL.

(2) Put the protective mat on the inner surface of the inlet cowl.

G. Eddy Current Inspection of the Fan Rotor Blades

S 846-115-N00

WARNING: TO PREVENT INJURY TO YOUR HANDS, GLOVES SHOULD BE WORN WHEN YOU HANDLE THE BLADES.

CAUTION: NICKS IN THE LEADING AND TRAILING EDGE BECOME MORE IMPORTANT THE CLOSER THEY ARE TO THE ROOT OF THE BLADE. THEREFORE, MAKE SURE THAT THE PART OF THE BLADE FROM THE PART SPAN SHROUD TO THE PLATFORM IS TOUCHED VERY CAREFULLY TO PREVENT DAMAGE TO THAT AREA.

(1) Prepare the blade for the inspection.

WARNING: DO NOT GET SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE SOLVENT. KEEP SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. SOLVENT IS POISONOUS. FLAMMABLE SOLVENT CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(a) Wipe the edges of the blades with a cloth which has been made moist with Methyl Propyl Ketone (MPK).
(b) Use a No. 240 grit emery cloth to remove any irregular areas on the surface before you do the inspection.

S 826-006-N00
(2) Calibrate and set the equipment.

NOTE: Instrumentation should be calibrated before and after each set of blades is inspected. Also calibrate the equipement if the instrumentation has been turned off. Teflon tape on the tip of probe tip must be changed regularly to prevent wear on the probe tip.

(a) Connect any of these probes: PWA75909, PWA28404 or PWA28443 to the eddy current instrument. If a recorder is used, connect the recorder to the eddy instrument. Then turn on the instrument and the recorder, if applicable, and allow both to warm up as specified by the manufacturers.

NOTE: If the Model 680 chart recorder is used, a fine control potentiometer must also be used to change the resistance in the circuit. This is used to adjust the eddy current trace to the correct amplitude.

(b) Cover the rub surface of the probe tip with teflon tape which has a thichness of six mil. This allows the probe to follow the surface more easily and also decreases the wear on the probe tip.
(c) Set the instrument to the Fe position.

(d) Tune the probe with a PWA28403 Crack Standard to set the lift-off compensation. Use the edge of the tool which has the sharp radius and is away from the crack standard slot. Move the probe across the slot moderately fast and with a constant velocity. Adjust the probe so that the meter deflection is five units when the probe is moved across the standard slot. If an optional recorder is used, set the sensitivity on the recorder so that the eddy current trace shows a 2.50 inches (63.50 mm) spike when the probe is moved across the standard slot.

NOTE: Moderately fast is specified as approximately 0.5 in per second (12.700 mm per second).

A spike is a fast movement of the meter which is over the base meter level.

(e) If a recorder is used, adjust the speed of the chart to show a 4.00 - 6.00 inches (101.60 - 152.40 mm) trace as the probe is moved along the edge of the blade.

S 256-007-N00

(3) Do the inspection of the blade edge

NOTE: As the probe moves closer to the platform, the edge of the blade may become too thick to fit into the probe. Therefore, it is permitted to slowly lift the probe off the blade edge if the usual eddy current signal for lift-off appears.

Table 604
Eddy Current Probe Application

PROBE	LOCATION CHECKED WITH BLADE TOOL	CONDITION OF BLADE
PWA 75909	Leading and Trailing Edges	Installed or Uninstalled
PWA 28404 (PWA 75909 OPT)	Leading and Trailing Edges	Uninstalled
	Leading Edge Only	Installed
PWA 28443 (PWA 75909 OPT)	Trailing Edge Only	Installed

(a) With the PWA75909 or the PWA28404 Probe, move the probe across the leading or trailing edge of the blade. Start at the blade tip and scan the full length of the leading edge. Refer to Table 1.

NOTE: The speed at which the probe is moved should be sufficiently slow so that the deflection of the meter is clearly different than the normal base indications.

CAUTION: OBEY THE INSTRUCTIONS WHEN YOU INSTALL THE TRAILING EDGE PROBE. INCORRECT INSPECTION OF THE BLADE EDGE COULD RESULT.

(b) Put the PWA75909, PWA28404, or PWA28443 Probe on the convex side of the airfoil with the eddy current coil in the lower ear of the probe. Move the probe along the trailing edge of the blade. Start at the blade tip and move the probe along the full length of the trailing edge. Refer to Table 1.

NOTE: Correct installation of the probe is necessary to inspect the blade root platform as carefully as possible.

(c) Any spikes which occur is cause for more inspection. Examine this area more carefully to make sure that the spikes are not caused by human error.
(d) Use your fingers to examine for damage on the blade edge.
(e) Small foreign object damage which can be repaired by blending can cause a signal to appear on the meter. This signal can cause a movement of the meter one unit upwards. This will be followed by a movement of the meter down to its original position. Blend this area per 72-31-02-8 and inspect again.
(f) If any one-unit or more movement of the meter occurs in an area which has been blended free of damage, the results should be seen as cracks.
   1) Repair the fan blade (AMM 72-31-02/801).
   2) If the depth of the crack is more than the limits, keep the blade for a possible subsequent repair.

1ST-STAGE (FAN) BLADES - APPROVED REPAIRS

1. General
   A. This procedure has three repairs for the fan blades.
      (1) The repair of the 1st-stage fan blades.
      (2) The replacement of damaged rubber seals.
      (3) The repair of the leading edge contour.
   B. The 1st-stage fan blades are the first stage of the low pressure compressor (LPC).
   C. You can go into the inlet cowl to get access to the 1st-stage fan blades.

TASK 72-31-02-308-003-N00

2. Repair 1st-Stage Blade Airfoil By Blending
   A. General
      (1) You will blend the edges and the surfaces of the 1st-stage fan blades to do the repair. You can blend the blades with a high quality file, an abrasive cloth, or an abrasive stone. You can blend with a slow speed power tool if you must remove a large quantity of material.
   B. References
      (1) AMM 70-11-06/201, Fluorescent Penetrant Inspection
      (2) AMM 70-11-07/201, Marking of Parts
      (3) AMM 70-11-08/201, Power Denicking and Buffing of Titanium Parts
      (4) AMM 72-31-02/401, LPC 1st-Stage Fan Blades
      (5) AMM 72-31-02/601, LPC 1st-Stage Fan Blades
   C. Access
      (1) Location Zones

410	Left Power Plant Nacelle
420	Right Power Plant Nacelle

   D. Repair the 1st-Stage Fan Blades.

S 868-001-N00

      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 228-054-N00

WARNING: ALWAYS WEAR GLOVES WHEN YOU TOUCH THE FAN BLADES. THE FAN BLADES ARE SHARP AND CAN CAUSE INJURY TO YOUR HANDS.

CAUTION: BE VERY CAREFUL WHEN YOU REPAIR DAMAGE THAT IS IN THE INNER HALF OF THE AIRFOIL. NICKS THAT ARE IN THE LEADING AND TRAILING EDGES CHANGE THE OPERATION OF THE ENGINE MORE WHEN THEY ARE NEARER TO THE BASE OF THE BLADE.

CAUTION: IF YOU USE A POWER TOOL TO BLEND, MAKE SURE THERE IS NOT TOO MUCH HEAT. THE POWER CUTTING TOOLS MAY BE USED IF YOU EXAMINE THE BLADE FROM TIME TO TIME FOR THE HEAT BUILD UP. IF THE BLADE BECOMES TOO HOT, IT CAN BECOME WEAK AND GET FRACTURES. IF THE BLADE BECOMES TOO HOT FOR YOU TO TOUCH, LET THE SURFACE BECOME COOL BEFORE YOU CONTINUE.

(2) Obey the steps that follow when you repair the 1st-stage fan blades.

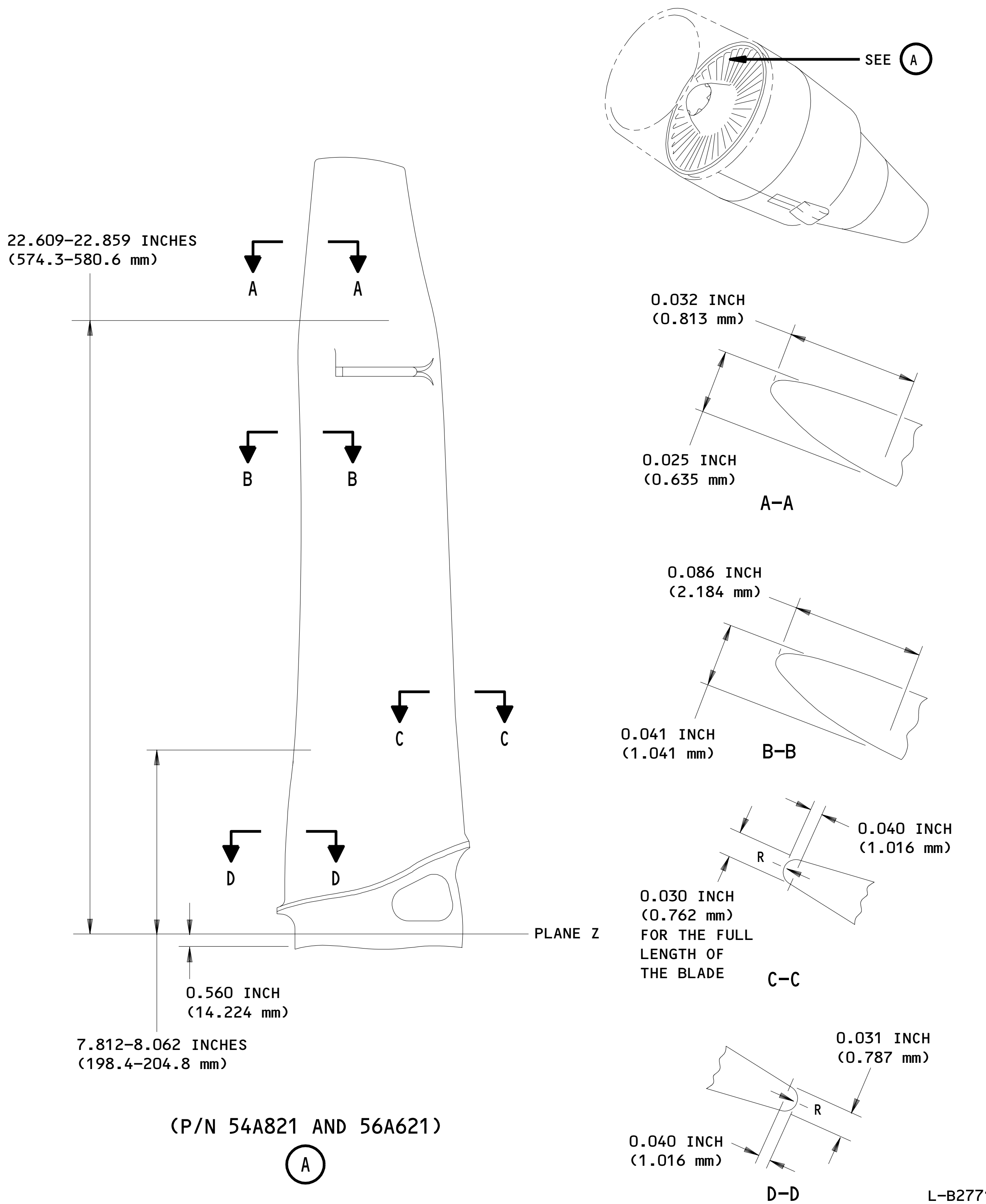
NOTE: Tools that are not sharp or are worn, or filled abrasive cloth cause the temperature to increase quickly. Examine the tools and equipment frequently and replace them when it is necessary.

(a) All blended areas on the blade surface must be smooth.
(b) All repairs on the leading and trailing edges must be smooth and have sufficiently rounded edges (Fig. 801).
(c) All repaired areas on the leading and trailing edges must have a thickness that is not less than the minimum edge thickness (Fig. 801).
(d) To use the blend limits, compare the depth of the blended area with the contour of a new blade (Fig. 804 and 805).

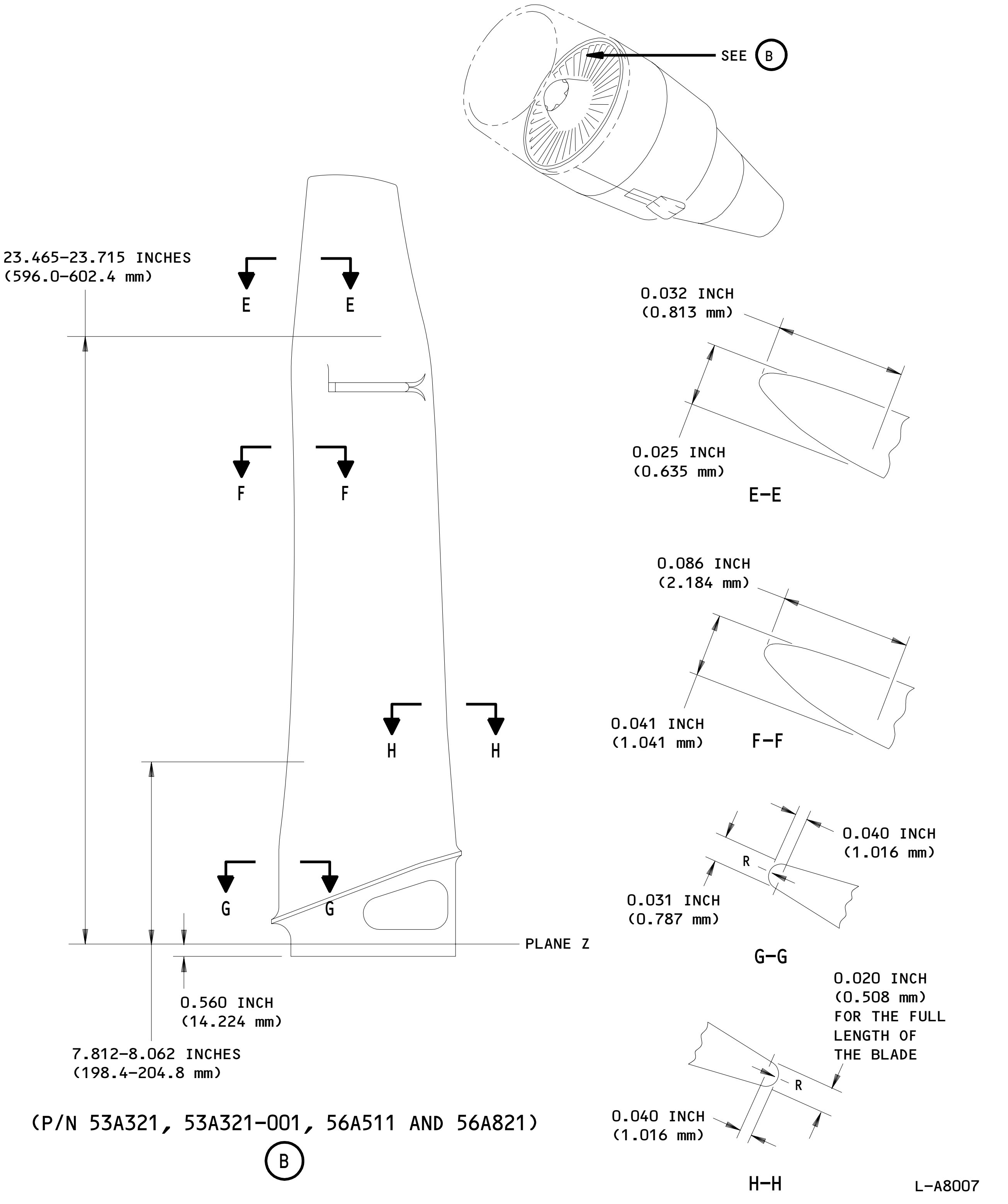
NOTE: For example, the blend depth limit is 0.500 inch (12.700 mm) and the blended area has a depth of 0.200 inch (5.080 mm). In this area, the sum of the depths of all subsequent repairs cannot be more than 0.300 inch (7.620 mm) in that location.

(e) The sum of the depths of blended areas that are on immediately opposite edges of the blade has the limit that follows.
1) The sum of the depths must not be more than the limit for one blended area on the leading or trailing edge.
(f) The minimum distance between blended areas that are at the maximum depth on opposite edges of the blade must not be less than the average blade width (Fig. 802).

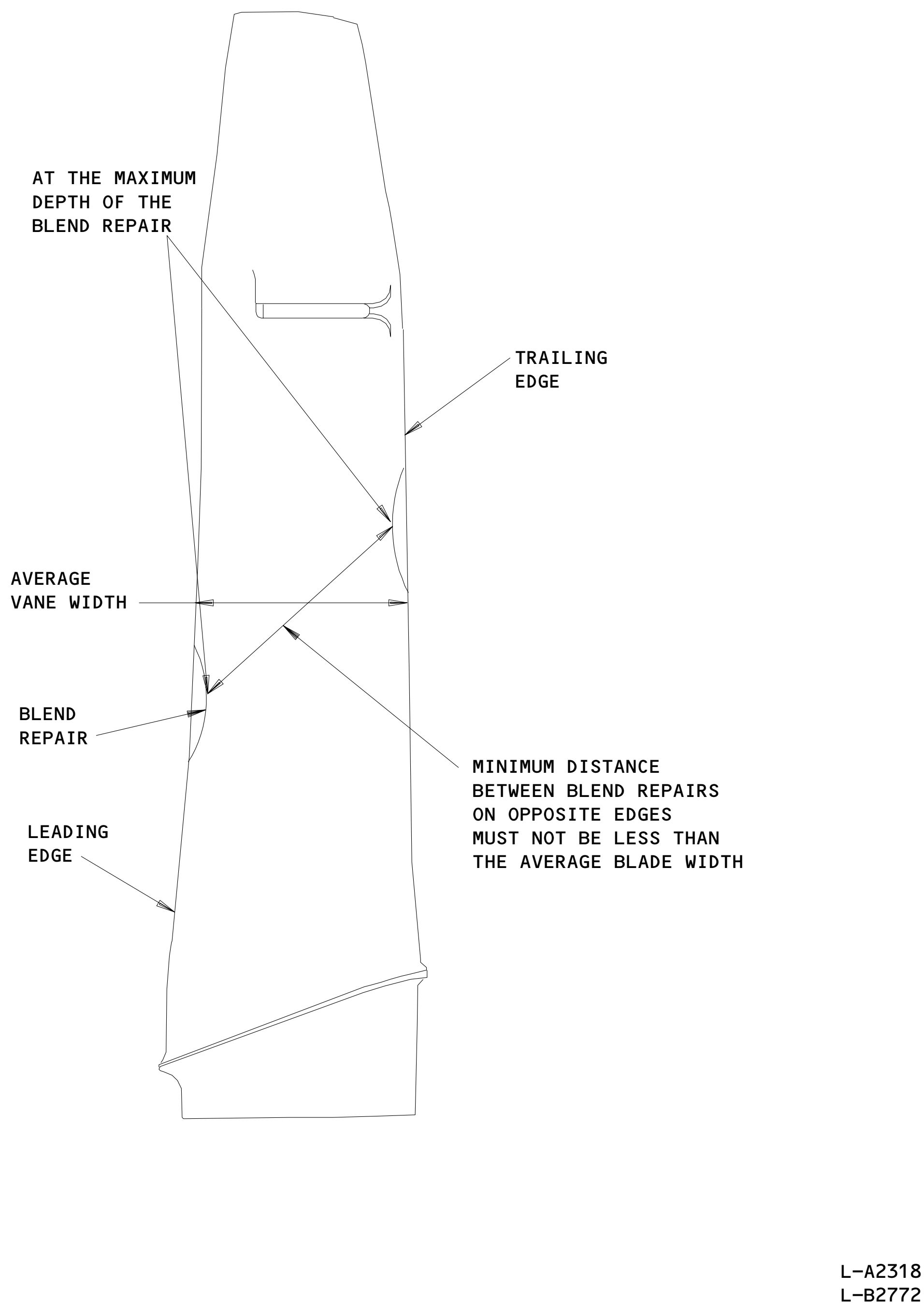
NOTE: The average vane width (mean chordal length) is measured equidistant between the two blend repairs.



Leading and Trailing Edge Minimum Thickness Limits
Figure 801 (Sheet 1)



Leading and Trailing Edge Minimum Thickness Limits
Figure 801 (Sheet 2)



Minimum Distance Between Blend Repairs on 1st-Stage Blade
Figure 802

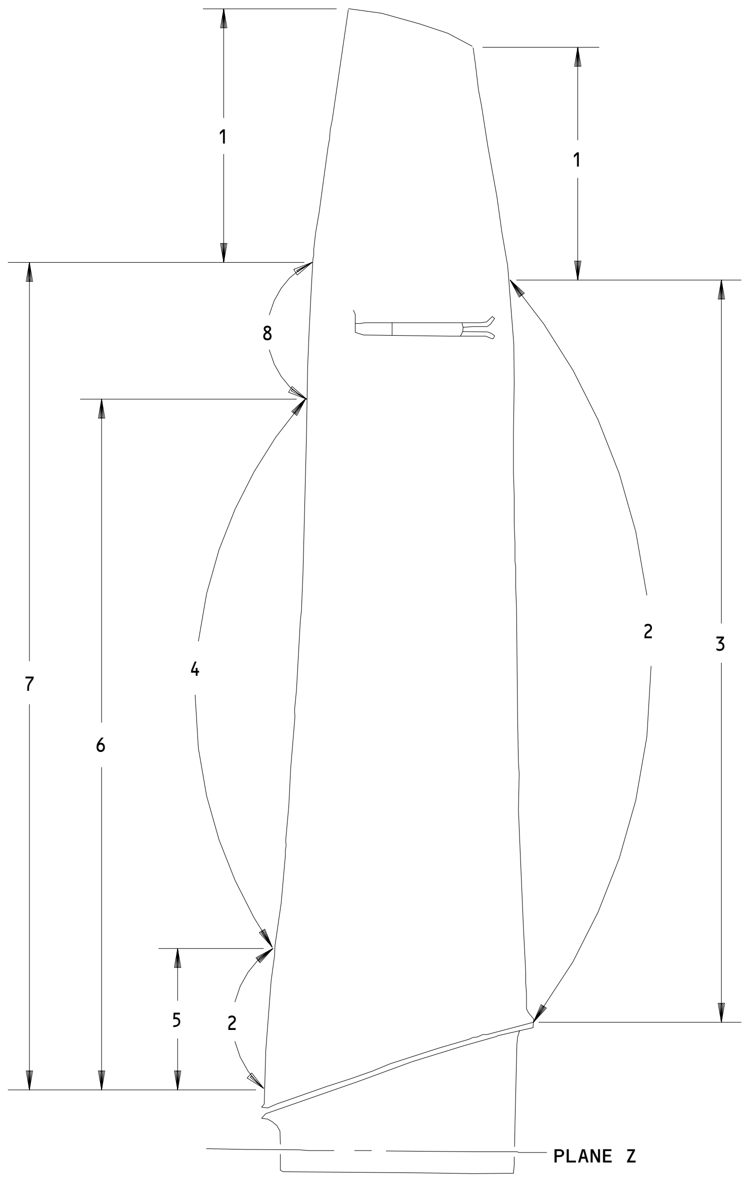
(g) You can do the steps that follow to make an estimate of the depth of a blended area.
   1) Put a straight edge on the leading or trailing edge of the blade, adjacent to the blended area of the blade.
   2) Measure the distance between the deepest part of the blended area and the straight edge.

(h) Make sure that all edges of a repaired area are polished until they have satisfactorily rounded radii with smooth surfaces.

(i) The radial length-to-depth ratio of blended airfoil areas must be in the limits that are shown in Fig. 803.

Key to Figure 804 (Sheet 1)			
	MAXIMUM DEPTH OF DAMAGE		
Inspect	Serviceable Limit	Repairable Limit	Repairable Limit (But With A 50 Hour Continue-In-Service Limit)
Area A Tip	0.020 inch (0.508 mm)	0.750 inch (19.050 mm)	1.000 inch (25.400 mm)
Area B Shroud to Airfoil Radius	No damage permitted	No damage permitted	No damage permitted
Area C Leading and Trailing Edges	0.005 inch (0.127 mm)	0.250 inch (6.350 mm)	0.300 inch (7.629 mm)
Area D Platform To Airfoil Radius	No damage permitted	No damage permitted	No damage permitted
Leading and Trailing Edges	0.005 inch (0.127 mm)	0.150 inch (3.810 mm)	None
Area E Other Airfoil Surfaces	0.020 inch (0.508 mm)	0.030 inch (0.762 mm)	0.060 inch (1.524 mm)
Area F Leading Edge Surfaces	0.005 inch (0.127 mm)	0.250 inch (6.350 mm) See *[1]	0.300 inch (7.629 mm) See *[1]

*[1] This limit may be found to be 0.500 inch (12.7 mm) maximum in the CIR Manual. The higher limit is permitted for the necessary bead peen and ECI at overhaul facility.

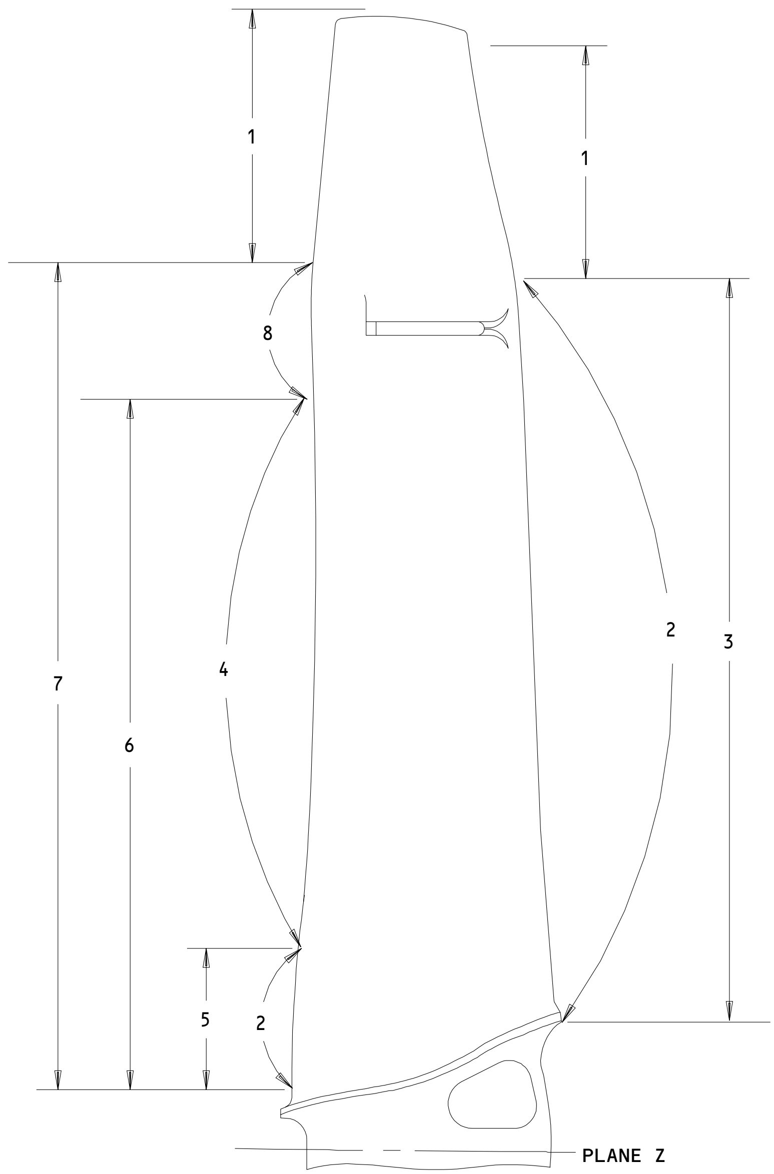


(P/N 52A121, 52A121-001, 52A121-002, 52A121-003,
52A321-001, 53A321, 56A511 AND 56A821)

1. THE OUTER HALF OF THE BLADE - THE LENGTH OF A BLENDED AREA MUST BE 4 TIMES ITS DEPTH.
2. THE IMPORTANT AIRFOIL AREA - THE LENGTH OF A BLENDED AREA MUST BE 12 TIMES ITS DEPTH
3. 19.515 INCHES (495.68 mm)
4. THE INNER HALF OF THE BLADE - THE LENGTH OF A BLENDED AREA MUST BE 6 TIMES ITS DEPTH.
5. 6.300 INCHES (160.02 mm)
6. 18.500 INCHES (469.9 mm)
7. 22.500 INCHES (571.50 mm)
8. THE LEADING EDGE AT THE PART SPAN SHROUD - THE LENGTH OF A BLENDED AREA MUST BE 12 TIMES ITS DEPTH.

L-A2321

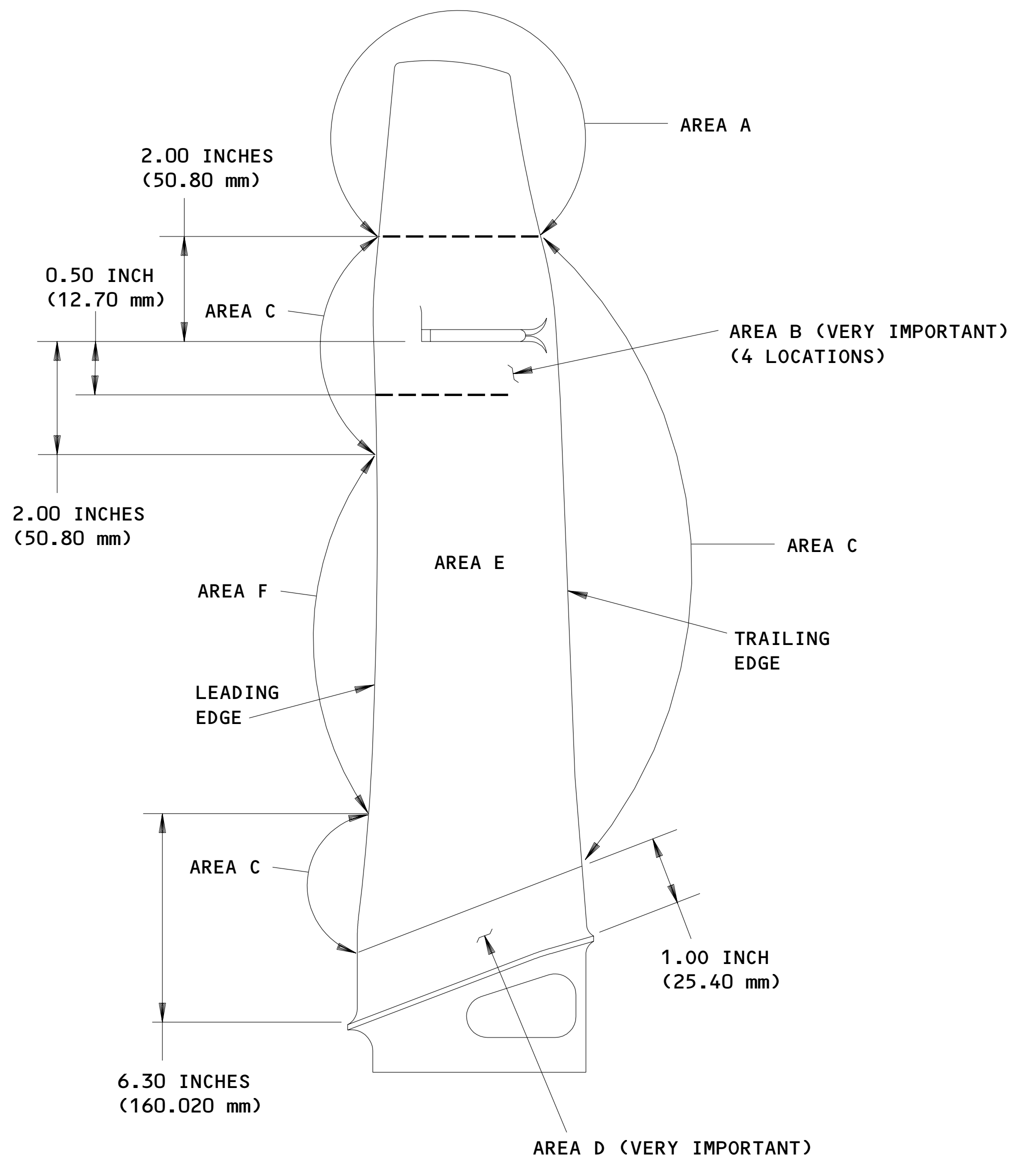
Radial Length - to - Depth Ratios
Figure 803 (Sheet 1)



(P/N 54A821, 56A621)

1. THE OUTER HALF OF THE BLADE - THE LENGTH OF A BLENDED AREA MUST BE 4 TIMES ITS DEPTH.
2. THE IMPORTANT AIRFOIL AREA - THE LENGTH OF A BLENDED AREA MUST BE 12 TIMES ITS DEPTH
3. 19.865 INCHES (504.57 mm)
4. THE INNER HALF OF THE BLADE - THE LENGTH OF A BLENDED AREA MUST BE 6 TIMES ITS DEPTH.
5. 6.300 INCHES (160.02 mm)
6. 18.500 INCHES (469.9 mm)
7. 22.850 INCHES (580.390 mm)
8. THE LEADING EDGE AT THE PART SPAN SHROUD - THE LENGTH OF A BLENDED AREA MUST BE 12 TIMES ITS DEPTH.

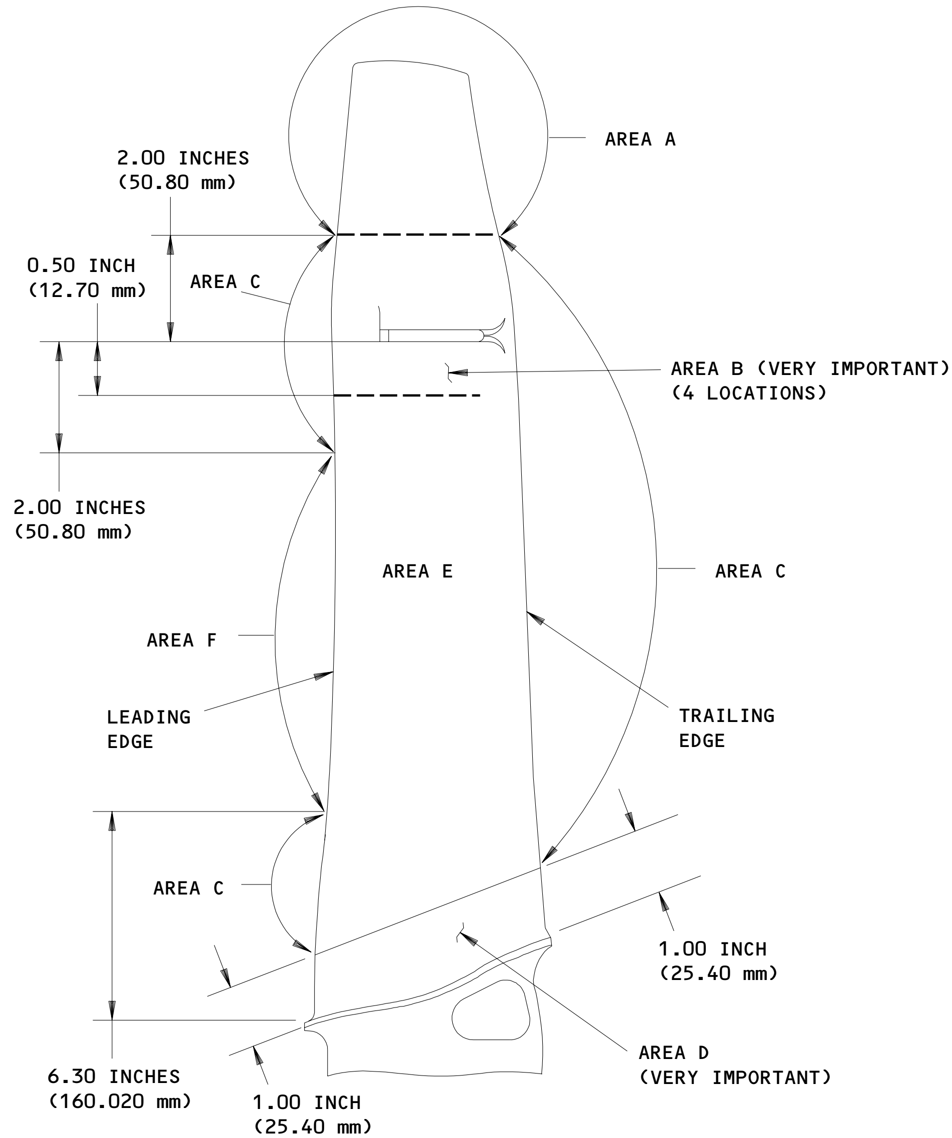
Radial Length - to - Depth Ratios
Figure 803 (Sheet 2)



(P/N 53A321, 53A321-001, 56A511 AND 56A821)

L-B2954 (0896)

Airfoil Damage Limits
Figure 804 (Sheet 1)



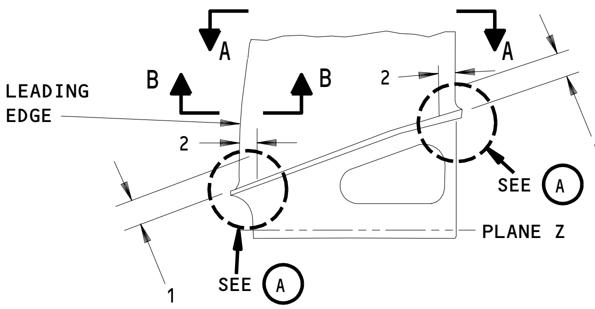
(P/N 54A821, 56A621)

L-B2955 (0896)

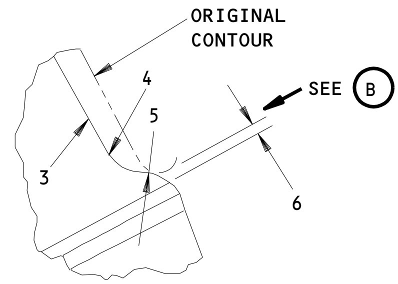
Airfoil Damage Limits
Figure 804 (Sheet 2)

Key to Figure 804 (Sheet 2)			
	MAXIMUM DEPTH OF DAMAGE		
Inspect	Serviceable Limit	Repairable Limit	Repairable Limit (But With A 50 Hour Continue-In-Service Limit)
Area A Tip	0.020 inch (0.508 mm)	0.750 inch (19.050 mm)	1.000 inch (25.400 mm)
Area B Shroud to Airfoil Radius	No damage permitted	No damage permitted	No damage permitted
Area C Leading and Trailing Edges	0.005 inch (0.127 mm)	0.250 inch (6.350 mm)	0.300 inch (7.629 mm)
Area D Platform To Airfoil Radius	No damage permitted	No damage permitted	No damage permitted
Leading and Trailing Edges	0.005 inch (0.127 mm)	0.150 inch (3.810 mm)	None
Area E Other Airfoil Surfaces	0.020 inch (0.508 mm)	0.030 inch (0.762 mm)	0.060 inch (1.524 mm)
Area F Leading Edge Surfaces	0.005 inch (0.127 mm)	0.250 inch (6.350 mm) See *[1]	0.300 inch (7.629 mm) See *[1]

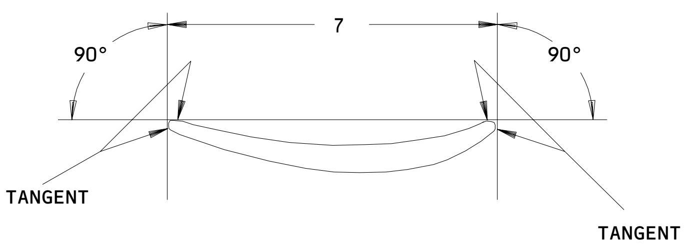
*[1] This limit may be found to be 0.500 inch (12.7 mm) maximum in the CIR Manual. The higher limit is permitted for the necessary bead peen and ECI at overhaul facility.



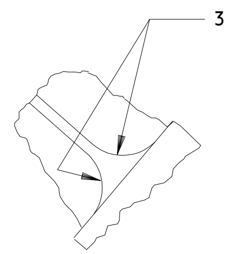
(P/N 52A121, 52A121-001, 53A321, 56A511, 56A821,
52A121-002, 52A121-003 AND 53A321-001)
(EXAMPLE)



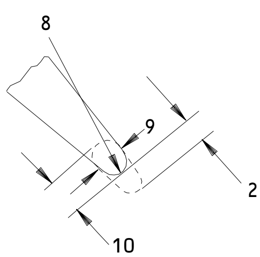
EXAMPLE LEADING AND
TRAILING EDGE
A



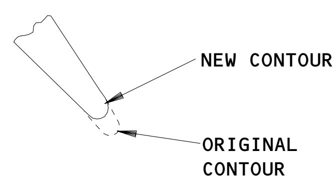
CHORD LENGTH MEASUREMENT
A-A



B



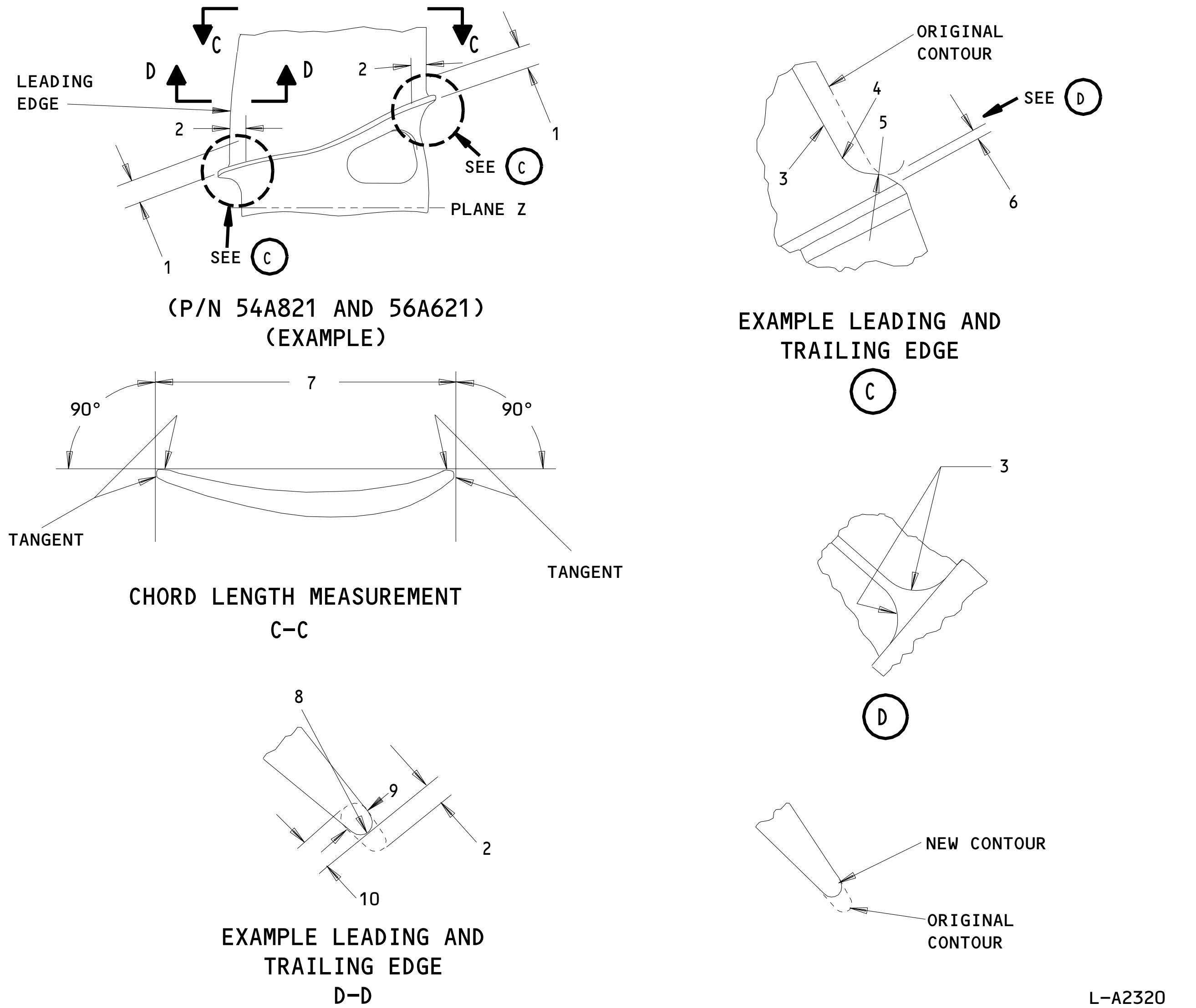
EXAMPLE LEADING AND
TRAILING EDGE
B-B



L-A2320

1. 1.000 INCH (25.400 mm) - YOU CAN BLEND DAMAGE ONLY IN THE PLATFORM TO LEADING OR TRAILING EDGE RADIUS TO A MAXIMUM DEPTH OF INDEX 2.
2. BLEND REPAIRS ON THE LEADING OR TRAILING EDGE MUST NOT BE MORE THAN 0.150 INCH (3.810 mm) IN DEPTH.
3. WHEN YOU BLEND DAMAGE IN THIS AREA ADJACENT TO THE PLATFORM, MAKE THE EDGES ROUNDED WITH A RADIUS OF INDEX 5. DO NOT UNDERCUT THE RADIUS OF THE AIRFOIL PLATFORM FILLET WHEN YOU BLEND DAMAGE ADJACENT TO THE PLATFORM.
4. 0.359-0.391 INCH (9.12-9.93 mm) RADIUS
5. 0.030-0.050 INCH (0.76-1.27 mm) RADIUS
6. 0.000-0.020 INCH (0.00-0.51 mm) VERTICAL TO (MEASURE AT 90° FROM) THE PLATFORM.
7. THE CHORD LENGTH MUST NOT BE LESS THAN 6.950 INCHES (176.53 mm) IN THE AREA 6.300 INCHES (160.02 mm) FROM THE LEADING EDGE PLATFORM. THE CHORD LENGTH MEASUREMENT MUST BE MEASURED TANGENT TO THE BLADES LEADING AND TRAILING EDGES AND LEVEL WITH PLANE Z.
8. MAKE THE RADIUS OF THE BLEND REPAIR EQUAL TO HALF OF THE EDGE THICKNESS. IF THE RADIUS IS MORE THAN 0.062 INCH (1.575 mm) SEE INDEX 10 FOR THE BLEND LIMITS.
9. KEEP THE EDGE THICKNESS IN THE MINIMUM THICKNESS LIMITS IN FIG. 801.
10. 0.130-0.190 INCH (3.30-4.83 mm). BLEND THE RADIUS AT INDEX 8. WITH A HAND FILE AND AN EMERY CLOTH MAKE THIS AREA SMOOTH ON EACH SIDE OF THE AIRFOIL.

Leading and Trailing Edge Root Blend Limits
Figure 805 (Sheet 1)



1. 1.000 INCH (25.400 mm) - YOU CAN BLEND DAMAGE ONLY IN THE PLATFORM TO LEADING OR TRAILING EDGE RADIUS TO A MAXIMUM DEPTH OF INDEX 2.
2. BLEND REPAIRS ON THE LEADING OR TRAILING EDGE MUST NOT BE MORE THAN 0.150 INCH (3.810 mm) IN DEPTH.
3. WHEN YOU BLEND DAMAGE IN THIS AREA ADJACENT TO THE PLATFORM, MAKE THE EDGES ROUNDED WITH A RADIUS OF INDEX 5. DO NOT UNDERCUT THE RADIUS OF THE AIRFOIL PLATFORM FILLET WHEN YOU BLEND DAMAGE ADJACENT TO THE PLATFORM.
4. 0.359-0.391 INCH (9.12-9.93 mm) RADIUS
5. 0.030-0.050 INCH (0.76-1.27 mm) RADIUS
6. 0.000-0.020 INCH (0.00-0.51 mm) VERTICAL TO (MEASURE AT 90° FROM) THE PLATFORM.
7. THE CHORD LENGTH MUST NOT BE LESS THAN 6.950 INCHES (176.53 mm) IN THE AREA 6.300 INCHES (160.02 mm) FROM THE LEADING EDGE PLATFORM. THE CHORD LENGTH MEASUREMENT MUST BE MEASURED TANGENT TO THE BLADES LEADING AND TRAILING EDGES AND LEVEL WITH PLANE Z.
8. MAKE THE RADIUS OF THE BLEND REPAIR EQUAL TO HALF OF THE EDGE THICKNESS. IF THE RADIUS IS MORE THAN 0.062 INCH (1.575 mm) SEE INDEX 10 FOR THE BLEND LIMITS.
9. KEEP THE EDGE THICKNESS IN THE MINIMUM THICKNESS LIMITS IN FIG. 801.
10. 0.130-0.190 INCH (3.30-4.83 mm). BLEND THE RADIUS AT INDEX 8. WITH A HAND FILE AND AN EMERY CLOTH MAKE THIS AREA SMOOTH ON EACH SIDE OF THE AIRFOIL.

Leading and Trailing Edge Root Blend Limits
Figure 805 (Sheet 2)

S 358-023-N00

(3) If the cracks and damage are more than the applicable limits, do a blend repair of the area using an eddy current inspection criteria (Fig. 804).

NOTE: You can perform the optional blending procedure using a fluorescent penetrant inspection (FPI) (alternative) criteria. The optional blending procedure follows the blending procedure using an eddy current inspection (recommended) criteria.

(a) Blend the blade to the bottom of the damage.

S 358-055-N00

(4) If the cracks and damage are more than the applicable limits, do a blend repair of the area.

(a) Blend the damage, to the bottom of the damage.

(b) Blend an additional 0.020 Inch (0.50mm).

(c) Blend repair the long dents (with a dented center and high edges) and all the damage with a small radius and rough edges on the blade.

NOTE: Remove only the edges of the damaged area, when the dents are smooth and rounded bottomed.

(d) Before the subsequent seventh flight cycle, do an eddy current inspection (recommended) or a fluorescent penetrant inspection (FPI) (alternative) to check for cracks.

(e) Before the subsequent 121st hour of operation, do an eddy current inspection to check for cracks.

NOTE: If you did an eddy current inspection before the subsequent seventh flight cycle, you do not need to do another eddy current inspection before the subsequent 121st hour of operation.

S 258-056-N00

(5) Do an eddy current inspection of the damaged area to check for cracks (AMM 72-31-02/601).

NOTE: The eddy current inspection is recommended compared to the FPI.

(a) If you do not find a crack, blend the area to a depth that is 0.020 inch (0.508 mm) more than the depth of the damage.
(b) If you find a crack, make a mark around the crack.
   1) Blend the area to a depth that is 0.020 inch (0.508 mm) more than the depth of the crack.
(c) Do an eddy current inspection of the area.
   1) Continue to blend and examine until you cannot find a crack.
      a) Make sure the repair is not more than the limits (Fig. 803).
(d) If the depth of the repair is more than the limits, replace the blade (AMM 72-31-02/401).

S 238-057-N00

(6) With some ultra high sensitivity penetrant, do a fluorescent penetrant inspection (FPI) of the damaged area to check for cracks (AMM 70-11-06/201).

NOTE: The FPI is an alternative compared to the eddy current inspection.

(a) If you do not find a crack, blend the area to 0.060 inch (1.524 mm) more than the depth of the crack.
(b) If you find a crack, make a mark around the crack.
   1) Blend the area to a depth that is 0.060 inch (1.524 mm) more than the depth of the crack.
(c) Do a fluorescent penetrant inspection of the area.
   1) Continue to blend and examine the area until you cannot find a crack.

(d) Before the subsequent 121st hour of operation, do an eddy current inspection to check for cracks.
(e) Make sure the repair is not more than the limits in Figure 803.
(f) If the depth of the repair is more than the limits, replace the blade (AMM 72-31-02/401).

S 328-061-N00
(7) Blend to remove the damage such as sustained indentations (have material compressed and edges raised) and ragged edges.

NOTE: Remove only the area that have damage edge when you repair the smooth and round bottomed identations.

S 328-062-N00
(8) Blend the leading and trailing edge root areas as shown Figure 805.

S 328-063-N00
(9) After the blend repair areas are completed, two or more heavily blended blades are grouped together.
(a) The blended blades and their matching blades will apply equally throughout the rotor.

NOTE: It is recommended that you do a vibration check to apply blend repair area successfully.

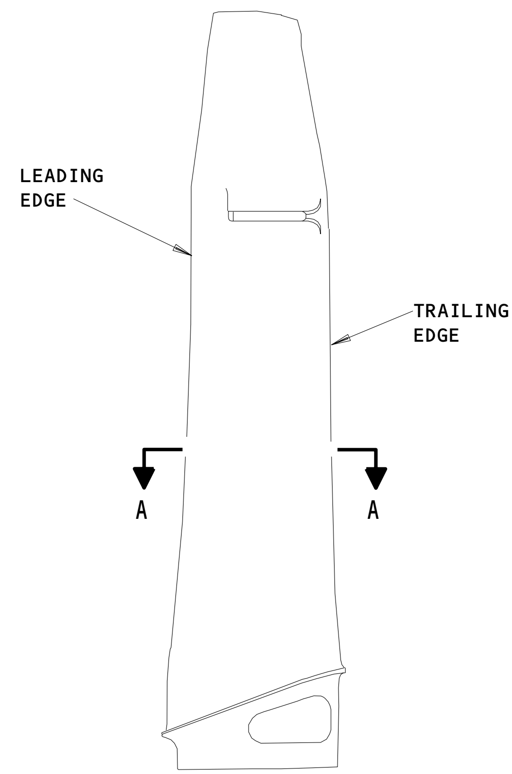
S 328-064-N00
(10) When you use the power cutting tool to blend the damage area, you must use hand tools to blend the last 0.060 inch (1.524 mm) in depth.

S 328-058-N00
(11) Polish the blended areas.

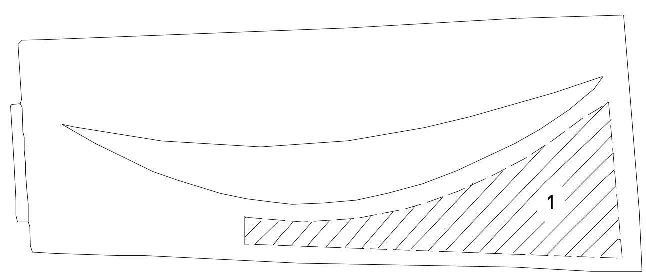
S 938-059-N00
(12) Write the depth of the blend with a vibration peen on the blade platform area (Fig. 806).
(a) Before the dimension, put the letter "L" for a leading edge or "T" for a trailing edge blend.
(b) The new dimension is the total of the new blend plus the other dimensions on the blade platform.

CAUTION: DO NOT REMOVE THE OTHER REPAIR CODES FROM THE BLADE PLATFORM. THESE CODES CAN SHOW REPAIRS OTHER THAN THE BLEND DEPTH. THESE CODES WILL BE USED FOR OTHER PROCEDURES.

(c) Remove all of the remaining blend dimensions from the blade platform.



(FOR ALL PART NUMBERS)
(EXAMPLE)



A-A

1. YOU CAN MAKE A RECORD OF THE REPAIR IN THIS AREA. THIS AREA IS 0.100 INCH (2.540 mm) FROM THE PLATFORM EDGES AND THE AIRFOIL PLATFORM FILLET RADIUS.

L-A2322
L-B2958

Repair Marking Area
Figure 806

S 828-060-N00

(13) After you repair all of the damage on the blades, do these steps:
   (a) Look for the blades which had a large quantity of material removed during the repair.
   (b) If two or more of these repaired blades are adjacent, move one or more or them to a new location.

   NOTE: When you move a blade, move it and its matched moment blade which is 180 degrees apart.

   (c) If you cannot symmetrically move the blades around the rotor, we recommend that you do a vibration survey (AMM 71-00-00/501, Test No. 8).

TASK 72-31-02-308-013-N00

3. 1st-Stage (Fan) Blade Rubber Seal Replacement (Fig. 807)

A. Consumable Materials
   (1) G02339 Emery Paper - Aluminum Oxide 250 grit
   (2) A00659 Adhesive - Neoprine, PWA 36027

B. References
   (1) AMM 70-11-13/201, Degreasing of Parts by Solvent Wiping (SPOP 208)
   (2) AMM 72-31-01/401, Inlet Cone
   (3) AMM 72-31-02/401, 1st-Stage Fan Blade

C. Access
   (1) Location Zones
      410 Left Power Plant Nacelle
      420 Right Power Plant Nacelle

D. Replace the rubber seal for the 1st-stage fan blade.

S 868-014-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 018-015-N00

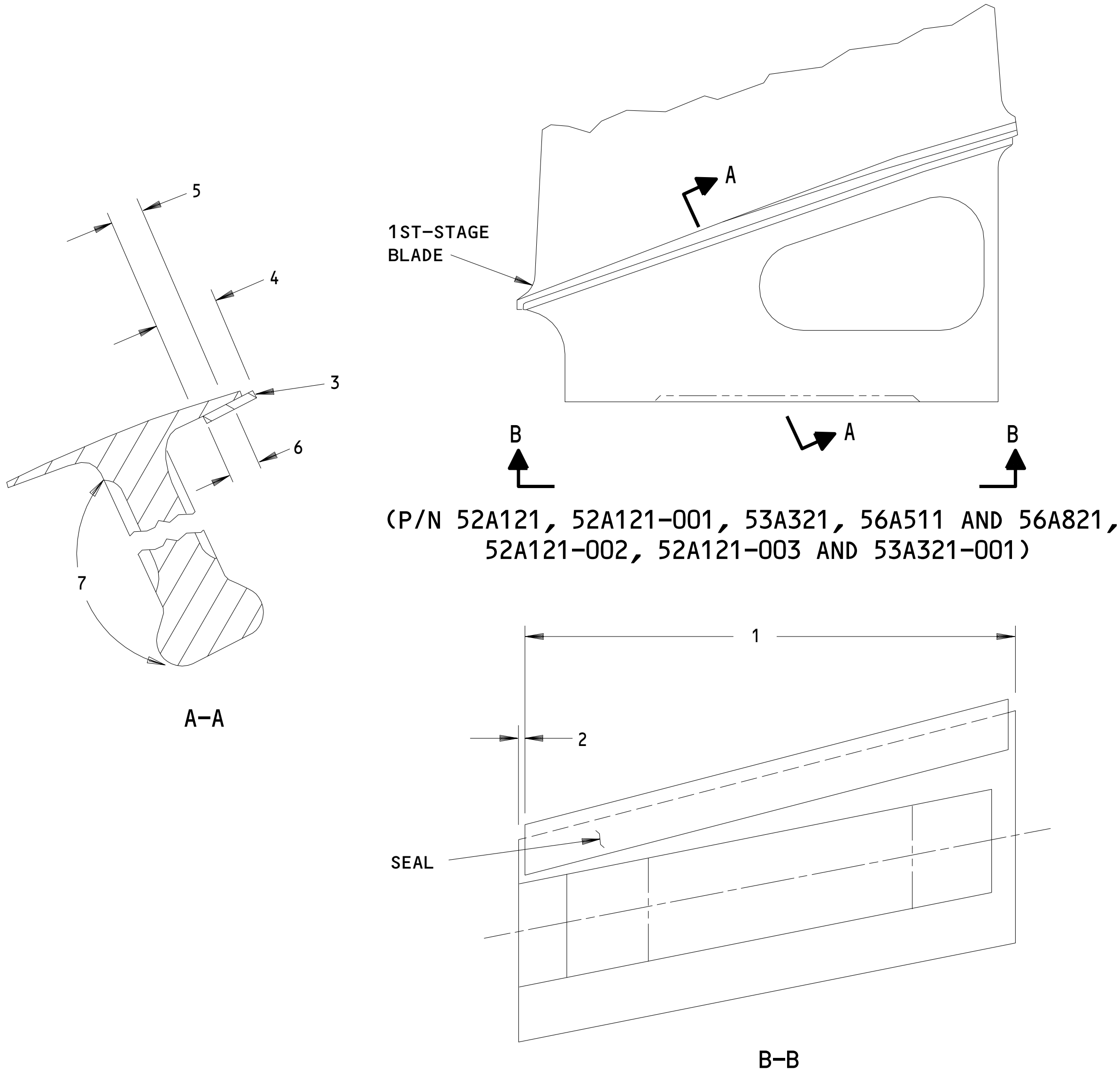
(2) Remove the inlet cone (AMM 72-31-01/401).

S 018-016-N00

(3) Remove the 1st-stage fan blade that has the defective rubber seal (AMM 72-31-02/401).

S 968-017-N00

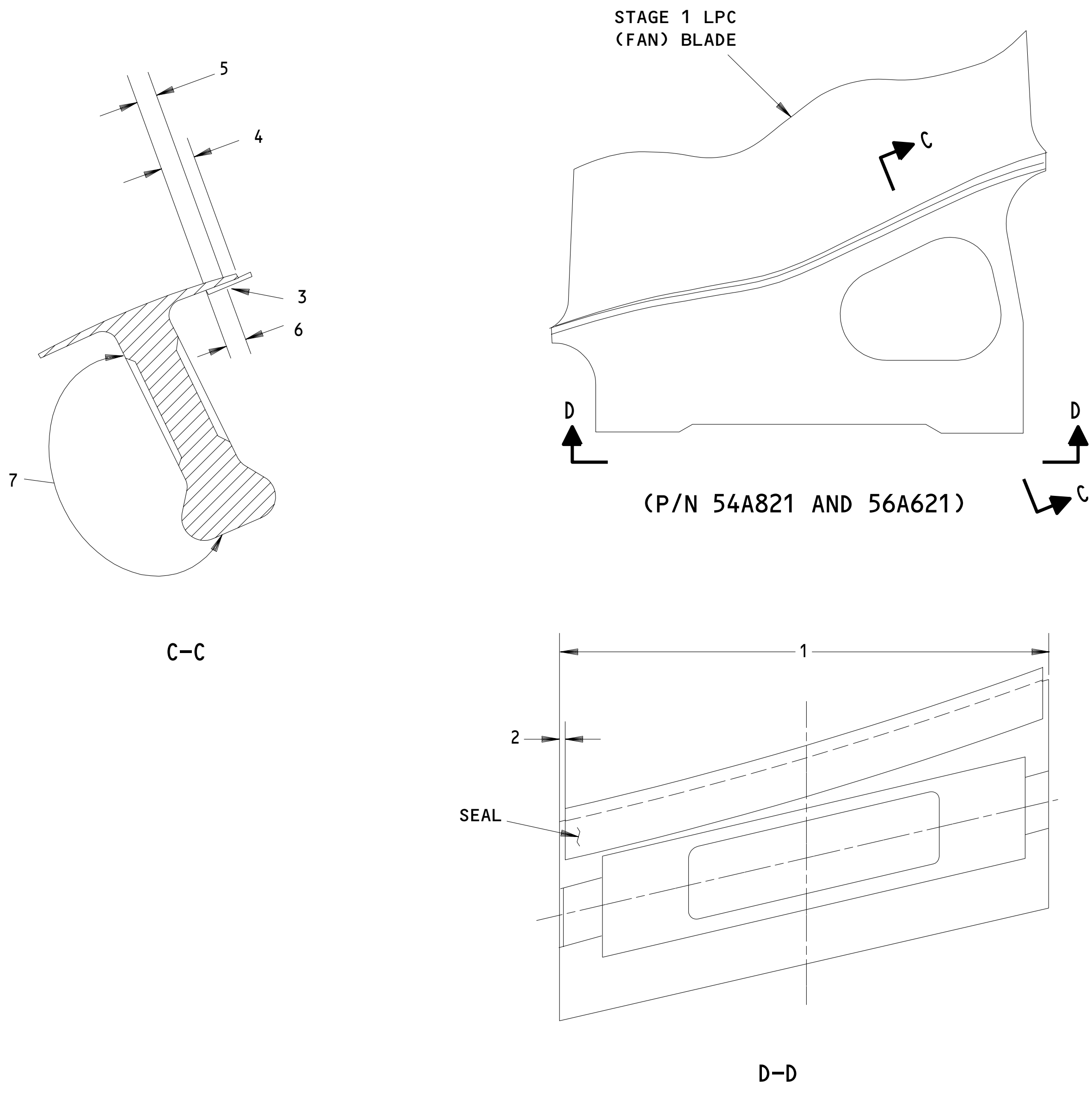
(4) Do the steps that follow to replace the rubber seal.
   (a) With a scraper, remove the damaged rubber seal from the platform of the 1st-stage fan blade.



1. THE LENGTH OF THE AREA WHERE YOU APPLY THE ADHESIVE BELOW THE PLATFORM.
2. 0.000-0.040 INCH (0.000-1.02 mm) ON EACH END.
3. RUBBER SEAL
4. 0.480-0.520 INCH (12.19-13.21 mm)
5. 0.300-0.350 INCH (7.62-8.89 mm)
6. THE WIDTH OF THE AREA WHERE YOU APPLY THE ADHESIVE FOR THE PLATFORM LENGTH.
7. NO CLEANING SOLVENT IS PERMITTED IN THIS CLOSED AREA ON EACH END.

L-A3791

Platform Seal Replacement
Figure 807 (Sheet 1)



L-A8824 (0000)

Platform Seal Replacement
Figure 807 (Sheet 2)

(b) Clean the lower left face of the blade platform by solvent wiping (AMM 70-11-13/201, SPOP 208).

NOTE: Look at the trailing edge to find the left side.

(c) With the emery paper (200 grit), to remove the glossy finish, lightly rub the area where the rubber seal will attach.
(d) Clean the surface of the rubber seal by solvent wiping (AMM 70-11-13/201, SPOP 208).
(e) In a clean dry area, apply a thin continuous layer of adhesive 0.003-0.005 inch (0.076-0.127 mm) in thickness on the areas shown in figure 807.
(f) Let the adhesive become dry and tacky.
(g) Put the rubber seal, in the correct position, on the blade platform.
(h) Push the rubber seal, with a sufficiently strong force, against the blade platform.
(i) Let the adhesive have a cure time of 24 hours, at ambient temperature.
(j) Remove the unwanted remaining adhesive.

S 418-018-N00
(5) Install the 1st-stage fan blade (AMM 72-31-02/401).

S 418-019-N00
(6) Install the inlet cone (AMM 72-31-01/401).

S 868-020-N00
(7) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

TASK 72-31-02-308-024-N00
4. Restore the Leading Edge Contour of the 1st-Stage Fan Blade Assembly
A. General
(1) This restoration repair is for engines that have had unsatisfactory fan performance operation. This repair can also be used to clean and remove fan blade leading edge damage.
(2) This repair is applicable to fan blade assemblies PN 52A121, 56A621, 56A821, 52A121-001, 52A121-002, 52A121-003 and 53A321-001 only.

NOTE: Other part numbers 53A321, 54A821 and 56A511 fan blades must be re-operated by SB PW4ENG 72-655 and re-identified to the new part numbers before you do this repair.

B. Equipment
   (1) PWA 29646 Gage, Inspection
   (2) PWA 29836 Sighting Template
   (3) PWA 29914 Angle Cutter
   (4) PWA 49065 Template, Plastic Chord (For PN 52A121 and 56A821 Blades)
   (5) PWA 75431 Marking Template (For PN 52A121 and 52A121-001 Blades)
   (6) PWA 75432 Radius Cutter (For PN 52A121 and 52A121-001 Blades)
   (7) PWA 86053 Marking Template (For PN 56A821 Blade)
   (8) PWA 86054 Handle, Edge Scraper (For PN 56A621, 56A821, 54A821, 53A321, 53A321-001, 56A511, 52A121-003 and 52A121-002 Blades)
   (9) PWA 86055 Insert, Edge Scraper (For PN 56A621, 56A821, 53A321-001, 52A121-002 and 52A121-003 Blades)
   (10) PWA 101157 Insert, Edge Scraper (For PN 56A621, 56A821, 52A121-002, 52A121-003 and 53A321-001 Blades)
   (11) PWA 101801 Marking Template (For PN 56A621 Blade)
   (12) 3013 Vise, Soft-Jawed (or equivalent)
        Wilton Tool Company
        9525 Irving Park Rd.
        Schiler Park, IL 60176
C. Consumables
   (1) G02373 Cloth, Emery #400 grit (P05-062)
   (2) B00107 Pad, Scotch Brite (Very Fine, Type A) (P05-252)
   (3) D50124 Paste, Anti-seize (PWA 36246) (P06-054)
   (4) D00651 Lubricant (PWA 587) (G-N Metal Assembly Paste) (P06-005)
   (5) B00649 Cleaner, Wipe (SPMC 148) (P11-049)
D. References
   (1) AMM 70-11-08/201, Power Denicking and Buffing of Titanium Parts (SPOP 532)
   (2) AMM 72-31-01/401, Inlet Cone
   (3) AMM 72-31-02/401, 1st-Stage (Fan) Blades
   (4) AMM 72-31-02/601, 1st-Stage (Fan) Blades
E. Access
   (1) Location Zones
        410   Left Power Plant Nacelle
        420   Right Power Plant Nacelle

F. Procedure

S 038-026-N00

(1) Remove the inlet cone (AMM 72-31-01/401).

S 028-027-N00

(2) Remove all fan blade assemblies (AMM 72-31-02/401).

S 168-029-N00

WARNING: TO AVOID POSSIBILITY OF INJURY TO HANDS, GLOVES SHOULD BE WORN WHEN HANDLING BLADES AND USING TOOLS.

CAUTION: USE OF POWER TOOLS OR GRINDING IS NOT PERMITTED.

(3) Clean the blade with a Scotch Brite Pad and Wipe Cleaner.
   (a) Carefully look at the leading edge and the first few inches (76.2 mm) of the convex side of the blade.

S 218-035-N00

(4) Visually inspect the blade for defects (AMM 72-31-02/601).
   (a) Repair or replace the blade if the defects are more than the acceptable service limits.

S 228-030-N00

(5) Examine each blade leading edge with PWA 29836 Sighting Template and PWA 29646 Thickness Gage to make sure there is sufficient material to incorporate the new leading edge configuration.

   NOTE: Thinning and dressing can be done with hand held scraping tools, files and abrasive paper or cloth.

S 168-031-N00

(6) Clean and paint both sides of the blade leading edge with non-etching, non-corrosive ink, or equivalent coating fluid in preparation for marking the work area.

S 938-032-N00

CAUTION: DO NOT USE AN AWL OR METAL SCRIBER WHEN MARKING LOCATIONS ON THE BLADE. THEY CAN LEAVE A STRESS RISER ON THE BLADE. USE A SHARPENED PIECE OF HARD PLASTIC OR OTHER NONMETALLIC MATERIAL.

(7) With the applicable marking template, scribe a line on the blade to mark the blades transition zones.
   (a) Use a PWA 75431 Marking Template for PN 52A121 and 52A121-001 blade.

(b) Use a PWA 86053 Marking Template for PN 56A821 blade.
(c) Use a PWA 101801 Marking Template for PN 56A621 blade.

S 958-033-N00
(8) Apply masking tape aft of the blade leading edge to protect the blade during rework.

S 328-034-N00
(9) Install the blade in a Wilton Tool Company Vise 3013 or equivalent soft-jaw vise that will permit the blade to be correctly positioned during repair.

S 328-036-N00
(10) Contour the blade leading edge as shown in Figures 808 and 809 for the entire length of the blade.
(a) Remove material as necessary with the PWA 29914 Cutter to form the 10 degree angle.
(b) To form the blade leading edge radius, use the tools that follow for the applicable blades:

<u>NOTE</u>: Hand held scraping tools, files and abrasive paper or cloth can be used but material removal must be uniform along the leading edge.

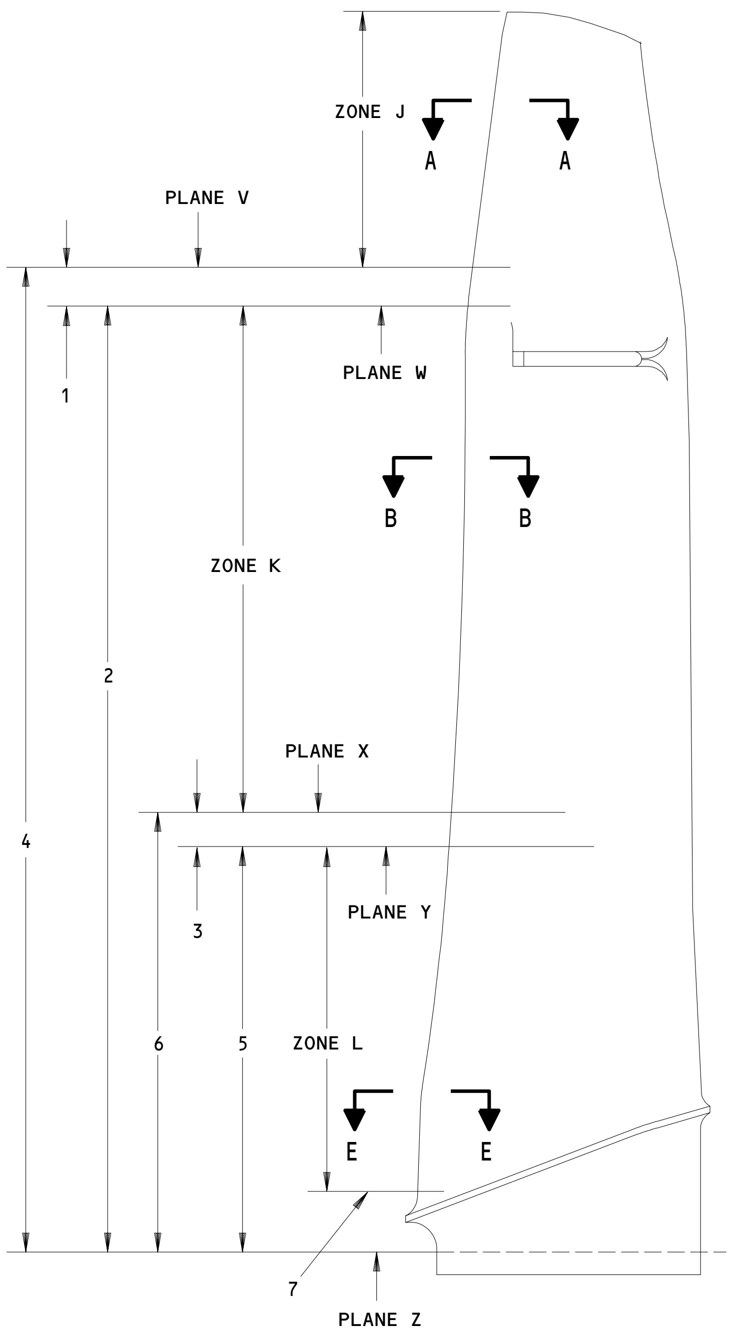
1) For PN 52A121 and 52A121-001 blades, use PWA 75432 Cutter.
2) For PN 56A621, 53A321-001, 52A121-002, 52A121-003, or 56A821 blades over zone J only, use PWA 86054 Handle with PWA 86055 Edge Scraper Insert.
3) For PN 56A621, 53A321-001, 52A121-002, 52A121-003 or 56A821 blades over zone K only, use PWA 86054 Handle with PWA 101157 Edge Scraper Insert.

(c) Do not remove more material than necessary and limit removal to 0.100 inch (2.54 mm) maximum.

<u>NOTE</u>: A tapered cut, starting at the tip and extending to the blade root fillet is optional.

S 228-037-N00
(11) FOR PN 52A121 AND 56A821 BLADES;
If necessary, after material has been removed, use the optional PWA 49065 Template to check the blade chord length.
(a) The minimum blade chord length at each section of the blade, as specified in Figure 810 or 811 as applicable, must be maintained.

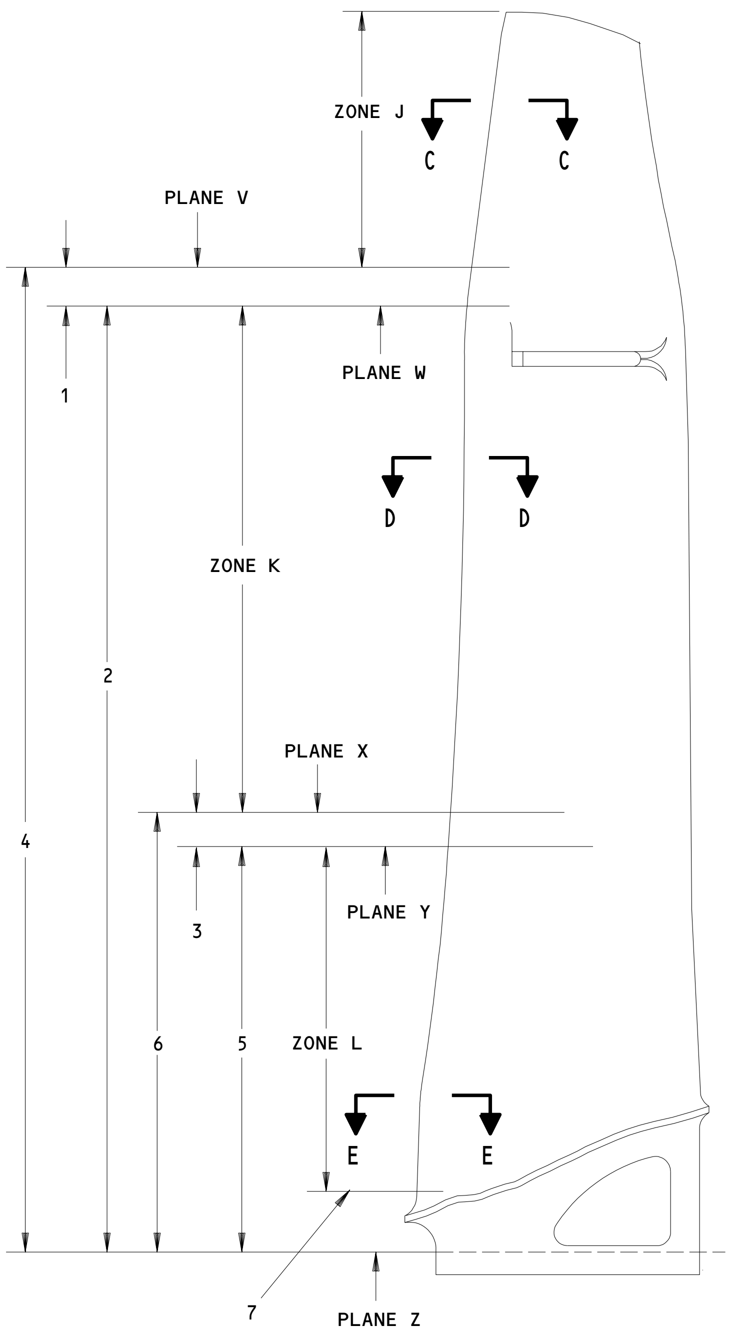
S 358-038-N00
(12) Polish the repair area to remove the scratches and machine marks (AMM 70-11-08/201).



(P/N 56A621, 56A821, 53A321-001, 52A121-002 AND 52A121-003 BLADES)

L-A6147
L-B1525

Leading Edge Contour Repair
Figure 808 (Sheet 1)



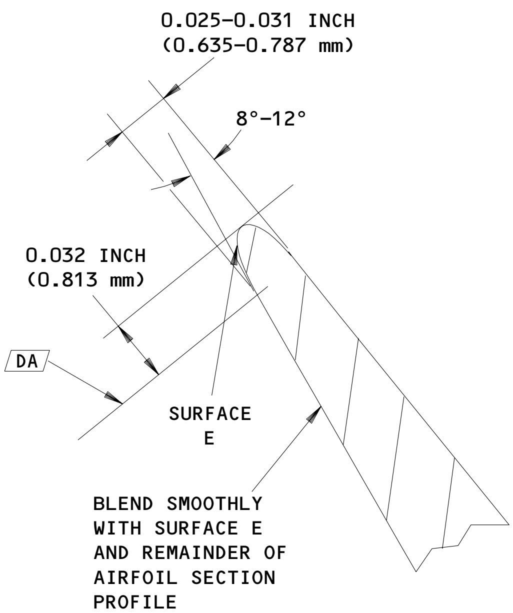
(P/N 56A621)

L-A6147
L-B1525

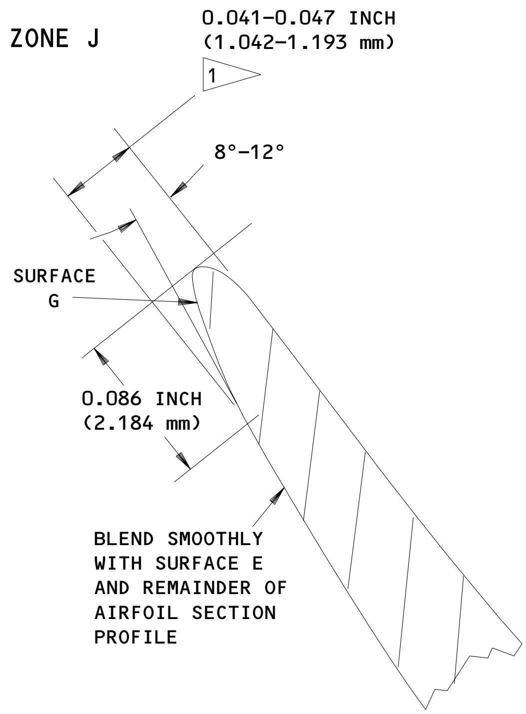
Leading Edge Contour Repair
Figure 808 (Sheet 2)

INDEX	P/N 56A621, 56A821, 53A321-001, 52A121-002 AND 52A121-003 BLADES)
1	MAKE SMOOTH BETWEEN ZONES J AND K WITHIN INDEX 1. MINIMUM THICKNESS WITHIN INDEX 1 IS NOT TO BE LESS THAN THE ACTUAL THICKNESS OF LEADING EDGE AT LOCATION DA (VIEW A-A OR VIEW C-C, ZONE J) OF ADJACENT ZONE ABOVE PLANE V.
2	23.465-23.715 INCHES (596.0-602.4 mm)
3	MAKE SMOOTH BETWEEN ZONES K AND L WITHIN INDEX 3. MINIMUM THICKNESS WITHIN INDEX 3 IS NOT TO BE LESS THAN THE ACTUAL THICKNESS OF LEADING EDGE AT LOCATION DE OF ADJACENT ZONE ABOVE PLANE X.
4	24.215-24.465 INCHES (615.1-621.4 mm)
5	7.812-8.062 INCHES (198.4-204.8 mm)
6	8.562-8.812 INCHES (217.5-223.8 mm)
7	TANGENT OF PLATFORM ROOT FILLET RADIUS

Leading Edge Contour Repair
Figure 808 (Sheet 3)



EXAMPLE SECTION OVER ZONE J
A-A

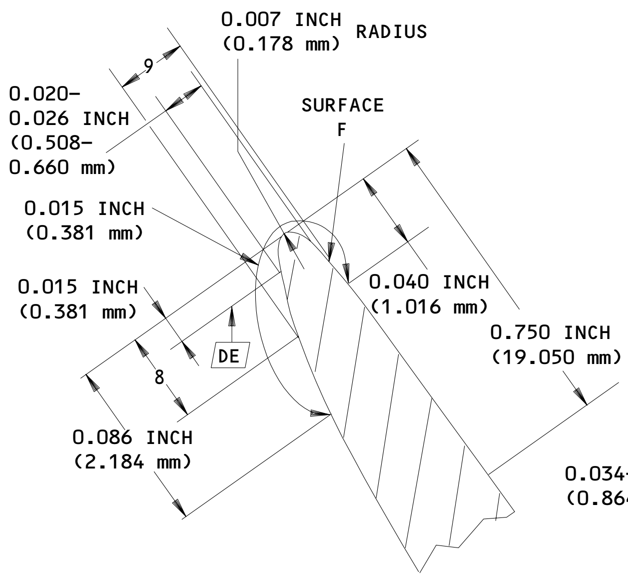


EXAMPLE SECTION OVER ZONE K
B-B

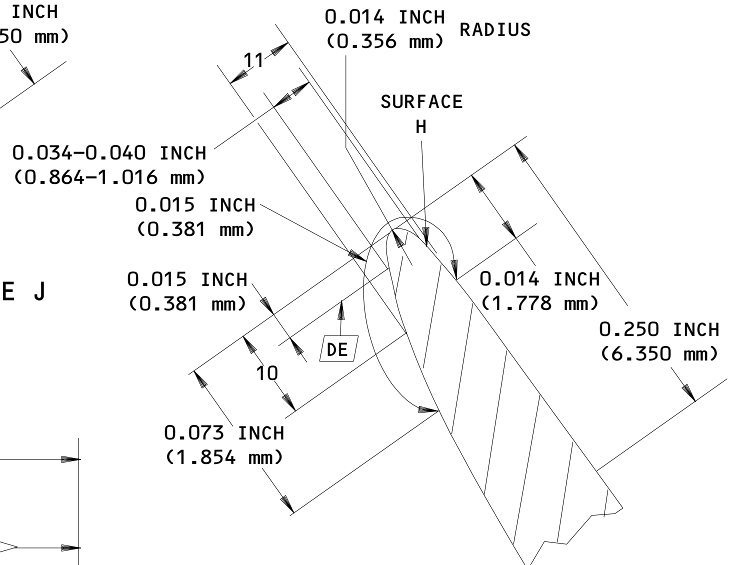
1 CHAMFER IF NECESSARY TO MAINTAIN THIS DIMENSION FROM PLANE M TO PLANE X.

L-A6148

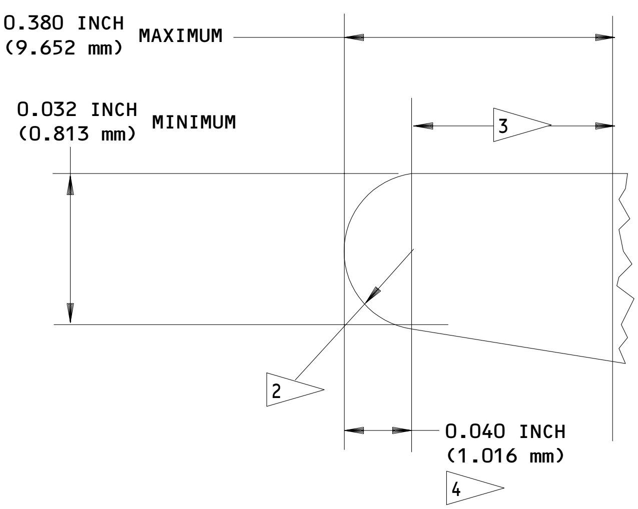
Leading Edge Contour Repair
Figure 808 (Sheet 4)



TYPICAL ENLARGED VIEW OVER ZONE J
C-C



TYPICAL ENLARGED VIEW OVER ZONE K
D-D



E-E

2 THIS RADIUS MUST BE BLENDED SMOOTHLY WITH REMAINDER OF AIRFOIL CONTOUR.

3 BLEND SMOOTHLY WITHIN REMAINDER OF AIRFOIL SECTION. PROFILE THICKNESS IN ZONE P MUST NOT BE LESS THAN THICKNESS MEASURED AT LOCATIONS Q OR R AS APPLICABLE.

4 MEASURE THICKNESS AT THIS DIMENSION.

L-A6148

Leading Edge Contour Repair
Figure 808 (Sheet 5)

SURFACE E	
INDEX 8	INDEX 9
0.0021 INCH (0.053 mm)	0.0162 INCH (0.411 mm)
0.0074 INCH (0.188 mm)	0.0202 INCH (0.513 mm)
0.0168 INCH (0.427 mm)	0.0251 INCH (0.638 mm)
0.0263 INCH (0.688 mm)	0.0290 INCH (0.737 mm)
0.0359 INCH (0.912 mm)	0.0323 INCH (0.820 mm)
0.0456 INCH (1.158 mm)	0.0352 INCH (0.894 mm)
0.0553 INCH (1.405 mm)	0.0378 INCH (0.960 mm)
0.0651 INCH (1.654 mm)	0.0401 INCH (1.019 mm)
0.0749 INCH (1.902 mm)	0.0422 INCH (1.072 mm)
0.0862 INCH (2.1.89 mm)	0.0443 INCH (1.125 mm)

SURFACE F	
INDEX 8	INDEX 9
0.0039 INCH (0.099 mm)	0.0048 INCH (0.122 mm)
0.0102 INCH (0.259 mm)	0.0027 INCH (0.069 mm)
0.0206 INCH (0.523 mm)	0.0009 INCH (0.023 mm)
0.0309 INCH (0.785 mm)	0.0002 INCH (0.051 mm)
0.0397 INCH (1.008 mm)	0.0000 INCH (0.0000 mm)

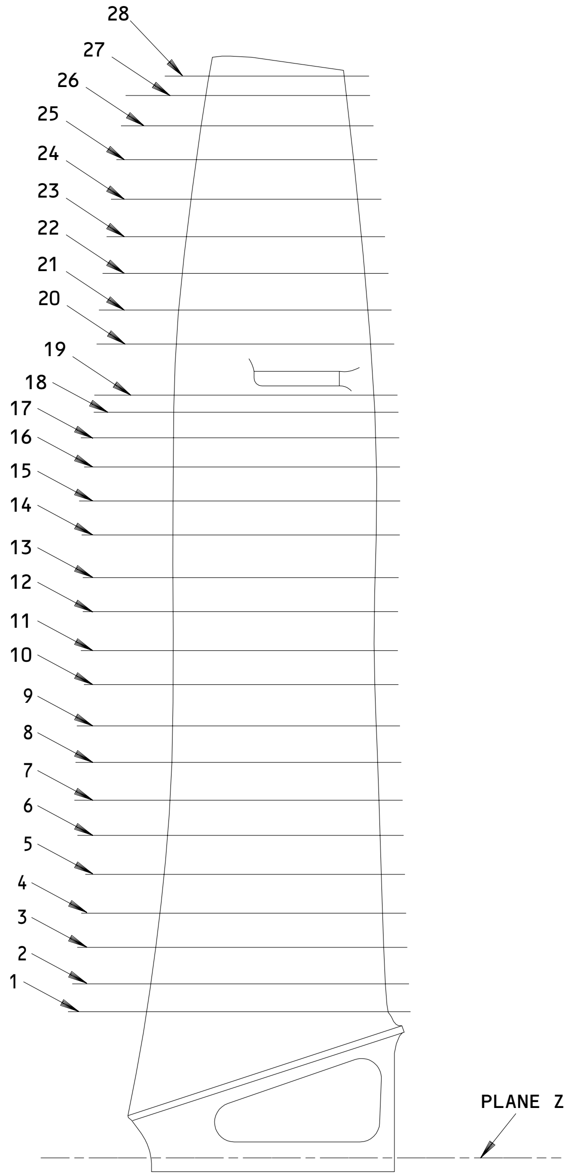
SURFACE G	
INDEX 11	INDEX 10
0.0087 INCH (0.221 mm)	0.0274 INCH (0.696 mm)
0.0129 INCH (0.328 mm)	0.0290 INCH (0.737 mm)
0.0225 INCH (0.572 mm)	0.0323 INCH (0.820 mm)
0.0322 INCH (0.818 mm)	0.0352 INCH (0.894 mm)
0.0419 INCH (1.064 mm)	0.0378 INCH (0.960 mm)
0.0517 INCH (1.313 mm)	0.0401 INCH (1.019 mm)
0.0615 INCH (1.562 mm)	0.0422 INCH (1.072 mm)
0.0728 INCH (1.849 mm)	0.0443 INCH (1.125 mm)

SURFACE H	
INDEX 11	INDEX 10
0.0131 INCH (0.333 mm)	0.0004 INCH (0.010 mm)
0.0175 INCH (0.444 mm)	0.0002 INCH (0.0051 mm)
0.0263 INCH (0.668 mm)	0.0000 INCH (0.000 mm)

L-A6149

Leading Edge Contour Repair
Figure 808 (Sheet 6)

Not Used
Figure 809



(P/N 56A821 AND 53A321-001)

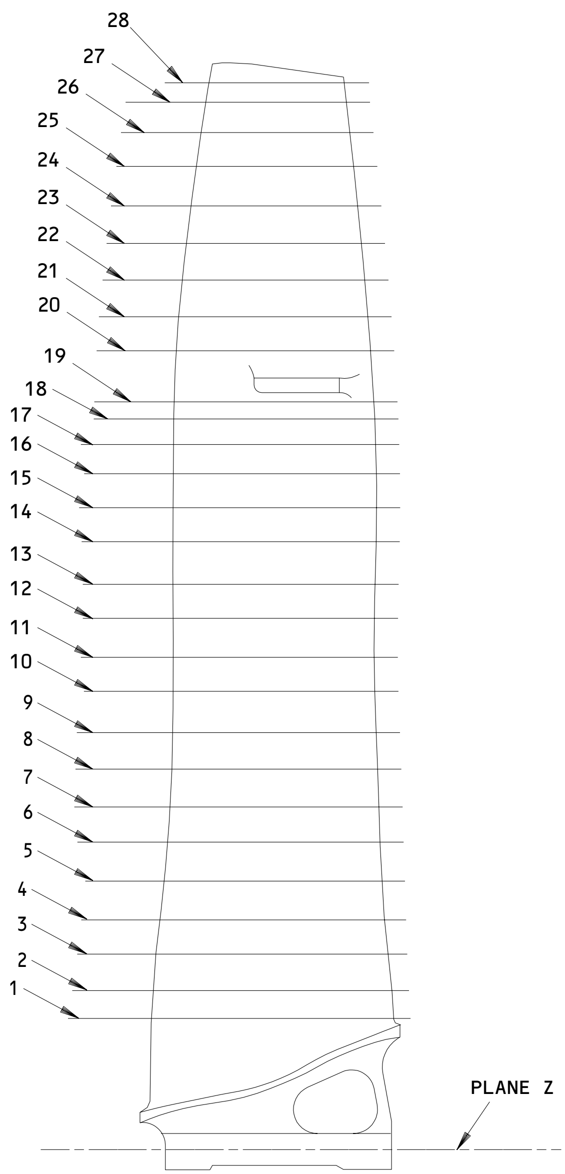
L-A4430

Minimum Fan Blade Chord Length
Figure 810 (Sheet 1)

INDEX	DIMENSION FROM PLANE Z INCHES (mm)	MINIMUM CHORD DIMENSION INCHES (mm)
1	4.009 (101.829)	6.994 (177.648)
2	4.669 (118.593)	7.008 (178.003)
3	5.669 (143.993)	7.023 (178.384)
4	6.669 (169.393)	7.075 (179.705)
5	7.669 (194.793)	7.154 (181.712)
6	8.669 (220.193)	7.228 (183.591)
7	9.669 (245.593)	7.291 (185.191)
8	10.669 (270.993)	7.362 (186.995)
9	11.669 (296.393)	7.450 (189.230)
10	12.669 (321.793)	7.550 (191.770)
11	13.669 (347.193)	7.652 (194.361)
12	14.669 (372.593)	7.740 (196.596)
13	15.669 (397.993)	7.831 (198.907)
14	16.669 (423.393)	7.928 (201.371)
15	17.669 (448.793)	8.023 (203.784)
16	18.669 (474.193)	8.119 (206.223)
17	19.669 (499.593)	8.225 (208.915)
18	20.289 (515.341)	8.292 (210.617)
19	20.809 (528.549)	8.338 (211.785)
20	22.249 (565.125)	8.524 (216.510)
21	22.719 (577.063)	8.594 (218.288)
22	22.469 (570.713)	8.664 (220.066)
23	24.469 (621.513)	8.826 (224.180)
24	25.469 (646.913)	8.998 (228.549)
25	26.469 (672.313)	9.188 (233.375)
26	27.469 (697.713)	9.292 (236.017)
27	28.469 (723.113)	9.453 (240.106)
28	29.189 (741.401)	9.578 (243.281)

(P/N 56A821 AND 53A321-001)

Minimum Fan Blade Chord Length
Figure 810 (Sheet 2)



L-B1526 (0000)
PW V

Minimum Fan Blade Chord Length (P/N 56A621)
Figure 811 (Sheet 1)

INDEX	DIMENSION FROM PLANE Z	MINIMUM CHORD DIMENSION (PN 56A621 BLADE)
1	4.009 (101.829)	6.929 (175.997)
2	4.669 (118.593)	6.966 (176.936)
3	5.669 (143.993)	7.006 (177.952)
4	6.669 (169.393)	7.047 (178.994)
5	7.669 (194.793)	7.108 (180.543)
6	8.669 (220.193)	7.153 (181.686)
7	9.669 (245.593)	7.203 (182.956)
8	10.669 (270.993)	7.273 (184.734)
9	11.669 (296.393)	7.358 (186.893)
10	12.669 (321.793)	7.454 (189.332)
11	13.669 (347.193)	7.558 (191.973)
12	14.669 (372.593)	7.654 (194.412)
13	15.669 (397.993)	7.744 (196.698)
14	16.669 (423.393)	7.840 (199.136)
15	17.669 (448.793)	7.993 (201.498)
16	18.669 (474.193)	8.032 (204.013)
17	19.669 (499.593)	8.134 (206.604)
18	20.603 (523.316)	8.236 (209.194)
19	21.169 (537.693)	8.300 (210.820)
20	21.953 (557.606)	(NONE, MIDSPAN SHROUD)
21	22.653 (575.386)	8.490 (215.646)
22	23.469 (596.113)	8.606 (218.592)
23	24.469 (621.513)	8.750 (222.250)
24	25.469 (646.913)	8.931 (226.847)
25	26.469 (672.313)	9.070 (230.378)
26	27.469 (697.713)	9.220 (234.188)
27	28.469 (723.113)	9.342 (237.287)
28	29.189 (741.401)	9.461 (240.309)

NOTE: ALL DIMENSIONS SHOWN ARE INCHES (mm).

Minimum Fan Blade Chord Length (P/N 56A621)
Figure 811 (Sheet 2)

S 328-039-N00

(13) Blend repair the blade airfoil area as necessary (AMM 72-31-02/801).

S 648-053-N00

WARNING: DO NOT PERMIT THE LUBRICANT TO TOUCH YOUR SKIN. IF IT DOES, WASH IMMEDIATELY WITH SOAP AND WATER.

(14) With a brush, apply lubricant (D00651) to the blade root area.
   (a) There is no cure requirement.

S 648-043-N00

(15) Use one of the two methods that follow to lubricate the blade mid-span shroud.

WARNING: DO NOT PERMIT THE LUBRICANT TO TOUCH YOUR SKIN. IF IT DOES, WASH IMMEDIATELY WITH SOAP AND WATER.

   (a) With a brush, apply lubricant (D00651) to the contact faces of the mid-span shroud of the blade.
      1) Wait five minutes before the you install the blade.
   (b) With a brush, apply the anti-seize paste (D50124) to the contact faces of the mid-span shroud of the blade.
      1) There is no cure requirement.

S 438-049-N00

(16) If it is necessary, install a new blade platform seal (AMM 72-31-02/801).

S 228-045-N00

(17) Measure the depth of cut made in the leading edge.

S 228-046-N00

(18) Use the vibropeen marking method to record the depth of cut on the blade platform.

S 428-047-N00

(19) Install all fan blade assemblies (AMM 72-31-02/401).

S 438-048-N00

(20) Install the inlet cone (AMM 72-31-01/401).

FAN EXIT FAIRING - REMOVAL/INSTALLATION

1. General
   A. These procedures give instructions to remove and install the fan exit fairing. The fan exit fairing is also refered to as the splitter. These procedures will refer to it as the fan exit fairing.
   B. The fan exit fairing is installed on the forward half of the low pressure compressor (LPC) stator assembly.
   C. You must go into the inlet cowl and remove all the 1st-stage fan blades to get to the fan exit fairing.

TASK 72-31-03-004-001-N00

2. Remove the Fan Exit Fairing (Fig. 401)
   A. General
      (1) This procedure gives instructions to remove the fan exit fairing.
   B. Equipment
      (1) Puller-Knocker - PWA85685
   C. References
      (1) AMM 72-31-01/401, Inlet Cone
      (2) AMM 72-31-02/401, 1st-Stage Fan Blades
   D. Access
      (1) Location Zones
         411 No. 1 Power Plant
         421 No. 2 Power Plant

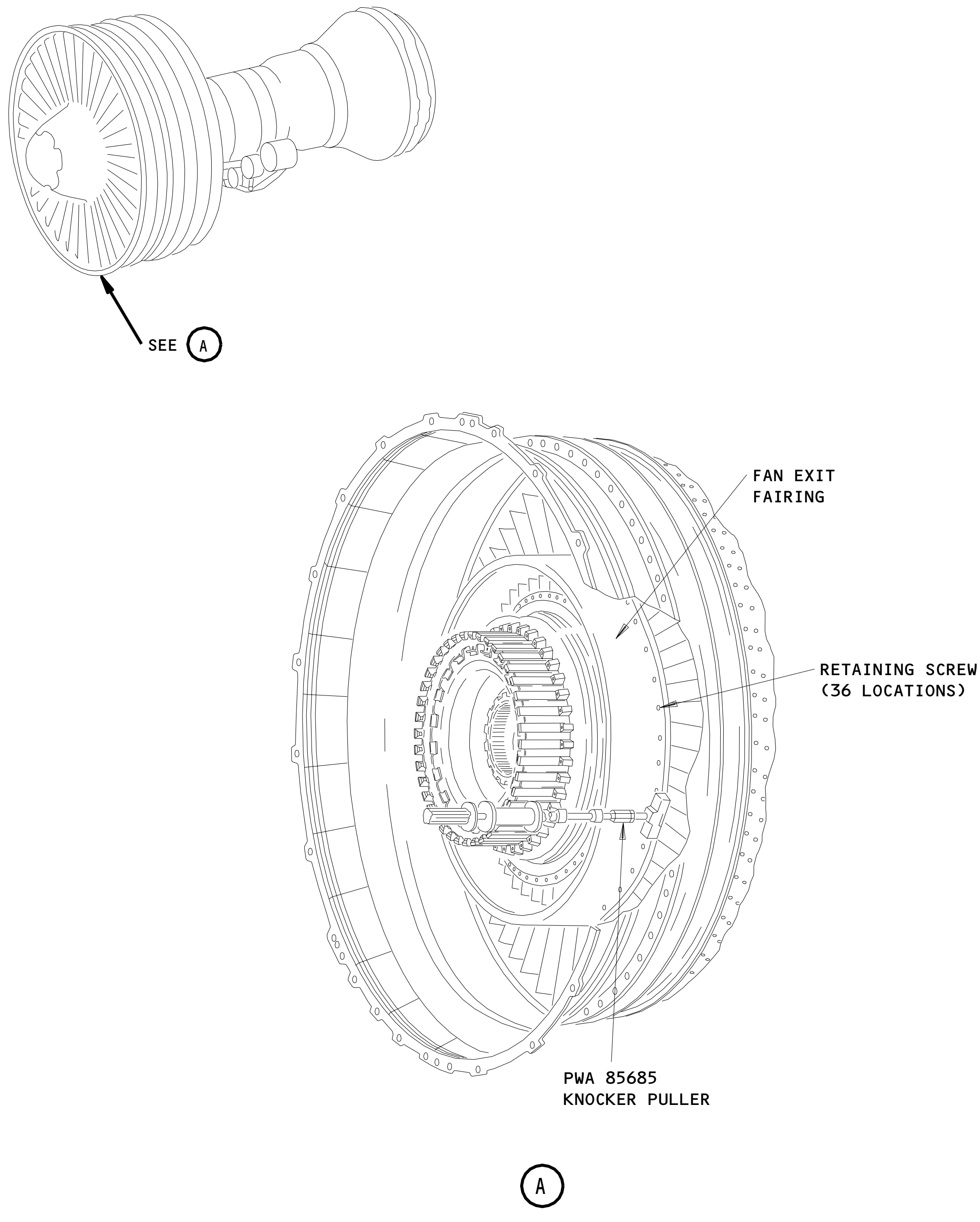
   E. Remove The Fan Exit Fairing (Fig. 401)

      S 434-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the P5 overhead panel.

      S 014-003-N00
      (2) Remove the inlet cone (AMM 72-31-01/401).

      S 014-004-N00
      (3) Remove all of the 1st-stage fan blades (AMM 72-31-02/401).

      S 424-005-N00
      (4) Install mats on the inner diameter of the fan case at the 6 o'clock position for protection of the rubstrip.



Fan Exit Fairing Installation
Figure 401

S 034-018-N00

(5) Remove the 36 screws that attach the fan exit fairing to the LPC stator assembly.

S 024-006-N00

(6) Do these steps to remove the fan exit fairing:
  (a) Put the small tooth side of the puller in one of the nine slots on the outer diameter of the fairing.
  (b) Move the fairing until you can use the opposite side of the puller jaw to complete the removal of the fairing.

TASK 72-31-03-404-007-N00

3. Install The Fan Exit Fairing (Fig. 401)

A. General
  (1) This procedure gives instructions to install the fan exit fairing.

B. Consumable Materials
  (1) D00137 Oil, Engine (PWA521B) (AMM 70-30-00).

C. References
  (1) AMM 70-30-00/201, Consumable Materials
  (2) AMM 72-31-01/401, Inlet Cone
  (3) AMM 72-31-02/401, 1st-Stage Fan Blades

D. Access
  (1) Location Zones
      411 No. 1 Power Plant
      421 No. 2 Power Plant

E. Install the fan exit fairing (Fig. 401)

S 984-008-N00

(1) Put the fan exit fairing on the outer diameter of the LPC stator assembly.

S 984-009-N00

(2) Engage the fan exit fairing with the front flange of the LPC stator assembly.

S 984-010-N00

(3) Align the holes in the fairing with the holes in the fan exit case and the inner front flange of the vane assembly.

S 424-011-N00

(4) Install the 36 screws, with lubricated threads, in the fan exit fairing.

S 434-012-N00

(5) Tighten the screws to 36-40 pound-inches (4.1-4.5 newton-meters).

S 034-013-N00

(6) Remove the protection mats from the inner diameter of the fan case.

S 414-014-N00

(7) Install the 1st-stage (Fan) blades (AMM 72-31-02/401).

S 414-015-N00

(8) Install the inlet cone (AMM 72-31-01/401).

S 034-016-N00

(9) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

S 724-017-N00

(10) Do the test for the fan exit case assembly that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

FAN EXIT FAIRING - INSPECTION/CHECK

1. General
   A. This procedure gives a visual inspection of the fan exit fairing for nick, gouges, cracks, and delamination.
   B. The fan exit fairing, or splitter, is aft of the 1st-stage fan blades and is mounted on the forward half of the low pressure compressor, LPC, stator assembly.
   C. You can go into the inlet cowl and look between the fan blades to examine the fan exit fairing.

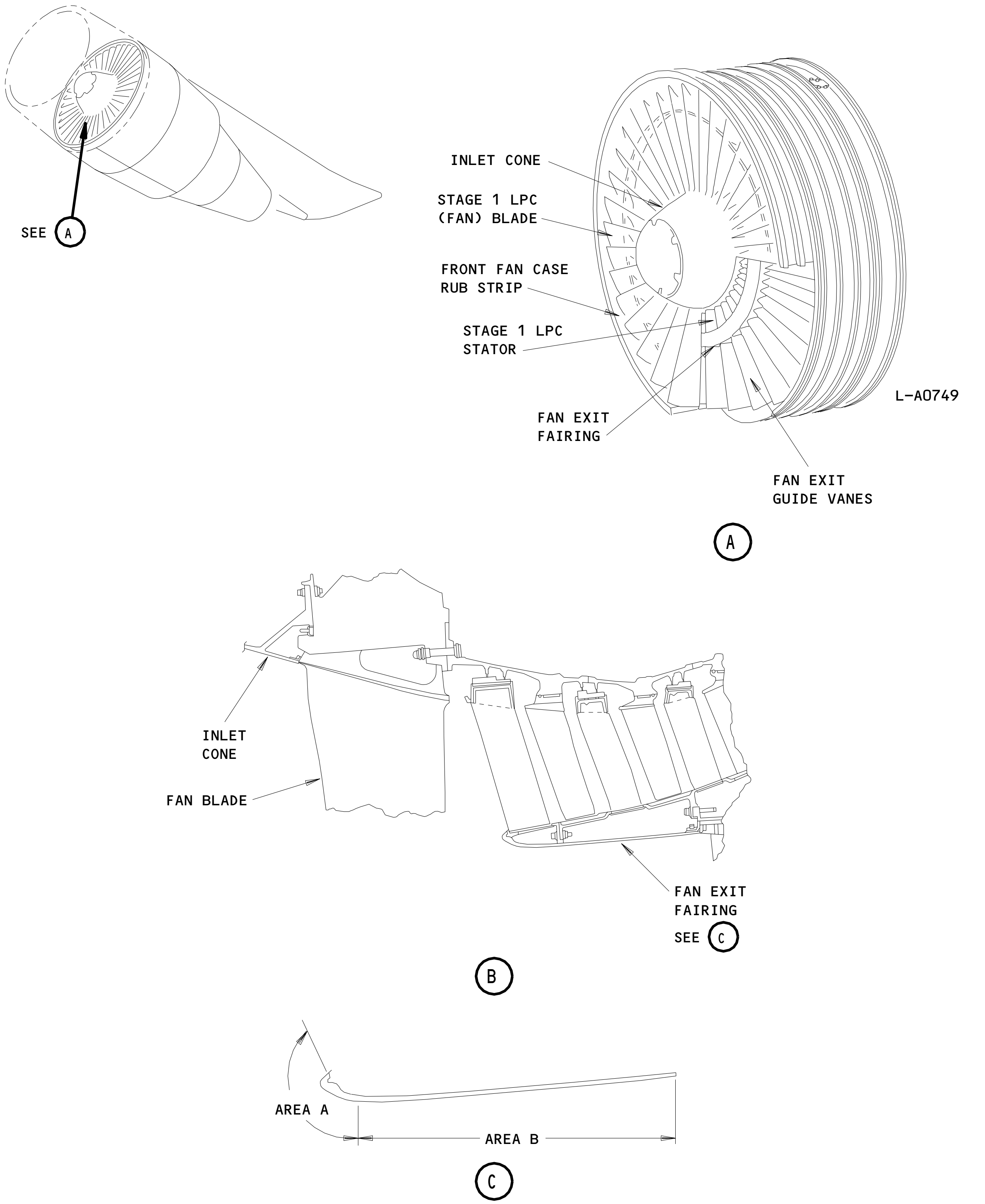
TASK 72-31-03-216-004-N00

2. Fan Exit Fairing - Inspection/Check
   A. References
      (1) AMM 72-31-03/401, Fan Exit Fairing
   B. Access
      (1) Location Zones
          410 Left Power Plant Nacelle
          420 Right Power Plant Nacelle

   C. Do an Inspection of the Fan Exit Fairing (Fig. 601)

      S 866-003-N00
      (1) Attach a DO-NOT-CLOSE tag to the ENG START switch on the pilot's overhead panel, P5.

      S 216-002-N00
      (2) Visually examine the fan exit fairing:



Fan Exit Fairing Inspection
Figure 601

AREA	EXAMINE FOR:	CONTINUE-IN-SERVICE LIMITS	CORRECTIONS IF DAMAGE IS WORSE THAN LIMITS
A	Nicks, Gouges, and Cracks and Cracks	Not more than 0.050 inch (1.270 mm) in depth, less than 0.50 inch (12.700 mm) in width, at least 2.00 inches (50.80 mm) apart from other nicks, gouges, or cracks, and no more than three in a 45 degree arc.	Replace the Fan Exit Fairing (AMM 72-31-03/401).
B	Nicks, and Gouges	Not more than 1.000 inch (25.400 mm) in diameter, not more than 0.050 inch (1.270 mm) in depth, at least 2.00 inches (50.800 mm) apart from other nicks, or gouges, and no more than three in a 45 degree arc.	Replace the Fan Exit Fairing (AMM 72-31-03/401).
A and B	Delamination of the composite material Examine after each 50 hours of operation for increased dimensions.	Not more than 1.000 inch (25.400 mm) by 1.500 inch (38.100 mm) in area, not more than 0.050 inch (1.270 mm) in depth, at least 2.00 inches apart from other delaminations, nicks, or gouges, and no more than three in a 45 degree arc.	Replace the Fan Exit Fairing before the 26th hour of operation (AMM 72-31-03/401).
		Not more than 2.50 inches (63.50 mm) by 2.00 inches (50.80 mm) in area.	Replace the Fan Exit Fairing immediately (AMM 72-31-03/401).

AREA	EXAMINE FOR:	CONTINUE-IN-SERVICE LIMITS	CORRECTIONS IF DAMAGE IS WORSE THAN LIMITS
A and B	Delamination, erosion, or loose areas of the Black Polyurethane Surface Layer	100 percent of the surface area NOTE: Fan exit fairing assemblies with a steel leading edge cap will not have the black polyurethane surface layer. Make sure this steel leading edge cap is correctly attached.	

S 866-001-N00

(3) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

1ST-STAGE STATOR - REMOVAL/INSTALLATION

1. General
   A. The procedure that follows gives the tasks for the removal and installation of the 1st-stage stator.
   B. The 1st-stage stator is aft of the 1st-stage (fan) blades.
   C. You must remove the fan blades to get access to the 1st-stage stator.

TASK 72-31-04-004-001-N00

2. Remove the 1st-Stage Stator (Fig. 401)
   A. Equipment
      (1) Puller - Knocker - PWA85685 Pratt & Whitney, East Hartford, Connecticut
      (2) Protective Mat-Rubber Manufacturer's Association, Grade SC43 neoprene sponge, 1-inch thick, approximately 5x6 feet with warning streamer attached (3 required).
   B. References
      (1) AMM 72-31-01/401, Inlet Cone
      (2) AMM 72-31-02/401, 1st-Stage (Fan) Blade
      (3) AMM 72-31-03/401, Fan Exit Fairing
   C. Access
      (1) Location Zones
         410 Left Power Plant Nacelle
         420 Right Power Plant Nacelle

   D. Prepare for the Removal

      S 434-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot overhead panel, P5.
   E. Remove the 1st-Stage Stator

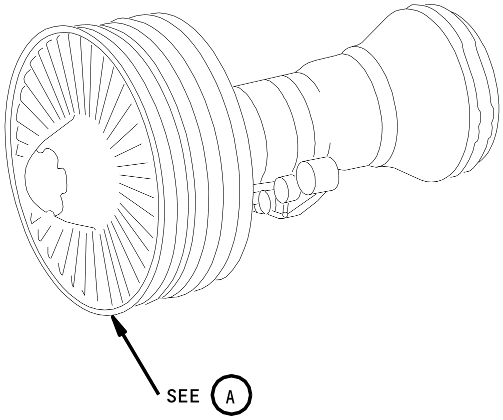
      S 424-022-N00

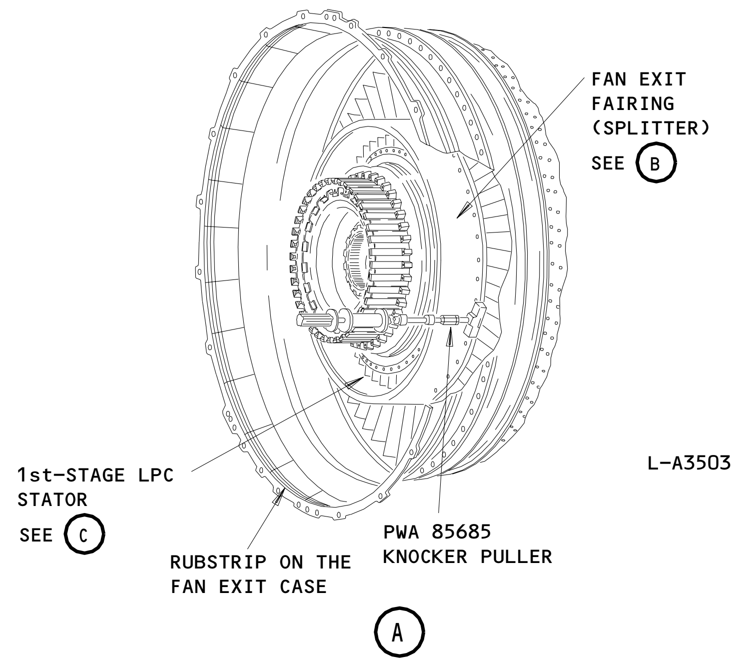
      CAUTION: PUT COVERS ON ALL OF THE LOWER HALF OF THE INNER SURFACE OF THE INLET COWL. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH TAPE. IF THE EDGES DO NOT TOUCH, THEN THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

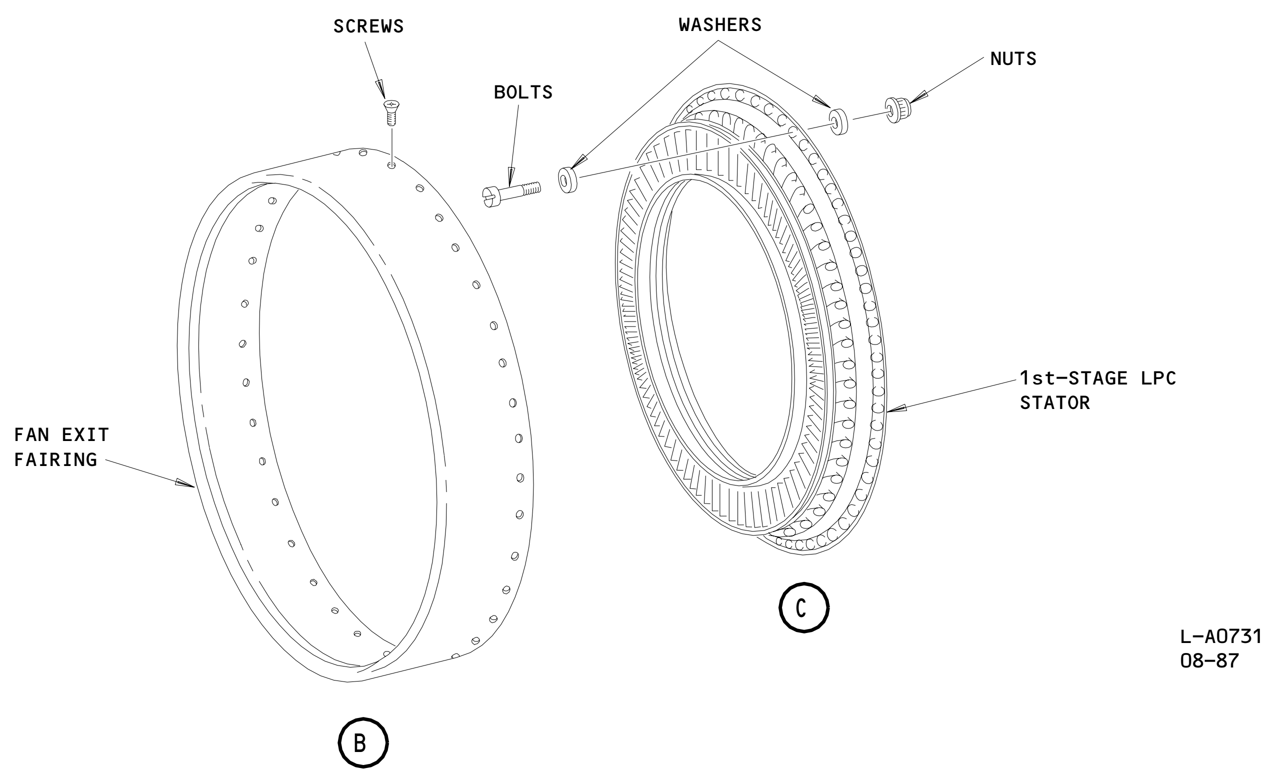
      (1) Put protective mats on the lower half of the inner surface of the inlet cowl.

      S 014-004-N00
      (2) Remove the inlet cone (AMM 72-31-01/401).

      S 014-005-N00
      (3) Remove all of the 1st-stage fan blades (AMM 72-31-02/401).







1st-Stage Stator Installation
Figure 401

S 424-006-N00
(4) Install mats on the inner diameter of the fan case at the 6 o'clock position for protection of the rubstrip.

S 014-007-N00
(5) With the PWA85685 Puller, remove the fan exit fairing (AMM 72-31-03/401).

S 034-008-N00
(6) Remove the bolts, washers, and nuts from the outer flange of the 1st-stage stator.

S 024-009-N00
(7) Remove the 1st-stage stator from the engine.

TASK 72-31-04-404-010-N00
3. Install the 1st-Stage Stator (Fig. 401)
A. Equipment
(1) Protective Mat-Rubber Manufacturer's Association, Grade SC43 neoprene sponge, 1-inch thick, approximately 5x6 feet with warning streamer attached (3 required).
B. Consumable Materials
(1) D00137 Engine Oil - PWA 521
C. References
(1) AMM 71-00-00/501, Power Plant
(2) AMM 72-31-01/401, Inlet Cone
(3) AMM 72-31-02/401, 1st-Stage Fan Blades
(4) AMM 72-31-03/401, Fan Exit Fairing
D. Access
(1) Location Zones
410 Left Power Plant Nacelle
420 Right Power Plant Nacelle

E. Install the 1st-Stage Stator Assembly

S 984-011-N00
(1) Put the 1st-stage stator, with the offset holes at approximately 3 and 9 o'clock, on the engine.

S 644-012-N00
(2) Lubricate the bolt threads with oil.

S 424-013-N00

(3) Attach the 1st-stage stator to the engine with bolts, washers, and nuts.

<u>NOTE</u>: The washers are adjacent to the bolt heads and the nuts.

(a) Tighten the bolts to 36-40 pound-inches (4.1-4.5 newton-meters).

S 414-015-N00

(4) Install the fan exit fairing on the 1st-stage stator (AMM 72-31-03/401).

S 434-021-N00

(5) Torque the screws to 36-40 pound-inches (4.1-4.5 newton-meters).

S 034-016-N00

(6) Remove the protective mat from the inner surface of the fan case.

S 414-017-N00

(7) Install all of the 1st-stage fan blades (AMM 72-31-02/401).

S 414-018-N00

(8) Install the inlet cone (AMM 72-31-01/401).

S 034-019-N00

(9) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot overhead panel, P5.

S 724-020-N00

(10) Do test No. 8, the Vibration Survey, and test No. 14, the PT2 System Leak Test (Ref 71-00-00/501).

1ST STAGE STATOR - INSPECTION/CHECK

TASK 72-31-04-206-007-N00

1. Examine the 1st-Stage Stator Vanes (Fig. 601)
   A. General
      (1) This procedure gives the steps for the inspection of the 1st-stage stator assembly.
      (2) The stator assembly is a circular flange to which the stator vanes are attached. This stator assembly is at the forward section of the front compressor, and is immediately aft of the fan rotor blades.

      (3) When you examine the blades and vanes, make sure you find the cause of all foreign object damage (FOD), to make sure that the LP compressor is fully serviceable. FOD damage in this area can be an indication of a more dangerous problem. If you find FOD damage, make sure no other components in the same area are damaged.
      (4) The limits in this section will help you know if the engine can continue to operate or if you must remove and repair it.
      (5) The edges or surfaces of the vanes that you will examine were possibly blended. To blend a vane is to remove material around damage on the vane until the damaged area becomes smooth.
   B. References

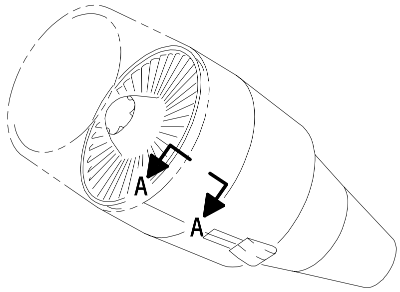
      (1) AMM 72-31-04/801, 1st-Stage Stator
   C. Access
      (1) Location Zones
          410 Left Engine
          420 Right Engine

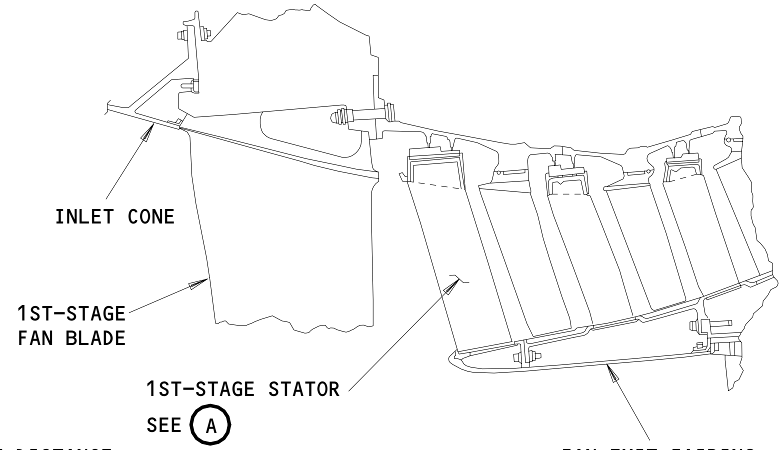
   D. Prepare for the Procedure.

      S 866-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the overhead panel, P5.

   E. Examine the 1st-Stage Stator Vanes.

      S 356-004-N00
      (1) Replace or repair vanes that have nicks or dents (AMM 72-31-04/401).





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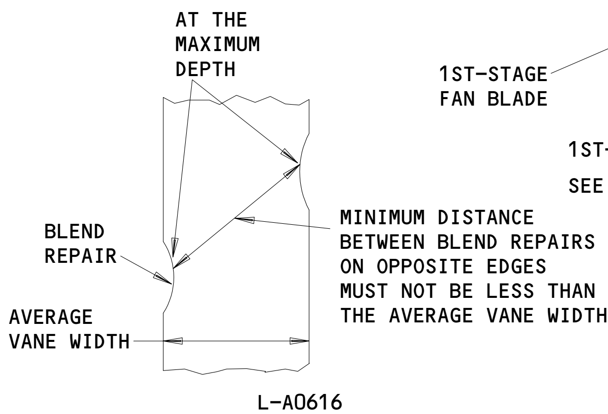
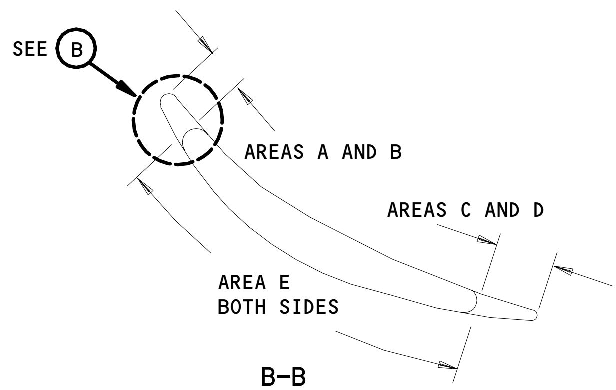


MINIMUM DISTANCE BETWEEN BLEND REPAIRS



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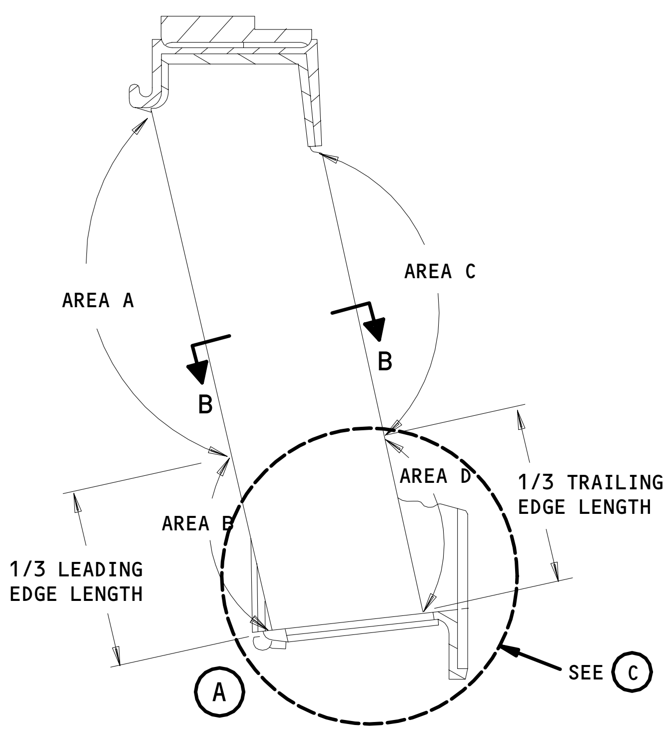
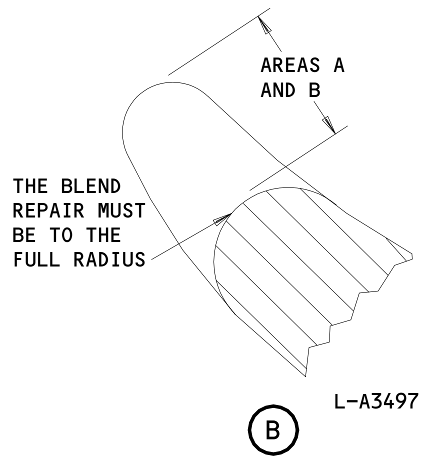
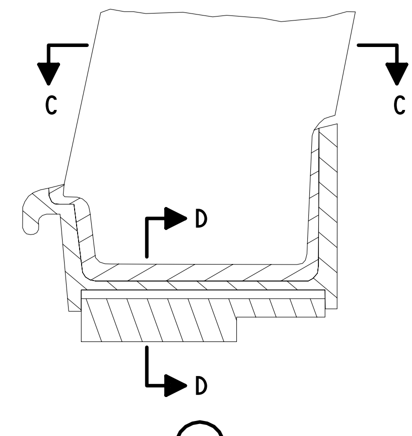




1st-Stage Stator Inspection
Figure 601 (Sheet 1)



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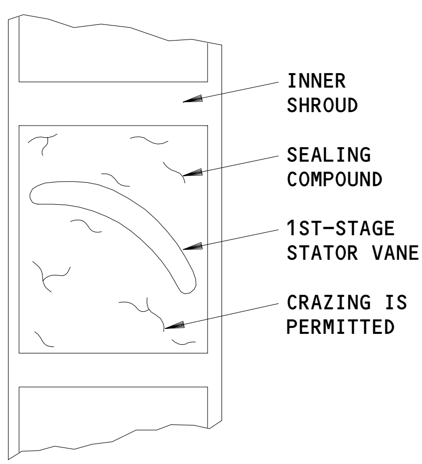

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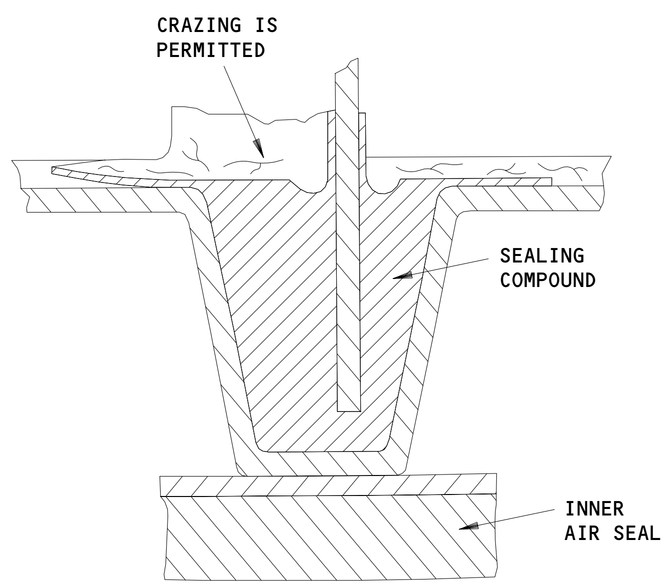

D-D

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1st-Stage Stator Inspection
Figure 601 (Sheet 2)

S 216-008-N00

(2) Compare the damage you find with Table 601 and the limits that follow (Fig. 601).

NOTE: These limits are for damage that was blended, and not for damage that is not blended.

TABLE 601
MAXIMUM PERMITTED BLEND LIMITS

VANE AREA	LIMIT
A	0.100 inch (2.540 mm)
B	0.090 inch (2.286 mm)
C	0.100 inch (2.540 mm)
D	0.090 inch (2.286 mm)
E	25 percent of local thickness

(a) Blended areas on the concave airfoil surface can be on no more than 20 percent of the surface area.
    1) Rounded bottom dents are permitted.
(b) Blended areas on the convex airfoil surface can be on no more than 5 percent of the surface area.
(c) The sum of the lengths of all blended areas on the two edges of a vane must not be more than 0.500 inch (12.700 mm).
(d) No more than two blended areas at the maximum depth limit are permitted on each vane.
(e) Areas that are blended must have a length that is not less than four times the depth.
(f) The limits that follow are for blended areas that are at the maximum depth on opposite edges of the vane.
    1) One blended area must not be immediately opposite the other.
    2) One blended area must not be less than the vane width average from the other blended area.
(g) The limit that follows is for blended areas that are not at the maximum depth, are on opposite edges, and one is nearer than the vane width average to the other.
    1) The sum of the depths of the two blended areas must not be more than the maximum depth for one blended nick.
(h) The sum of the lengths of all edge blended areas in the vane and shroud assembly must not be more than 6.000 inches (152.4 mm).

(i) All local blended areas on the concave and convex sides must have an area that is not less than 15 times the depth of the damage.

(j) Pitting and corrosion can be repaired if the damage does not have a depth that is more than 12 percent of the local vane thickness.

NOTE: Pitting is a concentration of corrosion at a point.

(k) The surface finish on a blended vane must be the same as the surface finish on a new vane.

(l) Damage which you can see on the opposite side of the vane is not permitted.

(m) Compare the damage to the sealing compound on the inner shroud with the limits that follow (Fig. 601):

1) Very small cracks (called crazing), dryness, and areas where there is little bond between the sealing compound and the vane or shroud are permitted if the vane is not loose.

2) Very small cracks (called crazing), dryness, and areas where there is little bond between the sealing compound and the vane or shroud are not permitted if the vane is loose.

(n) Repair the vanes that must be repaired (AMM 72-31-04/801).

F. Put the airplane back to its usual condition.

S 866-001-N00

(1) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

1ST-STAGE STATOR - APPROVED REPAIRS

1. General
   A. This procedure gives the steps to blend the 1st-Stage Stator vanes.
   B. The stator assembly is a circular flange to which the stator vanes are attached. This stator assembly is at the forward section of the front compressor, and is immediately aft of the fan rotor blades.
   C. You must go into the inlet cowl and remove the fan blades to get access to the 1st-stage stator.

TASK 72-31-04-308-015-N00

2. Repair the 1st-Stage Stator Vanes
   A. General
      (1) You will blend the edges or surfaces of the 1st-stage stator vanes to do the repair. You can blend the vanes with a high quality file, an abrasive cloth, or an abrasive stone. You can blend with a slow speed power tool if you must remove a large quantity of material.
   B. References
      (1) AMM 71-00-00/501, Power Plant
      (2) AMM 72-31-02/601, 1st-Stage Fan Blade
      (3) AMM 72-31-01/401, Inlet Cone
      (4) AMM 72-31-04/401, 1st-Stage Stator
   C. Equipment
      (1) Protective Mat-Rubber Manufacturer's Association, Grade SC43 neoprene sponge, 1-inch thick, approximately 5x6 feet with warning streamer attached (3 required).
   D. Prepare to repair the 1st-stage stator vanes.

      S 868-001-N00

      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

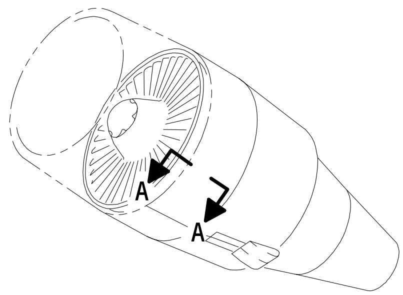
      S 428-019-N00

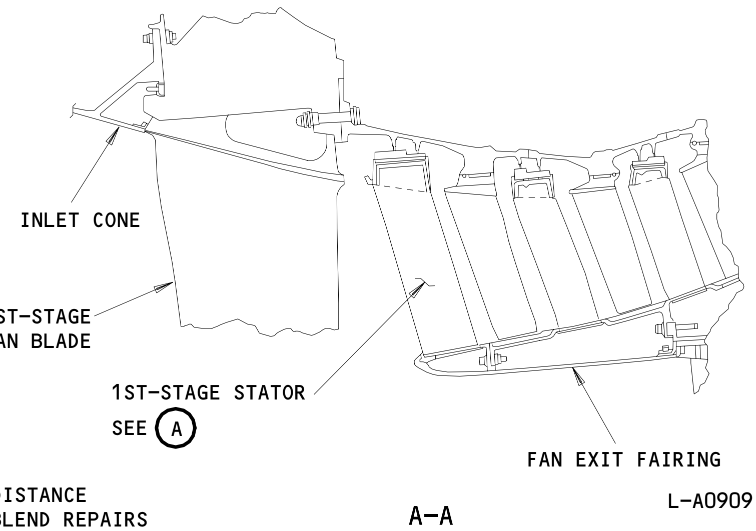
      CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER INNER SURFACE OF THE INLET COWL. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT TOGETHER, THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

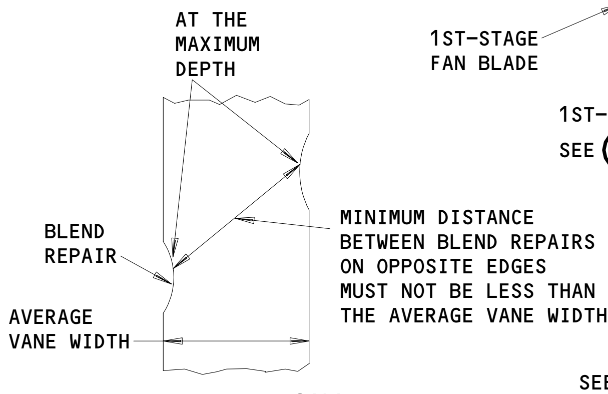
      (2) Put the protective mats on the lower inner surface of the inlet cowl.

      S 018-003-N00

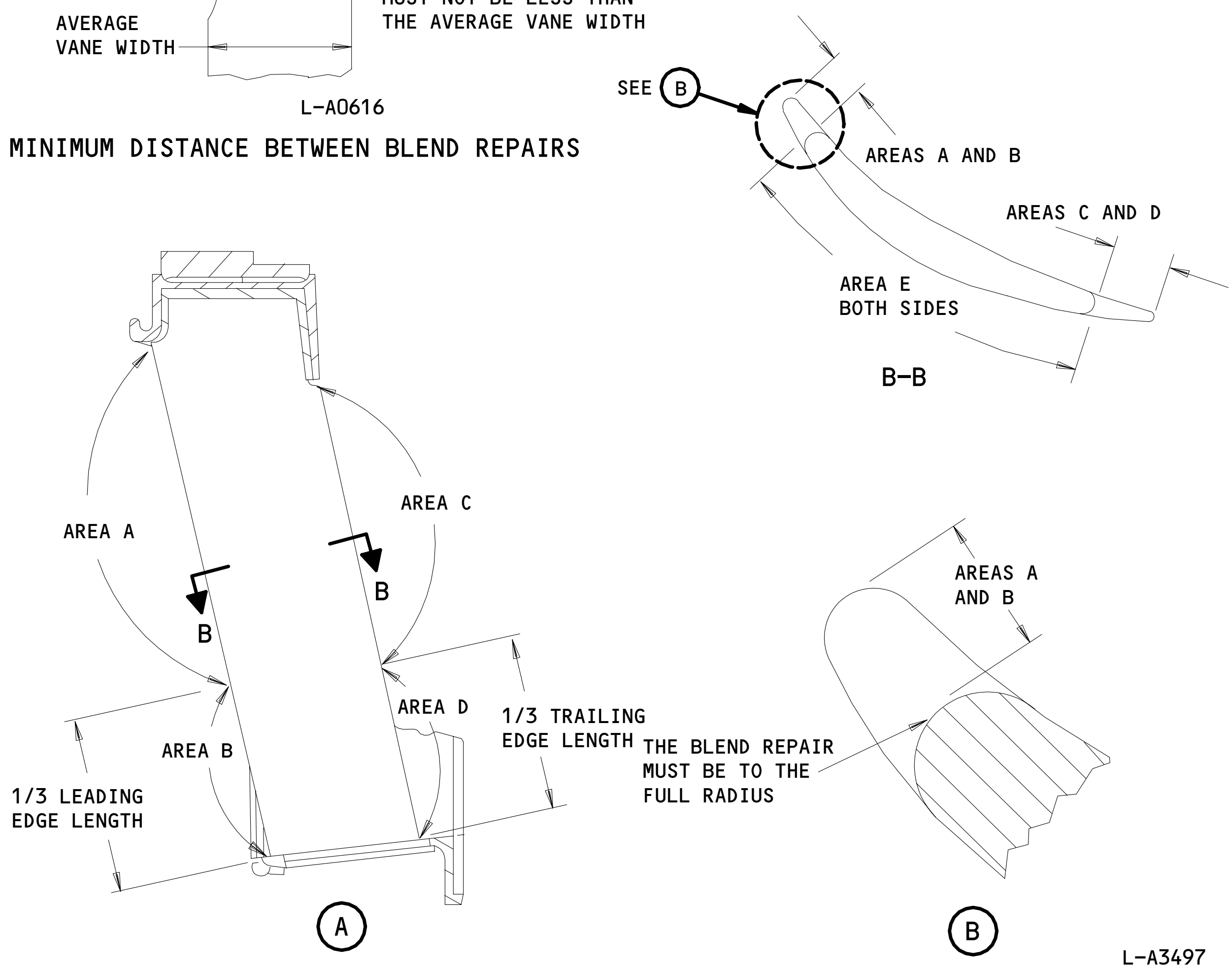
      (3) Remove the inlet cone (AMM 72-31-01/401).







MINIMUM DISTANCE BETWEEN BLEND REPAIRS



1st-Stage Stator Blend Limits
Figure 801

S 018-004-N00

(4) Remove all of the 1st-stage fan blades (AMM 72-31-04/401).

S 428-016-N00

(5) Put the protective mat on the inner surface of the fan case to prevent damage to the rubstrip.

S 028-005-N00

(6) Remove the 1st-stage stator (AMM 72-31-04/401).

E. Repair the 1st-Stage Stator Vanes (Fig. 801)

S 328-013-N00

CAUTION: IF YOU USE A POWER TOOL TO BLEND, MAKE SURE THERE IS NOT TOO MUCH HEAT. DAMAGE TO THE BLADE CAN OCCUR IF THERE IS TOO MUCH HEAT ON THE BLADE.

(1) Use a fine file, an abrasive cloth, or an abrasive stone to do the blend repair.

NOTE: If the damage is very large or deep, use a slow speed power tool first. Then, blend by hand to make the area smooth.

(a) Always blend in a longitudinal direction (parallel with the length of the blade).

(b) Refer to Table 801 for the Limits for the Blended 1st-stage Stator Vanes.

TABLE 801
LIMITS FOR THE BLENDED 1ST-STAGE STATOR VANES

VANE AREA	LIMIT
A	0.100 inch (2.540 mm)
B	0.090 inch (2.286 mm)
C	0.100 inch (2.540 mm)
D	0.090 inch (2.286 mm)
E	25 percent of the local thickness

NOTE: These limits are for blended areas on the vanes, and not for damage that is not blended.

S 328-014-N00

(2) Refer to the limits that follow when you blend the damage on the 1st-stage stator vanes.

(a) Blended areas on the concave airfoil surface can be on no more than 20 percent of the surface area.

1) Rounded bottom dents are permitted.

(b) Blended areas on the convex airfoil surface can be on no more than 5 percent of the surface area.

(c) The sum of the lengths of all blended areas on the two edges of a vane must not be more than 0.500 inch (12.700 mm).

(d) No more than two blended areas at the maximum depth limit are permitted on each vane.

(e) Areas that are blended must have at least a four to one length-to-depth ratio.

(f) The limits that follow are for blended areas that are at the maximum depth on opposite edges of the vane.

1) A blended area must not be immediately opposite the other blended area.

2) One blended area must not be less than the vane width average from the other blended area.

(g) The limit that follows is for blended areas that are not at the maximum depth are on opposite edges, and one is nearer than the vane width average to the other.

1) The sum of the depths of the two blended areas must not be more than the maximum depth for one blended nick.

(h) The sum of the lengths of all edge blended areas in the vane and shroud assembly must not be more than 6.000 inches (152.4 mm).

(i) All local blended areas on the concave and convex sides must have an area that is not less than 15 times the depth of the damage.

(j) Pitting and corrosion can be repaired if the damage does not have a depth that is more than 12 percent of local vane thickness.

<u>NOTE</u>: Pitting is a concentration of corrosion at a point.

(k) The surface finish on a blended vane must be the same as the surface finish on a new vane.

(l) Damage, which you can see on the opposite side of the vane, is not permitted.

S 238-007-N00

(3) Do a fluorescent penetrant inspection on the blended vanes (AMM 72-31-02/601) to make sure that all damage is repaired. Use ultra high sensitivity penetrant.

(a) Replace the vane if you find a crack.

F. Put the Airplane Back to its Usual Condition.

S 428-008-N00
(1) Install the 1st-stage stator (AMM 72-31-04/401).

S 428-017-N00
(2) Remove the protective mat from the inner surface of the fan case.

S 418-009-N00
(3) Install all of the 1st-stage fan blades (AMM 72-31-02/401).

S 418-010-N00
(4) Install the inlet cone (AMM 72-31-01/401).

S 028-018-N00
(5) Remove the protective mat from the inner surface of the inlet cowl.

S 868-011-N00
(6) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

S 728-012-N00
(7) Do Test 8 - Vibration Survey (AMM 71-00-00/501).

1.6-STAGE BLADE - INSPECTION/CHECK

1. General
   A. This procedure gives the steps for the inspection of the 1.6 stage blades.
   B. The 1.6 stage blades are immediately aft of the 1st-stage stator of the low pressure compresser (LPC).
   C. Remove the 1st-stage stator assembly to get access to the 1.6 stage blades.

TASK 72-31-05-206-001-N00

2. Examine the 1.6 Stage Blades
   A. General
      (1) It is necessary to examine the 1.6 stage blades only if the inpection of the 1st-stage stator showed damage.
      (2) Damaged areas that were made smooth for a repair is referred to as blended.
   B. References
      (1) AMM 70-11-06/201, Fluorescent Penetrant Inspection
      (2) AMM 72-31-01/401, Inlet Cone
      (3) AMM 72-31-02/401, 1st-Stage Fan Blades
      (4) AMM 72-31-04/401, 1st-Stage Stator
      (5) AMM 72-31-05/801, 1.6-Stage Blade
   C. Access
      (1) Location Zones
         410 Left Power Plant Nacelle
         420 Right Power Plant Nacelle

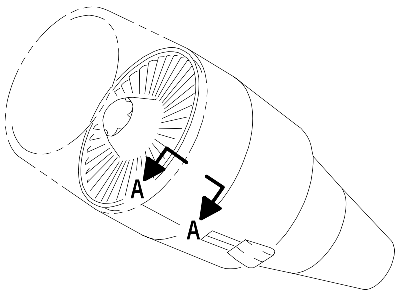
   D. 1.6-Stage Blades Inspection (Fig. 601)

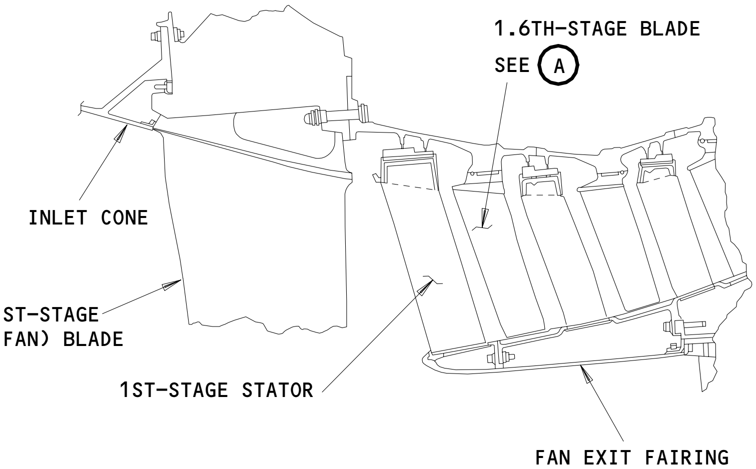
      S 866-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

      S 016-003-N00
      (2) Remove the inlet cone (AMM 72-31-01/401).

      S 016-004-N00
      (3) Remove the fan blades (AMM 72-31-02/401).

      S 016-005-N00
      (4) Remove the 1st-stage stator (AMM 72-31-04/401).





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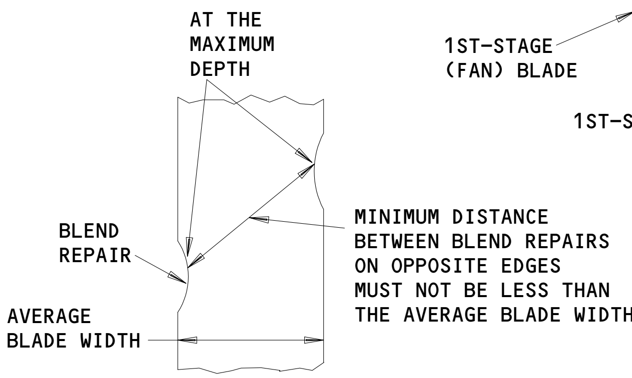

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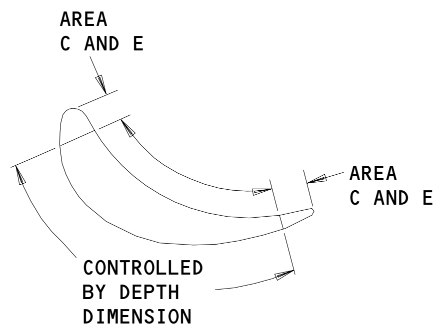
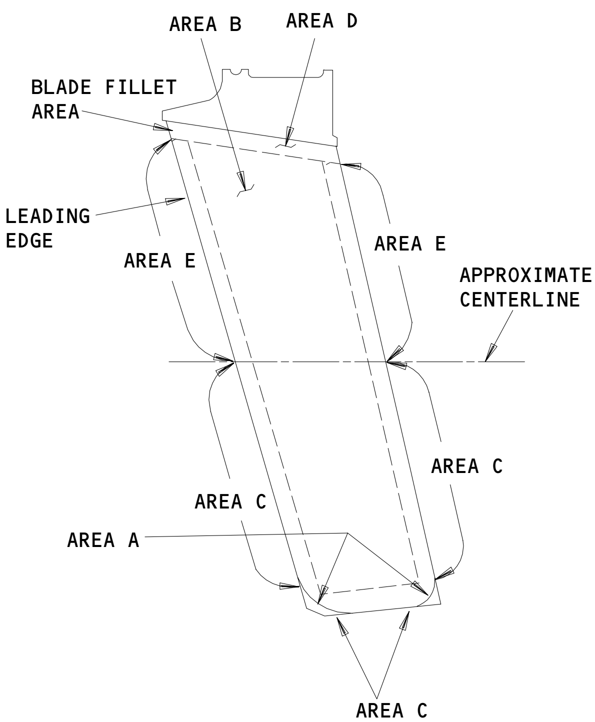
MINIMUM DISTANCE BETWEEN BLEND REPAIRS



TYPICAL AIRFOIL SECTION



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MAX ALLOWABLE BLEND REPAIR LIMITS	
BLADE AREA	DEPTH LIMITS
A	0.375 in. RADIUS (9.525 mm)
B	NO GREATER THAN 25% OF LOCAL THICKNESS
C	0.125 in. DEEP (3.175 mm)
D	NONE
E	0.032 in. DEEP (0.813 mm)

L-A3595

1.6-Stage Blade Inspection
Figure 601

S 236-006-N00

CAUTION: USE CAUTION WHEN YOU USE THIS PROCEDURE TO MAKE A DECISION ABOUT THE CONDITION OF THE ENGINE. THE INSPECTION LIMITS ARE A RESULT OF STRUCTURAL ANALYSIS. THE PART LIFE AND THE PERFORMANCE OF THE ENGINE CAN DECREASE QUICKLY WHEN THE DAMAGE OF THE PARTS BECOMES NEAR TO THE MAXIMUM CONTINUE-IN-SERVICE LIMITS.

(5) Do a fluorescent penetrant inspection of the blades for cracks (AMM 70-11-06/201). Use ultra high sensitivity penetrant.
    (a) No cracks are permitted.

S 216-007-N00

(6) Refer to figure 601 and the limits that follow when you repair the damage you find.
    (a) Blended areas must have a length that is not less than four times the depth.
    (b) The limits that follow are for blended areas that are at the maximum depth on opposite edges of the blades.
        1) One blended area must not be immediately opposite the other.
        2) One blended area must not be less than the average blade width from the other blended area.
    (c) No more than two blended areas at the maximum depth limit are permitted on each blade edge.
    (d) All blended edge damage which is not more than 1/2 the maximum depth limit are permitted, if 3/4 of each edge is not blended.
    (e) The sum of the lengths of blended tip damage must not be more than 25% of the total tip length.
    (f) On smooth, rounded bottom dents, remove only the edge of the damage.
        1) The blended repairs in area B must not be on more than 10% of the airfoil surface.

NOTE: Nicks that are on the leading and trailing edges change the performance of the engine more as they occur nearer to the blade root. All damage on the inner half of the airfoil must be repaired with caution.

    (g) Blades that have rough dents (blade material compressed and edges raised) and defects with small radii or ragged edges must be removed.
    (h) Rounded damage at the leading and trailing edges, which you can see on the opposite surface of the blade, are permitted as follows.
        1) The damage is on the outer half of the blade,
        2) The dent is not more than 0.010 inch (0.254 mm) in depth.

(i) Repair defects that are on the inner half of the blade only after you carefully examine them.

<u>NOTE</u>: Nicks in the leading and trailing edges change the performance of the engine more as they occur near to the root.

S 356-008-N00

(7) Repair the applicable blades (AMM 72-31-05/801).

S 416-009-N00

(8) Install the 1st-stage stator (AMM 72-31-04/401).

S 416-010-N00

(9) Install the fan blades (AMM 72-31-02/401).

S 416-011-N00

(10) Install the inlet cone (AMM 72-31-01/401).

S 866-012-N00

(11) Remove the DO-NOT-OPERATE tag from the ENG START switch on pilot's overhead panel, P5.

1.6-STAGE BLADES - APPROVED REPAIRS

1. General
    A. This procedure gives the steps for the blend repair of the 1.6-stage blades.
    B. The 1.6 stage blades are immediately aft of the 1st-stage stator of the low pressure compressor (LPC).
    C. You can remove the 1st-stage stator assembly to get access to the 1.6 stage blades.

TASK 72-31-05-308-006-N00

2. 1.6 Stage Blades Repair
    A. General
        (1) You will blend the edges or surfaces of the 1.6 stage blades to do the repair. You can blend the blades with a high quality file, an abrasive cloth, or an abrasive stone. You can blend with a slow speed power tool if you must remove a large quantity of material.
    B. Equipment
        (1) Protective Mat-Rubber Manufacturer's Association, Grade SC43 neoprene sponge, 1-inch thick, approximately 5x6 feet with warning streamer attached (3 required).
    C. References
        (1) AMM 70-11-06/201, Fluorescent Penetrant Inspection
        (2) AMM 72-31-01/401, Inlet Cone
        (3) AMM 72-31-02/401, 1st-Stage Fan Blades
        (4) AMM 72-31-04/401, 1st-Stage Stator
        (5) AMM 72-31-05/601, 1.6-Stage Blade
    D. Access
        (1) Location Zones
            410 Left Power Plant Nacelle
            420 Right Power Plant Nacelle

    E. Prepare to Repair the 1.6-Stage Blades.

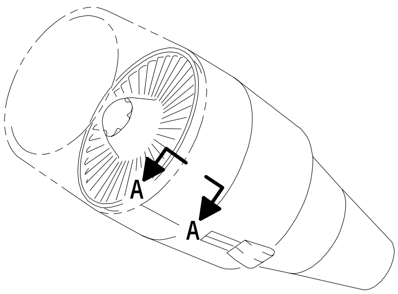
        S 868-001-N00
        (1) Attach a DO-NOT-OPERATE tag to the ENG START switch of the pilot's overhead panel, P5.

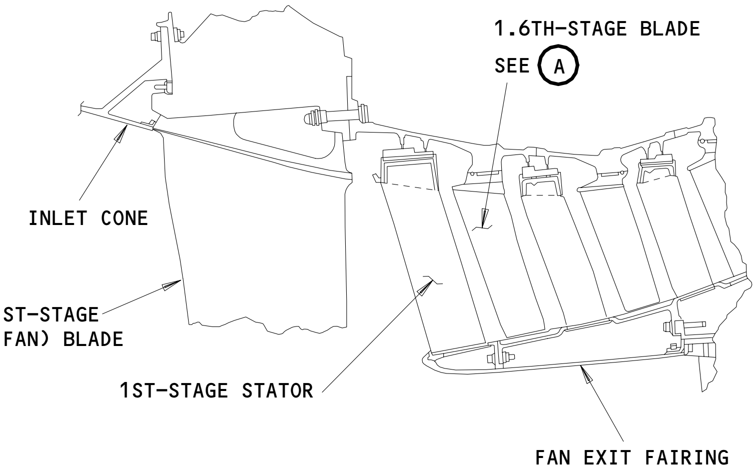
        S 948-002-N00

        CAUTION: MAKE SURE THAT YOU PUT COVERS ON ALL OF THE LOWER INNER SURFACE OF THE INLET COWL. ALSO MAKE SURE THAT THE EDGES OF THE MATS TOUCH OR ARE ATTACHED WITH SOME TAPE. IF THE EDGES ARE NOT TOGETHER, THE TOOLS OR PARTS CAN FALL AND CAUSE DAMAGE TO THE INLET COWL SURFACE.

        (2) Put the protective mats on the lower inner surface of the inlet cowl.

        S 018-003-N00
        (3) Remove the inlet cone (AMM 72-31-01/401).





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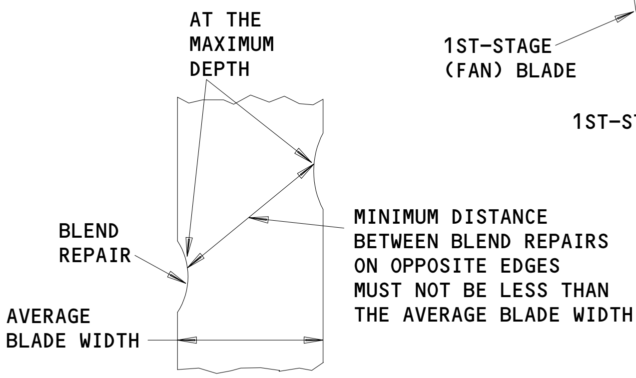

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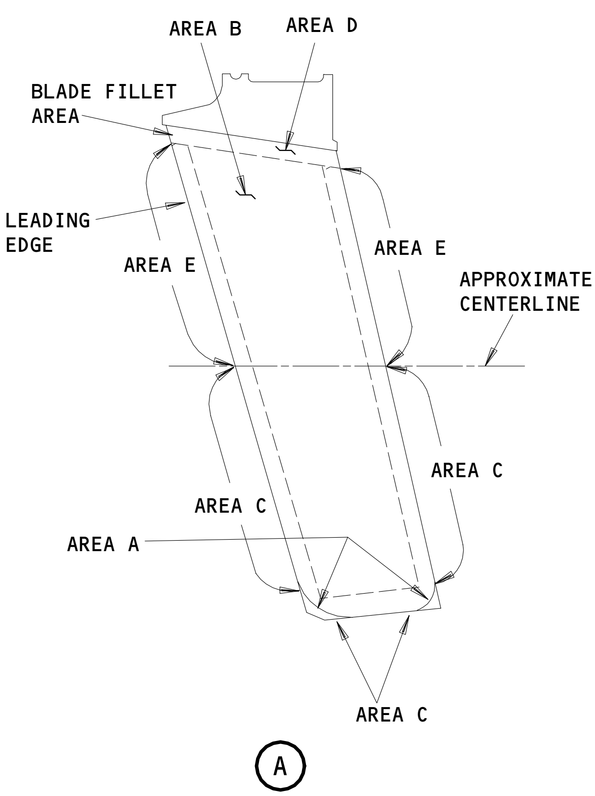
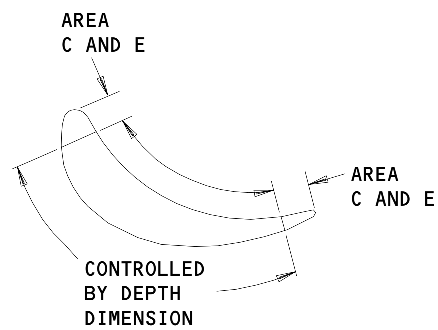
MINIMUM DISTANCE BETWEEN BLEND REPAIRS





TYPICAL AIRFOIL SECTION

MAX ALLOWABLE BLEND REPAIR LIMITS	
BLADE AREA	DEPTH LIMITS
A	0.375 in. RADIUS (9.525 mm)
B	NO GREATER THAN 25% OF LOCAL THICKNESS
C	0.125 in. DEEP (3.175 mm)
D	NONE
E	0.032 in. DEEP (0.813 mm)

L-A3596

1.6-Stage Blade Limits
Figure 801

S 018-004-N00

(4) Remove all of the 1st-stage fan blades (AMM 72-31-02/401).

S 018-005-N00

(5) Remove the 1st-stage stator (AMM 72-31-04/401).

F. Repair the 1.6-Stage Blades (Fig. 801).

S 328-009-N00

CAUTION: IF YOU USE A POWER TOOL TO BLEND, MAKE SURE THERE IS NOT TOO MUCH HEAT. DAMAGE TO THE BLADE CAN OCCUR IF THERE IS TOO MUCH HEAT ON THE BLADE.

(1) Use a fine file, an abrasive cloth, or an abrasive stone to do the blend repair.

NOTE: If the damage is very large or has a large depth, use a slow speed power tool first. Then, blend by hand to make the area smooth.

(a) Always blend in a longitudinal direction (parallel with the length of the blade).

S 358-007-N00

(2) Refer to figure 801 and the limits that follow when you repair the damage that you found during the inspection.

NOTE: These limits are a result of structural analysis. The part part life and the performance of the engine can decrease quickly when the damage of the parts becomes near to the maximum continue-in-service limits.

(a) Blended areas must have a length that is not less than four times the depth.

(b) The limits that follow are for blended areas that are at the maximum depth on opposite edges of the blades.

1) One blended area must not be immediately opposite the other.

2) One blended area must not be less than the average blade width from the other blended area.

(c) No more than two blended areas at the maximum depth limit are permitted on each blade edge.

(d) All blended edge damage which is not more than 1/2 the maximum depth limit are permitted, if 3/4 of each edge is not blended.

(e) The sum of the lengths of blended tip damage must not be more than 25% of the total tip length.

(f) On smooth, rounded bottom dents, remove only the edge of the damage.

1) The blended repairs in area B must not be on more than 10% of the airfoil surface.

(g) Repair defects that are on the inner half of the blade only after you carefully examine them.

NOTE: Nicks in the leading and trailing edges change the performance of the engine more when they occur near to the root.

S 238-008-N00

(3) Do a fluorescent penetrant inspection of the repaired areas of the blades (AMM 70-11-06/201). Use ultra high sensitivity penentrant.

(a) No cracks are permitted.

G. Put the Airplane Back to Its usual Condition.

S 418-011-N00

(1) Install the 1st-stage stator (AMM 72-31-04/401).

S 868-012-N00

(2) Remove the protective mat from the inner surface of the fan case.

S 418-013-N00

(3) Install all of the 1st-stage fan blades (AMM 72-31-02/401).

S 418-014-N00

(4) Install the inlet cone (AMM 72-31-01/401).

S 868-015-N00

(5) Remove the protective mat from the inner surface of the inlet cowl.

S 868-010-N00

(6) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

1.6TH-STAGE LPC STATOR RUBSTRIP - INSPECTION/CHECK

1. General
   A. This procedure gives the steps for the inspection of the 1.6th-stage LPC Stator Rubstrip for worn areas, damage, cracks, and holes.
   B. The 1.6th-stage stator rubstrip is immediately aft of the 1st-stage LPC stator of the low pressure compressor (LPC).
   C. To get access to the 1.6th-stage LPC stator rubstrip for the inspection, you must remove the inlet cone, the 1st-stage fan blades, and the 1st-stage stator.

TASK 72-31-08-206-001-N00

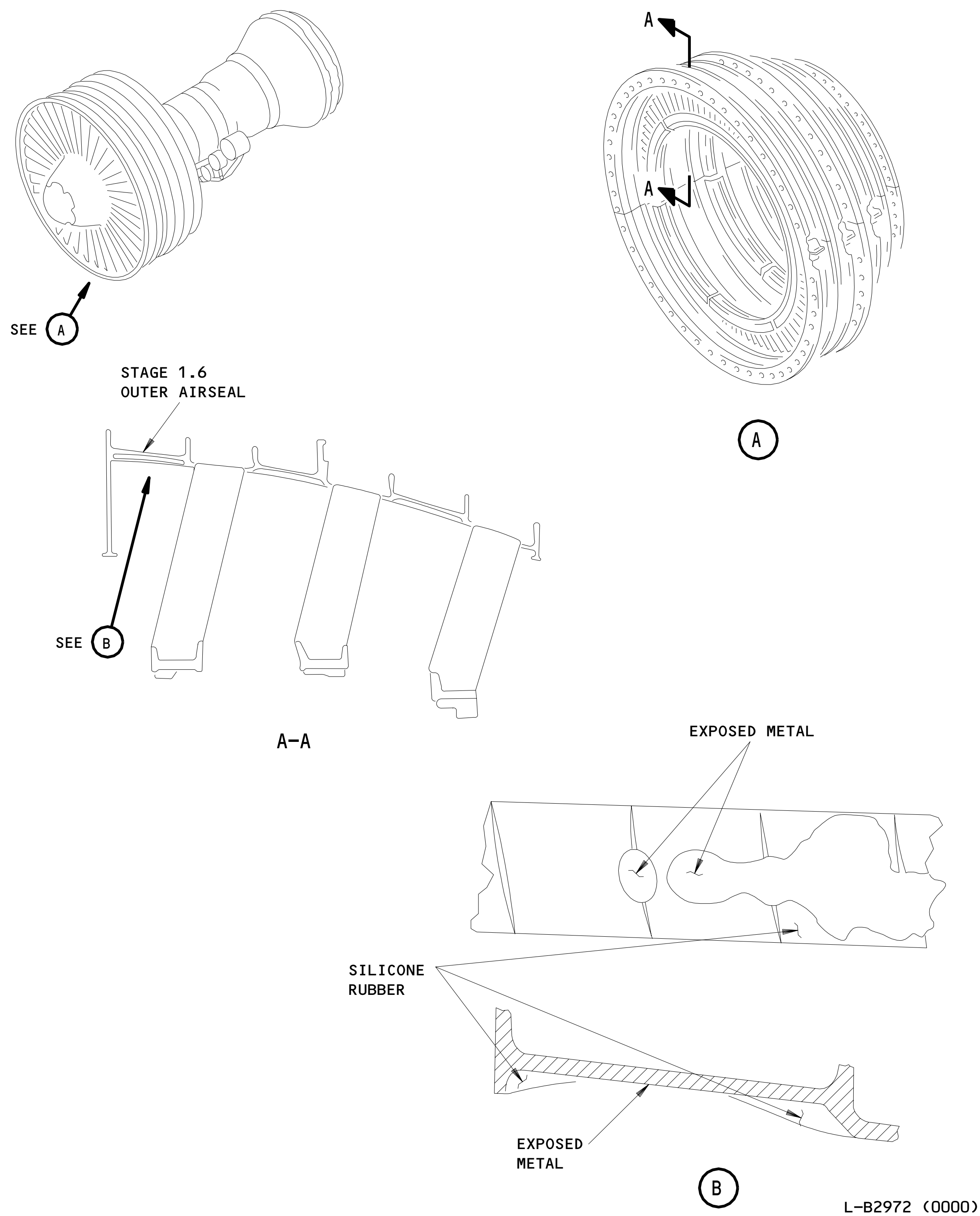
2. Examine the 1.6th-Stage LPC Stator Rubstrip (Fig. 601)
   A. General
      (1) It is necessary to examine the 1.6th-stage LPC stator rubstrip only if the inspection of the 1.6-stage stator (AMM 72-31-05/601) showed wear or erosion.
   B. Procedure

      S 216-002-N00

      (1) Do these steps to examine the 1.6 stage stator rubstrip for worn areas, damage, cracks, and holes:
         (a) Refer to Table 601 and the limits that follow when you examine the 1.6th-stage LPC stator rubstrip (Fig. 601).
         (b) The following continue-in-service limits should be applied to engines that have no recent operational discrepancies affecting the EGT margin.

TABLE 601
1.6-STAGE LPC STATOR RUBSTRIP CONTINUE-IN-SERVICE LIMITS

AREA	LIMIT
Blade wake erosion	Exposed metal all locations
Vane rub/erosion	Exposed metal 360 degrees
Other damage Scatches or Wear through the rubstrip that damages the metal	Not permitted



1.6 Low Pressure Compressor Stator Rubstrip
Figure 601

H19138

(c) Continued operation with worn or eroded 1.6 stage LPC rubstrips can result in a TSFC debit as high as 0.6 percent and an increase in EGT of 7 degrees C.

NOTE: If there is damage other than from wear and erosion, you must replace the engine immeadiately (AMM 71-00-02/401).

NOTE: If the damage exceeds the wear and erosion limits in Table 601, the engine can stay in service for 50 hours. After 50 hours, you must replace the engine (AMM 71-00-02/401).

FRONT FAN CASE - REMOVAL/INSTALLATION

1. General
   A. The removal and installation of the front fan case is done after you remove the inlet cowl, the inlet cone, the fan blades, and the Electronic Engine Control (EEC).

TASK 72-33-01-024-001-N00

2. Remove the Inlet Cowl
   A. Equipment
      (1) Bracket, Handling - PWA85677, Pratt & Whitney, East Hartford, Conn.
      (2) Hoist - 1-ton capacity, 20 foot lift, standard hand chain with safety hooks, Model 4504, C&M Hoist Division, Columbus McKinnon Corp., Tonowanda, New York, or equivalent
   B. Consumable Materials
      (1) D00137 Oil - PWA 521 (AMM 20-30-04)
   C. References
      (1) AMM 71-00-00/501, Power Plant
      (2) AMM 71-11-01/401, Inlet Cowl
      (3) AMM 71-11-04/201, Fan Cowl Panels
      (4) AMM 73-21-15/401, Supplemental Control Unit (SCU)
      (5) AMM 72-31-01/401, Inlet Cone
      (6) AMM 72-31-02/401, Fan Blades
      (7) AMM 73-21-04/401, Electronic Engine Control
   D. Access
      (1) Location Zones
          411 Left Engine
          421 Right Engine

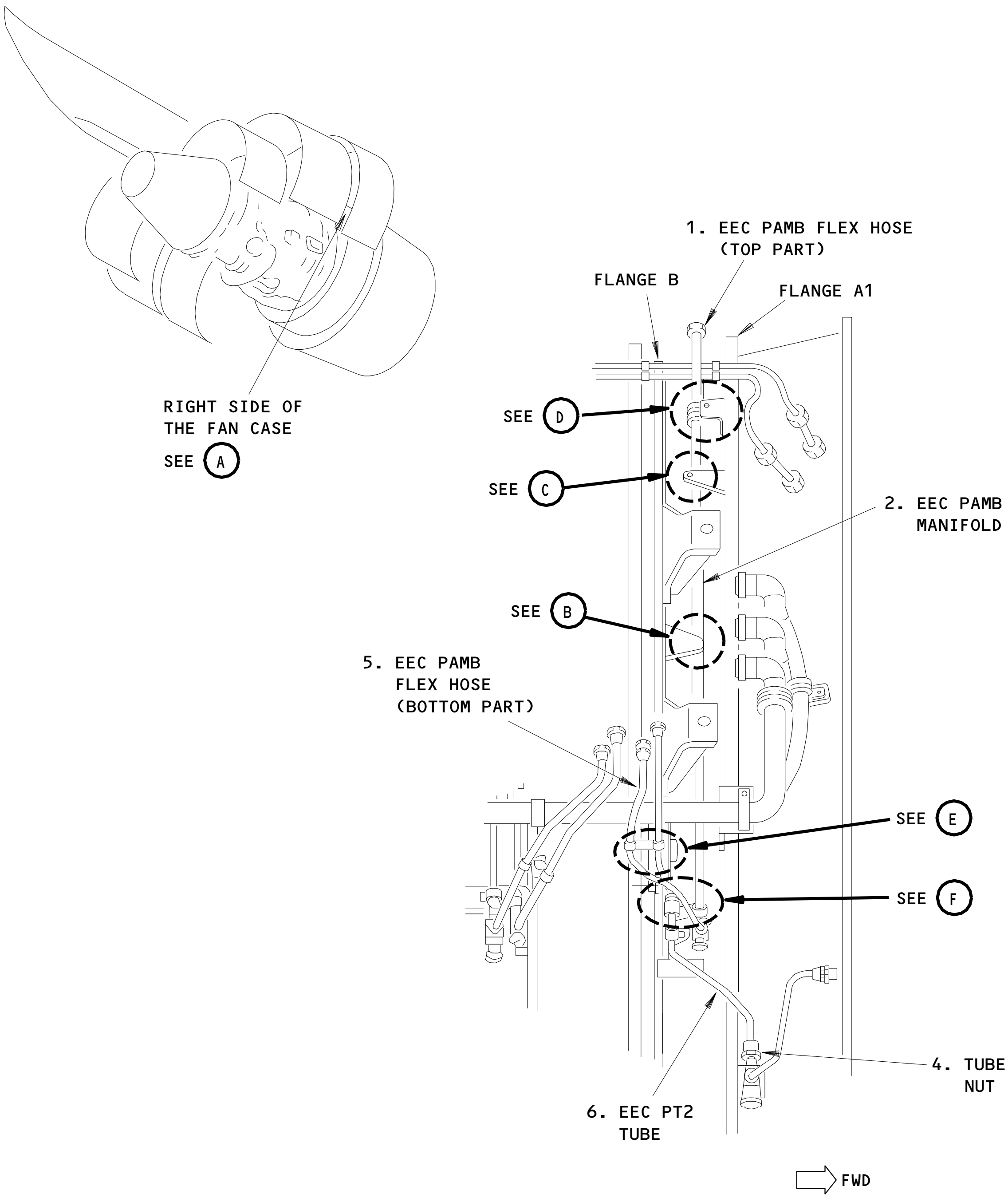
   E. Remove the Front Fan Case (Fig. 401 thru 406)

      S 864-002-N00
      (1) Attach the DO-NOT-OPERATE tag to the ENG START switch on the overhead panel, P5.

      S 014-003-N00

      WARNING: THE AIRCRAFT WING ON WHICH THE ENGINE IS MOUNTED MUST BE MADE STABLE BEFORE YOU REMOVE THE FRONT FAN CASE. INJURY TO PERSONS MAY RESULT IF THE WING IS NOT MADE STABLE.

      (2) Remove the inlet cowl (AMM 71-11-01/401).



EEC PLUMBING (EEC REMOVED)

A

1 ENGINES PRE-PW-SB 72-191

2 ENGINES POST-PW-SB 72-191

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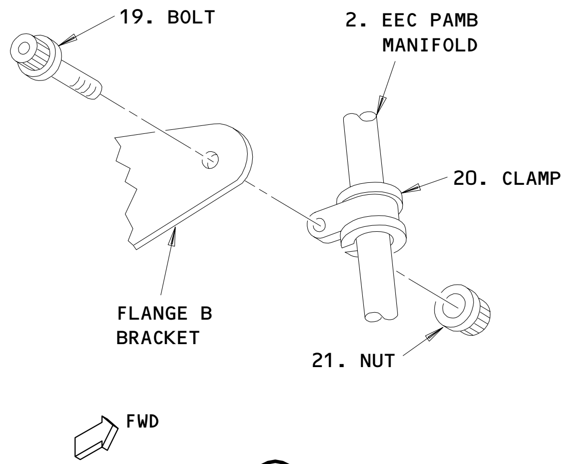
1189

Front Fan Case EEC Plumbing Installation
Figure 401 (Sheet 1)



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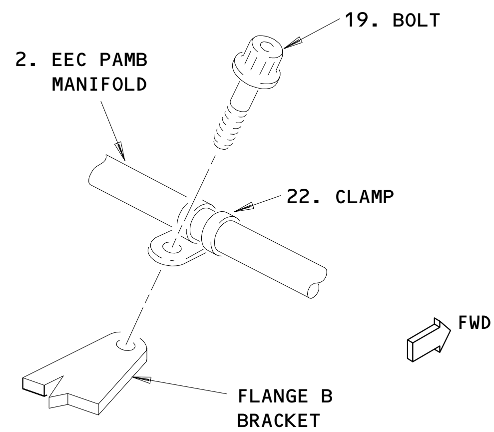

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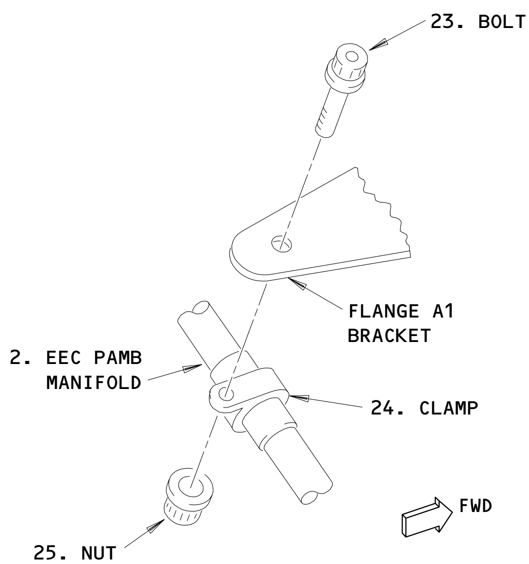
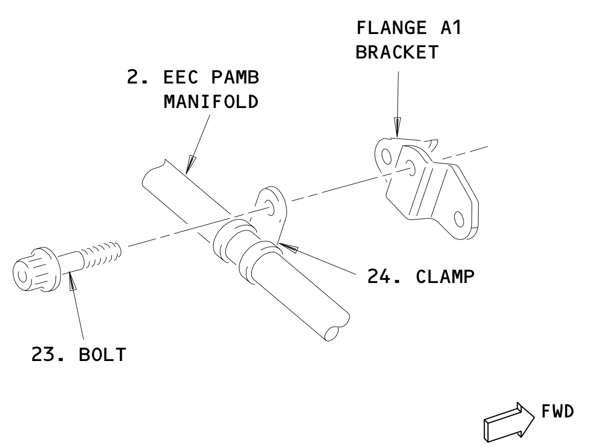


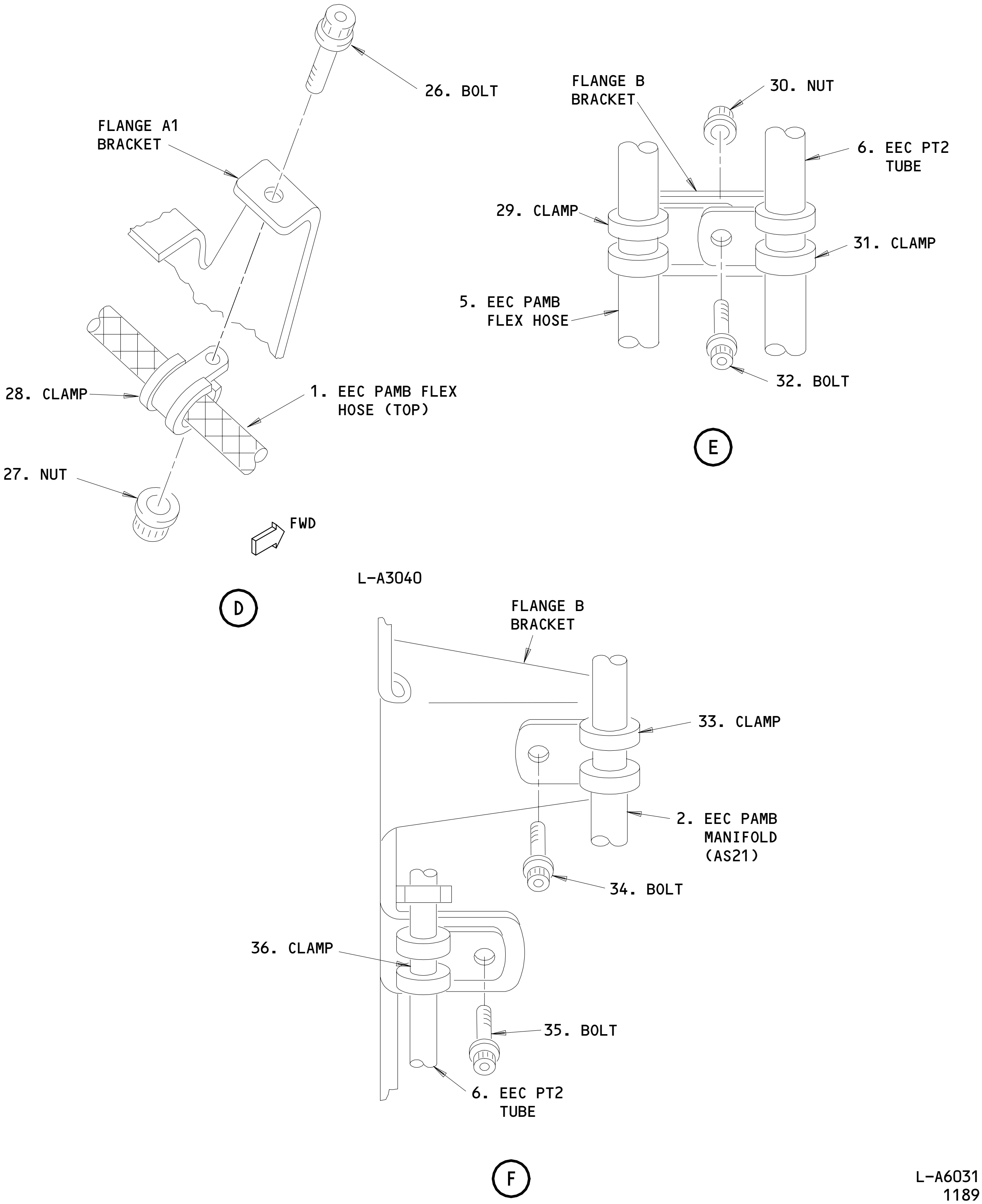
C 3



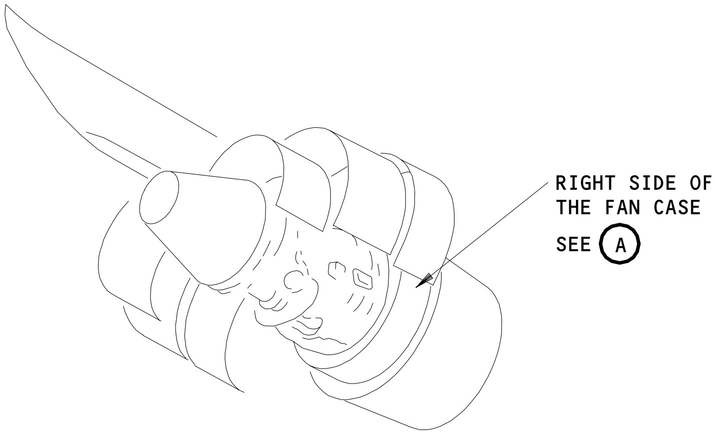
C 4

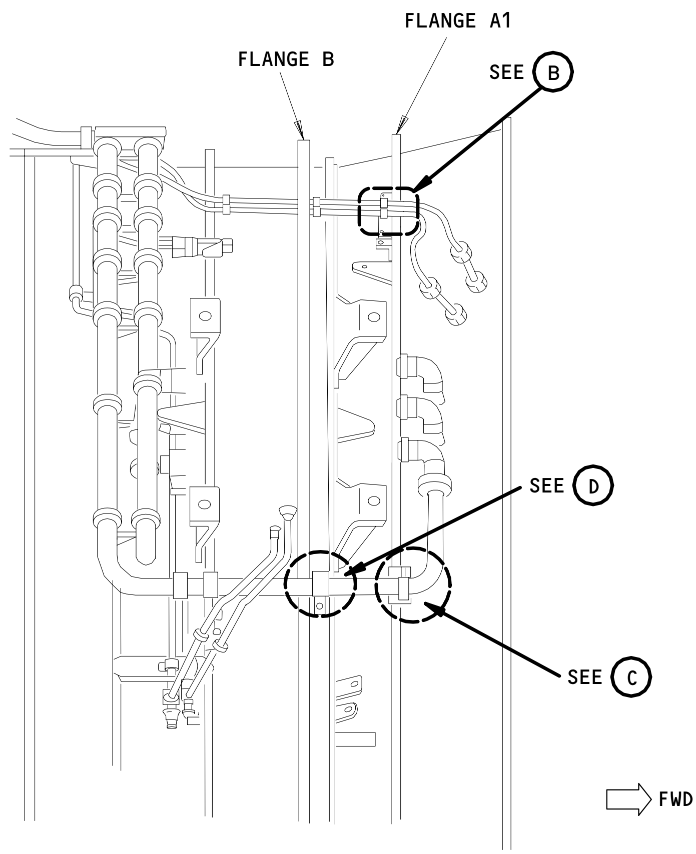
3 ENGINES PRE-PW-SB 72-230
4 ENGINES POST-PW-SB 72-230

Front Fan Case EEC Plumbing Installation
Figure 401 (Sheet 2)



Front Fan Case EEC Plumbing Installation
Figure 401 (Sheet 3)

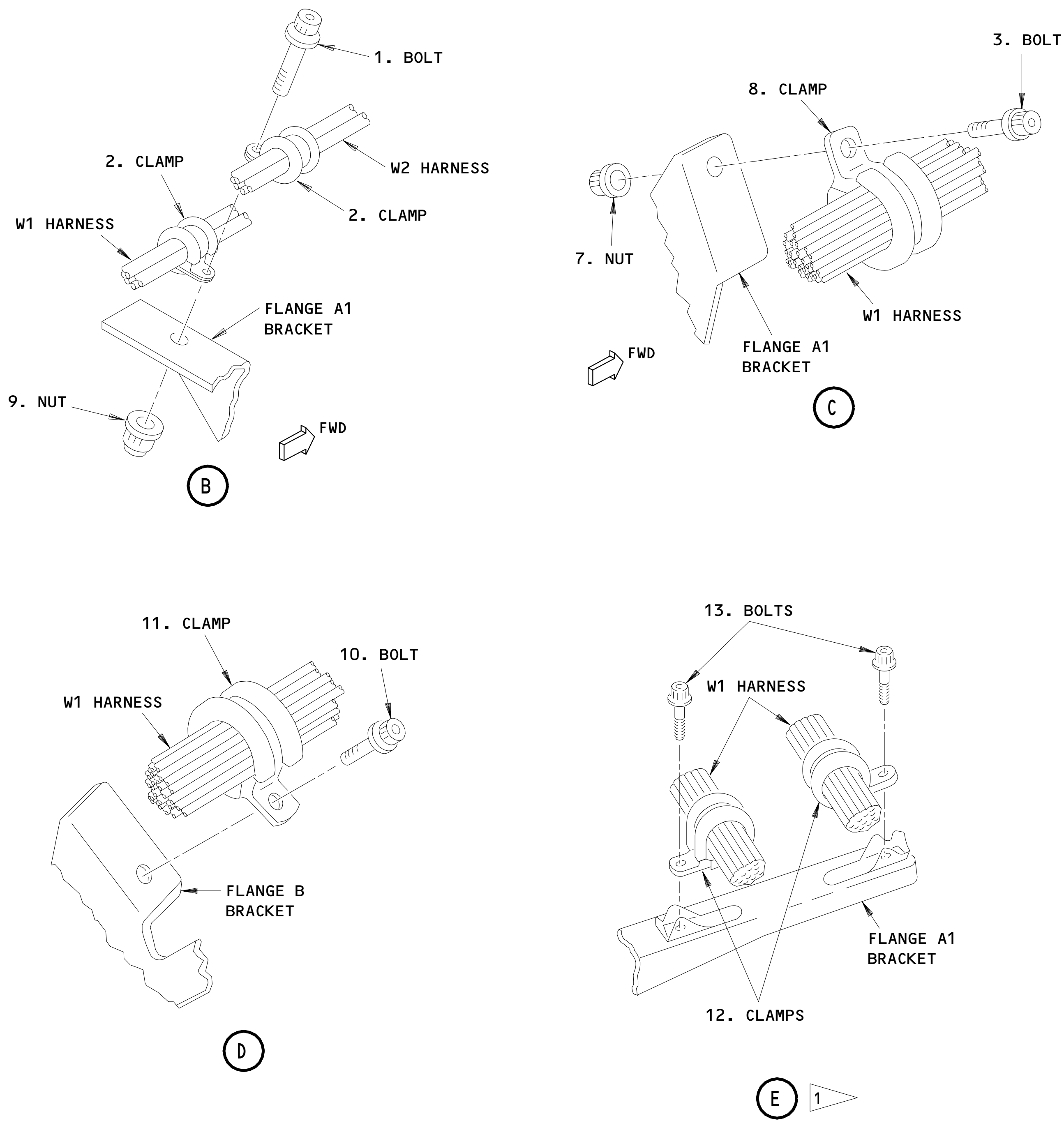




EEC PLUMBING (EEC REMOVED)
A

L-A3041
1189

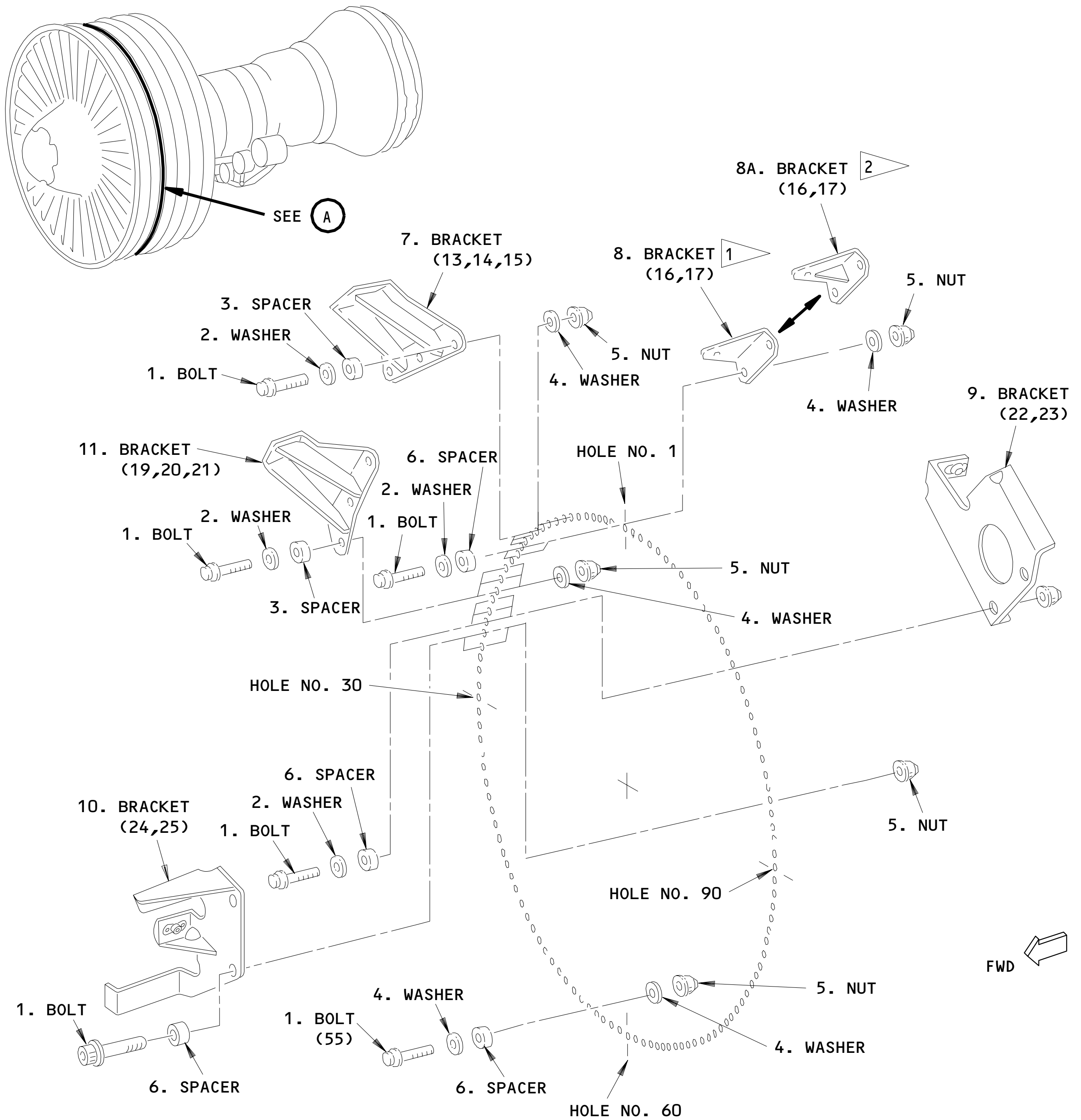
Front Fan Case EEC Wiring Installation
Figure 402 (Sheet 1)



L-A3042

1 ENGINES POST-PW-SB-73-101

Front Fan Case EEC Wiring Installation
Figure 402 (Sheet 2)



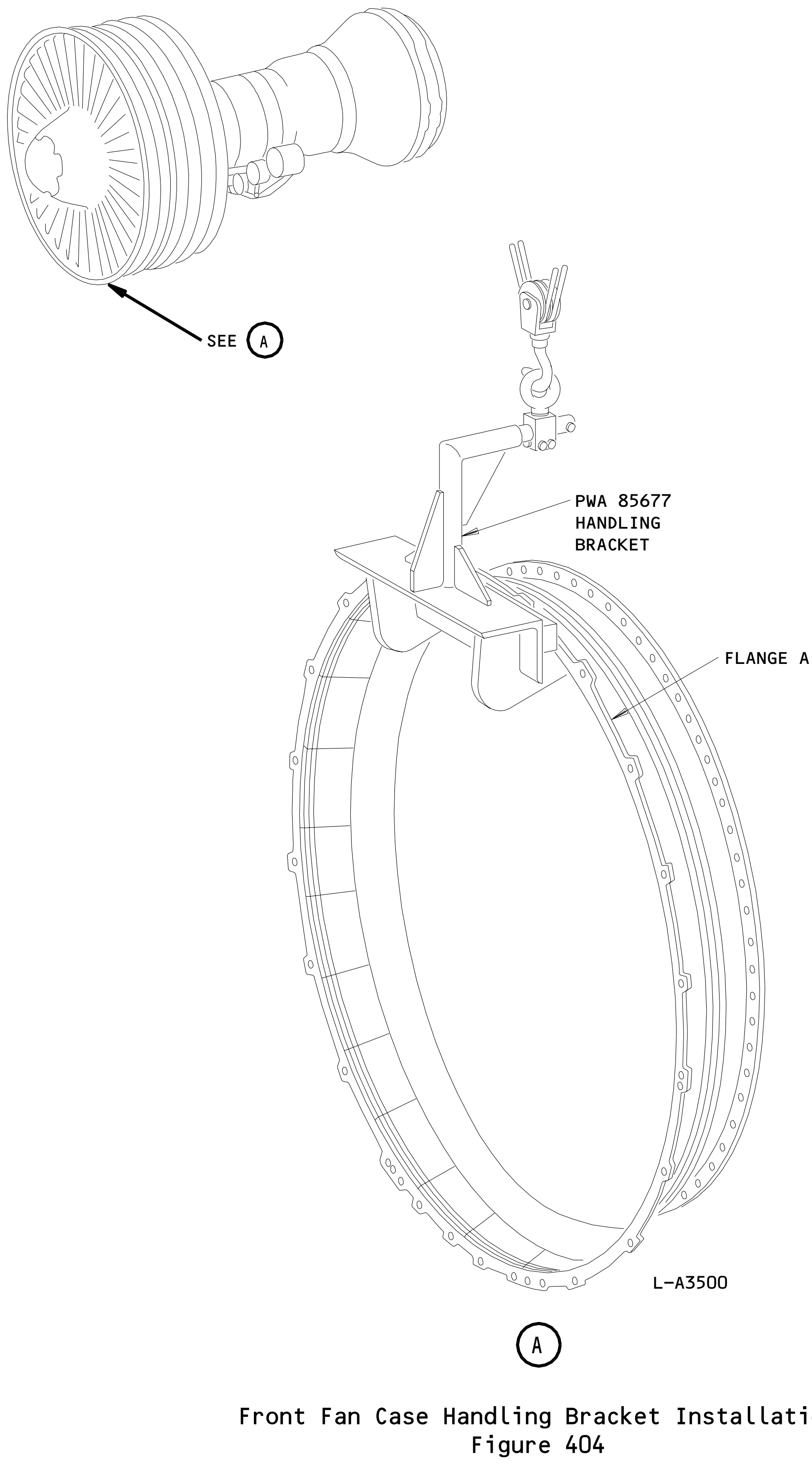
NOTE: NUMBERS IN PARENTHESIS ARE THE BOLT HOLE LOCATIONS.

A

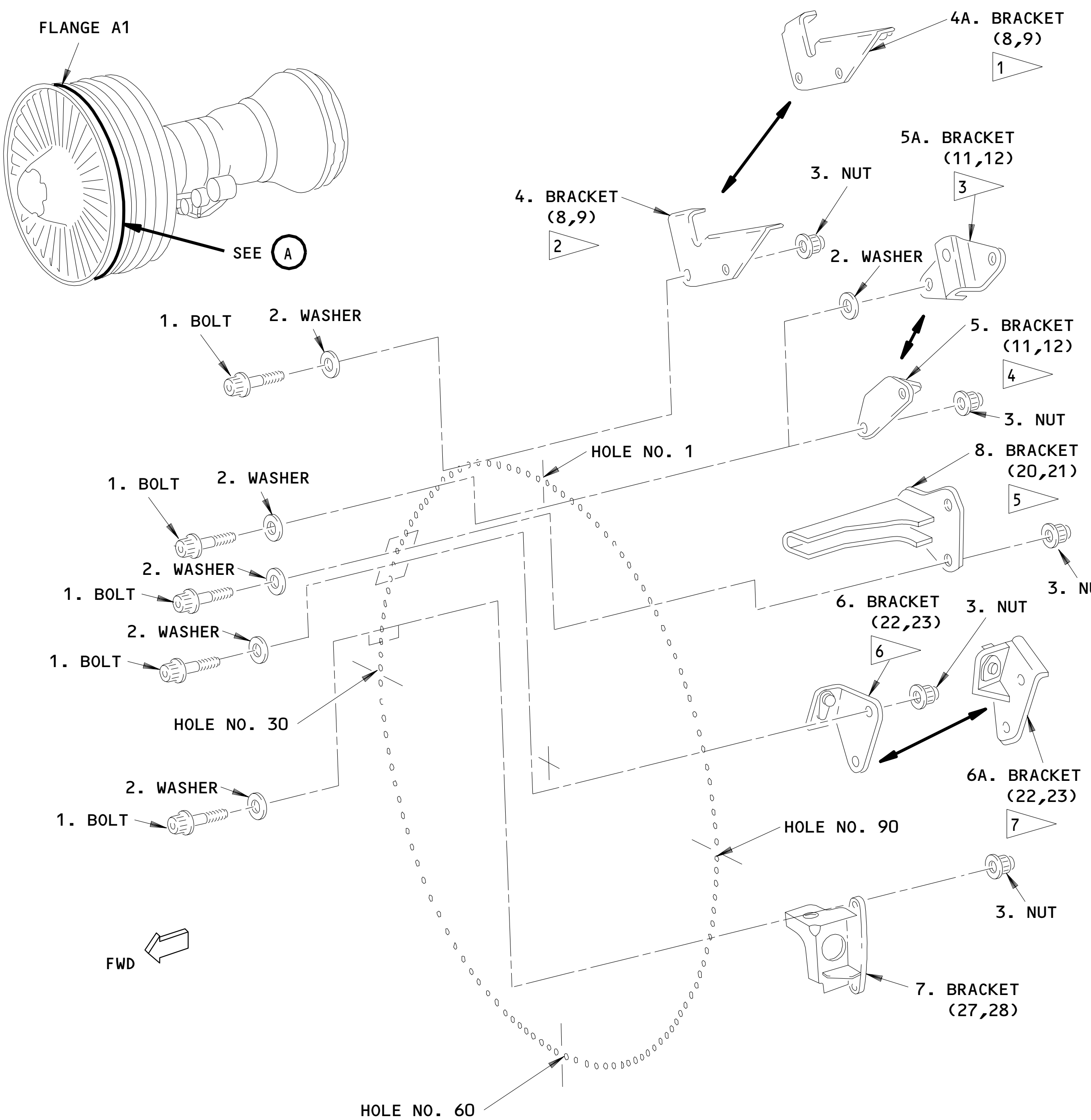
1 ENGINES PRE-PW-SB 72-230
2 ENGINES POST-PW-SB 72-230

L-A2958

Front Fan Case Flange B Bracket Installation
Figure 403



Front Fan Case Handling Bracket Installation
Figure 404



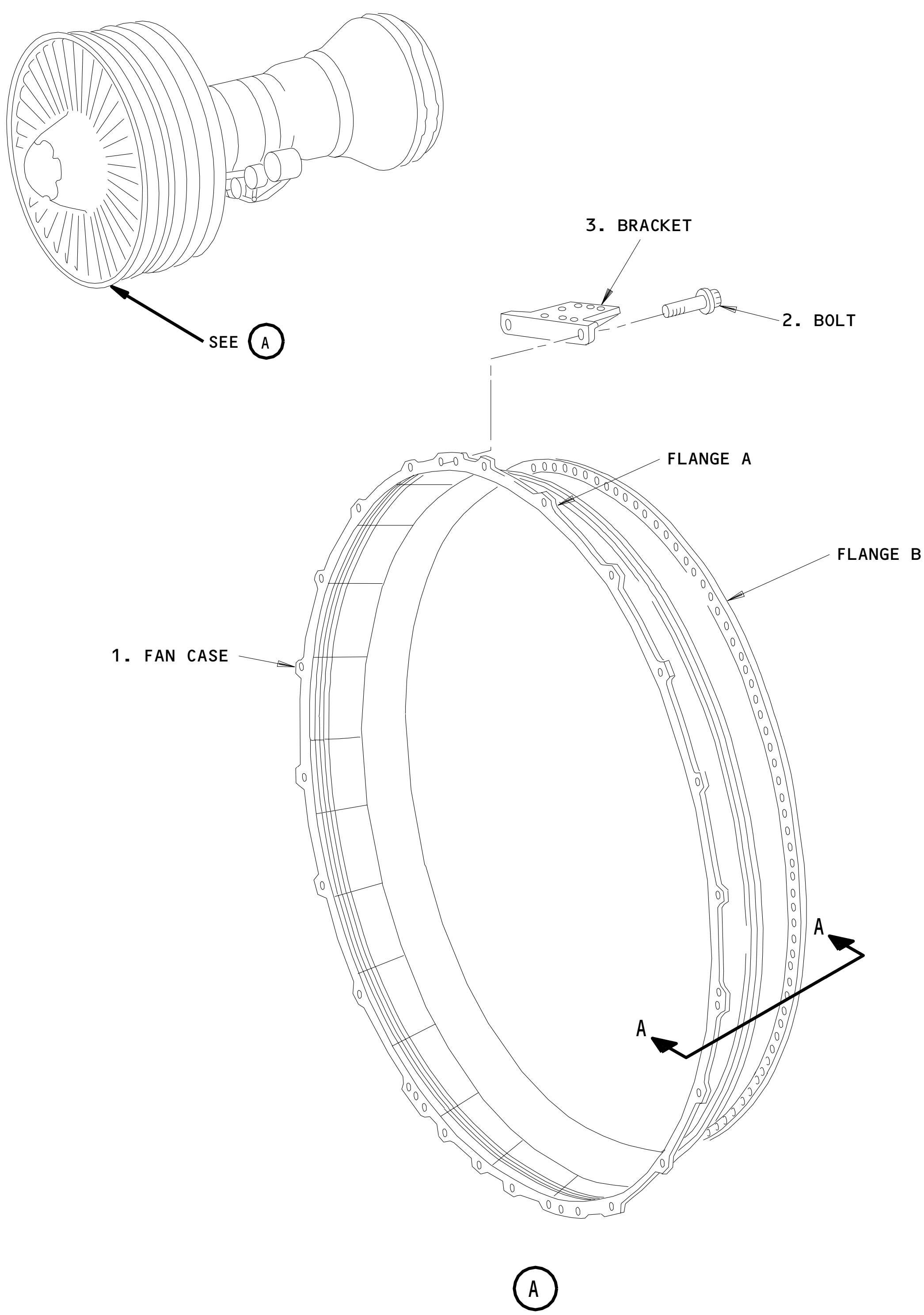
FLANGE A1 BRACKETS
A

L-A2474
0791

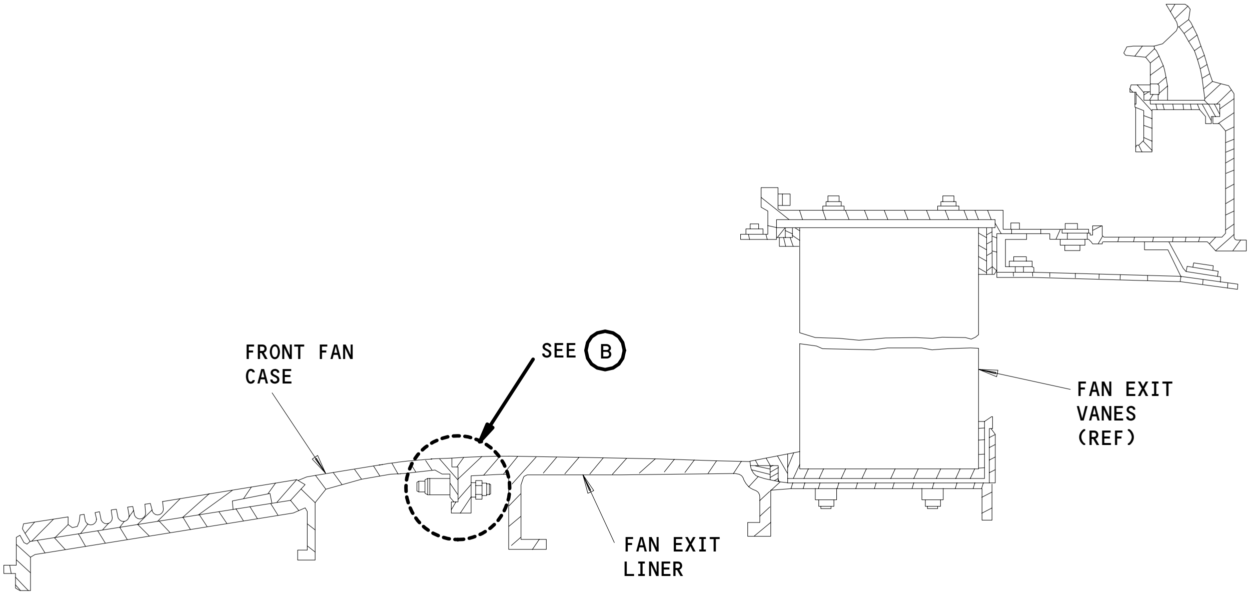
NOTE: NUMBERS IN PARENTHESIS ARE THE BOLT HOLE LOCATIONS.

1 ENGINES POST-PW-SB 72-332
2 ENGINES PRE-PW-SB 72-332
3 ENGINES POST-PW-SB 72-230
4 ENGINES PRE-PW-SB 72-230
5 ENGINES POST-PW-SB 73-101
6 ENGINES PRE-PW-SB 72-248
7 ENGINES POST-PW-SB 72-248

Front Fan Case Flange A1 Bracket Installations
Figure 405



Front Fan Case Installation
Figure 406 (Sheet 1)



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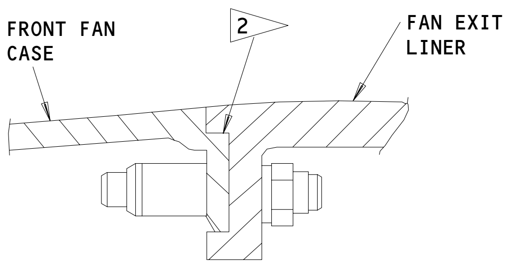


FLANGE B

B

2 CHECK DIMENSION BEFORE ASSEMBLY

L-A3303

Front Fan Case Installation
Figure 406 (Sheet 2)

S 014-005-N00
(3) Remove the inlet cone (AMM 72-31-01/401).

S 014-006-N00
(4) Remove all the 1st-stage fan blades (AMM 72-31-02/401).

S 014-007-N00
(5) Open the fan cowl panels (AMM 71-11-04/401).

S 014-008-N00
(6) Remove the electronic engine control (AMM 73-21-04/401).

S 014-040-N00
(7) Remove the SCU (AMM 73-21-15/401).

S 014-065-N00
(8) Remove the EEC PT2 flex hose (3, Fig. 401) as follows:
   (a) Remove the lockwire and disconnect the tube nut from the tee at approximately the 3 o'clock position.
   (b) Remove the bolts (32, 35), clamps (31, 36), and nut (30) that attach the EEC PT2 tube (6) and the EEC PT2 hose (3) from the two brackets on the Flange B.
   (c) Remove the tube and the hose assemblies as one component.
   (d) Install protection covers.

S 034-010-N00
(9) Remove the EEC PAMB manifold (2) and the top flex hose (1) as one component.
   (a) Disconnect the tube nut which attaches the EEC PAMB manifold (2) to the EEC PAMB flex hose (bottom) (5).
   (b) ENGINES POST-PW-SB 72-230;
       Remove the bolts (19, 23, 26), nut (27), and clamps (22, 24, 28) which attach the manifold to the Flange B brackets.
   (c) ENGINES PRE-PW-SB 72-230;
       Remove the bolts (19, 23, 26), nuts (21, 25, 27), and clamps (20, 24, 28) which attach the manifold to the Flange B brackets.

(d) Remove the bolt (34) and the clamp (33) which attach the manifold (2) to the Flange B bracket.
(e) Remove the manifold (2) and the flex hose (1).
(f) Install the end caps.

S 034-055-N00

(10) Remove the EEC PAMB flex hose (bottom) (5, Fig. 401).
(a) Remove the bolt (32), the nut (30), and the clamp (29) which attaches the flex hose to the Flange B brackets.
(b) Install the end caps.

S 034-012-N00

CAUTION: MAKE SURE THE WIRE HARNESS DOES NOT TWIST OR BADLY BEND DURING THE REMOVAL OR INSTALLATION. DAMAGE TO THE WIRE HARNESS MAY RESULT.

(11) Remove the bolts (1, 3, 5), nuts (6, 7, 9), and clamps (2, 4, 8, 10) which attach the EEC wiring harnesses to the Flange A1 and Flange B brackets at approximately the 1 o'clock and 2 o'clock positions. Temporarily attach the harnesses behind Flange B (Fig. 402).

S 034-068-N00

(12) Remove the brackets from Flange B as follows (Fig. 403):
(a) Remove the bolts (1), nuts (5), washers (2, 4) and spacers (3, 6) which secure the brackets (7, 9, 10, 11) to Flange B.
(b) ENGINES POST-PW-SB 72-230;
Remove the bolts (1), nuts (5), washers (2, 4) and spacers (6) which secure the bracket (8A) to Flange B.
(c) ENGINES PRE-PW-SB 72-230;
remove the bolts (1), nuts (5), washers (2, 4) and spacers (6) which secure the bracket (8) to Flange B.

S 094-014-N00

(13) Install the PWA85677 handling bracket to the front flange of the front fan case at the 12:00 o'clock position (Fig. 404).

S 094-015-N00

(14) Attach the hoist to the handling bracket.

S 824-016-N00

(15) Lightly put a load on the the hoist to maintain the fan case on the horizontal centerline of engine.

S 034-017-N00

(16) Remove all of the nuts, washers, spacers and bolts (2) from the rear flange (Flange B) of the front fan case (Fig. 406).

S 034-018-N00

(17) Use a fiber mallet to lightly tap the fan case (1) to loosen Flange B. Remove the front fan case from the engine (Fig. 406).

S 024-019-N00

(18) Put the front fan case on the pallet with the rear end (Flange B) down and remove the hoist and handling bracket.

S 024-020-N00

(19) If a new fan case is to be installed, remove the parts which follow from the fan case. Keep these parts for the new fan case installation.

(a) Remove the bolts (1), washer (2) and nuts (3) and remove the brackets from Flange A1 (Fig. 405).

(b) If applicable, remove the vibration accelerometer bracket from the Flange A at the 1 o'clock position.

TASK 72-33-01-424-021-N00

3. Install Front Fan Case (Fig. 401 thru 406)

A. Equipment

(1) Bracket, Handling - PWA85677, Pratt & Whitney, East Hartford, Conn.

(2) M303, M305 or M307 Bergen Mechanical Crimper
Bergen Cable Technologies Inc
170 Gregg St
P. O. Box 1300
Lodi, NJ 07644-9982

(3) Hoist - 1-ton capacity, 20 foot lift, standard hand chain with safety hooks, Model 4504, C&M Hoist Division, Columbus McKinnon Corp., Tonowanda, New York, or equivalent

B. Consumable Materials

(1) D00137 Oil - PWA 521 (AMM 20-30-04)
(2) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) AS3214-02
(3) G02332 Ferrule, Safety Cable (P05-292)
(4) G02335 Cable, Safety (P05-291)

C. Parts
(1) Refer to IPC for part numbers and effectivities of items in the table that follows:

AMM		NOMENCLATURE	AIPC		
FIG	ITEM		SUBJECT	FIG	ITEM
406	1	Fan Case	72-33-51	05	10

D. References
(1) AMM 71-00-00/501, Power Plant
(2) AMM 71-11-01/401, Inlet Cowl
(3) AMM 71-11-04/201, Fan Cowl Panels
(4) AMM 72-31-01/401, Inlet Cone
(5) AMM 72-31-02/401, Fan Blades
(6) AMM 73-21-04/401, Electronic Engine Control
(7) AMM 73-21-15/401, Supplemental Control Unit (SCU)

E. Access
(1) Location Zones
411 Left Engine
421 Right Engine

F. Install the Front Fan Case

NOTE: When this procedure refers to lubricated bolts, use the bolts which have the threads lubricated with engine oil (P03-001).

S 424-022-N00
(1) If a new front fan case (1) is to be installed, add the parts to the new case as follows (Fig. 406):
(a) Attach the brackets to the Flange A by doing the following:
1) Lubricate bolt (2) threads with engine oil.
2) Attach the brackets to Flange A with bolts (2) and nuts.

3) Tighten the bolts to 85-95 pound-inches (9.6-10.7 newton-meters).

(b) If applicable, attach the vibration accelerometer bracket to the flange A by doing the following:

1) Lubricate the vibration accelerometer's bolt threads with engine oil.
2) Attach the vibration accelerometer bracket to Flange A at approximately 1 o'clock position with the lubricated bolts.
3) Tighten the bolts to 65-85 pound-inches (7.3-9.6 newton-meters).
4) Lockwire (PO5-289) or Safety Cable (PO5-291) and Safety Cable Ferrule (PO5-292) the bolts.

S 494-023-N00

WARNING: AIRCRAFT WING ON WHICH THE ENGINE IS MOUNTED MUST BE MADE STABLE BEFORE YOU REMOVE THE FRONT FAN CASE. INJURY TO PERSONS MAY RESULT IF THE WING IS NOT MADE STABLE.

(2) Install the PWA85677 handling bracket to the front flange of the case at the 12:00 o'clock position (Fig. 404).

S 494-024-N00

(3) Attach the hoist to the handling bracket.

S 424-025-N00

(4) Lift the front fan case from the pallet and connect it to the case and vane assembly with the dowel pin hole in case and vane assembly.

S 824-026-N00

(5) Use a fiber mallet to tap the front fan case until it is engaged correctly.

S 424-071-N00

(6) Install the Flange B bolts, threads lubricated with engine oil, washers, spacers and nuts to (Flange B) of the front fan case.

NOTE: Do not install the bolts where you will install the brackets.

(a) Tighten all of the nuts to 180-200 pound-inches (20.3-22.6 newton-meters).

S 424-028-N00

(7) Install the forward two EEC mount brackets (7, 11) by doing the following (Fig. 403):

(a) Lubricate the bolt threads with engine oil.

(b) Attach the two EEC mount brackets (7,11) to the EEC shock mounts using the lubricated bolts and nuts with shorter spacers.

(c) Tighten all of the nuts to 180-200 pound-inches (20.3-22.6 newton-meters).

S 224-029-N00

(8) Refer to the table that follows when you measure the gap between the cases at the ID of Flange B.

NOTE: These dimensions are given only as data.

PART NAME	DIA	NEW PART DIMENSIONS INCHES (MM)		CLEARANCE LIMITS INCHES (MM)	
		MIN	MAX	MIN	MAX
FAN EXIT CASE	OD	90.334 (2294.48)	90.344 (2294.74)	0.026T (0.66T)	0.006T (0.15T)
FRONT FAN CASE	ID	90.318 (2294.08)	90.328 (2294.33)		

NOTE: "T" denotes a tight fit.

S 094-030-N00

(9) Remove the handling bracket from the fan case (Fig. 404).

S 434-031-N00

(10) Attach the harnesses to the flange brackets (Fig. 402).

(a) Attach the W1 and W2 harnesses to the Flange A1 bracket at approximately the 1 o'clock position with clamps (2, 10) and nuts (9). Attach the clamps with bolts (1) which have the threads lubricated with engine oil. Tighten the clamp bolts to 36-40 pound inches (4.07-4.52 newton-meter) (Fig. 402).

1) If the hose nuts have lockwire holds, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.

(b) Secure the W1 harness to the Flange B and Flange A1 brackets at approximately the 2 o'clock position with clamps (4, 8) and nuts (6, 7). Attach the clamps with bolts (3,5) which have their threads lubricated with engine oil. Tighten bolts to 36-40 pound inches (36-40 newton-meter) (Fig. 402).

1) If the hose nuts have lockwire holds, install the Lockwire (P05-289) or Safety Cable (P05-291) and Safety Cable Ferrule (P05-292) to safety the hose nuts.

S 414-032-N00

CAUTION: USE OF LUBRICANTS ON THE EEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF THE EEC.

(11) Install the EEC PAMB manifold (2) and the top flex hose (1) as one component.

(a) Remove the end caps.

(b) ENGINES POST-PW-SB 72-230;
Attach the manifold and the top flex hose to the Flange B brackets with the clamps (22, 24, 28), the bolts (19, 23, 26) and the nut (27).

(c) ENGINES PRE-PW-SB 72-230;
Attach the manifold and the top flex hose to the Flange B brackets with the clamps (20, 24, 28), the bolts (19, 23, 26), and the nuts (21, 25, 27)

(d) Attach the manifold to the Flange B bracket with the clamp (33) and the bolt (34).
(e) Tighten all the bolts to 36-40 pound-inches (4.07-4.52 newton-meters).

S 434-053-N00
(12) Install the EEC PAMB flex hose (bottom) (5, Fig. 401).
(a) Remove the end caps.
(b) Connect the flex hose (5) to the manifold (2).
1) Tighten the tube nut which attaches the manifold (2) to the flex hose (5) to 270-300 pound-inches (30.506-33.895 newton-meters).
(c) Attach the flex hose to the Flange B brackets with the clamp (29), the bolt (32), and the nut (30).
(d) Tighten all the bolts to 36-40 pound-inches (4.07-4.52 newton-meters).

NOTE: It is not necessary to tighten the bolt (32). This bolt will be removed when the EEC PT2 flex hose (3, Fig. 401) is installed.

S 434-054-N00
(13) Install the EEC PT2 flex hose (Fig. 401).
(a) Remove the end caps.
(b) Do these steps to install the EEC PT2 flex hose:
1) Connect the hose nut (4) to the tee at approximately the 3 o'clock position. This tee is found on the bracket on the Flange A1.
2) Tighten the tube nut to 90-100 pound-inches (10.169-11.298 newton-meters).
3) Install lockwire (P05-289) or safety cable (P05-291) and safety cable ferrule (P05-292) to the tube nut (4).
4) Attach the flex hose (6) to the Flange B brackets at approximately the 2:30 o'clock position. Use the clamp (36) and the bolt (35).

5) Tighten the bolt with your hand.
6) Loosen the bolt (32).
7) Attach the flex hose to the Flange B bracket with the clamp (31), the bolt (32) and the nut (30).
8) Tighten all the bolts to 36-40 pound-inches (4.07-4.52 newton-meters).

S 414-035-N00
(14) Install the fan blades (AMM 72-31-02/401).

S 414-036-N00
(15) Install the inlet cone (AMM 72-31-01/401).

S 414-037-N00
(16) Install the inlet cowl (AMM 71-11-01/401).

S 414-058-N00
(17) Install the SCU (AMM 73-21-15/401).

S 414-038-N00
(18) Close the fan cowl panels (AMM 71-11-04/401).

S 864-039-N00
(19) Remove DO-NOT-OPERATE tag from the ENG START switch on the panel P5.

S 034-011-N00
(20) Do a test of the front fan case as shown in the Power Plant Reference Table (AMM 71-00-00/501).

FAN CASE RUBSTRIPS - INSPECTION/CHECK

1. General
   A. This procedure contains the data to examine the fan case rubstrips.

   TASK 72-33-01-226-001-N00
2. Examine the Fan Case Rubstrips (Fig. 601)
   A. Equipment
      (1) Gage - PWA 29156 , Pratt & Whitney, Commercial Products Division,
          400 Main Street, East Hartford, CT 06108

          NOTE: This gage is an alternative to the standard dial indicator depth gage.

      (2) Gage - Depth, Standard Dial Indicatorm with tapered contact point

          NOTE: This Depth gage is an alternative to the PWA 29156 gage.

      (3) Mat - Protective, rubber Manufacturer's Association, grade sc43, neoprine sponge, 1 inch thick, 3x4 feet with warning streamers attached (three required)
   B. Access
      (1) Location Zones

411	No. 1 Engine (Left)
421	No. 2 Engine (Right)

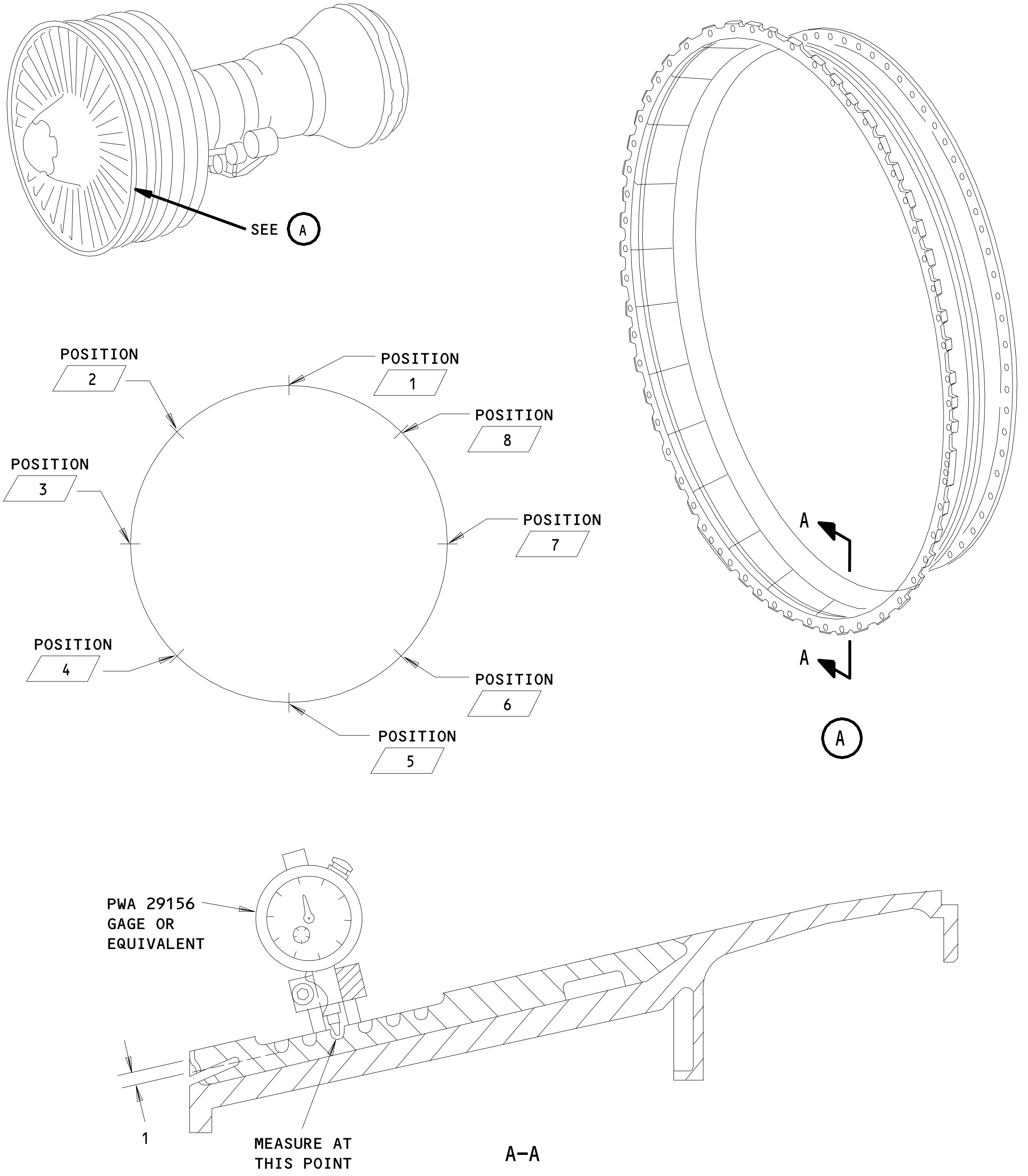
      (2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)

   C. Prepare for the Inspection

      S 866-002-N00
      (1) Attach the DO-NOT-OPERATE tag to the ENG START switch on the overhead panel, P5.

      S 946-009-N00
      (2) Put the protective mat in the inlet cowl.



1. 0.140 INCH (3.556 MM) MINIMAL DEPTH, AVERAGE OVER SPECIFIED POSITIONS

L-A3777

0987

Fan Case Duct Segment (rubstrip) Wear
Figure 601

D. Do an Inspection of the Fan Case Rubstrip

S 226-003-N00

(1) Do these steps to examine the ribs of the interrupted continuous groove (ICG) rubstrip on the fan case duct segments for worn areas:
  (a) Use an approved dial depth gage with a tapered contact point or a PWA 29156 gage to measure the depth of the worn areas on the rubstrip.
    1) Make sure there is no unwanted material in the rubstrip groove.

       NOTE: Unwanted material in the rubstrip groove can cause incorrect depth values.

    2) Make sure the point of the gage touches the bottom of the groove.

       NOTE: It is possible that you must measure more than once at the same position to find the largest depth, because the bottom of each groove is rounded.

  (b) If you use the PWA 29156 gage to measure the depth of the worn areas in the rubstrips, do the steps that follow:
    1) Put the gage in the set master on the surface marked 0.260 inch (6.604 mm).
    2) Set the revolution counter, the dial indicator hand, and the bezel to zero.
    3) Calculate the value of the depth for each position.

       NOTE: The depth that you measure must be subtracted from the 0.260 inch (6.604 mm) dimension to find the correct value of the depth. If you use a standard depth gage, it is not necessary to calculate the depth; the value on the gage is the correct value.

  (c) Make a record of the position and the depth of the worn areas at the eight locations shown (Fig. 601).
    1) Install the gage in the third groove from the front of the fan case (flange A).
    2) Write the calculated value of the depth for each position.
  (d) Calculate the average of the depth values at the three positions for each Group, A through F, as shown in Table 601.
    1) The average for each group must not be less than 0.140 inch (3.556 mm) in depth.
    2) If the average depth for one or more groups is less than 0.140 inch (3.556 mm) remove the fan case (AMM 72-33-01/401).

Group	Positions of the Gage	Group	Positions of the Gage
Group A	7, 8, 1	Group D	3, 4, 5
Group B	8, 1, 2	Group E	4, 5, 6
Group C	1, 2, 3	Group F	5, 6, 7

LOCATIONS OF THE DEPTH VALUES
TABLE 601

S 226-015-N00

(2) Examine the duct segments as follows to find if they are bonded to the fan case.

NOTE: A duct segment that is not bonded is not permitted.

(a) With your finger, press the duct segment in the area where you think there is no bond.
1) Examine the segment carefully to see if there is play in the rubstrip.

(b) With the plastic end of a screwdriver or other tool, hit the rubstrip lightly all around.
1) Listen to the sound.
2) If the sound is a clear ring, (has a high frequency) the rubstrip is well bonded.
3) If the sound is a dull thud (has a low frequency), the rubstrip is not bonded.

S 226-016-N00

(3) Compare the rib damage, cracks, and holes with the limits in table 601.

(a) The 60-hour continue-in-service limit for duct segments with rib damage that is more than the serviceable limits is as follows:
1) You can continue to operate the engine for 60 hours if 12 or less duct segments have rib damage that is more than the serviceable limits.

TABLE 601
DUCT SEGMENT INSPECTION LIMITS FOR RIB DAMAGE, CRACKS, AND HOLES

Examine	Serviceable Limits	Repairable Limits
Duct Segment Rib that is not There:		
Total length of each rib on each segment	3.0 inches (7.200 mm) Circumferentially Maximum	6.0 inches (152.400 mm) Circumferentially Maximum
Total length of one rib, on all segments	10.0 inches (254.200 mm) Circumferentially Maximum	15 inches (381.000 mm) Circumferentially Maximum
Distance from an area on an adjacent rib where there is no rib	6.0 inches (152.400 mm) Minimum	
Cracks:		
Width	0.015 inch (0.381 mm) Maximum	0.125 inch (3.175 mm) Maximum
Distance (from other Cracks)	4.0 inches (101.600 mm) Minimum	
Length of a circum- ferential crack	4.0 inches (101.600 mm) Maximum	6.0 inches (152.400 mm) Maximum
Length of an Axial Crack That is Within 0.250 inch (6.350 mm) of the Axial Edge of the Segment	No Limit	
Length of other Axial Cracks	4.0 inches (101.600 mm) Maximum	
Holes:		
Dimension at the largest width	0.125 inch (3.175 mm) Maximum	6.0 inches (152.400 mm) Maximum
Depth	0.125 inch (3.175 mm) Maximum	No Limit

(b) Repair the damage that you find (AMM 72-33-01/801).

S 976-013-N00

(4) Remove the mat from the inlet cowl.

S 866-014-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on panel P5.

FRONT FAN CASE - REPAIRS

1. General
   A. This procedure has three repairs for the duct segments of the front fan case:
      (1) The repair of large holes,
      (2) The repair of cracks,
      (3) The repair of surface damage.
   B. The inlet cowl is attached to the front fan case. The front fan case is around the outer circumference of the fan blades.
   C. You can open the fan cowl panels, and remove the inlet cowl and the 1st-stage fan blades to get access to the front fan case.

TASK 72-33-01-308-001-N00

2. Repair of Large Holes in the Duct Segment
   A. Consumable Materials
      (1) G00000 Tape - Magic Mending
      (2) G00842 Cheesecloth - Unsized
      (3) A00747 Compound - Potting (PWA 603)
      (4) B00666 - Solvent, Methyl Propyl Ketone (MPK)
      (5) B00143 - Solvent, Trichlorotriflourothane (PMC 9087)
   B. References
      (1) AMM 72-31-02/401, 1st-Stage Fan Blades
   C. Access
      (1) Location Zones
         411 Left Engine
         421 Right Engine

   D. Repair the Large Holes in a Duct Segment.

      S 018-005-N00
      (1) If you cannot get acces to the damage, remove the 1st—stage fan blades (AMM 72-31-02/401).

      S 348-006-N00
      (2) Refer to the limits in Table 801 and Fig. 801 to do the repair.

Table 801
Large Hole Repair Limits

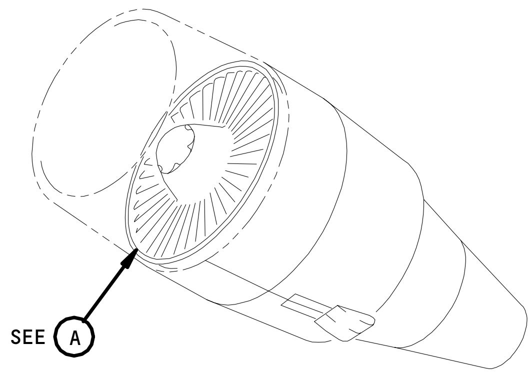
Type of Damage	Area A	Area B	Area C
1)Total Arc Length, on Each Segment	6 inches (152.4 mm) maximum	6 inches (152.4 mm) maximum	6 inches (152.4 mm) maximum
Total Arc Length, on All Segments		15 inches (381.0 mm) maximum	
2) Circumferential separation between incidents		12 inches (304.8 mm) minimum	
3) Diameter	0.125 inch (3.175 mm) minimum	0.125 inch (3.175 mm) minimum	0.125 inch (3.175 mm) minimum
4)Material that You must Remove, all around the damage	0.5 inch (12.70 mm) *	0.5 inch (12.70 mm) *	0.5 inch (12.70 mm) *
5) The Retention Pin is Visible			cannot be repaired
* For damage that is in a pocket, remove the full cracked area.			

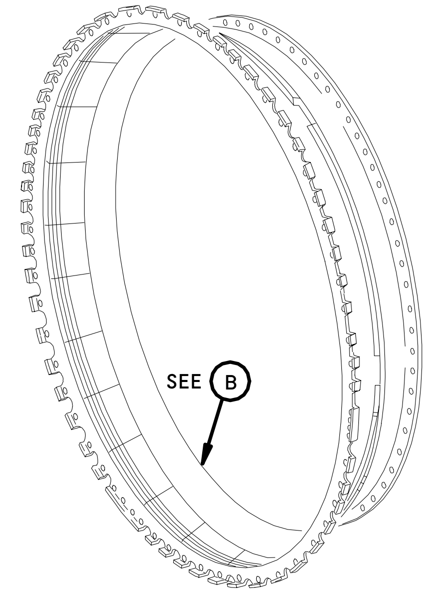
S 348-008-N00

CAUTION: MAKE SURE THAT THE CUTTING TOOL ONLY TOUCHES THE AREA THAT YOU WILL REMOVE FROM THE SURFACE OF THE DUCT SEGMENT. THE CUTTING TOOL CAN ACCIDENTALLY CUT THE DUCT SEGMENT THAT IS ADJACENT TO THE DAMAGED AREA, OR CAUSE DAMAGE TO THE FAN CASE.

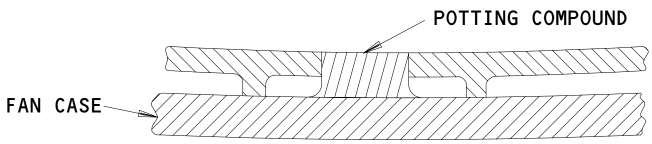
(3) Remove the damage from the duct segment with a cutting tool.

NOTE: It is not necessary to go through the duct segment, unless the damage is in a pocket.



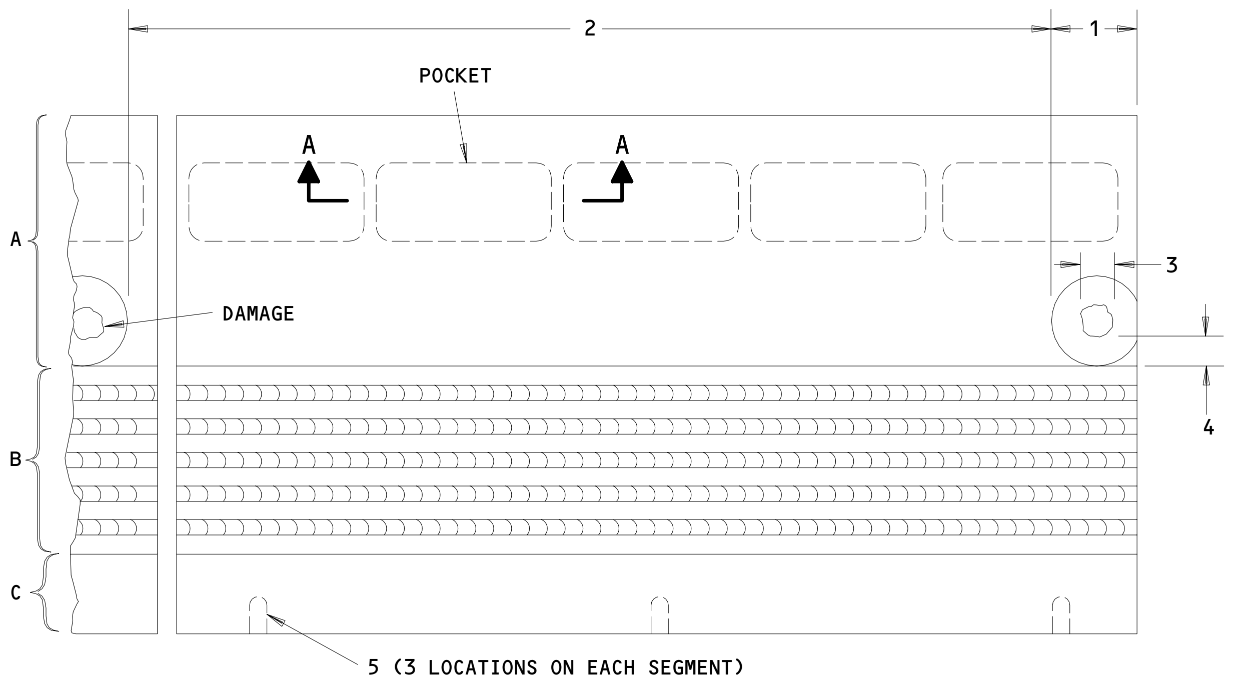


FRONT FAN CASE
A



NOTE: EXAMPLE OF POTTING COMPOUND THAT IS APPLIED TO REPAIRED DAMAGE THAT MAKES A HOLE THROUGH THE SURFACE.

A-A



DUCT SEGMENT
B

L-A6672

Repair of Large Holes in the Duct Segments
Figure 801

S 118-009-N00

WARNING: DO NOT GET THE SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. THE SOLVENT IS POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(4) Do the steps that follow with one of the two solvents (Methyl Propyl Ketone or Trichlorotrifluoroethane) to clean the repair area.
  (a) Apply some solvent, from a soft bottle, to the repair area.
  (b) Make wet a piece of cheesecloth with the solvent.
  (c) Clean the repair area with the cheesecloth.
  (d) Dry the repair area in air for 10 (ten) minutes.

S 398-010-N00

(5) Do the steps that follow to apply the potting compound to the repair area.
  (a) In a clean cup, mix 1.0 gram of Part A with 0.09 gram of Part B.
  (b) Stir the mixture for two minutes.

  NOTE: The mixture must be discarded after 30 minutes.

  (c) Use a clean dry tool to apply the compound to the repair area.
  (d) If the damage is a hole in one of the pockets, push in a quantity of compound sufficient to support the patch.
  (e) If the compound can easily fall out, use a piece of tape to keep the compound attached.
  (f) Dry the compound for 3 (three) hours at ambient temperature before you touch it, or before the operation of the engine.

  NOTE: The compound will be fully dry after 24 hours at ambient temperature.

(g) An alternate cure time of 2 (two) hours at 250°F (121.1°C) is also permitted.
(h) Remove the tape.

S 348-011-N00
(6) Make the surface of the repair area smooth, with a level that is not more than 0.015 inch (0.381 mm) higher than the adjacent surfaces.

NOTE: If the repair is in area B, it is not necessary to repair the grooves.

S 418-021-N00
(7) If you removed the 1st-stage fan blades, install them (AMM 72-31-02/401).

TASK 72-33-01-308-003-N00
3. Repair of Cracks in the Duct Segment
A. Consumable Materials
(1) G00000 Tape - Magic Mending
(2) G00842 Cheesecloth - Unsized
(3) A00747 Compound - Potting (PWA 603)
(4) B00666 - Solvent, Methyl Propyl Ketone (MPK)
(5) B00143 - Solvent, Trichlorotriflourothane (PMC 9087)
B. References
(1) AMM 72-31-02/401, 1st-Stage Fan Blades
C. Access
(1) Location Zones
411 Left Engine
421 Right Engine

D. Repair the Cracks in a Duct Segment.

S 018-023-N00
(1) If you cannot get acces to the damage, remove the 1-st stage fan blades (AMM 72-31-02/401).

S 348-024-N00

(2) Refer to the limits in Table 802 and Figure 802 when you repair the surface.

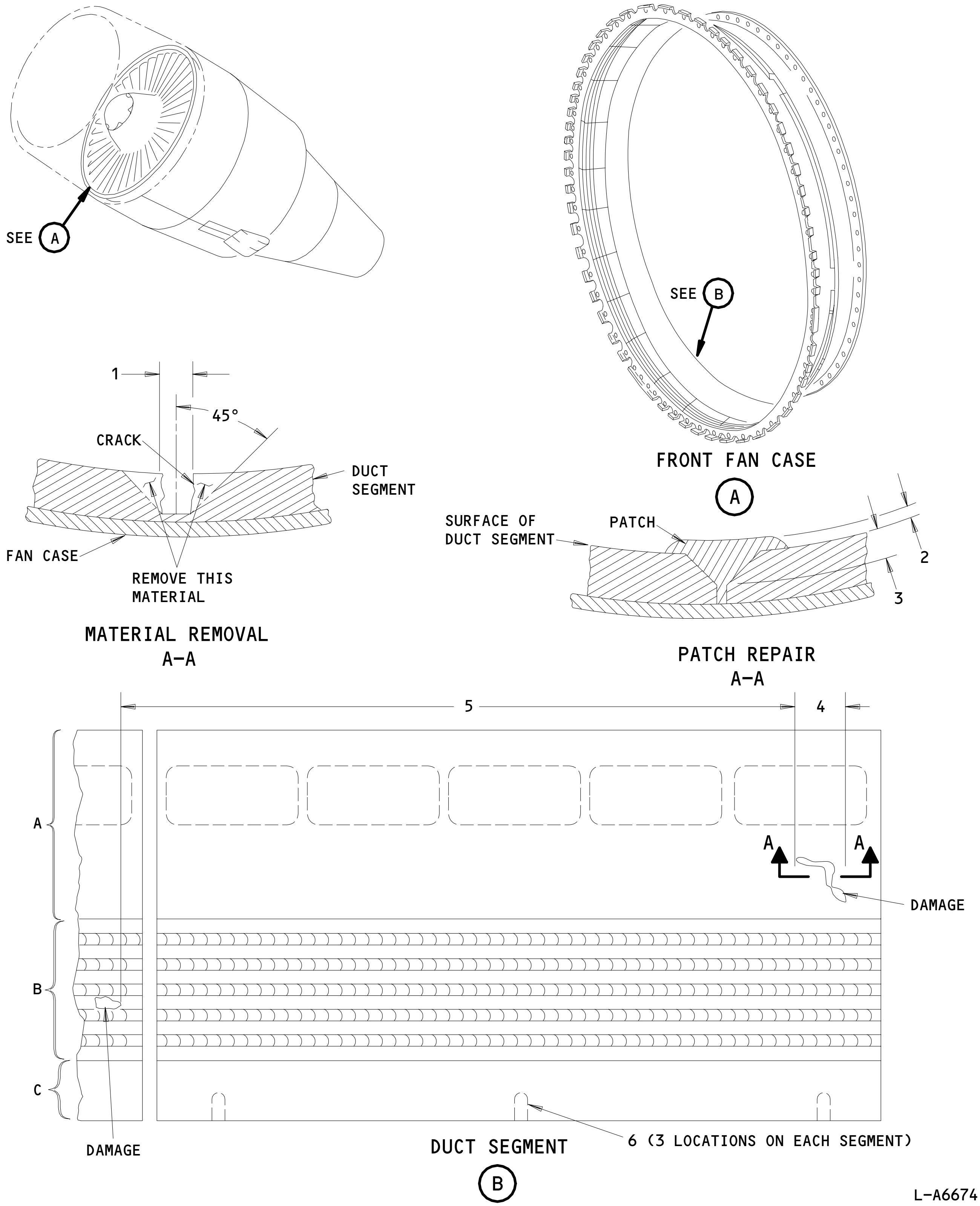
Table 802
Crack Repair Limits

Type of Damage	Area A	Area B	Area C
1) Crack Width on Each Segment	0.125 inches (3.175 mm) maximum	0.125 inches (3.175 mm) maximum	0.125 inches (3.175 mm) maximum
2) Height of Compound	level, 0.015 inch (0.381 mm) maximum	level, 0.015 inch (0.381 mm) maximum	level, 0.015 inch (0.381 mm) maximum
3) Depth of Material Removed	0.100 inches (2.540 mm) maximum	0.100 inches (2.540 mm) maximum	0.100 inches (2.540 mm) maximum
4)Total Arc Length, on Each Segment	6 inches (152.4 mm) maximum	6 inches (152.4 mm) maximum	6 inches (152.4 mm) maximum
Total Arc Length, on All Segments		15 inches (381.0 mm) maximum	
5) Circumferential separation between incidents		12 inches (304.8 mm) minimum	
6) The Retention Pin is Visible			cannot be repaired

S 348-015-N00

CAUTION: MAKE SURE THAT THE CUTTING TOOL ONLY TOUCHES THE AREA THAT YOU WILL REMOVE FROM THE SURFACE OF THE DUCT SEGMENT. THE CUTTING TOOL CAN ACCIDENTALLY CUT THE DUCT SEGMENT THAT IS ADJACENT TO THE DAMAGED AREA, OR CAUSE DAMAGE TO THE FAN CASE.

(3) With a cutting tool, remove material, as shown in Fig. 802, from the crack in the duct segment.



Repair of Cracks in the Duct Segments
Figure 802

S 118-016-N00

WARNING: DO NOT GET THE SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. THE SOLVENT IS POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(4) Do the steps that follow with one of the two solvents (Methyl Propyl Ketone or Trichlorotrifluoroethane) to clean the repair area.
   (a) Apply some solvent, from a soft bottle, to the repair area.
   (b) Make wet a piece of cheesecloth with the solvent.
   (c) Clean the repair area with the cheesecloth.
   (d) Dry the repair area in air for 10 (ten) minutes.

S 398-025-N00

(5) Do the steps that follow to apply the potting compound to the repair area.
   (a) In a clean cup, mix 1.0 gram of Part A with 0.09 gram of Part B.
   (b) Stir the mixture for two minutes.

   NOTE: The mixture must be discarded after 30 minutes.

   (c) Use a clean dry tool to apply the potting compound to the repair area.
   (d) If it is necessary, use a piece of tape to keep the potting compound in position.
   (e) Dry the potting compound for 3 (three) hours at ambient temperature before you touch it, or before the operation of the engine.

   NOTE: The potting compound will be fully dry after 24 hours at ambient temperature.

(f) An alternate cure time of 2 (two) hours at 250°F (121.1°C) is also permitted.
(g) Remove the tape.

S 348-028-N00
(6) Make the surface of the repair area smooth, with a level that is not more than 0.015 inch (0.381 mm) higher than the adjacent surfaces.

NOTE: If the repair is in area B, it is not necessary to repair the grooves.

S 418-027-N00
(7) If you removed the 1st-stage fan blades, install them (AMM 72-31-02/401).

TASK 72-33-01-308-002-N00

4. Repair of Surface Damage on the Duct Segment

A. Consumable Materials
(1) G00000 Tape - Magic Mending
(2) G00842 Cheesecloth - Unsized
(3) A00747 Compound - Potting (PWA 603) (Optional to Dent Filler)
(4) A00748 Filler - Aerodynamic Dent (Optional to potting compound)
(5) B00666 - Solvent, Methyl Propyl Ketone (MPK)
(6) B00143 - Solvent, Trichlorotriflourothane (PMC 9087)

B. References
(1) AMM 72-31-02/401, 1st-Stage Fan Blades

C. Access
(1) Location Zones
411 Left Engine
421 Right Engine

D. Repair the Surface Damage in the Duct Segment.

S 018-022-N00
(1) If you cannot get acces to the damage, remove the 1st-stage fan blades (AMM 72-31-02/401).

S 348-029-N00

CAUTION: DO NOT USE THIS PROCEDURE IF YOU CAN SEE THE METAL OF THE FAN CASE. THIS PROCEDURE WILL NOT MAKE A SUFFICIENT REPAIR IN THAT CONDITION.

(2) Refer to the limits in Table 803 and Figure 803 to do the repair.

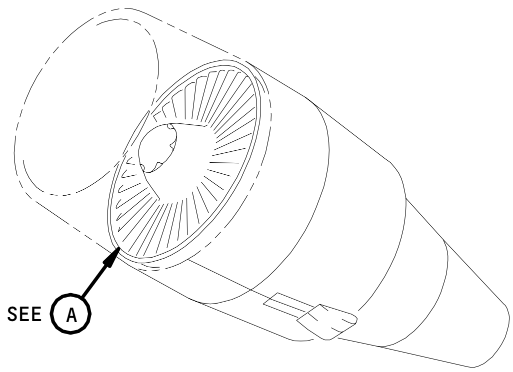
Table 803
Crack Repair Limits

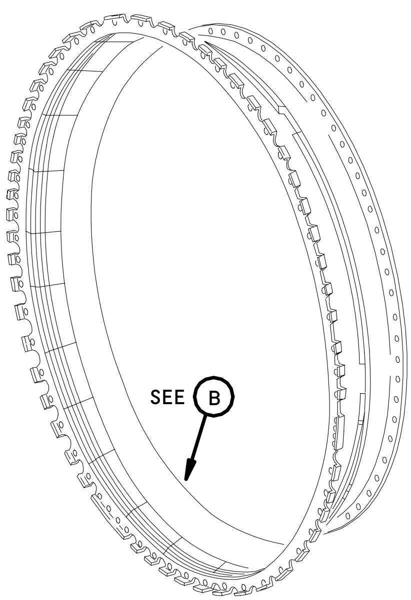
Type of Damage	Area A	Area B	Area C
1) Height of Compound	level, 0.015 inch (0.381 mm) maximum	level, 0.015 inch (0.381 mm) maximum	level, 0.015 inch (0.381 mm) maximum
2) Total Arc Length, on Each Segment	6 inches (152.4 mm) maximum	6 inches (152.4 mm) maximum	6 inches (152.4 mm) maximum
Total Arc Length, on All Segments		15 inches (381.0 mm) maximum	
3) Circumferential separation between incidents		12 inches (304.8 mm) minimum	
4) The Retention Pin is Visible			cannot be repaired

S 348-012-N00

CAUTION: MAKE SURE THAT THE CUTTING TOOL ONLY TOUCHES THE AREA THAT YOU WILL REMOVE FROM THE SURFACE OF THE DUCT SEGMENT. THE CUTTING TOOL CAN ACCIDENTALLY CUT THE DUCT SEGMENT THAT IS ADJACENT TO THE DAMAGED AREA, OR CAUSE DAMAGE TO THE FAN CASE.

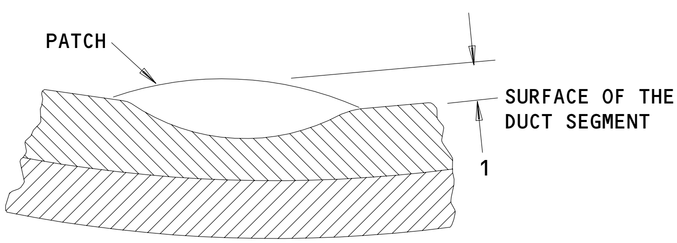
(3) Remove all cracks and loose material from the duct segment with a cutting tool.



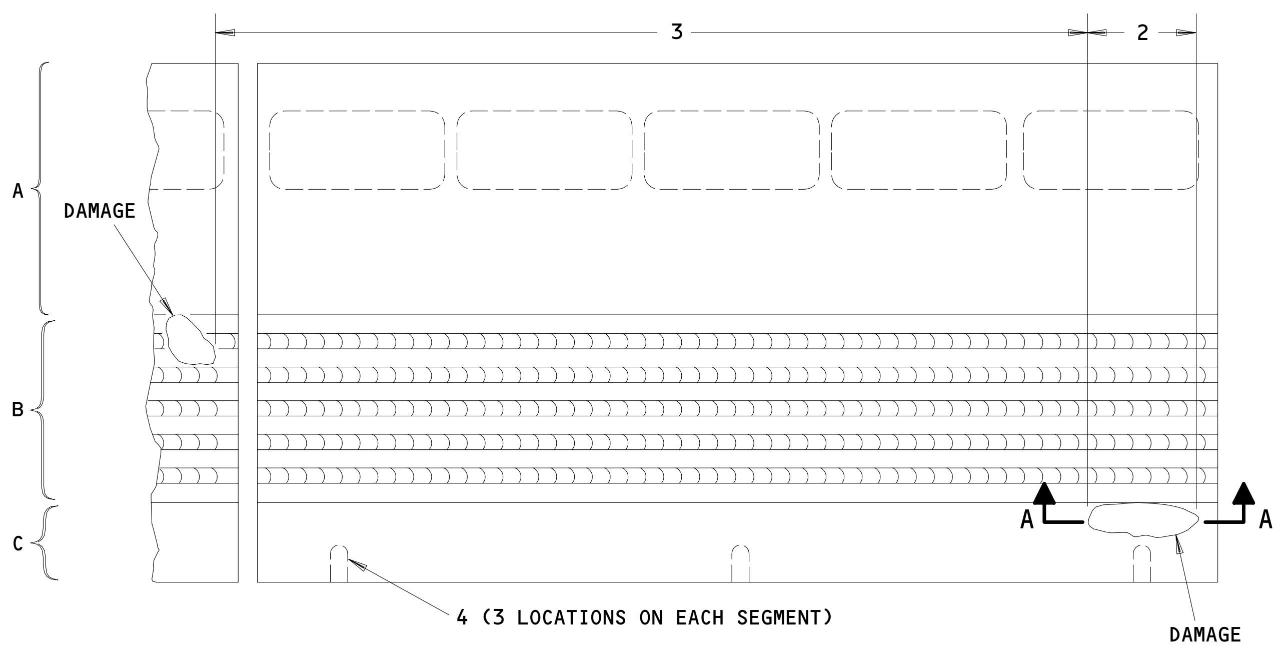


FRONT FAN CASE

A



PATCH REPAIR
A-A



DUCT SEGMENT

B

L-A6676

Repair of Surface Damage on the Duct Segment
Figure 803

S 348-013-N00

(4) Lightly make rough the repair area.

S 348-020-N00

(5) Remove all of the remaining particles of material from the surface.

S 118-015-N00

WARNING: DO NOT GET THE SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. THE SOLVENT IS POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(6) Do the steps that follow with one of the two solvents (Methyl Propyl Ketone or Trichlorotrifluoroethane) to clean the repair area.
   (a) Apply some solvent, from a soft bottle, to the repair area.
   (b) Make wet a piece of cheesecloth with the solvent.
   (c) Clean the repair area with the cheesecloth.
   (d) Dry the repair area in air for 10 (ten) minutes.
   (e) Clean the surface again until there is no remaining oil on the surface.

S 398-016-N00

(7) Do the steps that follow to apply the potting compound to the repair area (optional to the aerodynamic dent filler).
   (a) In a clean cup, mix 1.0 gram of Part A with 0.09 gram of Part B.
   (b) Stir the mixture for two minutes.

   NOTE: The mixture must be discarded after 30 minutes.

   (c) Use a clean dry trowel to apply the potting compound to the repair area.

(d) If it is necessary, use a piece of tape to keep the potting compound in position.
(e) Dry the compound for 3 (three) hours at ambient temperature before you touch it, or before the operation of the engine.

NOTE: The compound will be fully dry after 24 hours at ambient temperature.

(f) An alternate cure time of 2 (two) hours at 250°F (121.1°C) is also permitted.
(g) Remove the tape.

S 398-030-N00
(8) Do the steps that follow to apply the aerodynamic dent filler to the repair area (optional to the potting compound).
(a) In a clean cup, put one part with an equal volume or mass of the other part.
(b) Mix the two parts satisfactorily.

NOTE: The aerodynamic dent filler is prepared when it becomes thick (after six minutes at 70°-75°F (21.1°-23.9°C)).

(c) Use a clean dry trowel to apply the aerodynamic dent filler to the repair area.
(d) Refer to the manufacturer's instructions for the applicable cure time.

S 348-026-N00
(9) Make the surface of the repair area smooth, with a level that is not more than 0.015 inch (0.381 mm) higher than the adjacent surfaces.

NOTE: If the repair is in area B, it is not necessary to repair the grooves.

S 418-019-N00
(10) If you removed the 1st-stage fan blades, install them (AMM 72-31-02/401).

FAN EXIT CASE AND VANE - INSPECTION/CHECK

1. General
   A. This procedure gives the steps for the inspection of the fan exit case and vane.
   B. This procedure gives the continue-in-service and 50 hour limits.
   C. The fan exit case and vane have an inner and outer aluminum case assembly and 84 fan exit vanes.
   D. The fan exit case is attacked at the forward end to the fan case and at the aft end to the intermediate case.
   E. You must open the thrust reversers to get access to the fan exit case and vane assembly.

TASK 72-33-02-206-000-N00

2. Examine the Fan Exit Case and Vane
   A. References
      (1) AMM 70-11-06/201, Flourescent Penetrant Inspection
      (2) AMM 71-11-04/201, Fan Cowl Panels
      (3) AMM 71-11-06/201, Core Cowl Panels
      (4) AMM 72-33-02/801, Fan Exit Case and Vane - Approved Repairs
      (5) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zones

411	No. 1 Engine (Left)
421	No. 2 Engine (Right)

      (2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

   C. Prepare for the Inspection

      S 866-020-N00
      (1) Attach the DO-NOT-OPERATE tags to the ENG START switch on the overhead panel, P5.

S 046-021-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 016-022-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 016-023-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 016-024-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

D. Procedure

S 216-027-N00

(1) Visually compare the damage you find (on areas other than the vanes) to the damage limits in Table 601 (Fig. 601).

(a) If you find damage that could cause a crack in a repair weld or a permitted dent, do a fluorescent pentrant inspection (FPI) with ultra high sensitivity penetrant (AMM 70-11-06/201).

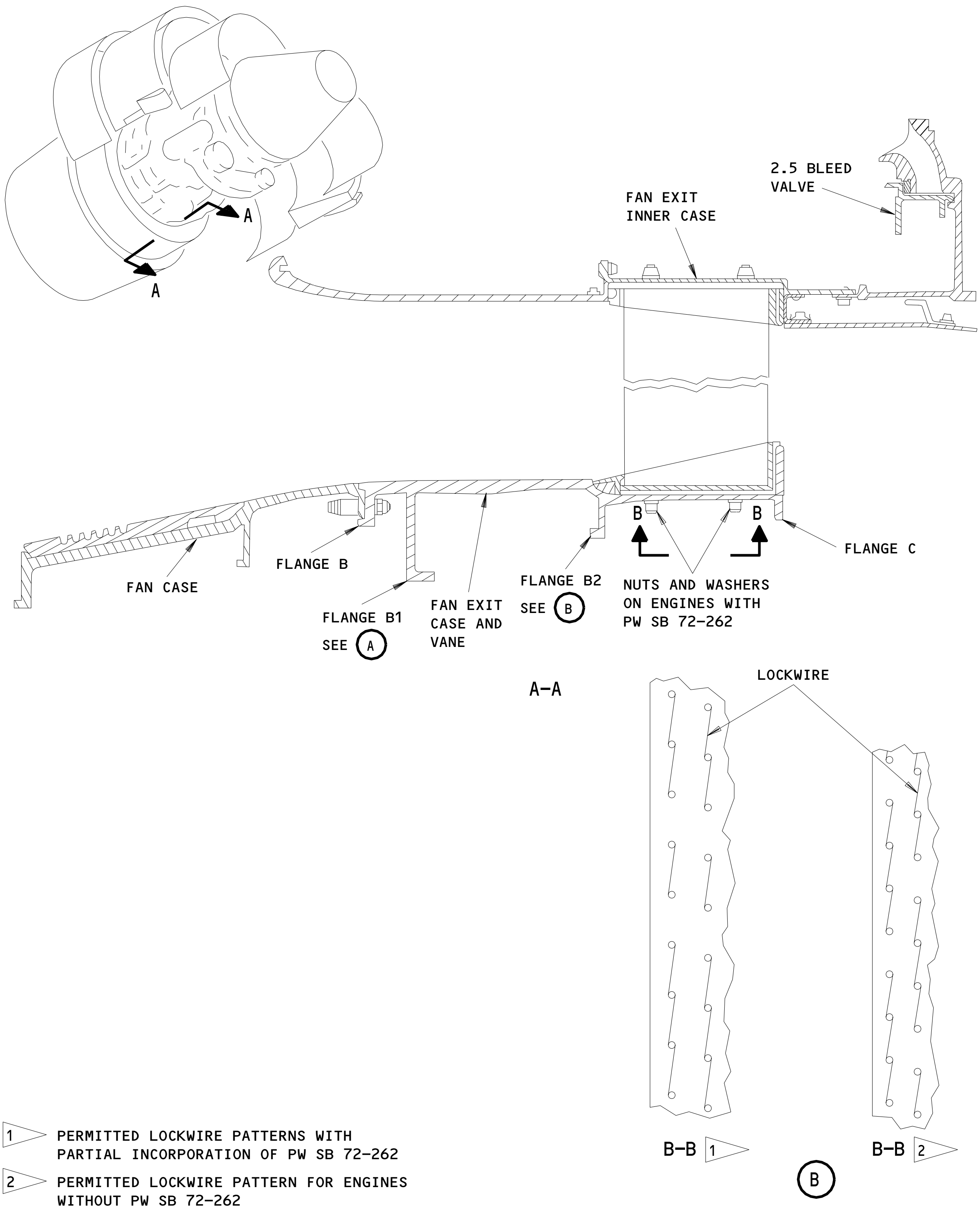
TABLE 601 INSPECTION OF AREAS OTHER THAN THE VANES		
Examine	Damage Limits	Necessary Procedure
ON ENGINES WITHOUT PW SB 72-262; Lockwire: not there, loose, or broken	None are permitted	Repair the damaged lockwire immediately (AMM 72-33-02/801)
ON ENGINES WITH PW SB 72-262; Nuts: not there, or loose	None are permitted	Replace the nuts that are not there and tighten the nuts that are loose (AMM 72-33-02/801).
Flanges B1 and B2, damaged corners: Index 1 Index 2	0.060 inch (1.542 mm), maximum, 2 locations 0.060 inch (1.524 mm), maximum	If the damage is less than the limits, repair the flange in less than 50 hours. Damage that is more than the limits is not permitted.
Index 3	This must not be less than ten times Index 2	
Circumferential length of each incident	1.000 inch (25.400 mm) maximum	Damage that is more than the limits is not permitted.
Total Circumferential length, all damage, on each flange	24.000 inches (609.600 mm) maximum	Damage that is more than the limits is not permitted.

TABLE 601 INSPECTION OF AREAS OTHER THAN THE VANES		
Examine	Damage Limits	Necessary Procedure
Repair Welds: cracks in the weld	None are permitted	If there are cracks, you must remove the case and vane assembly.
Other Areas: Dents	0.050 inch (1.270 mm) in depth, maximum, with rounded bottoms	Dents that are less than the limits and have no cracks, are permitted. If the dent is more than the limits, you must remove the case and vane assembly
Pits	0.010 inch (0.254 mm) in depth, maximum	You must make the area smooth. If the damage is worse than the limits, you must remove the case and vane assembly.
Cracks in the Inner Case	None are permitted	If there are cracks in the inner case, you must remove the case and vane assembly.
Cracks in the Outer Case	1.000 inch (25.400 mm) maximum circumferential length 0.500 inch (12.700 mm) maximum axial length	The engine can continue to operate for 20 more hours, if the crack has all 3 of the conditions that follow: 1) The crack is less than the limits. 2) You correctly stop drill the crack with a 0.0625 inch (0.1581 mm) drill 3) The crack does not go into a flange or boss.

S 216-028-N00

(2) See if the vane damage is local and isolated.

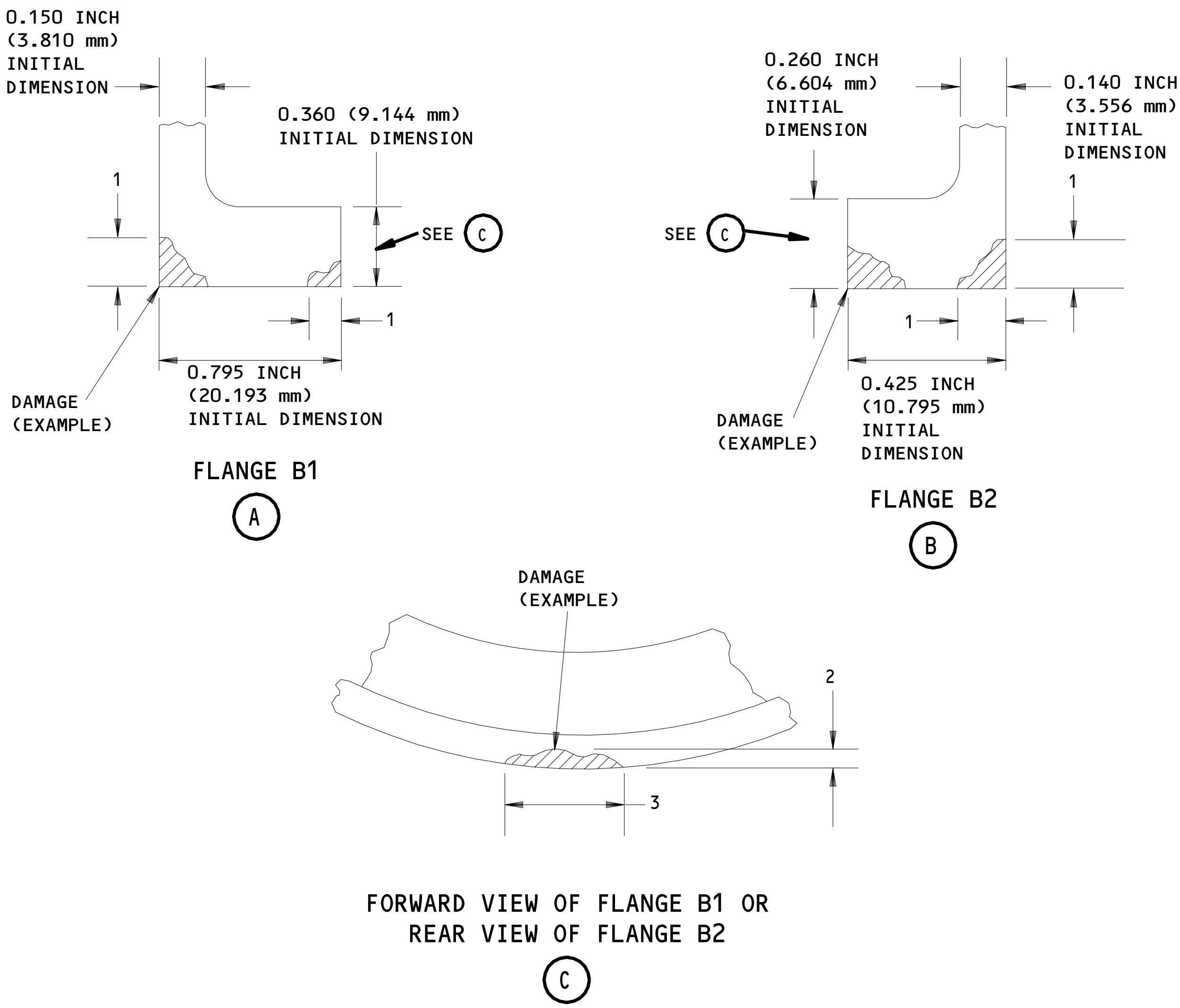
(a) If the vane damage is not local and isolated, you must replace the vane immediately.



1 PERMITTED LOCKWIRE PATTERNS WITH PARTIAL INCORPORATION OF PW SB 72-262

2 PERMITTED LOCKWIRE PATTERN FOR ENGINES WITHOUT PW SB 72-262

Fan Exit Case Inspection
Figure 601 (Sheet 1)



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Fan Exit Case Inspection
Figure 601 (Sheet 2)

S 716-029-N00

(3) Visually compare the damage you find on the vanes with the limits in Table 602 (Fig. 602).

TABLE 602 INSPECTION OF THE FAN EXIT VANES		
Examine	Damage Limits	Necessary Procedure (AMM 72-33-02/801)
Area A: Chord depth (axial length)	0.100 inch (2.540 mm) maximum *	No procedure is necessary, but you must examine it again in less than 50 hours and at the next "A" check for deterioration. If there is deterioration, repair the vane with a small patch in less than 50 hours.
	More than 0.100 inch (2.54 mm) in depth.*	Remove the damaged fan exit vane in less than 50 hours.
Area B: Chord depth (axial length)	0.100 inch (2.540 mm) maximum *	No procedure is necessary, but you must examine it again in less than 50 hours and at the next "A" check for deterioration. If there is deterioration, repair the vane with a small patch in less than 50 hours.
	Between 0.100-0.375 inch (2.5-9.5 mm) in depth.*	Repair the vane with a large patch in less than 50 hours.
	More than 0.375 inch (9.525 mm) in depth.*	Remove the damaged vane immediately.
Radial Length	More than 1.000 inch (2.540 mm) in length	Remove the damaged vane immediately.
Quantity of damage on each vane	No damage is more than 0.100 inch (2.540 mm) in depth.*	No procedure is necessary.
	4 maximum if the chord depth is 0.100 - 0.150 inch (2.54 - 3.81 mm). This counts against the 4 allowed above.	Repair the vane in less than 50 hours.
	More than one with a chord depth that is more than 0.150 inch (3.81 mm).	Remove the vane in less than 50 hours.

TABLE 602
INSPECTION OF THE FAN EXIT VANES

Examine	Damage Limits	Necessary Procedure (AMM 72-33-02/801)
Area C for: Nicks, dents, pits, and chips	Broken composite fibers	Repair the vane with a small patch in less than 50 hours.
	More than 0.030 inch (0.762 mm) in depth	Remove or replace the vane in less than 50 hours.
	More than 0.300 inch (7.620 mm) in width or height	Remove or replace the vane in less than 50 hours.
Area D for: Damage that decreased the chord length	Chord decreased by not more than 0.150 inch (3.810 mm)	Repair the vane with a small patch in less than 50 hours.
	Chord decreased by more than 0.150 inch (3.810 mm)	Remove or replace the vane in less than 50 hours.
Delamination	More than 1.0 square inch (645. square mm) in area	Remove or replace the vane in less than 50 hours.
Delamination/ Missing Wire Mesh	Full axial width both sides up to full span.	Replace leading edge up to full span.
Erosion of Leading edge (Wire mesh Configurat- ion)	Any location on leading edge up to 0.150 inch (3.81 mm) in depth and 60 percent of length of FEGV maximum.	Replace wire mesh leading edge up to full span.
		Replace with metal leading edge or wire mesh up to full span.
	Any location on leading edge beyound 0.150 inch (3.81 mm) in depth and 60 percent of length of FEGV maximum.	Replace vane.

TABLE 602
INSPECTION OF THE FAN EXIT VANES

Examine	Damage Limits	Necessary Procedure (AMM 72-33-02/801)
Metal Leading Edge for dents and impact only (Visually inspect only)	Dents or other damage up to 0.200 inch (5.080 mm) in length and 0.050 inch (1.270 mm) depth and within 3.0 inches (76.200 mm) of either base (Area A).	Serviceable
	Dents beyound 0.200 inch (5.080 mm) in length and 0.050 inch (1.270 mm) depth, and located beyound 3.0 inches (76.200 mm) of either Base (Area A)	Remove the vane at next shop visit

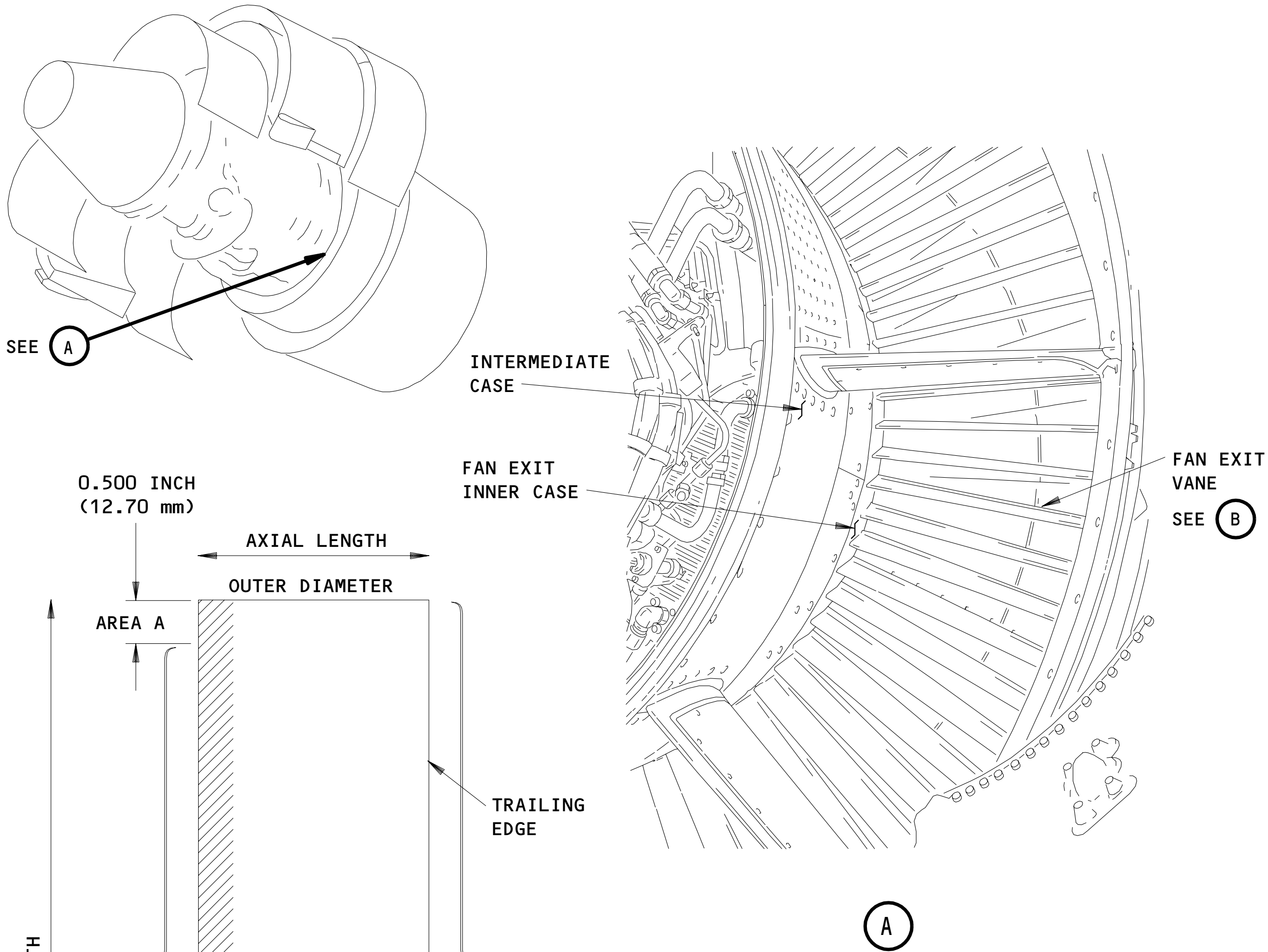
TABLE 602
INSPECTION OF THE FAN EXIT VANES

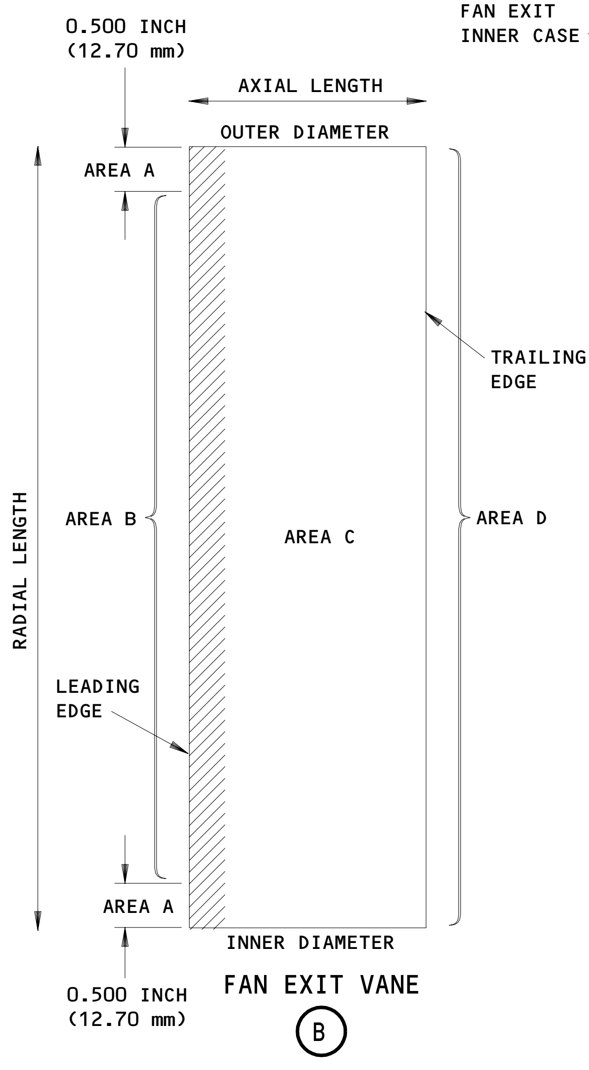
Examine	Damage Limits	Necessary Procedure (AMM 72-33-02/801)
Metal Leading Edge disbonded from vane (Visually inspect only)	Visual inspection shows leading edge is seperated from vane airfoil on one side only, and separation does not extend beyound 3.0 inches (76.200 mm) of either Base (Area A).	Serviceable
	Visual inspection shows leading edge is separated from vane airfoil on one side only, and separation does extend beyound 3.0 inches (76.200 mm) of either Base (Area A).	Remove the vane at next shop visit
	Visual inspections shows leading edge is separated from vane airfoil on both sides at the same location or is completely missing.	Remove vane immediately (see Note)

*NOTE: It is acceptable to continue service with leading edge missing or removed (operator's discretion). Vane will quickly erode and may not be repairable later. The same time and spacing limits apply as if the vane was not there and any vanes missing leading edges must be included in vane not there criteria.

TABLE 602
INSPECTION OF THE FAN EXIT VANES

Examine	Damage Limits	Necessary Procedure (AMM 72-33-02/801)
Metal leading edge contains crack(s). (Visually inspect only)	Any degree of cracking whether isolated or interconnected	Remove vane immediately (See Note)
Vanes that are not there	3 vanes maximum	Install a replacement vane during the subsequent removal of the engine.
	4-5 vanes can be gone, if no more than 3 are adjacent and there is not less than 5 vanes between each area of vanes that are gone	Immediately remove broken pieces. Install replacement vanes in less than 50 hours. If there are more vanes gone than the limit, install replacement vanes immediately.





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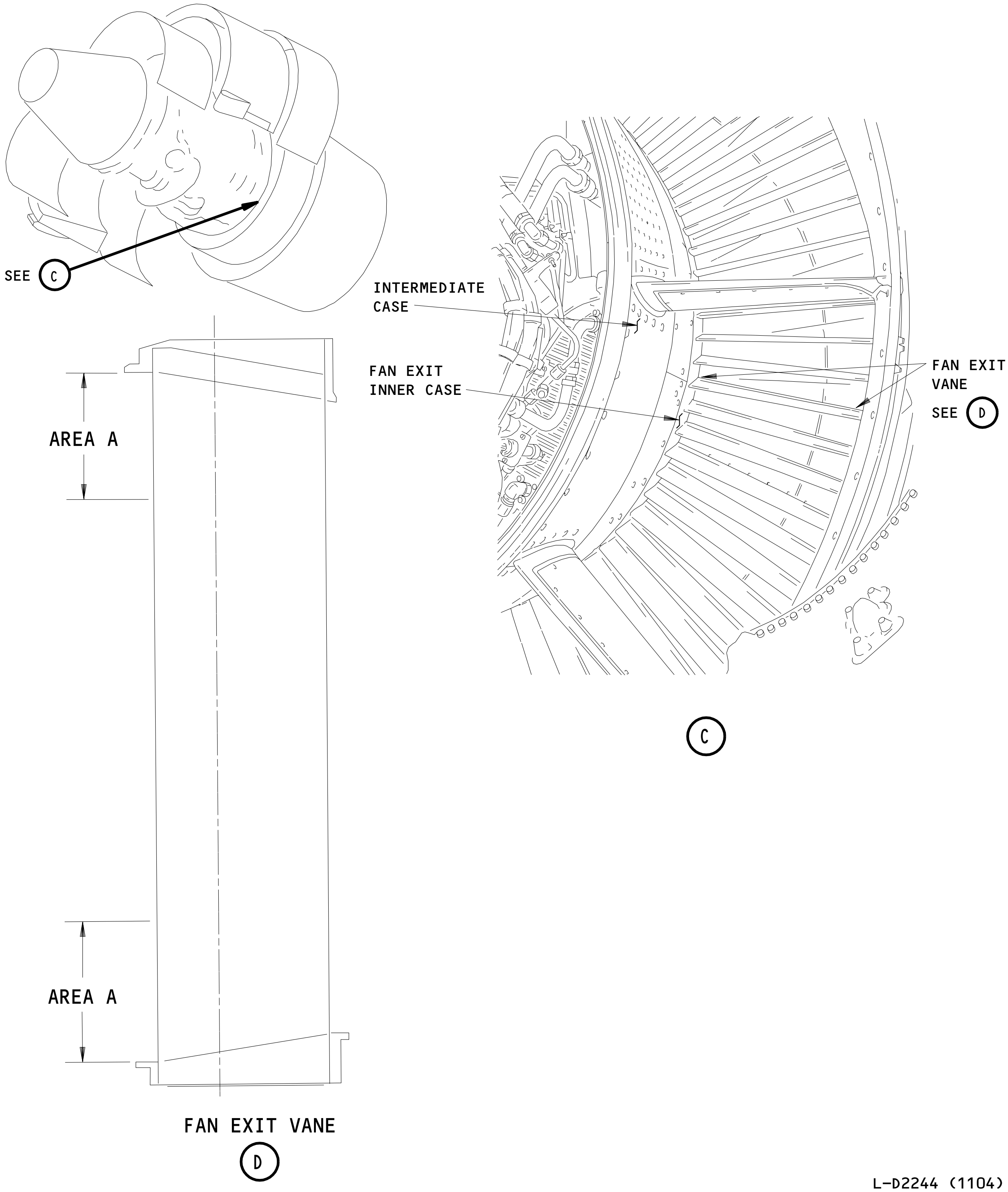
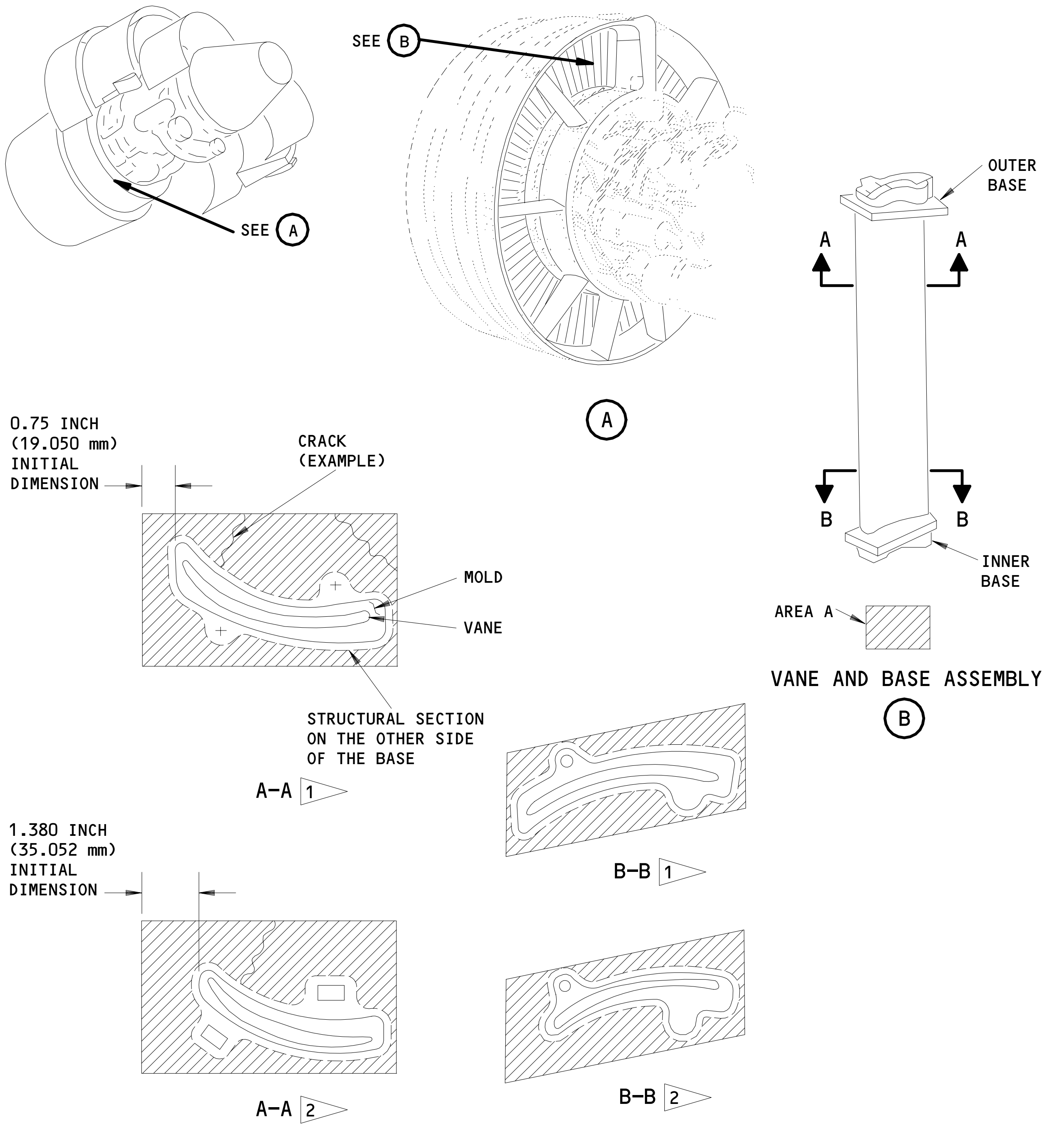
Inspection of the Vane Airfoils
Figure 602 (Sheet 1)



Inspection of the Vane Airfoils
Figure 602 (Sheet 2)



1 ENGINES WITHOUT PW SB 72-262

2 ENGINES WITH PW SB 72-262

L-A7587

Fan Exit Vane Base Inspection
Figure 603

S 216-026-N00

(4) Visually compare the damage you find on the vane platforms with the limits in Table 603 (Fig. 603).

TABLE 603
INSPECTION OF VANE PLATFORMS

Damage	Damage Limits	Necessary Procedure
Cracks	The base platform section on one side of a crack in Area A makes a continuous surface with the section on the other side of the crack	Serviceable
	The base platform section on one side of a crack in Area A is 0.100 inch (2.540 mm), or more, above the section on the other side of the crack.	Serviceable

* NOTE: If a crack in the base platform could lengthen to cause a piece to not be there, it is permitted to remove the piece.

Damage	Damage Limits	Necessary Procedure
	A crack in the structural section of the vane base makes the vane loose more, above the section on the other side of the crack.	Repair the vane base immediately (AMM 72-33-02/801)
	15 cracks in each mold	No procedure is necessary.
	More than 15 cracks in one mold	Remove the vane within 50 hours (AMM 72-33-02/801).
	Cracks in the mold with spaces between the vane base or the vane	Remove the vane within 50 hours (AMM 72-33-02/801).
	Cracks in the mold that cause damage to the attachment holes in the vane bases	Remove the vane within 50 hours (AMM 72-33-02/801).

TABLE 603
INSPECTION OF VANE PLATFORMS

Damage	Damage Limits	Necessary Procedure
Piece or pieces not there	In Area A	Engine can continue to operate until the next scheduled maintenance visit with inspection at 2A check intervals for vane security and further damage Any amount can be missing on one single vane. A total of 5 vanes can have this condition. Any two vanes with this condition must be separated by one undamaged vane.
Piece of the inner diameter or outer diameter vane base that is not there.	In Area A In the structural section of the base which makes the vane loose.	Repair the vane or base immediately (AMM 72-33-02/801). Remove the vane within 50 hours (AMM 72-33-02/801).

* NOTE: Foam baffles under the base platform can be missing in any amount.

E. Put the Airplane back to its Usual Condition

S 416-019-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 416-011-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 416-013-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 446-012-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 866-014-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

FAN EXIT CASE AND VANE - APPROVED REPAIRS

1. General
   A. This task contains nine procedures to repair the damaged fan exit case and vane assembly.
      (1) Patch repair of smaller damage on all areas of the fan exit vanes.
      (2) Repair of the engine by removal but not replacement of damaged fan exit vanes. This allows the plane to continue in service.
      (3) Installation of replacement lockwire and nuts for the fan exit vanes.
      (4) Repair of broken vane platforms.
      (5) Repair of damaged flanges on the fan exit case.
      (6) Repair of the fan exit vane leading edge with tape
      (7) Patch repair of larger damage on the leading edge of fan exit vanes.
      (8) Installation of fan exit vanes to replace vanes that are damaged or not there. You must fully remove at least one vane to do this task.
      (9) Repair of the airfoil of the vane with a partial or full span replacement of the wire mesh leading edge.
   B. The fan exit vanes (fan exit guide vanes) will be refered to as a vane.

TASK 72-33-02-308-000-N00

2. Patch Repair of the Fan Exit Vanes (Smaller Damage on all Areas)
   A. Consumable Materials
      (1) G00842 Cheesecloth, Unsized (PWA P05-038)
      (2) G02167 Sandpaper - 240-400 Grit
      (3) G02150 Wetting Agent (PWA P05-152)
      (4) Wire cloth (PWA P05-182)
      (5) A01028 Adhesive Paste - Epoxy, Non-Thixotropic, Aluminum Filled (Hysol EA 934 NA) - PWA 457-1 (PWA P08-016)
      (6) B00130 Alcohol - Isopropyl(P11-014)
      (7) B01056 Alcohol - Isopropyl, Reagent Grade (P11-014A)
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 72-33-02/601, Fan Exit Case and Vane
      (4) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones
         411 Left Engine
         421 Right Engine

(2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

D. Prepare for Repair of the Fan Exit Vanes

S 868-002-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-003-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-004-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-030-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

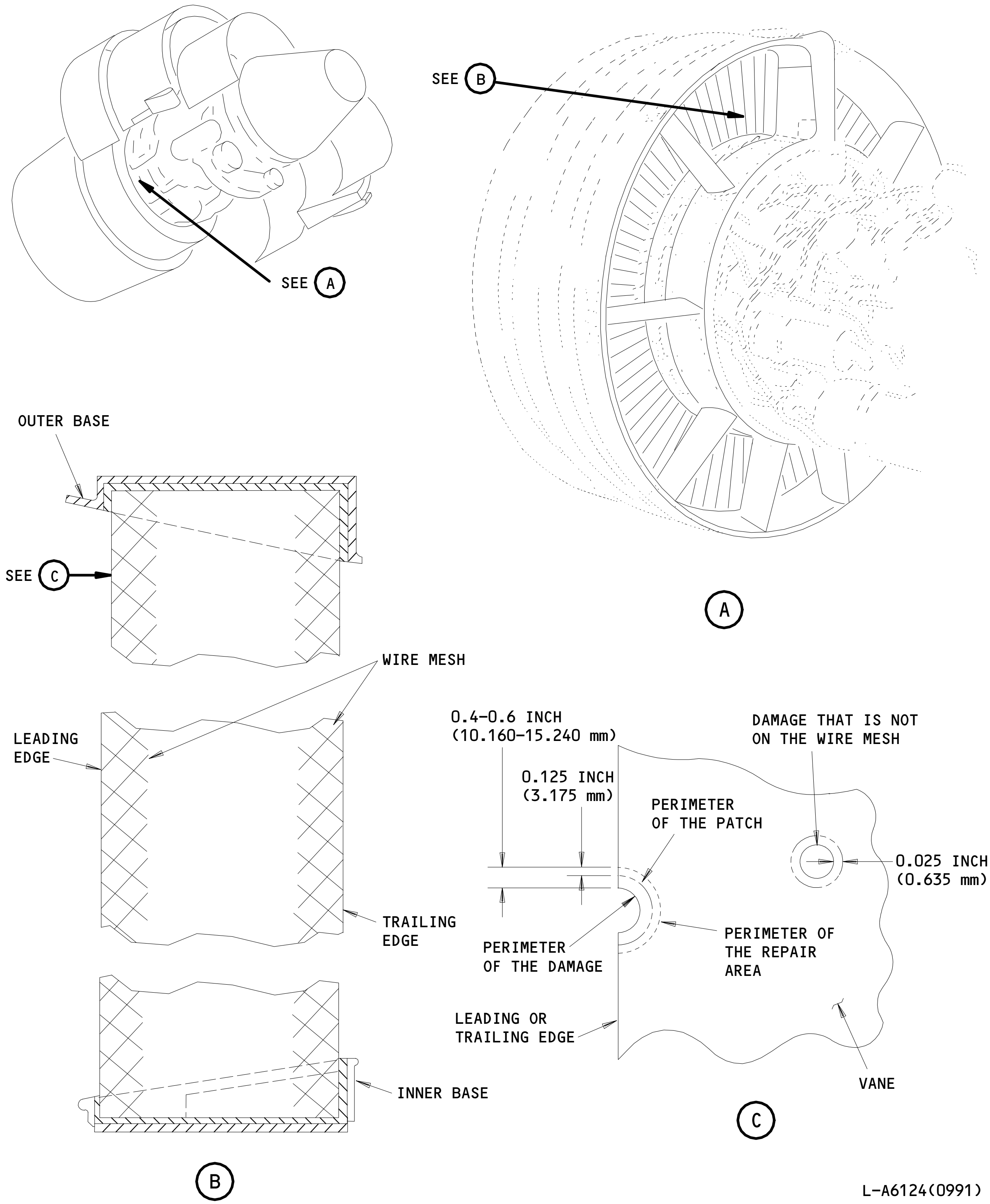
S 018-005-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Patch Repair for the Fan Exit Vanes (Small Damage, All Areas) (Fig. 801)

NOTE: In this procedure, the words "damage" and "repair area" are not the same thing. The repair area is larger than the area of the damage. The repair area includes the area that you clean, sand, and put the patch.



Fan Exit Case and Vane Repair (Patch Repair of Small Damage)
Figure 801

S 218-042-N00

(1) Find the damage that you must repair with a small patch (AMM 72-33-02/601).

S 118-043-N00

(2) Clean the area around the damaged fan exit vane with a soft brush and a solution of wetting agent and water. Flush with water and permit to air dry.

S 358-044-N00

(3) Sand the repair area lightly with 240-400 grit sandpaper. In area B, when you sand the repair area, make sure the area becomes larger by no more than 0.025 inch (0.635 mm). This slight increase in area will smoothen out any sharp edges on the perimeter of the repair area.

S 358-045-N00

(4) If necessary, cut a patch of wire cloth to put on the repair area of the leading or trailing edge.

NOTE: This patch must not be larger than the repair area, and the edge of the patch must not be more than 0.125 inch (3.175 mm) from the perimeter of the repair area.

(a) Fold the patch to shape the radius of the leading or trailing edge of the vane.

S 358-046-N00

(5) If the wire cloth is not smooth, make the wire cloth smooth with pliers.

S 118-047-N00

(6) Clean the surface of the stainless steel wire cloth before you apply the adhesive.

(a) Clean the wire cloth with unsized cheesecloth and isopropyl alcohol.

(b) Fully dry the wire cloth, at ambient temperature, until there is no more alcohol in it.

S 118-048-N00

(7) Clean the repair area.

(a) Clean the repair area with unsized cheesecloth and isopropyl alcohol.

(b) Fully dry the repair area, at ambient temperature, until there is no more isopropyl alcohol in it.

S 958-049-N00

(8) Apply mylar or teflon tape around the repair area.

S 398-050-N00

(9) Apply the epoxy mixture around both the repair area and the patch with a tongue depressor or a spatula. Make sure the patch is fully wet on both sides.

S 358-051-N00

(10) Put the patch on the repair area.

S 958-052-N00

(11) Wind a sheet of silicone rubber, teflon, or FEP release tape tightly around the patch. Apply a pressure of 5-10 psi (34.5-68.9 kPa) to the repair area for at least 24 hours at room temperature. An alternate procedure is to apply the same pressure for 90 minutes at a temperature of 240-260°F (116-127°C).

S 958-053-N00

(12) Remove the tape. Blend any areas where there is too much adhesive with 240-400 grit sandpaper.

F. Put the Airplane Back to Its Usual Condition

S 418-098-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-099-N00

(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-100-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-006-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-101-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-308-001-N00

3. Repair (Removal) of the Damaged Fan Exit Vane

A. Consumable Materials

(1) B00666 Methyl Propyl Ketone (MPK)

(2) A00482 Sealant, Silicone Rubber (PWA P09-014)
(3) A00482 Sealant, Silicone Rubber (PWA P09-029) (optional to P09-014)
(4) G02121 Tape, Heat Reflective Aluminum Foil (PWA P05-135)

B. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 72-33-02/601, Fan Exit Case and Vane
(4) AMM 78-31-00/201, Thrust Reverser System

C. Access
(1) Location Zones

411	Left Engine
421	Right Engine

(2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

D. Prepare for the Removal of the damaged Fan Exit Vanes

S 868-055-N00
(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-056-N00
(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-057-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-058-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-059-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Repair (Remove) the Damaged Fan Exit Vane (Fig. 802)

S 218-040-N00

(1) Find which vanes must be removed (AMM 72-33-02/601).

S 028-006-N00

(2) Cut the damaged vane at the edge of the flowpath surface ID and OD bases. Make sure you do not damage other vanes. Keep the OD base attached to the outer base.

S 028-007-N00

(3) Carefully lift the leading and trailing edge of the base and remove the base from the pins.

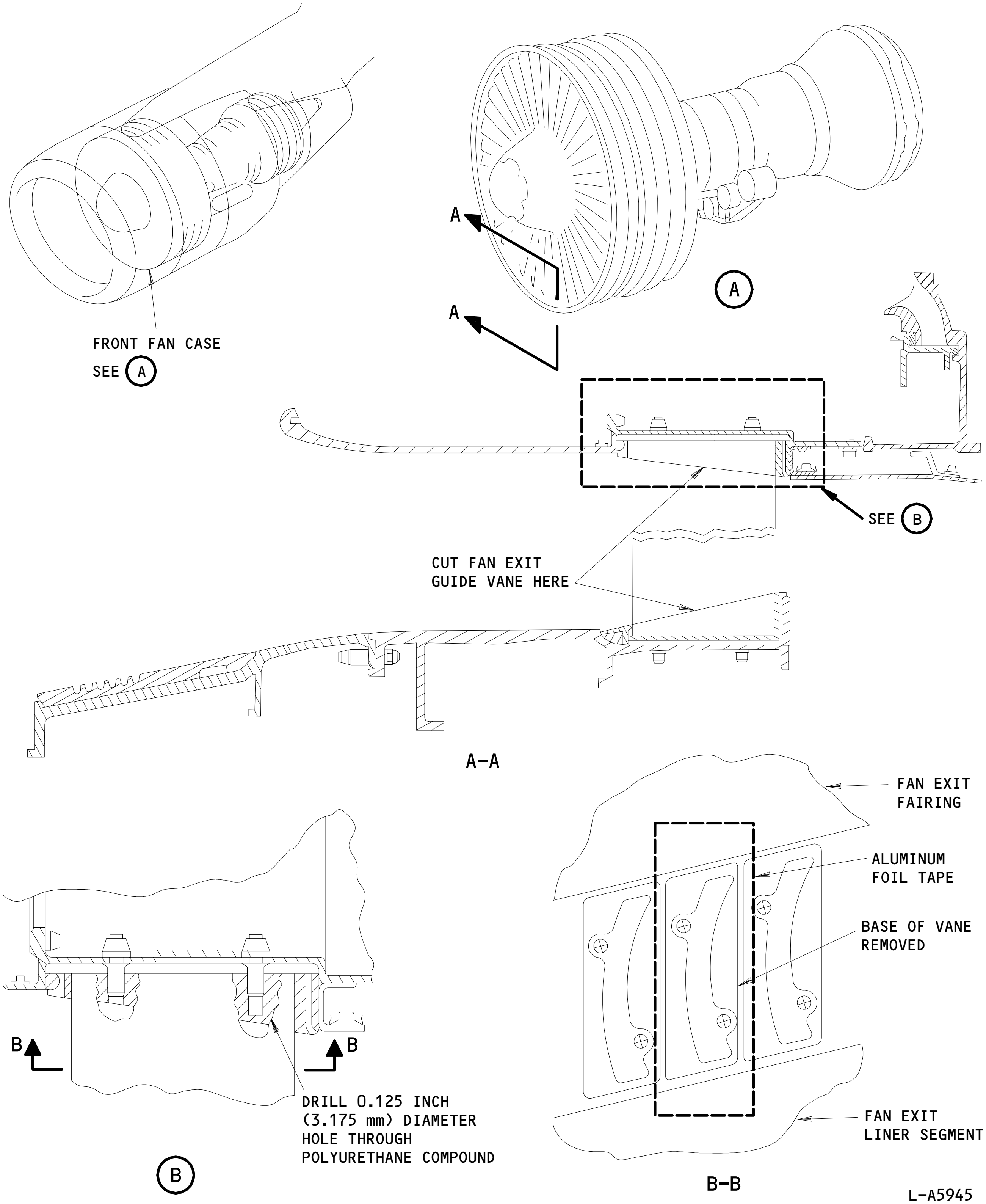
S 358-008-N00

(4) Drill a 0.125 inch (3.175 mm) diameter hole through the center of the trailing edge hole to the flowpath surface of the ID vane base.

S 118-031-N00

WARNING: DO NOT GET SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE SOLVENT. KEEP SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. SOLVENT IS POISONOUS. FLAMMABLE SOLVENT CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(5) Clean the base, baseplate, inner case, and pins with MPK solvent and allow to dry for 15 minutes.



Fan Exit Case and Vane Repair (Vane Removal)
Figure 802

S 398-010-N00
(6) Apply sealant heavily to the ID surface of the base, the case cavity, and the pins.

S 428-011-N00
(7) Install the ID base of the pins and push the base against the case to push out all unwanted sealant.

S 158-012-N00
(8) Rub and remove unwanted sealant from the flowpath surface.

S 958-013-N00
(9) Apply aluminum tape over the base, the adjacent bases, and the fan exit liner segment.

F. Put the Airplane Back to Its Usual Condition

S 418-094-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-095-N00
(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-096-N00
(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-007-N00
(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-097-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-308-002-N00

4. Installation of Replacement Lockwire and Nuts for Fan Exit Vanes

A. Consumable Materials
   (1) D00137 Oil, Engine (P03-001)
B. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 72-33-02/601, Fan Exit Case and Vane
   (4) AMM 78-31-00/201, Thrust Reverser System
C. Access
   (1) Location Zones

411	Left Engine
421	Right Engine

   (2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

D. Prepare for Repair of the Fan Exit Vanes

   S 868-060-N00
   (1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

   S 018-061-N00
   (2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-062-N00

<u>WARNING</u>: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-063-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-064-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Replace the Lockwire and Nuts that Hold the Vane in Position (Fig. 803).

S 218-034-N00

(1) Examine the fan exit case for lockwire that is gone, loose, broken, or for nuts that are gone (AMM 72-33-02/601).

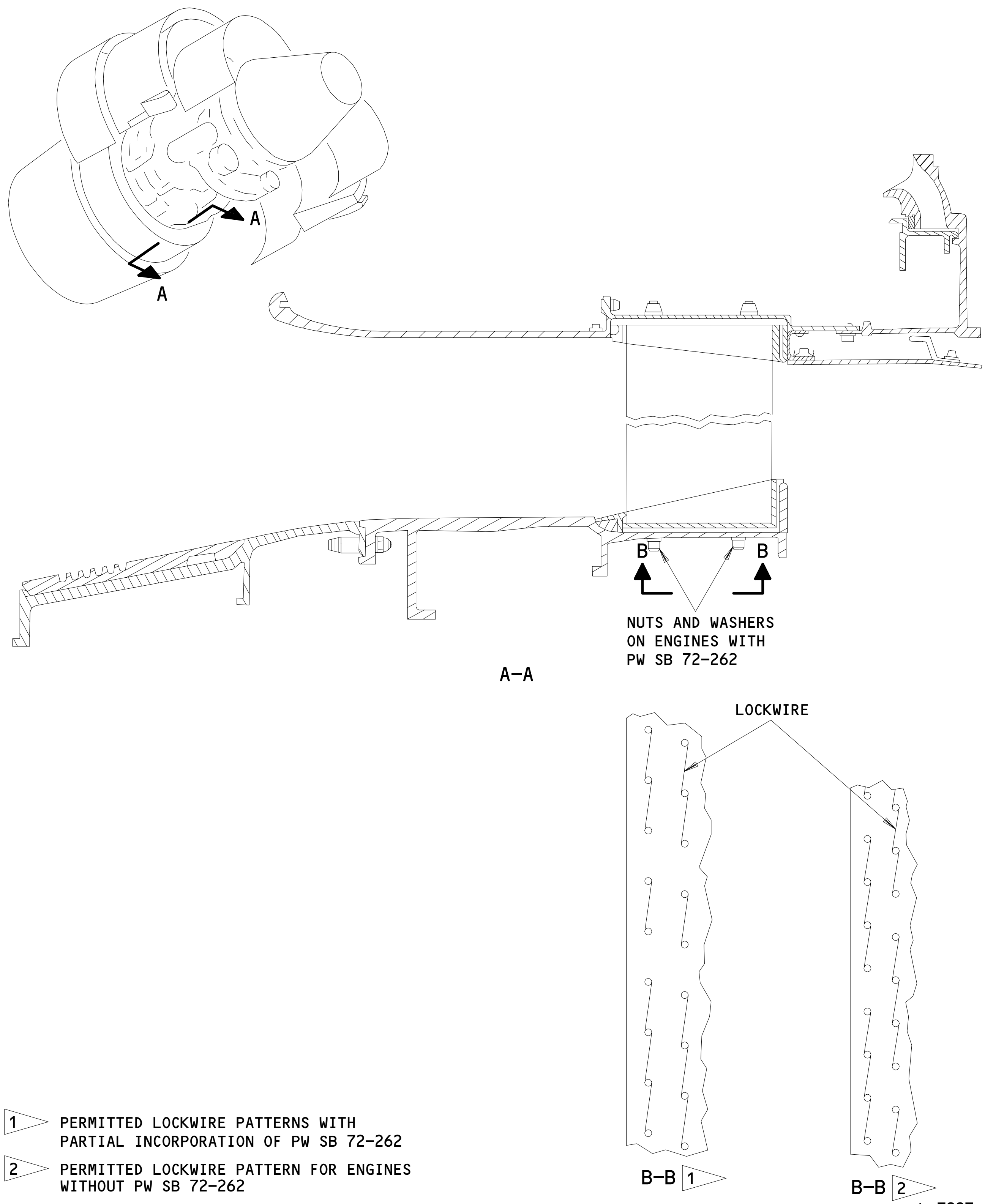
S 358-035-N00

(2) ENGINES PRE-PW-SB 72-262;
Replace the lockwire with new lockwire.

S 358-036-N00

(3) ENGINES POST-PW-SB 72-262;
Do the steps that follow to replace all nuts that keep the vanes in position and that are not there.

<u>NOTE</u>: The nuts are installed on the shanks of slab-bolts that come through the case.



Fan Exit Case and Vane Repair
(Installation of Replacement Lockwire and Nuts)
Figure 803

(a) Apply engine oil to the threads of the nut.
(b) Install the washer on the slab-bolt.
(c) Install the nut on the slab-bolt.
(d) Torque the nut to 85-95 pound-inches (9.60-10.73 newton-meters).

F. Put the Airplane Back to Its Usual Condition

S 418-090-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-091-N00
(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-092-N00
(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-008-N00
(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-093-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-308-003-N00

5. Broken Platform Repair for the Base and Vane Assembly

A. Consumable Materials
(1) B00130 Alcohol - Isopropyl
(2) A00482 Sealant, Silicone Rubber (PWA P09-014)
(3) A00482 Sealant, Silicone Rubber (PWA P09-029) (optional to P09-014)

B. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 72-33-02/601, Fan Exit Case and Vane
(4) AMM 78-31-00/201, Thrust Reverser System

C. Access
(1) Location Zones

411	Left Engine
421	Right Engine

(2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

D. Prepare for the Repair of the Fan Exit Vanes Bases

S 868-065-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-066-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-067-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-068-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-069-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Repair broken platforms on the base and vane assembly (Fig. 804).

S 218-037-N00

(1) Find the broken base platforms that can be repaired (AMM 72-33-02/601).

S 118-038-N00

(2) Do the steps that follow to prepare the area for the repair.
   (a) Remove all loose pieces from the corners of the platform you will repair.
   (b) Clean the repair area with alcohol.
   (c) Fully dry the repair area in air that is at ambient temperature until there is no remaining alcohol on the part.

S 398-039-N00

(3) Repair the area as follows.
   (a) Apply sealant to the repair area.
   (b) Make the contour of the repair area agree with the contour of the adjacent surfaces.
   (c) Cure the sealant as follows:
      1) in air at ambient temperature,
      2) in air that has a relative humidity of not less than 20 %,
      3) for a minimum of two hours,
      4) until it is not tacky.

F. Put the Airplane Back to Its Usual Condition

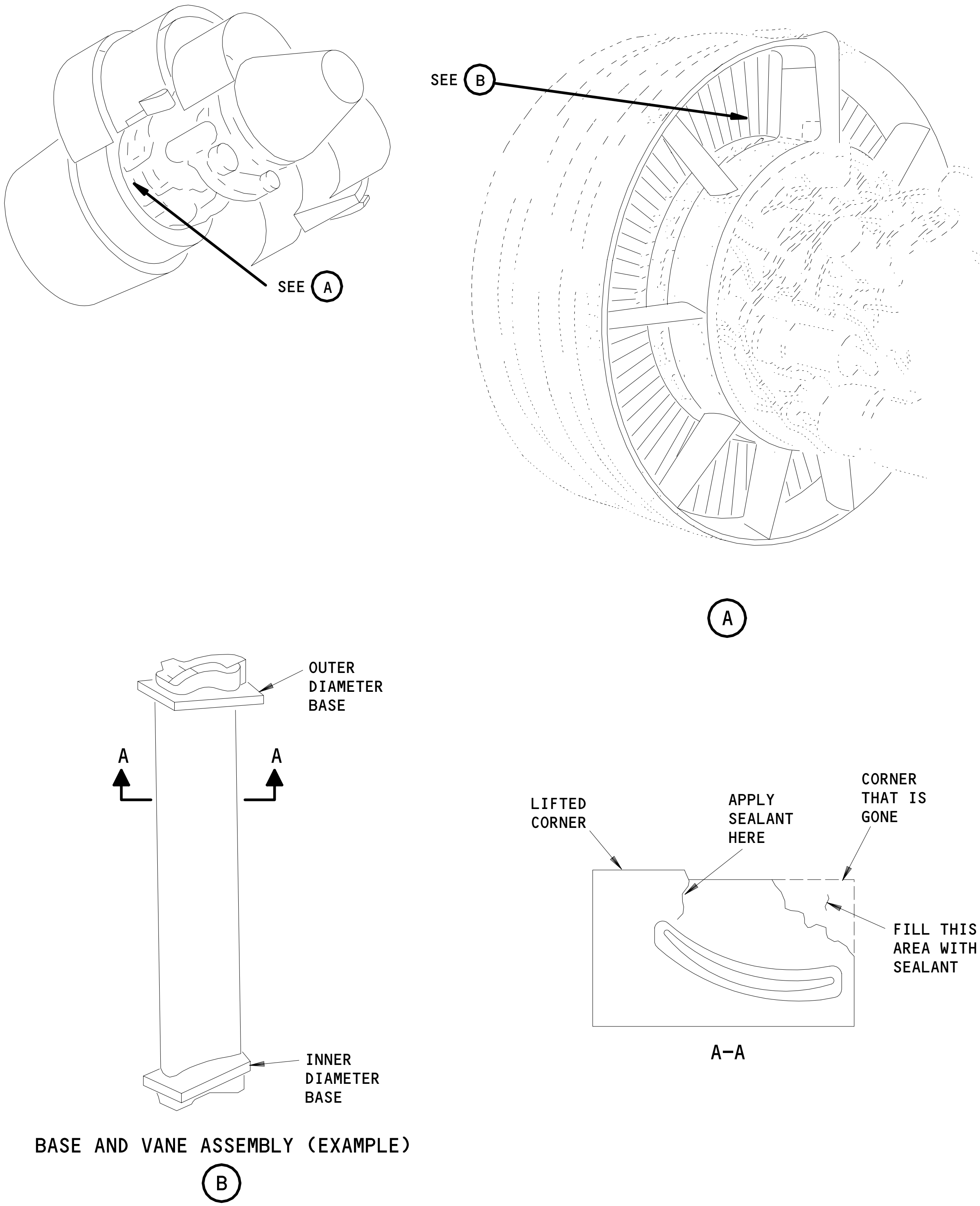
S 418-054-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-026-N00

(2) Close the fan cowl panels (AMM 71-11-04/201).



Fan Exit Case and Vane Repair (Repair of Damaged Bases)
Figure 804

S 418-028-N00
(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-009-N00
(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-025-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-308-018-N00

6. Repair Damaged Corners on the B1 and B2 Flanges on the Fan Exit Case

A. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 72-33-02/601, Fan Exit Case and Vane
(4) AMM 78-31-00/201, Thrust Reverser System

B. Access
(1) Location Zones

411	Left Engine
421	Right Engine

(2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

C. Prepare for Repair of the Fan Exit Case Flanges

S 868-010-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 418-011-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-015-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-013-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-014-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

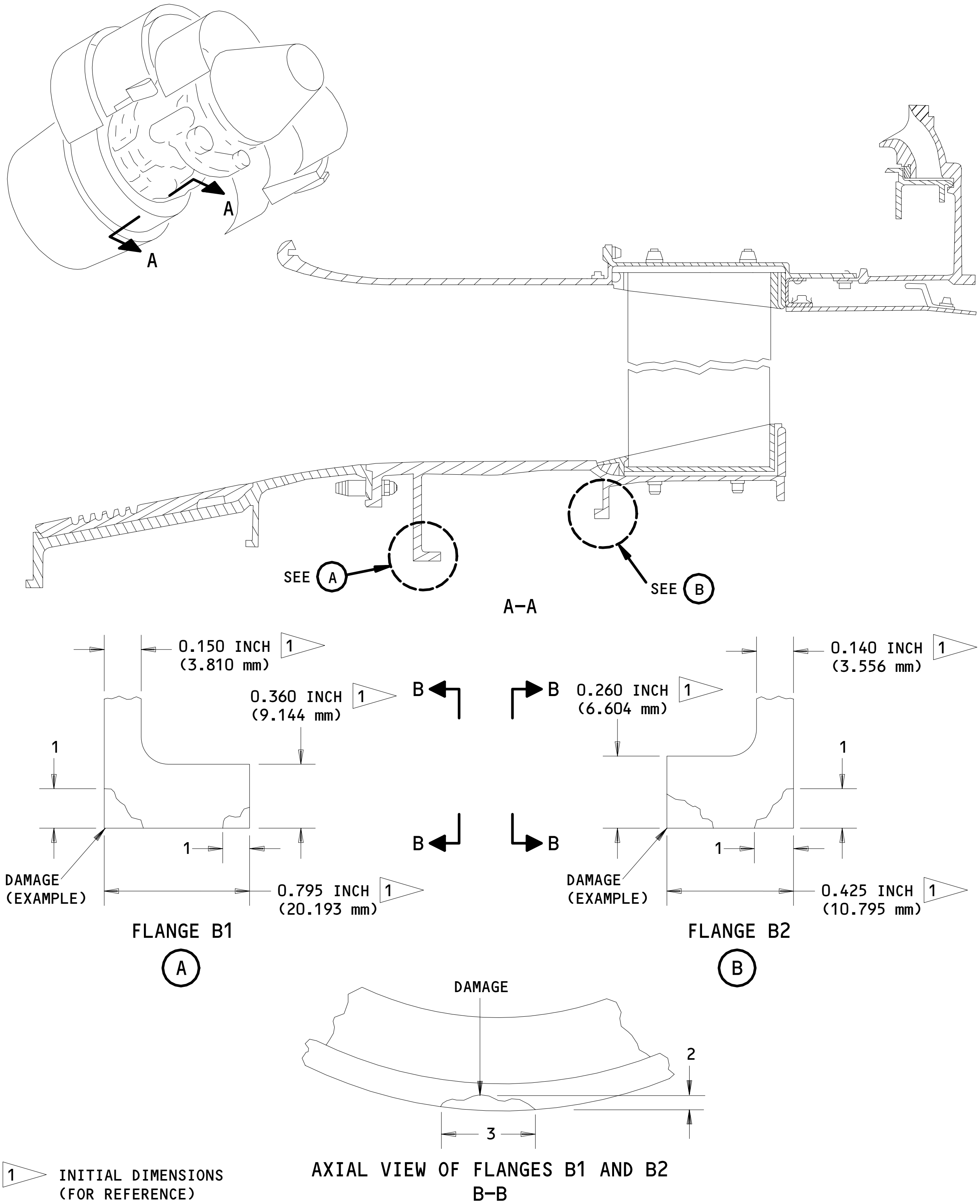
(5) Open the thrust reversers (AMM 78-31-00/201).

D. Repair the Damaged Corners on the B1 and B2 Flanges (Fig. 805).

S 218-016-N00

(1) Find the damaged B1 and B2 Flanges that can be repaired (AMM 72-33-02/601).

NOTE: All damage must be repaired immediately.



1 INITIAL DIMENSIONS (FOR REFERENCE)

Fan Exit Case and Vane Repair (Flange B1 and B2 Repair)
Figure 805

S 358-017-N00
(2) Make the damaged corners, on the B1 and B2 Flanges, smooth (Table 801).

TABLE 801
FLANGES B1 and B2 REPAIR LIMITS

Examine	Repair Limits
Damaged Corners: Index 1	0.060 inch (1.542 mm), maximum, 2 locations
Index 2	0.060 inch (1.524 mm), maximum
Index 3	This must not be less than ten times Index 2
Circumferential length of each incident	1.000 inch (25.400 mm) maximum
Total Circumferential length of all damage on each Flange	24.000 inches (609.600 mm) maximum

S 238-019-N00
(3) After you repair the damaged area, examine it with high sensitivity penetrant.
(a) No cracks are permitted.

S 378-020-N00
(4) Apply adonize touch-up solution to the repaired areas (AMM 70-11-01/201).

E. Put the Airplane Back to Its Usual Condition

S 418-102-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-103-N00
(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-104-N00
(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-021-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-105-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-728-150-N00

7. Repair of The Fan Exit Vane Leading Edge With Tape

A. General

(1) This repair should be applied if the fan exit guide vane leading edge (SST Wiremesh Weave) is loose, broken, or missing due to service damage.

(2) Use this repair only if leading edge damage is 0.300 inch (7.620 mm) of the vane airfoil chord or less.

NOTE: Vanes with damage greater than 0.300 inch (7.620 mm) must be replaced (AMM 72-33-02/801).

(3) Fan exit guide vanes repaired by this procedure which show tape deterioration can be repaired again. All old tape must be removed before the application of the new tape repair.

B. Consumable Materials

(1) G50016 Cheescloth, Unsized (P05-038)
(2) G02391 Abrasive Paper, Silicon Carbide (400 Grit) (P05-076)
(3) G50015 Tape, Masking (P05-145)
(4) G02478 Gloves, Plastic Polyethylene (P05-198)
(5) B00311 Abrasive Paper, Silicon Carbide (240 Grit) (P05-153)
(6) G50012 Tape, Protective Polyurethane (P05-278)
(7) G50011 Promoter, Adhesive 86A (P05-317)
(8) B01056 Isopropyl, Alcohol, Reagent Grade (P11-014A)

C. Procedure (Fig. 805A)

S 028-151-N00

(1) If necessary, remove 1st stage (fan) blades (AMM 72-31-02/401).

S 218-152-N00

(2) Find the leading edge of the fan exit vane that can be repaired.

S 038-153-N00

(3) Remove the leading edge damage as follows:
   (a) Sand the repair area lightly with 240 grit or 400 grit Abrasive Paper to remove any sharp edges.
   (b) Apply Masking Tape to a 1.00 inch (25.400 mm) wide area from both sides of the leading edge.

S 108-154-N00

(4) Prepare the leading edge for Polyurethane Tape application as follows:
   (a) Sand within the masked area with Abrasive Paper 240 grit or 400 grit.
   (b) Remove the Masking Tape.
   (c) Clean the repair area with Unsized Cheescloth and Isopropyl Alcohol.
   (d) Let air dry for 15 minutes.

      NOTE: The cleaning process is important to the tape adhering to the vane during service operation.

      NOTE: It is important to keep the surfaces that are bonded free from contamination. Use Plastic Polyethylene Gloves to help prevent surface contamination.

S 948-155-N00

(5) Apply Adhesive Promoter to the leading edge repair area as follows:
   (a) Use Unsized Cheescloth wetted with a minimum quantity of Adhesive Promoter and apply to the repair area.
   (b) Let air dry for 10 minutes or until the surface is not glossy.

      NOTE: Protective Polyurethane Tape applications over Adhesive Promoter will be more difficult to remove.

S 458-156-N00

(6) Apply the Protective Polyurethane Tape as follows:

NOTE: You must apply the Protective Polyurethane Tape within one hour of the application of the Adhesive Promoter.

(a) Mark the installation edge of the Protective Polyurethane Tape as follows:
   1) Apply the Masking Tape to a 0.75 inch (19.050 mm) wide area from both sides of the leading edge.

(b) Cut the Protective Polyurethane Tape to a width of 1.5 inch (38.100 mm).

(c) Cut the Protective Polyurethane Tape to a legnth of 0.50 inch (12.700 mm) to 0.75 inch (19.050 mm) less than the radial height of the vane leading edge.

(d) Remove the paper packing from the Protective Polyurethane Tape.

NOTE: Be careful not to allow tape adhesive side to attach to itself.

(e) Align one edge of the Protective Polyurethane Tape and put against the edge of the Masking Tape.

(f) Carefully apply the Protective Polyurethane Tape forward to the leading edge as follows:
   1) Make the tape smooth.
   2) Pull the tape around the leading edge.
   3) Continue to apply tape to the other side of the vane.
   4) Make the tape smooth to follow the vane contour.

   NOTE: If tape becomes wrinkled or is applied incorrectly, discard and apply new tape immediately.

CAUTION: INSTALLED APPEARANCE OF THE TAPE MUST BE SMOOTH AGAINST THE VANE SURFACE. FAILURE TO ENSURE THAT THE TAPE IS SMOOTH CAN CAUSE THE TAPE TO TEAR OR TO BE UNSERVICEABLE.

(g) Remove the Masking Tape.

S 428-157-N00

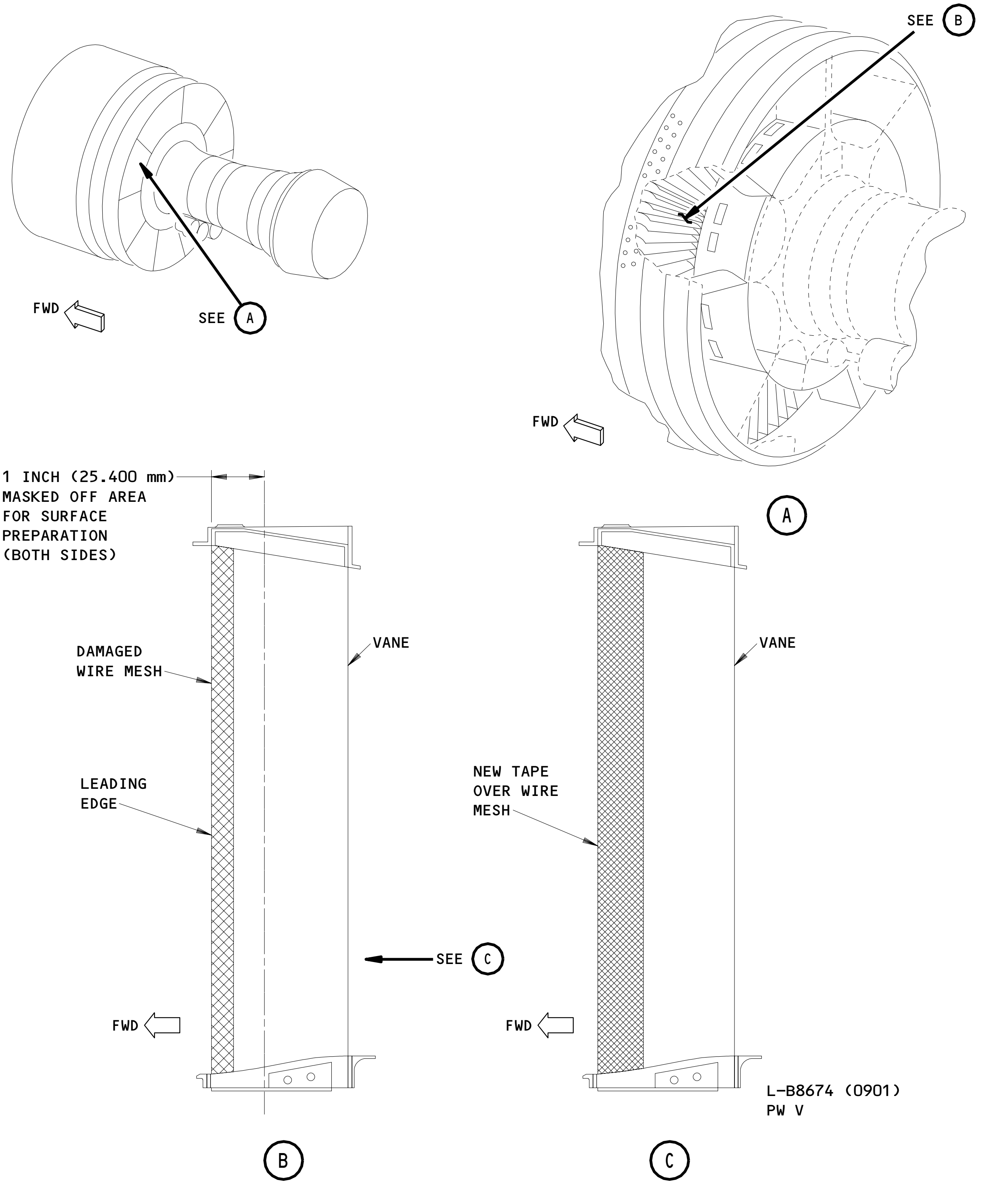
(7) If necessary, install 1st stage (fan) blades (AMM 72-31-02/401).

TASK 72-33-02-308-004-N00

8. Patch Repair of the Fan Exit Vanes (Larger Damage, Leading Edge)

A. General
   (1) This Repair is for damage on the leading edge that decreases the chord length between 0.100-0.375 inch (2.54-9.525 mm).

B. Equipment
   (1) Kit, FEGV (Fan Exit Guide Vane) Repair Kit
       Pratt & Whitney PN 814765



Fan Exit Guide Vane Tape Leading Edge Repair
Figure 805A

C. Consumable Materials
   (1) G00842 Cheesecloth, Unsized (PWA P05-038)
   (2) G02150 Wetting Agent (PWA P05-152)
   (3) G01520 Glass, Milled (Misc. 0257) (PWA Item No. P05-147)
   (4) Wire cloth (PWA P05-182)
   (5) A00920 Adhesive, Paste Epoxy (PWA P08-016)
   (6) A00000 Adhesive, Paste Epoxy (PWA P08-025)
   (7) A00744 Agent, Thickening (PWA 424-1, Item No. P08-20)
   (8) A00745 Agent, Thickening (PWA 424-2, Item No. P08-11)
   (9) B00130 Alcohol - Isopropyl
   (10) G00299 Tape, Masking, Polyester Film (PMC 4188)
   (11) Tape - Pressure Sensitive Polyester (PMC 4096) (P05-437)
   (12) Tape - Masking (PMC 4001) (P05-453)
   (13) Tape - Masking (High Temperature) (PMC 4009) (P05-454)
   (14) Tape - Fiberglass (Teflon Coated) (PMC 4107) (P05-455)

D. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 72-33-02/601, Fan Exit Case and Vane
   (4) AMM 78-31-00/201, Thrust Reverser System

E. Access
   (1) Location Zones

411	Left Engine
421	Right Engine

   (2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

F. Prepare for Repair of the Fan Exit Vanes

S 868-070-N00

   (1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-071-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-072-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-073-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-074-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

G. Patch Repair for Large Damage on the Vane of the Fan Exit Case (Fig. 806)

S 218-022-N00

(1) Find the damage that you must repair with a large patch (AMM 72-33-02/601).

S 358-023-N00

(2) Remove the damaged pieces as follows:
   (a) Lighty hit the surface of the vane, around the damage, to find the quantity of delamination.

      NOTE: An area of delamination makes a sound with a lower frequency than the other areas.

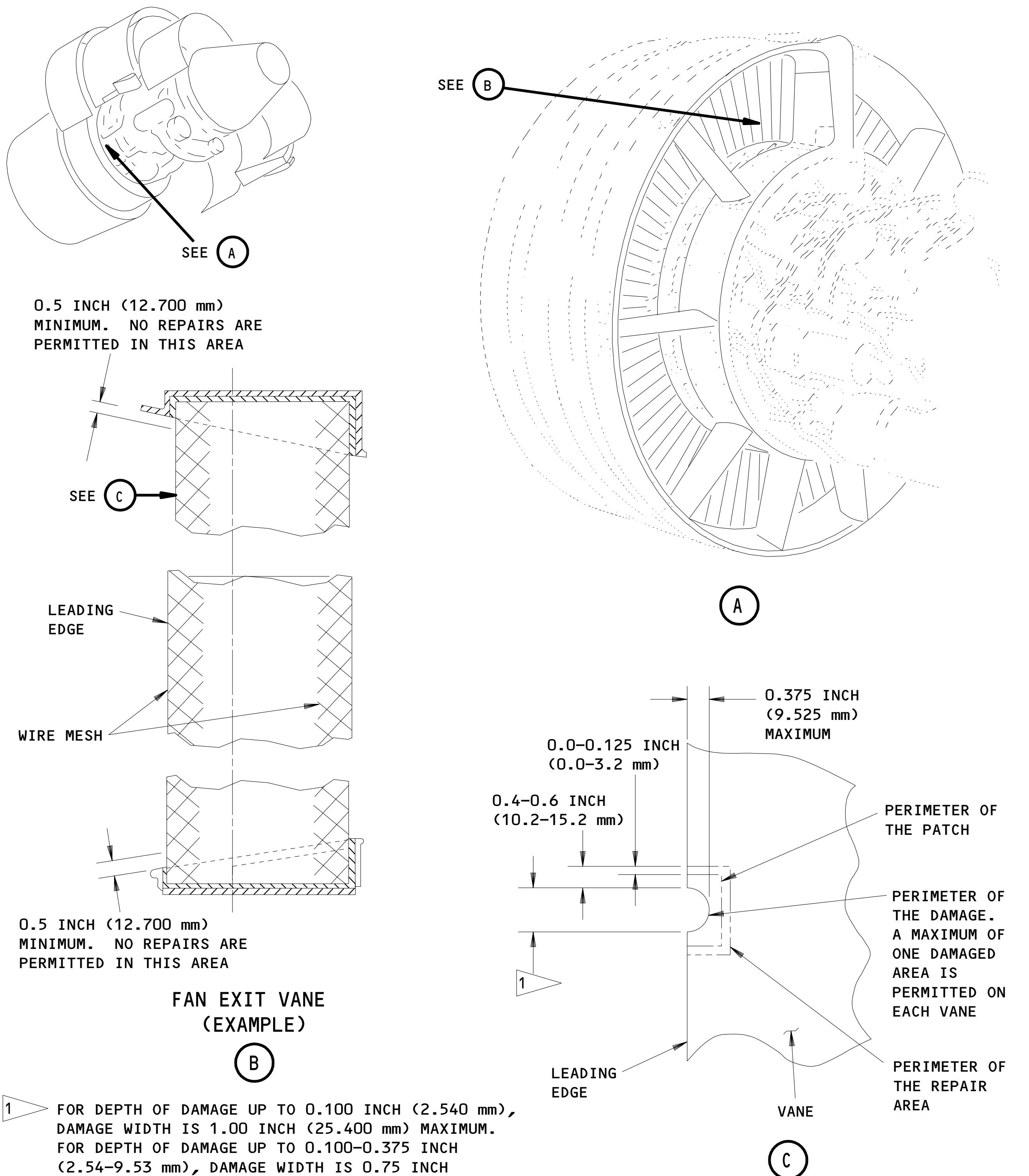
   (b) With a grease pencil, or other correct marker, make a mark around the perimeter of the damaged area.
   (c) Mechanically remove the damaged and loose material.
   (d) File or sand the edges of the damaged area.

S 358-024-N00

(3) Measure the size of the damaged area.
   (a) If the damage is more than the repair limits, you must remove or replace the vane.

S 118-075-N00

(4) Clean the area around the damaged fan exit vane with a soft brush and a solution of wetting agent and water. Flush with water and permit to air dry.



1 FOR DEPTH OF DAMAGE UP TO 0.100 INCH (2.540 mm), DAMAGE WIDTH IS 1.00 INCH (25.400 mm) MAXIMUM. FOR DEPTH OF DAMAGE UP TO 0.100-0.375 INCH (2.54-9.53 mm), DAMAGE WIDTH IS 0.75 INCH (19.05 mm) MAXIMUM.

Fan Exit Case and Vane Repair (Patch Repair of Large Damage)
Figure 806

S 358-076-N00

(5) Sand the repair area lightly with 240-400 grit sandpaper.

S 108-158-N00

(6) For the vanes with solid metal leading edges, it is optional but strongly recommended to clean and ferric chloride etch the repair area after sanding as follows:
   (a) Mask around the repair area with plastic and use rags to absorb any etchant that drips off of the part.
      1) The vane, base, and surrounding areas must be protected from the etchant.
      2) Rinse with water and air dry.
   (b) Wipe the repair area with a clean lint free rag saturated with water.
   (c) Etch with PS 503 ferric chloride solution at 60 - 80°F (16 - 27 °C) for five minutes.
      1) You must continue to change the new solution over the repair area during the etching time.
   (d) Wipe with a clean lint free rag saturated with water.
   (e) Dry with a clean lint free rag.
   (f) Wipe again with a clean lint free rag saturated with water.
   (g) Dry with a clean lint free rag again.

S 958-159-N00

(7) Mask around the patch area with masking tape, high temperature masking tape, or fiberglass tape to keep excess adhesive off of the adjacent areas.
   (a) Make sure that there is enough room to smooth the repair to the adjacent surface that will be required (approximately 0.062 inch (1.575 mm)).

S 358-160-N00

(8) Get the wire cloth patch material.
   (a) If the wire mesh or packaging material shows any indications of preservatives or oils, clean the wire mesh before it touches the vane as follows:
      1) Lay the wire on a piece of cheesecloth.

2) Flush and saturate the wire mesh with alcohol for three times minimum.
3) Shake out the alcohol and discard the cheesecloth each time.
4) Make a clean piece of cheesecloth moist with alcohol.
5) Clean the patch with cheesecloth.
6) Dry the patch at air temperature for 15 minutes minimum.

S 358-077-N00

(9) Cut a patch of wire cloth to put on the repair area.

<u>NOTE</u>: This patch must not be larger than the repair area, and the edge of the patch must not be more than 0.125 inch (3.175 mm) from the perimeter of the repair area.

(a) Fold the patch to make it the same shape as the leading edge radius.
(b) Turn the Patch to align it with the wire cloth in the leading edge.

S 358-162-N00

(10) Clean the wire mesh patch material as follows:

<u>NOTE</u>: This cleaning procedure is not necessary if you cleaned the patch before.

(a) Make a clean piece of cheesecloth moist with alcohol.
(b) Clean the patch with cheesecloth.
(c) Dry the patch at air temperature for 15 minutes minimum.

<u>NOTE</u>: There must be no alcohol on the patch material when you apply the adhesive.

S 358-078-N00

(11) If the wire cloth is not smooth, make the wire cloth smooth with pliers.

S 118-079-N00

(12) Clean the surface of the stainless steel wire cloth before you apply the adhesive.
  (a) Clean the wire cloth with unsized cheesecloth and isopropyl alcohol.
  (b) Fully dry the wire cloth, at air temperature, until there is no more alcohol in it.

S 118-080-N00

(13) Clean the repair area.
  (a) Clean the repair area with unsized cheesecloth and isopropyl alcohol.
  (b) Fully dry the repair area, at ambient temperature, until there is no more isopropyl alcohol in it.

S 348-005-N00

(14) Bond the patch to the vane as follows:
  (a) Apply mylar or teflon tape around the repair area.
  (b) Use the adhesive in the FEGV repair kit, or the optional Adhesive Paste Epoxy (P08-025), or prepare the adhesive mixture as follows:
    1) Add 30% ± 3% (by weight) Milled Glass and 5% ± 1% (by weight) Thickening Agent (PWA 424-1 or 424-2) to the Adhesive Paste Epoxy (P08-016).
    2) Mix the mixture fully.
  (c) Apply the epoxy mixture to completely fill the area of missing leading edge.
    1) Use the adjacent surfaces to establish the contour.
    2) It is permitted to mix in 27 - 33 percent (by weight) milled glass for filling the depression.
  (d) Clean a sheet of unused platic as follows:
    1) Make a clean piece of cheesecloth moist with alcohol.
    2) Clean the plastic with cheesecloth.
    3) Allow the plastic to dry for 15 minutes minimum.

(e) Lay the patch down on the clean sheet of plastic.

(f) Apply the epoxy mixture to one side of the patch and work the adhesive into the wire mesh with a clean spatula.

(g) Turn the patch over.

1) Make sure that you can see the epoxy mixture through the wire mesh.

2) If you can not see the epoxy mixture, repeat the preceeding steps below.

(h) Apply more epoxy mixture to the second side of the patch.

1) Complete coverage with the epoxy mixture is required.

(i) Put the patch on the repair area.

1) Turn the patch to align the wire strands with the leading edge.

2) The epoxy mixture must be squeezed out over the entire patch.

(j) Put a sheet of Tape (P05 -145), or equivalent, on the patch.

(k) Carefully attach the patch to the vane with a clamp.

NOTE: To make sure that the patch has a good fit and makes a conrinuous surface with the vane, use a silicone rubber tool that is cast from the leading edge or use shims.

(l) Cure the patch by one of the following methods, as permitted:

NOTE: The method A is not permitted for repairs over a solid metal sheet.

1) Method A:

a) Cure for 24 hours minimum at 60 - 100°F (16 - 38°C).

2) Method B:

a) Cure for 4 hours minimum at 60 - 100°F (16 - 38°C) followed by 90 minutes minimum at 140 - 180°F (60 - 82 °C).

S 958-164-N00

CAUTION: YOU CAN NOT USE SOLVENTS ON THE REPAIR AREA UNTIL THE FULL CURE IS COMPLETE OR THE ADHESIVE MATERIAL WILL BE DAMAGED.

(15) You can remove the tape and the clamp after 4 hours minimum at 60 - 100°F (16 - 38°C), and the patch can then be smoothed to the adjacent surfaces with 240 - 400 grit sandpaper.

S 358-025-N00

(16) Blend all areas where there is unwanted adhesive with 240-400 grit sandpaper.

(a) For vanes with wire mesh leading edges, a patch-to-vane mismatch of 0.030 inch (0.762 mm) maximum is permitted.

(b) For vanes with solid metal leading edges, a patch-to-vane mismatch of 0.020 inch (0.508 mm) maximum is permitted.

H. Put the Airplane Back to Its Usual Condition

S 418-086-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-087-N00

(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-088-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-027-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-089-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-308-028-N00

9. <u>Repair (Replacement) of the Damaged Fan Exit Vane</u>

A. General

(1) It is not necessary to remove the fan blades. If you remove the fan blades, the procedure will continue two times longer (take two times longer to do).

(2) It will be necessary to have no less than two people do this task.

(3) Foam fairings become rigid with time. When you remove a group of vanes, it will help if you use new foam fairings for the installation of the vanes.

B. Consumable Materials

(1) G00842 Cheesecloth, Unsized (PWA P05-038)

(2) A00482 Sealant, Silicone Rubber (PWA P09-014)
(3) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) - AS3214-02
(4) B00130 Alcohol - Isopropyl

C. Reference
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 72-33-02/601, Fan Exit Case and Vane
(4) AMM 78-31-00/201, Thrust Reverser System

D. Access
(1) Location Zones

411	Left Engine
421	Right Engine

(2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

E. Prepare for Repair of the Fan Exit Vanes

S 868-035-N00
(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-036-N00
(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-039-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-038-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-040-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

F. Repair the Fan Exit Vanes (Fig. 807).

S 358-029-N00

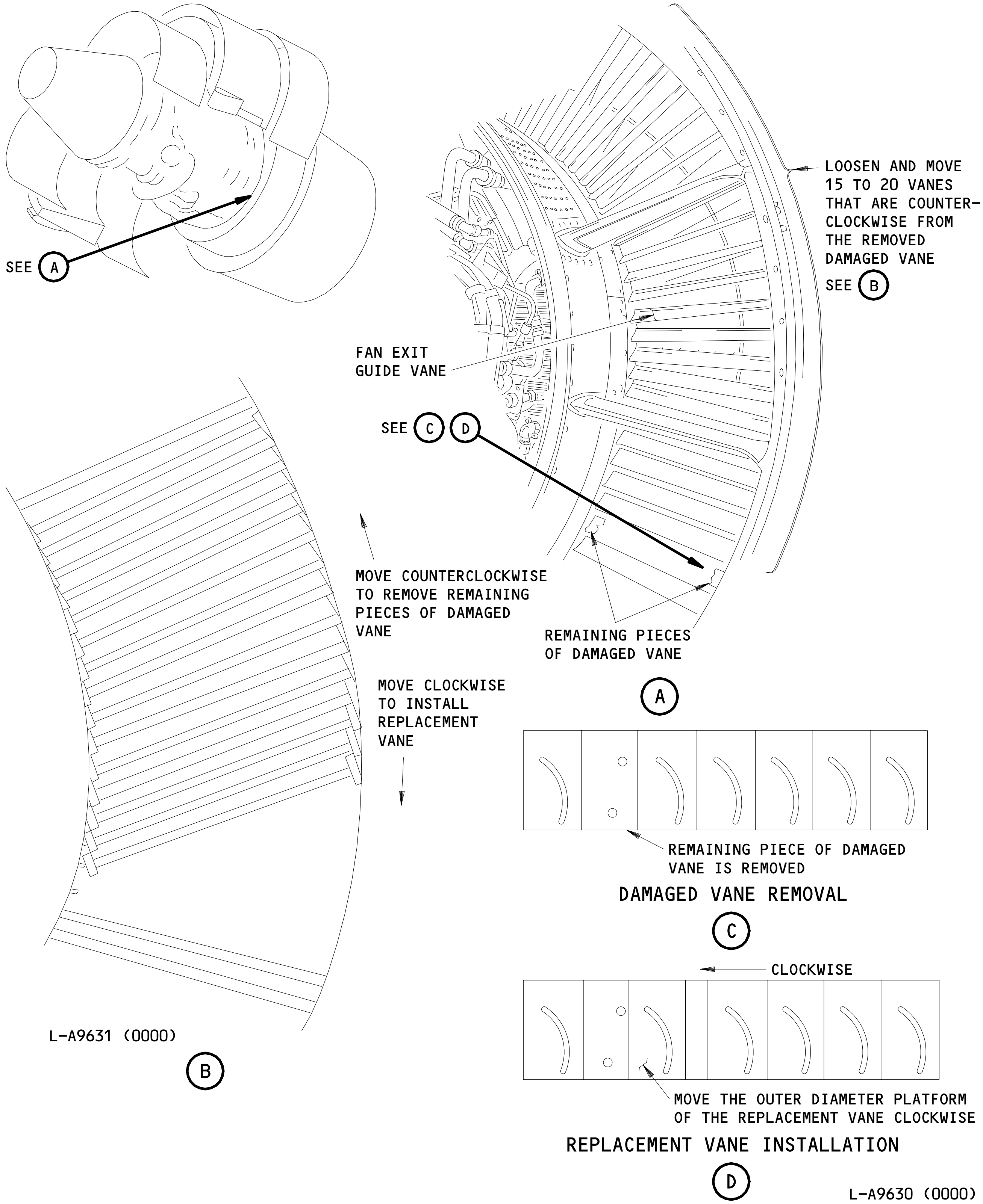
(1) If the damaged vane cannot be repaired (AMM 72-33-02/601), remove the inner diameter and outer diameter platforms and the fairings of the damaged vane(s).

WARNING: DO NOT LET THE VANE MATERIAL GET INTO YOUR EYES OR MOUTH OR ON YOUR SKIN. MAKE SURE YOU USE EQUIPMENT FOR PROTECTION. THE VANE MATERIAL IS POISONOUS AND CAN CAUSE INJURY TO PERSONS.

(a) Use a saw to remove the airfoil.
(b) If necessary, cut the wire that locks the bolts on the outer diameter of the fan case (Fig. 803).
    1) Remove the bolts or nuts and washers that hold the outer diameter of the vane.
(c) Remove the inner diameter and outer diameter platforms and fairings.

S 028-030-N00

(2) Remove the bolts or washers and nuts from the adjacent vanes.
(a) If necessary, cut the wire that locks the outer diameter bolts to the 15 to 20 adjacent vanes in the counterclockwise direction from the damaged vane.
    1) Remove the bolts or washers and nuts that hold the outer diameter platforms of the vanes.



Fan Exit Case and Vane Repair (Damaged Vane Replacement)
Figure 807

(b) Use the space (where the damaged vane was) to move the outer diameter of the adjacent vane clockwise (seen from the rear) to loosen the outer diameter foam fairings.

NOTE: Loosened outer diameter fairings will permit easier removal.

S 028-031-N00

(3) Collect space to remove other damaged vanes and to make space for the replacement vane (Fig. 806).

(a) Move the 15th to 20th vane (that is counterclockwise from the removed vane, as viewed from the rear) counterlockwise, at an angle, to collect space.

NOTE: This will make an overlap of the outer diameter platforms of vanes.

1) Hold the vane and push it radially to the inner diameter.
2) Move the outer diameter base of the vane counterclockwise to make an overlap on the adjacent vane base.

(b) Continue clockwise to make overlaps with the remaining vanes to collect space.

NOTE: The remaining two or three vanes adjacent to the removed vane will be almost off their pins.
The best procedure, to move a vane off of its pins, is to move the outer diameter of the vane axially forward and aft slowly.

S 428-032-N00

(4) Install the replacement vane.

(a) If necessary, put a new foam fairing on the inner dimeter of the inner case.

(b) If necessary, put a new foam fairing on the new vane.
(c) Put the new vane on the pins of the inner case.
1) Engage the forward pin first.
2) When the pins and the holes are aligned, move the outer diameter platform of the vane at an angle clockwise (seen from the rear) so that the vane will be against its inner diameter pins.

<u>NOTE</u>: Make sure the vane platform does not hit the fan exit case edges.

S 418-033-N00
(5) Put the remaining vanes back to the correct position.

S 418-034-N00
(6) Connect the new vane to the outer case.

<u>CAUTION</u>: DO NOT USE THE WASHERS AT THE BOLT HOLES IN THE FAN EXIT (OUTER) CASE WITH BUSHINGS IN THEM. YOU WILL CAUSE DAMAGE TO THE CASE AND VANE ASSEMBLY IF YOU USE THE WASHERS.

(a) ENGINES PRE-PW-SB 72-262;
Do the steps that follow:
1) Apply engine oil to the threads of the bolts.
2) Attach the vane to the outer case with washers and bolts.
3) Tighten the bolts to 74-82 pound-inches (8.361-9.265 newton meters).
a) Install lockwire.

<u>CAUTION</u>: DO NOT USE THE WASHERS AT THE BOLT HOLES IN THE FAN EXIT (OUTER) CASE WITH BUSHINGS IN THEM. YOU WILL CAUSE DAMAGE TO THE CASE AND VANE ASSEMBLY IF YOU USE THE WASHERS.

(b) ENGINES POST-PW-SB 72-262 OR POST PHASE 3;
Do the steps that follow:
1) Apply engine oil to the threads of the slab bolts.

2) Install the slab bolts through the vane, outer fairing, and outer case.
3) Install the washers and nuts on the bolts.
4) Tighten the nuts to 85-95 pound-inches (9.604-10.734 newton meters)

(c) ENGINES POST-PW-SB 72-262 OR ENGINES POST PHASE 3;
Apply sealant to the holes where the heads of the slab bolts are, as follows:
1) Clean the surfaces the sealant will touch, with clean cloth that is moist with alcohol.
   a) Fully dry the repair area in air that is at ambient temperature until there is no remaining alcohol on the part.
2) Fill the hole with sealant.
3) Make the contour of the sealant agree with the contour of the adjacent surfaces plus or minus 0.040 inch (1.016 mm).

   NOTE: It is permitted to have 0.060 inch (1.524 mm) surface voids in the rubber sealant.

4) Cure the sealant as follows:
   a) in air at ambient temperature,
   b) in air that has a relative humidity of not less than 25%.

(d) Apply sealant around the inner diameter bases of the vanes.
1) Clean the surfaces the sealant will touch, with clean cloth that is moist with alcohol.
   a) Fully dry the repair area in air that is at ambient temperature until there is no remaining alcohol on the part.
2) Fill the hole with sealant.
3) Make the contour of the sealant agree with the contour of the adjacent surfaces plus or minus 0.040 inch (1.016 mm).

   NOTE: It is permitted to have 0.060 inch (1.524 mm) surface voids in the rubber sealant.

4) Cure the sealant as follows:
   a) in air at ambient temperature,
   b) in air that has a relative humidity of not less than 25%.

G. Put the Airplane Back to Its Usual Condition

S 418-046-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-042-N00

(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-043-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-044-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 868-045-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-308-107-N00

10. <u>Repair the Airfoil of the Vane With a Partial or Full Span Replacement of the Wire Mesh Leading Edge - Fan Exit Case and Vane</u>

A. Equipment

(1) PWA 814765 Kit, FEGV (Fan Exit Guide Vane) Repair Kit

<u>NOTE</u>: P08-025 is an option to the mixture of P05-147, P08-011 or P08-020, P08-16 and is an option to the adhesive in the PN 814765 FEGV repair kit.

(2) Wire Mesh Leading Edge Detail - Pratt & Whitney PN 52D512

B. Consumable Materials

(1) G00842 Cheesecloth, Unsized (PWA P05-038)
(2) G02150 Wetting Agent (PWA P05-152)
(3) G01520 Glass, Milled (Misc. 0257) (PWA Item No. P05-147)
(4) Wire cloth (PWA 1170-3, Item No. P05-182)
(5) A01028 Adhesive, Paste Epoxy (PWA 457-1, Item No. P08-016)
(6) A01028 Adhesive, Paste Epoxy (PWA 457-2, Item No. P08-025)
(7) A00744 Agent, Thickening (PWA 424-1, Item No. P08-20)
(8) A00745 Agent, Thickening (PWA 424-2, Item No. P08-11)
(9) B00130 Alcohol - Isopropyl
(10) G00299 Tape, Masking, Polyester Film (PMC 4188)

C. References

(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System

D. Access

(1) Location Zones

411	Left Engine
421	Right Engine

(2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

E. Prepare for the Repair of the Airfoil of the Vane.

S 028-113-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-123-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-124-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-125-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-126-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO YOU AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

F. Repair the Airfoil of the Vane (Figs. 808 and 809).

NOTE: In this procedure, the words "damage" and "repair area" are not the same thing. The repair area is larger than the area of the damage. The repair area includes the area that you clean, sand, and put the patch.

S 148-108-N00

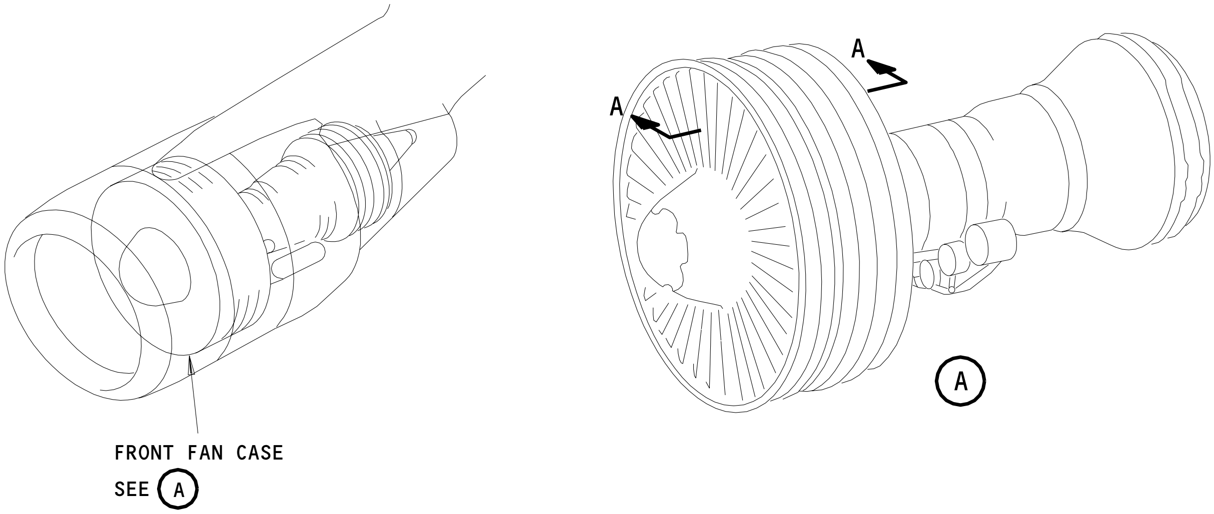
(1) Remove the damaged pieces:
   (a) Lighty hit the surface of the vane, around the damage, to find the quantity of delamination.

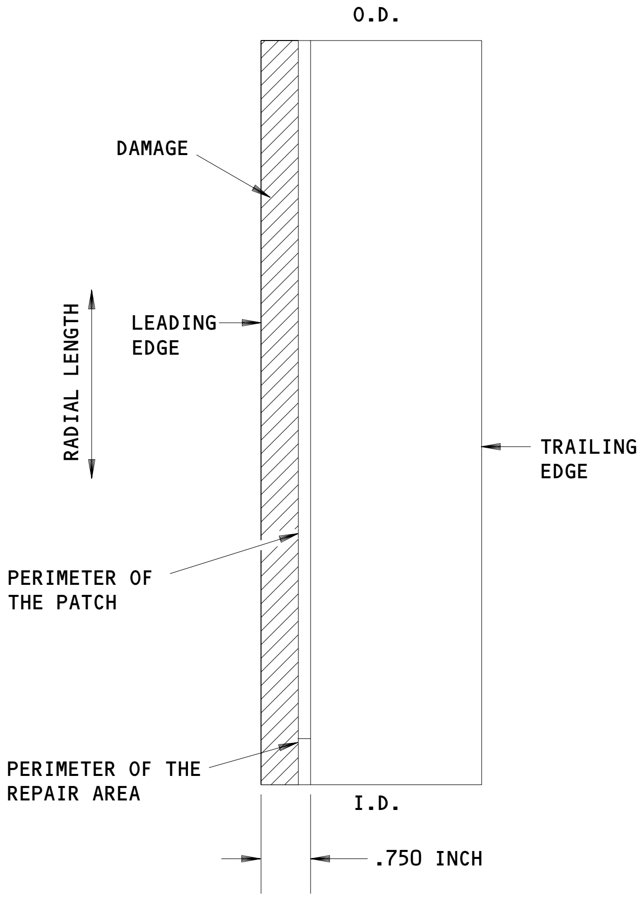
      NOTE: An area of delamination makes a sound with a lower frequency than the other areas.

   (b) With a grease pencil, or other correct marker, make a mark around the perimeter of the damaged area.
   (c) Mechanically remove the damaged and loose material, which includes loose or torn wire mesh.
   (d) File or sand the edges of the damaged area.

S 218-109-N00

(2) Measure the size of the damaged area.
   (a) If the area is more than the limits in Fig. 808, you must replace the vane.





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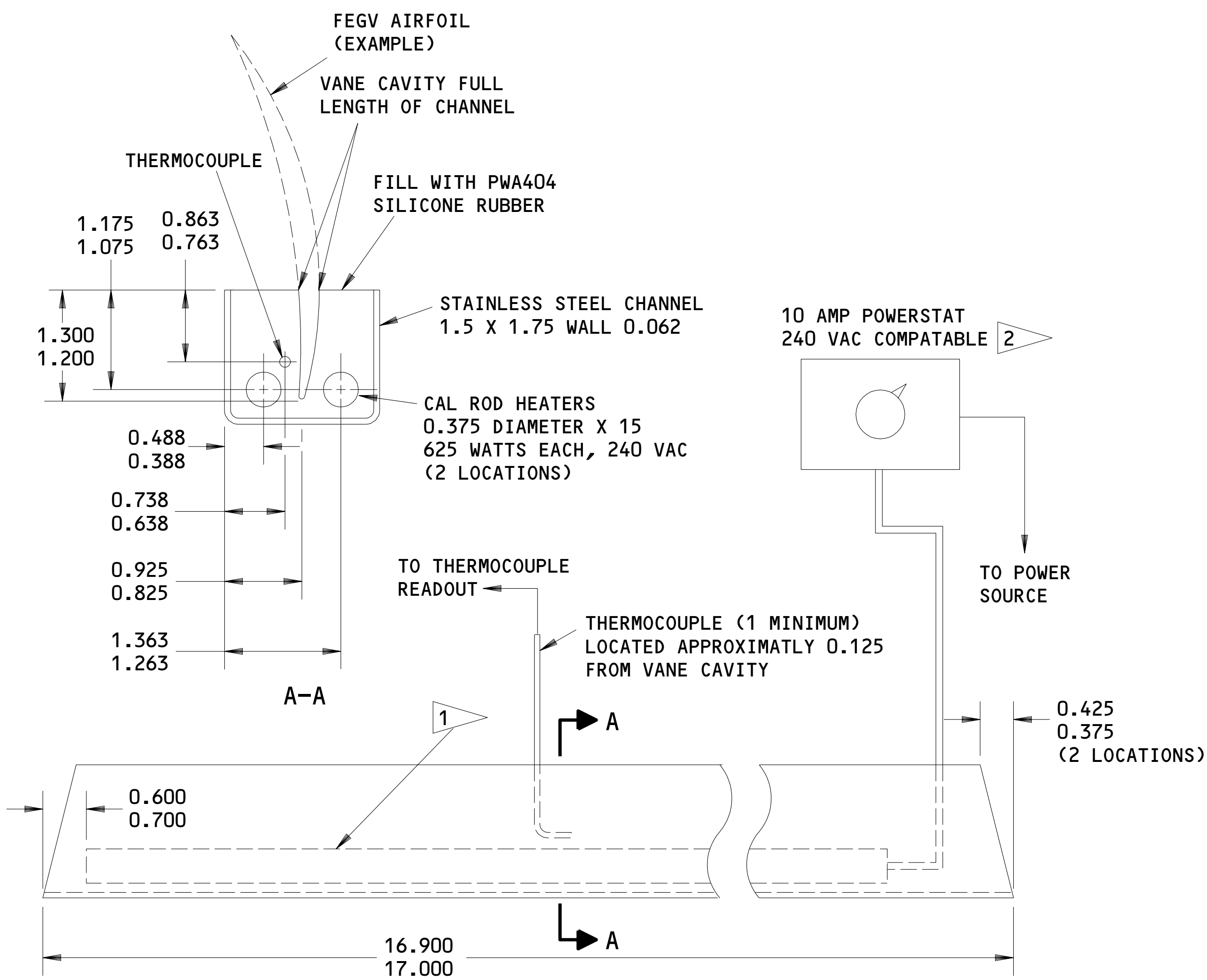
Fan Exit Case and Vane Repair (Patch Repair of the Airfoil with a Partial or Full Span Replacement of the WireMesh Leading Edge)
Figure 808



NOTE: DIMENSIONS ARE GIVEN IN INCHES ONLY

1 CHROMALOX INDUSTRIAL HEATING PRODUCTS
641 ALPHA DRIVE
PITTSBURGH, PA. 15238
CATALOG NO. C0225

2 PAYNE ENGINEERINGPOWER CONTROL PLANT
900 RAMBLEBROOK STREET
PALM BAY, FL. 32905
MOD18TB

L-B3202 (0000)

FEGV Leading Edge Repair Tool
Figure 809

S 338-110-N00

(3) Clean the repair area and patch:

(a) Clean the repair area with a soft brush and a solution of Wetting Agent (P05-152) and water.

1) Rinse the repair area with water and air dry.

(b) Sand the repair area lightly with 240 - 400 gritt sandpaper.

(c) Remove a full length wire mesh leading edge detail from the protective package.

(d) Pre-fit the partial or full length patch over the leading edge and trim the patch to the correct length with shears or scissors.

(e) Make a piece of cheesecloth (P05-038) moist with alcohol (P11-014).

(f) Clean the patch with the cheesecloth.

(g) Dry the patch fully at air temperature.

NOTE: There must be no alcohol on the patch when you apply the adhesive.

(h) Clean the repair area.

NOTE: Use the same method and materials that you used with the patch.

S 338-111-N00

(4) Bond the patch to the vane:

(a) Place mylar or teflon tape along the edge of the repair area, approximately 0.600 inches (15.240 mm) from the leading edge and parallel to the leading edge on both sides of the vane airfoil.

(b) Use the adhesive in the FEGV Repair Kit PN 814765 or use optional Adhesive Paste Epoxy (P08-025) or as an option mix Adhesive Paste Epoxy (P08-016) with 27 - 33 percent (by weight) Glass (P05-147) and 4 - 6 percent (by weight) Agent (P08-011) or (P08-020). Mix the mixture fully.

(c) Do the steps that follow to mix the adhesive supplied with the FEGV Repair Kit (PN 814765):

1) Insert the ramrod into the open end of the valved rod and apply pressure to release the catalyst into the cartridge.

2) Mix the material by hand for approximately 3 minutes until a uniform adhesive color is observed. Turn the valved rod in a clockwise direction to mix while moving the mixing head up and down within the cartridge. If a mixing machine is used, mix for approximately one minute.

3) Remove the ramrod and unscrew the valved rod.

4) Screw in the nozzle and dispense epoxy adhesive by use of either a pneumatic dispensing gun or by pushing on the cap at the back of the cartridge.

(d) Apply the mixture to both sides of the patch.

NOTE: Use a generous portion of the mixture. Spread the mixture with a tounge depressor or spatula. Also apply the adhesive to the damaged areas on the vane leading edge.

(e) Put the patch on the repair area.

NOTE: The epoxy mixture must not leak from the patch.

(f) Apply the locally fabricated leading edge tool over the leading edge of the vane until it is firmly seated.
1) Hold the tool in position on the vane with tape, cord, or some other acceptable method.
2) Wipe any excess adhesive from around the tool.

(g) Cure the patch for 24 hours at a minimum ambient temperature of 60 degrees F (15.6 degrees C) or for 90 minutes, minimum, at 140 - 260 degrees F (60 - 127 Degrees C).
1) If ambient temperature cure is used, you can remove the tool after eight hours.

(h) After the cure is complete, remove the tools, clamps, or tape.

S 128-112-N00

(5) Blend any unwanted adhesive with 240 - 400 gritt sandpaper.
(a) A patch-to-vane mismatch of 0.030 inches (0.762 mm), maximum, is permitted.

G. Put the Airplane Back to Its Usual Condition

S 418-129-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-119-N00

(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-120-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-127-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 418-122-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

TASK 72-33-02-728-165-N00

11. Repair the Airfoil of the Vane with a Full Replacement of Metal Leading Edge or Wire Mesh - Fan Exit Case and Vane

A. Equipment
   (1) Leading Edge Shield - Pratt & Whitney PN 53D011
   (2) Leading Edge Shield - Pratt & Whitney PN 52D705

B. Consumable Materials
   (1) G00846 Pencil, Metal Marking (PWA P05-018)
   (2) G00842 Cheesecloth, Unsized (Misc. 0018) (PWA P05-038)
   (3) G50015 Tape, Masking, Polyester Film (PMC 4188) (PWA P05-145)
   (4) G01520 Glass, Milled (Misc. 0257) (PWA P05-147)
   (5) G02475 Abrasive Paper, Silicon Carbide (240 Grit) (PWA P05-153)
   (6) G50433 Wire cloth (PWA 1170-3) (P05-182)
   (7) Gloves, Plastic Polyethylene (P05-198)
   (8) G02477 Applicator, Manual (LP-50 Cartridge) (P05-360)
   (9) G02476 Nozzle, Mixing (No. 9742) (P05-361)
   (10) A01028 Adhesive Paste, Epoxy, Thixotropic, Aluminum Filled (PWA 457-2) (P08-025)
   (11) A50107 Adhesive Paste, Epoxy (Toughened) Thixotropic, Aluminum Filled (PWA 457-5) (P08-044)
   (12) B00379 Alcohol, Isopropyl (PMC 9094) (P11-014A)

C. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 78-31-00/201, Thrust Reverser System

D. Access
   (1) Location Zones
      411 Left Engine
      421 Right Engine

(2) Access Panels

413AL Fan Cowl Panel (Left)
414AR Fan Cowl Panel (Right)
415AL Thrust Reverser (Left)
416AR Thrust Reverser (Right)
417AL Core Cowl Panel (Left)
418AR Core Cowl Panel (Right)
423AL Fan Cowl Panel (Left)
424AR Fan Cowl Panel (Right)
425AL Thrust Reverser (Left)
426AR Thrust Reverser (Right)
427AL Core Cowl Panel (Left)
428AR Core Cowl Panel (Right)

E. Prepare for the Repair of the Airfoil of the Vane.

S 028-166-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is located on the overhead panel P5.

S 018-167-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 048-168-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO YOU AND DAMAGE TO EQUIPMENT.

(3) Do the Deactivation Procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-170-N00

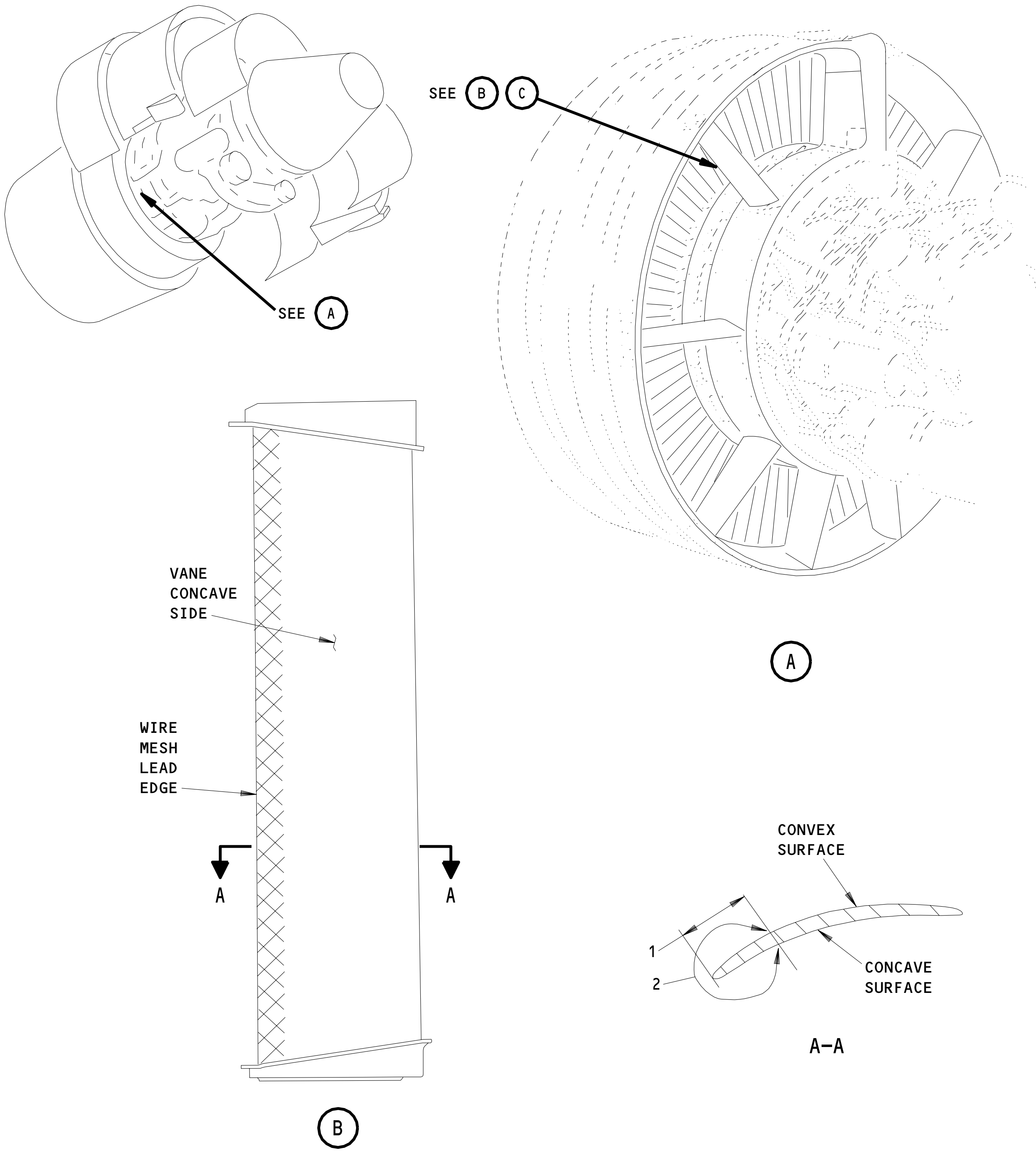
(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-171-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

F. Repair the Airfoil of the Vane (Fig. 810, Fig. 811).



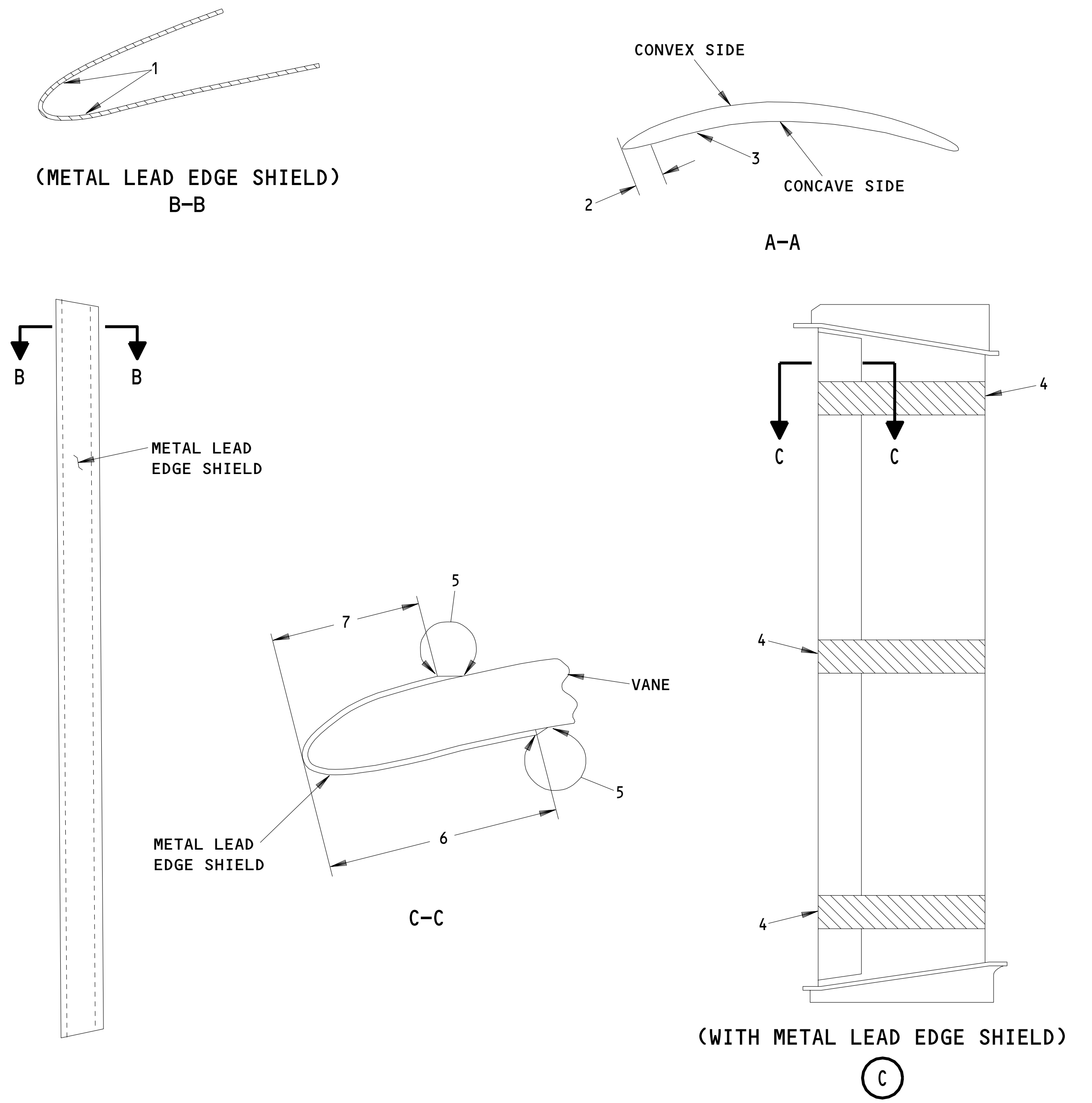
<u>NOTE</u>: 1. MEASURE THE FULL LENGTH FROM THE TWO SIDES WITH THE MAXIMUM OF 1.000 INCH (25.400 mm).

2. MAKE SURE THAT THE SURFACE AREA IS CLEAN.

L-B4683(0197)

Surface Preparation and Bond Areas for Leading Edge Shield Repair
Figure 810 (Sheet 1)

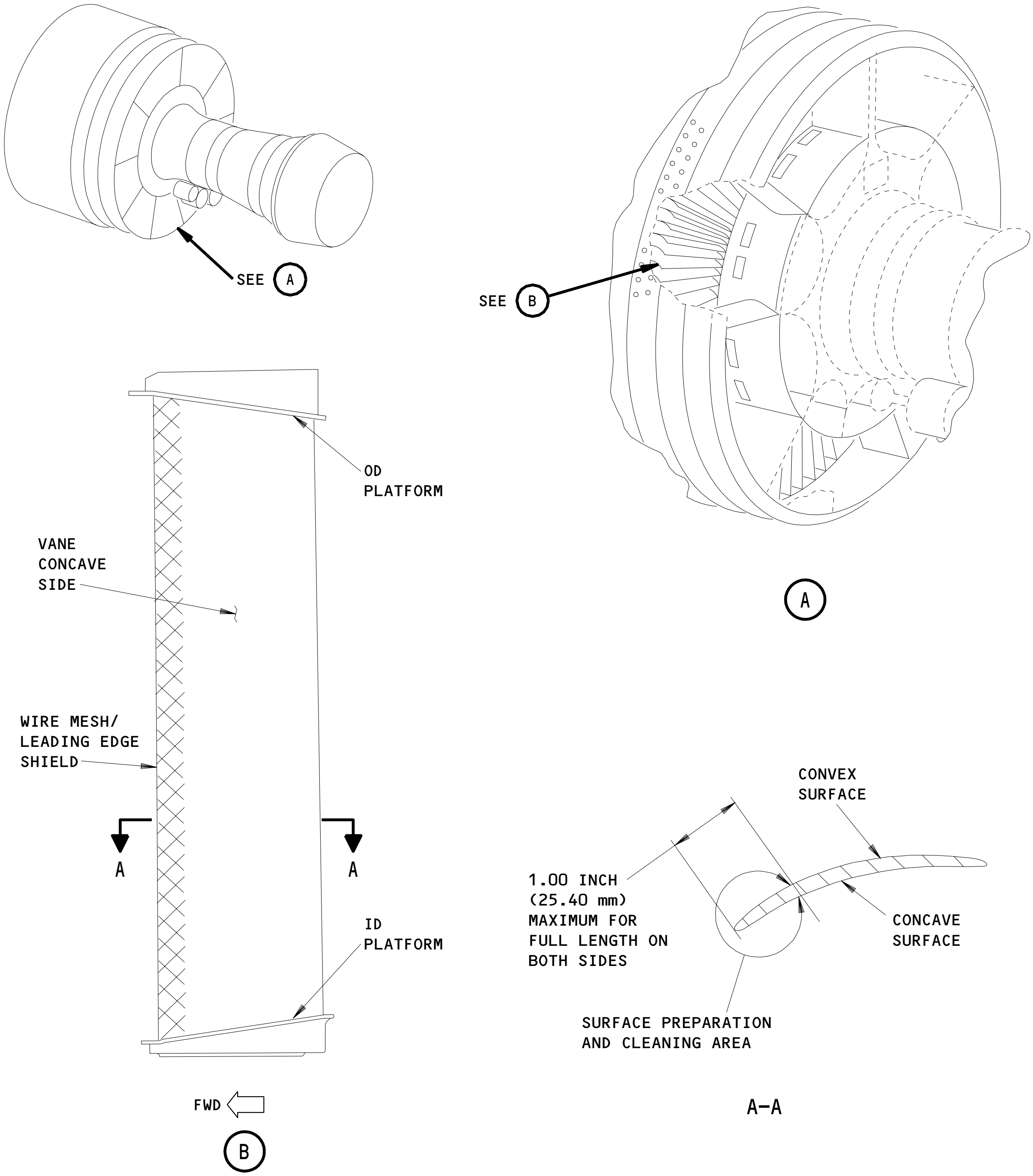
N96682



NOTE: 1. APPLY A SMALL QUANTITY OF URETHANE ADHESIVE IN THIS AREA.
2. MEASURE 0.060-0.070 INCH (1.52-1.78 mm).
3. APPLY URETHANE ADHESIVE IN THIS AREA, CONCAVE SIDE ONLY.
4. APPLY MASKING TAPE IN THESE AREAS.
5. APPLY THE URETHANE IN THESE AREAS AND AROUND IT UNTIL IT IS SMOOTH.
6. MEASURE THE REFERENCE OF 0.750 INCH (19.050 mm).
7. MEASURE THE REFERENCE OF 0.550 INCH (13.970 mm).

L-B4684(0197)

Surface Preparation and Bond Areas for Leading Edge Shield Repair
Figure 810 (Sheet 2)



L-D3255(0306)

Surface Preparation For Leading Edge Shield Repair
Figure 811

S 218-169-N00

(1) Find the leading edge of the fan exit vanes that can be repaired.

S 148-172-N00

(2) Remove leading edge damage as follows:

(a) Remove leading edge damage. See Figure 810 for the applicable repair area.

1) Use a smooth file or Sand Paper (Material No. P05-153) to remove any material in the repair area that is above the adjacent area with no damage.

2) Use a smooth file or Sand Paper (Material No. P05-153) and remove any lose material that is under the wire mesh.

3) Remove all the old rubber adhesive materials (Viton Coating and Old Lord) where the metal shield or wire mesh will be installed.

NOTE: The presence of any old coating or adhesive can adhesive can result in not sufficient bonding where the metal shield or wire mesh will be installed. Do not remove erosion coating aft of the leading edge.

4) Use Sand Paper (Material No. P05-153) to remove any contamination or glaze in the repair area.

S 848-173-N00

(3) Prepare the repair area by one of the procedures that follow.

(a) If metal leading edge shield is to be used for the repair:

1) Temporarily, install the applicable metal shield on the vane leading edge and do a check for correct tight fit as follows (See Fig. 811 for correct leading edge shield location).

NOTE: There is one camber for the metal leading edge shield. Use this shield for all camber classes of fan exit guide vanes.

a) If necessary, make a slight bend or pinch the leading edge shield to get the correct tight fit.

2) With the leading edge shield fully against the vane leading edge, use the Marking Pencil (Material No. P05-018) to make a permanent mark on the vane surface where the leading edge shield stops. Make sure that all rubber type adhesive has been removed.

3) Remove the leading edge shield from the fan exit guide vane.

CAUTION: IT IS IMPORTANT TO KEEP THE SURFACES THAT ARE BONDED FREE FROM CONTAMINATION. USE PLASTIC POLYETHYLENE GLOVES (MATERIAL NO. P05-198) TO HELP PREVENT SURFACE CONTAMINATION.

4) Clean the fan exit guide vane and the leading edge shield.
   a) Make a Cheesecloth (Material No. P05-038) moist with Isopropyl Alcohol (Material No. P11-014A). Clean the leading edge repair area of the exit guide vane and the inner area of the metal shield.
   b) Let the surface fully air dry for 15 minutes.

(b) If wire mesh is to be used for the repair:
1) Remove a full length wire mesh leading edge detail from the protective package.
2) With no adhesive, apply the wire mesh patch over the leading edge. Trim the wire mesh to the correct length with scissors or shears. Make sure that all rubber type adhesive has been removed.

CAUTION: IT IS IMPORTANT TO KEEP THE SURFACES THAT ARE BONDED FREE FROM CONTAMINATION. USE PLASTIC POLYETHYLENE GLOVES (MATERIAL NO. P05-198) TO HELP PREVENT SURFACE CONTAMINATION.

3) Clean the wire mesh patch with cheesecloth (P05-038) moistened with alcohol (P11-014A).
4) Let the wire mesh patch fully dry at air temperature. There must be no alcohol on the wire mesh patch when you apply the adhesive.
5) Clean the repair area of the vane with cheesecloth (P05-038) moistened with alcohol (P11-014A).

S 848-174-N00
(4) Prepare one of these adhesives:
(a) Prepare epoxy adhesive (P08-025) or epoxy adhesive (P08-044) according to the instructions provided by the manufacturer.

S 338-175-N00
(5) Bond the leading edge shield to the leading edge of the fan exit guide vane as follows. Use one of the epoxy adhesive pastes, (P08-025) or (P08-044) See Figure 811 for the correct bond application areas.
(a) Apply the epoxy adhesive paste (P08-025) or (P08-044) along the entire length of the vane repair area.
(b) Apply the epoxy adhesive paste (P08-025) or (P08-044) along the entire length of the leading edge shield.
(c) Pull the lead edge shield over the leading edge of the fan exit guide vane.

S 338-176-N00

(6) Bond the wire mesh patch to the vane as follows:
   (a) Place mylar or teflon tape along the edge of the repair area, approximately 0.600 inch (15.240 mm) from the leading edge and parallel to the leading edge on both sides of the vane airfoil.
   (b) Apply the epoxy adhesive paste on both sides of the patch. Use a tongue depressor or equivalent to push the adhesive in the wire mesh until the wire mesh is filled with adhesive. Also apply adhesive to the damaged areas on the vane leading edge.
   (c) Put the patch on the repair area. The epoxy mixture must squeeze out beyond the patch.

S 118-177-N00

(7) Use the Cheesecloth (Material No. P05-038) and remove any unwanted urethane adhesive from the leading edge shield or wire mesh and vane surfaces.
   (a) The adhesive must be made smooth between the edges of the leading edge shield or wire mesh and the vane surface all around.

S 428-178-N00

(8) Tightly wind several lengths of Masking Tape (Material No. P05-145) at three locations around the vane cord.

   NOTE: This will hold the leading edge shield or wire mesh in position.

S 118-179-N00

(9) If necessary, use the Cheesecloth (Material No. P05-038) and again remove any unwanted urethane adhesive from the leading edge shield and vane surfaces.

S 338-180-N00

(10) Cure the adhesive on the fan exit guide vane as follows:
   (a) Let the fan exit guide vane cure at a room temperature for 4 hours minimum followed by 150°F - 180°F (65.6°C - 82.2°C) for 2 hours minimum.

S 148-181-N00

(11) Remove the Masking Tape (Material No. P05-145) from the three locations around the vane cord.

S 218-182-N00

(12) Do a check for a complete bond between the leading edge shield or wire mesh and the fan exit guide vane.

G. Put the Airplane Back to Its Usual Condition

S 418-188-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-186-N00

(2) Close the fan cowl panels (AMM 71-11-04/201).

S 418-185-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 448-184-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 418-183-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch which is located on the overhead panel P5.

FAN EXIT LINER SEGMENTS (OUTER)- REMOVAL/INSTALLATION

1. General
   A. This procedure gives the tasks to remove and install the (outer) fan exit liner segments. These fan exit liner segments will be referred to as the outer liner segments.
   B. The nine outer liner segments are found on the outer rear circumference of the intermediate case, aft of the fan case. The outer liner segments are referred to as follows:

Liner Segment	PWA Part Number
No. 1	PN 50G522 or PN 51G899-01
No. 2	PN 50G520 or PN 51G897-01
No. 3	PN 50G519 or PN 51G896-01
No. 4	PN 50G524 or PN 51G901-01
No. 5	PN 50G521 or PN 51G898-01
No. 6	PN 50G524 or PN 51G901-01
No. 7	PN 50G518 or PN 51G895-01
No. 8	PN 50G517 or PN 51G894-01
No. 9	PN 50G523 or PN 51G900-01

   C. You can open each half of the thrust reverser to get access to the outer liner segments.

TASK 72-34-01-004-001-N00

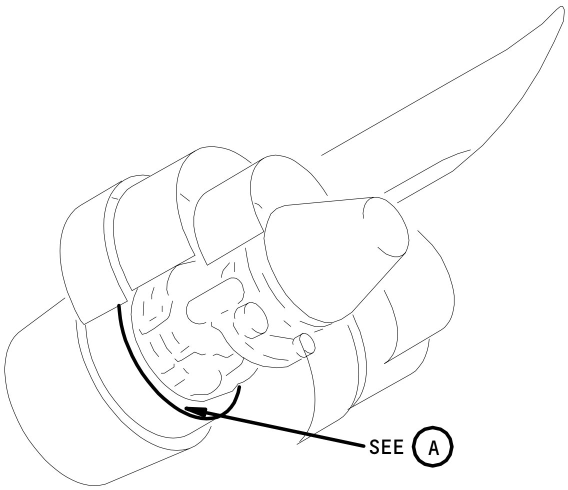
2. Remove the Fan Exit Liner Segments (Outer)

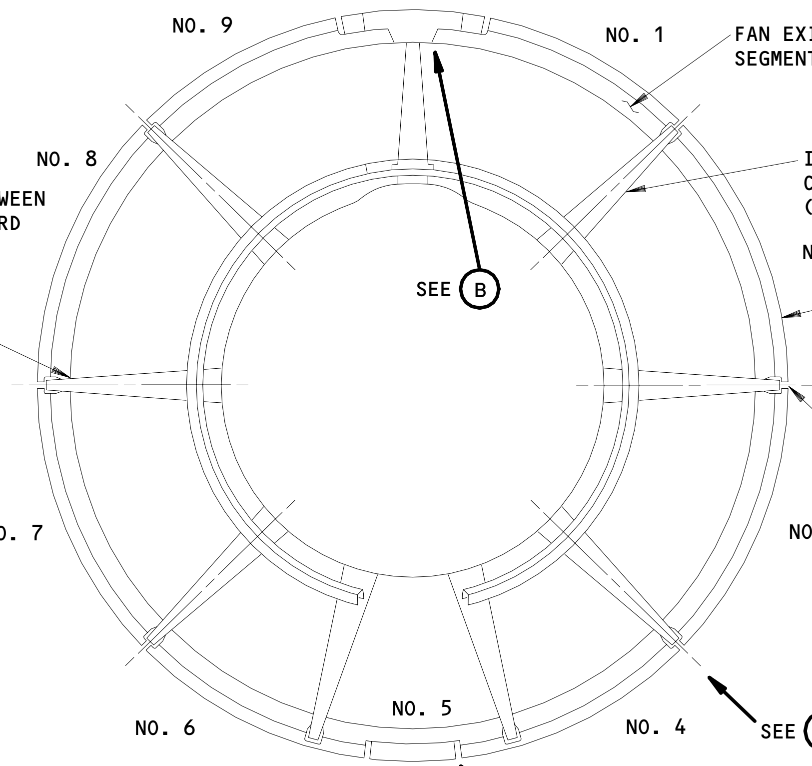
   A. Equipment
      (1) No. 10 Torq-set Drive
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones
          411 Engine (Left)
          421 Engine (Right)

      (2) Access Panels
          415AL Fan Reverser (Left)
          416AR Fan Reverser (Right)
          425AL Fan Reverser (Left)
          426AR Fan Reverser (Right)

   D. Prepare for the Procedure

      S 944-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.



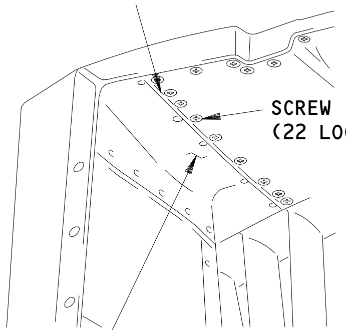


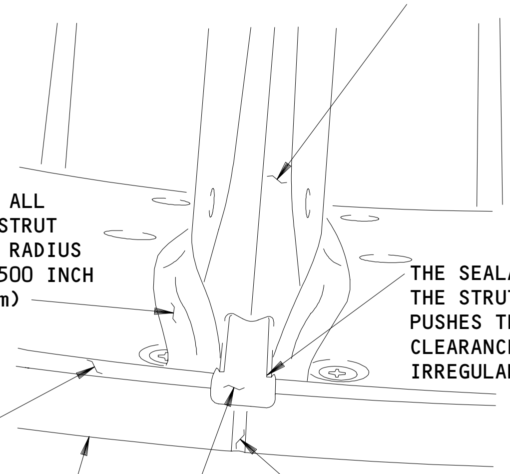
SCHEMATIC REAR VIEW OF THE INTERMEDIATE CASE

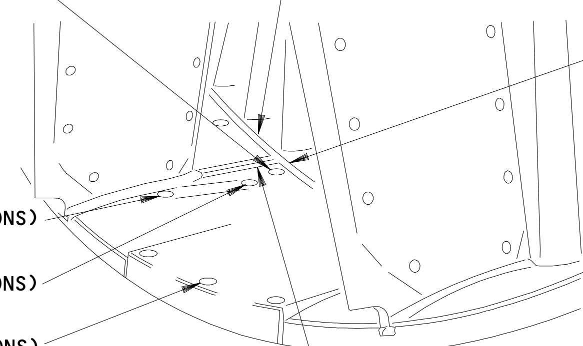
A

NOTE: ENGINES WITH PW SB 72-205;
THE CLEARANCE BETWEEN BRACKET
ASSEMBLIES IS NOT ALIGNED
WITH THE STRUTS.

Fan Exit Liner Segment (Outer) Installation
Figure 401 (Sheet 1)







1 ENGINES WITH PW SB 72-205; THE LIMIT FOR ENGINES WITHOUT PW SB 72-205 IS 0.020 INCH (0.508 mm).

Fan Exit Liner Segment (Outer) Installation
Figure 401 (Sheet 2)

S 044-003-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-004-N00
(3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-005-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Procedure

S 024-007-N00
(1) Do the steps that follow to remove the outer liner segments:
(a) With the No. 10 Torq-set Drive, remove the screws that attach the outer liner segment to the intermediate case.
(b) Cut the sealant at the edges of the outer liner segment.

CAUTION: DO NOT USE A TOOL TO LIFT THE OUTER LINER SEGMENT FROM THE INTERMEDIATE CASE. IF YOU USE A TOOL, YOU CAN CAUSE DELAMINATION OF THE OUTER LINER SEGMENT.

(c) Remove the outer liner segment.
(d) If you will use this outer liner segment again, carefully remove all of the sealant with a putty knife.
(e) Mechanically remove all old sealant from the brackets that the liner attaches to, and from the mating surfaces of the intermediate case.

S 024-018-N00
(2) Do the removal steps again for all the remaining liner segments.

TASK 72-34-01-404-008-N00

3. Install the Fan Exit Liner Segments (Fig. 401)

A. Consumable Materials
(1) A00482 Sealant - Silicone Rubber, PWA 36003

(2) B00666 Solvent - Methyl Propyl Ketone (MPK)
(3) D00137 Engine Oil - PWA 521B
(4) G00033 Cheesecloth - Unsized
(5) G00983 Paper - Kraft, Medium or Light Duty

B. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System

C. Access
(1) Location Zones

411	Engine (Left)
421	Engine (Right)

(2) Access Panels

415AL	Fan Reverser (Left)
416AR	Fan Reverser (Right)
425AL	Fan Reverser (Left)
426AR	Fan Reverser (Right)

D. Install the Fan Exit Lining Segments

S 824-009-N00
(1) Attach the liner to the intermediate case as follows:
(a) Apply engine oil to the threads of the screws.
(b) Attach the liner with the screws.
(c) Torque the screws to 36-40 pound-inches (4.1-4.5 newton-meters).

S 114-020-N00
(2) Clean the parts of the bracket, liner, and intermediate case that the sealant will touch.

WARNING: DO NOT GET SOLVENT IN YOUR MOUTH, OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT. PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE SOLVENT. KEEP SOLVENT AWAY FROM SPARKS, FLAMES, AND HEAT. SOLVENT IS POISONOUS. FLAMMABLE SOLVENT CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(a) Make a piece of new cheesecloth wet with MPK.
(b) With the cheesecloth, rub the areas the sealant will touch.
(c) Permit the cleaned areas to dry fully.

NOTE: There must be no solvent on the parts.

(d) If you do not apply the sealant immediately, cover the cleaned parts with the paper.
(e) You must apply sealant in two hours.

S 824-010-N00

(3) Apply sealant as shown in figure 401.
- (a) Remove unwanted sealant with clean cheesecloth.
- (b) Cure the sealant:
  - 1) Thickness of the sealant must be equal to or less than 0.250 inch (6.350mm).
  - 2) Permit the sealant to cure for 2 hours, minimum, before you touch it. If possible, cure the sealant for 6 hours, total, before operation of the engine.
  - 3) The relative humidity of the work area must be 50%, minimum. A local humidity environment is allowed if necessary. Do not apply heat with heat gun or humidity with water spray on the sealant.
  - 4) The temperature of the work area must be 73.4° F (23.0° C), minimum. A local temperature environment is allowed if necessary. Do not apply heat with heat gun or humidity with water spray on the sealant.

E. Put the Airplane Back to Its Usual Condition.

S 414-019-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-014-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 414-015-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 444-016-N00

(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-017-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

FAN EXIT LINER SEGMENTS (OUTER) - INSPECTION/CHECK

1. General
   A. This procedure gives the task do the inspection of the fan exit liner segments (outer). These fan exit liner segments will be referred to as the outer liner segments in this procedure.
   B. The nine outer liner segments are on the outer rear circumference of the intermediate case, aft of the fan case.
   C. You must open each half of the thrust reverser to get access to the outer liner segments.

TASK 72-34-01-206-005-N00

2. Outer Liner Segments Inspection
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 72-34-01/401, Fan Exit Liner Segments (Outer)
      (4) AMM 78-31-00/201, Thrust Reverser Opening
   B. Access
      (1) Location Zones
         411 No. 1 Power Plant
         421 No. 2 Power Plant

   C. Do the Inspection of the Outer Liner Sements.

      S 046-002-N00

      WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 016-003-N00

      (2) Open the fan cowl panel (AMM 71-11-04/201).

      S 016-004-N00

      (3) Open the core cowl panel (AMM 71-11-06/201).

S 016-005-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reverser (AMM 78-31-00/201).

S 226-006-N00

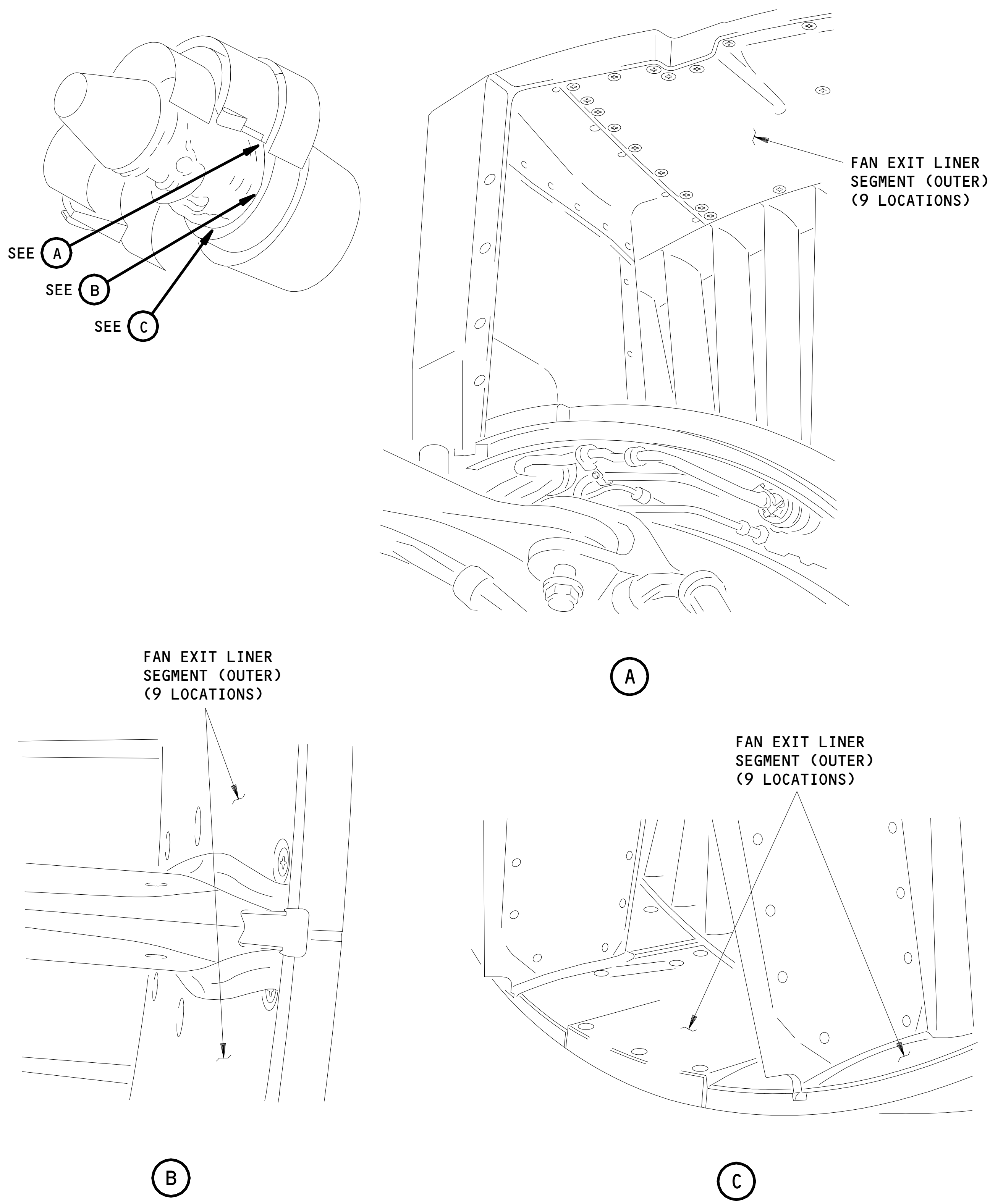
(5) Compare the damage that you find on the outer liner segments with the limits in Table 601, 602, and 603 (Fig. 601).

INSPECTION FOR PARTS THAT ARE NOT THERE OR ARE LOOSE
Table 601

AREA: CONDITION OBSERVED	NECESSARY PROCEDURE
Outer Liner Segment: all or part of the liner that is not there or loose	Replace or tighten the liner as applicable before the 51st hour of operation (AMM 72-34-01/401).
Screws: One or more screws that is loose or not there	Replace or tighten the screws as applicable before the 51st hour of operation.

(a) If the damage to the outer liner segment, referred to in Table 602, is less than the limits, no procedure is necessary.

(b) If the damage to the outer liner segment, in Table 602, is more than the limits, replace the outer liner segment before the subsequent flight.



Fan Exit Liner Segments - Inspection
Figure 601

INSPECTION FOR NICKS, DENTS, AND OTHER SURFACE DAMAGE
Table 602

CONDITION OBSERVED	REPLACE THE LINER BEFORE THE 51ST HOUR OF OPERATION	REPLACE THE LINER BEFORE NEXT ENGINE OPERATION
Nicks and gouges	More than 1.000 inch (25.400 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.800 mm) apart from other damage, or there are more than five (5) nicks and gouges.	
Dents with rounded bottoms	More than 0.030 inch (0.762 mm) in depth or on more than 10% of the surface area.	
Cracks	More than 1.000 inch (25.400 mm) in length or less than 0.500 inch (12.700 mm) from the center of an attachment screw.	
Areas of broken or (fuzzy stray) fraying fibers	Between 1.000 and 2.5000 inches (25 and 64 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.800 mm) from other damage.	Repair or replace more than 2.500 inches (63.500 mm) in width or length
Tears, holes, or punctures in the concave circles in the wire mesh	Damage that goes out of the concave circle, or total damage that is on more than 10% of the surface. NOTE: The concave circles in the wire mesh are caused by the wire screen behind the surface material.	
Wire cloth patch that is not bonded	More than 0.500 inch (12.700 mm) in width or length.	

INSPECTION FOR DELAMINATION Table 603			
DELAMINATION DIMENSION	EXAMINE AFTER EACH 50 HOURS	REPLACE BEFORE THE 51ST HOUR	REPLACE BEFORE YOU OPERATE THE ENGINE
Width or Length	Not more than 1.000 inch (25.400 mm)	Between 1.000-2.500 inches (25-64 mm)	Repair or replace more than 2.500 inches (63.500 mm)
Depth	Not more than 0.030 inch (0.762 mm)	More than 0.030 inch (0.762 mm)	
Distance from other damage	More than 2.000 inches (50.800 mm)	Less than 2.000 inches (50.800 mm)	

S 416-008-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(6) Close the thrust reverser (AMM 78-31-00/201).

S 416-009-N00

(7) Close the core cowl panel (AMM 71-11-06/201).

S 416-010-N00

(8) Close the fan cowl panel (AMM 71-11-04/201).

S 446-011-N00

(9) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

FAN EXIT LINER SEGMENTS (OUTER) - REPAIR

1. General
   A. This procedure gives the instructions for fan exit liner segment (outer) epoxy repair from the compressor intermediate case.

TASK 72-34-01-918-001-N00

2. Fan Exit Liner Segments (Outer) Epoxy Repair
   A. Consumable Materials
      (1) G00834 Cloth - Cotton, Lint-Free (P05-005)
      (2) Mold Release (PWA 36007) (P05-133)
      (3) Liquid Epoxy Resin (PWA 421-2) (P08-002)
      (4) Epoxy Resin Curing Agent (Amin Type) (PWA 422) (P08-012)
      (5) Adhesive Paste, Epoxy (PWA 457-1) (P08-016)
   B. References
      (1) AMM 70-11-13/201, Degreasing of Parts by Solvent Wiping (SPOP 208)
      (2) AMM 71-11-04/201, Fan Cowl Panel
      (3) AMM 71-11-06/201, Core Cowl Panel
      (4) AMM 72-34-01/401, Fan Exit Liner Segments (Outer)
      (5) AMM 78-31-00/201, Thrust Reverser Opening
   C. Access
      (1) Location Zone

411	Left Engine - LPC Intermediate Case
412	Right Engine - LPC Intermediate Case

      (2) Access Panel

415AL	Thrust Reverser (Left) - Left Engine
416AR	Thrust Reverser (Right) - Left Engine
425AL	Thrust Reverser (Left) - Right Engine
426AR	Thrust Reverser (Right) - Right Engine

   D. Procedure

S 018-003-N00

      (1) If necessary, remove the fan exit liner segment from the compressor intermediate case (AMM 72-34-03/401).

S 048-004-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-005-N00
(3) Open the fan cowl panel (AMM 71-11-04/201).

S 018-006-N00
(4) Open the core cowl panel (AMM 71-11-04/201).

S 848-007-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reverser (AMM 78-31-00/201).

S 028-008-N00
(6) Remove the damaged outer liner segments (AMM 72-3401/401).

E. Fan Exit Liner Segments Epoxy Repair

S 148-009-N00
(1) Remove any remaining sealant from exit liner.
   (a) Use a wooden or plastic scraper.
   (b) Do not cause damage to the wire mesh or liner in this process.

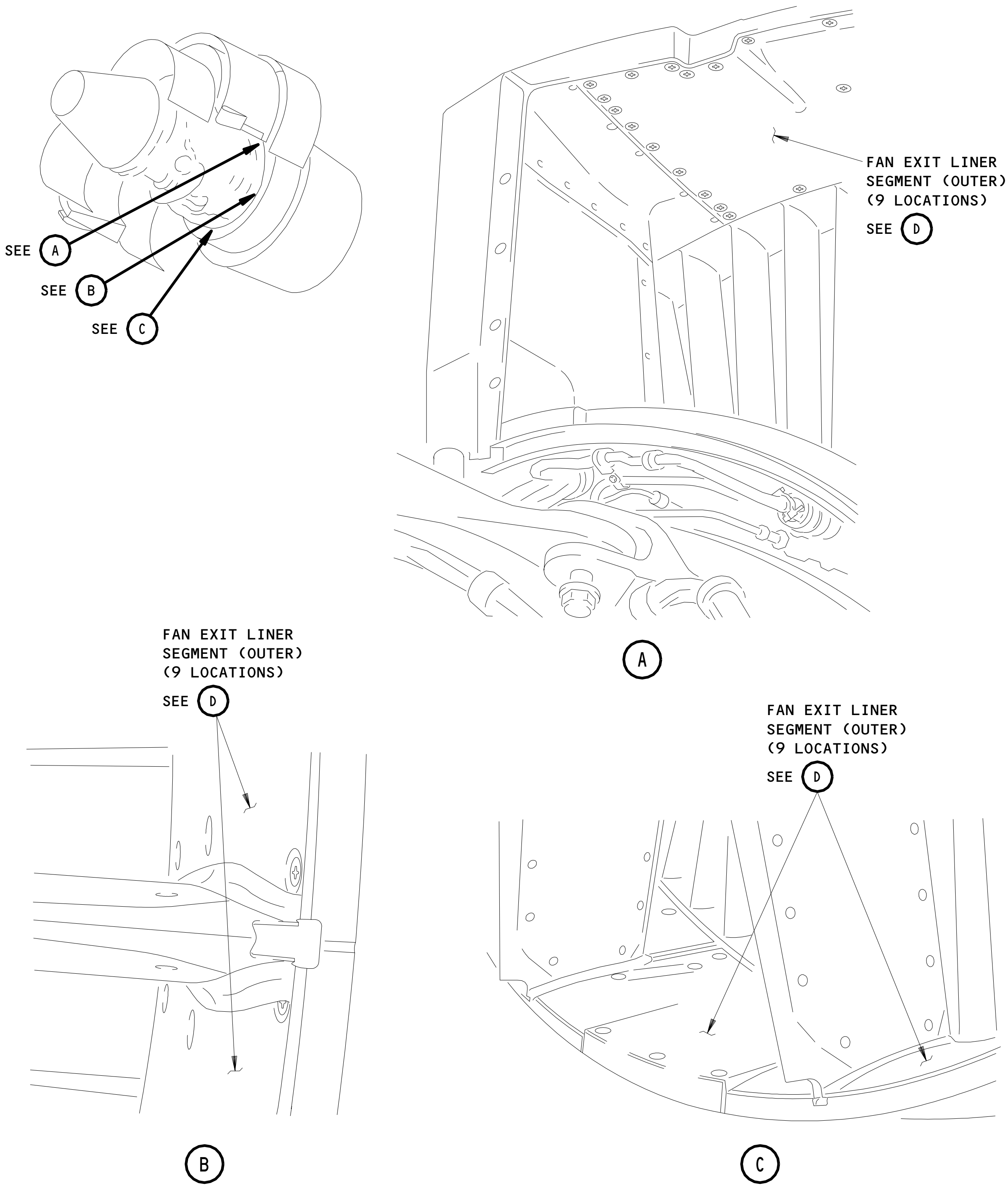
S 148-010-N00
(2) Cut off all the loose wire mesh.

S 358-028-N00
(3) Make a temporary mold or use spare liners for both sides of the repair area.
   (a) A temporary mold must be made of an equivalent material.
   (b) You can use the mold later to make sure that the patched area agree with the necessary shape.

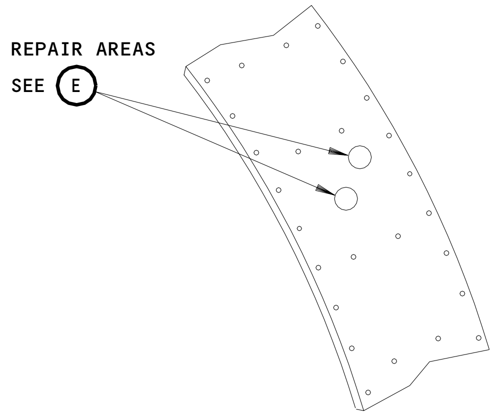
S 358-011-N00
(4) Clean the repair area that is not smooth and frayed edges of the wire mesh.

S 348-012-N00
(5) Fully mix the Epoxy Adhesive Paste:
   (a) Mix 3 parts by weight of Part A, with 1 part by weight of Part B.

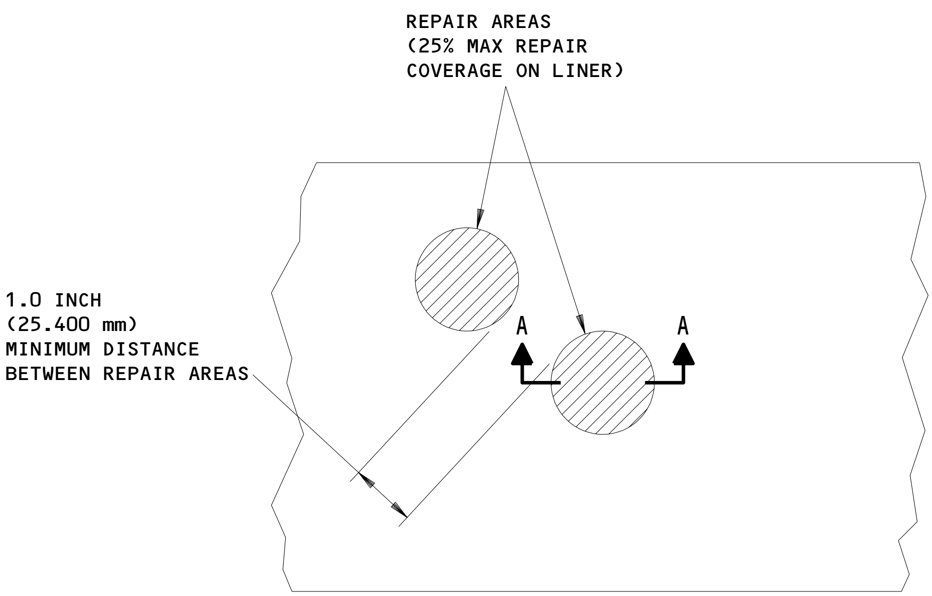
      NOTE: You must use the Epoxy Paste in 40 minutes or less.



Fan Exit Liner Segments - Repair
Figure 801 (Sheet 1)



FAN EXIT LINER SEGMENT
(TYPICAL)
D



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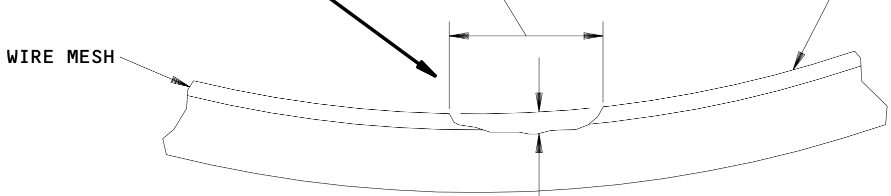
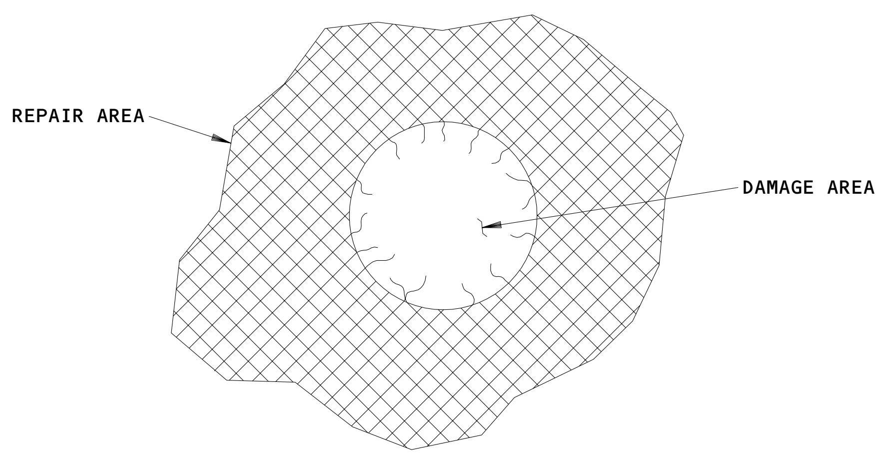
Fan Exit Liner Segments - Repair
Figure 801 (Sheet 2)



A-A



F

L-B8644

Fan Exit Liner Segments - Repair
Figure 801 (Sheet 3)

S 348-013-N00

(6) Apply Epoxy Adhesive Paste with a wooden or plastic scraper under the wire mesh.
   (a) Make sure that all edges of wire mesh are covered by Epoxy Adhesive Paste.

S 348-014-N00

(7) Apply Epoxy Adhesive Paste in any gaps between wire mesh and organic fiber cloth to keep the contour.

S 348-015-N00

(8) Make the repair area smooth and remove any unwanted Epoxy Adhesive Paste.

S 348-016-N00

(9) Apply a layer of Mold Release on the mold.
   (a) Put the mold on the repaired area and clamp with sufficient pressure to hold the contour.

S 348-017-N00

(10) Cure the liner at room temperature for 2 hours minimum, and followed by 1 hour at 140°- 160° F (60° - 71° C).

S 348-018-N00

(11) Remove or sand the repair area until you get a smooth continuous surface.

S 148-019-N00

(12) Clean the sanded surface with a clean cloth wet with solvent (AMM 70-11-13/201).
   (a) Let the area dry for a minimum of 30 minutes.

S 348-020-N00

(13) Fully mix Epoxy Resin and Epoxy Resin Curing Agent as follows:
   (a) Mix 4 parts by weight of Epoxy Resin with 1 part by weight of Epoxy Resin Curing Agent.

S 348-021-N00

(14) Apply a thin layer of Epoxy Resin mixture on the sanded area and any organic fiber cloth.
   (a) This will seal the area.

S 348-022-N00

(15) Cure the sealer of 160° - 190° F (71° - 88° C) for 1 hour with heat gun or blanket.

S 428-023-N00

(16) Install the fan exit liner segment on the compressor intermediate case (AMM 72-34-01/401).

S 418-024-N00

(17) Close the thrust reverser (AMM 78-31-00/201).

S 418-025-N00

(18) Close the core cowl panel (AMM 71-11-06/201).

S 448-026-N00

(19) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 418-027-N00

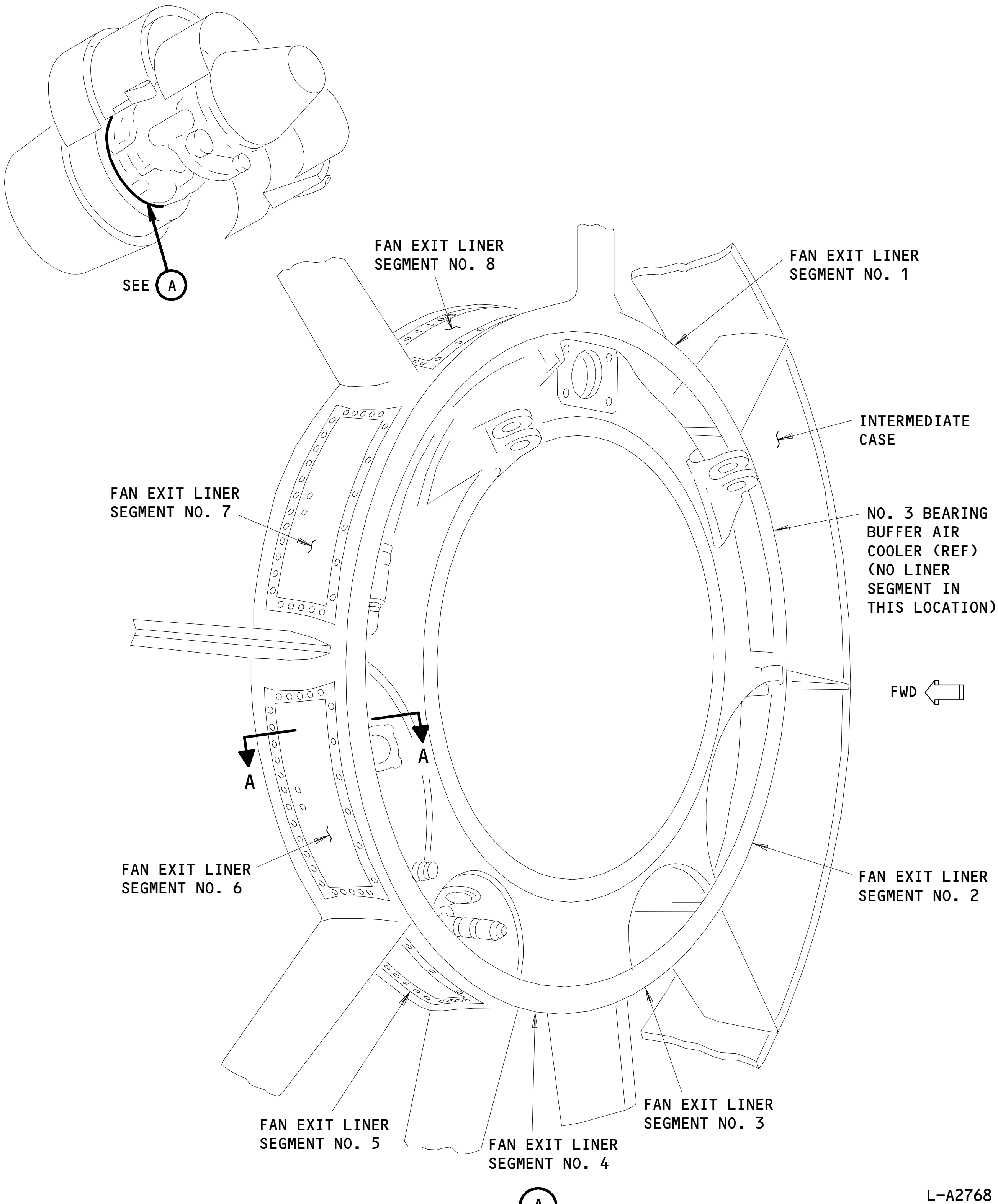
(20) Close the fan cowl panel (AMM 71-11-04/201).

FAN EXIT LINER SEGMENTS (INNER REAR) - REMOVAL/INSTALLATION

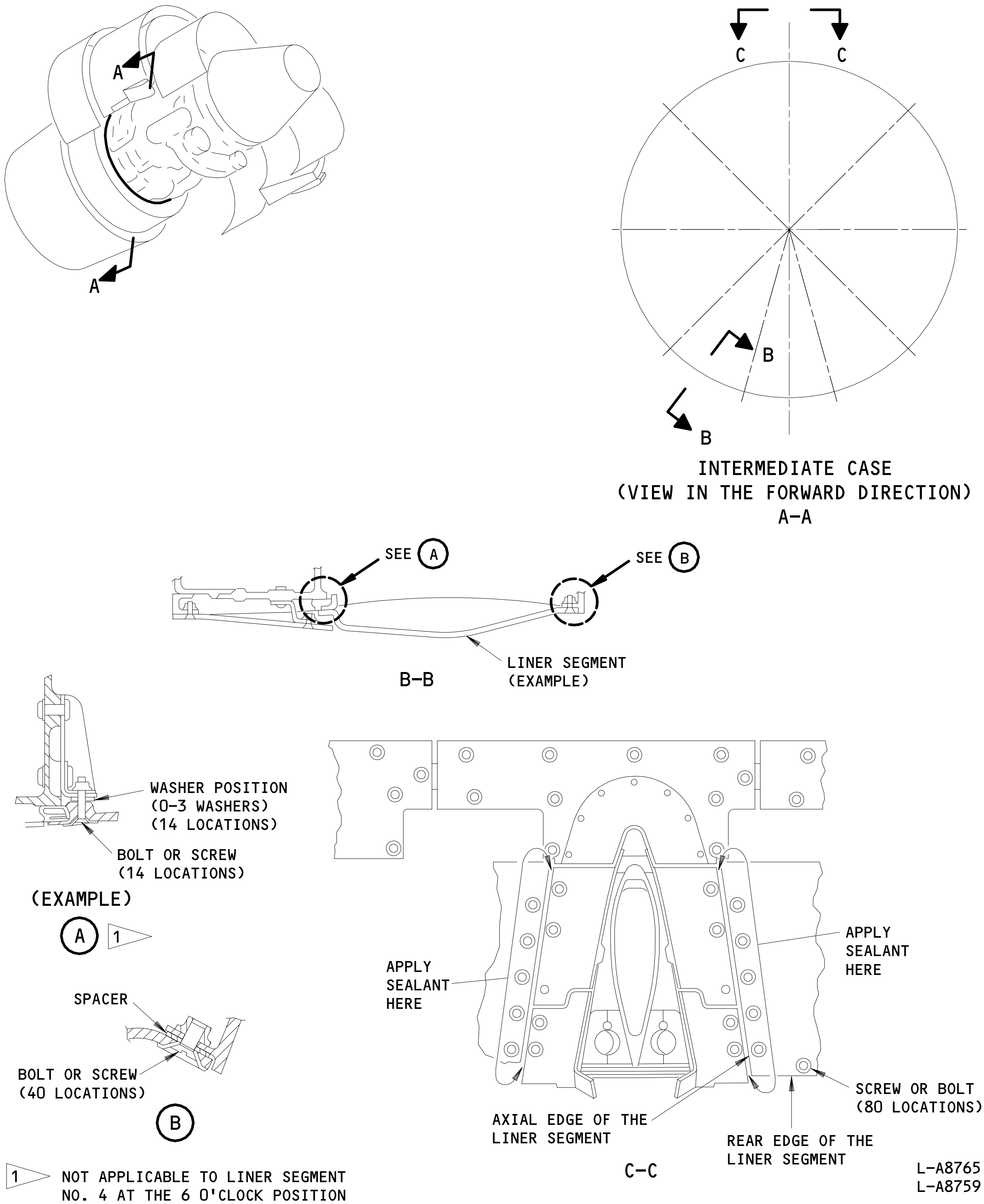
1. General
   A. This procedure gives two removal and installation tasks for the (inner rear) fan exit liner segments. These fan exit liner segments will be referred to as the liner segments.
   B. The first two tasks are used if you will install the same liner segment that you removed. The second removal and installation tasks are used if you will replace the liner segment.
   C. ENGINES PRE-PW-SB 72-546;
      The eight liner segments are found on the inner rear circumference of the intermediate case, aft of the fan case. The liner segments are referred to as follows:

      NOTE: The buffer air cooler for the No. 3 bearing is between the 1:30 and 3 o'clock struts. To remove and install it refer to AMM 75-22-01/401.

Liner Segment	PWA Part Number	Location
No. 1	(PN 50A508 or 51A166-01)	Between the 12 and 1:30 o'clock struts
No. 2	(PN 50G281 or 51A163-01)	Between the 3 and 4:30 o'clock struts
No. 3	(PN 50G279 or 51A162-01)	Between the 4:30 and 5:30 o'clock struts
No. 4	(PN 50G273 or 51A173)	Between the 5:30 and 6:30 o'clock struts
No. 5	(PN 50G440 or 51A164-01)	Between the 6:30 and 7:30 o'clock struts
No. 6	(PN 50G278 or 51A161-01)	Between the 7:30 and 9 o'clock struts
No. 7	(PN 50G277 or 51A160-01)	Between the 9 and 10:30 o'clock struts
No. 8	(PN 50G276 or 51A159-01)	Between the 10:30 and 12 o'clock struts



Fan Exit Liner Segments (Inner Rear)
Figure 401



Fan Exit Liner Segments (Inner Rear) Installation
Figure 402

D. ENGINES POST-PW-SB 72-546;
The PWA Part Numbers are as follows:

Liner Segment	PWA Part Number
No. 1	(PN 51A387-01)
No. 2	(PN 51A384-01)
No. 3	(PN 51A383-01)
No. 4	(PN 51A386-01)
No. 5	(PN 51A385-01)
No. 6	(PN 51A382-01)
No. 7	(PN 51A381-01)
No. 8	(PN 51A380-01)

E. You can open each half of the thrust reverser to get access to the liner segments.

TASK 72-34-03-004-020-N00

2. Remove the Fan Exit Liner Segments (To Install It again) (Inner Rear)

A. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System

B. Access
(1) Location Zones
411 Engine (Left)
421 Engine (Right)

(2) Access Panels
415AL Fan Reverser (Left)
416AR Fan Reverser (Right)
425AL Fan Reverser (Left)
426AR Fan Reverser (Right)

C. Prepare for the Removal of the Fan Exit Liner Segments

S 944-021-N00
(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 044-022-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-023-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-024-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-025-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

D. Remove the Fan Exit Liner Segments

S 424-049-N00

(1) To use the same fan exit liner segment.

NOTE: Use this procedure if you will install the same liner that you removed. Use the procedure in AMM 72-34-03/401 to replace a liner, spacer plate (PRE PW SB PW4ENG 72-519), or washers.

S 024-037-N00

(2) If applicable, cut the sealant at the axial edge of the liner segment.

S 024-041-N00

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(3) Do the steps that follow to remove the liner segments.

(a) Be very careful to keep the washers with the liner segment.

(b) ENGINES PRE-PW-SB 72-107;
Remove the 14 screws that attach the inner liner and the spacer plate to the fan exit case.

<u>NOTE</u>: These are at the top, bottom, aft, and forward center locations. Do not remove the screws from the forward edge of the No./4 liner segment. There are no forward center screws on the liner segment No. 4.

(c) ENGINES POST-PW-SB 72-107;
Remove the 14 bolts that attach the inner liner and the spacer plate to the fan exit case.

<u>NOTE</u>: These are at the top, bottom, aft, and forward center locations. Do not remove the bolts from the forward edge of the No. 4 liner segment. There are no forward center bolts on the liner segment No. 4.

(d) Carefully remove the liner and spacer plate from the case.

<u>NOTE</u>: Zero to three classified washers, washers with specified thicknesses, were possibly installed between the liner and the front center attachment bracket to keep the correct clearance. If these washers were used, they were attached to the bracket with some adhesive compound. When the engine operates or you install or remove the liner segments, the washers can become disconnected from the bracket.

(e) Remove the sealant, if necessary, from the axial edge of the liner segment and its mating parts.

(f) ENGINES PRE PW SB PW4ENG 72-519; keep the spacer with the liner segment, when the liner segment is not attached to the fan exit case.

TASK 72-34-03-404-027-N00

3. <u>Install the Removed Fan Exit Liner Segment (Inner Rear)</u> (Fig. 401)

A. Consumable Materials
   (1) D00137 Engine Oil - PWA 521B
   (2) G00033 Cheesecloth - Unsized
   (3) C00317 Sealant - Flame Resistant Silicone Rubber, (PWA 36751-1)
   (4) B00130 Alcohol - Isopropyl (PMC 9094)
   (5) A00160 Primer - Silicone (PWA 36086-2)

B. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 78-31-00/201, Thrust Reverser System

C. Access
(1) Location Zones
411 Engine (Left)
421 Engine (Right)

(2) Access Panels
415AL Fan Reverser (Left)
416AR Fan Reverser (Right)
425AL Fan Reverser (Left)
426AR Fan Reverser (Right)

D. Install the fan exit liner segments.

S 424-055-N00

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(1) To use the same fan exit liner segment.

NOTE: Use this procedure if you will install the same liner that you removed. Use the procedure in AMM 72-34-03/401 to replace a liner, spacer plate (PRE PW SB PW4ENG 72-519), or washers.

S 424-053-N00

(2) Do the steps that follow to install the liner segments (Fig. 401).

NOTE: ENGINES PRE-PW-SB 72-107 use screws, and ENGINES POST-PW-SB 72-107 use bolts.

(a) Install two screws/bolts, threads lubricated with engine oil, to holes in the leading edge of the liner segment.
(b) Put the liner segment in the correct position on the case.
(c) Tighten the screws/bolts with your hand.

NOTE: Screws are PRE PW SB PW4ENG 72-107 and POST PW SB PW4ENG 72-519. Bolts are POST PW SB PW4ENG 72-107. Spacer is not used with PW SB PW4ENG 72-519.

The 6 o'clock does not use bolts/screws at the leading edges.

(d) ENGINES PRE PW SB PW4ENG 72-519; if the spacer is loose, put it in the correct position at the trailing edge.
(e) Install screws/bolts, threads lubricated with engine oil, in the trailing and axial edges of the liner segments.
1) Tighten the screws/bolts with your hand.

(f) Tighten all the screws/bolts to 36-40 pound inches (4.067-4.519 newton-meters) in the sequence that follows:

- Front fasteners,
- Rear Fasteners,
- Axial Fasteners.

1) Visually examine each fastener to make sure that it touches the washer.
   a) If the screw does not touch the washer, remove it, apply new lubricant, and install it again.

      NOTE: It is not necessary for the fastener to be symmetrically installed in the recess in the liner segment.

S 394-045-N00

(3) If you installed a liner at the 11 o'clock or 1 o'clock position, apply sealant to the space adjacent to the bifercation fairing (Fig. 403).
   (a) With a piece on clean cheesecloth that is moist with alcohol, clean the areas the sealant will touch.
   (b) Apply the primer to all cleaned surfaces.
      1) It is necessary to apply the primer in less than two hours after you cleaned the area.
      2) The primer must cure in air at ambient temperature for a minimum of two hours.
         a) The air must have a minimum relative humidity of 25%.
   (c) Apply sealant as follows:
      1) It is necessary to apply the sealant from 2-24 hours after you applied the primer.
      2) Use a hot air gun at 175°-225°F (79°-107°C) for 5-7 minutes to dry the sealant.
      3) After you use the hot air gun, cure the sealant in air that has a minimum relative humidity of 25%, for eight hours, minimum, before you touch the parts.
   (d) Install the remaining liner segments.

E. Put the Airplane Back to Its Usual Condition.

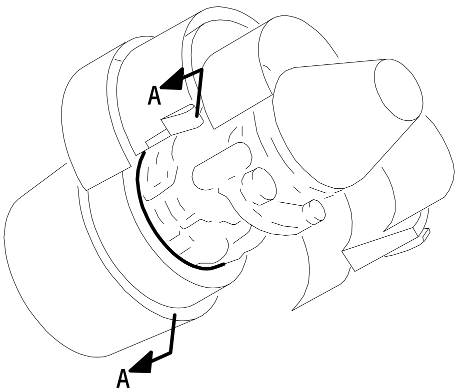
S 414-043-N00

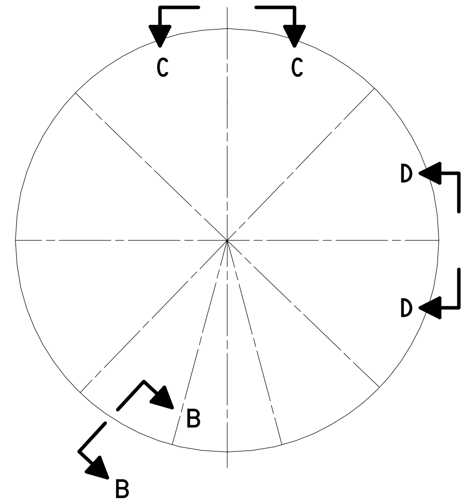
WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

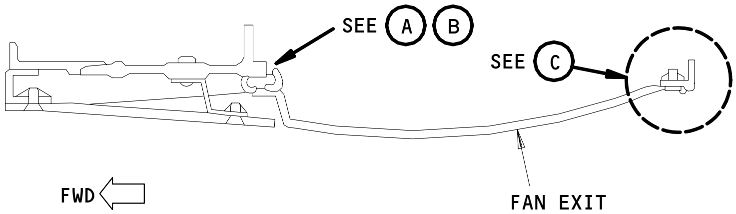
S 414-033-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

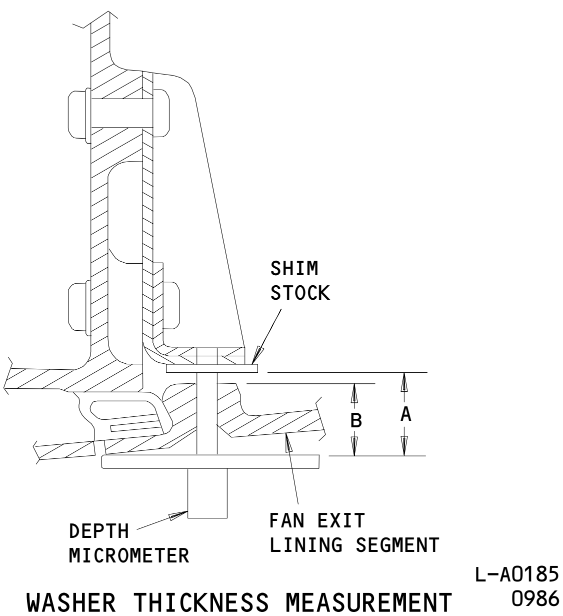




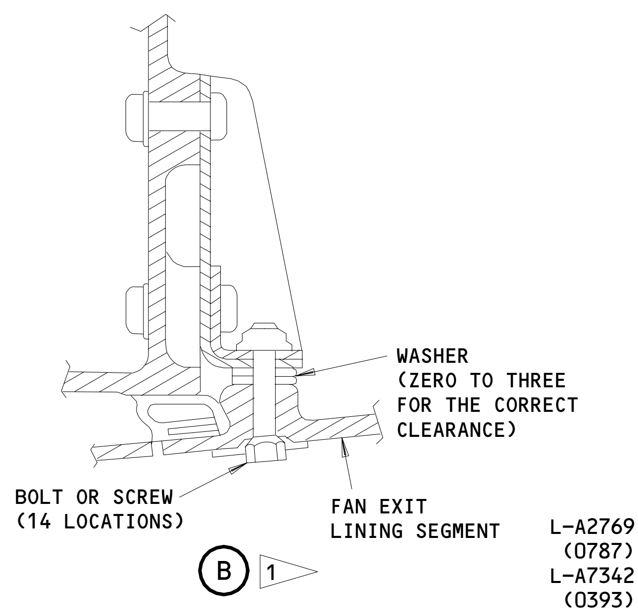
INTERMEDIATE CASE
(VIEW IN THE FORWARD DIRECTION)
A-A



B-B



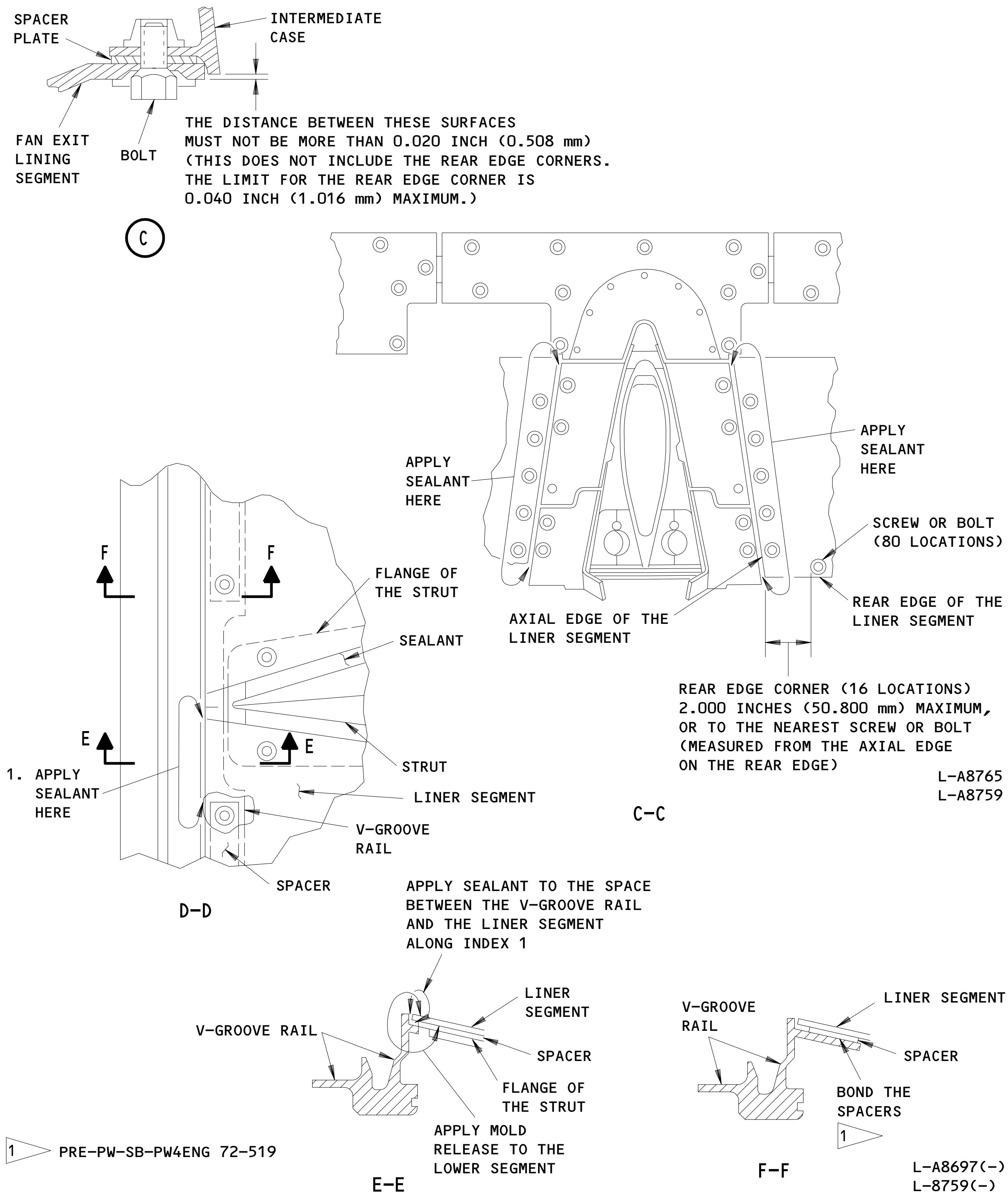
WASHER THICKNESS MEASUREMENT
A



B 1

1 NOT APPLICABLE TO LINER SEGMENT NO. 4

Fan Exit Liner Segments (Inner Rear) Replacement
Figure 403 (Sheet 1)



Fan Exit Liner Segments (Inner Rear) Replacement
Figure 403 (Sheet 2)

S 414-034-N00
(3) Close the fan cowl panels (AMM 71-11-04/201).

S 444-035-N00
(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-036-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

TASK 72-34-03-004-002-N00

4. Remove the Fan Exit Liner Segment (Inner Rear) (To replace a liner segment)

A. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System

B. Access
(1) Location Zones
411 Engine (Left)
421 Engine (Right)

(2) Access Panels
415AL Fan Reverser (Left)
416AR Fan Reverser (Right)
425AL Fan Reverser (Left)
426AR Fan Reverser (Right)

C. Prepare for the Removal of the Fan Exit Liner Segments

S 944-001-N00
(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 044-003-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-006-N00
(3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-007-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-008-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

D. Remove the Fan Exit Liner Segments

S 424-051-N00

(1) To use the same fan exit liner segment.

NOTE: Use this procedure to replace a liner. Use the procedure in AMM 72-34-03/401, if you will install the same liner you removed.

S 024-038-N00

(2) If applicable, cut the sealant at the axial edge of the liner segment.

S 024-044-N00

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(3) Do the steps that follow to remove the liner segments.

(a) Be very careful to keep the washers with the liner segment.

(b) ENGINES PRE-PW-SB 72-107;
Remove the 14 screws that attach the inner liner and the spacer plate to the fan exit case.

NOTE: These are at the top, bottom, aft, and forward center locations. Do not remove the screws from the forward edge of the No./4 liner segment. There are no forward center screws on the liner segment No. 4.

(c) ENGINES POST-PW-SB 72-107;
Remove the 14 bolts that attach the inner liner and the spacer plate to the fan exit case.

NOTE: These are at the top, bottom, aft, and forward center locations. Do not remove the bolts from the forward edge of the No. 4 liner segment. There are no forward center bolts on the liner segment No. 4.

(d) Carefully remove the liner and spacer plate from the case.

NOTE: Zero to three classified washers, washers with specified thicknesses, were possibly installed between the liner and the front center attachment bracket to keep the correct clearance. If these washers were used, they were attached to the bracket with some adhesive compound. When the engine operates or you install or remove the liner segments, the washers can become disconnected from the bracket.

(e) Remove the sealant, if necessary, from the axial edge of the liner segment and its mating parts.
(f) ENGINES PRE PW SB PW4ENG 72-519; if the spacer plate (called spacer) is attached to the case, do not remove it.

TASK 72-34-03-404-009-N00
5. Install a New Fan Exit Liner Segment (Inner Rear) (Fig. 401)
A. Equipment
(1) Depth Micrometer (capable of reading to 1 inch or more) - Commercially Available
B. Consumable Materials
(1) D00137 Engine Oil - PWA 521B
(2) G00033 Cheesecloth - Unsized
(3) G02134 Tape - Green, Moisture Resistant, PMC 4141
(4) G00803 Mold Release (PWA 36007-1)
(5) G02026 Tape - Adhesive Transfer NO. Y-9732 (PWA 36745)
(6) A00482 Sealant - Silicone Rubber, PWA 36003
(7) C00317 Sealant - Flame Resistant Silicone Rubber RTV-157 (PWA 36751-1)
(8) A00000 Sealant - Silicone Rubber, PWA 36003-2 (PWA 36003-2)
(9) B00130 Alcohol - Isopropyl (PMC 9094)
(10) B00143 Solvent - Trichlorotriflouroethane, PMC 9037
(11) A00160 Primer - Silicone (PWA 36096-2)
C. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System
D. Access
(1) Location Zones
411 Engine (Left)
421 Engine (Right)

(2) Access Panels
415AL Fan Reverser (Left)
416AR Fan Reverser (Right)
425AL Fan Reverser (Left)
426AR Fan Reverser (Right)

E. Prepare to Install the Fan Exit Liner Segments.

S 424-052-N00

(1) To use the same fan exit liner segment.

<u>NOTE</u>: Use this procedure to install a new liner, washers or spacers (PRE PW SB PW4ENG 72-519), etc. Use the procedure in AMM 72-34-03/401 to install the same liner you removed.

S 824-010-N00

(2) To install a liner segment, you must first calculate the number and thickness of washers that you will use for the installation.

<u>NOTE</u>: These washers are necessary to make a 0.005-0.020 inch (0.127-0.508 mm) clearance between the bracket and the liner.

(a) With some moisture resistant tape, attach a 0.020 inch (0.508 mm) shim to the outer diameter of the attachment bracket (Fig. 401).

(b) Put the liner segment between the struts and temporarily attach it with screws/bolts.

<u>NOTE</u>: ENGINES PRE-PW-SB 72-107 use screws, and ENGINES POST-PW-SB 72-107 use bolts.

(c) Measure the dimension "A" with a depth micrometer through each of the two forward holes in the liner segment.

<u>NOTE</u>: The dimension "A" is the depth from the top surface of the liner segment to the surface of the shim.

(d) Remove the screws/bolts.

(e) Remove the liner segment and the shim.

(f) Measure the dimension "B", the thickness of the liner segment.

(g) Subtract "B" from "A" to calculate the thickness of the necessary washers.

(h) Use Table I to find which washers (0-3) to use to make the necessary thickness.

Washer - Flat Thickness	
Table I	
Class	Washer Thickness - Inch (mm)
1	0.009-0.011 (0.229-0.279)
2	0.019-0.021 (0.483-0.503)
3	0.029-0.031 (0.737-0.787)
4	0.039-0.041 (0.991-1.041)
5	0.049-0.051 (1.244-1.295)
6	0.099-0.101 (2.514-2.565)

S 824-011-N00

(3) Do these steps to attach the washers in the correct position to the bracket.

WARNING: DO NOT GET THE SOLVENT IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAMES, AND HEAT. THE SOLVENT IS POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(a) With some cheesecloth that is wet with trichlorotriflouroethane solvent, clean the areas where you will attach the washers.

(b) Let the surfaces become fully dry at ambient temperature.

NOTE: This will remove all remaining solvent. Remaining solvent can cause a bad seal.

(c) Apply the sealant to the washers and the bracket.

(d) Use screws/bolts to temporarily hold the washers in the correct position.

(e) Do those steps again to attach all of the washers for the remaining liner segments.

S 824-013-N00

(4) ENGINES PRE PW SB PW4ENG 72-519; find the correct class of spacer from Table II that will make the distance between the surface of the liner segment not more than 0.020 inches (0.508 mm) from the level of the strut platform.

Spacer - Thickness (PRE PW SB PW4ENG 72-519)	
Table II	
Class	Washer Thickness - Inch (mm)
1	0.022-0.028 (0.559-0.711)
2	0.036-0.044 (0.914-1.118)
3	0.058-0.068 (1.473-1.727)
4	0.075-0.085 (1.905-2.159)
5	0.095-0.105 (2.413-2.667)
6	0.120-0.130 (3.048-3.302)

(a) ENGINES PRE PW SB PW4ENG 72-519; if necessary, replace the spacer that is now installed on the case, as follows:

1) Remove the adhesive transfer tape, if necessary, and the spacer from the case.

NOTE: It is possible that the spacer is bonded to the V-groove rail (fan exit case flange assembly) with adhesive transfer tape.

2) Prepare the spacer and V-groove rail for the installation for the tape as follows:
   a) With a clean cheese cloth that is moist with alcohol, clean the areas you will bond.
   b) Dry the surfaces fully in air that is at ambient temperature, until there is no more alcohol on the parts.
3) Install Tape on the V-groove rail or on the spacer.
4) Remove the tape from the bolt holes.
5) Align the holes of the V-groove rail and the spacer.
6) Install the spacer on the V-groove rail.

S 394-040-N00

(5) ENGINES PRE PW SB PW4ENG 72-519; apply sealant to the space on the V-groove rail between the spacer and the flange of the strut as follows:

NOTE: This step is not necessary if you install the same class spacer as the one you removed.

(a) remove any sealant that is in the space.

(b) Prepare the V-groove rail as follows:
1) With a clean cheese cloth that is moist with alcohol, clean the areas you will bond.
2) Dry the surfaces fully in air that is at ambient temperature, until there is no more alcohol on the parts.

(c) Apply sealant to the area.

(d) Apply mold release to the liner segment in the same area.

F. Install the fan exit liner segments.

S 424-047-N00

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(1) Do the steps that follow to install the liner segments (Fig. 401).

NOTE: ENGINES PRE-PW-SB 72-107 use screws, and ENGINES POST-PW-SB 72-107 use bolts.

(a) Install two screws/bolts, threads lubricated with engine oil, to holes in the leading edge of the liner segment.

(b) Put the liner segment in the correct position on the case.

(c) Tighten the screws/bolts with your hand.

NOTE: Screws are PRE PW SB PW4ENG 72-107 and POST PW SB PW4ENG 72-519. Bolts are POST PW SB PW4ENG 72-107. Spacer is not used with PW SB PW4ENG 72-519.

The 6 o'clock liner does not use bolts/screws at the leading edge.

(d) If the spacer is loose, put it in the correct position at the trailing edge.

(e) Install screws/bolts, threads lubricated with engine oil, in the trailing and axial edges of the liner segments.
1) Tighten the screws/bolts with your hand.

(f) Tighten all the screws/bolts to 36-40 pound inches (4.067-4.519 newton-meters) in the sequence that follows:

- Front Fasteners,
- Rear Fasteners,
- Axial Fasteners.

1) Visually examine each fastener to make sure that it touches the washer.
   a) If the screw does not touch the washer, remove it, apply new lubricant, and install it again.

   NOTE: It is not necessary for the fastener to be symmetrically installed in the recess in the liner segment.

S 394-046-N00

(2) If you installed a liner at the 11 o'clock or 1 o'clock position, apply sealant to the space adjacent to the bifercation fairing (Fig. 403).
   (a) With a piece on clean cheesecloth that is moist with alcohol, clean the areas the sealant will touch.
   (b) Apply the primer to all cleaned surfaces.
      1) It is necessary to apply the primer in less than two hours after you cleaned the area.
      2) The primer must cure in air at ambient temperature for a minimum of two hours.
         a) The air must have a minimum relative humidity of 25%.
   (c) Apply sealant as follows:
      1) It is necessary to apply the sealant from 2-24 hours after you applied the primer.
      2) Use a hot air gun at 175°-225°F (79°-107°C) for 5-7 minutes to dry the sealant.
      3) After you use the hot air gun, cure the sealant in air that has a minimum relative humidity of 25%, for eight hours, minimum, before you touch the parts.

G. Put the Airplane Back to Its Usual Condition.

S 414-039-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-016-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 414-017-N00
(3) Close the fan cowl panels (AMM 71-11-04/201).

S 444-018-N00
(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-019-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

FAN EXIT LINER SEGMENTS (INNER REAR) - INSPECTION/CHECK

1. General
   A. This procedure gives the task do the inspection of the fan exit liner segments (inner rear). These fan exit liner segments will be referred to as the liner segments in this procedure.
   B. The eight liner segments are on the inner rear circumference of the intermediate case, aft of the fan case.
   C. You must open each half of the thrust reverser to get access to the liner segments.

TASK 72-34-03-206-006-N00

2. Inner Rear Liner Segments Inspection
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 72-34-03/401, Fan Exit Liner Segments (Inner Rear)
      (4) AMM 72-34-03/801, Fan Exit Liner Segments (Inner Rear)
      (5) AMM 78-31-00/201, Thrust Reverser Opening
   B. Access
      (1) Location Zones
         411 No. 1 Power Plant
         421 No. 2 Power Plant

   C. Do the Inspection of the Inner Rear Liner Sements.

      S 046-001-N00

      WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 016-002-N00
      (2) Open the fan cowl panel (AMM 71-11-04/201).

      S 016-003-N00
      (3) Open the core cowl panel (AMM 71-11-06/201).

      S 016-004-N00

      WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

      (4) Open the thrust reverser (AMM 78-31-00/201).

S 226-005-N00

(5) Compare the damage that you find on the outer liner segments with the limits in Table 601, 602, and 603 (Fig. 601).

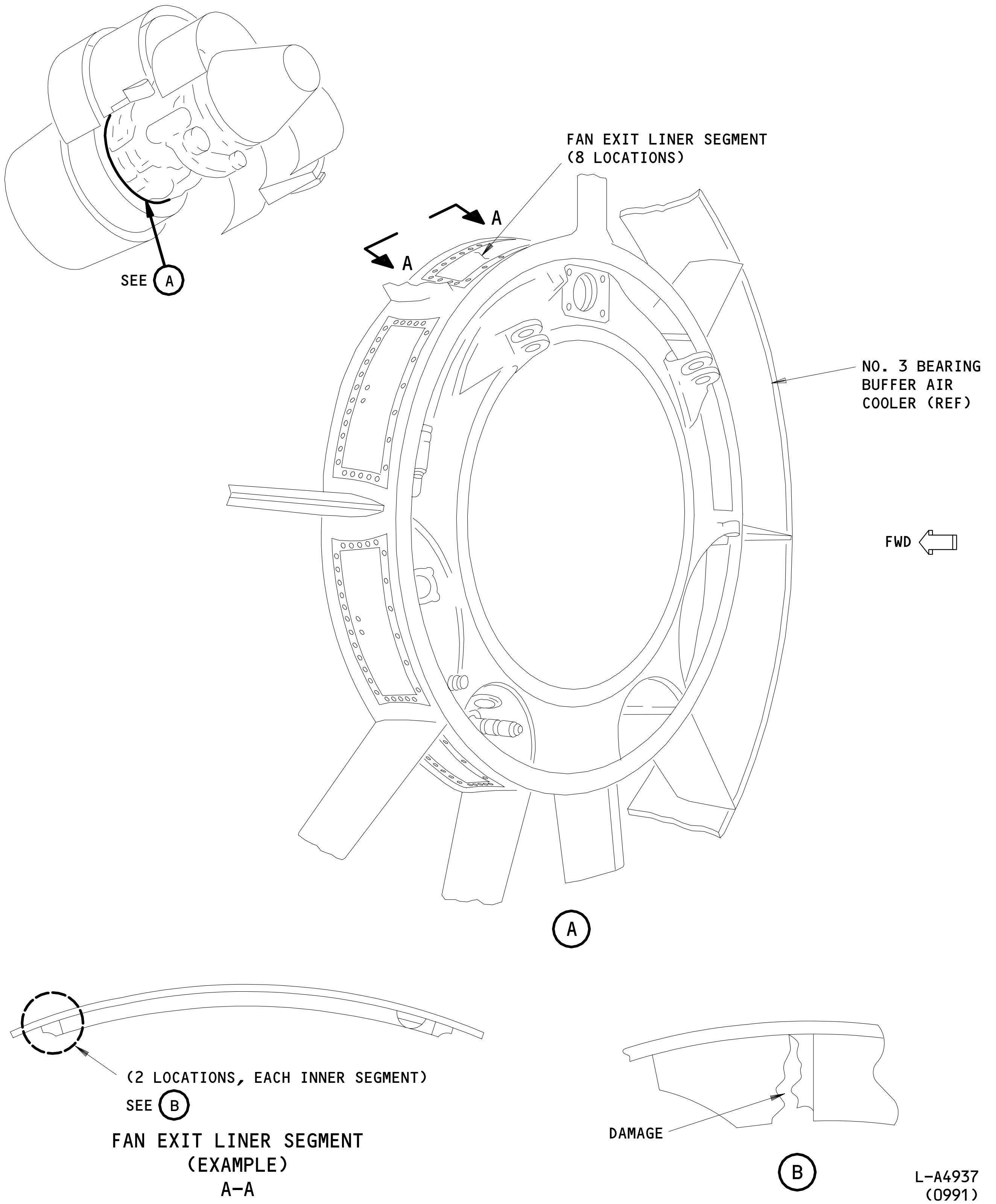
(a) If you find a liner segment or a fastener that is loose, make sure that the torque is not less than 15 pound-inches (1.695 newton-meters).

NOTE: ENGINES POST-PW-SB 72-107 use bolts here, and ENGINES PRE-PW-SB 72-107 use screws here.

INSPECTION FOR PARTS THAT ARE NOT THERE OR ARE LOOSE, AND FOR RUBBER SEALS
Table 601

AREA: CONDITION OBSERVED	NECESSARY PROCEDURE
Liner Segment: all or part of the liner that is not there or loose	Replace or tighten the liner as applicable within 50 hours of operation (AMM 72-34-03/401).
Screws/Bolts: One or more that is loose or not there	Replace or tighten the screws as applicable within 50 hours of operation.
Rubber Seals: Cuts or tears on the ends of the seals	Repair the rubber seal within 50 hours of operation (AMM 72-34-03/801).

(b) If the damage to the liner segment, referred to in Table 602, is less than the limits, no procedure is necessary.



Fan Exit Liner Segment (Inner Rear) Inspection
Figure 601

INSPECTION FOR NICKS, DENTS, AND OTHER SURFACE DAMAGE
Table 602

CONDITION OBSERVED	DAMAGE LIMITS	NECESSARY PROCEDURE
Nicks and Gouges	More than 1.000 inch (25.400 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.80 mm) apart from other damage, or there are more than five (5) nicks and gouges.	Replace before the subsequent flight.
Dents with Rounded Bottoms	More than 0.030 inch (0.762 mm) in depth or on more than 10% of the surface area	Replace Within 50 hours
Cracks	More than 1.000 inch (25.400 mm) in length or less than 0.500 inch (12.700 mm) from the center of an attachment rivet screw or bolt	Replace Within 50 hours
Areas of broken or fuzzy stray fibers	Between 1.000 and 2.500 inches (25 and 63.5 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.800 mm) from other damage	Replace Within 50 hours
	More than 2.500 inches (63.500 mm) in width or length	Replace Immediately
Holes or Punctures	None Permitted.	Replace in 50 hours
No Bond of a Wire Cloth Patch	More than 0.500 inch (12.700 mm) in length or width.	Replace in 50 hours
Leading Edge Erosion	More than 0.500 inch (12.700 mm) in length or width (of a dull or rough surface finish, visible fibers)	Replace in 50 hours

INSPECTION FOR DELAMINATION Table 603			
DELAMINATION DIMENSION	EXAMINE AFTER EACH 50 HOURS	REPLACE WITHIN 50 HOURS	REPLACE BEFORE YOU OPERATE THE ENGINE
Width or Length	Not more than 1.000 inch (25.400 mm)	Between 1.000-2.500 inches (25-64 mm)	More than 2.500 inches (63.500 mm)
Depth	Mot more than 0.030 inch (0.762 mm)	More than 0.030 inch (0.762 mm)	-----
Distance from other damage	More than 2.000 inches (50.800 mm)	Less than 2.000 inches (50.800 mm)	-----

S 026-010-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(6) Close the thrust reverser (AMM 78-31-00/201).

S 026-009-N00

(7) Close the core cowl panel (AMM 71-11-06/201).

S 026-008-N00

(8) Close the fan cowl panel (AMM 71-11-04/201).

S 446-007-N00

(9) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

FAN EXIT LINER SEGMENTS (INNER REAR) - APPROVED REPAIRS

1. General
   A. This procedure gives the task to repair the rubber seal ends on the fan exit liner segments (inner rear). These fan exit liner segments will be referred to as the liner segments in this procedure.
   B. The eight liner segments are on the inner rear circumference of the intermediate case, aft of the fan case.
   C. You must open each half of the thrust reverser to get access to the liner segments.

   TASK 72-34-03-308-012-N00

2. Inner Rear Liner Segments Repair
   A. Consumable Materials
      (1) G00033 Cheesecloth - Unsized
      (2) A00482 Sealant - Silicone Rubber, PWA 36003
      (3) B00666 Solvent - Methyl Propyl Ketone (MPK)
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 72-34-03/601, Fan Exit Liner Segments (Inner Rear)
      (4) AMM 78-31-00/201, Thrust Reverser Opening
   C. Access
      (1) Location Zones
          411 No. 1 Power Plant
          421 No. 2 Power Plant

   D. Repair the Seal Ends of the Liner Sements (Fig. 801).

      S 948-001-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead panel, P5.

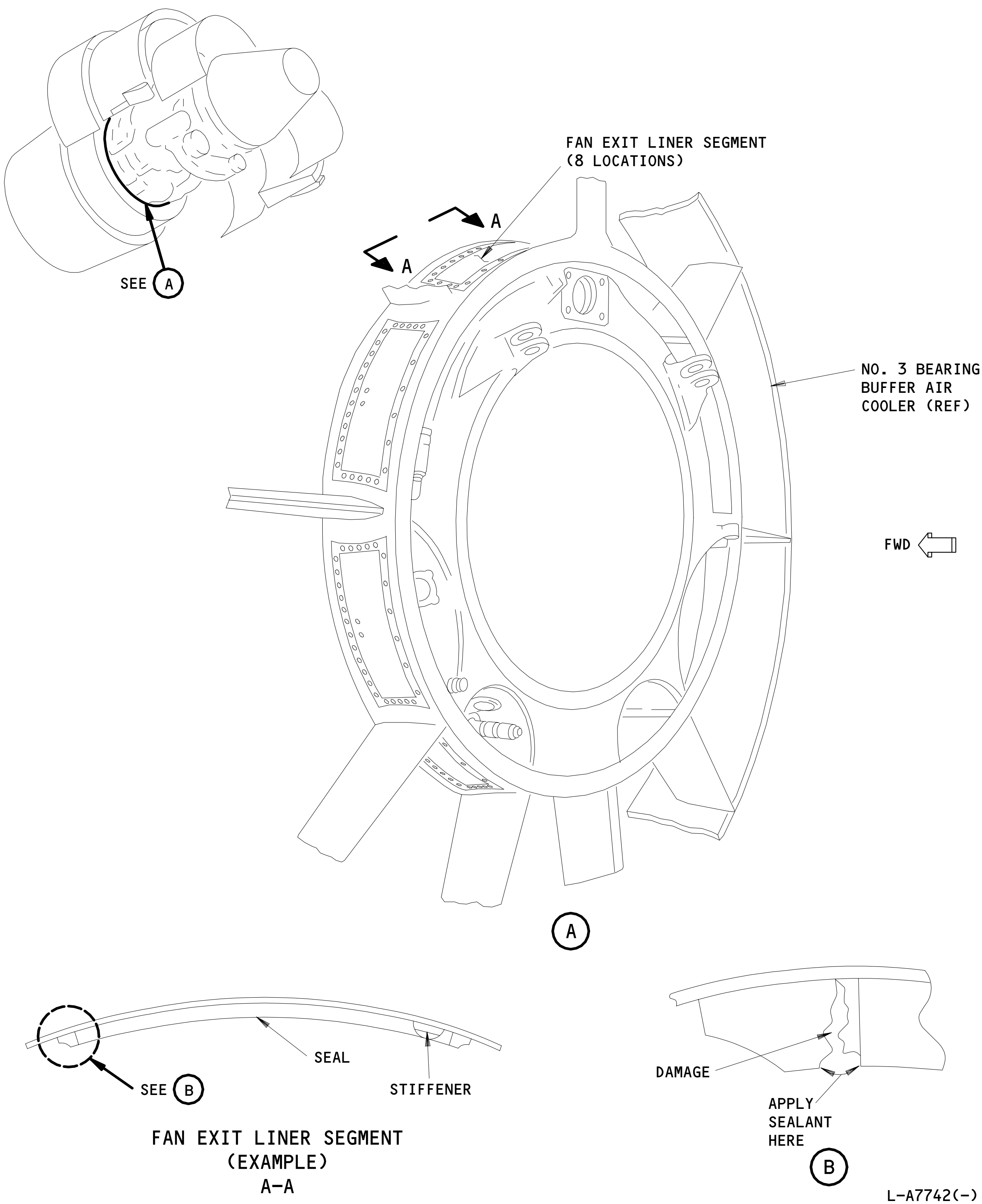
      S 048-002-N00

      WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 018-003-N00
      (3) Open the fan cowl panel (AMM 71-11-04/201).

      S 018-004-N00
      (4) Open the core cowl panel (AMM 71-11-06/201).



Fan Exit Liner Segment (Inner Rear) Repair
Figure 801

S 018-005-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reverser (AMM 78-31-00/201).

S 118-008-N00

<u>WARNING</u>: DO NOT GET THE SOLVENT IN YOUR MOUTH OR EYES,OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAMES, AND HEAT. THE SOLVENT IS POISONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(6) Clean the areas you will repair as follows (AMM 72-34-03/601):
- (a) Make a clean piece of cheesecloth moist with solvent.
- (b) With the moist cheesecloth, clean the surfaces you will repair.
- (c) Make sure the surfaces are fully dry before you apply the sealant.

S 398-007-N00

(7) Apply the sealant as follows:
- (a) Apply the sealant to the end of the seal to bond it to the liner segment.
- (b) Fill the empty spaces between the seal and the liner segment with the sealant.
- (c) Put pressure on the seal and the liner segment to bond them together.
- (d) Cure the sealant for 24 hours before you touch or move the seal and liner segment.

S 028-011-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(8) Close the thrust reverser (AMM 78-31-00/201).

S 028-010-N00

(9) Close the core cowl panel (AMM 71-11-06/201).

S 028-009-N00

(10) Close the fan cowl panel (AMM 71-11-04/201).

S 448-006-N00

(11) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 868-013-N00

(12) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

FAN EXIT (BIFURCATION) FAIRING- REMOVAL/INSTALLATION

1. General
   A. This procedure has four tasks as follows:
      (1) Removal of the Access Covers of the Fan Exit (Bifurcation) Fairing
      (2) Removal of the Fan Exit (Bifurcation) Fairings
      (3) Installation of the Fan Exit (Bifurcation) Fairing
      (4) Installation of the Access Cover of the Fan Exit (Bifurcation) Fairing
   B. The Fan Exit (Bifurcation) Fairing is found on the outer rear circumference of the intermediate case, aft of the fan case. It is at the 12 o'clock position. This fairing is referred to as the Fan Exit Fairing.
   C. You must open each half of the thrust reverser to get access to the Fan Exit Fairing.

TASK 72-34-04-024-023-N00

2. Remove The Access Covers of the Fan Exit Fairing
   A. Equipment
      (1) No. 10 Torq-set Drive
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

411	Engine (Left)
421	Engine (Right)

      (2) Access Panels

413	Fan Cowl Panel (Left)
414	Fan Cowl Panel (Right)
415	Fan Reverser (Left)
416	Fan Reverser (Right)
417	Core Cowl (Left)
418	Core Cowl (Right)
423	Fan Cowl Panel (Left)
424	Fan Cowl Panel (Right)
425	Fan Reverser (Left)
426	Fan Reverser (Right)
427	Core Cowl (Left)
428	Core Cowl (Right)

D. Prepare for the Procedure

S 944-024-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 044-025-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 014-026-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-027-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-028-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

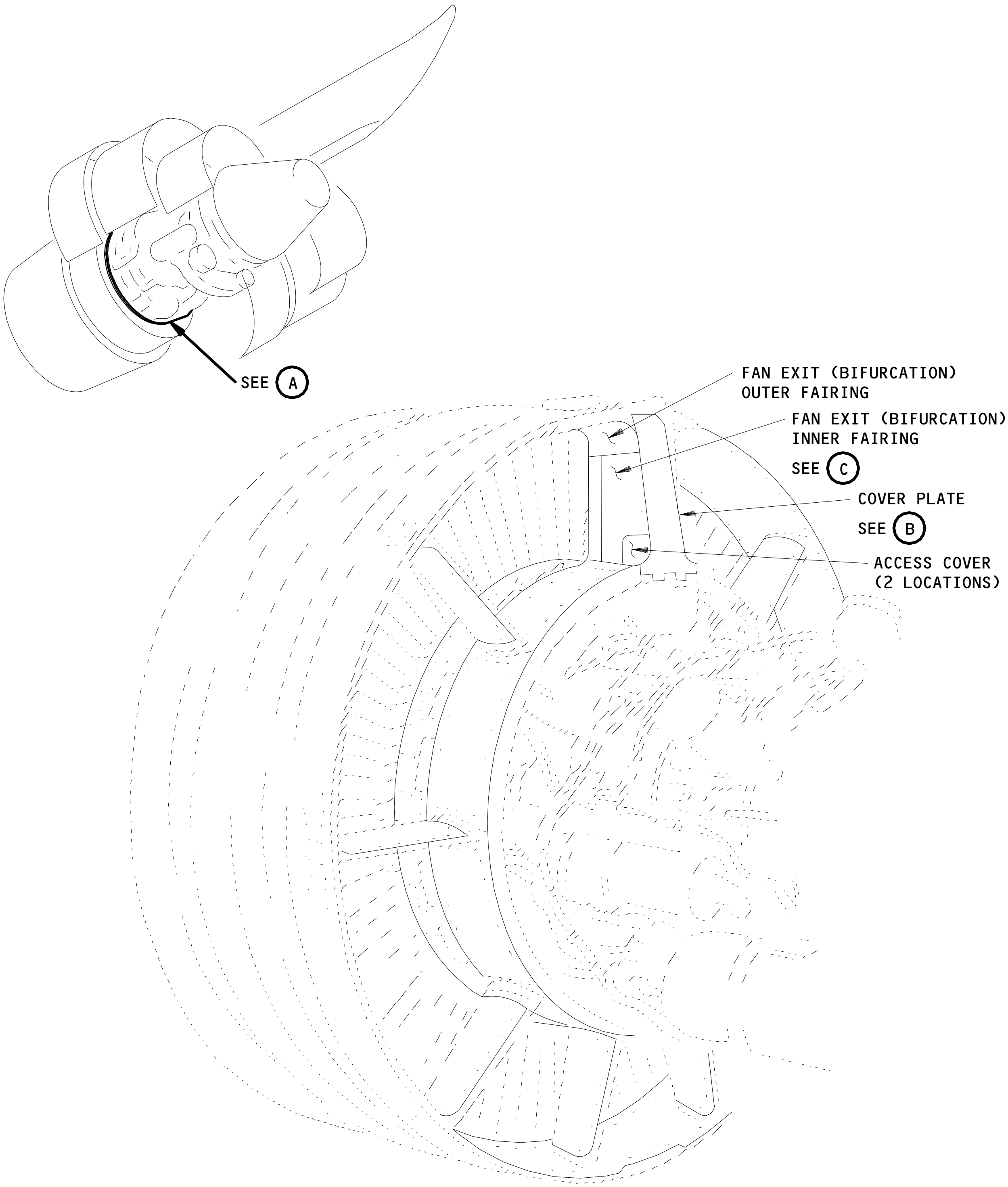
E. Remove the Access Covers of the Fan Exit Fairing (Fig. 401).

S 024-029-N00

(1) Do the steps that follow to remove the Access Covers of the Fan Exit Fairing:
   (a) Cut the sealant from around the (rear) cover plate (1).
      1) Remove the sealant from around the cover plate (1).
   (b) Remove the screws (2).

      NOTE: Use a No. 10 Torq-set drive to remove the screws.

   (c) Remove the cover plate (1).
   (d) Cut the sealant from around the two access covers (6).
      1) Remove the sealant from around the two access covers(6).
   (e) Remove the screws (4) from the two access covers (6).

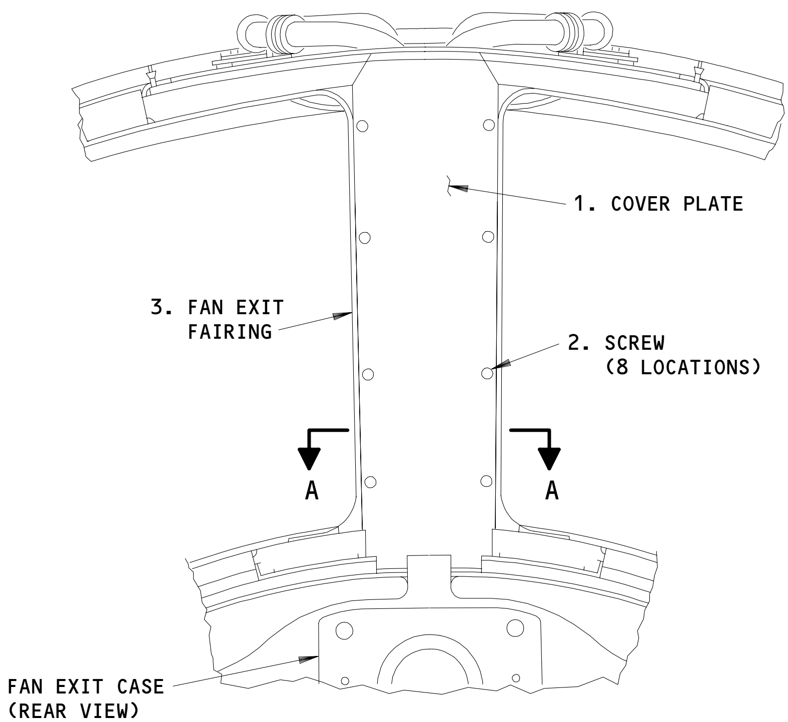


FAN EXIT (BIFURCATION) FAIRING

A

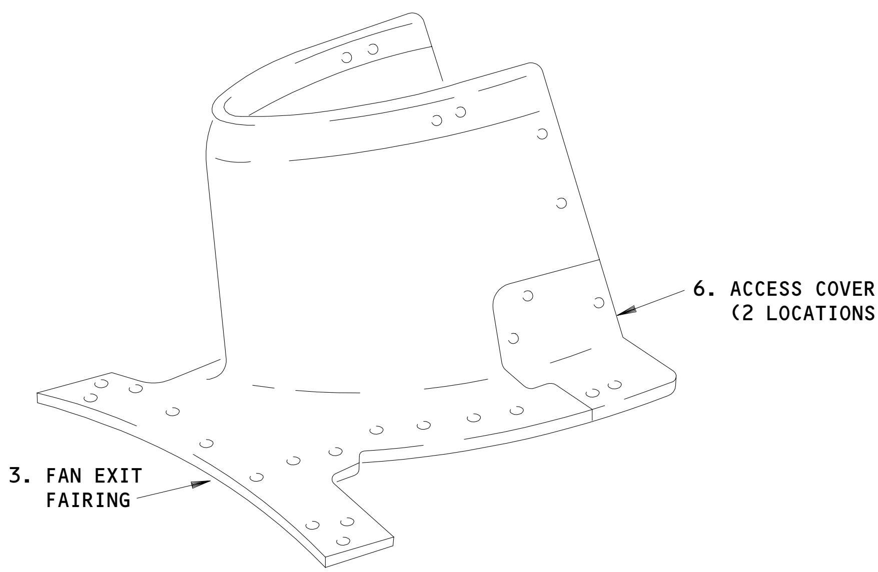
L-A8017 (000)

Fan Exit (Bifurcation) Fairing Access Cover
Figure 401 (Sheet 1)



FAN EXIT FAIRING COVER PLATE

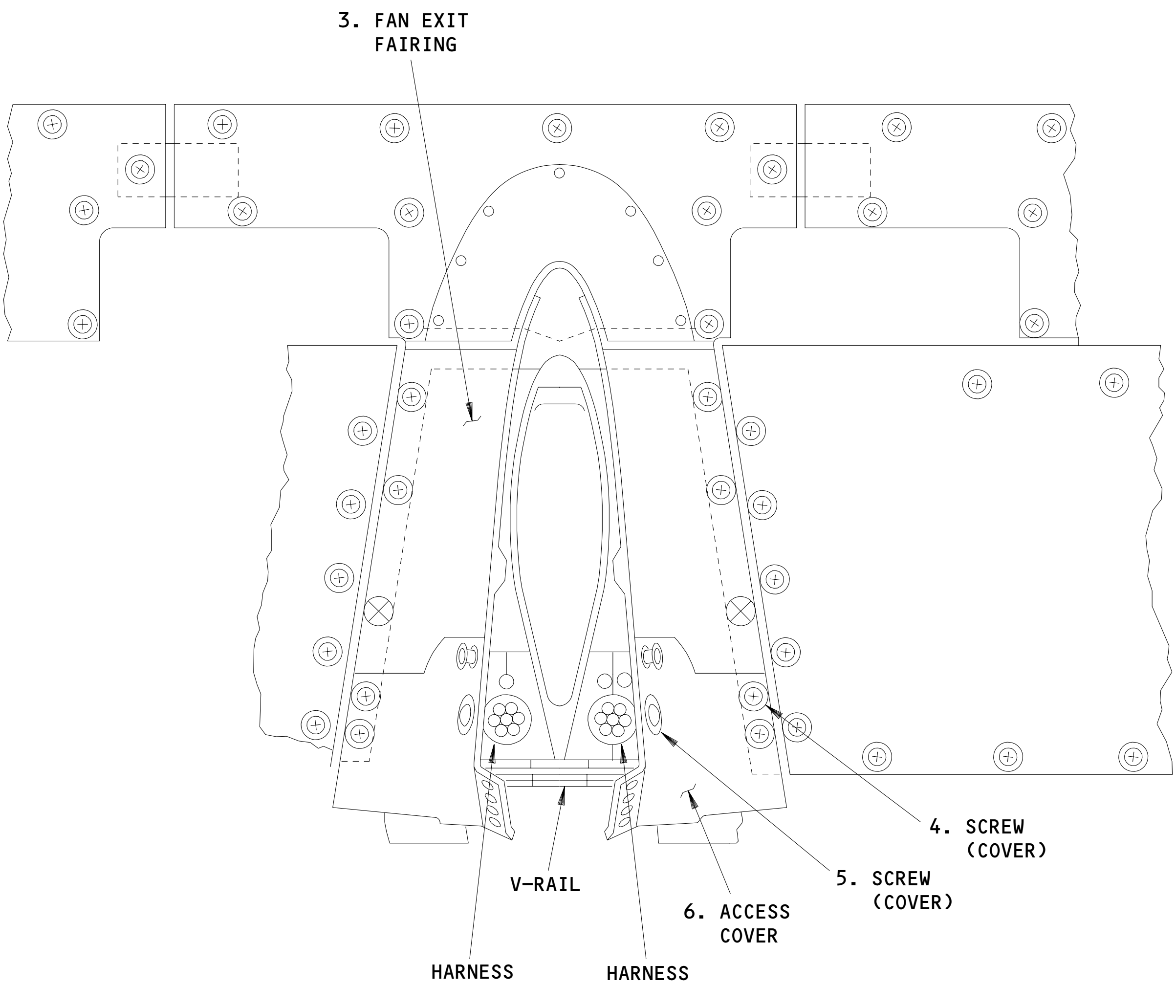
B



FAN EXIT (BIFURCATION) INNER FAIRING

C

Fan Exit (Bifurcation) Fairing Access Cover
Figure 401 (Sheet 2)



A-A

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Fan Exit (Bifurcation) Fairing Access Cover
Figure 401 (Sheet 3)

CAUTION: BE CAREFUL WHEN YOU REMOVE THE ACCESS COVERS. IT IS POSSIBLE THAT THERE ARE CLASSIFIED WASHERS BONDED TO BOLT HOLES (5). IT IS EASY FOR THESE WASHERS TO BECOME LOOSE.

(f) Remove the two access covers (6).
(g) ENGINES PRE-PW-SB 72-38;
When you replace an access cover, you must put classified washers on the new access cover.

NOTE: This is if the used access cover had classified washers installed.

NOTE: Classified washer are bonded to the access cover when they are installed.

(h) When the washers are loose or fall off the serviceable access cover, they must be bonded to the cover.

NOTE: The bonding procedure is in the task to install the Access Covers of the Fan Exit Fairing.

TASK 72-34-04-024-030-N00
3. ENGINES POST-PW-SB 72-382;
Remove the Fan Exit Fairing

A. Equipment
(1) No. 10 Torq-set Drive
(2) T-10 Torx Tip
(3) No. 10 Cross-Drive (Phillips)
B. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System
C. Access
(1) Location Zones
411 Engine (Left)
421 Engine (Right)

(2) Access Panels

413	Fan Cowl Panel (Left)
414	Fan Cowl Panel (Right)
415	Fan Reverser (Left)
416	Fan Reverser (Right)
417	Core Cowl (Left)
418	Core Cowl (Right)
423	Fan Cowl Panel (Left)
424	Fan Cowl Panel (Right)
425	Fan Reverser (Left)
426	Fan Reverser (Right)
427	Core Cowl (Left)
428	Core Cowl (Right)

D. Prepare for the Procedure

S 944-031-N00

(1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 044-032-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do the deactivation procedure for the thrust reversers for ground maintenance (AMM 78-31-00/201).

S 014-033-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-034-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-035-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Remove the Fan Exit Fairing (Fig. 402)

NOTE: The side panels, the leading edge, and the access covers together are the inner fairing.

S 024-036-N00

(1) Do the steps that follow to remove the Fan Exit Fairing

NOTE: Unless it is specified differently, remove the shoulder screws with a No. 3 cross-drive (Phillips). Remove all of the other screws with a No. 10 Torq-set drive.

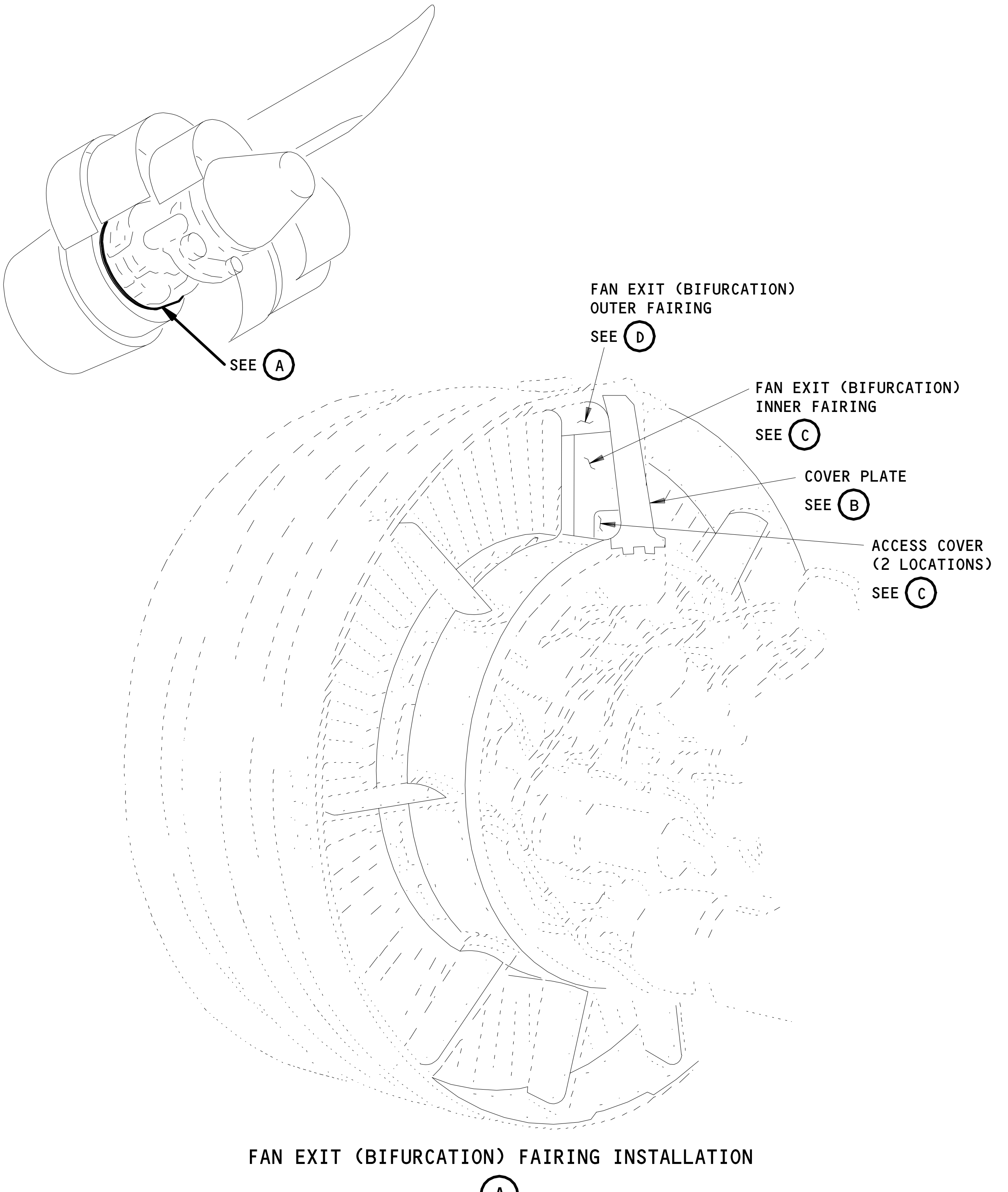
(a) Cut and remove the sealant from around the cover plate (10).
(b) Remove the screws (11) and the cover plate (10).
(c) Cut and remove the sealant from around the access covers (6).
(d) Remove the screws (4) and (5), and the access covers (6).
(e) Remove the classified washers that are on the inner side of the bolt holes (4), if there are some installed.
(f) Cut and remove the sealant from around the top of the outer fairing (1).
(g) Remove the screws (12), (13), and (14), and the outer fairing (1).

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE THE INNER FAIRING (LEADING EDGE). IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THIS PART OF THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME LOOSE AND FALL OFF.

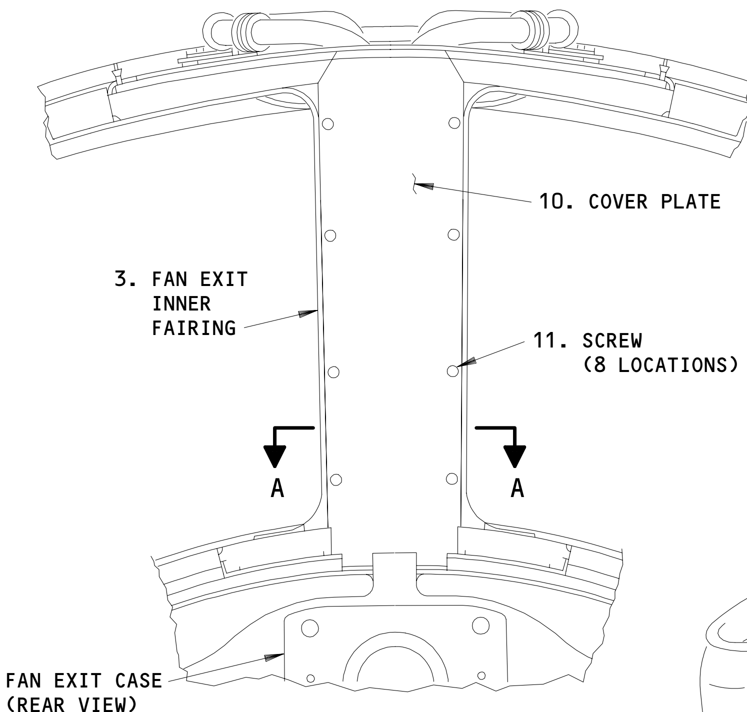
(h) Cut and remove the sealant from around the inner fairing (3) (leading edge).
(i) Remove the screws (7) and (15).

NOTE: Use a Torx T-10 tip with screws (7).

(j) Remove the inner fairing (3) (leading edge).
(k) Cut and remove the sealant from around the side panels of the inner fairing (3).
(l) Remove the screws (8) and (9).
(m) Remove the side panels of the inner fairing (3).
(n) Remove the classified washers, if installed, that are under the bolt holes (8) and (9).
(o) Remove the gasket (16).

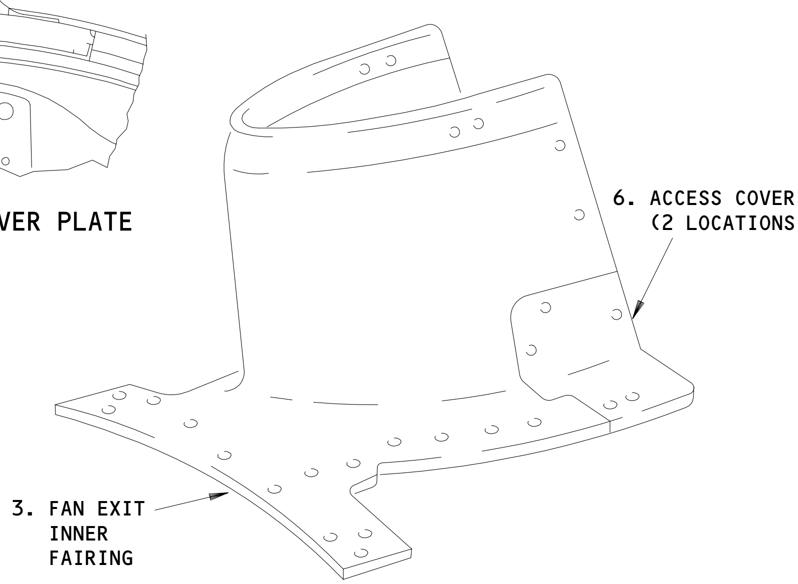


Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 1)



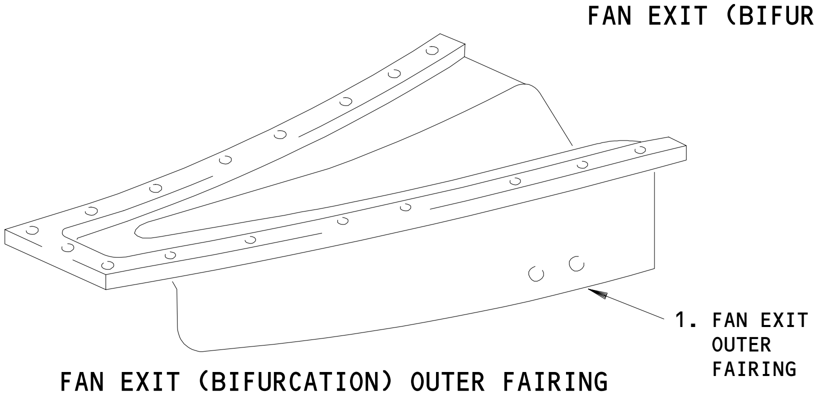
FAN EXIT FAIRING COVER PLATE

B



FAN EXIT (BIFURCATION) INNER FAIRING

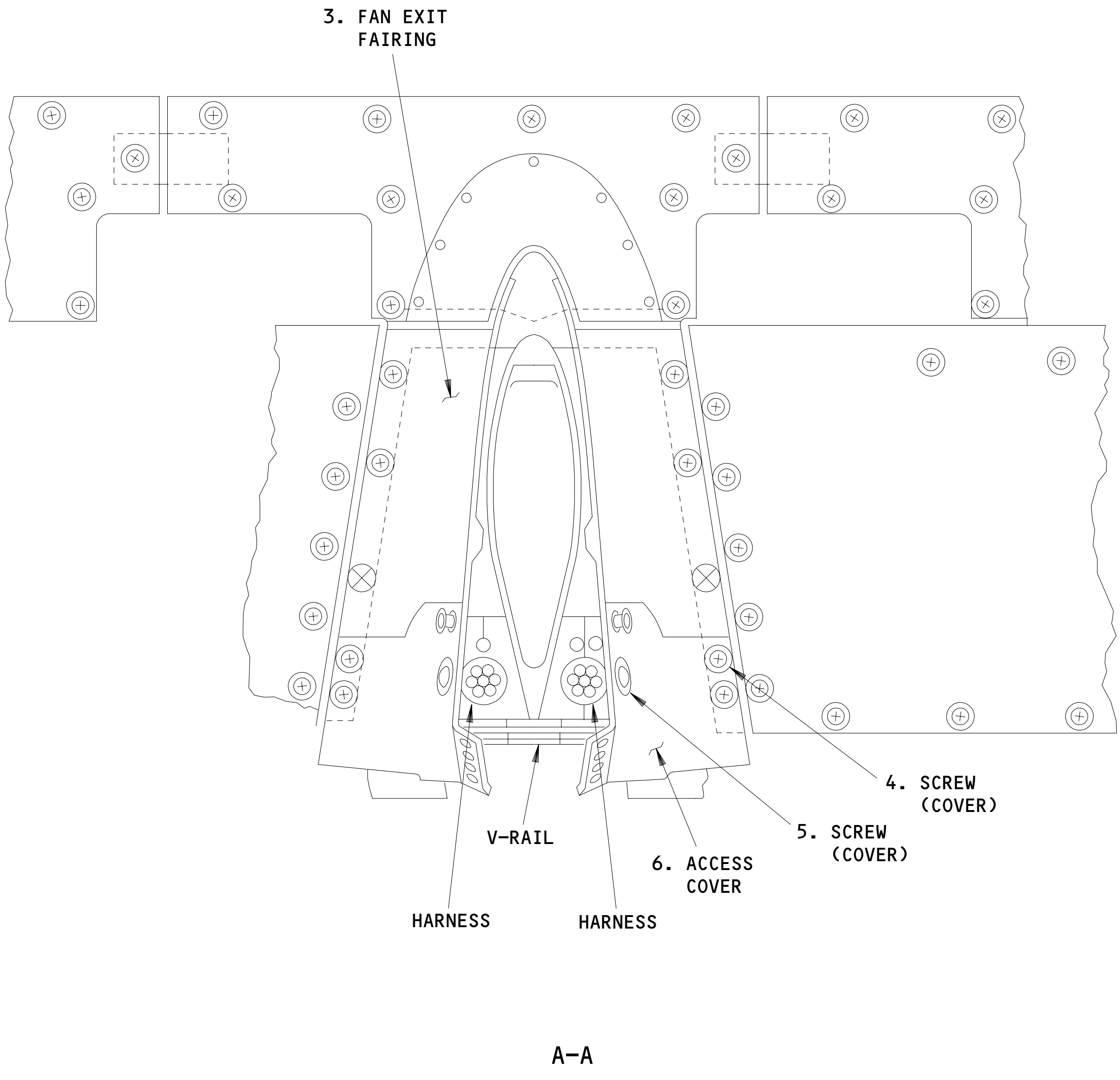
C



FAN EXIT (BIFURCATION) OUTER FAIRING

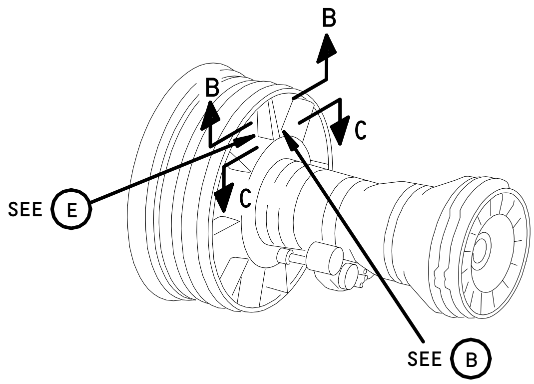
D

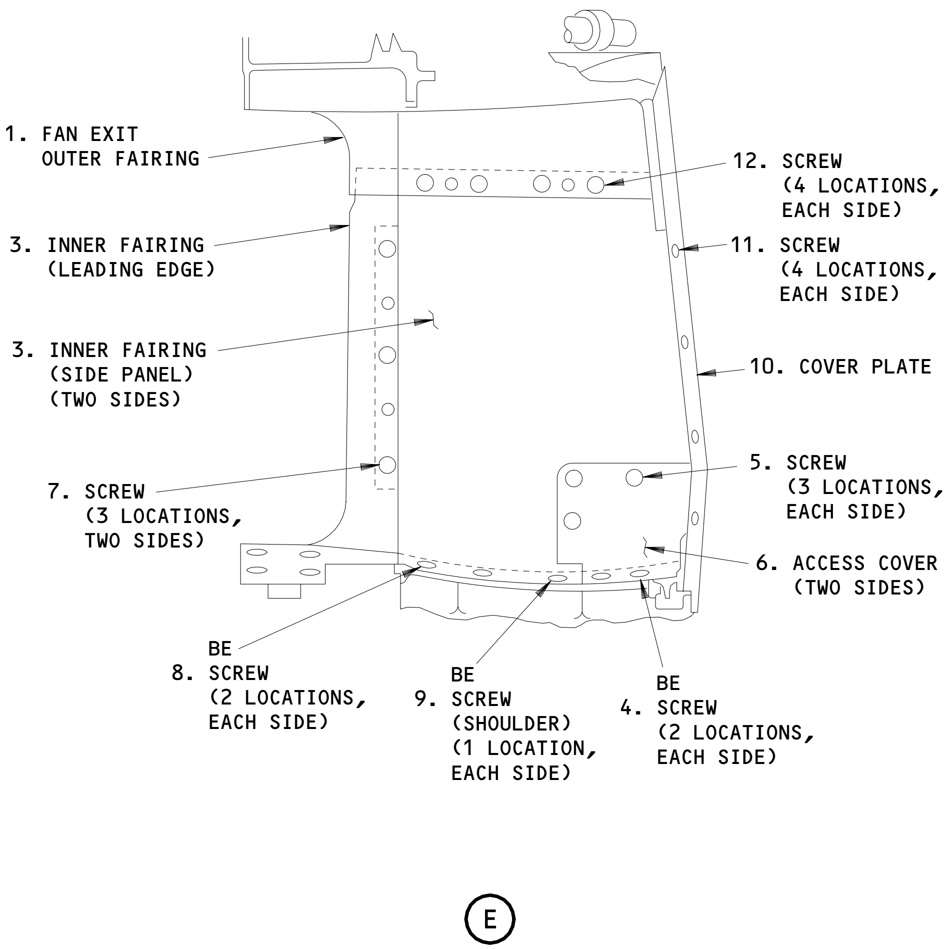
Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 2)



L-A5989 (0292)

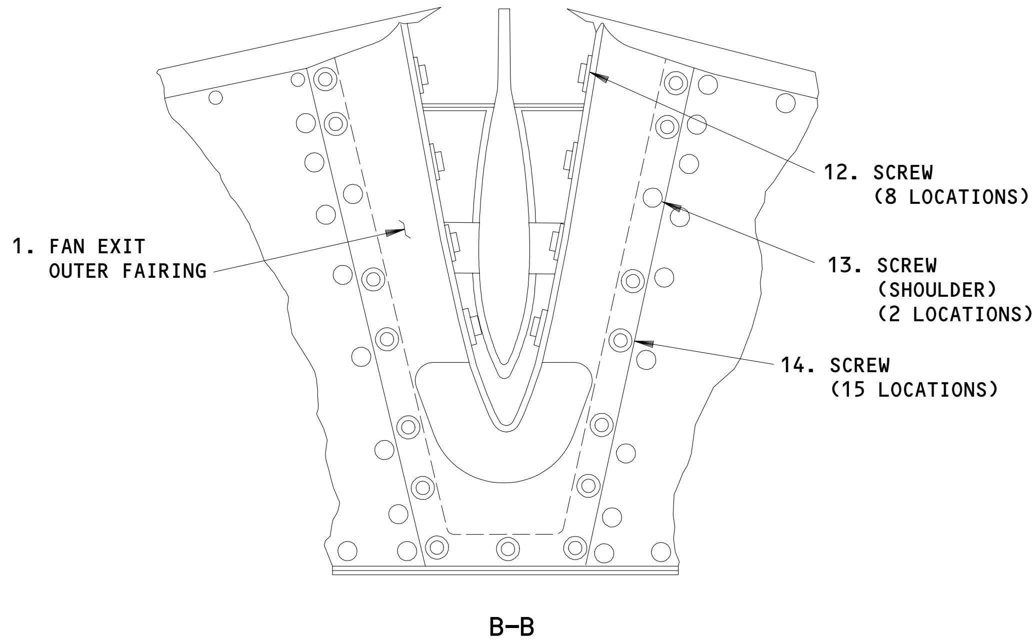
Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 3)

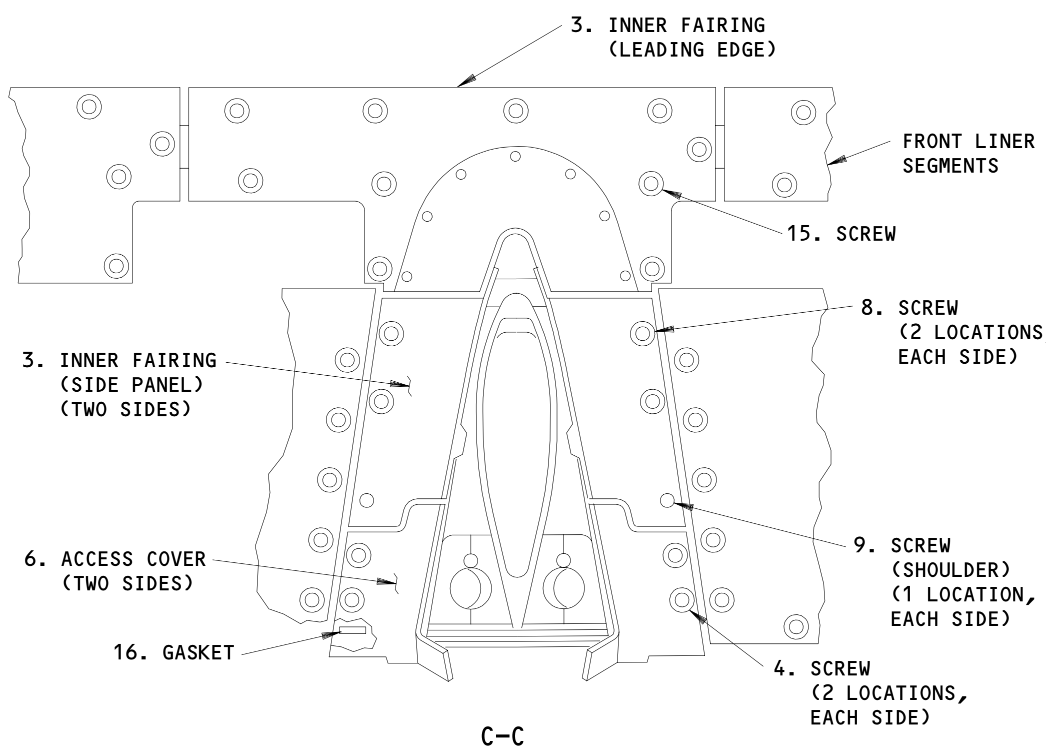




L-A8010 (0000)

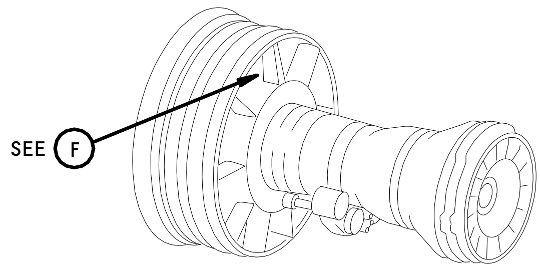
Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 4)

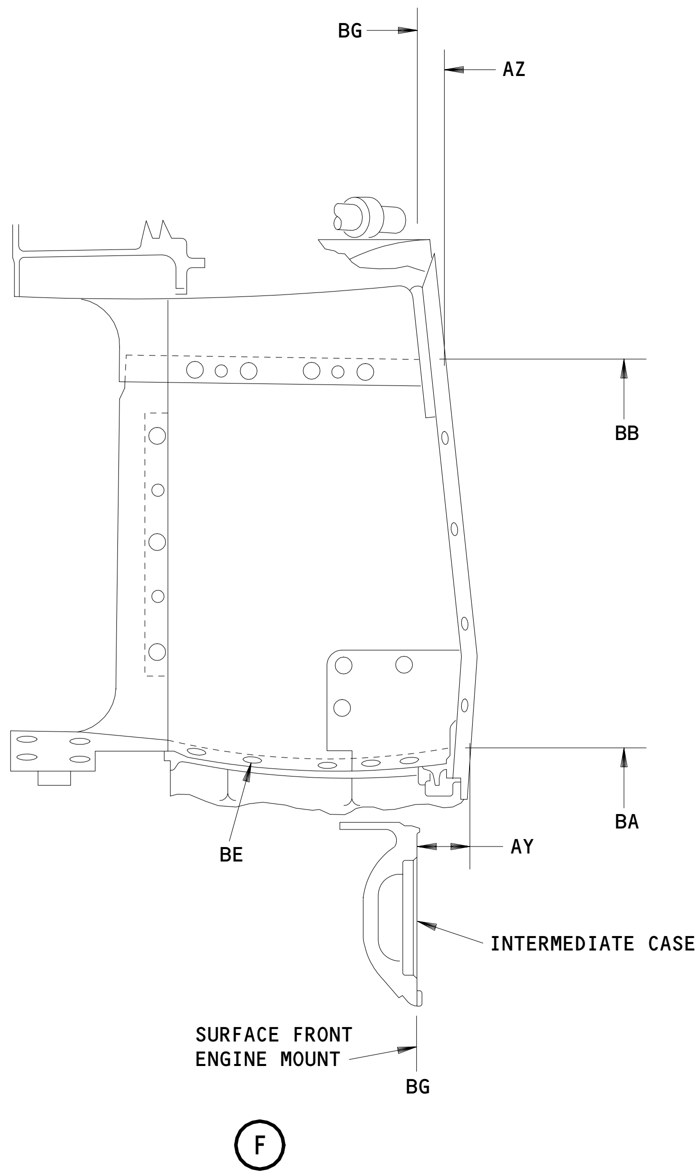




L-A8011

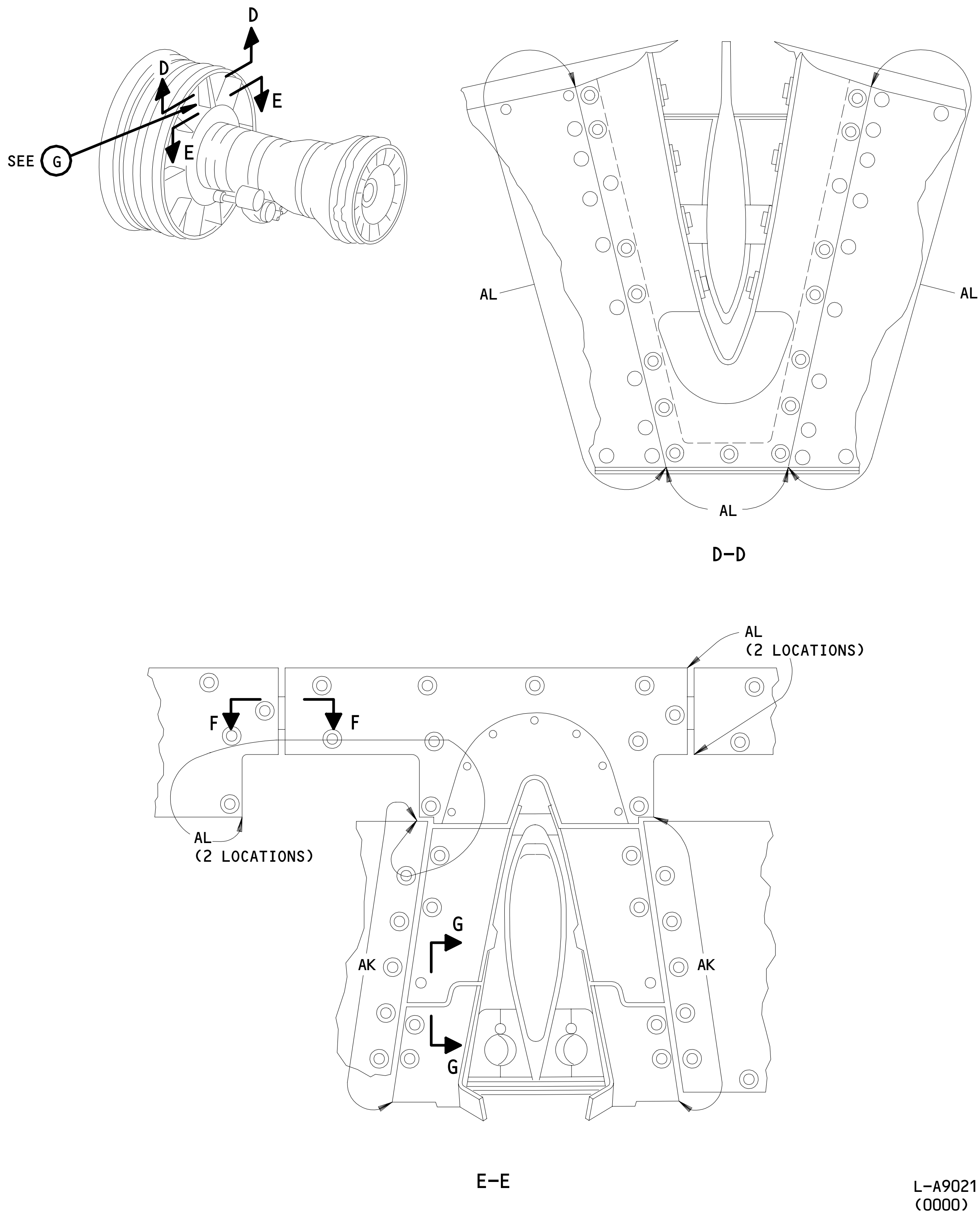
Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 5)



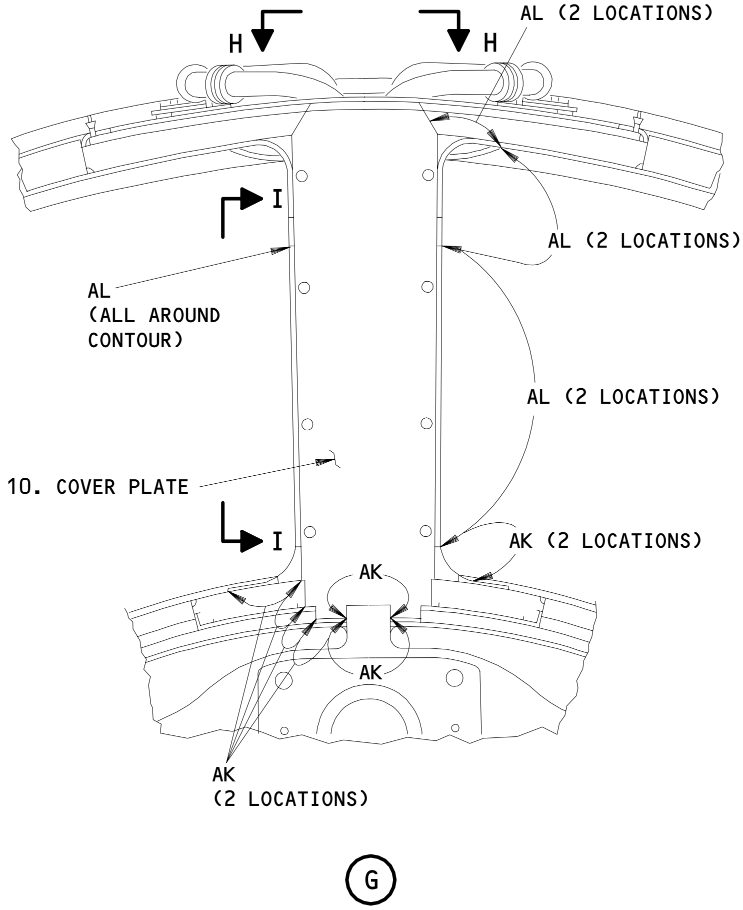


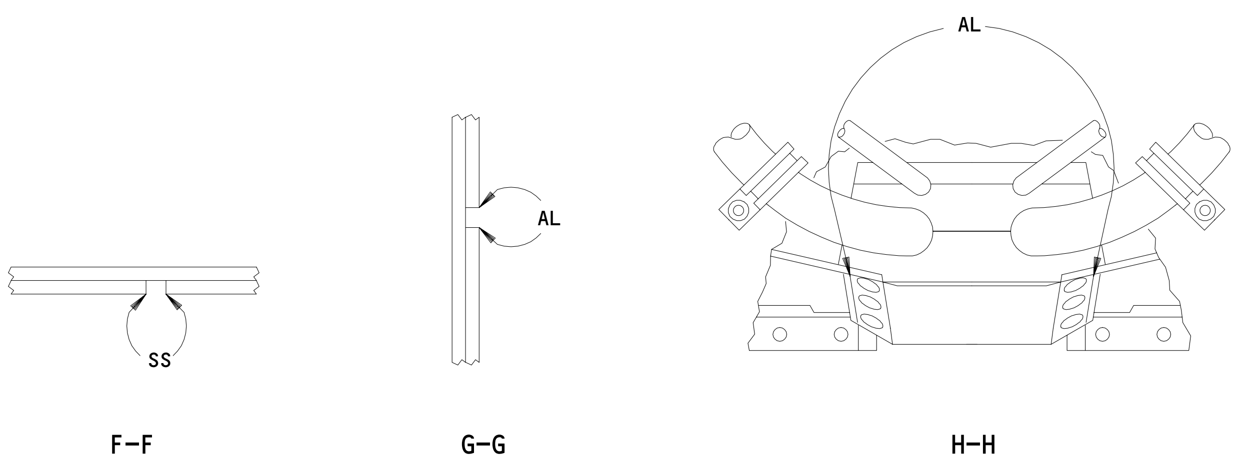
L-A8013 (0000)

Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 6)



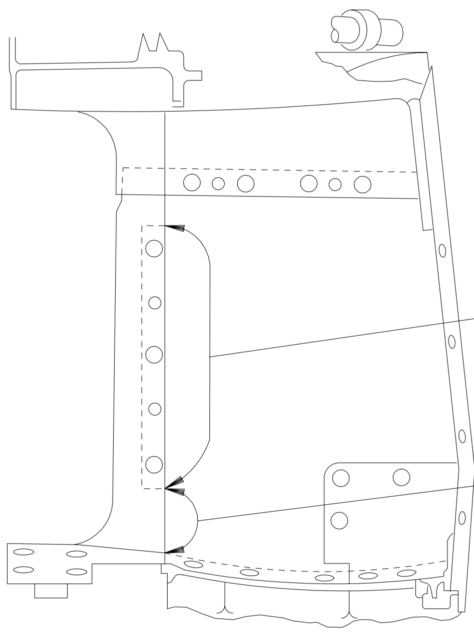
Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 7)





L-A7655 (1291)

Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 8)



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L-A7664

Fan Exit (Bifurcation) Fairing Installation
Figure 402 (Sheet 9)

TASK 72-34-04-424-037-N00

4. ENGINES POST-PW-SB 72-382;
Install the Fan Exit Fairing

A. General
   (1) If it is necessary to install a new access cover, do the procedure to repair the Fan Exit (Bifurcation) Fairing (AMM 72-34-04/801).

B. Consumable Materials
   (1) A00482 Sealant - Silicone Rubber, PWA 36003
   (2) B00666 Solvent - Methyl Propyl Ketone (MPK)
   (3) D00137 Engine Oil - PWA 521B
   (4) G00033 Cheesecloth - Unsized
   (5) G00983 Paper - Kraft, Medium or Light Duty

C. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 78-31-00/201, Thrust Reverser System

D. Access
   (1) Location Zones

411	Engine (Left)
421	Engine (Right)

   (2) Access Panels

413	Fan Cowl Panel (Left)
414	Fan Cowl Panel (Right)
415	Fan Reverser (Left)
416	Fan Reverser (Right)
417	Core Cowl (Left)
418	Core Cowl (Right)
423	Fan Cowl Panel (Left)
424	Fan Cowl Panel (Right)
425	Fan Reverser (Left)
426	Fan Reverser (Right)
427	Core Cowl (Left)
428	Core Cowl (Right)

E. Install the Fan Exit Fairing (Fig. 402)

NOTE: The side panels, the leading edge, and the access covers together are the inner fairing (3).

S 424-038-N00

(1) Do the steps that follow to install the Fan Exit Fairing

NOTE: Unless it is specified differently, remove the shoulder screws with a No. 3 cross-drive (Phillips). Remove all of the other screws with a No. 10 Torq-set drive.

CAUTION: MAKE SURE YOU USE THE CORRECT PART NUMBERS BECAUSE INCORRECT PARTS CAN BE INSTALLED. REFER TO PW SB 72-161 AND PW SB 72-382.

(a) Install the fairings loosely.
(b) Install the gasket (16), open end rearward, around the bottom of the 12 o'clock strut.
(c) Install the left and right side panels of the fan exit inner fairing (3) on the gasket.
(d) Install the countersunk screws (8), lubricated with Engine Oil, in the four forward bolt holes.
(e) Tighten the screws with your hand.

CAUTION: BE VERY CAREFUL WHEN YOU INSTALL THE INNER FAIRING (LEADING EDGE). IT IS POSSIBLE THAT THERE ARE WASHERS ATTACHED TO THIS PART OF THE FAIRING. IT IS EASY FOR THESE WASHERS TO BECOME LOOSE AND FALL OFF.

(f) Install the leading edge of the inner fairing (3) to have an overlap on the side panels.

NOTE: Make sure the forward ends of the leading edge do overlap the installed front liner segments correctly.

1) Attach the leading edge to the case.
2) Install the screws (15), lubricated with Engine Oil, in the bolt holes.
3) Tighten the screws with your hand.
4) Attach the leading edge to the side panels.
5) Install the screws (7), lubricated with Engine Oil, in the bolt holes.
6) Tighten the screws with your hand.

(g) Attach the two access covers (6) with screws (4) and (5), lubricated with Engine Oil.
1) Tighten the screws with your hand.
(h) Install the two shoulder screws (9), lubricated with Engine Oil, into the side panels.
1) Tighten the shoulder screws against the panels (3).
(i) Tighten the countersunk screws (8) of the side panels.
(j) Tighten the screws (7) and (8) of the leading edge.

NOTE: Use Torx tip T-10 with screws (7).

(k) Tighten the screws (4) and (5) of the access covers (6) against the covers.

S 224-039-N00
(2) Do a check of the clearance between the trailing edge of the inner fairing leading edge and the leading edge of the side panels (Fig. 402).

NOTE: The necessary clearance is 0.000 - 0.040 Inch (0.00 - 1.02 mm).

(a) Where the clearance is not correct, attach washers to the bolt holes at the trailing edge of the inner fairing leading edge as follows (See Table 401 for washer thicknesses):

TABLE 401
WASHER THICKNESSES

Class	Washer Thickness - Inch (mm)
1	0.009 - 0.011 (0.229 - 0.279)
2	0.019 - 0.021 (0.483 - 0.503)
3	0.029 - 0.031 (0.737 - 0.787)
4	0.039 - 0.041 (0.991 - 1.041)
5	0.049 - 0.051 (1.224 - 1.295)
6	0.099 - 0.101 (2.514 - 2.565)

(b) Remove the screws from the trailing edge of the inner fairing (3) leading edge.

(c) Clean the washers and the area around the bolt holes with a clean piece of Cheesecloth that is moist with Alcohol.
1) Dry the surfaces fully in air that is at ambient temperature.

NOTE: There must be no alcohol on the parts when the sealant is applied.

(d) Put the washers in the correct position on the fairing (install the screws if it is necessary).
(e) Bond the washers to the inner fairing (3) (leading edge) with a fillet of Sealant all around.
1) Cure the sealant in air that is at ambient temperature for two hours, minimum.

NOTE: Do this until it is dry (not tacky), before you touch it.

NOTE: It is permitted to have a very small quantity of the sealant between the washer and the fairing.

(f) Attach the trailing edge of the inner fairing (3) (leading edge) with screws.
1) Lubricate the threads of the screws with with Engine Oil (Refer to Table 402 for screw lengths).
(g) Tighten the screws against the inner fairing (3) (leading edge).

TABLE 402
WASHER THICKNESS AND SCREW LENGTH

Screw PN	Screw Length	Washer Thickness	Quanity of Screws
593111	0.495 - 0.505 in.	0.000 - 0.015 in.	0 - 2 As Necessary
ST1382-09	0.542 - 0.562 in.	0.016 - 0.070 in.	0 - 2 As Necessary
ST1382-10	0.594 - 0.625 in.	0.071 - 0.130 in.	0 - 2 As Necessary
ST1382-11	0.656 - 0.687 in.	0.131 - 0.210 in.	0 - 2 As Necessary

S 414-040-N00
(3) Continue to install the fairings loosely (Refer to Fig. 402).
(a) Loosen screws (9), (5), (15), (7), (4), and (5) one full turn.
(b) Install the fan exit outer fairing assembly (1).
1) Attach the outer fairing (1) to the inner fairings (3) with screws (12), lubricated with Engine Oil.
2) Tighten the screws with your hand.

(c) Attach the outer fairing (1) to the outer case with the screws (14) and shoulder screws (13), lubricated with Engine Oil.
   1) Tighten the screws with your hand.
(d) Tighten all the outer fairing screws (13), (14), and (12) in this sequence (13, 14, 12).
   1) Loosen the screws (13), (14), and (12) in this sequence (13, 14, 12), one full turn.
(e) Install the cover plate (10).
   1) Attach the cover plate (10) to the inner (3) and outer fairings (1) with screws (11), lubricated with Engine Oil.
   2) Tighten the screws against the cover, then loosen them one full turn.

      NOTE: The fairings must be sufficiently loose to permit radial movement. If they are not, loosen the screws another one quarter turn.

(f) Tighten the cover plate screws (11) to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self-locking feature.

   NOTE: The maximum torque is 40 lb-in (4.519 N.m).

S 824-041-N00
(4) Adjust the height of the fairing cover plate as follows (Fig. 402):
   (a) Lower the fairing/cover plate assembly (1) against the intermediate case platform,
      1) Do this while you keep to the dimensions in Figure 402 Sheet 6.

TABLE 403 DIMENSIONS FOR FIGURE 402 SHEET 6	
CALLOUT	LIMIT
AZ	0.731 - 0.831 in. (18.6 - 21.1 mm)
BB	42.000 in. (1066.800 mm) to the engine centerline.
BA	28.170 in. (715.518 mm) to engine center line.
AY	1.640 - 1.740 in. (41.7 - 44.2 mm)
BE	Choose the correct class of washer, 0 to 3 units as necessary, at positions BE. The total height must not be more than 0.253 in. (6.426 mm).

(b) If there are spaces under the flaps of the side panels (3) and access covers (6) , install classified washers below the bolt holes (See Figure 402, Sheet 6, Item BE).

(c) Bond the classified washers to the inside of the access covers (6) at boltholes BE as follows:

1) Clean the bond areas with Alcohol.

2) With the Sealant, make a fillet all around the edges of the washers.

<u>NOTE</u>: The sealant is not permitted between the washers and the intermediate case. It is also not permitted between the washers and the fairings.

3) Cure the sealant in air that is at ambient temperature, and that has a relative humidity of 25 percent.

a) Cure the sealant for two hours before you touch it.

(d) Tighten the remaining screws as follows (See Figure 402).
  1) Tighten the access cover screws (5) to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self-locking feature.

     NOTE: The maximum torque is 40 lb-in. (4.519 N.m).

  2) Tighten the two shoulder screws (9) in the side panels.
     a) Tighten these screws (9) to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self- locking feature.

        NOTE: The maximum torque is 95 lb-in. (10.734 N.m).

  3) Tighten the inner fairing screws (8), (15), and (4) that attach the fairings/access covers to the case.
     a) Tighten these screws (8), (15), (4), to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self-locking feature.

        NOTE: The maximum torque is 40 lb-in. (4.519 N.m).

  4) Tighten the two shoulder screws (13) in the outer fairing (1).
     a) Tighten these screws (13) to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self-locking feature.

        NOTE: The maximum torque is 95 lb-in. (10.734 N.m).

  5) Tighten the remaining outer fairing screws (14) that attach the outer fairing (1) to the case.
     a) Tighten these screws (14) to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self- locking feature.

        NOTE: The maximum torque is 40 lb-in. (4.519 N.m).

  6) Examine the position of the cover plate (10) to make sure that the dimensions agree with Figure 402 Sheet 6.

     NOTE: If they do not, loosen all the screws and do the procedure again.

7) Tighten the leading edge screws (7) that attach the leading edge to the side panels.

NOTE: Use Torx tip T-10.

a) Tighten these screws (7)to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self-locking feature.

NOTE: The maximum torque is 40 lb-in. (4.519 N.m).

8) Tighten the outer fairing screws (12) that attach the outer fairing to the inner fairings (3) .

a) Tighten these screws (12) to 22 lb-in. (2.486 N.m) plus the torque necessary to turn the screw through the self-locking feature.

NOTE: The maximum torque is 40 lb-in. (4.519 N.m).

(e) Apply the sealant to Area AK (See Table 404 and Figure 402 Sheet 7).

TABLE 404
SEALANT LIMITS FOR FIGURE 402 SHEET 7

	APPLICATION OF SEALANT
1	Apply the sealant to make a surface continuous with, to 0.010 Inch (0.254 mm) above, surface.
2	Apply the sealant to make a surface continuous with, to 0.010 Inch (0.254 mm) below, all around the access cover, two places.

(f) Clean the areas the sealant will touch, with Alcohol.

(g) Apply a layer of Primer to all cleaned surfaces.

NOTE: You must apply the primer in less than two hours after the area to be primed was cleaned.

The primer layer must dry in air at ambient temperature a minimum of two hours.

The air must have a minimum relative humidity of 25 percent.

(h) Apply the Sealant.
1) You must apply the sealant from 2 - 24 hours after the primer was applied.
2) Use a hot air gun at 175° - 225°F (79.° - 107.°C) for 5 - 7 minutes to dry the sealant.
3) After you use the hot air gun, the sealant must be cured in air that has a minimum relative humidity of 25 percent.

NOTE: Do this for a minimum of eight hours before you touch the parts.

(i) Apply the sealant to Area AL (Figure 402 Sheet 7) as follows:
1) Clean the areas the sealant will touch, with Alcohol.
2) Apply the sealant.
3) Dry the sealant in air that is at ambient temperature.
4) Make sure the relative humidity is a minimum of 25 percent.
5) Make sure the sealant dries for a minimum of two hours, and until it is dry (not tacky), before you touch the parts.
6) It is recommended that you cure the sealant for a minimum of eight hours, before you operate the engine.

F. Put the Airplane Back to Its Usual Condition.

S 414-042-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-044-N00
(2) Close the core cowl panels (AMM 71-11-06/201).

S 414-045-N00
(3) Close the fan cowl panels (AMM 71-11-04/201).

S 444-046-N00
(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-047-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

TASK 72-34-04-424-048-N00
5. Install The Access Covers of the Fan Exit (Bifurcation) Fairing
A. General
(1) If it is necessary to install a new access cover, and bolt holes in the cover, do the procedure that follows:
(a) Repair the Fan Exit (Bifurcation) Fairing (AMM 72-34-04/801).

B. Equipment
   (1) No. 10 Torq-set Drive
C. Consumable Materials
   (1) G02147 Cheesecloth, Unsized (GA 100-11)
   (2) D00524 Oil, Engine (PWA 521B)
   (3) Sealant, Silicone Rubber (PWA 36003)
   (4) Sealant, Flame Resistant Silicone (PWA 36751-1)
   (5) Sealant, Silicone Rubber (PWA 36003-2)
   (6) Primer, Silicone (PWA 36086-2)
   (7) B00740 Alcohol, Isopropyl (PMC 9094)
D. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 72-34-04/801, Fan Exit (Bifurcation) Fairing
   (4) AMM 78-31-00/201, Thrust Reverser System
E. Access
   (1) Location Zones

411	Engine (Left)
421	Engine (Right)

   (2) Access Panels

413	Fan Cowl Panel (Left)
414	Fan Cowl Panel (Right)
415	Fan Reverser (Left)
416	Fan Reverser (Right)
417	Core Cowl (Left)
418	Core Cowl (Right)
423	Fan Cowl Panel (Left)
424	Fan Cowl Panel (Right)
425	Fan Reverser (Left)
426	Fan Reverser (Right)
427	Core Cowl (Left)
428	Core Cowl (Right)

F. Prepare for the Procedure

S 944-049-N00
   (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

S 044-050-N00

<u>WARNING</u>: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

   (2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 014-051-N00
   (3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-052-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-053-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

G. Procedure

S 424-054-N00
(1) Do the steps that follow to install the access covers.

NOTE: Use a No. 10 Torq-set drive to install the screws.

CAUTION: MAKE SURE YOU USE THE CORRECT PART NUMBERS BECAUSE INCORRECT PARTS CAN BE INSTALLED. REFER TO PW SB 72-161 AND PW SB 72-382.

(a) Install the access covers (6) and the rear cover plate (1) as follows (Fig. 401):
(b) Install the two access covers (6) to the fan exit fairing (3) with the ten screws (5) and (4), lubricated with Engine Oil.

NOTE: If the engine has PW SB 72-382, do the step that follows when you do this step.

(c) AIRPLANES POST-PW-SB 72-382;
Bond the classified washers to the inside of the Access Covers at bolt holes (5) as follows:

1) Use this procedure for one of the two conditions that follow:
   a) The access covers are the same covers you removed, and they had classified washers bonded to them. But, the washers fell off or are loose.
   b) The access covers are new and the replacement covers had washers bonded to them.
2) Put the same quantity of washer, in the same positions on the new covers that, were on the old covers.
3) Clean the areas the sealant will touch, with alcohol on a the Cheesecloth.

4) With the sealant, make a fillet all around the edges of the washers.

NOTE: The sealant is not permitted between the washers and the intermediate case. It is also not permitted between the washers and the access covers.

5) Cure the sealant in air that is at ambient temperature, and has a minimum relative humidity of 25 percent.
a) Cure the sealant for two hours before you touch it.

(d) Tighten the four screws (5) against the two covers (6) and then loosen the screws (5) one full turn.
(e) Tighten the six screws (4) against the two covers (6) and then loosen all six screws (4) one full turn.
(f) Install the (rear) cover plate (1) to the fan exit fairing (3) with the eight screws (2), lubricated with Engine Oil.
(g) Tighten the screws (2) against the cover plate (1) and then loosen the screws (2) one full turn.
(h) Tighten the screws (2) to 22 pound-inches (2.486 newton-meters) plus the torque necessary to turn them through the locking feature of the nuts.

NOTE: The maximum torque is 40 pound-inches (4.519 newton-meters).

(i) Tighten the four screws (5) to 22 pound-inches (2.486 newton-meters) plus the torque necessary to turn them through the locking feature of the nuts.

NOTE: The maximum torque is 40 pound-inches (4.519 newton-meters).

(j) Torque the six screws (4) to 22 pound-inches (2.486 newton-meters) plus the torque necessary to turn them through the locking feature of the nuts.

NOTE: The maximum torque is 40 pound-inches (4.519 newton-meters).

S 394-055-N00
(2) Apply the sealant to Areas AK as follows (Fig. 402 Sheet 7):

TABLE 405 SEALANT LIMITS FOR FIGURE 402 SHEET 7	
	APPLICATION OF SEALANT
1	Apply the sealant to make a surface continuous with: To 0.010 Inch (0.254 mm) above the surface.
2	Apply the sealant to make a surface continuous with, to 0.010 Inch (0.254 mm) below, all around the access cover, two places.

(a) Clean the areas the sealant will touch.

NOTE: Use a Cheesecloth that is wet with Alcohol. Before you apply the primer, make sure there is no alcohol on the surfaces to be primed.

(b) Apply the Primer to all cleaned surfaces.
1) You must apply the primer in less than two hours after the area is cleaned.
2) The primer must dry in air at ambient temperature for a minimum of hours.
a) The air must have a minimum relative humidity of 25 percent.

(c) Apply the Sealant.

NOTE: You must apply the sealant from 2 - 24 hours after you have applied the primer.

1) Use a hot air gun at 175° - 225°F (79° - 107°C) for 5 - 7 minutes to dry the sealant.
2) After you complete the hot air gun procedure, cure the sealant in air with a minimum relative humidity of 25 percent.

NOTE: You must cure the sealant for a minimum of eight hours before you touch the parts.

S 394-056-N00

(3) Apply the Sealant to Area AL as follows (Fig. 402 Sheet 7):

(a) Clean the areas the sealant will touch with alcohol on a Cheesecloth.

<u>NOTE</u>: Before you apply the sealant, make sure there is no alcohol on the surfaces.

(b) Apply the sealant.

1) Cure the sealant in ambient air that has a minimum relative humidity of 25 percent, for a minimum of two hours.

<u>NOTE</u>: Make sure the parts are dry (not tacky) before you touch them.

2) Make sure you cure the sealant for eight hours before you operate the engine.

H. Put the Airplane Back to Its Usual Condition.

S 414-057-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-058-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 414-059-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 444-060-N00

(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-061-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

FAN EXIT (BIFURCATION) FAIRING - INSPECTION/CHECK

1. General
   A. This procedure gives the tasks to do an inspection of the Fan Exit (Bifurcation) Fairing. This fairing will be referred to as the Fan Exit Fairing.
   B. The Fan Exit Fairing is found on the outer rear circumference of the intermediate case, aft of the fan case.

TASK 72-34-04-216-001-N00

2. Do the Inspection of the Fan Exit (Bifurcation) Fairing
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 72-34-04/401, Fan Exit (Bifurcation) Fairing
      (4) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zones

411	Engine (Left)
421	Engine (Right)

      (2) Access Panels

413	Fan Cowl Panel (Left)
414	Fan Cowl Panel (Right)
415	Fan Reverser (Left)
416	Fan Reverser (Right)
417	Core Cowl (Left)
418	Core Cowl (Right)
423	Fan Cowl Panel (Left)
424	Fan Cowl Panel (Right)
425	Fan Reverser (Left)
426	Fan Reverser (Right)
427	Core Cowl (Left)
428	Core Cowl (Right)

   C. Prepare to Do the Inspection

      S 046-002-N00

      WARNING: DO THE PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

      (1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 016-003-N00
(2) Open the fan cowl panels (AMM 71-11-04/201).

S 016-004-N00
(3) Open the core cowl panels (AMM 71-11-06/201).

S 016-005-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reversers (AMM 78-31-00/201).

D. Do the Inspection of the Fan Exit Fairing (Fig. 601)

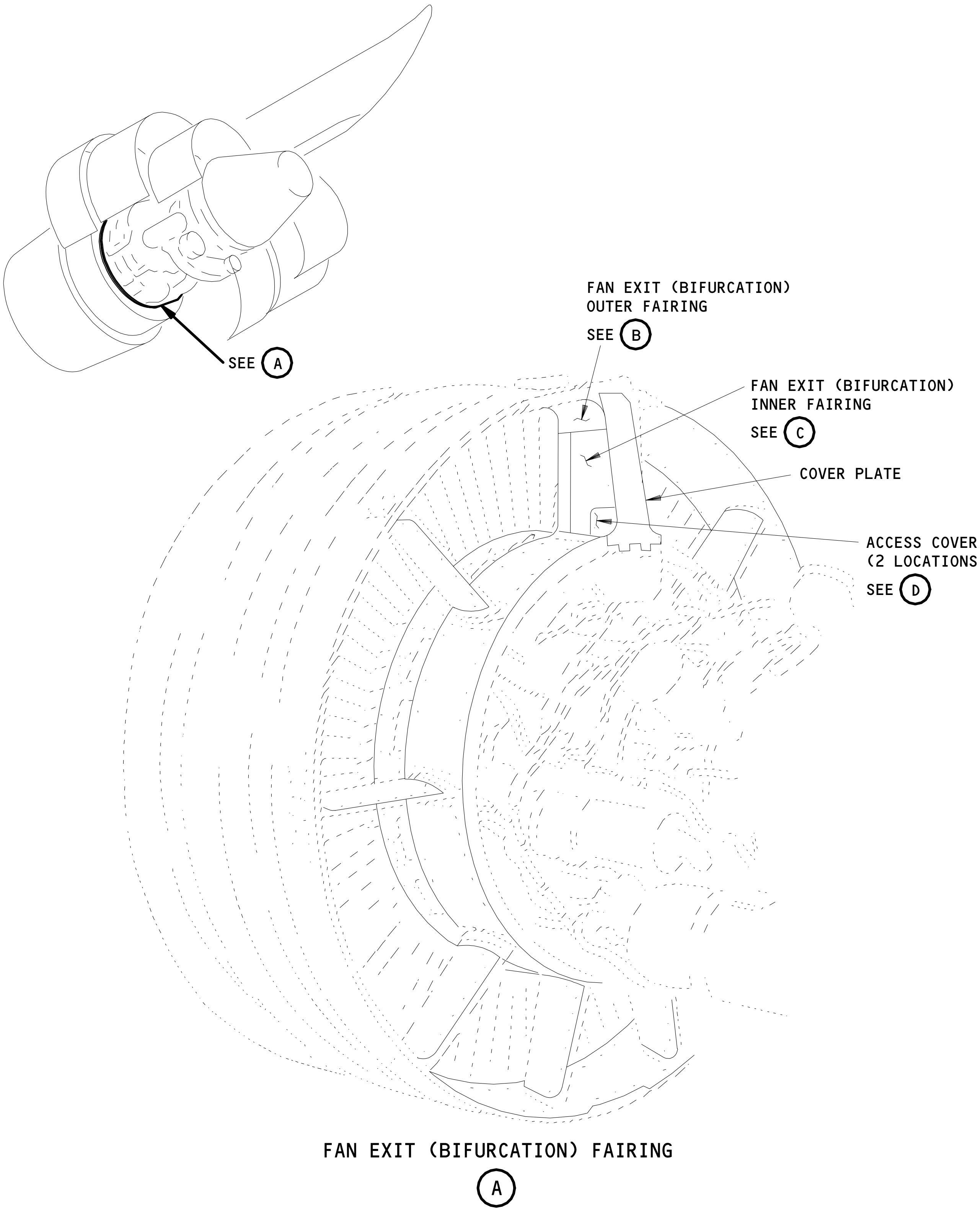
S 216-006-N00
(1) Visually examine the fairings for the signs of the damage shown in the tables that follow:

NOTE: This inspection does not include the inspection of the cover plate.

(a) If damage is not in the limits, replace the damaged part (AMM 72-34-04/401).

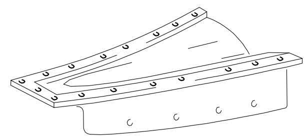
TABLE 601
INSPECTION FOR MISSING PARTS OR LOOSE PARTS

	DAMAGE LIMITS	
EXAMINE THE FAN EXIT FAIRINGS	REPLACE IN NOT MORE THAN 50 HOURS	TIGHTEN IN NOT MORE THAN 50 HOURS
Bifurcation Fairings If a part of, or all of the fairing is missing	Replace the fairing	
Screws If not there	Replace the screw	
If loose		Tighten the screw
Rivets If not there or loose	Replace the rivet	
Washers If not there	Replace the washer	



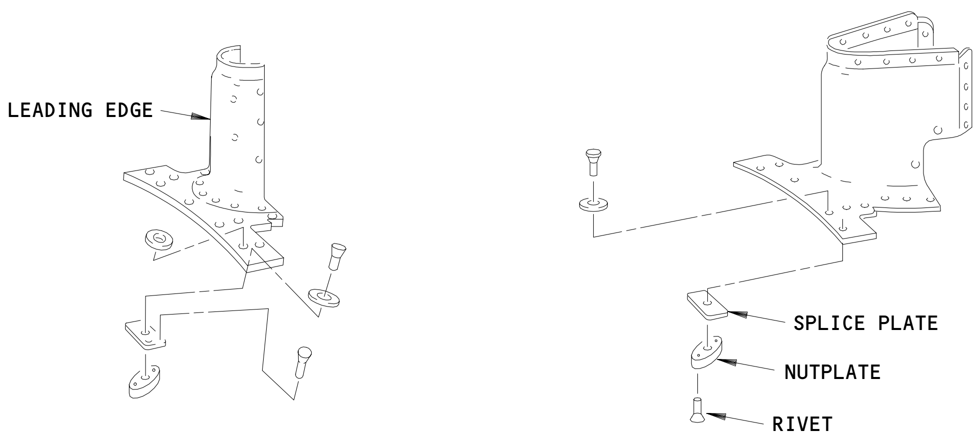
L-A8017 (000)

Fan Exit (Bifurcation) Fairing
Figure 601 (Sheet 1)



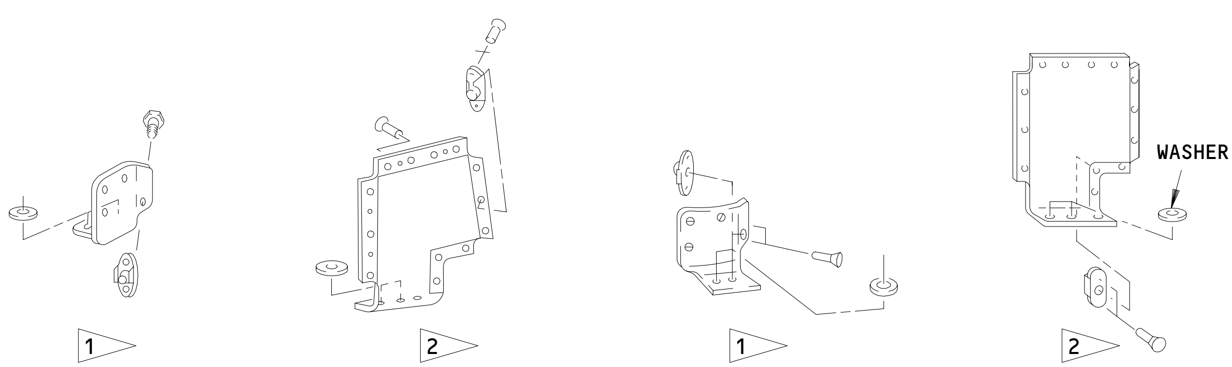
FAN EXIT OUTER FAIRING

B



FAN EXIT INNER FAIRING

C



ACCESS COVER
(2 LOCATIONS)

D

1 WITHOUT PW SB 72-161
2 WITH PW SB 72-161

L-A8543 (0000)

Fan Exit (Bifurcation) Fairing
Figure 601 (Sheet 2)

TABLE 602
INSPECTION FOR NICKS, DENTS, AND OTHER SURFACE DAMAGE

	DAMAGE LIMITS		
EXAMINE ALL SURFACES FOR:	PERMITTED	REPLACE IN NOT MORE THAN 50 HOURS	REPLACE BEFORE NEXT USE
Nicks and Gouges Width or Length Depth		More than 1.00 in. (25.400 mm) More than 0.030 in. (0.762 mm)	
Separation (from other damage) Number		Less than 2.000 in. (50.800 mm More than 5	
Dents (with rounded bottoms) Depth Quanity		More than 0.030 in. (0.762 mm) More than 10 percent of the surface area	
Cracks in the composite material Length		More than 1.000 in. (25.400 mm)	
Separation (from the center of an attachment rivet or screw)		Less than 0.500 in. (12.700 mm)	
Cracks in the titanium leading edge		None are permitted	

TABLE 602 INSPECTION FOR NICKS, DENTS, AND OTHER SURFACE DAMAGE			
	DAMAGE LIMITS		
EXAMINE ALL SURFACES FOR:	PERMITTED	REPLACE IN NOT MORE THAN 50 HOURS	REPLACE BEFORE NEXT USE
Areas of broken or fuzzy stray fibers			
Width or length		1.00 - 2.50 in. (25.40 - 63.50 mm)	More than 2.50 in. (63.500 mm)
Depth		More than 0.030 in. (0.762 mm)	
Separation (from any other damage)		Less than 2.00 in. (50.800 mm)	
Punctures, holes			
Leading edge of fairing			None are permitted
All other areas		None are permitted	
No bond of wire cloth patch			
Length or width		More than 0.50 in. (12.700 mm)	

TABLE 603
INSPECTION FOR DELAMINATION

	DAMAGE LIMITS		
EXAMINE FOR	EXAMINE EVERY 50 HOURS	REPLACE IN NOT MORE THAN 50 HOURS	REPLACE BEFORE NEXT USE
Delaminations Width or Length Depth	Up to 1.00 in. (25.400 mm) Up to 0.030 in. (0.762 mm)	1.000 - 2.500 in. (25.40 - 63.50 mm) More than 0.030 in. (0.762 mm)	More than 2.50 in. (63.500 mm)
Separation (from any other damage)	More than 2.00 in. (50.800 mm)	Less than 2.00 in. (50.800 mm)	

TABLE 604
INSPECTION FOR EROSION

	DAMAGE LIMITS		
EXAMINE THE LEADING EDGES FOR EROSION	REPLACE IN NOT MORE THAN 50 HOURS	REPLACE IN NOT MORE THAN 25 HOURS	REPLACE BEFORE NEXT USE
Dull or rough surface finish	Any Quanity		
Fibers are visible		Any quanity	
Holes			Any quanity

E. Put the Airplane Back to Its Usual Condition.

S 416-007-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 416-008-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 416-009-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 446-010-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

FAN EXIT (BIFURCATION) FAIRING - APPROVE REPAIRS

1. General
   A. This procedure gives the tasks to repair the Fan Exit (Bifurcation) Fairing. This fairing will be referred to as the Fan Exit Fairing.
   B. The Fan Exit Fairing is found on the outer rear circumference of the intermediate case, aft of the fan case.

TASK 72-34-04-348-001-N00

2. Repair The Fan Exit (Bifurcation) Fairing
   A. Consumable Materials
      (1) G02147 Cheesecloth, Unsized (GA 100-11)
      (2) C00161 Wetting Agent (PMC 1610)
      (3) A00940 Resin, Liquid Epoxy (PWA 421-2)
      (4) A00942 Agent, Epoxy Resin Curing (PWA 422)
      (5) A00016 Epoxy, Adhesive Paste (P08-016, PWA 457)
      (6) B00143 Solvent, Trichlorotrifluoroethane
      (7) B00740 Alcohol, Isopropyl (PMC 9094)
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones
         411 Engine (Left)
         421 Engine (Right)

   D. Prepare to Do the Repair of the Fan Exit Fairing

      S 048-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead panel, P5.

      S 048-003-N00

      WARNING: DO THE PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

      (2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-004-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 018-005-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 018-006-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

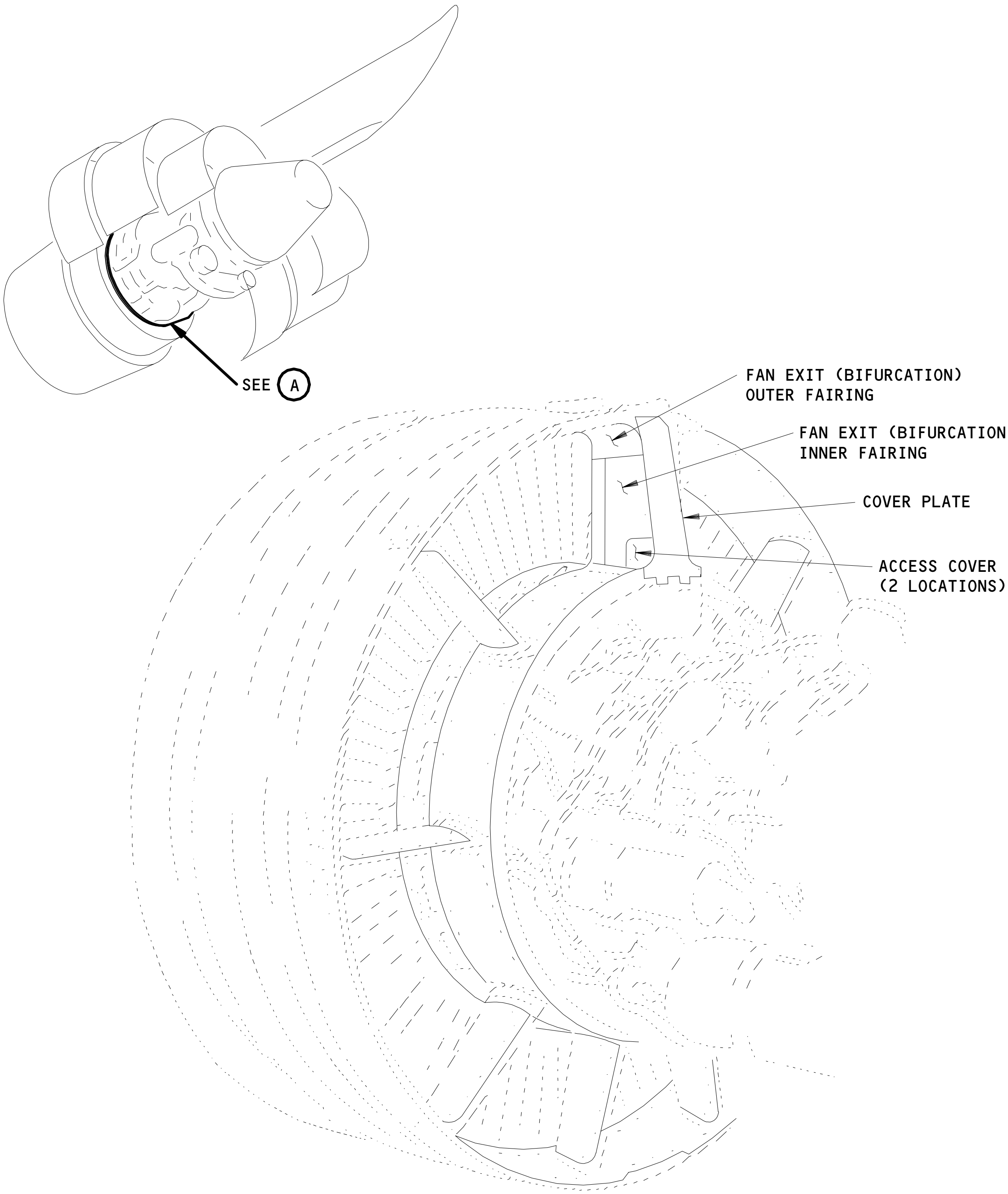
E. Install Bolt Holes In The Replacement Access Covers (Fig. 801)

S 348-007-N00

(1) Install bolt holes in the replacement access covers as follows:

(a) Remove the cover plate and the damaged access cover(s) from the strut at the 12 o'clock position (AMM 72-34-04/401).

NOTE: Do not remove the other fairings from the strut.

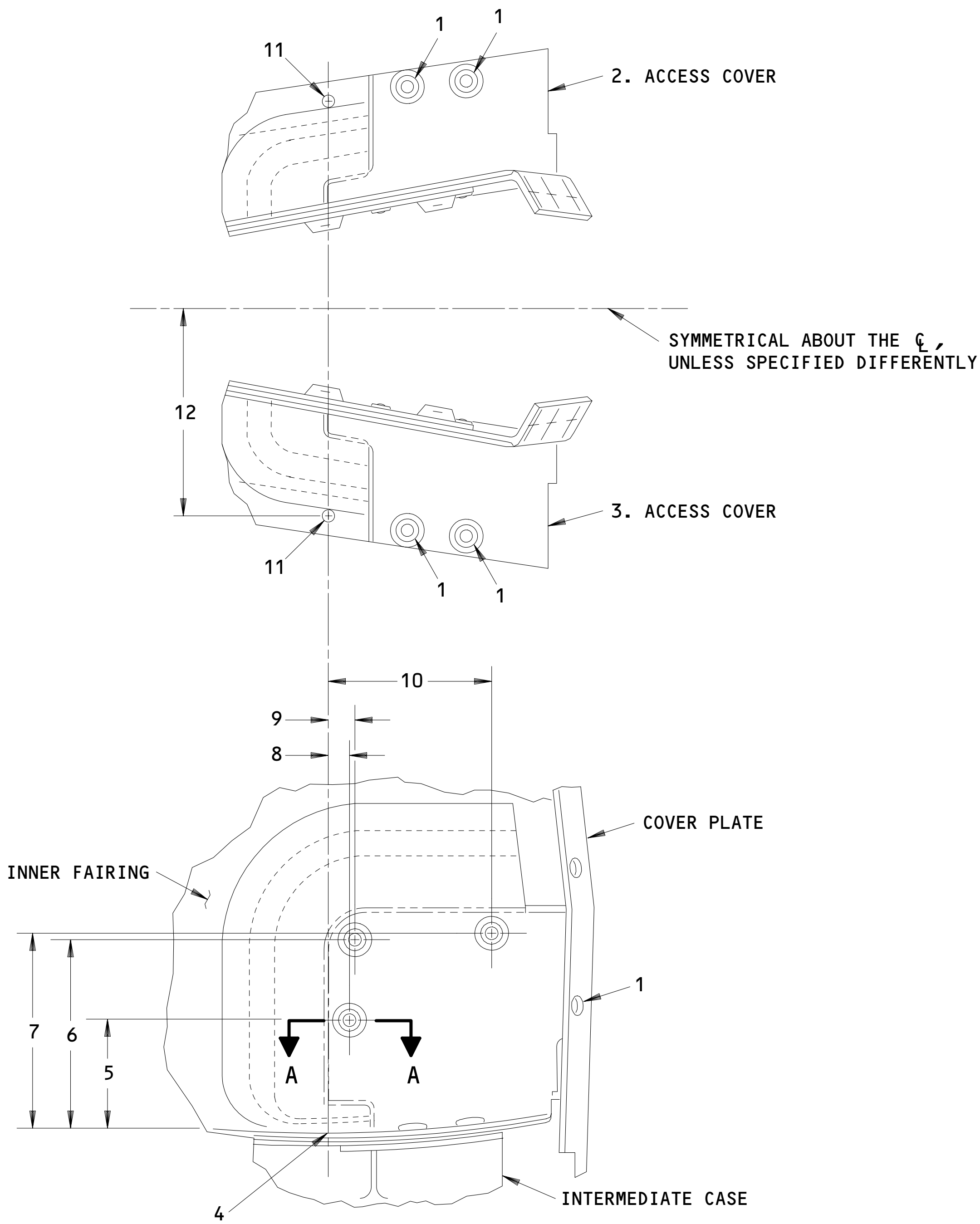


FAN EXIT (BIFURCATION) FAIRING

A

L-A8017 (000)

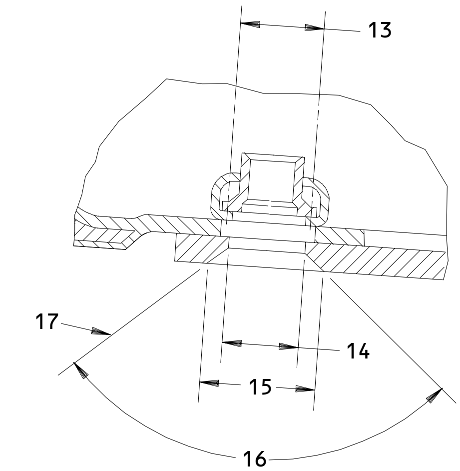
Fan Exit (Bifurcation) Fairing
Figure 801 (Sheet 1)



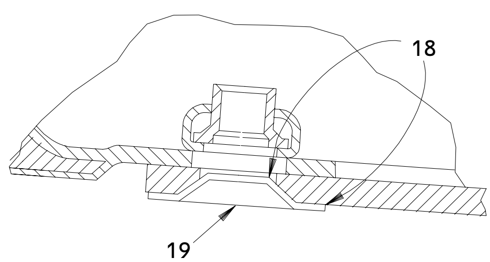
RIGHT SIDE VIEW
(LEFT SIDE EQUIVALENT)

L-A8018 (000)

Fan Exit (Bifurcation) Fairing
Figure 801 (Sheet 2)



A-A
(WASHERS NOT SHOWN)



A-A

L-A8022 (000)

Fan Exit (Bifurcation) Fairing
Figure 801 (Sheet 3)

TABLE 801
INSTALLATION CALLOUTS FOR FIGURE 801

CALLOUT	LIMIT
1	Install a work bolt here.
2	PN 51G752-01
3	PN 51G751-01
4	Points T and U
5	2.094 Inches (53.188 mm)
6	3.659 Inches (92.939 mm)
7	3.764 Inches (95.606 mm)
8	0.369 Inch (9.373 mm)
9	0.473 Inch ((12.014 mm)
10	3.105 Inches (78.867 mm)
11	0.327 Inch (8.306 mm)
12	4.011 Inches (101.879 mm)

TABLE 802
INSTALLATION CALLOUTS FOR FIGURE 801

CALLOUT	LIMIT
13	0.354 Inch (8.992 mm) diameter clearance envelope at Surface H is relative to Surface J
14	0.211 - 0.315 Inch (5.4 - 8.0 mm) diameter. Keep the clearance to this diameter. Machine if it is necessary.
15	0.390 - 0.410 Inch (9.91 - 10.41 mm) diameter
16	100° - 102°
17	Six holes normal to Surface K
18	Bond this area all around
19	PN NAS1169C10L Washers, six locations.

(b) Find the positions of the new holes as follows:
   1) Attach a replacement access cover(s) and a cover plate to the inner fairing with bolts at the positions shown in Figure 801.
   2) Make a mark on the centerlines of all the hole diameters.
   3) Remove the work bolts that were installed.
   4) Remove the cover plate.
   5) Remove the access covers.
(c) Install the bolt holes at the positions that were marked.
(d) Apply the sealant to the machined surfaces of the cover(s) as follows:
   1) Clean the machined surfaces of the fairings and the cover(s) with a solution of water and Wetting Agent.
   2) Fully flush the machined surfaces with clean water.
   3) Dry the machined surfaces fully in air that is at ambient temperature.
   4) Mix together, in a 4:1 proportion, Resin and Curing Agent.

5) Apply the epoxy mixture to the machined surfaces.
6) Make sure the epoxy mixture is cured at 175°F (79.4°C) for one hour, minimum.

(e) Bond the washers to the bolt holes.

1) Clean the bond area of the bolt holes with Cheesecloth that is wet with Solvent.
2) Dry the surfaces in air that is at ambient temperature.

NOTE: Make sure that it is for a sufficient length of time to remove all signs of the solvent.

3) Clean the bond area of the washers with Alcohol.
4) Apply a constant layer of Epoxy to each bond area of the access cover(s).

NOTE: Make sure you apply the epoxy in less than 30 minutes after you cleaned the access covers.

5) Bond the washers to the access cover(s).
6) Make sure the epoxy is cured at ambient temperature for two hours, minimum.

F. Put the Airplane Back to Its Usual Condition.

S 418-008-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-011-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 418-010-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 448-009-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 448-012-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

COMPRESSOR INTERMEDIATE CASE FAIRINGS - REMOVAL/INSTALLATION

1. General
   A. This procedure gives the tasks to remove and install the intermediate case fairings. This task includes the instructions to make rivet holes in the new fairing if you replace the old one. This procedure does not change the number of rivet holes in the strut.
   B. The intermediate case fairings are aft of the fan case vanes. On the intermediate case there are eight (8) struts that have two (2) fairings each.
   C. You must open each half of the thrust reverser to get access to the intermediate case fairings.

TASK 72-34-05-004-014-N00

2. Remove the Compressor Intermediate Case Fairing
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zone
          411 Left Engine - LPC Intermediate Case
          421 Right Engine - LPC Intermediate Case

   C. Procedure

      S 044-001-N00

      WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

      (1) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

      S 014-002-N00
      (2) Open the fan cowl panel (AMM 71-11-04/201).

      S 014-003-N00
      (3) Open the core cowl panel (AMM 71-11-06/201).

      S 014-015-N00

      WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

      (4) Open the thrust reversers (AMM 78-31-00/201).

S 024-004-N00
(5) Remove the used fairing.

CAUTION: BE VERY CAREFUL NOT TO MAKE THE RIVET HOLES LARGER OR NOT CIRCULAR WHEN YOU REMOVE THE RIVETS. IF YOU MAKE THE HOLES LARGER OR NOT CIRCULAR THE NEW FAIRING WILL NOT FIT PROPERLY.

(a) Grind off the rivet heads to remove the rivets; do not drill the rivets.
(b) Cut the used sealant at the edges of the old fairing.

CAUTION: DO NOT USE A TOOL TO LIFT THE FAIRING FROM THE STRUT. IF YOU USE A TOOL, YOU CAN CAUSE DELAMINATION OF THE FAIRING.

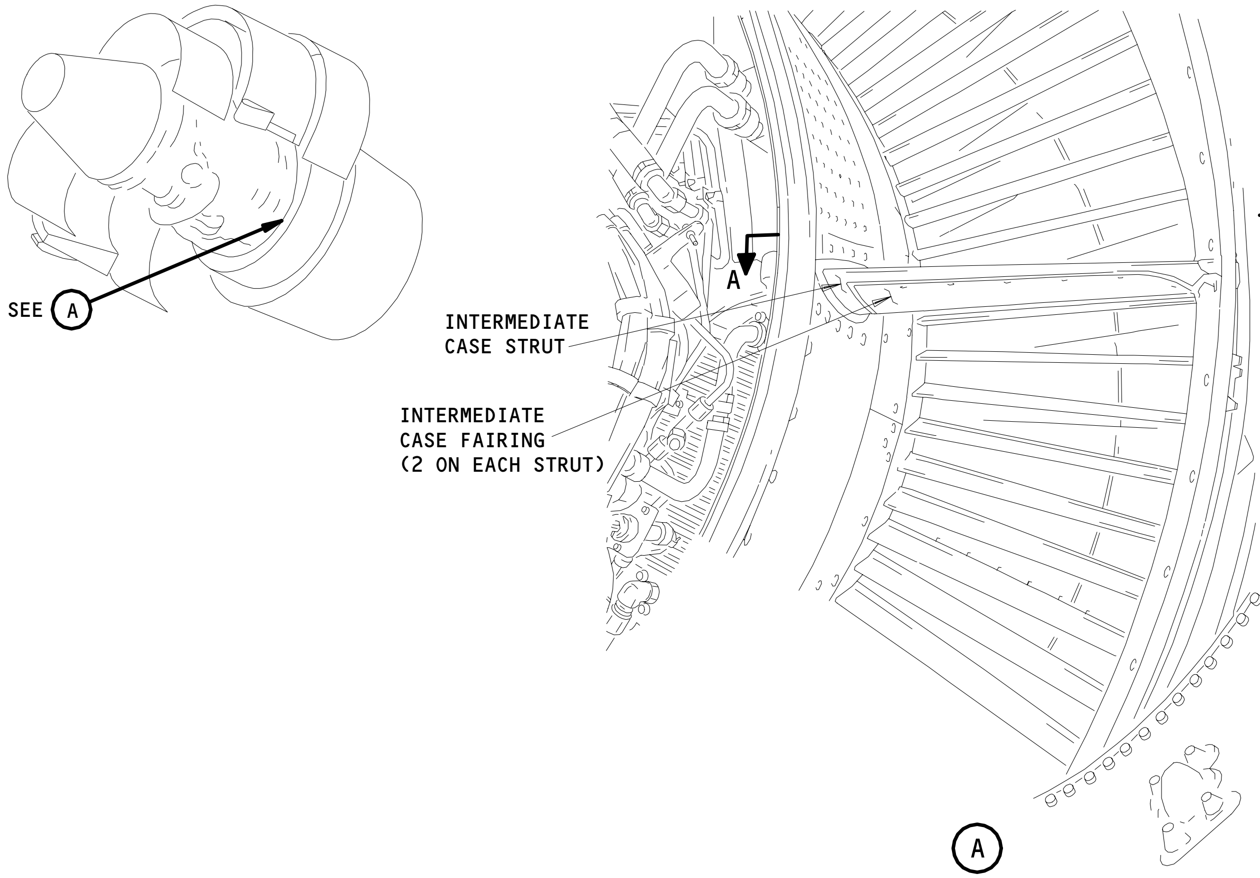
(c) Remove the fairing.
(d) Mechanically remove all damaged or loose sealant from the surfaces of the strut that were bonded.

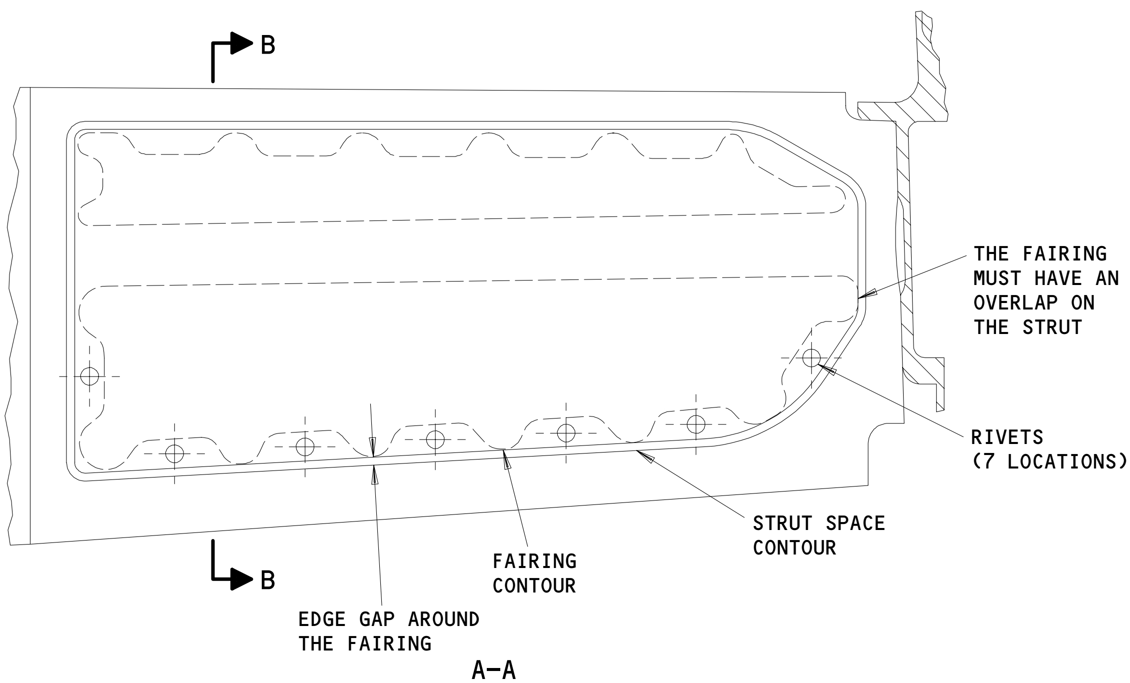
TASK 72-34-05-404-005-N00
3. Install the Intermediate Case Fairing
A. Consumable Materials
(1) G00033 Cheesecloth - Unsized
(2) G00983 Paper - Kraft, Medium or Light Duty
(3) A00091 Sealant - Silicone, Rubber, Red (RTV 159)
(4) A00482 Sealant - Silicone, Rubber, Gray (RTV 157)
(5) B00666 Solvent - Methyl Propyl Ketone (MPK)
(6) B00143 Solvent - Trichlotriflouroethane
(7) C00057 Primer - Zinc Chromate
B. References
(1) AMM 71-11-04/201, Fan Cowl Panels
(2) AMM 71-11-06/201, Core Cowl Panels
(3) AMM 78-31-00/201, Thrust Reverser System
C. Access
(1) Location Zone

412	Engine 1 - LPC Intermediate Case
422	Engine 2 - LPC Intermediate Case
432	Engine 3 - LPC Intermediate Case
442	Engine 4 - LPC Intermediate Case

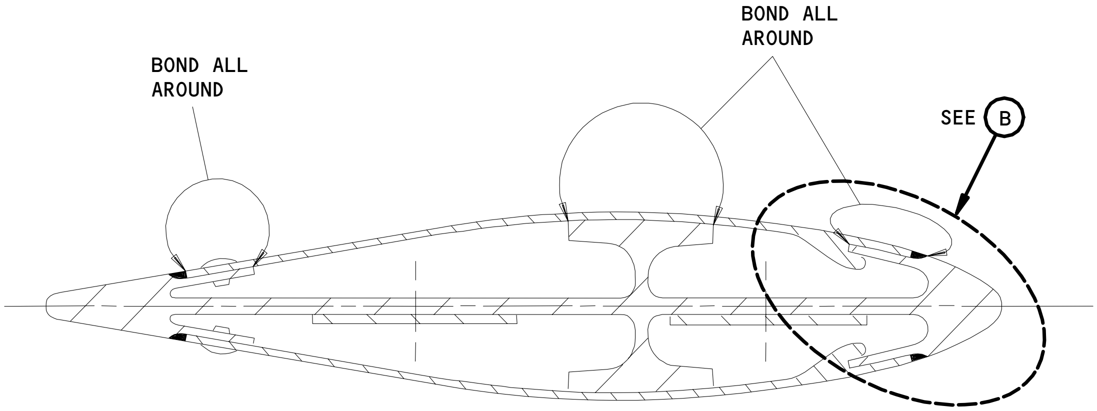
D. Procedure

S 144-010-N00
(1) If you install the used fairing, mechanically remove all damaged or loose sealant from the bonded surfaces of the fairing.

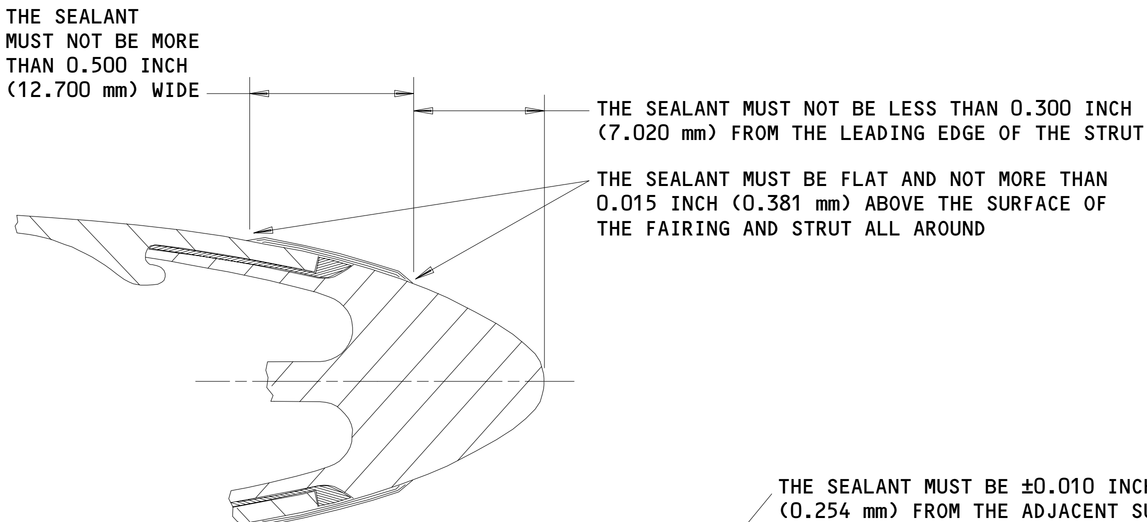




Intermediate Case Fairing with Seven Rivets
Figure 401 (Sheet 1)



(TURNED 90° CLOCKWISE)
B-B



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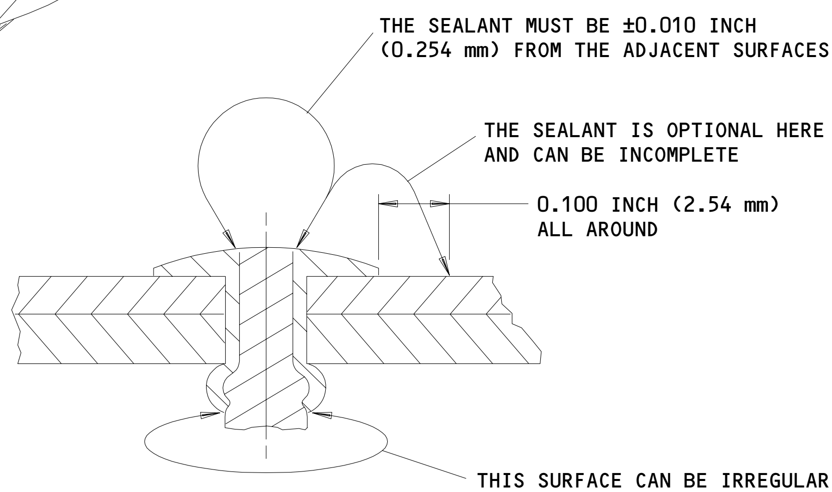
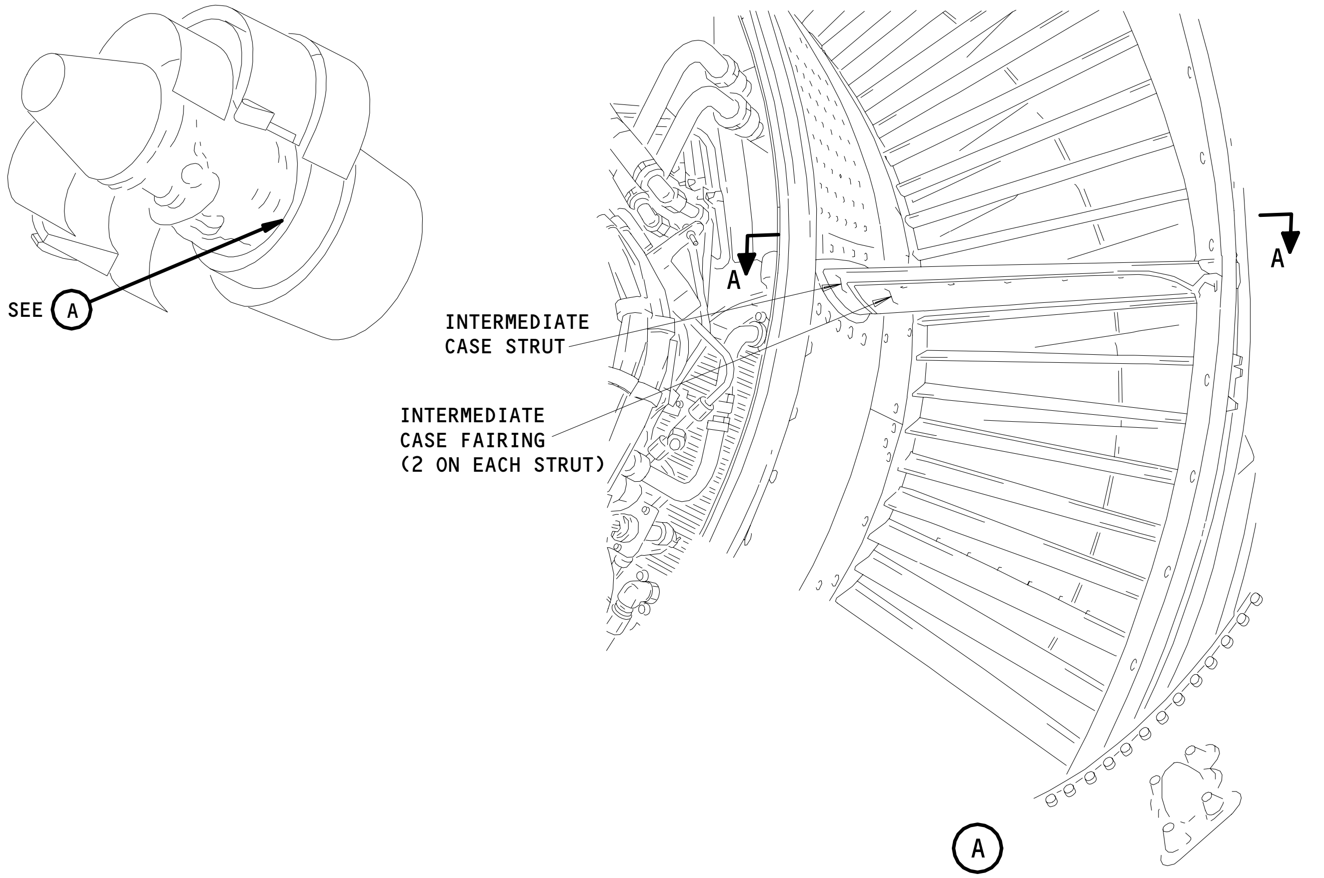
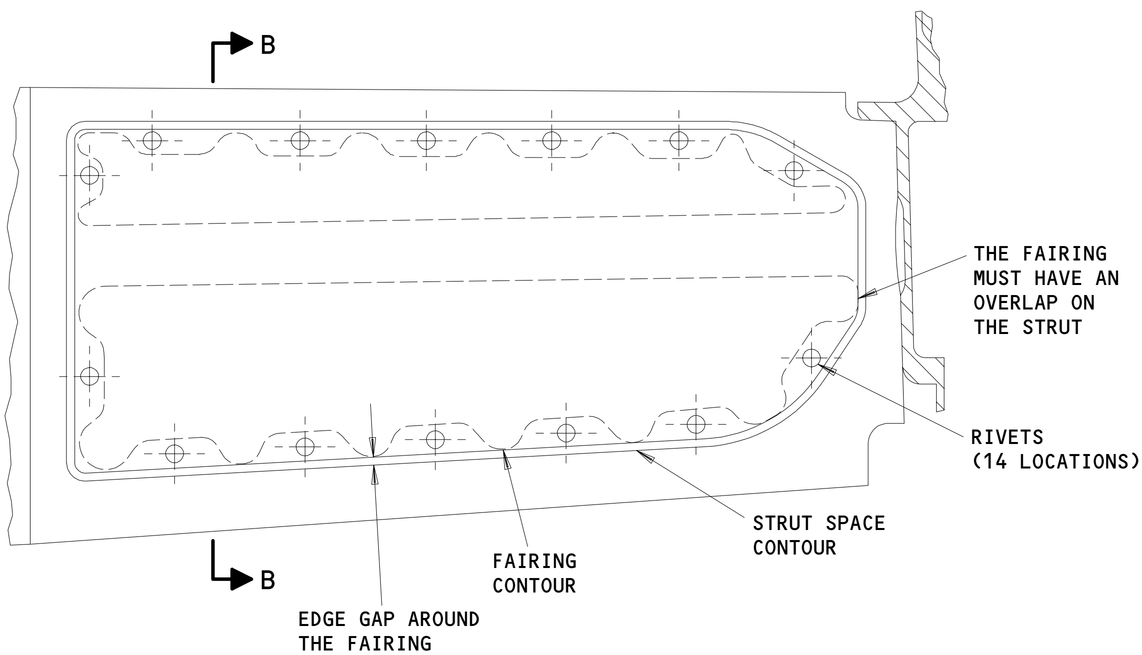


RIVETS

L-A6590
L-A6678

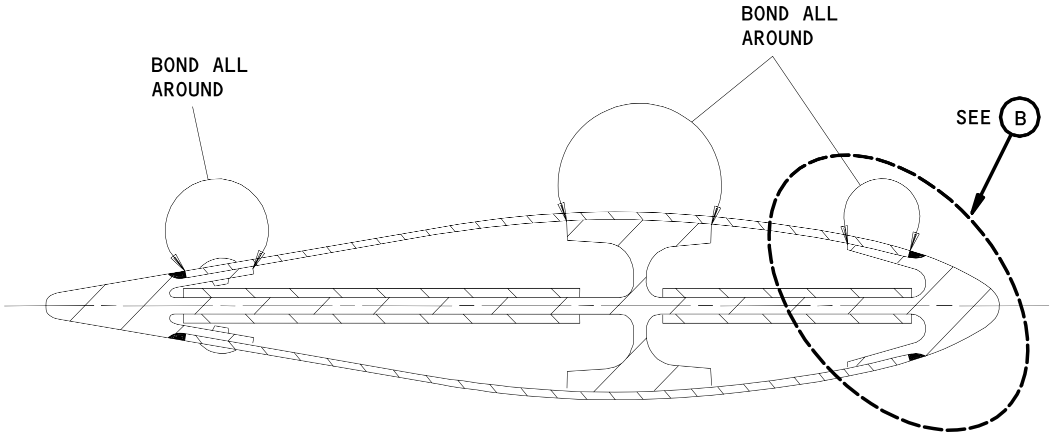
Intermediate Case Fairing with Seven Rivets
Figure 401 (Sheet 2)



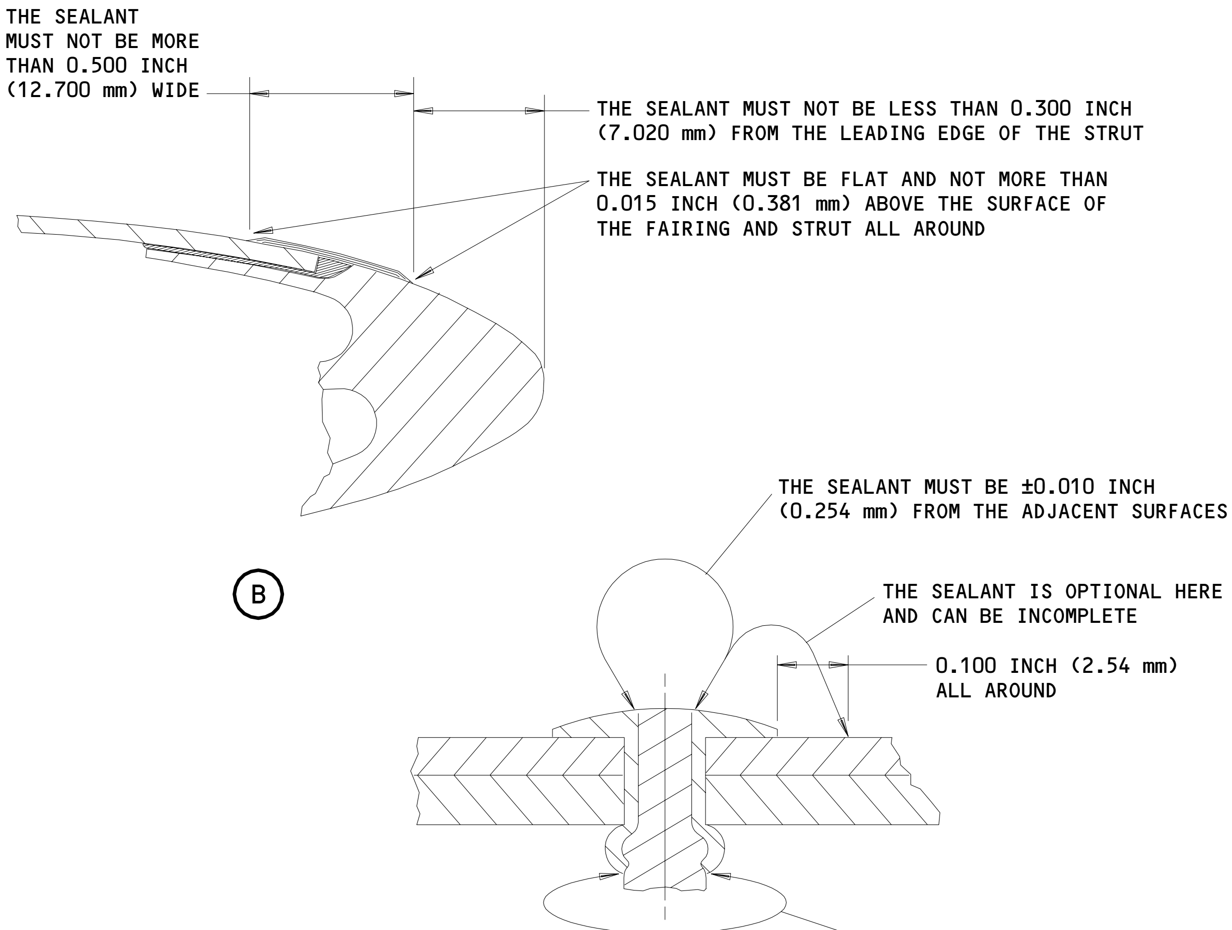


L-A6453

Intermediate Case Fairing with Fourteen Rivets
Figure 402 (Sheet 1)



(TURNED 90° CLOCKWISE)
B-B



RIVETS

L-A6590
L-A6678

Intermediate Case Fairing with Fourteen Rivets
Figure 402 (Sheet 2)

S 324-011-N00

(2) If you install a new fairing, put rivet holes in the new fairing (Fig. 401).

(a) Put the new fairing on the strut so that the edge gap is approximately equal on all sides.

1) The difference between each edge gap dimension must be less than 0.030 inch (0.762 mm).

2) Make the gap at the outer diameter edge smaller if the new fairing does not have an overlap there.

(b) Use applicable clamps to hold the new fairing in the correct position.

(c) Make a mark on the new fairing where each used rivet hole on the strut is.

(d) Remove the new fairing from the strut.

CAUTION: DO NOT USE FLUIDS OR LUBRICANTS WHEN YOU MACHINE THE RIVET HOLES. BE CAREFUL TO PROTECT THE MACHINED SURFACES FROM CONTAMINATION. IF YOU DO NOT PROTECT THE MACHINED SURFACES YOU CAN CAUSE DAMAGE TO THE LAMINATION.

(e) Machine the new rivet holes vertically through the new fairing.

(f) Remove all contamination from the new fairing.

S 424-012-N00

(3) Install the fairing.

WARNING: DO NOT GET THE SOLVENT IN YOUR MOUTH OR EYES,OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE THE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAMES, AND HEAT. THE SOLVENT IS POISIONOUS AND FLAMMABLE AND CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(a) With MPK or Trichlorotriflouroethane clean the parts of the strut, fairing, and intermediate case that the sealant will touch.

1) Apply solvent to a piece of clean cheesecloth.

2) Wipe the area of repair with the cheesecloth.

3) Dry the surfaces fully in air that is at ambient temperature.

4) If you do not apply the sealant immediately, put the paper over the cleaned parts.

a) You must apply the sealant in two (2) hours.

(b) Apply the red or gray sealant to the mating surfaces of the strut.

(c) With clamps attach the fairing to the strut.
(d) Install the rivets:
   1) Apply the wet primer to the rivets.
   2) Attach the fairing to the strut with rivets.
   3) Examine the rivets for cracks, clearance and correct installation.
      a) Around the rivet, in a radius equal to the rivet head diameter, the maximum clearance between surfaces is 0.005 inch (0.127 mm).
(e) Fill the gaps and edges with the red or gray sealant.
(f) Remove unwanted sealant with cheesecloth.
(g) Let the sealant cure as follows:
   1) in air at ambient tempurature,
   2) in air that has a relative humidity of at least 25 percent,
   3) until it is not tacky, for at least two (2) hours, before you touch it,
   4) if it is possible, for a total of eight hours before you operate the engine.

S 414-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Close the thrust reverser (AMM 78-31-00/201).

S 414-007-N00
(5) Close the core cowl panel (AMM 71-11-06/201).

S 414-008-N00
(6) Close the fan cowl panel (AMM 71-11-04/201).

S 444-009-N00
(7) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

COMPRESSOR INTERMEDIATE CASE FAIRINGS - INSPECTION/CHECK

1. General
   A. This procedure gives the task do the inspection of the compressor intermediate case fairings. The compressor intermediate case fairings will be referred to as the fairings in this procedure.
   B. The fairings are aft of the fan case vanes. On the intermediate case there are eight (8) struts, with two (2) fairings on each strut.
   C. You must open each half of the thrust reverser to get access to the fairings.

   TASK 72-34-05-206-005-N00

2. Intermediate Case Fairing Inspection
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 72-34-05/401, Compressor Intermediate Case Fairings
      (4) AMM 72-34-05/801, Compressor Intermediate Case Fairings
      (5) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zones
          411 No. 1 Power Plant
          421 No. 2 Power Plant

   C. Do the Inspection of the Fairings.

      S 046-001-N00

      WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

      (1) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

      S 016-002-N00
      (2) Open the fan cowl panel (AMM 71-11-04/201).

      S 016-003-N00
      (3) Open the core cowl panel (AMM 71-11-06/201).

S 016-004-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reverser (AMM 78-31-00/201).

S 226-006-N00

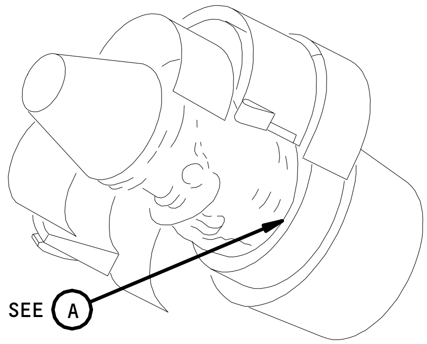
(5) Compare the damage that you find on the fairings with the limits in Table 601, 602, and 603 (Fig. 601).

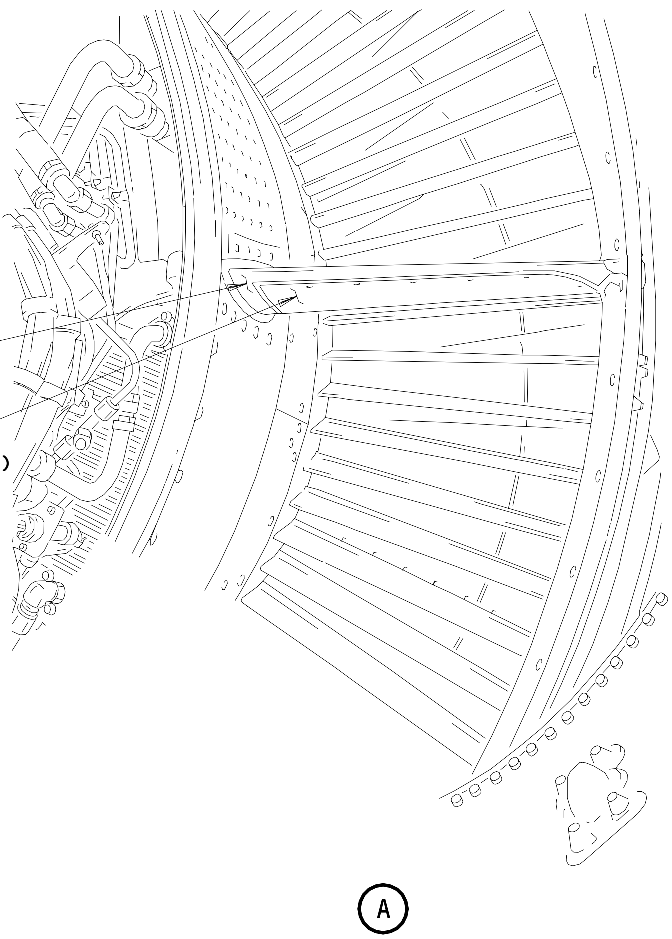
INSPECTION FOR PARTS THAT ARE NOT THERE OR ARE LOOSE
Table 601

AREA: CONDITION OBSERVED	NECESSARY PROCEDURE
Fairing:	
All of the fairing is not there	Replace the fairing before the 101st hour of operation
Part of the fairing is not there or the leading edge is loose	Replace the fairing before the 51st hour of operation
Rivets:	
One or more rivet is not there or loose	Replace the rivet(s) before the 101st hour of operation

(a) If the damage to the fairing, referred to in Table 602, is less than the limits, no procedure is necessary.

(b) If the damage to the fairing, in Table 602, is more than the limits, replace the fairing before the subsequent flight.





L-A6453

Intermediate Case Fairing Inspection
Figure 601

INSPECTION FOR NICKS, DENTS, AND OTHER SURFACE DAMAGE Table 602	
CONDITION OBSERVED	REPLACE IT BEFORE THE 51st HOUR OF OPERATION
Nicks and Gouges	More than 1.000 inch (25.400 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.800 mm) apart from other damage, or there are more than five (5) nicks and gouges.
Dents with Rounded bottoms	More than 0.030 inch (0.762 mm) in depth or on more than 10% of the surface area
Cracks	More than 1.000 inch (25.400 mm) in length or less than 0.500 inch (12.700 mm) from the center of an attachment screw
Areas of broken or (fuzzy stray) fraying fibers	Between 1.000 and 2.5000 inches (25 and 64 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.800 mm) from other damage
Punctures or Holes	None are permitted.
Wire cloth patch area - not bonded	More than 0.500 inch (12.700 mm) in length or width
*Leading edge erosion	More than 0.500 inch (12.700 mm) in length or width

* NOTE: A surface finish that is not smooth or not shiny, and fibers that are open to view are signs of erosion.

INSPECTION FOR DELAMINATION Table 603			
DELAMINATION DIMENSION	EXAMINE AFTER EACH 50 HOURS	REPLACE BEFORE THE 51ST HOUR	REPLACE BEFORE YOU OPERATE THE ENGINE
Width or Length	Not more than 1.000 inch (25.400 mm)	Between 1.000-2.500 inches (25-64 mm)	More than 2.500 inches (63.500 mm)
Depth	Mot more than 0.030 inch (0.762 mm)	More than 0.030 inch (0.762 mm)	-----
Distance from other damage	More than 2.000 inches (50.800 mm)	Less than 2.000 inches (50.800 mm)	-----

S 906-007-N00

(6) If it is necessary to replace a fairing, refer to the procedures that follow.
   (a) To replace a fairing that has no rivets at the leading edge with the same type of fairing, refer to AMM 72-34-05/401.
   (b) To replace a fairing that hase rivets all around the edge, refer to AMM 72-34-05/401.
   (c) To replace a fairing that has no rivets at the leading edge with one that has rivets all around, refer to AMM 72-34-05/801.

S 416-008-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(7) Close the thrust reverser (AMM 78-31-00/201).

S 416-009-N00

(8) Close the core cowl panel (AMM 71-11-06/201).

S 416-010-N00

(9) Close the fan cowl panel (AMM 71-11-04/201).

S 446-011-N00

(10) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

COMPRESSOR INTERMEDIATE CASE FAIRINGS - APPROVED REPAIRS

1. General
   A. This procedure gives the task to repair the intermediate case fairings. This task includes the instructions to make rivet holes in the strut and the new fairing.
   B. The intermediate case fairings are aft of the fan case vanes. On the intermediate case there are eight (8) struts that have two (2) fairings each.
   C. You must open each half of the thrust reverser to get access to the intermediate case fairings.

TASK 72-34-05-308-015-N00

2. Replace a Fairing that has only Rivets
   A. References
      (1) AMM 70-11-08/201, Maintenance Practices
      (2) AMM 70-11-13/201, Maintenance Practices
      (3) AMM 71-11-04/201, Fan Cowl Panels
      (4) AMM 71-11-06/201, Core Cowl Panels
      (5) AMM 72-34-05/401, Intermediate Case Fairings
      (6) AMM 78-31-00/201, Thrust Reverser System
      (7) AIPC 72-34-00, Fig. 8A
   B. Equipment
      (1) Scraper - Plastic or Hardwood
      (2) Putty Knife - Angled Blade, 1.0 inch (25.4 mm) Wide
   C. Consumable Materials
      (1) P05-038 Cheesecloth - Unsized
      (2) P05-155 Paper - Kraft (Medium Duty) (PMC 4128)
      (3) P05-289 Safety Wire - (Lockwire)
      (4) P05-421 Nylon Pads
      (5) P09-014 Sealant - Silicone Rubber (PWA 36003)
      (6) P09-027 Sealant - Silicone Rubber (PWA 36003-2)
      (7) P18-003 Primer - Zinc Chromate (AMS 3110)
      (8) Rivet, Blind, 14 Each
   D. Parts
      (1) 51G831-01 Fairing Assembly

(2) 51G832-01 Fairing Assembly

E. Access

(1) Location Zone

411	Left Engine - LPC Intermediate Case
421	Right Engine - LPC Intermediate Case

F. Procedure

S 048-059-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

(1) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 018-057-N00

(2) Open the fan cowl panel (AMM 71-11-04/201).

S 018-056-N00

(3) Open the core cowl panel (AMM 71-11-06/201).

S 018-055-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reververs (AMM 78-31-00/201).

S 948-050-N00

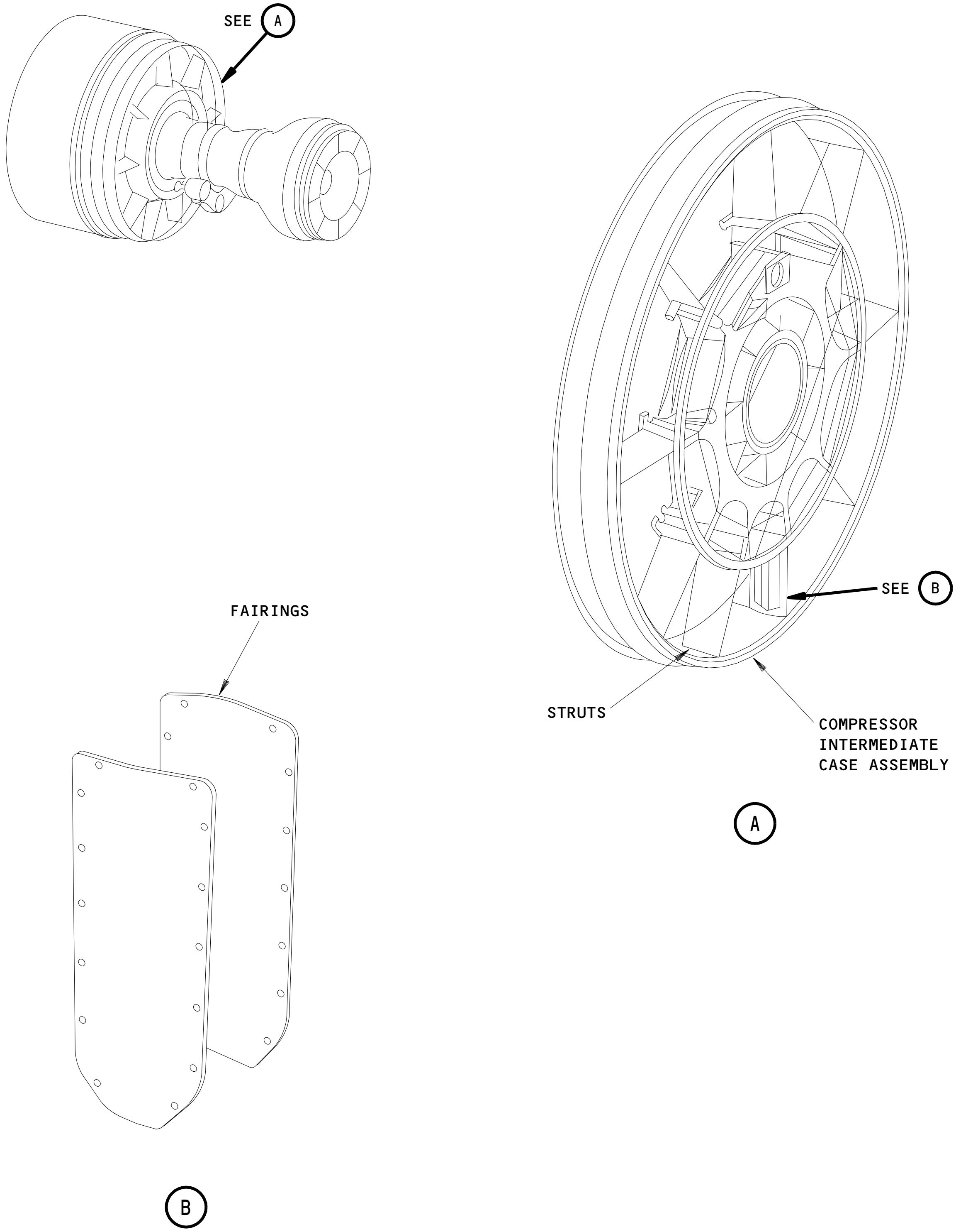
(5) Get access to the intermediate case strut fairings (Fig. 801).

S 358-018-N00

CAUTION: DO NOT DRILL INTO THE FAIRING. THIS CAN CAUSE HOLES THAT ARE TOO LARGE, AND CAUSE DAMAGE TO THE FAIRING.

(6) Find the 14 rivets that attach the fairing to the strut.

(a) Remove the rivets with a 0.125 inch (3.175 mm) drill bit.



Compressor Intermediate Case Strut Fairings
Figure 801

S 028-019-N00

(7) Carefully remove the rivet shanks with a 0.125 inch (3.175 mm) diameter punch.
   (a) Collect all the rivet shanks, and correctly discard.

S 028-060-N00

CAUTION: APPLY CLOTH OR PLASTIC TAPE TO THE ANGLED EDGE TO KEEP DAMAGE TO THE FAIRING AT A MINIMUM.

(8) Carefully lift one edge of the fairing with an angled blade along the perimeter to separate the fairing from the strut.

   NOTE: A blade tool with an angle is recommended to remove the aluminum fairing. Figure 802 shows how to change a 1.0-inch (25.4 mm) wide blade to one with an angle.

S 028-021-N00

(9) Move the tool fully around the perimeter to cut the bond.

   NOTE: A small hammer is recommended to tap the tool.

S 028-022-N00

CAUTION: DO NOT APPLY TOO MUCH FORCE WHEN YOU LIFT THE FAIRING FROM THE STRUT. DISTORTION OR DAMAGE TO FAIRING CAN OCCUR.

(10) Carefully lift the fairing to release the bond at the strut middle rib.

S 028-061-N00

(11) If the fairing does not loosen, lift the edge.
   (a) Cut the bond with a long plastic or wood tool.

S 158-062-N00

(12) Cut the adhesive bond with lockwire (P05-289) (Fig. 803).

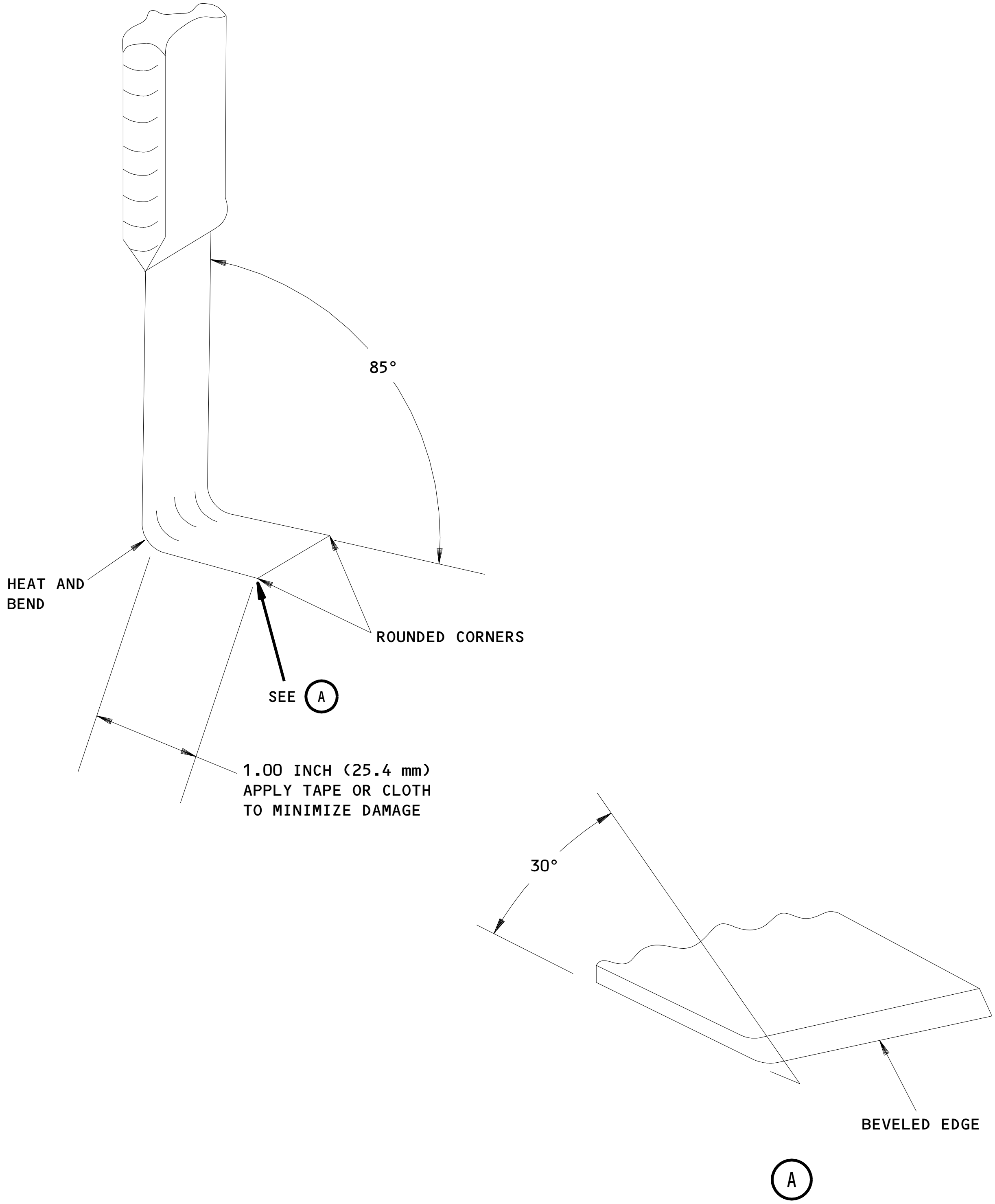
S 028-023-N00

(13) As you remove each fairing, record their strut locations.

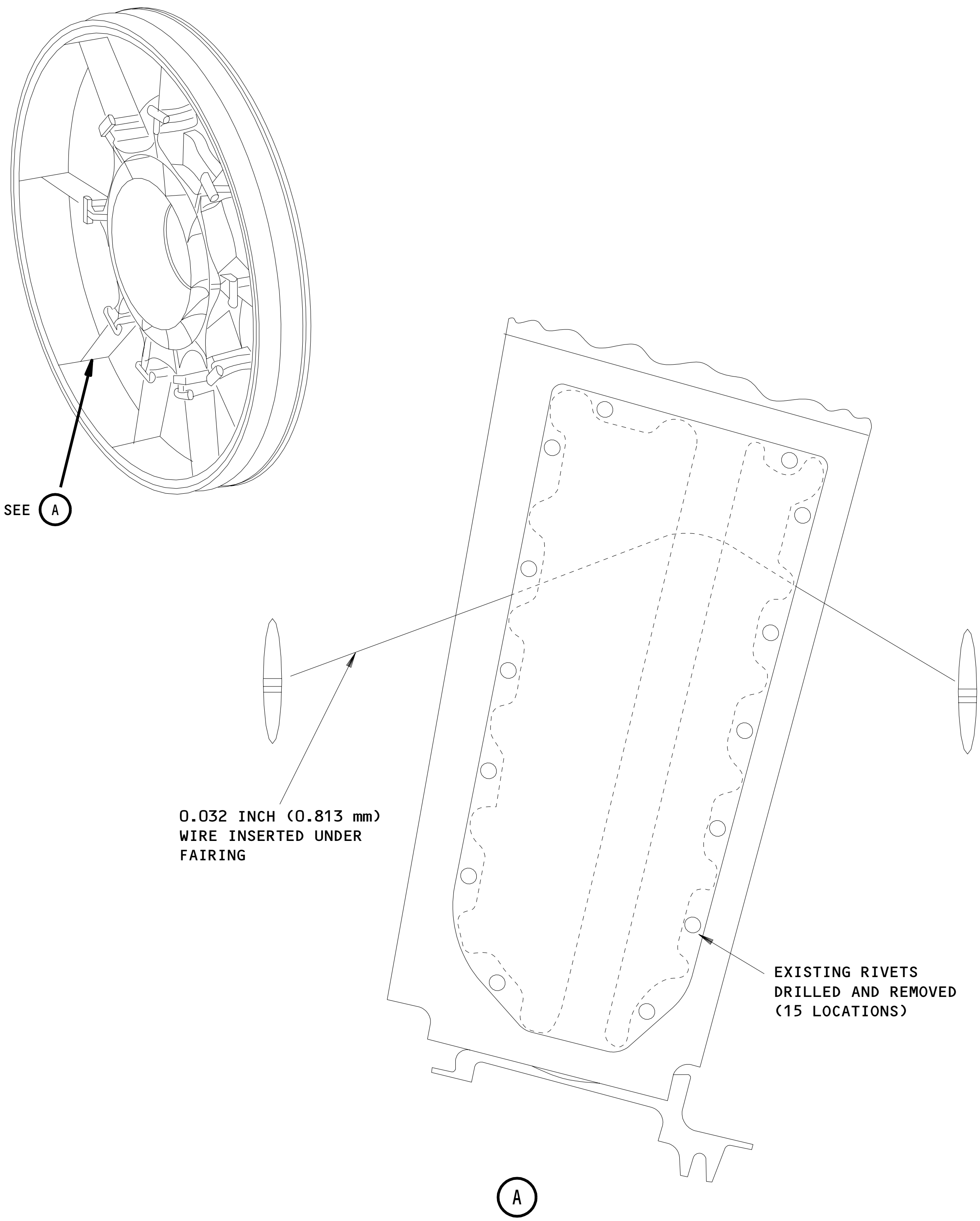
   NOTE: You must install the fairings in the same strut location. You can have patterns of rivet holes that are different between struts.

S 028-024-N00

(14) Find and remove all rivet shanks and unwanted material.



Putty Knife For Fairing Removal
Figure 802



Fairing Removal With Wire
Figure 803

S 148-025-N00

CAUTION: REMOVE ALL OF THE SILICONE ADHESIVE FROM THE STRUTS AND FAIRINGS. SILICONE ADHESIVE CAN CAUSE DAMAGE TO THE BOND. THIS CAN CAUSE DAMAGE TO THE ENGINE.

CAUTION: DO NOT USE METAL SCRAPERS. THIS CAN CAUSE DAMAGE TO THE STRUT OR FAIRING.

(15) Clean unwanted material from fairings and struts.

NOTE: Sharp wood scrapers, scoring pads (P05-421), or bristle brushes can be used to remove unwanted matarial from struts and fairings.

S 028-026-N00

CAUTION: COLLECT AND DISCARD ALL REMAINING RIVETS AND UNWANTED MATERIAL. UNWANTED OBJECTS CAN CAUSE DAMAGE TO THE ENGINE.

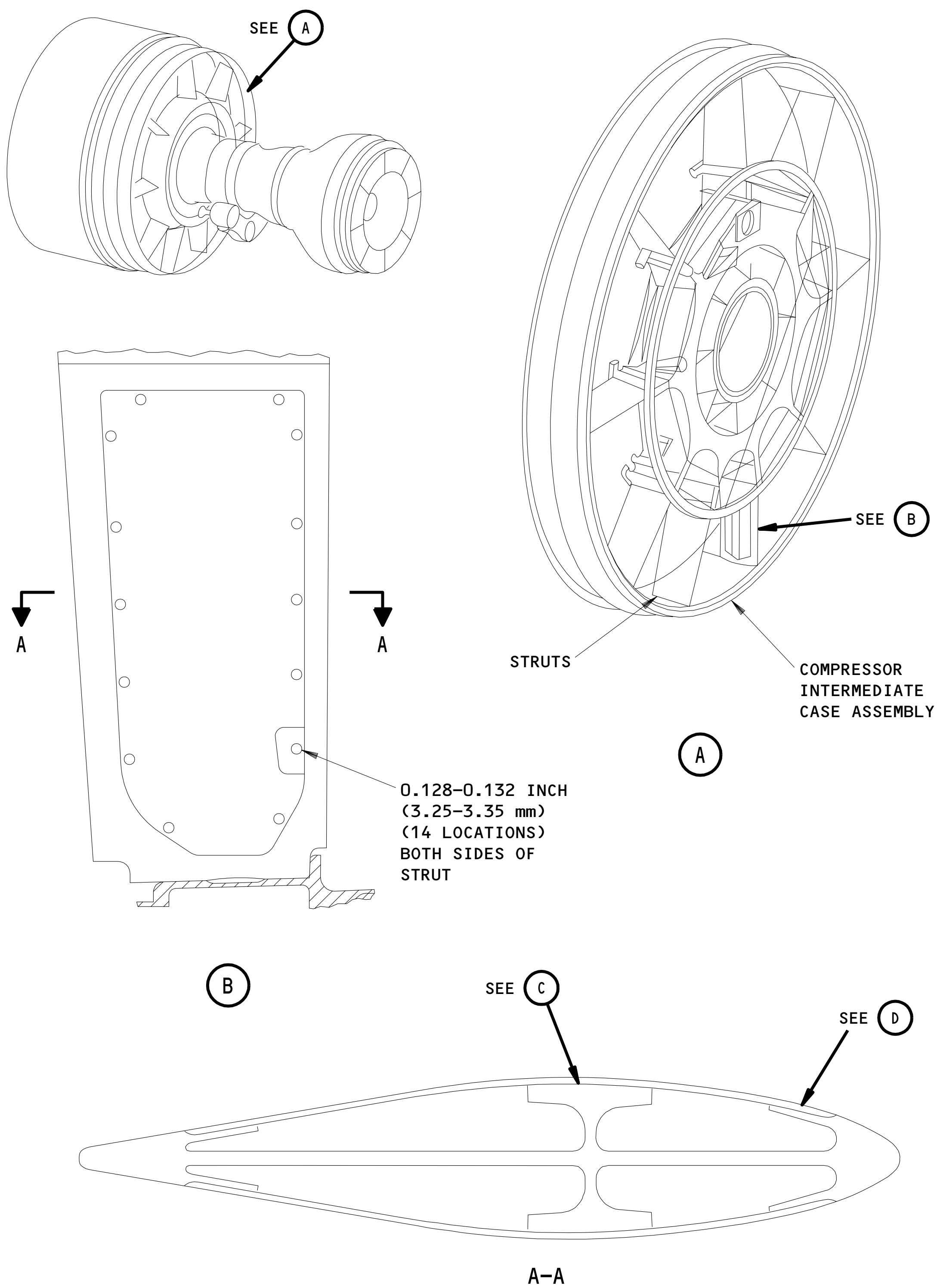
(16) Remove and correctly discard rivet pieces and unwanted material.

S 228-027-N00

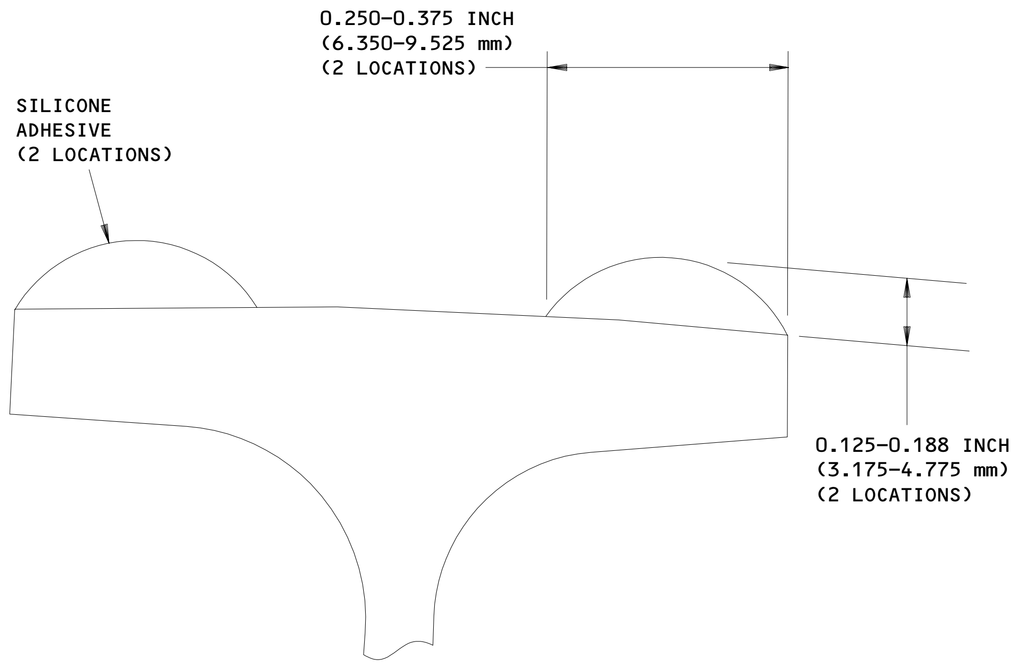
(17) Examine fairings and struts for tool damage as follows:
- (a) Scratches in aluminum fairings that are more than 0.020 inch (0.508 mm).
- (b) Replace fairings with scratches that are more than 0.020 inch (0.508 mm).
- (c) Smooth out minor scratches in aluminum fairings that are less than 0.020 inch (0.508 mm) and treat with SPOP 42 (AMM 70-11-08/201).

S 228-028-N00

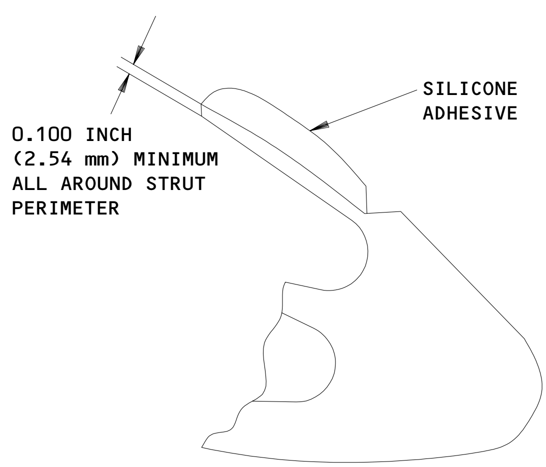
(18) Examine strut rivet holes:
- (a) Make sure that the rivet holes in strut composite fairings are 0.128 to 0.132 inch (3.252 to 3.352 mm) diameter (Fig. 804).
- (b) Do the Alternate Rivet Hole Repair if holes are larger than 0.132 inch (3.352 mm).
- (c) Make sure aluminum fairing strut rivet holes are 0.128 to 0.132 inch (3.252 to 3.352 mm) diameter.
  - 1) For holes not in location A that are larger than 0.132 inch (3.352 mm) diameter, drill holes to 0.143 to 0.146 inch (3.633 to 3.708 mm) diameter or 0.160 to 0.164 inch (4.064 to 4.165 mm) diameter to meet the requirements for oversized rivets (Fig. 805).



Typical Strut Rivet Holes And Locations And Silicon Adhesive Applications
Figure 804 (Sheet 1)

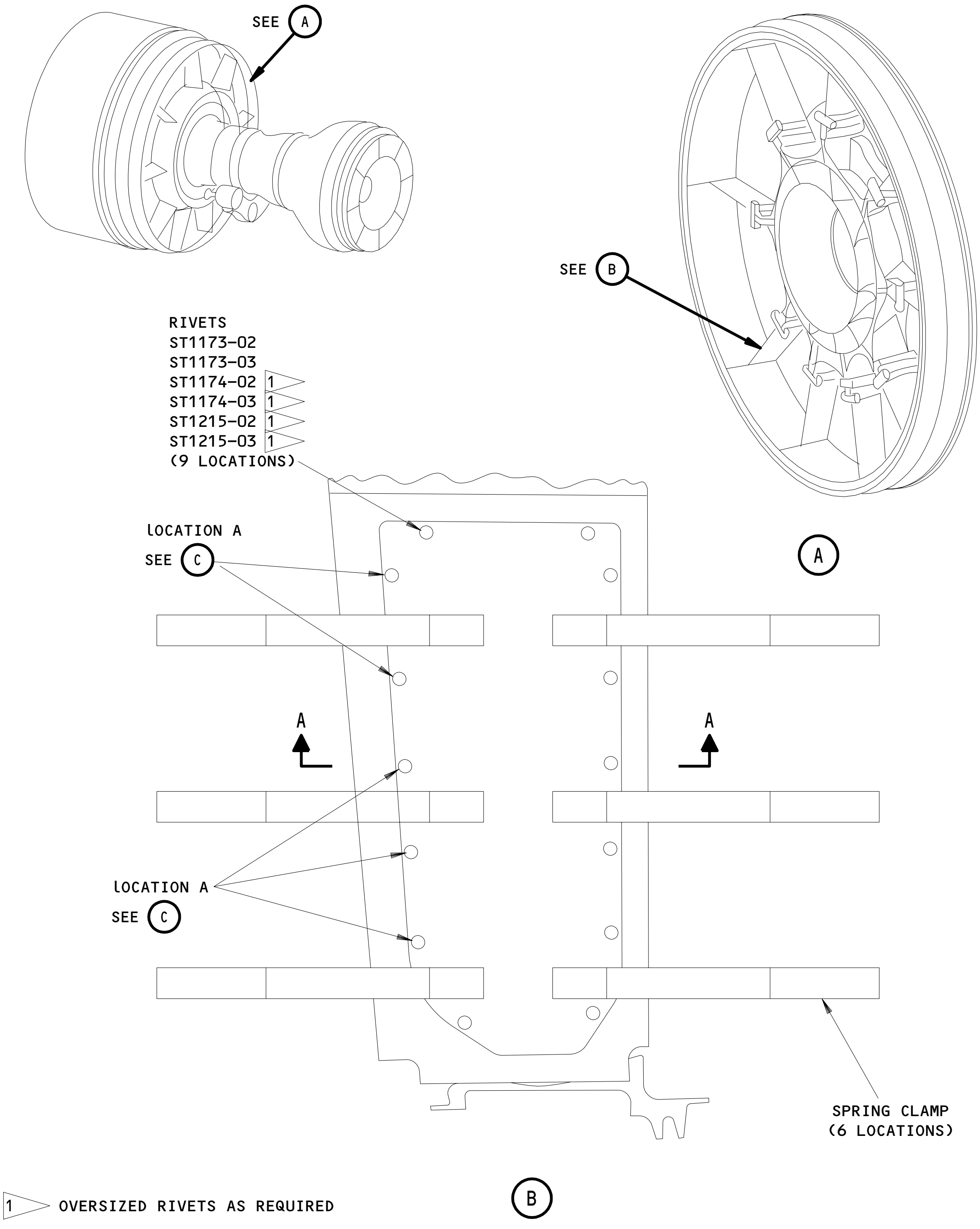


(PRIOR TO FAIRING
INSTALLATION)
C

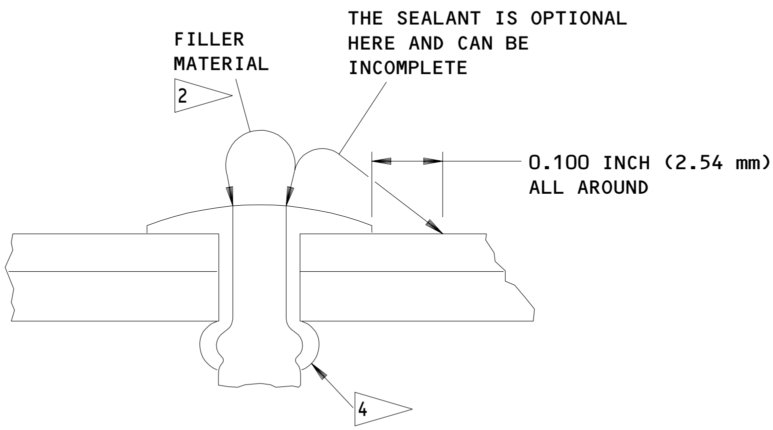


(PRIOR TO FAIRING
INSTALLATION)
D

Typical Strut Rivet Holes And Locations And Silicon Adhesive Applications
Figure 804 (Sheet 2)

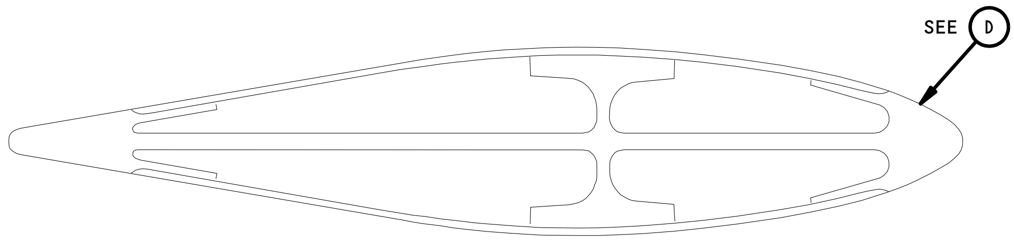


Rivet And Clamp Locations And Silicon Adhesive Applications
Figure 805 (Sheet 1)

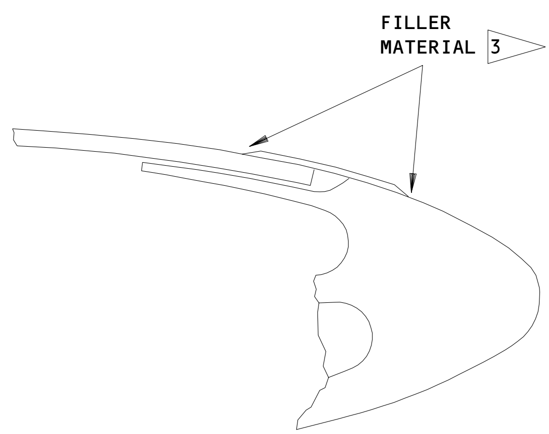


LOCATION A

C



A-A



D

2 MUST BE ±0.010 INCH (±0.25 mm) FROM ADJACENT SURFACE

3 AROUND GAP BETWEEN STRUT AND FAIRING ±0.015 INCH (±0.38 mm) RELATIVE TO SURFACE OF FAIRING

4 RIVET, P/N 51G122

Rivet, Clamp Locations and Sealant Limits
Figure 805 (Sheet 2)

2) Do the Alternate Rivet Hole Repair if rivet holes have one of these conditions:
   a) Larger than 0.132 inch (3.352 mm) diameter in the five positions (Location A, Fig. 805).
   b) Any other rivet hole that is more than 0.132 inch (4.165 mm) diameter.

      NOTE: Enlargement of the strut rivet holes may require that you enlarge the fairing rivet holes to the same size as the strut rivet holes.

   c) If a used aluminum fairing is installed with holes that are larger than 0.164 inch (4.165 mm).

      NOTE: Rivet holes on some in aluminum fairings can be 0.128 inch (3.252 mm) diameter.

S 358-030-N00

(19) Alternate Rivet Hole Repair:

(a) Find the best location for an alternate rivet hole.

NOTE: The alternate rivet hole must be 0.125 inch (3.175 mm) minimum away from the edge of the hole or the edge of the strut tab. If you cannot make the hole in the specified minimum limit, speak to Pratt & Whitney Customer Service.

(b) Drill alternate rivet holes in the strut 0.128 inch to 0.132 inch (3.252 to 3.352 mm) diameter.

(c) Mark and transfer drill the alternate rivet holes from the strut to the fairing.

NOTE: The alternate hole in the fairing must be 0.125 inch (3.175 mm) minimum from the edge of the enlarged hole or the edge of the fairing. If you cannot make the hole in the specified minimum limit, speak to Pratt & Whitney Customer Service.

S 148-033-N00

CAUTION: FULLY CLEAN ALL THE SURFACES. IF YOU DO NOT FULLY CLEAN THE SURFACES, DAMAGE TO THE BOND CAN OCCUR.

(20) Clean the strut and fairing areas that the silicone adhesive will touch by SPOP 208 (AMM 70-11-13/201).
(a) Make sure that surfaces become fully dry.

S 398-064-N00

CAUTION: COVER CLEANED FAIRINGS WITH PAPER (P05-155). IF FAIRINGS ARE NOT INSTALLED WITHIN 30 MINUTES OR LESS. DUST AND FINGERPRINTS CAN PREVENT PROPER BONDING OF THE MATING SURFACES.

CAUTION: APPLY SILICONE ADHESIVE WITHIN TWO HOURS OR LESS. IF MORE THAN TWO HOURS PASS, DO THE CLEAN PROCESS AGAIN. FAILURE TO APPLY SILICONE WITHIN TWO HOURS CAN PREVENT PROPER BONDING AND DAMAGE TO THE ENGINE.

(21) Apply silicone adhesive (P09-014 or P09-027) completely to the perimeter area of the strut and tabs to a minimum of 0.100 inch (2.540 mm) thickness.

NOTE: Sufficient thickness is required to let the adhesive squeeze out when the fairing is installed (View B, Fig. 804).

S 398-035-N00

(22) Apply silicone adhesive (P09-014 or P0-027) completely to the strut center rib area (View C, Fig. 804).
(a) Apply adhesive in two rows to the full length of the center rib on the edges.

NOTE: There must be no voids in the rows of silicone. The rows must be separated and the silicone adhesive must join with the silicone adhesive applied to the perimeter.

S 428-036-N00

CAUTION: APPLY FAIRING TO THE SILICONE ADHESIVE IN FIVE MINUTES OR LESS. PARTIAL CURING OF THE SILICONE CAN OCCUR AFTER FIVE MINUTES AND PREVENT A CORRECT BOND.

(23) Immediately install the correct fairing to the silicone adhesive.
   (a) Push firmly to be sure there is full contact.

S 428-037-N00

(24) Install a Cleco fastener in each corner and in the center of the leading and trailing edge.

S 428-038-N00

(25) Install three spring clamps on each leading edge and trailing edge (Fig. 805).
   (a) Tighten the clamp to 25.0 pound-feet (111.2 Nm).

S 628-039-N00

(26) Apply wet primer (P18-003) to the rivets.
   (a) Install rivets in a cross pattern (Fig. 805). Remove Cleco fasteners as necessary.

      NOTE: The pattern makes sure that the silicone adhesive will bond correctly.

S 428-041-N00

CAUTION: Do not remove the clamps until all the rivets have been installed. Removing clamps before all rivets have been installed could result in fairing being installed incorrectly.

(27) Install rivets as follows:
   (a) For composite fairings, install 14 rivets, PN 51G122.

(b) For aluminum fairings, use one of these methods

1) Install 14 rivets, PN 51G122, unless oversize rivets are necessary for aluminum fairings with pre SB PW4G-100-72-204 part numbers.

<u>CAUTION</u>: INSTALL NEW RIVETS IN NINE HOLES IF THE HOLES MEASURE 0.128 TO 0.132 INCH (3.3 TO 3.4 MM). USE PN ST1173-02, OR PN ST1173-03. OBEY THIS INSTRUCTION TO PREVENT DAMAGE TO EQUIPMENT.

2) Install five rivets, PN 51G122 in Location A, trailing edge only (Fig. 805).

<u>NOTE</u>: Rivets, PN ST1173-02 or PN ST1173-03 will only fit in Location A, Figure 105 and not in the other nine locations.

3) Install rivet, PN ST1174-02 or PN ST1174-03, in holes that are 0.143 to 0.146 inch (3.633 to 3.708 mm).

4) Install rivet, PN ST1215-02 or ST1215-03, in holes that are 0.160 to 0.164 inch (4.064 to 4.165 mm).

S 148-045-N00

(28) Remove unwanted silicone adhesive with a clean cheese cloth (P05-038).

S 398-042-N00

<u>CAUTION</u>: TO MAKE SURE THE PARTS ARE BONDED CORRECTLY, BE SURE TO SEAL THE TRAILING EDGE RIVETS AND FAIRING PERIMETER NO MORE THAN TWO HOURS AFTER THE RIVETING OPERATION. IF IT IS MORE THAN TWO HOURS AFTER RIVETING, THE AREA MUST BE CLEANED AGAIN BEFORE THE SEALANT IS APPLIED.

(29) Apply silicone adhesive (P09-014 or P09-027) to seal the perimeter of the fairing (View D, Fig. 805).

S 398-043-N00

(30) Apply silicone adhesive (P09-014 or P09-027) to seal the rivet stem holes of rivets PN 51G122 (View C, Fig. 805).

<u>NOTE</u>: Rivets PN ST1173-02, PN ST1173-03, PN ST1174-02, PN ST1174-03 or PN ST1215-03 do not need to be sealed.

S 398-044-N00

(31) If an alternate rivet hole has been drilled in the fairing, apply silicone adhesive (P09-014 or P09-027) to seal the enlarged rivet holes.

S 148-046-N00

(32) Remove all rivet pieces and silicone adhesive residue and properly discard.

S 398-048-N00

(33) Let the silicone adhesive cure for 24 hours at room temperature in air that has a relative humidity of 25 percent minimum.

S 418-051-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT CAN OCCUR.

(34) Close the thrust reverser (AMM 78-31-00/201).

S 418-052-N00

(35) Close the core cowl panel (AMM 71-11-06/201).

S 418-053-N00

(36) Close the fan cowl panel (AMM 71-11-04/201).

S 448-054-N00

(37) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

FAN EXIT LINER SEGMENTS (INNER FRONT) - REMOVAL/INSTALLATION

1. General
    A. This procedure gives the removal and installation tasks for the (inner front) fan exit liner segments. These fan exit liner segments will be referred to as the liner segments.
    B. The seven liner segments are found on the inner front circumference of the intermediate case, aft of the fan case. The liner segments are referred to as follows:

Liner Segment	PWA Part Number
No. 1	(PN 50G664 or 51G768-01)
No. 2	(PN 50G666 or 51G769-01)
No. 3	(PN 50G667 or 51G770-01)
No. 4	(PN 50G668 or 51G771-01)
No. 5	(PN 50G669 or 51G772-01)

    C. You can open each half of the thrust reverser to get access to the liner segments.

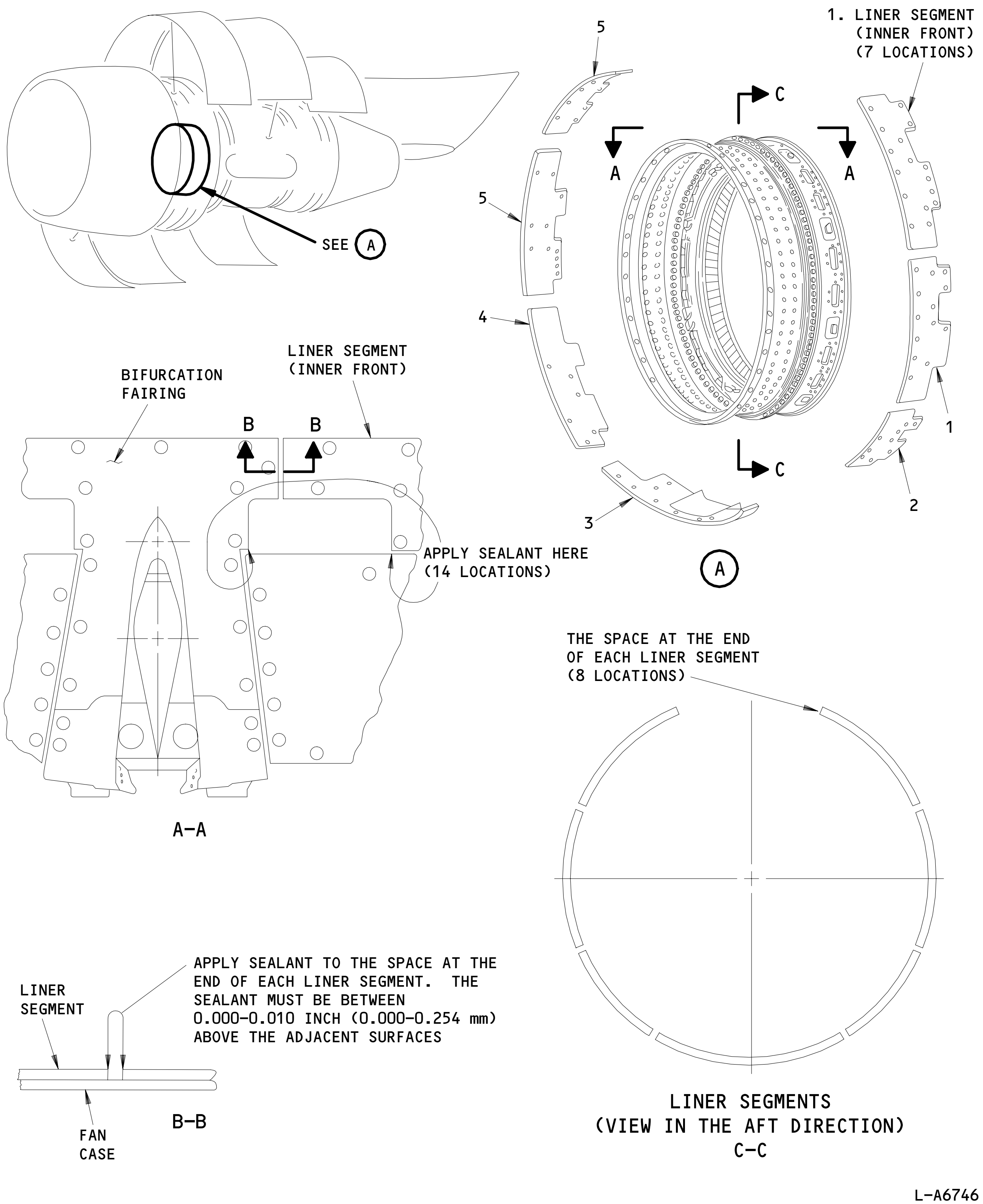
TASK 72-34-06-004-010-N00

2. Remove the Fan Exit Liner Segments (Inner Front)
    A. References
        (1) AMM 71-11-04/201, Fan Cowl Panels
        (2) AMM 71-11-06/201, Core Cowl Panels
        (3) AMM 78-31-00/201, Thrust Reverser System
    B. Access
        (1) Location Zones
            411 Engine (Left)
            421 Engine (Right)

        (2) Access Panels
            415AL Fan Reverser (Left)
            416AR Fan Reverser (Right)
            425AL Fan Reverser (Left)
            426AR Fan Reverser (Right)

    C. Prepare for the Removal of the Fan Exit Liner Segments

        S 944-002-N00
        (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.



Fan Exit Liner Segments (Inner Front) Installation
Figure 401

S 044-003-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 014-017-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 014-004-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-005-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

D. Remove the Fan Exit Liner Segments (Fig. 401)

S 024-007-N00

(1) If necessary, cut the sealant at the axial edge of the liner segment.

S 024-008-N00

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(2) Do the steps that follow to remove the liner segments.
  (a) Remove the screws that attach the liner segment to the fan exit case.
  (b) Remove the liner segment.
  (c) With a tool, remove the old sealant from the surfaces that the new sealant will touch.

TASK 72-34-06-404-001-N00

3. Install the Fan Exit Liner Segment (Inner Front)

A. Consumable Materials
  (1) D00137 Engine Oil - PWA 521B
  (2) G00033 Cheesecloth - Unsized
  (3) A00091 Sealant - Silicone, Rubber, Red (RTV 159)
  (4) A00482 Sealant - Silicone, Rubber, Gray (RTV 157)
  (5) B00130 Alcohol - Isopropyl (PMC 9094)

B. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 78-31-00/201, Thrust Reverser System

C. Access
   (1) Location Zones

411	Engine (Left)
421	Engine (Right)

   (2) Access Panels

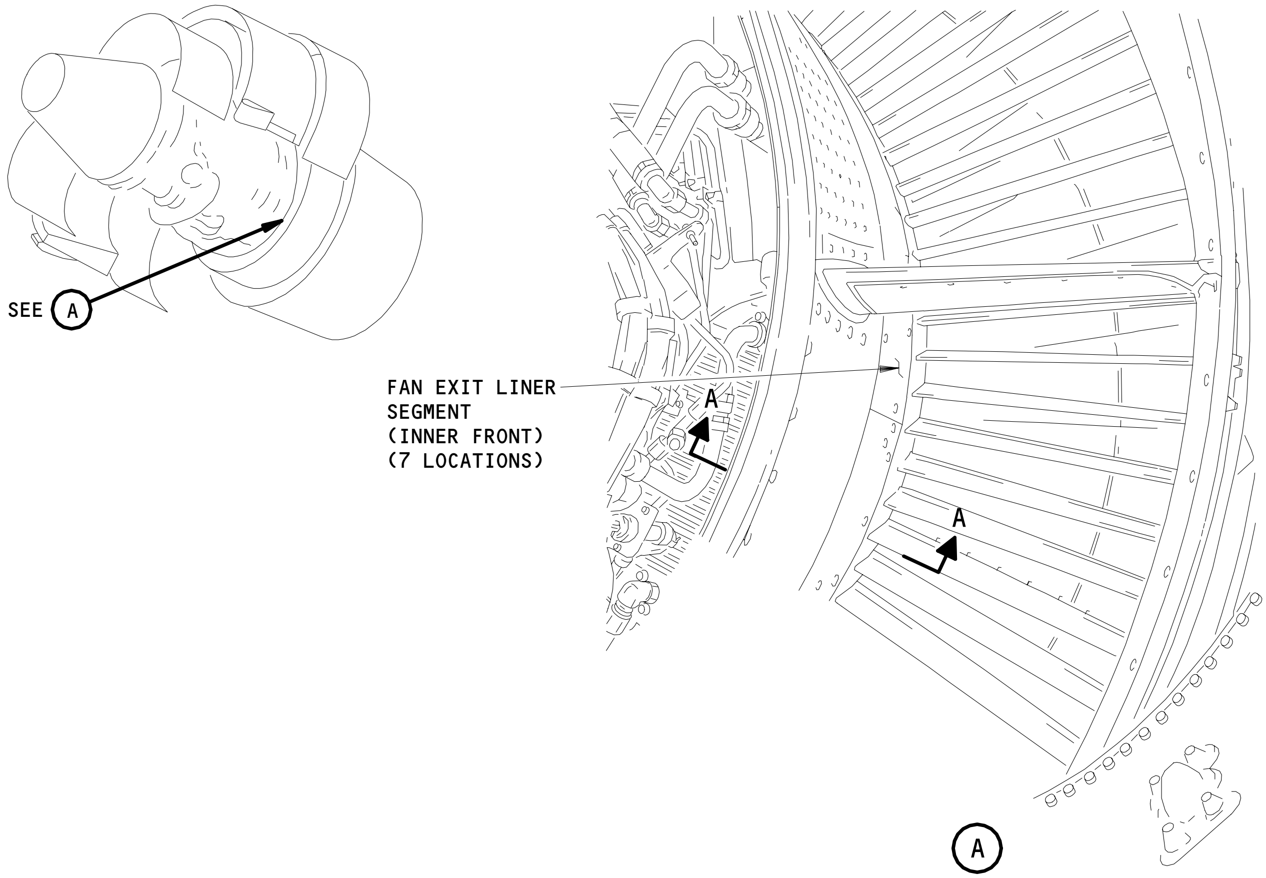
415AL	Fan Reverser (Left)
416AR	Fan Reverser (Right)
425AL	Fan Reverser (Left)
426AR	Fan Reverser (Right)

D. Install the fan exit liner segments.

S 824-009-N00

<u>CAUTION</u>: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. THE WASHERS THAT ARE ATTACHED TO THE FRONT LINER BRACKET CAN BECOME DISCONNECTED FROM THE BRACKET. ALSO, IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(1) Do the steps that follow to make sure the clearance between the trailing edge of the liner segment (inner front) and the front of the liner segment (inner rear) is correct (Fig. 402).
   (a) Apply engine oil to the threads of the screws.
   (b) Attach the liner segment to the fan exit case with the screws.
      1) Tighten the screws, with your hand, against the liner.
   (c) Do a check of the clearance between the trailing edge of the liner segment (inner front) and the front of the liner segment (inner rear), as follows (Fig. 402).
   (d) If the clearance is not correct, use Table 401 to find which washers (0-4) to use to make the necessary thickness.



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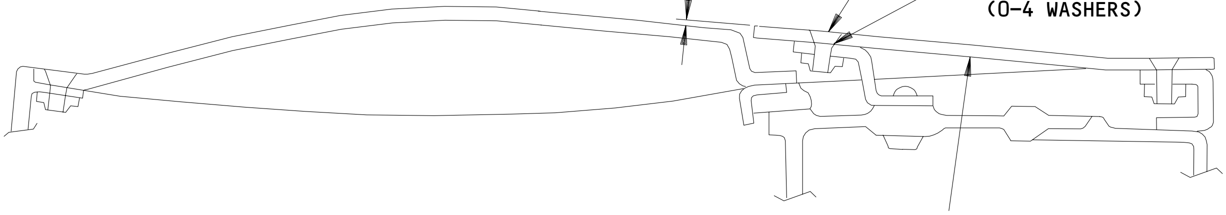

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Fan Exit Liner Segments (Inner Front) Installation
Figure 402

Washer - Flat Thickness	
Table 401	
Class	Washer Thickness - Inch (mm)
1	0.009-0.011 (0.229-0.279)
2	0.019-0.021 (0.483-0.503)
3	0.029-0.031 (0.737-0.787)
4	0.039-0.041 (0.991-1.041)
5	0.049-0.051 (1.244-1.295)
6	0.099-0.101 (2.514-2.565)

1) Remove the screws from the trailing edges of the (front) liner segments and, if necessary, the fairing at Flange D.
2) Clean the washers and the area around the bolt holes, with a clean cheese cloth that is moist with alcohol.
   a) Dry the surfaces fully in air that is at ambient temperature, until there is no more alcohol on the parts.

      NOTE: There must be no alcohol on the parts when the sealant is applied.

3) Use screws to temporarily hold the washers in the correct position.

(e) Bond the washers to the (front) liner segments with a fillet of sealant (RTV 195 or RTV 197) all around.

NOTE: It is permitted to have a very small quantity of sealant between the washer and the liner segment.

(f) Cure the sealant in in air that is at ambient temperature , for a minimum of two hours, until it is not tacky, before you touch it.

S 424-011-N00

(2) Install the liner segments as follows:
   (a) Lubricate the threads of the applicable screws with engine oil (Table 402).

Washer Thickness And Screw Lengths			
Table 402			
Screw PN	Screw Length	Washer Thickness	Quantity of Screws
593111	0.495 - 0.505	0.000 - 0.015	0 - 43 As Necessary
ST1382-09	0.542 - 0.562	0.016 - 0.070	0 - 43 As Necessary
ST1382-10	0.594 - 0.625	0.071 - 0.130	0 - 43 As Necessary
ST1382-11	0.656 - 0.687	0.131 - 0.210	0 - 43 As Necessary

(b) Attach the trailing edges of the liner segments to the fan exit case, with the lubricated screws.
  1) Tighten all the screws to 36-40 pound inches (4.067-4.519 newton-meters).

(c) Clean the axial edges of the liner segments.
  1) Make a clean piece of cheesecloth moist with alcohol.
  2) With the moist cheesecloth, clean the axial edges of the liner segments and the areas where the sealant will touch.
  3) Dry the cleaned areas in air, until there is no alcohol on the parts.

(d) Apply sealant to the edges of the liner segment as follows:
  1) Apply the sealant (RTV 157 or RTV 159) to the edges of the liner segment.
  2) Cure the sealant in air that has a minimum relative humidity of 25%.
  3) Cure the sealant for two hours, minimum, until it is not tacky, before you touch it.
  4) If it is possible, cure the sealant for eight hours, total, before operation of the engine.

E. Put the Airplane Back to Its Usual Condition.

S 414-012-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-013-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 414-014-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 444-015-N00

(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-016-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

FAN EXIT LINER SEGMENTS (INNER FRONT) - INSPECTION/CHECK

1. General
   A. This procedure gives the task do the inspection of the fan exit liner segments (inner front). These fan exit liner segments will be referred to as the liner segments in this procedure.
   B. The seven liner segments are on the inner front circumference of the intermediate case, aft of the fan case.
   C. You must open each half of the thrust reverser to get access to the liner segments.

TASK 72-34-06-206-001-N00

2. Inner Front Liner Segments Inspection
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 72-34-06/401, Fan Exit Liner Segments (Inner Front)
      (4) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zones
          411 No. 1 Power Plant
          421 No. 2 Power Plant

   C. Do the Inspection of the Inner Front Liner Sements.

      S 046-002-N00

      WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 016-003-N00
      (2) Open the fan cowl panel (AMM 71-11-04/201).

      S 016-004-N00
      (3) Open the core cowl panel (AMM 71-11-06/201).

      S 016-005-N00

      WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

      (4) Open the thrust reverser (AMM 78-31-00/201).

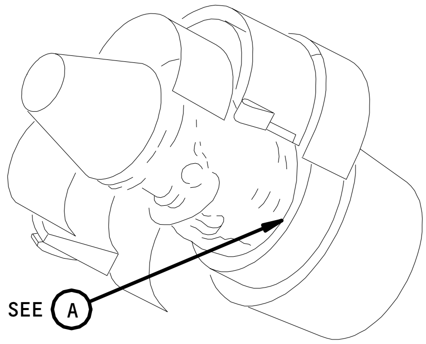
S 226-006-N00

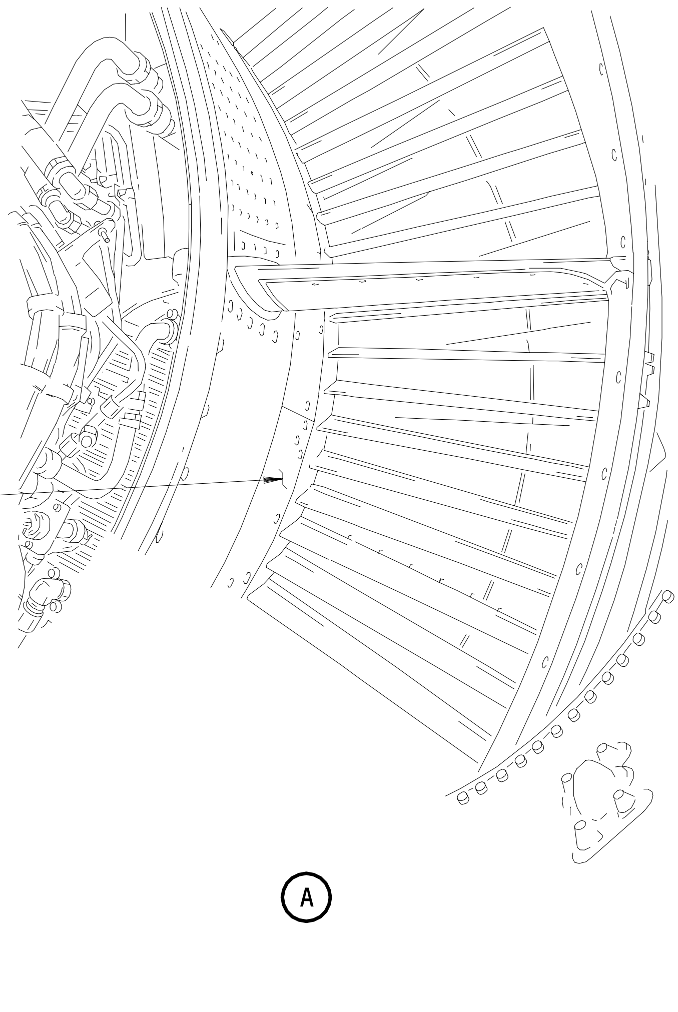
(5) Compare the damage that you find on the outer liner segments with the limits in Table 601, 602, and 603 (Fig. 601).

INSPECTION FOR PARTS THAT ARE MISSING OR ARE LOOSE
Table 601

AREA: CONDITION OBSERVED	NECESSARY PROCEDURE (AMM 72-34-06/401)
Liner Segment: all or part of the liner that is missing	Replace the liner segment within 50 hours of operation.
Screws/Rivets: One or more that is loose or missing	Replace the screw/rivet or tighten the screw as applicable within 50 hours of operation.
Washers: Missing	Replace the washer within 50 hours of operation.

(a) If the damage to the liner segment, referred to in Table 602, is less than the limits, no procedure is necessary.





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Fan Exit Liner Segments (Inner Front) Inspection
Figure 601

INSPECTION FOR NICKS, DENTS, AND OTHER SURFACE DAMAGE Table 602		
CONDITION OBSERVED	DAMAGE LIMITS	NECESSARY PROCEDURE
All Surfaces for Nicks and Gouges	More than 1.000 inch (25.400 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.80 mm) apart from other damage, or there are more than five (5) nicks and gouges.	Replace before the subsequent flight.
Dents with Rounded Bottoms	More than 0.030 inch (0.762 mm) in depth or on more than 10% of the surface area	Replace Within 50 hours
Cracks	More than 1.000 inch (25.400 mm) in length or less than 0.500 inch (12.700 mm) from the center of an attachment rivet or screw	Replace Within 50 hours
Areas of broken or fuzzy stray fibers	Between 1.000 and 2.500 inches (25 and 63.5 mm) in width or length, or more than 0.030 inch (0.762 mm) in depth, or less than 2.000 inches (50.800 mm) from other damage	Replace Within 50 hours
	More than 2.500 inches (63.500 mm) in width or length	Replace Immediately
Holes or Punctures	None Permitted.	Replace in 50 hours
No Bond of a Wire Cloth Patch	More than 0.500 inch (12.700 mm) in length or width.	Replace in 50 hours
Leading Edge Erosion	More than 0.500 inch (12.700 mm) in width, or more than 0.750 inch (19.050 mm) in length, or more than 0.020 inches (0.508 mm) in depth. (Erosion that is within the length and depth limits are permited, if no cracks or delamination are in the worn areas.)	Replace in 50 hours

INSPECTION FOR DELAMINATION
Table 603

DELAMINATION DIMENSION	EXAMINE AFTER EACH 50 HOURS	REPLACE WITHIN 50 HOURS	REPLACE BEFORE YOU OPERATE THE ENGINE
Width or Length	Not more than 1.000 inch (25.400 mm)	Between 1.000-2.500 inches (25-64 mm)	More than 2.500 inches (63.500 mm)
Depth	Not more than 0.030 inch (0.762 mm)	More than 0.030 inch (0.762 mm)	-----
Distance from other damage	More than 2.000 inches (50.800 mm)	Less than 2.000 inches (50.800 mm)	-----

S 416-007-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(6) Close the thrust reverser (AMM 78-31-00/201).

S 416-009-N00
(7) Close the core cowl panel (AMM 71-11-06/201).

S 416-010-N00
(8) Close the fan cowl panel (AMM 71-11-04/201).

S 446-011-N00
(9) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

COMPRESSOR INTERMEDIATE CASE - INSPECTION/CHECK

1. General
   A. This procedure gives the task do the inspection of the compressor intermediate case.
   B. The compressor intermediate case is aft of the fan case and forward of the HPC (High Pressure Compressor).
   C. You must open each half of the thrust reverser to get access to the compressor intermediate case.

TASK 72-34-07-206-010-N00

2. Compressor Intermediate Case Inspection
   A. General
      (1) This task examines these two areas:
         (a) The bracket assemblies which attach the aft edge of the intermediate case fairings (outer) to the outer circumference of the intermediate case.
         (b) The E Flange bolts which attach the intermediate case to the HPC.
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 75-32-00/601, Compressor Bleed Control System
      (4) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones
         411 No. 1 Power Plant
         421 No. 2 Power Plant

   D. Do the Inspection of the Compressor Intermediate Case.

S 046-001-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 016-003-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 016-004-N00

(3) Open the core cowl panels (AMM 71-11-06/201).

S 016-005-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reversers (AMM 78-31-00/201).

S 226-002-N00

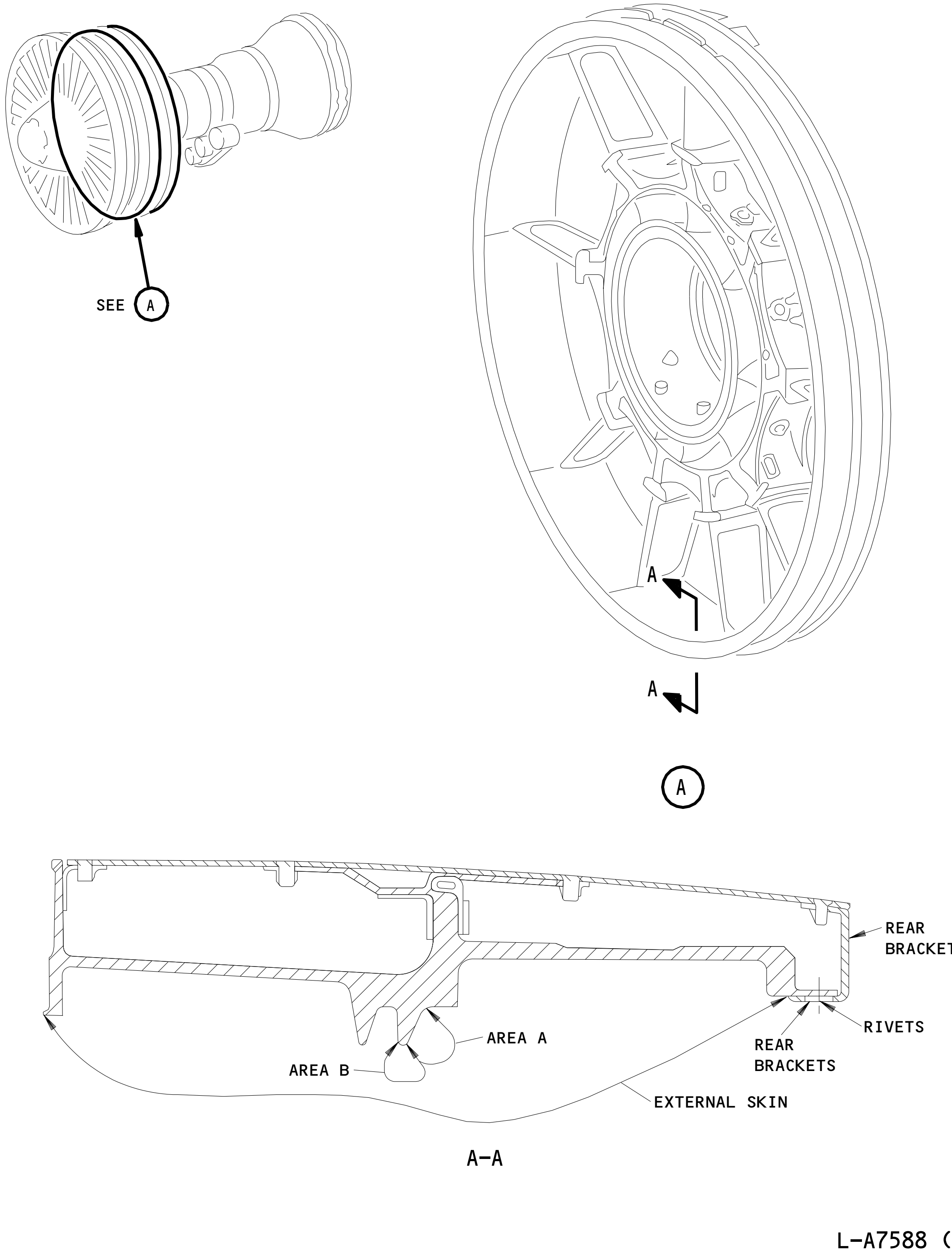
(5) Compare the damage that you find on the compressor intermediate case with the limits in Table 601 and Table 602.
  (a) If the damage to the compressor intermediate case is less than the limits in Table 601 or Table 602, no procedure is necessary.
  (b) If the damage to the compressor intermediate case is worse than the limits in Table 601 or Table 602, remove the engine before the subsequent flight.

S 216-012-N00

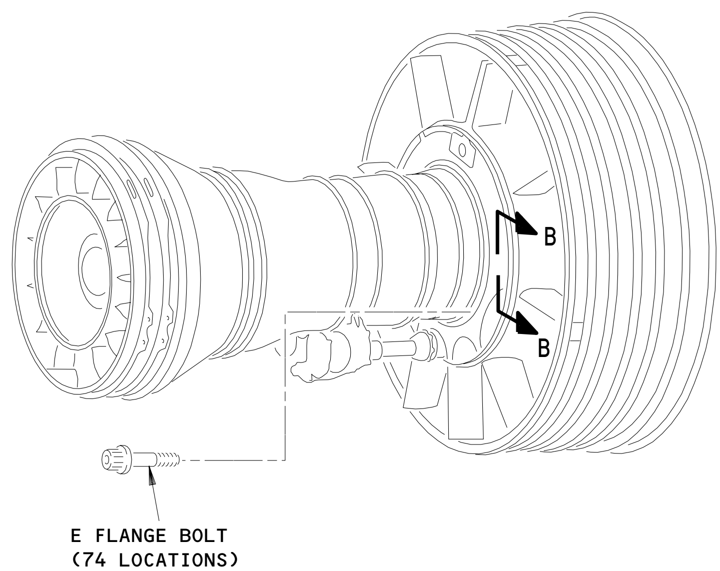
(6) Examine the 2.5 bleed area for loose pieces of seal on the 2.5 bleed valve ring and the bleed duct. If you find loose pieces of seal material, refer to AMM 75-32-00/601.

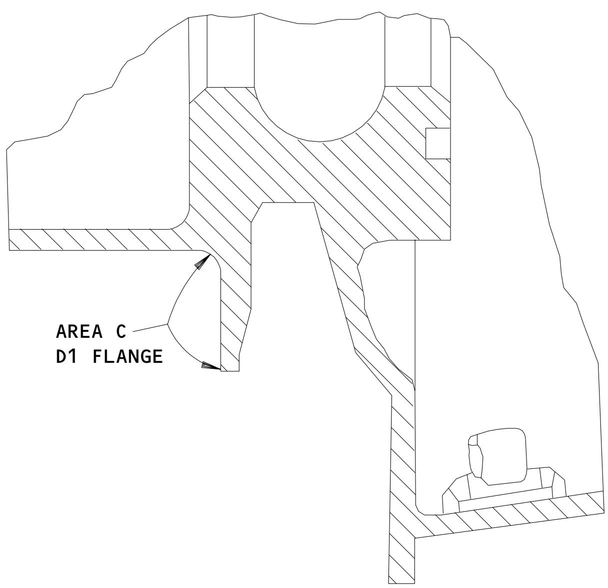
Table 601

AREA: CONDITION OBSERVED	DAMAGE LIMITS
Brackets: Wear or galling on the surfaces which touch the nacelle	No more than 0.250 inch (6.350 mm) in width, 0.015 inch (0.381 mm) in depth, and 24.00 inch (609.600 mm) in length
Rivets/Screws which attach the brackets to the intermediate case (screws are on ENGINES POST-PW-SB 72-264)	No damage is permitted
External skin for scratches, nicks and dents	Any quantity less than 6.00 inches (152.40 mm) maximum length and 0.012 inch (0.305 mm) maximum depth and 1.00 inch (25.40mm) minimum separation from other similar damage. Blends for damage below the handling pads at 3 and 9 o'clock positions can not extend into the fillet radius.



Compressor Intermediate Stage - Visual Inspection
Figure 601 (Sheet 1)





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Compressor Intermediate Case - Visual Inspection
Figure 601 (sheet 2)

Table 601	
AREA: CONDITION OBSERVED	DAMAGE LIMITS
Outer V Groove, for: Area A, 11:00 - 1:00 o'clock location:	
Surface damage galling:	0.025 inch (0.635 mm) maximum from orginal surface. Blend repair damaged area smooth.
Raised material sharp edges:	Remove raised material and sharp edges.
Outer V Groove, for: Area B, 11:00 - 1:00 o'clock location:	
Length:	6.00 inches (152.4 mm) maximum. Blend repair damaged area smooth.
Depth:	0.0625 inch (1.588 mm) maximum. Blend repair damaged area smooth.
Lenth:Depth ratio:	10:1 Minimum.
Outer V Groove, for: Area B, 2:30 - 9:30 o'clock locations:	
Length:	1.00 inch (25.40 mm) maximum. Blend repair damaged area smooth.
Depth:	0.125 inch (3.175 mm) maximum. Blend repair damaged area smooth.
Length:Depth ratio:	10:1 Minimum.

Table 601	
AREA: CONDITION OBSERVED	DAMAGE LIMITS
Outer V Groove, for: Area B, 1:00 - 2:30 and 9:30 - 11:00 o'clock locations:	
Length:	0.050 inch (1.270 mm) maximum. Blend repair damaged area smooth.
Depth:	0.050 inch (1.270 mm) maximum. Blend repair damaged area smooth.
Length:Depth ratio:	10:1 Minimum.
Minimum separation from similar damage:	1.00 inch (25.400 mm) minimum.

Table 602	
AREA: CONDITION OBSERVED	DAMAGE LIMITS
E Flange for: Bolts that are not there: 9:30 - 11:00 o'clock	No more than one (1) bolt that is missing.
Fan Exit Case, D1 flange assembly:	
Area C, all around for:	
Surface damage, galling:	0.015 inch (0.381 mm) maximum. Blend repair damaged area smooth.
Raised Material, Sharp edges:	Remove raised material and sharp edges.

S 416-006-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN AMM 78-31-00 TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(7) Close the thrust reversers (AMM 78-31-00/201).

S 416-007-N00
(8) Close the core cowl panels (AMM 71-11-06/201).

S 416-008-N00
(9) Close the fan cowl panels (AMM 71-11-04/201).

S 446-009-N00
(10) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

COMPRESSOR INTERMEDIATE CASE - APPROVED REPAIRS

1. General
   A. This procedure gives the steps for the blend repair of the external skin of the compressor intermediate case.
   B. The compressor intermediate case is aft of the fan case and forward of the HPC (High Pressure Compressor).
   C. You must open each half of the thrust reverser to get access to the compressor intermediate case.

TASK 72-34-07-308-011-N00

2. Compressor Intermediate Case External Skin Approved Repairs
   A. General
      (1) You will blend the damage that is on the external skin of the intermediate case to do this repair.
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panel
      (2) AMM 71-11-06/201, Core Cowl Panel
      (3) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

411	No. 1 Power Plant
421	No. 2 Power Plant

   D. Prepare to Do the Repair of the Intermediate Case External Skin

      S 048-012-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch which is found on the overhead panel, P5.

      S 048-002-N00

      WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (2) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 018-003-N00
      (3) Open the fan cowl panels (AMM 71-11-04/201).

      S 018-004-N00
      (4) Open the core cowl panels (AMM 71-11-06/201).

S 018-005-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

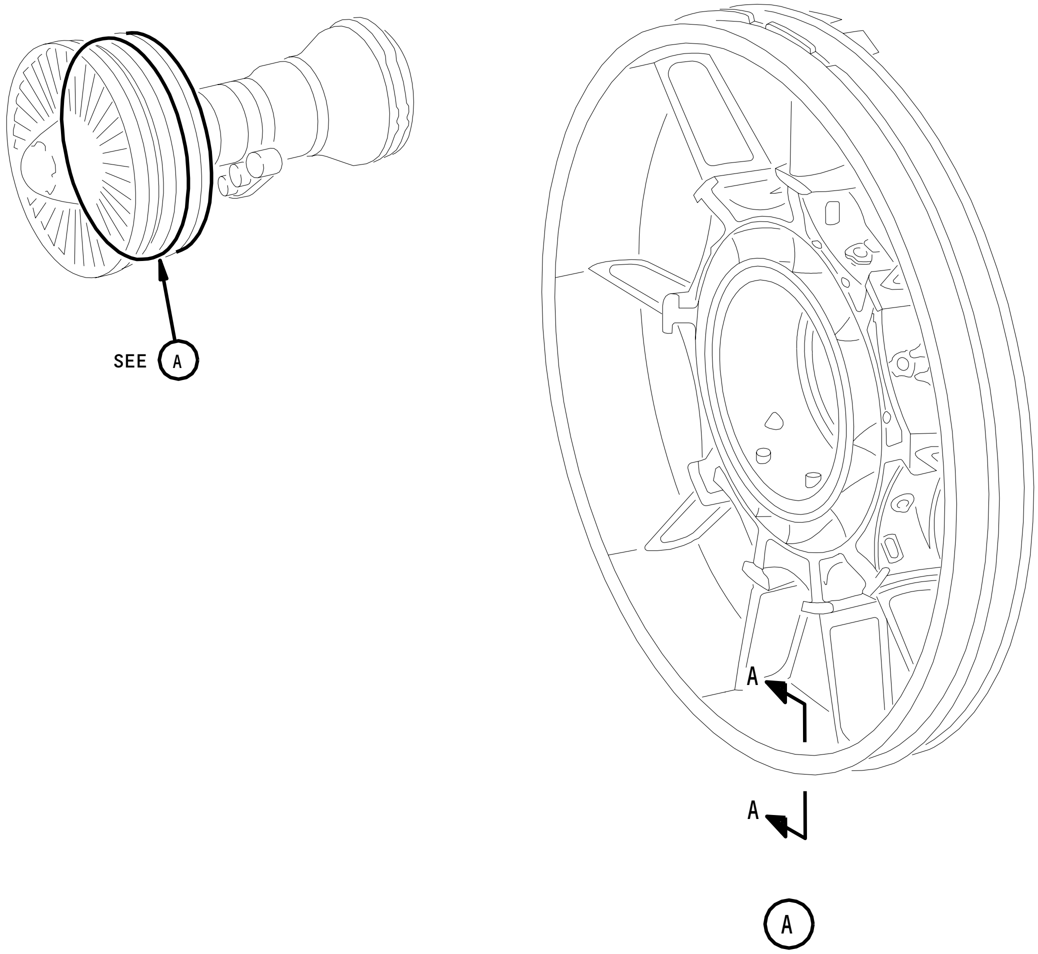
E. Repair the Intermediate Case External Skin

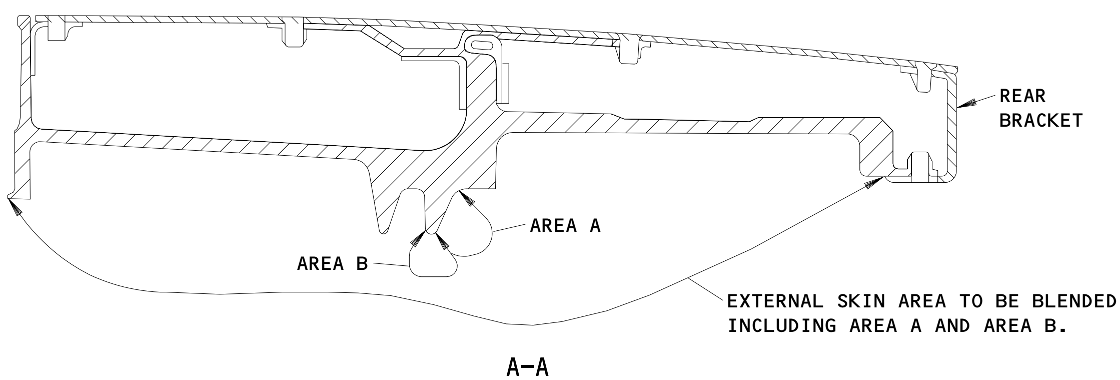
S 328-013-N00

(1) Use a fine file, an abrasive cloth, or an abrasive stone to do the blend repair within the limits in Table 801 (Fig. 801).
   (a) Blends for damage below the handling pads at 3 o'clock and 9 o'clock positions can not extend into the fillet radius.
   (b) Surface polish can extend into the fillet radius.

Table 801
Repair Limits

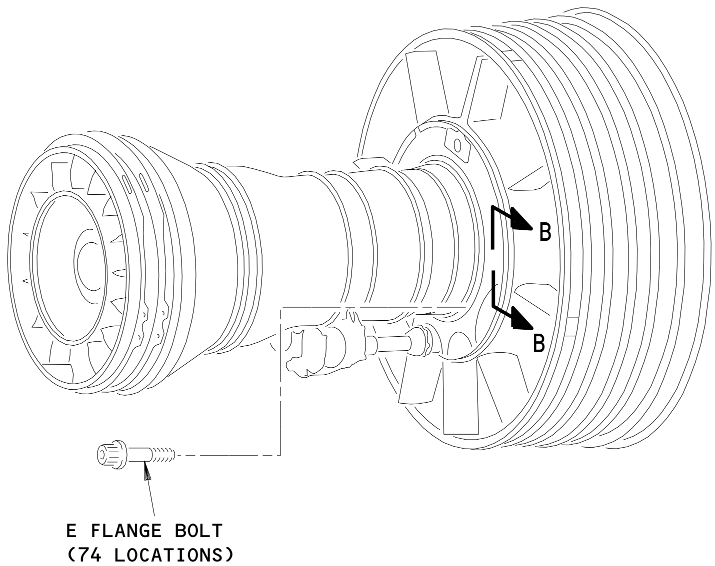
INSPECT	SERVICEABLE LIMITS	REPAIRABLE LIMITS
External Skin for: Scratches, nicks and dents		Any quantity less than 6.00 inches (152.40 mm) maximum length and 0.012 inch (0.305 mm) maximum depth and 1.00 inch (25.40 mm) minimum separation from other similar damage blend length to depth ratio of 10:1 minimum.
Outer Groove, for: Area A, 11:00 - 1:00 o'clock Location		
Surface Damage Galling		0.025 inches (0.0635 mm) maximum from original surface - blend smooth.
Raised Material and Sharp Edges	Not Permitted.	Blend raised material and sharp edges and make smooth.

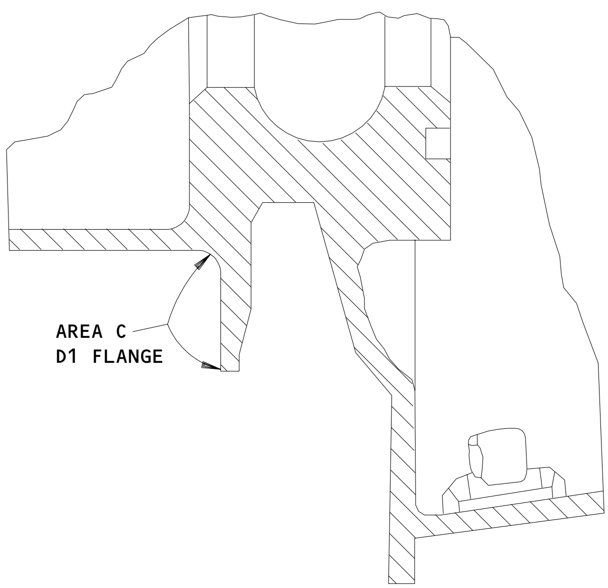




L-B3128 (0997)

Blend Repair Surface Damage Compressor Intermediate Stage
Figure 801 (Sheet 1)





B-B

L-A8488 (0997)

Blend Repair Surface Damage Compressor Intermediate Case
Figure 801 (sheet 2)

Table 801
Repair Limits

INSPECT	SERVICEABLE LIMITS	REPAIRABLE LIMITS
Outer Groove, for: Area B, 11:00 - 1:00 o'clock Location		
Length		6.00 inches (152.4 mm) maximum
Depth		0.0625 inches (1.588 mm) maximum
Length:Depth Ratio		10:1 Minimum
Outer Groove, for: Area B, from 2:30 - 9:30 o'clock Locations		
Length		1.00 inches (25.40 mm) maximum
Depth		0.125 inches (3.175 mm) maximum
Length:Depth Ratio		10:1 Minimum
Outer Groove, for: Area B, from all Other Locations:		
Length		0.050 inches (1.270 mm) maximum
Depth		0.050 inches (1.270 mm) maximum
Length:Depth Ratio		10:1 Minimum
Minimum Separation From Other Similar Damage		1.00 inch (25.400 mm) minimum

Table 801 Repair Limits		
INSPECT	SERVICEABLE LIMITS	REPAIRABLE LIMITS
Fan Exit Case, D1 Flange Assembly: Area C, All Around for:		
Surface Damage, Galling		0.015 inches (0.381 mm) depth maximum from original surface - blend smooth.
Raised Material and Sharp Edges	Not Permitted	Blend raised material and sharp edges and make smooth.

S 418-007-N00

<u>WARNING</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(2) Close the thrust reversers (AMM 78-31-00/201).

S 418-008-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 418-009-N00

(4) Close the fan cowl panels (AMM 71-11-04/201).

S 448-010-N00

(5) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

HIGH PRESSURE COMPRESSOR REAR CASE ASSEMBLY - APPROVED REPAIRS

1. General
   A. This procedure has one task. The task repairs the inserts that are damaged in the borescope holes at the locations AP-2 thru AP-7. The locations AP-2 thru AP-7 are found on the rear case of the high pressure compressor.

TASK 72-35-01-308-014-N00

2. Insert Repair
   A. Equipment
      (1) Heli-Coil (535-9) - Inserting Tool, Heli-Coil Products Division/Mite Corp. (HPDC), Danbury, CT 06810 (Commercially Available)
      (2) Heli-Coil (1227-16) - Extracting Tool - HPDC (Commercially Available)
      (3) Heli-Coil (7552-8) - Inserting Tool - HPDC (Commercially Available)
      (4) Heli-Coil (535-10) - Inserting Tool - HPDC (Commercially Available)
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 72-00-00/601, Engine - General
      (4) AMM 78-31-00/201, Thrust Reverser System
      (5) IPC 72-35-53-01, Plugs - Borescope HPC Rear Case
   C. Access
      (1) Location Zones

411	Engine (Left)
421	Engine (Right)

      (2) Access Panels

415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)

   D. Prepare To Repair The Inserts That Are Damaged

      S 048-001-N00

      WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

      (1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 018-002-N00
      (2) Open the right fan cowl panel (AMM 71-11-04/201).

S 018-003-N00
(3) Open the right core cowl panel (AMM 71-11-06/201).

S 018-014-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the right thrust reverser (AMM 78-31-00/201).

S 018-010-N00
(5) Remove the plug from the insert that is damaged.

E. Repair The Inserts That Are Damaged

S 028-013-N00
(1) Remove the insert that is damaged:

TABLE 801
Insert Cross Reference And Tool Part Number

Pratt And Whitney Insert Part Number	Helicoil Insert Part Number	Extracting Tool Part Number	Inserting Tool Part Number	Break-Off Tool
743636	3591-9TN-0562	1227-16	535-9	Long-Nose Pliers
743637	3591-8TN-0500	1227-16	7552-8	Long-Nose Pliers
MS124661	1191-9CN-0562	1227-16	535-9	Long-Nose Pliers
MS124662	1191-10CN-0625	1227-16	535-10	Long-Nose Pliers

(a) Put the blade of the extracting tool into the insert that is damaged until the top of the blade is 1/4 of a turn from the bottom of the insert that is damaged.

NOTE: If the top of the blade can not go to the depth of 1/4 of a turn from the bottom of the insert that is damaged, you can use an extension on the extracting tool.

(b) Lightly hit the extracting tool with a hammer to engage the top of the blade with the bottom of the insert that is damaged.

(c) Keep pressure on the extracting tool as you slowly turn it counterclockwise to remove the insert that is damaged.

S 428-012-N00

(2) Install the insert:
(a) Put the insert on the top of the inserting tool.
(b) Align the inserting tool with the borescope hole.
(c) Keep pressure on the inserting tool as you slowly lower and turn it clockwise until the top of the insert is at a depth of 1-1.5 threads below the surface of the borescope hole.

CAUTION: DO NOT LET THE TANG FALL INTO THE ENGINE. IF THE TANG FALLS INTO THE ENGINE, IT CAN CAUSE DAMAGE TO THE ENGINE.

(d) Use the break-off tool to bend the tang until it breaks off.
(e) Discard the tang.

F. Put The Airplane In Its Usual Condition.

S 418-009-N00

(1) Install the plug in the insert (AMM 72-00-00/601).

S 418-013-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(2) Close the right thrust reverser (AMM 78-31-00/201).

S 418-006-N00

(3) Close the right core cowl panel (AMM 71-11-06/201).

S 418-007-N00

(4) Close the right fan cowl panel (AMM 71-11-04/201).

S 448-008-N00

(5) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

HPC ROTOR BLADES - REPAIRS

1. General

A. This procedure has one task. The task blends the leading edges of the blades that are damaged in the 5th, 6th, and 7th stage of the high pressure compressor (HPC). You can blend the blades that are damaged more than the Service Limits until you get to the Blend Limits. The Blend Limits include 0.012 inch (0.305 mm) of material that is not damaged that must be blended along with the material that is damaged.

NOTE: You can not blend the leading edges of the blades that are damaged in Area E of the 5th stage.

B. This repair uses a rigid tube borescope with an attached power rotary diamond ball and rotary kratex. The power rotary diamond ball blends the blades that are damaged. The rotary kratex removes the burrs and polishes the blades that were damaged. A video monitor is necessary to see both the blades and the repair of the blades that are damaged. Some video monitors have a video micrometer to measure the damage, location, and depth of the repair.

TASK 72-35-02-328-006-N00

2. Stage 5, 6, And 7 Rotor Blades - Repairs

A. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 72-00-00/601, HPC Vane and Blade (5th thru 15th-Stage)
   (4) AMM 78-31-00/201, Thrust Reverser System

B. Equipment
   (1) PWA 49057 Kit, Blending - 5th, 6th, and 7th Stage HPC Blades (Borescope Access)
   (2) PWA 49117 Kit, Video System - 5th, 6th, and 7th Stage HPC Blades (Machida) (alternative to PWA 101045)
   PWA 101045 Kit, Video System - 5th, 6th, and 7th Stage HPC Blades (Olympus) (alternative to PWA 49117)

C. Access
   (1) Location Zones

411	Engine (Left)
421	Engine (Right)

   (2) Access Panels

415AL	Thrust Reverser Half (Left)
416AR	Thrust Reverser Half (Right)
425AL	Thrust Reverser Half (Left)
426AR	Thrust Reverser Half (Right)

D. Prepare for the Repair of the Stage 5, 6, and 7 Rotor Blades

S 048-002-N00

WARNING: DO THE DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 018-003-N00
(2) Open the right fan cowl panel (AMM 71-11-04/201).

S 018-004-N00
(3) Open the right core cowl panel (AMM 71-11-06/201).

S 018-005-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

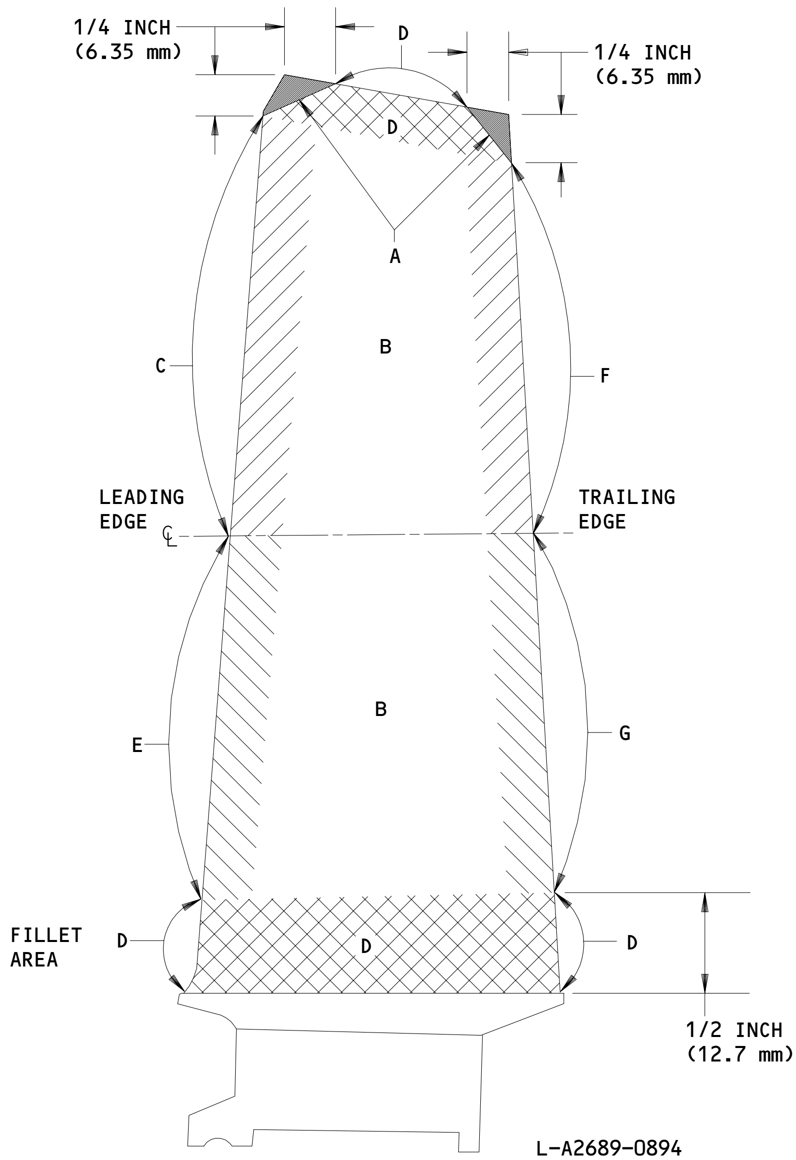
(4) Open the right thrust reverser (AMM 78-31-00/201).

S 018-006-N00
(5) Remove the plugs from the borescope ports AP-2 and AP-3 (AMM 72-00-00/601).

S 488-007-N00
(6) Set up the PWA Video System Kit 49117 (alternative) or PWA Video System Kit 101045 (alternative) (Fig. 802).

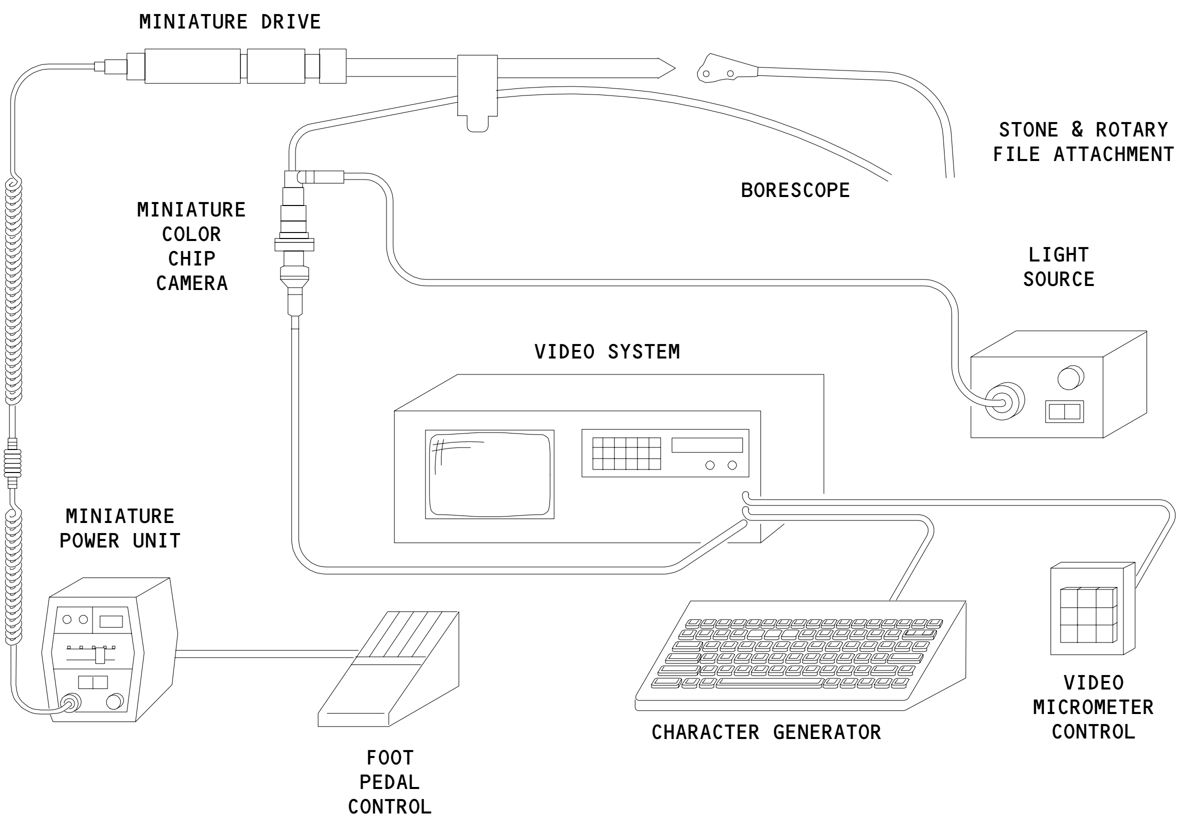
S 488-008-N00
(7) Set up the PWA Blending Kit 49057 (Fig. 802).

E. Repair the Stage 5, 6, and 7 Rotor Blades (Fig. 801 and 802)



TYPICAL BLADE

Borescope Inspection/Repair Limits For Foreign Object Damage (Stages 5, 6 and 7)
Figure 801



Borescope Blend Repair Equipment Schematic
Figure 802

S 998-013-N00

(1) Use the table that follows to find the damage limits for foreign object damage.

Borescope Inspection/Repair Limits For Foreign Object Damage
(Stages 5, 6, and 7)
Table 801

Blade Area	Service Limits	Blend Limits
A	1/4 in. (6.35 mm) corner broken-off completely is permitted. Curled, deformed, or impact damaged materials are permitted in this area.	None
B	Indentations in this area are permitted. Raised spots on the opposite side of the foil are permitted if there are no cracks.	None
C	Damage that has a depth of 1/32 in. (0.794 mm) and is isolated by a minimum of 1/4 in. (6.35 mm) radially is permitted.	A maximum depth of 5/32 in. (3.969 mm) is permitted. See NOTE.
D	No damage is permitted.	None
E	Damage that has a depth of 1/64 in. (0.397 mm) and is isolated by a minimum of 1/4 in. (6.35 mm) radially is permitted.	For blades in the 5th stage, no repair is permitted. For blades in the 6th and 7th stage, a maximum depth of 3/32 in. (2.381 mm) is permitted. See NOTE.
F	Damage that has a depth of 1/32 in. (0.794 mm) and is isolated by a minimum of 1/4 in. (6.35 mm) radially is permitted.	None
G	Damage that has a depth of 1/64 in. (0.397 mm) and is isolated by a minimum of 1/4 in. (6.35 mm) radially is permitted.	None

NOTE: The Blend Limits include 0.012 inch (0.305 mm) of material that is not damaged that must be blended along with the material that is damaged.

S 328-012-N00

WARNING: DO THIS REPAIR IN AN AREA THAT IS PROTECTED FROM THE WEATHER. IF THIS REPAIR IS DONE IN WET CONDITIONS, USE SUFFICIENT PROTECTION TO PREVENT INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(2) Blend the blades that are damaged.
   (a) This repair and equipment only applies to the leading edges of the blades that are damaged in the 5th, 6th, and 7th stage of the HPC.
   (b) Get access to the blades that are damaged through the borescope ports AP-2 and AP-3.
   (c) Only one repair that is more than the Service Limits is permitted for each blade. The Service Limits and Blend Limits are found on Figure 801 and Table 801.

      NOTE: When you repair a blade to remove the damage that is greater than the Service Limits, you can also repair the other damage on the blade. You can repair this other damage on the blade until you get to the Blend Limits for that blade.

   (d) There are no limits to the number of blades that can be repaired in one stage or in all three stages.
   (e) The length of the repair, the radial direction along the leading edge, must be a minimum of four times the depth of the repair.
   (f) The Blend Limits in Table 801 give you the maximum depth of all repairs.
   (g) Blades that show indications of cracks can not be repaired.
   (h) Damage to the leading and trailing edges becomes more important near the fillet area. Thus all damage in Area E must be thought of for repair only after a very careful inspection.

      NOTE: You can not blend the blades that are damaged in Area E of the 5th stage.

   (i) Only use a power drive that limits the speed of the tool to 4000 RPM. Only use the tools that make the correct finish on the surface of the blades. Do not machine the blades too much. No sparks are permitted.
   (j) Use a PWA 49117 or a PWA 101045 Video System Kit through the AP-2 and AP-3 borescope access ports to monitor and measure the repair of the blades that are damaged.
   (k) No edges that are sharp are permitted after the repair of a blade that was damaged.

CAUTION: DO NOT REMOVE THE BURRS WITH A ROTARY FILE OR DAMAGE TO THE BLADES CAN OCCUR.

(l) The burrs and material that is rolled over is not permitted and must be removed with a rotary stone.
(m) After the blades are repaired, it is necessary to polish the blades that were repaired.

F. Repair the Stage 5, 6 and 7 Rotor Blades

S 308-016-N00
(1) This repair applies to all HPC blades part numbers on 5th- thru 15th HPC blade stages except as follows:
(a) It is not possible to in-situ repair the leading edge of the 10th and 12th HPC blades stages due to the tooling access.
(b) It is also not possible to in-situ repair the trailing edge of the 9th, 11th and 15th HPC blades due to the tooling access.
(c) It is not possible to in-situ repair the 12th and 13th HPC blades stages on the engines that incorporate the HPC ring case configuration, since you can not insert the blending tool through the AP-6 borescope port.

S 308-017-N00
(2) This repair can be used to blend minor damage on the leading and/or trailing edges of the HPC blades in assembled engines.

NOTE: See AMM 72-00-00-601 for the blade stage access locations and its continue-in-service limits.

S 308-018-N00

CAUTION: EXCEPT FOR WORK OR SUPPLIES TO BE PERFORMED OR FURNISHED BY PRATT & WHITNEY, PRATT & WHITNEY DOES NOT ENDORSE THE WORK PERFORMED BY THE COMPANY OR COMPANIES IDENTIFIED HEREIN OR ANY OTHER COMPANY AND DOES NOT ACCEPT RESPONSIBILITY TO ANY DEGREE FOR THE SELECTION OF SUCH COMPANY OR COMPANIES FOR THE PERFORMANCE OF ANY WORK OR PRECUREMENT OF SUPPLIES.

(3) Send the repair parts to an approved source licensed for your repair.

Pratt & Whitney Services, Inc.
d.b.a. Dallas Aviation Field Service
400 Main Street
East Hardford, CT 06108 USA
Tel: (860) 565-0140
Fax: (860) 565-5442

Eagle Service ASIA
51 Calshot Road
Singapore 509927
Tel: 65-548-2900
Fax: 65-542-1227

S 308-019-N00

(4) Due to the critical nature of this repair, the repair sources must demonstrate to Pratt & Whitney their capabilities to perform this repair and be licensed by Pratt & Whitney.
   (a) You can write to the address below about the qualification program to become an approved and licensed source.

Pratt & Whitney
Materials & Processes Engineering
Manager, Repair Licensing And Audit
400 Main Street, Mail Stop 169-04
East Hardford, CT 06108

Fax: (860) 557-2515

G. Put the Airplane Back to Its Usual Condition

S 088-011-N00

(1) Remove the PWA Blending Kit 49057 (Fig. 802).

S 088-012-N00

(2) Remove the PWA Video System Kit 49117 (alternative) or PWA Video System Kit 101045 (alternate) (Fig. 802).

S 418-010-N00

(3) Install the plugs in the borescope ports AP-2 and AP-3 (AMM 72-00-00/601).

S 418-011-N00

WARNING: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Close the right thrust reverser (AMM 78-31-00/201).

S 418-012-N00

(5) Close the right core cowl panel (AMM 71-11-06/201).

S 418-013-N00

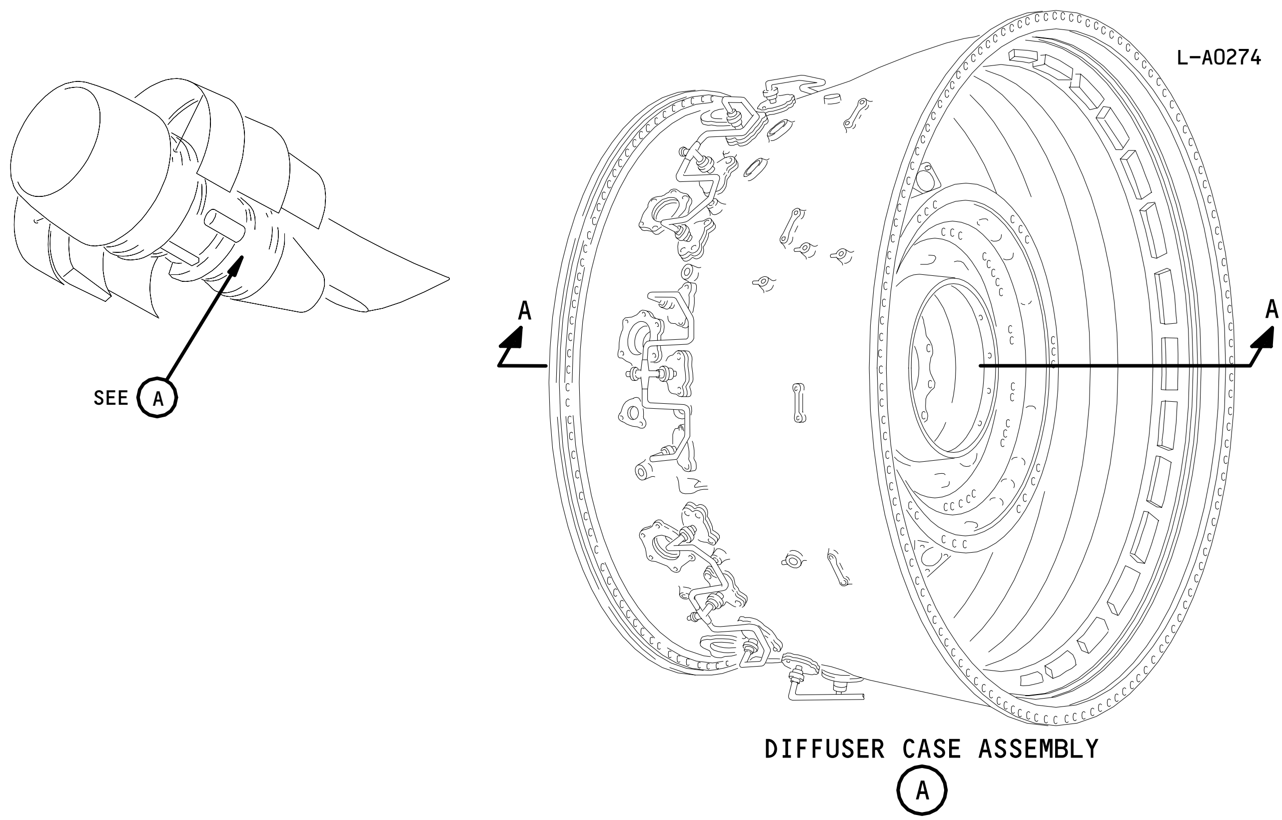
(6) Close the right fan cowl panel (AMM 71-11-04/201).

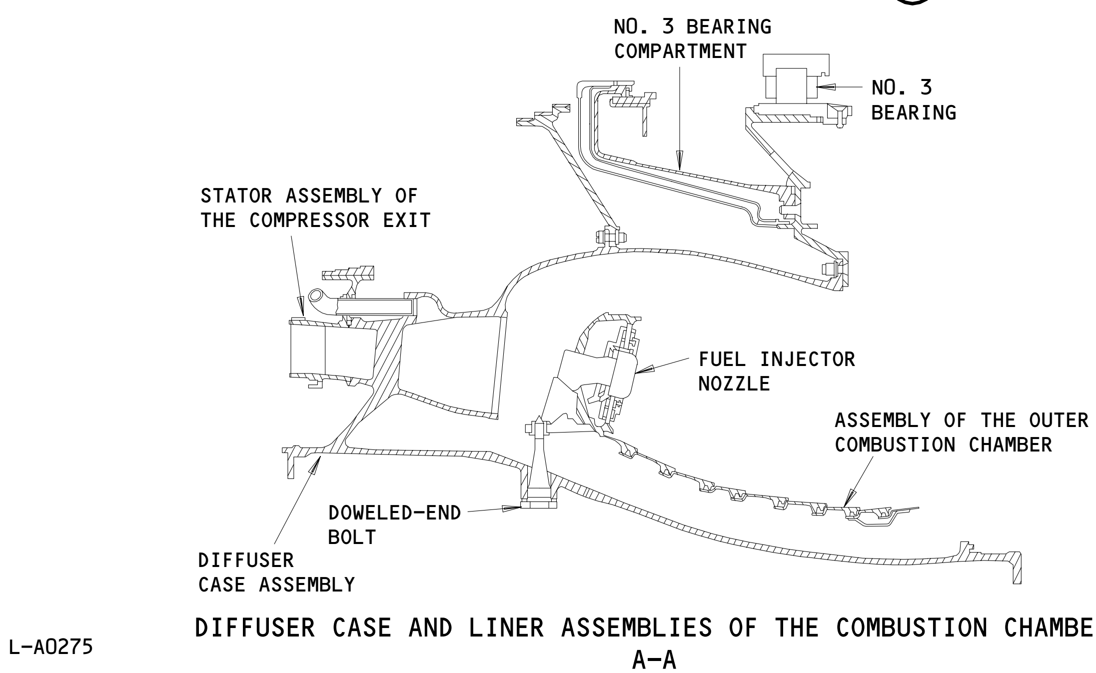
S 448-014-N00

(7) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

COMBUSTION SECTION - DESCRIPTION AND OPERATION

1. General
   A. The diffuser and combustion section consists of a cast nickel alloy case, a cast stator assembly for the compressor exit (Stage 15), 24 fuel injector nozzles and corresponding support assemblies, two igniter plugs, the No. 3 bearing compartment and the assembly for the outer combustion chamber (liner).
2. Component Details
   A. Diffuser Case Assembly (Fig. 1)
      (1) The diffuser case is a main structural support for the engine as it supports the No. 3 bearing and the rear of the high pressure rotor system. The outer wall of the case forms the outer contour of the diffused (expanded) gaspath. The outer wall also has mounting provisions for the externally removeable fuel injectors and igniter plugs.
      (2) There are eight removeable, borescope access ports in the outer wall. These ports provide access for inspection of the stator vanes of the compressor exit, combustion chamber liners, fuel injectors, vane cluster assemblies of the 1st-stage high pressure turbine (HPT), and 1st-stage HPT blades. Four mounting bosses are provided for connecting to the aircraft pneumatic (service bleed) system.
      (3) The inner structure of the case is supported by integrally cast hollow struts at the forward end. This structure consists of the wall which forms the inner contour of the diffused gaspath, as well as the attachment flange for the No. 3 bearing housing. The structure also provides radial load distribution support for the bearing compartment through the struts.
      (4) The hollow struts provide radial passage across the gaspath for the oil supply, breather and scavenge tubes, and for tubes supplying cooling air to the No. 3 bearing compartment and the high pressure turbine.
   B. Stator Assembly of the Compressor Exit
      (1) The stator assembly of the compressor exit is bolted to a flange in the forward diffuser case in front of the struts and divergent nozzle for the diffuser airflow. The stator is an integrally cast vane, shroud and transition duct assembly.
      (2) The vanes straighten the rotational motion of the airflow as it exits the compressor rotor (Stage 15) and directs it axially rearward. The inner and outer shrouds form a transition duct for the discharge gaspath of the high pressure compressor into the diffuser airflow nozzle.
   C. No. 3 Bearing and Compartment
      (1) The No 3 Bearing is roller type bearing with a one piece inner and a one piece outer race. The individual rollers are positioned to the inner race by a retainer device.





DIFFUSER CASE AND LINER ASSEMBLIES OF THE COMBUSTION CHAMBER
A-A

Diffuser Case Assembly
Figure 1

(2) The No. 3 Bearing compartment consists of the front (spring loaded) carbon seal assembly, the bearing housing, and the rear (spring loaded) carbon seal assembly. The bearing housing is attached to the inner rear flange of the diffuser case. The assemblies for the front and rear carbon seal are bolted to the bearing housing.

(3) The carbon seal assemblies form the compartment oil sump. The nozzle which supplies oil to the bearing and seals is attached to the front seal assembly.

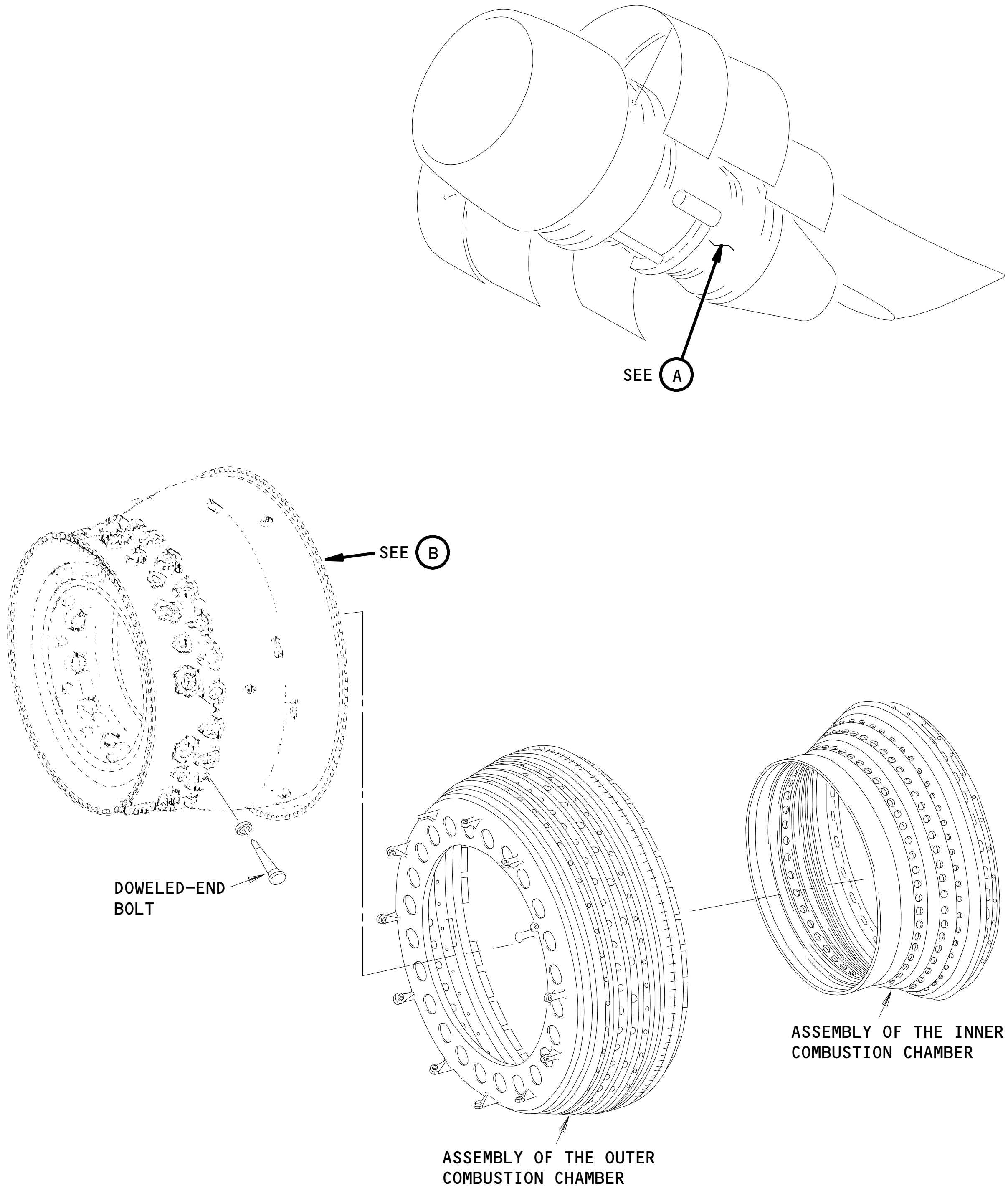
(4) The bearing compartment is provided with a heat shield duct which is supplied with precooled, 12th-stage air of the high pressure compressor.

D. Liner Assemblies for the Combustion Chamber (Fig. 2)

(1) There are two liner assemblies for the combustion chamber. The liner assembly for the inner combustion chamber is part of the turbine nozzle section for assembly. The liner assembly for the outer combustion chamber is part of the diffuser and combustor section for assembly. The two combustor assemblies form a short double pass flow type burner of welded, rolled ring construction. The inner combustor surfaces, exposed to combustion gases, are coated with a magnesium zirconate material for thermal protection.

(2) The outer combustion chamber is retained to the outer wall of the diffuser case, at the forward end, by twelve doweled-end bolts. The rear of the chamber is positioned and retained to the turbine nozzle by a guide and circumferential clamp assembly. The guide and clamp assembly is adjusted during assembly to provide a slip-fit sealing feature with the outer diameter of the combustion chamber.

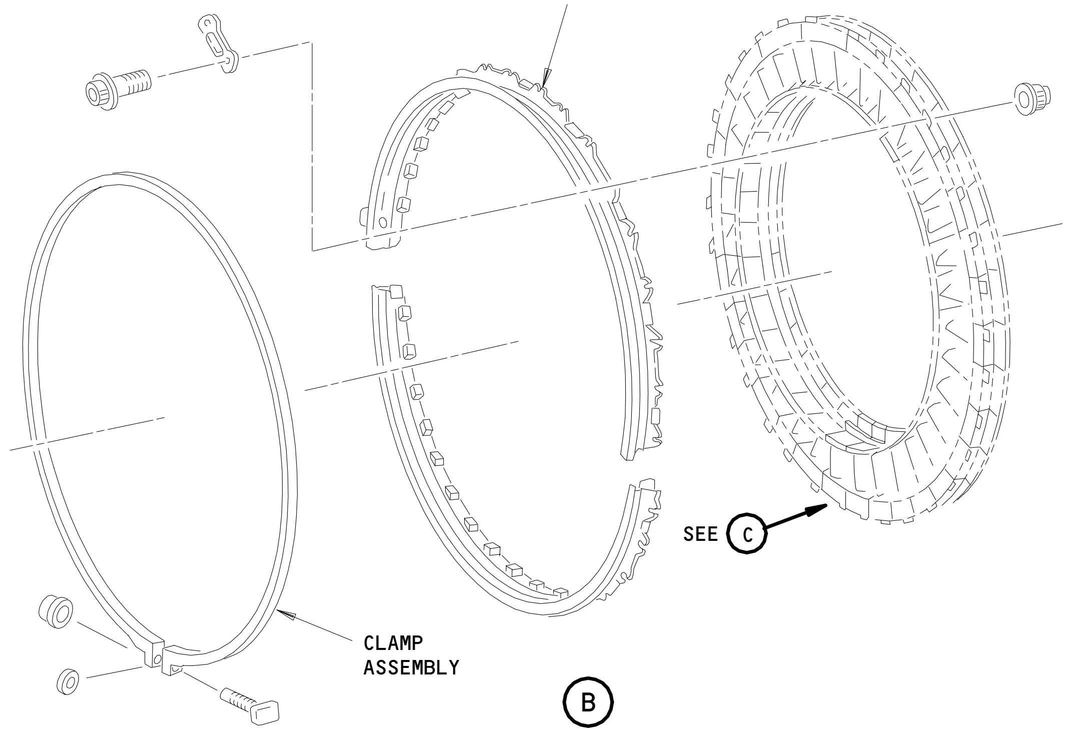
(3) The combustion chamber allows a proper mix of fuel, from the fuel injectors, and air for optimum combustion. Combustion of the fuel occurs in the forward and middle section of the chamber, aft of the fuel injector nozzles. Complete mixing of the remaining air and the hot combustion gasses and transition to the turbine nozzle occurs in rear section of the chamber.

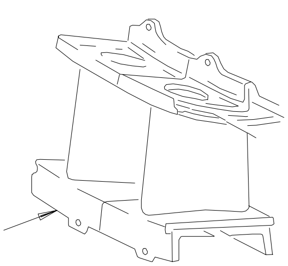


LINER ASSEMBLIES OF THE COMBUSTION CHAMBER

A

Combustion Chamber Liner Assemblies
Figure 2 (Sheet 1)





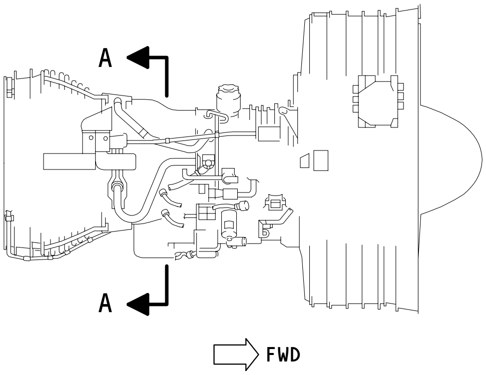
Combustion Chamber Liner Assemblies
Figure 2 (Sheet 2)

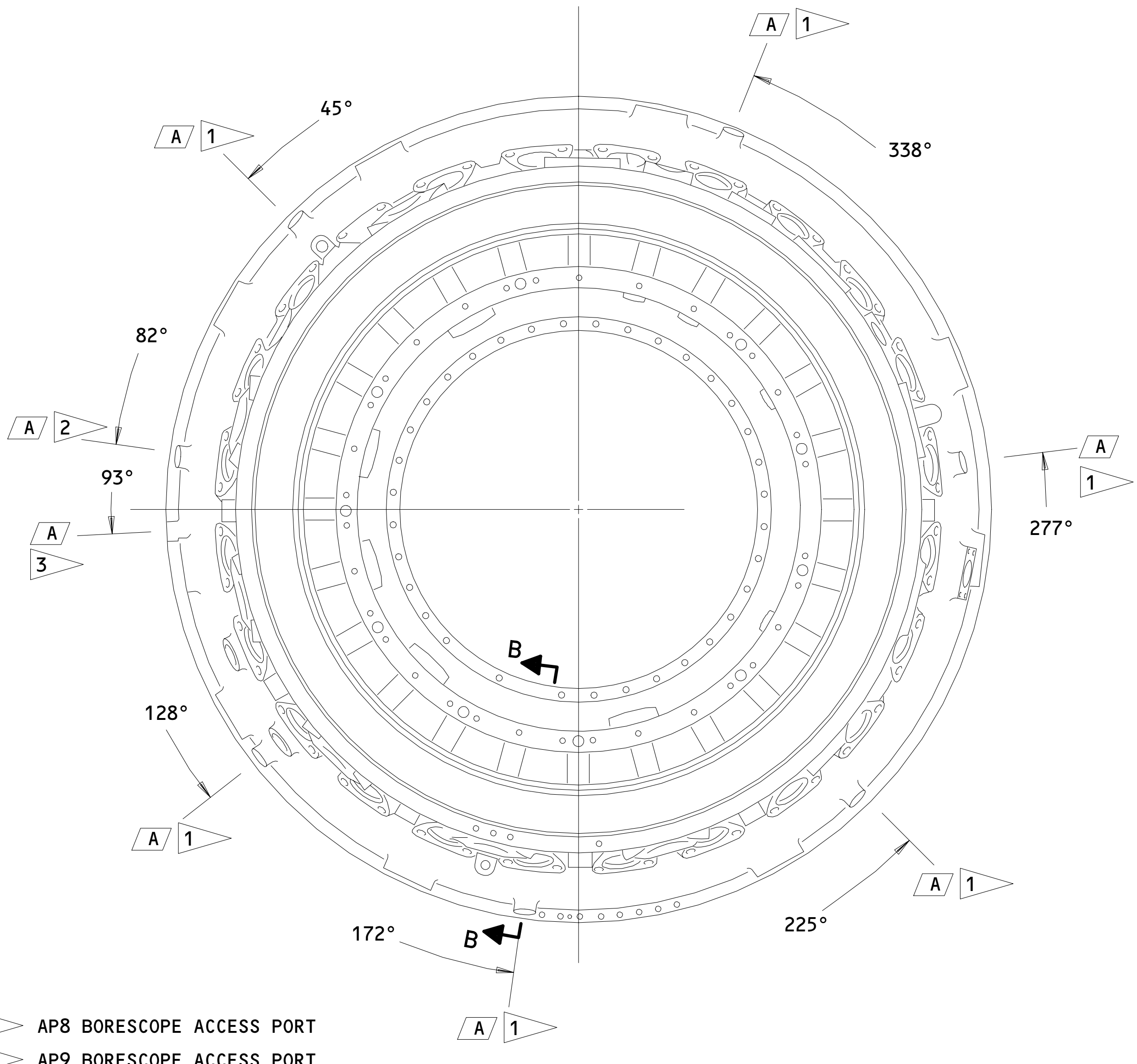
DIFFUSER CASE ASSEMBLY - APPROVED REPAIRS

1. General
   A. This procedure gives instructions when you repair the thread bosses on the diffuser case.
   B. Three boss threads are repaired in this procedure. They are the AP8 borescope access port, the AP9 borescope access port, and the immersion thermocouple port.

TASK 72-41-02-328-001-N00

2. Diffuser Case Assembly - Approved Repairs (Fig. 801)
   A. General
      (1) Do this repair after you repair the boss threads with a tap if this condition does not occur:
         (a) There are a minimum of four full threads which are not less than 0.350 inch (8.890 mm) from the surface A (Fig. 801).
      (2) It is not necessary to machine the inner counterbore when you do this repair.
      (3) When the engine is disassembled sufficiently to give access to the inner surface of the diffuser case, then you must machine the counterbore.
   B. Equipment
      (1) Insert Installation Tool - 535-9, Heli-Coil Products Division/Mite Corporation: Danbury Connecticut 06810 (Recommended), or Commercially Available (Alternative)
      (2) Insert Extracting Tool - 1227-16, Heli-Coil Products Division/Mite Corporation (Recommended), or Commercially Available (Alternative)
      (3) Thread Plug Gage - 1694-9, Heli-Coil Products Division/Mite Corporation (Recommended), or Commerically Available (Alternative)
      (4) Tap - 38193-9, Heli-Coil Products (Recommended), or Commercially Available (Alternative)
      (5) Bottoming Tap - 43193-9, Heli-Coil Products Division/Mite Corporation (Recommended), or Commercially Available (Alternative)
      (6) Tap Guide, PWA 81439
      (7) Reamer Guide, PWA 81441
      (8) Special Reamer, PWA 81442
      (9) Special Reamer, PWA 81443
      (10) Insert - 1191-9TN-0500, Heli-Coil Products Division/Mite Corporation (Recommended), or Commercially Available (Alternative)



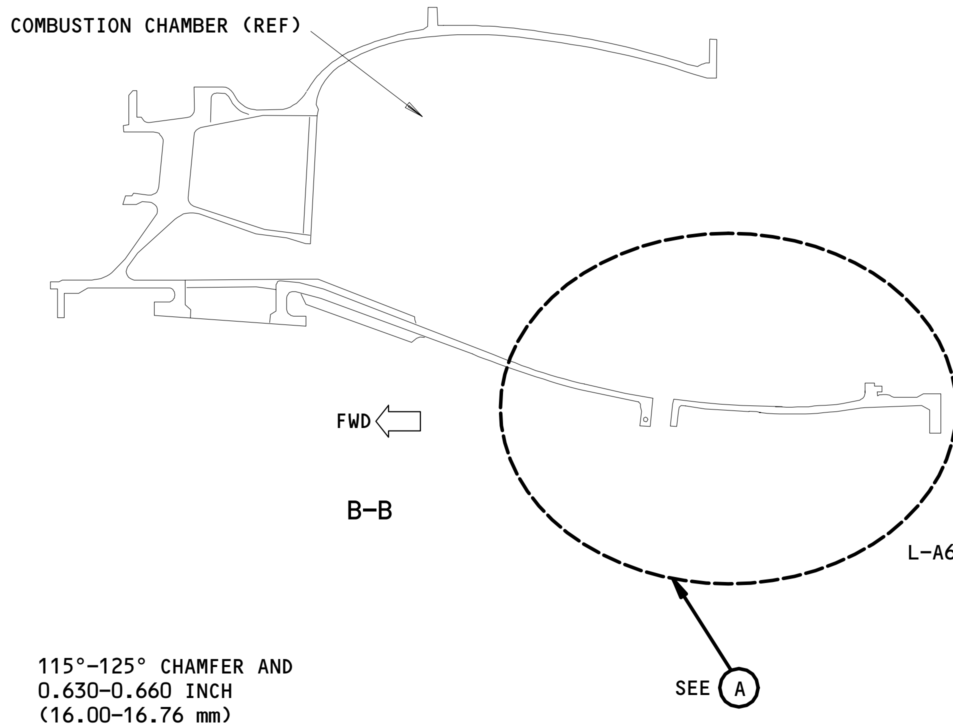


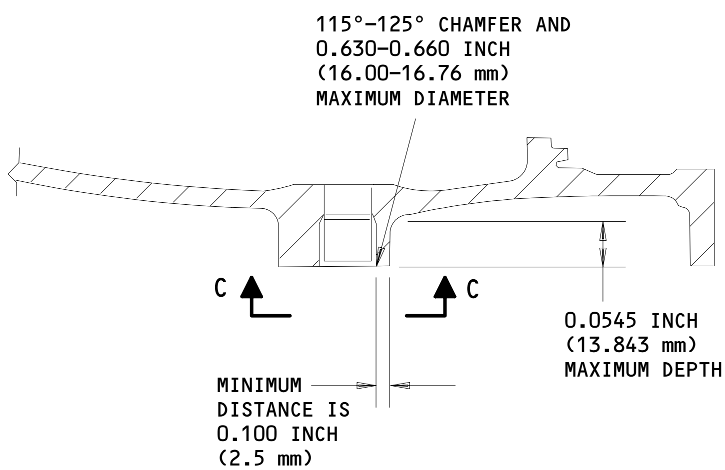
1 AP8 BORESCOPE ACCESS PORT
2 AP9 BORESCOPE ACCESS PORT
3 IMMERSION THERMOCOUPLE

(VIEW IN THE AFT DIRECTION)
A-A

L-A6338

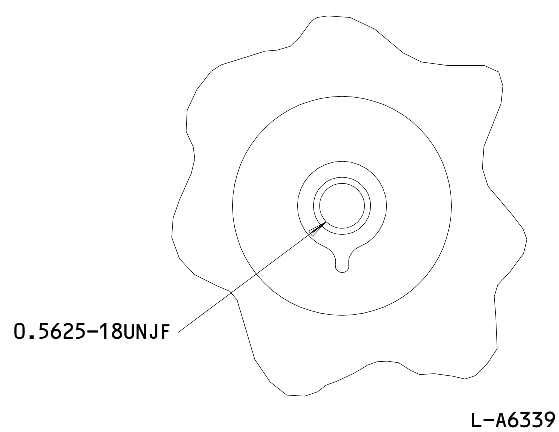
Boss Thread Repair
Figure 801 (Sheet 1)





EXAMPLE OF BOSS AT A

A



C-C

Boss Thread Repair
Figure 801 (Sheet 2)

C. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 78-31-00/201, Thrust Reverser System

D. Access
   (1) Location Zones

411	Left Engine
421	Right Engine

   (2) Access Panels

415AL	Fan Reverser (Left), Left Engine
416AR	Fan Reverser (Right), Left Engine
425AL	Fan Reverser (Left), Right Engine
426AR	Fan Reverser (Right), Right Engine

E. Prepare to Repair the Diffuser Case Assembly

S 018-002-N00

(1) Open the fan cowl panels (AMM 71-11-04/201).

S 048-003-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 018-004-N00

(3) Open the core cowl panels (AMM 71-11-06/201).

S 018-005-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT COULD OCCUR.

(4) Open the thrust reversers (AMM 78-31-00/201).

F. Repair the Diffuser Case Assembly

S 328-006-N00

CAUTION: THE THICKNESS OF THE BOSS WALL CAN NOT BE LESS THAN 0.100 INCH (2.5 MM). IF YOU DRILL TO A DEPTH WHICH IS MORE THAN 0.545 INCH (13.843 MM), THE LIFE OF THE CASE WILL BE DECREASED.

(1) Do these steps to machine the damaged threads (Fig. 801).

NOTE: The areas which are machined must be not more than 0.010 inch (0.254 mm) in all directions from the correct position of surface A. The areas must also not be more than 0.010 inch (0.254 mm) in all directions from the original location of the minor diameter of the damaged thread.

(a) Attach a shop vacuum cleaner to the PWA 81441 Reamer Guide.
(b) Install the PWA 81442 Special Reamer in the PWA 81441 Reamer Guide.
(c) Use a standard electric drill to machine the damaged threads.
(d) Remove the PWA 81442 Special Reamer for the PWA 81441 Reamer Guide and install the PWA 81443 Special Reamer.
(e) Use a standard electric drill to machine the damaged threads.

S 328-007-N00
(2) Do the steps that follow to tap the boss threads (Fig. 801).
(a) Attach a shop vacuum cleaner to the PWA 81439 Tap Guide.
(b) Attach the tap in the PWA 81439 Tap Guide. Tap the boss thread.
(c) Remove the tap form the PWA 81439 Tap Guide and install the bottoming tap in the hole.
(d) Tap the boss thread. Remove all the particles.

S 228-008-N00
(3) Use a thread plug gage to do an inspection of the threads.

S 328-009-N00
(4) Do the steps that follow to install the inserts in the boss thread.
(a) Install the insert in the inserting tool. Put the end of the inserting tool in the boss threads.
(b) Turn the handle of the inserting tool clockwise until the top of the insert is 3/4 to 1-1/2 pitch below the face of the boss.

NOTE: Remove the insert with the extracting tool.

(c) Use a long nose pliers to break off the insert tang.

G. Put the Airplane Back to Its Usual Condition

S 418-010-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IS YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT COULD OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 418-011-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 448-012-N00

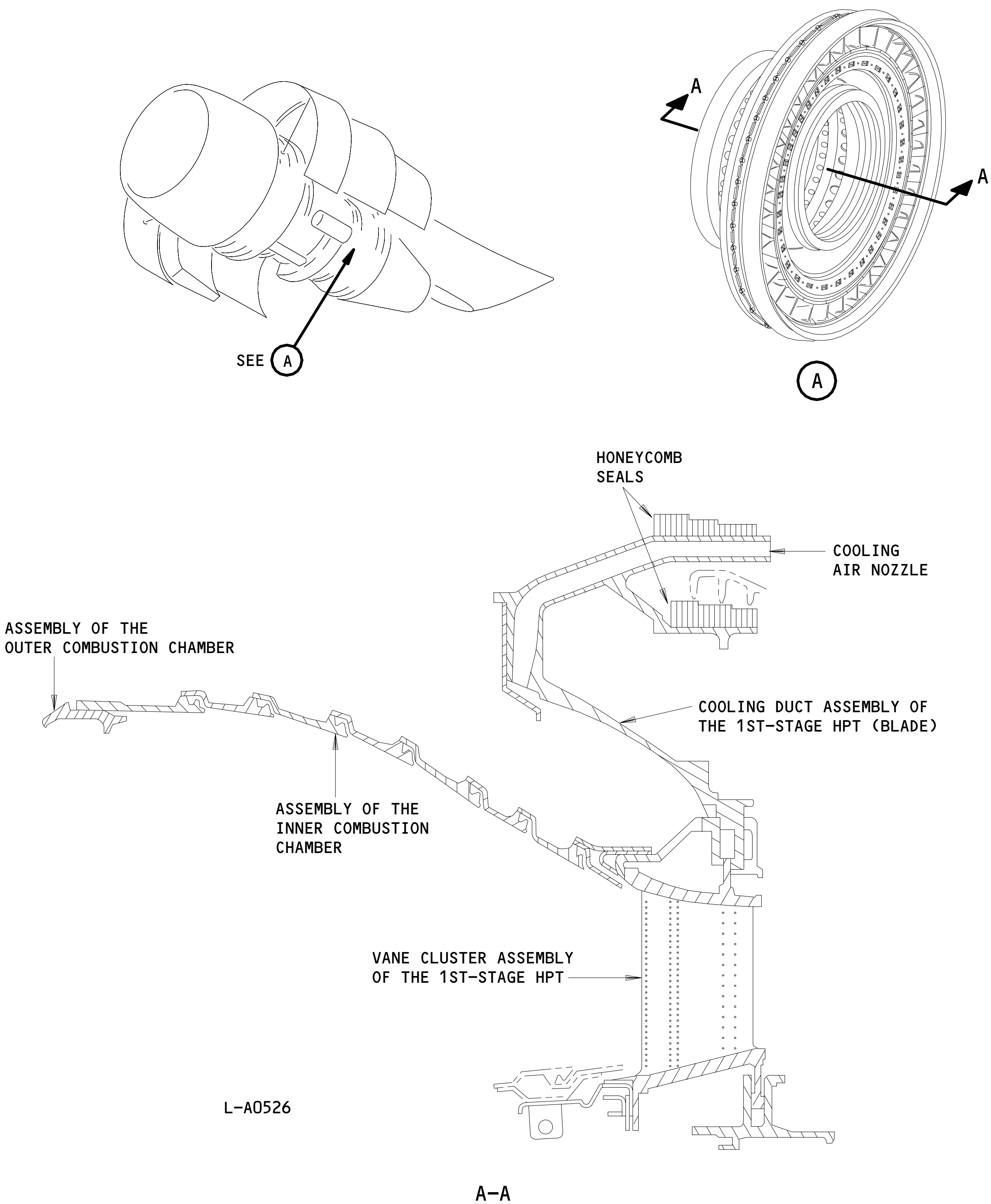
(3) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 418-013-N00

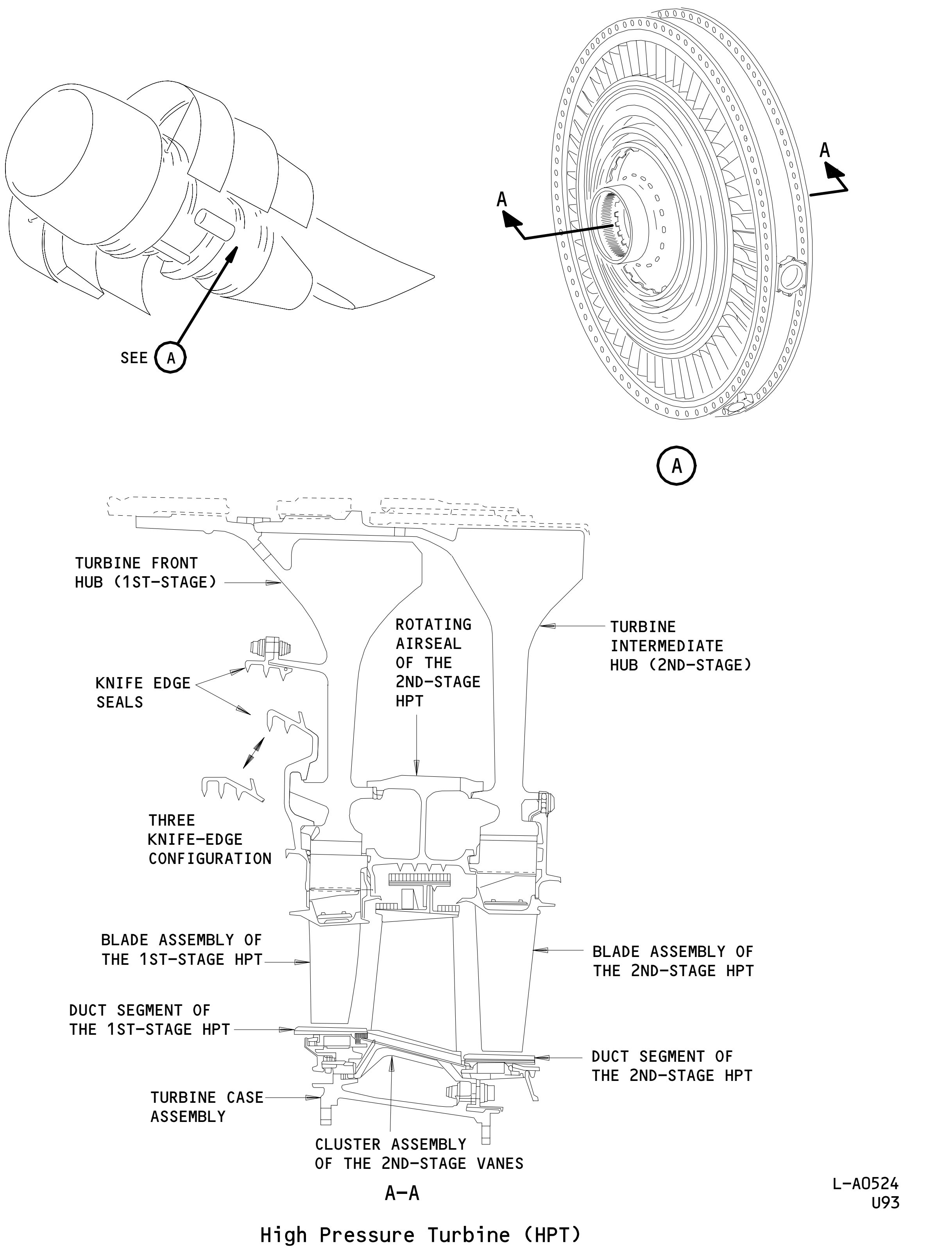
(4) Close the fan cowl panels (AMM 71-11-04/201).

TURBINE SECTION - DESCRIPTION AND OPERATION

1. General
    A. The turbine section consists of the turbine nozzle, high pressure turbine, low pressure turbine, and turbine exhaust case. Reaction to the combustion gasses passing through the turbines causes the turbines to rotate and drive their respective compressors.
2. Component Details
    A. Turbine Nozzle (Fig. 1)
        (1) The turbine nozzle section consists of the inner combustion chamber, the vane cluster assemblies of the 1st-stage HPT, and the blade cooling duct of the 1st-stage HPT.
        (2) Inner Combustion Chamber
            (a) The assembly for the inner combustion chamber consists of nickel alloy ring sections welded together to form inner diameter portion of the combustion chamber. The forward section (lip) fits into the inner (bulkhead) section of the assembly of the outer combustion chamber (liner). A slip joint seal fits between the two assemblies. These liner assemblies form the complete combustion chamber. The inner chamber surfaces, exposed to combustion gases, are coated with a magnesium zirconate material which acts as a thermal barrier.
        (3) Vane Clusters of the 1st-stage HPT
            (a) The vane cluster assemblies of the 1st-stage HPT number 17 and consist of 2 vanes per cluster. These clusters are located near the rear of the combustion chamber between the assemblies for the inner and outer combustion chambers. The nickel cobolt alloy vanes are hollow with internal baffles and cooling holes. Boundary air, from the diffuser case, is then distributed through and over the vane for cooling. Sheet metal seals between adjacent cluster platforms reduce gaspath leakage and ensure adequate cooling airflow.
        (4) Cooling Duct of the 1st-stage HPT Blades
            (a) The cooling duct assembly of the 1st-stage HPT blades consists of a cast case and nozzle with honeycomb nozzle seals. The cast case is also attached to the assembly for the inner combustion chamber and diffuser case, at the rear of the inner diameter wall. Both the vane clusters and inner combustion chamber are supported by the cooling air duct at a flange on the the rear outer diameter of the duct cases. The cooling air nozzles are sealed by two honeycomb seal lands that align with knife-edge seals on the 1st-stage HPT rotor.
    B. High Pressure Turbine (HPT) (Fig. 2)
        (1) The high pressure turbine section consists of the 1st- and 2nd-stage of the turbine rotor assemblies, a case and vane assembly, and an inner air seal. All of these components are housed within the turbine case and are air cooled. The HPT case utilizes an automatic control system for turbine rotor clearance.



Turbine Nozzle
Figure 1



High Pressure Turbine (HPT)
Figure 2

(2) The high pressure turbine (HPT) primarily provides the rotational driving force for the high pressure compressor (HPC). Energy is extracted from the combustion gasses flowing across the turbine blades and translates into rotational energy to drive the high pressure compressor.

(3) 1st-stage Turbine Rotor

(a) The 1st-stage turbine rotor consists of a nickel alloy hub and 60 blades, which are manufactured from single crystal material. Cooling air is metered through cooling air duct in the turbine nozzle, through holes to the 1st-stage rotor blades. Air flows through blade passages for internal surface cooling and through leading edge holes for external surface cooling.

(b) The 2nd-stage turbine rotor consists of a nickel alloy hub splined in tandem behind the turbine front hub on the rear compressor hub. The rotor incorporates 82 directionally fixed shroudless blades which are cooled by a mixture of 12th-stage compressor and diffuser case air. A single retaining plate for the rear blades engages a segmented flange to retain the 2nd-stage blades in the hub. The plate is locked in place to prevent circumferential movement.

(c) Turbine blade tips abrade ceramic duct seals for more efficient rotor sealing. Cooling air supply for the 1st-stage is sealed by two knife edge seals on the forward side of the rotor hub. The rotating airseal for the 2nd-stage HPT is attached to the rear of the turbine front hub and acts as a seal for the 2nd-stage inner gaspath and spacer between the 1st- and 2nd-stage rotors. The 1st-stage rotor is splined and mates directly to the rear compressor hub.

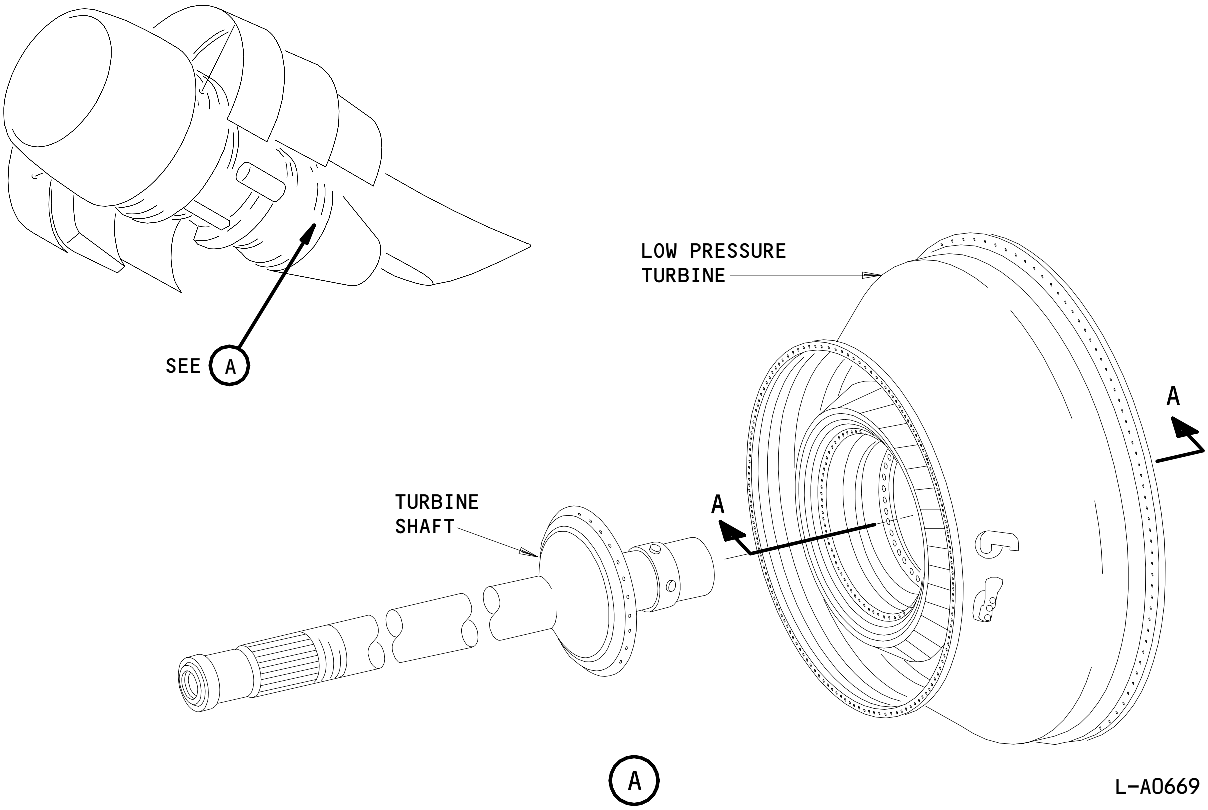
(4) Turbine Case and Vane

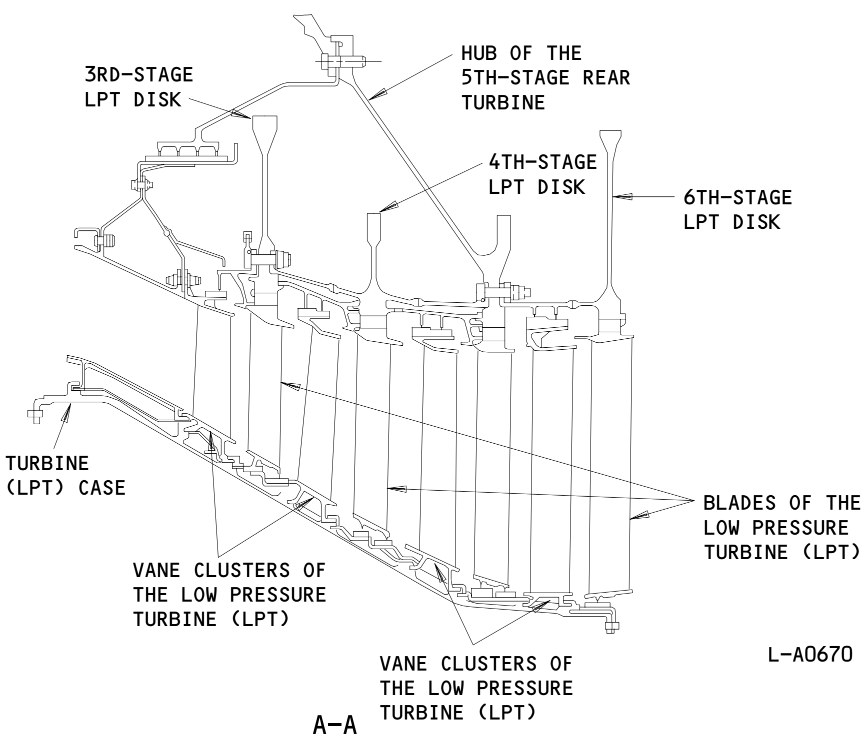
(a) The turbine case and vane assembly consists of the turbine case, 21 duct segments for the 1st-stage HPT, 2nd-stage vane clusters, and duct segments for the 2nd-stage HPT. Extensive sealing reduces leakage of the gaspath and cooling air passage. The outer buttress of the 2nd-stage vane cluster is secured to turbine case by tongue and groove fit. The vane cluster buttress at the rear outer diameter is secured to the rear inner flange of turbine case. Cooling air for the 2nd-stage vanes is supplied by the 12th-stage compressor through four externally routed tubes which mount to bosses on the turbine case. Cooling air is modulated to reduce flow at cruise elevations to improve efficiency. The segmented honeycomb inner land and rotor rimseal lands of the 2nd-stage HPT airseal are mounted on the inner diameter of each 2nd-stage vane cluster to seal the inner area of vanes. The seals are cooled by airflow through 2nd-stage vanes and nozzles mounted on the inner diameter of the vanes.

(5) Automatic Control for the Turbine Rotor Clearance
    (a) The tubes of the automatic control system for the turbine rotor clearance surround the external turbine case and circulate fan discharge air to cool the surface of the case. This cooling results in shrinkage of the case and decreased clearance between blade tips and case, and thus an improved turbine efficiency.

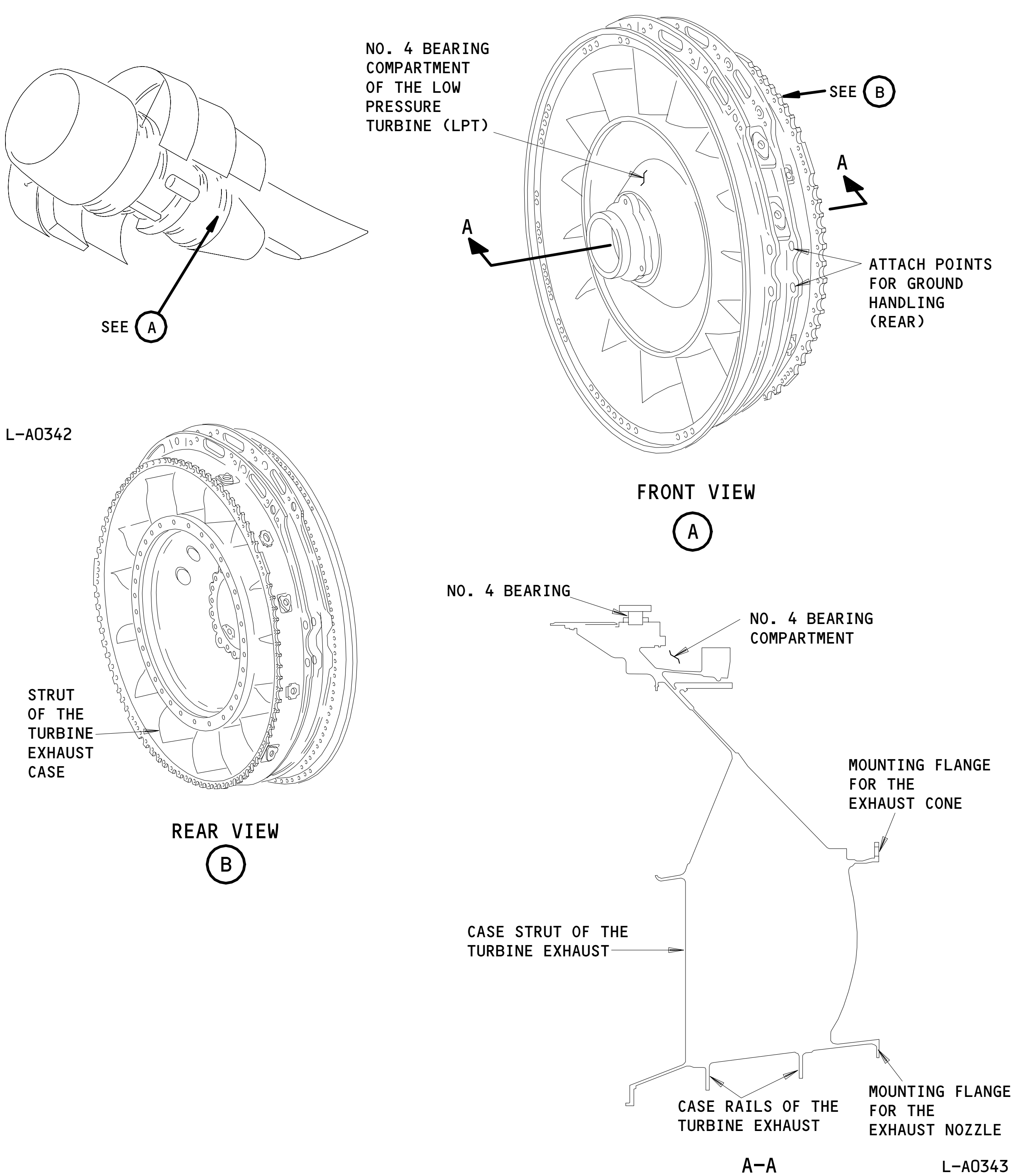
C. Low Pressure Turbine (LPT) (Fig. 3)
  (1) The section for the low pressure turbine consists of four rotor stages and four stages of stator vanes. Cooling air is supplied to the case wall at the forward inner diameter, disk rim and blade root, and inner cavity rotor. The case for the low pressure turbine is also cooled, to improved operating efficiency, by the automatic control system for the turbine rotor clearance. A removable plug at the 4:30 position provides borescope access for inspection of the 2nd-stage HPT and the 3rd-stage LPT.
  (2) The low pressure turbine (LPT) primarily provides the rotational driving force for the low pressure compressor (LPC). Energy is extracted from the combustion gasses flowing across the turbine blades and translates into rotational energy to drive the shaft which drives the low pressure compressor.
  (3) Rotors of the Low Pressure Turbine
    (a) The rotors of the low pressure turbine are a cantilevered design. The hub of the 5th-stage rear turbine is the primary rotating structural member, with provisions for attachment of the low pressure compressor and the 4th- and 6th-stage LPT disks. The turbine shaft mounts to inner diameter and the 4th- and 6th-stage LPT disks to the outer diameter of the hub of the 5th-stage rear turbine. The 4th-stage disk mounts forward of the 5th-stage hub with a bolted attachment to the 3rd-stage disk. The 6th-stage turbine rotor is cantilevered to the rear from the 5th-stage hub.
    (b) Rotating, knife-edge seals are located between the 3rd- and 4th-stage, and th 4th- and 5th-stage turbine rotors. The seals are retained by each adjacent turbine disk. These knife edge seals and a seal integral to the 6th-stage disk abrade a honeycomb vane inner seal to prevent gaspath leakage around the inner diameter of the stator vanes.
    (c) 3rd-stage rotor blades are coated with an aluminized material, while remaining stages are uncoated. Outer shrouds of the turbine blades incorporate interlocking hardfaced notches and double knife-edged seals, while the 6th-stage disk has a single knife-edge seal. These knife-edge seals align with abradable honeycomb airseal land segments.

D. Turbine Exhaust Case (Fig. 4)
  (1) The turbine exhaust case provides a main structural support member for the engine as well as an aft attach point for the power plant to the strut. It also provides a housing for the No. 4 shaft bearing of the low pressure turbine (LPT).
  (2) The turbine exhaust case is the transition duct from the divergent turbine gas flow to the convergent exhaust nozzle.





Low Pressure Turbine (LPT)
Figure 3



Turbine Exhaust Case
Figure 4

(3) The construction of the turbine exhaust case is greek ascoloy stainless steel welded together as a concentric inner cone and outer duct joined by 15 airfoil-shaped radial struts. Two circumferential rails provide structural stiffness to the outer duct as well as an attach point to the strut for the rear of the engine, suitable for ground handling. These ground handling attachments consist of two holes per side, on the horizontal centerline, through the circumferential rails. Provisions are made in the rails for attachment of the engine mount links on the lower aft side to carry engine vertical, side, and torsional loads to the airframe structure.

(4) No. 4 Shaft Bearing of the Low Pressure Turbine

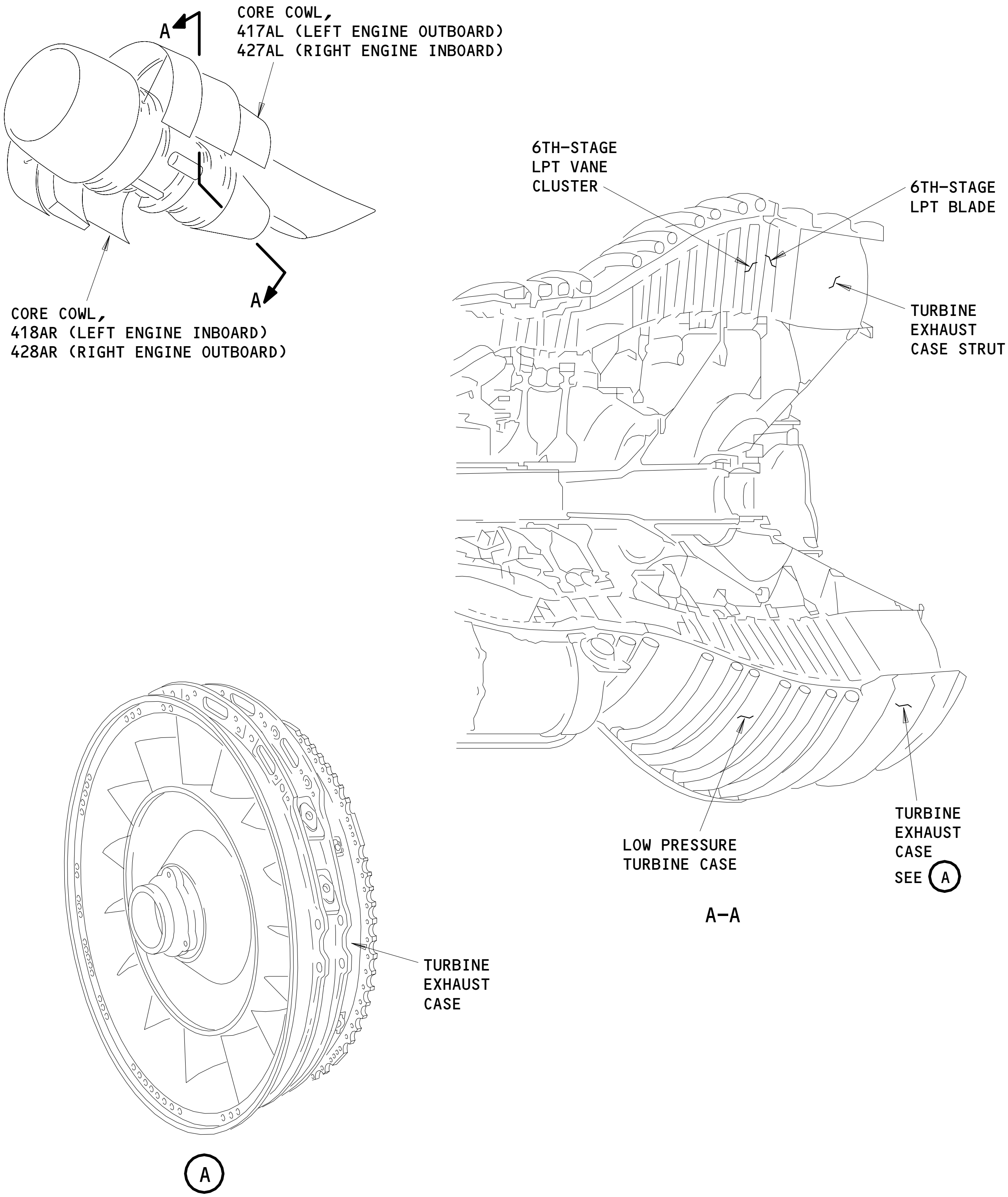
(a) The inner cone portion of the turbine exhaust case provides support for the No. 4 bearing, and load forces are transmitted from the bearing through the struts to the outer case structure. The oil pressure tube for the No. 4 bearing is at the 1:30 position and the scavenge tube is at the 2:30 position.

(5) Four turbine exhaust pressure and temperature sensing probes are installed. At two locations PT probes measure total gaspath temperature and pressure, and at two other locations, TT probes measure total gaspath temperature.

TURBINE SECTION

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
BLADES - 6TH-STAGE TURBINE		128	417AL,418AR, CORE COWL, LEFT ENGINE	72-53-01
BLADES - 7TH-STAGE TURBINE		128	427AL,428AR, CORE COWL, RIGHT ENGINE	72-53-01
VANE CLUSTERS - 6TH-STAGE TURBINE		36	417AL,418AR, CORE COWL, LEFT ENGINE	72-53-01
VANE CLUSTERS - 6TH-STAGE TURBINE		36	427AL,428AR, CORE COWL, RIGHT ENGINE	72-53-01

Turbine Section - Component Index
Figure 101



Turbine Section - Component Location
Figure 102

316313

6TH-STAGE TURBINE BLADE AND VANE - INSPECTION/CHECK

1. General
   A. This procedure contains information for the visual inspection of the 6th-stage turbine blades and vanes. To do the inspection, look forward through the turbine exhaust area.

TASK 72-53-01-206-005-N00

2. Do the 6th-Stage Turbine Blade Inspection
   A. Do the inspection of the 6th Stage Blades

      S 866-001-N00
      (1) Attach the DO-NOT-OPERATE tags to the ENG START switch which is located on the overhead panel P5.

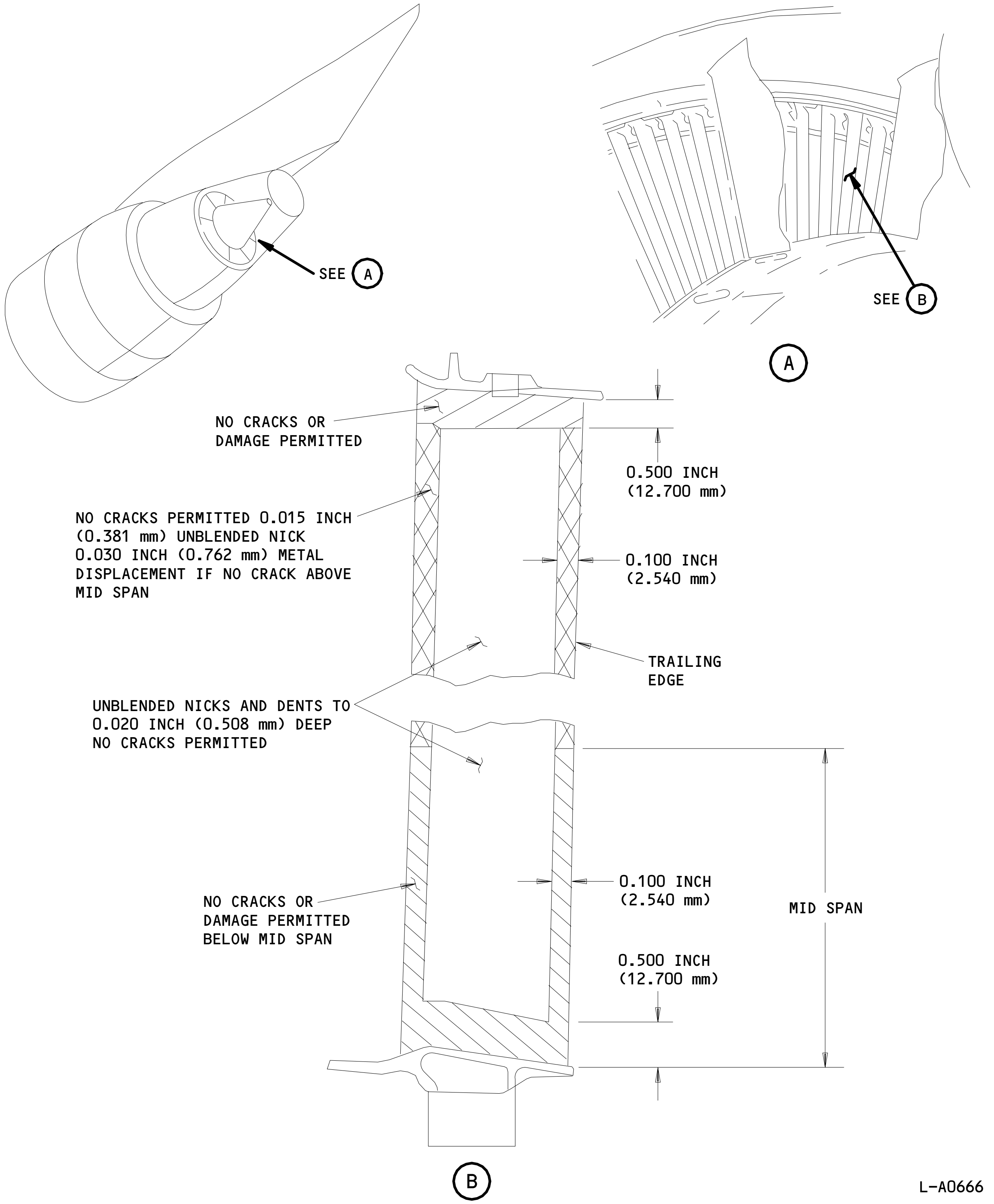
      S 216-002-N00
      (2) Do a visual check of the 6th-stage turbine blades for foreign object damage. Compare the damage with the limits which are given in Fig. 601.

   B. Do the 6th Stage Turbine Vane Inspection

      S 216-004-N00
      (1) Do a visually check for the trailing edges of the turbine vane. Also do a visual check of the shrouds, and airfoils for foreign object damage. Compare this damage with the limits which are given in Fig. 602.

      NOTE: Only one airfoil side, shroud, and trailing edge is visible at one time. If damage can be seen on the visible areas of the vane, a complete inspection of vane should be done. This should be done with a borescope, mirror or other tools so that the vane leading edge and remainder of airfoil surfaces can be observed.

      S 866-003-N00
      (2) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel P5.



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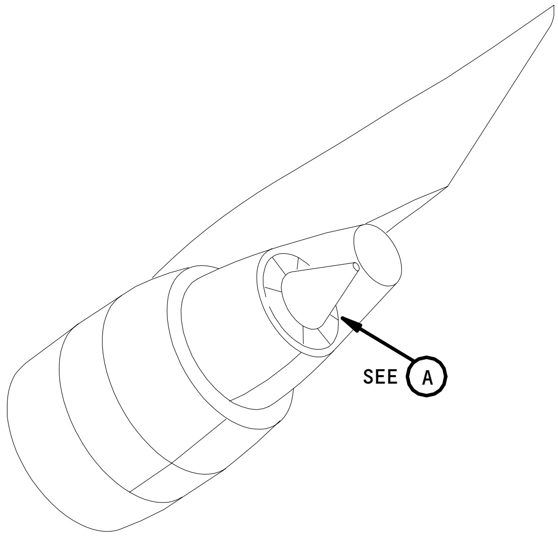
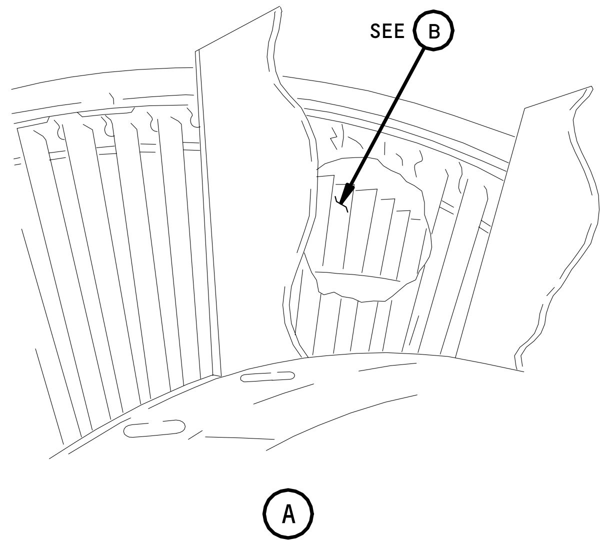
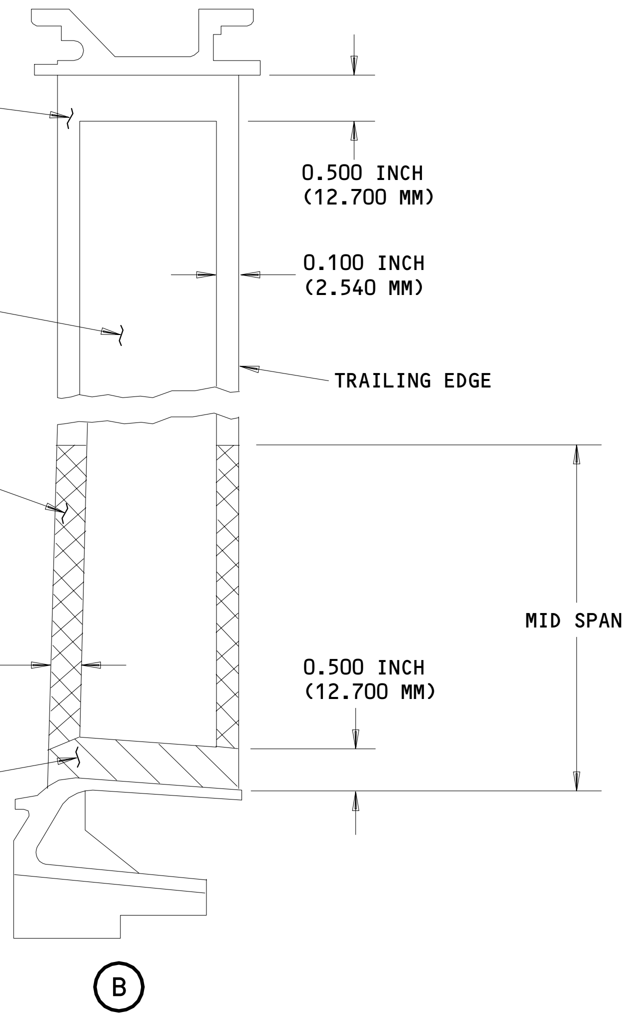
6th-Stage Turbine Blade Foreign Object Damage Limits
Figure 601







L-A0609

6th-Stage Turbine Vane Foreign Object Damage Limits
Figure 602

6TH-STAGE LPT (OUTER) AIRSEALING RING SEGMENT - INSPECTION/CHECK

1. General
   A. This procedure gives the steps for the inspection of the outer airsealing ring segment of the 6th-stage low pressure turbine (LPT). This outer airsealing ring segment of the 6th-stage LPT will be referred to as the outer airsealing ring segment.
   B. This outer airsealing ring segment is made of honeycomb that can become worn. It is aligned with the knife-edges of the 6th-stage LPT blades.
   C. You can remove the turbine exhaust sleeve and plug to get access to the outer airsealing ring segment.

TASK 72-53-03-206-005-N00

2. Examine the 6th-Stage LPT (Outer) Airsealing Ring Segment
   A. References
      (1) AMM 78-11-02/401, Turbine Exhaust Plug
   B. Access
      (1) Location Zones
         411 Left Engine
         421 Right Engine

   C. Procedure (Ref 601)

      S 016-002-N00

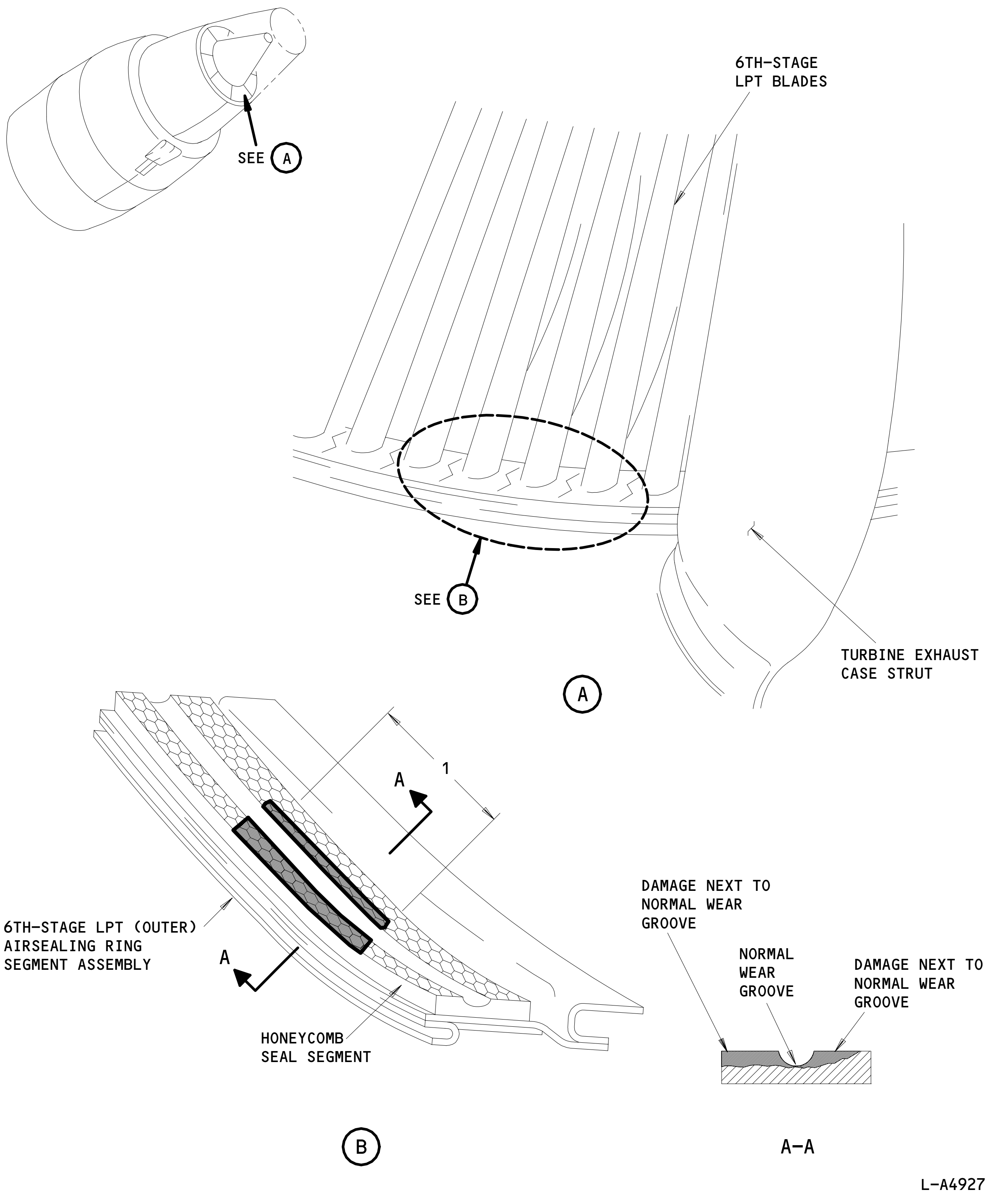
      (1) Remove the turbine exhaust plug (AMM 78-11-02/401).

      S 226-003-N00

      (2) Make an inspection of the Stage 6 LPT (Outer) Airsealing Ring Segment Assembly.
         (a) Damage that is next to the wear groove and is more than 3.0 inches (76.2 mm) in length in each segment, unlimited segments, is not permitted.

            NOTE: Look forward through the turbine exhaust case to examine the Stage 6 LPT (Outer) Airsealing Ring Segment Assembly.

            An increase in segment damage will show a decrease in performance.



6th-Stage LPT (Outer) Airsealing Ring Segment Assembly Inspection
Figure 601

(b) If it is necessary to remove the airsealing ring, remove the engine.

S 416-004-N00

(3) Install the turbine exhaust plug (AMM 78-11-02/401).

LPT BORESCOPE (AP-10) - APPROVED REPAIRS

TASK 72-53-04-728-016-N00

1. Reposition LPT Outer Transition Duct Heatshield

A. General

(1) This task supplies instructions to reposition or modify of the LPT Outer Transition Duct Heatshield. If you grind the heatshield, it will require repair or replacement at overhaul.

B. Equipment

(1) File - Locally available

(2) Grinder - Locally available

C. Procedure

S 018-014-N00

(1) If necessary, remove the AP-10 borescope plug (AMM 72-00-00/601).

S 218-015-N00

(2) Visually examine the LPT access port AP-10 to make sure that the outer transition duct heatshield is in the correct position.

S 828-017-N00

(3) If the outer transition duct heatshield is not in the correct position and has moved into the plane of the borescope hole or path of the borescope plug, put the heatshield in the correct position as follows:

(a) Put a small diameter drift or bar into the borescope port to the depth of the heatshield.

(b) Carefully move the heatshield into the correct position with the outer transition duct segment borescope hole.

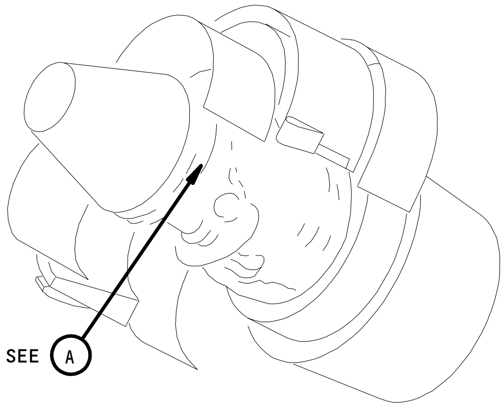
S 488-023-N00

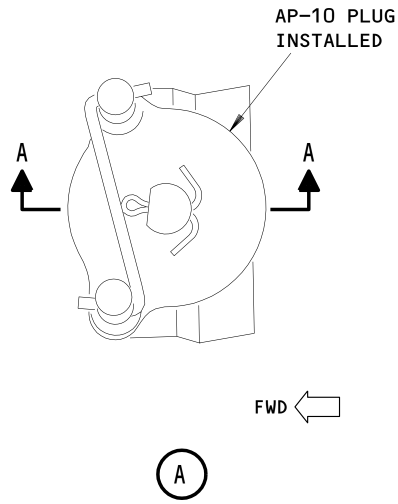
(4) If the heatshield moves as in Fig. 801, install the AP-10 borescope plug (AMM 72-00-00/601).

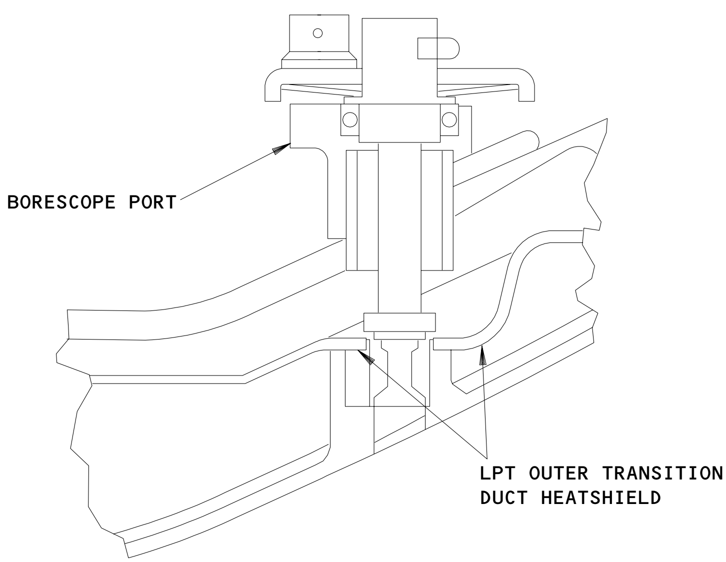
S 848-018-N00

(5) If you are unable to move the heatshield into the correct position do the steps that follow.

NOTE: This modification will make larger the outer transition duct heatshield borescope hole and or part of the outer transition duct segment borescope hole. This will make necessary repair or possible replacement of these parts at the next overhaul. Small quantities of grinding chips removed from the outer transition heatshield may enter into the engine space. This will not cause damage to engine operation or the gaspath and non-gaspath parts. A heatshield hole made larger will not have unwanted effect on the heatshield or outer transition duct function, other engine parts, or engine operation.







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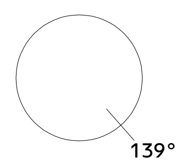
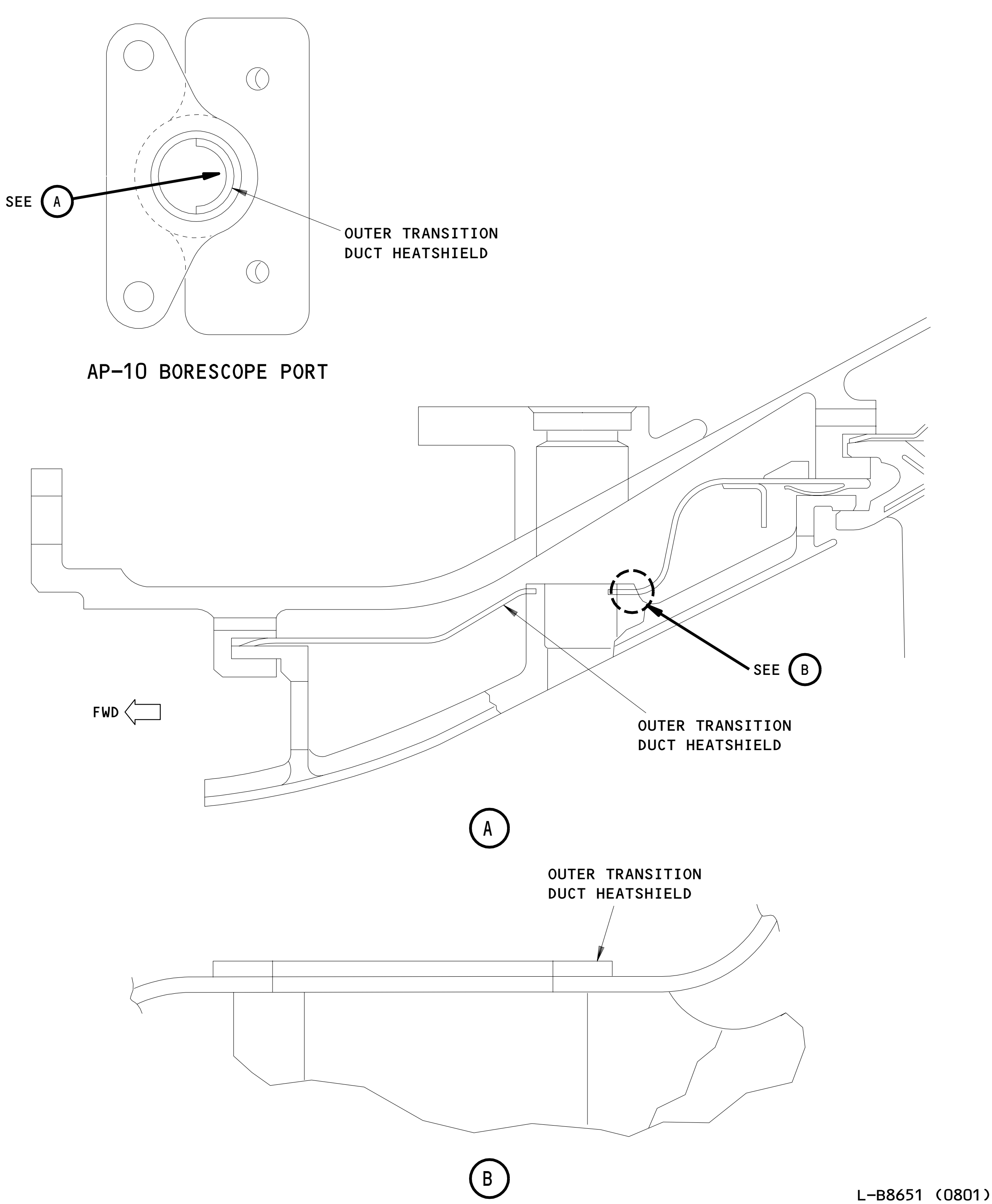


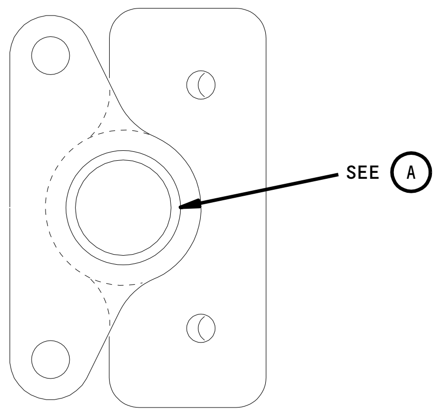
(AP-10)
REAR VIEW SCHEMATIC

L-B8650 (0801)

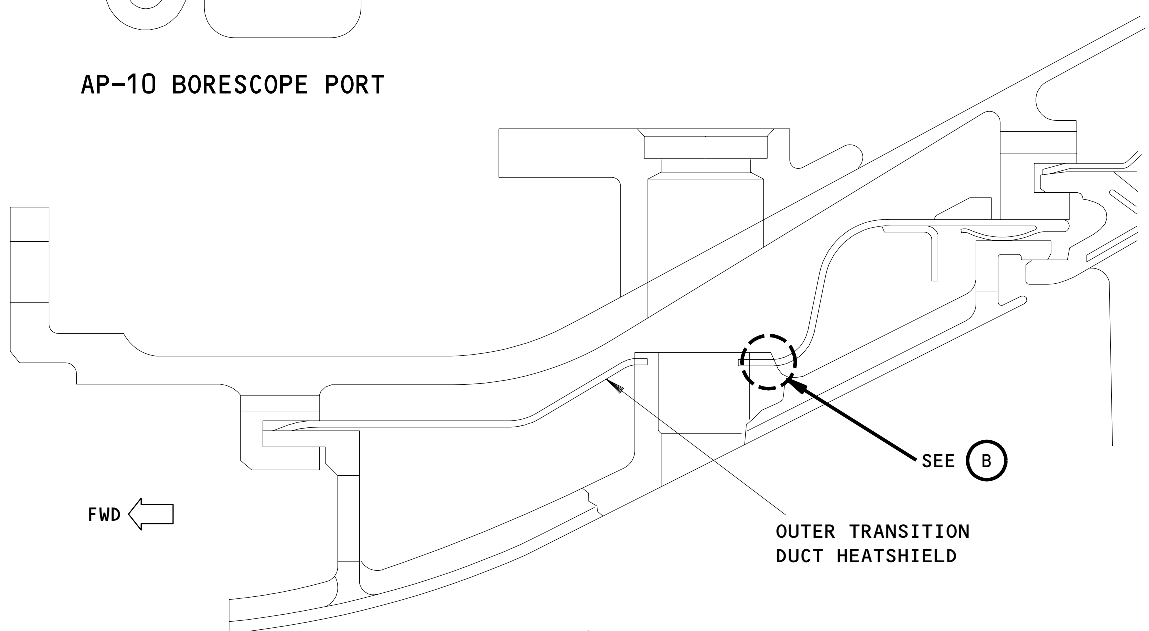
LPT Outer Transition Duct Heatshield Alignment
Figure 801 (Sheet 1)



LPT Outer Transition Duct Heatshield Alignment
Figure 801 (Sheet 2)



AP-10 BORESCOPE PORT



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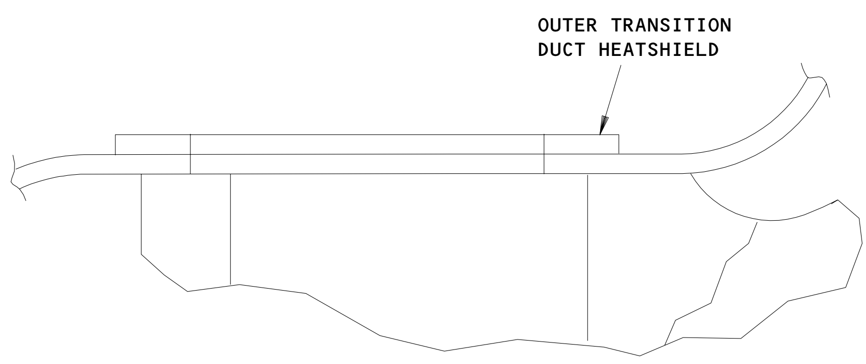


B

L-B8651 (0801)

LPT Outer Transition Duct Heatshield Alignment
Figure 801 (Sheet 3)

(a) Visually examine the LPT access port AP-10 to find the transition duct heatshield that blocks the installation of the borescope plug.

CAUTION: DO NOT REMOVE MATERIAL FROM THE OUTER TRANSITION DUCT SEGMENT HOLE. THIS MAY CAUSE THE SEGMENT TO BE SCRAPPED AT THE NEXT OVERHAUL.

(b) Remove material from the transition duct heatshield as follows:

NOTE: Remove only enough material from the heatshield to allow installation of the borescope plug.

1) Use a small diameter grinder or file to carefully remove unwanted material from the transition duct heatshield.

NOTE: Remove only that unwanted material that is necessary to make sure that the heatshield is flush or almost flush with the 0.548 inch (13.919 mm) diameter outer transition duct borescope hole.

Do not increase the diameter of the borescope hole greater than 0.060 inch (1.524 mm) maximum.

(c) Install the AP-10 borescope plug (AMM 72-00-00/601).

TURBINE EXHAUST CASE - MAINTENANCE PRACTICES

1. General
   A. This procedure gives the steps to examine the No. 4 bearing compartment and to replace the No. 4 bearing oil nozzle, oil pressure, and scavenge tubes.
   B. The No. 4 bearing compartment is in the rear inner flange of the turbine exhaust case. The turbine exhaust case is attached to the external rear flange of the low pressure turbine (LPT) case.
   C. You must open the core cowl panels and remove the turbine sleeve and plug, and the No. 4 bearing compartment cover to get access to the No. 4 bearing compartment.

TASK 72-54-01-102-001-N00

2. No. 4 Bearing Compartment and Tube Inspection and Cleaning
   A. Equipment
      (1) Jackscrews - 0.190-32 (8 to 10 each), for the removal of the No. 4 bearing compartment cover (Engines Post-PW-SB 72-385)
      (2) M303, M305 or M307 Bergen Mechanical Crimper
          Bergen Cable Technologies Inc
          170 Gregg St
          P. O. Box 1300
          Lodi, NJ 07644-9982
   B. Consumable Materials
      (1) D00137 Oil - Engine (PWA 521B)
      (2) G01869 Brush - Tube (Nylon Bristle)
      (3) D50124 Paste - Anti-seize (PWA 36246)
      (4) D00406 Compound - Antigalling (PWA 550)
      (5) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) - AS3214-02
      (6) G02332 Ferrule, Safety Cable (P05-292)
      (7) G02335 Cable, Safety (P05-291)
   C. References
      (1) AMM 71-11-06/201, Core Cowl Panels
      (2) AMM 72-00-00/601, Engine
      (3) AMM 72-54-04/401, No. 4 Bearing Compartment Cover
      (4) AMM 78-11-02/401, Turbine Exhaust Plug
      (5) AMM 78-31-00/201, Thrust Reverser System
      (6) AMM 79-21-10/601, Magnetic Chip Detector
   D. Access
      (1) Location Zones
          411 No. 1 Engine (Left)
          421 No. 2 Engine (Right)
   E. Procedure

S 042-002-N00

WARNING: DO THE DEACTIVATION PROCEDURE FOR THE THRUST REVERSER TO PREVENT THE OPERATION OF THE THRUST REVERSER. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(1) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

S 012-003-N00

(2) Open the core cowl panels (AMM 71-11-06/201).

S 012-004-N00

(3) Remove the turbine exhaust plug (AMM 78-11-02/401).

S 012-005-N00

(4) Remove the No. 4 Bearing Shield and Cover (AMM 72-54-04/401).

S 012-006-N00

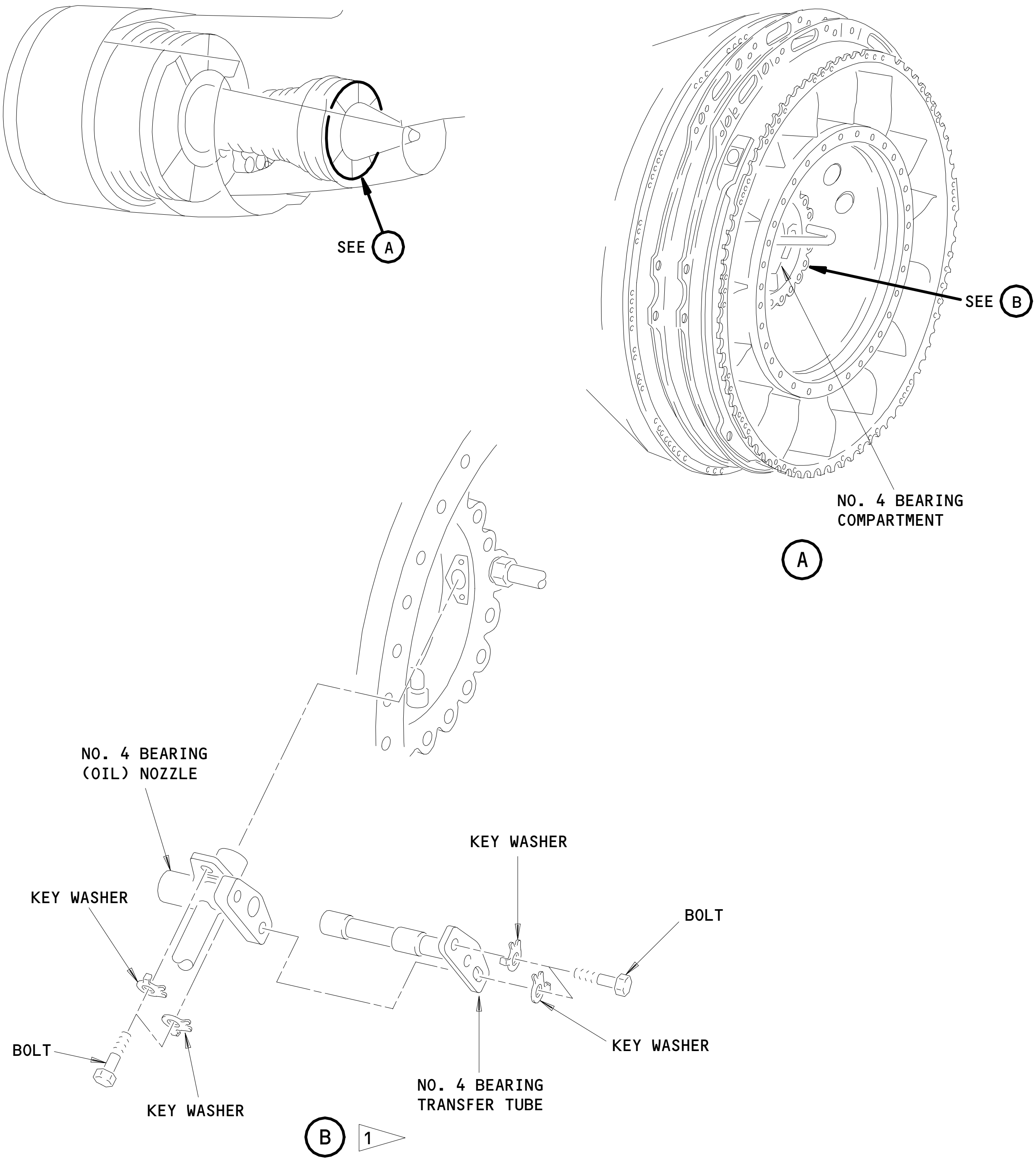
(5) Do the steps that follow to examine the No. 4 bearing compartment (rear) and cover for coke (Fig. 201).

NOTE: Coke is a collected quantity of carbon that is black in color, brittle, and has an irregular surface finish. Some of the coke can become flakes and fall away from the compartment walls. Loose coke is coke that you can easily remove with a vacuum or tweezers.

(a) Do a visual inspection of the eight oil supply holes as follows (Fig. 203):
   1) Carefully remove all loose coke from the oil supply holes.
   2) If you can not remove the coke from the holes, remove the engine from service immediately.

(b) Do a visual inspection of the eleven oil drain holes as follows (Fig. 203):
   1) Carefully remove all loose coke from the oil drain holes.
   2) If the flow in one or more holes is decreased or fully stopped because of coke, remove the engine from service immediately.

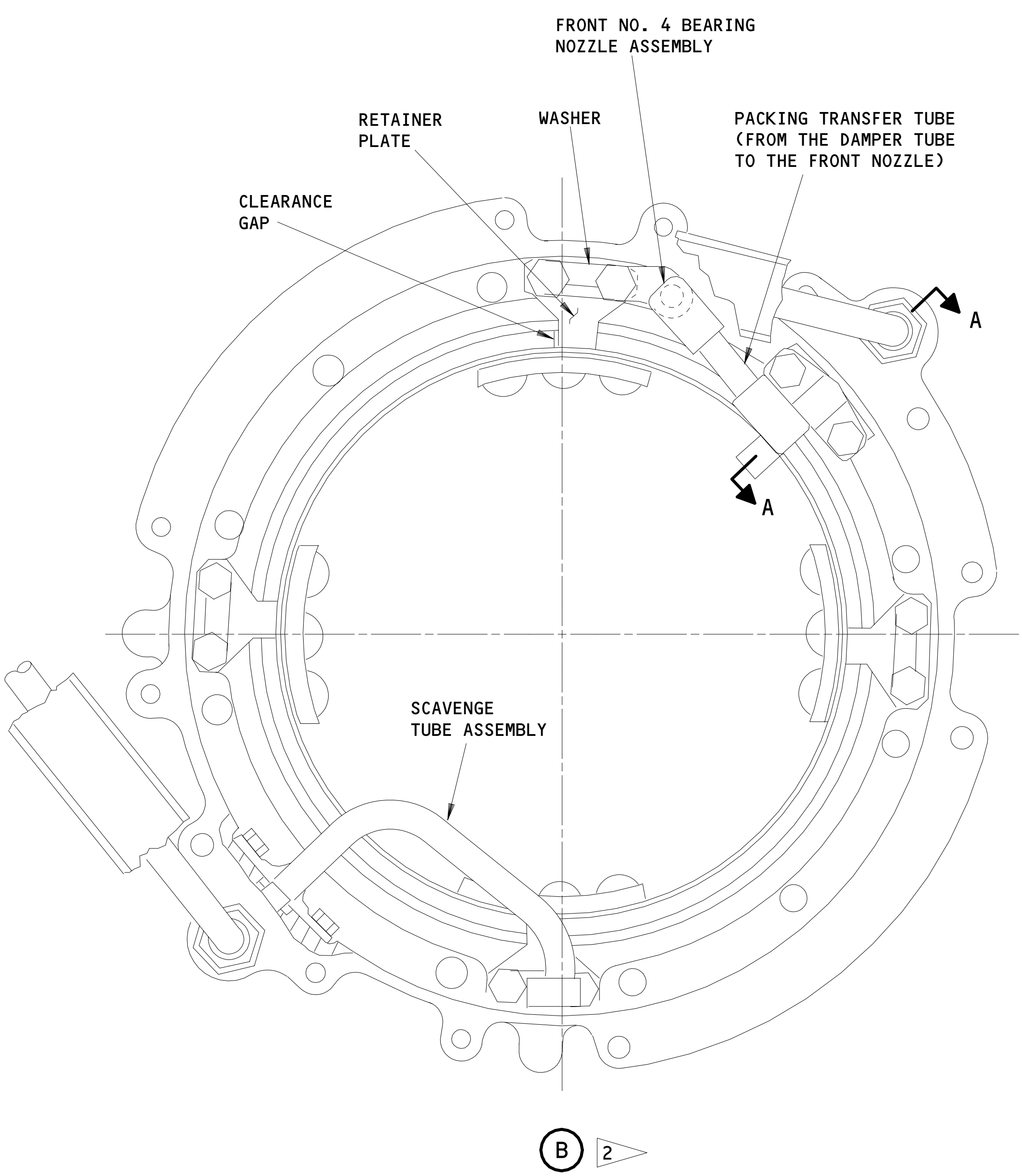
(c) If the No. 4 bearing compartment has coke on the bearing, cage or rollers, or on more than 50% of the compartment surfaces, do the steps that follow:
   1) Do the Oil System Contamination Inspection (AMM 72-00-00/601).
   2) Complete this procedure for the No. 4 bearing compartment and the No. 4 bearing oil nozzle, oil pressure, and scavenge tubes before you operate the engine.



1 ENGINES WITHOUT PW SB 72-472
2 ENGINES WITH PW SB 72-472

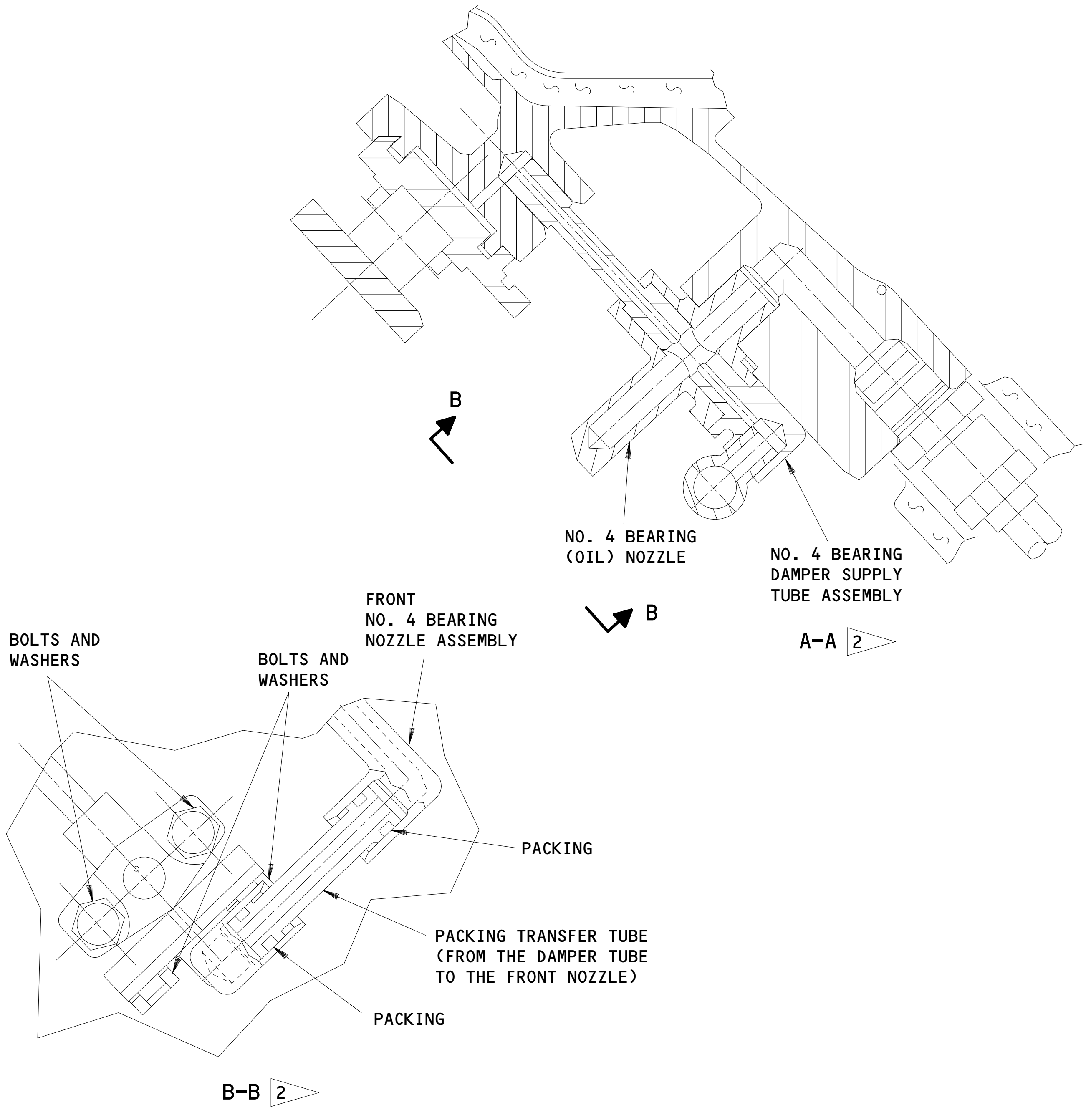
L-A3821

No. 4 Bearing (Oil) Nozzle - Removal/Installation
Figure 201 (Sheet 1)



L-A8960

No. 4 Bearing (Oil) Nozzle - Removal/Installation
Figure 201 (Sheet 2)



No. 4 Bearing (Oil) Nozzle - Removal/Installation
Figure 201 (Sheet 3)

3) After this procedure is completed, examine the oil tank magnetic chip detector after each 25 hours of service (AMM 79-21-10/601).
4) Remove the engine before the 101st hour of operation.

(d) If the No. 4 bearing compartment does not have coke, do the steps that follow:
1) ENGINES PRE-PW-SB 72-472;
Remove the No. 4 bearing (oil) nozzle and No. 4 bearing transfer tube.
2) ENGINES POST-PW-SB 72-472;
Remove the No. 4 bearing (oil) nozzle, the No. 4 bearing damper supply tube, the front No. 4 bearing transfer tube, and the packing transfer tube.
3) Remove the No. 4 bearing oil scavenge (inner) tube.
4) Remove the No. 4 bearing (oil) pressure tube.
5) Remove the No. 4 bearing scavenge tube.

S 012-027-N00

(6) ENGINES PRE-PW-SB 72-472;
Remove the No. 4 bearing (oil) nozzle and No. 4 bearing transfer tube as follows (Fig. 201):
(a) Remove the bolts and keywashers that attach the No. 4 bearing transfer tube to the No. 4 bearing nozzle.
(b) Remove the No. 4 bearing transfer tube.
(c) Remove the bolts and keywashers that attach the No. 4 bearing nozzle to the exhaust case.
(d) Remove the No. 4 bearing nozzle.

S 012-025-N00

(7) ENGINES POST-PW-SB 72-472;
Remove the No. 4 bearing (oil) nozzle and the front No. 4 bearing nozzle as follows (Fig. 201):
(a) Remove the bolts and key washer that attach the front No. 4 bearing nozzle to the No. 4 bearing support flange at the 12 o'clock position.
1) Discard the key washer.
(b) Move the packing transfer tube into the elbow of the No. 4 bearing damper supply tube.
1) Remove the nozzle.
(c) Remove the packing transfer tube from the damper supply tube.
1) Discard the two packings.
(d) Remove the bolts and key washers that attach the No. 4 bearing damper supply tube to the No. 4 bearing oil nozzle.
1) Remove the tube.
(e) Remove the bolts and key washers that attach the No. 4 bearing nozzle to the exhaust case.
1) Remove the nozzle.

S 012-026-N00

(8) Remove the No. 4 bearing oil scavenge (inner) tube as follows (Fig. 202):

(a) Remove the keywasher and bolt that attach the tube bracket to the No. 4 bearing housing inner diameter at the 6 o'clock position.

(b) Remove the keywashers and bolts that attach the No. 4 bearing oil scavenge (inner) tube to the housing inner diameter at the 7:30 o'clock location.

1) Remove the No. 4 bearing oil scavenge tube.

2) Discard the gasket.

S 012-009-N00

(9) ENGINES WITHOUT SB PW4ENG 79-76;
Remove the No. 4 bearing (oil) pressure tube as follows (Fig. 202):

CAUTION: HOLD THE PRESSURE TUBE (UPPER) AT THE WRENCHING FLATS WHEN YOU LOOSEN THE TUBE NUT. IF YOU DO NOT USE THE WRENCHING FLATS, YOU CAN CAUSE TWIST DAMAGE TO THE TUBE ASSEMBLY.

(a) Remove the lockwire to disconnect the No. 4 bearing (oil) pressure tube from the No. 4 bearing oil pressure tube (upper) at the 11 o'clock position between Flanges R and S.

(b) Remove and discard the thrust wire.

(c) Remove the nut from the pressure tube.

(d) Remove the lockwire that attaches the No. 4 bearing pressure tube heat shield to the tube.

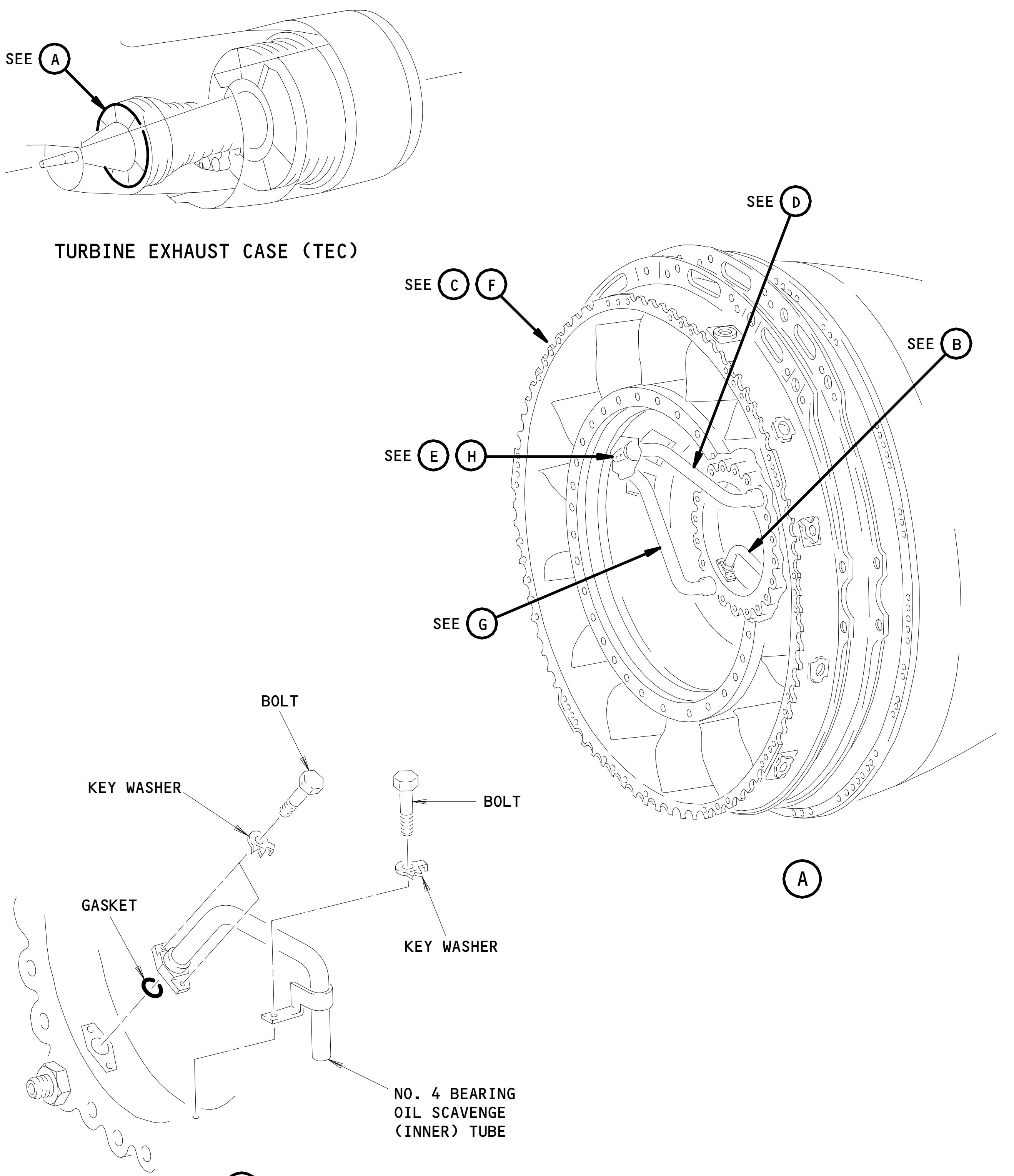
1) Remove the heat shield (front and rear) from the tube.

(e) Remove the lockwire and bolts that attach the No. 4 bearing tube guide to the case.

(f) While you hold the adapter with a wrench, disconnect the nut that attaches the tube to the adapter.

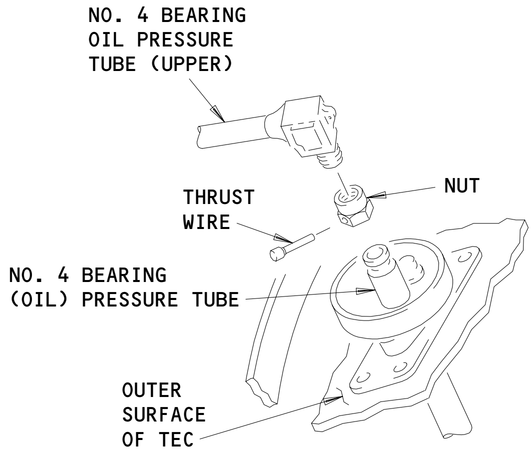
(g) Move the tube radially to the inside to remove it from the case.

(h) Install covers on the openings.



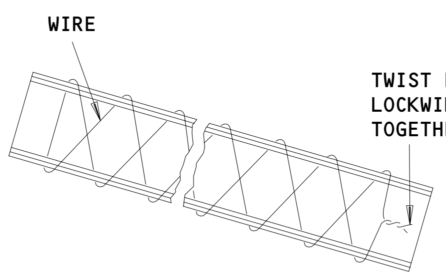
L-A3518(0292)

No. 4 Bearing Oil Components - Removal and Installation
Figure 202 (Sheet 1)

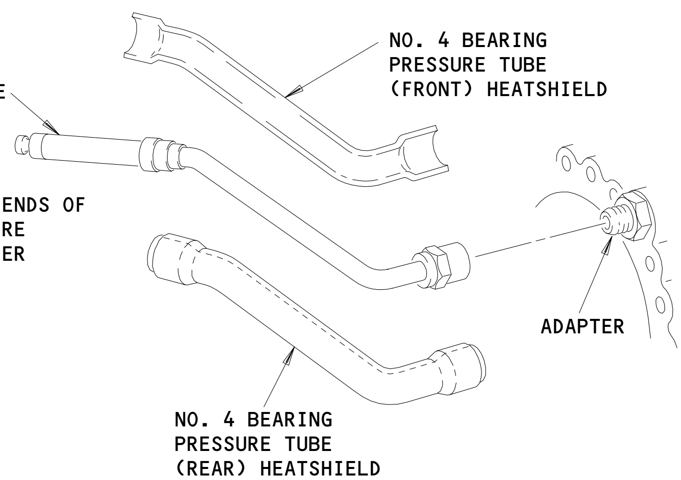


PARTS SHOWN FROM A DIFFERENT ANGLE

C



EXAMPLE OF LOCKWIRE
INSTALLATION ON HEATSHIELD



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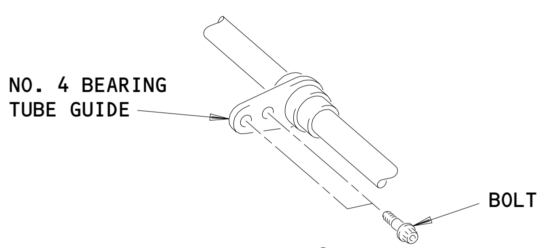
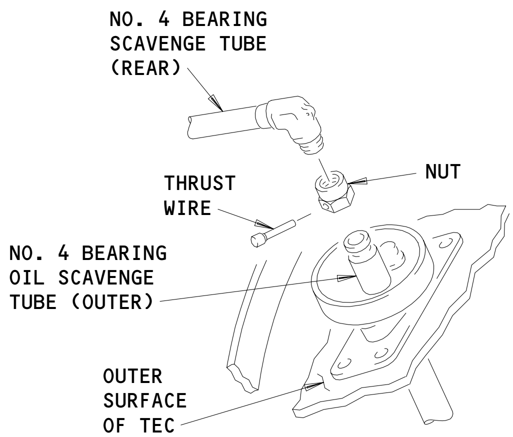


E

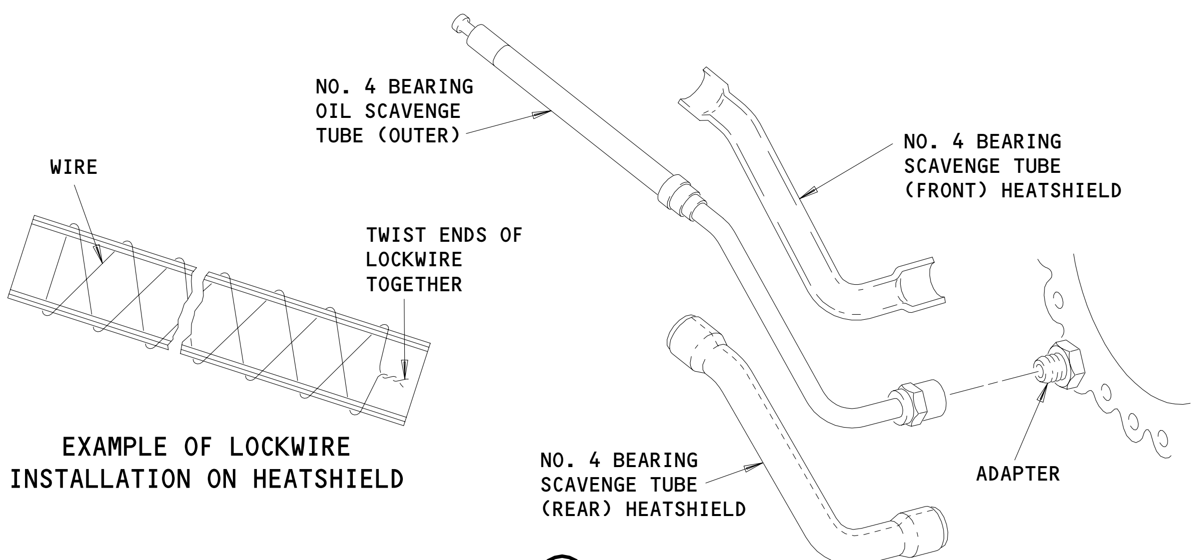
L-A3820(0292)

No. 4 Bearing Oil Components - Removal and Installation
Figure 202 (Sheet 2)



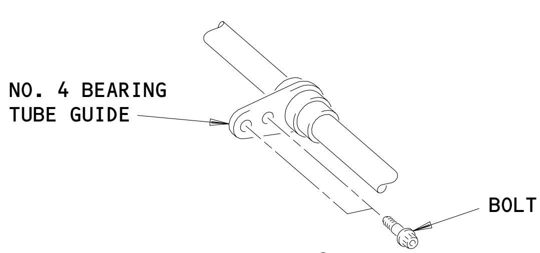
(PARTS SHOWN FROM A DIFFERENT ANGLE)

F



EXAMPLE OF LOCKWIRE
INSTALLATION ON HEATSHIELD

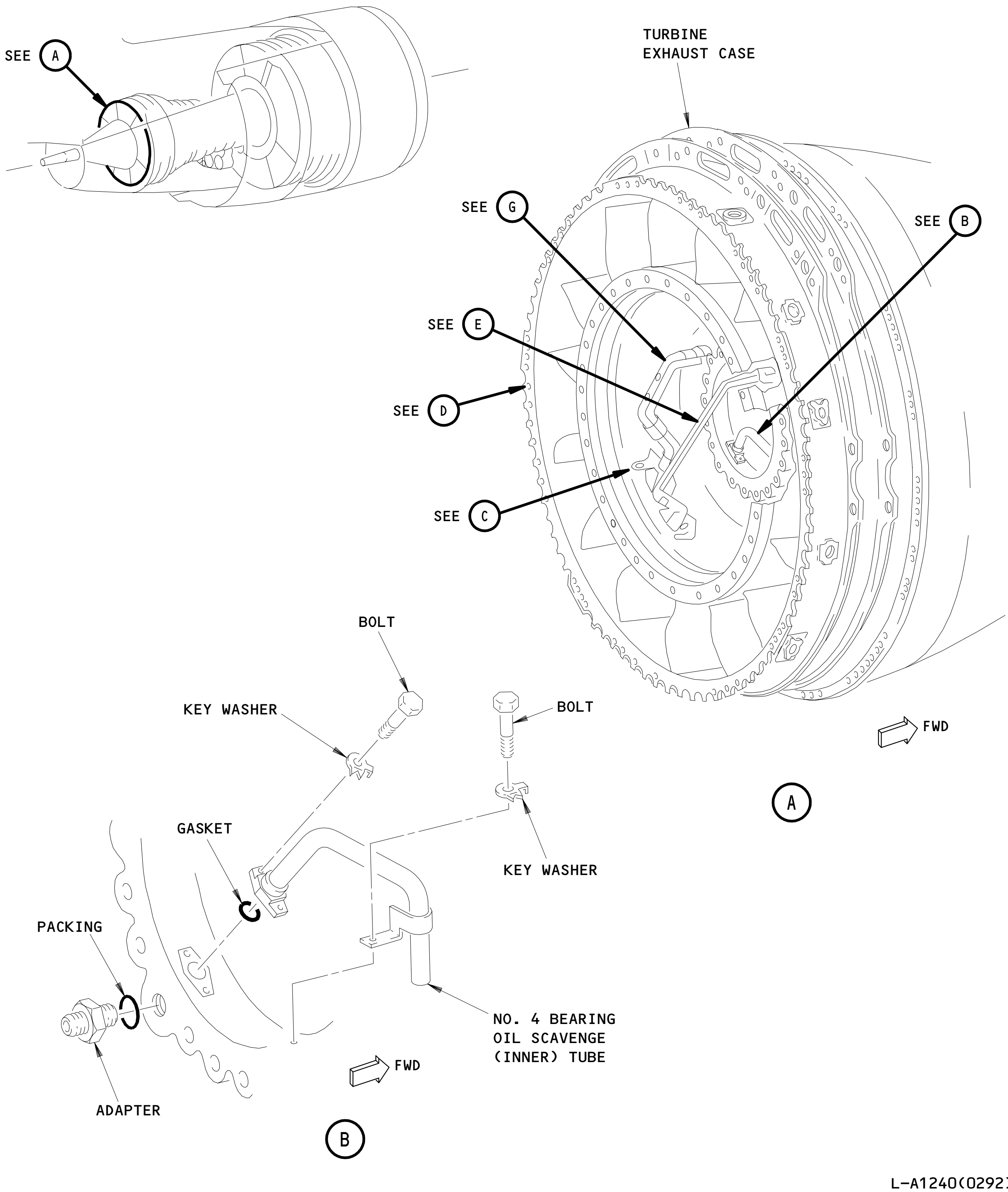
G



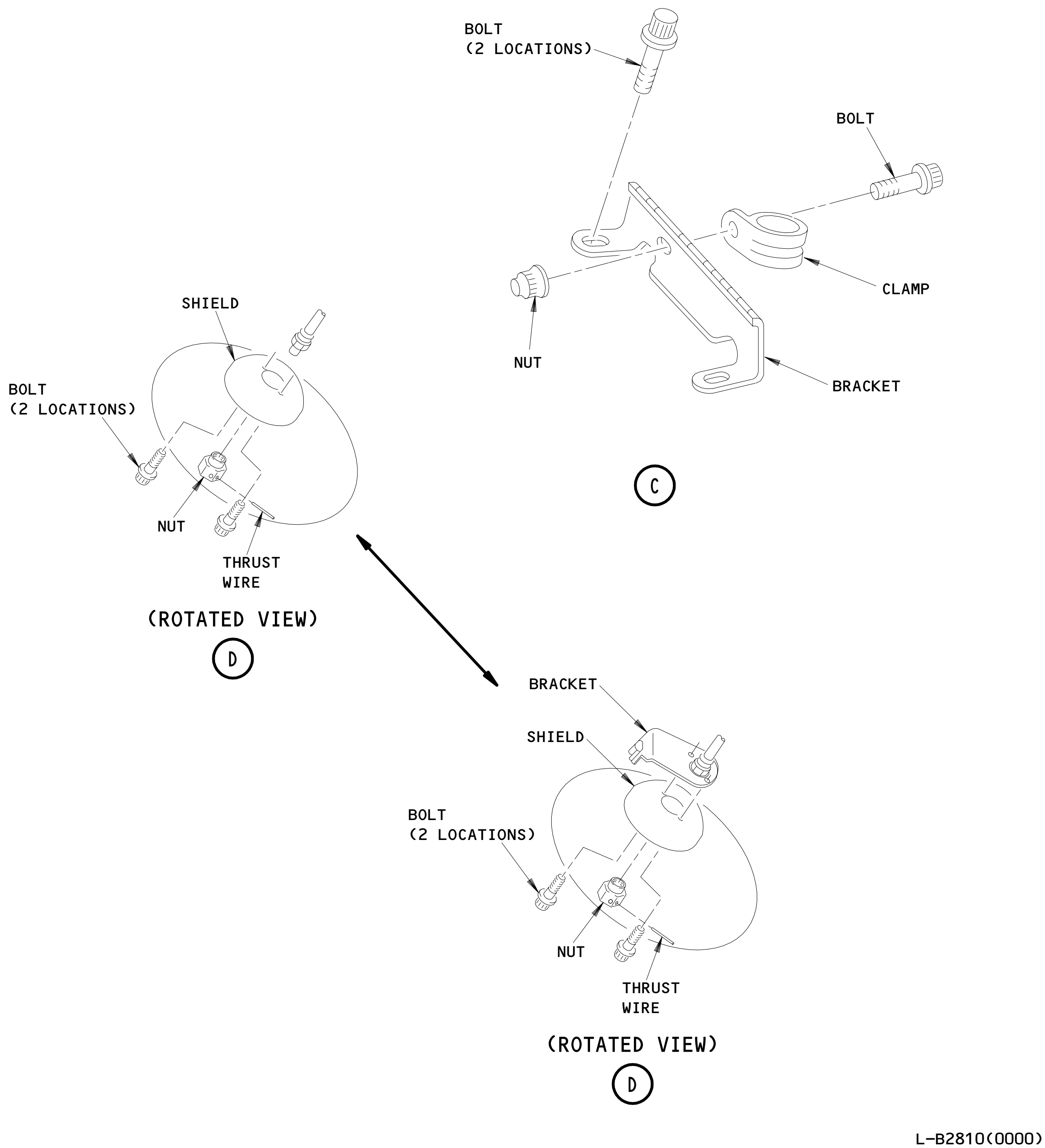
H

L-A3517(0292)

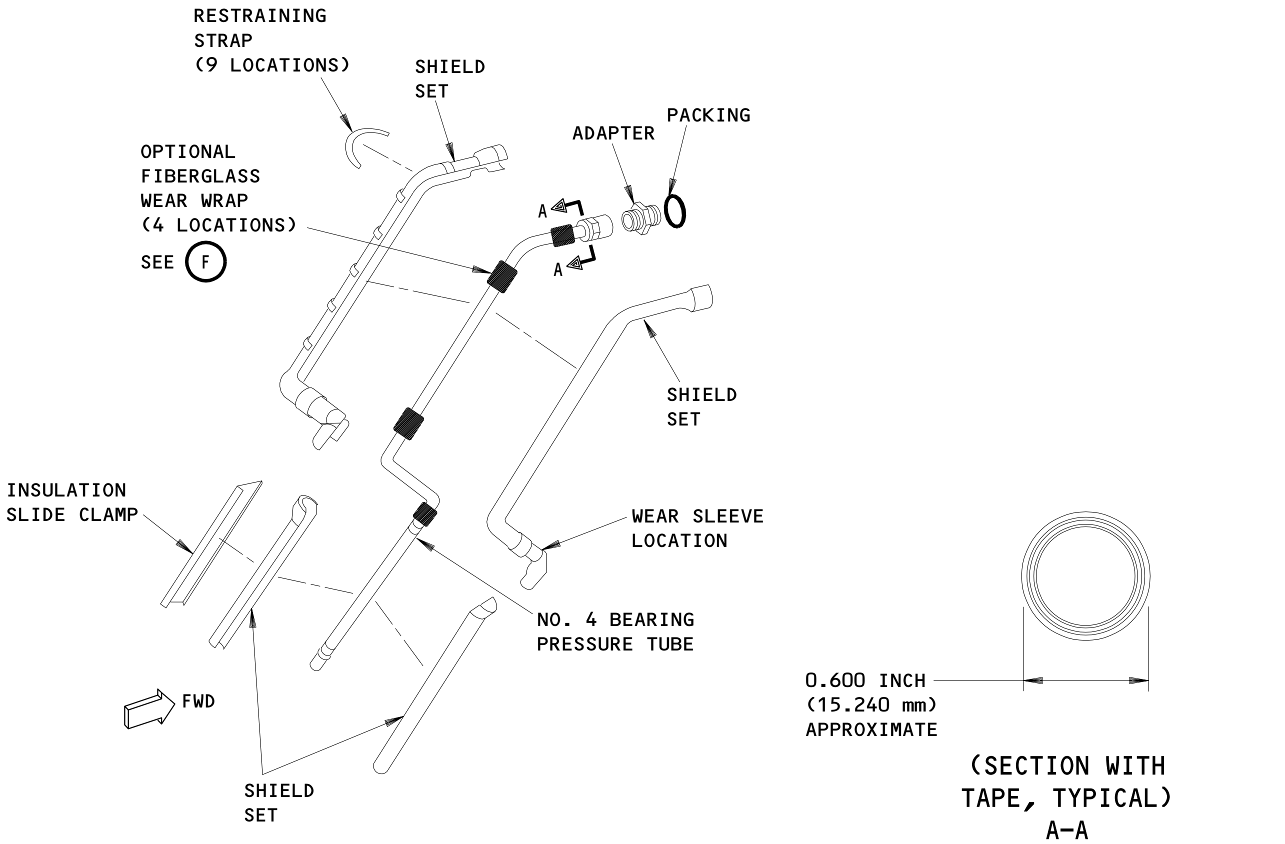
No. 4 Bearing Oil Components - Removal and Installation
Figure 202 (Sheet 3)



No. 4 Bearing Oil Components - Removal and Installation
Figure 202A (Sheet 1)



No. 4 Bearing Oil Components - Removal and Installation
Figure 202A (Sheet 2)



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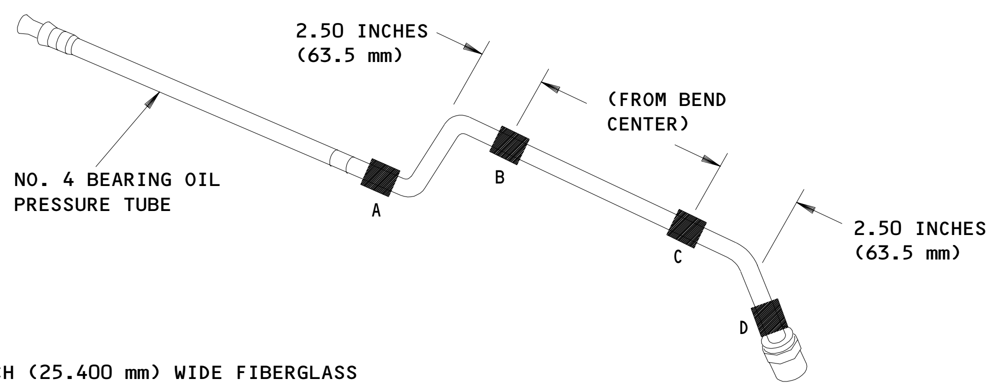


NOTE: 1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR LOCATIONS:
- A AND D AT TUBE ENDS AS SHOWN.
- B AND C AT STRAIGHT SECTION AS SHOWN.

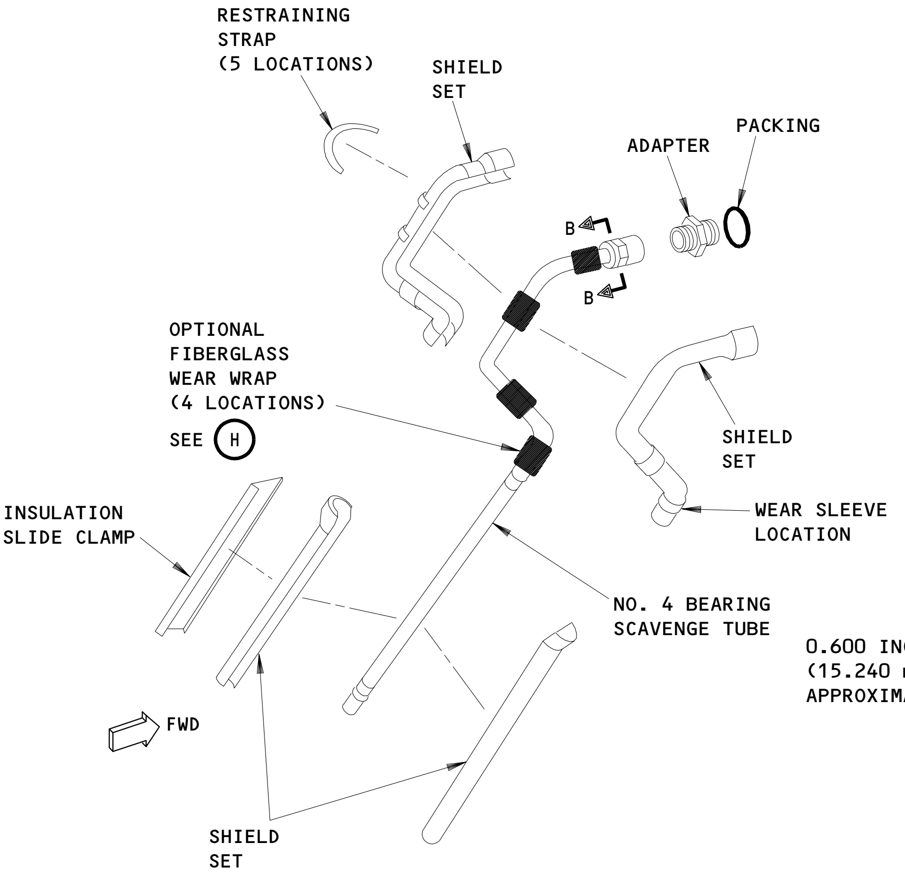
2. WRAP TAPE TO BE 0.600 INCH (15.240 mm) DIAMETER AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.

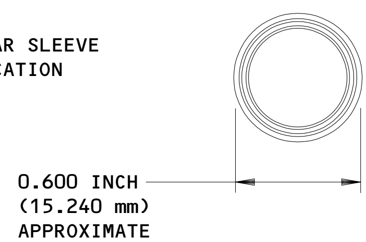
FIBERGLASS WEAR WRAP

F

L-B2811(0000)
L-B2800(0000)

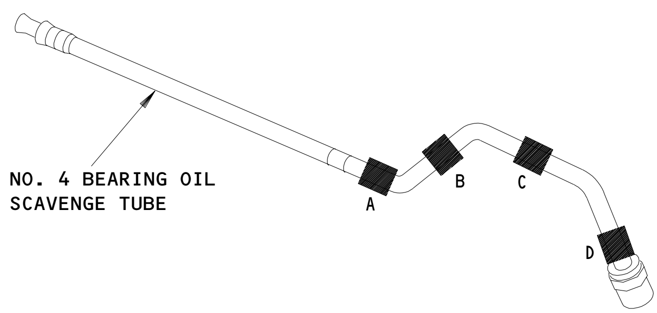
No. 4 Bearing Oil Components - Removal and Installation
Figure 202A (Sheet 3)





(SECTION WITH
TAPE, TYPICAL)
B-B

G



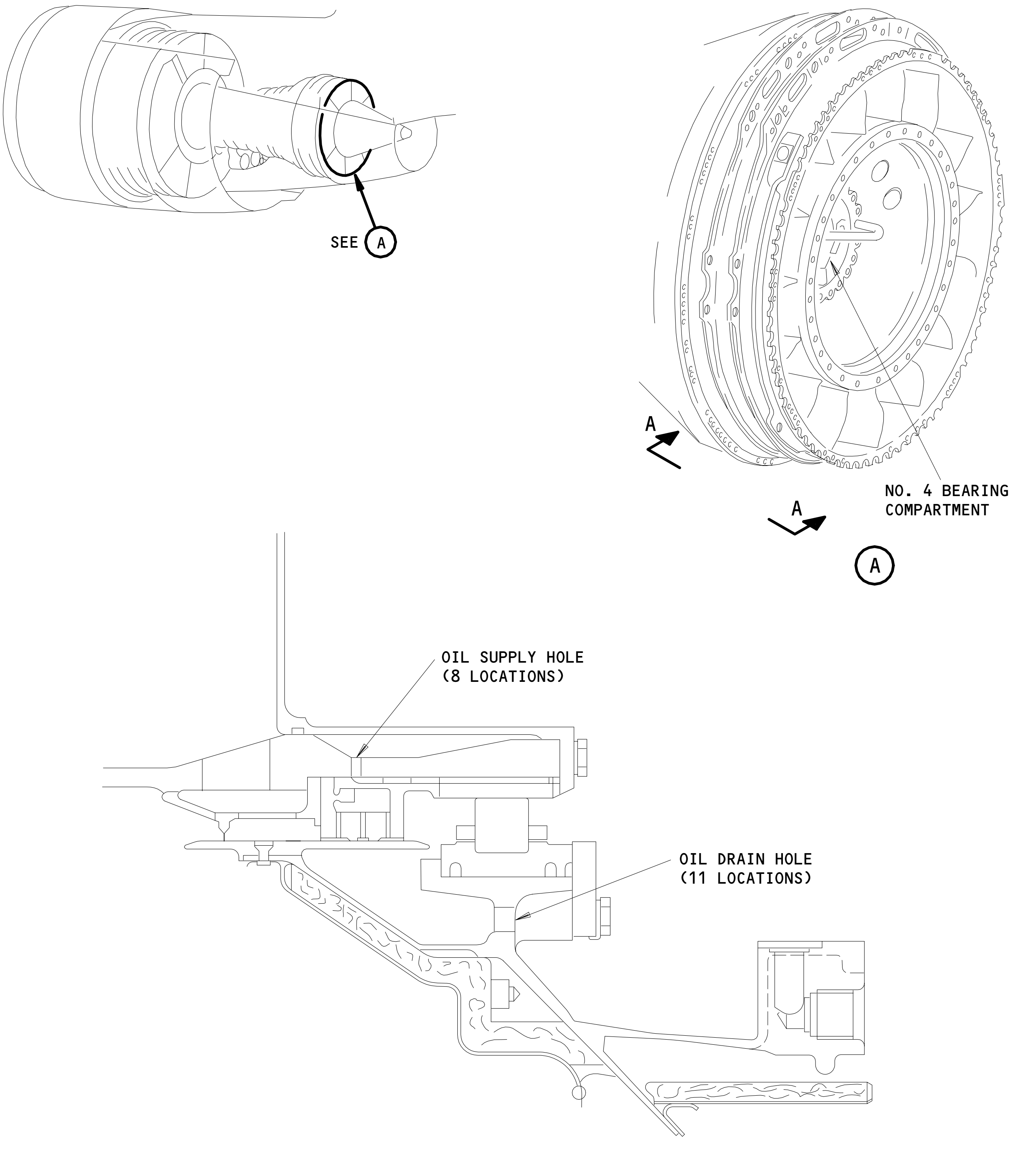
FIBERGLASS WEAR WRAP
H

NOTE: 1. WRAP 1.00 INCH (25.400 mm) WIDE FIBERGLASS TAPE, P05-136, AT FOUR LOCATIONS:
- A AND D AT TUBE ENDS AS SHOWN.
- B AND C CENTERED ON STRAIGHT SECTIONS AS SHOWN.

2. WRAP TAPE TO BE 0.600 INCH (15.240 mm) DIAMETER AND ABOUT 0.100 INCH (2.54 mm) HEIGHT ABOVE TUBE SURFACE.

L-B2810(0000)
L-B2798(0000)

No. 4 Bearing Oil Components - Removal and Installation
Figure 202A (Sheet 4)



L-A8367 (0000)

No. 4 Bearing Compartment - Inspection for Coke
Figure 203

S 012-033-N00

(10) ENGINES WITH SB PW4ENG 79-76;
Remove the No. 4 bearing (oil) pressure as follows (Fig. 202A):

(a) Remove the No. 4 pressure tube from the turbine exhaust case at the 4:30 o'clock position.
 1) Remove the two bolts and bracket that attach the tube shield to the turbine exhaust case.
 2) Remove the bracket, thrust wire, and nut that attach the tube shield from the outboard end of the pressure tube.
 3) Remove the bolt and nut that attach the tube to the bracket.
 4) Remove the tube nut from the adapter.
  a) Remove the tube radially inward.
  b) Remove the pressure tube from the case.

(b) Cut the restraining straps from the tube.
 1) Remove the insulation slide clamp.
 2) Remove the shield sets from the tube.

(c) Remove the optional fiberglass wear wrap from the tube as necessary.

(d) Remove the bolts and bracket from the turbine exhaust case.

(e) Remove the adapter and packing from the tube.
 1) Discard the packing.

S 012-028-N00

(11) ENGINES WITHOUT SB PW4ENG 79-76;
Remove the No. 4 bearing oil scavenge tube (outer) (Fig. 202).

CAUTION: HOLD THE SCAVENGE TUBE (REAR) AT THE WRENCHING FLATS WHEN YOU LOOSEN THE TUBE NUT. IF YOU DO NOT USE THE WRENCHING FLATS, YOU CAN CAUSE TWIST DAMAGE TO THE TUBE ASSEMBLY.

(a) Remove the lockwire to disconnect the No. 4 scavenge tube (outer) from the No. 4 bearing oil scavenge tube (rear) are the 10 o'clock position between flanges R and S.

(b) Remove and discard the thrust wire and remove the nut from the scavenge tube.

(c) Remove the lockwire that attaches the No. 4 bearing scavenge tube heat shield to the tube.
 1) Remove the heat shield (front and rear) from the tube.

(d) Remove the lockwire and bolts that attach the No. 4 bearing tube guide to the case.

(e) While you hold the adapter with a wrench, disconnect the nut that attaches the tube to the adapter.

(f) Move the tube radially to the inside to remove it from the case.

(g) Install covers on the openings.

S 012-034-N00

(12) ENGINE WITH SB PW4ENG 79-76;
Remove the No. 4 bearing oil scavenge tube (outer) (Fig. 202A).
- (a) Remove the No. 4 scavenge tube from the turbine exhaust cast at the 4:00 o'clock position.
  - 1) Remove the two bolts and bracket that attach the tube shield to the turbine exhaust case.
  - 2) Remove the bracket, thrust wire, and nut that attach the tube shield from the outboard end of the pressure tube.
  - 3) Remove the bolt and nut that attach the tube to the bracket.
  - 4) Remove the tube nut from the bracket.
    - a) Move the tube radially inward.
    - b) Remove the scavenge tube from the case.
- (b) Cut the restraining straps from the tube.
  - 1) Remove the insulation slide clamp from the tube.
  - 2) Remove the shield sets from the tube.
- (c) Remove the optional fiberglass wear wrap from the tube as necessary.
- (d) Remove the bolts, and bracket from the turbine exhaust case.
- (e) Remove the adapter and packing from the tube.
  - 1) Discard the packing.

S 162-011-N00

(13) Clean the bearing compartment pressure oil passage way.
- (a) Apply air at a minimum pressure of 10 psig (68.9 kPa) through the adapter to the passage way of the pressure supply core in the bearing compartment.

  NOTE: The air will clean the passage way of any coke flakes that possibly fell through the pressure tube during the removal.

  - 1) Make sure that the passage way is fully open.
  - 2) Air leaks are permitted, because this is not a test.

S 162-012-N00

(14) Clean the tubes internally, as necessary.

NOTE: The tubes must be removed before they can be cleaned.

CAUTION: DO NOT USE COMPRESSED AIR OR A CABLE THAT TWISTS TO CLEAN THE TUBES. IF YOU USE THE WRONG PROCEDURES, YOU CAN CAUSE DAMAGE TO THE TUBES.

(a) Clean the tubes internally with an applicable tube brush.

NOTE: Alternatively, you can clean the tubes in a vapor or solvent degreasing fluid.

S 212-013-N00

(15) Examine the tubes for cracks.
  (a) Make sure you examine the area near the middle support spacer on the tubes.
  (b) Repair or replace tubes with cracks or bad distortion.

S 162-014-N00

(16) With a tube brush, remove all loose coke from the No. 4 bearing compartment.
  (a) Make sure you remove all loose coke which can block the scavenge tube.

S 412-029-N00

(17) ENGINES PRE-PW-SB 72-472;
Install a clean No. 4 bearing oil nozzle and No. 4 bearing transfer tube as follows (Fig. 201):

NOTE: It is not necessary to do an oil flow or airflow test on the clean oil nozzle before or after the installation.

(a) Install a clean No. 4 bearing nozzle into the port in the pad on the exhaust case rear inner diameter.
1) Attach the nozzle with two bolts, lubricated with engine oil, and two washers.
2) Tighten the bolts with your hand.

(b) Install the No. 4 bearing transfer tube through the port in the nozzle and into the port in the exhaust case rear flange.
1) Attach the transfer tube with two bolts, lubricated with engine oil, and washers.
2) Tighten the bolts to attach the nozzle to the exhaust case and bolts to attach the transfer tube to the nozzle to 75-85 pound-inches (8.5-9.6 newton-meters).
3) Bend the tabs of the key washers.

S 422-030-N00

(18) ENGINES POST-PW-SB 72-472;
Install a clean No. 4 bearing (oil) nozzle and No. 4 bearing damper supply tube as follows (Fig. 201):

(a) Install the No. 4 bearing nozzle in the port in the pad on the rear inner diameter of the exhaust case at the 1:30 o'clock position.
1) Install the nozzle with two bolts, with threads lubricated with engine oil, and two washers.

(b) Install the No. 4 bearing damper supply tube through the 0.380 inch (9.652 mm) diameter hole in the nozzle and into the port in the rear flange of the exhaust case.
1) Install the damper tube with two bolts, with threads lubricated with engine oil, and washers.
2) Tighten the bolts that attach the nozzle to the exhaust case and bolts that attach the damper supply tube to the nozzle to 75-85 pound-inches (8.5-9.6 newton-meters).
a) Bend the tabs of the wahsers.

S 422-031-N00

(19) ENGINES POST-PW-SB 72-472;
Install a clean No. 4 bearing front nozzle assembly and the packing transfer tube (the damper tube to the front nozzle) as follows (Fig. 201):

(a) Lubricate two packings with engine oil.
(b) Install the packings in the grooves of the packing transfer tube.

(c) Put one end of the tube into the port on the front No. 4 bearing nozzle.
(d) Align the bolt holes in the flange of the front nozzle with the two retainer plate bolt holes at the 12 o'clock position.
 1) Put the nozzle through the hole in the No. 4 bearing support flange at the 12:30 o'clock position.
(e) Put the end of the transfer tube in the port in the elbow of the No. 4 bearing damper supply tube.
(f) Put the retaining plate, chamfered side out, on the retainer plate pad (under the nozzle flange).
(g) Put the key washer on the oil nozzle flange, and install two bolts, with threads lubricated with engine oil.
(h) Make sure that the clearance gap between the retaining plate and the grooves in the bearing outer race is 0.10-0.050 inch (0.25-1.27 mm).
 1) Tighten the bolts that attach the retainer plate to 75-85 pound-inches (8.5-9.6 newton-meters).
 2) Bend the tabs of the key washers.

S 412-016-N00
(20) ENGINES WITHOUT SB PW4ENG 79-76;
Install a clean No. 4 bearing scavenge (inner) tube as follows (Fig. 202).
(a) Install a new gasket in the groove in the recessed pad in the No. 4 bearing housing rear inner diameter.
(b) Align the bolt holes in the flange of the No. 4 bearing oil scavenge tube with the bolt holes in the recessed pad.
(c) Also align the bolt holes in the tube bracket with the bolt hole in the No. 4 bearing housing inner diameter.
(d) Connect the tube with three bolts to 32-36 pound-inches (3.6-4.1 newton-meters).
 1) Bend the tabs of the key washers.

S 412-018-N00
(21) Install the No. 4 bearing scavenge (outer) tube as follows (Fig. 202):
(a) Remove the covers from the openings.
(b) Install the No. 4 bearing tube guide onto the scavenge tube.
(c) Install the scavenge tube, with the straight end first, into the opening in the exhaust case inner wall and through the strut at approximately the 10:30 o'clock location.
(d) Connect the tube nut detail lubricated with engine oil, to the adapter in the rear inner location.
 1) Tighten the nut with your hand.
(e) Install the two bolts, lubricated with engine oil, to attach the tube guide to the inner wall of the case.
 1) Tighten the bolts with your hand.
(f) Apply air at a minimum pressure of 10 psig (68.9 kPa) to the outboard end of the tube.
(g) Make sure that air flows through the scavenge tube in the sump.
(h) Air leaks are permitted, because this is not a test.

(i) If the airflow is blocked, remove and install the No. 4 bearing oil scavenge tube (inner and outer) again to find the cause.
  1) Tighten the two bolts that hold the tube guide to 75-85 pound-inches (8.5-9.6 newton-meters).
  2) Install lockwire or safety cable and safety cable ferrule.

(j) Use a wrench to hold the adapter while you torque the tube nut to 320-350 pound-inches (36.2-39.5 newton-meters).
  1) Install lockwire.

(k) Correctly put the nut on the outboard end of the scavenge tube.
  1) Connect the nut to the tube with the new thrust wire.

S 412-036-N00

(22) ENGINES WITH SB PW4ENG 79-76;
Install the No. 4 bearing oil scavenge (inner) tube and (outer) tube as follows (Fig. 202A).

(a) Lubricate the adapter and packing with engine oil.
  1) Install the adapter and new packing into the threaded hole in the rear inner flange of exhaust case at 7:30 o'clock position.
  2) Tighten the adapter to 150 - 170 Pound-inches (16.948 - 19.204 Newton-meters).

(b) Install the new gasket in the groove of the exhaust case rear inner diameter.

(c) Align the bolt holes in the flange of the No. 4 bearing oil scavenge tube with both bolt holes in the recessed pad in exhaust case inner diameter.
  1) Align the bolt holes in detail tube bracket with bolt hole in exhaust case inner diameter.
  2) Lubricate the three bolts with engine oil.
    a) Attach the tube with the three bolts and bracket.
  3) Tighten the bolts to 32 - 36 Pound-inches (3.616 - 4.067 Newton-meters).
    a) Bend the key washer tabs.

(d) Optional, install the fiberglass wear wrap to the No. 4 bearing scavenge tube to prevent the possible wear to the scavenge tube.

(e) Install the shield set and heat shield insulation slide clamp on the elliptical section of the No. 4 bearing scavenge tube.

NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(f) Install the shield set on the No. 4 bearing scavenge tube as follows:
1) Place the two halves over the round section of the tube.
2) Install one restraining strap through the loop on the section of the shield set that overlaps the shield set.
3) Put the loop clamp on the wear sleeve of the shield set and temporarily attach a work bolt and nut.
4) Pull the strap to make the shield set tight on the tube.
a) Cut off excess strap material.

(g) Attach the bracket to the turbine exhaust case with the two bolts.
1) Tighten the bolts to 75 - 85 pound-inches (8.474 - 9.604 Newton-meters).

(h) Install the No. 4 bearing scavenge tube through the strut at the 4:00 o'clock position.
1) Attach the tube nut to the adapter with handtight only.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2) Remove the work bolt and replace with the bolt and nut.
a) Attach the bolt and nut to the bracket.
3) Tighten the nut on the inboard end of the scavenge tube to the adpater to 225 - 250 Pound-inches (25.422 - 28.246 Newton-meters).
a) Install the tube nut with the lockwire.
4) Tighten the bolt that attaches the clamp to the bracket to 32 - 36 Pound-inches (3.616 - 4.067 Newton-meters).
5) Install four more straps to hold the shield in position.
6) Pull the strap to make the shield set tight on the tube.
a) Cut off excess strap material.
7) Install the nut to the outboard end of the scavenge tube.
a) Install the tube nut with the lockwire.
8) Attach the tube shield to the turbine exhaust case at the 4:00 o'clock position.
a) Push the rub shield over the nut.
9) Install the two bolts to retain the shield.
a) Tighten the bolts to 32 - 36 Pound-inches (3.616 - 4.067 Newton-meters).
b) Install the bolts with the lockwire or safety cable and safety cable ferrule.

S 412-019-N00

(23) ENGINE WITHOUT SB PW4ENG 79-76;
Install a clean No. 4 bearing (oil) pressure tube as follows (Fig. 202).

(a) Remove the covers from the opening.
(b) Install the No. 4 bearing tube guide on the No. 4 bearing pressure tube.
(c) Install the pressure tube, with the straight end first, into the opening in the exhaust case inner wall and through the strut at approximately the 11:00 o'clock location.
(d) Connect the tube nut detail, lubricated with engine oil, to the adapter on the rear inner flange of the exhaust case at the 1:30 o'clock position.
    1) Tighten the nut with your hand.
(e) Install the two bolts, lubricated with engine oil, to attach the tube guide to the inner wall of the case.
    1) Tighten the bolts with your hand.
(f) Apply air at a minimum pressure of 10 psig (68.9 kPa) to the outboard end of the tube.
(g) Make sure that air flows through the oil nozzle.
(h) Air leaks are permitted, because this is not a test.
(i) If the airflow is blocked, remove and install the No. 4 bearing oil pressure tube and the No. 4 bearing oil nozzle and transfer tube.
    1) Tighten the two bolts that hold the tube guide to 75-85 pound-inches (8.5-9.6 newton-meters).
    2) Install lockwire.
(j) Use a wrench to hold the adapter while you torque the tube nut to 320-350 pound-inches (36.2-39.5 newton-meters).
    1) Install lockwire.
(k) Correctly put the nut on the outboard end of the tube.
    1) Connect the nut to the tube with the new thrust wire.

S 412-037-N00

(24) ENGINES WITH SB PW4ENG 79-76;
Install a clean No. 4 bearing (oil) pressure tube (Fig. 202A).

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE THE COVER PACKING OR YOU WILL CUT THE PACKING DURING THE INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTODWN.

CAUTION: INSTALL THE COVER INTO POSITION USING EIGHT TO TEN WORKING BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(a) Lubricate the adapter and packing with engine oil.
   1) Install the adapter and new packing into the threaded hole in the rear inner flange of the exhaust case at 1:30 o'clock position.
   2) Tighten the adapter to 150 - 170 Pound-inches (16.948 - 19.207 Newton-meters).
(b) Provide as an option, install the fiberglass wear wrap to prevent possible wear to the No. 4 bearing pressure tube.
(c) Install the shield set and the heat shield insulation slide clamp on the elliptical section of the No. 4 scavenge tube.

   NOTE: The shield is installed on the section of the tube that goes through the strut of the turbine exhaust case.

(d) Install the shield set on the No. 4 scavenge tube as follows:
   1) Place the two halves over the round section of the tube.
   2) Install one restraining strap through the loops on the section of the shield that overlap the shield set.
   3) Pull the strap to make the shield set tight on the tube.
      a) Cut off excess strap material.
(e) Attach the bracket to the turbine exhaust case with the two bolts.
   1) Tighten the bolts to 75 - 85 Pound-inches (8.474 - 9.604 Newton-meters).

(f) Put the loop clamp on the wear sleeve of the shield set and temporarily attach a work bolt and nut.
1) Tighten the bolt to 75 - 85 Pound-inches (8.474 - 9.604 Newton-meters).

(g) Install the No. 4 pressure tube through the strut at the 4:00 o'clock position.
1) Attach the tube nut to the adapter with handtight only.

NOTE: The shield may be separated to attach the tube nut to the adapter.

2) Remove the work bolt and replace with the bolt and nut.
a) Attach the bolt and nut to the bracket.
3) Tighten the tube nut to the adapter to 225 - 250 Pound-inches (25.422 - 28.246 Newton-meters).
a) Install the tube nut with the lockwire.
4) Tighten the bolts that attaches the clamp to the bracket to 32 - 36 Pound-inches (3.616 - 4.067 Newton-meters).
5) Install four more straps to hold the shield in position.
6) Pull the strap to make the shield set tight on the tube.
a) Cut off excess strap material.
7) Install the bracket over the outboard end of the tube.
8) Position the nut on the outboard end of the tube.
a) Install the nut to the tube with the thrust wire.
9) Attach the tube shield to the turbine exhaust case at the 4:30 o'clock position.
a) Push the tube shield over the nut.
b) Align the tube shield with the bracket.
10) Install the two bolts to retain the shield.
a) Tighten the bolts to 32 - 36 Pound-inches (3.616 - 4.067 Newton-meters).
b) Install the bolts with the lockwire or safety cable and safety cable ferrule.

S 412-038-N00

(25) Install the No. 4 bearing cover as follows (AMM 72-54-04/401):
(a) Lubricate the new packing with engine oil.
(b) Install the new packing into the groove at the rear flange of the No. 4 bearing cover.
(c) Install 8 to 10 work bolts equally spaced around the cover.
(d) Tighten the bolts equally in small increments to pull the cover into equal position.
(e) Monitor the engagement of the cover to make sure the packing is not cut.
(f) Tighten the work bolts to 85 - 95 Pound-inches (9.604 - 10.734 Newton-meters) after the cover is fully seated.

S 792-039-N00

(26) Do the leak check on the No. 4 bearing cover, the No. 4 bearing oil pressure tube, the No. 4 bearing oil scavenge tube and the bearing cover mating flanges,

(a) Install a cap to the outboard end of the oil pressure tube.

(b) Apply air pressure of 18.0 - 20.0 Psig (124.1 - 137.9 Kpa) to the outboard end of the scavenge tube.

(c) Apply the leak test fluid at the tube connections on the inboard end of the pressure tube.

1) Apply the leak test fluid at the inboard end of the oil scavenge tube.

2) Apply the leak test fluid at the empty bolt holes in the bearing cover.

3) Apply the leak test fluid on all around the bearing cover to exhaust case mating flanges.

(d) No leaks are permitted.

1) If leaks are found, disassemble and correct the cause of leaks.

2) If no leaks are found, continue with the assembly.

(e) Remove the 8 to 10 work bolts.

S 412-040-N00

(27) Install the No. 4 bearing heat shield as follows (AMM 72-54-04/401):

(a) Position the No. 4 bearing heat shield into the recess in the No. 4 bearing shield.

1) Align the holes and install the shield over the No. 4 bearing cover.

2) Lubricate the 30 bolts with engine oil.

a) Install the 30 bolts to the shield.

b) Tighten the bolts to 85 - 95 Pound-inches (9.604 - 10.734 Newton-meters).

S 412-041-N00

(28) Complete the installation of the No. 4 bearing scavenge tube (outer) and the No. 4 bearing oil pressure tube as follows:

<u>CAUTION</u>: HOLD THE SCAVENGE TUBE (REAR) AT THE WRENCHING FLATS WHEN YOU TIGHTEN THE TUBE NUT. IF YOU DO NOT USE THE WRENCHING FLATS, YOU CAN CAUSE TWIST DAMAGE TO THE TUBE ASSEMBLY.

(a) Connect the nut, threads lubricated with anti-seize paste (PWA 36246), to the No. 4 bearing scavenge tube (rear).

1) Tighten the nut to 200-225 pound-inches (22.6-25.4 newton-meters).

2) Install lockwire.

(b) Correctly put the No. 4 bearing scavenge tube heat shields (front and rear) around the inboard end of the tube.

1) Install lockwire through the eyelets to hold the heat shield.

CAUTION: HOLD THE SCAVENGE TUBE (UPPER) AT THE WRENCHING FLATS WHEN YOU TIGHTEN THE TUBE NUT. IF YOU DO NOT USE THE WRENCHING FLATS, YOU CAN CAUSE TWIST DAMAGE TO THE TUBE ASSEMBLY.

(c) Connect the nut, lubricated with antigalling compound to the No. 4 bearing oil pressure tube.

1) Tighten the nut to 200 - 225 Pound-inches (22.597 - 25.422 Newton-meters).

2) Install the lockwire.

(d) Put the No. 4 bearing heat shields (front and rear) around the inboard end of the tube.

1) Install the lockwire through the eyelets to hold the heat shields.

S 412-021-N00

(29) Install the turbine exhaust plug (AMM 78-11-02/401).

S 412-022-N00

(30) Close the core cowl panels (AMM 71-11-06/201).

S 442-023-N00

(31) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 712-024-N00

(32) Do the test for the external oil tubes that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

TURBINE EXHAUST CASE - INSPECTION/CHECK

1. General
   A. This inspection of the turbine exhaust case gives the instructions for (1) the external area of the turbine exhaust case for cracks and damage, and (2) the gaspath area OD and ID of the turbine exhaust case for cracks and damage.

TASK 72-54-01-206-001-N00

2. Do the Inspection of the Turbine Exhaust Case
   A. References
      (1) AMM 71-11-06/201, Core Cowl Panels
      (2) AMM 78-11-02/401, Turbine Exhaust Plug
      (3) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zones

411	Left Engine
421	Right Engine

      (2) Access Panels

417AL	Core Cowl (Left)
418AR	Core Cowl (Right)
427AL	Core Cowl (Left)
428AR	Core Cowl (Right)

   C. Do the Inspection of the Turbine Exhaust Case

S 046-002-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

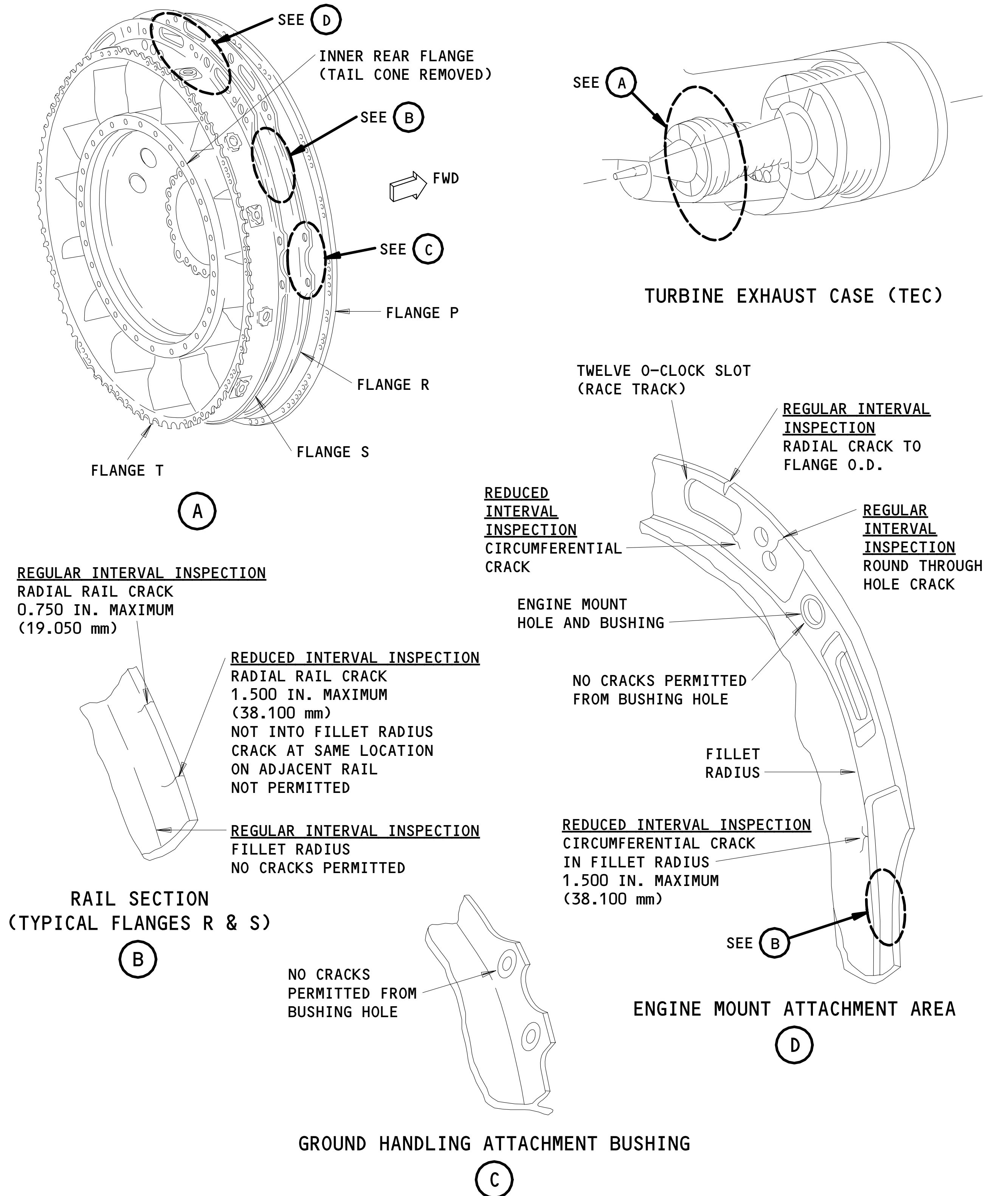
      (1) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 016-003-N00

      (2) Open the core cowl panels (AMM 71-11-06/201).

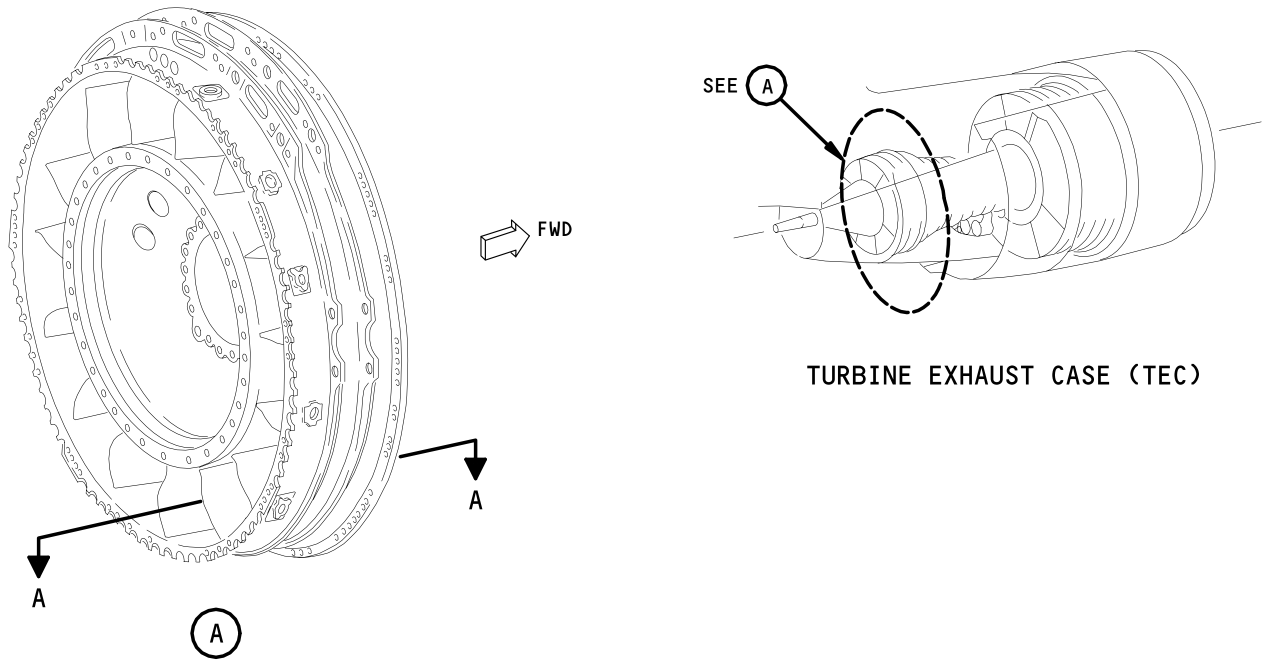
S 216-004-N00

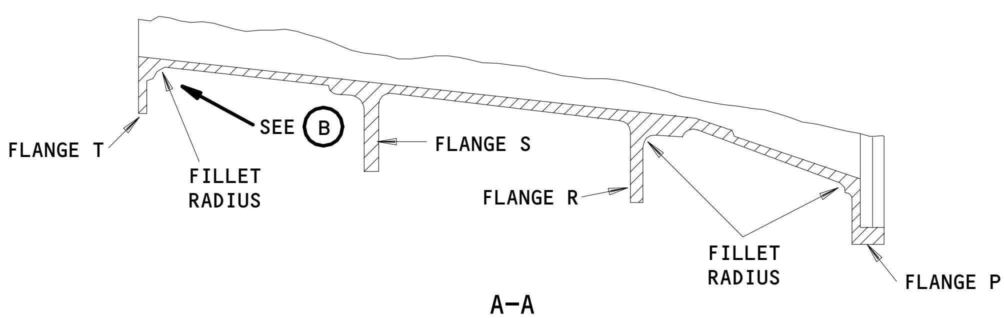
      (3) Examine the external area of the turbine exhaust case for cracks and damage (Fig. 601 and 602).

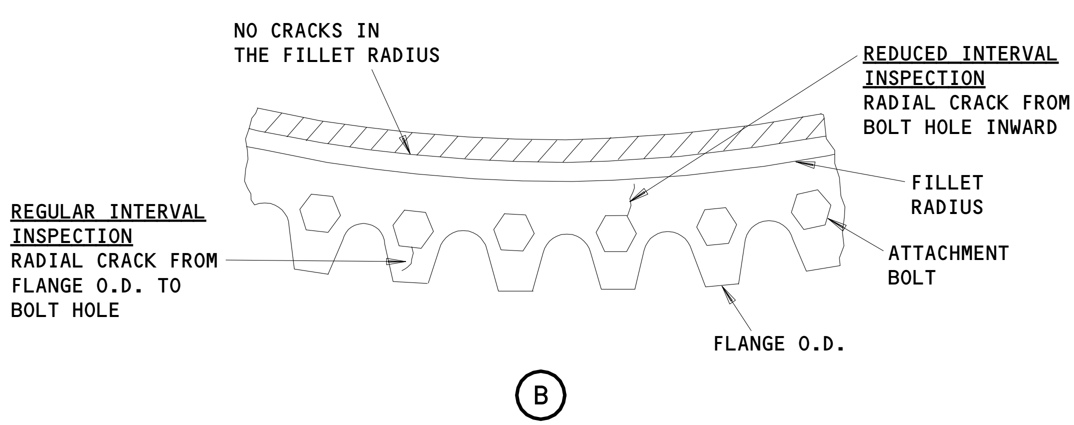


L-A0588

Flanges R and S - Turbine Case Exterior Inspection
Figure 601







L-A0582

Flanges P and T - Turbine Case Exterior Inspection
Figure 602

CAUTION: THE LIMIT THAT FOLLOWS IS APPLICABLE ONLY TO CONTINUE THE PART IN OPERATION. THE LIMIT IS MADE FROM THE STRUCTURAL LIMITS OF THE PART. THE LIMIT DOES NOT SHOW THAT THE ENGINE PERFORMANCE, STABILITY, OPERATION LIMITS, OR THE TIME YOU CAN REPAIR THE PARTS CAN POSSIBLY CHANGE.

(a) For the permitted damage which is in Continue In Operation Limits Tables below the "Permitted Without Limits", it is necessary to do an inspection at the regular inspection times which you get from the Boeing Maintenance Planning Document. For the damage in the "Permitted If the Inspection Time is Decreased", it is necessary to do an inspection at half of the regular inspection time.

(b) If the damage is more than the limits for the "Permitted If the Inspection Time is Decreased", you must remove the engine from operation in less than 5 cycles or 10 hours of operation.

(c) Visually examine the Flanges R and S for cracks and damage.

1) The maximum permitted damage and crack conditions for a regular inspection time or an inspection time which is decreased are given in the table that follows:

CONDITION FOUND	CONTINUE IN OPERATION LIMITS	
	PERMITTED WITHOUT LIMITS	PERMITTED IF THE INSPECTION TIME IS DECREASED
Flanges R and S Rail Cracks (Fig. 60)	Radial or circumferential cracks not more than 0.75 inch (19.050 mm) in length are permitted.	Radial or circumferential cracks not more than 1.5 inches (38.100 mm) in length are permitted. No cracks into the fillet radius are permitted.
	Cracks at the same circumferential location are not permitted on adjacent rails.	Cracks at the same circumferential locations are NOT permitted.
	No circumferential or axial cracks are permitted in the fillet radius.	Single circumferential cracks which are not more than 1.0 inch (25.400 mm) in length and only in the fillet radius are permitted.
Flanges R and S Engine mount ground handling mount, rail slots and through hole cracks. (See Fig. 602, Views A & D)	A single radial crack in a slot to the rail OD is permitted.	A single radial or circumferential crack on the ID side of a slot or through hole is permitted to a maximum length of 1.0 inch (25.400 mm).
	Cracks from the bushing hole of the engine mount or ground handling holes at the 10:30, 11:30, 12:30 and 1:30, 3:00 and 9:00 o'clock positions are NOT permitted.	

CAUTION: THE LIMIT THAT FOLLOWS IS APPLICABLE ONLY TO CONTINUE THE PART IN OPERATION. THE LIMIT IS MADE FROM THE STRUCTURAL LIMITS OF THE PART. THE LIMIT DOES NOT SHOW THAT THE ENGINE PERFORMANCE, STABILITY, OPERATION LIMITS, OR THE TIME YOU CAN REPAIR THE PARTS CAN POSSIBLY CHANGE.

(d) For the permitted damage which is in Continue In Operation Limits Tables below the "Permitted Without Limits", it is necessary to do an inspection at the regular inspection times which you get from the Boeing Maintenance Planning Document. For the damage in the "Permitted If the Inspection Time is Decreased", it is necessary to do an inspection at half of the regular inspection time.

(e) If the damage is more than the limits for the "Permitted If the Inspection Time is Decreased", you must remove the engine from operation in less than 5 cycles or 10 hours of operation.

(f) Visually examine the Flanges P and T for cracks and damage.

1) The maximum permitted damage and crack conditions for a regular inspection time or an inspection time which is decreased are given in the table that follows:

CONDITION FOUND	CONTINUE IN OPERATION LIMITS	
	PERMITTED WITHOUT LIMITS	PERMITTED IF THE INSPECTION TIME IS DECREASED
Flanges P and T, T1 OD Flanges and ID Flange T1 (Fig. 602)	Radial crack from flange OD bolt hole is permiited.	Radial crack from the bolt hole in to the fillet radius is permitted. NO cracks are permitted in the fillet readius.
		Radial crack from the bolt hole which goes in is NOT permitted.

D. Do the Inspection of the Gaspath Area of the Turbine Exhaust Area (Fig. 603-605).

S 226-005-N00

(1) Do the inspection of the strut and duct of the turbine exhaust case with the steps that follow:

(a) You can continue the strut in operation if the surface skin has bulges or depressions, buckles and distortion of the leading or trailing edges are not more than the limits that follow:

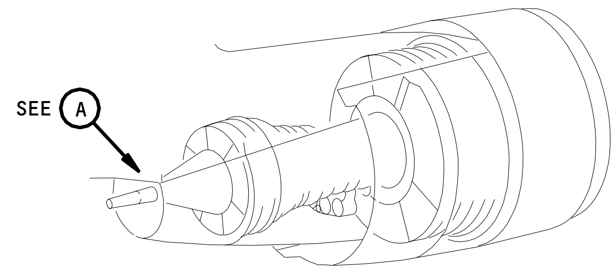
1) The leading and trailing edge contours are smooth and the crack limits are not more than the limits in the table.

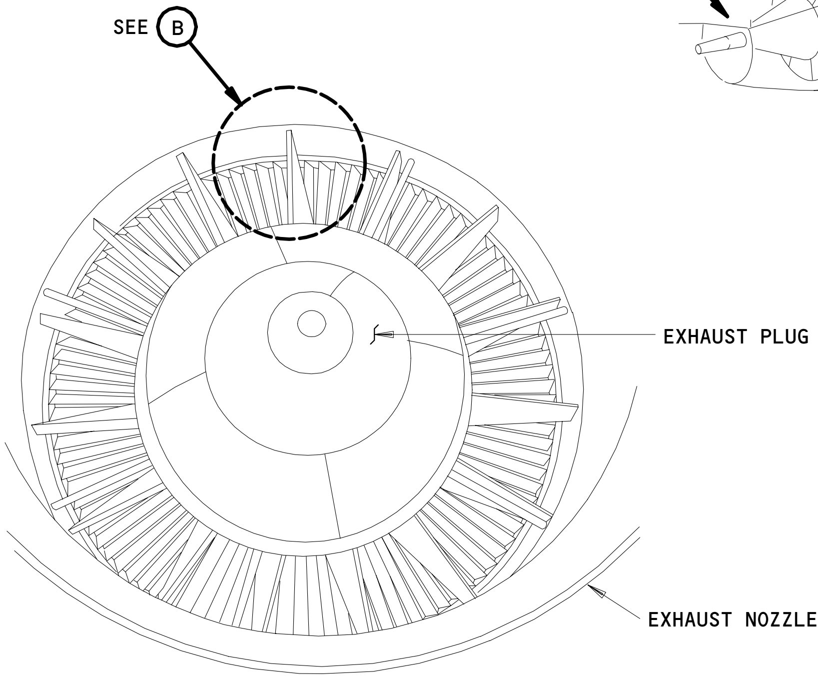
2) Skin separation from the strut stiffeners is not permitted.

3) Use the crack limits for angular dents which are straight line creases, holes and tears.

<u>NOTE</u>: The cracks which are permitted will let hot exhaust gases flow through the vanes into the adjacent cowled area. It is recommended you do the inspection of the engine/aircraft tubes and cables in this area when you do the full inspection for continued operation.

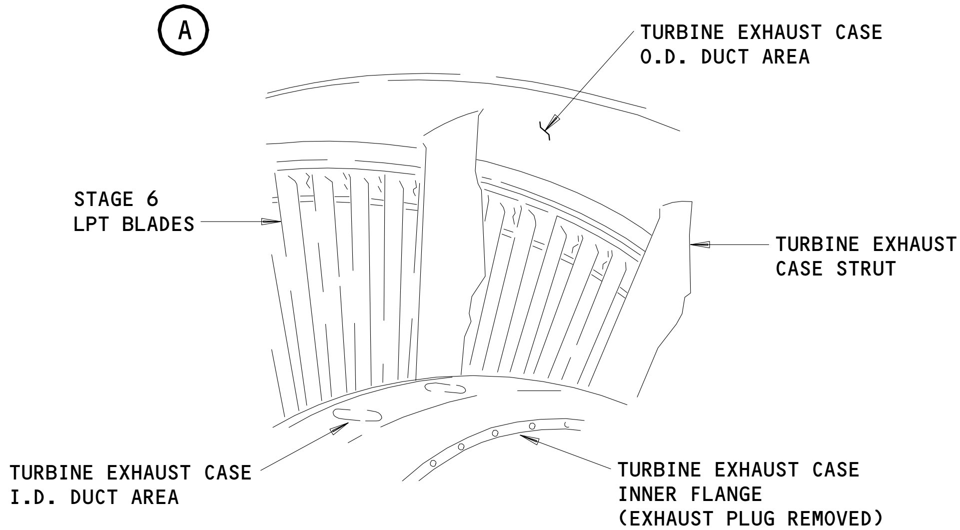
a) You must add the length of the straight line creases, holes and tears to the length of the cracks when you try to find the permitted limits.





(REAR VIEW AS SEEN WITH EXHAUST
PLUG AND NOZZLE)

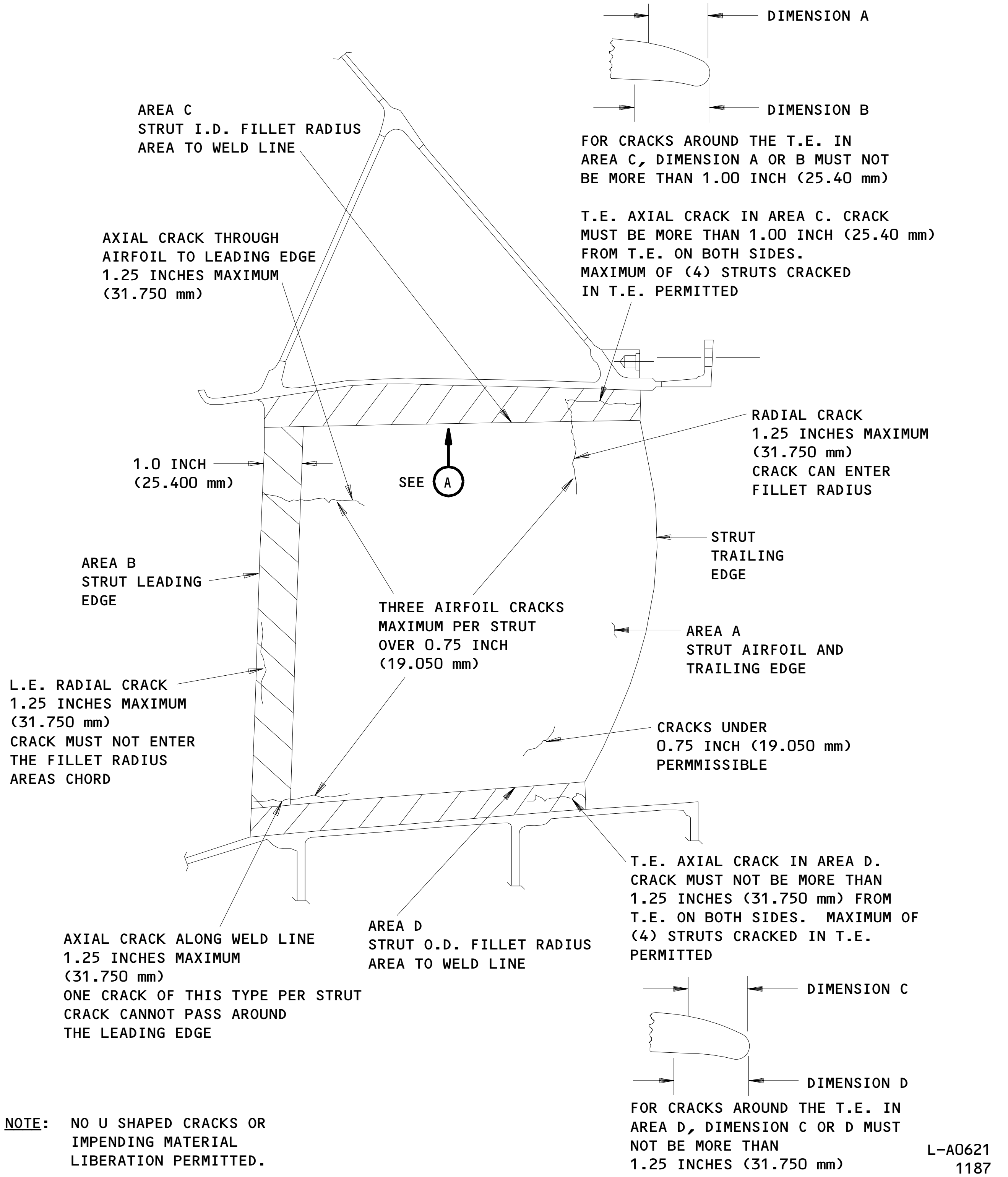
A



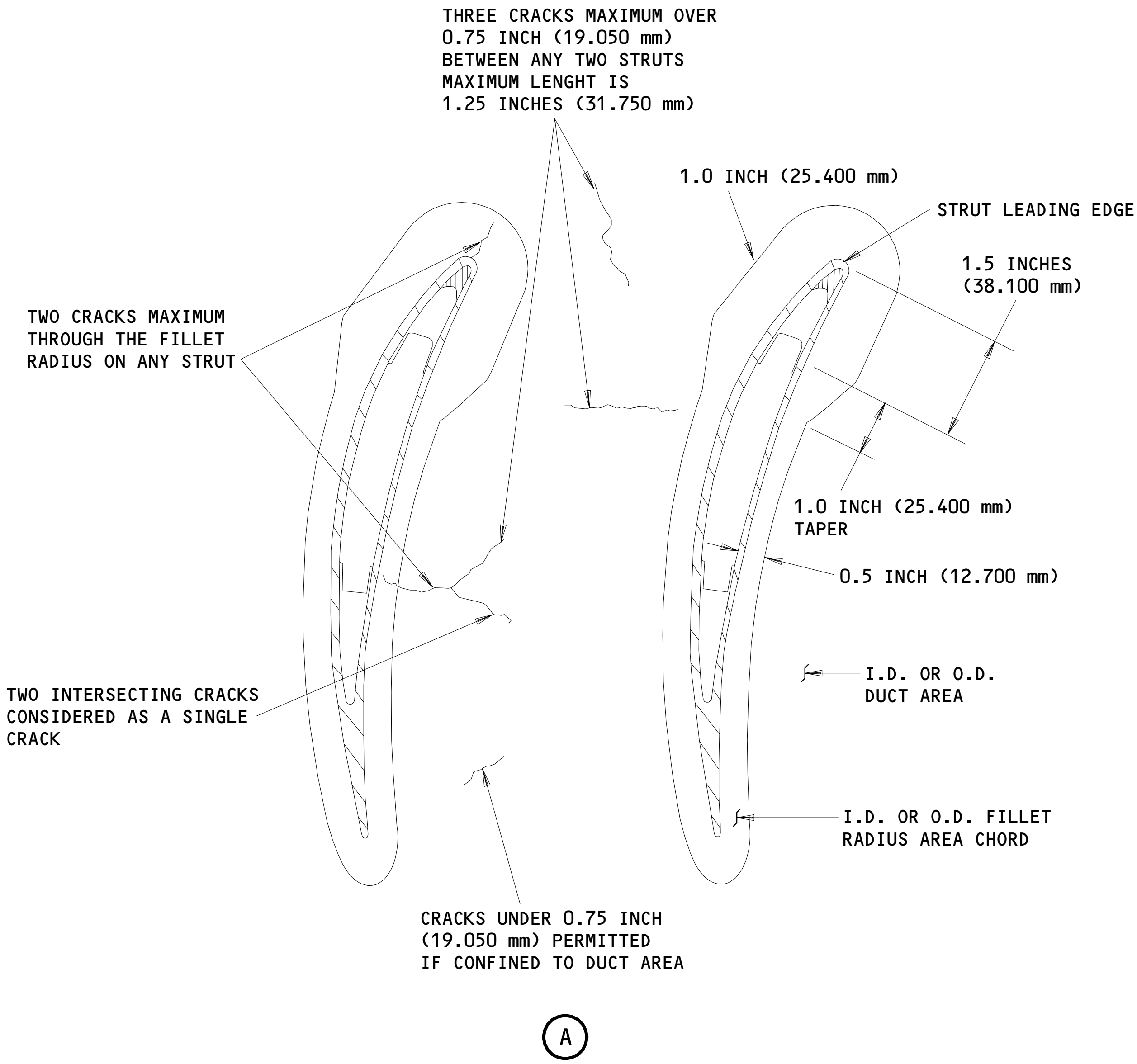
B

L-A0615

Turbine Exhaust Case Assembly Gaspath Area Inspection
Figure 603



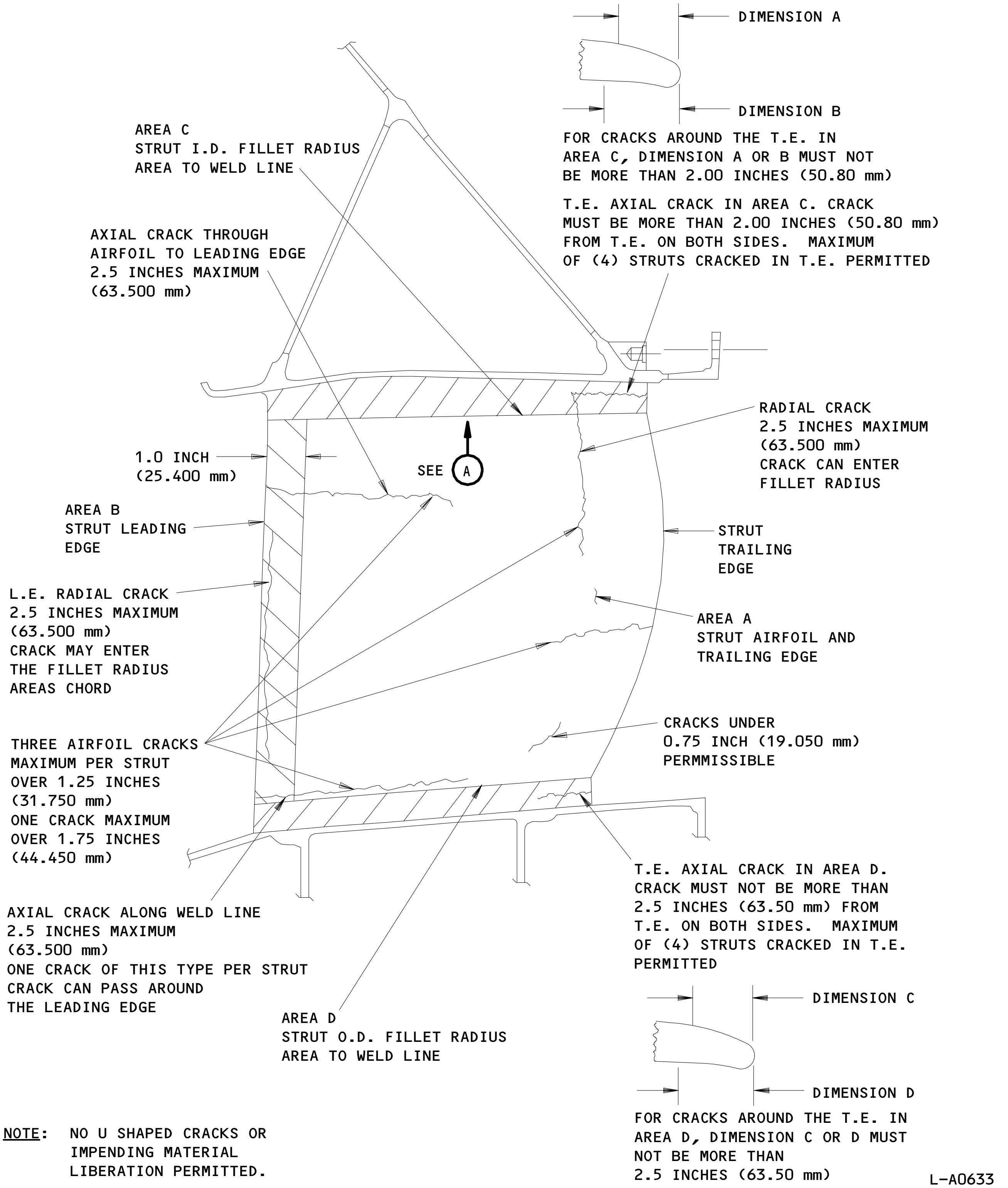
Turbine Exhaust Case Inspection - Regular Interval
Figure 604 (Sheet 1)



NOTE: NO U SHAPED CRACKS OR IMPENDING MATERIAL LIBERATION PERMITTED

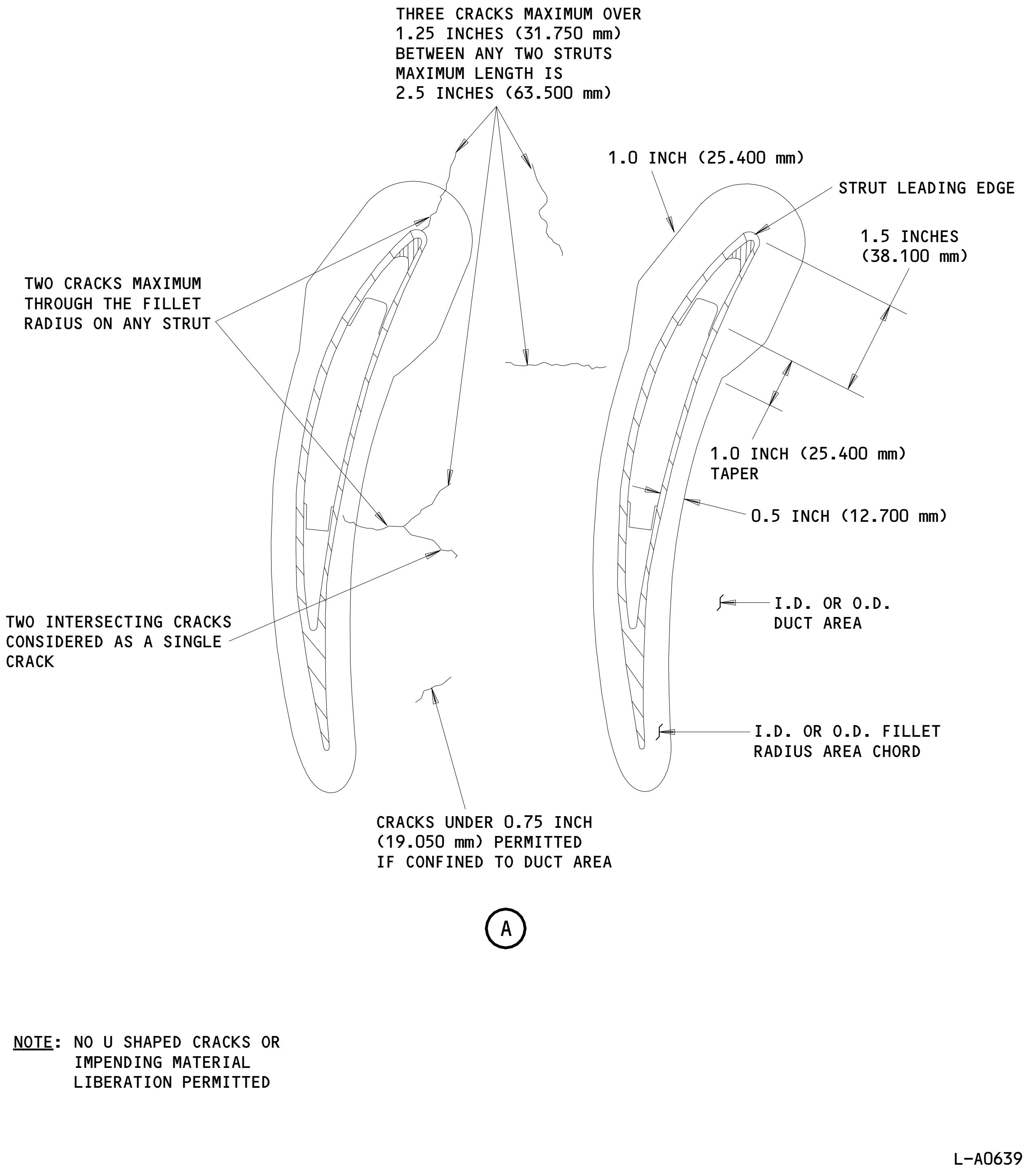
L-A0627

Turbine Exhaust Case Inspection - Regular Interval
Figure 604 (Sheet 2)



Turbine Exhaust Case Inspection - Reduced Interval
Figure 605 (Sheet 1)

315681



NOTE: NO U SHAPED CRACKS OR
IMPENDING MATERIAL
LIBERATION PERMITTED

L-A0639

Turbine Exhaust Case Inspection - Reduced Interval
Figure 605 (Sheet 2)

CAUTION: THE LIMIT THAT FOLLOWS IS APPLICABLE ONLY TO CONTINUE THE PART IN OPERATION. THE LIMIT IS MADE FROM THE STRUCTURAL LIMITS OF THE PART. THE LIMIT DOES NOT SHOW THAT THE ENGINE PERFORMANCE, STABILITY, OPERATION LIMITS, OR THE TIME YOU CAN REPAIR THE PARTS CAN POSSIBLY CHANGE.

(b) For the permitted damage which is in Continue In Operation Limits Tables below the "Permitted Without Limits", it is necessary to do an inspection at the regular inspection times which you get from the Boeing Maintenance Planning Document. For the damage in the "Permitted If the Inspection Time is Decreased", it is necessary to do an inspection at half of the regular inspection time.

(c) If the damage is more than the limits for the "Permitted If the Inspection Time is Decreased", you must remove the engine from operation in less than 5 cycles or 10 hours of operation.

(d) The crack limits for the struts of the turbine exhaust case, and the OD and ID duct area are given in the table that follows:

CONDITION FOUND	CONTINUE IN OPERATION LIMITS	
	PERMITTED WITHOUT LIMITS	PERMITTED IF THE INSPECTION TIME IS DECREASED
Strut airfoil and trailing edge Area A for cracks (Fig. 604)	A maximum of three cracks with a length of more than 0.75 inch (19.050 mm) are permitted on a single strut.	A maximum of three cracks with a length more than 1.25 inches (31.750 mm) are permitted on a single strut. A maximum of one crack with a length of 1.75 inches (44.450 mm) is permiited.
	Radial cracks with a maximum length of 1.25 inches (31.750 mm) is permitted.	Radial (spanwise) and axial (chordwise) cracks to a maximum length of 2.5 inches (63.500 mm) are permitted on the airfoil areas. The can go through the fillet radius or leading edge.
	Axial cracks, which go through the airfoil to the leading edge, with a maximum length of 1.25 inches (31.750 mm) are permitted.	NO "U" shaped cracks or material which will fall off are permitted.
	All cracks less than 0.75 inch (19.050 mm) which are only in the airfoil area, are permitted.	You must not have a total sum of the lengths of all cracks more than 5.00 inches (127.000 mm).
	Cracks are permitted to go into the leading edge or fillet radius.	
	NO "U" shaped cracks or material which will fall off are permitted.	
Leading edge Area B for cracks (Fig. 604)	A radial crack on, or adjacent to the weld of the strut leading edge has a maximum length of 1.25 inches (31.750 mm). The radial crack must not go into the ID or OD fillet radius.	A radial crack on or adjacent to the weld of the strut leading edge has a maximum length of 2.5 inches (63.500 mm). The radial crack can go through the fillet radius.

CONDITION FOUND	CONTINUE IN OPERATION LIMITS	
	PERMITTED WITHOUT LIMITS	PERMITTED IF THE INSPECTION TIME IS DECREASED
	An axial or chordwise crack through the leading edge to the airfoil surface is permitted. The length of the airfoil area crack applies.	
For cracks in Area C and Area D	Radial cracks to a maximum of two on one strut can go through the fillet radius. The maximum length is 1.25 inches (31.750 mm) and includes all portions of the crack on the airfoil or duct surfaces.	Radial cracks to a maximum of two on one strut can go through the fillet radius. The maximum length is 2.5 inches (63.500 mm) and includes all portions of the crack on the airfoil or duct surfaces.
	An axial crack along the airfoil ID or OD weld line has a maximum length of 1.25 inches (31.750 mm). Only one crack is permitted on a strut. The crack cannot go around the leading edge.	An axial crack along the airfoil ID or OD weld line has a maximum length of 2.5 inches (63.500 mm). Only one crack is permiited on a strut. The crack cannot go around the leading edge.
For stand up crack in Area C	Crack up to 1.00 inch (25.400 mm) long from the trailing edge.	Crack up to 2.00 inch (50.800 mm) long from the trailing edge.
For stand up crack in Area D	Crack up to 1.25 inch (31.750 mm) long from the trailing edge.	Crack up to 2.50 inch (63.500 mm) long from the trailing edge.
Inner and Outer Areas C and D For cracks (Fig. 605)	Circumferential or axial cracks have a maximum length of 1.25 inches (31.750 mm) with a maximum quantity of three.	Circuferential or axial cracks have a maximum length of 2.5 inches (63.500 mm) with a maximum quantity of three.

CONDITION FOUND	CONTINUE IN OPERATION LIMITS	
	PERMITTED WITHOUT LIMITS	PERMITTED IF THE INSPECTION TIME IS DECREASED
	A continuous crack or a maximum of two cracks which go across each other and are between two struts has the same limits as a single crack. No "U" shaped cracks or material which will fall off is permitted.	A continuous crack or a maximum of two cracks which go across each other and are between two struts has the same limits as a single crack.
	A maximum of three cracks between two adjacent struts with a length more than 0.75 inch (19.050 mm) up to 1.25 inches maximum (31.750 mm) are permitted.	NO "U" shaped cracks or material which will fall off is permitted.
	All cracks which are less than 0.75 inch (19.050 mm) in length in the duct area only, are permitted.	
		A maximum of three cracks which are between two struts and more than 1.25 inch (31.75 mm) in length. The maximum length is 2.5 inches (63.500 mm).

NO. 4 BEARING SHIELD AND COVER - REMOVAL/INSTALLATION

1. General
   A. This procedure gives the steps for the removal and the installation of the No. 4 bearing compartment cover, which will be referred to as the No. 4 bearing cover.
   B. The No. 4 bearing cover is installed on the rear inner flange of the turbine exhaust case.
   C. You must remove the turbine exhaust sleeve and plug to get access to the No. 4 bearing cover.

TASK 72-54-04-004-002-N00

2. Remove the No. 4 Bearing Shield and Cover (Fig. 401)
   A. Equipment
      (1) ENGINES PRE-PW-SB 72-385;
          Puller, Jackscrew - PWA85307
      (2) ENGINES POST-PW-SB 72-385;
          Jackscrews - 0.190-32 (eight to ten are necessary)
   B. References
      (1) AMM 78-11-02/401, Turbine Exhaust Plug
      (2) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

411	No. 1 Engine (Left)
421	No. 2 Engine (Right)

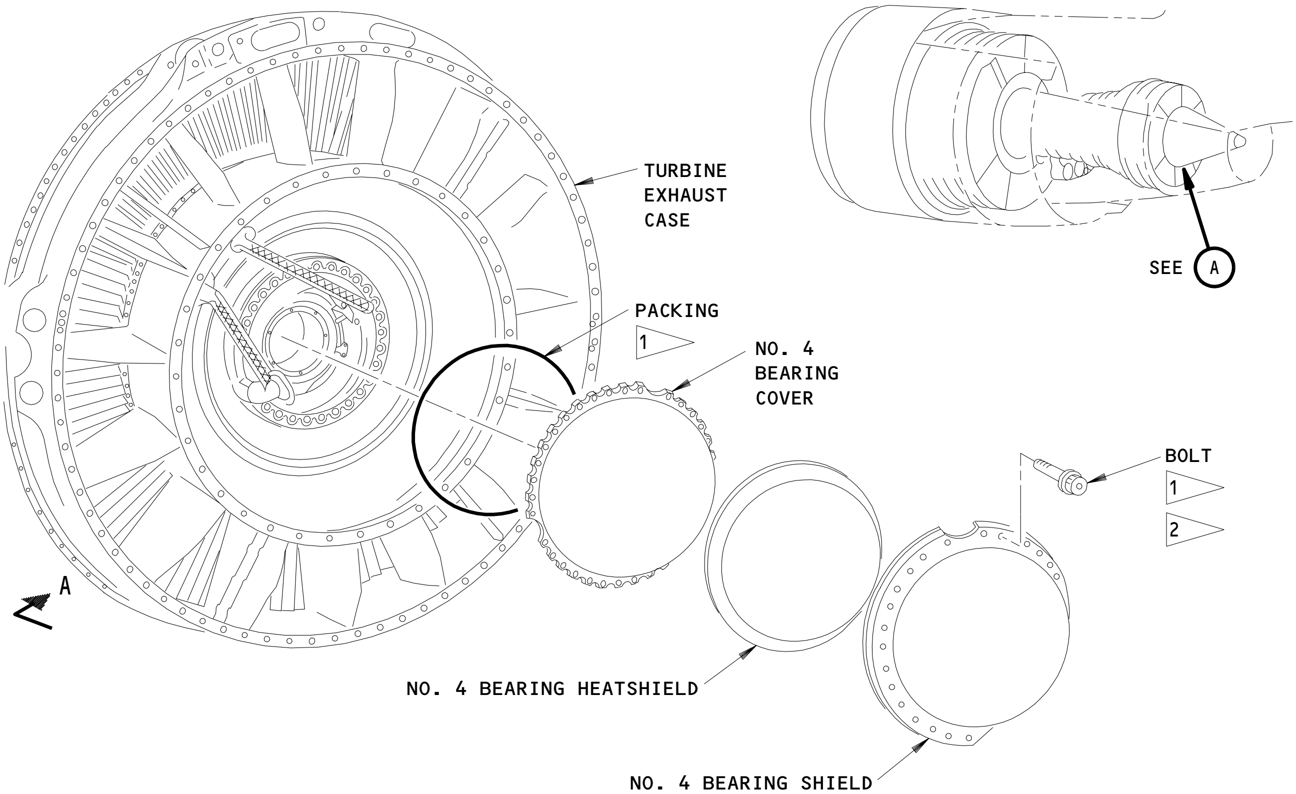
   D. Procedure

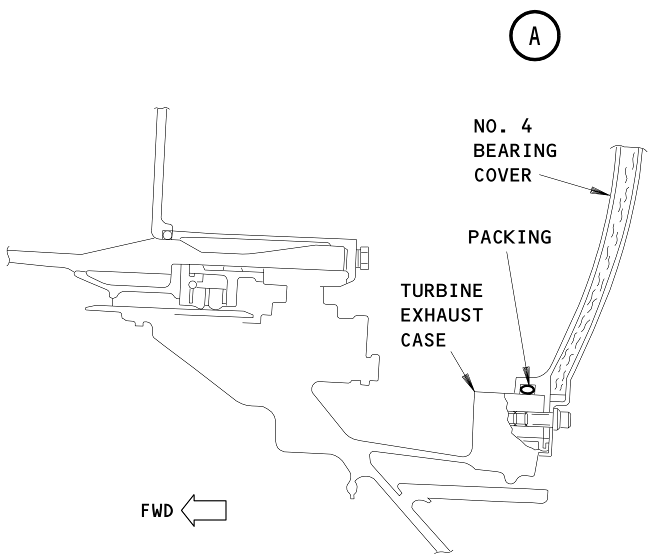
      S 024-004-N00

      (1) Do the steps that follow to remove the shield and heat shield:

      WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

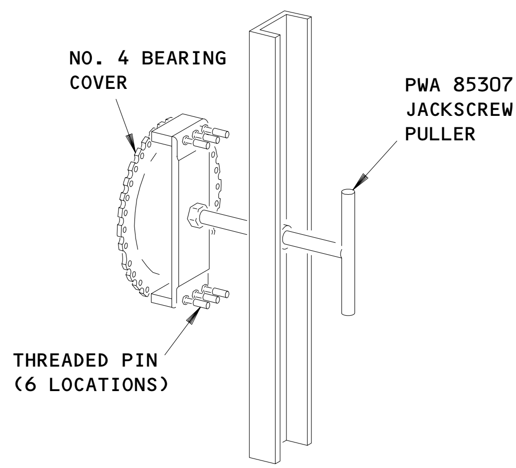
         (a) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).





A-A

L-A3304



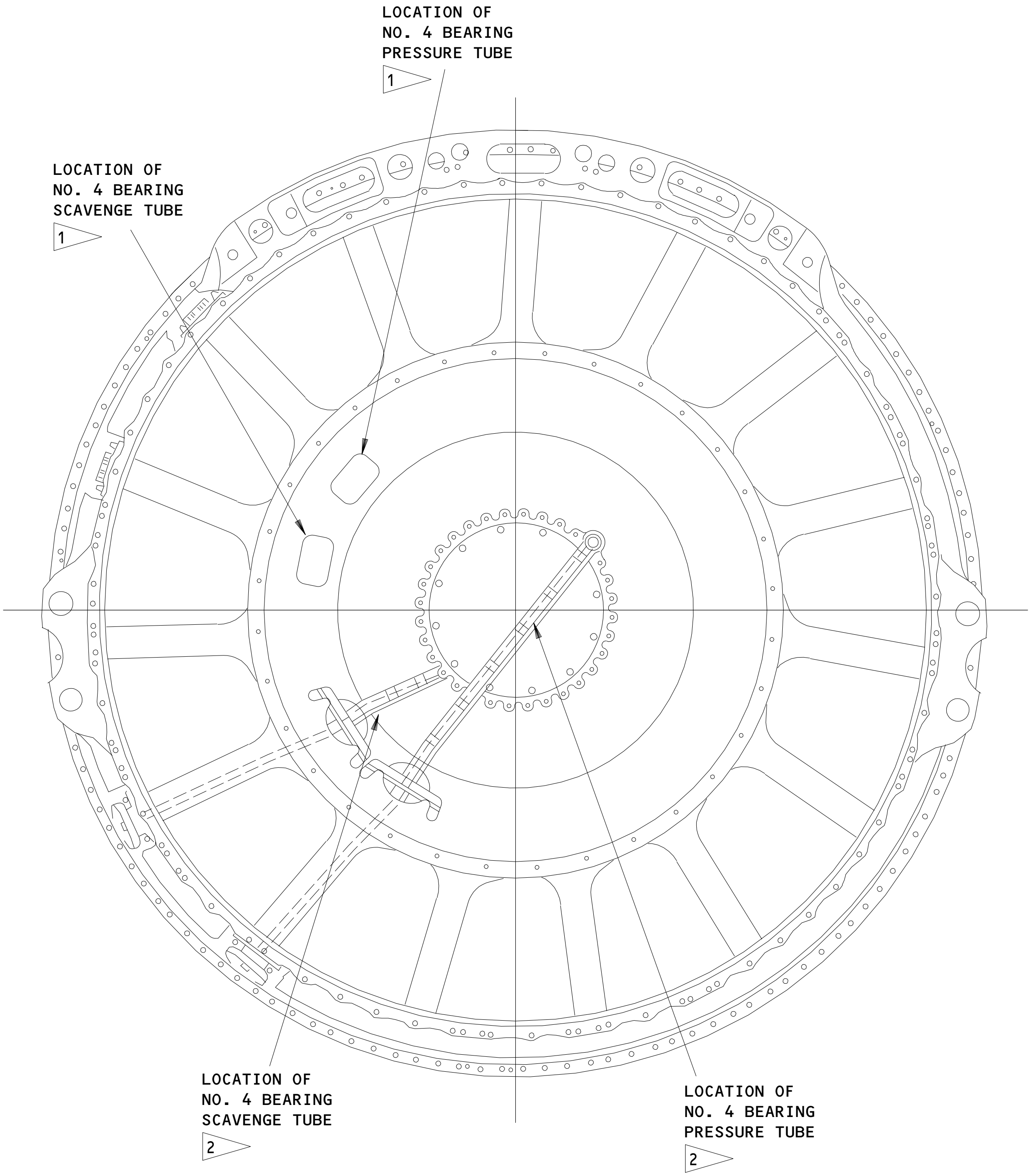
PWA 85307 JACKSCREW

L-A4493

1 LUBRICATE WITH ENGINE OIL

2 PRE-PW SB 72-456: 30 LOCATIONS
POST-PW SB 72-456: 16 LOCATIONS

No. 4 Bearing Shield and Cover
Figure 401 (Sheet 1)



1 ENGINES PRE-PW-SB 79-76
2 ENGINES POST-PW-SB 79-76

L-B2782 (0000)

No. 4 Bearing Shield and Cover
Figure 401 (Sheet 2)

(b) Remove the turbine exhaust plug (AMM 78-11-02/401).
(c) Remove the bolts that attach the shield to the No. 4 bearing and the rear inner flange of the turbine exhaust case.
(d) Remove the shield.
(e) Remove the heat shield on the No. 4 bearing.

S 024-005-N00
(2) ENGINES PRE-PW-SB 72-385;
Do the steps that follow to remove the No. 4 bearing cover:
(a) Attach the Jackscrew Puller (PWA 85307) to the cover on the No. 4 bearing.

NOTE: The Jackscrew Puller attaches to the bearing cover with six screws.

(b) Turn the jackscrew T handle to remove the cover from the inner flange of the turbine exhaust case.

NOTE: For engines with PW SB 79-76, it will be necessary to angle the cover and heat shield to clear the No. 4 Bearing oil pressure tube.

(c) Discard the packing.
(d) Remove the Jackscrew Puller from the cover.

S 024-006-N00
(3) ENGINES POST-PW-SB 72-385;
Do the steps that follow to remove the No. 4 bearing cover.
(a) Install and equally tighten eight 0.190-32 jackscrews to remove the cover.
(b) Discard the packing.

TASK 72-54-04-404-001-N00
3. Install the No. 4 Bearing Shield and Cover (Fig. 401)
A. Consumable Materials
(1) D00390 Engine Oil - PWA 521B

(2) Fluid - Leak Check (P05-007)

B. References

(1) AMM 78-11-02/401, Turbine Exhaust Plug

(2) AMM 78-31-00/201, Thrust Reverser System

C. Access

(1) Location Zones

411 No. 1 Engine (Left)

421 No. 2 Engine (Right)

D. Procedure

S 424-008-N00

CAUTION: YOU MUST APPLY ENGINE OIL FULLY TO THE COVER PACKING OR YOU WILL CUT THE PACKING DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

CAUTION: INSTALL THE COVER INTO POSITION USING EIGHT TO TEN WORK BOLTS EQUALLY SPACED AROUND THE COVER. TIGHTEN THE BOLTS EQUALLY IN SMALL INCREMENTS TO PULL THE COVER INTO POSITION EQUALLY. MONITOR THE ENGAGEMENT OF THE COVER TO MAKE SURE THAT THE PACKING IS NOT CUT DURING INSTALLATION. A CUT PACKING WILL CAUSE SUBSEQUENT OIL LOSS AND CAN CAUSE AN IN-FLIGHT SHUTDOWN.

(1) Do the steps that follow to install the bearing cover:

(a) Refer to the table that follows for the clearance between the cover of the No. 4 bearing and the inner flange of the turbine exhaust case.

NOTE: It is not necessary to measure this unless there is a problem with the fit.

PART NAME	DIA	NEW PART REFERENCE DIMENSIONS INCHES (MM)		CLEARANCE LIMITS INCHES (MM)	
		MIN	MAX	MIN	MAX
COVER	OD	10.876 (276.251)	10.878 (276.301)	0.002 (0.051)	0.008 (0.202)
TURBINE EXHAUST CASE	ID	10.880 (276.352)	10.884 (276.453)		

(b) Fully lubricate the new packing with engine oil.
(c) Install the new packing in the groove in the rear flange of the cover.
(d) Install the cover into the rear inner flange of the exhaust case.
(e) Install eight to ten work bolts equally spaced around the cover.
(f) Tighten the bolts equally in small increments to pull the cover into position equally.
(g) Monitor the engagement of the cover to make sure the packing is not cut.
(h) Tighten the work bolts to 85-95 pound-inches (9.604-10.732 Newton-meter) after the cover is fully seated.

S 784-012-N00

(2) Do the leak check on the No. 4 bearing cover, the No. 4 bearing oil pressure tube, the No. 4 bearing oil scavenge tube and the bearing cover mating flanges.
(a) Install a cap on the outboard end of the oil pressure tube.
(b) Apply 18.0-20.0 psig (124.1-137.9 kPa) air pressure to the outboard end of the scavenge tube.
(c) Apply leak check fluid to:
1) The tube connections on the inboard end of the pressure tube.
2) The inboard end of the oil scavenge tube.
3) The empty bolt holes in the bearing cover.
4) All around the bearing cover to exhaust case mating flanges.
(d) No leaks are permitted.
1) If leaks are found, disassemble and correct the cause of the leaks.
2) If no leaks are found, continue assembly.
(e) Remove the 8 to 10 work bolts.

S 424-009-N00

(3) Do the steps that follow to install the No. 4 bearing heat shield:
(a) Put the No. 4 bearing heat shield in the recess of the No. 4 bearing shield.
1) Align the boltholes.
(b) Install the No. 4 bearing shield over the No. 4 bearing cover installed at the rear inner flange of the turbine exhaust case.

NOTE: For engines POST-PW-SB 79-76, it will be necessary to angle the cover and heat shield to clear the No. 4 Bearing oil pressure tube.

(c) ENGINES PRE-PW-SB 72-456;
    1) Lubricate the 30 bolts with engine oil.
    2) Attach the shield with the 30 bolts.
(d) ENGINES POST-PW-SB 72-456;
    1) Lubricate the 16 bolts with engine oil.
    2) Attach the shield with the 16 bolts.
(e) Tighten the bolts to 85-95 pound-inches (9.604-10.734 Newton-meters)

S 424-013-N00

(4) Complete the installation of the No. 4 bearing oil scavenge tube (outer) and the No. 4 bearing oil pressure tube as follows:

CAUTION: HOLD THE SCAVENGE TUBE (REAR) AT THE WRENCHING FLATS WHEN YOU TIGHTEN THE TUBE NUT. IF YOU DO NOT DO THIS YOU CAN CAUSE DAMAGE TO THE TUBE ASSEMBLY.

(a) Connect the nut to the No. 4 bearing scavenge tube (rear).
    1) Lubricate the threads with antigalling compound.
    2) Tighten the nut to 200-225 pound-inches (22.597-25.422 Newton-meters).
    3) Install the lockwire (AMM 72-00-00/201).

S 424-014-N00

(5) Position the No. 4 bearing scavenge tube heatshields and around the inboard end of the tube.
(a) Install the lockwire through the eyelets in the heatshields (AMM 72-00-00/201).

CAUTION: HOLD THE PRESSURE TUBE (UPPER) AT THE WRENCHING FLATS WHEN YOU TIGHTEN THE TUBE NUT. IF YOU DO NOT DO THIS YOU CAN CAUSE DAMAGE TO THE TUBE ASSEMBLY.

(b) Connect the nut to the No. 4 bearing oil pressure tube.
    1) Lubricate the threads with antigalling compound.
(c) Tighten the nut to 200-225 pound-inches (22.597-25.422 Newton-meters).
(d) Install the lockwire (AMM 72-00-00/201).

S 424-015-N00

(6) Position the No. 4 bearing heatshields (front and rear) around the inboard end of the tube.
(a) Install the lockwire through the eyelets in the heatshields (AMM 72-00-00/201).

S 424-010-N00

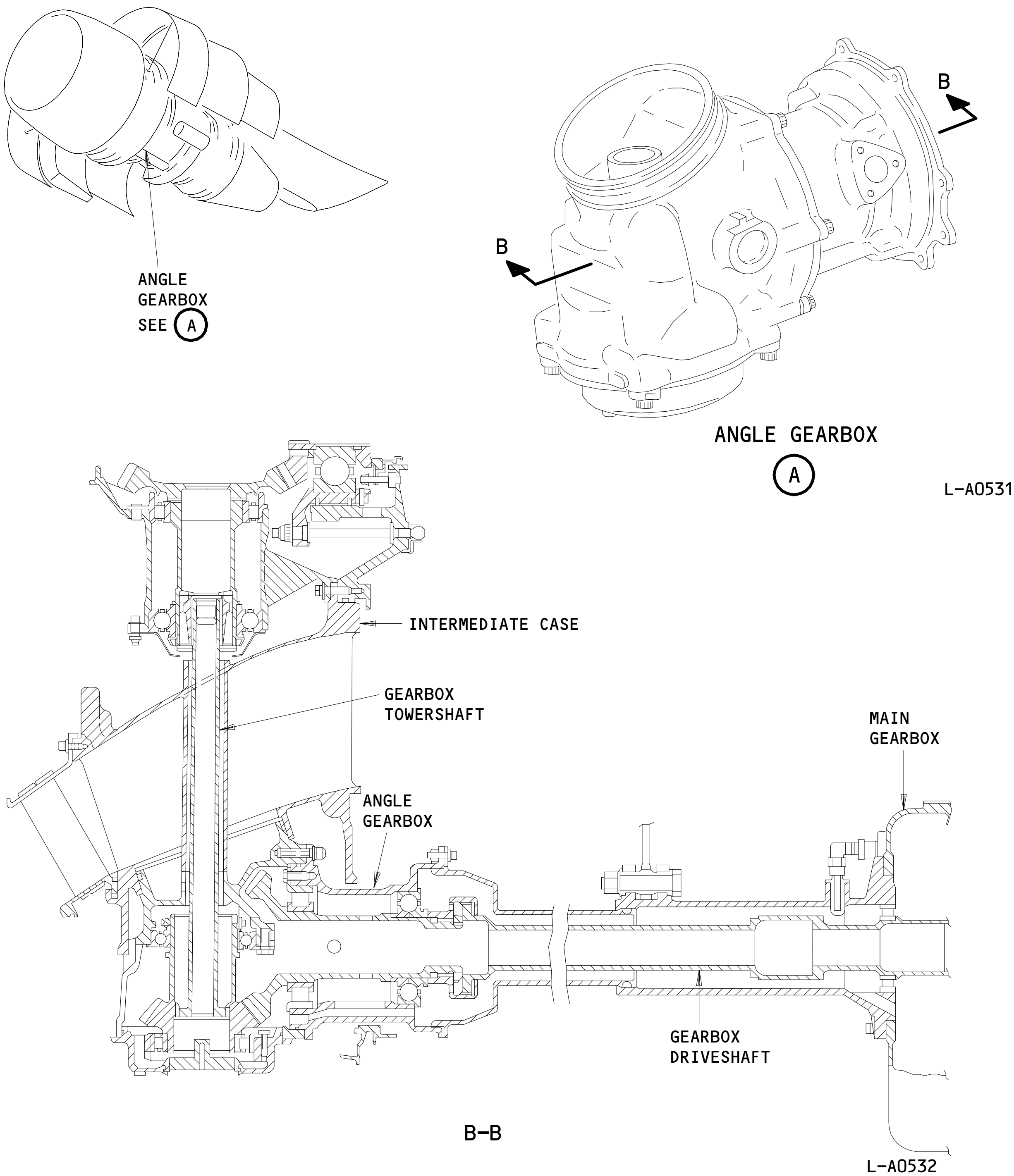
(7) Install the turbine exhaust plug (AMM 78-11-02/401).

S 444-011-N00

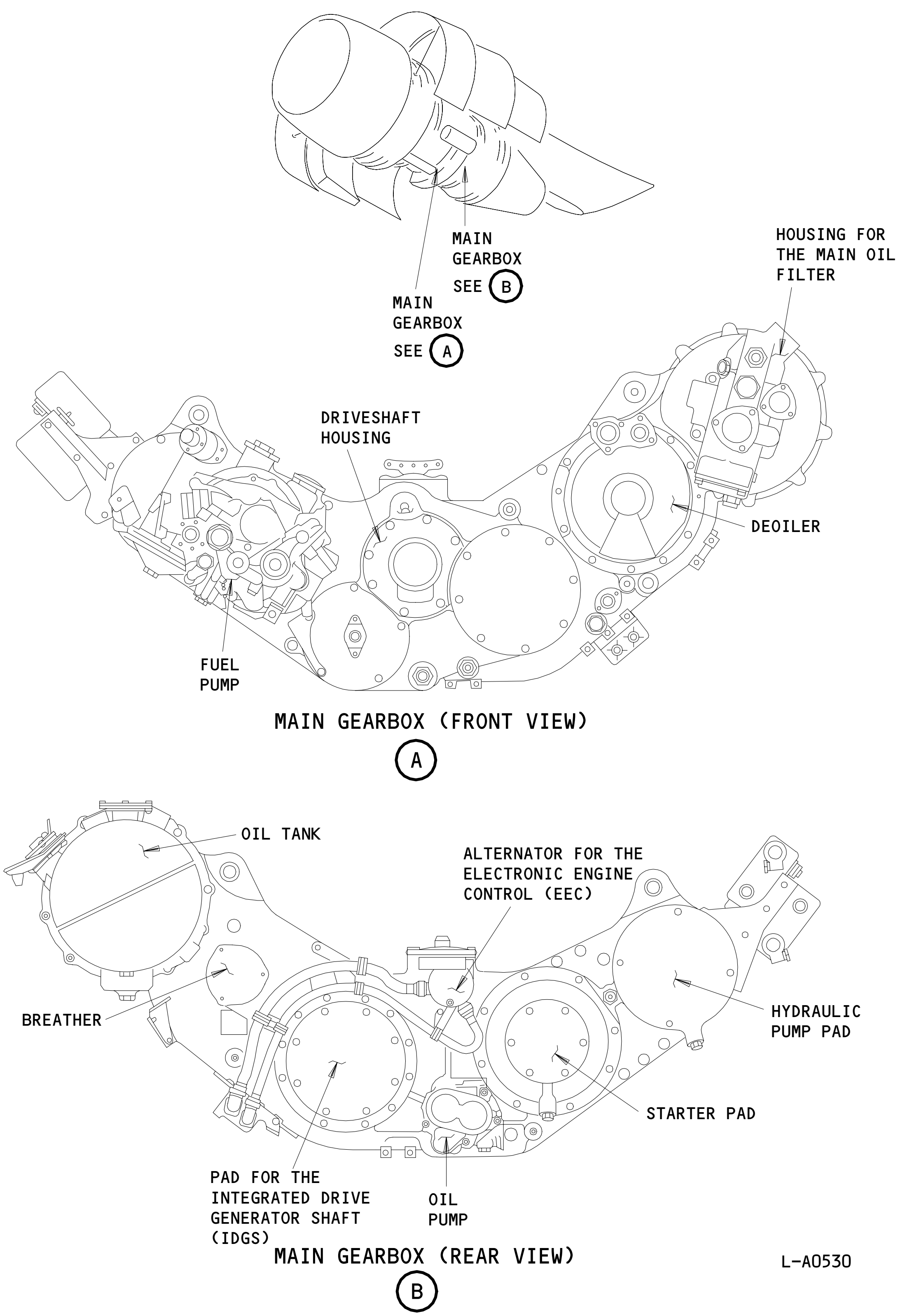
(8) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

ACCESSORY DRIVES - DESCRIPTION AND OPERATION

1. General
   A. The accessory gearboxes consist of an angle gearbox and a main gearbox. The gearboxes provide mechanical connection between the horizontal drive shaft (layshaft) of the rotor and the accessory components mounted on the main gearbox. The accessory components of the main gearbox are the integrated drive generator, starter, engine rear hydraulic pump, and main oil/scavenge pump. These components as well as the EEC alternator and breather are mounted on the aft face of the main gearbox. The fuel pump/fuel metering unit, mounted in tandem, deoiler, and the housing for the main oil filter are mounted on the forward side of the main gearbox.
2. Component Details
   A. Angle Gearbox (Fig. 1)
      (1) The angle gearbox is located between the outer diameter wall of the intermediate case and the inner diameter attachment of the guide vanes for the fan exit at the bottom of the intermediate case.
      (2) The angle gearbox transmits power from the engine rotor (drive shaft) to the main gearbox and/or from the starter, on the main gearbox, to the engine rotor. The angle gearbox housing is a cast aluminum housing that contains a bevel gear set and an oil scavenge pump. General lubrication is accomplished by oil splash and by pressurized spray directed at bearings and splines.
   B. Main Gearbox (Fig. 2)
      (1) The main gearbox is located at the bottom of the high pressure compressor (HPC) in front of the diffuser case. It is attached to the compressor utilizing a three point, ball-joint mount system to allow for expansion of the compressor case. Two attach points are widely spaced, transverse-pin supported ball joints. The third support consists of a vertical link with a single ball joint attachment on the housing of the gearbox drive shaft.
      (2) The main gearbox translates power from the engine rotor (drive shaft) to the accessories mounted on the gearbox. The main gearbox provides mounting provisions for accessory components as well as specific speeds and torques for their various functions.
      (3) Main Gearbox Components
         (a) The main gearbox housing is cast aluminum and incorporates a gear train and mounting pads for accessory components. All accessory drive gearshafts are plug-in units. The pad seals are spring-loaded carbon which bear on a carburized surface. All of the drive pads incorporate drain lines which converge at the drain mast.
         (b) Shaft for the Integrated Drive Generator (IDG)
            1) The direction of rotation is counterclockwise. Oil is scooped into the center of the drive shaft and then discharged, through 17 radial holes, into the main gearbox.



Angle Gearbox
Figure 1



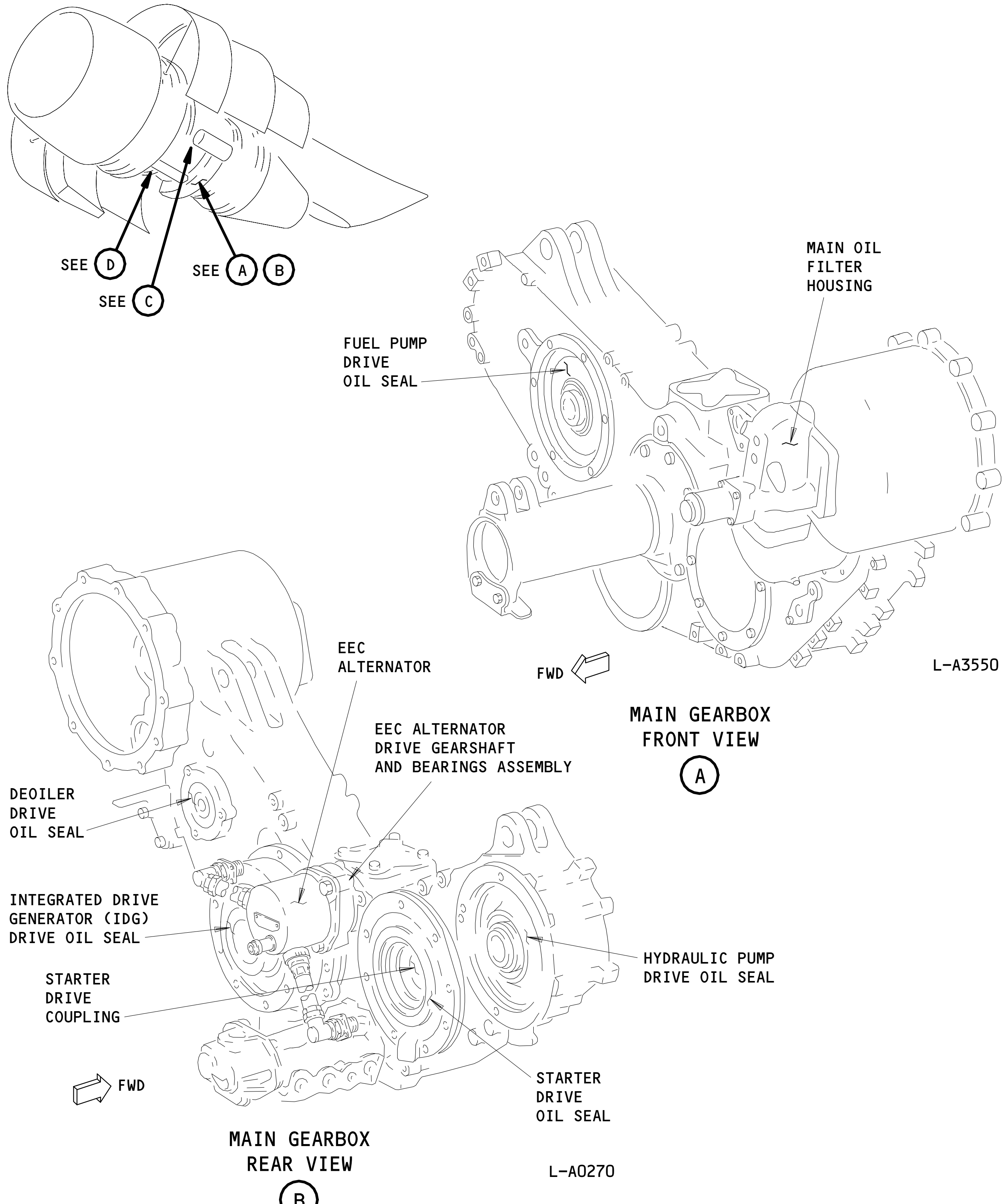
Main Gearbox
Figure 2

(c) Rear Drive of the Hydraulic Pump
   1) The direction of rotation is counterclockwise. An oil nozzle distributes oil to the center of the drive shaft. After passing through the splines, through 12 radial holes, the oil is discharged into the main gearbox.
(d) Starter Drive
   1) The direction of rotation is counterclockwise. Splines are not lubricated.
(e) Alternator for the Electronic Engine Control (EEC)
   1) The direction of rotation is counterclockwise.
(f) Drive for the Fuel Pump/Fuel Metering Unit
   1) The direction of rotation is clockwise. Lubricating oil is introduced into the drive shaft center by an oil nozzle. After passing through the splines oil is discharged, through 12 radial holes in drive shaft, into main gearbox cavity.
(g) Main Oil Pressure/Scavenge Pump Drive
   1) The main oil pressure pump and five scavenge pumps are enclosed in one housing mounted on aft face of the main gearbox. The main oil pump is a single stage, positive displacement gear pump that delivers oil flow proportional to engine rotor speed, and engine operating condition. Scavenge pumps return oil from the 1, 1.5, 2, and 3 bearing compartments, as well as the angle and main gearboxes, to the oil tank. Combined breather air and scavenge oil is returned to the oil tank from No. 4 bearing compartment.
(h) Engine Deoiler
   1) The deoiler is mounted on the forward face of the main gearbox below the main oil tank. Breather air from the 1, 1.5, 2, and 3 bearing compartments passes through the deoiler. Oil entrapped in the air is removed and returned to the oil tank.
(i) Engine Oil Filter
   1) The main oil filter is mounted on the forward end of the engine oil tank. The oil filter is a 15 micron nominal disposable type filter. If the filter becomes plugged, a bypass feature allows uninterrupted oil flow.
(j) Main Gearbox Bearings
   1) All of the bearings within the main gearbox are roller bearings. Support bearings for the accessory driveshaft have outer races which are flanged. The inner race on the idler gear bearing is clamped. Flanged bearings have double-shouldered inner races and single-shouldered outer races. Bearing lubrication and cooling is accomplished by mist oil.
(k) Main Gearbox Seals
   1) The gearbox seal assemblies are spring-loaded, carbon face seals retained in an aluminum housing. The entire seal assembly can be replaced or repaired.

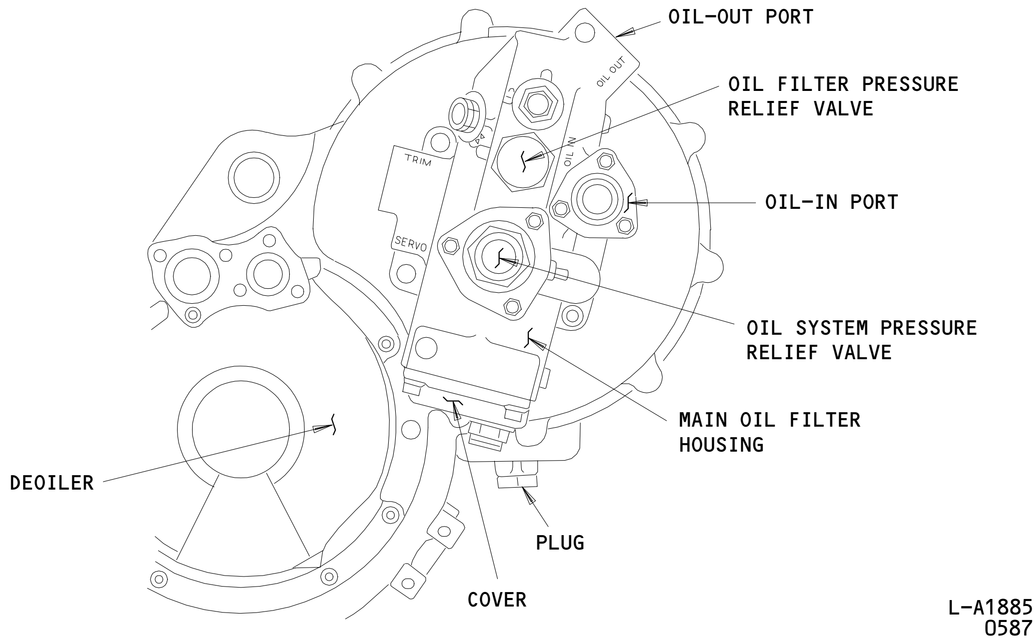
ACCESSORY DRIVES

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ASSEMBLY - EEC ALTERNATOR DRIVE GEARSHAFT AND BEARINGS	1	1	417AL,418AR, LEFT ENGINE MAIN GEARBOX	72-61-14
ASSEMBLY - EEC ALTERNATOR DRIVE GEARSHAFT AND BEARINGS	1	1	427AL,418AR, RIGHT ENGINE MAIN GEARBOX	72-61-14
COUPLING - STARTER DRIVE	1	1	418AR, LEFT ENGINE, MAIN GEARBOX	72-61-09
COUPLING - STARTER DRIVE	1	1	428AR, RIGHT ENGINE, MAIN GEARBOX	72-61-09
GEARBOX - ANGLE	2	1	415AL,416AR, LEFT ENGINE	72-62-01
GEARBOX - ANGLE	2	1	425AL,426AR, LEFT ENGINE	72-62-01
HOUSING - MAIN OIL FILTER	1,2	1	415AL, LEFT ENGINE	72-61-11
HOUSING - MAIN OIL FILTER	1,2	1	425AL, RIGHT ENGINE	72-61-11
SEAL - DEOILER DRIVE OIL	1	1	417AL, LEFT ENGINE, MAIN GEARBOX	72-61-02
SEAL - DEOILER DRIVE OIL	1	1	427AL, RIGHT ENGINE, MAIN GEARBOX	72-61-02
SEAL - EEC ALTERNATOR DRIVE OIL	1	1	417AL,418AR, LEFT ENGINE, MAIN GEARBOX	72-61-05
SEAL - EEC ALTERNATOR DRIVE OIL	1	1	427AL,428AR, RIGHT ENGINE, MAIN GEARBOX	72-61-05
SEAL - FUEL PUMP DRIVE OIL	1	1	416AR,418AR, LEFT ENGINE, MAIN GEARBOX	72-61-06
SEAL - FUEL PUMP DRIVE OIL	1	1	426AR,428AR, RIGHT ENGINE, MAIN GEARBOX	72-61-06
SEAL - HYDRAULIC PUMP REAR DRIVE OIL	1	1	418AR, LEFT ENGINE, MAIN GEARBOX	72-61-07
SEAL - HYDRAULIC PUMP REAR DRIVE OIL	1	1	428AR, RIGHT ENGINE, MAIN GEARBOX	72-61-07
SEAL - INTEGRATED DRIVE GENERATOR (IDG) DRIVE OIL	1	1	417AL,418AR, LEFT ENGINE, MAIN GEARBOX	72-61-04
SEAL - INTEGRATED DRIVE GENERATOR (IDG) DRIVE OIL	1	1	427AL,428AR, RIGHT ENGINE, MAIN GEARBOX	72-61-04
SEAL - STARTER DRIVE OIL	1	1	418AR, LEFT ENGINE, MAIN GEARBOX	72-61-03
SEAL - STARTER DRIVE OIL	1	1	428AR, RIGHT ENGINE, MAIN GEARBOX	72-61-03

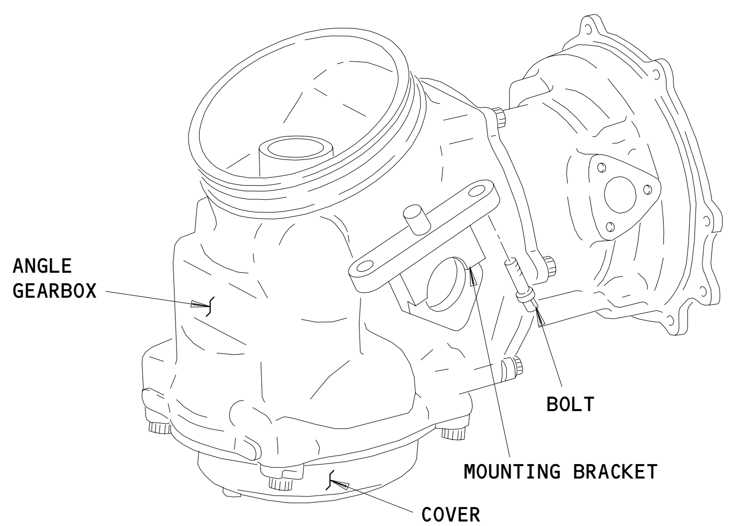
Accessory Drives - Component Index
Figure 101



Accessory Drives - Component Location
Figure 102 (Sheet 1)



MAIN OIL FILTER HOUSING
C



ANGLE GEARBOX
D

Component Location
Figure 102 (Sheet 2)

316288

MAIN GEARBOX - INSPECTION/CHECK

1. General
   A. This procedure provides a method for visual examination of the main gearbox for cracks, corrosion and oil leakage.

   TASK 72-61-01-216-001-N00
2. Main Gearbox Inspection/Check
   A. Consumable Materials
      (1) D00137 Oil - Engine (PWA521B) (AMM 20-30-04)
      (2) B00448 Trichloroethane - Commercially Available
   B. References
      (1) AMM 12-13-01/301, Engine Oil System Servicing
      (2) AMM 71-11-04/201, Fan Cowl Panels
      (3) AMM 71-11-06/201, Core Cowl Panels
      (4) AMM 78-31-00/201, Thrust Reverser System
      (5) AMM 79-21-10/401, Magnetic Chip Detectors
   C. Access
      (1) Location Zones
         410 Left Power Plant Nacelle
         420 Right Power Plant Nacelle

   D. Prepare for the main gearbox inspection.

      S 016-002-N00
      (1) Open the fan cowl panels (AMM 71-11-04/201).

      S 866-003-N00

      WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

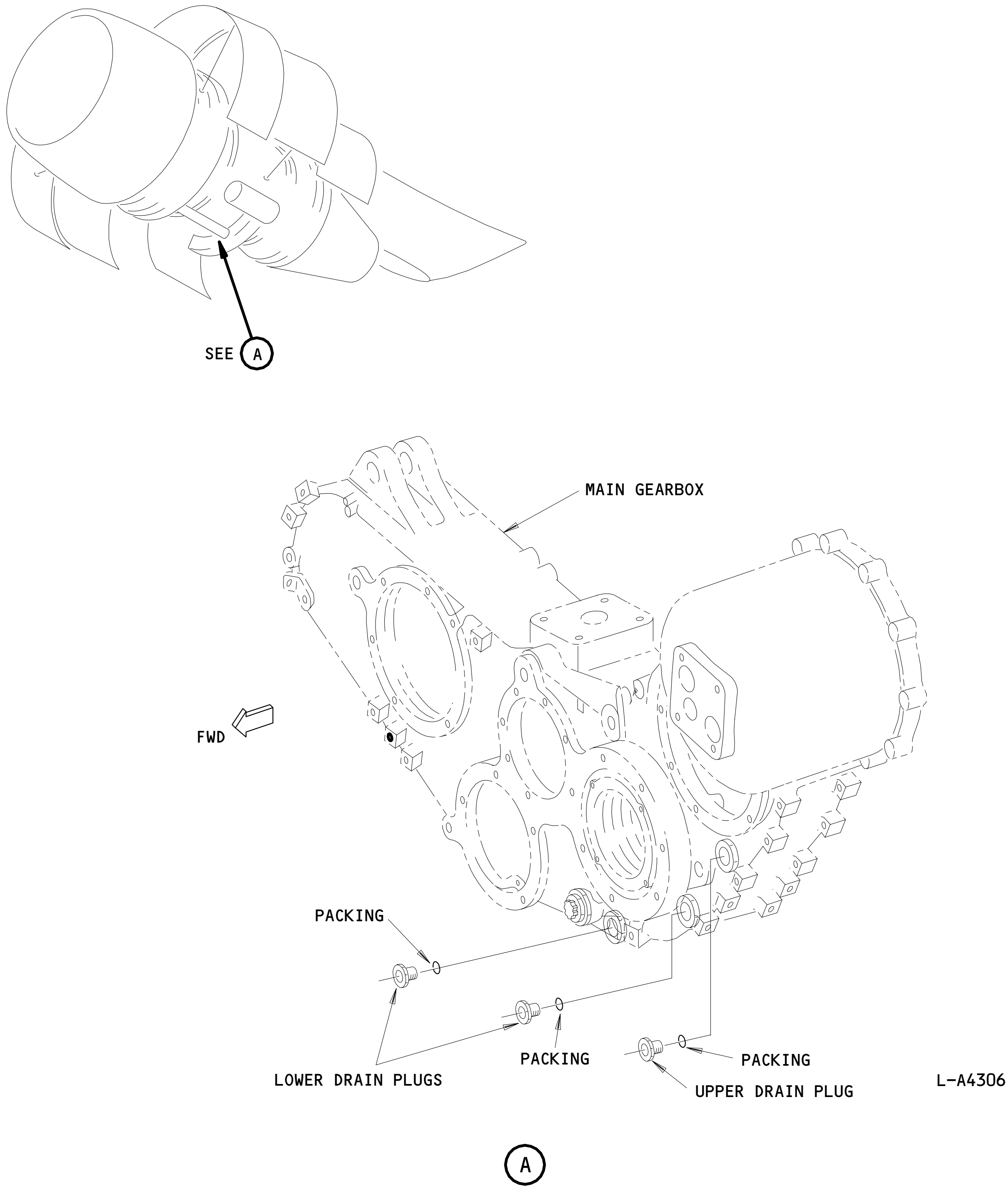
      (2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

      S 016-004-N00
      (3) Open the core cowl panels (AMM 71-11-06/201).

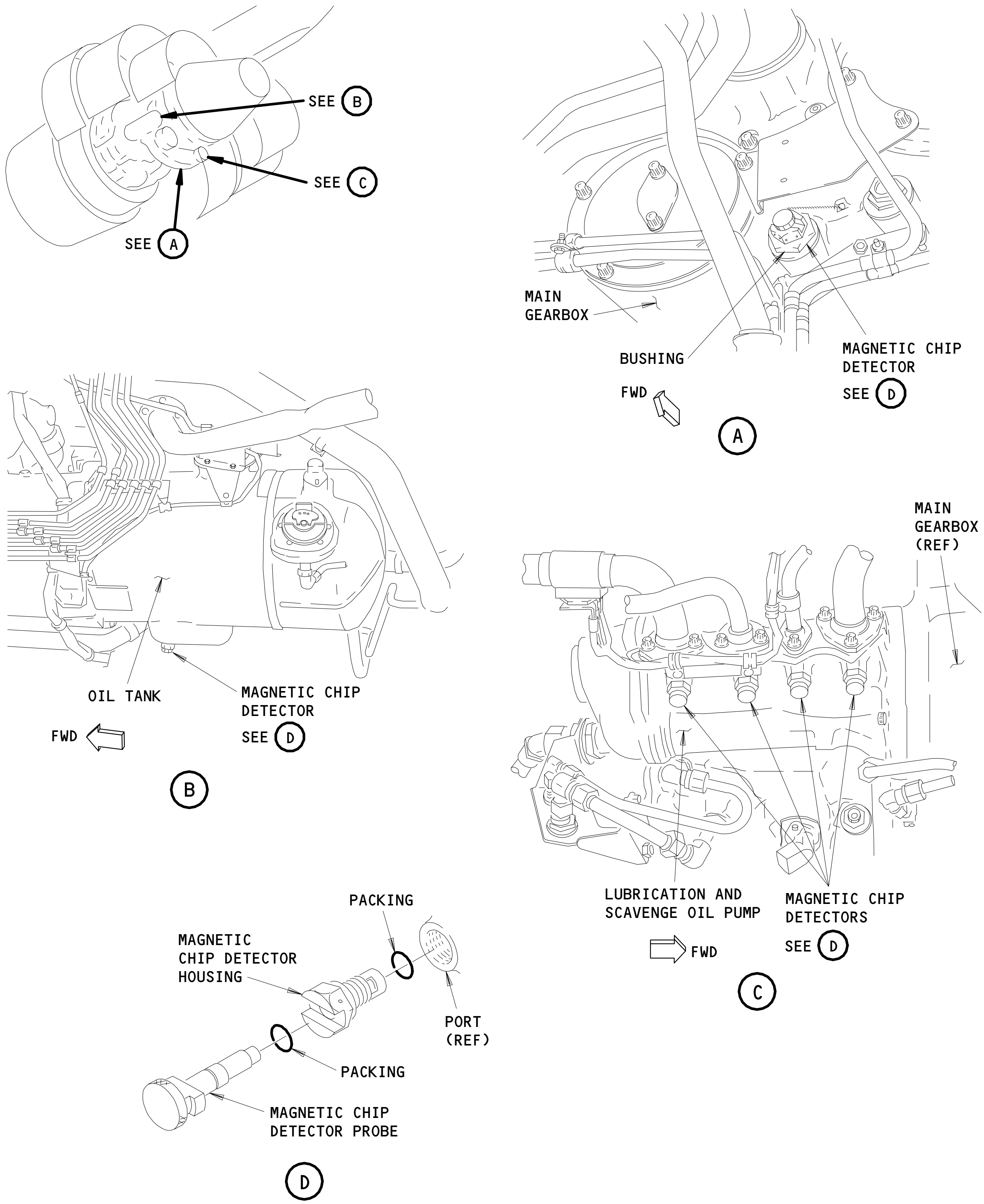
      S 016-005-N00

      WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

      (4) Open the thrust reversers (AMM 78-31-00/201).



Main Gearbox Drain Plug Locations
Figure 601



Main Gearbox Magnetic Chip Detector Locations
Figure 602

E. Do the main gearbox inspection.

S 866-006-N00

(1) Open the ENG START switch on the P5 overhead panel and attach the DO-NOT-OPERATE tag.

S 216-017-N00

WARNING: ALLOW A MINIMUM OF FIVE MINUTES AFTER ENGINE IS SHUTDOWN TO ALLOW THE OIL TANK PRESSURE TO BLEED OFF BEFORE THE OIL TANK CAP IS OPENED. HOT OIL WHICH FLOWS FROM THE TANK CAN CAUSE INJURY TO YOU.

WARNING: DO NOT KEEP THE LUBRICATING OIL ON YOUR SKIN FOR A LONG TIME. IF YOU DO NOT CLEAN THE OIL OFF, INJURY TO YOU CAN OCCUR.

(2) Do a check of the main gearbox, oil pump, and oil tank for any signs of oil spills.

CAUTION: WHEN THE DRAIN PLUGS ARE REMOVED, HOLD THE BUSHINGS AT THE WRENCHING FLATS TO PREVENT THE BUSHINGS FROM BECOMING LOOSE.

(a) If any signs of oil spills are found around the drain plugs, do the following steps:
1) Remove the plugs and discard the packings.
2) Permit the oil to fully drain into an applicable container.

CAUTION: MAKE SURE TO INSTALL PACKINGS ON ALL DRAIN PLUGS TO PREVENT LOSS OF ENGINE OIL DURING ENGINE OPERATION. THIS CAN RESULT IN POSSIBLE ENGINE FAILURE.

3) Lubricate the drain plug threads and install using new packings lubricated with engine oil.
4) Install the lower drain plugs and tighten to 110-120 pound inches (12.2-13.6 newton-meters). Install the upper drain plug and tighten to 150-170 pound inches (16.9-19.2 newton-meters).

5) Fill the engine oil system (AMM 12-13-01/301).

(b) Examine the main gearbox, the oil pump, and the oil tank for oil leaks from the magnetic chip detectors (MCD) (Fig. 602).

NOTE: The shape of the MCD probe and the quantity of packings can be different from what is shown in the Fig. 602.

1) If the leak comes from between the MCD probe and the MCD housing, replace the packing on the probe and, if applicable, the packing on the housing (AMM 79-21-10/401).
2) If the leak comes from between the MCD housing and the port, replace the packing on the housing (AMM 79-21-10/401).

S 216-016-N00

(3) Examine the oil tank cap for leaks. If you find a leak which comes from the cap stem, replace the packing in the cap (AMM 79-11-03/201).

S 216-008-N00

(4) Do a check of the main gearbox, oil pump and oil tank for any cracks. If any cracks are found, replace the cracked parts before the airplane returns to service.

S 216-009-N00

(5) Do a check of the main gearbox and oil pump for evidence of corrosion.

CAUTION: CORROSION MAY BE CAUSED BY HYDRAULIC FLUID WHICH HAS SPILLED ON A HOT ALUMINUM GEARBOX AND HAS DECOMPOSED. MAKE ALL SPILLS CLEAN WITH CLOTH SOAKED WITH TRICHLOROETHANE.

(a) A part may continue in service if the guidelines that follow are met:
1) The corrosion of an area must be equal to but no more than 0.050 inch (1.270 mm) in depth
2) The corrosion must not be more than 1.00 sq inch in area
3) The separation between any areas of corrosion must be at least 2.00 inches.

(b) Corrosion that is more than the limits above is not satisfactory and the part may not continue in service.

F. Put the Airplane Back To Its Usual Condition

S 416-015-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 416-011-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 416-020-N00

(3) Close the fan cowl panels (AMM 71-11-04/201).

S 446-019-N00

(4) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 866-014-N00

(5) Remove the DO-NOT-OPERATE tag and close the ENG START switch on the P5 overhead panel.

MAIN GEARBOX - CLEANING/PAINTING

1. General
   A. This procedure provides methods for cleaning shaft seal face(s) to remove carbon deposits when gearbox carbon seal(s) are replaced.

TASK 72-61-01-147-005-N00

2. Main Gearbox Shaft Seal Face Cleaning
   A. Equipment
      (1) Lapping Tool for Hydraulic Pump Shaft - PWA 27357, Pratt & Whitney Aircraft, East Hartford, Connecticut
      (2) Lapping Tool for Fuel Pump Shaft - PWA 27357
      (3) Lapping Tool for Starter Shaft - PWA 27443
      (4) Lapping Tool for Deoiler Shaft - PWA 27444
      (5) Lapping Tool for VSCF Shaft - PWA 101858
      (6) Lapping Tool for IDGS Shaft - PWA 102096
   B. Consumable Materials
      (1) B00821 Gel - Alkaline
      (2) C00832 Compound - P05-006 Lapping
      (3) E00017 Scraper - Plastic
      (4) G00842 Cloth - Unsized Cheese cloth P05-038
   C. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser
   D. Access
      (1) Location Zones
          410 Left Power Plant Nacelle
          420 Right Power Plant Nacelle

   E. Prepare for the main gearbox inspection.

      S 017-001-N00
      (1) Open the fan cowl panels (AMM 71-11-04/201).

      S 867-002-N00

      WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

      (2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

      S 017-003-N00
      (3) Open the core cowl panels (AMM 71-11-06/201).

S 017-004-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reversers (AMM 78-31-00/201).

F. Procedure (Preferred)

S 847-013-N00

CAUTION: PREVENT LAPPING COMPOUND AND/OR ALKALINE GEL FROM FALLING INTO THE GEARBOX AND ENTERING THE OIL SYSTEM. OIL CONTAMINATION MAY OCCUR AND BEARINGS MAY BE DAMAGED.

(1) Pack the area around the gearshaft with clean unsized cheese cloth (P05-038) to prevent any lapping compound to fall into the gearbox. Make sure that the gearbox seal is fully exposed.

S 127-008-N00

(2) Using the appropriate lapping tool, scrape off any carbon deposits from the gearshaft seal face at the point of interface with the carbon seal.

NOTE: Remove the starter coupling prior to use of the lapping tool PWA 27443.

(a) Use the lapping tool with a standard 0.375 inch (9.525 mm) square drive "T" handle, or equivalent.
1) Use lapping compound (P05-006) to lap the gearshaft with the tool by hand with axial pressure applied to obtain the desired effect.
2) Clean and recharge the lapping tool with fresh lapping compound as necessary.
3) For heavy carbon buildups, prior to final lapping, it is necessary to resurface the tool by lapping it on the appropriate flat plate to restore the tool face wavyness to within 0.0003 inch (0.0076 mm) and surface finish of 10 microinches (0.25 micrometers).

(b) Wipe the lapped gearshaft seal surface and the adjacent areas with a clean, unsized cheese cloth (P05-038) and carefully remove the cloth previously inserted around the gearshaft.

(c) Wipe off any lapping compound residue and visually inspect the gearshaft area to make sure that no lapping compound particles have fallen into the gearbox.

NOTE: The lapping tool will remove only carbon buildup and is not recommended for the repair of scored gearshaft seal faces.

G. Procedure (Optional)

S 847-014-N00

CAUTION: ALKALINE GEL MAY CAUSE DAMAGE TO PROTECTIVE COATINGS ON ALUMINUM PARTS. IF ANY ALKALINE GEL GETS IN CONTACT WITH ANY ALUMINUM SURFACE, WIPE IT OFF IMMEDIATELY WITH A CLEAN, DAMP, UNSIZED CHEESE CLOTH FOLLOWED BY A WIPING WITH CLEAN, DRY, UNSIZED CHEESE CLOTH.

(1) Pack the area around the gearshaft with clean unsized cheese cloth (P05-038).

S 117-010-N00

(2) Remove light carbon deposits (stains) as follows:
   (a) With a paint brush of appropriate size, apply a thin coat of alkaline gel directly to the gearshaft face seal.
   (b) Let the gel work for a minumum of 15 minutes.
   (c) Wipe the gearshaft seal face with a dry, clean, unsized cheese cloth (P05-038).
      1) If necessary, re-apply alkaline gel to the gearshaft face seal followed by a wipe with a clean, dry, unsized cheese cloth (P05-038).
   (d) Use a clean, damp, unsized cheese cloth to wipe the entire area where the alkaline gel was applied and follow with a wipe with a dry, unsized cheese cloth (P05-038).

S 127-011-N00

(3) Remove heavy carbon deposits as follows:
   (a) With a paint brush of appropriate size, apply a thin coat of alkaline gel directly to the gearshaft seal face.
      1) Let the gel work for a minimum of 20 minutes to allow the carbon deposits to soften.
   (b) Scrape off the softened carbon deposits using a plastic scraper.
      1) Wipe the excess off with a clean, dry, unsized cheese cloth (P05-038).
      2) Repeat this procedure until only a thin layer of carbon deposit remains.

(c) Use a clean, damp, unsized cheese cloth (P05-038) to wipe the entire area were the alkaline gel was applied and follow with a wipe with a clean, dry, unsized cheese cloth (P05-038).

(d) Pack the area around the gearshaft with clean unsized cheese cloth (P05-038) to prevent any lapping compound to fall into the gearbox.

1) Make sure that the gearshaft seal is fully exposed.

(e) Using the appropriate lapping tool, remove any remaining carbon deposits from the gearshaft seal face at the point of interface with the carbon seal.

<u>NOTE</u>: Remove the starter coupling prior to use of the lapping tool PWA 27443.

1) Use the lapping tool with a standard 0.375 inch (9.525 mm) square drive "T" handle, or equivalent.
2) Use lapping compound P05-006 to lap the gearshaft with the tool by hand with axial pressure applied to obtain the desired effect.
3) Clean and recharge the lapping tool with fresh lapping compound as necessary.

(f) Prior to final lapping, it may be necessary to resurface the tool by lapping it on the appropriate flat plate to restore the tool face wavyness to within 0.0003 inch (0.0076 mm) and surface finish of 10 microinches (0.25 micrometers).

(g) Wipe the lapped gearshaft seal surface and the adjacent areas with a clean, dry unsized cheese cloth (P05-038) and carefully remove the cloth previously inserted around the gearshaft.

(h) Wipe off any lapping compound residue and visually inspect the gearshaft area to make sure that no lapping compound particles have fallen into the gearbox.

<u>NOTE</u>: The lapping tool will remove only carbon buildup and is not recommended for the repair of scored gearshaft seal faces.

DEOILER DRIVE OIL SEAL - REMOVAL/INSTALLATION

1. General
   A. This procedure contains the data for the removal and installation of the deoiler drive oil seal (referred to as the oil seal).

TASK 72-61-02-004-001-N00

2. Remove The Deoiler Drive Oil Seal (Fig. 401)
   A. Equipment
      (1) Puller - PWA 85204 (optional to PWA 88110), Pratt & Whitney Aircraft, East Hartford, Connecticut
      (2) Puller - PWA 88110
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

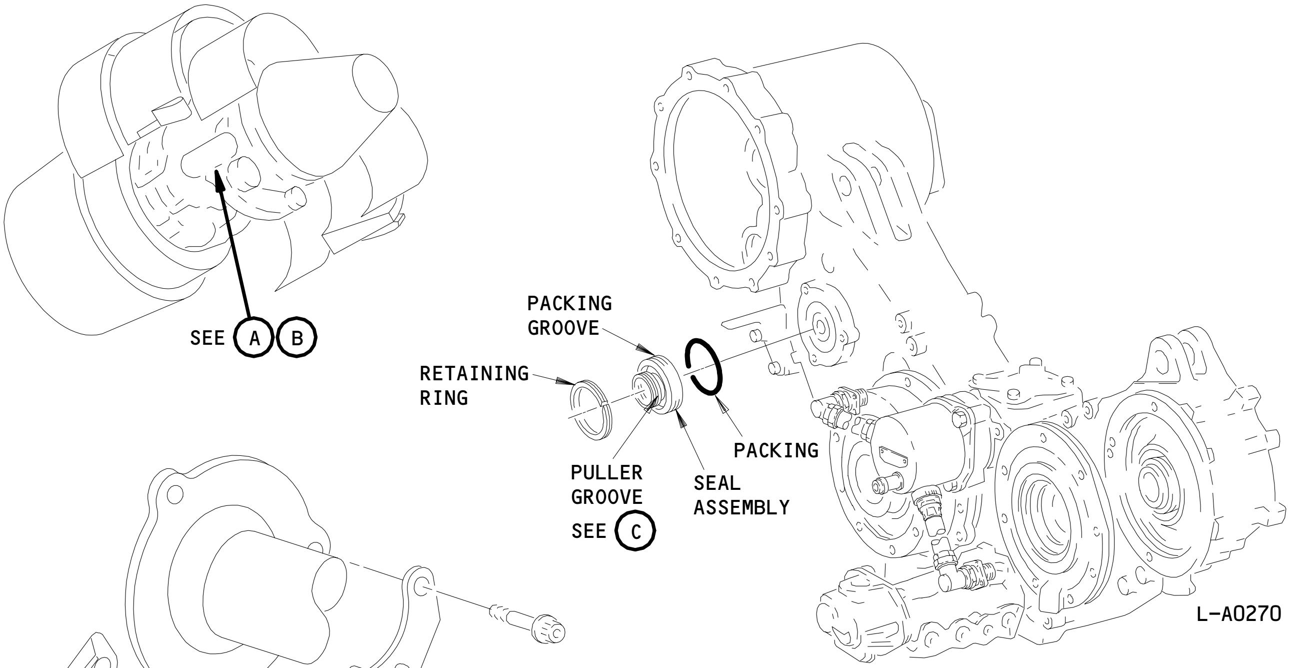
411	No. 1 Engine (Left)
421	No. 2 Engine (Right)

      (2) Access Panels

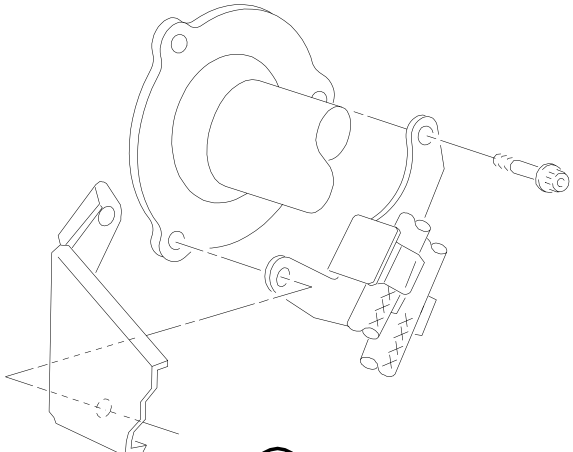
413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

   D. Procedure

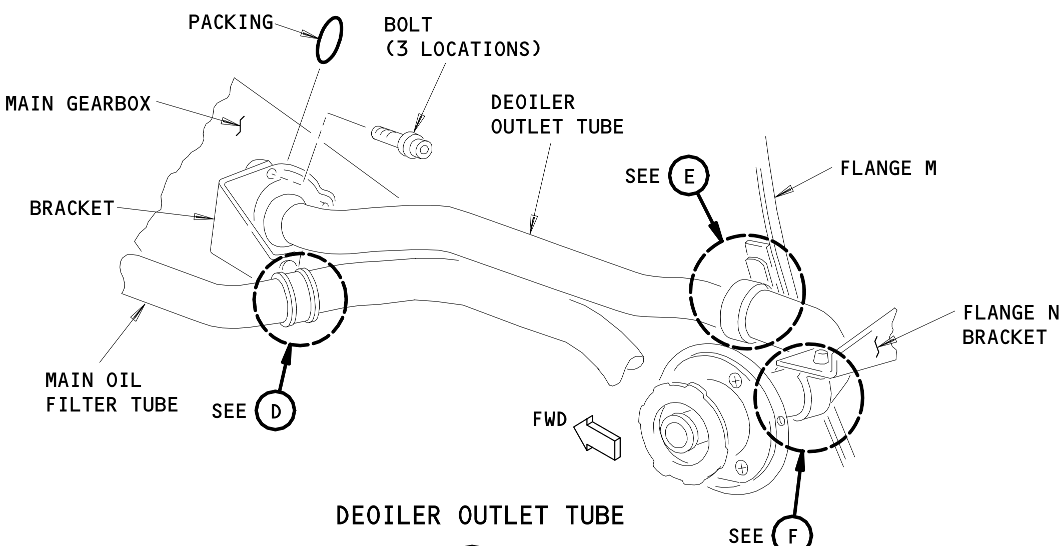
      S 024-002-N00
      (1) Do the steps that follow to remove the oil seal:
         (a) Attach the DO-NOT-OPERATE tag to the ENG START switch on the overhead panel, P5.



MAIN GEARBOX (REAR VIEW)
A



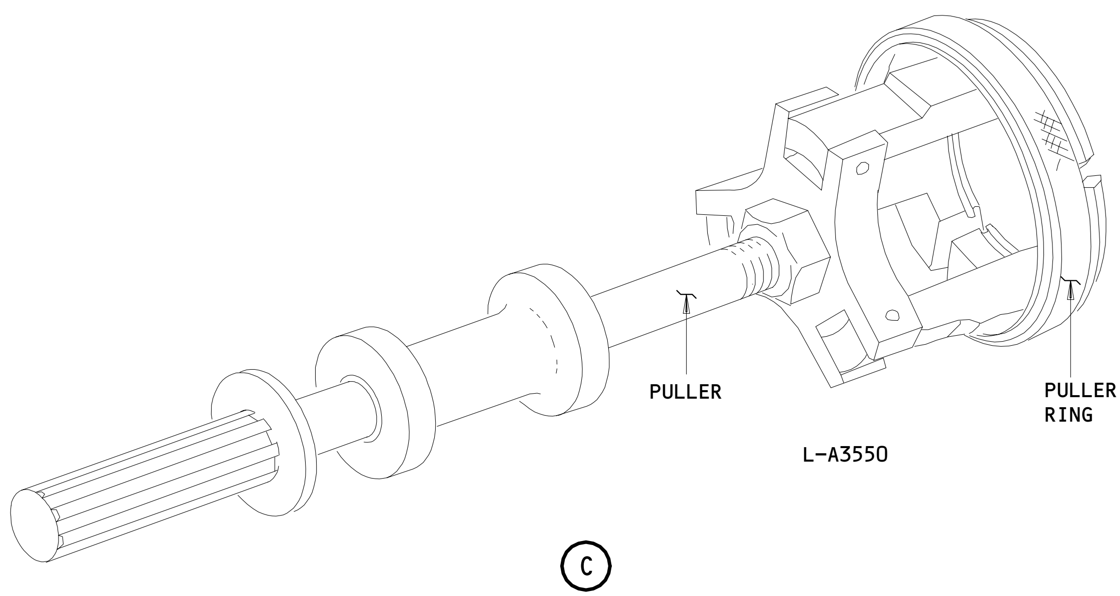
A 1

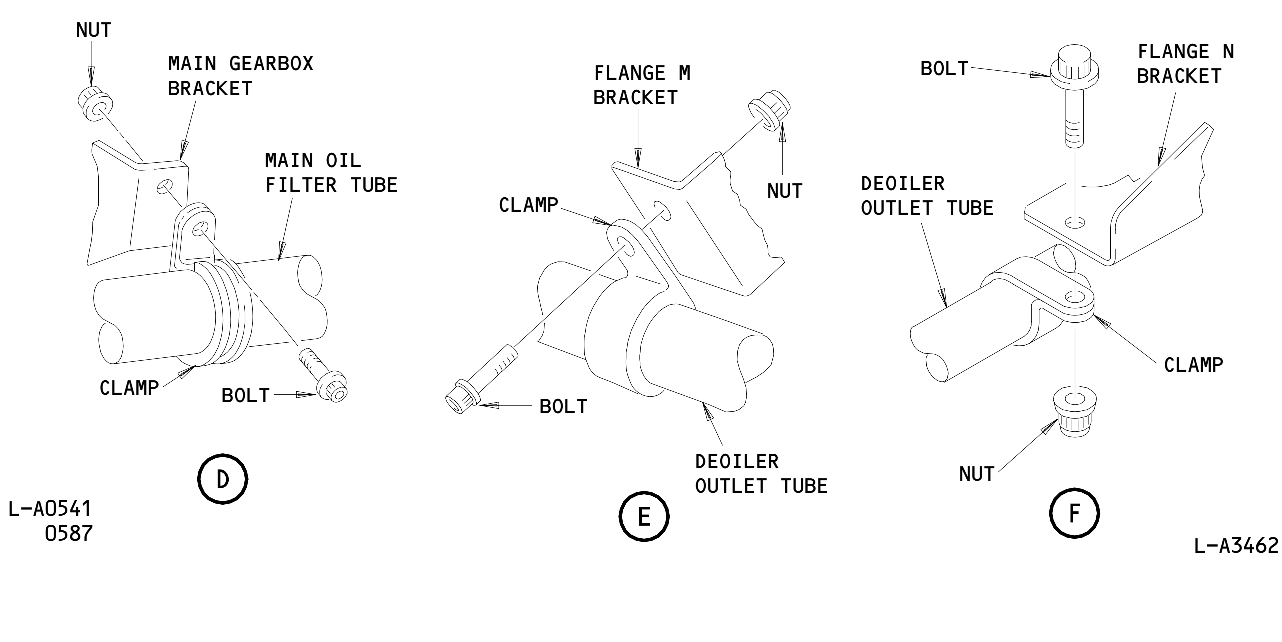


DEOILER OUTLET TUBE
B

1 WITH PW SB 72-375

Deoiler Drive Oil Seal
Figure 401 (Sheet 1)





Deoiler Drive Oil Seal
Figure 401 (Sheet 2)

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(b) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).
(c) Open the fan cowl panels (AMM 71-11-04/201).
(d) Open the core cowl panels (AMM 71-11-06/201).

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(e) Open the thrust reversers (AMM 78-31-00/201).
(f) Remove the bolts that attach the deoiler outlet tube (referred to as the outlet tube) to the aft face of the main gearbox.
(g) Loosen the bolt that attaches the outlet tube to the bracket on the flange M.
(h) Move the bracket clear of the outlet tube.
(i) Remove the bolts, the nuts, the clamps, and the brackets that attach the outlet tube to the Flange M.
(j) Install the bracket that holds the EEC alternator wires away from the outlet tube.
(k) Remove the outlet tube from the main gearbox.
(l) Remove and discard the packing from the outlet tube.
(m) Install the covers on the tube.
(n) Remove the retaining ring that attaches the oil seal to the ejector port on the rear face of the main gearbox.
(o) Put the jaws of PWA 85204 or PWA 88110 puller in the groove of the oil seal.
(p) Tighten (slide down) the puller ring until the jaws are in the groove.
(q) Use the puller to remove the oil seal.
(r) Remove the puller and discard the packing.
(s) Install the covers.

TASK 72-61-02-404-003-N00

3. Install The Deoiler Drive Oil Seal (Fig. 401)

A. Consumable Materials
   (1) D00137 Oil - PWA 521B
   (2) D50124 Anti-seize Paste - PWA 36246

B. References
   (1) AMM 12-13-01/301, Engine - Servicing (Oil Replenishing)
   (2) AMM 71-00-00/501, Power Plant
   (3) AMM 71-11-04/201, Fan Cowl Panels
   (4) AMM 71-11-06/201, Core Cowl Panels
   (5) AMM 78-31-00/201, Thrust Reverser System

C. Access
   (1) Location Zones

411	No. 1 Engine (Left)
421	No. 2 Engine (Right)

   (2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

D. Procedure

S 424-004-N00

   (1) Do these steps to install the oil seal:
      (a) Examine the clearance between the oil seal face and the drive housing.
      (b) Make sure the clearances are in the limits shown in the table that follows:

PART NAME	DIA	NEW PART REFERENCE DIMENSIONS INCHES (MM)		CLEARANCE LIMITS INCHES (MM)	
		MIN	MAX	MIN	MAX
SEAL	OD	3.3570 (85.268)	3.3640 (85.445)	0.0010 (0.0260)	0.0092 (0.2340)
HOUSING	ID	3.3650 (85.471)	3.3662 (85.501)		

(c) Remove the covers.
(d) Install the packing lubricated with oil on the seal.
(e) Lubricate the mating (carbon) surface with oil.
(f) Install the oil seal in the ejector port with the retaining ring.
(g) Remove the covers from the outlet tube.
(h) Install the lubricated packing to the groove in the front of the tube.
(i) Install the outlet tube to the main gearbox:
    1) Put the two brackets on the flange of the tube.
    2) Install the bolts lubricated with the anti-seize paste.
    3) Tighten the bolts with your hand.
(j) Attach the outlet tube to the brackets on flange M and flange N:
    1) Lubricate the bolts with oil.
    2) Attach the outlet tube to the brackets with the clamps, bolts, and nuts.
    3) Tighten to 36-40 pound-inches (4.1-4.5 newton-meters).
(k) Tighten the bolts that attach the outlet tube to the main gearbox to 62-72 pound-inches (7.0-8.1 newton-meters).
(l) Tighten the bolt that attaches the filter tube to the bracket on the front flange of the outlet tube to 36-40 pound-inches (4.1-4.5 newton-meters).

S 614-011-N00

(2) Do the oil servicing procedure (AMM 12-13-01/301).

S 414-005-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(3) Close the thrust reversers (AMM 78-31-00/201).

S 414-006-N00

(4) Close the core cowl panels (AMM 71-11-06/201).

S 414-007-N00

(5) Close the fan cowl panels (AMM 71-11-04/201).

S 444-008-N00

(6) Do the activation procedure for the thrust reversers (AMM 78-31-00/201).

S 864-010-N00

(7) Remove the DO-NOT-OPERATE tag from the ENG START switch on the overhead panel, P5.

S 714-009-N00

(8) Do the test of the accessory drive seals that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

STARTER DRIVE OIL SEAL - REMOVAL/INSTALLATION

1. General
   A. The starter drive oil seal (referred to as the oil seal) is found on the aft side of the main gearbox. You must remove the starter control valve, pneumatic starter, and starter QAD adapter to get access to the oil seal.

TASK 72-61-03-004-001-N00

2. Remove the Starter Drive Oil Seal (Fig. 401)
   A. Equipment
      (1) Puller - PWA 85204 (optional to PWA 88110), Pratt & Whitney Aircraft, East Hartford, Connecticut
      (2) Puller - PWA 88110
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
      (4) AMM 80-11-01/401, Pneumatic Starter
      (5) AMM 80-11-02/401, Starter Control Valve
      (6) AMM 80-11-03/401, Starter QAD Adapter
   C. Access
      (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

      (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

   D. Prepare to Remove the Starter Drive Oil Seal

      S 864-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the overhead panel P5.

S 014-003-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 044-004-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-005-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

E. Remove the Starter Drive Oil Seal

S 034-007-N00

(1) Remove the starter control valve (AMM 80-11-02/401).

S 034-008-N00

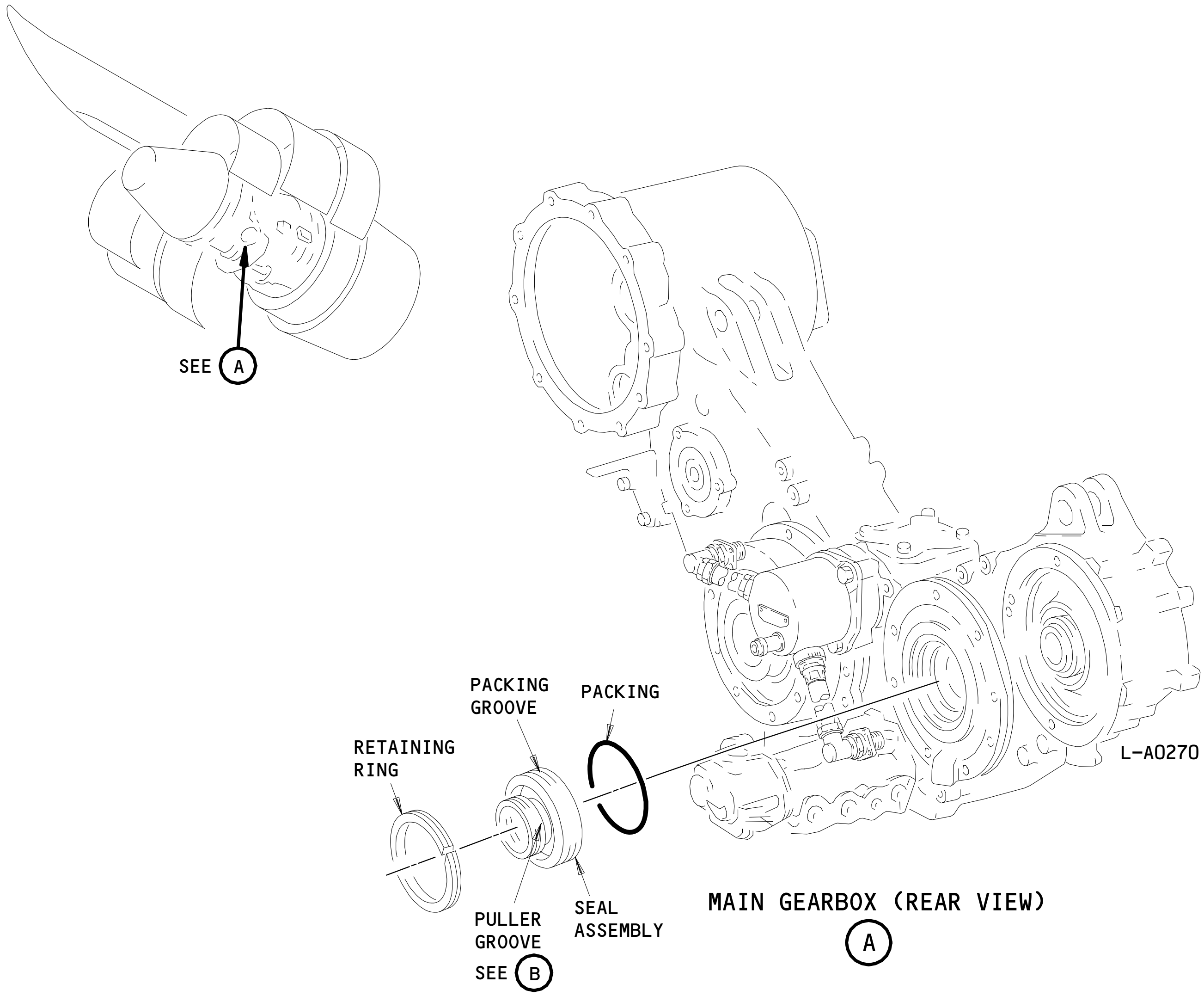
(2) Remove the pneumatic starter (AMM 80-11-01/401).

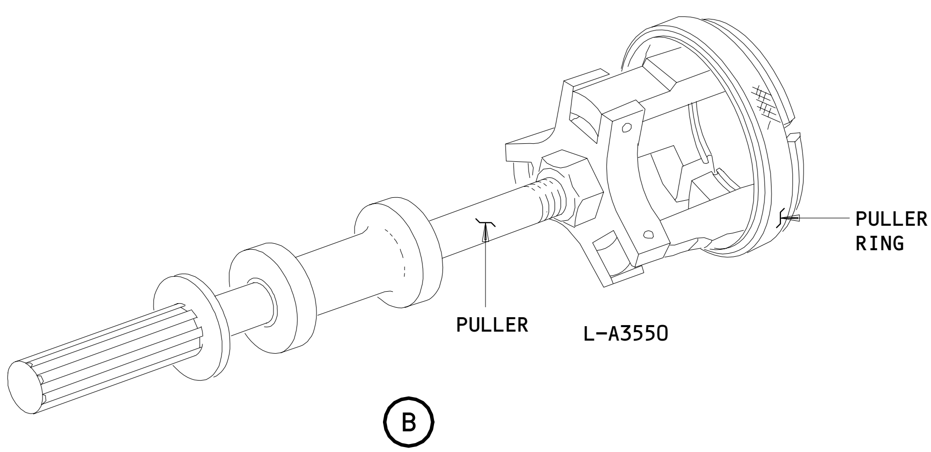
S 034-009-N00

(3) Remove the starter QAD adapter (AMM 80-11-03/401).

S 034-010-N00

(4) Remove the retaining ring that attaches the oil seal.





Starter Drive Oil Seal
Figure 401

S 494-011-N00

(5) Put the jaws of PWA 85204 or PWA 88110 puller in the groove.

(a) Tighten (slide down) the puller ring until the jaws are installed in the groove.

S 024-012-N00

(6) Use the slide hammer effect of the puller to move the packing to remove the oil seal.

S 094-013-N00

(7) Remove the PWA 85204 puller.

(a) Discard the packing.

S 034-014-N00

(8) Install a cover.

TASK 72-61-03-404-015-N00

3. Install the Starter Drive Oil Seal (Fig. 401)

A. Consumable Materials

(1) D00137 Engine Oil - PWA 521

B. References

(1) AMM 12-13-01/301, Engine - Servicing (Oil Replenishing)
(2) AMM 71-00-00/501, Power Plant
(3) AMM 71-11-04/201, Fan Cowl Panels
(4) AMM 71-11-06/201, Core Cowl Panels
(5) AMM 78-31-00/201, Thrust Reverser System
(6) AMM 80-11-01/401, Pneumatic Starter
(7) AMM 80-11-02/401, Starter Control Valve
(8) AMM 80-11-03/401, Starter QAD Adapter

C. Access

(1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

(2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

D. Procedure

S 434-016-N00

(1) Remove the cover.

S 224-017-N00

(2) Measure the clearance between the oil seal face and the bearing housing.

(a) Make sure that the clearances are in the limits shown in the table below.

PART NAME	DIA	NEW PART REFERENCE DIMENSIONS INCHES (MM)		CLEARANCE LIMITS INCHES (MM)	
		MIN	MAX	MIN	MAX
SEAL	OD	3.3570 (85.268)	3.3640 (85.445)	0.0010 (0.0260)	0.0092 (0.2340)
HOUSING	ID	3.3662 (85.471)	3.3662 (85.501)		

S 434-018-N00
(3) Install the packing lubricated with engine oil on the seal.

S 644-019-N00
(4) Lubricate the contact (carbon) surface with engine oil.

S 424-020-N00
(5) Install the oil seal, on the end of the starter drive coupling.
(a) Attach the oil seal with the retaining ring.

S 434-021-N00
(6) Install the starter QAD adapter (AMM 80-11-03/401).

S 434-022-N00
(7) Install the pneumatic starter (AMM 80-11-01/401).

S 434-023-N00
(8) Install the starter control valve (AMM 80-11-02/401).

S 614-024-N00
(9) Do the engine oil servicing procedure (AMM 12-13-01/301).

E. Put the Airplane Back to Its Usual Condition

S 414-025-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-026-N00
(2) Close the core cowl panels (AMM 71-11-06/201).

S 444-027-N00
(3) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 414-028-N00
(4) Close the fan cowl panels (AMM 71-11-04/201).

S 864-029-N00
(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the panel P5.

S 714-030-N00
(6) Do the test of the accessary drive seals that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

INTEGRATED DRIVE GENERATOR (IDG) DRIVE OIL SEAL - REMOVAL/INSTALLATION

1. General
   A. The IDG is found on the aft side of the main gearbox. You must remove the IDG to get access to the IDG drive oil seal (referred to as the oil seal).

TASK 72-61-04-004-001-N00

2. Remove the IDG Drive Oil Seal (Fig. 401)
   A. Equipment
      (1) Puller - PWA 85203, Pratt & Whitney Aircraft, East Hartford, Connecticut
   B. References
      (1) AMM 24-11-01/401, Integrated Drive Generator.
      (2) AMM 71-11-04/201, Fan Cowl Panels
      (3) AMM 71-11-06/201, Core Cowl Panels
      (4) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

      (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

   D. Prepare to Remove the IDG Drive Oil Seal

      S 864-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the overhead panel P5.

S 014-003-N00
(2) Open the fan cowl panels (AMM 71-11-04/201).

S 044-004-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-005-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

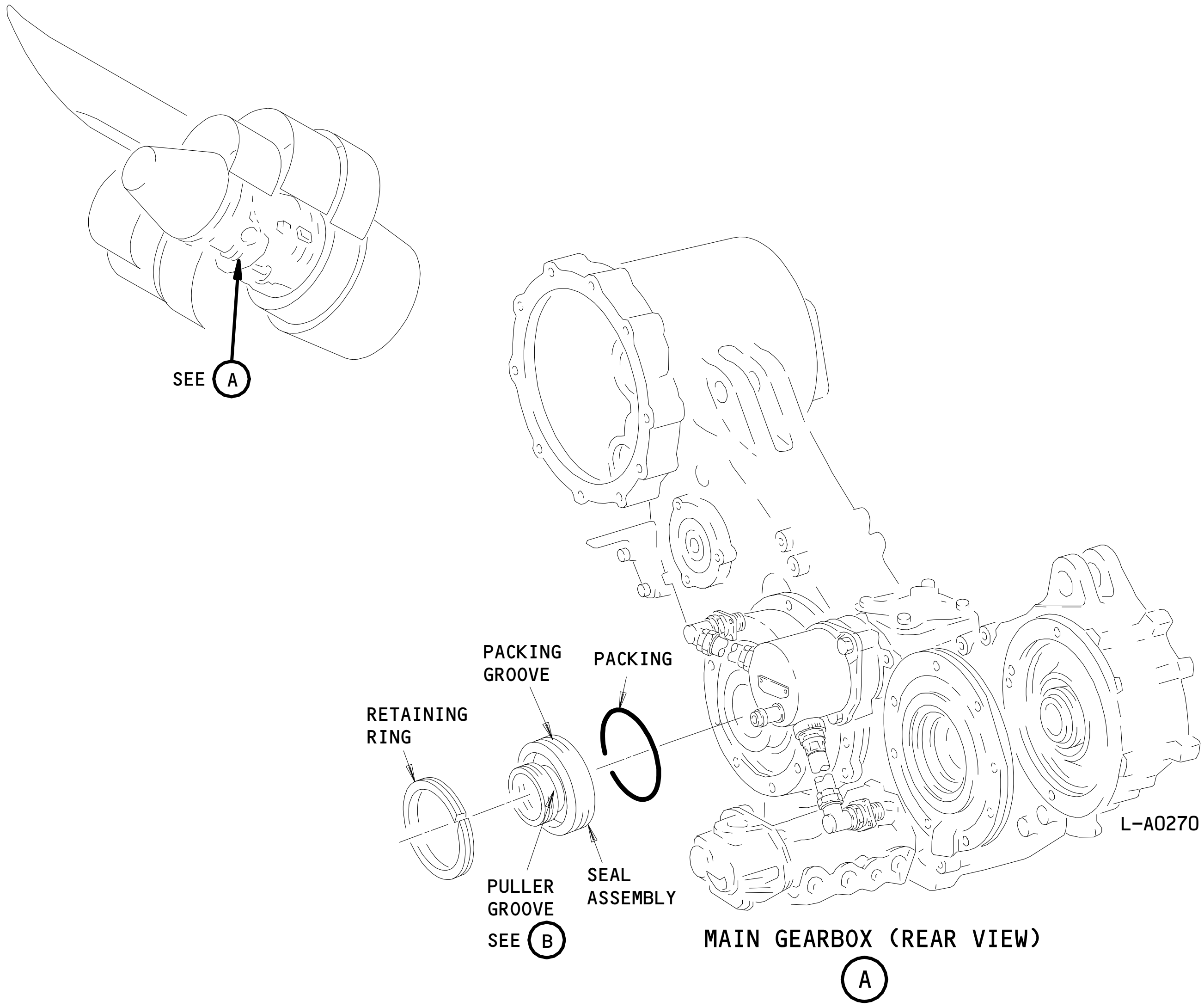
(5) Open the thrust reversers (AMM 78-31-00/201).

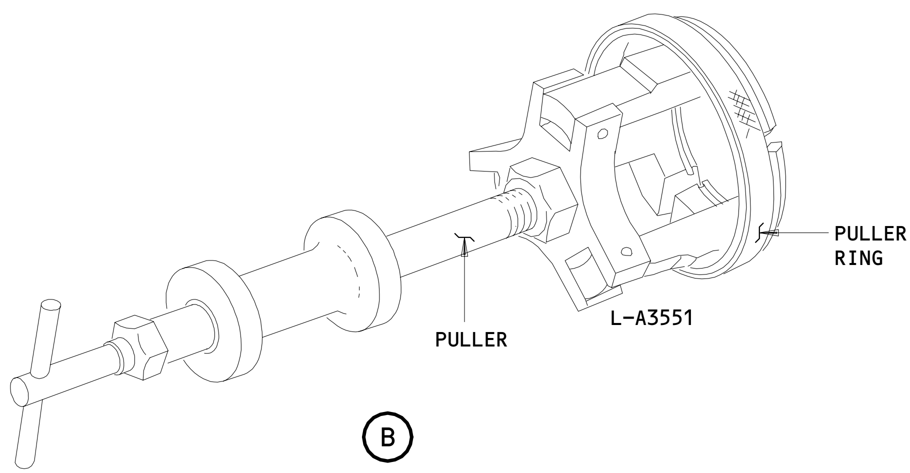
E. Remove the IDG Drive Oil Seal

S 034-007-N00
(1) Remove the IDG (AMM 24-11-01/401).

S 034-008-N00
(2) Remove the retaining ring that attaches the oil seal.

S 494-009-N00
(3) Put the jaws of the PWA 85203 puller in the groove.
    (a) Tighten (slide down) the puller ring until the jaws are installed in the groove.





Integrated Drive Generator (IDG) Drive Oil Seal
Figure 401

S 024-010-N00

(4) Use the slide hammer effect of the puller to move the packing to remove the oil seal.

S 094-011-N00

(5) Remove the puller.

S 034-012-N00

(6) Discard the packing.

S 034-013-N00

(7) Install a cover.

TASK 72-61-04-404-014-N00

3. Install the IDG Drive Oil Seal (Fig. 401)

A. Consumable Materials

(1) D00137 Engine Oil - PWA 521

B. References

(1) AMM 12-13-01/301, Engine - Servicing (Oil Replenishing)
(2) AMM 24-11-01/401, Integrated Drive Generator
(3) AMM 71-00-00/501, Power Plant
(4) AMM 71-11-04/201, Fan Cowl Panels
(5) AMM 71-11-06/201, Core Cowl Panels
(6) AMM 78-31-00/201, Thrust Reverser System

C. Access

(1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

(2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

D. Procedure

S 434-015-N00

(1) Remove the cover.

S 434-016-N00

(2) Install the lubricated packing on the oil seal.

S 644-017-N00

(3) Lubricate the contact (carbon) surface with engine oil.

S 424-018-N00

(4) Install the oil seal on the end of the gear shaft.
   (a) Attach the oil seal with the retaining ring.

S 434-019-N00

(5) Install the IDG (AMM 24-11-01/401).

S 614-020-N00

(6) Do the engine oil servicing procedure (AMM 12-13-01/301).

E. Put the Airplane Back to Its Usual Condition

S 414-021-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Close the thrust reversers (AMM 78-31-00/201).

S 414-022-N00

(2) Close the core cowl panels (AMM 71-11-06/201).

S 444-023-N00

(3) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 414-024-N00

(4) Close the fan cowl panels (AMM 71-11-04/201).

S 864-025-N00

(5) Remove the DO-NOT-OPERATE tag from the ENG START switch on the panel P5.

EEC ALTERNATOR DRIVE OIL SEAL - REMOVAL/INSTALLATION

1. General

SAS A. This procedure contains two tasks. The first task is the removal of the EEC alternator drive oil seal (referred to as oil seal). The second task is the installation of the oil seal. You must remove the EEC alternator to get access to the oil seal. You can find the EEC alternator on the upper aft side of the main gearbox.

SAS NOTE: For EEC Alternator Seal Replacement on-wing, the preferred method is to replace the complete EEC Alternator Drive Gearshaft and Bearing Assembly according to 72-61-14. The instructions below may be used as an alternate method.

TASK 72-61-05-004-001-N00

2. Remove EEC Alternator Drive Oil Seal (Fig. 401)

A. Equipment
   (1) Puller - PWA 85723, Pratt & Whitney Aircraft, East Hartford, Connecticut

B. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 73-21-05/401, EEC Alternator
   (4) AMM 78-31-00/201, Thrust Reverser System

C. Access
   (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

   (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

D. Prepare for the Removal of the Oil Seal.

   S 864-002-N00
   (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilots' overhead panel, P5.

S 014-003-N00

(2) Open the fan cowl panels (AMM 71-11-04/201).

S 044-004-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-005-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

S 014-034-N00

(6) Remove the EEC alternator (AMM 73-21-05/401).

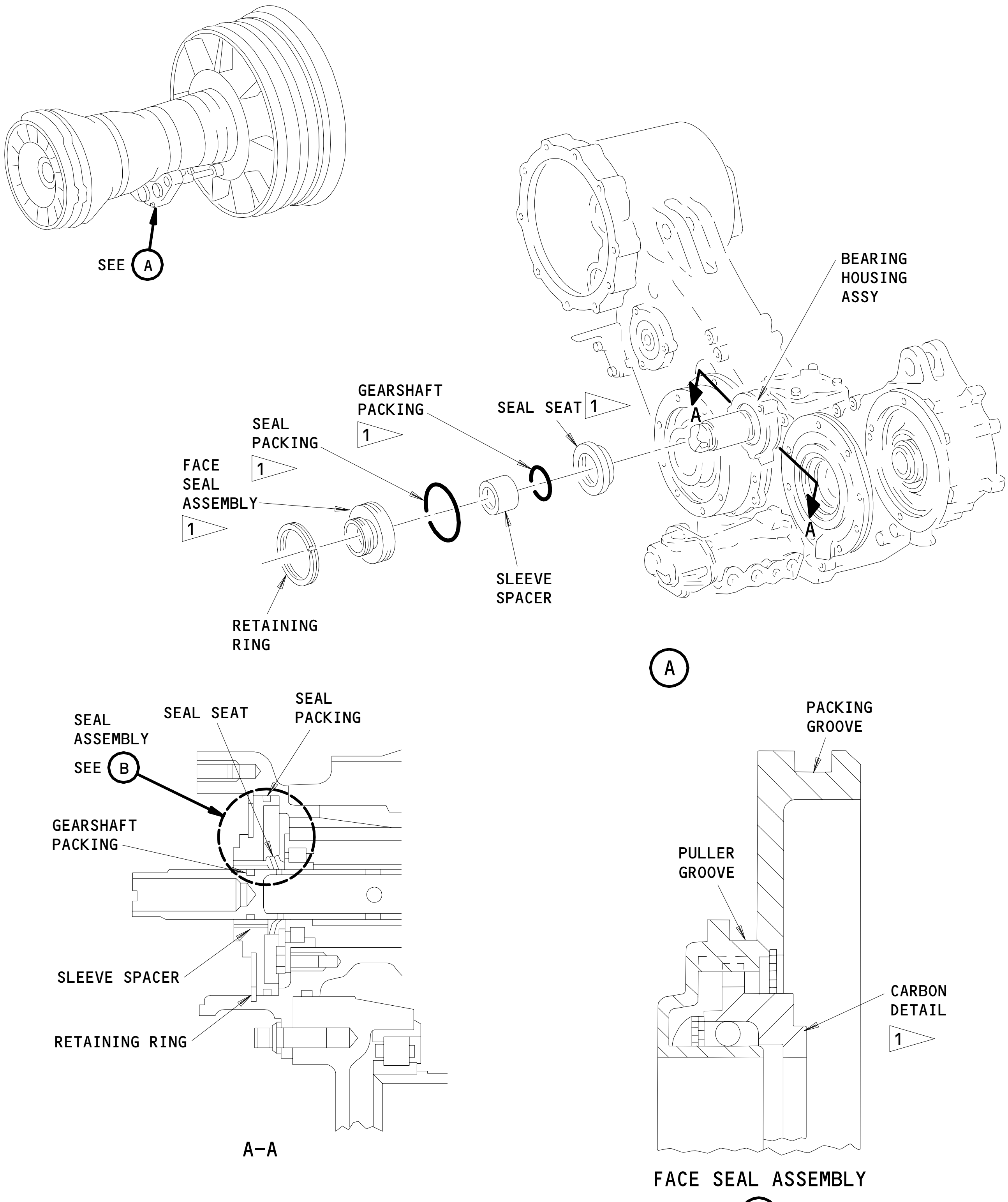
E. Remove the Oil Seal.

S 034-008-N00

(1) Remove the retaining ring that attaches to the face seal assembly.

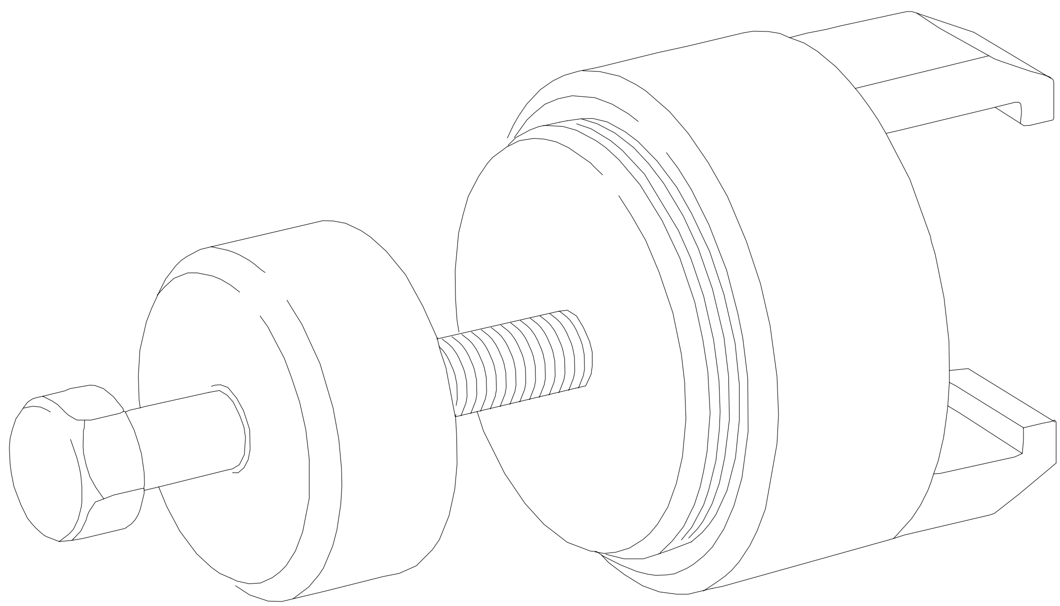
S 494-010-N00

(2) Put the jaws of the puller into the groove, and tighten the puller ring.



1 LUBRICATE WITH ENGINE OIL

EEC Alternator Drive Oil Seal Installation
Figure 401 (Sheet 1)



PULLER

EEC Altenator Drive Oil Seal Installation
Figure 401 (Sheet 2)

S 024-031-N00
(3) Use the puller to slowly remove the face seal assembly.

S 034-012-N00
(4) Remove the puller, and discard the packing.

S 214-030-N00
(5) If it is possible that the seal seat is damaged, do the steps that follow:
(a) Remove the sleeve spacer.
(b) Remove and discard the gearshaft packing.
(c) Remove the seal seat.
(d) Examine the seal seat for damage.

S 434-014-N00
(6) Install the protective cap.

TASK 72-61-05-404-015-N00
3. Install EEC Alternator Drive Oil Seal (Fig. 401)
A. Consumable Materials
(1) D00137 Oil - PWA 521B
B. References
(1) AMM 71-00-00/501, Power Plant
(2) AMM 71-11-04/201, Fan Cowl Panels
(3) AMM 71-11-06/201, Core Cowl Panels
(4) AMM 73-21-05/401, EEC Alternator
(5) AMM 78-31-00/201, Thrust Reverser System
C. Access
(1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

(2) Access Panels

413AL/414AR Fan Cowl Panel, Left Engine
415AL/416AR Fan Reverser, Left Engine
417AL/418AR Core Cowl, Left Engine
423AL/424AR Fan Cowl Panel, Right Engine
425AL/426AR Fan Reverser, Right Engine
427AL/428AR Core Cowl, Right Engine

D. Procedure

S 034-016-N00

(1) Remove the protective cap from the EEC alternator gearshaft on the upper rear of the gearbox.

S 434-017-N00

(2) Install the seal seat.

S 434-018-N00

(3) Install the gearshaft packing on the alternator shaft.

S 434-019-N00

(4) Install the sleeve spacer over the gearshaft packing.

S 424-035-N00

(5) Install the seal packing in the groove of the oil seal.

S 434-020-N00

(6) Measure the clearances between the face seal assembly and the bearing housing.

(a) Make sure that the clearances are in the limits shown in the table below.

PART NAME	DIA	NEW PART REFERENCE DIMENSIONS INCHES (MM)		CLEARANCE LIMITS INCHES (MM)	
		MIN	MAX	MIN	MAX
FACE SEAL ASSY	OD	3.111 (79.020)	3.116 (79.146)	0.002 (0.050)	0.012 (0.300)
BEARING HOUSING ASSY	ID	3.118 (79.198)	3.123 (79.324)		

S 424-032-N00

(7) Install the face seal assembly over the stud end of the gearshaft.

S 434-022-N00

(8) Install the retaining ring for the face seal assembly.

E. Put the Airplane Back to its Usual Condition

S 414-033-N00

(1) Install the EEC alternator (AMM 73-21-05/401).

S 414-024-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(2) Close the thrust reversers (AMM 78-31-00/201).

S 414-025-N00

(3) Close the core cowl panels (AMM 71-11-06/401).

S 414-026-N00

(4) Close the fan cowl panels (AMM 71-11-04/401).

S 444-027-N00

(5) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 864-028-N00

(6) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

S 714-029-N00

(7) Do the test of the accessory drive seals that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

FUEL PUMP DRIVE OIL SEAL - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the fuel pump drive oil seal (referred to as the oil seal). The second task is the installation of the oil seal. You must remove the fuel pump to get access to the oil seal. You can find the fuel pump on the right forward side of the main gearbox.

TASK 72-61-06-004-001-N00

2. Remove the Fuel Pump Drive Oil Seal (Fig. 401)
   A. Equipment
      (1) Puller - PWA 85204 (optional to PWA 88110), Pratt & Whitney Aircraft, East Hartford, Connecticut
      (2) Puller - PWA 88110
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 73-11-01/401, Fuel Pump
      (4) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

      (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

   D. Prepare to Remove the Oil Seal

      S 864-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilots' overhead panel, P5.

S 014-003-N00
(2) Open the fan cowl panels (AMM 71-11-04/201).

S 044-004-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-005-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

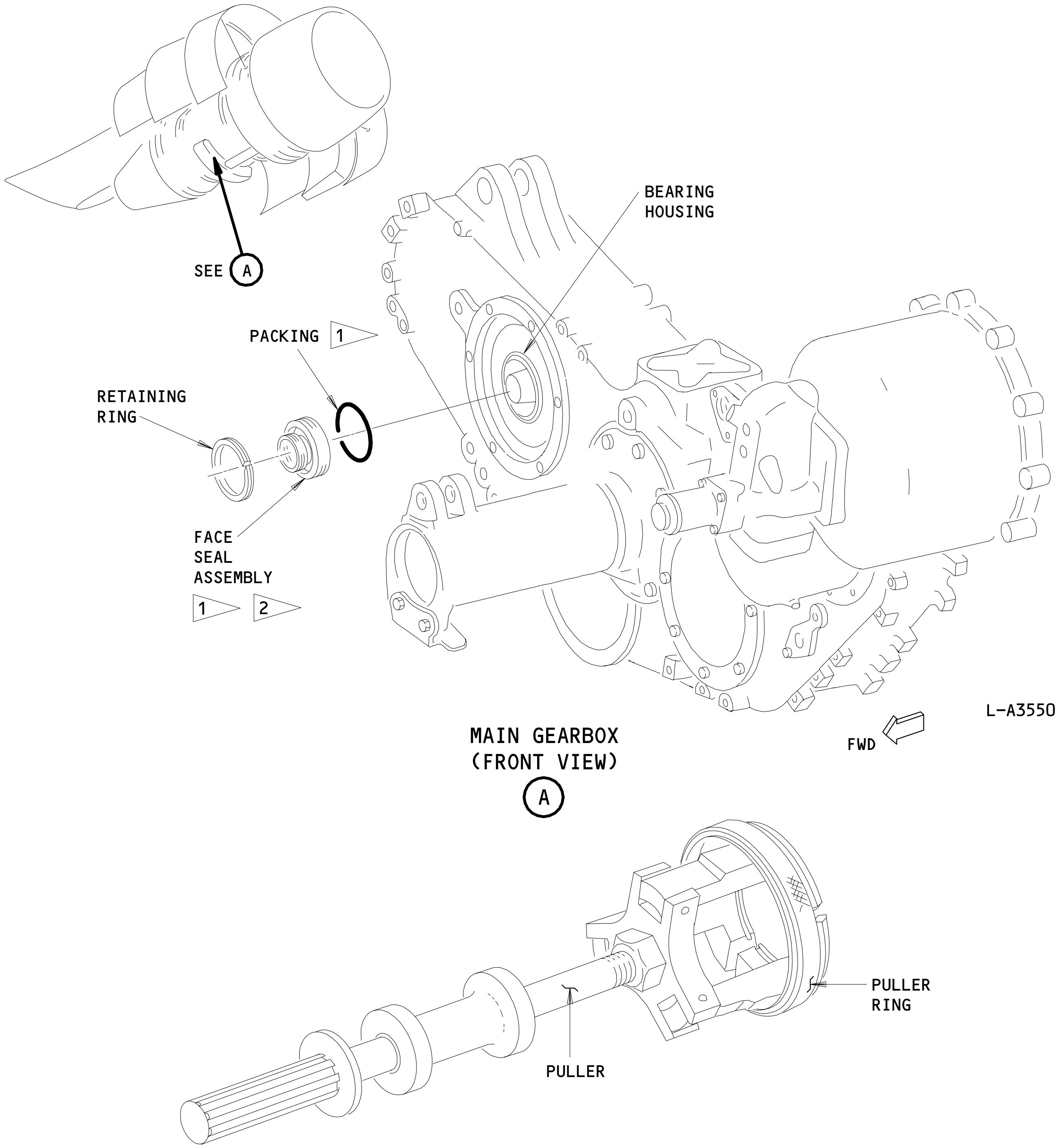
(5) Open the thrust reversers (AMM 78-31-00/201).

S 014-024-N00
(6) Remove the fuel pump (AMM 73-11-01/401).

E. Remove the Oil Seal

S 034-008-N00
(1) Remove the retaining ring that attaches the oil seal to the main gearbox.

S 494-009-N00
(2) Put the jaws of the puller in the groove.
    (a) Move the puller ring down until the jaws are installed in the groove.



1 LUBRICATE WITH ENGINE OIL

2 LUBRICATE CARBON CONTACT SURFACE WITH ENGINE OIL

Fuel Pump Drive Oil Seal
Figure 401

S 024-010-N00
(3) Use the slide hammer effect of the puller to remove the oil seal and the packing.
   (a) Discard the packing.

S 034-011-N00
(4) Install the protective cap.

TASK 72-61-06-404-012-N00

3. Install the Fuel Pump Drive Oil Seal (Fig. 401)
   A. Consumable Materials
      (1) D00137 Oil - PWA 521B
   B. References
      (1) AMM 71-00-00/501, Power Plant
      (2) AMM 71-11-04/201, Fan Cowl Panels
      (3) AMM 71-11-06/201, Core Cowl Panels
      (4) AMM 73-11-01/401, Fuel Pump
      (5) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

      (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

   D. Procedure

S 434-013-N00
(1) Remove the protective cap.

S 224-014-N00

(2) Measure the clearance between the face seal assembly and bearing housing.

(a) Make sure that the clearances are in the limits shown in the table below.

PART NAME	DIA	NEW PART REFERENCE DIMENSIONS INCHES (MM)		CLEARANCE LIMITS INCHES (MM)	
		MIN	MAX	MIN	MAX
FACE SEAL ASSY	OD	3.3570 (85.268)	3.3640 (85.501)	0.0010 (0.0260)	0.0092 (0.2340)
BEARING HOUSING	ID	3.3650 (85.471)	3.3662 (85.501)		

S 434-015-N00

(3) Install the packing in the packing groove of the face seal.

S 424-016-N00

(4) Install the oil seal over the end of the gearshaft.

(a) Install the retaining ring to attach the oil seal to the main gearbox.

E. Put the Airplane Back to Its Usual Condition

S 414-025-N00

(1) Install the fuel pump (AMM 73-11-01/401).

S 414-018-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(2) Close the thrust reversers (AMM 78-31-00/201).

S 414-019-N00

(3) Close the core cowl panels (AMM 71-11-06/201).

S 444-020-N00
(4) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 414-021-N00
(5) Close the fan cowl panels (AMM 71-11-04/201).

S 864-022-N00
(6) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

S 714-023-N00
(7) Do the test of the accessory drive seals that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

HYDRAULIC PUMP DRIVE OIL SEAL - REMOVAL/INSTALLATION

1. General
   A. This procedure gives the steps to remove and install the the hydraulic pump drive oil seal. In this procedure, the the hydraulic pump drive oil seal will be referred to as the EDP oil seal (the engine-driven pump oil seal).
   B. The EDP oil seal is found on the right, aft side of the main gearbox, where the hydraulic pump is installed.
   C. You can open the right thrust reverser half and remove the hydraulic pump (EDP) to get access to the EDP oil seal.

TASK 72-61-07-004-018-N00

2. Remove the Hydraulic Pump Drive Oil Seal
   A. Equipment
      (1) Puller - PWA 85204 (optional to PWA 88110), Pratt & Whitney Aircraft, East Hartford, Connecticut
      (2) Puller - PWA 88110
   B. References
      (1) AMM 29-11-05/401, Engine Driven Pump (EDP)
      (2) AMM 71-11-04/201, Fan Cowl Panels
      (3) AMM 71-11-06/201, Core Cowl Panels
      (4) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

411	Left Engine
421	Right Engine

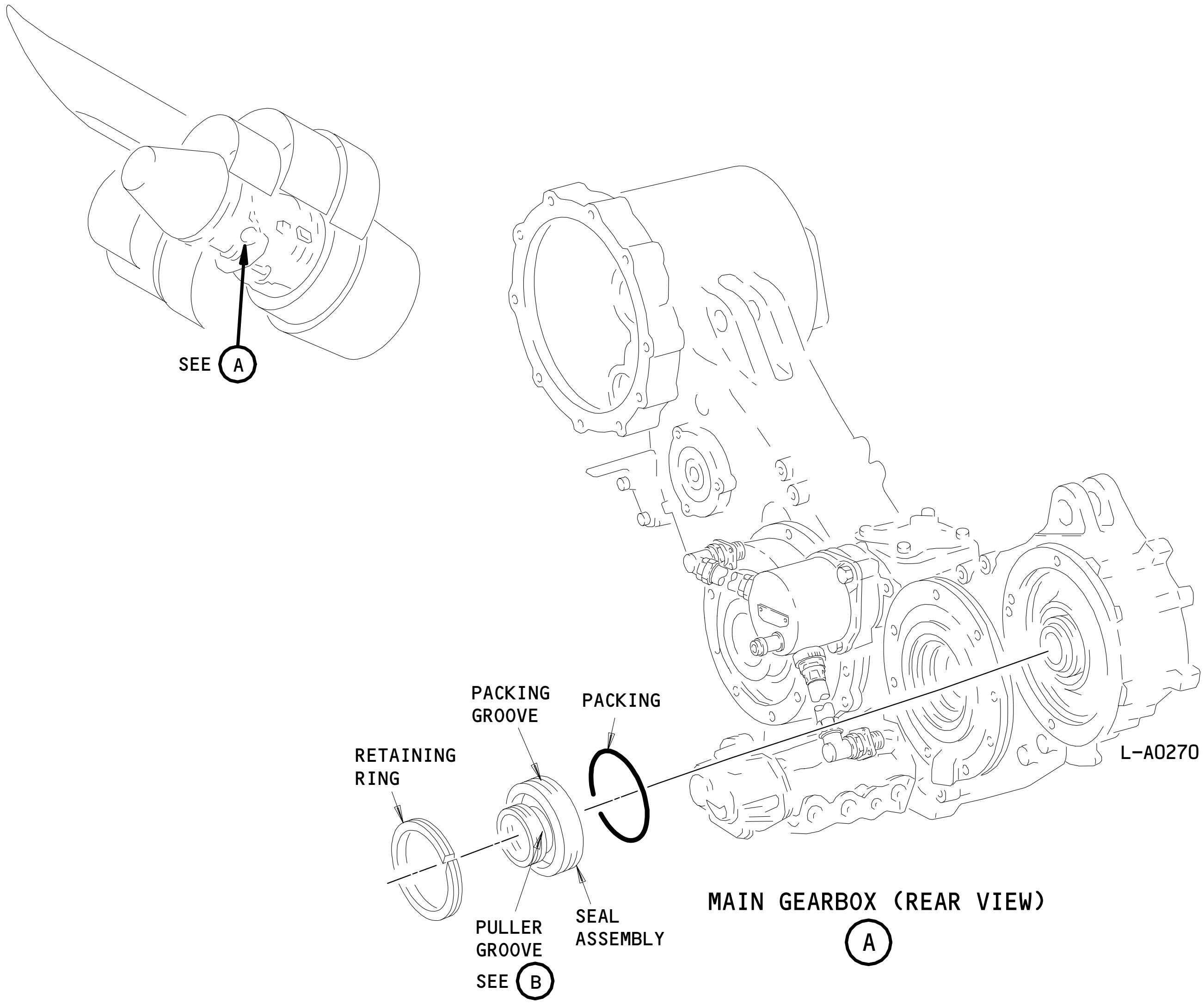
      (2) Access Panels

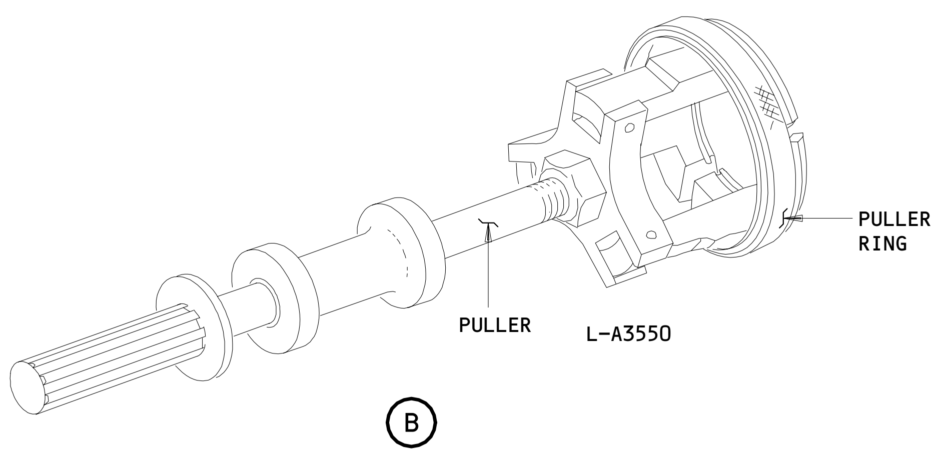
414AR	Fan Cowl Panel, Left Engine
416AR	Thrust Reverser, Left Engine
418AR	Core Cowl Panel, Left Engine
424AR	Fan Cowl Panel, Right Engine
426AR	Thrust Reverser, Right Engine
428AR	Core Cowl Panel, Right Engine

   D. Remove the EDP Oil Seal (Fig. 401).

      S 864-001-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilot's overhead panel, P5.

      S 014-005-N00
      (2) Open the right fan cowl panel (AMM 71-11-04/201).





Hydraulic Pump Drive Oil Seal
Figure 401

S 044-002-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSERS. THE ACCIDENTAL OPERATION OF THE THRUST REVERSERS CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-003-N00

(4) Open the right core cowl panel (AMM 71-11-06/201).

S 014-004-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, YOU CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(5) Open the right thrust reverser (AMM 78-31-00/201).

S 024-006-N00

(6) Do the steps that follow to remove the EDP oil seal.

CAUTION: IMMEDIATELY REMOVE ALL HYDRAULIC FLUID THAT FALLS ON THE ENGINE GEARBOX. HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE ENGINE GEARBOX.

(a) Remove the engine-driven hydraulic pump (EDP) (AMM 29-11-05/401).
(b) Remove the retaining ring that keeps the EDP oil seal in the correct position.
(c) Put the jaws of PWA 85204 or PWA 88110 puller in the puller groove on the seal assembly.
(d) Move the puller ring until the jaws are tightly engaged in the puller groove.
(e) With a slide hammer action of the puller, remove the EDP oil seal.

NOTE: This slide hammer action will make a force that is stronger than the force of the packing.

(f) Remove the puller.
(g) Discard the packing.

S 034-007-N00

(7) Install a cover on the engine gearbox.

TASK 72-61-07-404-017-N00

3. Install the Hydraulic Pump Drive Oil Seal

A. Equipment

(1) Puller - PWA 85204, Pratt & Whitney Aircraft, East Hartford, Connecticut

B. Consumable Materials

(1) D00137 Oil - PWA 521B

C. References

(1) AMM 12-13-01/301, Engine - Servicing (Oil Replenishing)
(2) AMM 29-11-05/401, Engine Driven Pump (EDP)
(3) AMM 71-00-00/501, Power Plant
(4) AMM 71-11-04/201, Fan Cowl Panels
(5) AMM 71-11-06/201, Core Cowl Panels
(6) AMM 78-31-00/201, Thrust Reverser System

D. Install the EDP Oil Seal (Fig. 401).

S 414-009-N00

(1) Remove the cover from the gearbox.

S 424-008-N00

(2) Do the steps that follow to install the EDP oil seal.
(a) Lubricate the packing with oil.
(b) Install the packing on the seal assembly.
(c) Lubricate the mating (carbon) surface of the EDP oil seal with oil.
(d) Install the EDP oil seal on the end of the gearshaft.
(e) Install the retaining ring.
(f) Install the engine-driven hydraulic pump (EDP) (AMM 29-11-05/401).

S 614-010-N00

(3) Fill the engine oil system with oil (AMM 12-13-01/301).

S 414-011-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, YOU CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(4) Close the right thrust reverser (AMM 78-31-00/201).

S 414-012-N00

(5) Close the right core cowl panel (AMM 71-11-06/201).

S 444-016-N00

(6) Do the thrust reverser activation procedure (AMM 78-31-00/201).

S 414-013-N00

(7) Close the right fan cowl panel (AMM 71-11-04/201).

S 864-014-N00

(8) Remove the DO-NOT-OPERATE tag from the ENG START switch on the pilot's overhead panel, P5.

S 714-015-N00

(9) Do the test of the accessory drive seals that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

STARTER DRIVE COUPLING - REMOVAL/INSTALLATION

1. General
   A. It is necessary to remove the starter control valve, pneumatic starter, and starter QAD adapter before you remove the starter drive coupling.

TASK 72-61-09-004-001-N00

2. Remove the Starter Drive Coupling (Fig. 401)
   A. Equipment
      (1) Holder - PWA 26377, Pratt & Whitney, East Hartford, CT
      (2) Puller - PWA 85502, Pratt & Whitney, East Hartford, CT
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
      (4) AMM 80-11-01/401, Pneumatic Starter
      (5) AMM 80-11-02/401, Starter Control Valve
      (6) AMM 80-11-03/401, Starter QAD Adapter
   C. Access
      (1) Location Zone

410	Left Engine
420	Right Engine

      (2) Access Panels

413/423	Fan Cowl Panel (LH)
414/424	Fan Cowl Panel (RH)
415/425	Fan Reverser (LH)
416/426	Fan Reverser (RH)
417/427	Core Cowl (LH)
418/428	Core Cowl (RH)

   D. Procedure

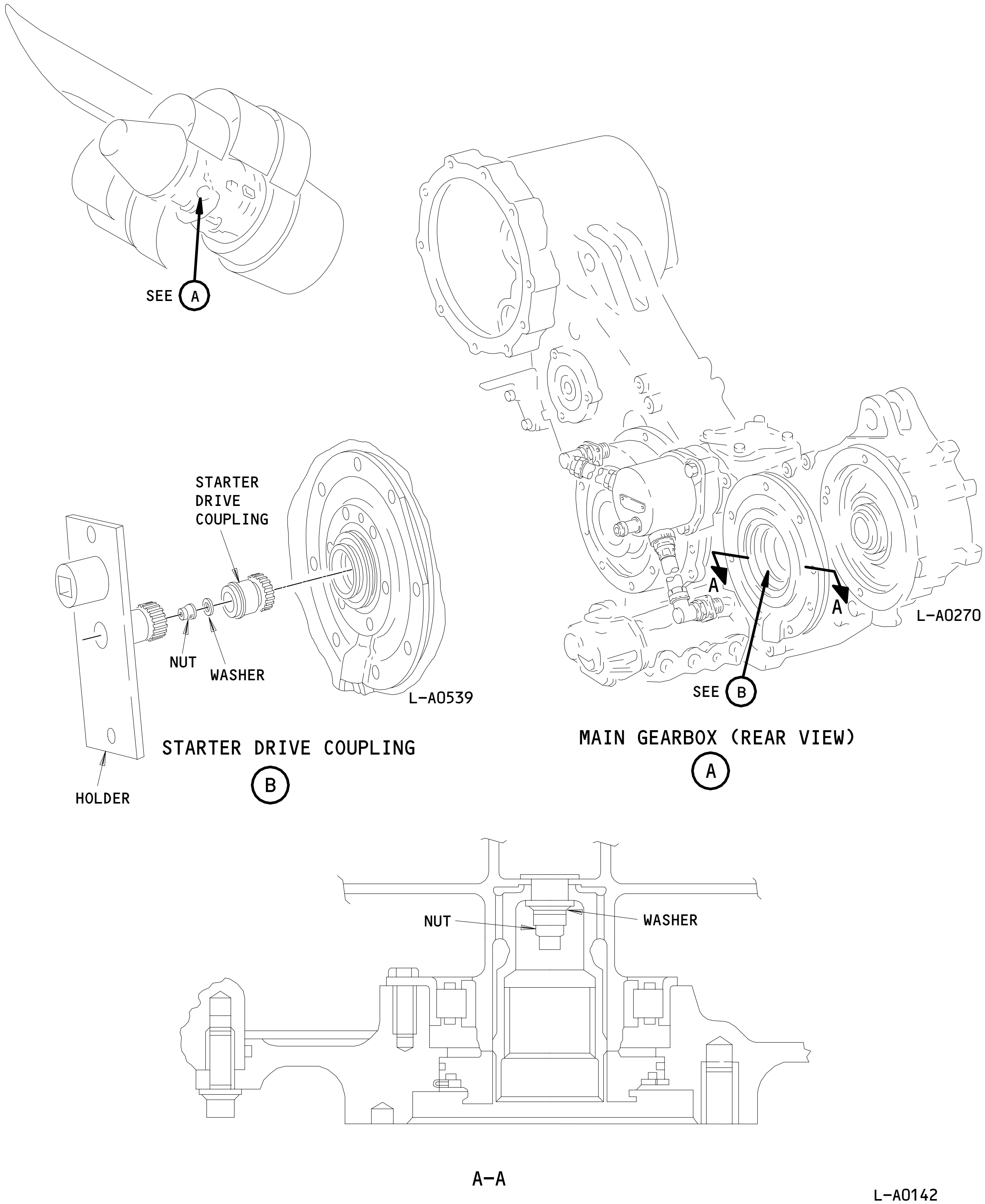
      S 434-002-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the overhead panel, P5.

      S 014-003-N00
      (2) Open the fan cowl panels (AMM 71-11-04/201).

      S 044-004-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

      (3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).



Starter Drive Coupling
Figure 401

S 014-005-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

S 024-007-N00
(6) Remove the starter control valve (AMM 80-11-02/401).

S 024-008-N00
(7) Remove the pneumatic starter (AMM 80-11-01/401).

S 024-009-N00
(8) Remove the starter QAD adapter (AMM 80-11-03/401).

S 434-010-N00
(9) Put the splined drive of the PWA 26377 holder into the starter drive coupling and attach it to the starter-drive-mount-pad with the bolts (2 locations).

S 034-011-N00
(10) Go through the holder and remove the retaining nut.

S 034-012-N00
(11) Remove the holder from the starter-drive mount pad.

S 034-013-N00
(12) Put the PWA 85502 puller in the puller hole and pull continuously on the handle of puller to remove the coupling.

S 034-014-N00
(13) Remove the coupling from the tool.

S 034-015-N00
(14) Remove the washer from the coupling.

S 434-016-N00
(15) Install the protection cap.

TASK 72-61-09-404-017-N00
3. Install the Starter Drive Coupling (Fig. 401).
A. Equipment
(1) Holder - PWA 26377, Pratt & Whitney, East Hartford, CT

B. Consumable Materials
(1) D00137 Oil - PWA 521
(2) D00675 Lubricant, Silicon (P06-052)
(3) D50033 Grease, Fluorinated Lubricant (P06-059)

C. References
(1) AMM 71-00-00/501, Power Plant
(2) AMM 71-11-04/201, Fan Cowl Panels
(3) AMM 71-11-06/201, Core Cowl Panels
(4) AMM 78-31-00/201, Thrust Reverser System
(5) AMM 80-11-01/401, Pneumatic Starter
(6) AMM 80-11-02/401, Starter Control Valve
(7) AMM 80-11-03/401, Starter QAD Adapter

D. Access
(1) Location Zone

410	Left Engine
420	Right Engine

(2) Access Panels

413/423	Fan Cowl Panel (LH)
414/424	Fan Cowl Panel (RH)
415/425	Fan Reverser (LH)
416/426	Fan Reverser (RH)
417/427	Core Cowl (LH)
418/428	Core Cowl (RH)

E. Procedure

S 034-022-N00
(1) Remove the protection cap.

S 434-041-N00

CAUTION: BEFORE YOU APPLY FLUORINATED GREASE LUBRICANT (PWA 36230) TO THE STARTER DRIVE COUPLING, MAKE SURE THE STARTER DRIVE GEARSHAFT SPLINES ARE CLEAN AND NOT DAMAGED. APPLY FLUORINATED GREASE LUBRICANT (PWA 36230) TO THE STARTER DRIVE COUPLING SPLINES TO REDUCE WEAR AND INCREASE THE SERVICE LIFE OF THE PARTS.

(2) Apply Fluorinated Grease Lubricant (PWA 36230) the inner diameter and outer diameter splines of the starter drive coupling.

S 434-023-N00

(3) Carefully put the coupling into gearbox drive gear shaft through the opening in the oil seal assembly.

S 434-039-N00

(4) Align the splines of the coupling and the gear shaft.

S 434-040-N00

(5) Push the coupling into its position.

S 434-024-N00

(6) Lubricate with Engine Oil (P03-001) and install the retaining nut washer that attach the coupling.
   (a) Tighten the retaining nut with your hand.

S 434-025-N00

(7) Put the splined drive of the PWA 26377 holder into the starter drive coupling and attach it to the starter-drive mount pad with the bolts (2 locations).

S 434-026-N00

(8) Go through the holder and torque the retaining nut to 290-325 pound-inches (32.8-36.7 newton-meters).

S 034-027-N00

(9) Remove the holder from the starter-drive-mount-pad.

S 424-028-N00

(10) Install the starter QAD adapter (AMM 80-11-03/401).

S 424-029-N00

(11) Install the pneumatic starter (AMM 80-11-01/401).

S 424-030-N00

(12) Install the starter control valve (AMM 80-11-02/401).

S 414-031-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(13) Close the thrust reversers (AMM 78-31-00/201).

S 414-032-N00

(14) Close the core cowl panels (AMM 71-11-06/201).

S 444-033-N00
(15) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 414-034-N00
(16) Close the fan cowl panels (AMM 71-11-04/201).

S 034-035-N00
(17) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

S 714-036-N00
(18) Do the test of the starter that is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

MAIN OIL FILTER HOUSING - REMOVAL/INSTALLATION

1. General
   A. This procedure gives the steps for the removal and the installation of the main oil filter housing.
   B. The main oil filter housing is on the forward face of the main gearbox at approximately the 8 o'clock position.
   C. To get access to the main oil filter housing, you can open the left thrust reverser half.

TASK 72-61-11-004-001-N00

2. Remove the Main Oil Filter Housing
   A. Equipment
      (1) Container - 5 gallon (20 liter) capacity, used to collect oil
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 78-31-00/201, Thrust Reverser System
      (4) AMM 79-21-05/401, Main Oil Filter
      (5) AMM 79-21-06/401, Main Oil Filter Bypass Valve
      (6) AMM 79-21-07/401, Oil System Pressure (Regulator) Relief Valve
   C. Access
      (1) Location Zone

410	Left Engine
420	Right Engine

      (2) Access Panels

413/423	Fan Cowl Panel (LH)
414/424	Fan Cowl Panel (RH)
415/425	Fan Reverser (LH)
416/426	Fan Reverser (RH)
417/427	Core Cowl (LH)
418/428	Core Cowl (RH)

   D. Procedure

      S 014-062-N00
      (1) Open the fan cowl panels (AMM 71-11-04/201).

S 044-063-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-064-N00

(3) Open the core cowl panels (AMM 71-11-06/201).

S 014-065-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(4) Open the thrust reversers (AMM 78-31-00/201).

S 014-066-N00

(5) Remove the oil filter differential pressure switch (AMM 79-35-01/401).

S 014-067-N00

(6) Remove the five pneumatic tubes (15, 16, 17, 18, and 19), the drain tube (13), and the fire extinguishing tube assembly (7):
  (a) Disconnect the four pneumatic tube nuts and the fire extinguishing tube nut (Fig. 401, View A).

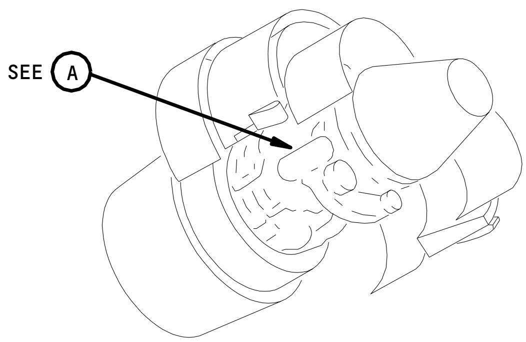
    NOTE: These tube nuts are near the top of the oil tank at approximately the 10 o'clock position.

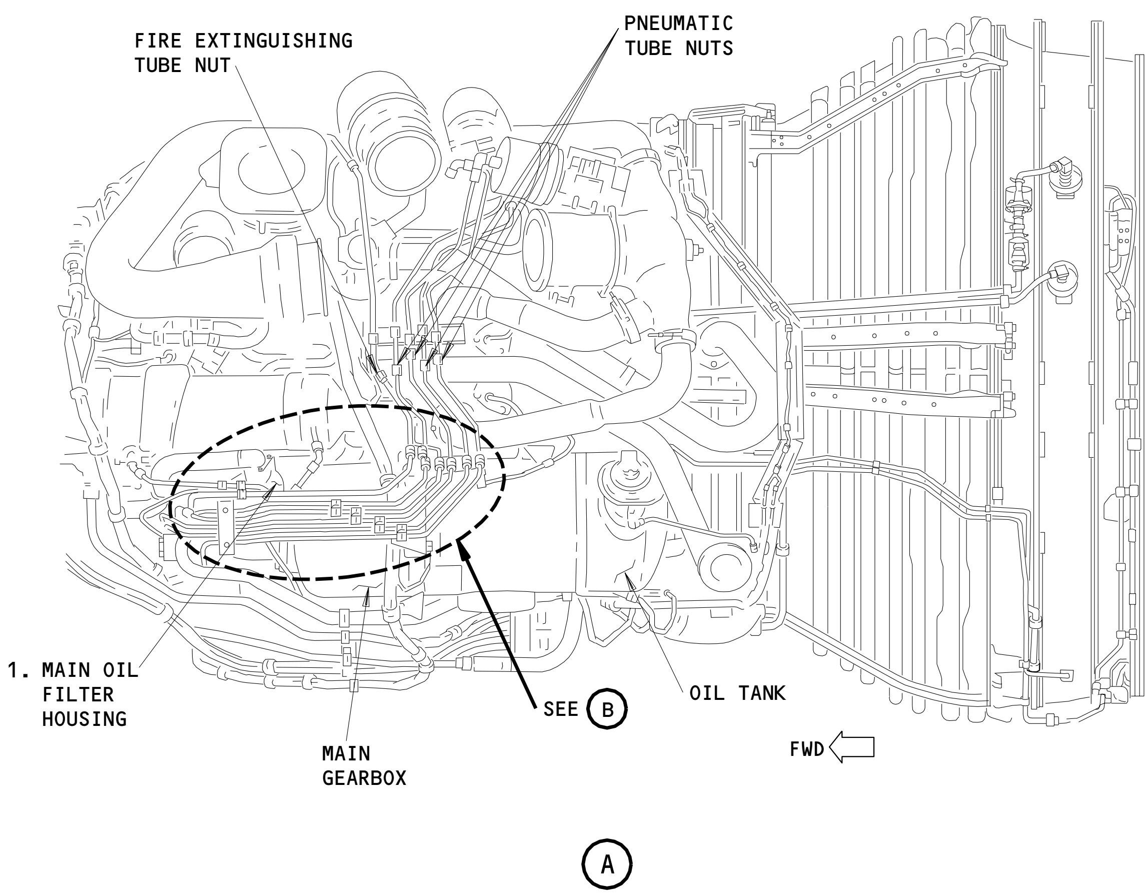
  (b) Remove the three screws (8), washers (9), and nuts (10) that attach the five pneumatic tube clamps to the bracket (Fig. 401, View C).

    NOTE: This bracket is on the top of the oil tank at approximately the 9 o'clock position.

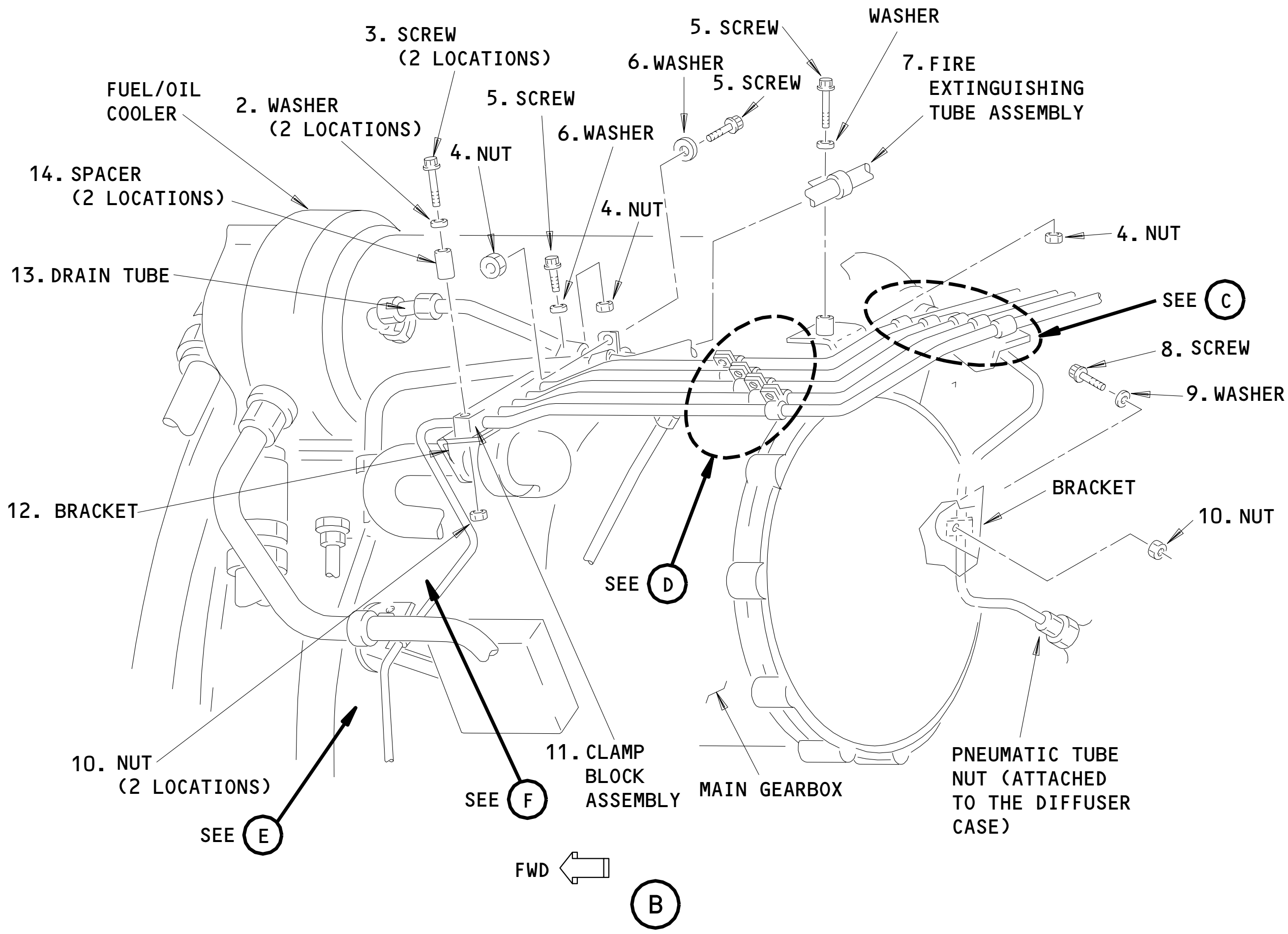
  (c) Remove the four screws (8), washers (9), and nuts (10) that hold the pneumatic tube clamps which are near the top of the oil tank (Fig. 401, View D).
  (d) Remove the screw (5), washer (6), and nut (4) that attach the fire extinguishing tube clamp to the bracket.

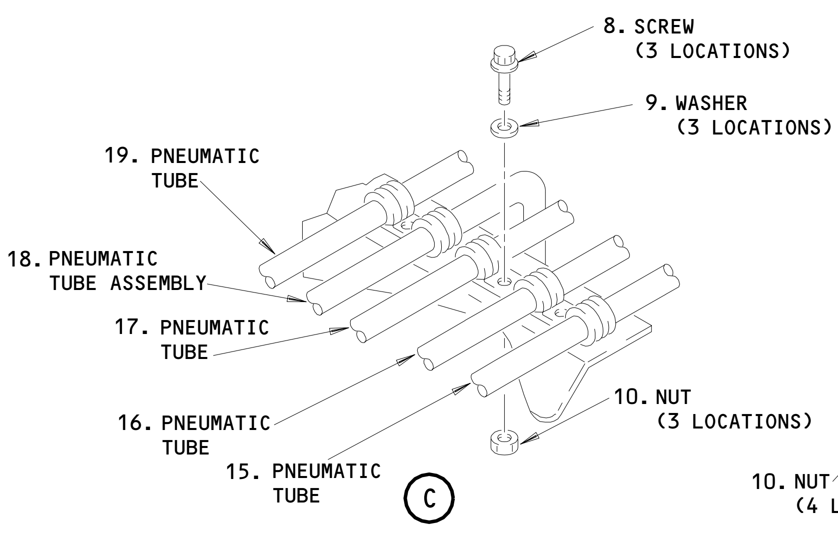
    NOTE: This bracket is on the top of oil tank at approximately the 9 o'clock position.

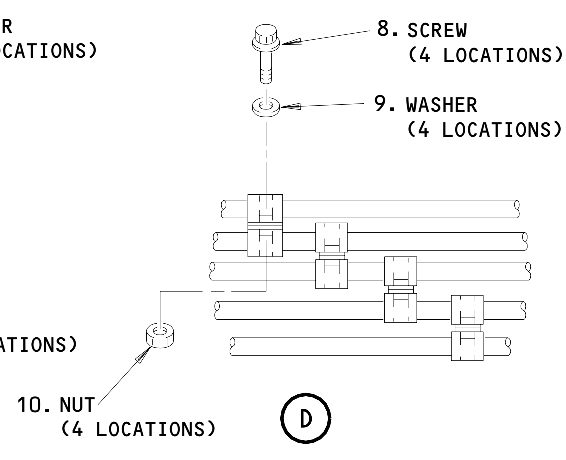




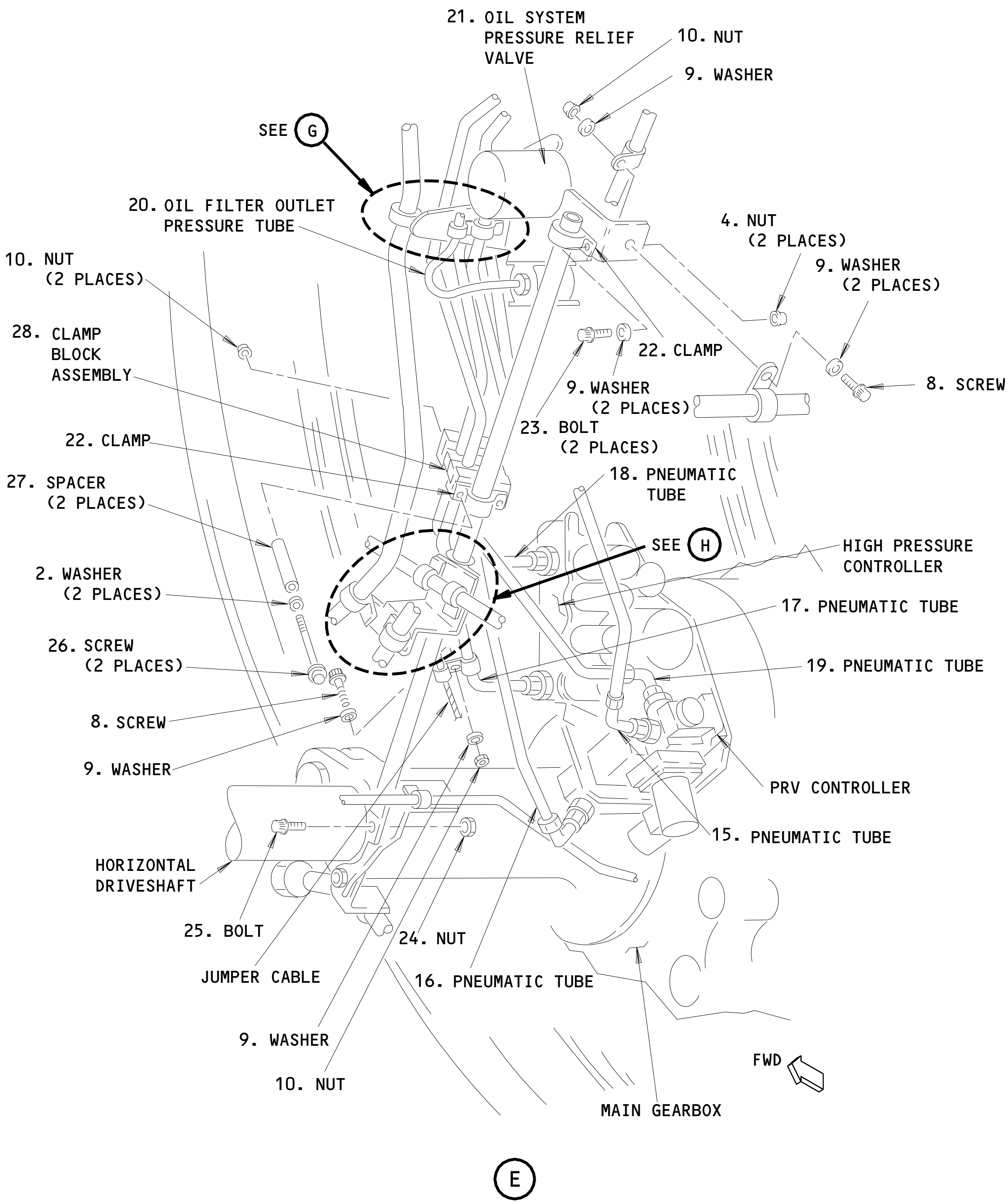
Controller Preumatic Tubing
Figure 401 (Sheet 1)



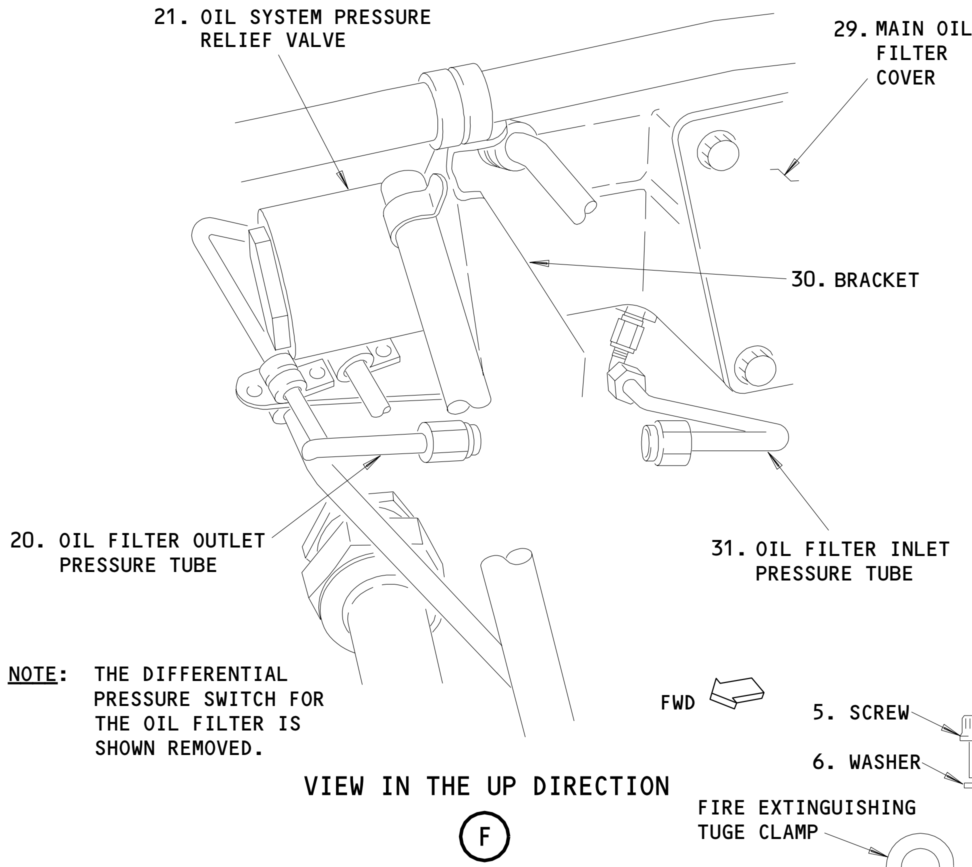


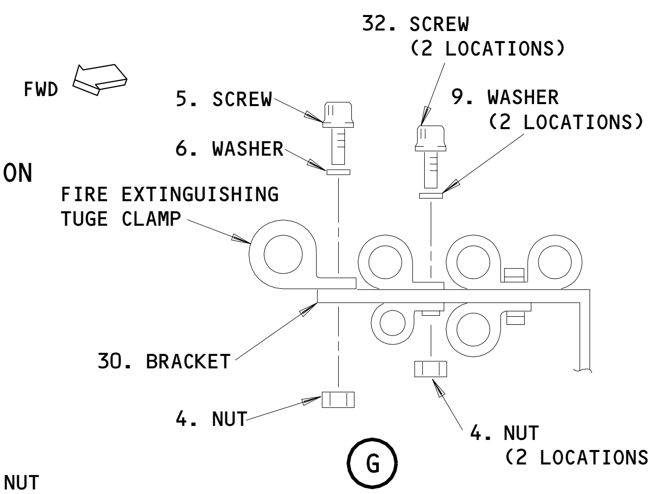


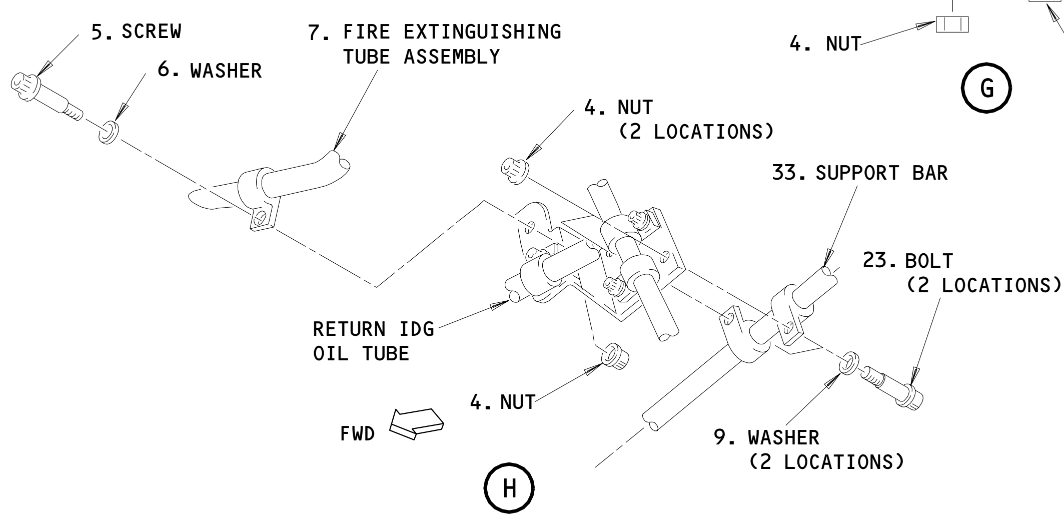
Controller Pneumatic Tubing
Figure 401 (Sheet 2)



Pneumatic Tubes Installation
Figure 401 (Sheet 3)







Pneumatic Tubes Installation
Figure 401 (Sheet 4)

(e) Disconnect the tube nut for the pneumatic tube assembly (18) from the boss on the diffuser case at approximately the 7 o'clock position.
(f) Remove the screw (8), washer (9), and nut (10) that attach the pneumatic tube clamp to the bracket on the right side of the oil tank mounting flange.
(g) Remove the screw (5), washer (6), and nut (4).

NOTE: These hold the fire extinguishing tube clamp and the clamp for the fuel/oil cooler drain tube at the top of the main gearbox.

(h) Remove the drain tube (13) for the fuel/oil cooler:
1) Remove the screw (5), washer (6), and nut (4) that attach the drain tube clamp to the bracket (12) at the top of the main gearbox.
2) Disconnect the tube nuts from the drain port elbow for the fuel/oil cooler and from the tee.

NOTE: This tee is near the top of the main oil filter housing (1).

3) Remove the drain tube (13).
4) Put covers on all of the openings.
(i) Remove the screw (5), washer (6), and nut (4) that attach the fire extinguishing tube clamp to the bracket (30).

NOTE: This bracket (30) is at the forward right side of the pressure relief valve (12) for the oil system (Fig. 401, View G).

(j) Remove the screw (32), washer (9), and nut (4) that attach the clamp for the (oil filter) outlet pressure tube (20) and the pneumatic tube clamp to the (main oil filter housing bracket) bracket (30) (Fig. 401, View F and G).
(k) Remove the screw (32), washer (9), and nut (4) that attach the other pneumatic tube clamps to the (main oil filter housing bracket) bracket (30) (Fig. 401, View G).
(l) Remove the clamp block assembly (11), which is on the top of the main oil filter housing (1):
1) Remove the two screws (3), washers (2), spacers (14), and nuts (10) that attach the five pneumatic tubes (15, 16, 17, 18, and 19) to the clamp block assembly (11).
2) Remove the clamp block assembly (11).
(m) Remove the screw (8), washers (9), and nut (10) that attach the pneumatic tube clamp and the fuel inlet tube clamp for the fuel/oil cooler to the bracket (30).

NOTE: This is attached at the forward left side of the pressure relief valve (21) for the oil system.

(n) Disconnect the pneumatic tube nut (15) from the pressure regulating valve (PRV) controller which is at the 6:30 o'clock position.
   1) Remove the pneumatic tube (15) from the engine.
(o) Remove the two bolts (23), washers (9), and nuts (4) that attach the support bar clamp (22) to the bracket (30).

   NOTE: This is forward of the main oil filter housing (1).

(p) Remove the clamp (22) from the support bar (33).
(q) Remove the bolt (25) and nut (24) that attach the other end of the support bar (33) to the horizontal driveshaft bracket.
(r) Remove the bolts (23), washers (9), and nuts (4) that attach the support bar clamps to the bracket at the 7 o'clock position (Fig. 401, View H).
(s) Remove the clamp block assembly (28), which is at approximately the 7 o'clock position:
   1) Remove the two screws (26), washers (2), clamp (22), spacers (27), and nuts (10) that attach the four pneumatic tubes (16, 17, 18, and 19) to the clamp block assembly (28).
   2) Remove the clamp block assembly (28).
(t) Disconnect the pneumatic tube nuts (16 and 19) from the pressure regulating valve (PRV) controller.
(u) Remove the screw (8), washers (9), and nut (10) that attach the jumper cable clamp to the pneumatic tube clamp.
(v) Disconnect the pneumatic tube nut (17 and 18) from the high pressure controller which is at the 6:30 o'clock position.
(w) Remove the screw (5), washer (6), and nut (4) that attach the fire extinguishing tube clamp to the bracket.

   NOTE: This clamp is forward of the high pressure controller at the 7 o'clock position (Fig. 401, View H).

(x) Remove the pneumatic tubes (15, 16, 17, 18, and 19) and the fire extinguishing tube assembly (7) from the engine.

S 014-068-N00
(7) Remove the oil filter inlet and outlet pressure tubes (20 and 31):
   (a) Disconnect the inlet pressure tube (31) nut from the reducer (LP4 port) on the top forward and inboard face of the main oil filter housing (1).
      1) Remove the inlet pressure tube (31) from the engine.
   (b) Disconnect the outlet pressure tube (20) nut from the reducer (LP5 port) on top forward face of the main oil filter housing (1).
      1) Remove the outlet pressure tube (20) from the engine.

S 684-069-N00

(8) Drain the oil from the main oil filter housing (1) (Fig. 402):

(a) Prepare to catch the oil by placing a five gallon container below the main oil filter housing (1) to catch the oil.

(b) Remove the plug from the cover assembly (29).

1) Remove the lockwire from the plug.

2) If applicable, hold the insert with a wrench while you remove the pluge. Remove the plug.

3) Discard the packing (58).

(c) Let the oil fully drain.

S 034-070-N00

(9) Disconnect the inlet tube (LP02) (34) for the air/oil heat exchanger as follows:

(a) Remove the three bolts (34A) that attach the inlet tube (LP02) (34) to the oil-out port of the main oil filter housing (1).

(b) Discard the packing (45).

S 034-071-N00

(10) ENGINES PRE-PW-SB 79-75;
Remove the main filter oil tube (LP01) (35) as follows:

(a) Remove the three bolts (44) that attach the main filter oil tube (LP01) (35) to the oil-in port on the forward left side of the main oil filter housing (1).

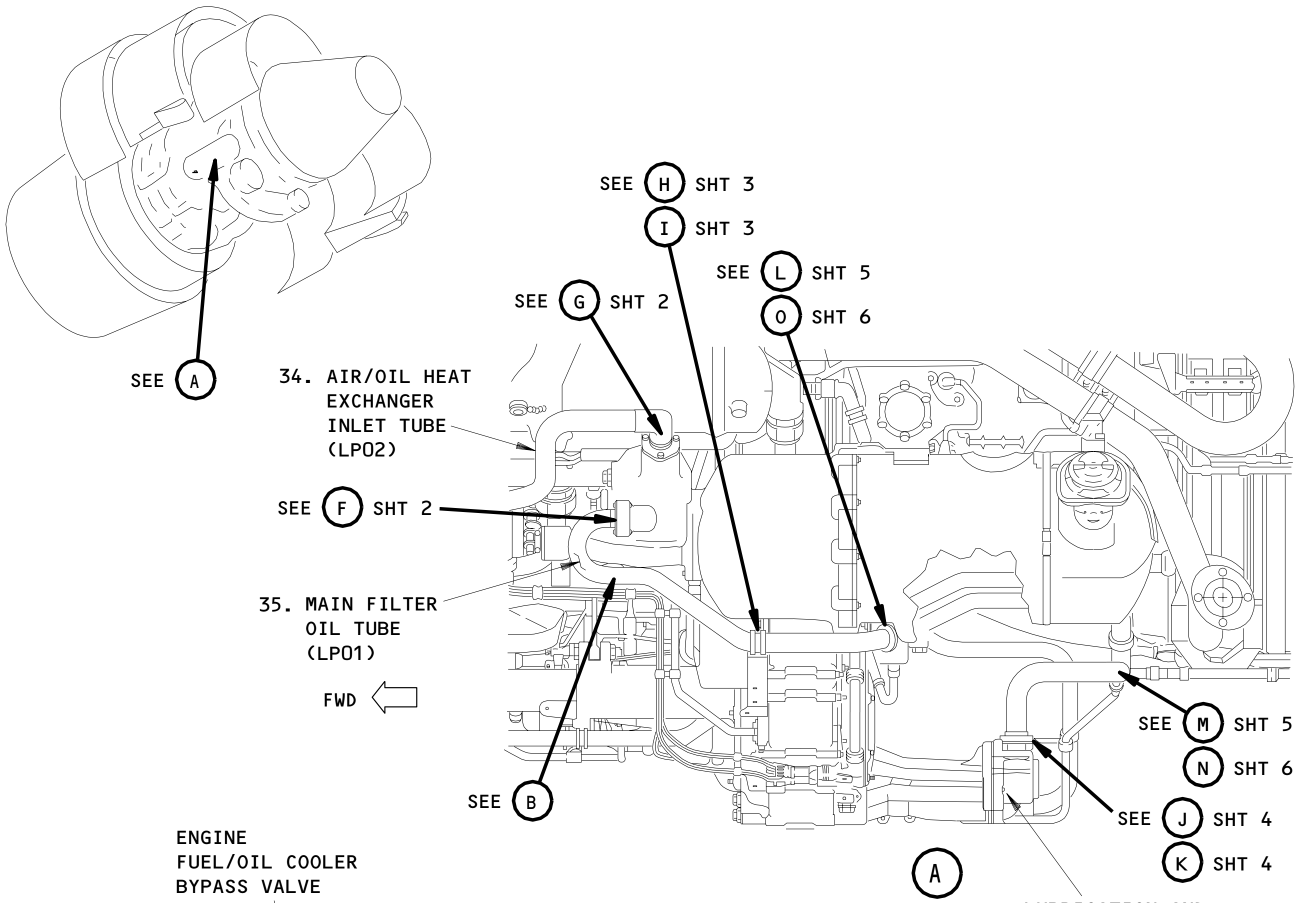
(b) Remove the bolts (48) that attach the main filter oil tube (LP01) (35) and the bracket to the top of the lubrication and scavenge oil pump.

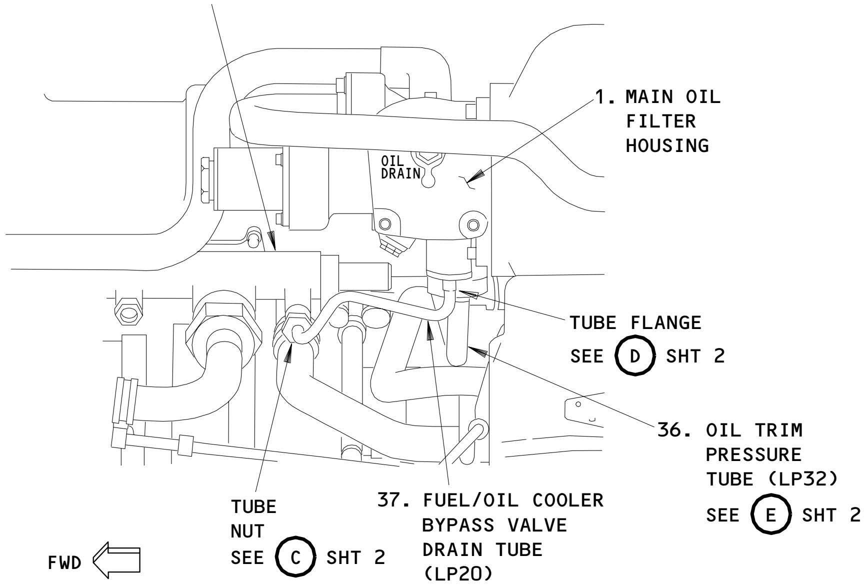
(c) Remove the bolts (46) and nuts (47) that attach the main filter oil tube clamps to the main gearbox bracket at two places (Fig. 402, Views H and J).

(d) Remove the bolts (46) and nuts (47) that attach the clamps and clampshells (for the main filter oil tube) to the scavenge tube clamps for the No. 4 bearing oil and to the diffuser case bracket (Fig. 402, View K).

(e) Remove the main filter oil tube (LP01) (35) from the engine.

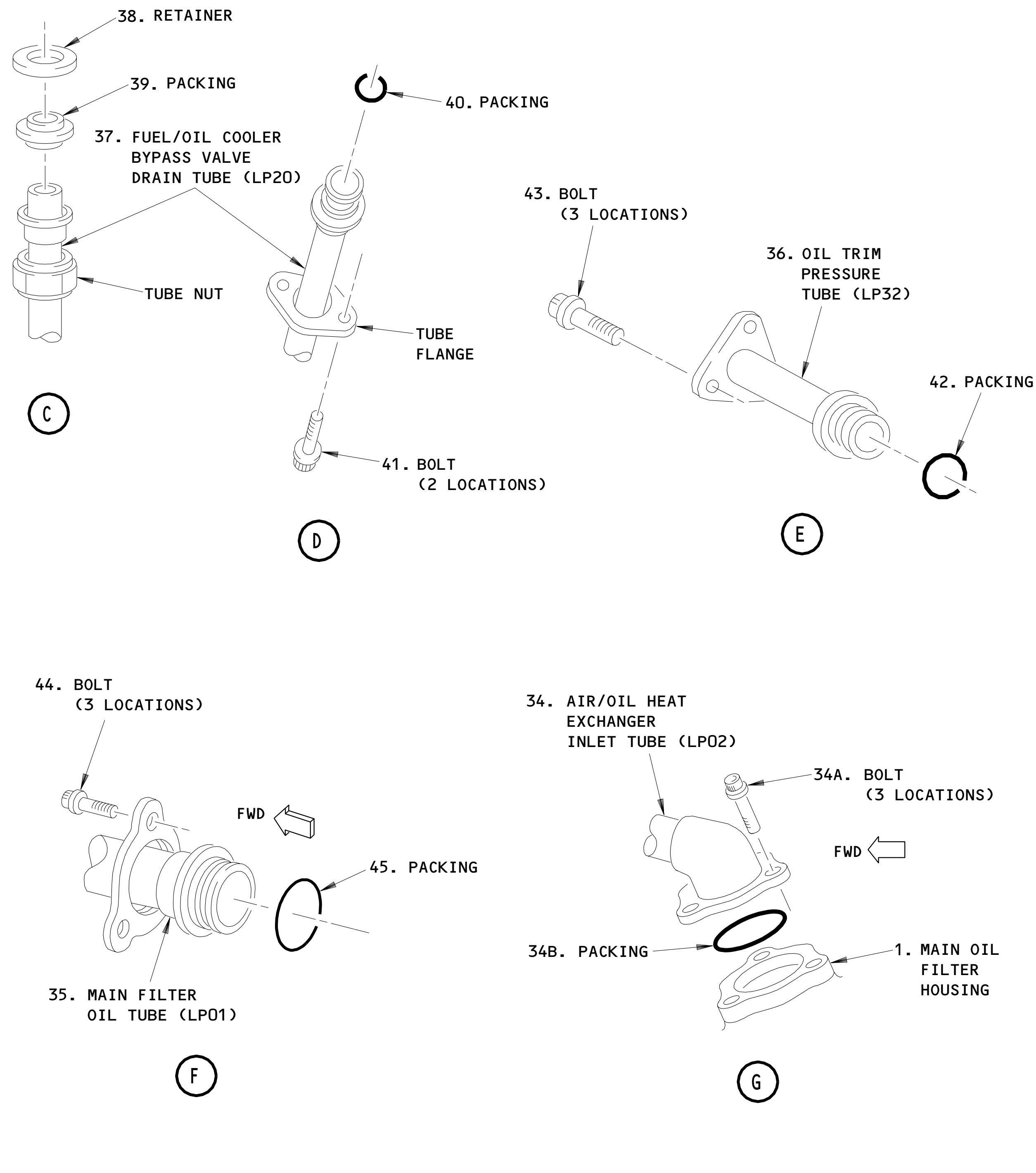
1) Discard the packing (45).



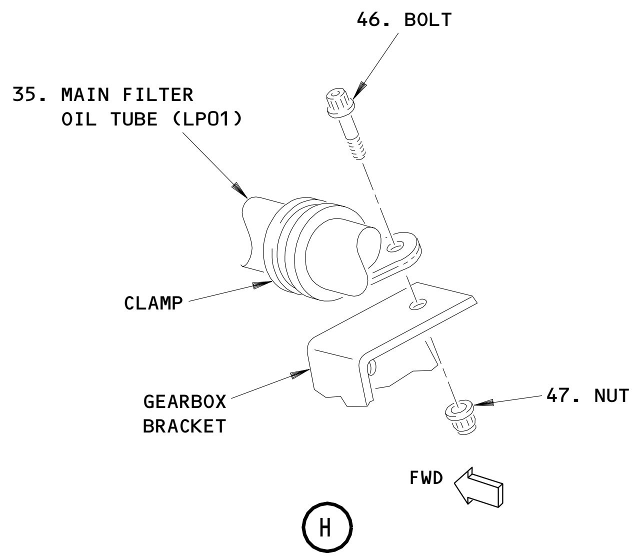


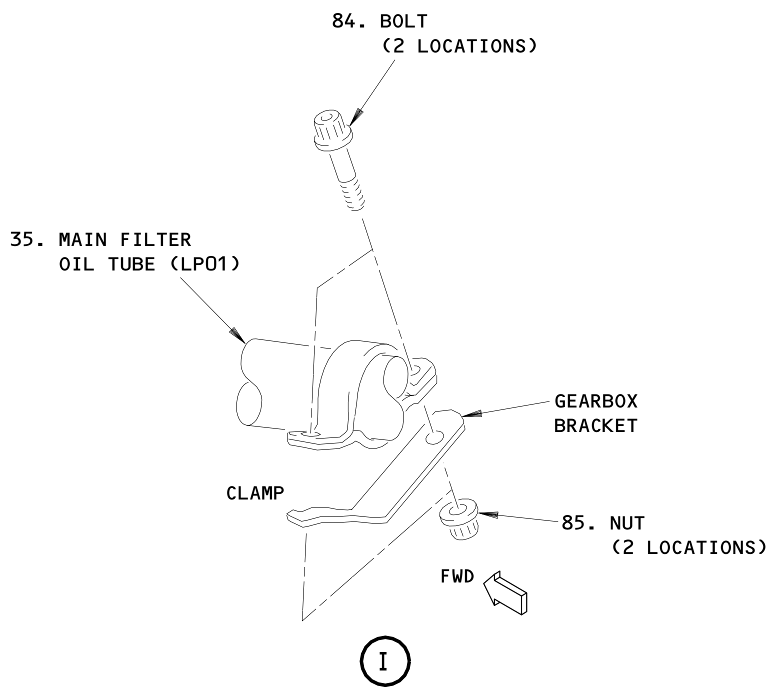
(VIEW IN THE UP DIRECTION)
B

Main Oil Filter Housing and Associated Tubing
Figure 402 (Sheet 1)

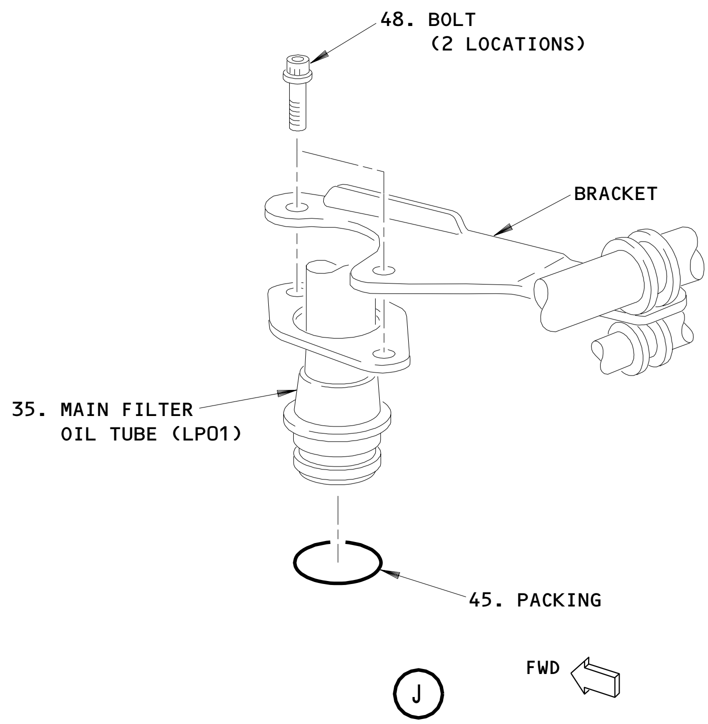


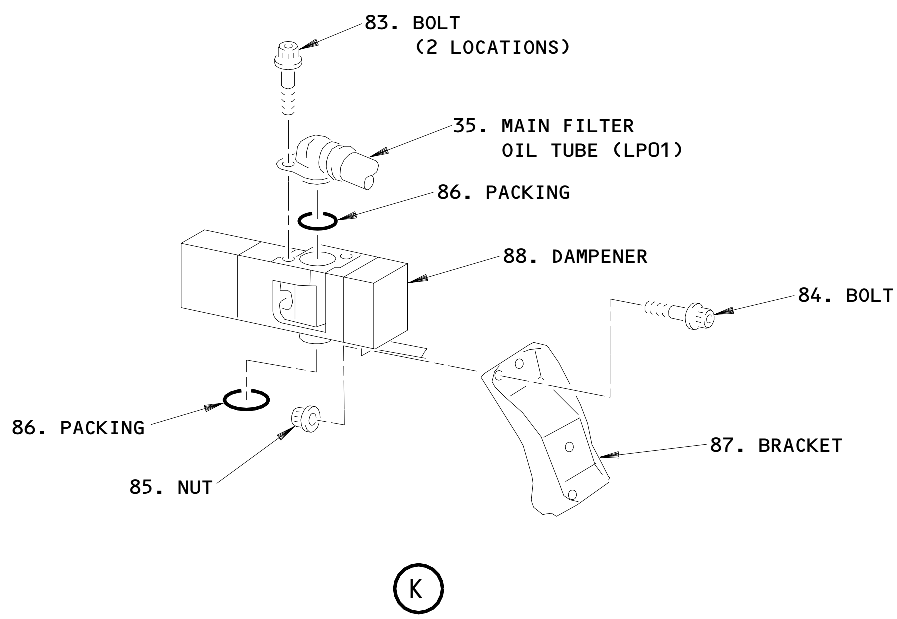
Main Oil Filter Housing and Associated Tubing
Figure 402 (Sheet 2)



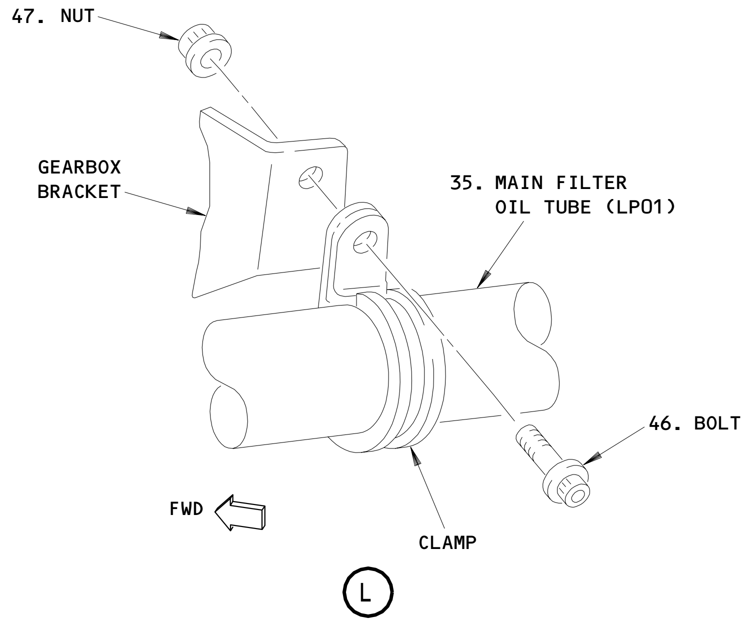


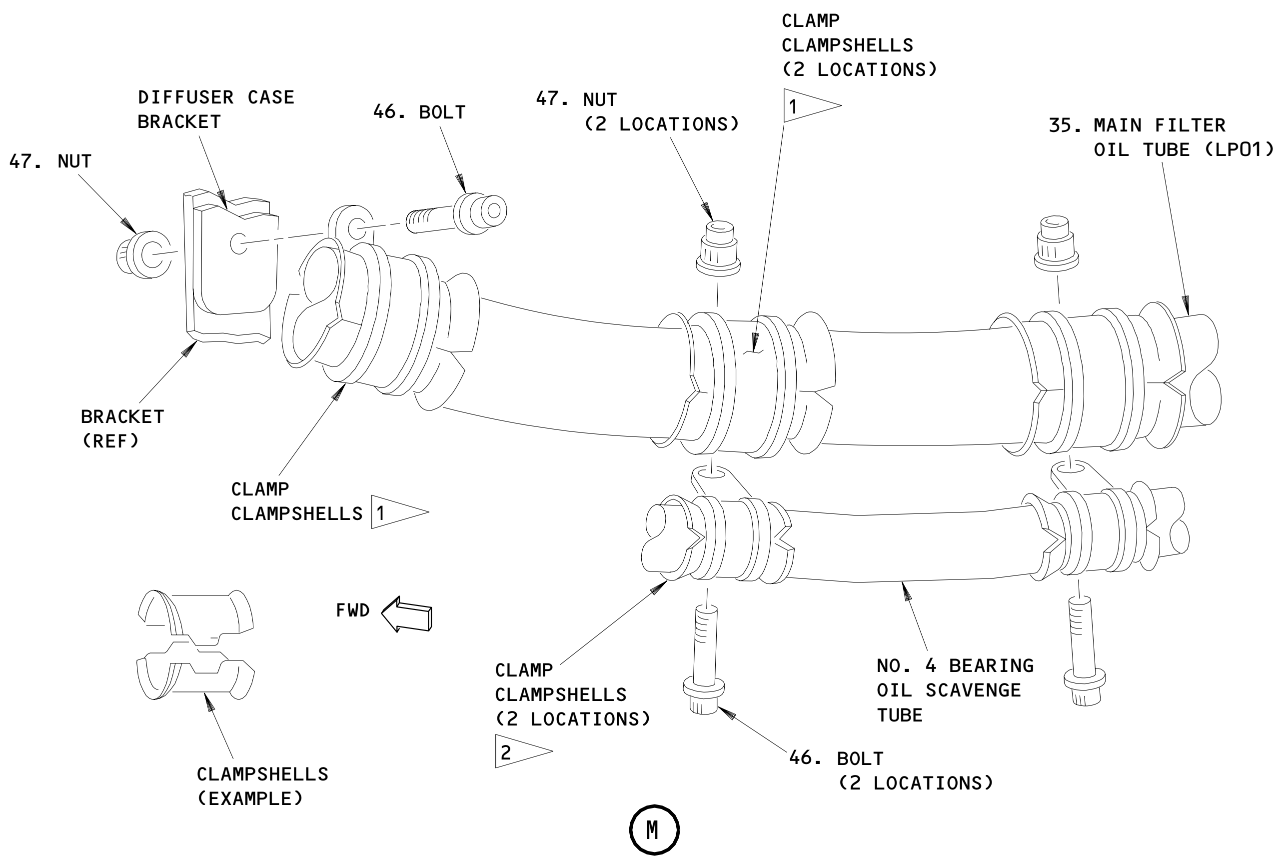
Main Oil Filter Housing and Associated Tubing
Figure 402 (Sheet 3)





Main Oil Filter Housing and Associated Tubing
Figure 402 (Sheet 4)



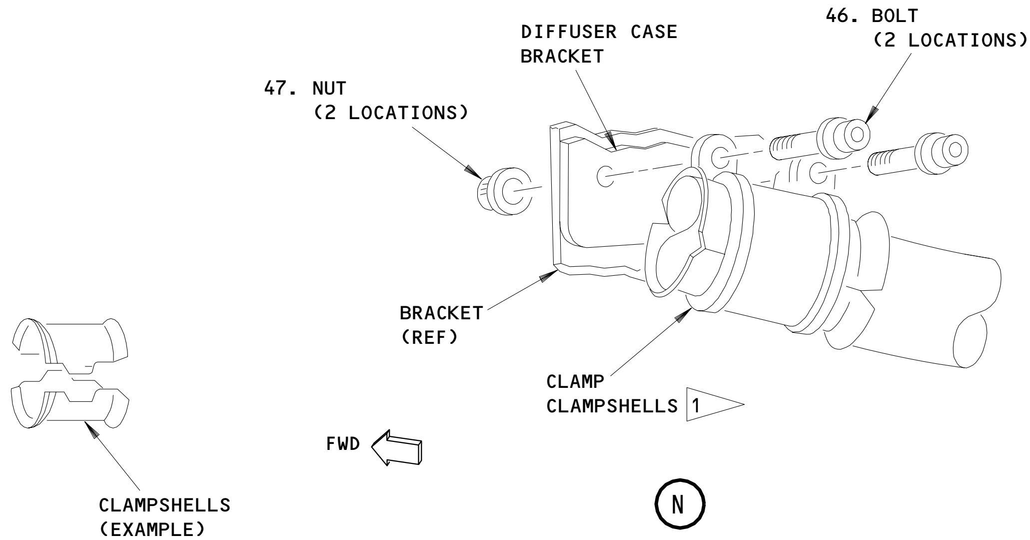


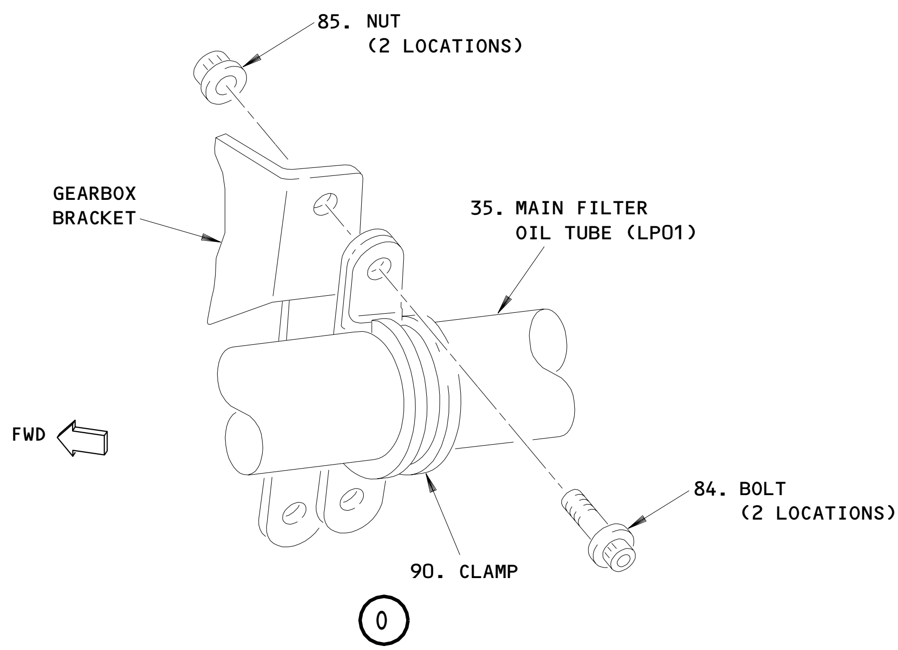
1 CLAMPSHELLS ARE ON ENGINES POST-PW-SB 79-36

2 CLAMPSHELLS ARE ON ENGINES POST-PW-SB 79-46

L-A3458
0689

Main Oil Filter Housing and Associated Tubing
Figure 402 (Sheet 5)

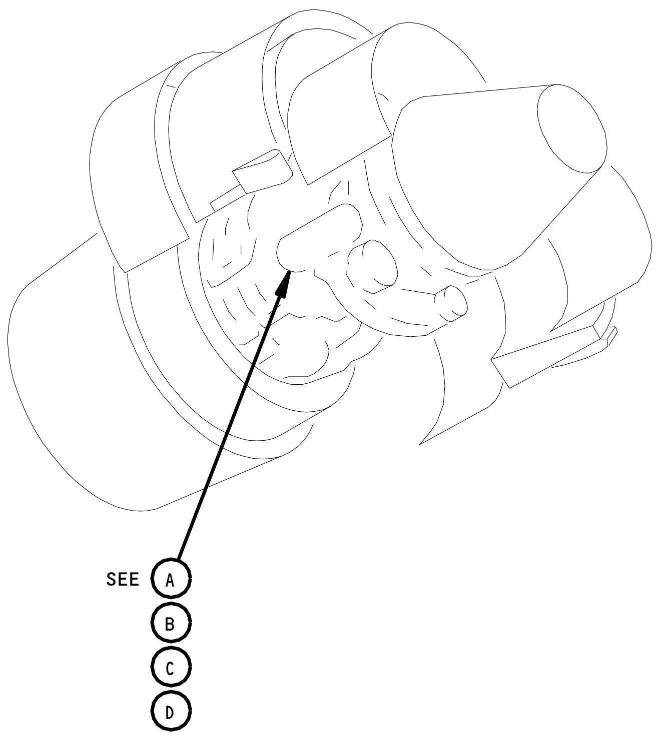




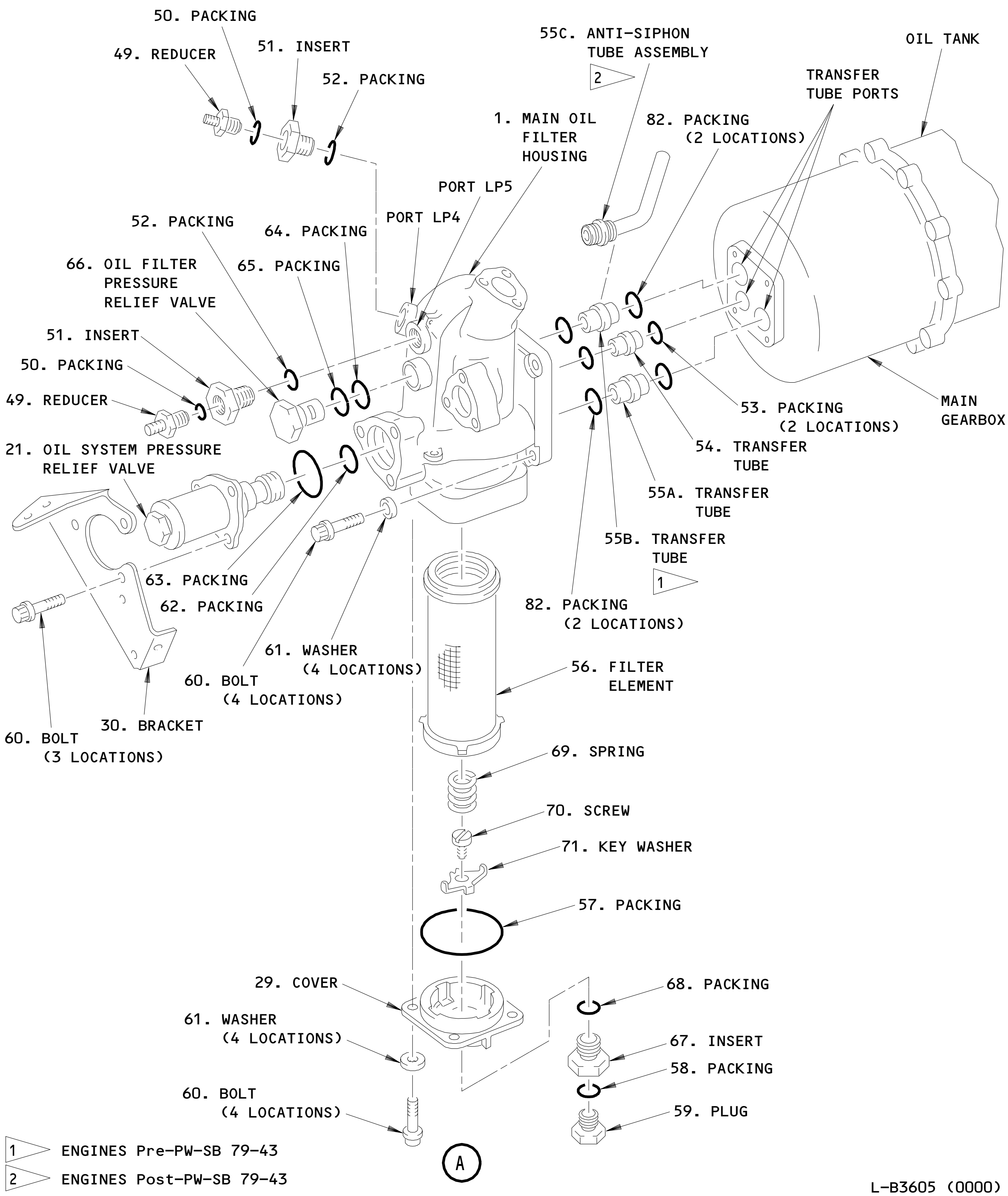
1 CLAMPSHELLS ARE ON ENGINES Post-PW-SB 79-36

L-A3458
0689

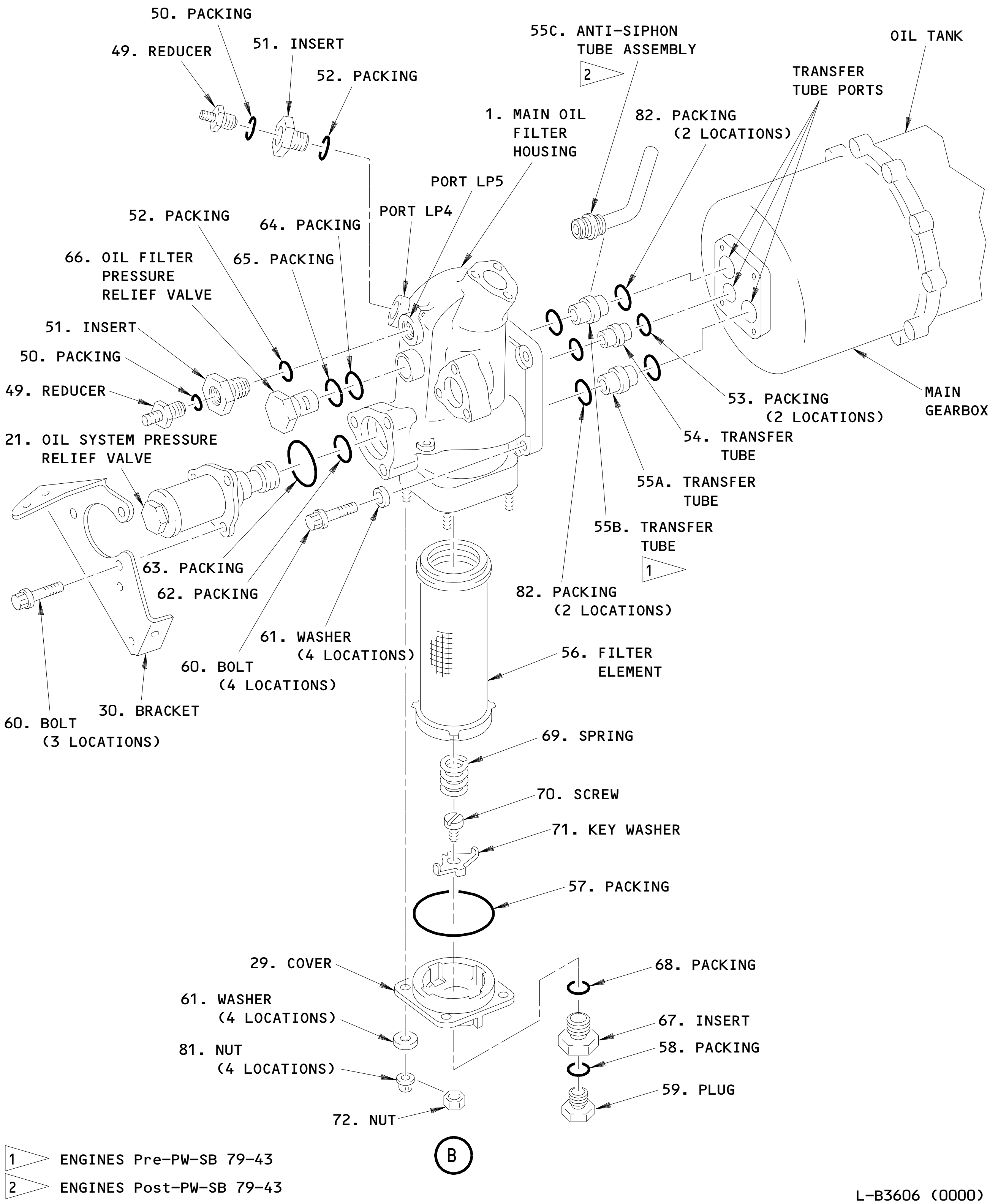
Main Oil Filter Housing and Associated Tubing
Figure 402 (Sheet 6)



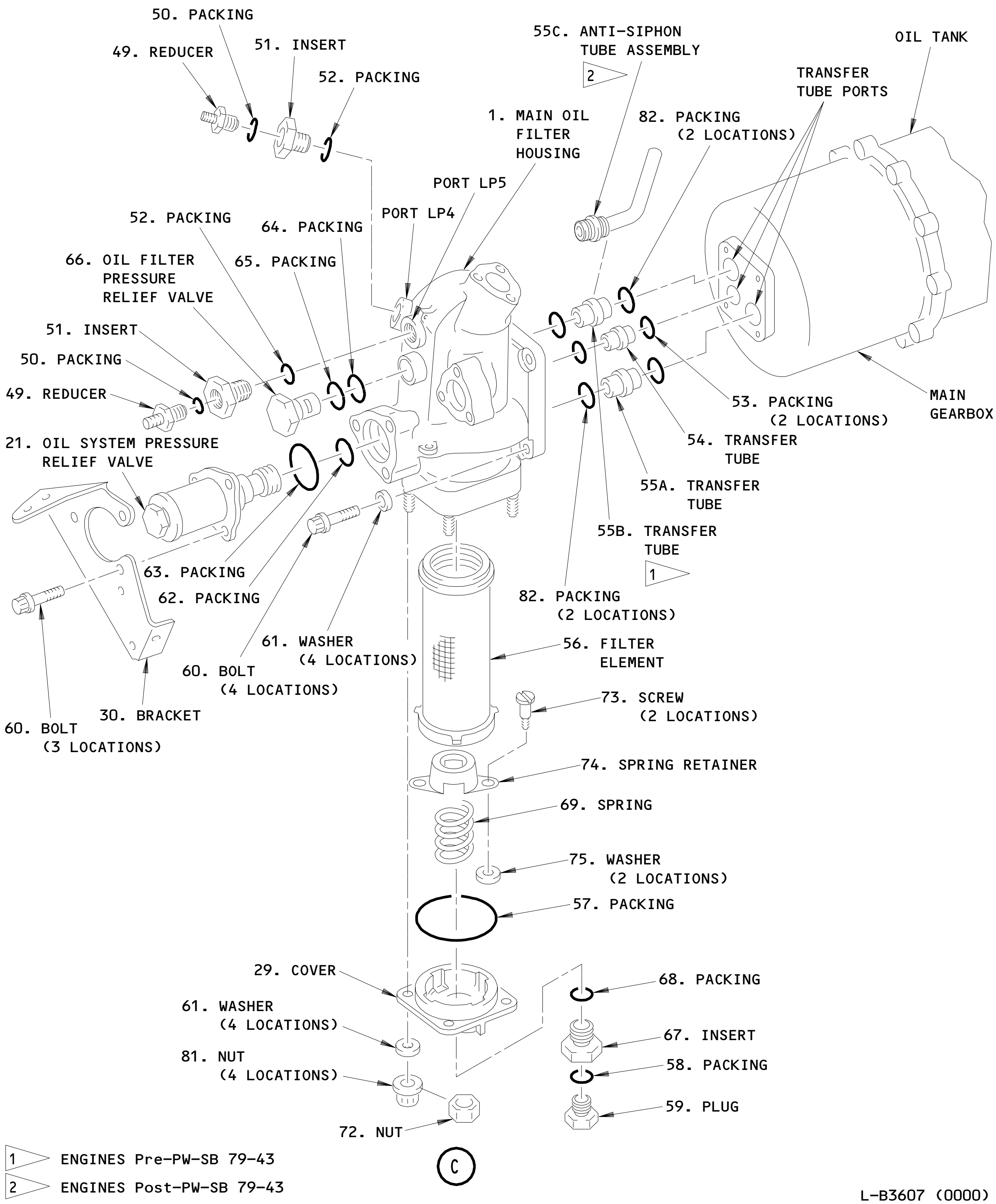
Main Oil Filter Housing Installation
Figure 403 (Sheet 1)



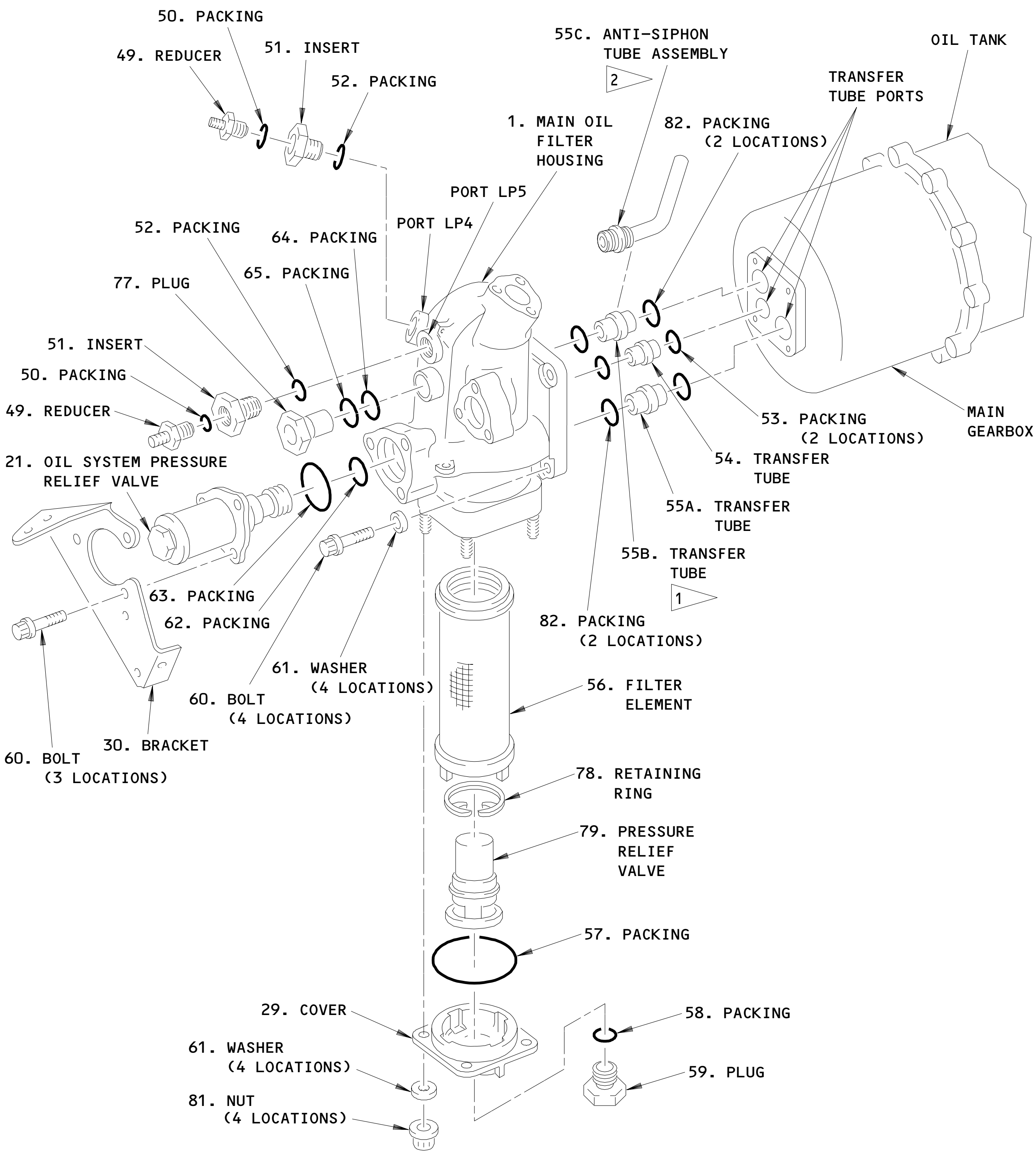
Main Oil Filter Housing Installation
Figure 403 (Sheet 2)



Main Oil Filter Housing Installation
Figure 403 (Sheet 3)



Main Oil Filter Housing Installation
Figure 403 (Sheet 4)



1 ENGINES Pre-PW-SB 79-43
2 ENGINES Post-PW-SB 79-43

L-B3608 (0000)

Main Oil Filter Housing Installation
Figure 403 (Sheet 5)

S 034-100-N00

(11) ENGINES POST-PW-SB 79-75;
Remove the main filter oil tube (LP01) (35) as follows:

(a) Remove the three bolts (44) that attach the main filter oil tube (LP01) (35) to the oil-in port on the forward left side of the main oil filter housing (1).
(b) Remove the bolts (83) that attach the main filter oil tube (LP01) (35) to the top of the fluid pressure dampener (88).
(c) Remove the bolts (46) and nuts (47) that attach the main filter oil tube clamps to the main gearbox bracket at two places (Fig. 402, Views H and J).
(d) Remove the bolts (46) and nuts (47) that attach the clamps and clampshells (for the main filter oil tube) to the scavenge tube clamps for the No. 4 bearing oil and to the diffuser case bracket at approximately the 7 o'clock position (Fig. 402, View K).
(e) Remove the main filter oil tube (LP01) (35) from the engine.
    1) Discard the packing (45).
(f) If necessary, remove the fluid pressure dampener (88) as follows:
    1) Remove the bolts (TBD) that attach the fluid pressure dampener (88) to the top of the main oil pump.
    2) Remove the bolts (84) and nuts (85) that attach the fluid pressure dampener (88) to the loop clamp bracket (87).
    3) Remove the fluid pressure dampener (88).
    4) Discard the packing (86).

S 034-104-N00

(12) ENGINES POST-PW-SB 79-86;
Remove the main filter oil tube (LP01) (35) as follows:

(a) Remove the three bolts (44) that attach the main filter oil tube (LP01) (35) to the oil-in port on the forward left side of the main oil filter housing (1).
(b) Remove the bolts (83) that attach the main filter oil tube (LP01) (35) to the top of the fluid pressure adapter (tbd).
(c) Remove the bolts (46) and nuts (47) that attach the main filter oil tube clamps to the main gearbox bracket at two places (Fig. 402, Views H and J).
(d) Remove the bolts (46) and nuts (47) that attach the clamps and clampshells (for the main filter oil tube) to the scavenge tube clamps for the No. 4 bearing oil and to the diffuser case bracket at approximately the 7 o'clock position (Fig. 402, View K).
(e) Remove the main filter oil tube (LP01) (35) from the engine.
    1) Discard the packing (45).
(f) If necessary, remove the fluid pressure adapter (tbd) as follows:
    1) Remove the bolts (TBD) that attach the fluid pressure adapter (tbd) to the top of the main oil pump.

2) Remove the bolts (84) and nuts (85) that attach the fluid pressure adapter (tbd) to the loop clamp bracket (87).
3) Remove the fluid pressure adapter (tbd).
4) Discard the packing (86).

S 034-072-N00
(13) Remove the bypass valve drain tube (LP20) (37) for the fuel/oil cooler:
(a) Remove the bolts (41) that attach the drain tube (LP20) (37) to the lower inboard "SERVO" port on the main oil filter housing (1).
(b) Disconnect the drain tube nut from the bypass valve.
(c) Remove the drain tube (LP20) (37) from the engine.
(d) Discard the packings (39), (40) and the retainer (38).

S 034-073-N00
(14) Disconnect the oil trim pressure tube assembly (LP32) (36):
(a) ENGINES PRE-PW-SB 72-211;
Do these steps that follow:
1) Remove the bolts (46) and nuts (47) that attach the oil trim pressure tube (LP32) to the bracket behind the fuel/oil cooler.
(b) ENGINES POST-PW-SB 72-211;
Do these steps that follow:
1) Remove the bolts (46) and nuts (47) that attach the oil trim pressure tube (LP32) to the No. 3 bearing pressure manifold.
(c) Remove the bolts (43) that attach the oil trim pressure tube (LP32) to the top inboard "TRIM" port on the main oil filter housing (1).
(d) Disconnect the oil trim pressure tube assembly (LP32) (36) from the main oil filter housing (1).
(e) Discard the packing (42).

S 024-074-N00
(15) Remove the main oil filter housing (1) from the main gearbox:
(a) Remove the bolts (60) and washers (61) that attach the main oil filter housing (1) to the forward face of the main gearbox.
(b) Remove the main oil filter housing (1) from the engine.

S 034-103-N00
(16) Remove the transfer tubes and, if applicable, the anti-siphon tube assembly as follows:
(a) ENGINES PRE-PW-SB 79-43;
Remove the three transfer tubes (54, 55A, and 55B) from the transfer tube ports in the main gearbox.
(b) ENGINES POST-PW-SB 79-43;
Remove the transfer tubes (54 and 55A) and the anti-siphon tube assembly (55C) from the transfer tube ports in the main gearbox.
(c) Discard the packings (45 and 53).

S 034-087-N00

(17) ENGINES PRE-PW-SB 72-524;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View L):

(a) Remove the pressure relief valve (66) for the oil filter from the main oil filter housing (1).
   1) Discard the packings (64 and 65).

(b) Remove the reducers (49), inserts (51), and packings (50 and 52) from the LP4 and LP5 ports on the top forward and inboard face of the main oil filter housing (1).
   1) Discard the packings (50 and 52).

(c) Remove the plug (59) and insert (67) from the bottom port in the main oil strainer cover.
   1) Discard the packings (58 and 68).

WARNING: CAREFULLY REMOVE THE MAIN OIL FILTER COVER. THE MAIN OIL FILTER COVER HAS SPRING PRESSURE ON IT. INJURY TO PERSONS CAN OCCUR WHEN YOU REMOVE IT.

(d) Remove the bolts (60) and washers (61) that attach the main oil filter cover (29) to the main oil filter housing (1).
   1) Remove the cover (29).
   2) Discard the packing (57).

(e) Remove the filter element (56) from the main oil filter housing (1).
   1) Discard the filter element (56).

(f) Remove the screw (70), spring (69), and keywasher (71) from the cover (29).
   1) Remove and discard the keywasher (71).

(g) Remove the oil system pressure relief valve (21).
   1) Remove the bolts (60) that attach the bracket (30) and pressure relief valve (21) to the main oil filter housing (1).
   2) Remove the bracket (30), and the pressure relief valve (21).
   3) Discard the packings (62 and 63).

S 034-097-N00

(18) ENGINES POST-PW-SB 72-524 AND PRE-PW-SB 79-79;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View M):

(a) Remove the pressure relief valve (66) for the oil filter from the main oil filter housing (1).
   1) Discard the packings (64 and 65).

(b) Remove the reducers (49), inserts (51), and packings (50 and 52) from the LP4 and LP5 ports on the top forward and inboard face of the main oil filter housing (1).
   1) Discard the packings (50 and 52).

(c) Remove the plug (59) and insert (67) from the bottom port in the main oil strainer cover.
   1) Discard the packings (58 and 68).

WARNING: CAREFULLY REMOVE THE MAIN OIL FILTER COVER. THE MAIN OIL FILTER COVER HAS SPRING PRESSURE ON IT. INJURY TO PERSONS CAN OCCUR WHEN YOU REMOVE IT.

(d) Remove the nuts (81 or 72) and washers (61) that attach the main oil filter cover (29) to the main oil filter housing (1).
   1) Remove the cover (29).
   2) Discard the packing (57).
(e) Remove the filter element (56) from the main oil filter housing (1).
   1) Discard the filter element (56).
(f) Remove the screw (70), spring (69), and keywasher (71) from the cover (29).
   1) Remove and discard the keywasher (71).
(g) Remove the oil system pressure relief valve (21).
   1) Remove the bolts (60) that attach the bracket (30) and pressure relief valve (21) to the main oil filter housing (1).
   2) Remove the bracket (30), and the pressure relief valve (21).
   3) Discard the packings (62 and 63).

S 034-089-N00
(19) ENGINES POST-PW-SB 72-524 AND POST-PW-SB 79-79;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View N):
(a) Remove the the pressure relief valve (66) for the oil filter from the main oil filter housing (1).
   1) Discard the packings (64 and 65).
(b) Remove the reducers (49), inserts (51), and packings (50 and 52) from the LP4 and LP5 ports on the top forward and inboard face of the main oil filter housing (1).
   1) Discard the packings (50 and 52).
(c) Remove the plug (59) and insert (67) from the bottom port in the main oil strainer cover.
   1) Discard the packings (58 and 68).

WARNING: CAREFULLY REMOVE THE MAIN OIL FILTER COVER. THE MAIN OIL FILTER COVER HAS SPRING PRESSURE ON IT. INJURY TO PERSONS CAN OCCUR WHEN YOU REMOVE IT.

(d) Remove the bolts (81 or 72) and washers (61) that attach the main oil filter cover (76) to the main oil filter housing (1).
   1) Remove the cover (76).
   2) Discard the packing (57).

(e) Remove the filter element (56) from the main oil filter housing (1).
   1) Discard the filter element (56).
(f) Remove the two screws (73) and washers (75) which hold the spring retainer (74) and spring (69) to the cover (76).
(g) Remove the oil system pressure relief valve (21).
   1) Remove the bolts (60) that attach the bracket (30) and pressure relief valve (21) to the main oil filter housing (1).
   2) Remove the bracket (30), and the pressure relief valve (21).
   3) Discard the packings (62 and 63).

S 034-088-N00

(20) ENGINES POST-PW-SB 72-525;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View O):
(a) Remove the the plug (77) from the main oil filter housing (1).
   1) Discard the packings (64 and 65).
(b) Remove the reducers (49), inserts (51), and packings (50 and 52) from the LP4 and LP5 ports on the top forward and inboard face of the main oil filter housing (1).
   1) Discard the packings (50 and 52).

WARNING: CAREFULLY REMOVE THE MAIN OIL FILTER COVER. THE MAIN OIL FILTER COVER HAS SPRING PRESSURE ON IT. INJURY TO PERSONS CAN OCCUR WHEN YOU REMOVE IT.

(c) Remove the nuts (81) and washers (61) that attach the main oil filter cover (80) to the main oil filter housing (1).
   1) Remove the cover (80).
   2) Discard the packing (57).
(d) Remove the filter element (56) from the main oil filter housing (1).
   1) Discard the filter element (56).
(e) Remove the retaining ring (78) from the pressure relief valve (79).
(f) Remove the pressure relief valve (79) from the cover (80).
(g) Remove the oil system pressure relief valve (21).
   1) Remove the bolts (60) that attach the bracket (30) and pressure relief valve (21) to the main oil filter housing (1).
   2) Remove the bracket (30), and the pressure relief valve (21).
   3) Discard the packings (62 and 63).

TASK 72-61-11-404-024-N00

3. Install the Main-Oil-Filter Housing

A. Equipment

(1) M303, M305 or M307 Bergen Mechanical Crimper
Bergen Cable Technologies Inc
170 Gregg St
P. O. Box 1300
Lodi, NJ 07644-9982

B. Consumable Materials

(1) D00390 Oil - Engine
(2) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) AS3214-02
(3) G02335 Cable, Safety (P05-291)
(4) G02332 Ferrule, Safety Cable (P05-292)
(5) D50124 Paste - Anti-Size, P06-054

C. Parts

AMM		NOMENCLATURE	AIPC		
FIG	ITEM		SUBJECT	FIG	ITEM
401	1	Main Oil Filter Housing (POST-PW-SB 79-43)	72-61-11	05	55 55J
402	34B	Packing	79-21-01	20	40
	39	Packing	79-21-51	05	95
	40	Packing			90
	42	Packing	79-21-01	20	55
	45	Packing	79-21-05	05	30
	86	Packing			32
403	50	Packing	72-61-11	05	20
	52	Packing (PRE-PW-SB 79-70)			30
	52	Packing (POST-PW-SB 79-70)	79-21-06	01	155
	53	Packing	72-61-11	05	45
	56	Filter Element	79-21-06	01	60
	57	Packing			40
	58	Packing			10
	62	Packing			105
	63	Packing			100
	64	Packing			120
	65	Packing			115
	68	Packing			20
	82	Packing	72-61-11	05	35

D. References
(1) AMM 12-13-01/301, Oil Servicing
(2) AMM 71-11-04/201, Fan Cowl Panels
(3) AMM 71-11-06/201, Core Cowl Panels
(4) AMM 78-31-00/201, Thrust Reverser System
(5) AMM 79-21-05/401, Main Oil Filter
(6) AMM 79-21-06/401, Main Oil Filter Bypass Valve
(7) AMM 79-21-07/401, Oil System Pressure (Regulator) Relief Valve

E. Access
(1) Location Zone
410 Left Engine
420 Right Engine

(2) Access Panels
413/423 Fan Cowl Panel (LH)
414/424 Fan Cowl Panel (RH)
415/425 Fan Reverser (LH)
416/426 Fan Reverser (RH)
417/427 Core Cowl (LH)
418/428 Core Cowl (RH)

F. Procedure

S 434-090-N00

(1) ENGINES PRE-PW-SB 72-524;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View L):

(a) Install the spring on the key washer.
   1) Align the bolt hole and put the key washer (71) in the center of the cover with the tab of the key washer in the mating hole in the cover.
   2) Install the key washer (71) with the screw (70) lubricated with engine oil.
   3) Tighten the screw to 36-40 pound-inches (4.1-4.5 newton-meters).
   4) Install the spring on the key washer by bending the tabs of the washer out between the coils of the spring.

CAUTION: MAKE SURE THAT THE REMOVABLE PLUG IS IN THE END CAP OF THE FILTER ELEMENT. IF THE PLUG IS NOT THERE, THE ELEMENT WILL NOT OPERATE CORRECTLY.

(b) Install the filter element (56), with the plugged end outward, into the main oil filter housing (1).
(c) Install the packing (57), lubricated with engine oil, in the groove in the cover (29).

CAUTION: MAKE SURE YOU INSTALL THE COVER CORRECTLY. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

CAUTION: DO NOT USE THE BOLTS TO MOVE THE COVER INTO THE MAIN OIL FILTER HOUSING. IF YOU DO THAT, DAMAGE TO THE PACKING CAN OCCUR.

(d) Put the cover (29) on the main oil filter housing (1), with the drain opening in the cover away from the engine.
(e) Align the bolt holes with the holes in the cover (29) as you fully install it into the main oil filter housing (1).

CAUTION: MAKE SURE YOU TIGHTEN THE BOLTS TO THE CORRECT TORQUE. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

(f) Install the bolts (60) and washers (61) to attach the cover (29).
   1) Tighten the bolts (60) to 125-140 pound-inches (14.1-15.8 newton-meters).
(g) Lubricate the packing (58) and the threads of the plug (59) with engine oil.

(h) Lubricate the packing (68) and the threads of the insert (67) with engine oil.

(i) Install the insert (67) and the packing (68) in the cover (29).

1) Tighten the insert to 200-225 pound-inches (22.6-25.4 newton-meters).

(j) Install the plug (59) and the packing (58) in the cover (29).

1) While you hold the insert with a wrench on the flats, tighten the plug (59) to 110-120 pound-inches (12.4-13.6 newton-meters).

2) Install lockwire or safety cable and safety cable ferrule on the plug (59).

(k) Lubricate the packings (52) and the insert threads (51) with engine oil.

(l) Install the packings (52) on the inserts (51).

(m) Install the inserts (51) to the LP4 and LP5 ports.

1) Tighten the inserts (51) to 200-225 pound-inches (22.6-25.4 newton-meters).

(n) Lubricate the packings (50) and the reducer threads (49) with engine oil.

(o) Install the packings (50) on the reducers (49).

(p) Install the reducers (49) in the inserts on the LP4 and LP5 ports.

1) Tighten the reducers (49) to 110-120 pound-inches (12.4-13.6 newton-meters).

(q) Install the oil filter pressure relief valve (66) to the main oil filter housing (1):

1) Install the packings (64 and 65), lubricated with engine oil, in the groove in the pressure relief valve (66).

2) Install the pressure relief valve (66) to the main oil filter housing (1).

3) Tighten the the pressure relief valve (66) to 525-625 pound-inches (59.3-70.6 newton-meters).

4) Install lockwire or safety cable and safety cable ferrule on the pressure relief valve (66).

(r) Install the oil system pressure relief valve (21) to the port on the main oil filter housing:

NOTE: This port is below the oil filter pressure relief valve (66).

1) Install the packings (62 and 63), lubricated with engine oil, in the groove in the pressure relief valve (21).

2) Align the boltholes of the pressure relief valve (21) and of the bracket (30) with those of the main oil filter housing (1).
   a) Install the bolts (60).
   b) Tighten the bolts (60) to 125-140 pound-inches (14.1-15.8 newton-meters).
   c) Install the lockwire or safety cable and safety cable ferrule.

S 434-091-N00

(2) ENGINES POST-PW-SB 72-524 AND PRE-PW-SB 79-79;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View M):

(a) Install the spring on the key washer.
   1) Align the bolt hole and position the keywasher (71) in the center of the cover (29) with the tab of the keywasher in the mating hole in the cover.
   2) Install the keywasher (71) with the screw (70) lubricated with engine oil.
   3) Tighten the screw (70) to 36-40 pound-inches (4.1-4.5 newton-meters).
   4) Install the spring (69) on the keywasher.
   5) Bend the tabs of the keywasher out between the coils of the spring.

CAUTION: MAKE SURE THAT THE REMOVABLE PLUG IS IN THE END CAP OF THE FILTER ELEMENT. IF THE PLUG IS NOT THERE, THE ELEMENT WILL NOT OPERATE CORRECTLY.

(b) Install the filter element (56), with the plugged end outward, into the main oil filter housing (1).

(c) Install the packing (57), lubricated with engine oil, in the groove in the cover (29).

CAUTION: MAKE SURE YOU INSTALL THE COVER CORRECTLY. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

CAUTION: DO NOT USE THE NUTS TO MOVE THE COVER INTO THE MAIN OIL FILTER HOUSING. IF YOU DO THAT, DAMAGE TO THE PACKING CAN OCCUR.

(d) Put the cover (29) on the main oil filter housing (1), with the drain opening in the cover away from the engine.

CAUTION: MAKE SURE YOU TIGHTEN THE NUTS TO THE CORRECT TORQUE. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

(e) Install the nuts (81 or 72) and washers (61) to attach the cover (29).
   1) Lubricate the threads with engine oil.
   2) If self-locking nuts (81) are used, tighten the nuts to 150-170 pound inches (16.9-19.2 newton-meters).
   3) If hex nuts (72) with lockwire provisions are used, tighten the nuts to 125-150 pound-inches (14.1-16.9 newton-meters) and install lockwire.

(f) Lubricate the packing (68) and the threads of the insert (67) with engine oil.

(g) Install the insert (67) and the packing (68) in the cover (29).
   1) Tighten the insert to 200-225 pound-inches (22.6-25.4 newton-meters).

(h) Lubricate the packing (58) and the threads of the plug (59) with engine oil.

(i) Install the plug (59) and the packing (58) in the insert (67).
   1) While you hold the insert with a wrench on the flats, tighten the plug (59) to 110-120 pound-inches (12.4-13.6 newton-meters).
   2) Install lockwire or safety cable and safety cable ferrule on the plug (59).

(j) Lubricate the packings (50 and 52) with engine oil.

(k) Lubricate the packings (52) and the insert threads (51) with engine oil.

(l) Install the packings (52) on the inserts (51).

(m) Install the inserts (51) to the LP4 and LP5 ports.
   1) Tighten the inserts (51) to 200-225 pound-inches (22.6-25.4 newton-meters).

(n) Lubricate the packings (50) and the reducer threads (49) with engine oil.

(o) Install the packings (50) on the reducers (49).
(p) Install the reducers (49) in the inserts on the LP4 and LP5 ports.
 1) Tighten the reducers (49) to 110-120 pound-inches (12.4-13.6 newton-meters).
(q) Install the pressure relief valve (66) of the oil filter to the main oil filter housing (1):
 1) Install the packings (64 and 65), lubricated with engine oil, in the groove in the pressure relief valve (66).
 2) Install the pressure relief valve (66) to the main oil filter housing (1).
 3) Tighten the the pressure relief valve (66) to 525-625 pound-inches (59.3-70.6 newton-meters).
 4) Install lockwire or safety cable and safety cable ferrule on the pressure relief valve (66).
(r) Install the pressure relief valve (21) to the port on the main oil filter housing:

NOTE: This port is below the oil filter pressure relief valve (66).

 1) Install the packings (62 and 63), lubricated with engine oil, in the groove in the pressure relief valve (21).
 2) Align the boltholes of the pressure relief valve (21) and of the bracket (30) with those of the main oil filter housing (1).
  a) Install the bolts (60).
  b) Tighten the bolts (60) to 125-140 pound-inches (14.1-15.8 newton-meters).
  c) Install lockwire or safety cable and safety cable ferrule.

S 434-092-N00
(3) ENGINES POST-PW-SB 72-524 AND POST-PW-SB 79-79;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View N):

(a) Install the spring (69) in the spring retainer (74).
(b) Install two screws (73) through the spring retainer screw holes and install two washers (75) on the ends of the two screws.
(c) Lubricate the threads of the two screws (73) with engine oil.
(d) With the spring in position in the spring retainer, install the two screws (73) into the cover (29).
  1) Tighten the screws to 36-40 pound-inches (4.1-4.5 newton-meters).
(e) Install the packing (57), lubricated with engine oil, in the groove in the cover (29).

CAUTION: MAKE SURE THAT THE REMOVABLE PLUG IS REMOVED FROM THE END CAP OF THE FILTER ELEMENT. IF THE PLUG IS IN PLACE, THE ELEMENT WILL NOT OPERATE CORRECTLY.

(f) Install the filter element (56) into the cover (29).
  1) Align the tabs on the end of the filter element with the slots in the inside of the cover.

CAUTION: MAKE SURE YOU INSTALL THE COVER CORRECTLY. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

CAUTION: DO NOT USE THE NUTS TO MOVE THE COVER INTO THE MAIN OIL FILTER HOUSING. IF YOU DO THAT, DAMAGE TO THE PACKING CAN OCCUR.

(g) Put the cover (29) on the main oil filter housing (1), with the drain opening in the cover away from the engine.

CAUTION: MAKE SURE YOU TIGHTEN THE NUTS TO THE CORRECT TORQUE. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

(h) Install the nuts (81 or 72) and washers (61) to attach the cover (76).
  1) Lubricate the threads with engine oil.

2) If self-locking nuts (81) are used, tighten the nuts to 150-170 pound inches (16.9-19.2 newton-meters).
3) If hex nuts (72) with lockwire provisions are used, tighten the nuts to 125-150 pound-inches (14.1-16.9 newton-meters) and install lockwire or safety cable and safety cable ferrule.

(i) Lubricate the packing (68) and the threads of the insert (67) with engine oil.
(j) Install the insert (67) and the packing (68) in the cover (29).
1) Tighten the insert to 200-225 pound-inches (22.6-25.4 newton-meters).
(k) Lubricate the packing (58) and the threads of the plug (59) with engine oil.
(l) Install the plug (59) and the packing (58) in the cover (29).
1) While you hold the insert with a wrench on the flats, tighten the plug (59) to 110-120 pound-inches (12.4-13.6 newton-meters).
2) Install lockwire or safety cable and safety cable ferrule on the plug (59).
(m) Lubricate the packings (50 and 52) with engine oil.
(n) Lubricate the packings (52) and the insert threads (51) with engine oil.
(o) Install the packings (52) on the inserts (51).
(p) Install the inserts (51) to the LP4 and LP5 ports.
1) Tighten the inserts (51) to 200-225 pound-inches (22.6-25.4 newton-meters).
(q) Lubricate the packings (50) and the reducer threads (49) with engine oil.
(r) Install the packings (50) on the reducers (49).
(s) Install the reducers (49) in the inserts on the LP4 and LP5 ports.
1) Tighten the reducers (49) to 110-120 pound-inches (12.4-13.6 newton-meters).
(t) Install the pressure relief valve (66) of the oil filter to the main oil filter housing (1):
1) Install the packings (64 and 65), lubricated with engine oil, in the groove in the pressure relief valve (66).

2) Install the pressure relief valve (66) to the main oil filter housing (1).
3) Tighten the the pressure relief valve (66) to 525-625 pound-inches (59.3-70.6 newton-meters).
4) Install lockwire or safety cable and safety cable ferrule on the pressure relief valve (66).

(u) Install the pressure relief valve (21) of the oil system to the port on the main oil filter housing:

NOTE: This port is below the oil filter pressure relief valve (66).

1) Install the packings (62 and 63), lubricated with engine oil, in the groove in the pressure relief valve (21).
2) Align the boltholes of the pressure relief valve (21) and of the bracket (30) with those of the main oil filter housing (1).
   a) Install the bolts (60).
   b) Tighten the bolts (60) to 125-140 pound-inches (14.1-15.8 newton-meters).
   c) Install lockwire or safety cable and safety cable ferrule.

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(4) ENGINES POST-PW-SB 72-525 OR POST-PW-SB 79-73;
If you will install a new main oil filter housing (1), do the steps that follow (Fig. 402, View O):

(a) Install the pressure relief valve (79) in the center of the cover (29).
   1) Attach the pressure relief valve with the retaining ring (78).

(b) Install the packing (57), lubricated with engine oil, in the groove in the cover (29).

CAUTION: MAKE SURE THAT THE PLUG IS REMOVED FROM THE END CAP OF THE FILTER ELEMENT. IF THE PLUG IS IN PLACE, THE ELEMENT WILL NOT OPERATE CORRECTLY.

(c) Install the filter element (56) into the cover (29).

CAUTION: MAKE SURE YOU INSTALL THE COVER CORRECTLY. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

CAUTION: DO NOT USE THE BOLTS TO MOVE THE COVER INTO THE MAIN OIL FILTER HOUSING. IF YOU DO THAT, DAMAGE TO THE PACKING CAN OCCUR.

(d) Put the cover (29) on the main oil filter housing (1), with the drain opening in the cover away from the engine.

CAUTION: MAKE SURE YOU TIGHTEN THE NUTS TO THE CORRECT TORQUE. AN INCORRECTLY INSTALLED COVER CAN CAUSE DAMAGE TO THE PACKING AND AN IN-FLIGHT SHUTDOWN.

(e) Install the nuts (81) and washers (61) to attach the cover (80).
  1) Lubricate the threads with engine oil.
  2) Tighten the nuts (81) to 150-170 pound-inches (16.9-19.2 newton-meters).
(f) Lubricate the packing (58) and the threads of the plug (59) with engine oil.
(g) Install the plug (59) and the packing (58) in the cover (29).
  1) Tighten the plug (59) to 110-120 pound-inches (12.4-13.6 newton-meters).
  2) Install lockwire or safety cable and safety cable ferrule on the plug (59).
(h) Lubricate the packings (50 and 52) with engine oil.
(i) Lubricate the packings (52) and the insert threads (51) with engine oil.
(j) Install the packings (52) on the inserts (51).
(k) Install the inserts (51) to the LP4 and LP5 ports.
  1) Tighten the inserts (51) to 200-225 pound-inches (22.6-25.4 newton-meters).

(l) Lubricate the packings (50) and the reducer threads (49) with engine oil.
(m) Install the packings (50) on the reducers (49).
(n) Install the reducers (49) in the inserts on the LP4 and LP5 ports.
1) Tighten the reducers (49) to 110-120 pound-inches (12.4-13.6 newton-meters).
(o) Install the plug (77) to the main oil filter housing (1):
1) Install the packings (64 and 65), lubricated with engine oil, in the groove in the plug (77).
2) Install the plug (77) to the main oil filter housing (1).
3) Tighten the the plug (77) to 525-625 pound-inches (59.3-70.6 newton-meters).
4) Install lockwire or safety cable and safety cable ferrule on the plug (77).
(p) Install the pressure relief valve (21) of the oil system to the port on the main oil filter housing:

NOTE: This port is below the oil filter pressure relief valve (66).

1) Install the packings (62 and 63), lubricated with engine oil, in the groove in the pressure relief valve (21).
2) Align the boltholes of the pressure relief valve (21) and of the bracket (30) with those of the main oil filter housing (1).
a) Install the bolts (60).
b) Tighten the bolts (60) to 125-140 pound-inches (14.1-15.8 newton-meters).
c) Install lockwire or safety cable and safety cable ferrule.

S 434-079-N00
(5) Install the main oil filter housing (1) to the main gearbox:
(a) ENGINES PRE-PW-SB 79-43;
Do the steps that follow to install the transfer tubes:

1) Lubricate six packings (45 and 53) with engine oil.
2) Install the packings (45 and 53) on the transfer tubes (54, 55A, and 55B).

NOTE: The packings (45 and 53) are installed on the threads on each end of the transfer tube.

3) Install the transfer tubes (54, 55A and 55B) in the transfer tube ports in the main gearbox.

(b) ENGINES POST-PW-SB 79-43;
Do the steps that follow to install the transfer tubes:
1) Lubricate four packings (82 and 53) with engine oil.
2) Install the packings (82 and 53) on the transfer tubes (54, and 55A).

NOTE: The packings (82 and 53) are installed on the threads on each end of the transfer tube.

3) Install the transfer tubes (54, and 55A) in the transfer tube ports in the main gearbox.

(c) ENGINES POST-PW-SB 79-43;
Do the steps that follow to install the anti-siphon tube assembly (55C):
1) Do the steps that follow to find the correct position for the anti-siphon tube assembly (55C).
   a) Before you install the packings, put the eccentric flange of the tube assembly (55C) in the mating counterbore of the main oil filter housing (1).
   b) Make sure that the anti-siphon tube assembly (55C) can turn only a small amount.

   NOTE: The anti-siphon tube assembly (55C) will not turn much if the fit of the main oil filter housing and the anti-siphon tube is correct.

c) Compare the position of the anti-siphon tube assembly (55C) with the main oil filter housing (1) held in the installed position.
d) Remove the anti-siphon tube assembly (55C).

2) Apply engine oil to the two packings (82).
3) Install the packings (45) on the anti-siphon tube assembly (55C).
4) Install the anti-siphon tube assembly (55C) in the hole in the front of the gearbox.

(d) ENGINES POST-PW-SB 79-43;
With the anti-siphon tube assembly (55C) turned in the correct position, install the main oil filter housing (1) on the transfer tubes (54 and 55A) and the anti-siphon tube assembly.

NOTE: The anti-siphon tube assembly must fit correctly in the mating hole of the main oil filter housing (1).

(e) Install the bolts (60) and washers (61) that attach the main oil filter housing (1) to the forward face of the main gearbox.

1) Do a check of the position of the anti-siphon tube assembly.

NOTE: The end of the tube assembly must be approximately 0.25 inch (6.350 mm) from the top of the gearbox housing.

2) Tighten the bolts (60) to 125-140 pound-inches (14.1-15.8 newton-meters).

S 434-080-N00

(6) Connect the oil trim pressure tube (LP32) (36):
(a) Install the packing (42), lubricated with engine oil, in the groove on the oil trim pressure tube (LP32) (36).
(b) Install the oil trim pressure tube (LP32) (36), to the top inboard "TRIM" port on the main oil filter housing (1).

(c) Install the bolts (43), threads lubricated with engine oil, that attach the oil trim pressure tube (LP32) (36) to the main oil filter housing (1).

(d) ENGINES PRE-PW-SB 72-211;
Install the bolts (46), threads lubricated with engine oil, and nuts (47) that attach the oil trim pressure tube (LP32) to the bracket behind the fuel/oil cooler.

(e) ENGINES POST-PW-SB 72-211;
Install the bolts (46), threads lubricated with engine oil, and nuts (47) that attach the oil trim pressure tube (LP32) to the No. 3 bearing pressure manifold.

(f) Tighten the bolts (43) to 85-95 pound-inches (9.6-10.7 newton-meters).

(g) Tighten the clamp bolt (46) and nut (47) to 36-40 pound-inches (4.1-4.5 newton-meters).

S 434-081-N00

(7) Install the drain tube (LP20) (37) (bypass valve drain tube for the fuel/oil cooler):

(a) Install the new packings (40), lubricated with engine oil, on both ends of the drain tube (LP20) (37).

(b) Install the retainer (38) at the end of the tube (LP20) (37) with the flange.

(c) Put the drain tube (LP20) (37) in the bottom inboard "servo" port on the main oil filter housing (1).

(d) Attach the drain tube (LP20) (37) to the main oil filter housing (01) with two bolts (41) lubricated with oil.

1) Tighten the bolts (41) with your hand.

(e) Connect the tube nut to the bypass valve port of the fuel/oil cooler.

1) Tighten the tub nut with your hand.

(f) Tighten the tube nut to 65-70 pound-inches (7.3-7.9 newton-meters).

(g) Loosen and tighten, again, the tube nut to 65-70 pound-inches (7.3-7.0 newton-meters).

(h) Install lockwire on the tube nut.
(i) Tighten the bolts (41) to 36-40 pound-inches (4.1-4.5 newton-meters).

S 434-094-N00

(8) Install the oil filter inlet and outlet pressure tubes (20 and 31):
(a) Connect the inlet pressure tube nut (31) to the reducer (LP4 port) on the top forward and inboard face of the main oil filter housing (1).
1) Tighten the tube nut to 65-70 pound-inches (7.3-7.9 newton-meters).
(b) Connect the outlet pressure tube nut (20) to the reducer (LP5 port) on the forward face of main oil filter housing (1).
1) Tighten the tube nut to 65-70 pound-inches (7.3-7.9 newton-meters).

S 434-110-N00

(9) ENGINES POST-PW-SB 79-75;
If applicable, install the fluid pressure dampener (88) as follows:
(a) Install the packings (86), lubricated with engine oil, in the grooves on the bottom of the fluid pressure dampener (88).
(b) With bolts (TBD), threads lubricated with anti-seize paste, attach the fluid pressure dampener (88) to the top of the main oil pump.
(c) With bolts (84) and nuts (85), threads lubricated with anti-seize paste, attach the fluid pressure dampener (88) to the engine bracket (87).
(d) Tighten the bolts (TBD) securing the fluid pressure dampener to the bracket to 32-36 pound-inches (3.6-4.1 newton-meters).
(e) Tighten the bolts (TBD) securing the fluid pressure dampener (88) to the top of the main oil filter housing (1) to 60-72 pound-inches (7.0-8.1 newton-meters).

S 434-111-N00

(10) ENGINES PRE-PW-SB 79-75;
Install main filter oil tube (LP01) (35) as follows:

S 434-101-N00

(11) ENGINES POST-PW-SB 79-75;
If applicable, install the fluid pressure dampener (88) as follows:
(a) Install the packings (86), lubricated with engine oil, in the grooves on the bottom of the fluid pressure dampener (88).
(b) With bolts (TBD), threads lubricated with anti-seize paste, attach the fluid pressure dampener (88) to the top of the main oil pump.
(c) With bolts (84) and nuts (85), threads lubricated with anti-seize paste, attach the fluid pressure dampener (88) to the engine bracket (87).
(d) Tighten the bolts (TBD) securing the fluid pressure dampener to the bracket to 32-36 pound-inches (3.6-4.1 newton-meters).
(e) Tighten the bolts (TBD) securing the fluid pressure dampener (88) to the top of the main oil filter housing (1) to 60-72 pound-inches (7.0-8.1 newton-meters).

S 434-083-N00

(12) ENGINES PRE-PW-SB 79-75;
Install main filter oil tube (LP01) (35) as follows:
(a) Remove protective closures and install the packings (45), lubricated with engine oil, in the grooves on each end of the main filter oil tube (LP01) (35).
(b) Install the main filter oil tube (LP01) (35) to the oil-in port on the forward left side of the main oil filter housing (1).
    1) Attach the main filter oil tube (LP01) (35) with the three bolts (44), threads lubricated with engine oil.
    2) Tighten the bolts (44) with your hand.
(c) Install the other end of the main filter oil tube (LP01) (35) to the top of the lubrication and scavenge oil pump.
    1) With the two bolts (48), bolt threads lubricated with anti-seize paste, attach the main filter oil tube (LP01) (35) and the bracket.
    2) Tighten the bolts (48) with your hand.

(d) ENGINES POST-PW-SB 79-36;
Install the six (clip-on) loop clamp grommet halves at the three rearward clamp locations.
1) Install the bolts (46), threads lubricated with engine oil, and nuts (47) and clamps securing the main filter oil tube (LP01) (35) to the clamps and clampshells of the oil scavenge tube (for the No. 4 bearing).
(e) Install bolt (46), threads lubricated with engine oil, nut and clamp securing tube to diffuser case bracket at approximately 7 o'clock position.
1) Tighten the bolts (46) with your hand.
(f) Tighten all clamp bolts to to 36-40 pound-inches (4.1-4.5 newton-meters).
(g) Tighten the three bolts (44) that attach the main filter oil tube (LP01) (35) to the main oil filter housing (1) to 85-95 pound-inches (9.6-10.7 newton-meters).
(h) Tighten the bolts (48) that attach the main filter oil tube (LP01) (35) to the top of the scavenge pump to 62-72 pound-inches (7.0-8.1 newton-meters).

S 434-109-N00
(13) ENGINES POST-PW-SB 79-86;
Install main filter oil tube (LP01) (35) as follows:
(a) Remove protective closures and install the packings (45), lubricated with engine oil, in the grooves on each end of the main filter oil tube (LP01) (35).
(b) Install the main filter oil tube (LP01) (35) to the oil-in port on the forward left side of the main oil filter housing (1).
1) Attach the main filter oil tube (LP01) (35) with the three bolts (44), threads lubricated with engine oil.
2) Tighten the bolts (44) with your hand.
(c) Install the other end of the main filter oil tube (LP01) (35) to the top of the fluid pressure adapter (tbd).
(d) Install the bolts (46), threads lubricated with engine oil, and nuts (47) that attach the clamps for the main filter oil tube (LP01) (35) to the main gearbox brackets.
1) Tighten the bolts (46) with your hand.

(e) Install bolts, threads lubricated with engine oil, on the main filter oil tube (LP01) (35) to the diffuser case bracket.
(f) Tighten all clamp bolts to to 36-40 pound-inches (4.1-4.5 newton-meters).
(g) Tighten the three bolts (44) that attach the main filter oil tube (LP01) (35) to the main oil filter housing (1) to 85-95 pound-inches (9.6-10.7 newton-meters).
(h) Tighten the bolts (48) that attach the main filter oil tube (LP01) (35) to the top of the adapter to 62-72 pound-inches (7.0-8.1 newton-meters).
(i) Tighten the bolts securing the main filter oil tube (LP01) (35) to the diffuser case bracket to 65-75 pound-inches (7.3-8.5 newton-meters).

S 434-102-N00

(14) ENGINES POST-PW-SB 79-75;
Install main filter oil tube (LP01) (35) as follows:
(a) Remove protective closures and install the packings (45), lubricated with engine oil, in the grooves on each end of the main filter oil tube (LP01) (35).
(b) Install the main filter oil tube (LP01) (35) to the oil-in port on the forward left side of the main oil filter housing (1).
1) Attach the main filter oil tube (LP01) (35) with the three bolts (44), threads lubricated with engine oil.
2) Tighten the bolts (44) with your hand.
(c) Install the other end of the main filter oil tube (LP01) (35) to the top of the fluid pressure dampener (88).
(d) Install the bolts (46), threads lubricated with engine oil, and nuts (47) that attach the clamps for the main filter oil tube (LP01) (35) to the main gearbox brackets.
1) Tighten the bolts (46) with your hand.
(e) Install bolts, threads lubricated with engine oil, on the main filter oil tube (LP01) (35) to the diffuser case bracket.
(f) Tighten all clamp bolts to to 36-40 pound-inches (4.1-4.5 newton-meters).

(g) Tighten the three bolts (44) that attach the main filter oil tube (LP01) (35) to the main oil filter housing (1) to 85-95 pound-inches (9.6-10.7 newton-meters).
(h) Tighten the bolts (48) that attach the main filter oil tube (LP01) (35) to the top of the dampener to 62-72 pound-inches (7.0-8.1 newton-meters).
(i) Tighten the bolts securing the main filter oil tube (LP01) (35) to the diffuser case bracket to 65-75 pound-inches (7.3-8.5 newton-meters).

S 434-084-N00

(15) Install the inlet tube (34) of the air/oil heat exchanger on the top of the main oil filter housing (1):
(a) Install the packing (45) in the groove on the inlet tube seat of the air/oil heat exchanger.
(b) Put the inlet tube (34) of the air/oil heat exchanger in the oil-out port.
(c) Attach the inlet tube (34) with the bolts (44), threads lubricated with engine oil.
(d) Tighten the bolts (44) to 85-95 pound-inches (9.6-10.7 newton-meters).

S 434-095-N00

(16) Install the five pneumatic tubes (15, 16, 17, 18, and 19), the drain tube (13), and the fire extinguishing tube assembly (7):
(a) Connect the four pneumatic tube nuts and the fire extinguishing tube nut that is near the top of the oil tank at approximately the 10 o'clock position.
1) Tighten the tube nut to 257-283 pound-inches (29.0-32.0 newton-meters).
(b) Connect the pneumatic tube nut (18) to the boss on the HPC forward case at approximately the 7 o'clock position.
1) Tighten the tube nut to 257-283 pound-inches (29.0-32.0 newton-meters).
(c) Connect the pneumatic tube nuts (17 and 18) to the high pressure controller which is at the 6:30 o'clock position.
1) Tighten the tube nuts to 257-283 pound-inches (29.0-32.0 newton-meters).

(d) Connect the pneumatic tube nuts (16 and 19) to the PRV (pressure regulating valve) controller.
(e) Tighten the tube nuts to 257-283 pound-inches (29.0-32.0 newton-meters).
(f) Install the drain tube (13) for the fuel/oil cooler:
  1) Remove the plugs from the drain tube (13) for the fuel/oil cooler.
  2) Connect the drain tube (13) to the drain port elbow of the fuel/oil cooler and to the tee which is near the top of the main oil filter housing (1).
  3) Tighten the tube nuts to 70-80 pound-inches (7.9-9.0 newton-meters).
(g) Install the screw (5), washer (6), and nut (4) that attach the drain tube clamp to the bracket (12) at the top of the main gearbox.
  1) Tighten the screw (5) to 30-35 pound-inches (3.4-4.0 newton-meters).
(h) Connect the pneumatic tube nut (15) to the PRV (pressure regulating valve) controller at the 6:30 o'clock position.
  1) Tighten the tube nut to 257-283 pound-inches (29.0-32.0 newton-meters).
(i) Install the screw (5), washer (6), and nut (4) that attach the fire extinguishing tube clamp to the bracket on the top of the oil tank at approximately the 9 o'clock position.
  1) Tighten the screw (5) to 25-35 pound-inches (2.8-4.0 newton-meters).
(j) Install the screw (8), washer (9), and nut (10) that attach the pneumatic tube clamp to the bracket on the right side of the oil tank mounting flange.
  1) Tighten the screw (8) to 25-35 pound-inches (2.8-4.0 newton-meters).
(k) Install the screw (5), washer (6), and nut (4) that attach the drain tube clamp of the fuel/oil cooler and the fire extinguishing tube clamp at the top of the main gearbox.
  1) Tighten the screw (5) to 25-35 pound-inches (2.8-4.0 newton-meters).

(l) Install the screw (5), washer (6), and nut (4) that attach the fire extinguishing tube clamp to the bracket (30) at the forward right side of pressure relief valve (21) of the oil system (Fig. 401, View G).
  1) Tighten the screw (5) to 25-35 pound-inches (2.8-4.0 newton-meters).

(m) Install the screw (32), washer (9), and nut (4) that attach the outlet pressure tube clamp of the oil filter and the pneumatic tube to the bracket (30) (Fig. 401, View F and G).
  1) Tighten the screw (32) to 25-35 pound-inches (2.8-4.0 newton-meters).

(n) Install the screw (32), washer (9), and nut (4) that attach the other pneumatic tubes to the bracket (30) (Fig. 401, View G).
  1) Tighten the screw (32) to 25-35 pound-inches (2.8-4.0 newton-meters).

(o) Install the two bolts (23), washers (9), clamp (22), and nuts (4) that attach the support bar clamp (22) to the bracket (30) that is forward of the main oil filter housing (1).
  1) Tighten the bolts (23) to 30-35 pound-inches (3.4-4.0 newton-meters).

(p) Install the bolt (25) and nut (24) that attach the other end of the support bar (33) to the horizontal driveshaft bracket.
  1) Tighten the nut (24) to 85-90 pound-inches (9.6-10.2 newton-meters).

(q) Install the bolts (23), washers (9), and nuts (4) that attach the support bar clamps to the bracket at the 7 o'clock position (Fig. 401, View H).
  1) Tighten the bolts (23) to 30-35 pound-inches (3.4-4.0 newton-meters).

(r) Install the clamp block assembly (28), that is at approximately the 7 o'clock position:
  1) Install the clamp block assembly (28) with the four pneumatic tubes attached to it.
  2) Install the two screws (26), washers (2), spacers (27), and nuts (10) that attach the four pneumatic tubes (16, 17, 18, and 19) to the clamp block assembly (28).

3) Tighten the screws (26) to 25-35 pound-inches (2.8-4.0 newton-meters).

(s) Install the clamp block assembly (11), that is on the top of the main oil filter housing (1):

1) Install the clamp block assembly (11) with the five pneumatic tubes attached to it.

2) Install the two screws (3), washers (2), spacers (14), and nuts (10) that attach the pneumatic tubes (15, 16, 17, 18, and 19) to the clamp block assembly (11).

a) Tighten the screws (3) to 25-35 pound-inches (2.8-4.0 newton-meters).

(t) Install the three screws (8), washers (9), and nuts (10) that attach the five pneumatic tube clamps to the bracket on the top of the oil tank at approximately the 9 o'clock position (Fig. 401, View C).

1) Tighten the screws (8) to 25-35 pound-inches (2.8-4.0 newton-meters).

(u) Install the four screws (8), washers (9), and nuts (10) that attach the pneumatic tube clamps which are near the top of the oil tank (Fig. 401, View D).

1) Tighten the screws (8) to 25-35 pound-inches (2.8-4.0 newton-meters).

(v) Install the screw (8), washers (9), and nut (10) that attach the pneumatic tube clamp and the fuel tube clamp of the fuel/oil cooler to the bracket (30).

NOTE: This is at the forward left side of the pressure relief valve (21) of the oil system.

1) Tighten the screw (8) to 25-35 pound-inches (2.8-4.0 newton-meters).

(w) Install the screw (5), washer (6), and nut (4) that attach the fire extinguishing tube clamp to the bracket that is forward of the high pressure controller at the 7 o'clock position (Fig. 401, View H).

1) Tighten the screw (5) to 30-35 pound-inches (3.4-4.0 newton-meters).

(x) Install the screw (8), washers (9), and nut (10) that attach the jumper cable clamp to the pneumatic tube clamp.
    1) Tighten the screw (8) to 25-35 pound-inches (2.8-4.0 newton-meters).

S 414-086-N00

(17) Install the oil filter differential pressure switch (AMM 79-35-01/401).

S 614-051-N00

(18) Do the engine servicing procedure (AMM 12-13-01/301).

S 414-052-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(19) Close the thrust reversers (AMM 78-31-00/201).

S 414-053-N00

(20) Close the core cowl panels (AMM 71-11-06/201).

S 444-054-N00

(21) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 414-055-N00

(22) Close the fan cowl panels (AMM 71-11-04/201).

S 714-096-N00

(23) Do the test of the main oil filter housing which is shown in the Power Plant Test Reference Table (AMM 71-00-00/501).

EEC ALTERNATOR DRIVE GEARSHAFT AND BEARINGS ASSEMBLY - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task gives the steps to remove and disassemble the EEC alternator drive gearshaft and bearings assembly. The second task gives the steps to assemble and install the EEC alternator drive gearshaft and bearings assembly.
   B. You can find the EEC alternator drive gearshaft and bearings assembly on the upper aft side of the main gearbox.
   C. You must remove the EEC alternator to get access to the EEC alternator drive gearshaft and bearings assembly.

   TASK 72-61-14-004-001-N00
2. EEC Alternator Drive Gearshaft and Bearings Assembly Removal and Disassembly (Fig. 401)
   A. Equipment
      (1) Base - PWA 12126, Pratt & Whitney Aircraft, East Hartford, Connecticut
      (2) Drift - PWA 85273
      (3) Plate - PWA 85274
      (4) Puller - PWA 86086
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 72-61-05/401, EEC Alternator Drive Oil Seal
      (4) AMM 73-21-05/401, EEC Alternator
      (5) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

      (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

   D. Prepare for the procedure.

      S 944-007-N00
      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the pilots' overhead panel, P5.

S 044-008-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(2) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 044-009-N00

(3) Open the fan cowl panels (AMM 71-11-04/201).

S 044-010-N00

(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-011-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

S 014-012-N00

(6) Remove the EEC alternator stator and rotor (AMM 73-21-05/401).

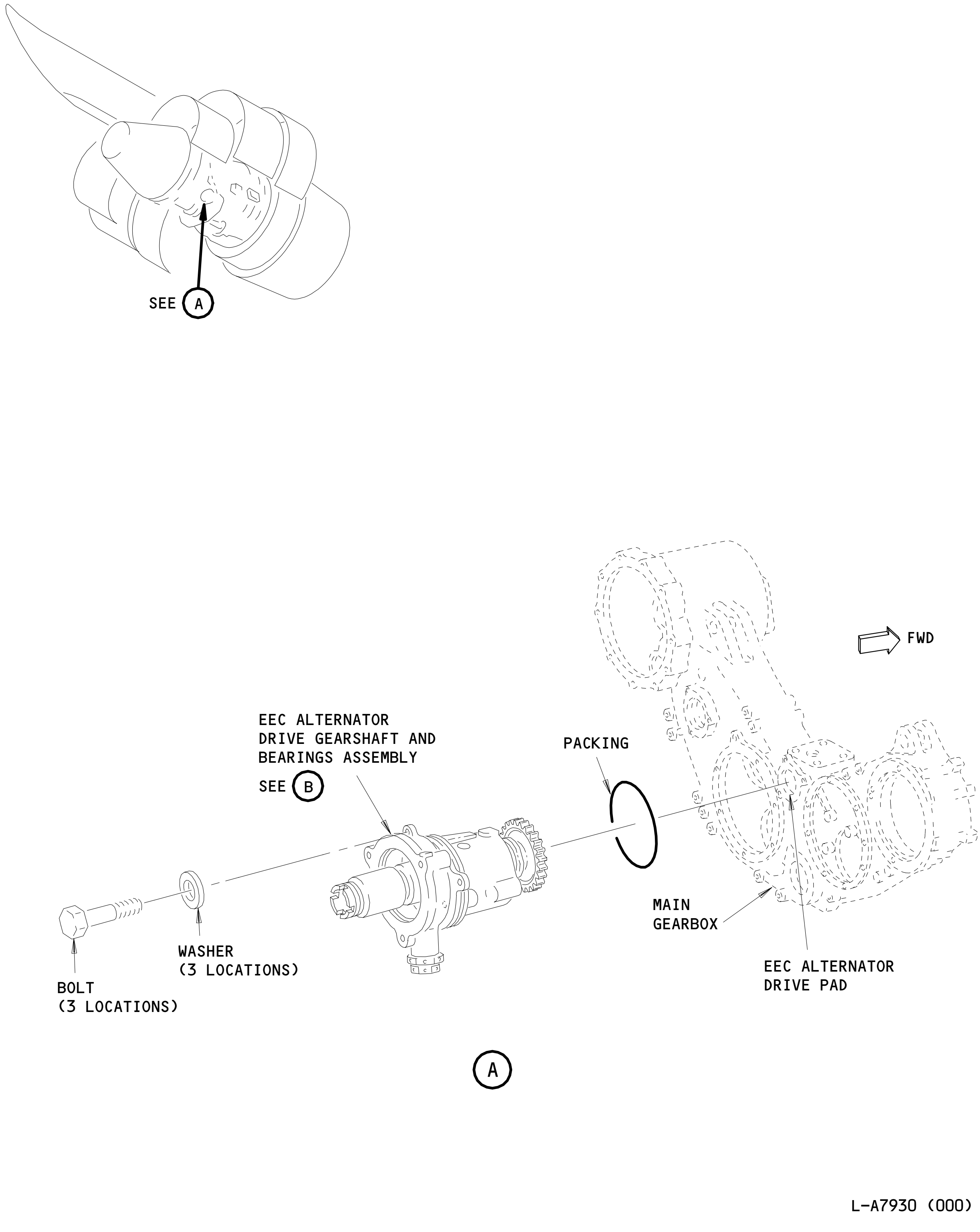
S 014-013-N00

(7) Remove the EEC alternator drive oil seal (AMM 72-61-05/401).

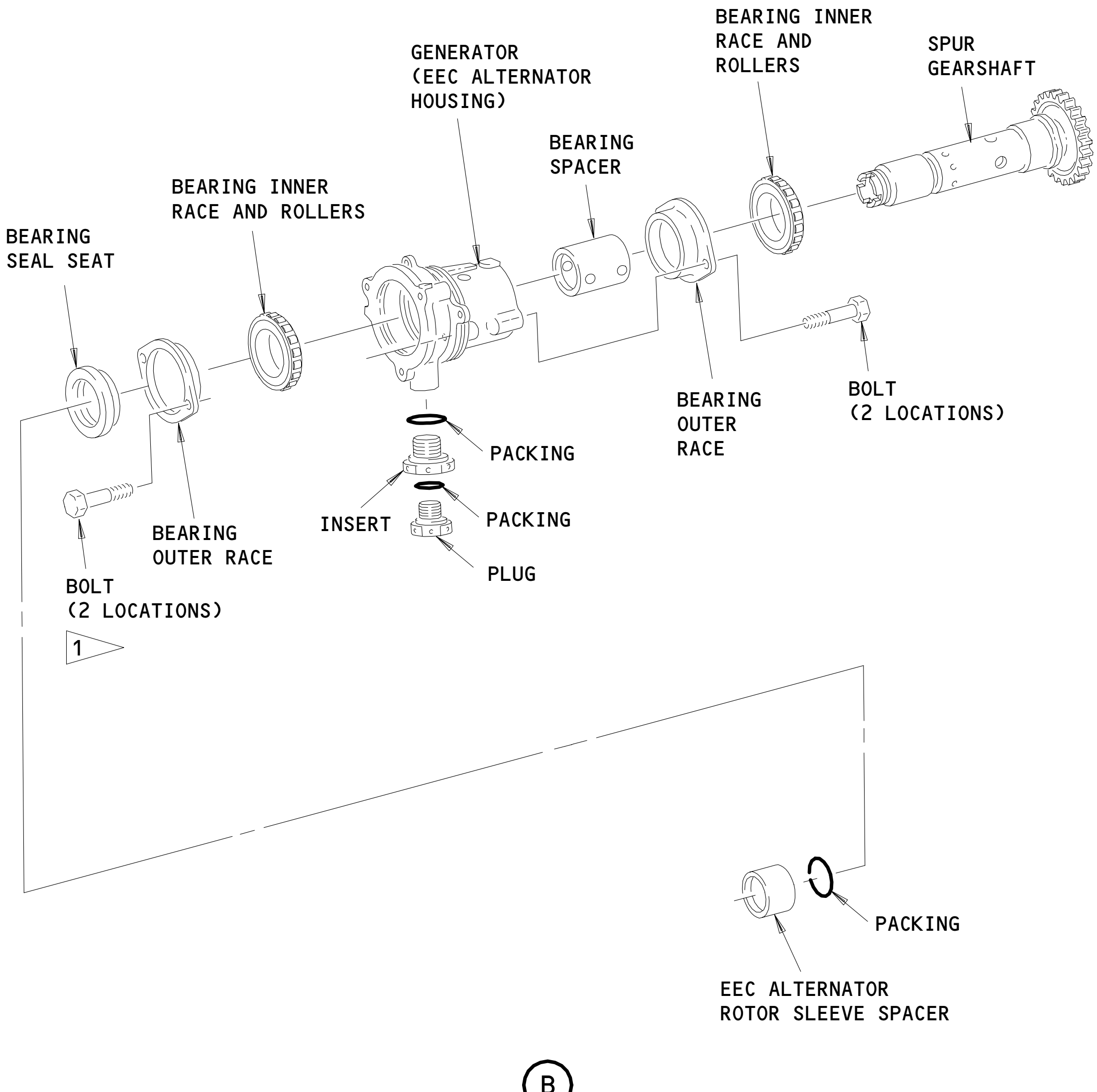
E. Procedure.

S 024-014-N00

(1) Do the steps that follow to remove the EEC Alternator Drive Gearshaft and Bearings Assembly (Fig. 401).
   (a) Remove the three bolts and washers that attach the EEC alternator drive gearshaft and bearings assembly to the EEC alternator drive pad.
   (b) Remove the assembly from the gearbox.
   (c) Discard the packing.



EEC Alternator Drive Gearshaft and Bearings Assembly
Figure 401 (Sheet 1)



1 ENGINES WITH PW SB 72-206
HAVE ONLY ONE BOLT

L-A7933 (000)

EEC Alternator Drive Gearshaft and Bearings Assembly
Figure 401 (Sheet 2)

S 034-015-N00

(2) Do the steps that follow to disassemble the EEC alternator drive gearshaft and bearings assembly (Fig. 401).

(a) Remove the sleeve spacer for the EEC alternator rotor.
(b) Discard the packing from the spur gearshaft.
(c) With the PWA 86086 Puller, remove the bearing seal seat.
(d) ENGINES PRE-PW-SB 72-206;
Remove the two bolts that attach the bearing outer race to the generator housing.
(e) ENGINES POST-PW-SB 72-206 AND PRE-PW-SB 72-375;
Remove the bolt that attaches the bearing outer race to the generator housing.
(f) ENGINES POST-PW-SB 72-375;
Remove the two bolts that attach the bearing outer race to the generator housing.

CAUTION: MAKE SURE YOU KEEP THE DETAILS OF THE BEARINGS ASSEMBLY TOGETHER. IT IS NOT EASY TO ASSEMBLE THE DETAILS OF THE BEARINGS ASSEMBLY.

(g) Put the halves of the PWA 85274 Plate under the mounting flange of the generator housing.
(h) Put the EEC alternator drive gearshaft and bearings assembly, with the gear end down, into the PWA 12126 Base.
(i) With the PWA 85273 Drift and an arbor press, push the gearshaft out of the upper bearing.
(j) Remove the bearing inner race and rollers from the gearshaft.
(k) Remove the bearing outer race from the housing.
(l) Put the bearing in a container with a label.
(m) Carefully remove the housing from the gearshaft.
(n) Make sure that the gearshaft and inner race does not suddenly fall out of the bearing outer race.
(o) Remove the gearshaft and bearing inner race from the base.
(p) Remove the bearing spacer from the gearshaft.

CAUTION: MAKE SURE YOU KEEP THE DETAILS OF THE BEARINGS ASSEMBLY TOGETHER. IT IS NOT EASY TO ASSEMBLE THE DETAILS OF THE BEARINGS ASSEMBLY.

(q) Put the halves of the PWA 85274 Plate under the bearing inner race and rollers.
(r) Put the gearshaft, with the gear end down, into the PWA 12126 Base.
(s) With the PWA 85723 Drift and an arbor press, push the gearshaft out of the lower inner race and rollers.
(t) Remove the two bolts that attach the bearing outer race to the gearshaft housing.
(u) Remove the bearing outer race.
(v) Remove the lockwire, the plug, and the insert from the hole at the bottom of the housing.

(w) Discard the two packings.

TASK 72-61-14-404-016-N00

3. EEC Alternator Drive Gearshaft and Bearings Assembly - Assembly and Installation (Fig. 401)

A. Equipment
   (1) Gage - Force, PWA 80130, Pratt & Whitney Aircraft, East Hartford, Connecticut
   (2) Base - PWA 85267 (optional to PWA 88683)
   (3) Drift - Assemnbly, PWA 85348
   (4) Drift - Hand, PWA 86087
   (5) Base - PWA 88683

B. Consumable Materials
   (1) D00226 Oil - engine (PWA 521B)
   (2) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) - AS3214-02
   (3) G02332 Ferrule, Safety Cable (P05-292)
   (4) G02335 Cable, Safety (P05-291)

C. References
   (1) AMM 71-11-04/201, Fan Cowl Panels
   (2) AMM 71-11-06/201, Core Cowl Panels
   (3) AMM 72-61-05/401, EEC Alternator Drive Oil Seal
   (4) AMM 73-21-05/401, EEC Alternator
   (5) AMM 78-31-00/201, Thrust Reverser System

D. Access
   (1) Location Zones

211	Flight Compartment
212	Flight Compartment
410	Left Engine
420	Right Engine

   (2) Access Panels

413AL/414AR	Fan Cowl Panel, Left Engine
415AL/416AR	Fan Reverser, Left Engine
417AL/418AR	Core Cowl, Left Engine
423AL/424AR	Fan Cowl Panel, Right Engine
425AL/426AR	Fan Reverser, Right Engine
427AL/428AR	Core Cowl, Right Engine

E. Procedure

S 434-017-N00

   (1) Do the steps that follow to assemble the EEC alternator drive gearshaft and bearings assembly (Fig. 401).
      (a) Heat the two sets of bearing inner race and rollers in an oil bath.

CAUTION: MAKE SURE YOU KEEP THE DETAILS OF THE BEARINGS ASSEMBLY TOGETHER. IT IS NOT EASY TO ASSEMBLE THE DETAILS OF THE BEARINGS ASSEMBLY.

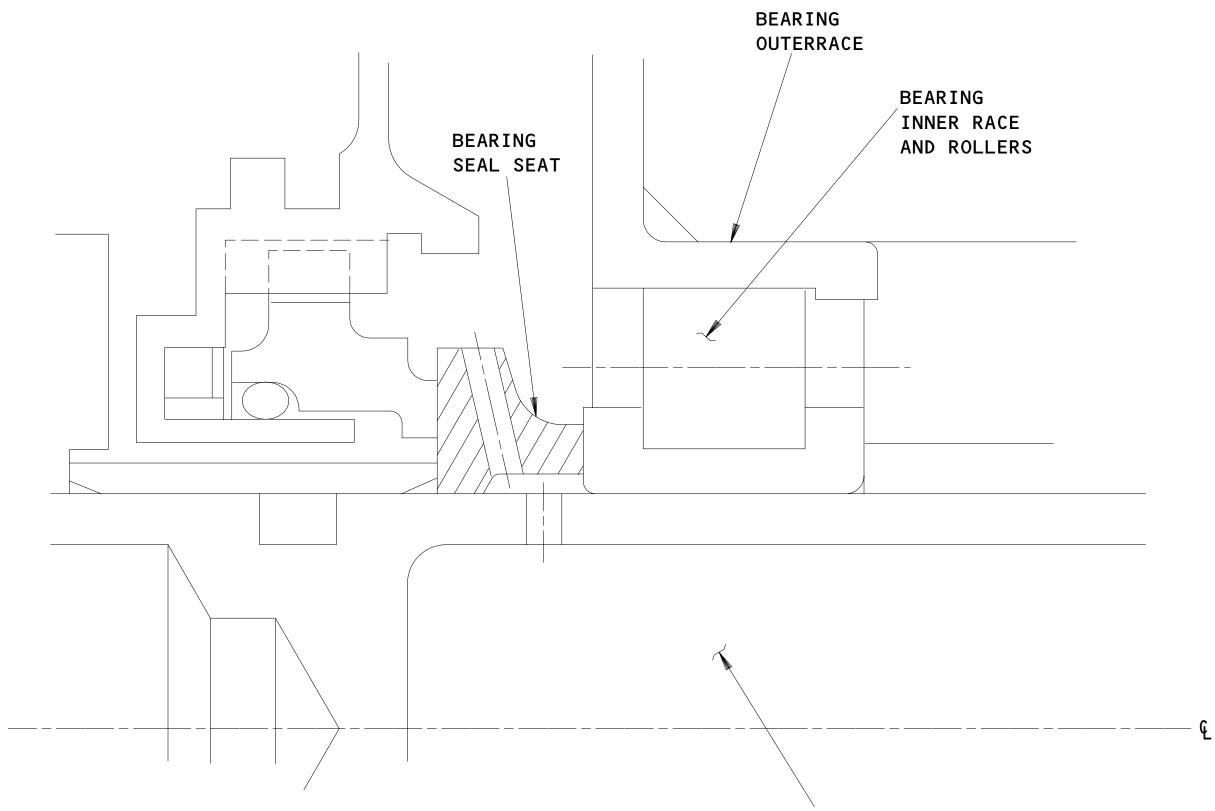
(b) Put the gearshaft, with the gear end down, into the PWA 85267 Base.
(c) Remove one of the inner race and rollers from the oil bath and put it on the lower bearing journal of the gearshaft.
(d) With the PWA 85348 Drift, the PWA 80130 Force Gage, and an arbor press, put a load of 1500 pounds (680.39 kg) on the bearing.
    1) Remove the drift.

CAUTION: TO AVOID THE INCORRECT INSTALLATION OF THE BEARING SEAL SEAT ON THE GEARSHAFT, THE SMALLER RADIAL SURFACE OF THE SEAL SEAT SHOULD TOUCH THE BEARING INNER RACE. SEE FIG 402.

(e) Attach the bearing outer race to the generator housing with the two bolts.
    1) Torque the two bolts to 27-30 pound-inches (3.051-3.390 newton-meters).
(f) Install the bearing rollers in the mating outer race installed in the housing while you carefully install the gearshaft in the housing.
(g) Install the bearing spacer on the gearshaft intil it touches against the bearing inner race.

CAUTION: MAKE SURE YOU KEEP THE DETAILS OF THE BEARINGS ASSEMBLY TOGETHER. IT IS NOT EASY TO ASSEMBLE THE DETAILS OF THE BEARINGS ASSEMBLY.

(h) ENGINES PRE-PW-SB 72-206;
    Attach the bearing outer race to the housing with two bolts.
(i) ENGINES POST-PW-SB 72-206 AND PRE-PW-SB 72-375;
    Attach the bearing outer race to the housing with one bolt.
(j) ENGINES POST-PW-SB 72-375;
    Attach the bearing outer race to the housing with two bolts.
    1) Torque the bolt or bolts to 27-30 pound-inches (3.1-3.4 newton-meters).
(k) Remove the bearing inner race and rollers from the oil bath.
(l) Do the two steps that follow, at the same time.
    1) Install the inner race and roller on the upper bearing journal of the gearshaft.
    2) Install the rollers with the mating outer race installed on the housing.
(m) With the PWA 85438 Drift, the PWA 80130 Force Gage, and an arbor press, put a load of 1500 pounds (680.39 kg) on the bearing.
    1) Remove the drift.



L-B5212 (0597)
PW V

EEC/PMA Alternator Drive Gearshaft and Bearing Assemby
Bearing Seal Seat Installation
Figure 402

H50466

(n) Put the bearing seal seat of the gearshaft to touch against the bearing inner race.

NOTE: You can use the PWA 86087 Drift, if it is necessary

(o) Install a new packing, lubricated with engine oil, in the groove on the gearshaft.
(p) Install the EEC alternator rotor sleeve spacer in the gearshaft to touch against the bearing seal seat.

NOTE: You can use the PWA 86087 Drift, if it is necessary.

(q) Install a new packing, lubricated with engine oil, on the insert.
(r) Install the insert, lubricated with engine oil, in the hole in the outer diameter of the housing.
1) Torque the insert to 150-170 pound-inches (16.9-19.2 newton-meters).
(s) Install a new packing, lubricated with engine oil, on the plug.
(t) Install the plug, lubricated with engine oil, in the insert installed in the housing.
1) Torque the plug to 65-75 pound-inches (7.3-8.5 newton-meters).
(u) Install lockwire or safety cable and safety cable ferrule.

S 424-018-N00
(2) Do the steps that follow to install the EEC alternator drive gearshaft and bearings assembly on the main gearbox (Fig. 401).
(a) Install the packing, lubricated with engine oil, in the groove in the outer diameter on the EEC alternator drive gearshaft and bearings assembly.
(b) Install the EEC alternator drive gearshaft and bearings assembly, with the gear end first, into the EEC alternator drive pad.
(c) Make sure the gears engage and the housing touches the drive pad.
(d) Attach the assembly to the main gearbox with the three bolts and washers.
1) Torque the bolts to 62-72 pound-inches (7.2-8.1 newton-meters).

F. Put the Airplane Back to Its Usual Condition.

S 414-019-N00
(1) Install the EEC alternator drive oil seal assembly (AMM 72-61-05/401).

S 414-020-N00
(2) Install the EEC alternator rotor and stator (AMM 73-21-05/401).

S 414-002-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(3) Close the thrust reversers (AMM 78-31-00/201).

S 414-003-N00
(4) Close the core cowl panels (AMM 71-11-06/201).

S 414-004-N00
(5) Close the fan cowl panels (AMM 71-11-04/201).

S 444-005-N00
(6) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 944-006-N00
(7) Remove the DO-NOT-OPERATE tag from the ENG START switch on the P5 panel.

ANGLE GEARBOX - REMOVAL/INSTALLATION

1. General
   A. This procedure contains two tasks. The first task is the removal of the angle gearbox. The second task is the installation of the angle gearbox.
   B. The angle gearbox is found on the intermediate case at the 6 o'clock position. The angle gearbox is the mechanical connection between the high pressure rotor (N2) and accessory components installed on the main gearbox.
   C. You must open each thrust reverser half to get access to the angle gearbox.

TASK 72-62-01-004-001-N00

2. Remove the Angle Gearbox
   A. Equipment
      (1) Container - 5 gallon (20 liters)
      (2) PWA 85518 - Puller, Pratt & Whitney, Commercial Products Division, 400 Main Street, East Hartford, CT 06108
      (3) PWA 101035 - Jackscrew Puller, Pratt & Whitney
      (4) PWA 87502 - Knocker Puller, Pratt & Whitney, (Optional to PWA 101035 Jackscrew Puller)
      (5) PWA 102830 - Adapter, Pratt & Whitney
   B. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 72-34-03/401, Fan Exit Liner Segments
      (4) AMM 78-31-00/201, Thrust Reverser System
   C. Access
      (1) Location Zones

411	No. 1 Engine (Left)
421	No. 2 Engine (Right)

      (2) Access Panels

413AL	Fan Cowl Panel (Left)
414AR	Fan Cowl Panel (Right)
415AL	Thrust Reverser (Left)
416AR	Thrust Reverser (Right)
417AL	Core Cowl Panel (Left)
418AR	Core Cowl Panel (Right)
423AL	Fan Cowl Panel (Left)
424AR	Fan Cowl Panel (Right)
425AL	Thrust Reverser (Left)
426AR	Thrust Reverser (Right)
427AL	Core Cowl Panel (Left)
428AR	Core Cowl Panel (Right)

   D. Prepare for the removal of the angle gearbox.

      S 044-002-N00

      (1) Attach a DO-NOT-OPERATE tag to the ENG START switch on the overhead panel, P5.

S 014-003-N00
(2) Open the fan cowl panels (AMM 71-11-04/201).

S 044-004-N00

WARNING: DO THE THRUST REVERSER DEACTIVATION PROCEDURE TO PREVENT THE OPERATION OF THE THRUST REVERSER. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Do this procedure: Thrust Reverser Deactivation for Ground Maintenance (AMM 78-31-00/201).

S 014-005-N00
(4) Open the core cowl panels (AMM 71-11-06/201).

S 014-006-N00

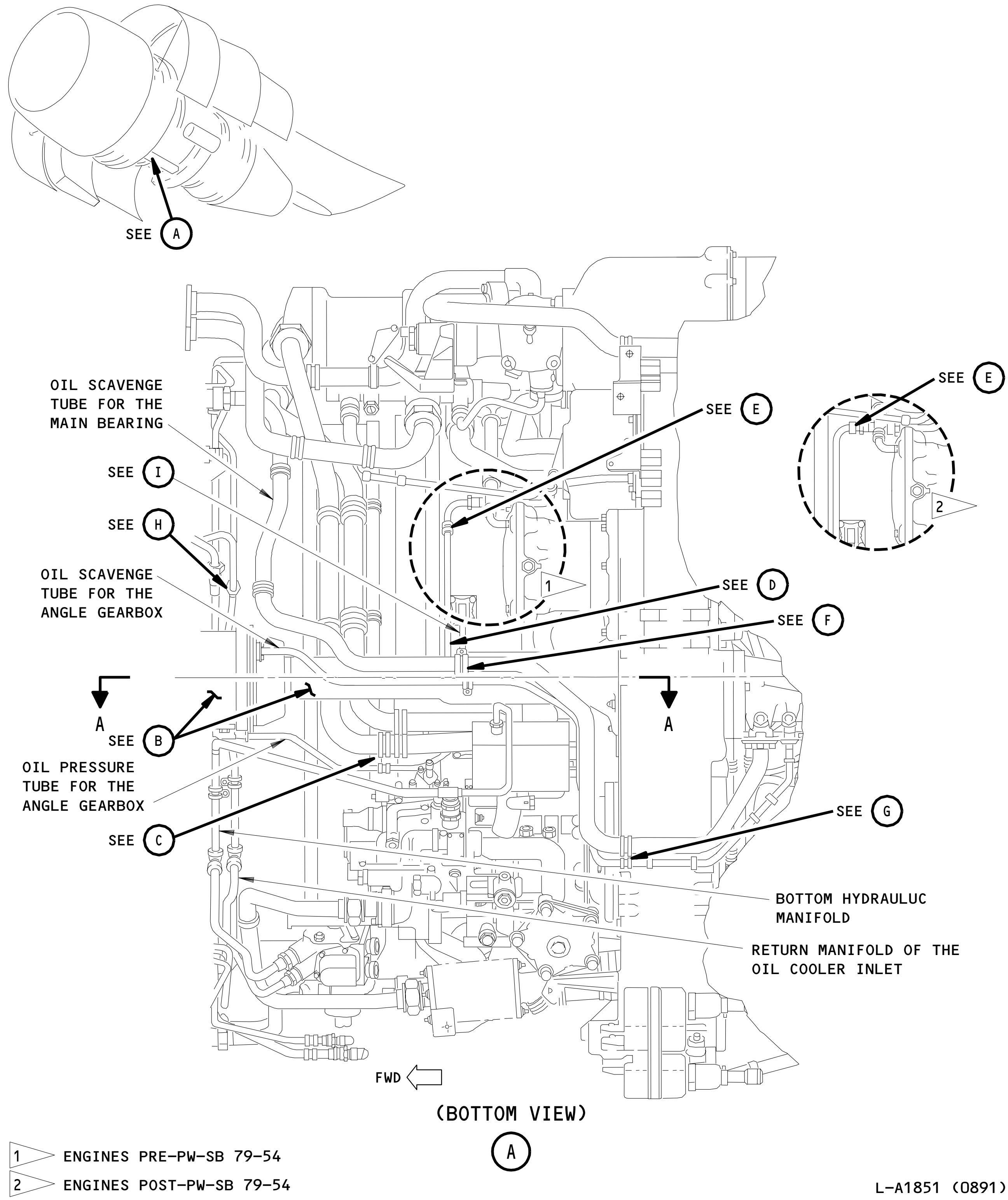
WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(5) Open the thrust reversers (AMM 78-31-00/201).

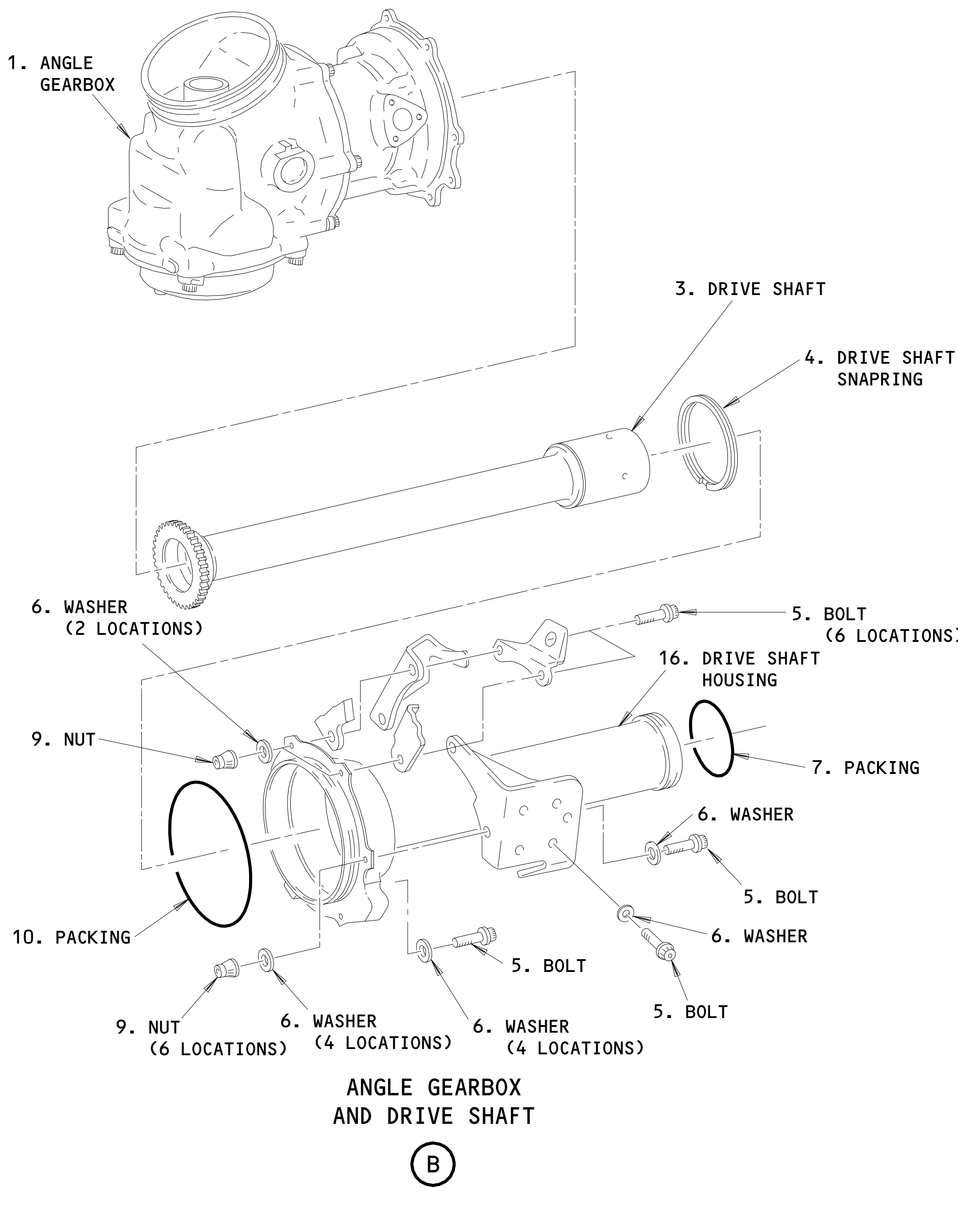
S 944-007-N00
(6) Put a 5 gallon (20 L) container below the angle gearbox and drive shaft housing to collect the oil.

E. Remove the angle gearbox

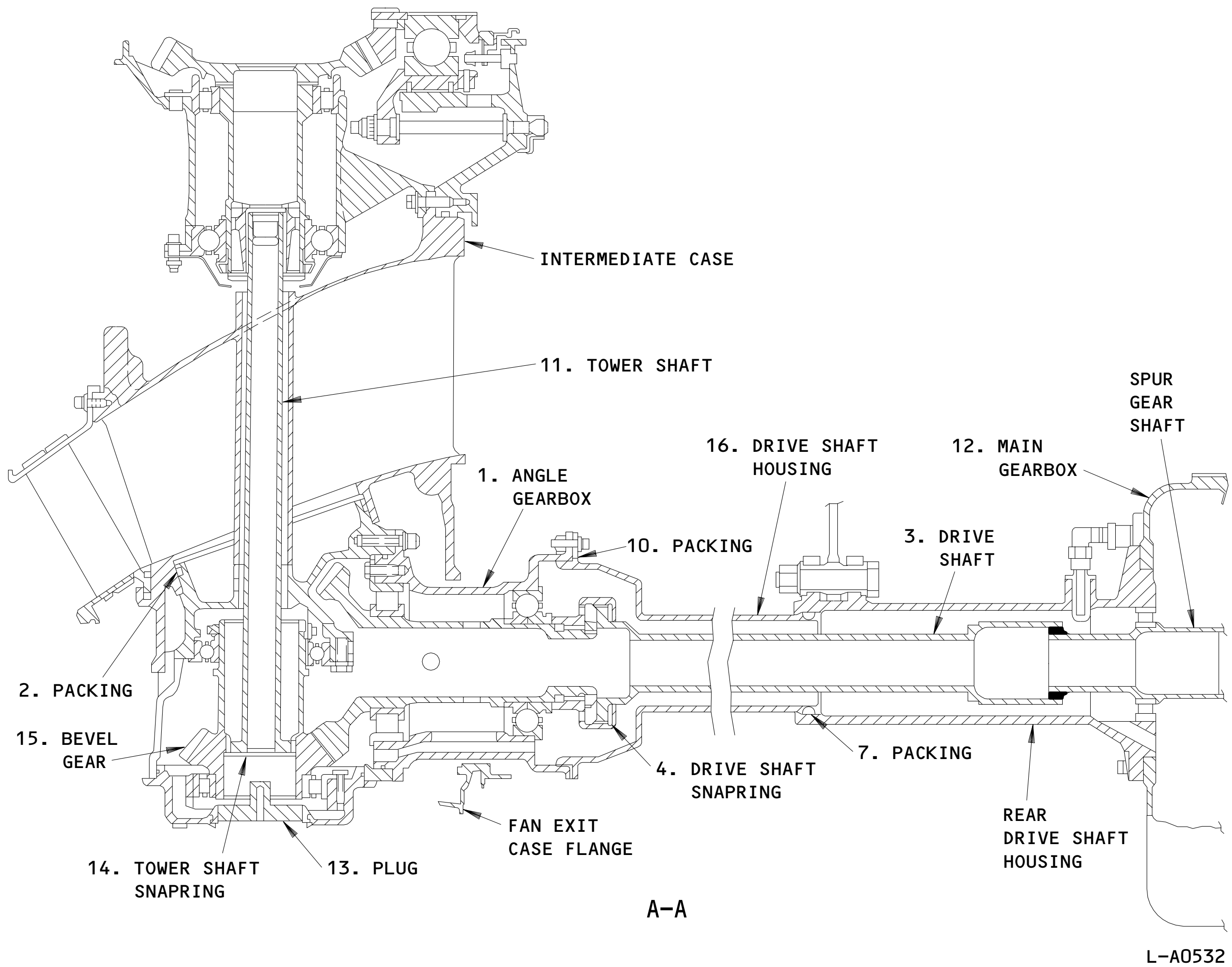
S 034-008-N00
(1) Disconnect the angle gearbox oil pressure tube assembly (LP09) as follows:
   (a) Remove the lockwire and disconnect the tube from the adapter port on the right side of the angle gearbox.
      1) Put a cap on the end of the tube.
   (b) ENGINES PRE-PW-SB 79-54;
   Remove the clamp bolt (17) and nut (19) that attaches the oil pressure tube to the High Pressure Compressor (HPC) bracket at approximately the 5:30 o'clock position (Fig. 401, View E).



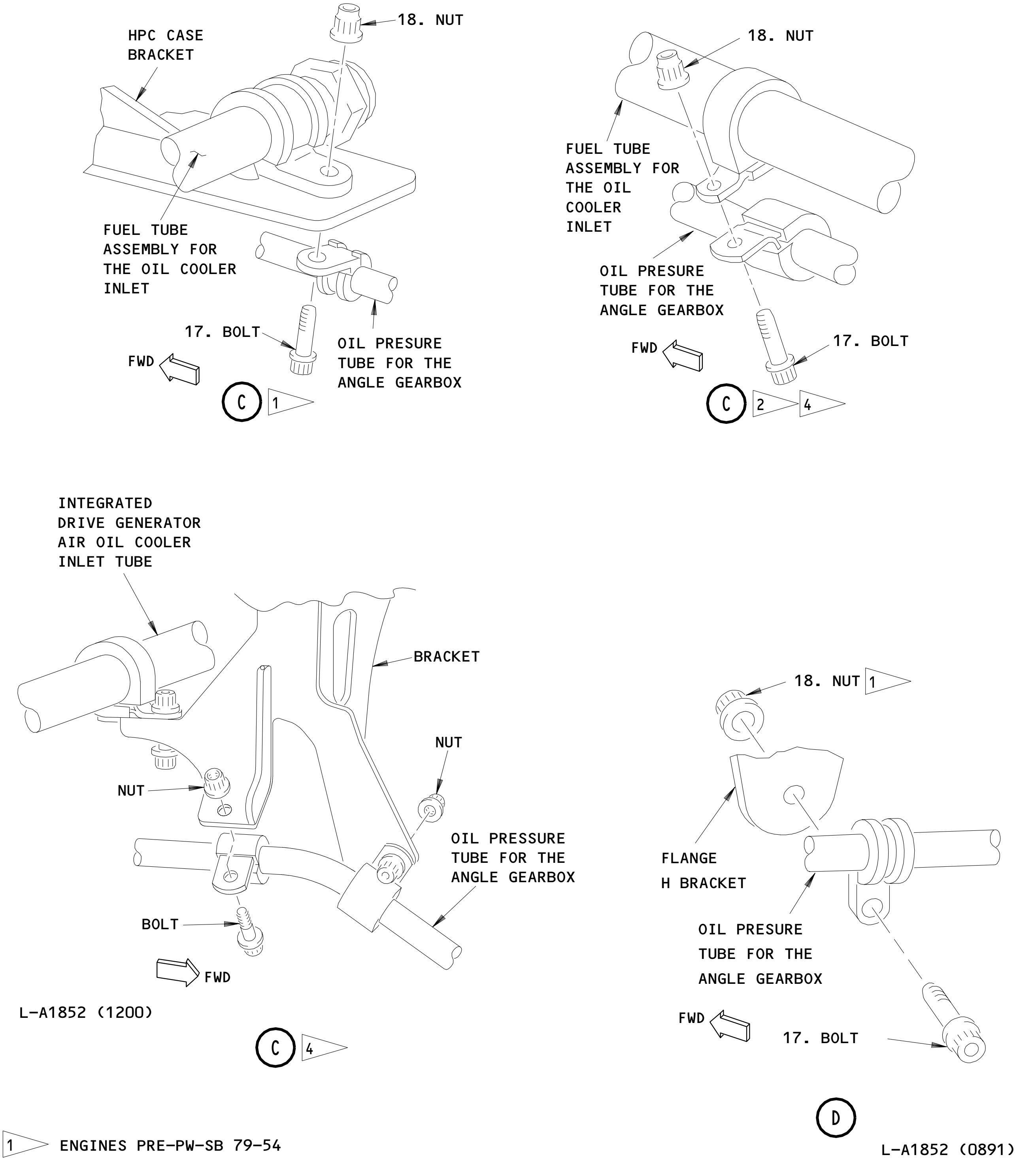
Angle Gearbox - Removal/Installation
Figure 401 (Sheet 1)



Angle Gearbox - Removal/Installation
Figure 401 (Sheet 2)

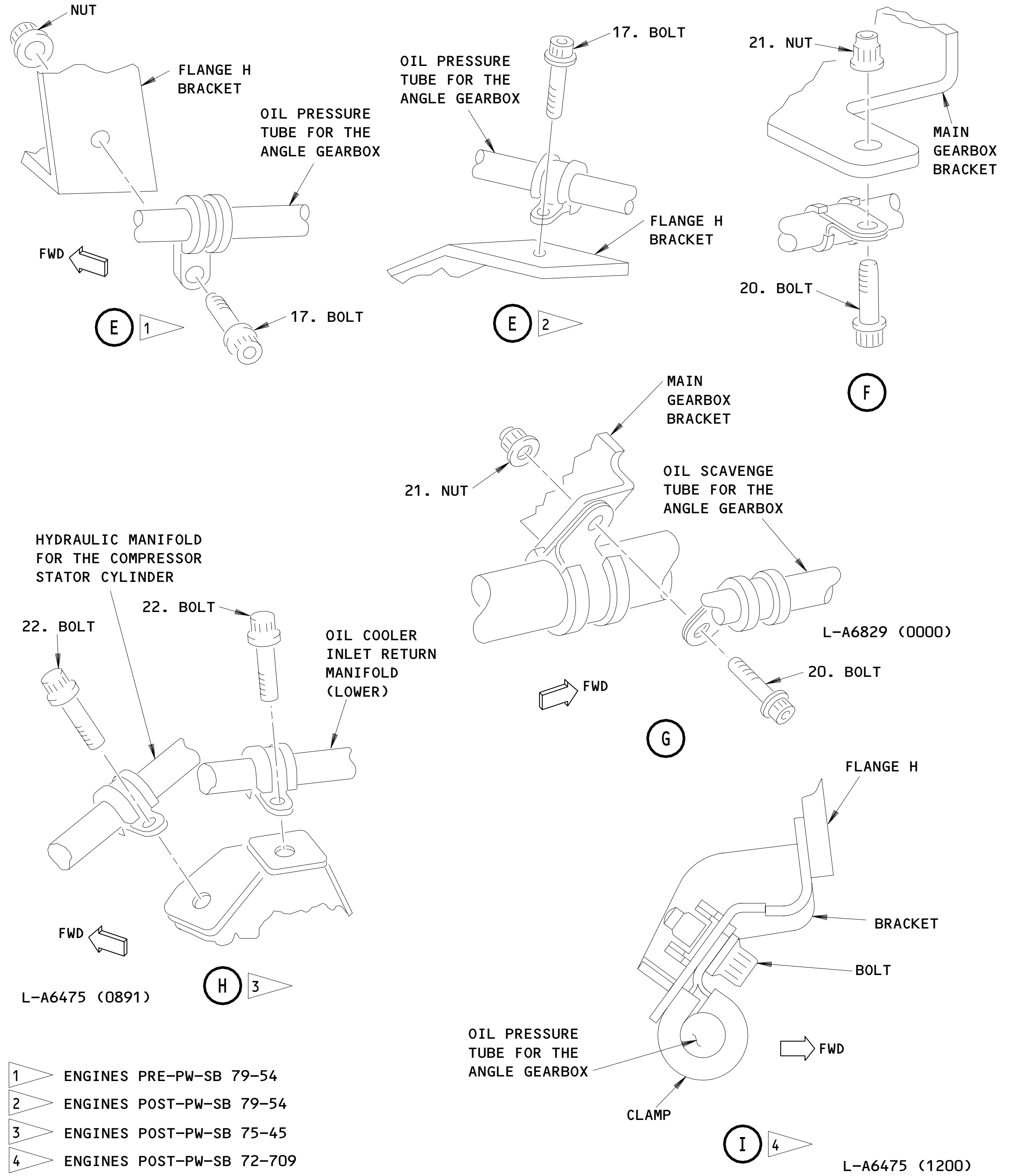


Angle Gearbox - Removal/Installation
Figure 401 (Sheet 3)



1 ENGINES PRE-PW-SB 79-54
2 ENGINES POST-PW-SB 79-54
4 ENGINES POST-PW-SB 72-709

Angle Gearbox - Removal/Installation
Figure 401 (Sheet 4)



Angle Gearbox - Removal/Installation
Figure 401 (Sheet 5)

(c) ENGINES POST-PW-SB 79-54;
Remove the clamp bolt (17) which attaches the oil pressure tube to the oil cooler tube at approximately the 5:30 o'clock position.
(d) Loosen the bolts and nuts that attach the tube to the Flange H brackets.
(e) Move the tube enough to give sufficient clearance for the angle gearbox removal.

S 034-009-N00

(2) Remove the angle gearbox oil scavenge tube assembly (LR01) as follows:
(a) Remove the two bolts which attach the scavenge tube to the housing of the horizontal drive shaft at approximately the 6:30 o'clock position.
1) Remove the bolt and nut that attach the loop clamp to the left bracket on the gearbox driveshaft (front) housing.
(b) Remove the bolts that attach the scavenge tube to the main oil pump scavenge inlet port.
(c) Remove the clamps that attach the scavenge tube to the drive shaft housing bracket and main gearbox bracket.
(d) Remove the tube from the engine.
(e) Install caps on the tube.

S 034-010-N00

(3) Remove the clamps that attach the bleed valve drain tube and wire bundles to the bracket on the left, rear side of the angle gearbox.

S 034-011-N00

(4) Remove the clamp that attaches the IDGS tube assembly to the bracket on the right, rear side of the angle gearbox.

S 034-072-N00

(5) ENGINES POST-PW-SB 75-45;
Remove the clamps which attach the fuel hydraulic tubes to the bracket on the top left side of the angle gearbox.

S 034-012-N00

(6) Disconnect the gearbox drive shaft and the front housing from the angle gearbox:
(a) Put a 5 gallon (20 liter) container below the mating connection.
(b) Remove the bolts which connect the brackets on the front housing to the HPC.
(c) Remove the nuts (9), washers (6), and bolts (5) which connect the front housing (16) of the horizontal drive shaft to the HPC.
(d) Loosen the clamp bolt that attaches the main bearing oil-scavenge tube assembly (LR03) to the left bracket.
1) Move the bracket out of the way.

(e) Use PWA 102830 Adapter to break loose the front and rear packings on the front housing.
(f) Move the housing (16) of the horizontal drive shaft rearward to open the drive shaft connection.
1) Discard the packing (10) from the housing.
(g) Remove the snapring (4) that attaches the drive shaft (3) to the angle gearbox (1).
(h) Move the drive shaft aft.

S 024-014-N00
(7) Remove the fan exit liner segment (4) (Fig. 402) at the 6 o'clock position (AMM 72-34-03/401).

S 034-079-N00
(8) Remove the fan exit case flange (1) as follows:
(a) Cut the sealant that is at the ends of the fan exit case flange (1).
(b) Bend the key at each end of the fan exit case flange (1).
1) Remove and discard the keys (2).
(c) Remove the fan exit case flange (1) from the intermediate case (3).

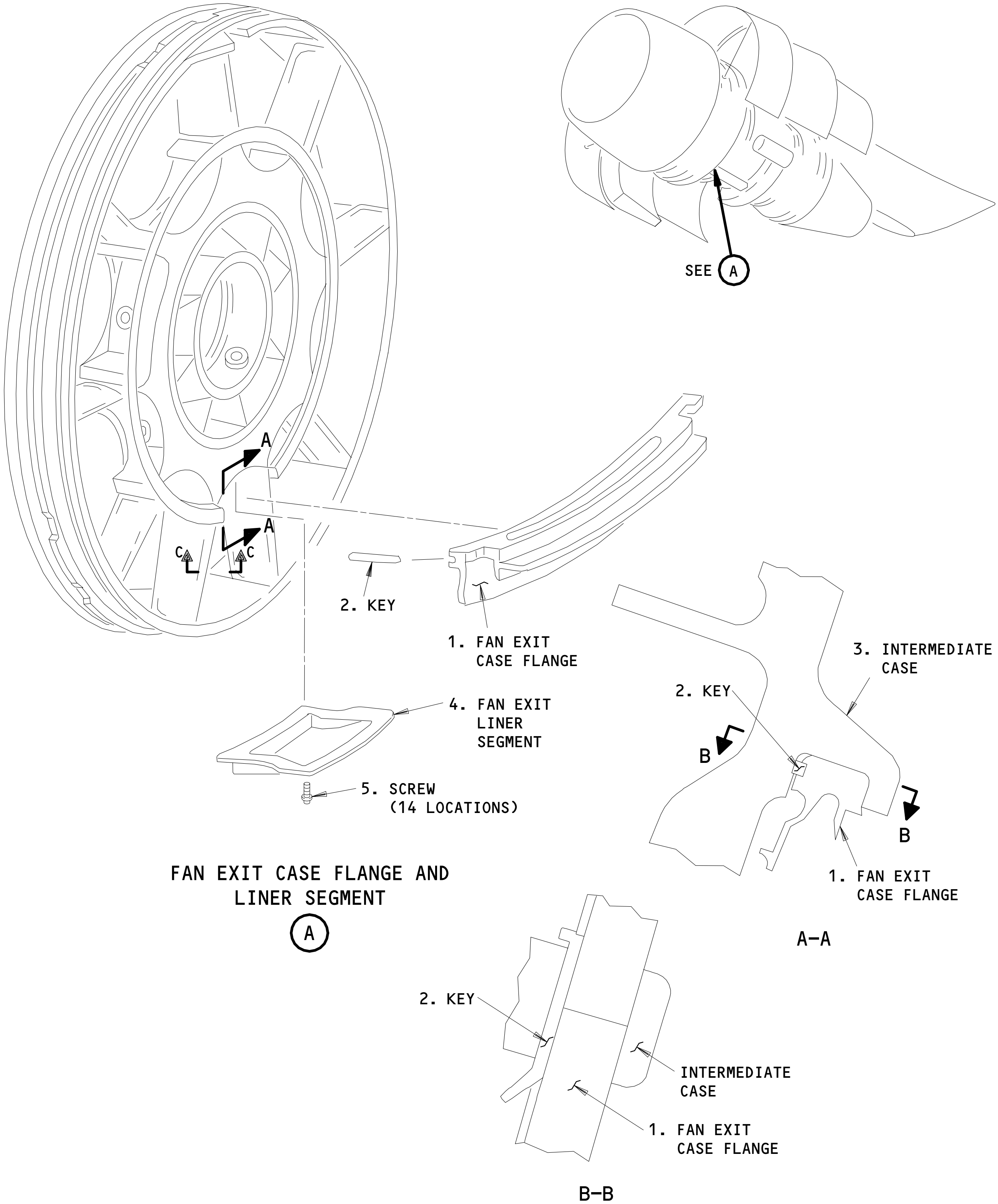
F. Remove the angle gearbox (Fig. 403):

S 944-017-N00
(1) Put the 5 gallon (20 L) container below the angle gearbox to collect the oil.

S 034-018-N00
(2) Remove the bolts (1), washer (11), and cover (2) from the lower right side of the angle gearbox (Fig. 403).
(a) Discard the packing (10).

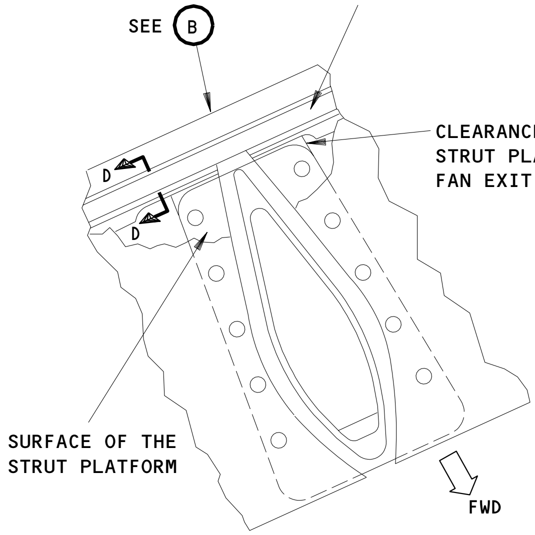
S 034-019-N00
(3) Remove the snapring (9) that attaches the plug (8) to the bottom of the angle gearbox.

S 034-020-N00
(4) Remove the plug (8) from the bottom of the angle gearbox with the PWA85518 puller.
(a) Discard the packing (7).

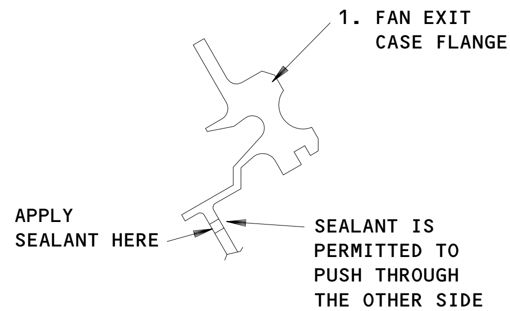


L-A0052

Fan Exit Case Liner Segment Removal/Installation
Figure 402 (Sheet 1)

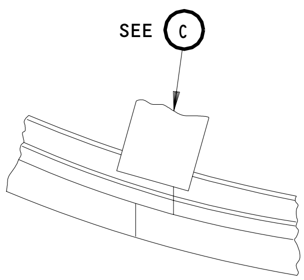


C-C



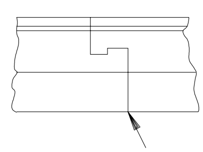
D-D

L-A8400 (0393)



(2 LOCATIONS)

B

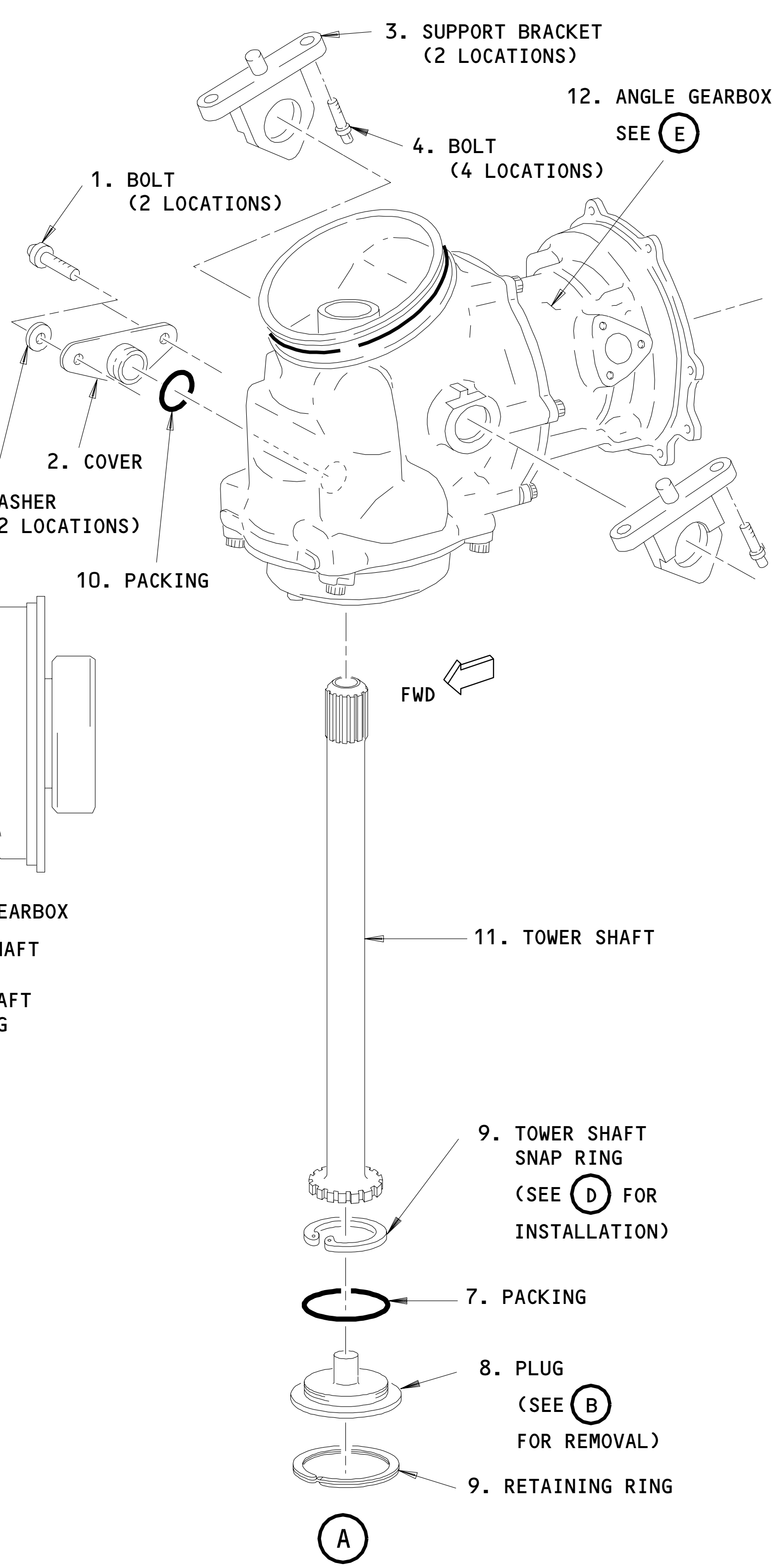


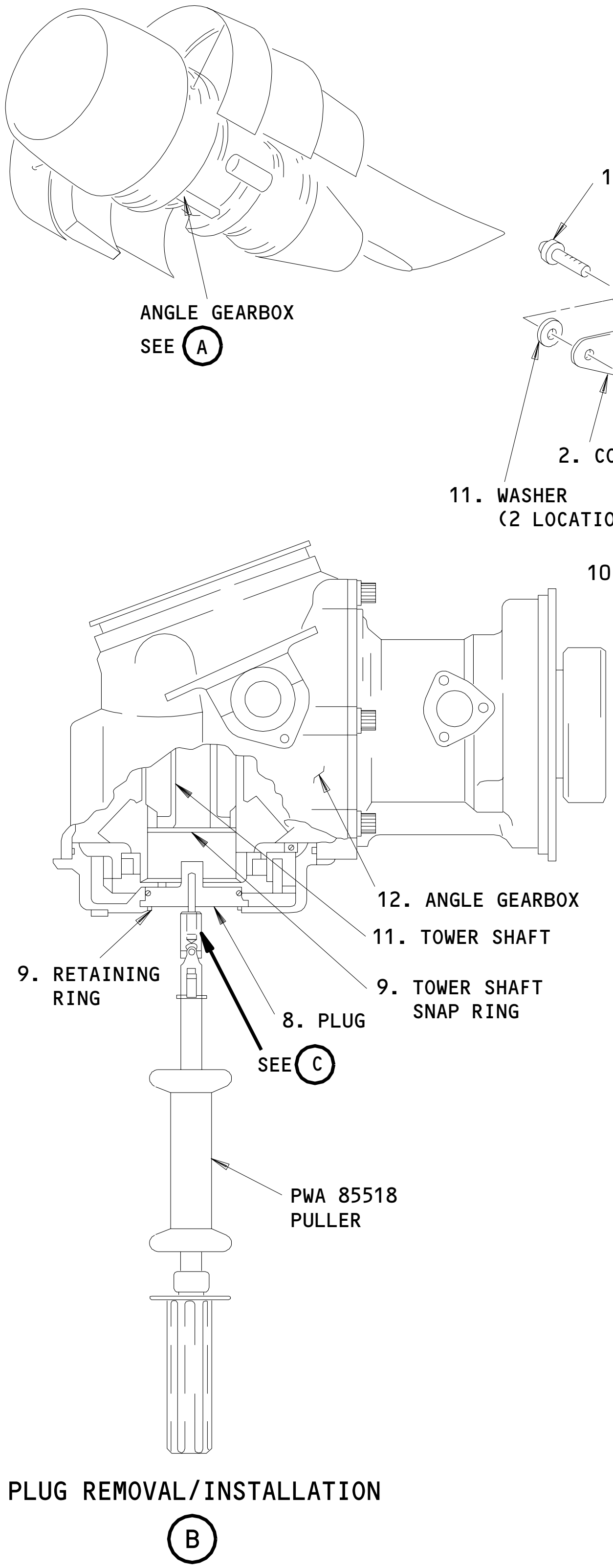
APPLY SEALANT TO THE ENDS
OF THE FAN EXIT CASE FLANGE.
FILL THE JOINT
0.0-0.010 INCH (0.254 mm)
ABOVE ALL SURFACES

C

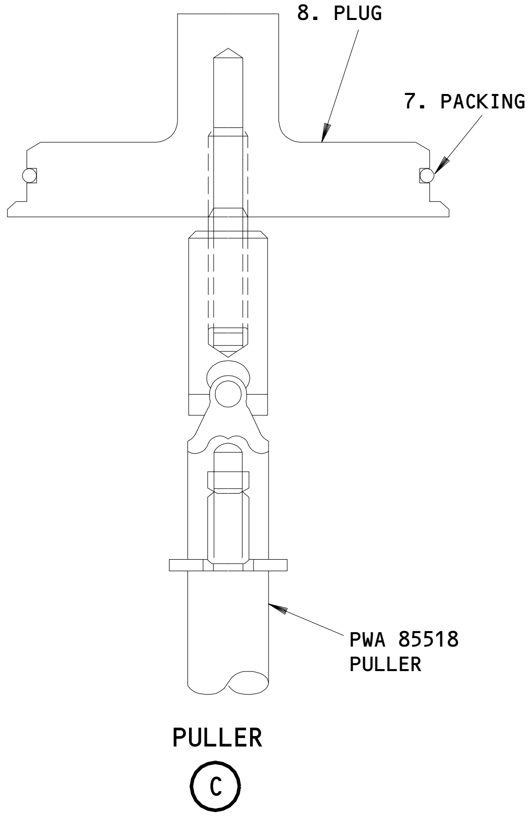
L-A8649 (0593)

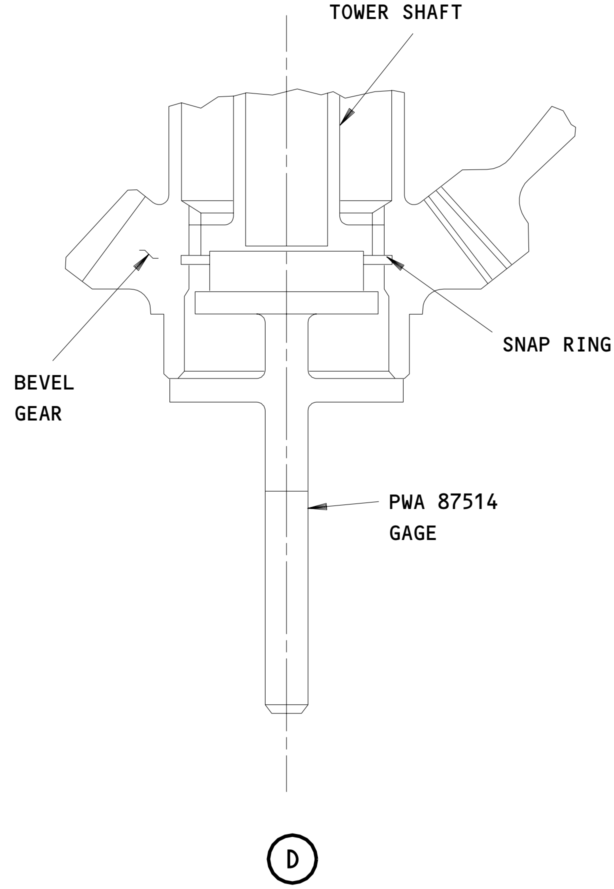
Fan Exit Case Liner Segment Removal/Installation
Figure 402 (Sheet 2)





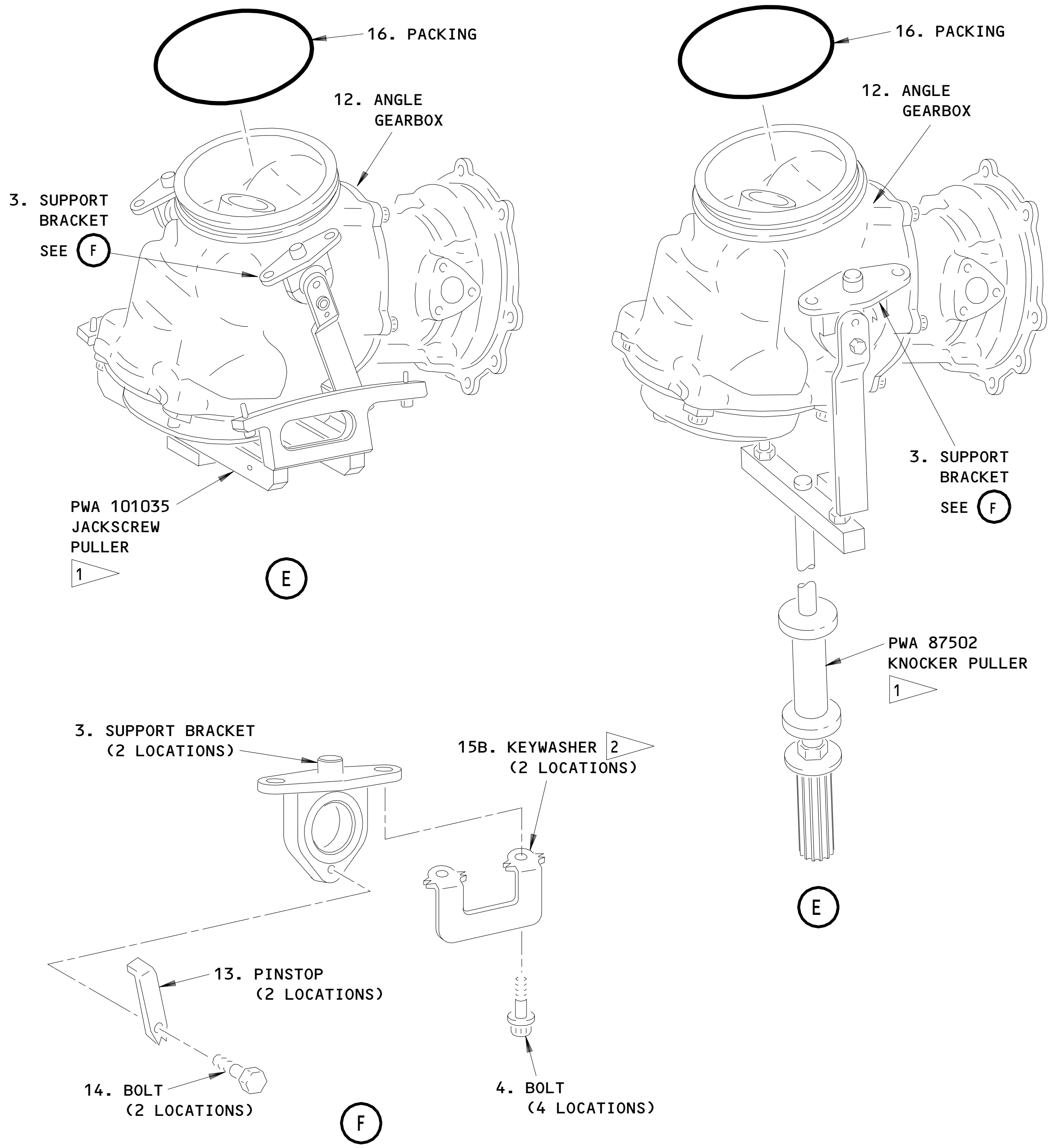
Angle Gearbox Plug Installation
Figure 403 (Sheet 1)





L-A6598 (0692)
L-A7540 (0692)

Angle Gearbox Plug Installation
Figure 403 (Sheet 2)



1 PWA 87502 KNOCKER PULLER OPTIONAL TO PWA 101035 JACKSCREW PULLER

2 ENGINES POST-PW-SB 72-438

L-B1829 (0496)

L-A6598 (0692)

Angle Gearbox Plug Installation
Figure 403 (Sheet 3)

S 034-021-N00

(5) Remove the snapring (14) that attaches the tower shaft (11) to the angle gearbox bevel gear (15) (Fig. 401).

S 024-022-N00

(6) Remove the tower shaft (11).

S 034-076-N00

(7) ENGINES PRE-PW-SB 72-438;
Remove the lockwire and bolts that attach the angle gearbox to the intermediate case.

NOTE: These are at the sides of the angle gearbox.

S 024-087-N00

(8) ENGINES POST-PW-SB 72-438;
Make the tabs of the key washers flat to remove the key washers (15) and the bolts (4) that attach the angle gearbox to the intermediate case.
- (a) Discard the key washers (15).

S 034-077-N00

(9) Remove the bolt (14) and pin stop (13) from each support bracket (3).
- (a) Discard the pin stop.

S 024-092-N00

(10) Remove the angle gearbox with the PWA 101035 Jackscrew Puller:
- (a) Position the PWA 101035 Jackscrew Puller between the 5th and 6th stage strut of the intermediate case and attach the puller to the inner strut flanges with the four hex head cap screws.
- (b) Attach the PWA 101035 Jackscrew Puller arms to the support brackets (3) with the detail bolts (14).
- (c) Move the two arm assemblies of the jackscrew puller to the outer position and tighten the two bolts to lock the arms in position.
- (d) Turn the large jackscrew nut to disengage the angle gearbox (12) from the intermediate case.
- (e) Lower the angle gearbox (12) and install it onto the support stand.
- (f) Remove the four hex head cap screws that attach the PWA 101035 Jackscrew Puller to the inner strut flanges.
- (g) Remove the packing (16) from the top of the angle gearbox and discard.
- (h) If you will install a different angle gearbox, remove the support bracket (3) from each side of the angle gearbox.
- (i) Install covers on all open areas.

S 024-093-N00

(11) Remove the angle gearbox with the PWA 87502 Knocker Puller (optional to the PWA 101035 Jackscrew Puller):

(a) Attach the PWA 87502 Puller to the angle gearbox support brackets (3) with the detail bolts (14).

(b) With the puller, loosen the angle gearbox (12) from the intermediate case.

(c) Lower the angle gearbox and install it onto the support stand.

(d) Remove the packing (16) from the top of the angle gearbox and discard.

(e) If you will install a different angle gearbox, remove the support bracket (3) from each side of the angle gearbox.

(f) Install covers on all open areas.

S 024-027-N00

(12) Remove the drive shaft (3) from the main gearbox housing (12) (Fig. 401).

S 024-028-N00

(13) Remove the drive shaft housing (16) from the main gearbox housing (12).

S 034-029-N00

(14) Remove the packing (7) from the main gearbox housing-drive shaft housing interface and discard.

TASK 72-62-01-404-030-N00

3. Install the Angle Gearbox (Fig. 401)

A. Equipment

(1) M303, M305 or M307 Bergen Mechanical Crimper
Gergen Cable Technologies Inc
170 Gregg St
P. O. Box 1300
Lodi, NJ 07644-9982

(2) Puller - PWA 85518

(3) Puller - PWA 85768

(4) Puller - PWA 87502

(5) Gage - Plug, PWA 87514

(6) Crimper - Finish, PWA 87552

(7) Crimper - Prebend, PWA 87553

B. References

(1) AMM 71-11-04/201, Fan Cowl Panels

(2) AMM 71-11-06/201, Core Cowl Panels

(3) AMM 72-34-03/401, Fan Exit Liner Segments

(4) AMM 78-31-00/201, Thrust Reverser System

C. Consumable Materials

(1) D00137 Lubricant - Engine Oil (PWA521B)

(2) G00033 Cheesecloth - Unsized

(3) G02334 Lockwire, (P05-289) 0.032 inch (0.813 mm) AS3214-02

(4) G02335 Cable, Safety (P05-291)

(5) G02332 Ferrule, Safety Cable (P05-292)
(6) D50124 Paste - Anti-seize (P06-054)
(7) A00091 Sealant - Silicone, Rubber, Red (RTV 159)
(8) A00482 Sealant - Silicone, Rubber, Gray (RTV 157)
(9) B00130 Alcohol - Isopropyl

D. Parts

AMM		NOMENCLATURE	AIPC		
FIG	ITEM		SUBJECT	FIG	ITEM
401	1	Angle Gearbox	72-62-01	15	7
	7	Packing - Drive Shaft	72-62-01	35	30
	10	Packing			35
402	2	Key	72-34-00	10	57
403	7	Packing	72-62-01	20	60
	10	Packing			20
	13	Pin Stop	72-62-51	01	10
	15	Keywasher (Post-PW-SB 72-438)	72-34-00	10	85
	16	Packing	72-62-01	15	5

E. Procedure

S 434-082-N00

(1) Install the drive shaft (3) and the drive shaft housing (16) in the rear driveshaft housing on the main gearbox (12) as follows (Fig. 401):
   (a) Put the drive shaft snapring (4) on the drive shaft (3).
   (b) Install the driveshaft (3) in the driveshaft housing (16).
   (c) Install new packings (7) and (10), lubricated with engine oil, into the front and rear grooves in the driveshaft housing (16).
   (d) Install the drive shaft housing (16) into the rear driveshaft housing on the main gearbox (12).

(e) Move the drive shaft housing (16) aft.
(f) Engage the splines on the aft end of the drive shaft (3) with the spur gear shaft inside the rear drive shaft housing.

S 424-083-N00
(2) Install the angle gearbox (12) as follows (Fig. 403):
(a) Install the cover (2) on the the side of the angle gearbox (12) as follows:
1) Install the new packing (10), lubricated with engine oil, into the groove on the cover (2).
2) Attach the cover with the bolts (1), lubricated with anti-seize paste, and the washers (11).
a) Tighten the bolts to 62-72 pound-inches (7.0-8.1 newton-meters).
(b) Install a support bracket (3) on the hollow pin at each side of the angle gearbox (12) as follows:
1) Apply engine oil to the threads of four bolts (4) with engine oil.
2) Attach a pin stop (13) to each support bracket (3) with the bolts (4).
a) Tighten the bolts (4) with your fingers.
3) Install the support brackets (3) on the pins at the sides of the angle gearbox (12).
4) Twist the free end of the pin stop (13) counterclockwise until it touches the inner diameter of the pin.
a) While you hold the pin stops (13), tighten the bolts (4) to a torque of 32-36 pound-inches (3.6-4.1 newton-meters).
b) Bend the keys on the pin stops (13).
(c) Install the angle gearbox (12) in the intermediate case as follows:
1) Install the new packing (2, Fig. 401), lubricated with engine oil, into the groove in the top outer diameter of the angle gearbox (12) (Fig. 403).
2) Raise the angle gearbox (12) to the correct position and align the support bracket assembly with the bolt holes in the intermediate case.
3) ENGINES PRE-PW-SB 72-438;

Attach the angle gearbox (12) to the intermediate case with the four bolts.
a) Tighten the bolts to 225-300 pound-inches (25.4-33.9 newton-meters).
b) Install lockwire or safety cable and ferrule on the bolts.

4) ENGINES POST-PW-SB 72-438;
Put the two keywashers (15) in the correct position against the support brackets (3).
a) Attach the angle gearbox (12) with the bolts (4) through the keywashers (15) and support brackets (3).
b) Tighten the bolts to 225-300 pound inches (25.4-33.9 newton-meters).
c) Bend the tabs of the keywshers against the bolts with the PWA 87553 Crimper, then the PWA 87552 Crimper.

(d) Install the tower shaft (11) as follows (Fig. 401):
1) Put the tower shaft (11) splines, lubricated with engine oil, up into the angle gearbox.
2) Make sure the tower shaft (11) splines engage correctly.
3) Install the tower shaft snapring (14) to keep the towershaft (11) in the correct position.

(e) Do a check of the installation of the tower shaft snapring (Fig. 403).
1) Put the PWA 87514 gage in the bore of the bevel gear.
2) If the tower shaft snapring is installed correctly, the detail stop bar will touch the bottom of the bevel gear.

(f) Install the plug (8) as follows:
1) Install the new packing (7), lubricated with engine oil, into the groove in plug (8).
2) Install the plug (8) into the bottom of the angle gearbox (12).
3) Attach the plug with the retaining ring (9).

S 434-088-N00

(3) Install the intermediate case parts as follows (Fig. 402):
(a) Mechanically remove all sealant that is at the ends of the fan exit case flange (1) and at the trailing edges of the platforms of struts five and six.
(b) Install the fan exit case flange (1) as follows:
1) Install the fan exit case flange (1) to connect with the intermediate case (3).
2) Install the one key (2) at each end of the fan exit case flange (1) in the lugs of the struts of the intermediate case (3).
a) Select the correct class of key which will make sure there is no empty space between the key and the intermediate case.
3) Bend the keys (2), as shown, to attach the fan exit case flange (1).

(c) Apply sealant to the clearance between the fan exit case flange (1) and the platforms of struts five and six as follows:
   1) With a piece of clean cheesecloth that is moist with alcohol, clean the area where you will put sealant.
   2) Dry the surfaces fully in air at approximately 21°C.
   3) Apply the red or gray sealant as shown.
   4) Cure the sealant in air at approximately 21°C, and at a relative humidity of 25%, minimum.
   5) Cure the sealant at the ends of the fan exit case flange (1) for eight hours before you operate the engine.
   6) Cure the sealant at the struts for at least two hours, and until no longer tacky, before you operate the engine.

CAUTION: BE VERY CAREFUL WHEN YOU REMOVE OR INSTALL A LINER SEGMENT. IF THE EDGE OF THE LINER SEGMENT HITS SOMETHING, IT CAN CAUSE DELAMINATION.

(d) Install the fan exit liner segment (5) into the opening below the angle gearbox (AMM 72-34-03/401).

S 434-085-N00

(4) Connect the driveshaft (3) and driveshaft housing (16) to the angle gearbox (1) as follows (Fig. 401):
   (a) Lubricate the drive shaft (3) splines with engine oil.
   (b) Move the drive shaft (3) forward to engage the mating splines of the drive shaft (3) and the angle gearbox (1).
   (c) If the splines do not engage, turn the gearshaft in the main gearbox as follows (Fig. 401):

CAUTION: DO NOT REMOVE THE BEARING HOUSING ASSEMBLY OF THE SCAVENGE PUMP DRIVE. THE INSTALLATION OF THE BEARING HOUSING ASSEMBLY IS VERY DIFFICULT AND CAN CAUSE DAMAGE TO THE BEARINGS.

1) Remove the two bolts and washers that attach the cover (manual crank) to the main gearbox.
2) Remove the manual crank cover with the PWA 85768 puller.
   a) Discard the packing.
3) With a standard wrench, turn the gearshaft that is inside.
4) Engage the mating splines of the driveshaft (3) and the angle gearbox (1).
5) Lubricate a new packing with engine oil.
6) Install the lubricated packing on the manual crank cover.
7) Lubricate two bolts with anti-seize paste.
8) Attach manual crank cover to the main gearbox with two washers and the two bolts.
   a) Tighten the bolts to 62-72 pound-inches (7.0-8.1 newton-meters).

(d) Install the drive shaft snap ring (4) in the angle gearbox to keep the drive shaft (3) in position.
(e) Lubricate the threads of six nuts (9) with anti-seize paste.
(f) Attach the drive shaft housing (16) and brackets to the angle gearbox (1), with the six bolts (5) (boltheads aft), 10 washers (6), and six nuts (9).
(g) Attach the brackets on the drive shaft housing to the HPC as follows:
   1) Lubricate with engine oil the threads of four bolts.
   2) Attach the brackets to the HPC with the four bolts.
   3) Tighten the bolts on the HPC brackets to 85-95 pound-inches (9.6-10.7 newton-meters).
   4) Install lockwire on these four bolts.
(h) Tighten the nuts (9) that connect the angle gearbox (1) to the drive shaft housing to 62-72 pound-inches (7.0-8.1 newton-meters).
(i) Attach the tube clamp to the front of the left bracket that is found on the front of the gearbox driveshaft housing, with the bolt, threads lubricated with engine oil.
   1) Tighten the clamp bolt to a torque of 36-40 pound-inches (4.1-4.5 newton-meters).

S 434-063-N00

(5) Install the clamp with screw, washer, and nut to attach the IDGS oil tube to the bracket on the right rear side of the angle gearbox.

S 434-064-N00

(6) Install the clamps with the screws to attach the drain tube and wire bundles to the bracket on the left rear side of the angle gearbox.

S 434-065-N00

(7) Install the oil pressure tube for the angle gearbox (Fig. 401).
  (a) Remove the caps from the ends of the tubes.
  (b) Apply anti-seize paste to the threads of the tube nut.
  (c) Put the tube into the adapter port on the right, rear side of the angle gearbox and attach it with the tube nut.
    1) Tighten the tube nut with your hand.
  (d) Install the clamp that attaches the tube to the HPC bracket at the 5:30 o'clock position and attach it with the bolt, threads lubricated with oil, and nut.
    1) Tighten the clamp bolts to 36-40 pound-inches (4.1-4.5 newton-meters).
    2) Tighten the tube nut to 200-225 pound-inches (22.6-25.4 newton-meters).
      a) Install lockwire or safety cable and ferrule.

S 434-066-N00

(8) Install the angle gearbox oil scavenge tube.
  (a) Remove the caps from the end(s) of the tube.
  (b) Install the packings, lubricated with oil, into the grooves at each end of the scavenge tube.
  (c) Put the scavenge tube against the main oil pump scavenge inlet port.
    1) At the rear end, attach the tube to the oil pump with the two bolts, threads lubricated with anti-seize paste.
    2) Tighten the bolts with your hand.
  (d) At the front end, attach the scavenge tube to the drive shaft housing (16) with the two bolts, threads lubricated with engine oil.
    1) Tighten the bolts with your hand.
  (e) Attach the scavenge tube clamps to the drive shaft housing bracket and main gearbox bracket with the clamp bolts lubricated with engine oil, and nuts.
    1) Tighten the bolts to 36-40 pound-inches (4.1-4.5 newton-meters).
  (f) Tighten the bolts at the front end of the tube to 85-95 pound-inches (9.6-10.7 newton-meters).
  (g) Tighten the bolts at the rear end of the tube to 62-72 pound-inches (7.0-8.1 newton-meters).

S 434-086-N00

(9) For engines with the bracket attached to the top left of the angle gearbox (ENGINES POST-PW-SB 75-45), do the steps that follow:
  (a) Lubricate the threads of two bolts (22) with engine oil.
  (b) Install the clamps, bolts and nuts that attach the hydraulic manifold for the compressor stator cylinder and the oil cooler inlet return manifold (lower).
    1) Tighten the clamp bolts to 36-40 pound-inches (4.1-4.5 newton-meters).

S 414-067-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00 WHEN YOU CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(10) Close the thrust reversers (AMM 78-31-00/201).

S 414-068-N00

(11) Close the core cowl panels (AMM 71-11-06/201).

S 444-069-N00

(12) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).

S 414-070-N00

(13) Close the fan cowl panels (AMM 71-11-04/201).

S 444-071-N00

(14) Remove the DO-NOT-OPERATE tag from the ENG START switch on the panel, P5.

ANGLE GEARBOX - INSPECTION/CHECK

1. General
   A. This procedure gives the task for the inspection of the angle gearbox for signs of oil leaks, cracks, or corrosion.
   B. The angle gearbox is found at the 6 o'clock position between the inner and outer walls of the intermediate case.
   C. You must open each half of the thrust reverser to get access to the angle gearbox.

TASK 72-62-01-226-012-N00

2. Angle Gearbox Inspection (Fig. 601)
   A. References
      (1) AMM 71-11-04/201, Fan Cowl Panels
      (2) AMM 71-11-06/201, Core Cowl Panels
      (3) AMM 72-34-03/401, Fan Exit Liner Segment
      (4) AMM 72-62-01/401, Angle Gearbox
      (5) AMM 78-31-00/201, Thrust Reverser System
   B. Access
      (1) Location Zones
          411 Left Engine
          421 Right Engine

   C. Do the Inspection of the Angle Gearbox

      S 016-019-N00
      (1) Open the fan cowl panels (AMM 71-11-04/201).

      S 016-020-N00
      (2) Open the core cowl panels (AMM 71-11-06/201).

      S 046-021-N00

      WARNING: DO THE DEACTIVATION PROCEDURE FOR THE THRUST REVERSER TO PREVENT THE OPERATION OF THE THRUST REVERSER. ACCIDENTAL OPERATION OF THE THRUST REVERSER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

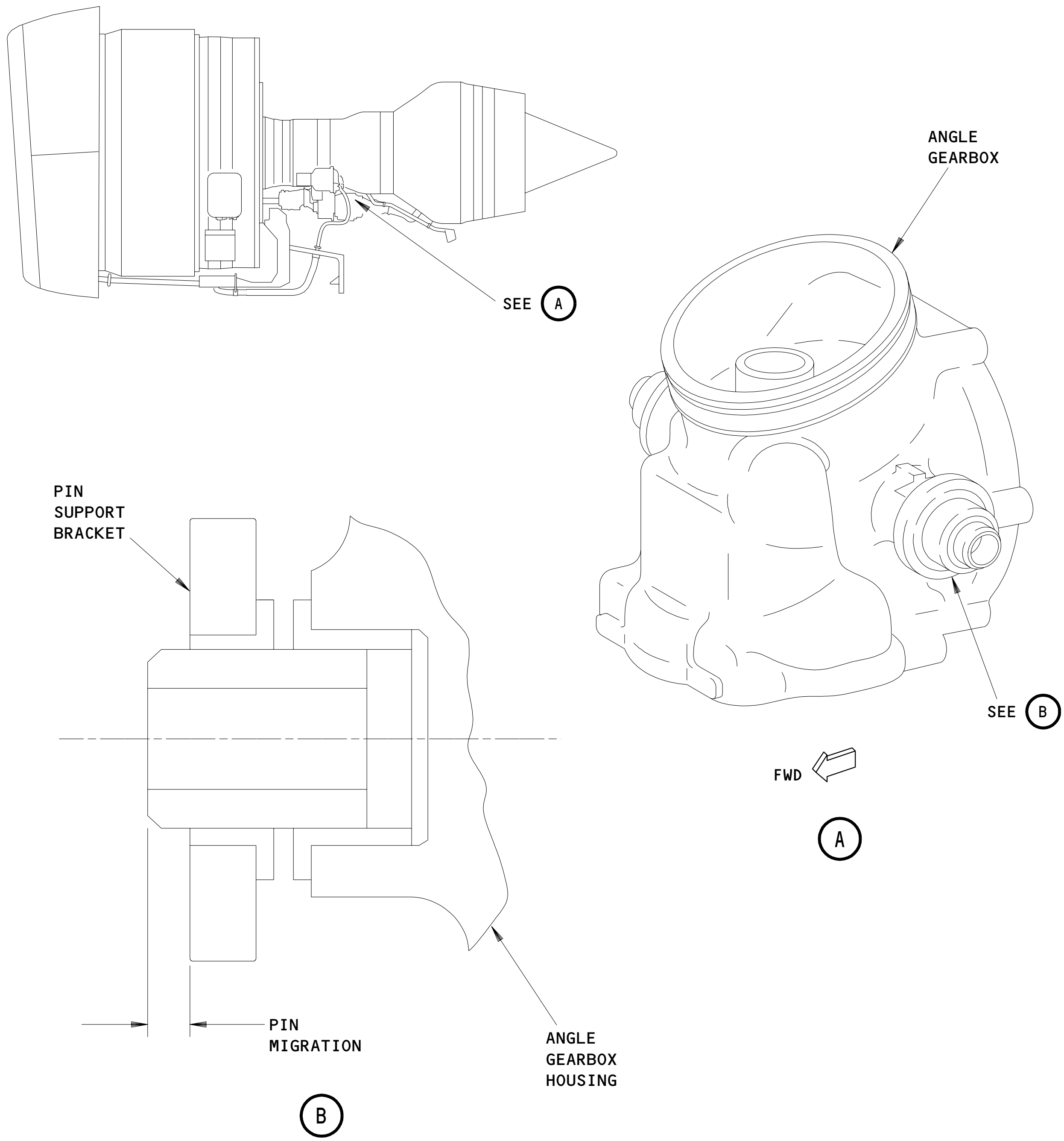
      (3) Do the deactivation procedure for the thrust reverser for ground maintenance (AMM 78-31-00/201).

      S 016-013-N00

      WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU OPEN THE THRUST REVERSERS. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT COULD OCCUR.

      (4) Open the thrust reversers (AMM 78-31-00/201).

      S 016-014-N00
      (5) Remove the No. 4 fan exit lining segment (AMM 72-34-03/401).



Angle Gearbox
Figure 601

S 226-015-N00

(6) Examine the angle gearbox for cracks, oil leaks and corrosion to make sure that the damage is less than the limits given in the damage limit table.

(a) If the damage is more than the given limits, replace the angle gearbox (AMM 72-62-01/401).

DAMAGE LIMIT TABLE

DAMAGE TYPE	AMOUNT OF DAMAGE PERMITTED inches (mm)
Cracks	No Damage Permitted
Oil Leaks	No Damage Permitted
Corrosion	Max. Depth - 0.05 (1.270) Max. Area - 1.00 sq in. (645 sq mm) Min. Separation - 2.00 (50.80)

S 216-026-N00

(7) Visually inspect for pin migration beyond the support bracket on both sides of the angle gearbox (Fig./601).

(a) Pin migration that is greater than 0.125 inch (3.175 mm) is to be inspected every 25 cycles.

(b) Maximum pin migration is 0.250 inch (6.350 mm). Remove angle gearbox from service if migration exceeds maximum.

S 416-016-N00

(8) Install the No. 4 fan exit lining segment (AMM 72-34-03/401).

S 416-017-N00

WARNING: OBEY THE INSTRUCTIONS IN AMM 78-31-00/201 WHEN YOU CLOSE THE THRUST REVERSER. IF YOU DO NOT OBEY THE INSTRUCTIONS, INJURY TO PERSONS AND DAMAGE TO EQUIPMENT COULD OCCUR.

(9) Close the thrust reversers (AMM 78-31-00/201).

S 416-023-N00

(10) Close the core cowl panels (AMM 71-11-06/201).

S 416-024-N00

(11) Do the activation procedure for the thrust reverser (AMM 78-31-00/201).