CHAPTER

70

STANDARD PRACTICES

(GE90-100 SERIES ENGINES)

BOEING

777-200/300
AIRCRAFT MAINTENANCE MANUAL

CHAPTER 70
STANDARD PRACTICES

A = Added, R = Revised, D = Deleted, O = Overflow, C = Customer Originated Change

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ASSEMBLY AND DISASSEMBLY TECHNIQUES - MAINTENANCE PRACTICES

1. General

A. The basic disassembly techniques applicable to many procedures are presented in this section. The subjects that are covered are in the table as follows:

Table 201/70-00-01-993-802-H01 Disassembly Techniques

Electrical Bonding Strap Installation	Par. 2
Correction of Leaks	Par. 3
Unpacking and Repacking	Par. 4
Use of Jackscrews	Par. 5
Use of Protective Closures, Covers, Caps, Plugs, and Tapes	Par. 6
Gaskets and Preformed Packing Seals Practices	Par. 7
Tube Installation	Par. 8
Clamp Installation	Par. 9
Electrical Cable Installation	Par. 10
Electrical Connection - Disconnect and Connect	Par. 11
Electrical Harness (Cable) Repair	Par. 12
Hose Installation	Par. 13

B. The parts or the assemblies that are designated as matched, will be maintained as matched sets throughout the maintenance process. The set numbers, the part numbers, and the serial numbers will be protected during cleaning or rework to prevent removal. When the identification is removed or is no longer legible, then the item must be remarked per the original marking method.

C. Prior to the installation of a part, a quick visual check should be made and any obvious discrepancies noted and reported, so that corrective action can be taken.

D. Observe all applicable precautions for removal and installation of parts as described in the general steps in the Components and Accessories Removal, TASK 70-00-02-000-801-H01 and Components and Accessories Installation, TASK 70-00-02-400-801-H01.

TASK 70-00-01-400-801-H01

2. Electrical Bonding Straps Installation

A. General

(1) Before the installation of the electrical bonding strap, make sure that the any anodic film, grease, paint, lacquer, or other high-resistance material has been removed from the mating surfaces. The abraded area must be a minimum of one and one-half times bonding surface contact area.

(2) Use SWPM 20-20-00 for installation procedures for bonding jumpers (straps) and ground leads.

B. References

Reference	Title
SWPM 20-20-00	Standard Wiring Practices Manual

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

END OF TASK

TASK 70-00-01-360-801-H01

3. Correction of Leaks

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-00-01-020-001-H01

CAUTION

DO NOT OVERTIGHTEN THREADED FASTENERS AS A MEANS TO CORRECT A CONNECTION THAT LEAKS. PARTS FAILURE COULD OCCUR.

(1) Disassemble connection.

SUBTASK 70-00-01-020-002-H01

(2) Discard seal, gasket, or preformed packing, if present.

SUBTASK 70-00-01-210-001-H01

(3) Examine the mating surfaces, look for these problems:
   (a) Contamination
   (b) Scratches
   (c) Dents
   (d) Surface defects.
      1) Repair or replace the problems that you find.

SUBTASK 70-00-01-210-002-H01

(4) Examine threaded fasteners, look for these problems:
   (a) Thread damage
   (b) Damaged fasteners.
      1) If you find damage, then replace the fastener.
   (c) Make sure that the fasteners will seat properly when tightened to specified torque value.

SUBTASK 70-00-01-420-001-H01

(5) Assemble the connection using new seals, gaskets, or preformed packing, as it is necessary.

END OF TASK

TASK 70-00-01-500-801-H01

4. Unpacking and Repacking

A. General

(1) This task gives a general instructions that apply during unpacking and repacking to minimize possible part damage and contamination.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-00-01-540-001-H01

(1) Initially remove only that portion of package material that is necessary to install the part.

(a) Whenever possible, remove remainder of the pack, including protective covers one at a time, as each connection (fluid, air, or electrical) is made.

SUBTASK 70-00-01-540-002-H01

(2) Keep the protective covers and reusable package material for installation on the removed part.

SUBTASK 70-00-01-530-001-H01

(3) Install a protective cover on each connection (fluid, air, or electrical) as it is disconnected.

SUBTASK 70-00-01-530-002-H01

(4) Whenever possible, repack the removed part for storage or shipment using same package material in which replacement part was received.

SUBTASK 70-00-01-530-003-H01

(5) When the original package material is not available, use locally available package materials and container to pack part.

(a) Make sure that all of the ports, openings, connections, and mating surfaces are capped or covered.

(b) Make sure that the part is protected from potential handling and environmental damage.

——— END OF TASK ———

TASK 70-00-01-400-802-H01

5. Use of Jackscrews

A. General

(1) The jackscrew holes are often in flanges that are only thick enough to accept three or four threads. If regular bolts are used as jackscrews, the tips must be blunt and polished. The ends of most of the standard bolts are chamfered, and the first couple of threads are missing or incomplete. Standard bolts should not be used as jackscrews without modification, since only one or two threads will engage in the flange, and the threads in the flange are likely to strip. The jackscrews (frequently designed and identified as special tools), are not chamfered and full thread engagement will occur.

(2) If manufactured jackscrews are not available, make sure that the ends of the standard bolts are ground to remove the chamfers and the incomplete threads so that a maximum number of threads may be engaged in the flange.

(3) When using jackscrews to remove components, do not bend the flange or strip the threads in the flange.

B. Consumable Materials

Reference	Description	Specification
D00552 [C02-019]	Oil - Engine Lubricating	GE Spec. D50TF1

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-00-01-210-003-H01

(1) Check the jackscrews for burrs or rough edges.

SUBTASK 70-00-01-350-001-H01

(2) Remove any burrs or rough edges that are found on the jackscrews.

SUBTASK 70-00-01-420-002-H01

(3) Install the jackscrews.

NOTE: Do not allow the component to fall free as the jackscrew are tightened.

(a) Lubricated the jackscrews with oil, D00552 [C02-019].

(b) Turn the jackscrews slowly and evenly into the flange.

——— END OF TASK ———

TASK 70-00-01-000-801-H01

6. Use of Protective Closures, Covers, Caps, Plugs, and Tapes

A. General

(1) This task contains the instructions to install and remove protective closures, to include covers, caps, plugs, and tapes. Use protective closures to stop the entry of the unwanted materials into the engine or the components during maintenance. The protective closures protect drilled passages, machined surfaces, fluids, fluid or air passages, tubes or ports.

(2) Make sure to protect the components and parts that you remove from the foreign object damage and corrosion.

(3) Make sure to drain the components or parts that carry fluids before you put the protective closures, covers, caps, or plugs on the opening.

B. Consumable Materials

Reference	Description	Specification
G02417 [C10-021]	Tape - Duct	

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-00-01-480-001-H01

(1) Installation Methods

(a) Make sure to drain and to clean all the fluid from the tubes, lines, hoses, and components.

CAUTION

DO NOT USE TAPE AS A PROTECTIVE CLOSURE ON OIL, FUEL, HYDRAULIC TUBES, LINES. IF YOU DO, DAMAGE CAN OCCUR TO THE COMPONENTS FROM THE TAPE ADHESIVE.

(b) Install the protective closures; covers, caps, plugs to the drilled passages, machined surfaces, fluid or air passages, tubes, or ports.

1) Make sure to use the correct size of the protective closures.

(c) Apply the tape, G02417 [C10-021] to seal the openings on the upper bleed air deflector panels and the upper variable bleed valve areas when you do maintenance above the panels.

SUBTASK 70-00-01-080-001-H01

(2) Removal Methods.

(a) Make sure that there is no loose hardware or small parts around the protective closures or parts as you remove the protective closures.

(b) Remove the protective closures (covers, caps, plugs) from the drilled passages, machined surfaces, fluid or air passages, tubes, or ports.

(c) Remove the tape, G02417 [C10-021] from the upper bleed air deflector panels and the upper variable bleed valve areas, if installed.

——— END OF TASK ———

TASK 70-00-01-400-803-H01

7. Gaskets and Preformed Packing Seals Installation

A. General

(1) Make sure that you do not reuse gaskets and preformed packings, unless otherwise specified in the maintenance manual (TASK 70-00-04-200-801-H01).

B. References

Reference	Title
70-00-04-200-801-H01	Gasket Seal (with Imbedded Flexible Seal Material) Removal (P/B 201)

C. Consumable Materials

Reference	Description	Specification
D00504	Grease - Petrolatum	VV-P-236
D00552 [C02-019]	Oil - Engine Lubricating	GE Spec. D50TF1
D00554 [C02-021]	Oil - Jet Engine Lubricating Oil	MIL-PRF-6081, Grade 1010
D50072 [C02-023]	Oil - Engine Lubricating	MIL-PRF-23699
D50190 [C02-007]	Lubricant - Ultrachem Assembly Fluid # 1	A50TF92
D50191 [C02-090]	Lubricant - Silicone (Novagard Silicones - G661)	

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-00-01-420-003-H01

CAUTION: APPLY ONLY ENOUGH LUBRICANT TO WET THE SURFACE OF THE PREFORMED PACKING AND ADJACENT SURFACE. TOO MUCH LUBRICANT CAN CAUSE CONTAMINATION WHICH CAN CAUSE LEAKS.

CAUTION: USE A PROTECTIVE DEVICE WHEN YOU INSTALL PREFORMED PACKINGS OVER THREADS OR SHARP CORNERS OR DAMAGE TO THE PREFORMED PACKING CAN OCCUR.

CAUTION: DO NOT USE SHARP OR POINTED TOOLS TO REMOVE THE PREFORMED PACKINGS OR DAMAGE TO THE PREFORMED PACKING SEALING SURFACE CAN OCCUR.

(1) Use only the new seals and rubber items when you install components.

(2) Use only the specified lubrication.

(a) Install the gasket or preformed packing seal, lightly lubricated with the engine lubrication oil, D00552 [C02-019] or engine lubricating oil, D50072 [C02-023], the grease, D00504, or oil, D00554 [C02-021].

NOTE: In case the preformed packing (o-ring) requires a tacky type assembly fluid to perform the function of retaining the preformed packing in the seal groove to minimize the risk of damage during the assembly, it is permissible to use the Ultrachem Assembly Fluid # 1, D50190 [C02-007] or Novagard G661 Lubricant, D50191 [C02-090].

(3) Make sure that the seals are in good condition and do not have cuts or damage.

(4) Make sure that the groove on the component for the seal does not have nicks, cuts, or other sharp edges.

(5) Put the seal in the correct position on the component.

NOTE: Do not permit the seal to touch during the installation of the seal. If the seal touches threads during the installation, it can cause damage to the seal. Put a conical sleeve on the threads, if it is necessary, when you install the seal.

END OF TASK

TASK 70-00-01-400-804-H01

8. Tube Installation

A. References

Reference	Title
70-51-00-910-802-H01	Wrench Arc Method (Except for the Fuel Manifold to Fuel Nozzle B-Nuts) (P/B 201)

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-00-01-350-002-H01

(1) If it is necessary, bend the tube as follows:

(a) Use a bending tool to prevent the tube from collapsing.

1) It is necessary to use a bending tool on tubes 1.0 inch (25.4 mm) or more in diameter to prevent tube damage.

(b) Bend the tube in existing straight sections if possible.

1) Do not bend the tube near a fitting or a weld area.

2) Pre-existing bends in tube may be bent in same direction as the original bend; no reverse bending is allowed.

(c) The bend radius shall not be less than twice the tube diameter.

(d) Pre-existing bends shall not have their bend angle changed by more than 3 degrees.

(e) No kinks or wrinkles are allowed.

SUBTASK 70-00-01-390-001-H01

(2) Apply a sealant if specified in the maintenance manual procedure.

(a) If it is necessary, allow the sealant to cure before you install the tube.

(b) Make sure that no sealant is inside the tube.

1) If it is necessary, wipe off any sealant on inside of tube with a clean cloth and water.

(c) Make sure that the sealant does not enter the air system.

SUBTASK 70-00-01-420-004-H01

(3) Attach the tube fittings and tighten them with your hand. Make sure the coupling nuts thread freely and the mating flanges on the tube seat flush.

SUBTASK 70-00-01-420-005-H01

(4) Install the tube clamps per par. 9. and tighten them with your hand.

SUBTASK 70-00-01-210-004-H01

(5) Make sure that the clearance between the tube and each adjacent part is maintained.

SUBTASK 70-00-01-420-006-H01

(6) Use the wrench arc method to tighten the tube fittings (TASK 70-51-00-910-802-H01).

——— END OF TASK ———

TASK 70-00-01-400-805-H01

9. Clamp Installation

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-00-01-420-007-H01

(1) Clamp the part loosely in place and move the hose or tube to get the best clearance from adjacent parts before you tighten the clamps.

(a) Make sure that the clamps are the proper size for the hose or tube, and will permit slippage during engine thermal growth.

(b) Make sure that the hoses and the tubes cannot chafe on adjacent structures.

SUBTASK 70-00-01-420-008-H01

(2) Refer to Figure 201 for correct and incorrect clamp installations.

SUBTASK 70-00-01-420-018-H00

CAUTION

MAKE SURE THAT THERE IS NOT A LOOSE OR BROKEN CLAMP. THIS CAN CAUSE TUBE DISLOCATION FROM ITS INITIAL POSITION. A DISLOCATED TUBE CAN CAUSE AN INTERFACE PROBLEM WITH OTHER PARTS AND IT CAN CAUSE DAMAGE THE TUBE. THIS CAN ALSO CAUSE STRESS ON THE ADJACENT CLAMPS AND TUBES AROUND THE TUBE BEND AREA.

(3) If you see loose or broken clamps, or chafing on the tube, do as follows:

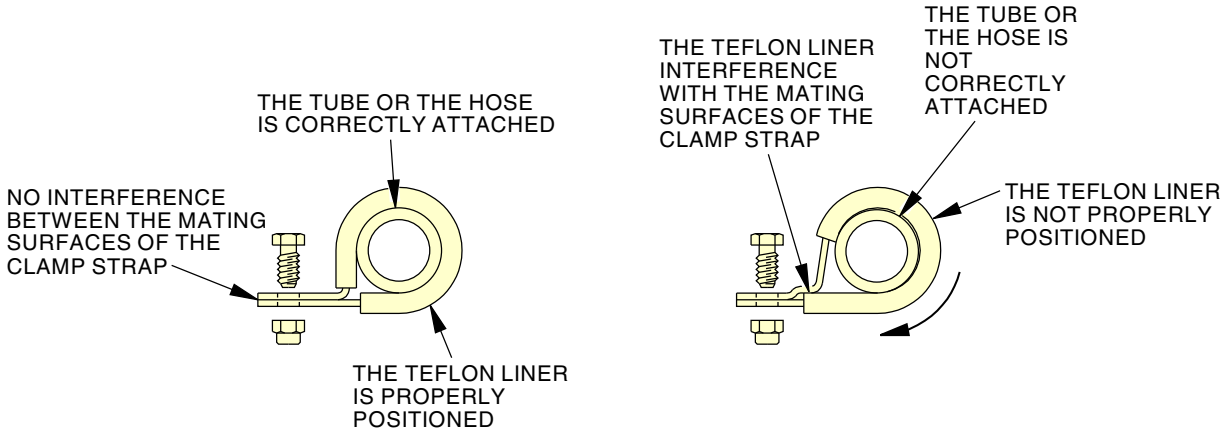
(a) Check all other clamps on the tube for damage, distress, chafing or other signs of possible failure.

(b) Check the tube for damage, distress, chafing or other signs of possible failure. Replace the tube if you find damage.

(c) Replace the broken clamp and replace one clamp upstream and one clamp downstream from the broken clamp.

(d) If you find the clamp is only loose and there is no damage, then correctly install the clamp again.

END OF TASK



Clamp Installation
Figure 201/70-00-01-990-801-H01

TASK 70-00-01-400-806-H01

10. Electrical Cable Installation

A. References

Reference	Title
70-11-11-100-802-H00	Electrical Harness and Contact Cleaning (P/B 201)

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-00-01-010-006-H00

CAUTION REMOVE THE PROTECTION COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.

CAUTION MAKE SURE THAT THE HARNESS CONNECTION AREA IS CLEAN AND FREE FROM WATER OR FLUID CONTAMINATION.

(1) Make sure that you remove protective covers as necessary to prevent engine damage.

SUBTASK 70-00-01-200-002-H00

(2) Examine each harness electrical connector and the mating component receptacle as follows:

(a) Examine for broken, bent, or corroded pins.

(b) Examine for arcing between the pins or sockets.

(c) Examine the threads.

(d) Examine the backshells and backshell clamps for damage and tightness.

SUBTASK 70-00-01-100-001-H00

(3) If necessary, clean the connectors and receptacles (TASK 70-11-11-100-802-H00).

SUBTASK 70-00-01-200-001-H00

(4) Examine the harness wires adjacent to each connector for cracks, wear, or breaks.

SUBTASK 70-00-01-410-004-H00

CAUTION DO NOT BEND OR TWIST THE HARNESS TOO MUCH. IF YOU DO, DAMAGE TO THE HARNESS CAN OCCUR.

CAUTION DO NOT TIGHTEN THE CLAMPS UNTIL YOU CONNECT ALL ELECTRICAL CONNECTORS AND THE HARNESS IS IN THE CORRECT POSITION. IF YOU DO NOT DO THIS, DAMAGE TO THE HARNESS CAN OCCUR.

(CAUTION PRECEDES)

CAUTION

DO NOT LET THE WEIGHT OF THE HARNESS HANG ON THE CONNECTORS. IF YOU DO, DAMAGE TO THE HARNESS CAN OCCUR.

(5) Install the wiring harness assembly as follows:

(a) If necessary, use any special fixtures as specified by the maintenance task to simulate the aircraft pylon or any components that are not installed.

(b) Put the harness in position on the engine as follows:

1) Start at the top, continue to work down and around the engine, and put the harness in position on any hinge clamps, block clamps, or brackets as applicable.

a) Do no twist the harness.

b) Do not close or tighten any clamps at this time.

CAUTION

USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU DO NOT, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR CAN HAVE AN UNWANTED EFFECT ON ENGINE OPERATION, LIGHTNING PROTECTION, AND CAUSE AN IN FLIGHT SHUTDOWN.

(c) Connect the harness self-locking electrical connectors to the mating components as follows:

1) Make sure the electrical connector pins are straight before you connect the connectors.

2) Examine, align, and engage the connector.

3) Push lightly inward on the connector while you tighten the coupling ring.

4) Use the Soft Jaw Pliers and tighten the connector against the receptacle.

5) While you tighten, push the connector in and from side to side.

6) Make sure you can feel the ratchet feature.

7) Tighten the connector until the Soft Jaw Pliers slip on the connector ring.

8) Make sure that you cannot tighten the connector any more.

NOTE: When you use these tools correctly, the contacts are sufficiently engaged and the connector is tight. If you use too much force, these tools will turn on the connector coupling nut. This is to protect the connector from too much torque

(d) Attach the harness to the engine as follows:

1) Adjust the harness in the hinged clamps, loop clamps, and block clamps to remove any stress (too loose or too tight).

a) Make sure there is a minimum of 0.125 in. (3.2 mm) clearance between electrical cables and any component other than hoses.

2) Supply the slack in the harness equally.

3) Make a large radius where the harness changes direction.

4) Attach the harness to the engine with the applicable hinged clamps, loop clamps, and block clamps as applicable.

5) Tighten the bolts to the Maintenance Manual specifications.

6) Examine the assembly for foreign objects, damage, and correct assembly.

——— END OF TASK ———

TASK 70-00-01-400-807-H01

11. Electrical Connector - Disconnect and Connect

A. Tools/Equipment

Reference	Description
STD-664	Pliers - Teflon-jawed (or Equivalent Soft-Jawed)

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-00-01-020-003-H01

CAUTION MAKE SURE ELECTRICAL CONNECTORS ARE CLEAN WHEN YOU DISCONNECT THEM. CONTAMINATION OF ELECTRICAL CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

CAUTION USE TEFLON-JAWED PLIERS TO LOOSEN ELECTRICAL CONNECTORS. DO NOT USE METAL-JAWED PLIERS. DAMAGE TO THE ELECTRICAL CONNECTORS COULD OCCUR.

(1) Disconnect the electrical connector.

(a) Use your hand or teflon-jawed pliers, STD-664 to loosen the electrical connector.

(b) Visually examine the electrical connector and the receptacle for obvious signs of damage, bent pins, contamination, or corrosion.

1) If you find damage, repair or replace the component as it is necessary.

2) Install protective caps on the electrical connector and receptacle.

SUBTASK 70-00-01-420-010-H01

CAUTION MAKE SURE THAT THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

CAUTION DO NOT USE PLIERS THAT HAVE METAL JAWS TO TIGHTEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

(2) Connect the electrical connector.

(a) Remove the protective caps from the electrical connector and receptacle.

(b) Engage the electrical connector with its receptacle.

(c) Turn the knurled coupling ring with your hand.

(d) Move the backshell assembly from side-to-side, while you turn the knurled coupling ring, until the electrical connector is fully seated.

(e) If you can get access to the electrical connector with the teflon-jawed pliers, STD-664, do these steps:

1) Put the teflon-jawed pliers, STD-664 on the knurled coupling ring of the electrical connector.

2) Tighten the electrical connector until it cannot be moved.

(f) If you can not get access to the electrical connector with the teflon-jawed pliers, STD-664, do these steps:

1) Tighten the knurled coupling ring of the electrical connector with your hand.

2) Make sure that the electrical connector backshell assembly does not move from side-to-side with your hand.

3) If the electrical connector does move, disconnect the electrical connector.

4) Do the above steps again to connect the electrical connector.

——— END OF TASK ———

TASK 70-00-01-400-808-H01

12. Electrical Harness (Cable) - Repair

A. General

(1) This task gives the instructions to repair a damaged external cover of the FADEC electrical harnesses (cables). It also gives instructions to repair other electrical harnesses (cables) on the engine.

(2) An alternative procedure is also available here after to repair the damaged external cover of the (FADEC) electrical harnesses (cables) only.

(3) These procedures can be used to repair chafing, cuts, cracks or tears of the external covering of electrical harnesses.

(4) You can repair the electrical harnesses with the harness installed on the engine.

B. References

Reference	Title
27-81-00-040-801	Leading Edge Slat - Deactivation (P/B 201)
27-81-00-440-801	Leading Edge Slat Reactivation (P/B 201)
27-81-00-860-805	Retract the Leading Edge Slats (P/B 201)
71-11-04-010-814-H00	Open the Fan Cowl Panel (Selection) (P/B 201)
71-11-04-410-814-H00	Close the Fan Cowl Panel (Selection) (P/B 201)
78-31-00-010-816-H00	Open the Thrust Reverser (Selection) (P/B 201)
78-31-00-040-806-H00	Thrust Reverser Deactivation For Ground Maintenance (P/B 201)
78-31-00-410-816-H00	Close the Thrust Reverser (Selection) (P/B 201)
78-31-00-440-805-H00	Thrust Reverser Activation After Ground Maintenance (P/B 201)

C. Tools/Equipment

Reference	Description
STD-762	Scissors - Electrical

D. Consumable Materials

Reference	Description	Specification
A50002	Adhesive - General Purpose - Loctite 495	

(Continued)

Reference	Description	Specification
G02329	Tape - Aluminum Foil, Pressure Sensitive - Vibration Damping Tape 434	
G50023	Kit - Aerazur Kermel Band Repair X55 Kit (Kit Composed of Kermel Band Tape and Nomex Lacing Tape (A-A-52084))	
G51329	Tape - Silicone Rubber (Arlon MOX-Tape Reference # 600-1)	A-A-59163

E. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

F. Access Panels

Number	Name/Location
413AL	Left Fan Cowl Panel, Left Engine
414AR	Right Fan Cowl Panel, Left Engine
415AL	Left Thrust Reverser, Left Engine
416AR	Right Thrust Reverser, Left Engine
423AL	Left Fan Cowl Panel, Right Engine
424AR	Right Fan Cowl Panel, Right Engine
425AL	Left Thrust Reverser, Right Engine
426AR	Right Thrust Reverser, Right Engine

G. Prepare for the Repair

SUBTASK 70-00-01-010-004-H01

WARNING DO ALL OF THE SPECIFIED TASKS IN THE CORRECT SEQUENCE TO OPEN THE THRUST REVERSER(S). IF YOU DO NOT OBEY THIS INSTRUCTION, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR

(1) Do these tasks in sequence to safely open the left and right thrust reversers on the applicable engine:

(a) Do this task: Retract the Leading Edge Slats, TASK 27-81-00-860-805.

(b) Do this task: Leading Edge Slat - Deactivation, TASK 27-81-00-040-801.

(c) Do this task: Thrust Reverser Deactivation For Ground Maintenance, TASK 78-31-00-040-806-H00.

(d) For the left and right fan cowl panels, do this task:

Open the Fan Cowl Panel (Selection), TASK 71-11-04-010-814-H00

Number	Name/Location
413AL	Left Fan Cowl Panel, Left Engine
414AR	Right Fan Cowl Panel, Left Engine
423AL	Left Fan Cowl Panel, Right Engine
424AR	Right Fan Cowl Panel, Right Engine

(e) For the left and right thrust reversers, do this task:

Open the Thrust Reverser (Selection), TASK 78-31-00-010-816-H00

Number	Name/Location
415AL	Left Thrust Reverser, Left Engine
416AR	Right Thrust Reverser, Left Engine
425AL	Left Thrust Reverser, Right Engine
426AR	Right Thrust Reverser, Right Engine

H. Procedure

SUBTASK 70-00-01-350-005-H00

NOTE: The first and second repair procedures apply to electrical harnesses on the engine including FADEC electrical harnesses.

NOTE: The third repair procedure applies to FADEC electrical harnesses only.

(1) The repairs are defined in the following paragraphs I, J and K.

I. Repair 1.

SUBTASK 70-00-01-350-003-H01

CAUTION MAKE SURE THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU DISCONNECT THEM. CONTAMINATION CAN CAUSE DAMAGE TO THE EQUIPMENT.

CAUTION DO NOT USE THE METAL-JAWED PLIERS TO LOOSEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

NOTE: The electrical harnesses can be repaired with the electrical harness installed on the engine or in a shop, excepted for the FADEC Electrical Harnesses that can be repaired on wing only.

(1) Repairable limits:

(a) The procedure can be used to repair chafing, cuts, cracks or tears of the external cover of less than 2.0 in. (50.8 mm) in length. If the damage is more than 2.0 in. (50.8 mm), replace the electrical harness.

(2) Disconnect the electrical connector, loosen the clamps, and remove clamps if necessary. You must have access to all sides of the repair area (TASK 70-00-01-400-807-H01).

(3) Repair the electrical harness (cable) as follows (Figure 202):

(a) Use electrical scissors, STD-762 to cut and remove the external cover of the electrical harness. Remove 0.5 in. (12.7 mm) of the cover on each side of the damaged area.

(b) Wind the Aerazur's Kermel Band Repair X55 Kit, G50023, around the cable. Start 1.0 in. (25.4 mm) from where you removed the cover of the electrical harness.

1) Make sure that the black side of the Aerazur's Kermel Band Repair X55 Kit, G50023 shows. If the black side does not show, start again with the opposite side down.

(c) Continue to wind the Aerazur's Kermel Band Repair X55 Kit, G50023 around the electrical harness.

1) Make sure that there is 30% overlap of the Aerazur's Kermel Band Repair X55 Kit, G50023. Complete the wind of the tape 1.0 in. (25.4 mm) from where you removed the cover of the electrical harness.

(d) Cut three 10.0 in. (25.4 cm) pieces of lacing cord (found in the Aerazur's Kermel Band Repair X55 Kit, G50023).

(e) Tie the lacing cord, at the center of the Aerazur's Kermel Band Repair X55 Kit, G50023.

(f) Tie a second and third lacing cord 0.3 in. (7.6 mm) from each end of the Aerazur's Kermel Band Repair X55 Kit, G50023.

(g) Put a drop of the Loctite 495 adhesive, A50002 on each knot to safety the knots.

SUBTASK 70-00-01-420-011-H01

CAUTION MAKE SURE THAT THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

CAUTION DO NOT USE PLIERS THAT HAVE METAL JAWS TO TIGHTEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

(4) Connect the electrical connector if necessary (TASK 70-00-01-400-807-H01):

(a) Install the clamps for the electrical harness as necessary (TASK 70-00-01-400-805-H01).

J. Repair 2.

SUBTASK 70-00-01-300-001-H00

CAUTION MAKE SURE THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU DISCONNECT THEM. CONTAMINATION CAN CAUSE DAMAGE TO THE EQUIPMENT.

CAUTION DO NOT USE THE METAL-JAWED PLIERS TO LOOSEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

NOTE: The electrical harnesses can be repaired with the electrical harness on the wing or in a shop, except for the FADEC Electrical Harnesses that can be repaired on the wing only.

NOTE: This procedure gives instructions to repair the worn outer cover of the electrical harness. You must examine the repair area again every 10 days until the electrical harness is replaced.

(1) Remove the outer cover of the electrical harness with the scissors or knife to expose a minimum of 1.0 in. (25.4 mm) of the metallic braid insulation for a maximum of 50 percent of the outer diameter of the electrical harness.

(2) Apply the Vibration Damping Tape 434 tape, G02329 around the damaged part of the electrical harness (Figure 203).

(a) Put a wrap with the shiny side down (sticky side up).

(b) Start to put the wrap of the Vibration Damping Tape 434 tape, G02329 at a minimum of 2.0 in. (50.8 mm) from the damaged area and overlap the wrap of the Vibration Damping Tape 434 tape, G02329 by 50 percent.

(c) Continue to wrap the Vibration Damping Tape 434 tape, G02329 to cover at a minimum of 2.0 in. (50.8 mm) more than the damaged part of the electrical harness.

(3) Apply the Vibration Damping Tape 434 tape, G02329 over the first layer of the Vibration Damping Tape 434 tape, G02329.

(a) Put a wrap with the shiny side up (sticky side down).

(b) Start to wrap the Vibration Damping Tape 434 tape, G02329 at a minimum of 2.0 in. (50.8 mm) from the damaged area and overlap the wrapping of the Vibration Damping Tape 434 tape, G02329 by 50 percent.

(c) Continue to wrap the Vibration Damping Tape 434 tape, G02329 to cover at a minimum of 2.0 in. (50.8 mm) more than the damaged part of the electrical harness.

(4) Examine the repair area in 10 day intervals until the electrical harness is replaced.

(a) If the Vibration Damping Tape 434 tape, G02329 is damaged, remove both layers of the Vibration Damping Tape 434 tape, G02329 and do the repair procedure again.

CAUTION MAKE SURE THAT THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

CAUTION DO NOT USE PLIERS THAT HAVE METAL JAWS TO TIGHTEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

(5) Connect the electrical connector if necessary (TASK 70-00-01-400-807-H01):

(a) Install the clamps for the electrical harness if necessary (TASK 70-00-01-400-805-H01).

K. Repair 3 (FADEC electrical harnesses only)

SUBTASK 70-00-01-800-001-H00

CAUTION MAKE SURE THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU DISCONNECT THEM. CONTAMINATION CAN CAUSE DAMAGE TO THE EQUIPMENT.

CAUTION DO NOT USE THE METAL-JAWED PLIERS TO LOOSEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

CAUTION THE USE OF THE SILICON RUBBER TAPE TO REPAIR WEARS LOCATED UNDER BOBBINS AND/OR CLAMPS IS NOT PERMITTED.

(1) Repair limitation:

(a) This is a temporary repair applicable on the wing only. The harness must be sent to the harness shop as soon as removed from the engine or when the engine is in the shop.

(b) This repair using Arlon MOX-Tape, G51329 is applicable on Fan and Core Harnesses for outer sheath damages.

(c) If high wear (when the EMI metallic braid is visible), it is necessary to make sure that the braid strands are not damaged.

1) No break of strands, no holes higher than X=0.098 in. (2.5 mm) permitted. Refer to Figure 204.

2) Harnesses with a high quantity of damage (EMI braid damage) found on the wing must be removed/replaced.

(d) The maximum damaged area that can be repaired with this procedure is only limited by the clamping points. Damaged area must be at least 0.5 in. (12.7 mm) from the clamping points.

(2) Damages can be located at 3 different areas on the harness:

(a) Behind the backshell outlet (Figure 205).

(b) Behind the transition outlet (Figure 205).

(c) Between the two clamping points (Figure 206).

(3) Wrap dimension limits:

(a) The coverage must be extended on both sides of the damaged area to make sure strength of the patch is sufficient. Put a tight wrapping of the Arlon MOX-Tape, G51329 around the braid in a single spiral with 50 percent overlap.

1) In case of wear located behind connector backshell outlet or transition outlet (Figure 205), the Arlon MOX-Tape, G51329 must cover the metallic bands used to tighten the EMI braid and outer sheath on the outlet. The other end must be in the dimensions (Dimension C) specified in Figure 205 and Table 202.

2) In case of wear located between two clamping points (Figure 206), the dimension limits of the Arlon MOX-Tape, G51329 must be in the dimensional limits specified in Figure 206 and Table 202.

Table 202/70-00-01-993-804-H00 Dimension Limits (Units in Inches with Millimeters in Parentheses)

Configuration	Description	Minimum Finish Dimension	Maximum Finish Dimension
Conf 1, Conf 2	C	0.5 (12.7)	1.0 (25.5)
Conf 3	A	0.5 (12.7)	1.0 (25.5)
Conf 3	B	0.5 (12.7)	1.0 (25.5)
Conf 1, Conf 2 & Conf 3	Damaged area (Maximum damaged area)		Between two clamping points

CAUTION

MAKE SURE THAT THE ELECTRICAL CONNECTOR AND RECEPTACLE ARE CLEAN WHEN YOU CONNECT THEM. DIRTY CONNECTORS CAN CAUSE DAMAGE TO EQUIPMENT.

CAUTION

DO NOT USE PLIERS THAT HAVE METAL JAWS TO TIGHTEN THE ELECTRICAL CONNECTOR. DAMAGE TO THE ELECTRICAL CONNECTOR CAN OCCUR.

(4) Connect the electrical connector if necessary (TASK 70-00-01-400-807-H01):

(a) Install the clamps for the electrical harness if necessary (TASK 70-00-01-400-805-H01).

L. Put the Airplane Back to its Usual Condition.

SUBTASK 70-00-01-410-002-H01

WARNING DO ALL OF THE SPECIFIED TASKS IN THE CORRECT SEQUENCE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THIS INSTRUCTION, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Do these tasks in sequence to safely close the left and right thrust reversers on the applicable engine:

(a) Do this task: Close the Thrust Reverser (Selection), TASK 78-31-00-410-816-H00.

1) Close these access panels:

Number	Name/Location
415AL	Left Thrust Reverser, Left Engine
416AR	Right Thrust Reverser, Left Engine
425AL	Left Thrust Reverser, Right Engine
426AR	Right Thrust Reverser, Right Engine

(b) Do this task: Close the Fan Cowl Panel (Selection), TASK 71-11-04-410-814-H00.

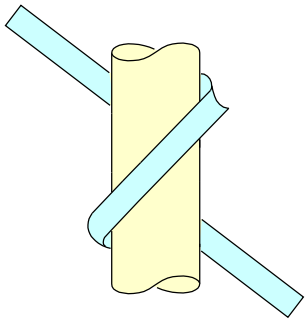
1) Close these access panels:

Number	Name/Location
413AL	Left Fan Cowl Panel, Left Engine
414AR	Right Fan Cowl Panel, Left Engine
423AL	Left Fan Cowl Panel, Right Engine
424AR	Right Fan Cowl Panel, Right Engine

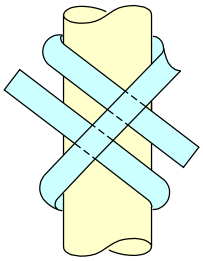
(c) Do this task: Thrust Reverser Activation After Ground Maintenance, TASK 78-31-00-440-805-H00.

(d) Do this task: Leading Edge Slat Reactivation, TASK 27-81-00-440-801.

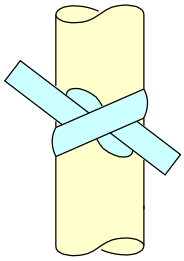
END OF TASK



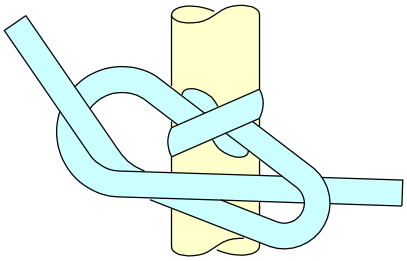
STEP 1



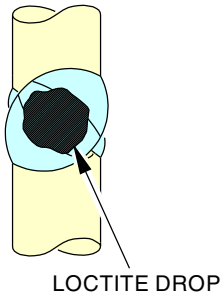
STEP 2



STEP 3



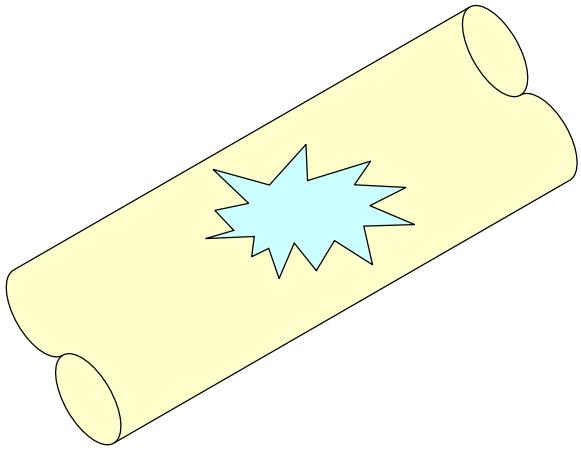
STEP 4



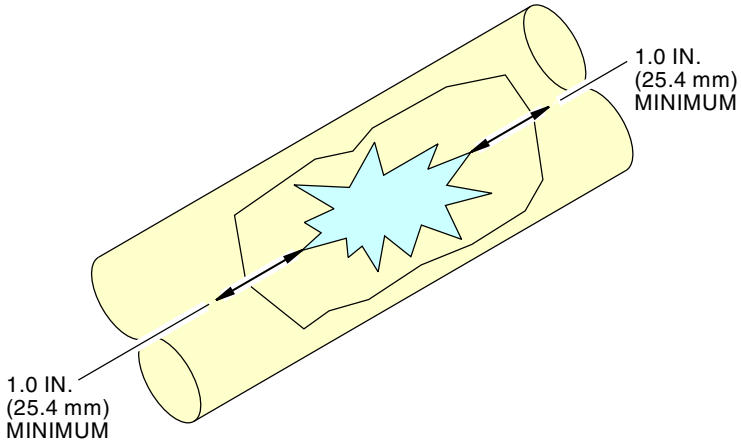
STEP 5

1167560-00-A
M06305 S0004285397_V2

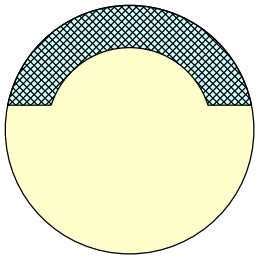
Tying of the Lacing Cord on the Kernel Band
Figure 202/70-00-01-990-802-H01



DAMAGED AREA



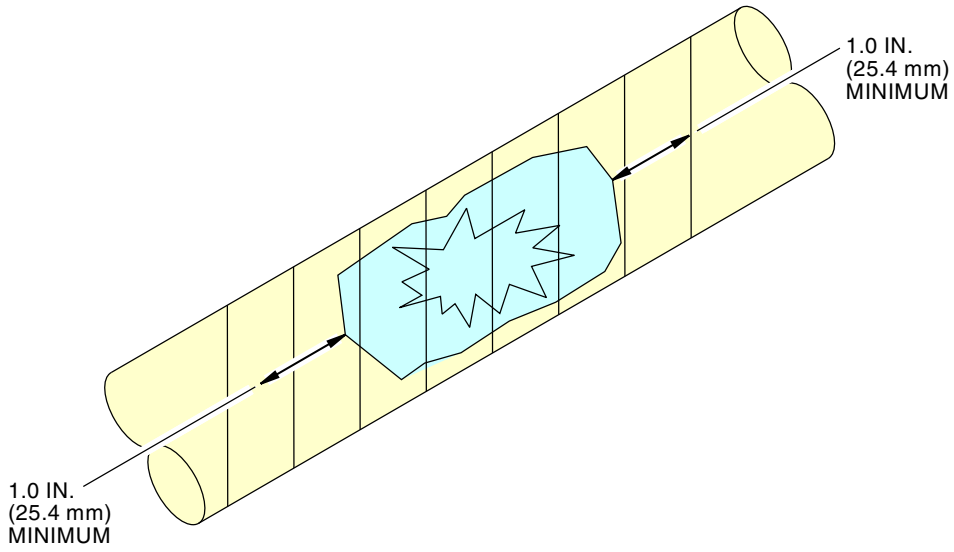
REMOVE THE OUTER COVERING



50% MAXIMUM

2424903 S0000559588_V2

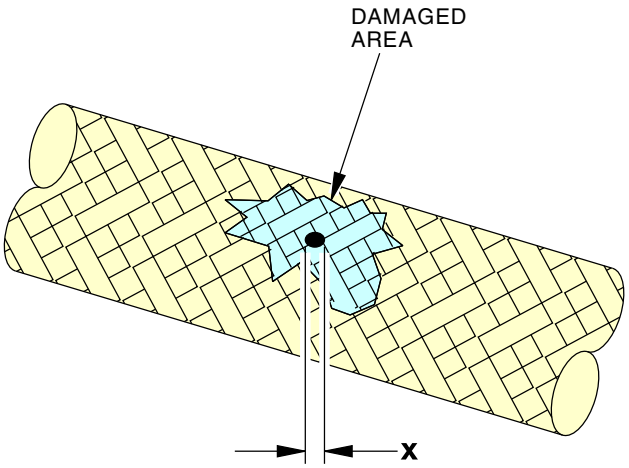
Electrical Harness Chafing Repair
Figure 203/70-00-01-990-806-H00 (Sheet 1 of 2)



WRAP THE ELECTRICAL HARNESS

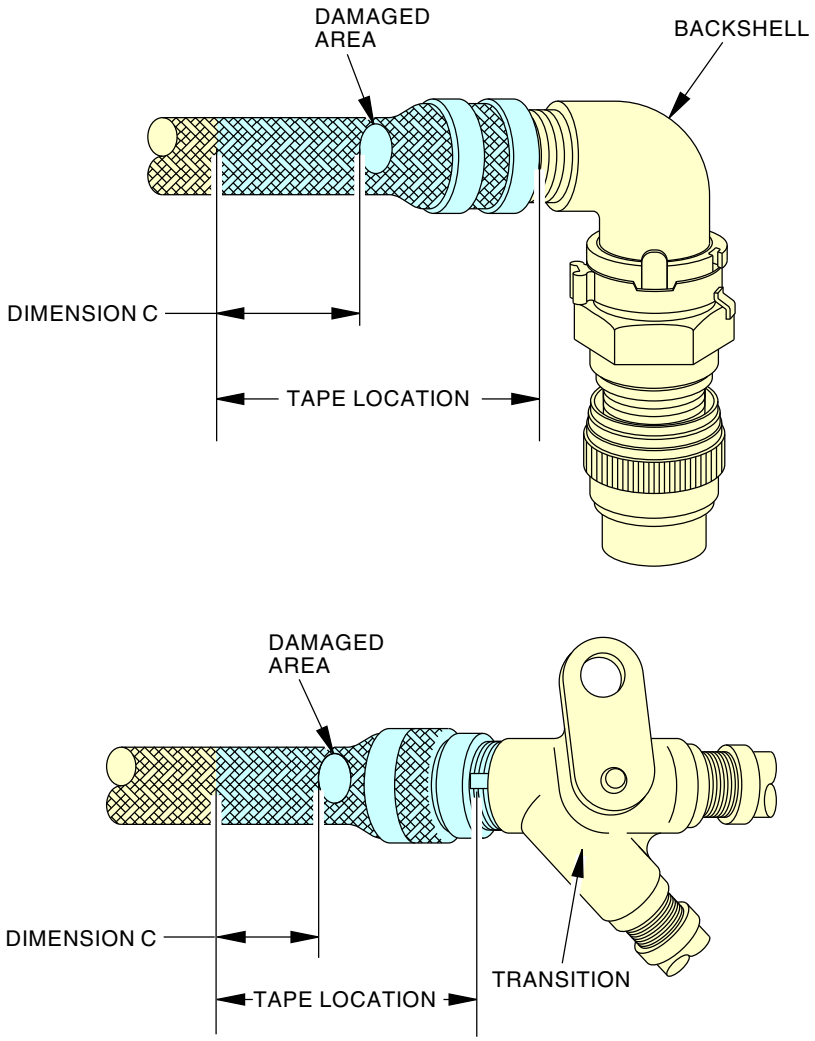
2424905 S0000559589_V2

Electrical Harness Chafing Repair
Figure 203/70-00-01-990-806-H00 (Sheet 2 of 2)



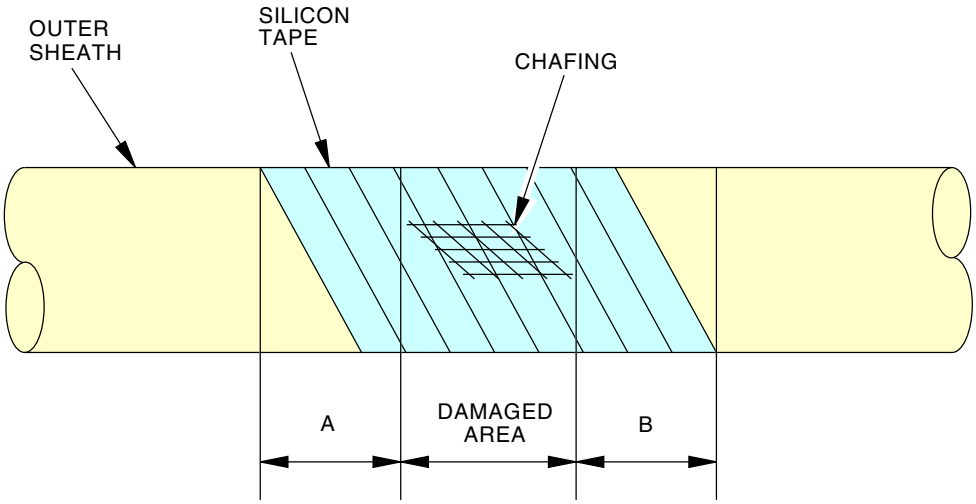
2424920 S0000559590_V2

Max Hole Size of the Metallic Braid
Figure 204/70-00-01-990-807-H00



2424924 S0000559591_V2

Damages Located Behind Outlets/Backshells
Figure 205/70-00-01-990-808-H00



2424922 S0000559592_V2

Damages Located Between Two Clamping Points
Figure 206/70-00-01-990-809-H00

TASK 70-00-01-300-801-H00

13. Electrical Harness (Cable without Bobbin) Repair

(Figure 207)

A. General

(1) This task gives the instructions to replace missing bobbin of the FADEC electrical harnesses (cables) on the engine.

(2) This procedure can be used to replace missing bobbin on an electrical harness that does not show any chaffing, cuts, cracks or tears in the external braid. If the harness is damaged, repair the harness (TASK 70-00-01-400-808-H01 or TASK 73-22-00-760-801-H01).

(3) Silicon rubber tape repair is intended for on-wing temporary repair only. In case of missing bobbin found in shop, replace the harness.

B. References

Reference	Title
27-81-00-040-801	Leading Edge Slat - Deactivation (P/B 201)
27-81-00-440-801	Leading Edge Slat Reactivation (P/B 201)
27-81-00-860-805	Retract the Leading Edge Slats (P/B 201)
71-11-04-010-814-H00	Open the Fan Cowl Panel (Selection) (P/B 201)
71-11-04-410-814-H00	Close the Fan Cowl Panel (Selection) (P/B 201)
73-22-00-760-801-H01	Electrical Harness Repair (P/B 201)
78-31-00-010-816-H00	Open the Thrust Reverser (Selection) (P/B 201)
78-31-00-040-806-H00	Thrust Reverser Deactivation For Ground Maintenance (P/B 201)
78-31-00-410-816-H00	Close the Thrust Reverser (Selection) (P/B 201)
78-31-00-440-805-H00	Thrust Reverser Activation After Ground Maintenance (P/B 201)

C. Consumable Materials

Reference	Description	Specification
G00834	Cloth - Lint-free Cotton	
G50489 [C10-125]	Tape - Silicone Self-Adhering	A-A-59163 Type I

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Access Panels

Number	Name/Location
413AL	Left Fan Cowl Panel, Left Engine
414AR	Right Fan Cowl Panel, Left Engine
415AL	Left Thrust Reverser, Left Engine
416AR	Right Thrust Reverser, Left Engine
423AL	Left Fan Cowl Panel, Right Engine
424AR	Right Fan Cowl Panel, Right Engine
425AL	Left Thrust Reverser, Right Engine
426AR	Right Thrust Reverser, Right Engine

F. Prepare for the Repair

SUBTASK 70-00-01-010-005-H00

WARNING DO ALL OF THE SPECIFIED TASKS IN THE CORRECT SEQUENCE TO OPEN THE THRUST REVERSER(S). IF YOU DO NOT OBEY THIS INSTRUCTION, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR

(1) Do these tasks in sequence to safely open the left and right thrust reversers on the applicable engine:

(a) Do this task: Retract the Leading Edge Slats, TASK 27-81-00-860-805.

(b) Do this task: Leading Edge Slat - Deactivation, TASK 27-81-00-040-801.

(c) Do this task: Thrust Reverser Deactivation For Ground Maintenance, TASK 78-31-00-040-806-H00.

(d) For the left and right fan cowl panels, do this task:

Open the Fan Cowl Panel (Selection), TASK 71-11-04-010-814-H00

Number	Name/Location
413AL	Left Fan Cowl Panel, Left Engine
414AR	Right Fan Cowl Panel, Left Engine
423AL	Left Fan Cowl Panel, Right Engine
424AR	Right Fan Cowl Panel, Right Engine

(e) For the left and right thrust reversers, do this task:

Open the Thrust Reverser (Selection), TASK 78-31-00-010-816-H00

Number	Name/Location
415AL	Left Thrust Reverser, Left Engine
416AR	Right Thrust Reverser, Left Engine
425AL	Left Thrust Reverser, Right Engine
426AR	Right Thrust Reverser, Right Engine

G. Electrical Harness (Cable without Bobbin) Repair

SUBTASK 70-00-01-000-001-H00

(1) Loosen other clamps as necessary to get access to the area.

SUBTASK 70-00-01-210-010-H00

(2) Examine the conditions that follow to see if you can do the repair:

(a) This procedure applies only for harnesses with bobbin missing at clamp point.

(b) This procedure does not apply to harnesses that show damaged areas.

SUBTASK 70-00-01-350-004-H00

(3) Prepare the surface for the tape application.

(a) Thoroughly clean the outer braid in and adjacent to the clamping area with a lint-free cloth, G00834.

(b) Wind the silicone self-adhering tape, G50489 [C10-125] tightly around the braid in a single spiral with 50 percent overlap.

NOTE: The tape coverage must be extend on both sides of the clamp area.

1) Make sure there is clamping on the patch.

(c) Wrap the tape a minimum of 3 times.

SUBTASK 70-00-01-211-001-H00

(4) Do a visual inspection of the taped area.

(a) Tape bonding on the parent material

1) No lift off permitted.

(b) Nicks and dents

1) None permitted.

SUBTASK 70-00-01-420-016-H00

(5) Put the harness on the clamp.

SUBTASK 70-00-01-420-017-H00

(6) Install the clamps (TASK 70-00-01-400-805-H01).

(a) Make sure that the clamp is tightened correctly.

(b) If it is necessary, apply silicone self-adhering tape, G50489 [C10-125] again as follow:

1) Wind the silicone self-adhering tape, G50489 [C10-125] tightly around the braid in a single spiral with 50 percent overlap.

(c) Put the harness on the clamp.

(d) Install the clamps (TASK 70-00-01-400-805-H01).

1) Make sure that the clamp is tightened correctly.

(e) If it is necessary, remove all of the silicone self-adhering tape, G50489 [C10-125], and do the full procedure again.

H. Put the Airplane Back to its Usual Condition

SUBTASK 70-00-01-410-003-H00

WARNING DO ALL OF THE SPECIFIED TASKS IN THE CORRECT SEQUENCE TO CLOSE THE THRUST REVERSERS. IF YOU DO NOT OBEY THIS INSTRUCTION, INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT CAN OCCUR.

(1) Do these tasks in sequence to safely close the left and right thrust reversers on the applicable engine:

(a) Do this task: Close the Thrust Reverser (Selection), TASK 78-31-00-410-816-H00.

1) Close these access panels:

Number	Name/Location
415AL	Left Thrust Reverser, Left Engine
416AR	Right Thrust Reverser, Left Engine
425AL	Left Thrust Reverser, Right Engine
426AR	Right Thrust Reverser, Right Engine

(b) Do this task: Close the Fan Cowl Panel (Selection), TASK 71-11-04-410-814-H00.

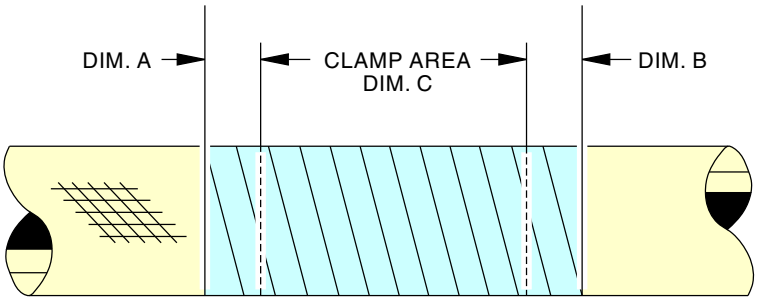
1) Close these access panels:

Number	Name/Location
413AL	Left Fan Cowl Panel, Left Engine
414AR	Right Fan Cowl Panel, Left Engine
423AL	Left Fan Cowl Panel, Right Engine
424AR	Right Fan Cowl Panel, Right Engine

(c) Do this task: Thrust Reverser Activation After Ground Maintenance, TASK 78-31-00-440-805-H00.

(d) Do this task: Leading Edge Slat Reactivation, TASK 27-81-00-440-801.

——— END OF TASK ———



ELECTRICAL HARNESS
(CABLE WITHOUT BOBBIN)

DESCRIPTION	MINIMUM IN-PROCESS DIMENSION	MAXIMUM IN-PROCESS DIMENSION	MINIMUM FINISH DIMENSION	MAXIMUM FINISH DIMENSION	REFERENCE DIMENSION
DIM. A			0.591 INCH (15.0 mm)	0.784 INCH (20.0 mm)	
DIM. B			0.591 INCH (15.0 mm)	0.784 INCH (20.0 mm)	
DIM. C					0.784 INCH (20.0 mm)

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Electrical Harness (Cable without Bobbin) Repair
Figure 207/70-00-01-990-805-H00

TASK 70-00-01-400-809-H01

14. Hose Installation

A. General

(1) When you remove the hoses, make sure that you put a cap on the open ends. Do not use tape as an alternative to a cap.

(2) You must not make new bends to a pre-formed hose or hose with a large diameter.

(3) You must not bend a hose when you install it. If you bend a hose when it is cold, you can cause damage to the hose more easily. You can cause damage to the Teflon lining if you bend the hose.

(4) You must not use a hose with a kink in it.

(5) When you install the hose, make sure that you do not stretch or twist the hose.

(6) Do not apply too much torque to the connectors. Do not apply too much torque to the connectors to try to correct a leak.

B. References

Reference	Title
70-51-00-910-801-H01	Instruction for Torque (P/B 201)
70-51-00-910-802-H01	Wrench Arc Method (Except for the Fuel Manifold to Fuel Nozzle B-Nuts) (P/B 201)

C. Consumable Materials

Reference	Description	Specification
D00552 [C02-019]	Oil - Engine Lubricating	GE Spec. D50TF1

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-00-01-210-008-H01

(1) Examine the inner wall of the pre-formed hose to make sure that the Teflon lining is not damaged (Figure 208).

(a) Replace the hose if the lining is damaged.

SUBTASK 70-00-01-420-012-H01

(2) Lubricate the tube or the hose coupling nut and ferrule with oil, D00552 [C02-019], and install it.

SUBTASK 70-00-01-420-013-H01

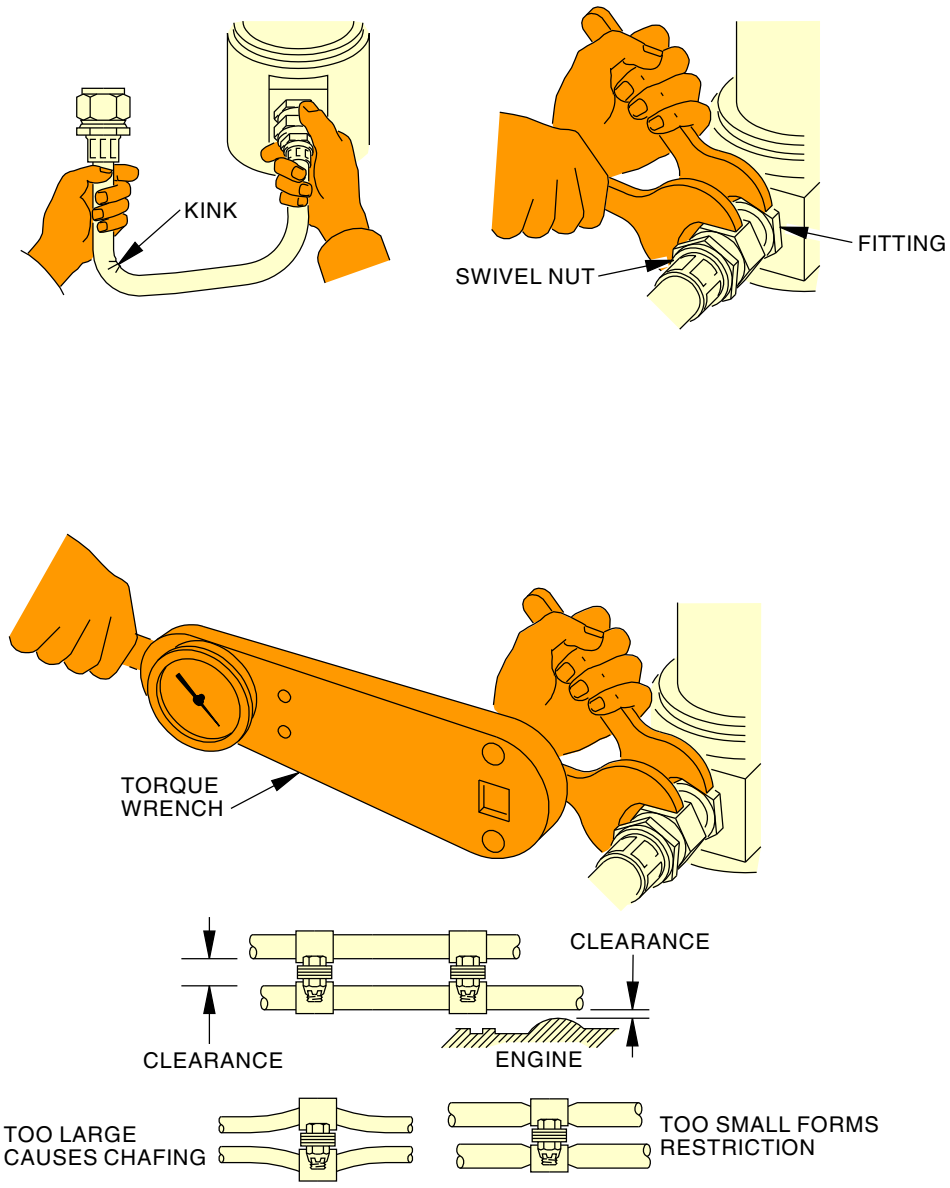
(3) Use the wrench arc procedure to tighten the fluid fittings (TASK 70-51-00-910-802-H01).

NOTE: Use two wrenches to tighten swivel coupling nuts on hoses, tubes, or fittings. Hold the stable part with one wrench while you apply torque with the second wrench.

(a) If you use torque wrenches to tighten the fluid fittings, follow the instructions in this task:Instruction for Torque, TASK 70-51-00-910-801-H01.

NOTE: The adapter drive can be in one of three positions on the torque wrench. The illustration in the Instructions for Torque task shows these positions. A change in the position of the adapter drive on the torque wrench will also change the torque applied. Use the examples in the Instructions for Torque task to help find the correct torque values.

——— END OF TASK ———



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Hose Installation
Figure 208/70-00-01-990-803-H01

TASK 70-00-01-400-810-H01

15. Moeller Lockring Installation

A. General

(1) This task gives instructions for the installation of a Moeller Lockring on a nipple with 0.375 inch (9.53 mm) or 3/8 inch tubing and thread size 0.5625-18UNJF. If the 3/8 inch tubing is used, pressure cap Part Number J1314G06 or J1314G106 is used with the thread size of 0.5625-18UNJF.

B. Tools/Equipment

Reference	Description
STD-725	Punch

C. Consumable Materials

Reference	Description	Specification
D00004	Compound - Antiseize, Graphite-Petrolatum	SAE AMS 2518
D00552 [C02-019]	Oil - Engine Lubricating	GE Spec. D50TF1

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-00-01-860-001-H01

(1) Get a pressure cap.

SUBTASK 70-00-01-010-002-H01

(2) Remove the center of the pressure cap with a punch, STD-725 (Figure 209).

NOTE: Use any circular punch of diameter less than 0.432 inch (10.907 mm).

SUBTASK 70-00-01-420-014-H01

(3) Lightly lubricate the internal diameter of the lockring with oil, D00552 [C02-019] or compound, D00004.

SUBTASK 70-00-01-860-002-H01

(4) Install the Moeller Lockring.

(a) Put the lockring over the coupling or nipple.

(b) Thread on the pressure cap by hand until the pressure cap is inside the lockring.

SUBTASK 70-00-01-210-009-H01

(5) Do a visual check to make sure that the lockring is aligned.

SUBTASK 70-00-01-420-015-H01

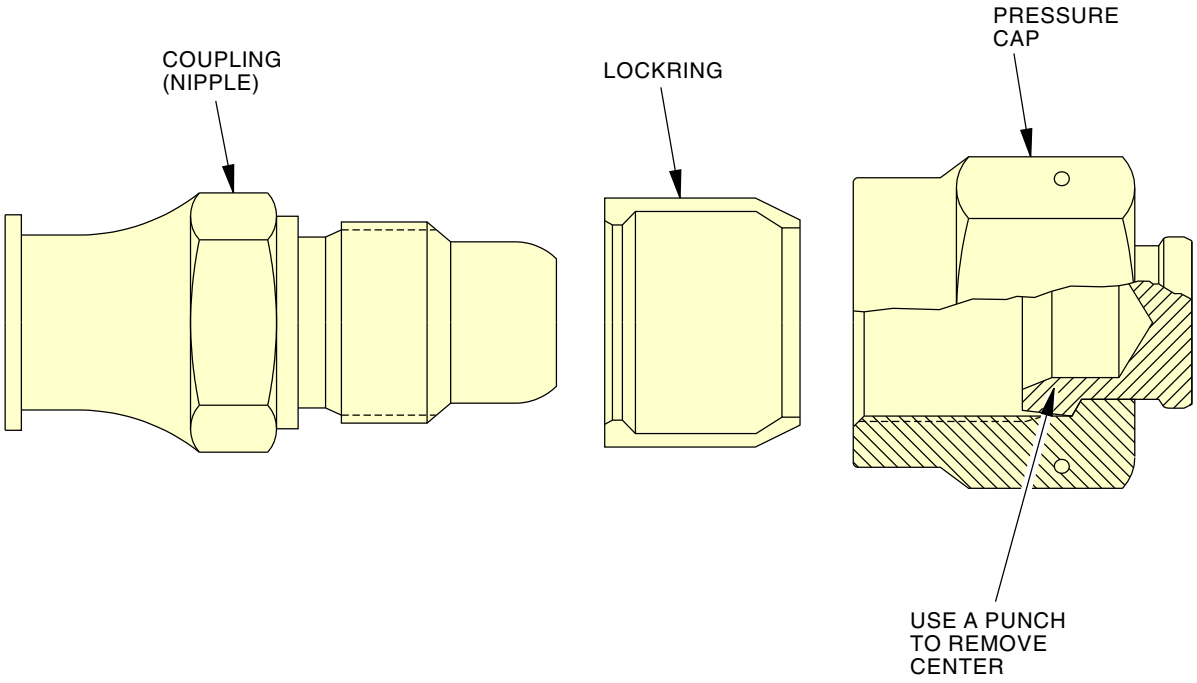
(6) Use one wrench to hold the hex of the coupling or nipple and a second wrench to tighten the pressure cap.

(a) Tighten the lockring fully against the coupling or nipple.

SUBTASK 70-00-01-010-003-H01

(7) Remove the pressure cap.

END OF TASK



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Moeller Lockring Installation
Figure 209/70-00-01-990-804-H01

ENGINE COMPONENTS (PRECAUTIONS FOR REMOVAL/INSTALLATION) - MAINTENANCE PRACTICES

1. General

A. Engine Critical Areas

(1) You must be very careful when you do maintenance operations in engine critical areas. Foreign objects (FOD) that go into the engine and engine parts not correctly attached can cause damage to the engine.. You must make sure that all critical areas at and around the engine are clean before you operate the engine.

(2) The areas that follow are the engine critical areas where you must be very careful.

(a) Air inlet cowl.

(b) Bleed valve compartments.

(c) The interface with engine bleed air.

B. General Precautions

(1) If an object falls into an engine component, stop the procedure immediately. You must find and remove the object before you continue with the procedure.

(2) Lift heavy parts with correct fixtures and hoists to prevent damage to parts or injury to personnel.

(3) Hands and gloves must be clean when you touch machined surfaces.

(4) Do not use metal hammers and drifts (including brass) to move engine components into their positions during maintenance. Use a plastic, nylon, or rawhide-faced hammer and drift to move engine components into their positions, if necessary. This will prevent damage to engine components.

(5) Do not remove the plugs and covers from a part until you install that part.

(6) Do not mix plated and unplated hardware. Do not use silver or cadmium plated tools or hardware on titanium parts. Plating contains small quantities of chlorine salts which can cause damage to titanium.

CAUTION DO NOT USE WIRE BUNDLES, TUBING, DUCTS, OR OTHER ENGINE COMPONENTS AS A STEP OR HAND-HOLD. DAMAGE TO EQUIPMENT CAN OCCUR.

(7) Use the correct ladders and work stands when you do maintenance on the engine.

(8) Do not use the engine as a shelf to hold tools or parts while you do work.

(9) Unless specified, do not use motor-driven hydraulic pumps to operate hydraulically operated special support equipment. If it is necessary to use hydraulically operated equipment, use a hand operated pump to supply power to the equipment. Pushers and pullers are examples of hydraulically operated equipment. You can use a motor-driven hydraulic pump to operate a torque multiplier. If you use a tool that has a motor-driven hydraulic pump, you can easily cause damage to the equipment.

(10) Do these steps before you do maintenance on the engine:

(a) Make sure that you remove the contents of your pockets.

(b) Make sure that the bottoms of your shoes are clean.

(c) Make sure that the critical areas of the engine are clear of tools and materials that are not necessary.

(11) Do these steps after you complete the maintenance tasks on the engine:

(a) Make sure that you remove all tools, rags, loose parts, and materials from the engine.

(b) Make sure that all of the clamps and the brackets in the work area are correctly installed.

(c) Make sure that you remove all of the loose wire (instrumentation and lockwire) from the work area.

(d) Visually examine the air inlet cowl and the ducts for the variable bypass valves. Make sure that these areas are clear of unwanted objects.

1) Use a vacuum cleaner to clean areas of the engine that are not easy to get access to.

(e) Make sure that the protective covers are installed.

TASK 70-00-02-000-801-H01

2. Components and Accessories Removal

A. References

Reference	Title
70-00-04-000-801-H01	Seal (Preformed Packing and O-Ring) Removal (P/B 201)
70-00-04-200-801-H01	Gasket Seal (with Imbedded Flexible Seal Material) Removal (P/B 201)
70-00-04-400-801-H01	Seal (Preformed Packing and O-Ring) Installation (P/B 201)

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-00-02-860-001-H01

(1) Gasket removal instructions and guidelines for installation of a used gasket are in this task:Gasket Seal (with Imbedded Flexible Seal Material) Removal, TASK 70-00-04-200-801-H01.

SUBTASK 70-00-02-860-002-H01

(2) Seal removal instructions are in this task: Seal (Preformed Packing and O-Ring) Removal, TASK 70-00-04-000-801-H01.

SUBTASK 70-00-02-860-003-H01

(3) Seal installation instructions are in this task: Seal (Preformed Packing and O-Ring) Installation, TASK 70-00-04-400-801-H01.

SUBTASK 70-00-02-860-004-H01

(4) Do the necessary steps to prevent damage caused by metal tools on engine components before you remove the components.

SUBTASK 70-00-02-840-001-H01

WARNING

PROLONGED CONTACT OF OIL WITH THE SKIN MAY CAUSE DERMATITIS AND SHOULD BE AVOIDED. THE OIL WILL STAIN CLOTHING AND CAN SOFTEN PAINT. REMOVE SATURATED CLOTHING IMMEDIATELY AND WASH SKIN THOROUGHLY AFTER CONTACT. CLEAN SPILLED OIL OFF PAINTED SURFACES IMMEDIATELY.

(5) The accessories, tubes, and hoses can have oil or fuel in them when you remove them. Make sure that you drain the fluids as much as possible before you remove them.

(a) Install protective covers on all of the hoses and tubes that connect to the component.

SUBTASK 70-00-02-410-001-H01

(6) Put a clean cover or cap on the openings during the removal of a component or accessory.

SUBTASK 70-00-02-410-002-H01

(7) Install protective covers on the electrical systems connectors when you disconnect them.

SUBTASK 70-00-02-410-003-H01

(8) Make sure that drive shafts, fittings, connections, and other parts that extend are not damaged when you remove the component.

END OF TASK

TASK 70-00-02-400-801-H01

3. Components and Accessories Installation

A. References

Reference	Title
70-41-00-400-801-H01	Self-Locking, Hexagonal, or Castellated Nut Installation (P/B 201)
70-41-00-910-803-H00	Lockwire Installation (P/B 201)

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-00-02-930-001-H01

(1) Record the model and serial number of the component before it is installed.

SUBTASK 70-00-02-210-001-H01

(2) Visually examine the general condition of the component to make sure that it was not damaged before installation.

SUBTASK 70-00-02-220-001-H01

(3) Make sure that all of the parts are clean before installation.

SUBTASK 70-00-02-210-002-H01

(4) Make sure that the mating surfaces and seal grooves are clean and not damaged before installation.

SUBTASK 70-00-02-160-001-H01

(5) Make sure that the mating flanges, fittings, and couplings are clean and not damaged before installation.

SUBTASK 70-00-02-420-001-H01

CAUTION

REMOVE PROTECTIVE COVERS AND PLUGS IMMEDIATELY BEFORE YOU INSTALL THE COMPONENT.

(6) Make sure that you do not apply too much force to the tube assemblies during installation.

(a) You can make a small elastic distortion of the tube if necessary to engage the connectors.

SUBTASK 70-00-02-160-002-H01

(7) Bearing installation

(a) Make sure that you prevent contamination of the bearings when you assemble and install them.

(b) Make sure that you do not touch bearings with bare hands. Wear clean rubber or plastic gloves when you touch bearings.

(c) Make sure that you do not use a device that could cause a gouge or scratch on the bearing.

(d) Makes sure that you do not use too much force on the balls or rollers

(e) Make sure that you use fiber or plastic blocks between the bearing and the press on a press-to-fit installation.

SUBTASK 70-00-02-640-001-H01

(8) Unless specified differently, lubricate all gears and splines with oil before installation.

SUBTASK 70-00-02-860-005-H01

(9) Make sure that you use the special tools that are specified in the procedure.

SUBTASK 70-00-02-410-004-H01

(10) Make sure that you use fiber or plastic blocks between the part and the press on a press-to-fit installation.

SUBTASK 70-00-02-210-003-H01

(11) Nut and bolt installation

(a) Make sure that a minimum of one thread goes through the nut or chamfer after you complete the installation.

(b) Make sure that you do not use bolts, screws, or nuts that have damaged threads.

(c) Make sure that the beam type (pinched castellated) and the self-locking nuts with an elliptical shape have the correct locking quality (TASK 70-41-00-400-801-H01).

1) Do not change the shape of a self-locking nut to get the correct locking quality.

(d) Make sure that you remove unwanted material from a blind tapped hole before you install a stud or a bolt.

(e) Make sure that you obey the torque values specified in the sequence of operations.

SUBTASK 70-00-02-420-003-H01

(12) Unless specified differently, use new cotter pins, lockwashers, tab washers, spring washers, preformed packing, and gaskets during installation procedures.

(13) Make sure that the lockwire is installed correctly. Refer to the instructions in this task: (Lockwire Installation, TASK 70-41-00-910-803-H00).

END OF TASK

CLAMPSHELL TYPE CLAMPS - MAINTENANCE PRACTICES

1. General

A. This procedure contains one task, the installation of clampshell type clamps.

B. The clampshell type clamps attach tubing for these systems:

(1) Pneumatic

(2) Oil

(3) Hydraulic

(4) Fuel

C. The clampshell clamp has three parts. There are two clampshells and a cushioned or uncushioned clamp.

D. Make sure that you use an unplated clampshell in high vibration and high temperature (maximum 800° F (427° C)) areas.

E. Make sure that you use the cadmium-plated clampshells on aluminum tubing only.

NOTE: Do not use the cadmium-plated clampshells in areas that are 400° F (204° C) or more.

F. If one of the three parts of the clamp is worn or damaged, you must replace the full clamp assembly.

TASK 70-00-03-400-801-H01

2. Clampshell Type Clamp Installation

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-00-03-420-001-H01

CAUTION

DO NOT PUT THE CLAMPSHELL ON A BEND IN THE TUBING. YOU CAN CAUSE DAMAGE TO THE CLAMPSHELL OR THE TUBING.

(1) Put the clampshell type clamp on the straight part of the tube only (Figure 201).

(a) Put the clampshell halves on the tube.

(b) Put the clamp on the clampshell.

NOTE: Install the clamp in the center of the clampshells, if it is possible.

SUBTASK 70-00-03-420-002-H01

(2) Install a fastener to attach the clampshell type clamp to the engine.

NOTE: The Boeing engine build-up (EBU) and the thrust reverser use a 1/4-inch fastener for the clampshell type clamp.

SUBTASK 70-00-03-420-003-H00

CAUTION

MAKE SURE THAT THERE IS NOT A LOOSE OR BROKEN CLAMP. THIS CAN CAUSE TUBE DISLOCATION FROM ITS INITIAL POSITION. A DISLOCATED TUBE CAN CAUSE AN INTERFACE PROBLEM WITH OTHER PARTS AND IT CAN CAUSE DAMAGE THE TUBE. THIS CAN ALSO CAUSE STRESS ON THE ADJACENT CLAMPS AND TUBES AROUND THE TUBE BEND AREA.

(3) If you see loose or broken clamps, or chafing on the tube, do as follows:

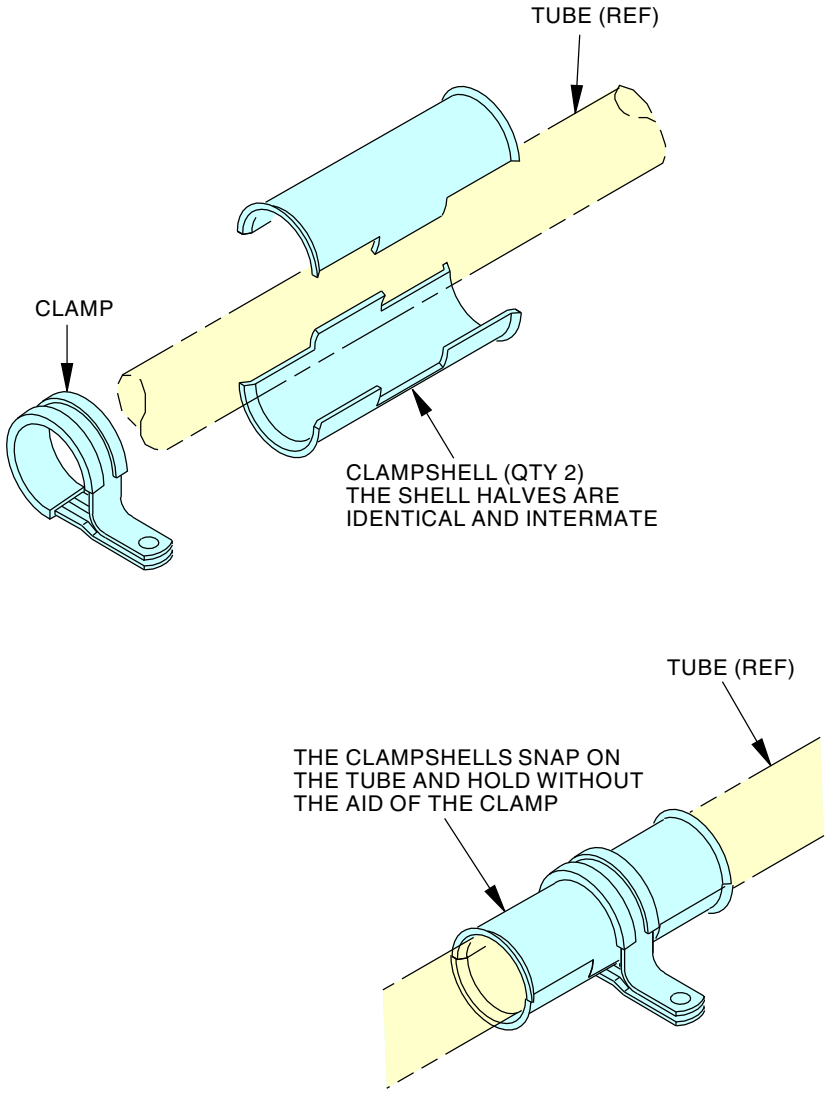
(a) Check all other clamps on the tube for damage, distress, chafing or other signs of possible failure.

(b) Check the tube for damage, distress, chafing or other signs of possible failure. Replace the tube if you find damage.

(c) Replace the broken clamp and replace one clamp upstream and one clamp downstream from the broken clamp.

(d) If you find the clamp is only loose and there is no damage, then correctly install the clamp again.

——— END OF TASK ———



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Clampshell-Type Clamp Installation
Figure 201/70-00-03-990-801-H01

SEALS (PREFORMED PACKING AND O-RINGS) AND GASKETS

1. General

A. This procedure contains seven tasks:

(1) Seal (preformed packing and O-ring) removal

(2) Seal (preformed packing and O-ring) installation

(3) E, C, and W metal seal removal

(4) E, C, and W metal seal installation

(5) Gasket seal (with imbedded flexible seal material) removal

(6) Gasket seal (with imbedded flexible seal material) installation

(7) Onetime Reuse of O-ring, Preformed Packing, Seals and Gaskets.

TASK 70-00-04-000-801-H01

2. Seal (Preformed Packing and O-Ring) Removal

A. General

(1) This task gives the instructions for the removal of a seal (preformed packing and O-ring).

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Seal (Preformed Packing and O-Ring) Removal

SUBTASK 70-00-04-020-001-H01

(1) Do these steps to remove the seal.

CAUTION

DO NOT USE A SHARP OR POINTED TOOL TO REMOVE A SEAL. DAMAGE TO THE SEALING SURFACE OF A COMPONENT CAN CAUSE AN ENGINE FAILURE AND DAMAGE TO THE EQUIPMENT.

(a) Remove the seal (preformed packing or O-ring) from the component.

(b) Discard the seal (preformed packing or O-ring).

——— END OF TASK ———

TASK 70-00-04-400-801-H01

3. Seal (Preformed Packing and O-Ring) Installation

A. General

(1) This task contains the instructions for the installation of a seal (preformed packing or O-ring).

(2) Use only a new seal (preformed packing or O-ring).

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Seal (Preformed Packing and O-Ring) Installation

SUBTASK 70-00-04-420-001-H01

(1) Do these steps to install the seal.

(a) Make sure that you have the correct part number for the seal (preformed packing or O-ring) for the application.

(b) Lubricate the seal (preformed packing or O-ring) with the lubricant called out in the component installation procedure.

(c) Make sure that the groove for the seal (preformed packing or O-ring) does not have nicks, or high metal.

CAUTION

BE CAREFUL WHEN YOU REMOVE OR INSTALL THE SEAL (PREFORMED PACKING OR O-RING). THE SEAL CAN BE DAMAGED WHEN THE SEAL MOVES OVER THE THREADS AND INTO THE PACKING GROOVE. A DAMAGED SEAL CAN CAUSE AN ENGINE FAILURE AND DAMAGE TO EQUIPMENT.

(d) Install the seal (preformed packing or O-ring) in the groove of the component.

END OF TASK

TASK 70-00-04-000-802-H01

4. E, C, and W Metal Seal Removal

A. General

(1) This task contains the steps that are necessary to install a used E, C, and W metal seal.

(2) The pneumatic system uses the E, C, and W metal seals.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. E, C, or W Metal Seal Removal

SUBTASK 70-00-04-020-002-H01

(1) Remove the E, C, or W metal seal from the component.

SUBTASK 70-00-04-210-001-H01

(2) Examine the E, C, or W metal seal for damage.

(a) Make sure that the seal is not out of round.

1) None permitted.

(b) Make sure that the seal is not bent or twisted.

1) None permitted.

(c) Make sure that the seal does not have discoloration from heat damage.

1) None permitted.

(d) Make sure that the seal does not have a crack.

1) None permitted.

(e) Make sure that the seal does not have a dent.

1) None permitted.

——— END OF TASK ———

TASK 70-00-04-400-802-H01

5. E, C, and W Metal Seal Installation

A. General

(1) This procedure contains the task to install the E, C, or W metal seals.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. E, C, or W metal seal installation

SUBTASK 70-00-04-420-002-H01

(1) Install the E, C, or W metal seal on the component.

(a) Make sure that you have the correct part number for the E, C, or W metal seal.

——— END OF TASK ———

TASK 70-00-04-200-801-H01

6. Gasket Seal (with Imbedded Flexible Seal Material) Removal

A. General

(1) This task contains the steps to remove and reuse a gasket seal that is imbedded with flexible seal material.

(2) The gasket seal is imbedded with a flexible seal material that is attached to a metal plate.

(3) You use this type of gasket seal in the fuel and the lubrication systems.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Gasket Seal (with Imbedded Flexible Seal Material) Removal

SUBTASK 70-00-04-020-003-H01

(1) Remove the gasket seal (imbedded with flexible seal material) from the component.

SUBTASK 70-00-04-210-002-H01

(2) Examine the gasket seal (imbedded with flexible seal material) for these types of damage.

(a) The flexible seal material is not attached to the metal plate.

1) None permitted.

(b) The flexible seal material that is flat and does not extend above the metal plate.

1) None permitted.

(c) The flexible seal material is missing or damaged.

1) None permitted.

(d) The flexible seal material is hard or brittle.

1) None permitted.

(e) The flexible seal material has a cut.

1) None permitted

(f) There is a crack in the metal plate.

1) None permitted.

(g) There is a distortion of the metal plate.

1) None permitted.

CAUTION DO NOT REMOVE THE IMBEDDED FLEXIBLE SEAL MATERIAL FROM THE METAL PLATE. DAMAGE TO THE IMBEDDED FLEXIBLE SEAL MATERIAL CAN CAUSE AN ENGINE FAILURE AND DAMAGE TO EQUIPMENT.

(h) Remove all the thin, lacy flexible seal material that extends away from the surface of the metal plate.

CAUTION DO NOT DAMAGE THE IMBEDDED SEAL MATERIAL WHEN YOU REMOVE HIGH METAL ON THE METAL PLATE. DAMAGE TO THE IMBEDDED SEAL MATERIAL CAN CAUSE AN ENGINE FAILURE AND DAMAGE TO EQUIPMENT.

(i) Remove all high metal that extends from the surface of the metal plate or bolt holes of the gasket seal (imbedded with flexible seal material).

——— END OF TASK ———

TASK 70-00-04-400-803-H01

7. Gasket Seal (with Imbedded Flexible Seal Material) Installation

A. General

(1) This task contains the procedure to install the gasket seal (imbedded with flexible seal material).

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Installation of the Gasket Seal (with Imbedded Flexible Seal Material)

SUBTASK 70-00-04-420-003-H01

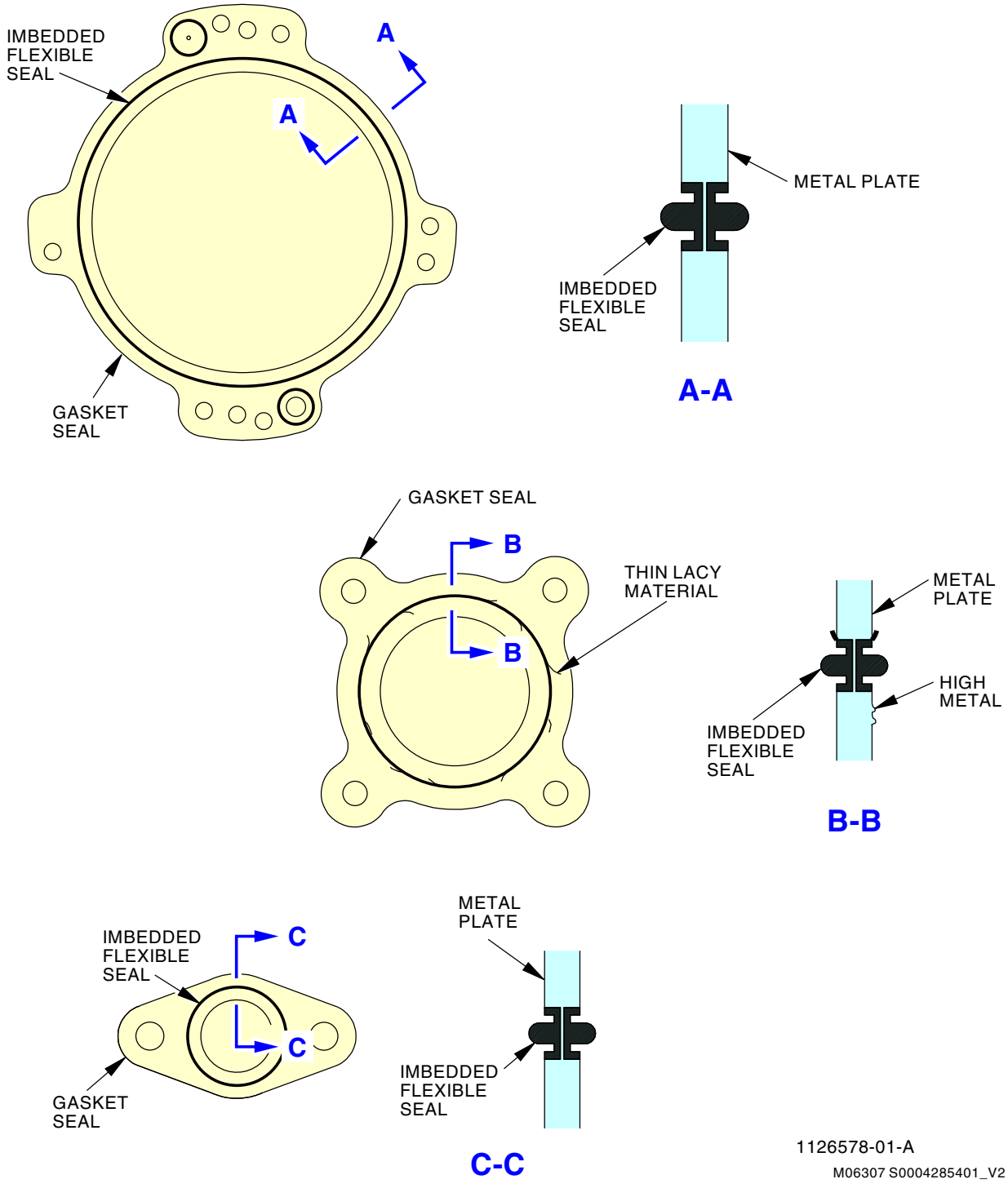
(1) Install the gasket seal (imbedded with flexible seal material), Figure 201.

(a) Make sure that you have the correct gasket seal (imbedded with flexible seal material).

(b) Lubricate the gasket seal with the lubricant specified in the installation procedure.

(c) Install the gasket seal (imbedded with flexible seal material) on the component.

——— END OF TASK ———



Gasket Seal (with Imbedded Flexible Seal Material) - Installation
Figure 201/70-00-04-990-801-H01

TASK 70-00-04-210-801-H01

8. Onetime Reuse of O-ring, Preformed Packing, Seals and Gaskets

A. General

(1) This task provides instructions for one time reuse of O-ring, preformed packing, seals and gaskets which are generally instructed to discard as per AMM.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Seals (Preformed Packing and O-ring) and Gaskets Reuse

SUBTASK 70-00-04-210-003-H00

(1) Onetime reuse of O-ring, preformed packing, seals and gaskets as follows:

NOTE: This task provides instructions for reuse of O-ring, preformed packing, seals and gaskets which normally needs to be discarded as per the related AMM task.

NOTE: The reuse of O-ring, preformed packing, seals and gaskets are permitted to support AOG conditions. During normal maintenance practices, all these parts must be discarded. Refer to the instructions given in the related AMM.

(a) The reuse of O-ring, perforated packing, seals and gaskets are permitted for the continue in service for 2 cycles after satisfactory visual inspection as follows:

NOTE: Refer to the related AMM installation task, note, caution and warning.

1) Do a visual inspection of O-ring, preformed packing, seals and gaskets to make sure that they are free of damage including nicks, pinches, cuts, dents or heavily flattened.

2) After you use the parts again, for oil wetted parts, do a part power leak check and for other parts, do an ideal leak check.

3) Do an inspection of all locations where O-ring, preformed packing, seals and gaskets were used again.

a) Leakage is not permitted.

——— END OF TASK ———

ENGINE STORAGE STANDARD PRACTICES

1. General

A. This procedure contains one task:

(1) The standard practices for engine storage.

TASK 70-00-05-500-801-H00

2. Engine Storage Standard Practices

A. General

(1) This task is used when an engine is kept in storage after preservation activity. The correct engine storage conditions keep the effectiveness of the engine preservation.

(2) This task gives standard practices for engine storage. You must think about variations in storage and environmental conditions.

(3) When you store an engine, it is important to keep it away from water, dust, dirt and pollutants that can cause corrosion and (or) contamination.

(4) This task is applicable to both engines on-wing and off-wing.

B. References

Reference	Title
10-11-02 P/B 201	PROLONGED PARKING - MAINTENANCE PRACTICES
71-00-03 P/B 201	POWER PLANT (ENGINE PRESERVATION AND DEPRESERVATION) - MAINTENANCE PRACTICES

C. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
SPL-4260	Cover - Engine Protective (GE90-115B) Part #: 9C1103P04 Supplier: 06083

D. Consumable Materials

Reference	Description	Specification
G00253	Material - Barrier Materials, Greaseproofed, Waterproof, Flexible, Heat-Sealable	MIL-PRF-121 (Supersedes MIL-B-121)
G00920	Tape - Waterproof, Packaging	ASTM D5486
G51442 [C10-001]	Desiccant	MIL-D-3464, Type I

E. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

F. Procedure

SUBTASK 70-00-05-550-001-H00

(1) Make sure that the engine preservation activity is completed before you store it. Refer to POWER PLANT (ENGINE PRESERVATION AND DEPRESERVATION) - MAINTENANCE PRACTICES, PAGEBLOCK 71-00-03/201.

CAUTION

KEEP WATER AND CONTAMINATION OUT OF THE ENGINE. IT CAN CAUSE CORROSION OF ENGINE PARTS, ENGINE OIL AND FUEL SYSTEM CONTAMINATION.

(a) Tightly seal all the open ports of the engine that include inlet and exhaust ports, with barrier material, G00253 and tape, G00920.

(b) Always cover the engine when it is in either indoor or outdoor storage.

1) Use engine protective cover (GE90-115B), SPL-4260 to protect the complete engine.

(c) Monitor the humidity of the engine storage area and take necessary actions as shown in step (5) below.

NOTE: There is no specific requirement for the temperature of the storage area.

SUBTASK 70-00-05-550-002-H00

(2) Engine in storage installed on aircraft (Engine on-wing).

CAUTION

MAKE SURE THAT THE ENGINE AREA IS CLEAN. IF YOU DO MAINTENANCE ON THE AIRCRAFT, MAKE SURE TO CLEAN THE AREA TO PREVENT CONTAMINATION TO THE ENGINE.

(a) Minimize the opening of fan cowl and thrust reverser cowl for long periods of time unless it is necessary for any specific maintenance activity.

(b) Fill and seal all engine openings. This includes inlet and exhaust openings.

NOTE: Refer to PROLONGED PARKING - MAINTENANCE PRACTICES, PAGEBLOCK 10-11-02/201 for any additional requirements for engines storage (engine on-wing).

SUBTASK 70-00-05-550-003-H00

(3) Preferred method: Engine stored in an enclosed area (Engine off-wing).

CAUTION

AVOID MACHINE WORK NEAR THE ENGINE STORAGE AREA. IT CAN CAUSE UNWANTED MATERIAL WHICH CAN CAUSE CONTAMINATION.

(a) Make sure that the enclosed area is free from dust, dirt and unwanted material from machine work to prevent possible contamination of engine oil, fuel and cooling air systems.

(b) Control direct exposure of the engine to outside climate and weather conditions. The enclosed area will keep a stable environment around the engine against variations in climate and weather conditions outside.

NOTE: The enclosed area can be a hangar, warehouse or any controlled area. It protects the engine from direct exposure to climate and weather conditions such as rain, wind, storm, snow and pollutants.

SUBTASK 70-00-05-550-004-H00

(4) Optional Method: Engine stored in an outside area (Engine off-wing).

(a) When engine is stored outside, it is directly exposed to climate and weather condition such as rain, wind, snow, storm and pollutants.

1) Make sure that you put a cover on the engine.

2) Seal the cover correctly against the environmental effects.

(b) Do an inspection of the engine cover and seal regularly for any damage or leakages. The damaged cover or seal will expose engine directly to climate and weather conditions.

SUBTASK 70-00-05-550-005-H00

(5) Monitor the humidity of the storage environment.

(a) If humidity level is higher than 70 percent, use the desiccant, G51442 [C10-001].

(b) Do not put the desiccant material in contact with engine hardware.

(c) The desiccant must be checked regularly at a maximum of every 2 months or less (given the atmospheric conditions) and replaced as necessary.

NOTE: Based on your atmospheric conditions, you can replace the desiccant at regular intervals.

NOTE: You must be able to replace the desiccant with minimum disturbance or interference to the protective cover.

NOTE: For GE90 engines, you can use approximately 40 pounds of desiccant material.

SUBTASK 70-00-05-550-006-H00

(6) Put a tag on the engine cover where you can see it to show the engine preservation type and preservation due date.

——— END OF TASK ———

FLUORESCENT PENETRANT INSPECTION

1. General

A. This fluorescent penetrant inspection procedure contains instructions for two tasks:

(1) Inspection of localized areas of metal parts.

(2) Water-washable fluorescent penetrant inspection.

B. If a part has previously been inspected with visible nonfluorescent color dye penetrant, contamination by the dye will prevent reliable fluorescent penetrant inspection.

C. Titanium alloy parts must be thoroughly cleaned with non-halogen compounds after exposure to any halogen containing compound to prevent stress-corrosion, cracking and possible failure of parts.

(1) Use de-ionized water to clean and rinse the parts that are made of titanium or titanium alloy.

TASK 70-11-06-230-801-H01

2. Fluorescent Penetrant Inspection

A. General

(1) An applicable pair of Ardrox 9813 penetrant, G51470 and dry powder developer - Met-L-Chek D-72, G51471 can be used for the inspection. If the recommended penetrant and developer are not available, you can use equivalent penetrants and developers from a different manufacturer. Refer to QPL-AMS-2644-QPD for the approved manufacturers and materials.

B. Tools/Equipment

Reference	Description
STD-77	Air Source - Regulated, Dry Filtered, 0-50 psig
STD-123	Brush - Soft Bristle
STD-473	Hood - Black, Prevents Excessive Admission of White Light
STD-560	Lens - Magnifying, 3x, Hand Held
STD-562	Lens - Magnifying, 10x
STD-569	Light - Black, Ultraviolet
STD-572	Light - White

C. Consumable Materials

Reference	Description	Specification
B00130	Alcohol - Isopropyl	TT-I-735
B00678 [C04-003]	Solvent - General	ASTM D329
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G01659	Swab - Cotton Or Rayon, (Disposable)	
G51470	Penetrant - Fluorescent, Post Emulsifiable - Ardrox 9813	AMS2644 Sensitivity Level 3
G51471	Developer - Powder, Dry - Ardrox 9D4A	AMS2644

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-11-06-160-001-H01

CAUTION

IF YOU GRIND, SCRAPE, CHIP OR PEEN A PART TO CLEAN IT, YOU CAN PUSH METAL ON TOP OF THE DAMAGE YOU MUST FIND. MAKE SURE THAT THE PROCEDURES YOU USE TO CLEAN THE PARTS WILL NOT COVER UP DAMAGE TO THE PART.

(1) Use the instructions from the manufacturer to clean the part(s) that you will examine.

SUBTASK 70-11-06-950-001-H01

(2) Use caps and plugs to fill the tubes and holes in the area you will examine.

NOTE: This will prevent the entry of inspection materials into the internal areas of the part that you will examine.

SUBTASK 70-11-06-230-001-H01

(3) Use the manufacturers instructions to apply an approved penetrant.

WARNING

THE PENETRANT IS FLAMMABLE WHEN YOU USE IT AS A SPRAY. YOU MUST MAKE SURE TO PREVENT IGNITION OF THE PENETRANT.

(a) Use a spray or a brush to apply the penetrant.

NOTE: Penetrants used for the inspection must be at a temperature between 40°F (5°C) and 120°F (49°C). You can use equivalent penetrants, but the developer used must be in the same system as the penetrant.

(b) Stop for 30 minutes to let the penetrant dry.

SUBTASK 70-11-06-230-002-H01

(4) If you applied more penetrant than necessary, use the manufacturers instructions to remove it.

(a) Remove the unwanted penetrant from the part with a clean, dry cotton wiper, G00034.

WARNING

DO NOT GET THE SOLVENT IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON GOGGLES, AND GLOVES WHEN YOU USE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENT IS POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

CAUTION

USE A HALOGEN-FREE SOLVENT OR ALCOHOL ON PARTS MADE OF TITANIUM OR TITANIUM ALLOY.

(b) If necessary, use a clean cotton wiper, G00034, with solvent, B00678 [C04-003] or alcohol, B00130, to remove the unwanted penetrant.

(c) Visually examine the part with a ultraviolet black light, STD-569 to make sure that all the unwanted penetrant is removed.

NOTE: Make sure that your glasses are not sensitive to ultraviolet light. The ultraviolet light can make photochromatic glasses become dark. With dark glasses you can not see the damage easily.

CAUTION

WHEN YOU USE SOLVENT OR ALCOHOL, APPLY IT IN A SMALL QUANTITY. IF YOU USE TOO MUCH SOLVENT OR ALCOHOL, YOU CANNOT FIND THE INDICATIONS OF DEFECTS IN THE PARTS.

(d) If there continues to be too much of the penetrant, apply solvent, B00678 [C04-003] or alcohol, B00130 in a fine mist while you visually examine the part with the ultraviolet black light, STD-569.

1) Make sure that you point the solvent spray at an angle to the part.

2) Do not use the solvent spray on the test area more than once.

3) Use a clean cotton wiper, G00034, to remove the unwanted solvent.

SUBTASK 70-11-06-230-003-H01

(5) Use the manufacturers instructions to apply an approved developer.

(a) Make sure that the part is dry and at room temperature.

WARNING

DO NOT BREATHE THE FUMES FROM THE DEVELOPER. THE FUMES ARE POISONOUS.

CAUTION

USE DEVELOPER THAT IS IN THE SAME SYSTEM AS THE PENETRANT.

(b) Hold the spray nozzle about 8-10 inches (200-250 mm) from the part surface. With a fine spray, apply a thin layer of the developer on the part.

NOTE: When you use an aerosol container, follow the manufacturer's directions. It is usually sufficient to make two passes of the spray.

1) The layer of developer must be constant and flat and you must see the metal through the developer.

(c) Stop for 10 minutes to let the developer dry.

SUBTASK 70-11-06-230-004-H01

(6) Examine the part:

(a) Use the ultraviolet black light, STD-569 and the black hood, STD-473 to do a visual inspection of the part.

NOTE: Make sure that your glasses are not sensitive to ultraviolet light. The ultraviolet light can make photochromatic glasses become dark. With dark glasses you can not see the damage easily.

(b) If you find an indication that could be damage, do these steps to examine the indication.

1) Clean the area one time with solvent, B00678 [C04-003] or alcohol, B00130. Use a cotton swab, G01659 or a soft bristle brush, STD-123.

2) After the solvent dries, apply the developer again to the area of the indication.

3) Use the ultraviolet black light, STD-569 to examine the area again.

a) If the indication shows again in less than 2 minutes, then it is an indication of a defect.

4) If the indication does not show again, then examine the same area with a white light, STD-572 and a 10x magnifying lens, STD-562 or 3x hand held magnifying lens, STD-560.

5) Make a mark on the part to show the location of the defects. Make sure that you use an approved procedure to make a mark.

6) Reject the parts that contain surface defects that are more than the permitted limits.

   a) If the permitted damage limits are not specified, reject the part if it has damage as given in the list below:

      <1> shrinkage cracks or porosity

      <2> cold shuts

      <3> fatigue cracks

      <4> forming cracks

      <5> grinding or heat treat cracks

      <6> seams

      <7> laps

      <8> bursts

7) Unless specified differently, use the procurement specification for the raw casting to accept a machined casting.

   a) If a radiographic inspection of the castings is necessary, then base the disposition of a possible penetrant indication of microshrinkage or porosity on the radiographic inspection results.

   b) If a radiographic inspection is not necessary, use a destructive cross-sectioning or a radiographic inspection to base the disposition of a possible penetrant indication.

   c) If you use destructive cross-sectioning, then use parts that represent a typical penetrant indication.

8) Unless specified differently, do not reject magnesium alloy castings because of microshrinkage or porosity on the surface.

9) Do an inspection of all the welds and use the applicable weld specifications to accept or reject the welds.

10) You must do the inspection again on all parts that you repair as a result of a penetrant inspection indication. Use this specification to find if the part is serviceable after the second inspection.

SUBTASK 70-11-06-230-005-H01

(7) Use the manufacturers instructions to clean parts after the inspection.

CAUTION

REMOVE THE REMAINING PENETRANT AND DEVELOPER MATERIALS FROM THE PARTS IN LESS THAN FOUR HOURS. THESE MATERIALS CAUSE CORROSION AT HIGHER TEMPERATURES AND PROBLEMS DURING WELDING.

CAUTION

DO NOT CLEAN TITANIUM PARTS WITH COMPOUNDS THAT CONTAIN HALOGEN. HALOGEN WILL CAUSE DAMAGE TO THE METAL.

(CAUTION PRECEDES)

CAUTION

MAKE SURE YOU ONLY USE DEIONIZED WATER WHEN YOU CLEAN PARTS MADE OF TITANIUM OR TITANIUM ALLOYS. IF YOU DO NOT USE DEIONIZED WATER, DAMAGE TO THE PARTS CAN OCCUR.

(a) Remove the developer and the penetrant with a spray of water or use a soft bristle brush, STD-123 and water.

WARNING

DO NOT GET THE SOLVENT IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE SOLVENT. PUT ON GOGGLES, AND GLOVES WHEN YOU USE SOLVENT. KEEP THE SOLVENT AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENT IS POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

(b) Use a spray of solvent, B00678 [C04-003] or alcohol, B00130 to remove the remaining penetrant. You can also soak the part in the solvent, B00678 [C04-003] or alcohol, B00130 to remove the penetrant.

CAUTION

KEEP THE DRYER TEMPERATURE TO A MAXIMUM OF 160 DEGREES F (71 DEGREES C). HIGHER TEMPERATURES MAKE THE FLUORESCENT DYE IN THE PENETRANT LESS BRIGHT.

(c) Make sure that all of the internal and external areas of the part are fully clean and dry.

1) Use a 0-50 psig dry filtered regulated air source, STD-77 to blow out the internal and external areas of the part.

SUBTASK 70-11-06-230-006-H01

(8) Do an inspection of the part with the ultraviolet black light, STD-569. Make sure that there is no penetrant or developer on the part.

SUBTASK 70-11-06-230-007-H01

(9) Make sure that the penetrant or developer is not on the titanium and titanium alloy parts.

——— END OF TASK ———

TASK 70-11-06-230-802-H00

3. Water-Washable Fluorescent Penetrant Inspection

A. General

(1) This is a water-washable, medium sensitivity, fluorescent penetrant inspection procedure.

(2) An applicable pair of Ardrox 9813 penetrant, G51470 and dry powder developer - Met-L-Chek D-72, G51471 can be used for the inspection. If the recommended penetrant and developer are not available, you can use equivalent penetrants and developers from a different manufacturer. Refer to QPL-AMS-2644-QPD for the approved manufacturers and materials.

B. Tools/Equipment

Reference	Description
STD-123	Brush - Soft Bristle
STD-473	Hood - Black, Prevents Excessive Admission of White Light
STD-560	Lens - Magnifying, 3x, Hand Held
STD-562	Lens - Magnifying, 10x

(Continued)

Reference	Description
STD-569	Light - Black, Ultraviolet
STD-572	Light - White
STD-1082	Source - Air, Regulated, Dry Filtered, 0-50 PSIG
STD-1104	Bottle - HDPE Polyethylene, Capacity 500ml, with LDPE Polyethylene Internal Plug and Self Seal Polypropylene Screw Cap

C. Consumable Materials

Reference	Description	Specification
B00130	Alcohol - Isopropyl	TT-I-735
B00678 [C04-003]	Solvent - General	ASTM D329
G01659	Swab - Cotton Or Rayon, (Disposable)	
G51470	Penetrant - Fluorescent, Post Emulsifiable - Ardrox 9813	AMS2644 Sensitivity Level 3
G51471	Developer - Powder, Dry - Ardrox 9D4A	AMS2644

D. Procedure

SUBTASK 70-11-06-230-008-H00

(1) Use the manufacturer's instructions to clean the inspection parts.

SUBTASK 70-11-06-230-009-H00

(2) Use caps and plugs to fill the tubes and holes in the inspection area.

NOTE: This will prevent the entry of inspection materials into the internal areas of the part that you will examine.

SUBTASK 70-11-06-230-010-H00

WARNING

BE CAREFUL WHEN YOU APPLY THE PENETRANT WITH A SPRAYER. YOU MUST MAKE SURE THAT YOU PREVENT IGNITION OF THE PENETRANT. THE PENETRANT IS FLAMMABLE WHEN YOU APPLY IT AS A SPRAY AND CAN CAUSE INJURIES TO PERSONNEL.

(3) Use the manufacturer's instructions to apply an approved penetrant.

(a) Use a spray or a brush to apply the penetrant.

NOTE: You can use any of the approved penetrants, but use the developer from the same manufacturer as the penetrant.

(b) Let the penetrant settle for 15 to 30 minutes.

SUBTASK 70-11-06-230-011-H00

(4) If you applied more penetrant than necessary, refer the manufacturer's instructions to remove the unwanted penetrant.

(a) Remove the penetrant from the surface of part by water spray.

NOTE: Water pressure must not be more than 40 psi (276 kPa).

(b) Visually examine the part with a ultraviolet black light, STD-569 to make sure that all the unwanted penetrant is removed.

NOTE: Make sure that your glasses are not sensitive to ultraviolet light. The ultraviolet light can make photochromatic glasses to become dark. With dark glasses you cannot see the damage easily.

1) If you continue to get too much unwanted fluorescence, apply the water with a squeeze polyethylene bottle (500ml), STD-1104, to clean the part.

NOTE: You must be careful to apply a minimum quantity of water because too much water will remove the indication penetrant.

(c) Set the parts in a position to let the unwanted water drain.

(d) If necessary, turn or shake the part to remove the water from the part.

(e) Put the parts in a hot air dryer to dry them.

NOTE: The dryer temperature must not be more than 160°F (70°C).

1) Do not keep the parts in the dryer longer than necessary to remove moisture.

SUBTASK 70-11-06-230-012-H00

WARNING PUT ON A RESPIRATOR. DO NOT BREATHE THE FUMES. THE FUMES OF THE DEVELOPER ARE POISONOUS. INJURIES TO PERSONNEL CAN OCCUR.

(5) Apply an approved dry developer or non-aqueous developer with a spray to a dry part at ambient temperature.

NOTE: Use the penetrants and developers from the same manufacturer.

(a) Hold the spray nozzle approximately 8-10 inches (200-250 mm) from the part surface.

(b) With a fine spray, apply a thin layer of the developer on the part.

NOTE: When you use an aerosol container, follow the manufacturer's directions. It is usually sufficient to use the spray two times along the part.

(c) Make sure that the developer layer is equal and you can see the metal background through the developer.

NOTE: For powder type developer, blow the unwanted developer by clean dry air at 5 psi (34 kPa) maximum.

(d) Stop for a minimum of 2 hours for dry powder and a minimum of 1 hour for non-aqueous wet developer to let the developer absorb the penetrant before inspecting parts.

SUBTASK 70-11-06-230-013-H00

(6) Do the penetrant inspection:

(a) Use the ultraviolet black light, STD-569 and the black hood, STD-473 to do a visual inspection of the part.

NOTE: Make sure that your glasses are not sensitive to ultraviolet light. The ultraviolet light can make photochromatic glasses become dark. With dark glasses you cannot see the damage easily. Make sure that you get applicable time for dark adaption.

(b) If you find an indication, do these steps to examine the indication.

WARNING DO NOT GET SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. PUT ON A RESPIRATOR, PROTECTIVE SPLASH GOGGLES, AND GLOVES WHEN YOU USE SOLVENTS. KEEP THE SOLVENTS AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENTS ARE POISONOUS AND FLAMMABLE. SOLVENTS CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

1) Use a swab, G01659 or a soft bristle brush, STD-123 to clean the area, with solvent, B00678 [C04-003] or alcohol, B00130.
2) Apply the developer again to the area of the indication after the solvent dries.
3) Use the ultraviolet black light, STD-569 to examine the area again.
   a) If the inspection area shows the indication again in less than 10 minutes, then it is a defect.
   b) If the inspection area does not show the indication, then examine the same area with a white light, STD-572 and a 10x magnifying lens, STD-562 or 3x hand held magnifying lens, STD-560.
4) Make a mark on the part to show the location of the defects.
   a) Make sure that you use an approved procedure to make a mark.

SUBTASK 70-11-06-230-014-H00

CAUTION REMOVE THE REMAINING PENETRANT AND DEVELOPER MATERIALS FROM THE PARTS IN LESS THAN FOUR HOURS. THESE MATERIALS CAUSE CORROSION AT HIGHER TEMPERATURES AND PROBLEMS DURING WELDING.

CAUTION DO NOT CLEAN TITANIUM PARTS WITH COMPOUNDS THAT CONTAIN HALOGEN. HALOGEN WILL CAUSE DAMAGE TO THE METAL.

CAUTION MAKE SURE YOU ONLY USE DEIONIZED WATER WHEN YOU CLEAN PARTS MADE OF TITANIUM OR TITANIUM ALLOYS. IF YOU DO NOT USE DEIONIZED WATER, DAMAGE TO THE PARTS CAN OCCUR.

(7) Use the manufacturer's instructions to clean parts after the inspection.
   (a) Remove the developer and penetrant by water spray or use a soft bristle brush, STD-123 and water.

WARNING DO NOT GET SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. PUT ON A RESPIRATOR, PROTECTIVE SPLASH GOGGLES, AND GLOVES WHEN YOU USE SOLVENTS. KEEP THE SOLVENTS AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENTS ARE POISONOUS AND FLAMMABLE. SOLVENTS CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

   (b) Spray the solvent on the part or soak the part in the solvent to remove the remaining penetrant.
   (c) Make sure that all the internal and external areas of the part are fully clean and dry.

1) Blow the internal and external areas of the part by a 0-50 psig dry filtered regulated air source, STD-1082.

SUBTASK 70-11-06-230-015-H00

(8) Do an inspection of the part with the ultraviolet black light, STD-569.

(a) Make sure that there is no remaining penetrant or developer on the part.

SUBTASK 70-11-06-230-016-H00

(9) Make sure that the penetrant or developer is not on the titanium and titanium alloy parts.

END OF TASK

TEMPORARY MARKING PROCEDURES

1. General

A. Use these procedures to make a temporary mark on a part. You use a temporary mark on a part when it is necessary to have temporary identification of a part. These procedures give instructions on how to attach a tag or an adhesive label to a part. They also give instructions on how to make a mark directly on the part.

B. Operation of the engine can remove a temporary mark made on a part. You usually remove the mark when you do the maintenance procedure, or immediately after you complete the procedure.

C. You must carefully make a selection of materials you use to make a temporary mark on a part. The material must not cause damage to the part if you do not remove the mark. High temperatures can change the materials you use to make the mark. This material can then cause corrosion of the part, which can make the part become unserviceable.

TASK 70-11-07-900-801-H01

2. Application

A. General

(1) You use a temporary mark to do one or more of the steps that follow:

(a) Show the location of a defect you find during an inspection.

(b) Show the correct position of parts in an assembly by a series of numbers or a matchmark.

(c) Identify the subassembly, the module, or the engine location where you removed the part.

(d) Show that you did a procedure, or that you must do a procedure.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

——— END OF TASK ———

TASK 70-11-07-900-802-H01

3. Marking Methods

A. General

(1) When it is necessary to make a temporary mark, the correct procedure and location is usually specified.

(2) If the correct procedure and location to make the mark are not specified, use the steps that follow:

(a) If you use a metal tag, the tag must be stainless steel. Connect the tag to the part with a wire made of stainless steel.

(b) If you use adhesive tape or labels, then they must not cause corrosion on the parts. The adhesive must go through a test to make sure that it will not cause corrosion. The test must include a check for changes in the adhesive at high temperatures which could cause corrosion.

CAUTION DO NOT USE GREASE PENCILS OR LEAD (GRAPHITE) PENCILS TO MAKE MARKS ON THE COMBUSTION SECTION AND HOT SECTION PARTS. THESE MATERIALS CAN CAUSE DAMAGE WHEN THEY GET HOT.

(c) The inks, paints, pencil graphites and other materials you can use must go through tests and get approval. These tests are to make sure that the material will not cause corrosion on parts when at high temperatures.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

END OF TASK

TRI-WING FASTENERS - MAINTENANCE PRACTICES

1. General

A. This procedure contains two tasks:

(1) The removal of a tri-wing fastener

(2) The installation of a tri-wing fastener.

B. The tri-wing fasteners are available in a wide range of dimensions. You must use the correct drive tool to remove or install a tri-wing fastener. This will keep possible damage to the fastener and the adjacent surfaces to a minimum. If you cannot move the fastener because of corrosion or other conditions, you can drill the fastener. The center of the fastener top is in the shape of a cup. This cup holds the drill bit in its position when you drill the fastener. This will decrease possible damage to the adjacent surfaces when you drill the fastener.

C. A full selection of drivers is recommended. This will let you use the correct driver for the tri-wing fastener that is necessary to remove or install. The drivers are available as offset or universal joint types, or with a screw holder installed.

D. Use this table to identify the correct tri-wing fastener:

TRI-WING DRIVERS AND STANDARD-THREAD FASTENERS					
SCREW THREAD SIZE	TENSION HEAD	SHEAR HEAD	SCREW THREAD SIZE	TENSION HEAD	SHEAR HEAD
0 - 80	0	--	3/8 - 24	8	7
2 - 56	1	--	7/16 - 20	9	8
4 - 40	2	1	1/2 - 20	10	9
6 - 32	3	2	9/16 - 18	11	10
8 - 32	4	3	5/8 - 18	12	11
10 - 32	5	4	3/4 - 16	13	12
1/4 - 28	6	5	7/8 - 14	14	13
5/16 - 24	7	6	1 - 12	15	14

TASK 70-11-08-000-801-H01

2. Tri-Wing Fastener Removal

A. General

(1) This task is the removal of a tri-wing fastener.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-11-08-020-001-H01

(1) Remove the fastener (Figure 201).

(a) Make sure that you use the correct driver for the fastener.

NOTE: The driver number must agree with the recess number of the fastener head as shown in the figure. If the fastener recess has a layer of paint or material for protection, use a driver one number smaller.

(b) Put the driver into the recess of the fastener.

CAUTION

MAKE SURE THAT THE AXIS OF THE DRIVE IS ALIGNED WITH THE AXIS OF THE FASTENER WHEN YOU INSTALL OR REMOVE THE FASTENER. IF THE DRIVE TOOL IS NOT ALIGNED WITH THE FASTENER, YOU CAN CAUSE DAMAGE TO THE RECESS OF THE FASTENER.

(c) Align the axis of the driver with the axis of the fastener.

(d) Turn the driver counterclockwise.

SUBTASK 70-11-08-020-002-H01

(2) If the recess of the fastener is damaged, then remove the fastener as follows:

(a) Make a selection of the correct drill bit and the correct screw removal tool for the dimension of the fastener.

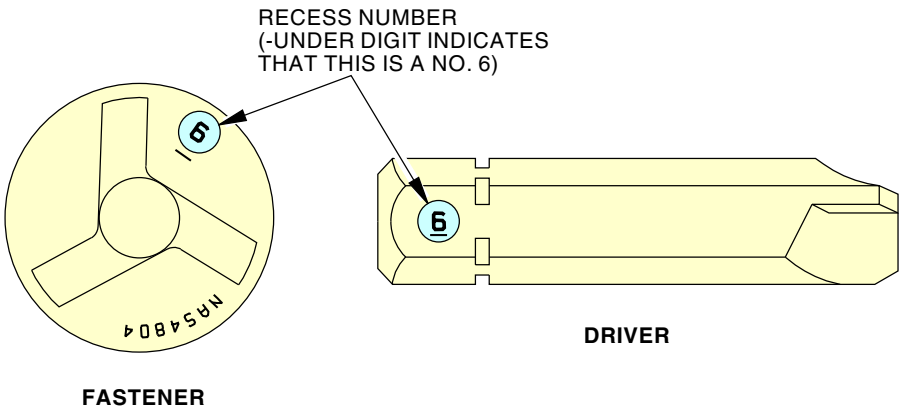
(b) Drill a hole into the fastener to a depth that will let you use the screw removal tool.

NOTE: The bottom of the fastener recess has a shape that helps the bit to stay in the center of the fastener.

(c) Install the screw removal tool.

(d) Turn the screw removal tool counterclockwise to remove the fastener.

——— END OF TASK ———



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Tri-Wing Fastener and Drive Configuration
Figure 201/70-11-08-990-802-H01

TASK 70-11-08-400-801-H01

3. Tri-Wing Fastener Installation

A. General

(1) This task is the installation of a tri-wing fastener.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-11-08-420-001-H01

(1) Install the fastener:

(a) Make sure that you use the correct driver for the fastener.

NOTE: The driver number must agree with the recess number of the fastener head as shown in the figure. If the recess of the fastener has a layer of paint or other material for protection, use a driver one size smaller.

(b) Put the driver into the recess of the fastener.

CAUTION

MAKE SURE THAT THE AXIS OF THE DRIVE IS ALIGNED WITH THE AXIS OF THE FASTENER WHEN YOU INSTALL OR REMOVE THE FASTENER. IF THE DRIVE TOOL IS NOT ALIGNED WITH THE FASTENER, YOU CAN CAUSE DAMAGE TO THE RECESS OF THE FASTENER.

(c) Align the axis of the driver with the axis of the fastener.

(d) Turn the driver clockwise to install the fastener.

——— END OF TASK ———

HOSE ASSEMBLIES - REPAIRS

1. General

A. This procedure has one task.

(1) Hose assembly fire sleeve repair.

TASK 70-11-10-230-801-H01

2. Hose Assembly Fire Sleeve Repair

A. General

(1) This procedure contains the instructions to repair a damaged fire sleeve of a hose assembly. You can use this procedure if the damaged area is less than 0.5 in^2 (322.6 mm^2).

B. Tools/Equipment

Reference	Description
STD-549	Knife - Putty, Broad Blade

C. Consumable Materials

Reference	Description	Specification
A01072 [C01-049]	Compound - RTV Potting, 2-Part - RTV 577 (white)	
B00130	Alcohol - Isopropyl	TT-I-735
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G00252	Film - Polyethylene Film And Sheeting	ASTM D2103 (Supersedes L-P-512)
G02462 [C10-136]	Tape - Flash-Breaker - No. 855	

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-11-10-160-001-H01

(1) Do these steps to repair a damaged area on the fire sleeve of a hose assembly (Figure 801).

WARNING

DO NOT GET ALCOHOL IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM ALCOHOL. PUT ON GOGGLES, AND GLOVES WHEN YOU USE ALCOHOL. KEEP ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. ALCOHOL IS POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

(a) Use a cotton wiper, G00034 and alcohol, B00130 to clean the damaged area.

(b) Prepare the damaged area as follows:

1) Use a broad blade putty knife, STD-549 to remove the material from around the damage area.

NOTE: Do not remove more than 0.25 inch (6.3 mm) around the damaged area.

2) Make sure that the contour is smooth and that all of the damaged and loose material is removed.

(c) Use a cotton wiper, G00034 and alcohol, B00130 to clean the repair area.

WARNING

DO NOT GET SILICONE RUBBER IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SILICONE RUBBER. PUT ON GOGGLES, AND GLOVES WHEN YOU USE SILICONE RUBBER. KEEP SILICONE RUBBER AWAY FROM SPARKS, FLAME, AND HEAT. SILICONE RUBBER IS POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

(d) Mix the RTV 577 compound, A01072 [C01-049] to this ratio.

1) Use 99.5 parts (by weight) of the RTV 577 compound, A01072 [C01-049].
2) Use 0.5 part (by weight) of the catalyst.

(e) Do these steps to apply RTV 577 compound, A01072 [C01-049] to the repair area.

1) Fill the repair area with the RTV 577 compound, A01072 [C01-049].
2) Put more RTV 577 compound, A01072 [C01-049] on one side of the repair area.

(f) Do these steps to put a layer of the polyethylene film, G00252 around the repair area of the hose assembly:

1) Wind the polyethylene film, G00252 around the hose in a direction that will push the compound above the repair area.
2) Tighten the polyethylene film, G00252 around the hose to remove the air caught below the polyethylene film, G00252. Make sure that you push the compound into the repair area.

(g) Apply the No. 855 tape, G02462 [C10-136] around the polyethylene film, G00252 and the hose assembly. Make sure that the No. 855 tape, G02462 [C10-136] holds the polyethylene film, G00252 on the repair area.

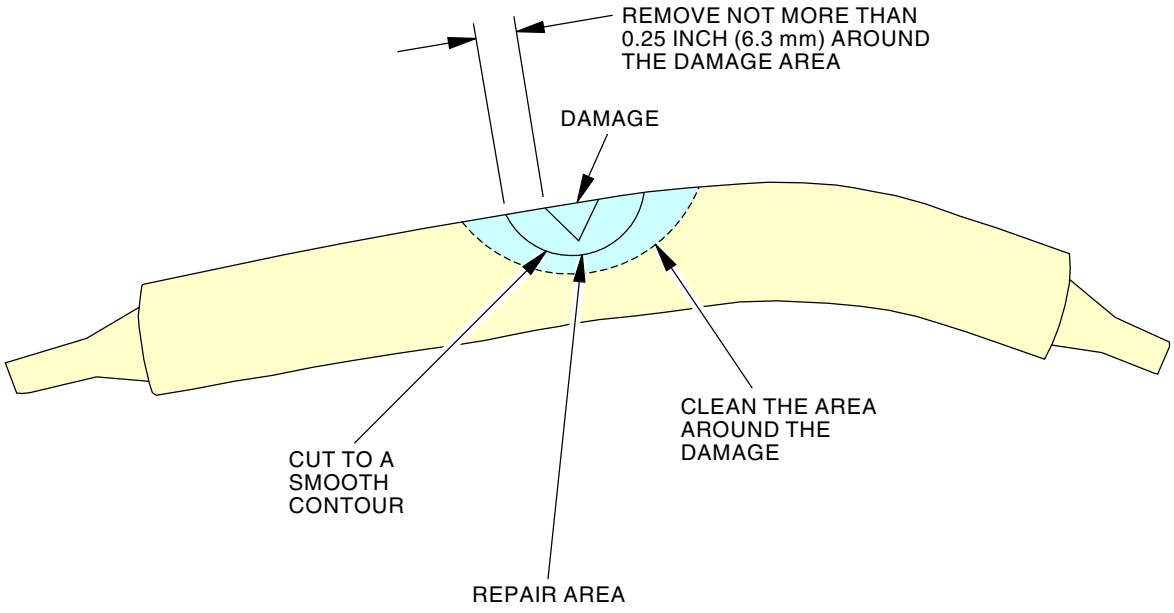
(h) A minimum of 6 hours at room temperature is necessary for the RTV 577 compound, A01072 [C01-049] to dry.

(i) Remove the No. 855 tape, G02462 [C10-136] tape and polyethylene film, G00252.

SUBTASK 70-11-10-210-001-H01

(2) Do a visual inspection to make sure that the RTV 577 compound, A01072 [C01-049] is fully bonded.

END OF TASK



PREPARATION OF THE REPAIR AREA

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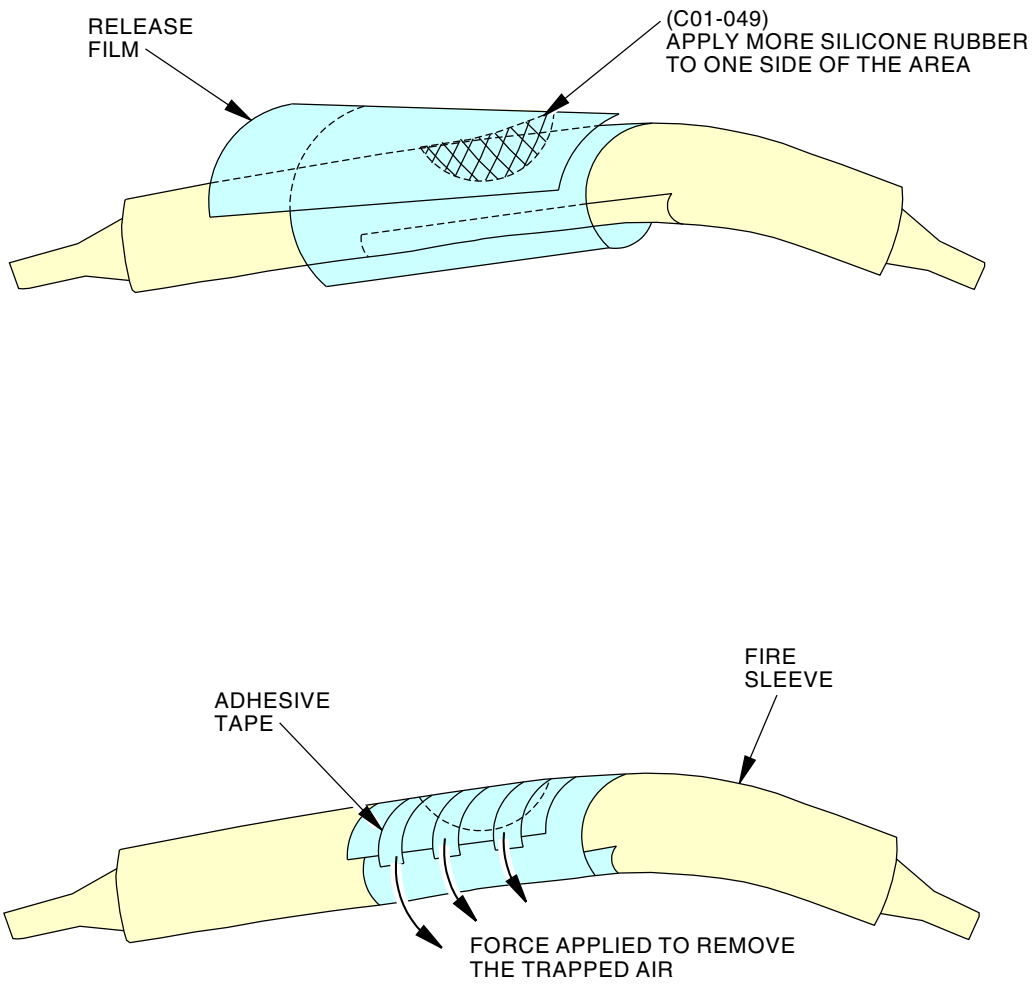
Hose Assembly Fire Sleeve Repair
Figure 801/70-11-10-990-801-H01 (Sheet 1 of 2)



APPLICATION OF THE RELEASE FILM OVER THE REPAIR AREA

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Hose Assembly Fire Sleeve Repair
Figure 801/70-11-10-990-801-H01 (Sheet 2 of 2)

CLEANING PROCEDURES - MAINTENANCE PRACTICES

1. General

A. This procedure has three tasks.

(1) The cleaning of metallic parts by hand.

(2) The cleaning of electrical harnesses and contacts.

(3) A dry abrasive blast cleaning (Method No. 4).

TASK 70-11-11-100-801-H00

2. Engine Hand Wipe Cleaning - Metallic Parts

A. General

(1) This procedure is for general hand-wipe cleaning of metallic parts, both titanium and non-titanium hardware.

(2) Cleaners must be applied to the wipe cloths from dispensers that prevent contamination of the working fluid.

(3) It is necessary to rinse some cleaners with water after use and others are very slow to dry. These conditions must be considered when you use these products.

B. Equipment

(1) Correct personal protection equipment must be used and include, but is not limited to, protective gloves and eye wear. Specific equipment to safely handle cleaners is given in the manufacturer's Material Safety Data Sheet for the specific cleaner.

(2) Hand-wipe cleaning must be done in an area with sufficient ventilation.

(3) Various types of bristle brushes for part configuration or Scotch-Brite 7447 pad, G02348 [C10-010] can be used in addition to the cloth, G50035 [C10-182], clean, white, lint-free cotton cloths, or unsized cheesecloth.

C. Consumable Materials

Table 201/70-11-11-993-805-H00 Solvents for Wipe Procedure

Reference	Description
C04-001	Methyl-Ethyl-Ketone
C04-002	Stoddard
C04-003	Acetone
C04-035	Isopropyl Alcohol
C04-036 / C04-035	50/50 Toluene/Isopropyl Alcohol
C04-196	Methyl-Propyl-Ketone
C04-197	MagChem Diestone
C04-198	Positron
C04-199	Selig CE-SX-94, GB-SX-94, L-SX-94
C04-200	Monsanto SkyKleen 1000 Aviation Solvent *[1]
C04-201	Turco 4460-BK
C04-202	Turco 6869

Table 201/70-11-11-993-805-H00 Solvents for Wipe Procedure (Continued)

Reference	Description
C04-251	Bioact 105 Precision Cleaner
C04-256	Supersolve AS
C04-260	MagChem Diestone
C04-261	Novec HFE-7100
C04-262	Vertrel XF
C04-269	Lotoxane Fast
C04-282	Magnaflux SKC-S
C04-284	Supersolve (Aerosol)
C04-285	Lotoxane Fast Wipes *[2]

*[1] SkyKleen is a cleaning agent that can effectively remove Skydrol deposits.

*[2] Lotoxane Fast Wipes consists of cloths soaked with C04-269 Lotoxane Fast solvent.

Table 202/70-11-11-993-806-H00 Aqueous Cleaners for Spray or Wipe Procedure

Reference	Description	Concentration	Rinse Required
C04-140 *[1]	Gas Path Cleaner Type II RTU	As Received	Yes
C04-140 *[2]	Gas Path Cleaner Type II	20%	Yes
C04-203	Turco 6780	Full Strength	No
C04-204	Ardrox Aviaclenz 6077 Window Cleaner Plus	Full Strength	No
C04-205	MagChem Evasol	Full Strength	No
C04-206	Nuvite Nu-Gear-Sc	20-25 v/v	Yes
C04-207	Bio-T-Max	Full Strength	Yes

*[1] Type III RTU cleaners that meet MIL-PRF-85704C can be used in place of the Type II RTU cleaners for this procedure.

*[2] Type III cleaners that meet MIL-PRF-85704C can be used in place of the Type II cleaners for this procedure.

D. Consumable Materials

Reference	Description	Specification
G02348 [C10-010]	Pad - Abrasive - Scotch-Brite 7447	
G50035 [C10-182]	Cloth - Cleaning For Aircraft Structural	SAE-AMS 3819, BMS 15-5

E. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

F. Procedure

SUBTASK 70-11-11-140-001-H00

(1) Wipe the part with cloth soaked with one of the cleaners shown in Table 201. When you use cleaners shown in Table 202, spray or wipe application can be used.

NOTE: Various types of bristle brushes suitable for the part configuration or Scotch-Brite 7447 pad, G02348 [C10-010] can be used in addition to the wiping cloths to help with the cleaning process. When you use brushes or cleaning pads, a final wipe of the part surface must be performed with a cloth, G50035 [C10-182] soaked with the cleaner that is used.

SUBTASK 70-11-11-170-001-H00

CAUTION

TITANIUM PARTS CAN BE DAMAGED WHEN EXPOSED TO CHLORIDE CONTENT BEYOND ACCEPTABLE LIMITS.

(2) Flush the part completely with clean water when shown in Table 202. The final rinse water used on the parts must not be more than 50 ppm chloride.

(a) Dry the part with one of the cloths specified in Equipment.

(b) Blow dry with clean, dry air.

G. Quality Assurance

SUBTASK 70-11-11-210-001-H00

(1) Visually check the part to make sure it is clean.

(a) Do the process again if necessary.

——— END OF TASK ———

TASK 70-11-11-100-802-H00

3. Electrical Harness and Contact Cleaning

A. General

(1) This procedure is to clean the electrical harnesses and contacts.

(2) Part cleaning must be done in an area with sufficient ventilation.

B. References

Reference	Title
71-00-00-800-833-H00	Power Plant Test Reference Table (P/B 501)

C. Consumable Materials

Reference	Description	Specification
B00679 [C04-035]	Alcohol - Isopropyl	
B50318 [C04-257]	Cleaner - Electrical Contact - Eco Spray	
B50319 [C04-254]	Cleaner - Electrical Contact - CRC Precision Cleaner Plus	
B50320 [C04-197]	Solvent - General - MagChem Diestone MTK	
B50321 [C04-198]	Solvent - General - Positron	
B50322 [C04-199]	Solvent - Isoparaffinic - CE-SX-94, GB-SX-94, and L-SX-94	
B50323 [C04-252]	Cleaner - Electrical Contact - Envirosolv 655	

(Continued)

Reference	Description	Specification
B50324 [C04-253]	Cleaner - Electrical Contact - Super Degreaser	
B50325 [C04-259]	Cleaner - Electrical Contact - CaiKleen TNX Tarnish Remover	
C50233 [C04-258]	Cleaner - Electrical Contact Cleaner / Lubricant - ProGold GX100L or GX5L	
G01659	Swab - Cotton Or Rayon, (Disposable)	
G50222	Brush - Tampico Fiber, Non-Metallic	
G50321	Air - Clean, Dry	BAC5402 Table I

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-11-11-020-001-H00

WARNING

DO NOT SPRAY FLAMMABLE CLEANERS AROUND POSSIBLE IGNITION SOURCES. MAKE SURE ALL ELECTRICAL POWER IS TURNED OFF, OR INJURY CAN OCCUR. IF CLEANING OF THE CONNECTORS IS DONE DURING THE ENGINE TEST, FOLLOW ALL OF THE LOCAL PROCEDURES RELATED TO COMBUSTIBLE MATERIAL HANDLING AND USE IN AND AROUND HOT ENGINE HARDWARE.

WARNING

ISOPROPYL ALCOHOL IS TOXIC AND FLAMMABLE. USE PROTECTION EQUIPMENT. USE IN A WELL−VENTILATED AREA.

(1) Disconnect the applicable electrical harness connector from the component or sensor with the Soft Jaw Pliers.

(a) Examine the socket contacts and pins of the electrical connector for damage. If the socket contacts or pins show heavy damage, are oxidized or blackened, replacement of the electrical connector and mated component or sensor is recommended.

SUBTASK 70-11-11-110-001-H00

WARNING

REFER TO THE PRODUCT LABEL AND THE MANUFACTURER'S (MATERIAL) SAFETY DATA SHEET (SDS) FOR INSTRUCTIONS ON THE HAZARDS, STORAGE, SAFE HANDLING AND PROPER USE OF THESE PRODUCTS.

CAUTION

DO NOT PUT THE WHOLE HARNESS OR THE CONNECTORS FULLY INTO THE CLEANING AGENT.

NOTE: For T4.9 Thermocouple Cable Assemblies, refer to OEM Component Maintenance Manual GEK 109970 for cleaning instructions.

(2) Spray the cleaner on the wiring harness and electrical contacts at ambient temperature, or at safe temperatures recommended by the manufacturer. Only use the cleaners listed in the consumable material section.

NOTE: Use one of the following cleaners on the wiring harness and electrical contacts, alcohol, B00679 [C04-035], electrical contact cleaner, B50318 [C04-257], electrical contact cleaner, B50319 [C04-254], electrical contact cleaner, B50324 [C04-253], electrical contact cleaner, B50323 [C04-252], solvent, B50321 [C04-198], solvent, B50320 [C04-197], and solvent, B50322 [C04-199].

SUBTASK 70-11-11-140-002-H00

(3) Wipe off the area to be cleaned with a clean cloth, tampico fiber brush, G50222, or equivalent to remove loosened dirt and unwanted cleaner. While the area is wet with cleaner, use a tampico fiber brush, G50222 to clean around connector contacts and flush with cleaner as necessary.

NOTE: Various types of non-metallic bristle brushes can be used around the connector contacts.

SUBTASK 70-11-11-140-004-H00

WARNING USE EYE PROTECTION WHEN YOU USE COMPRESSED AIR TO CLEAN, COOL, OR DRY PARTS OR TOOLS. PARTICLES CAN CAUSE AN INJURY TO YOUR EYES. DO NOT USE MORE THAN 30 PSIG (200 KPA). DO NOT POINT COMPRESSOR AIR AT YOURSELF OR OTHER PERSONS.

(4) If necessary, blow dry with clean dry air, G50321 at 30 psi (200 kPa) pressure maximum.

NOTE: Use any source of dry, filtered air, compressed at 30 psi (200 kPa) maximum.

SUBTASK 70-11-11-210-004-H00

(5) Do an inspection for the dirt removal. Do steps 1 thru 4. again, if necessary.

SUBTASK 70-11-11-140-005-H00

(6) Put a layer of electrical contact cleaner, C50233 [C04-258] on the metal surfaces of the contacts at each contact location with a short burst from the spray container or a swab, G01659 wet with the liquid version. Let it air dry for 10-15 seconds.

F. Alternative Procedure

SUBTASK 70-11-11-140-003-H00

NOTE: This Alternative Procedure uses a pre-cleaner and is recommended for electrical contacts that are more difficult to clean. The pre-cleaner is identified in the consumable materials section.

(1) Clean the metal surfaces of the contacts with a swab, G01659 or equivalent that is wet with electrical contact cleaner, B50325 [C04-259]. Let the cleaner stay on for 15 to 20 seconds.

SUBTASK 70-11-11-110-002-H00

(2) Immediately after the cleaning, a triple flush is recommended using alcohol, B00679 [C04-035].

(a) Put the alcohol on the contact area that you cleaned with electrical contact cleaner, B50325 [C04-259] and shake off the unwanted amount.

NOTE: If you hold the connector upside down, it will help with the removal of particles and residue.

(b) Do this flush three times.

SUBTASK 70-11-11-110-003-H00

WARNING: USE EYE PROTECTION WHEN YOU USE COMPRESSED AIR TO CLEAN, COOL, OR DRY PARTS OR TOOLS. PARTICLES CAN CAUSE AN INJURY TO YOUR EYES. DO NOT USE MORE THAN 30 PSIG (200 KPA). DO NOT POINT COMPRESSOR AIR AT YOURSELF OR OTHER PERSONS.

(3) Blow dry with clean dry air, G50321 at 30 psi (200 kPa) pressure maximum. Put a layer of electrical contact cleaner, C50233 [C04-258] on the metal surfaces of the contacts, listed in Table 3 (TASK 71-00-00-800-833-H00), with short bursts from the spray container or a lint-free swab wet with the liquid version. Let it air dry for 10-15 seconds.

G. Post Cleaning Task

SUBTASK 70-11-11-210-002-H00

(1) Visually check the part to make sure it is clean.

SUBTASK 70-11-11-210-003-H00

(2) Make sure the connector contact area is fully dry before you connect it again.

SUBTASK 70-11-11-420-001-H00

(3) Install the electrical connector on the applicable harness to the component or sensor as follows:

(a) Tighten the electrical connector with your hand.

(b) Use Soft Jaw Pliers to tighten the connector. Tighten the connector until the Soft Jaw Pliers slip on the connector ring.

SUBTASK 70-11-11-710-001-H00

(4) After the installation of the harness and connector, do the applicable (Power Plant Test Reference Table, TASK 71-00-00-800-833-H00).

——— END OF TASK ———

TASK 70-11-11-100-803-H00

4. Dry Abrasive Blast Cleaning

A. General

(1) Abrasive blast cleaning is a mechanical technique for removing scale, corrosion, oxidation, and carbon deposits from all kinds of materials that could not be removed by chemical cleaning. It should only be used to supplement chemical cleaning, not as a replacement.

(2) Abrasive blast cleaning is often employed for surface preparation of steels that have a breaking strength greater than 210,000 psi (1,447,899 kPa) and which cannot be cleaned by chemical process.

WARNING: OBEY THIS PROCEDURE. ONLY THIS PROCEDURE IS RECOMMENDED. OTHER PROCEDURES ARE DANGEROUS. OTHER PROCEDURES CAN CAUSE INJURIES TO PERSONNEL AND CAUSE DAMAGE TO PARTS.

CAUTION: DO NOT REMOVE TOO MUCH MATERIAL. MOVE THE ABRASIVE JET IN AN OVAL PATTERN ABOVE THE SURFACE. DO NOT HOLD IT ON ONE AREA FOR MORE THAN TWO SECONDS. DAMAGE TO THE SURFACE CAN OCCUR.

(3) The Engine/Shop Manual specifies the particular process to be used in each case, the choice depends upon:

(a) The standard of cleanliness desired.

(b) The nature of the part.

(c) The part shape and how fragile.

(d) The surface finish necessary.

(4) Approved dry abrasive blast methods are:

(a) Method No. 4A - Aluminum Oxide 220 (Fine) Mesh or 120 (Medium) Mesh.

(b) Method No. 4B - Shells and Rice Hulls.

(c) Method No. 4C - Aluminum Oxide 500 (Very Fine) Mesh.

(d) Method No. 4D - Fruit Stones.

(e) Method No. 4E - Plastic Media.

CAUTION

DO NOT USE ALTERNATIVE MEDIA IF A SPECIAL SURFACE FINISH IS NECESSARY FOR A SUBSEQUENT PROCEDURE. THIS CAN CAUSE DAMAGE TO THE PART.

(5) Alternative Media Criteria.

(a) Changing the media size, shape, and density (hardness) affect how aggressive the grit blast will remove material from the parts being cleaned.

NOTE: Nozzle pressure, offset distance, offset angle, and media fracture mechanics also affect the rate of material removal.

(b) If the function of the grit blast operation is for only cleaning the surface:

1) A finer gritty or less aggressive media can be used in place of a coarse grit or more aggressive media without damaging the part.

(c) A list of the media recommended in this section follows from the least aggressive to most aggressive.

(d) An acceptable alternative media will appear above the media specified.

(6) For example, if 4D (fruit stones) is required for cleaning, 4E is equivalent and 4B or 4C would be acceptable alternatives.

Least Aggressive:	4B Shells And Rice Hulls
	4C 500 Mesh Aluminum Oxide (very Fine)
	4D Fruit Stones and 4E Plastic Media Type 2 NOTE: These two media are equivalent alternatives
	4A 220 Mesh Aluminum Oxide (Fine)
Most Aggressive:	4A 120 Mesh Aluminum Oxide (Medium)

B. Equipment

(1) The following equipment is required for dry abrasive.

WARNING

CLEAN THE DRY-ABRASIVE EQUIPMENT THAT YOU USE FOR TITANIUM AND TITANIUM ALLOYS REGULARLY. TITANIUM PARTICLES ARE FLAMMABLE. FIRE CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO PARTS.

(WARNING PRECEDES)

WARNING

PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

(a) Dry abrasive blast operations must be performed using installations specifically designed for that purpose (blast booths) complete with safety devices such as air-extraction systems, sound proofing, exhaust mufflers, etc. These installations must also be equipped with devices guaranteeing good quality processing, such as, dust removers, catch and select units for broken particles, internal lighting, and air pressure adjustments.

(b) To prevent contamination of parts being processed, a blast booth should be reversed, whenever possible, for use with a given material (alloyed steel, aluminum alloy, or titanium parts, as applicable).

(c) To minimize fire hazards from an accumulation of very fine particles of titanium (or its alloys), the blast booths used for dry abrasive blast of titanium parts must be carefully cleaned frequently.

(d) A dry blast booth lined with anti-abrasive material.

C. Consumable Materials

Reference	Description	Specification
G50245 [C04-112]	Abrasive - Grit, 500 Mesh	
G50248 [C04-113]	Abrasive - Grit, 220 Mesh	
G50249 [C04-114]	Abrasive - Grit, 120 Mesh	
G50250 [C04-115]	Abrasive - Walnut Shells	
G50251 [C04-116]	Abrasive - Rice Hulls	
G50252 [C04-117]	Abrasive - Fruit Stones (Pits)	
G50253 [C04-153]	Abrasive - Plastic Blast Media	

D. Procedure for Dry Abrasive Blast - Method No. 4A

SUBTASK 70-11-11-120-001-H00

CAUTION

DRY ABRASIVE BLASTING CAN DECREASE THE STRENGTH OF TITANIUM OR TITANIUM ALLOYS. DO NOT BLAST TITANIUM OR TITANIUM ALLOYS WITHOUT INSTRUCTIONS FROM THE ENGINE/SHOP MANUAL. COMPLETE BLASTING IN ACCORDANCE WITH THE SPECIFICATIONS AND IN INSTALLATIONS RESERVED FOR THAT PURPOSE.

(1) In most cases, using either medium or fine mesh ensures efficient cleaning. However, the surface finish achieved with the fine mesh is smoother than that obtained with the medium mesh.

SUBTASK 70-11-11-950-001-H00

(2) Cover all ports, pockets, cavities, or tube ends to prevent entry of abrasive which may be difficult to detect and remove after cleaning. Mask all surfaces, if required, as indicated in the Engine/Shop Manual. The part must be free of oil and grease to prevent the quality of the abrasive from deteriorating

SUBTASK 70-11-11-120-002-H00

WARNING PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

CAUTION DO NOT REMOVE TOO MUCH MATERIAL. MOVE THE ABRASIVE JET IN AN OVAL PATTERN ABOVE THE SURFACE. DO NOT HOLD IT ON ONE AREA FOR MORE THAN TWO SECONDS. DAMAGE TO THE SURFACE CAN OCCUR.

(3) Grit blast parts using 220 mesh abrasive grit, G50248 [C04-113] or 120 mesh abrasive grit, G50249 [C04-114]. Maintain air pressure at 25 psia (172 kPa) to 90 psi (621 kPa) with the nozzle held at a distance of 6 in. (152 mm) to 8 in. (203 mm) from the part. The recommended angle to the surface being blasted is 60 ±10°arc (1 ±0 rad).

SUBTASK 70-11-11-020-002-H00

(4) Remove masking if applied.

SUBTASK 70-11-11-160-001-H00

(5) Blow out all residues from the abrasive cleaning operation with clean, dry air.

SUBTASK 70-11-11-210-005-H00

(6) Make sure that the part has been evenly cleaned and no blast residues have accumulated.

SUBTASK 70-11-11-211-002-H00

(7) Make sure you check media for wear at an interval that will prevent blasting with deteriorated media. Inspect using a 10x to 20x magnification to the media sample for rounded edges (loss of cutting edges) and under-size particles (broken-down media). Verify that the residues removed from the components are being removed by the reclaiming system. The media should be replaced when approximately 50% of the sample is rounded and/or undersized. Use a sample of new media for visual comparison if necessary.

E. Procedure for Dry Abrasive Blast - Method No. 4B

SUBTASK 70-11-11-120-003-H00

WARNING CLEAN THE DRY-ABRASIVE EQUIPMENT THAT YOU USE FOR TITANIUM AND TITANIUM ALLOYS REGULARLY. TITANIUM PARTICLES ARE FLAMMABLE. FIRE CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO PARTS.

CAUTION DRY ABRASIVE BLASTING CAN DECREASE THE STRENGTH OF TITANIUM OR TITANIUM ALLOYS. DO NOT BLAST TITANIUM OR TITANIUM ALLOYS WITHOUT INSTRUCTIONS FROM THE ENGINE/SHOP MANUAL. COMPLETE BLASTING IN ACCORDANCE WITH THE SPECIFICATIONS AND IN INSTALLATIONS RESERVED FOR THAT PURPOSE.

(1) This technique uses a mild abrasive (crushed shells and rice hulls) and is an effective method of cleaning light scale or carbon deposits, corrosion, and rust from parts where retarded cutting action is required. It can be used, without any detriment to the part treated, on components of high precision or of low mechanical strength. Its cleaning efficiency is limited to rather loosely adhering contaminations.

SUBTASK 70-11-11-950-002-H00

(2) Cover all ports, pockets, cavities, or tube ends to prevent entry of abrasive which may be difficult to detect and remove after cleaning. Mask all surfaces, if necessary, as indicated in the Engine/Shop Manual. The part must be free of oil and grease to prevent the quality of the abrasive from deterioration.

SUBTASK 70-11-11-120-004-H00

WARNING PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

CAUTION DO NOT REMOVE TOO MUCH MATERIAL. MOVE THE ABRASIVE JET IN AN OVAL PATTERN ABOVE THE SURFACE. DO NOT HOLD IT ON ONE AREA FOR MORE THAN TWO SECONDS. DAMAGE TO THE SURFACE CAN OCCUR.

(3) Grit blast parts using walnut shells abrasive, G50250 [C04-115] and rice hulls abrasive, G50251 [C04-116]. Use 50 percent by volume of each. Maintain air pressure at 80 psi (552 kPa) to 100 psi (689 kPa) with the nozzle held at a distance between 6 in. (152 mm) to 8 in. (203 mm) from the part. The recommended angle to the surface being blasted is between 75°arc (1 rad) to 105°arc (2 rad).

SUBTASK 70-11-11-020-003-H00

(4) Remove masking if applied.

SUBTASK 70-11-11-160-002-H00

(5) Blow out all residues from the abrasive cleaning operation with clean, dry air.

SUBTASK 70-11-11-210-006-H00

(6) Make sure that the part has been evenly cleaned and no blast residues have accumulated.

SUBTASK 70-11-11-211-003-H00

(7) Make sure you check media for wear at an interval that will prevent blasting with deteriorated media. Inspect using a 10x to 20x magnification to the media sample for rounded edges (loss of cutting edges) and under-size particles (broken-down media). Verify that the residues removed from the components are being removed by the reclaiming system. The media should be replaced when approximately 50% of the sample is rounded and/or undersized. Use a sample of new media for visual comparison if necessary.

F. Procedure for Dry Abrasive Blast - Method No. 4C

SUBTASK 70-11-11-120-005-H00

WARNING CLEAN THE DRY-ABRASIVE EQUIPMENT THAT YOU USE FOR TITANIUM AND TITANIUM ALLOYS REGULARLY. TITANIUM PARTICLES ARE FLAMMABLE. FIRE CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO PARTS.

(WARNING PRECEDES)

CAUTION

DRY ABRASIVE BLASTING CAN DECREASE THE STRENGTH OF TITANIUM OR TITANIUM ALLOYS. DO NOT BLAST TITANIUM OR TITANIUM ALLOYS WITHOUT INSTRUCTIONS FROM THE ENGINE/SHOP MANUAL. COMPLETE BLASTING IN ACCORDANCE WITH THE SPECIFICATIONS AND IN INSTALLATIONS RESERVED FOR THAT PURPOSE.

(1) The surface finish from this is smoother than that from the medium procedure. Usually this procedure will clean satisfactorily.

SUBTASK 70-11-11-950-003-H00

(2) Cover all ports, pockets, cavities, or tube ends to present entry of abrasive which may be difficult to detect and remove after cleaning. Mask all surfaces, if necessary, as indicated in the Engine/Shop Manual. The part must be free of oil and grease to prevent the quality of the abrasive from deterioration.

SUBTASK 70-11-11-120-006-H00

WARNING

PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

CAUTION

DO NOT REMOVE TOO MUCH MATERIAL. MOVE THE ABRASIVE JET IN AN OVAL PATTERN ABOVE THE SURFACE. DO NOT HOLD IT ON ONE AREA FOR MORE THAN TWO SECONDS. DAMAGE TO THE SURFACE CAN OCCUR.

(3) Grit blast parts using 500 mesh abrasive grit, G50245 [C04-112]. Maintain air pressure at 25 psi (172 kPa) to 30 psi (207 kPa) for direct pressure equipment or 50 psi (345 kPa) to 60 psi (414 kPa) for suction-type equipment. Hold the nozzle between the distance of 2 in. (51 mm) to 4 in. (102 mm) from the part. The recommended angle to the surface is 60 ±10°arc (1 ±0 rad).

SUBTASK 70-11-11-020-004-H00

(4) Remove masking if applied.

SUBTASK 70-11-11-160-003-H00

(5) Blow out all residues from the abrasive cleaning operation with clean, dry air.

SUBTASK 70-11-11-210-007-H00

(6) Make sure that the part has been evenly cleaned and no blast residues have accumulated.

SUBTASK 70-11-11-211-004-H00

(7) Make sure you check media for wear at an interval that will prevent blasting with deteriorated media. Inspect using a 10x to 20x magnification to the media sample for rounded edges (loss of cutting edges) and under-size particles (broken-down media). Verify that the residues removed from the components are being removed by the reclaiming system. The media should be replaced when approximately 50% of the sample is rounded and/or undersized. Use a sample of new media for visual comparison if necessary.

G. Procedure for Dry Abrasive Blast - Method No. 4D

SUBTASK 70-11-11-120-007-H00

WARNING CLEAN THE DRY-ABRASIVE EQUIPMENT THAT YOU USE FOR TITANIUM AND TITANIUM ALLOYS REGULARLY. TITANIUM PARTICLES ARE FLAMMABLE. FIRE CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO PARTS.

CAUTION DRY ABRASIVE BLASTING CAN DECREASE THE STRENGTH OF TITANIUM OR TITANIUM ALLOYS. DO NOT BLAST TITANIUM OR TITANIUM ALLOYS WITHOUT INSTRUCTIONS FROM THE ENGINE/SHOP MANUAL. COMPLETE BLASTING IN ACCORDANCE WITH THE SPECIFICATIONS AND IN INSTALLATIONS RESERVED FOR THAT PURPOSE.

(1) This technique uses a mild abrasive (crushed fruit stones) and is an effective method of cleaning light scale or carbon deposit, corrosion, and rust from parts where retarded cutting action is required. It can be used, without any detriment to the part treated, on components of high precision or low mechanical strength. Its cleaning efficiency is limited to rather loosely adhering contaminations.

SUBTASK 70-11-11-950-004-H00

(2) Cover all ports, pockets, cavities, or tube ends to prevent entry of abrasive which may be difficult to detect and remove after cleaning. Mask all surfaces, if necessary, as indicated in the Engine/Shop Manual. The part must be free of oil and grease to prevent the quality of the abrasive from deterioration.

SUBTASK 70-11-11-120-008-H00

WARNING PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

CAUTION DO NOT REMOVE TOO MUCH MATERIAL. MOVE THE ABRASIVE JET IN AN OVAL PATTERN ABOVE THE SURFACE. DO NOT HOLD IT ON ONE AREA FOR MORE THAN TWO SECONDS. DAMAGE TO THE SURFACE CAN OCCUR.

(3) Grit blast parts using fruit stones abrasive, G50252 [C04-117]. Maintain air pressure at 22 psi (152 kPa) to 72 psi (496 kPa) with the nozzle held at a distance of 6 in. (152 mm) to 8 in. (203 mm) from the part. The recommended angle to the surface being blasted is 75°arc (1 rad) to 105°arc (2 rad).

SUBTASK 70-11-11-020-005-H00

(4) Remove masking if applied.

SUBTASK 70-11-11-160-004-H00

(5) Blow out all residues from the abrasive cleaning operation with clean, dry air.

SUBTASK 70-11-11-210-008-H00

(6) Make sure that the part has been evenly cleaned and no blast residues have accumulated.

SUBTASK 70-11-11-211-005-H00

(7) Make sure you check media for wear at an interval that will prevent blasting with deteriorated media. Inspect using a 10x to 20x magnification to the media sample for rounded edges (loss of cutting edges) and under-size particles (broken-down media). Verify that the residues removed from the components are being removed by the reclaiming system. The media should be replaced when approximately 50% of the sample is rounded and/or undersized. Use a sample of new media for visual comparison if necessary.

H. Procedure for Dry Abrasive Blast - Method No. 4E

SUBTASK 70-11-11-120-009-H00

WARNING CLEAN THE DRY-ABRASIVE EQUIPMENT THAT YOU USE FOR TITANIUM AND TITANIUM ALLOYS REGULARLY. TITANIUM PARTICLES ARE FLAMMABLE. FIRE CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO PARTS.

CAUTION DRY ABRASIVE BLASTING CAN DECREASE THE STRENGTH OF TITANIUM OR TITANIUM ALLOYS. DO NOT BLAST TITANIUM OR TITANIUM ALLOYS WITHOUT INSTRUCTIONS FROM THE ENGINE/SHOP MANUAL. COMPLETE BLASTING IN ACCORDANCE WITH THE SPECIFICATIONS AND IN INSTALLATIONS RESERVED FOR THAT PURPOSE.

(1) This technique uses a mild abrasive plastic media which is effective for parts cleaning as an alternate to chemical methods. Direct pressure or suction type machines may be used. Direct pressure machines are recommended to allow media flow rate control.

SUBTASK 70-11-11-910-001-H00

(2) This process is capable of dirt and light scale removal. It may be also used to remove RTV materials, dry film lubricants (spray on or resin bonded), epoxy/polyurethane paint systems, and many other metal finish coatings.

SUBTASK 70-11-11-910-002-H00

CAUTION DO NOT USE PLASTIC MEDIA IN MACHINES USED FOR OTHER ABRASIVE MEDIA OPERATIONS. MACHINES USED FOR ALUMINIUM OR SILICA BLAST OPERATIONS ARE DIRTY. THESE DIRTY PARTICLES WILL COMPROMISE THE PLASTIC MEDIA AND CAUSE A MINIMAL EFFECT TO THE SURFACE.

(3) Plastic media blasting equipment should have a suitable media filter and reclaim system to remove residues from the blast stream. Systems with no functioning reclaiming should be checked frequently to monitor the media condition.

SUBTASK 70-11-11-910-003-H00

(4) Set up machine so that media flow rate is heavy. Back off media flow just slightly from a full choke condition.

SUBTASK 70-11-11-950-005-H00

CAUTION MAKE SURE THAT THE COMPONENT DOES NOT HAVE RESIDUE ON THE SURFACE. NO MEDIA OR RESIDUE CAN REMAIN.

(CAUTION PRECEDES)

CAUTION DECREASE THE BLAST TIMES AT LOCATIONS WHERE TOO MUCH METAL REMOVAL CAN OCCUR.

CAUTION BLAST PARTS WITH METAL THICKNESS LESS THAN 0.035 IN. (0.89 MM) WITH LESS PRESSURE TO PREVENT DISTORTION OR OTHER DAMAGE TO THE SURFACES.

CAUTION USE MORE PRECAUTIONS WITH ALUMINUM PARTS. SHOT-PEEN, IF NECESSARY, AFTER THE PLASTIC BLAST, TO REPAIR THE SURFACE CONDITION.

CAUTION MAKE SURE THAT THE PROTECTIVE LAYER ON THE ANODIZED ALUMINUM PARTS IS NOT DAMAGED OR REMOVED. BEFORE AND AFTER CONDUCTIVITY CHECKS MUST BE COMPARABLE.

(5) Cover all ports, pockets, cavities, or tube ends to prevent entry of abrasive which may be difficult to detect and remove after cleaning. Mask all surfaces, if necessary, indicated in the Engine/Shop Manual. The part must be free of oil and grease to prevent the quality of the abrasive from deterioration.

SUBTASK 70-11-11-120-010-H00

(6) Set the machine parameters. Set the air pressure for direct pressure machines to 25 psi (172 kPa) to 40 psi (276 kPa) and suction machines from 30 psi (207 kPa) to 60 psi (414 kPa). Use minimum pressure setting required. Set the nozzle at 4 in. (102 mm) to 8 in. (203 mm) at an angle to the surface of 30°arc (1 rad) to 80°arc (1 rad). The nozzle diameter shall be 0.3 in. (7.6 mm) to 0.5 in. (12.7 mm).

SUBTASK 70-11-11-120-011-H00

WARNING PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

CAUTION DO NOT REMOVE TOO MUCH MATERIAL. MOVE THE ABRASIVE JET IN AN OVAL PATTERN ABOVE THE SURFACE. DO NOT HOLD IT ON ONE AREA FOR MORE THAN TWO SECONDS. DAMAGE TO THE SURFACE CAN OCCUR.

(7) Grit blast parts using plastic blast media, G50253 [C04-153] at the machine parameters in the step above.

SUBTASK 70-11-11-020-006-H00

(8) Remove masking if applied. Remove an residue or media using clean, dry air.

SUBTASK 70-11-11-160-005-H00

(9) Blow out all residues from the abrasive cleaning operation with clean, dry air.

SUBTASK 70-11-11-210-009-H00

(10) Make sure that the part has been cleaned and no blast residues have accumulated.

SUBTASK 70-11-11-211-001-H00

(11) Make sure you check media for wear at an interval that will prevent blasting with deteriorated media. Inspect using a 10x to 20x magnification to the media sample for rounded edges (loss of cutting edges) and under-size particles (broken-down media). Verify that the residues removed from the components are being removed by the reclaiming system. The media should be replaced when approximately 50% of the sample is rounded and/or undersized. Use a sample of new media for visual comparison if necessary.

——— END OF TASK ———

ENGINE BORESCOPE BOSSES LOCKING INSERT REPLACEMENT

1. General

A. This procedure has one task.

(1) The repair of missing, loose or worn locking inserts in the borescope bosses.

TASK 70-11-13-960-801-H00

2. Engine Case Borescope Bosses Locking Insert Replacement

(Figure 201, Figure 202, Figure 203, Figure 204, Figure 205 and Figure 206)

A. General

(1) This procedure provides the instructions to repair missing, loose or worn locking inserts in the borescope bosses.

B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00679 [C04-035]	Alcohol - Isopropyl	
D50043 [C02-058]	Compound - Antiseize, Acheson GP460 (For Threaded Fasteners 0.250 Inches Diameter Or Larger, C02-079 Is An Alternative)	GE A50TF201 Class A
G00829	Ice - Dry	
G00834	Cloth - Lint-free Cotton	

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-11-13-220-001-H00

(1) Do an inspection of the counterbore (diameter AB, diameter AC, diameter AD and/or diameter AE) in the borescope boss with the missing or removed locking insert as follows (Figure 201, Figure 202 and Figure 203):

NOTE: The dimensional data in this procedure uses inches as the unit of measurement. The conversion to millimeters is rounded to one less decimal digit than inches. To prevent conversion errors, do not convert from millimeters to inches.

Dimensional Data

Description	Minimum In-Process Dimension	Maximum In-Process Dimension	Minimum Finish Dimension	Maximum Finish Dimension	Reference Dimension
Counterbore Dia AB (combustor ports)	0.9705 inch (24.651 mm)	0.9845 inch (25.006 mm)	0.9705 inch (24.651 mm)	0.9845 inch (25.006 mm)	---
Counterbore Dia AC (stage 1 nozzle port)	1.095 inch (27.81 mm)	1.105 inch (28.07 mm)	1.095 inch (27.81 mm)	1.105 inch (28.07 mm)	---

Dimensional Data (Continued)

Description	Minimum In-Process Dimension	Maximum In-Process Dimension	Minimum Finish Dimension	Maximum Finish Dimension	Reference Dimension
Counterbore Dia AD (stage 2 nozzle port)	1.095 inch (27.81 mm)	1.105 inch (28.07 mm)	1.095 inch (27.81 mm)	1.105 inch (28.07 mm)	---
Counterbore Dia AE (LPT port)	0.845 inch (21.46 mm)	0.851 inch (21.62 mm)	0.845 inch (21.46 mm)	0.851 inch (21.62 mm)	---

(a) Use a diameter gage with accuracy of ± 0.002 inch (± 0.005 mm) or better.

(b) Make four checks of the diameter 45 degrees apart and use the average diameter for the actual size of the counterbore.

SUBTASK 70-11-13-970-001-H00

(2) Find the locking insert in the figure that will give an interference fit with the measured counterbore diameter (diameter AB, diameter AC, diameter AD and/or diameter AE) (Figure 205).

NOTE: The outer diameter (diameter A) must be 0.003-0.005 inch (0.08-0.13 mm) larger than the measured diameter of the counterbore.

SUBTASK 70-11-13-420-001-H00

(3) Install the locking insert into the counterbore of the borescope boss (diameter AB, diameter AC, diameter AD and/or diameter AE) as follows:

NOTE: The outer diameter (diameter A) must be 0.003-0.005 inch (0.08-0.13 mm) larger than the measured diameter of the counterbore.

WARNING

DO NOT GET ACETONE, ISOPROPYL ALCOHOL OR CLEANING SOLVENT DESOCLEAN IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE GAS FROM ACETONE, ISOPROPYL ALCOHOL OR CLEANING SOLVENT DESOCLEAN. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE ACETONE, ISOPROPYL ALCOHOL OR CLEANING SOLVENT DESOCLEAN. KEEP ACETONE, ISOPROPYL ALCOHOL AND CLEANING SOLVENT DESOCLEAN AWAY FROM SPARKS, FLAME, AND HEAT. ACETONE, ISOPROPYL ALCOHOL AND CLEANING SOLVENT DESOCLEAN ARE POISONOUS AND FLAMMABLE SOLVENTS WHICH CAN CAUSE INJURY OR DAMAGE.

(a) Use a lint-free cloth, G00834 moistened with solvent, B00062 or alcohol, B00679 [C04-035] to clean the bushing and the counter bore in the applicable borescope boss.

WARNING

WHEN YOU DO WORK WITH DRY ICE, MAKE SURE YOU USE SAFETY GOGGLES AND INSULATED GLOVES. IF DRY ICE TOUCHES YOUR EYES OR SKIN, FROSTBITE CAN OCCUR.

(b) Put the locking insert on dry ice, G00829 for 10-15 minutes to help in the installation of the locking insert.

WARNING WHEN YOU DO WORK WITH DRY ICE, MAKE SURE YOU USE SAFETY GOGGLES AND INSULATED GLOVES. IF DRY ICE TOUCHES YOUR EYES OR SKIN, FROSTBITE CAN OCCUR.

(c) Remove the locking insert from the dry ice and put the locking insert in the counterbore of the applicable borescope boss.

(d) Lightly tap the outer face of the locking insert to push the locking insert into the counterbore.

1) Continue to tap until the face of the locking insert is 0.000-0.005 inch (0.00-0.13 mm) below the surface of the borescope boss.

SUBTASK 70-11-13-420-002-H00

(4) Install the locking insert into the counterbore of the borescope boss (diameter AB, diameter AC, diameter AD and/or diameter AE) as follows (alternative procedure):

NOTE: The outer diameter (diameter A) must be 0.003-0.005 inch (0.08-0.13 mm) larger than the measured diameter of the counterbore.

WARNING DO NOT GET ACETONE, ISOPROPYL ALCOHOL OR CLEANING SOLVENT DESOCLEAN IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE GAS FROM ACETONE, ISOPROPYL ALCOHOL OR CLEANING SOLVENT DESOCLEAN. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE ACETONE, ISOPROPYL ALCOHOL OR CLEANING SOLVENT DESOCLEAN. KEEP ACETONE, ISOPROPYL ALCOHOL AND CLEANING SOLVENT DESOCLEAN AWAY FROM SPARKS, FLAME, AND HEAT. ACETONE, ISOPROPYL ALCOHOL AND CLEANING SOLVENT DESOCLEAN ARE POISONOUS AND FLAMMABLE SOLVENTS WHICH CAN CAUSE INJURY OR DAMAGE.

(a) Use a lint-free cloth, G00834 moistened with solvent, B00062 or alcohol, B00679 [C04-035] to clean the bushing and the counter bore in the applicable borescope boss.

(b) If necessary, locally manufacture the installation tools (Figure 206).

(c) Apply Acheson GP460 compound, D50043 [C02-058] to the threads and the insert setting shoulder of the locally manufactured installation tool.

NOTE: The D50043 Compound (C02-058) applied to the insert setting shoulder on the installation tool helps to hold the locking insert on the tool during assembly.

(d) Apply Acheson GP460 compound, D50043 [C02-058] to the counterbore (diameter AB, diameter AC, diameter AD and/or diameter AE) in the applicable borescope pad.

(e) Put the new locking insert on the insert setting shoulder of the installation tool.

(f) Thread the installation tool with the locking insert attached to the thread in the borescope pad being repaired

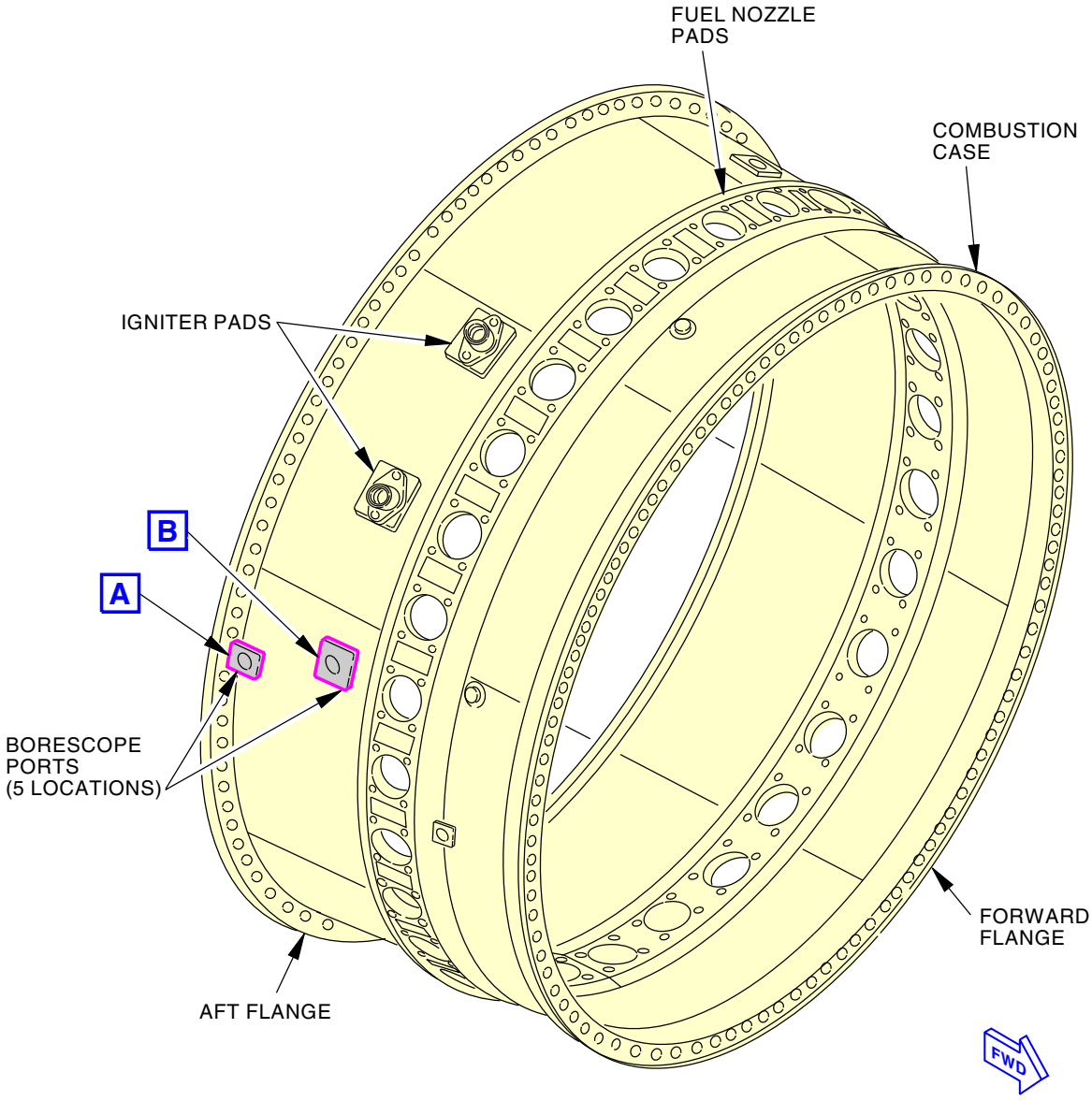
(g) Tighten the hex head of the installation tool until the locking insert is pushed into the counter bore.

1) Make sure that the face of the locking insert is 0.000-0.005 inch (0.00-0.13 mm) below the surface of the borescope boss.

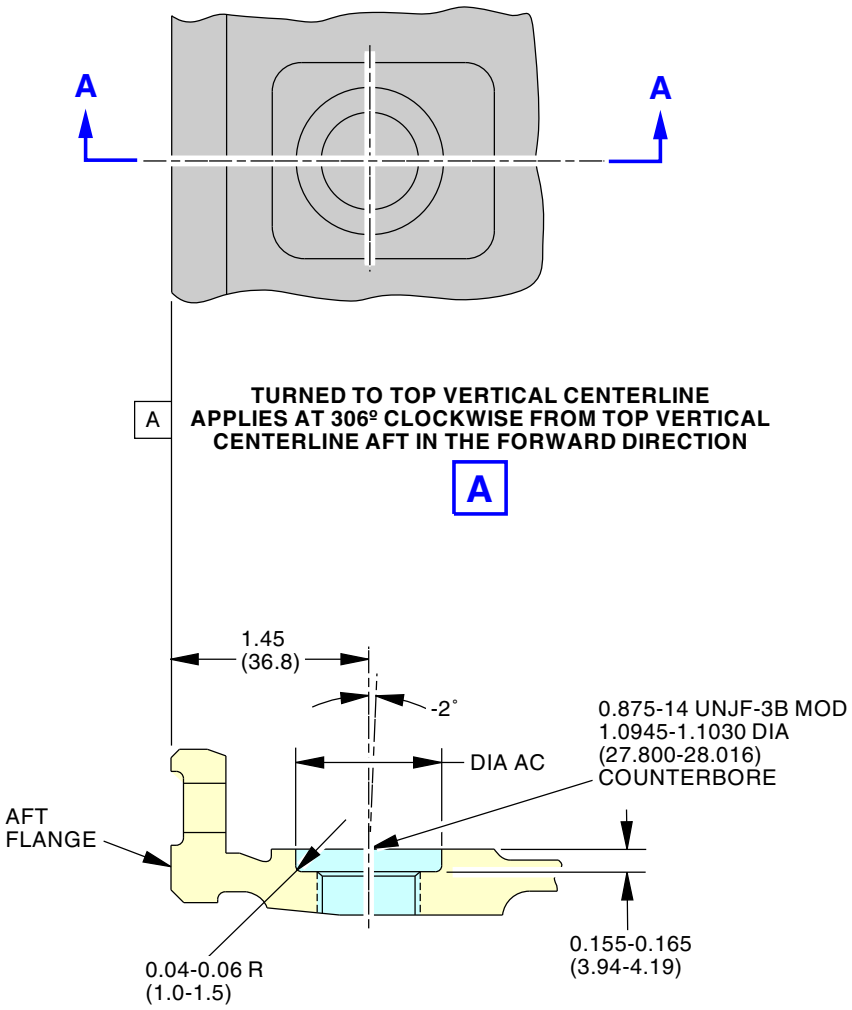
(h) Remove the installation tool.

(i) Wipe off unwanted lubricant from the locking insert and counterbore with a clean lint-free cloth, G00834.

——— END OF TASK ———



Combustion Case Counterbore Inspection
Figure 201/70-11-13-990-801-H00 (Sheet 1 of 3)



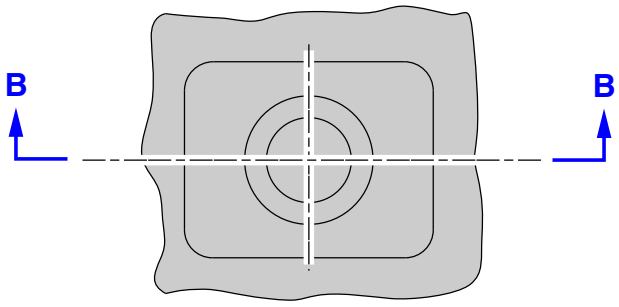
NOTE:

ALL DIMENSIONS ARE IN INCHES
(MILLIMETERS ARE IN PARENTHESES).

1229501-01

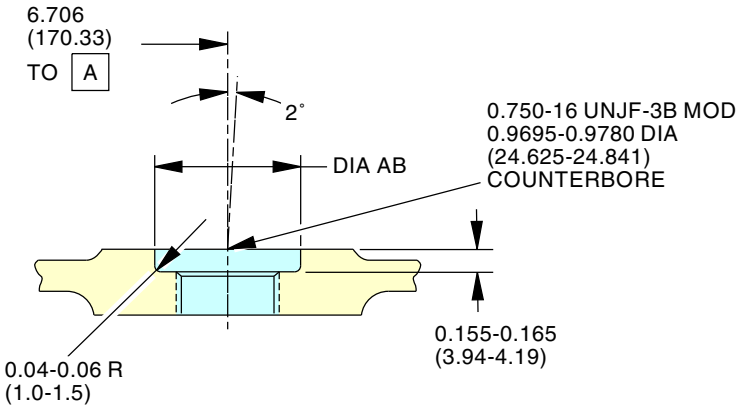
1744814 S0000311819_V2

Combustion Case Counterbore Inspection
Figure 201/70-11-13-990-801-H00 (Sheet 2 of 3)



**TURNED TO TOP VERTICAL CENTERLINE
APPLIES AT 36˚, 108˚, 192º AND 300º
CLOCKWISE FROM TOP VERTICAL CENTERLINE
AFT IN THE FORWARD DIRECTION**

B



**TURNED TO TOP
VERTICAL CENTERLINE
COMBUSTOR PORT**

A-A

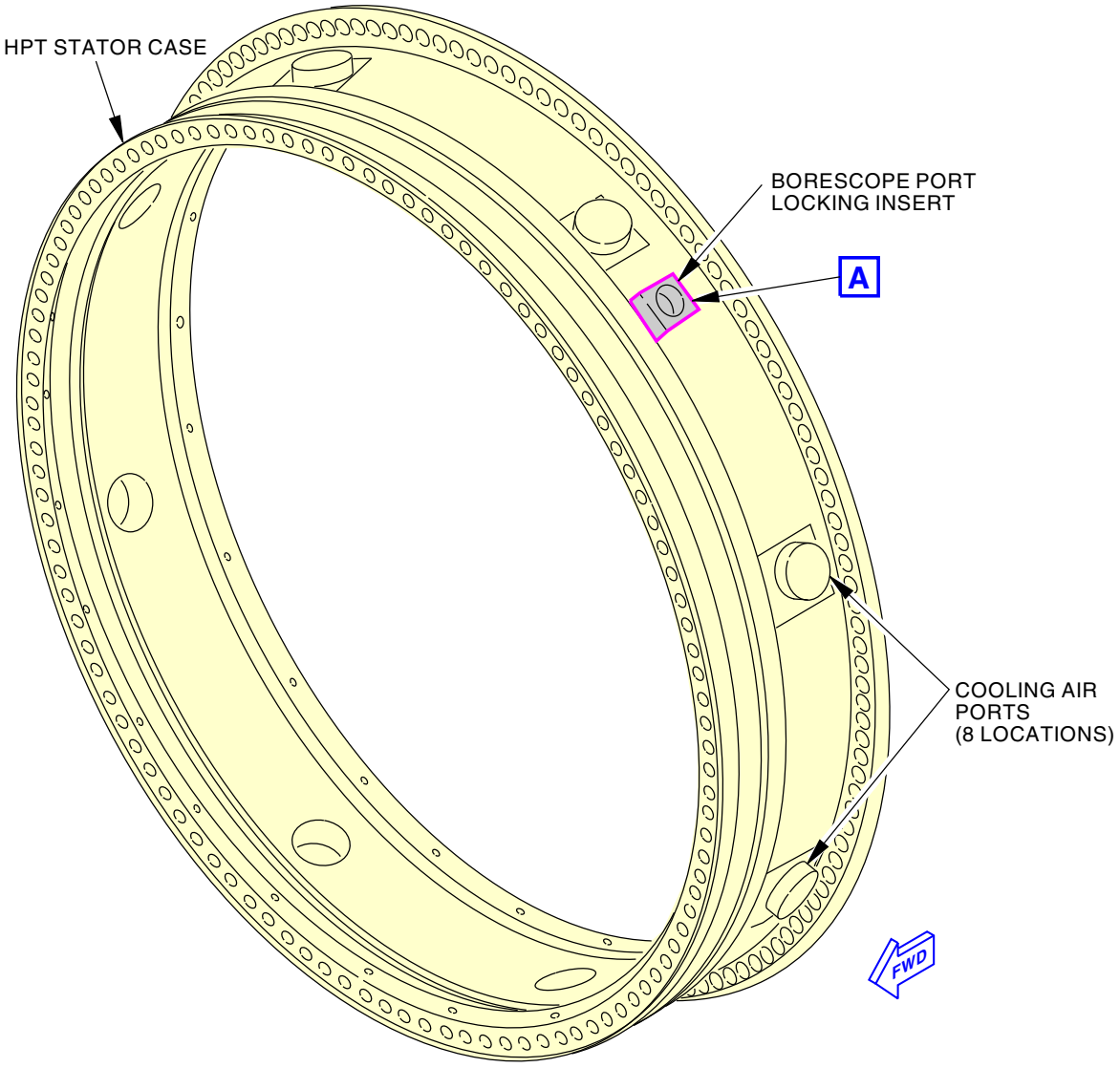
NOTE:

ALL DIMENSIONS ARE IN INCHES
(MILLIMETERS ARE IN PARENTHESES).

1229602-01

1744820 S0000311820_V2

**Combustion Case Counterbore Inspection
Figure 201/70-11-13-990-801-H00 (Sheet 3 of 3)**

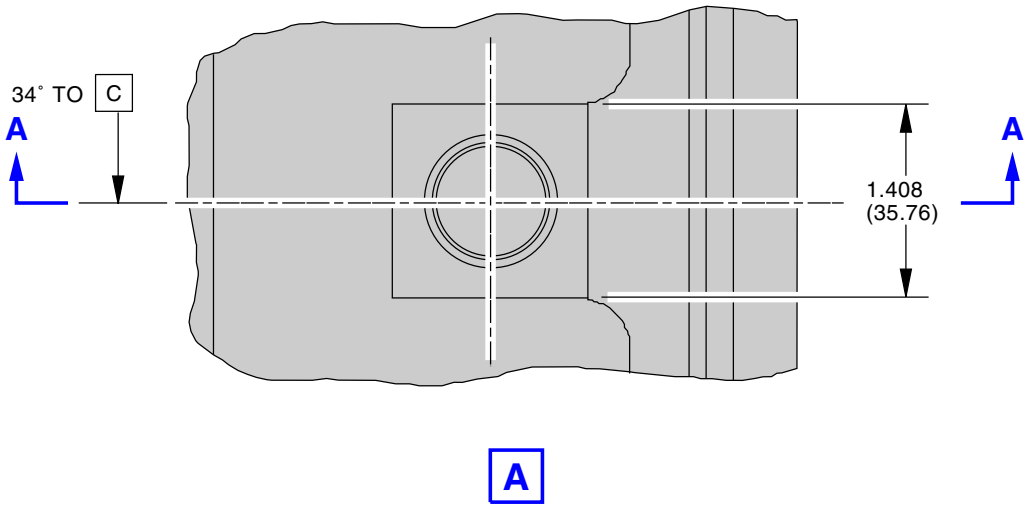


CONFIGURATION 1 AND 2

1246634-01

1744749 S0000311821_V2

HPT Case Counterbore Inspection
Figure 202/70-11-13-990-802-H00 (Sheet 1 of 3)



CONFIGURATION 1

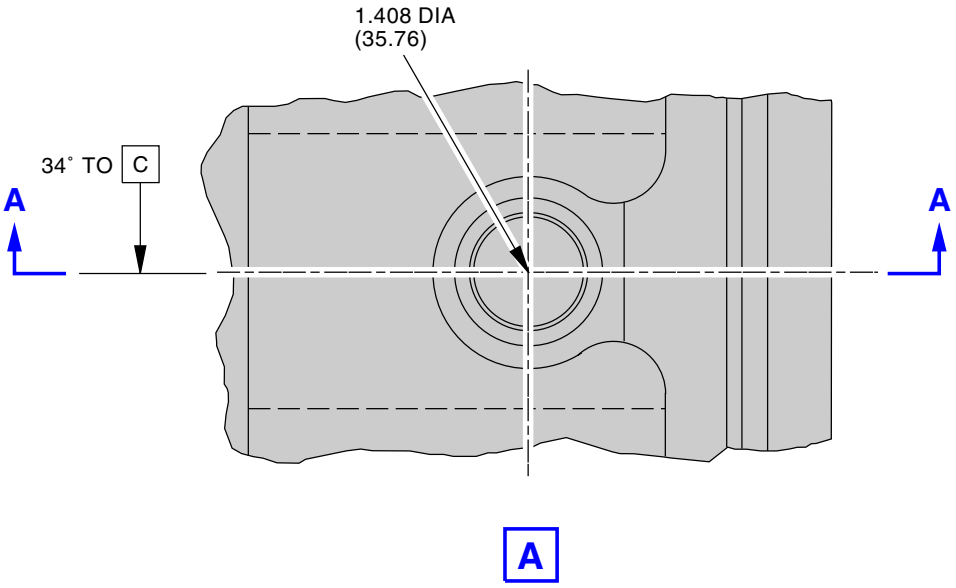
A-A

NOTE:

ALL DIMENSIONS ARE IN INCHES
(MILLIMETERS ARE IN PARENTHESES).

1246639-01
1744743 S0000311822_V2

HPT Case Counterbore Inspection
Figure 202/70-11-13-990-802-H00 (Sheet 2 of 3)



CONFIGURATION 2

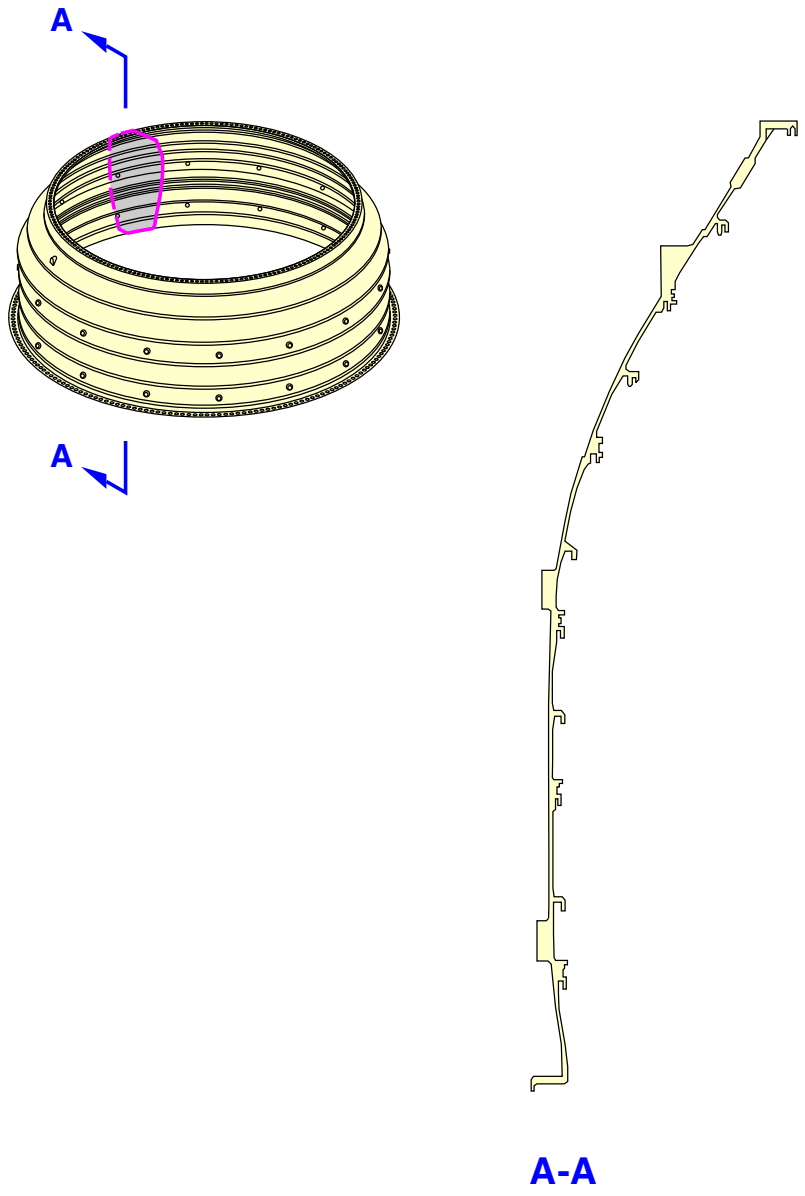
A-A

NOTE:

ALL DIMENSIONS ARE IN INCHES
(MILLIMETERS ARE IN PARENTHESES).

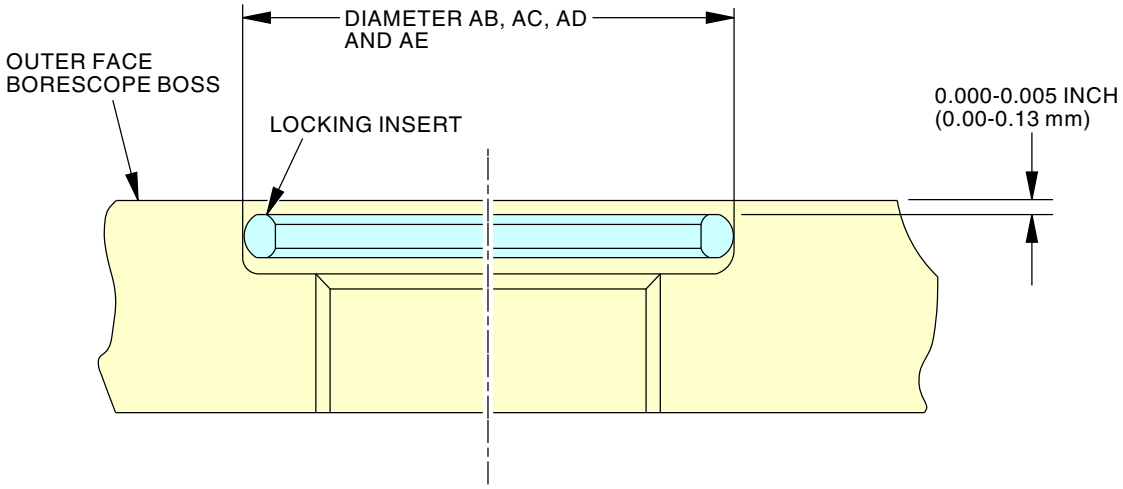
1246640-00
1745105 S0000311823_V2

HPT Case Counterbore Inspection
Figure 202/70-11-13-990-802-H00 (Sheet 3 of 3)

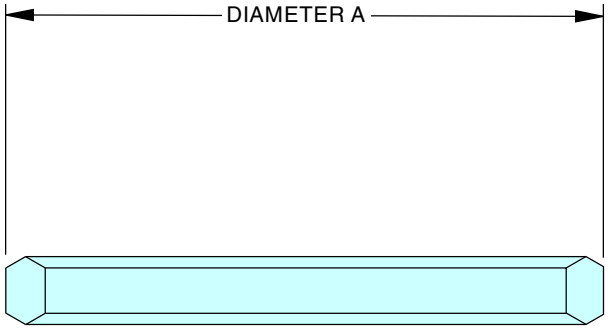


1141680-01
1745102 S0000311838_V2

LPT Case Counterbore Inspection
Figure 203/70-11-13-990-803-H00



VIEW APPLIES AT ALL BORESCOPE BOSS LOCATIONS



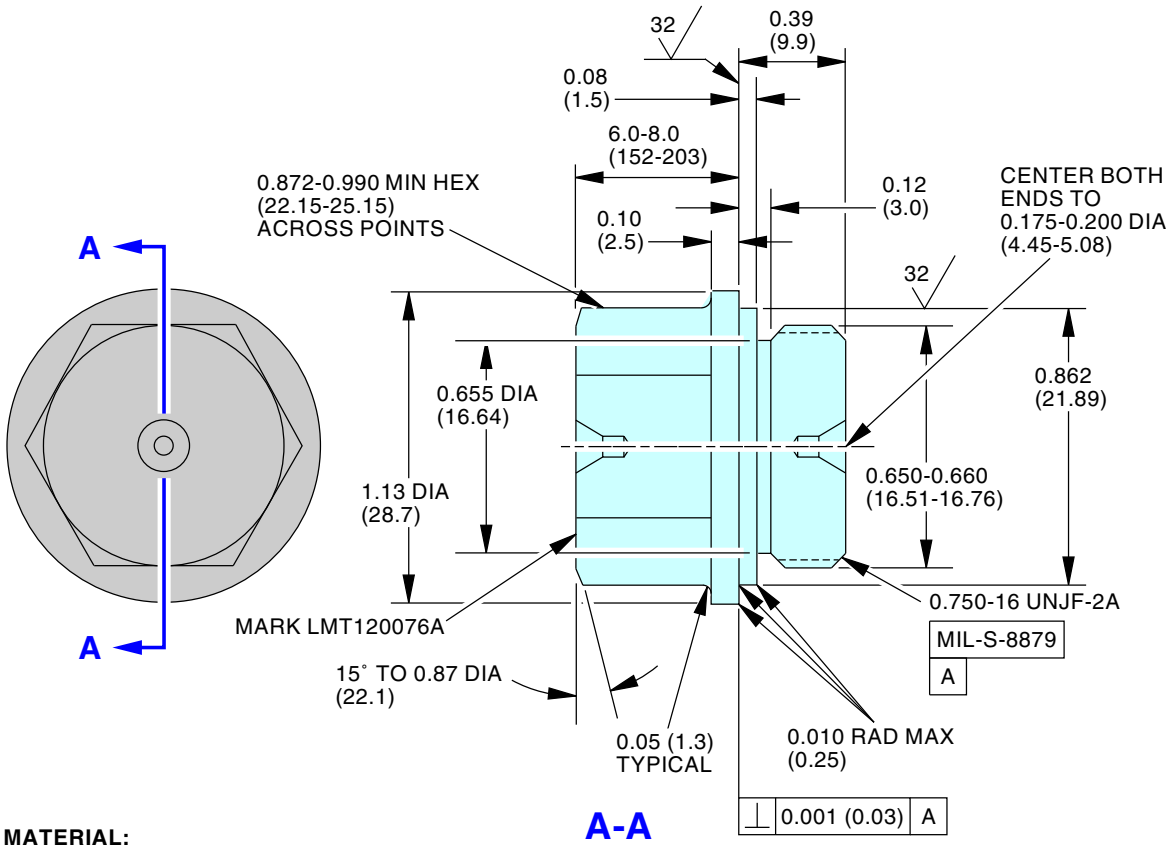
1229503-01
1750925 S0000311842_V3

Borescope Boss Counterbore Dimensions
Figure 204/70-11-13-990-804-H00

LOCKING INSERT			
LOCKING INSERT PART NUMBER	DIAMETER A	DIAMETER B	APPLICABLE COUNTERBORE
1805M37P01	0.8495-0.8500 INCH (21.577-21.590 mm)	0.765 INCH (19.43 mm)	DIAMETER AD
1805M37P02	0.8515-0.8520 INCH (21.628-21.641 mm)	0.765 INCH (19.43 mm)	DIAMETER AD
1805M37P03	0.8535-0.8540 INCH (21.679-21.692 mm)	0.765 INCH (19.43 mm)	DIAMETER AD
1805M37P04	0.8555-0.8560 INCH (21.730-21.742 mm)	0.765 INCH (19.43 mm)	DIAMETER AD
1805M37P05	0.9745-0.9750 INCH (24.752-24.765 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P06	0.9765-0.9770 INCH (24.803-24.816 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P07	0.9785-0.9790 INCH (24.854-24.867 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P08	0.9805-0.9810 INCH (24.905-24.917 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P09	1.0995-1.1000 INCH (27.927-27.940 mm)	1.015 INCH (25.78 mm)	DIAMETER AC
1805M37P10	1.1015-1.1020 INCH (27.978-27.991 mm)	1.015 INCH (25.78 mm)	DIAMETER AC
1805M37P11	1.1035-1.1040 INCH (28.029-28.042 mm)	1.015 INCH (25.78 mm)	DIAMETER AC
1805M37P12	1.1055-1.1060 INCH (28.080-28.092 mm)	1.015 INCH (25.78 mm)	DIAMETER AC
1805M37P13	1.1075-1.1080 INCH (28.131-28.143 mm)	1.015 INCH (25.78 mm)	DIAMETER AC
1805M37P14	1.1095-1.1100 INCH (28.181-28.194 mm)	1.015 INCH (25.78 mm)	DIAMETER AC
1805M37P15	0.9825-0.9830 INCH (24.956-24.968 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P16	0.9845-0.9850 INCH (25.006-25.019 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P17	0.9865-0.9870 INCH (25.057-25.070 mm)	0.890 INCH (22.61 mm)	DIAMETER AB
1805M37P18	0.9885-0.9890 INCH (25.108-25.121 mm)	0.890 INCH (22.61 mm)	DIAMETER AB

1751016 S0000311844_V1

Locking Insert Dimensions
Figure 205/70-11-13-990-805-H00



MATERIAL:

440C OR TOOL STEEL

NOTE:

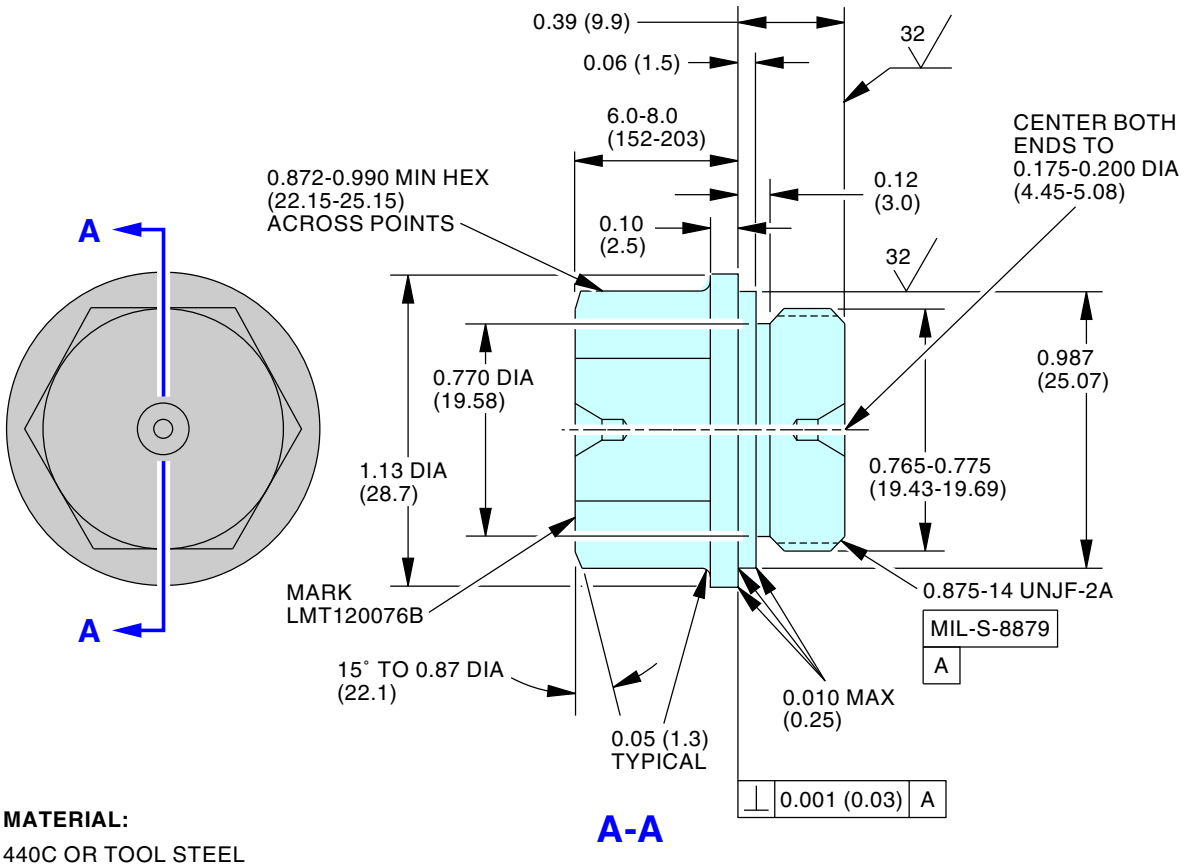
1. LOCALLY MANUFACTURED TOOL FOR THE 1805M37P05, P06, P07, P08, P15, P16, P17, P18, 1322M32G08 AND 1322M32G06 LOCKING INSERTS.
2. DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESIS).
3. ALL DIAMETERS CONCENTRIC INCH 0.002 (0.05) OR LESS T.I.R.
4. MARK REFER TO AS748 METHOD 2D2 OR 2F3 BEFORE HEAT TREAT.
5. HEAT TREAT Rc55-63.
6. DIMENSION APPLIES BEFORE COAT.
7. BLACK OXIDE ALL OVER.
8. UNLESS SPECIFIED TOLERANCES ARE (REFER TO ANSI Y14.5):

0.00 (0.0)	±0.01 (0.3)
0.000 (0.00)	±0.003 (0.08)
ANGLE	±2°
BREAK EDGE	0.003-0.015 (0.08-0.38)
CORNERS	0.005-0.020 (0.13-0.51) MOD
UNSPECIFIED CHAMFERS	45°
ALL HEATERS	⌖ 0.010 (0.30) F.I.M.
ALL SURFACES	125

1229506-00

1745028 S0000311846_V2

Locally Manufactured Locking Insert Tool Fabrication
Figure 206/70-11-13-990-807-H00 (Sheet 1 of 3)



MATERIAL:

440C OR TOOL STEEL

NOTE:

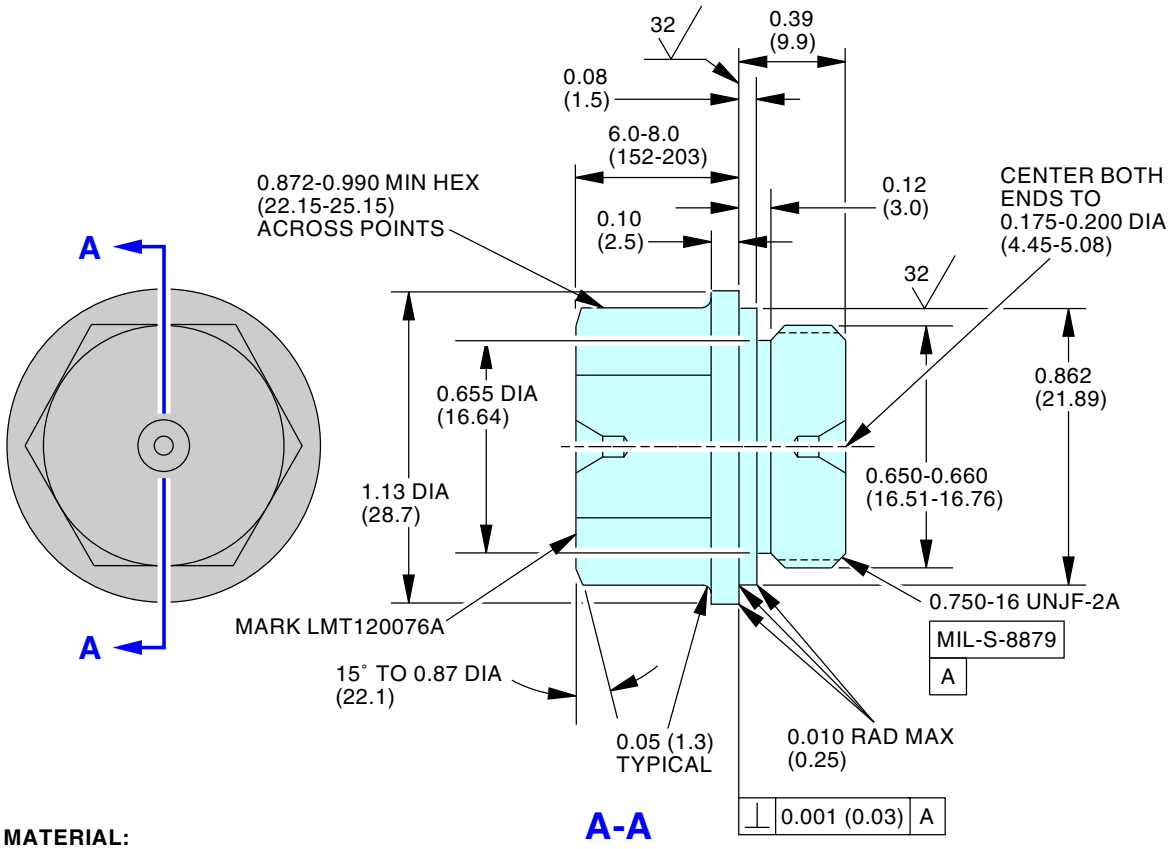
1. LOCALLY MANUFACTURED TOOL FOR THE 1805M37P05, P06, P07, P08, P15, P16, P17, P18, 1322M32G08 AND 1322M32G06 LOCKING INSERTS.
2. DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESIS).
3. ALL DIAMETERS CONCENTRIC INCH 0.002 (0.05) OR LESS T.I.R.
4. MARK REFER TO AS748 METHOD 2D2 OR 2F3 BEFORE HEAT TREAT.
5. HEAT TREAT Rc55-63.
6. DIMENSION APPLIES BEFORE COAT.
7. BLACK OXIDE ALL OVER.
8. UNLESS SPECIFIED TOLERANCES ARE (REFER TO ANSI Y14.5):

0.00 (0.0)	±0.01 (0.3)
0.000 (0.00)	±0.003 (0.08)
ANGLE	±2°
BREAK EDGE	0.003-0.015 (0.08-0.38)
CORNERS	0.005-0.020 (0.13-0.51) MOD
UNSPECIFIED CHAMFERS	45°
ALL HEATERS	⌖ 0.010 (0.30) F.I.M.
ALL SURFACES	125

1229508-00

1745031 S0000311858_V2

Locally Manufactured Locking Insert Tool Fabrication
Figure 206/70-11-13-990-807-H00 (Sheet 2 of 3)



MATERIAL:

440C OR TOOL STEEL

NOTE:

1. LOCALLY MANUFACTURED TOOL FOR THE 1805M37P05, P06, P07, P08, P15, P16, P17, P18, 1322M32G08 AND 1322M32G06 LOCKING INSERTS.
2. DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESIS).
3. ALL DIAMETERS CONCENTRIC INCH 0.002 (0.05) OR LESS T.I.R.
4. MARK REFER TO AS748 METHOD 2D2 OR 2F3 BEFORE HEAT TREAT.
5. HEAT TREAT Rc55-63.
6. DIMENSION APPLIES BEFORE COAT.
7. BLACK OXIDE ALL OVER.
8. UNLESS SPECIFIED TOLERANCES ARE (REFER TO ANSI Y14.5):

0.00 (0.0)	±0.01 (0.3)
0.000 (0.00)	±0.003 (0.08)
ANGLE	±2°
BREAK EDGE	0.003-0.015 (0.08-0.38)
CORNERS	0.005-0.020 (0.13-0.51) MOD
UNSPECIFIED CHAMFERS	45°
ALL HEATERS	⊕ 0.010 (0.30) F.I.M.
ALL SURFACES	125

1229506-01

1745037 S0000311847_V2

Locally Manufactured Locking Insert Tool Fabrication
Figure 206/70-11-13-990-807-H00 (Sheet 3 of 3)

ENGINE CONTROL PRESSURE LINE INSPECTION

1. General

A. This procedure has one task:

(1) Inspection of the engine control pressure line.

TASK 70-11-14-200-801-H00

2. Engine Control Pressure Line Inspection

A. General

(1) This general engine control pressure line inspection can be used for inspection, cleaning, leak check and re-torque of fittings for the component system that is serviced.

(2) This procedure can be used for reference when inspection of specific pressure lines is necessary as part of the fault troubleshooting.

B. References

Reference	Title
71-00-00-800-833-H00	Power Plant Test Reference Table (P/B 501)

C. Consumable Materials

Reference	Description	Specification
B00679 [C04-035]	Alcohol - Isopropyl	
G50650 [C10-071]	Wire - Safety, 0.020 or 0.032 inch (0.508 or 0.813 mm) Diameter	SAE AS5685, AMS 5687, AMS 5689, AMS 5690
G50951 [C05-005]	Liquid - Leak (Bubble) Test	ASTM E515

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

WARNING ISOPROPYL ALCOHOL IS TOXIC AND FLAMMABLE. USE PERSONAL PROTECTION EQUIPMENT. USE IN A WELL-VENTILATED AREA.

WARNING USE EYE PROTECTION WHEN YOU USE COMPRESSED AIR, ARGON OR NITROGEN. PARTICLES CAN CAUSE AN INJURY TO YOUR EYES. DO NOT POINT COMPRESSED AIR, ARGON OR NITROGEN AT YOURSELF OR OTHER PERSONS.

CAUTION DO NOT APPLY PRESSURIZED AIR TO THE INLET FITTING OF THE COMPONENT UNDER INVESTIGATION. INTERNAL DAMAGE TO THE COMPONENT CAN OCCUR AND THE COMPONENT CAN FAIL TO OPERATE CORRECTLY.

(CAUTION PRECEDES)

CAUTION

DO NOT BLOW COMPRESSED AIR INTO THE ECU (FADEC). DAMAGE TO THE ECU (FADEC) CAN OCCUR.

CAUTION

MAKE SURE THAT THERE IS NO WATER IN THE SENSE LINES. IF ALL THE WATER IS NOT REMOVED FROM THE SENSE LINES, ENGINE OPERATION PROBLEMS CAN OCCUR.

CAUTION

WHEN TORQUE IS APPLIED TO THE PRESSURE LINE NUT, USE A SECONDARY WRENCH APPLIED TO THE COMPONENT FITTING TO APPLY A COUNTER TORQUE. FAILURE TO USE A SECONDARY WRENCH ON THE COMPONENT FITTING CAN CAUSE DAMAGE AND FAILURE OF THE COMPONENT OR PRESSURE LINE.

NOTE: Carefully follow the Warnings and Cautions given in the subject task.

SUBTASK 70-11-14-210-001-H00

(1) Do a visual inspection of the engine control pressure line from the air source on the engine to the component that is serviced and fittings as follows:

(a) Check for correct installation of the mounting clamps as follows:

1) If the mounting clamps are loose or show evidence of wear, remove the mounting clamp and do an inspection for wear damage into the pressure line.

(b) Replace the damaged mounting clamps and damaged sections of the hose or tubing.

SUBTASK 70-11-14-100-001-H00

(2) Clean the component inlet hole as follows:

(a) Disconnect the pressure line from the component.

(b) Do a visual inspection of the inlet hole in the component fitting for any blockage as follows:

1) If you find contamination, corrosion or blockage of the inlet fitting to the component then replace the inlet filter to the component. Refer to the procedure in the applicable maintenance manual (if so equipped) or replace the component.

(c) Install the pressure line on the component fitting as follows:

1) Tighten the pressure line nut to the torque value given in the applicable tube/hose assembly or installation procedure.

SUBTASK 70-11-14-211-001-H00

(3) Do an inspection of the pressure line for blockage as follows:

(a) Disconnect the pressure line from the component.

(b) Supply up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen to the component side of the pressure line to do an inspection for blockage.

(c) If air is not flowing freely into the pressure line air source, do as follows:

1) Stop the air flow to the pressure line.

2) Remove the pressure line from the air source and do a visual inspection for blockage inside the fitting from air source to the pressure line as follows:

a) If blocked, use a piece of safety wire, G50650 [C10-071] or equivalent to clear the blockage and clean with up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen and alcohol, B00679 [C04-035].

b) If no blockage is found at the air source fitting to the pressure line, do an inspection of the inlet fitting to the pressure line. If blocked, use a piece of safety wire, G50650 [C10-071] or equivalent to the clear blockage and clean with up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen and alcohol, B00679 [C04-035].

3) Connect the pressure line to its air source and tighten to the torque value stated in the applicable tube/hose assembly or installation procedure.

4) Use up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen to the component side of the pressure line to test again and do an inspection for blockage.

5) If air, argon or nitrogen still does not flow freely into the pressure line air source, do as follows:

a) Do an inspection for blockage at other fittings. Disconnect the fittings and do an inspection for airflow one at a time.

b) If blocked, use a piece of safety wire, G50650 [C10-071] or equivalent to remove blockage and clean with up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen and alcohol, B00679 [C04-035] or replace the blocked section of the pressure line.

(d) Stop and remove the filtered dry air, argon or nitrogen attached to the pressure line.

(e) Install the pressure line on the component fitting as follows:

1) Tighten the pressure line nut to the necessary torque value given in the applicable tube/hose assembly or installation procedure.

2) Attach safety wire, G50650 [C10-071] or equivalent, if necessary.

SUBTASK 70-11-14-211-002-H00

(4) Do an inspection of the fittings in the pressure line for leakage as follows:

(a) Remove the pressure line from its air source.

(b) Seal the pressure line with an applicable plug and torque.

(c) Remove the pressure line from the component fitting.

(d) Supply up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen attached to the component side of the pressure line.

(e) Use audible test or leak test liquid, G50951 [C05-005] to do an inspection of all fittings for leakage.

(f) Apply the correct torque to any leaking fittings as applicable.

(g) If the fitting still leaks after you apply the correct torque, do as follows:

1) Stop the supply of air, argon or nitrogen.

2) Disconnect the fitting.

3) Clean the fitting and pressure line with alcohol, B00679 [C04-035].

4) Assemble and correctly tighten the fitting.

5) Use up to 150 psig (10.3 bar) filtered dry air, argon or nitrogen attached to the component side of the pressure line.

6) If the fitting still leaks, replace the tubing.

(h) Stop and remove the supply of air, argon or nitrogen attached to the pressure line.

(i) Install the pressure line on the component fitting as follows:

1) Tighten the pressure line nut to the necessary torque value given in the applicable tube/hose assembly or installation procedure.

2) Attach safety wire, G50650 [C10-071] or equivalent if necessary.

(j) Remove the plug from the pressure line.

(k) Connect the pressure line to its air source fitting and tighten the pressure line nut to the necessary torque value given in the applicable tube/hose assembly or installation procedure.

SUBTASK 70-11-14-100-002-H00

(5) Clean the engine control pressure line weep hole as follows:

(a) If the engine control pressure line has a weep hole, then clean as follows:

1) Use a piece of non-metallic wire or safety wire, G50650 [C10-071] or equivalent with a maximum diameter of 0.02 in. (0.51 mm) to clear any blockage.

2) Blow filtered dry air, argon or nitrogen up to 150 psig (10.3 bar) attached to the component side of the pressure line to clear any blockage. Make sure that air, argon or nitrogen flows freely out of the weep hole.

3) Install the pressure line on the component fitting as follows:

a) Tighten the pressure line nut to the necessary torque value stated in the applicable tube/hose assembly or installation procedure.

b) Attach safety wire, G50650 [C10-071] or equivalent, if necessary.

SUBTASK 70-11-14-211-003-H00

(6) Do an inspection of the fittings for looseness as follows:

(a) Tighten any loose fittings to the necessary torque value stated in the applicable tube/hose assembly or installation procedure.

(b) Attach safety wire, G50650 [C10-071] or equivalent, if necessary.

SUBTASK 70-11-14-720-001-H00

(7) Do the applicable test shown in the Power Plant Test Reference Table, TASK 71-00-00-800-833-H00.

——— END OF TASK ———

SPECIFICATIONS AND MATERIALS - MAINTENANCE PRACTICES

1. General

A. This section contains lists of consumable materials that you use during regular maintenance of the engine.

TASK 70-30-00-800-801-H01

2. Specifications and Materials

A. General

(1) The specifications and materials sections contain lists of consumable materials that you can use during regular maintenance of the engine.

(2) When possible, the Airplane Maintenance Manual will refer to consumable materials by a material specification. The engine manufacturer gives a reference number to many consumable materials. The AMM will supply this number. For specifications that start with "CP" followed by numbers (for example CP2198 or CP05-003), refer to the CFM56 Consumable Products manual. For specifications that start with "C" followed by numbers (for example C05-003) refer to the GE Aircraft Engines Commercial Standard Practice Manual (70-80-0 - Consumable Product Section).

(3) If a material has no material specification, the material will be a specific vendor product or will be commercially available.

(4) For vendor data on a material, refer to the U-File or the IPC Specification Cross Reference Index. You can also refer to the qualified products list of the applicable material specification.

(5) The data on the materials and their sources uses the newest Boeing specifications and available vendor data. If you find that an item on the list is not available, please tell Boeing. You can tell Boeing through your local Boeing Field Service Representative. You can also send an e-mail directly into the Boeing Communications system at ame-boecom@boeing.com. Make sure that you supply your airline name, your name, your telephone number and your e-mail address. Give all the data you can about your request. If possible, supply the identification number of the bulk code.

B. References

Reference	Title
20-30-01-910-801	Structure Adhesives, Cements, and Sealants (P/B 201)
20-30-02-910-801	Structure Cleaners and Polishes (P/B 201)
20-30-03-910-801	Structure Finishing Materials (P/B 201)
20-30-04-910-801	Structure Lubricants (P/B 201)
20-30-05-910-801	Structure Welding Materials (P/B 201)
20-30-06-910-801	Structure Stripper Materials (P/B 201)
20-30-07-910-801	Structure Miscellaneous Materials (P/B 201)
70-30-11-910-801-H01	Engine Adhesives, Cements, and Sealants (P/B 201)
70-30-12-910-801-H01	Engine Cleaners and Polishes (P/B 201)
70-30-13-921-801-H01	Engine Finishing Materials (P/B 201)
70-30-14-910-801-H01	Engine Lubricants (P/B 201)
70-30-17-910-801-H01	Engine Miscellaneous Materials (P/B 201)

C. Location Zones

Zone	Area
411	Engine, Left

(Continued)

Zone	Area
421	Engine, Right

D. Procedure

SUBTASK 70-30-00-800-001-H01

(1) Refer to these sources for data on consumable materials used on the airplane structure.

(a) Structure Adhesives, Cements, and Sealants, TASK 20-30-01-910-801.

(b) Structure Cleaners and Polishes, TASK 20-30-02-910-801.

(c) Structure Finishing Materials, TASK 20-30-03-910-801.

(d) Structure Lubricants, TASK 20-30-04-910-801.

(e) Structure Stripper Materials, TASK 20-30-06-910-801.

(f) Structure Miscellaneous Materials, TASK 20-30-07-910-801.

(g) Structure Welding Materials, TASK 20-30-05-910-801.

SUBTASK 70-30-00-800-002-H01

(2) Use these tasks for data on General Electric/CFMI engine consumable materials:

(a) Engine Adhesives, Cements, and Sealants, TASK 70-30-11-910-801-H01.

(b) Engine Cleaners and Polishes, TASK 70-30-12-910-801-H01.

(c) Engine Finishing Materials, TASK 70-30-13-921-801-H01.

(d) Engine Lubricants, TASK 70-30-14-910-801-H01.

(e) Engine Miscellaneous Materials, TASK 70-30-17-910-801-H01.

——— END OF TASK ———

ENGINE ADHESIVES, CEMENTS, AND SEALANTS - MAINTENANCE PRACTICES

1. General

A. This procedure lists adhesives, cements, and sealants for General Electric engines. There are no procedural steps in this procedure. Specific C numbers are listed in the GE Commercial Engine Standard Practices Manual (70-80 series, Consumable Materials Section). Specific CP numbers are listed in the CFMI Consumable Products Manual.

TASK 70-30-11-910-801-H01

2. Engine Adhesives, Cements, and Sealants

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-30-11-800-001-H01

(1) The data contained in this task has been moved to the Introduction section of the AMM.

——— END OF TASK ———

ENGINE CLEANERS AND POLISHES - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of cleaners and polishes for General Electric engines. There are no procedural steps in this procedure. Specific C numbers are listed in the GE Commercial Engine Standard Practices Manual (70-80 series, Consumable Products Section). Specific CP numbers are listed in the CFMI Consumable Products Manual.

TASK 70-30-12-910-801-H01

2. Engine Cleaners and Polishes

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-30-12-800-001-H01

(1) The data contained in this task has been moved to the Introduction section of the AMM.

——— END OF TASK ———

ENGINE FINISHING MATERIALS - MAINTENANCE PRACTICES

1. General

A. This procedure contains the lists of finishing materials for General Electric engines. There are no procedural steps in this procedure. Specific C numbers are listed in the GE Commercial Engine Standard Practices Manual (70-80 series, Consumable Materials Section). Specific CP numbers are listed in the CFMI Consumable Products Manual.

TASK 70-30-13-921-801-H01

2. Engine Finishing Materials

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-30-13-800-001-H01

(1) The data contained in this task has been moved to the Introduction section of the AMM.

——— END OF TASK ———

ENGINE LUBRICANTS - MAINTENANCE PRACTICES

1. General

A. This procedure contains a list of lubricants for General Electric engines. There are no procedural steps in this procedure. Specific C numbers are listed in the GE Commercial Engine Standard Practices Manual (70-80 series, Consumable Materials Section). Specific CP numbers are listed in the CFMI Consumable Products Manual.

TASK 70-30-14-910-801-H01

2. Engine Lubricants

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-30-14-800-001-H01

(1) The data contained in this task has been moved to the Introduction section of the AMM.

——— END OF TASK ———

ENGINE MISCELLANEOUS MATERIALS - MAINTENANCE PRACTICES

1. General

A. This procedure contains the lists of miscellaneous consumable materials for General Electric engines. There are no procedural steps in this procedure. Specific C numbers are listed in the GE Commercial Engine Standard Practices Manual (70-80 series, Consumable Materials Section). Specific CP numbers are listed in the CFMI Consumable Products Manual.

TASK 70-30-17-910-801-H01

2. Engine Miscellaneous Materials

A. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

B. Procedure

SUBTASK 70-30-17-800-001-H01

(1) The data contained in this task has been moved to the Introduction section of the AMM.

——— END OF TASK ———

LOCKING METHODS

1. General

A. This procedure has tasks for these five standard practices.

(1) The installation of lockwire

(2) The installation of a safety cable

(3) The installation of self-locking, hexagonal, or castellated nuts

(4) The installation of cotter pins

(5) The installation of tab washers.

B. You do not use a locking device to set or keep torque. You use a locking device as a safety to make sure that fasteners and other parts do not disengage.

C. Locking devices are important to airplane safety. You must use the best shop practices when you install locking devices.

TASK 70-41-00-910-803-H00

2. Lockwire Installation

A. General

(1) This procedure contains the task to install lockwire.

(2) You install lockwire to make sure that parts do not loosen.

(3) You must install lockwire in the correct direction. The lockwire must prevent movement of the part that can cause it to loosen.

(4) When you install lockwire, you must obey the steps that follow.

(a) Where possible, install stainless steel lockwire (AMS 5689). Unless specified differently, always use the double-twist procedure to install lockwire. To install lockwire with the double-twist installation procedure, you start at a part that you must safety. Put the lockwire through the lockwire hole in the part. Make a loop with the lockwire. Twist the two ends of the lockwire together until you get to the subsequent part. You put the lockwire through the lockwire hole on that part and make a loop with the lockwire. Twist the two ends of the lockwire together again. You do these steps on each subsequent part. You use the single strand procedure to install lockwire only when it is specified ((Figure 201 or Figure 202 or Figure 203), (See C)).

(b) When you complete the lockwire installation, visually examine the installation for these problems.

1) Make sure that the lockwire does not rub against other parts.

2) Make sure that engine vibration will not cause damage to the lockwire.

3) Make sure that the only tension on the lockwire is that which is necessary to safety the part.

(5) You must install the lockwire through the lockwire holes in the parts. If there is no hole, you can attach the lockwire to an adjacent part ((Figure 201 or Figure 202 or Figure 203), (See F and G)).

(6) Unless specified differently, these are the lockwire length limits: ((Figure 201 or Figure 202 or Figure 203), (See H and I)).

(a) The maximum distance between points safetied with lockwire is 6.0 inches (152.4 mm).

(b) The maximum length of one strand of lockwire is 24.0 inches (609.6 mm).

1) You can safety only the maximum number of parts possible with a 24.0 inch (609.6 mm) piece of the lockwire.

(c) The maximum number of parts that you can safety with one strand of lockwire is three (3).

(d) You must use the double-twist procedure to install lockwire on parts that are more than 2.0 inches (50.8 mm) apart.

CAUTION ALWAYS USE NEW LOCKWIRE. MAKE SURE THAT YOU USE THE LOCKWIRE THAT IS SPECIFIED FOR THIS LOCATION. USED LOCKWIRE CAN BREAK AND CAUSE DAMAGE TO EQUIPMENT.

(7) Make sure that you use only 0.020 ± 0.001 inch (0.510 ± 0.030 mm) or 0.032 ± 0.001 inch (0.810 ± 0.030 mm) stainless steel lockwire on the engine.

(a) Use that largest diameter lockwire that will go through the lockwire hole in the part.

1) When it is possible, use the 0.032 inch (0.810 mm) diameter lockwire.

(8) Install lockwire to hose and electrical coupling nuts with the same procedure that you use for the tube coupling nuts ((Figure 201 or Figure 202 or Figure 203), (See F, G, J, K, L, and M)).

CAUTION WHEN YOU TWIST THE LOCKWIRE, MAKE SURE THAT IT IS TIGHT. MAKE SURE THAT YOU DO NOT PUT TOO MUCH FORCE ON THE LOCKWIRE. MAKE SURE THAT YOU DO NOT MAKE NICKS, KINKS OR CAUSE OTHER DAMAGE TO THE LOCKWIRE.

(9) Use caution when you twist the lockwire to make sure that you do not cause damage to the lockwire.

(a) When you twist the lockwire, pull the lockwire tight.

1) For the 0.020 inch (0.510 mm) diameter lockwire, there must be 9 to 12 twists for each inch (25.4 mm).

2) For the 0.032 inch (0.810 mm) diameter lockwire, there must be 7 to 10 twists for each inch (25.4 mm).

(10) Use a safety wire wrench, COM-977, to twist the lockwire. The illustration shows two different tools (Figure 202).

(11) Use the illustration to identify correct and incorrect lockwire installations ((Figure 201 or Figure 202 or Figure 203)(Sheet 2)).

(12) Do not break the lockwire. Always use wire cutters to cut the lockwire.

(a) If the lockwire is broken, it can cause damage to the lockwire holes in the part.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-977	Wrench - Safety Wire Part #: WTR1A Supplier: 5K761

C. Consumable Materials

Reference	Description	Specification
G01505	Lockwire - Safety And Lock	NASM20995

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Lockwire Installation

SUBTASK 70-41-00-420-001-H01

(1) Install the lockwire, G01505.

CAUTION

ALWAYS USE NEW LOCKWIRE. MAKE SURE THAT YOU USE THE LOCKWIRE THAT IS SPECIFIED FOR THIS LOCATION. USED LOCKWIRE CAN BREAK AND CAUSE DAMAGE TO EQUIPMENT.

(a) Make sure that the lockwire holes in the parts are correctly aligned.

NOTE: Do not tighten the part more than the specified limits to align the holes.

(b) If the holes do not correctly align when you tighten the part to the specified limits, replace the part.

(c) Install the lockwire through the hole in one part.

(d) Bend the lockwire that you put through the hole above the part or around it.

(e) Do this step if you bend the lockwire around the part.

1) Make sure that the lockwire that goes around the part goes below the lockwire that comes out of the hole. This will satisfactorily attach the lockwire ((Figure 201), (step 1 and 2)).

(f) Make sure that the lockwire is tight. Then twist the lockwire until the twisted piece of lockwire will touch the hole in the subsequent part.

1) The twisted lockwire must not be more than 0.125 inch (3.18 mm) from the hole in the part ((Figure 201), (step 3 and 4)).

(g) Do these steps if you bend the lockwire around the second part.

1) Install the lockwire through the hole in the second part.

2) Bend the lockwire that you put through the hole above the part or around it.

3) Do this step if you bend the lockwire around the second part.

a) Make sure that the lockwire that goes around the part goes below the wire that comes out of the hole.

4) If the lockwire is bent above the second part, the direction that you twist the lockwire is not important.

5) If you install lockwire to more than two parts in a row, do the last 4 steps again ((Figure 201), (step 5 and 6)).

(h) Do these steps after you attach the lockwire to the last part.

1) Twist the lockwire 3 to 6 times. The twisted section of the lockwire must be 0.25-0.50 inch (6.40-12.70 mm) long.

2) Cut off all the unwanted lockwire.

3) Bend the twisted lockwire into the part ((Figure 201, (step 7 and 8)).

NOTE: All lockwire must look almost the same as the examples shown in the illustration.

SUBTASK 70-41-00-910-001-H01

(2) Make sure that the lockwire is satisfactory. Refer to the limits that follow: Table 201

Table 201/70-41-00-993-802-H01

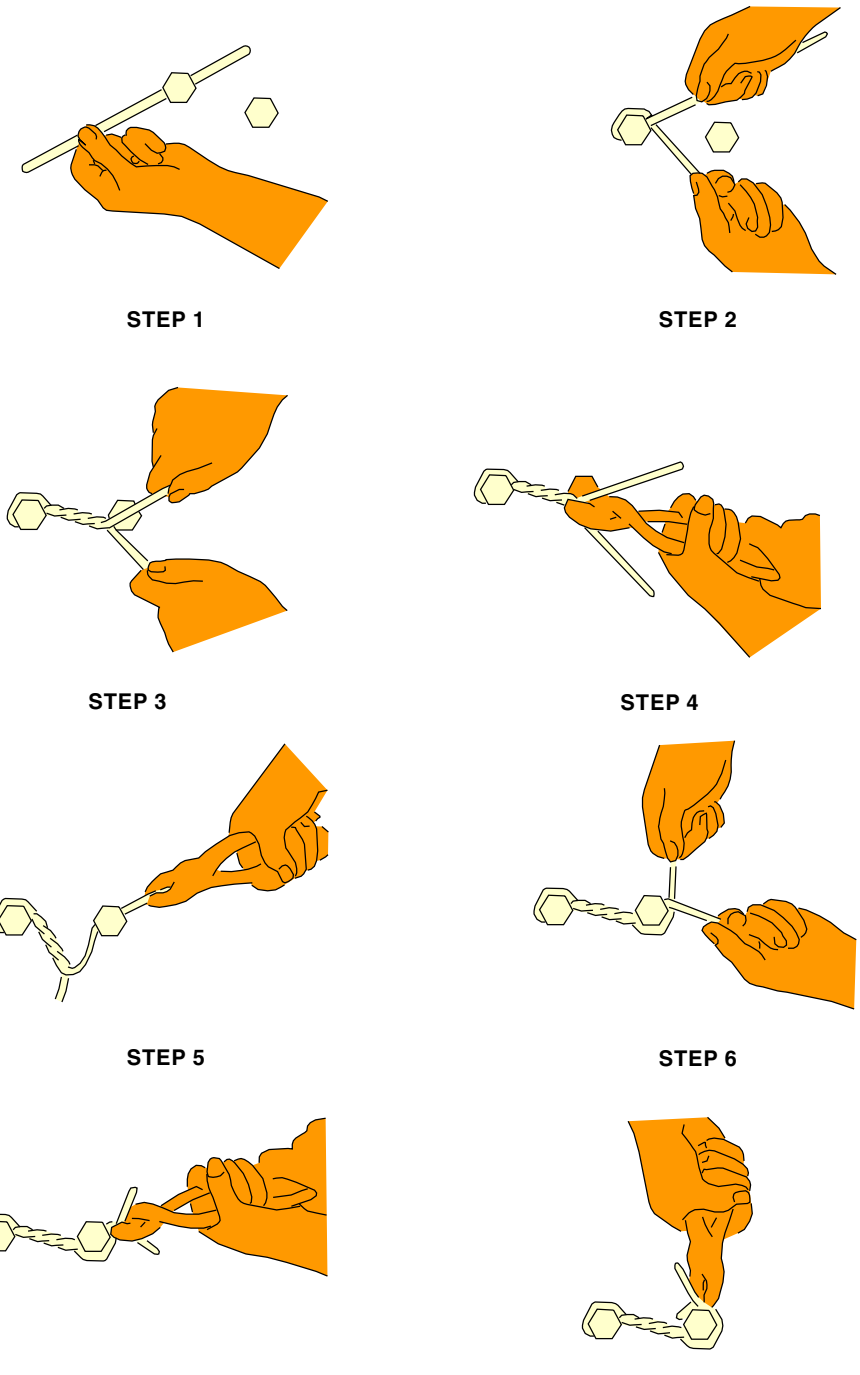
Length of Lockwire Between Parts	Maximum Movement at Center
0.5 in. (12.7 mm)	0.125 in. (3.2 mm)
1.0 in. (25.4 mm)	0.250 in. (6.4 mm)
2.0 in. (50.8 mm)	0.375 in. (9.5 mm)
3.0 in. (76.2 mm)	0.500 in. (12.7 mm)
4.0 in. (101.6 mm)	0.750 in. (19.1 mm)
5.0 in. (127.0 mm)	0.750 in. (19.1 mm)
6.0 in. (152.4 mm)	0.750 in. (19.1 mm)

(a) Apply a light finger force to the center of the lockwire and push the wire in two directions.

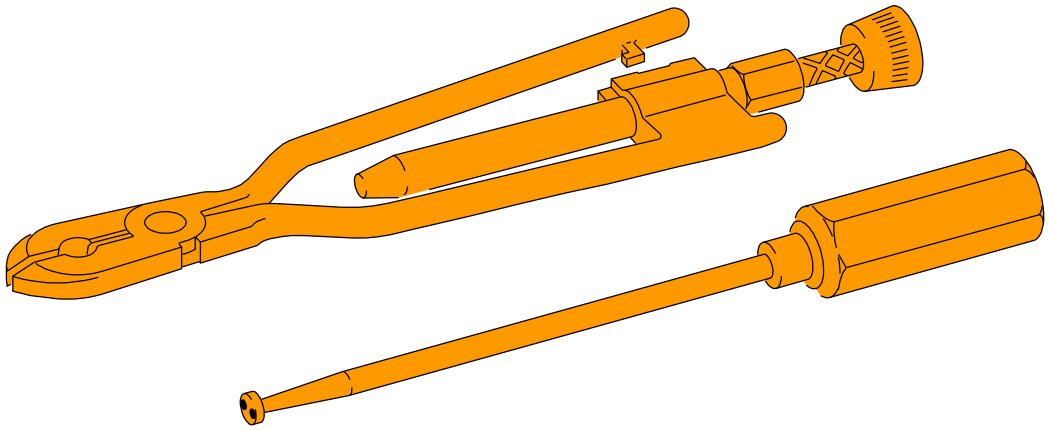
(b) If you cannot accept the lockwire, remove it and install new lockwire.

(c) Always cut the lockwire to remove it. This will prevent damage to the holes.

——— END OF TASK ———



Lockwire Installation Techniques
Figure 201/70-41-00-990-801-H01



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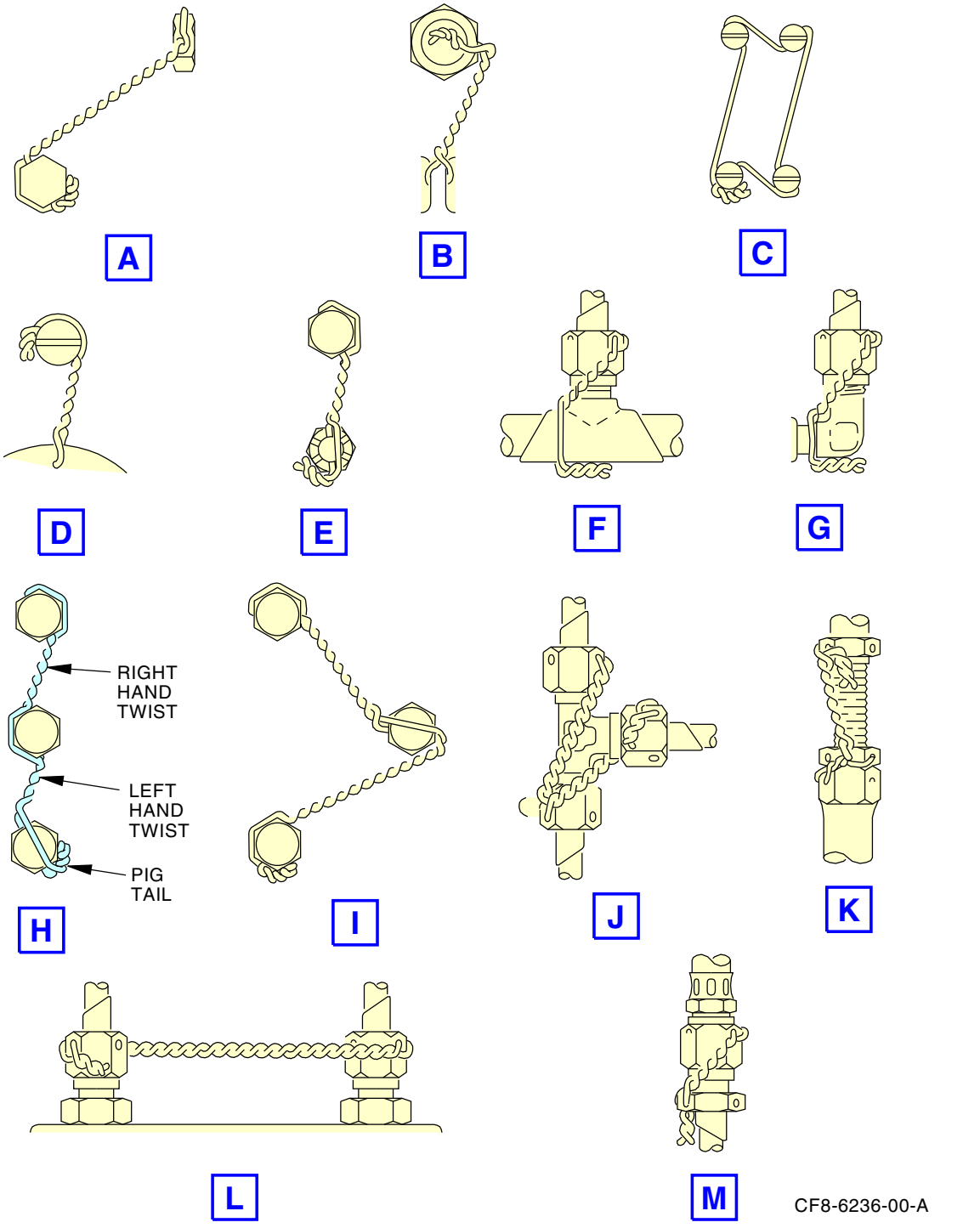
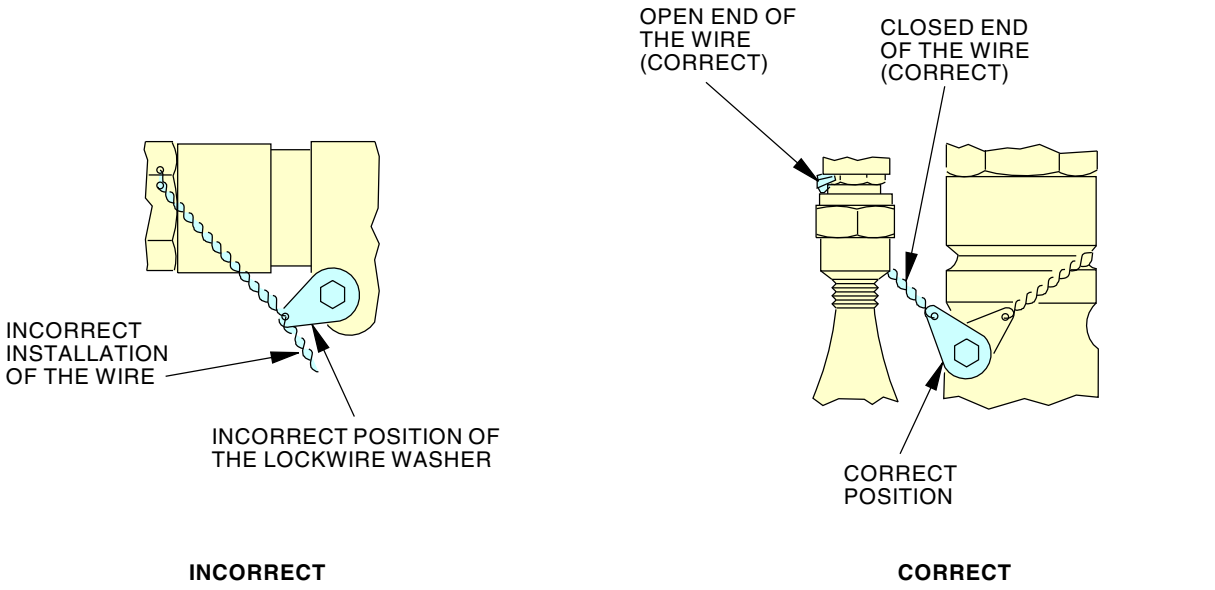
Lockwire Twisting Tools
Figure 202/70-41-00-990-802-H01



Lockwire Installation Examples
Figure 203/70-41-00-990-803-H01 (Sheet 1 of 2)



Lockwire Installation Examples
Figure 203/70-41-00-990-803-H01 (Sheet 2 of 2)

TASK 70-41-00-910-802-H01

3. Safety Cable Installation

A. General

(1) A safety cable installation is an alternative to a lockwire installation. You install a safety cable on two or more parts to make sure that the parts do not loosen.

(2) The installation system for the safety cable has three components (Figure 204 and Figure 205):

(a) The safety cable

(b) The ferrules

(c) The crimping tool.

(3) The safety cable, G02325 [C10-145], is 0.032 in. (0.813 mm) in diameter and is made from AMS 5689 (321 stainless steel) material. There is a fitting on one end of the cable. The cable end fitting is made of AMS 5674 (347 stainless steel) material. The cable strands on the opposite end are fused together to make sure that the strands do not fray.

(4) The ferrule, G02324 [C10-144], is made of AMS 5674 (347 stainless steel) material. The ferrule is held in a spring-loaded magazine. When the safety cable is installed, the ferrule is crimped on the open end of the cable.

(5) There are two types of tools you can use to crimp the ferrule.

(a) The Bergen tool, M303, (Figure 204). This tool comes in different lengths. The manufacturer sets the crimping pressure of the tool. The primary parts of the crimping tool are the crimping head, tensioning wheel, slotted wheel, and handles. You use this tool to crimp the ferrule on the end of the safety cable. The crimping tool will also cut off the safety cable that extends through the ferrule.

(b) The Snap-On tool, C10-148, (Figure 205). This tool operates in one direction only. It has a cycle-end stop to let the user know when the ferrule is fully crimped. The manufacturer sets the crimping pressure of the tool. If necessary, you can adjust the crimping pressure with standard hand tools. The tool has a spring-loaded crimp rod to hold the ferrule in its position during the crimping procedure. The internal retraction mechanism controls the cable tension automatically.

(6) Follow these steps to install the safety cable correctly.

(a) Do not let the safety cable touch parts that do not attach to the safety cable.

(b) Make sure that the cable is not damaged or bent when you install it.

1) Frayed cable assemblies are not permitted.

(c) Install the safety cable only through safety cable or lockwire holes in the applicable parts.

(d) Unless specified differently, these are the safety cable limits:

1) The maximum distance between two parts that use the same safety cable installation is 6.0 inches (152.4 mm).

2) The maximum number of parts that you can safety with one safety cable installation is three (3).

3) Do not use the safety cable on titanium parts.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-877	Test Block - Safety Cable Part #: SCT-TB1 Supplier: 11851 Part #: TB-201 Supplier: 70958 Opt Part #: TB-101 Supplier: 70958
COM-905	Tester - Safety Cable Part #: BCT-MPT-250C Supplier: 70958 Opt Part #: MPT-200A-SC Supplier: 70958 Opt Part #: MPT-250B-SC Supplier: 70958
STD-257	Cutter - Diagonal, Side-Cushioned

C. Consumable Materials

Reference	Description	Specification
G02324 [C10-144]	Ferrule - Safety Cable	
G02325 [C10-145]	Cable, Safety - GE P/N J1285P01	

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Crimping Tool Verification for the Bergen Crimping Tool

NOTE: You can use the safety cable tester, COM-905, as an alternative to this test (Refer to the manufacturer's instructions).

SUBTASK 70-41-00-910-002-H01

(1) Do a test of the pull-off load on the crimping tool. (Figure 204 and Figure 206).

(a) Do this test when it is necessary to make sure that the tool is in the specified limits.

SUBTASK 70-41-00-820-001-H01

(2) Do the pull-off load test as follows (Figure 204 and Figure 206):

(a) Use the manufacturer's instructions to set up the safety cable test block, COM-877.

(b) Make sure that the pivot joint is in the forward direction.

(c) Move the cable stop at the end of the test block.

(d) Install the safety cable, G02325 [C10-145], through the cable stop hole.

(e) Pull the safety cable through the cable stop hole.

(f) Pull the safety cable through the hole in the pivot joint.

(g) Put the end of the safety cable (from the pivot joint) through a ferrule, G02324 [C10-144], in the ferrule magazine.

(h) Pull the safety cable through the ferrule.

1) Use the safety cable to remove the ferrule from the magazine ((Figure 207), (step 2)).

(i) Put the end of the safety cable through the crimping head of the Bergen tool ((Figure 207), (Step 3)).

(j) Make sure that the large hole of the crimping head is on the same side as the ferrule.

(k) Move the crimping tool along the safety cable until the crimping head is against the part ((Figure 207), (Step 4)).

(l) Make sure that the ferrule is fully in the hole of the crimping head.

(m) If the ferrule will not go in the crimping head, do these steps:

1) Remove the safety cable from the Bergen tool.
2) Push the handles fully together.

NOTE: When you release the handles after you push them fully together, they will open automatically.

3) Put the safety cable back through the crimping head.
4) Move the Bergen tool along the safety cable until the crimping head is against the part.
5) Make sure that the ferrule goes into the hole of the crimping head.

CAUTION

DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL BREAK THE SAFETY CABLE.

(n) Put the safety cable across the slotted tensioning wheel on the side of the Bergen tool.

1) Make sure that the safety cable is in the two slots in the wheel that align with the crimping head.
2) Hold the Bergen tool at 90 degrees to the cable.
3) Make sure that the ferrule is tight against the bolt head.
4) Turn the tensioning wheel on the side of the Bergen tool until you hear a click ((Figure 207), (Step 5)).

CAUTION

DO NOT TRY TO REMOVE THE CRIMPING TOOL FROM THE FERRULE WITH THE HANDLES IN THE CRIMPED OR CLOSED POSITION. DAMAGE TO THE FERRULE COULD OCCUR.

CAUTION

DO NOT CRIMP THE FERRULE UNTIL YOU APPLY THE CORRECT TENSION TO THE TENSIONING WHEEL. IF YOU DO NOT APPLY THE CORRECT TENSION, A FAILURE OF THE FERRULE CAN OCCUR.

(o) Apply constant pressure until you fully close the crimping tool handles and you cut the cable.

NOTE: If you release the handles on the Bergen tool before they are fully closed, the handles will not open. If this occurs, apply pressure to close the handles again until the handles release.

1) Release the pressure on the handles.
2) Remove and discard the unwanted safety cable from the tensioning wheel.

(p) Do the load test for the torque breakaway as follows (Figure 206):

1) Set a calibrated breakaway torque wrench to 70 in-lb (8 N·m).
2) Install the torque wrench in the pivot joint on the safety cable test block, COM-877 (Figure 206).
3) Move the torque wrench handle counterclockwise until the torque wrench clicks or the ferrule moves.
4) If the ferrule moves before you hear the torque wrench click, remove the Bergen tool from service.

(q) Do a finger-pressure test as follows (Figure 206):

1) Find the center of the safety cable in the safety cable test block, COM-877.

2) With light finger pressure, try to push the center of the safety cable to the wall of the test block.

NOTE: The safety cable must not touch the wall.

(r) If the safety cable does not touch the wall, then the safety cable is serviceable.

(s) If the safety cable touches the wall, the safety cable is not serviceable.

1) Cut the safety cable with the wire side-cushioned diagonal cutters, STD-257.

2) Remove the safety cable from the safety cable test block, COM-877.

3) Install a new safety cable and do the pull-off load test again.

4) Make sure that the tension on the safety cable is correct.

5) When you crimp the ferrule, make sure that you hold the Bergen tool at 90 degrees to the safety cable.

6) Make sure that the ferrule is tight against the bolt head.

7) Do the finger pressure test again.

8) If the safety cable touches the wall again, use a new Bergen tool to do the pull-off load test.

SUBTASK 70-41-00-820-002-H01

(3) Do a test to find the force necessary to break the crimped ferrule or safety cable, G02325 [C10-145].

(a) Do this test a minimum of one time each month.

(b) Refer to the manufacturer's instructions to use a safety cable tester, COM-905, to do this test ((Figure 206)).

F. Safety Cable Installation - Bergen tool, M303

SUBTASK 70-41-00-420-002-H01

(1) Install the safety cable, G02325 [C10-145] with the Bergen tool, M303.

(a) Do a visual inspection of the safety cable holes for damage.

NOTE: Keep the safety cable as straight as possible when you safety cable fasteners or parts together.

1) If the hole is damaged, replace the part or use a different hole for the safety cable (Figure 208).

(b) Put the end of the safety cable (without the cable end fitting) into the hole in the part.

(c) Pull the safety cable through the hole until the cable end fitting is against the part ((Figure 207), (Step 1)).

NOTE: The illustrations show examples of correct safety cable installations. The illustrations do not show all types of safety cable patterns. When you install a safety cable, use the examples of correct safety cable installations as shown in the illustrations.

NOTE: On two bolt patterns, do not install the safety cable in a negative pull direction. Make sure that the cable has a positive or neutral pull.

(d) Put the end of the safety cable through the second part.

(e) Use the hole in the part that will keep the safety cable as straight as possible.

(f) Pull the safety cable through the second part.

(g) If you install the safety cable on three parts, pull the safety cable through the third part.

(h) Put the end of the safety cable (from the last part of the safety cable installation) through a ferrule, G02324 [C10-144].

(i) Pull the safety cable through the ferrule. Use the safety cable to pull the ferrule out of the ferrule magazine ((Figure 207), (Step 2)).

(j) Put the end of the safety cable through the crimping head of the Bergen tool ((Figure 207), (Step 3)).

(k) Make sure that the large hole in the crimping head is on the same side as the ferrule.

(l) Move the Bergen tool along the safety cable until the crimping head is against the part ((Figure 207), (Step 4)).

(m) Make sure that the ferrule is fully in the hole in the crimping head.

(n) If the ferrule will not go in the crimping head, do these steps:

1) Remove the safety cable from the Bergen tool.

2) Push the handles together.

NOTE: When you release the handles, they will open automatically again.

3) Put the safety cable back through the crimping head.

4) Move the Bergen tool along the safety cable until the crimping head is against the part.

5) Make sure that the ferrule goes into the hole in the crimping head.

CAUTION DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL BREAK THE SAFETY CABLE.

(o) Put the safety cable across the slotted tensioning wheel on the side of the Bergen tool.

(p) Make sure that the safety cable is in the two slots in the wheel that align with the crimping head.

(q) Hold the Bergen tool at 90 degrees to the safety cable.

1) Make sure that the ferrule is tight against the bolt head.

(r) Turn the tensioning wheel on the side of the Bergen tool until you hear a click ((Figure 207), (Step 5)).

CAUTION DO NOT TRY TO REMOVE THE CRIMPING TOOL FROM THE FERRULE WITH THE HANDLES IN THE CRIMPED OR CLOSED POSITION. DAMAGE TO THE FERRULE COULD OCCUR.

CAUTION DO NOT CRIMP THE FERRULE UNTIL YOU APPLY THE CORRECT TENSION TO THE TENSIONING WHEEL. IF YOU DO NOT APPLY THE CORRECT TENSION, A FAILURE OF THE FERRULE CAN OCCUR.

(s) Apply constant pressure to close the Bergen tool handles until you cut the safety cable.

NOTE: If you do not fully close the handles on the Bergen tool before you release them, the handles will not open. If this occurs, apply pressure on the handles to close them fully. This will release the handles and let them open.

(t) Release the pressure on the handles.

(u) Remove and discard the unwanted safety cable from the tensioning wheel.

SUBTASK 70-41-00-220-001-H01

(2) Examine the ferrule to make sure that it has a good crimp ((Figure 207), (Step 6)).

(a) Do a visual inspection of the safety cable, G02325 [C10-145], for kinks, frayed wires, or incorrect crimps.

1) Replace the safety cable if you find damage.

(b) Push on the safety cable with light finger pressure on a point halfway between the two parts with the safety cable installation.

(c) If the cable feels loose, do an inspection to make sure that the safety cable is serviceable (Figure 209):

1) Measure the distance between the safety cable parts (Dimension A).

a) Make a record of Dimension A.

b) If three parts are in a safety cable installation together, measure the distance between each of the parts (Figure 209).

<1> Add the two distances together to get Dimension A.

2) Push on the safety cable with light finger pressure on a point halfway between the two parts with the safety cable installation.

3) Measure the distance the safety cable moves laterally in one direction.

NOTE: If you measure the distance the safety cable moves laterally in the two directions, then write this as Dimension B.

a) Make a record of Dimension C.

4) Compare Dimensions A and C to the limits given in (Figure 209).

CAUTION

DO NOT TRY TO BREAK THE SAFETY CABLE. IF YOU MUST REMOVE THE SAFETY CABLE, CUT THE SAFETY CABLE TO PREVENT DAMAGE TO THE HOLES IN THE PARTS.

(d) If the safety cable is not in the limits, then cut and remove the safety cable. Use the side-cushioned diagonal cutters, STD-257 to cut the cable.

1) Replace the safety cable.

G. Crimping tool verification procedure- Snap-On tool, C10-148 - test block, C10-146

NOTE: You can use the safety cable tester, COM-905 to do this test. Refer to the manufacturer's instructions to use a safety cable tester, COM-905.

SUBTASK 70-41-00-910-003-H01

(1) Do a test of the pull-off load on the tool, C10-148.

(a) Do this test when it is necessary to make sure that the tool, C10-148 is in the limits.

SUBTASK 70-41-00-820-003-H01

(2) Do the pull-off load test as follows (Figure 205 and Figure 206):

(a) Refer to the manufacturer's instructions to set up the safety cable test block, COM-877.

(b) Make sure that the pivot joint is in the forward direction.

(c) Move the cable stop to the end of the test block.

(d) Install the safety cable, G02325 [C10-145] through the cable stop hole.

(e) Pull the safety cable through the cable stop hole.

(f) Put the safety cable through the hole in the pivot joint. Pull the cable through the hole.

(g) Put the end of the safety cable (from the pivot joint) through a ferrule, G02324 [C10-144] in the ferrule magazine.

(h) Pull the safety cable through the ferrule.

1) Use the safety cable to pull the ferrule out of the ferrule magazine ((Figure 207), (Step 2)).

(i) Put the end of the safety cable through the crimping head of the Snap-On tool ((Figure 207), (Step 3)).

(j) Make sure that the large hole in the crimping head is on the same side as the ferrule.

(k) Move the Snap-On tool along the safety cable until the crimping head is against the ferrule ((Figure 207), (Step 4)).

(l) Pull on the retraction knob ((Figure 207), (Step 5)).

(m) Put the crimping head on the ferrule and release the retraction knob ((Figure 207), (Step 5)).

(n) Make sure that the ferrule is fully in the crimping head ((Figure 207), (Step 5)).

(o) Pull the safety cable through the tension block ((Figure 207), (Step 5)).

CAUTION DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL BREAK THE SAFETY CABLE.

(p) Make sure that the safety cable is between the tension spring and the tension block.

(q) Hold the Snap-On tool at 90 degrees to the cable in the bolt head.

(r) Make sure that the ferrule is tight against the bolt head.

(s) Lightly pull on the end of the safety cable to remove slack ((Figure 207), (Step 5)).

(t) Push the start cycle button.

NOTE: At the start of the cycle, the tension block will move rearward. This movement rearward gives the cable tension.

(u) Turn the drive handle clockwise and release the start cycle button.

(v) Turn the drive handle until it stops (approximately two full turns).

(w) Pull up the end of the safety cable to remove it from the tension block.

(x) Pull back on the retraction knob.

1) Remove the Snap-On tool from the crimped ferrule and the remaining safety cable.

(y) Use the side-cushioned diagonal cutters, STD-257 and cut the unwanted safety cable flat with the crimped ferrule ((Figure 207), (Step 6)).

1) Discard the safety cable end.

(z) Do the load test for torque breakaway that follows (Figure 206):

1) Set a calibrated breakaway torque wrench to 70 in-lb (8 N·m).

2) Install the torque wrench in the pivot joint of the safety cable test block, COM-877 (Figure 206).

3) Move the torque wrench handle counterclockwise until the torque wrench clicks or the ferrule moves.

4) If the ferrule moves before you hear the torque wrench click, remove the Snap-On tool from service.

(aa) Do a finger-pressure test as follows (Figure 206):

1) Find the center of the safety cable in the test block.

2) Use light finger pressure and push the center of the safety cable to the wall of the test block.

3) The safety cable must not touch the wall.

(ab) If the safety cable does not touch the wall, then the Snap-On tool is serviceable.

(ac) If the safety cable touches the wall, the Snap-On tool is not serviceable.

1) Cut the safety cable with the side-cushioned diagonal cutters, STD-257.

2) Remove the safety cable from the test block.

3) Install a new safety cable and do the pull-off load test again.

4) Make sure that the tension on the safety cable is correct.

5) When you crimp the ferrule, make sure that you hold the Snap-On tool at 90 degrees to the safety cable.

6) Make sure that the ferrule is tightly against the bolt head.

7) Do the finger pressure test again.

8) If the safety cable touches the wall again, use a new Snap-On tool to do the pull-off load test.

SUBTASK 70-41-00-820-004-H01

(3) Do a test to find the force necessary to cause the crimped ferrule or the safety cable to break.

(a) You must do this test a minimum of one time each month.

(b) Use a safety cable tester, COM-905 to do this test ((Figure 206)(Refer to the manufacturer's instructions)).

H. Safety Cable Installation - Snap-On tool, C10-148

SUBTASK 70-41-00-420-003-H01

(1) Install the safety cable, G02325 [C10-145], with the Snap-On tool:

(a) Do a visual inspection of the safety cable holes for damage.

NOTE: Keep the safety cable as straight as possible when you safety cable fasteners or parts together.

1) If the hole is damaged, replace the part or use a different safety cable hole (Figure 208).

(b) Put the end of the safety cable without the cable end fitting into the hole in the part.

(c) Pull the safety cable through the hole until the cable end fitting is against the part ((Figure 207), (Step 1)).

NOTE: The illustrations show examples of correct safety cable installations. The illustrations do not show all types of safety cable patterns. When you install a safety cable, use the examples of correct safety cable installations as shown in the illustrations.

NOTE: On two bolt patterns, do not safety cable in a negative pull direction. Make sure that the cable has a positive or neutral pull.

(d) Put the end of the safety cable through the second part.

(e) Use the hole in the part that keeps the safety cable as straight as possible.

(f) Pull the safety cable through the second part.

(g) If you install the safety cable on three parts, pull the safety cable through the third part.

(h) Put the end of the safety cable (from the last part of the safety cable installation) through a ferrule, G02324 [C10-144].

(i) Pull the safety cable through the ferrule. Use the safety cable to pull the ferrule out of the ferrule magazine ((Figure 207), (Step 2)).

(j) Put the end of the safety cable through the crimping head of the Snap-On tool ((Figure 207), (Step 3)).

(k) Make sure that the large hole in the crimping head is on the same side as the ferrule.

(l) Move the Snap-On tool along the safety cable until the crimping head is against the ferrule.

(m) Pull back on the retraction knob ((Figure 207), (Step 5)).

(n) Put the crimping head on the ferrule and release the retraction knob ((Figure 207), (Step 5)).

(o) Make sure that the ferrule is fully in the crimping head ((Figure 207), (Step 5)).

(p) Pull the safety cable through the tension block ((Figure 207), (Step 5)).

CAUTION DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL BREAK THE SAFETY CABLE.

(q) Make sure that the safety cable is between the tension spring and the tension block.

(r) Hold the Snap-On tool at 90 degrees to the safety cable in the bolt head.

(s) Make sure that the ferrule is tight against the bolt head.

(t) Lightly pull on the end of the safety cable to remove the slack ((Figure 207), (Step 5)).

(u) Push the start cycle button.

NOTE: At the start of the cycle, the tension block will move rearward. This movement rearward gives the cable tension.

(v) Turn the drive handle clockwise and release the start cycle button.

(w) Turn the drive handle until it stops (approximately two full turns).

(x) Pull up the end of the safety cable to remove it from the tension block.

(y) Pull back on the retraction knob.

1) Remove the Snap-On tool from the crimped ferrule and the remaining safety cable.

(z) Use the side-cushioned diagonal cutters, STD-257 to cut the safety cable flat with the crimped ferrule ((Figure 207), (Step 6)).

1) Discard the unwanted safety cable end.

SUBTASK 70-41-00-220-002-H01

(2) Examine at the ferrule to make sure it has a good crimp ((Figure 207), (Step 6)):

(a) Examine the safety cable, G02325 [C10-145] for kinks, frayed wires, or incorrect crimps.

1) Replace the safety cable if you find damage.

(b) Push on the safety cable with light finger pressure at a point halfway between the safety cabled parts.

(c) If the cable feels loose, do an inspection to make sure that the safety cable is serviceable (Figure 209):

1) Measure the distance between the parts with the safety cable installation (Dimension A).

a) Make a record of Dimension A.

b) If three parts are safety cabled together, measure the distance between each of the parts (Figure 209).

<1> Add the two measurements together to get Dimension A.

2) Push on the safety cable with light finger pressure at a point halfway between two safety cabled parts.

3) Measure the distance the safety cable moves laterally in one direction.

NOTE: If you measure the distance the safety cable moves laterally in two directions, then write this as Dimension B.

a) Make a record of Dimension C.

4) Compare Dimensions A and C to the limits in (Figure 209).

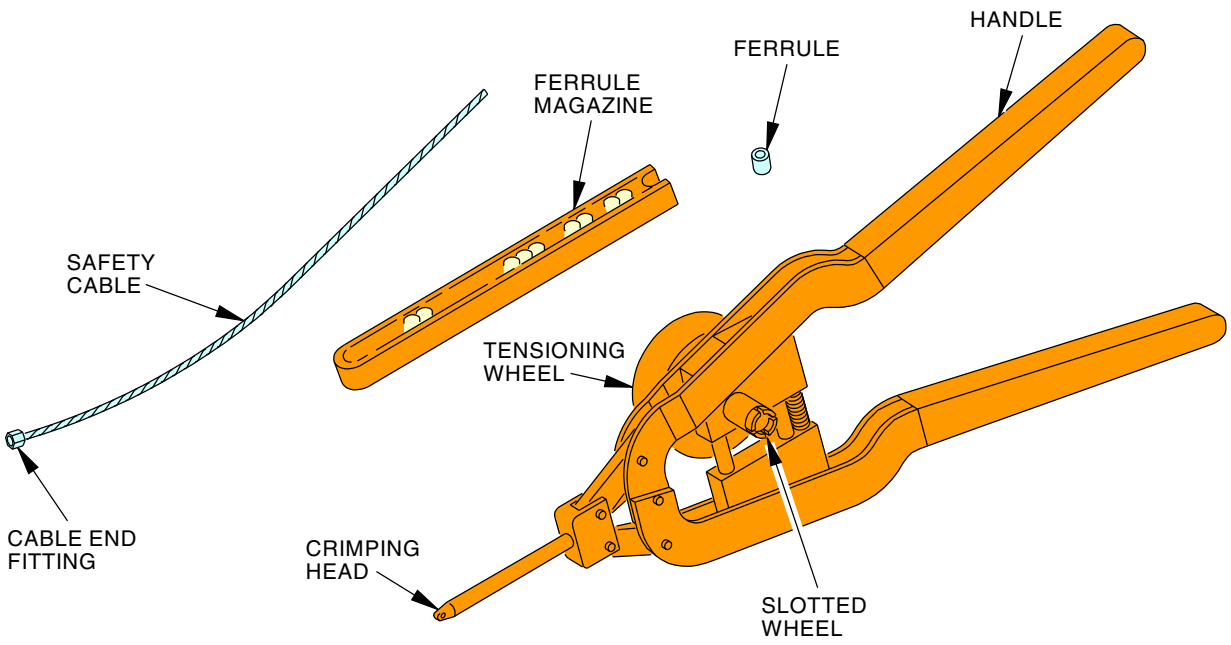
CAUTION

DO NOT TRY TO BREAK THE SAFETY CABLE. IF YOU MUST REMOVE THE SAFETY CABLE, CUT THE SAFETY CABLE TO PREVENT DAMAGE TO THE HOLES IN THE PARTS.

(d) If the safety cable is not in the limits in the illustration (Figure 209), remove the cable. Use the side-cushioned diagonal cutters, STD-257 to remove the safety cable.

1) Replace the safety cable.

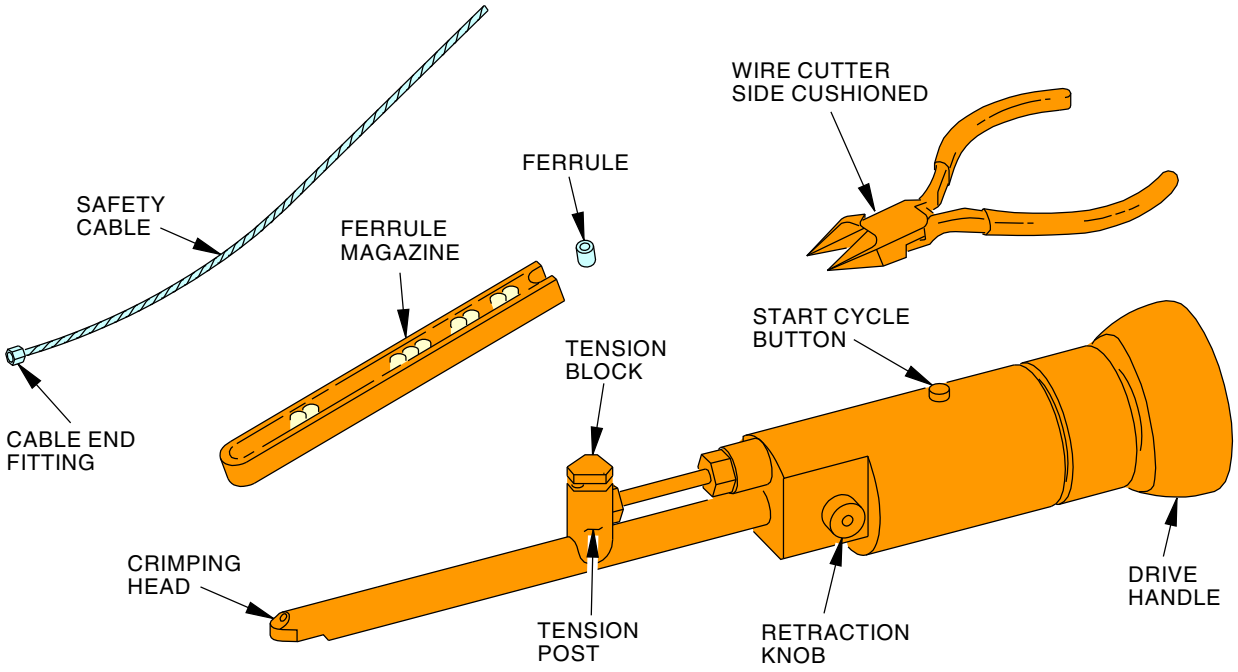
——— END OF TASK ———



1108131-00-C

M06315 S0004285409_V2

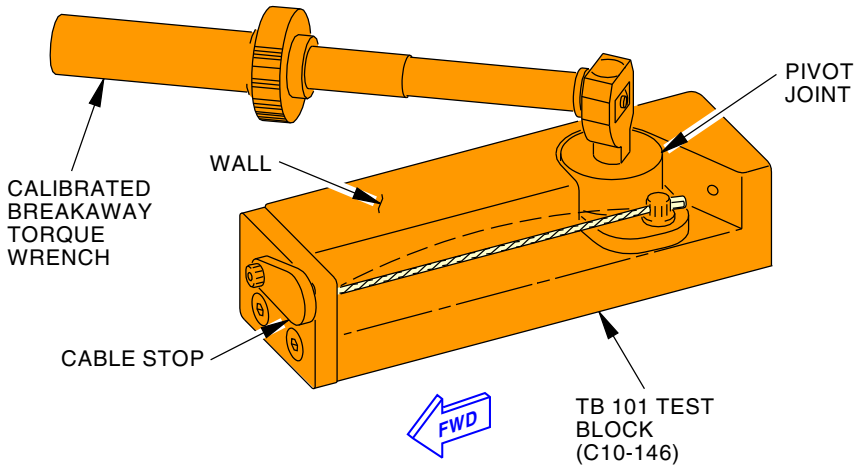
Bergen Crimping Tool (C10-148) - Safety Cable Components
Figure 204/70-41-00-990-804-H01

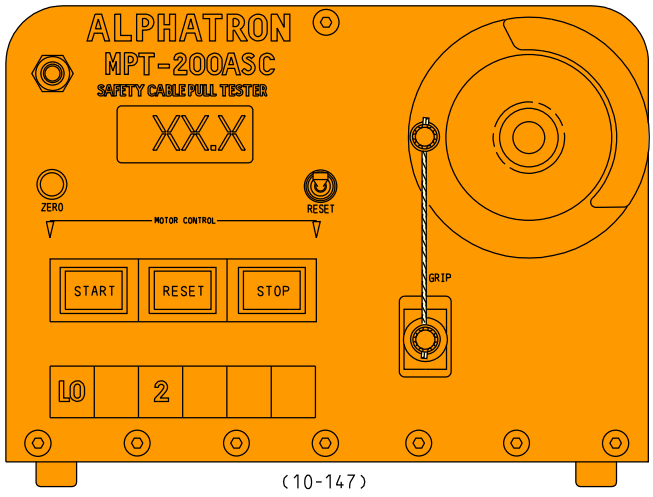


1105965-01-C

M06316 S0004285410_V2

Snap-On Crimping Tool (C10-148) - Safety Cable Components
Figure 205/70-41-00-990-805-H01





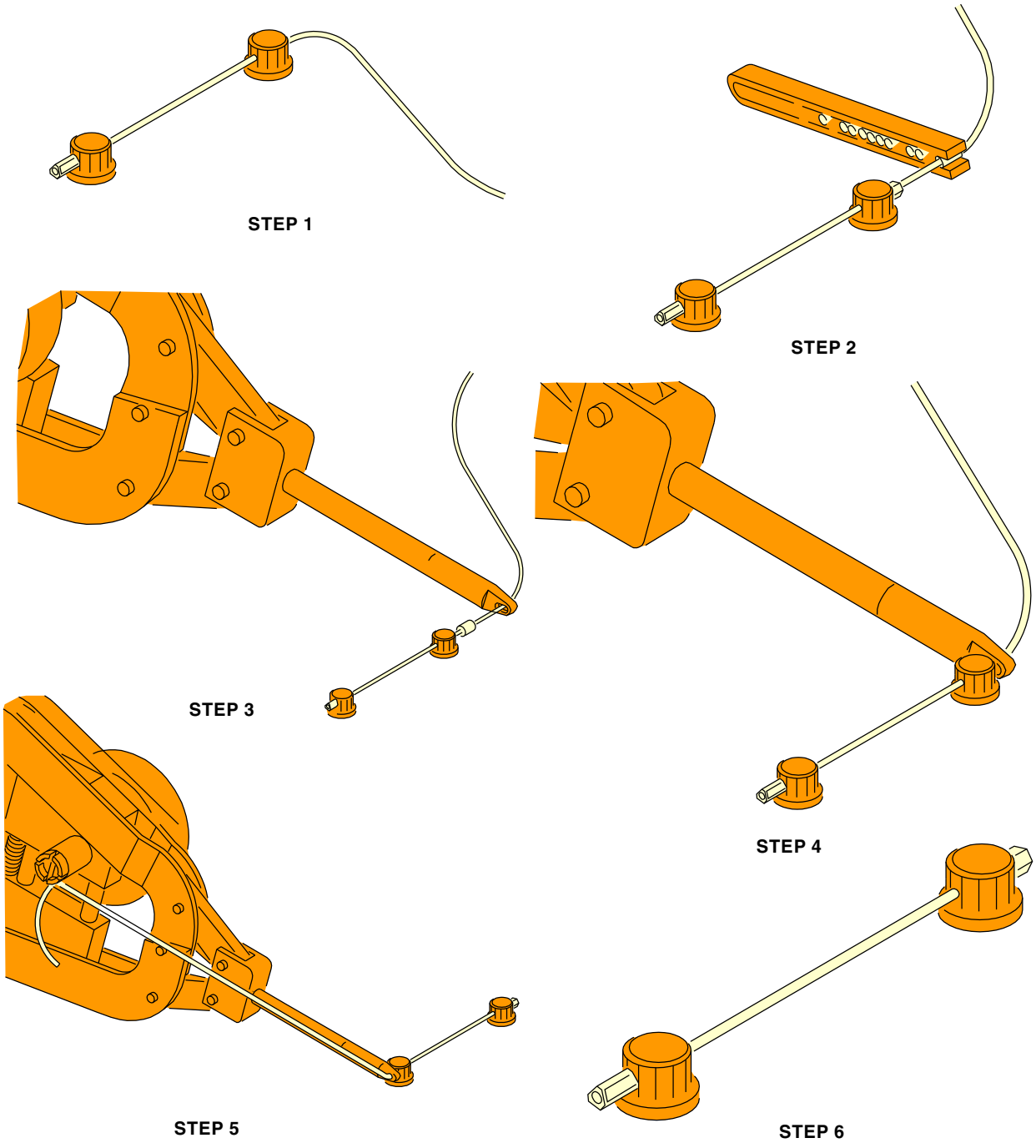
NOTE:

WHEN CRIMPED, WIRE CAN NOT TOUCH WALL WITH LIGHT FINGER PRESSURE.

1108126-00-A

M06317 S0004285411_V2

Crimping Tool Verification Equipment
Figure 206/70-41-00-990-806-H01

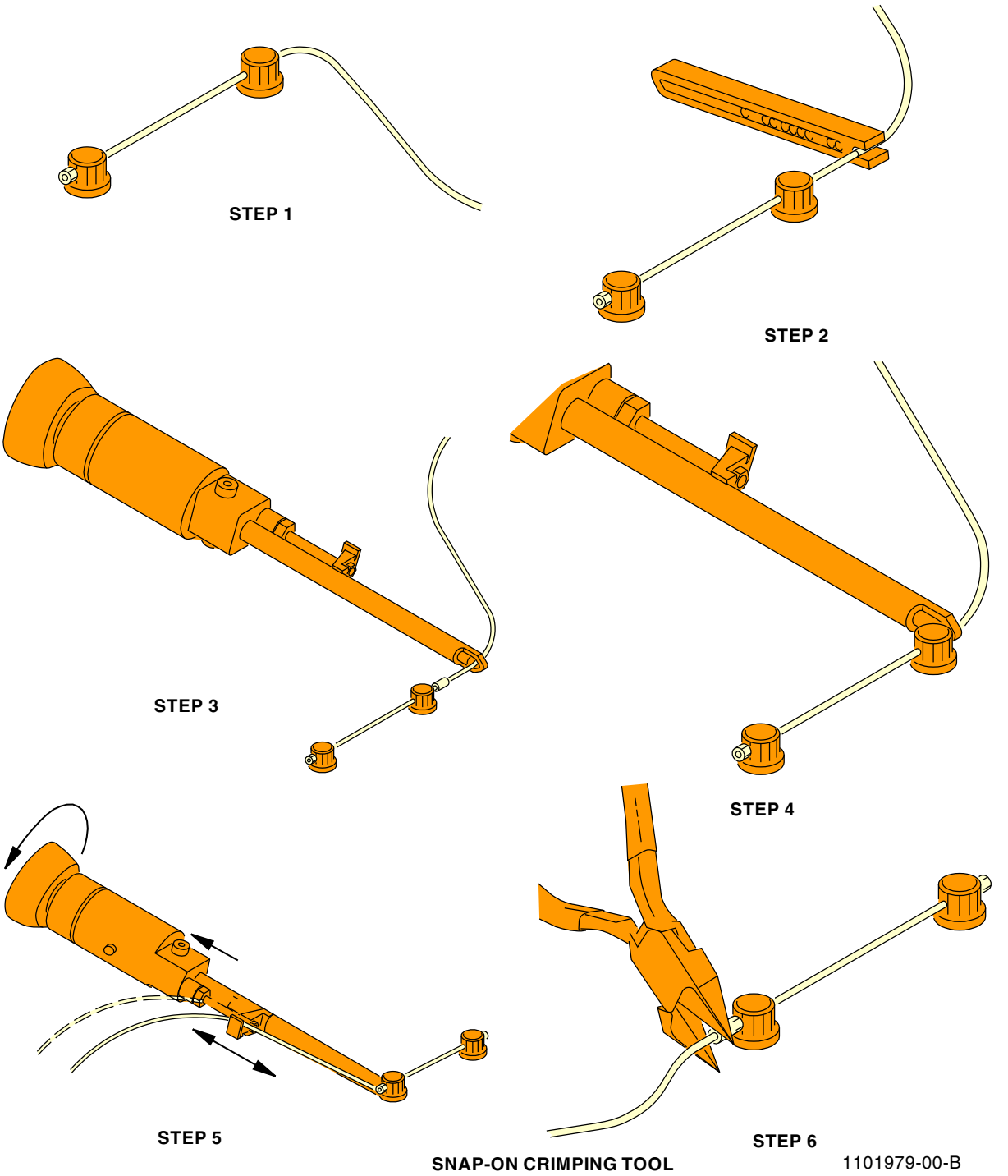


BERGEN CRIMPING TOOL

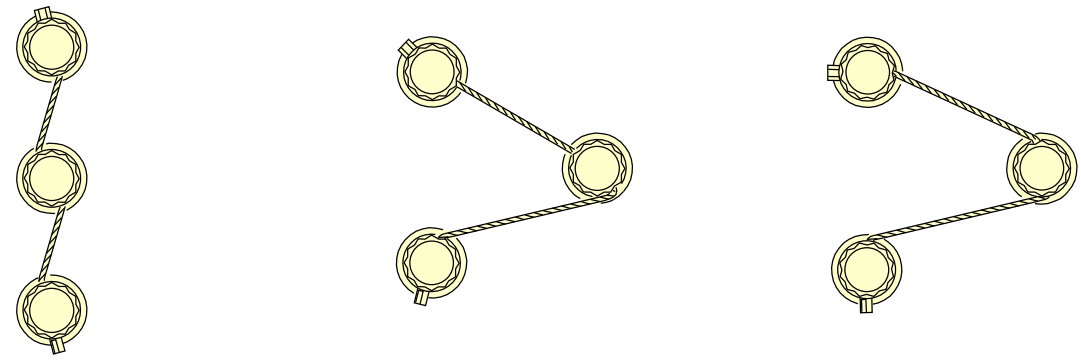
1108127-00-A

M06318 S0004285412_V2

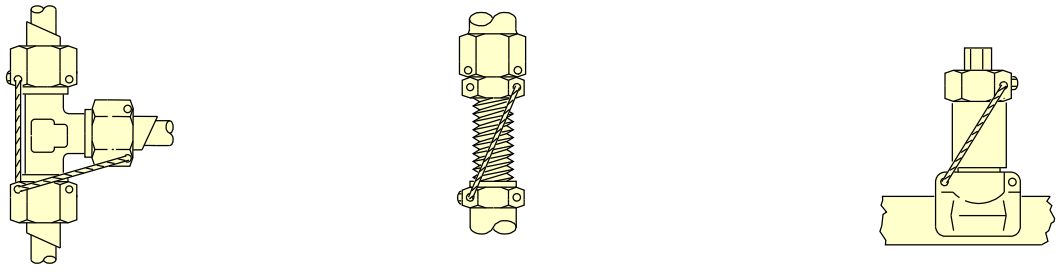
Crimping Tool (C10-148) - Safety Cable Procedure
Figure 207/70-41-00-990-807-H01 (Sheet 1 of 2)



Crimping Tool (C10-148) - Safety Cable Procedure
Figure 207/70-41-00-990-807-H01 (Sheet 2 of 2)



STANDARD HARDWARE
EXAMPLE 1

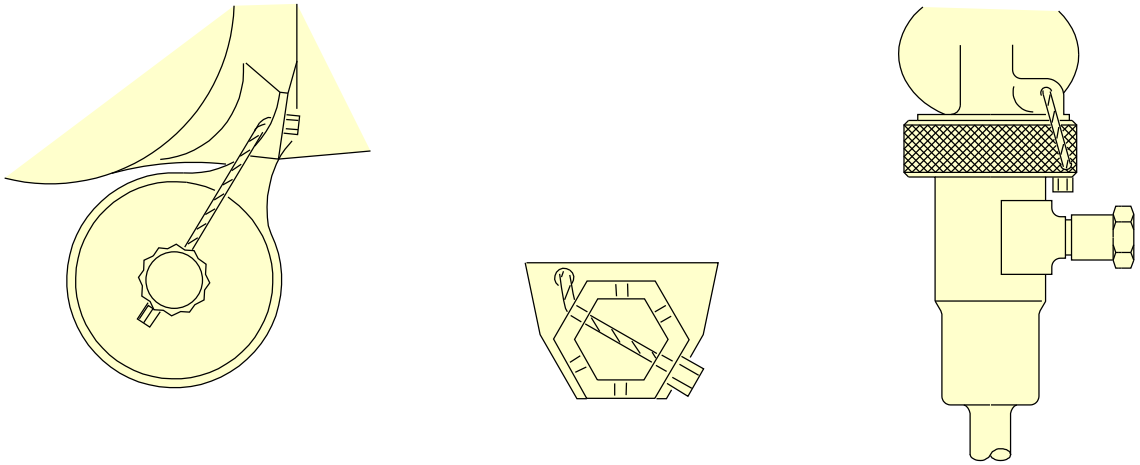


COUPLINGS
EXAMPLE 2

1101185-00-B

M06320 S0004285414_V2

Safety Cable Installation Examples
Figure 208/70-41-00-990-808-H01 (Sheet 1 of 2)

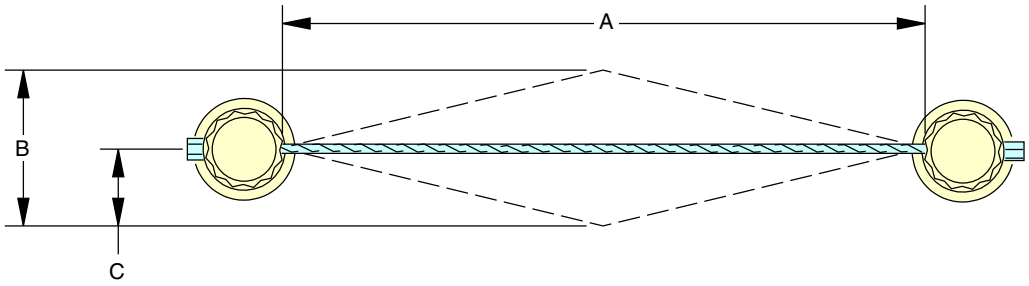


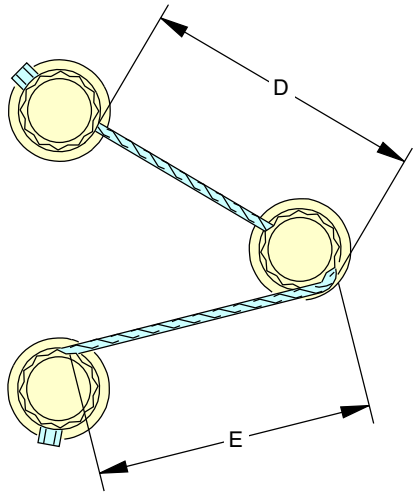
OTHER APPLICATIONS
EXAMPLE 3

1101980-00-B

M06321 S0004285415_V2

Safety Cable Installation Examples
Figure 208/70-41-00-990-808-H01 (Sheet 2 of 2)





A INCH (mm)	B INCH (mm)	C INCH (mm)
0.5 (12.7)	0.125 (3.175)	0.062 (1.575)
1.0 (25.4)	0.250 (6.350)	0.125 (3.175)
2.0 (50.8)	0.375 (9.525)	0.188 (4.775)
3.0 (76.2)	0.375 (9.525)	0.188 (4.775)
4.0 (101.6)	0.500 (12.700)	0.250 (6.350)
5.0 (127.0)	0.500 (12.700)	0.250 (6.350)
6.0 (152.4)	0.625 (15.875)	0.312 (7.925)

FLEX LIMITS, DIMENSIONS

NOTE:

FOR THREE BOLT PATTERNS,
DIMENSION A = DIMENSION D+E

1108129-00-A

M06322 S0004285416_V2

Safety Cable Flex Limits
Figure 209/70-41-00-990-809-H01

TASK 70-41-00-400-801-H01

4. Self-Locking, Hexagonal, or Castellated Nut Installation

A. General

(1) This procedure contains the task to install self-locking or castellated nuts.

B. References

Reference	Title
70-51-00-910-801-H01	Instruction for Torque (P/B 201)

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-41-00-210-001-H01

(1) Make sure that the new or the used nut meets the assembly specifications.

(a) Replace the nut if it does not meet the specification.

SUBTASK 70-41-00-420-004-H01

(2) Install the nut on the bolt or the stud.

SUBTASK 70-41-00-210-002-H01

(3) Make sure that the threads of the stud or bolt extend through the nut by a minimum of 1.5 threads unless specified differently.

SUBTASK 70-41-00-420-005-H01

(4) Tighten the nut (TASK 70-51-00-910-801-H01).

——— END OF TASK ———

TASK 70-41-00-400-802-H01

5. Cotter Pin Installation

A. General

(1) This procedure contains the task to install the cotter pin.

B. References

Reference	Title
70-51-00-910-801-H01	Instruction for Torque (P/B 201)

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-41-00-420-006-H01

CAUTION DO NOT APPLY MORE THAN THE MAXIMUM SPECIFIED TORQUE WHEN YOU TIGHTEN THE PARTS. DAMAGE TO THE PARTS CAN OCCUR IF YOU APPLY TOO MUCH TORQUE.

(1) Install the castellated nut on the bolt or stud (Figure 210).

(a) Tighten the nut to the minimum torque value (TASK 70-51-00-910-801-H01).

(b) Tighten the nut slowly, until a slot on the nut aligns with the hole in the bolt or stud.

(c) If the slot in the nut will not align with the hole, loosen the nut by a half turn. Then tighten the nut again.

(d) If you cannot make the slot align with the hole after you loosen and tighten the nut, replace the nut.

SUBTASK 70-41-00-420-007-H01

CAUTION

ALWAYS USE A NEW COTTER PIN. A USED COTTER PIN CAN BREAK, AND DAMAGE TO EQUIPMENT CAN OCCUR.

(2) Install the cotter pin (Figure 211).

(a) Put the cotter pin through the hole in the bolt or stud.

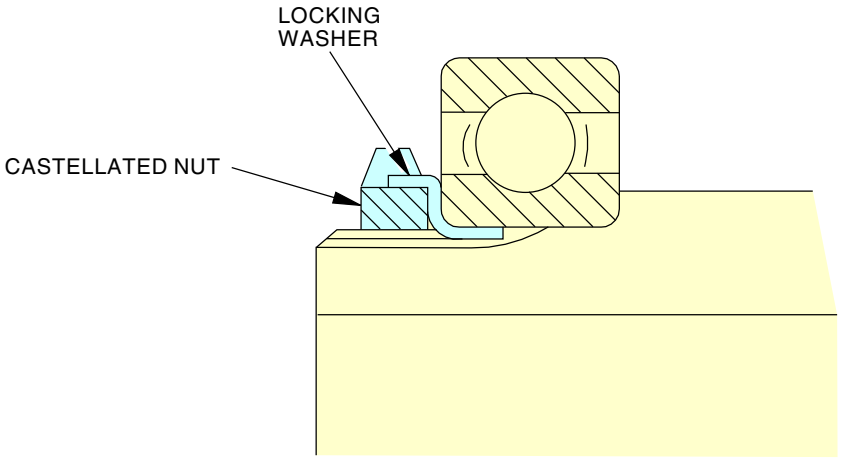
(b) Make sure that the head of the cotter pin is in the slot of the castellated nut.

(c) Bend the top prong of the cotter pin up and back until it is on top of the bolt or stud.

NOTE: Make sure that the head of the cotter pin stays in the slot of the castellated nut.

(d) Bend the lower prong of the cotter pin down against the side of the nut.

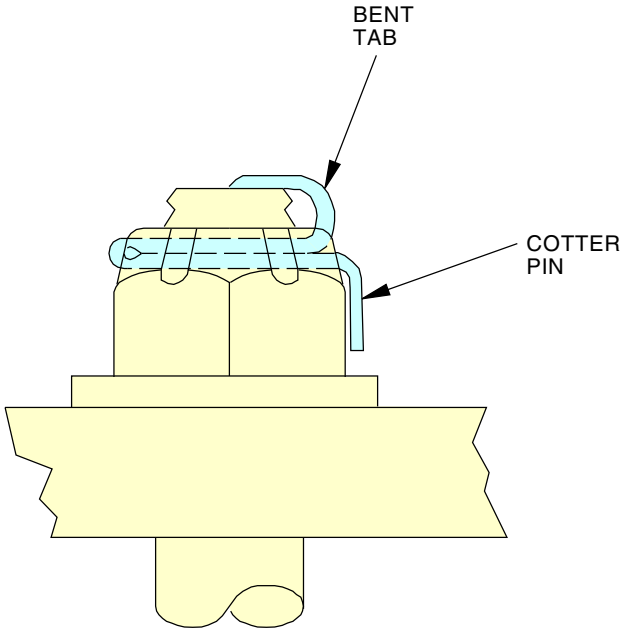
——— END OF TASK ———

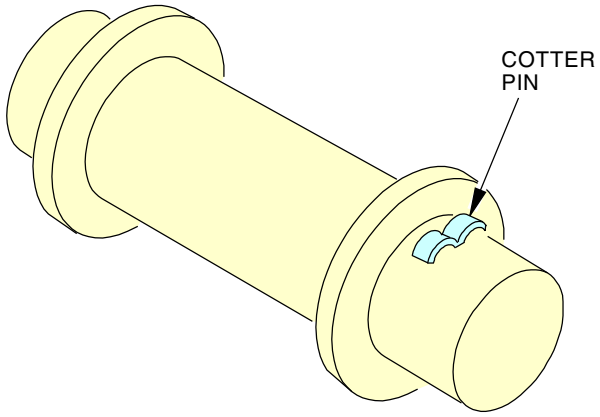


CF8-1029-00-C

M06323 S0004285418_V2

Castellated Nut Installation
Figure 210/70-41-00-990-813-H01





CF8-1029-00-C

M06324 S0004285419_V2

Cotton Pin Installation
Figure 211/70-41-00-990-814-H01

TASK 70-41-00-400-803-H01

6. Tab Washer Installation

A. General

(1) This procedure contains the task to install the tab washer.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-41-00-420-008-H01

(1) Install the tab washer with the lock tab against the part (Figure 212).

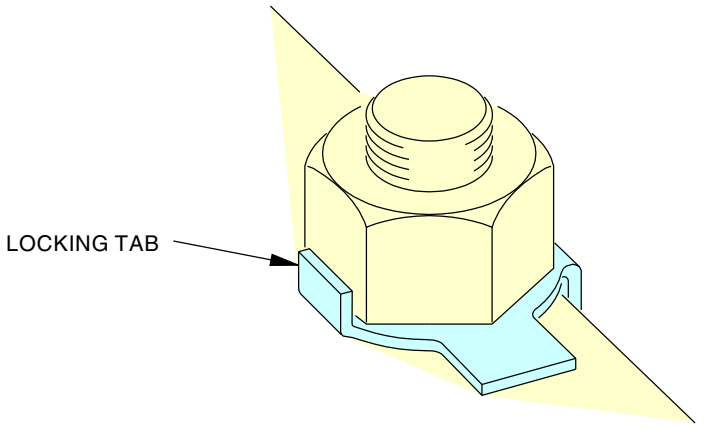
SUBTASK 70-41-00-430-001-H01

(2) Install and tighten the nut or bolt.

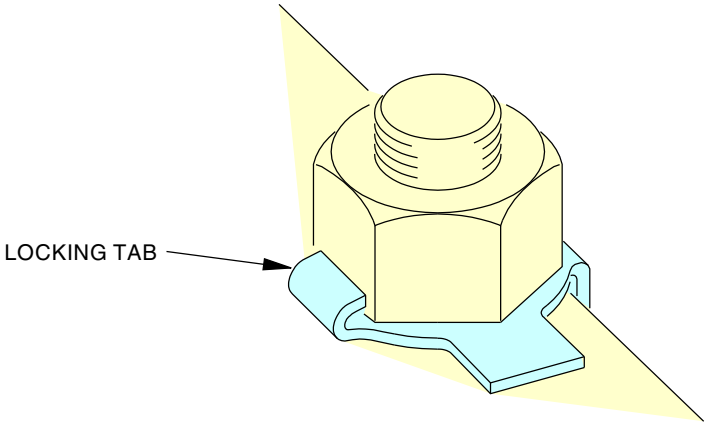
SUBTASK 70-41-00-420-009-H01

(3) Bend the lock tab tightly against the flat side of the nut or bolt.

——— END OF TASK ———



CORRECT



INCORRECT

CF8-1030-00-C

M06325 S0004285417_V2

Tab Washer Installation
Figure 212/70-41-00-990-810-H01

CHEMICAL TOUCH UP FOR ALUMINUM

1. General

A. This procedure has one task:

(1) A chemical touch up for aluminum surfaces.

TASK 70-43-07-900-801-H01

2. Chemical Touch Up for Aluminum

A. General

(1) This procedure contains the task to apply an anodized finish to an aluminum surface.

(2) An anodized finish supplies protection for an aluminum part.

(3) If you remove an anodized finish from an aluminum surface, you must apply the anodized finish to the surface again.

(4) To apply an anodized finish to an aluminum surface, you put a solution on a prepared surface. You can use a brush, a spray or a sponge to put the solution on a prepared surface.

(5) The anodized finish is usually a golden iridescent, yellow or gold in color. The color can be different with different alloys or if the conditions of the procedure are different. The anodized surface can give the appearance of a painted surface.

B. Tools/Equipment

Reference	Description
STD-77	Air Source - Regulated, Dry Filtered, 0-50 psig
STD-197	Container - Plastic, Polyethylene or Polypropylene

C. Consumable Materials

Reference	Description	Specification
B01041 [C04-208]	Solvent - Degreaser - Turco 5948 DPM	
C00943 [C03-006]	Coating - Chemical Conversion - Bonderite M-CR 1200S Aero (Formerly Alodine 1200S)	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G00116	Sponge - Synthetic	
G02439	Brush - Nylon Bristle	
G02442 [C10-141]	Abrasive - 120 Grit, SiC, Wet/Dry, Abrasive Paper / 180 Grit, SiC, Wet/Dry, Abrasive Paper	

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-43-07-370-001-H01

(1) Do these steps to apply the anodized finish to the applicable area:

WARNING DO NOT GET CHLORINATED HYDROCARBON SOLVENTS IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM CHLORINATED HYDROCARBON SOLVENTS. PUT ON GOGGLES, AND GLOVES WHEN YOU USE CHLORINATED HYDROCARBON SOLVENTS. KEEP CHLORINATED HYDROCARBON SOLVENTS AWAY FROM SPARKS, FLAME, AND HEAT. CHLORINATED HYDROCARBON SOLVENTS ARE POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

(a) Use a clean brush, G02439 or cotton wiper, G00034 to clean the surface with Turco 5948 DPM solvent, B01041 [C04-208] or other approved solvent.

(b) Lightly sand the area with abrasive paper, G02442 [C10-141].

WARNING SOAK THE MATERIALS THAT YOU USED TO APPLY AND REMOVE THE ALODINE IN WATER BEFORE YOU DISCARD THEM. MAKE SURE THAT YOU FULLY REMOVE THE ALODINE FROM THESE MATERIALS. ALODINE IS FLAMMABLE WHEN IT IS DRY AND CAN CAUSE FIRE.

CAUTION BE CAREFUL WHEN YOU APPLY THE SOLUTION. DO NOT LET THE SOLUTION TOUCH METAL WHERE IT IS NOT NECESSARY TO APPLY AN ANODIZED FINISH. THE SOLUTION CAN CAUSE CORROSION AND DAMAGE TO METAL SURFACES.

(c) Apply the Bonderite M-CR 1200S Aero coating, C00943 [C03-006] with a brush, G02439, a sponge, G00116, or with spray equipment.

1) Keep the part wet with the solution until the anodized finish develops fully, 1-10 minutes.

NOTE: The anodized finish is usually a golden iridescent color. The color can be different with different alloys or if the conditions of the procedure are different. If the finish becomes a powder, the time that you let the solution stay on the part was too long. You must remove the powder and then apply the anodized finish again.

WARNING SOAK THE MATERIALS THAT YOU USED TO APPLY AND REMOVE THE ALODINE IN WATER BEFORE YOU DISCARD THEM. MAKE SURE THAT YOU FULLY REMOVE THE ALODINE FROM THESE MATERIALS. ALODINE IS FLAMMABLE WHEN IT IS DRY AND CAN CAUSE FIRE.

CAUTION BE CAREFUL WHEN YOU APPLY THE SOLUTION. DO NOT LET THE SOLUTION TOUCH METAL WHERE IT IS NOT NECESSARY TO APPLY AN ANODIZED FINISH. THE SOLUTION CAN CAUSE CORROSION AND DAMAGE TO METAL SURFACES.

(d) Flush all of the Bonderite M-CR 1200S Aero coating, C00943 [C03-006] solution from the part.

NOTE: Do not flush with the jet from a hose or with a pressure spray. Make sure that you fully remove the solution from all areas of the part that can hold liquid.

1) Put the part fully into a slow flow of warm water [120-140 °F (49-60 °C)]. You can also use a clean sponge, G00116 to flush the part with warm water.

CAUTION BE CAREFUL NOT TO MAKE A SCRATCH ON THE NEW ANODIZED FINISH. MAKE SURE THAT YOU DO NOT RUB THE NEW ANODIZED FINISH OFF THE PART. DAMAGE TO THE ANODIZED FINISH CAN OCCUR.

(e) Dry the part with a 0-50 psig dry filtered regulated air source, STD-77 (0-10 psig) or with a clean cotton wiper, G00034.

(f) After a minimum of 30 minutes, you can paint the surface if it is necessary.

(g) Keep the Bonderite M-CR 1200S Aero coating, C00943 [C03-006] in a plastic container, STD-197.

NOTE: Do not keep the alodine in a regular glass or steel container. The alodine will deteriorate in a regular glass or steel container.

——— END OF TASK ———

EPOXY REPAIR OF MATING SURFACES AND INSERTS

1. General

A. This procedure has one task:

(1) The epoxy repair of mating surfaces and inserts.

TASK 70-43-17-900-801-H01

2. Epoxy Repair of Mating Surfaces and Inserts

A. General

(1) You use this procedure when it is necessary to fill nicks, dents, or scratches on mating surfaces.

(2) You can also use this procedure to apply epoxy when you install threaded inserts, studs and bolts.

B. Tools/Equipment

Reference	Description
STD-200	Container - Fuel Resistant, 10 gallon (38 l)

C. Consumable Materials

Reference	Description	Specification
A01059 [C01-011]	Paste - Adhesive, Two Part (Hysol EA 934NA)	A50TF94 Class B
B01041 [C04-208]	Solvent - Degreaser - Turco 5948 DPM	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A
G02439	Brush - Nylon Bristle	
G02442 [C10-141]	Abrasive - 120 Grit, SiC, Wet/Dry, Abrasive Paper / 180 Grit, SiC, Wet/Dry, Abrasive Paper	

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-43-17-110-001-H01

(1) Do these steps to repair the mating surfaces and inserts:

WARNING

DO NOT GET CHLORINATED HYDROCARBON SOLVENTS IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM CHLORINATED HYDROCARBON SOLVENTS. PUT ON GOGGLES, AND GLOVES WHEN YOU USE CHLORINATED HYDROCARBON SOLVENTS. KEEP CHLORINATED HYDROCARBON SOLVENTS AWAY FROM SPARKS, FLAME, AND HEAT. CHLORINATED HYDROCARBON SOLVENTS ARE POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONNEL AND DAMAGE TO EQUIPMENT.

(a) Use a clean brush, G02439 or cotton wiper, G00034 to clean the surface with Turco 5948 DPM solvent, B01041 [C04-208], or other approved solvent.

(b) Fully clean the part(s) of oil, grease or other contamination that is on the surface.

(c) Clean each void with a sharp pointed tool.

1) Use the tool as a scraper on the surface until bright metal shows.

CAUTION DISCARD THE EPOXY COMPONENTS IF THE CATALYST IS AN AMBER COLOR, OR IF THE PROPERTIES OF THE EPOXY CHANGE AT ROOM TEMPERATURE. THESE CONDITIONS WILL CAUSE THE BOND TO BE UNSATISFACTORY.

(d) Fully mix the Hysol EA 934NA adhesive paste, A01059 [C01-011] in a clean 10 gallon (38 l) fuel resistant container, STD-200.

NOTE: This lets the catalyst mix equally through the resin.

(e) After you fully mix the epoxy, use it immediately.

NOTE: The pot life of 220 grams mass of Hysol EA 934NA adhesive paste, A01059 [C01-011] resin at 77 °F (25 °C) is approximately 20 minutes.

(f) Fill the voids with the Hysol EA 934NA adhesive paste, A01059 [C01-011] mixture to a small height above the adjacent surfaces.

1) If you have more Hysol EA 934NA adhesive paste, A01059 [C01-011] than is necessary, remove it immediately.

(g) On an installation of a threaded insert or threaded part, apply the Hysol EA 934NA adhesive paste, A01059 [C01-011] resin mixture to the male threads only.

1) Install the threaded part and immediately remove the Hysol EA 934NA adhesive paste, A01059 [C01-011] that is more than necessary.

(h) Let the Hysol EA 934NA adhesive paste, A01059 [C01-011] dry at room temperature, 75 °F (24 °C) for a minimum of 24 hours.

(i) Sand the area lightly in a circular motion with abrasive paper, G02442 [C10-141].

——— END OF TASK ———

SOLID FILM LUBRICANT - MAINTENANCE PRACTICES

1. General

A. This procedure has one task.

(1) The application of solid film lubricant (C02-027).

TASK 70-43-19-600-801-H00

2. Solid Film Lubricant

A. General

(1) Prepare the surface and apply the solid-film lubricant.

B. Tools/Equipment

NOTE: When more than one tool part number is listed under the same "Reference" number, the tools shown are alternates to each other within the same airplane series. Tool part numbers that are replaced or non-procurable are preceded by "Opt:", which stands for Optional.

Reference	Description
COM-4296	Gun - Spray (external atomizing at 25-40 psi) Part #: JGA-510 Supplier: 07334

C. Consumable Materials

Reference	Description	Specification
B00148	Solvent - Methyl Ethyl Ketone (MEK)	ASTM D740
B00678 [C04-003]	Solvent - General	ASTM D329
D50070 [C02-027]	Lubricant - Solid Film, Heat Cured (Molydag 254)	
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5 Class A

D. Procedure

SUBTASK 70-43-19-110-001-H00

WARNING DO NOT GET THE SOLVENT IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM IT. PUT ON GOGGLES, AND GLOVES WHEN YOU USE IT. KEEP IT AWAY FROM SPARKS, FLAMES, AND HEAT. IT IS POISONOUS AND FLAMMABLE. THE SOLVENT CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

CAUTION DO NOT TOUCH THE CLEANED AREA WITH YOUR BARE HANDS, OR LET CONTAMINATION GET ON IT. CLEAN THE PART AGAIN IF MORE THAN 15 MINUTES OCCURS BEFORE YOU APPLY THE COATING. THE COATING WILL NOT BOND CORRECTLY IF THERE IS CONTAMINATION

(1) Clean the surface to be coated with a clean cotton wiper, G00034, moistened with MEK solvent, B00148, or acetone solvent, B00678 [C04-003]. Repeat, if necessary, until the surface of the cloth remains clean. Let the cleaned surface air-dry or wipe it dry with a clean, dry cotton wiper, G00034.

SUBTASK 70-43-19-640-001-H00

(2) Apply the coating as follows:

CAUTION: DO NOT MIX THE LUBRICANT WITH OTHER FLUIDS. DAMAGE TO EQUIPMENT CAN OCCUR IF THE LUBRICANT IS LESS THAN FULL STRENGTH.

(a) Open the container of Molydag 254 solid film lubricant, D50070 [C02-027] and stir the contents until thoroughly mixed. Pour out enough for about one hour of use into a clean container. Reseal the original container.

CAUTION: FULLY MIX THE LUBRICANT FIRST. KEEP IT FULLY MIXED WHILE YOU APPLY IT. THIS WILL MAKE SURE THAT THE COATING IS SMOOTH, THIN, AND FREE OF LUMPS, STREAKS, AND CONTAMINATION. THE COATING WILL BE UNSATISFACTORY IF YOU DO NOT KEEP THE LUBRICANT MIXED.

CAUTION: MIX THE LUBRICANT FULLY. KEEP IT MIXED AT ALL TIMES. THE LAYER WILL BE UNSATISFACTORY IF YOU DO NOT KEEP THE LUBRICANT MIXED.

(b) Apply the Molydag 254 solid film lubricant, D50070 [C02-027] to the clean surfaces with a camel hair brush, or with a spray gun, COM-4296, or equivalent.

NOTE: Containers of lubricant that do not have close-fitting lids that remove excess air must be thrown away. The lubricant poured into the working container must not be put back into the original container.

1) The coating must be uniform, thin, and free from lumps, streaks, and foreign materials.

2) Stir the lubricant as often as possible, using a wide paddle.

3) The best conditions are obtained by continuous stirring.

(c) Let coated surfaces air-dry for a minimum of 15 minutes until the wet look is gone, or until the coating looks dull. You can heat to a maximum of below 175°F (79°C) speed the drying.

(d) Check the thickness and continuity of the coating. No metal should be visible through the coating. Re-coat and air-dry as necessary to complete the coverage or to increase thickness. Do not overlap areas that have already been coated. Refer to Quality Provisions below.

CAUTION: KEEP WATER, OIL, SOLVENTS, AND OTHER CONTAMINATION OFF THE SURFACE. THE COATING WILL NOT BOND IF THERE IS CONTAMINATION.

(e) Bake the air-dried coated parts in a preheated oven at 375°F (191°C) to 400°F (204°C) for 60 to 90 minutes (part temperature).

(f) Let parts air-cool.

E. Quality Provisions

SUBTASK 70-43-19-640-002-H00

(1) Use the material before the shelf-life period. When the oven-curing is done the layer must have these characteristics:

(a) No sags, blisters, bubbles, flakes, and foreign material.

(b) Brush strokes in the layer must not be seen at arms length under usual lighting.

(c) The layer must not peel or flake when a strip of cellophane or paper masking tape is applied, pressed down firmly, then quickly pulled off.

WARNING DO NOT BREATHE THE FUMES, OR LET THE SOLVENT TOUCH YOUR SKIN. GENERAL SOLVENTS ARE POISONOUS, AND VERY FLAMMABLE. KEEP THE SOLVENTS AWAY FROM SPARKS AND FLAMES. INJURIES TO PERSONNEL AND DAMAGE TO PARTS CAN OCCUR.

(d) Rub the oven-cured coating for one minute with a clean cotton wiper, G00034, moistened with MEK solvent, B00148, or acetone solvent, B00678 [C04-003].

1) The layer must not come off.

2) A small amount of black residue on the cloth is OK.

(e) The layer must not come off when you scratch it with your fingernail.

(f) The layer must look dull. A shiny or glossy layer is not permitted.

F. Handling

SUBTASK 70-43-19-640-003-H00

(1) Layered parts should be handled so that no chips, scratches, or other damage can occur.

END OF TASK

ETCHING PROCEDURES FOR FLUORESCENT-PENETRANT INSPECTION

1. General

A. This procedure has three tasks:

(1) A preparation of etchant mixtures

(2) A swab etching procedure

(3) A dip etching procedure.

B. Chemical etching is primarily used on stationary weldments as a preliminary step before fluorescent-penetrant inspection.

C. Smeared surface material, caused by operations such as benching of welds, can mask cracks and flaws in metal parts preventing identification during the inspection.

D. Etchants are selected to remove this extraneous material and open the flaws to detection. The etchants are classified in the following text by their application to specific metals; however, other applications may be made when authorized by the parts specific manual.

E. Chemical etching may be done by one of two methods:

(1) Swab Etching Procedure (Swab Etching Procedure, TASK 70-43-24-110-802-H01)

(2) Dip Etching Procedure (Dip Etching Procedure, TASK 70-43-24-110-803-H01).

F. Etchants of the following classification shall be used only on the metals listed, unless otherwise specified by the parts specific manual.

(1) Swab Etchants: Refer to (Swab Etching Procedure, TASK 70-43-24-110-802-H01).

(a) Class A: Magnesium alloys

(b) Class B: Titanium alloys

(c) Class C: (Schantz Reagant)

(d) Stainless Steel Etchant: 300 and 400-series stainless steels, precipitation hardening steels, A286, maraging steels, René 77, René 80, René 95, René 100, René 125, Udimet 500, Sel, Sel15, TD-Ni-Cr, Waspalloy, M152, 17-4 PH Hastelloy B, C, and W.

Superalloy Etchant: René 41, Astroloy, Hastelloy X, HS 188, Inconel 718 and all other Inconel metals.

(e) Class D: Cancelled, Superseded by Class C.

(f) Class E: Carbon steel, bearing and gear alloys.

(g) Class F: Aluminum alloys.

(h) Class G: High chromium superalloys (alternative to Class D).

(2) Dip Etchants: Refer to Dip Etching Procedure, TASK 70-43-24-110-803-H01.

(a) Class G: Inconel 718

TASK 70-43-24-110-801-H01

2. Preparation of Etchant Mixtures

A. General

(1) This procedure gives instructions that are necessary to prepare the etchant mixtures for swab etching and dip etching.

B. Consumable Materials

Reference	Description	Specification
B50034 [C04-097]	Acid - Glacial Acetic Acid	A-A-55829
B50035 [C04-241]	Compound - Ammonium bifluoride (flakes)	
B50036 [C04-098]	Compound - Ferric chloride, anhydrous (FeCl3)	
B50037 [C04-098]	Compound - Ferric chloride (FeCl3 6H2O)	
B50038 [C04-071]	Acid - Hydrochloric (36.5 - 38%)	
B50039 [C04-011]	Acid - Hydrofluoric (48 - 50%)	
B50040 [C04-072]	Acid - Nitric acid (67 - 71%)	
B50041 [C04-099]	Acid - Oxalic acid, crystals	
B50042 [C04-084]	Compound - Sodium hydroxide (pellets or flakes)	
B50043 [C04-100]	Acid - Tartaric acid, crystals	
B50044 [C04-101]	Acid - Sulfuric acid (93 - 98%)	O-S-809

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-43-24-110-001-H01

WARNING DO NOT LET THE ACIDS TOUCH YOU. YOU MUST WEAR CLOTHING THAT SUPPLIES PROTECTION. YOU MUST WEAR GLOVES AND A FACE SHIELD. THE ACIDS ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS. IF THE ACID GETS INTO YOUR EYES, FLUSH YOUR EYES WITH COOL WATER. GET MEDICAL AID IMMEDIATELY.

WARNING DO NOT BREATHE THE FUMES FROM THE ACIDS. YOU MUST USE THE ACIDS IN AN AREA WITH GOOD AIRFLOW. THE FUMES ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS.

WARNING TO MAKE THE SOLUTION, YOU MUST ADD THE ACID TO THE WATER WHILE YOU CONTINUOUSLY MIX IT. DO NOT ADD WATER TO ACID BECAUSE THE HEAT WILL CAUSE THE ACID TO COME OUT OF THE CONTAINER. PUT ON CORRECT CLOTHING FOR PROTECTION. PUT ON GOGGLES (OR A FACE MASK), AND RUBBER (OR NEOPRENE) GLOVES. IF THE SOLUTION TOUCHES YOU, IT WILL BURN YOU.

CAUTION BE CAREFUL WHEN YOU LOOSEN STOPPERS OR CAPS ON FULL BOTTLES. IF YOU ARE NOT CAREFUL, THE BOTTLES CAN SPURT ACID AND CAN CAUSE DAMAGE TO THE COMPONENT OR INJURY TO PERSON.

(CAUTION PRECEDES)

CAUTION

BE CAREFUL WHEN YOU USE THE FERRIC CHLORIDE. FERRIC CHLORIDE IS EXTREMELY HYGROSCOPIC. KEEP UNUSED SUPPLY TIGHTLY SEALED. IF NOT TIGHTLY SEALED IT WILL QUICKLY EVAPORATE INTO THE ATMOSPHERE.

(1) For swab etchant, add chemicals in the sequence and proportions given in the formulas that follow:

NOTE: The ferric chloride you use in the Class C and G etchants is usually supplied in a lump form. To help mix it, it can be added in molten form. The ferric chloride will melt at 98.6°F (37°C). It can also be crushed and added in granular or powdered form with constant stirring until it dissolves.

NOTE: Ferric chloride dissolves quickly in hot water 150-190°F(66-88°C).

NOTE: Glacial acetic acid will freeze at slightly below room temperature (63°F (16.6°C)). Before you pour or mix the chemicals, put the container fully in warm water for several minutes.

(a) Mix each formula fully before you add the subsequent components.

NOTE: The formulas that follow are based on quantities, that, with normal use, will not last more than the shelf-life period of the etchant.

NOTE: You can mix larger or smaller quantities if necessary, if the proportions are equal to those given. The values are nominal. A measurement tolerance of plus or minus 5% of the nominal value is permitted.

CLASS A:		
Magnesium Alloys		
	oxalic acid, B50041 [C04-099] or tartaric acid, B50043 [C04-100]	10 grams
	Distilled water	90 ml

CLASS B:		
Titanium Alloys		
	Distilled water	62 ml
	nitric acid, B50040 [C04-072]	35 ml
	hydrofluoric acid, B50039 [C04-011]	3 ml

CLASS B: (Alternative mixture)		
Titanium Alloys		
	Distilled water	65 ml
	nitric acid, B50040 [C04-072]	35 ml
	ammonium bifluoride, B50035 [C04-241]	9 grams

(Continued)

CLASS B: (Alternative mixture)		
Titanium Alloys		
NOTE: The use of Ammonium bifluoride is a safer alternative to Hydrofluoric acid.		

CLASS C:		
Stainless Steels and High Chromium Superalloys Schantz Reagent		
	Distilled water	750 ml
	sulfuric acid, B50044 [C04-101]	150 ml
	hydrochloric acid, B50038 [C04-071]	1800 ml
	nitric acid, B50040 [C04-072]	500 ml
	glacial acidic acid, B50034 [C04-097]	750 ml
	ferric chloride, B50037 [C04-098] (FeCl3.6H20)	454 grams (1 pound)
NOTE: Add ferric chloride without delay.		

CLASS C: (Alternative mixture)		
Stainless Steels and High Chromium Superalloys Schantz Reagent		
	Distilled water	930 ml
	sulfuric acid, B50044 [C04-101]	150 ml
	hydrochloric acid, B50038 [C04-071]	1800 ml
	nitric acid, B50040 [C04-072]	500 ml
	glacial acidic acid, B50034 [C04-097]	750 ml
	anhydrous ferric chloride, B50036 [C04-098] (FeCl3 Anhydrous)	272 grams (0.6 pound)
NOTE: Add ferric chloride without delay.		
NOTE: Alternative mixtures using anhydrous Ferric Chloride (FeCl3) can reduce errors when preparing these solutions.		

CLASS D:		
NOTE: Cancelled. Superseded by Class C.		

CLASS E:		
Carbon steels, bearing and gear alloys		
	Distilled water	95 ml
	nitric acid, B50040 [C04-072]	5 ml

CLASS F:		
Aluminum alloys		
	Distilled water	60 ml
	sodium hydroxide, B50042 [C04-084]	20 grams
	Distilled water to make	100 ml

CLASS G(1):		
High Chromium Superalloys		
	ferric chloride, B50037 [C04-098]	38 grams
	Tap water	23 ml
	hydrochloric acid, B50038 [C04-071]	28 ml
	Tap water to make	76 ml
NOTE: Let the solution cool to room temperature before you add more water. Use distilled or deionized water unless otherwise noted.		

CLASS G(1): (Alternative mixture)		
High Chromium Superalloys		
	anhydrous ferric chloride, B50036 [C04-098] (FeCl3 Anhydrous)	23 grams
	Tap water	38 ml
	hydrochloric acid, B50038 [C04-071]	28 ml
	Tap water to make	76 ml
NOTE: Use anhydrous Ferric Chloride (FeCl3) as an alternative mixtures which can reduce errors when you prepare these solutions.		

CLASS G(2):		
NOTE: Class G(2) is cancelled. Use Class G(1).		

SUBTASK 70-43-24-110-003-H01

WARNING DO NOT LET THE ACIDS TOUCH YOU. YOU MUST WEAR CLOTHING THAT SUPPLIES PROTECTION. YOU MUST WEAR GLOVES AND A FACE SHIELD. THE ACIDS ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS. IF THE ACID GETS INTO YOUR EYES, FLUSH YOUR EYES WITH COOL WATER. GET MEDICAL AID IMMEDIATELY.

WARNING DO NOT BREATHE THE FUMES FROM THE ACIDS. YOU MUST USE THE ACIDS IN AN AREA WITH GOOD AIRFLOW. THE FUMES ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS.

WARNING TO MAKE THE SOLUTION, YOU MUST ADD THE ACID TO THE WATER WHILE YOU CONTINUOUSLY MIX IT. DO NOT ADD WATER TO ACID BECAUSE THE HEAT WILL CAUSE THE ACID TO COME OUT OF THE CONTAINER. PUT ON CORRECT CLOTHING FOR PROTECTION. PUT ON GOGGLES (OR A FACE MASK), AND RUBBER (OR NEOPRENE) GLOVES. IF THE SOLUTION TOUCHES YOU, IT WILL BURN YOU.

CAUTION BE CAREFUL WHEN YOU LOOSEN STOPPERS OR CAPS ON FULL BOTTLES. IF YOU ARE NOT CAREFUL, THE BOTTLES CAN SPURT ACID AND CAN CAUSE DAMAGE TO THE COMPONENT OR INJURY TO PERSON.

CAUTION BE CAREFUL WHEN YOU USE THE FERRIC CHLORIDE. FERRIC CHLORIDE IS EXTREMELY HYGROSCOPIC. KEEP UNUSED SUPPLY TIGHTLY SEALED. IF NOT TIGHTLY SEALED IT WILL QUICKLY EVAPORATE INTO THE ATMOSPHERE.

(2) For Dip Etchants, add the chemicals in the sequence and proportions given in the formulas that follow:

NOTE: For dip etching, mix the chemicals that follow in a polyethylene or polyvinyl chloride rigid tank in order to make 100 gallons (379 liters). You can mix larger or smaller quantities if necessary, if the proportions are equal to those given.

CLASS G:		
Inconel 718		
	anhydrous ferric chloride, B50036 [C04-098]Ferric chloride (FeCl3 Anhydrous)	191 Kg
	Tap water	114 Liters
	hydrochloric acid, B50038 [C04-071]Hydrochloric acid	125 Liters
	Tap water to make	379 Liters

END OF TASK

TASK 70-43-24-110-802-H01

3. Swab Etching Procedure

A. General

(1) This procedure describes the materials and process for swab etching used as a preliminary step before fluorescent-penetrant inspection. These etchants are used as described herein or with exceptions as specified for individual parts in the parts specific manual.

(2) Materials Storage and Handling

(a) Plastic containers (polyethylene or polypropylene, acid-resistant quality) are recommended for all stock etchant solutions storage. Class B etchant attacks glass. You can store the Class B and Class F etchants in plastic bottles; and store the class A, C, D, E, and G etchants in the glass bottles. Make sure that you store away from heat, and keep it from freezing.

(3) The shelf life of each class of etchants is:

(a) Class A: 1 year.

(b) Class B: One month in a stoppered plastic bottle. Allow 24 hours for gas evolution and discharge after mixing and before replacing the bottle stopper.

(c) Class C: 6 months.

(d) Class D: Cancelled. Superseded by Class C.

(e) Class E: 6 months.

(f) Class F: 1 year.

(g) Class G: 6 months.

(4) Each container of stock solution should be labelled with the Class identification of the contents, and the expiration date of the shelf-life period. A supply of distilled water should be available for mixing etchants, and for rinsing them from the etched area of the work.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

WARNING

DO NOT LET THE ACIDS TOUCH YOU. YOU MUST WEAR CLOTHING THAT SUPPLIES PROTECTION. YOU MUST WEAR GLOVES AND A FACE SHIELD. THE ACIDS ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS. IF THE ACID GETS INTO YOUR EYES, FLUSH YOUR EYES WITH COOL WATER. GET MEDICAL AID IMMEDIATELY.

WARNING

DO NOT BREATHE THE FUMES FROM THE ACIDS. YOU MUST USE THE ACIDS IN AN AREA WITH GOOD AIRFLOW. THE FUMES ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS.

(WARNING PRECEDES)

WARNING

TO MAKE THE SOLUTION, YOU MUST ADD THE ACID TO THE WATER WHILE YOU CONTINUOUSLY MIX IT. DO NOT ADD WATER TO ACID BECAUSE THE HEAT WILL CAUSE THE ACID TO COME OUT OF THE CONTAINER. PUT ON CORRECT CLOTHING FOR PROTECTION. PUT ON GOGGLES (OR A FACE MASK), AND RUBBER (OR NEOPRENE) GLOVES. IF THE SOLUTION TOUCHES YOU, IT WILL BURN YOU.

SUBTASK 70-43-24-110-004-H01

(1) Unless otherwise specified in the parts specific manual, etch specimens as follows:

(a) All surfaces to be etched must be free from oil, grease, scale or other extraneous material.

(b) Pour a small quantity of the stock solution into a clean plastic beaker or dish.

NOTE: This quantity will be the working solution, and is not to be returned to the stock bottle.

(c) Saturate a cotton swab with the working solution, and swab the surface to be etched.

(d) Etch the area for the time specified in the repair or use the following table to determine the etching time for the etchant class and material type.

NOTE: All etchant solutions must be at room temperature.

NOTE: Keep fresh solution in contact with the metal surface at all times by dipping the swab into the working solution periodically. Localized pitting may occur if the solution becomes weakened due to lack of periodic swabbing. Rub the swab continuously over the surface of the metal being etched, to prevent the formation of an inert sludge.

Guideline for Etching Time, Etchant Class, and Material Time

Material	Time	Etchant Class					
		A	B	C	E	F	G
All Magnesium Alloys	60-90 seconds	X					
All Titanium Alloys	60-90 seconds		X				
All Aluminum Alloys	60-90 seconds					X	
Carbon and Low Alloy Steels (4340, 9310, etc.)	60-90 seconds				X		
Maraging Steels (Marage 250, etc.)	60-90 seconds				X		
Low Expansion Alloys (IN90X, Thermospan, etc.)	60-90 seconds			X			
All Stainless Steels (300s, 400s, PH, etc.)	4-5 minutes			X			

(Continued)

Guideline for Etching Time, Etchant Class, and Material Time							
Material	**Time**	**Etchant Class**					
Iron superalloys (A286, V57, etc.)	4-5 minutes			X			
Low Cr Nickel Superalloys (R77, R142, Rn5, etc.)	60-90 seconds			X			
Medium Cr Nickel Superalloys (IN718, R88DT, R95, etc.)	4-5 minutes			X			X
High Cr Nickel Superalloys (Hast X, IN625, etc.)	4-5 minutes			X			
Cobalt Superalloys (X40, L605, HS188, etc.)	4-5 minutes			X			
NOTE: The materials listed in parentheses are examples only. The lists are not intended to be all inclusive.							

1) Make sure that the surface area being swab etched at a given time is not more than approximately 4 square inches (25 square cm).
2) Keep the etching solution within defined boundaries of the area to be etched.
3) Masking is required to contain etchant to areas for etching.

SUBTASK 70-43-24-110-005-H01

(2) After etching, blot up etching solution from the metal surface with a clean paper towel or cloth.

SUBTASK 70-43-24-110-006-H01

(3) Gently wipe the etched area at least three times with a cloth or paper towel saturated with clean water.

NOTE: Do not pour working solution back into stock container. Dispose of the used working solution in accordance with local environmental, health, and safety regulations.

(a) Blot dry with clean cloth or paper towel.

SUBTASK 70-43-24-160-001-H01

(4) Discard the used work solution.

(a) Rinse and dry the plastic container for future use.

——— END OF TASK ———

TASK 70-43-24-110-803-H01

4. Dip Etching Procedure

A. General

CAUTION	DO NOT GET THIS SOLUTION ON THERMAL SPRAYED SILVER COATINGS OR BRAZED ALLOYS. MAKE SURE THAT THIS SOLUTION WILL NOT DAMAGE THE BASE MATERIAL. DAMAGE TO THESE MATERIALS WILL OCCUR QUICKLY.

(1) This task gives instructions for the dip etch procedure of Inconel 718. You do this procedure before you do a fluorescent penetrant inspection on a part. You can also use this task as specified by a shop manual procedure. Do not let the solution touch a thermal spray applied silver coating on the part. Do not let the solution touch a braze alloy that is attached to the part.

(2) Materials Storage and Handling

(a) Keep Class G etchants in glass bottles. Keep the etchant away from heat. Do not let the etchant freeze.

(b) The shelf life of the Class G etchant is 1 year.

(c) Put a label on each container of the stock solution. The label must show the Class identification of the contents and the end date of the shelf-life period.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

WARNING	DO NOT LET THE ACIDS TOUCH YOU. YOU MUST WEAR CLOTHING THAT SUPPLIES PROTECTION. YOU MUST WEAR GLOVES AND A FACE SHIELD. THE ACIDS ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS. IF THE ACID GETS INTO YOUR EYES, FLUSH YOUR EYES WITH COOL WATER. GET MEDICAL AID IMMEDIATELY.

WARNING	DO NOT BREATHE THE FUMES FROM THE ACIDS. YOU MUST USE THE ACIDS IN AN AREA WITH GOOD AIRFLOW. THE FUMES ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS.

WARNING	TO MAKE THE SOLUTION, YOU MUST ADD THE ACID TO THE WATER WHILE YOU CONTINUOUSLY MIX IT. DO NOT ADD WATER TO ACID BECAUSE THE HEAT WILL CAUSE THE ACID TO COME OUT OF THE CONTAINER. PUT ON CORRECT CLOTHING FOR PROTECTION. PUT ON GOGGLES (OR A FACE MASK), AND RUBBER (OR NEOPRENE) GLOVES. IF THE SOLUTION TOUCHES YOU, IT WILL BURN YOU.

(WARNING PRECEDES)

CAUTION

DO NOT PUT TWO DIFFERENT METALS IN THE SOLUTION UNLESS YOU KNOW THAT NO ELECTROCHEMICAL DAMAGE WILL OCCUR. DAMAGE TO THE PARTS CAN OCCUR WHEN YOU PUT DIFFERENT METALS IN THE SOLUTION.

SUBTASK 70-43-24-110-007-H01

(1) Unless specified differently in the parts manual, do the etch procedure on the parts as follows:

(a) All surfaces to be etched must be free from oil, grease, scale, and other unwanted material.

NOTE: Before you do the dip etch procedure on hardware, do a dip test on a panel of the same material. You do this test to find the time necessary to etch the part. You also do this test to find how effective the etch procedure is on the material.

(b) Put the clean parts fully into the room temperature (60°-100°F (16°-38°C)) etchant. Keep the parts in the etchant for 3-4 minutes or for a maximum of 7 minutes.

NOTE: You do this to find the time necessary to get a visual macro-etch.

NOTE: If you cannot see a macro-etch in 7 minutes or less, examine the solution. Refer to Control of Etching Mixture that follows.

(c) Remove the part from acid. Fully flush the part with potable water.

(d) If there is smut on the etched surface, remove it with an air/water spray. Use wet cheese cloth or clean, wet paper towels, if necessary, to remove residue that stays on the part.

(e) Dry the part with clean shop air.

D. Control of etching solution

SUBTASK 70-43-24-110-008-H01

(1) Do a check with the test panels, or do a chemical analysis to keep chemical concentration controls:

(a) Test Panel Control:

1) Do a dip test on a panel of equivalent material.

a) Dip the panel into the etch solution for 3-4 minutes.

b) Remove the panel. If there is smut on the etched surface, remove it with an air/water spray. Use wet cheese cloth or clean, wet paper towels, if necessary, to remove residue that stays on the part.

c) If no visual macro-etch is apparent, put the panel back into the etchant again for 2-3 minutes.

d) Remove the panel. If there is smut on the etched surface, remove it with an air/water spray. Use wet cheese cloth or clean, wet paper towels, if necessary, to remove residue that stays on the part.

e) If you do not see a satisfactory macro-etch, replace the etching solution. You can also do a chemical analysis of the solution to find the applicable adjustments to the tank solution.

NOTE: Make sure that you obey the environmental regulations when you discard the solution.

(b) Chemical Analysis and Control

1) The etch procedure will make sludge that will collect in the bottom of the tank. Do these steps to remove the sludge.

a) Do not use or move the solution in the tank for a minimum of 8 hours.

b) Drain off the clear acid into a different container.

c) Remove the sludge from the tank.

d) Flush the tank clean with water.

e) Dry the tank and fill the tank with the acid that you drained out.

2) Do a chemical analysis of the tank contents to find the chemical component that is necessary to add. See the control limits that follow.

3) Make more of the acid solution and add it to the tank. Then increase the level of the solution to the necessary height with potable water.

4) Make sure that the solution concentrations are between the control limits that follow.

a) 250-300 grams per liter of ferric chloride, 100-200 grams per liter of hydrochloric acid (muriatic).

——— END OF TASK ———

PAINT - EPOXY POLYAMIDE COATING FOR COMPOSITES

1. General

A. This procedure has one task:

(1) The epoxy polyamide coating repair for composites.

TASK 70-43-27-300-801-H00

2. Paint - Epoxy Polyamide Coating for Composites

A. General

(1) You use this procedure when it is necessary to repair composite surfaces.

B. References

Reference	Title
70-46-01-300-801-H00	Mask and Clean the Epoxy and Polyester Matrix Repair (P/B 201)

C. Consumable Materials

Reference	Description	Specification
C50177 [C04-029]	Reducer	MIL-T-81772 Type I or Type II
C50317 [C03-010]	Coating - Epoxy Polyamide	MIL-C-22750
G02442 [C10-141]	Abrasive - 120 Grit, SiC, Wet/Dry, Abrasive Paper / 180 Grit, SiC, Wet/Dry, Abrasive Paper	
G50035 [C10-182]	Cloth - Cleaning For Aircraft Structural	SAE-AMS 3819, BMS 15-5

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-43-27-370-001-H00

(1) Do these steps to repair the epoxy coating:

(a) Prepare bare surface of composite material for painting as follows:

CAUTION

DO NOT EXPOSE THE UNDERLYING FIBERS OR DAMAGE TO THE PART CAN OCCUR.

1) Use abrasive paper, G02442 [C10-141], to hand-sand the surface of the unfinished composite material. Dry sand the surface.

a) On new composites, sand sufficiently to break the resin surface glaze.

b) On existing composites that do not have surface glaze, lightly sand to remove surface contamination.

WARNING USE EYE PROTECTION WHEN YOU USE COMPRESSED AIR TO CLEAN, COOL, OR DRY PARTS OR TOOLS. PARTICLES CAN CAUSE AN INJURY TO YOUR EYES. DO NOT USE MORE THAN 30 PSIG (200 KPA). DO NOT POINT COMPRESSED AIR AT YOURSELF OR OTHER PERSONS.

2) Clean unwanted material from the area to be repaired with clean, dry, oil-free compressed shop air.

3) Mask areas adjacent to the area to be painted as follows (TASK 70-46-01-300-801-H00):

   a) Use Composite Masking Method No. 3.

WARNING USE ALL SOLVENT TYPE CLEANING AGENTS IN A WELL VENTILATED AREA. AVOID BREATHING VAPORS AND PROLONGED CONTACT WITH SKIN OBSERVE FIRE PRECAUTIONS.

4) Clean surface to be painted as follows (TASK 70-46-01-300-801-H00):

   a) Use Composite Cleaning Method No.4 or Composite Cleaning Method No. 5.

   b) Let the part dry completely.

5) Mask clean surface to be painted as follows (TASK 70-46-01-300-801-H00):

   a) Use Composite Masking Method No.4.

(b) Apply epoxy polyamide coating, C50317 [C03-010] and reducer, C50177 [C04-029] as follows:

1) Mix each individual component in its original container before you use it. Mix the coating and the reducer as specified by the manufacturer. Stir thoroughly and let this mixture stand at room temperature for 30 minutes minimum (chemical reaction time).

   NOTE: This waiting period will apply after the addition of reducer if reducer is necessary.

   NOTE: For spray application, the two components can be thinned by the addition of reducer, C50177 [C04-029] as specified by the manufacturer.

2) Remove the masking previously applied by Composite Masking Method No.4 to the area to be painted.

3) Spray the paint in thin coats to produce a satisfactory surface finish of 0.003- 0.005 inch (0.08-0.13 mm).

4) Let painted parts air dry for 30 minutes minimum.

5) Do an inspection of the painted area for grit, seeds, runs, craters, and blisters. Use the inspection limits in the repair procedure, or in the steps that follow:

   a) Grit - any number is acceptable. The total collected amount cannot be more than 0.062 x 0.062 x 0.010 inch (1.57 x 1.57 x 0.25 mm) high in any 1.0 in^2 (645.2 mm^2) area.

   b) Seeds - any number is acceptable. The total collected amount cannot be more than 0.062 x 0.062 x 0.010 inch (1.57 x 1.57 x 0.25 mm) high in any 1.0 in^2 (645.2 mm^2) area.

   c) Runs - cannot be more that 0.01 in. (0.25 mm) above the coating surface.

d) Craters - any number is acceptable. The total collected amount cannot be more than 0.125 x 0.125 x 0.010 inch (3.18 x 3.18 x 0.25 mm) in depth in any 1.0 in^2 (645.2 mm^2) area.

e) Blisters - none permitted.

6) Rework as necessary.

a) Apply reducer, C50177 [C04-029] to a cleaning cloth, G50035 [C10-182] and wipe surface to remove imperfections.

b) If needed, do the previous steps again: "Prepare bare surface of composite material for painting" and "Apply epoxy polyamide coating, C50317 [C03-010] and reducer, C50177 [C04-029]".

WARNING

MAKE SURE THE PAINT IS DRY BEFORE YOU PUT THE PARTS IN THE OVEN. WET PAINT CAN START A FIRE OR AN EXPLOSION.

7) Alternative Procedure Available. Do an oven cure at 165 to 185 degrees F (73 to 85 degrees C) for 60-90 minutes.

8) Alternative Procedure. Cure paint for 24 hours at 70 to 90 degrees F (22 to 32 degrees C).

9) Remove all masking and clean as necessary.

——— END OF TASK ———

BLENDING PROCEDURES

TASK 70-43-42-300-801-H01

1. Blending Procedures

A. General

(1) This task gives the instructions to blend engine parts.

(2) This task gives instructions on the four types of blending that follow:

(a) Hand blending

(b) Power blending

(c) Blending airfoils

NOTE: There are special blending instructions specified for airfoil components.

(d) The removal of high metal

(3) General Information

NOTE: Refer to the applicable manual or Service Bulletin for the blending limits of the piece part that you will blend. Use the limits in this procedure only when no limits are specified in the applicable manual or Service Bulletin.

(a) Blending is a repair procedure that you use to remove stress concentrations on important parts. Nicks, scratches, or other damage with sharp edges can cause stress concentrations on parts. To make a blend, you remove material from around the damage to make a smooth contour. The blend will remove the stress concentration. When you remove the stress concentration on the part, you decrease the risk that a crack will start on the part.

(b) You can use this procedure to remove sharp edges that occur when you use machine tools on a part. On parts that have a welded repair or brazing, you can use the blend procedure to repair the contours and surface finish.

(c) If there is more than 0.25 inch (6.4 mm) between the areas of damage on the part, do not blend the areas together. If there is less than 0.25 inch (6.4 mm) between the areas with damage, blend the areas together (not applicable to splines). Do not blend damage on splines together.

(d) Try to make the finish on the completed blend equivalent to the finish on the remaining area of the part.

B. References

Reference	Title
70-11-06-230-801-H01	Fluorescent Penetrant Inspection (P/B 201)
70-43-24-110-802-H01	Swab Etching Procedure (P/B 201)
70-43-24-110-803-H01	Dip Etching Procedure (P/B 201)

C. Procedure

SUBTASK 70-43-42-350-001-H01

(1) Hand Blending (Figure 201 or Figure 202 or Figure 203).

WARNING DO NOT BREATHE THE PARTICLES, OR GET THEM IN YOUR MOUTH, EYES, OR ON YOUR SKIN. PUT ON A RESPIRATOR, GOGGLES, AND GLOVES AND OTHER EQUIPMENT FOR PROTECTION. THESE PARTICLES CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

(a) Use abrasive stones, paper, files, or a crocus cloth to blend the sharp edges on the part. You can use a coarse abrasive or a file to remove metal quickly. Make a smooth surface finish with a less coarse abrasive or crocus cloth.

1) When you blend rotor blades, stator vanes or equivalent type parts, make the blend in the radial direction. When you remove metal from an airfoil section, make sure that the edges do not become thin or sharp. Make sure that you do not change the original contour of the airfoil section.

NOTE: Refer to the applicable inspection and repair procedures for blend limits on each part of the engine.

2) When you blend a part with a cylinder shape, blend in a circumferential direction. Do not blend along the axis of the part.

3) Try to make the finish on the completed blend equivalent to the finish on the remaining area of the part.

4) When you blend on a part that has a radius, keep the radius as specified in the repair procedures. If the radius is not specified, keep it as near as possible to the original contour. If necessary, refer to an equivalent part to find the original radius.

5) After you blend the part, do these tasks:

a) Swab Etching Procedure, TASK 70-43-24-110-802-H01 or Dip Etching Procedure, TASK 70-43-24-110-803-H01

b) Fluorescent Penetrant Inspection, TASK 70-11-06-230-801-H01

SUBTASK 70-43-42-350-002-H01

(2) Power Blending (Figure 201 or Figure 202 or Figure 203)

WARNING DO NOT BREATHE THE PARTICLES, OR GET THEM IN YOUR MOUTH, EYES, OR ON YOUR SKIN. PUT ON A RESPIRATOR, GOGGLES, AND GLOVES AND OTHER EQUIPMENT FOR PROTECTION. THESE PARTICLES CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

CAUTION YOU MUST REFER TO THE SPECIFIED PART INSTRUCTIONS WHEN YOU DO THE POWER BLENDING PROCEDURE ON AN AIRFOIL SECTION. IF YOU DO THE POWER BLENDING PROCEDURE WITHOUT A SPECIFIED PART INSTRUCTION, YOU CAN CAUSE DAMAGE TO THE PART.

CAUTION POWER BLENDING MUST BE ACCOMPLISHED IN SUCH A MANNER THAT NO EXCESSIVE HEAT AND THERMAL STRESSES WILL BE GENERATED. IF THERE IS EXCESSIVE HEAT OR THERMAL STRESSES, DAMAGE TO THE PARTS CAN OCCUR.

(a) You use points made of an abrasive material bonded to rubber to blend most parts. You use these points with a power drive to blend and polish the parts. If there are special instructions to blend a part, you must follow those instructions.

1) You use the coarser grades of the abrasive tools or materials to start the blend of the part. You use the less coarse grades to complete the blend of the part.

2) When you blend with power tools, you follow the same specifications as when you blend the part manually.

3) After you blend the part, do these tasks:

a) Swab Etching Procedure, TASK 70-43-24-110-802-H01 or Dip Etching Procedure, TASK 70-43-24-110-803-H01.

b) Fluorescent Penetrant Inspection, TASK 70-11-06-230-801-H01

NOTE: After you complete a power blend on titanium, you must blend the area 0.002 inch (0.05 mm) more in depth manually. This will remove the remaining stress in the surface material.

SUBTASK 70-43-42-320-001-H01

(3) Component Specific Requirements - Blending Airfoils

NOTE: Refer to the engine manual, airplane maintenance manual, or service bulletin for the blend limits of the piece part. Use the limits in this procedure only when no limits are specified in the manual or applicable service bulletin.

(a) A manual or power blend can repair these types of airfoil damage. Always refer to the applicable part inspection paragraph for the specifications of the airfoil damage limits.

1) Nick

a) A V-shaped depression in the airfoil with a sharp edge.

2) Pit

a) A circular hole with sharp edges with a rounded bottom caused by erosion.

3) Scratch

a) A V-shaped line or furrow made by a sharp object that touched the surface of the airfoil.

4) Dent

a) A smooth, circular depression made by a circular object that hit the airfoil. If there is a sharp edge in the depression, then the damage is a nick. If the leading edge or trailing edge has a wave shape, the damage is a dent.

5) Erosion

a) The effect of sand or dust that goes through the engine. Sand or dust will wear down the leading edges and the leading part of the concave side.

6) Torn Metal

a) A separation of material by force that has left jagged edges.

(b) Do a manual blend of the airfoils as follows:

1) Blend the airfoil to remove nicks, pits, and scratches.

2) Blend to remove high metal and to straighten the dents (where permitted). You must repair the airfoil shape to as near as possible to its initial aerodynamic contour.

3) Complete the blend with a fine stone or crocus cloth.

a) You can use coarser tools for the initial removal of material. Complete the blend in a direction along the length of the blade or vane. Make sure to remove all marks on the airfoil that you made during the initial steps of the blend procedure.

CAUTION KEEP THE SHAPE OF THE BLENDED AIRFOIL LEADING EDGE AS NEAR AS POSSIBLE TO THE ORIGINAL CONTOUR OF THE AIRFOIL. IF THE SHAPE OF THE BLENDED AIRFOIL IS NOT NEAR TO THE ORIGINAL CONTOUR OF THE AIRFOIL, ENGINE STALLS AND ENGINE DAMAGE CAN OCCUR.

4) Do a check of the airfoil dimensions after you blend:

NOTE: The procedure gives the blend limits as depth dimensions. This makes it easy to see the quantity of damage you can repair. You can use the depth limits for rework. The minimum chord limit is the most important dimension. Make sure that you do not exceed this limit. If you blend an area that shows signs of a previous repair, make sure that you obey the minimum chord limit. The procedure supplies depth limits and minimum chord limits in decimal and fraction forms. If the depth and chord limits do not agree, use the minimum chord dimension to find if the part is serviceable.

NOTE: The procedure gives defect limits as depth dimensions since this dimension has an effect on the strength of the part. Special equipment is necessary to measure a depth limit accurately. You can compare the depth of the defect with the thickness of a known item. You can use a thickness gage or a piece of lockwire to make a good estimate of the depth (Figure 201 or Figure 202 or Figure 203).

a) If there is more than 0.25 inch (6.4 mm) between the defect areas, do not blend them together.

b) If there is less than 0.25 inch (6.4 mm) between the defect areas, you can blend the areas together.

c) All blends must have a minimum radius of 0.25 inch (6.4 mm).

d) You can decrease the chord width on only one side of the part or divide it between the two sides.

e) The minimum limit of the chord width controls the quantity of blend work you can do. The procedure gives the minimum permitted chord for the root and tip of the airfoil. The minimum chord at the other points is proportional.

f) Make sure that you do not change the contour of the airfoil section. (Figure 201 or Figure 202 or Figure 203). This will help prevent an engine stall.

CAUTION YOU MUST USE A BRUSH OR SWAB TO APPLY THE PENETRANT ON THE PARTS THAT HAVE OPENINGS FOR AIR FLOW. IF YOU DO NOT USE A BRUSH OR SWAB, THE PENETRANT WILL FILL THE OPENINGS AND CAUSE DAMAGE TO THE PART.

5) Do a swab-etch procedure on the area where you did the blend repair. Do this task: Swab Etching Procedure, TASK 70-43-24-110-802-H01.

6) Examine the part again. Do this task: Fluorescent Penetrant Inspection, TASK 70-11-06-230-801-H01.

(c) Power blend the rotor blades, the variable vanes, and the vane segments as follows:

1) Apply masking tape on the airfoil adjacent to the area you will do the blend procedure.

NOTE: This will prevent damage to the airfoil during the blend procedure.

2) Use a coarse grade silicone carbide impregnated rubber wheel or point for the initial blend of the blades or vanes.

3) Use fine to extra-fine grades of an abrasive wheel to complete the blend of the defects.

a) Remove only the minimum necessary quantity of material to repair the defect.

b) Apply light pressure on the wheel to make a radius on the leading and the trailing edges of the airfoil.

NOTE: This will let the cushion effect of the abrasive wheel blend the radius and buff the defect.

CAUTION

YOU MUST USE A BRUSH OR SWAB TO APPLY THE PENETRANT ON THE PARTS THAT HAVE OPENINGS FOR AIR FLOW. IF YOU DO NOT USE A BRUSH OR SWAB, THE PENETRANT WILL FILL THE OPENINGS AND CAUSE DAMAGE TO THE PART.

4) Do a swab-etch procedure on the area where you did the blend repair. Do this task: Swab Etching Procedure, TASK 70-43-24-110-802-H01.

5) Examine the part again. Do this task: Fluorescent Penetrant Inspection, TASK 70-11-06-230-801-H01.

6) If they are loose parts, put the repaired blades and the vanes in containers for protection. This will help to prevent damage when you move the parts.

7) Carefully do a check on the blades and the vanes.

(d) Do the blend procedure on small indications in tubing as follows:

WARNING

DO NOT BREATHE THE PARTICLES, OR GET THEM IN YOUR MOUTH, EYES, OR ON YOUR SKIN. PUT ON A RESPIRATOR, GOGGLES, AND GLOVES AND OTHER EQUIPMENT FOR PROTECTION. THESE PARTICLES CAN CAUSE INJURIES TO PERSONNEL, AND DAMAGE TO EQUIPMENT.

1) Use a fine abrasive stone, a small needle file with fine teeth, emery cloth, or crocus cloth to blend.

2) Blend around the circumference of the tubing.

NOTE: Try to make the finish on the completed blend equivalent to the finish on the remaining area of the part.

SUBTASK 70-43-42-320-002-H01

(4) Removal of High Metal

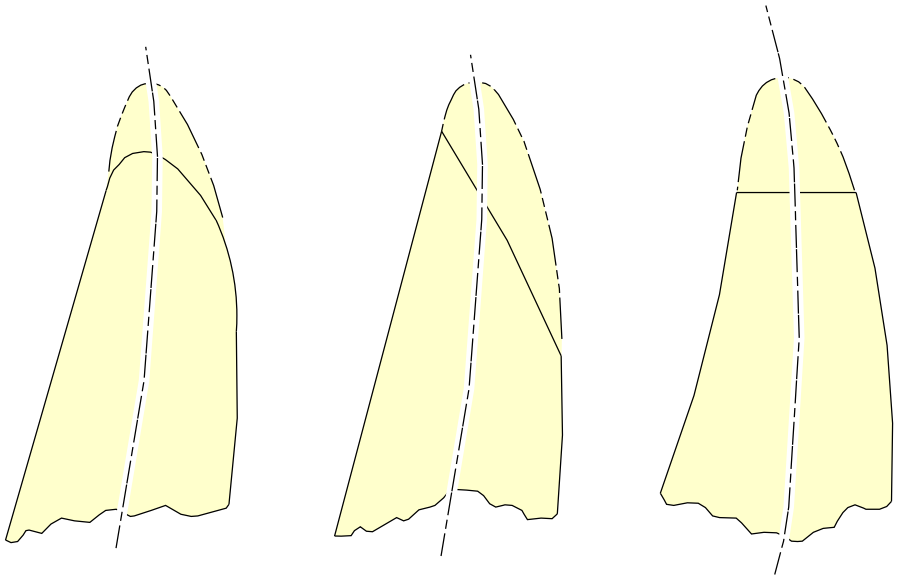
(a) Remove high metal as follows:

NOTE: High metal is metal that is above the usual surface of the metal. You usually find high metal around nicks and scratches.

1) Use a fine abrasive stone, emery cloth, or crocus cloth to remove high metal.

2) Remove only the material that is above the initial surface contour (Figure 201 or Figure 202 or Figure 203).

END OF TASK



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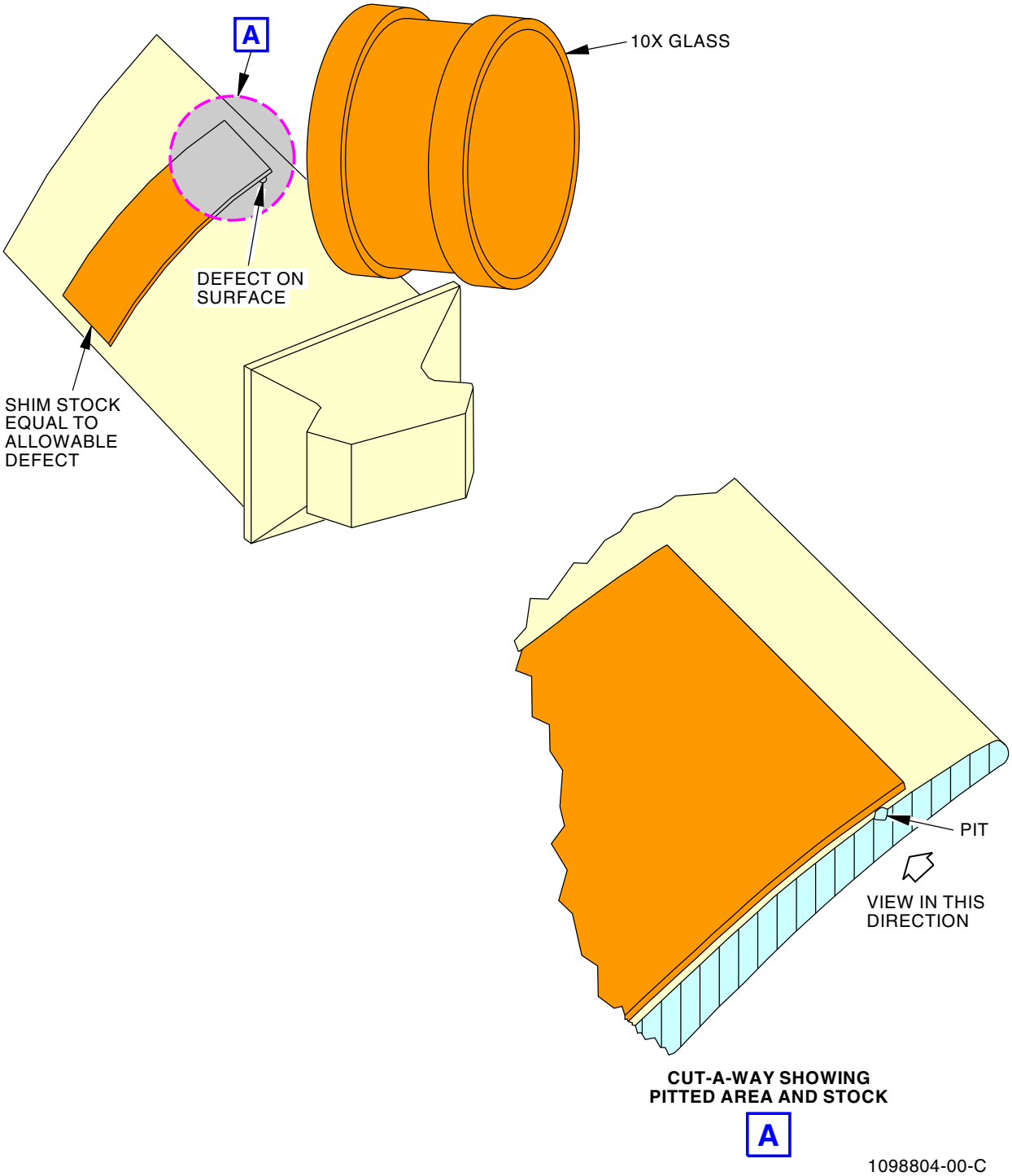
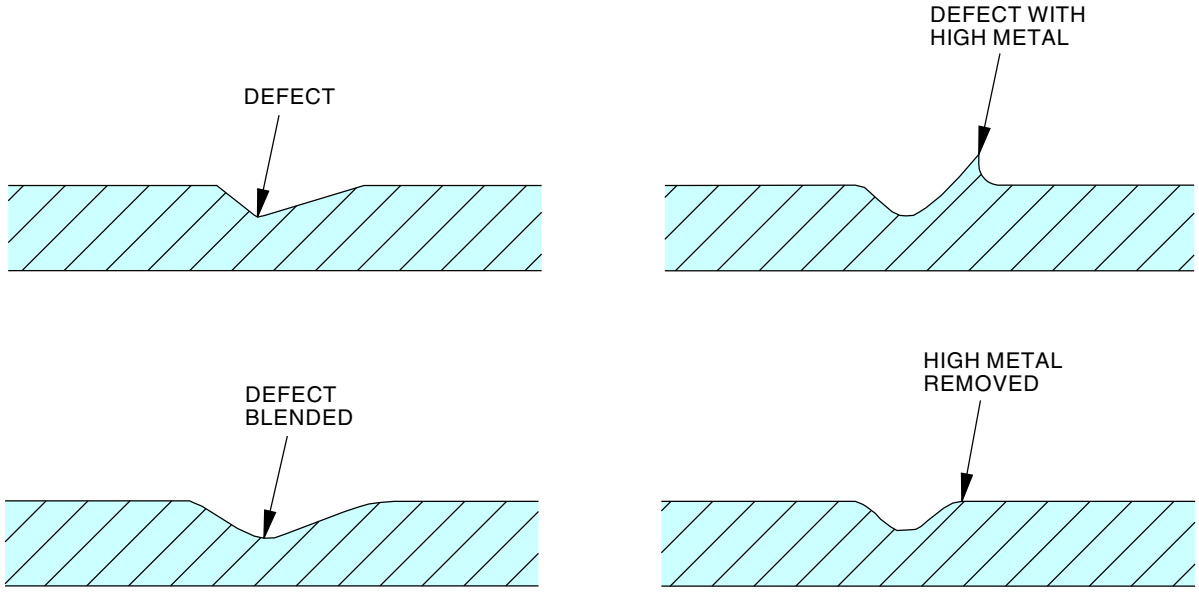
Airfoil Leading Edge - Blending
Figure 201/70-43-42-990-806-H01



Airfoil Defect - Measurement
Figure 202/70-43-42-990-805-H01



BLENDING OF A DEFECT

REMOVAL OF HIGH METAL

1098805-00-C
421201 S0000137265_V2

Defect Blending and High Metal Removal
Figure 203/70-43-42-990-804-H01

THERMOSETTING COMPOSITE MATERIALS

1. General

A. This procedure has one task:

(1) Mask and Clean the Epoxy and Polyester Matrix Repair

TASK 70-46-01-300-801-H00

2. Mask and Clean the Epoxy and Polyester Matrix Repair

(Figure 201, Figure 202, and Figure 203)

A. General

(1) This task is the mask and clean the epoxy and polyester matrix repair.

(2) Use this standard practice for composite materials only.

(3) This procedure describes methods to mask and clean commercial aircraft epoxy and polyester matrix composite parts in preparation for repairs and wipe cleaning during repair and before bonding procedures. This procedure also shows how to do a water break check.

B. Consumable Materials

Reference	Description	Specification
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00148	Solvent - Methyl Ethyl Ketone (MEK)	ASTM D740
B00151	Solvent - Methyl Isobutyl Ketone	ASTM D1153
B00679 [C04-035]	Alcohol - Isopropyl	
B50200 [C04-152]	Cleaner - Turco 5948-R Mild Alkaline	
B50223 [C04-164]	Cleaner - Mild Alkaline, Water Based (Blue Gold Industrial Cleaner)	
G01659	Swab - Cotton Or Rayon, (Disposable)	
G02462 [C10-136]	Tape - Flash-Breaker - No. 855	
G50030 [C10-040]	Tape -Teflon, Scotch Brand 5490, Teflon 1 x 0.002 in. thick	
G50033 [C10-133]	Film, Polymer FEP, Unperforated, 0.001 inch (0.03 Mm) Thick	
G50035 [C10-182]	Cloth - Cleaning For Aircraft Structural	SAE-AMS 3819, BMS 15-5
G50208 [C10-137]	Film - Vacuum bag, 0.001 or 0.002 inch width	
G50209 [C10-142]	Film - Polyester (Mylar) film, 0.002-0.004 inch thick	

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Prepare for the Repair

SUBTASK 70-46-01-860-001-H00

(1) Do these steps to make sure that the ENGINE START switch and the FUEL CONTROL switch are not operated:

(a) On the flight compartment overhead panel, P5, make sure that the applicable engine Start/Ignition switch us in the NORM position.

1) Put a DO-NOT-OPERATE tag on the applicable engine Start/Ignition switch.

(b) On the pilot's aisle control stand, make sure that the applicable Fuel Control switch is in the CUTOFF position.

1) Put a DO-NOT-OPERATE tag on the applicable Fuel Control switch.

E. Mask and Clean the Epoxy and Polyester Matrix Repair

SUBTASK 70-46-01-160-001-H00

(1) Composite Masking Method 3 - Masking An Uncleaned Part To Prevent Contamination From Uncleaned Areas And To Prevent Resin Spills.

NOTE: This procedure gives instructions for masking around the damage on an uncleaned part to prevent contamination from uncleaned areas and to prevent resin spills.

NOTE: This masking can be done for several different reasons. It may be that the part is large, or is still located on wing so that overall cleaning is not practical and the dirty area needs masking to prevent cross contamination. Also if a wet lay up repair is being done or liquid or paste adhesives are used the remainder of the part will need to be protected from spills and drips.

NOTE: It is necessary to estimate the size of the largest repair patch or ply that will be put on the outside so that the masking does not interfere with the accomplishment of the repair. If the masking is too small, you must increase the size of the masking.

(a) Use a dry cloth, G50035 [C10-182] to remove all the water you can see and as much dirt as you can from around the repair area.

(b) Use Composite Cleaning Method 4, or Composite Cleaning Method 5, to clean the area where you will put the film and tape.

(c) Measure the size and shape of the damage area.

(d) Cut pieces of film, G50033 [C10-133], vacuum bag film, G50208 [C10-137], or 0.002 - 0.004 inch thick polyester film, G50209 [C10-142], to fit around the repair area for at least 24.0 inches (610.0 mm) larger on each side than the damage area.

1) Do not put film over the damage area.

2) Make the inside edge 1.0 inch (25.4 mm) larger than the outside edge of the estimated repair area.

(e) Make the film smooth over the area around the damage.

(f) Hold the film at each corner with small pieces of Scotch 5490 tape, G50030 [C10-040], or No. 855 tape, G02462 [C10-136].

(g) Put the tape along all the edges of the film next to the repair area.

1) If the film is folded, hold the folds down with a piece of tape.

2) Make sure that the tape around the edge covers the film edge at the fold (Figure 201).

(h) Put the tape on the outer edges of the film at equal distances as necessary to hold it in position.

1) If the repair is in an open area, put tape along all the edges of the film.

(i) Rub the surface of the tape firmly with your fingers.

1) Push any air bubbles to the edge of the tape.

2) Make sure that all edges are firmly pushed down.

(j) Make sure all the edges are held down with tape.

SUBTASK 70-46-01-160-002-H00

(2) Composite Masking Method 4 - Masking Of A Prepared Repair Area When It Is Not Being Worked On.

NOTE: This masking is for shop or outdoor use and is to prevent airborne contamination from people working in adjacent areas and general atmospheric contamination. It also helps to prevent people from touching a prepared surface. This masking can be applied over the masking applied using Masking Method 3. In this case the tape should be attached to the existing masking.

(a) Cut a piece of film, G50033 [C10-133], vacuum bag film, G50208 [C10-137], or 0.002 - 0.004 inch thick polyester film, G50209 [C10-142], approximately 6.0 inches (152.4 mm) bigger all around than the exposed repair area.

(b) Put the film over the repair and hold it in place with pieces of Scotch 5490 tape, G50030 [C10-040], or No. 855 tape, G02462 [C10-136].

1) Put the tape at equal distances as necessary to hold it in position.

(c) If the repair is out in an open area where wind, rain or dust could fall on it, put tape along all the edges of the film.

1) If the film is folded, hold the folds down with a piece of tape.

2) Make sure that the tape around the edge covers the film edge at the fold.

SUBTASK 70-46-01-160-003-H00

(3) Composite Masking Method 5 - Masking To Prevent Excess Resin On Part During The Cure Procedure.

NOTE: If a lot of flash is possible, a heavy duty flashbreaker tape should be used to prevent the tape being trapped under the repair adhesive. When bonding small details, all the nonbonding surfaces of the detail should be covered in tape.

(a) Make a decision where the resin or adhesive edge must be.

1) Make an allowance for an adhesive fillet when making overlap joints.

(b) Apply pieces of Scotch 5490 tape, G50030 [C10-040], or No. 855 tape, G02462 [C10-136], along the edge to cover the part up to the surrounding masking.

F. Procedure for Cleaning Composite Materials

SUBTASK 70-46-01-160-004-H00

(1) Composite Cleaning Method 3 - Hot Or Cold Water Hand Wash Cleaning Procedure.

NOTE: Water hand wash cleaning combines hand rubbing with the chemical and physical action of the cleaning solution to remove oils, greases, and light soil from parts.

NOTE: This method can be used to clean single skin composite components and sandwich panels with or without acoustically treated areas. Care should be taken not to apply more water than is necessary to clean and rinse the part especially with thin skinned honeycomb sandwich structures or where porosity is suspected. Special care should be taken with parts with aluminum core or fittings, as the residue of alkaline cleaners could cause corrosion of the aluminum.

NOTE: The advantage of this method is its flexibility in that it can be done with a minimum of equipment. The disadvantages are that it is labor intensive and the results are directly related to the diligence of the operator to get good results. Care is necessary to make sure that there are no residual chemical deposits after drying.

NOTE: This method is only suitable for initial part cleaning. Do not use for cleaning of prepared areas.

WARNING OBEY THE VENDOR SAFETY PROCEDURES FOR THE ALKALINE CLEANER. IF YOU TOUCH THE ALKALINE CLEANER, YOU CAN IRRITATE OR BURN THE SKIN OR EYES.

(a) Prepare Turco 5948-R cleaner, B50200 [C04-152], in a polypropylene bucket at a temperature of 160.0 - 180.08°F (71.0 - 82.28°C) as follows:

1) Fill a bucket two-thirds full with water.
2) Add Turco 5948-R cleaner, B50200 [C04-152], slowly and carefully while stirring the solution to mix.
3) Fill the bucket with water to working level.
4) Stir solution again to mix.

(b) Alternative Procedure: Prepare mild alkaline cleaner, B50223 [C04-164], in a polypropylene bucket at a temperature of 130.0 - 150.08°F (55.0 - 66.08°C).

1) Prepare a bucket of water at the same temperature as the diluted solution.
2) Fill a bucket two-thirds full with water.
3) Add mild alkaline cleaner, B50223 [C04-164], slowly and carefully while stirring the solution to mix.
4) Fill the bucket with water to working level.
5) Stir solution again to mix.

WARNING PUT ON A FACE SHIELD, GLOVES, PROTECTIVE CLOTHING, AND PROTECTIVE SHOES. INJURIES TO PERSONNEL CAN OCCUR.

(c) Make a clean cloth, G50035 [C10-182], moist with the solution.

1) Use the cloth to put the solution on the surface to remove the dirt and oil until the part is clean.

NOTE: A stiff bristle brush may be used to remove dirt that cannot be removed with the cloth.

(d) Make a clean cloth, G50035 [C10-182], moist with water and wipe over the surface to rinse the part.

1) Take care not to put more water on the part than is necessary to remove the cleaning solution.

(e) Dry the part with a clean cloth, G50035 [C10-182], to remove all the moisture that you can see.

WARNING BEFORE YOU USE COMPRESSED AIR, PUT ON GOGGLES FOR EYE PROTECTION. DO NOT POINT THE NOZZLE AT OTHER PERSONNEL. IF YOU DO NOT OBEY THESE PRECAUTIONS, INJURIES TO PERSONNEL CAN OCCUR.

(f) Use clean, dry, compressed air that does not contain oil to remove any moisture that stays in areas that you can not get access to.

(g) Make sure that the part is clean.

1) Look for dirt trapped in holes and areas that are difficult to get access to.

2) If the part is not clean, repeat the cleaning steps.

SUBTASK 70-46-01-160-005-H00

(2) Composite Cleaning Method 4 - Wipe Cleaning with a Commercial Solvent- One Cloth Method Procedure

NOTE: This method of cleaning is most commonly used in small local areas and for degreasing composite parts immediately before bonding.

NOTE: The advantages of this method are that it can be done easily with no special equipment and is a reliable method of degreasing before bonding. No water is introduced onto the part surface so no further drying is necessary although care should be taken to make sure that all the solvent has had time to evaporate from the wiped surface.

NOTE: The disadvantages of the method are that solvents used are toxic and often highly flammable, some also contribute to the CFC emissions. The high volatility of some of the solvents can cause the solvent to evaporate before the next wipe so that the grease is spread over the surface instead of being lifted from it.

(a) Get several cloth, G50035 [C10-182].

WARNING SOLVENTS ARE TOXIC AND HIGHLY FLAMMABLE. AVOID PROLONGED INHALATION OF VAPORS OR CONTACT WITH THE SKIN. TAKE PRECAUTIONS AGAINST FIRE.

(b) Get solvent, B00148, solvent, B00151, solvent, B00062, or alcohol, B00679 [C04-035].

(c) Put solvent on a cloth, G50035 [C10-182], to make the cloth moist.

1) Do not use so much solvent that drops of solvent fall from the cloth.

(d) Move the cloth lightly in one direction across the part that is to be cleaned.

(e) Look at the cloth.

1) If the cloth is dirty, turn the cloth to a clean area and wipe the area again.

(f) Do this procedure until a clean area of the cloth stays clean.

(g) Do the last wipe with a dry cloth before the solvent on the part dries.

(h) Use a swab, G01659, in the small areas to make sure that all areas are clean.

(i) Let the part dry for a minimum of 15 minutes.

SUBTASK 70-46-01-160-006-H00

(3) Composite Cleaning Method 5 - Wipe Cleaning with a Commercial Solvent- Two Cloth Method Procedure

NOTE: This method is preferred with the faster evaporating solvents as a way of wiping the surface before the solvent evaporates.

(a) Get several cloth, G50035 [C10-182].

WARNING

SOLVENTS ARE TOXIC. AVOID INGESTION, BREATHING THE VAPORS, AND CONTACT WITH THE SKIN AND EYES.

(b) Get solvent, B00148, solvent, B00151, solvent, B00062, or alcohol, B00679 [C04-035].

(c) Put solvent on a cloth, G50035 [C10-182], to make the cloth moist.

1) Do not use so much solvent that drops of solvent fall from the cloth.

(d) Move the first cloth lightly in one direction across the part that is to be cleaned.

(e) Use a second dry cloth to wipe the part before the solvent on the part dries (Figure 202).

(f) Do this procedure until a clean part of the cloth stays clean.

(g) Do the last wipe with a clean dry cloth before the solvent on the part dries.

(h) Use a swab, G01659, in the small areas to make sure that all areas are clean.

(i) Let the part dry for a minimum of 15 minutes.

G. Water Break Test Procedure

SUBTASK 70-46-01-160-007-H00

(1) Do the water break test procedure as follows:

NOTE: A water break test is used to find if any residual oils or greases stay on surfaces to be bonded. This test is normally used after all cleaning has been completed.

NOTE: The water break test is a simple way to see if a surface is grease free. It should be used with caution on bonding surfaces adjacent to honeycomb because water entering the honeycomb can be difficult remove. In these cases it is difficult to make sure that the repair area is thoroughly dry.

NOTE: The test works well on normal composite abraded surfaces, however, if the surface is polished to a very smooth finish it can be difficult to pass the test even with a clean surface. But if the surface is very rough the surface tension of the water film may be interrupted making assessment of the water breaks more difficult. You can get good sensitivity in composite laminates abraded with grits in the range 80 to 400 grit.

(a) Put de-ionized or distilled water in a clean polyethylene bottle with a small spray nozzle and spray the water onto the prepared surface until the surface is just covered.

(b) Alternative procedure: Put de-ionized or distilled water on a clean cloth, G50035 [C10-182], and move the cloth across the surface to put a thin layer of water on the surface.

(c) Look at the water on the surface.

1) The water shall form a thin layer over the surface with no areas where the surface tension causes the water to separate into drops or beads of water to form.

2) The water shall not leave any part of the surface uncovered (Figure 203).

(d) Leave the water on the surface for 30 seconds.

1) The water shall remain on all of the surface.

(e) If the water separates or drops or beads form within 30 seconds do the cleaning procedure and the test again.

(f) After you do the test, dry the surface with a dry cloth, G50035 [C10-182].

(g) Allow the surface to dry for 30 minutes minimum before bonding.

H. Put the Airplane Back to Its Usual Condition

SUBTASK 70-46-01-860-002-H00

(1) Do these steps to remove the DO-NOT-OPERATE tags from the engine Start/Ignition switch and the Fuel Control switch:

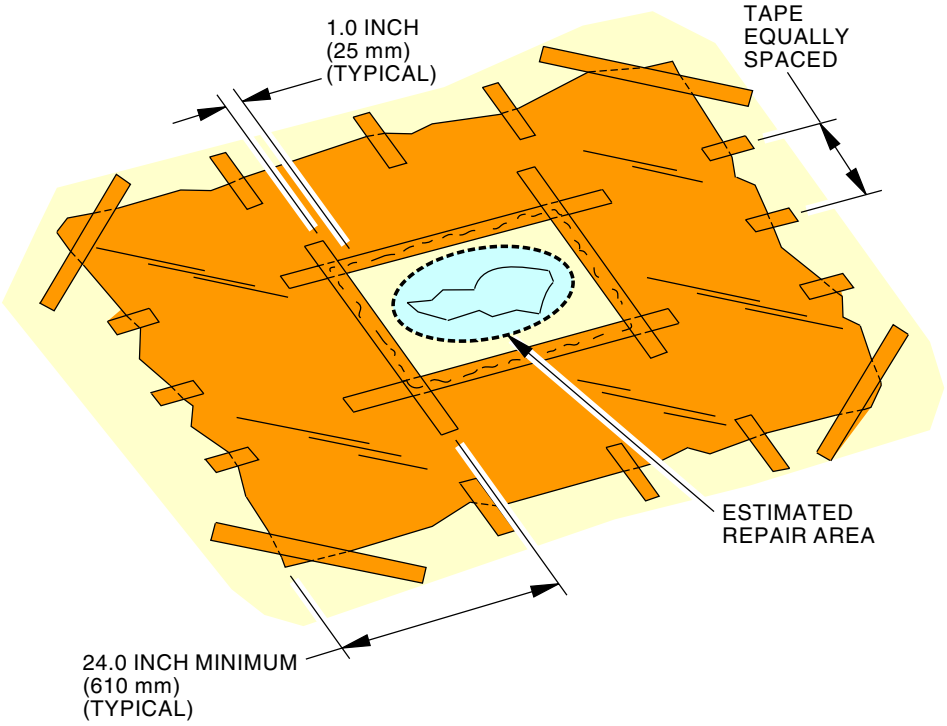
(a) On the flight compartment overhead panel, P5, remove the DO-NOT-OPERATE tag from the applicable engine Start/Ignition switch.

1) Put the applicable engine Start/Ignition switch to the NORM position.

(b) On the pilot's aisle control stand, remove the DO-NOT-OPERATE tag from the applicable Fuel Control switch.

1) Put the applicable Fuel Control switch to the CUTOFF position.

——— END OF TASK ———



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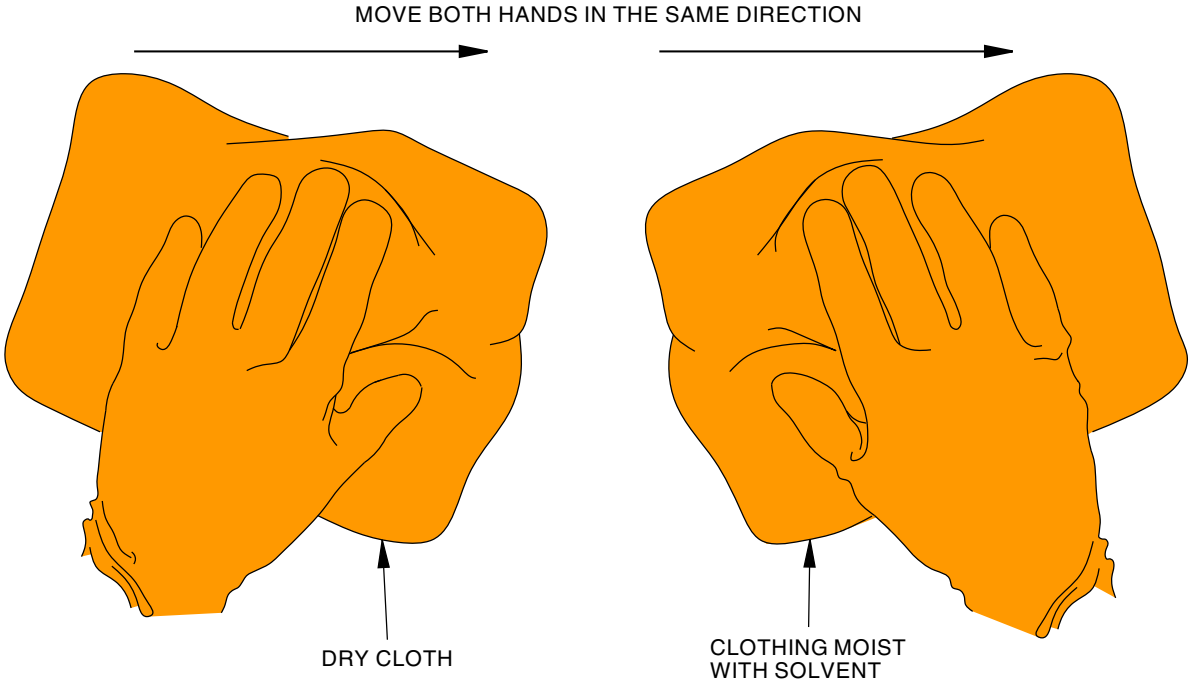
Masking Around the Damaged Area
Figure 201/70-46-01-990-801-H00



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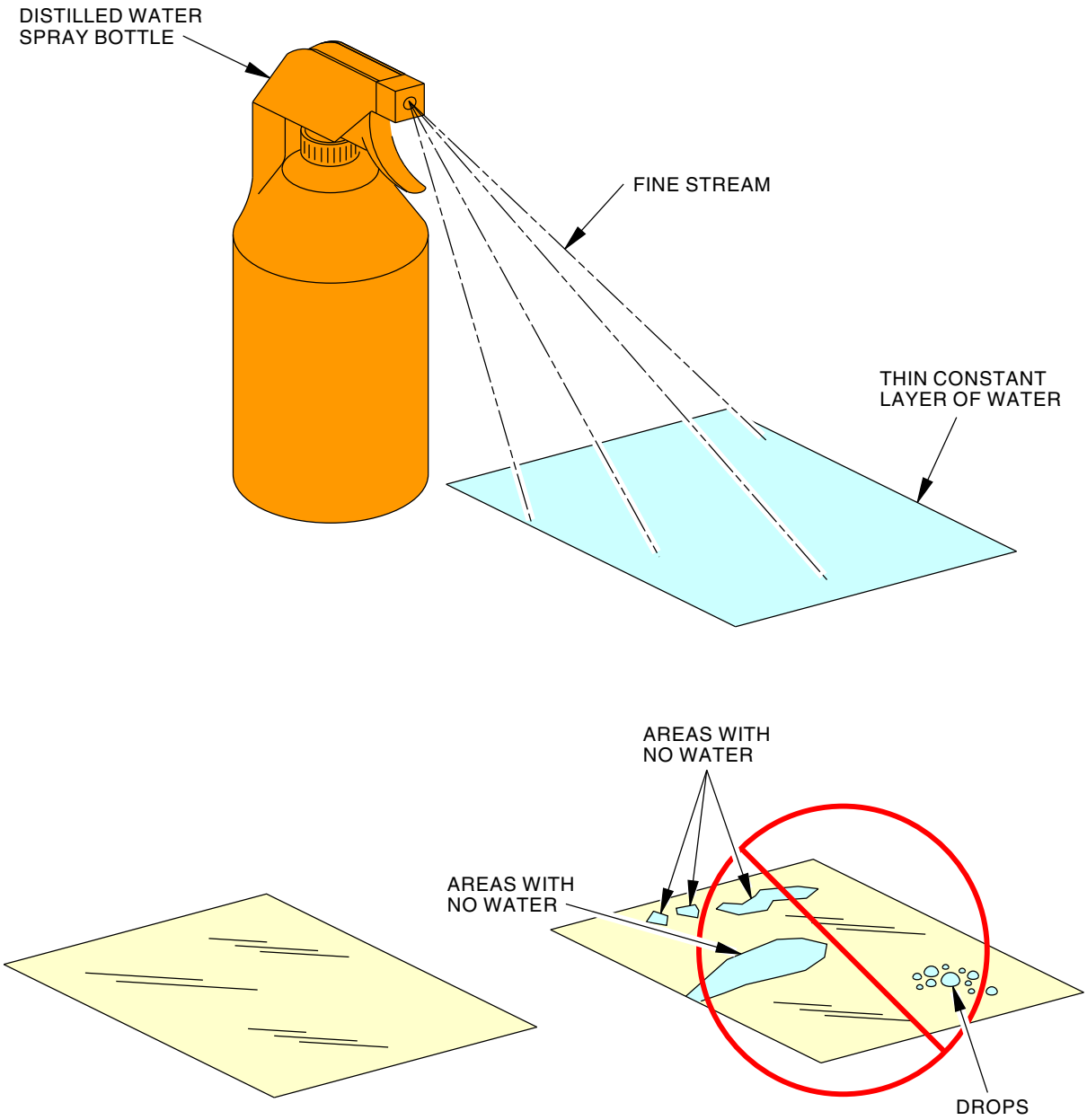
Two-Cloth Cleaning Method
Figure 202/70-46-01-990-802-H00



Water Break Test
Figure 203/70-46-01-990-803-H00

REPAIR OF BLIND THREADED HOLES IN ALUMINUM CASTINGS

1. General

A. This procedure has one task:

(1) Repair of blind threaded holes in aluminum castings.

TASK 70-48-09-900-801-H01

2. Repair of Blind Threaded Holes in Aluminum Castings

A. General

(1) This task gives the instructions to repair a blind threaded hole in an aluminum casting.

(2) You can repair a blind threaded hole in an aluminum casting when there is sufficient wall thickness in the part. The procedure is almost the same as the installation of a threaded insert into a hole. You must prepare the threaded hole and make a threaded plug.

B. References

Reference	Title
70-43-07-900-801-H01	Chemical Touch Up for Aluminum (P/B 201)
70-43-17-900-801-H01	Epoxy Repair of Mating Surfaces and Inserts (P/B 201)

C. Tools/Equipment

Reference	Description
STD-293	Drill - Tap
STD-864	Tap - Bottoming

D. Consumable Materials

Reference	Description	Specification
A01059 [C01-011]	Paste - Adhesive, Two Part (Hysol EA 934NA)	A50TF94 Class B
D00656 [C02-047]	Lubricant - Cutting Fluid - Cimperial 1070	

E. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

F. Procedure

SUBTASK 70-48-09-320-001-H01

(1) Do these steps to repair a damaged blind threaded hole in an aluminum casting (Figure 201):

(a) Prepare the threaded hole:

1) Use a tap drill, STD-293 with Cimperial 1070 lubricant, D00656 [C02-047] and drill out all the damage.

a) After you use the tap drill, make sure that there is a minimum wall thickness of 0.125 inch (3.180 mm).

b) Make sure that the tapped bushing has a minimum wall thickness of 0.063 inch (1.600 mm).

2) Visually align the centerline of the tap drill, STD-293 with the centerline of the damaged hole.

3) Set the drill perpendicular to the hole, and drill out the boss to the depth of the original hole.

4) Tap the hole in two operations:
   a) Use a plug tap of the correct size to start the threads.
   b) Use a bottoming tap, STD-864 tap to continue the threads to the bottom of the hole.
5) Use a vacuum to remove all the loose metal particles from the hole.

(b) Make a threaded plug:

NOTE: This procedure gives instructions to make a threaded plug from Aluminum, AMS 4117, 4218, or 4219, or Aluminum bronze , AMS 4640.

1) Machine a plug to the correct diameter and length to fit in the threaded hole.
   a) Make sure that the completed length of the plug is a minimum of 0.10 inch (2.54 mm) longer than the threaded depth of the hole.
2) Thread the plug.
3) Chamfer one end of the plug.
4) The steps that follow are optional:
   a) Drill a pilot hole through the full length of the plug along its axial centerline.
   b) The diameter of the hole must be smaller than the tap drill, STD-293 that you will use to make the final internal threads of the bushing. Make sure that the diameter of the hole is sufficiently large to use as a pilot hole.
   c) Make sure that the hole is concentric to a maximum of 0.007 inch (0.180 mm) with the external thread diameter.

      NOTE: The pilot hole will be a vent when the plug is installed into the boss.

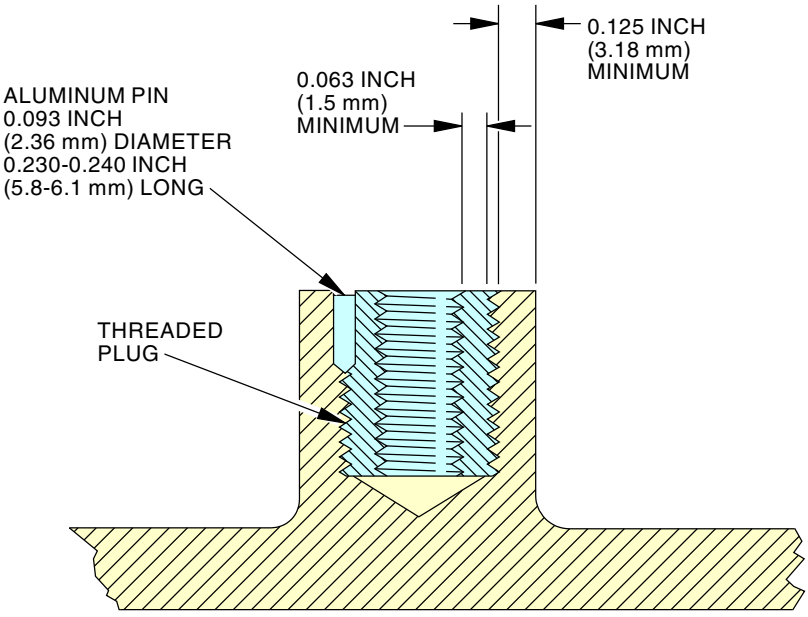
   d) Make a cut or mill a diametrical slot in the unchamfered end of the plug, not less than 0.063 inch (1.600 mm) in depth. You do this step to let you use a screwdriver to assemble the parts.
5) Use a vacuum to remove all loose metal particles from the plug.

(c) Install the threaded plug into the tapped hole.

1) Put a light layer of Hysol EA 934NA adhesive paste, A01059 [C01-011](TASK 70-43-17-900-801-H01) on the plug and threaded hole.
2) Install the plug into the threaded hole until the plug bottom touches the bottom of the threaded hole.
3) Immediately remove the unwanted Hysol EA 934NA adhesive paste, A01059 [C01-011].
4) Let the Hysol EA 934NA adhesive paste, A01059 [C01-011] on the threads dry for 24 hours at room temperature.
5) Machine the plug flush with the face of the boss.
6) Drill a hole of 0.093-0.094 inch (2.360-2.390 mm) diameter and 0.250-0.260 inch (6.350-6.600 mm) in depth at the pitch line of the threaded hole and plug.
7) Use a vacuum to remove all loose metal particles from the hole.
8) Machine an aluminum (AMS 4218, 4219, or AMS 4640) pin with a diameter of 0.093 inch (2.360 mm) and a length of 0.230-0.240 inch (5.840-6.100 mm).
9) Put the pin into the hole.
   a) Peen or stake the pin to keep it in the hole.
   b) Remove the high metal.

10) Use the tap drill, STD-293 and drill a hole in the same location and same dimension of the original threaded hole.
    a) Visually align the centerline of the tap drill, STD-293 with the centerline of the damaged hole.
    b) Set the drill perpendicular to the hole, and drill out the boss to the depth of the original hole.
    c) Make sure that the completed wall thickness of the bushing is a minimum of 0.063 inch (1.60 mm).
11) Make a chamfer and tap the hole to the dimension of the original threaded hole.
    a) Use a plug tap of the correct size to start the threads.
    b) Use a bottoming tap, STD-864 to continue the threads to the bottom of the hole.
    c) Use a vacuum to remove all loose metal particles from the hole.
12) Apply a finish to the repaired surfaces (TASK 70-43-07-900-801-H01).
13) If it is necessary, do a pressure check of the part(s).
    a) Make sure that there are no leaks.

——— END OF TASK ———



NOTE:

DRILL TO THE DEPTH OF THE ORIGINAL HOLES.

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Repair of Blind Threaded Holes
Figure 201/70-48-09-990-801-H01

REPAIR OF THREADED THROUGH-HOLES IN ALUMINUM CASTINGS

1. General

A. This procedure has one task:

(1) Repair of threaded through-holes in aluminum castings.

TASK 70-48-10-900-801-H01

2. Repair of Threaded Through-Holes in Aluminum Castings

A. General

(1) This task gives instructions to repair a threaded through-hole in an aluminum casting.

(2) You can repair a threaded through-hole in an aluminum casting when there is sufficient wall thickness in the part.

B. References

Reference	Title
70-43-07-900-801-H01	Chemical Touch Up for Aluminum (P/B 201)
70-43-17-900-801-H01	Epoxy Repair of Mating Surfaces and Inserts (P/B 201)

C. Tools/Equipment

Reference	Description
STD-293	Drill - Tap

D. Consumable Materials

Reference	Description	Specification
A01059 [C01-011]	Paste - Adhesive, Two Part (Hysol EA 934NA)	A50TF94 Class B
D00656 [C02-047]	Lubricant - Cutting Fluid - Cimperial 1070	

E. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

F. Procedure

SUBTASK 70-48-10-869-001-H01

(1) Prepare the threaded hole (Figure 201).

(a) Use a tap drill, STD-293 with Cimperial 1070 lubricant, D00656 [C02-047] and drill out all the damage.

1) Make sure that the tap drill, STD-293 is sufficiently large to accept a tapped bushing with a wall thickness a minimum of 0.063 inch (1.600 mm).

2) Make sure that there is a minimum wall thickness of 0.125 inch (3.180 mm) after you drill the hole.

(b) Visually align the centerline of the tap drill, STD-293 with the centerline of the damaged hole.

(c) Set the drill perpendicular to the hole and drill through the full depth of the boss.

(d) Use a vacuum to remove all the loose metal particles from the work area.

(e) Use a plug tap of the correct size to tap the hole until all the truncated threads of the tap extend through the bottom surface of the casting.

SUBTASK 70-48-10-869-002-H01

(2) Make a threaded plug (Figure 201).

NOTE: This procedure gives instructions to make a threaded plug from aluminum, AMS 4117, 4218, or 4219, or aluminum bronze , AMS 4640.

(a) Machine a plug to the correct diameter and length to fit in the threaded hole.

1) Make sure that the completed length of the plug is a minimum of 0.10 inch (2.54 mm) longer than the threaded depth of the hole.

(b) Thread the plug.

(c) Chamfer one end of the plug.

(d) The steps that follow are optional:

1) Drill a pilot hole through the full length of the plug along its axial centerline.

2) The diameter of the hole must be smaller than the tap drill, STD-293 that you will use to make the final internal threads of the bushing. Make sure that the diameter of the hole is sufficiently large to use as a pilot hole.

3) Make sure that the hole is concentric to a maximum of 0.007 inch (0.180 mm) with the external thread diameter.

4) Make a cut or mill a diametrical slot in the unchamfered end of the plug, not more than 0.063 inch (1.600 mm) in depth. You do this step to let you use a screwdriver to assemble the parts.

(e) Use a vacuum to remove all loose metal particles from the work area.

SUBTASK 70-48-10-420-001-H01

(3) Install the threaded plug into the tapped hole (Figure 201).

(a) Put a light layer of Hysol EA 934NA adhesive paste, A01059 [C01-011](TASK 70-43-17-900-801-H01) on the plug and threaded hole.

(b) Install the plug into the threaded hole until the bottom of the plug is flush with the bottom surface of the casting.

(c) Immediately remove the unwanted Hysol EA 934NA adhesive paste, A01059 [C01-011].

(d) Let the Hysol EA 934NA adhesive paste, A01059 [C01-011] on the threads dry for 24 hours at room temperature.

(e) Machine the plug flush with the face of the boss.

(f) Drill a hole of 0.093-0.094 inch (2.360-2.390 mm) diameter and 0.250-0.260 inch (6.350-6.600 mm) in depth at the pitch line of the threaded hole and plug.

(g) Use a vacuum to remove all loose metal particles from the hole.

(h) Machine an aluminum (AMS 4218, 4219, or AMS 4640) pin with a diameter of 0.093 inch (2.36 mm) and a length of 0.23-0.24 inch (5.84-6.10 mm) long.

(i) Put the pin into the hole.

1) Peen or stake the pin to keep it in the hole.

2) Remove the high metal.

(j) Use the tap drill, STD-293 and drill a hole in the same location and same dimension of the original threaded hole.

1) Visually align the centerline of the tap drill, STD-293 with the centerline of the damaged hole.

2) Set the drill perpendicular to the hole, and drill the hole through the boss.

3) Make sure that the completed wall thickness of the bushing is a minimum of 0.063 inch (1.600 mm).

(k) Make a chamfer at the top of the hole to let the plug tap start easily.

1) Use a plug tap of the correct size to tap the hole until all truncated threads of the tap extend through the bottom surface of the casting.

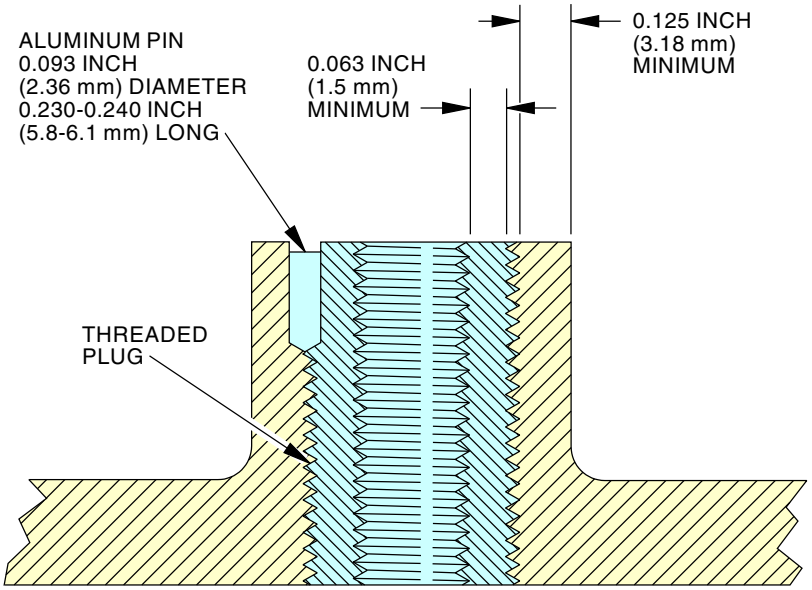
2) Use a vacuum to remove all loose metal particles from the work area.

(l) Apply a finish to the repaired surfaces (TASK 70-43-07-900-801-H01).

(m) If it is necessary, do a pressure check of the part(s).

1) Make sure that there are no leaks.

——— END OF TASK ———



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Repair of Open or Through Threaded Holes
Figure 201/70-48-10-990-801-H01

SHANK NUT - REPAIRS

1. General

A. This procedure has one task.

(1) Shank Nut Repair.

TASK 70-48-13-300-801-H00

2. Shank Nut Repair

(Figure 801)

A. General

(1) This procedure gives the instructions to repair shank nuts that are damaged more than the approved limits.

B. Procedure

SUBTASK 70-48-13-300-001-H00

(1) Repair the shank nut as follows:

(a) Remove the shank nut from its mounting flange as follows:

1) Set the correct size drill into the bottom of the shank nut.

2) Remove the shank nut.

(b) Remove the burrs from around the shank nut hole.

(c) Remove the dirt from around the shank nut hole.

(d) Put a new shank nut into the hole.

NOTE: Make sure that the shank nut is set to not turn.

NOTE: Make sure that the face of the shank nut is on the flange fully.

(e) Set the flaring tool until you find the pilot hole on the shank nut.

(f) Apply pressure to keep the shank nut in its position. Turn the flared point into its position.

(g) Flare the shank nut until the axial movement is 0.005 in. (0.13 mm) or less.

1) Examine the shank nut with a 0.005 in. (0.13 mm) shim.

NOTE: The shim can go in tightly.

(h) Thread a bolt completely through the shank nut and then remove the bolt.

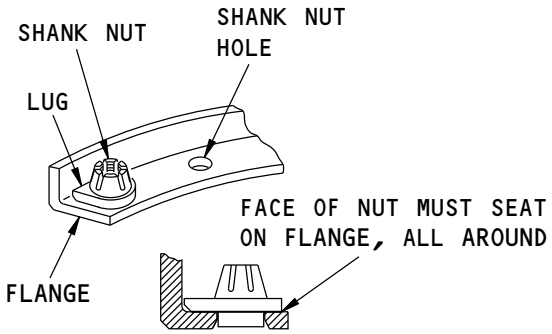
(i) Examine the space between the shank nut and the flange again with the 0.005 in. (0.13 mm) shim.

1) Make sure the maximum axial spacing is 0.005 in. (0.13 mm) or less.

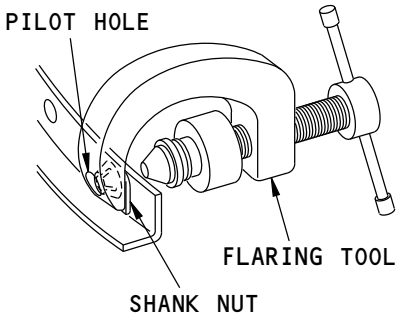
END OF TASK

1 REMOVE BURRS AND DIRT FROM SHANK NUT HOLES IN FLANGE.

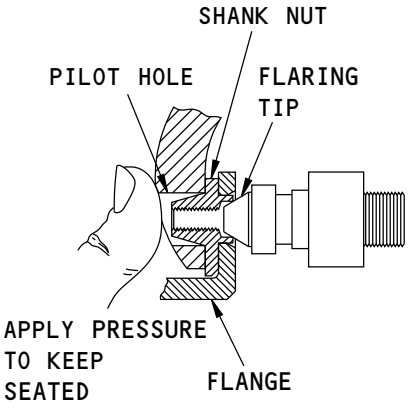
2 PLACE SHANK NUT INTO HOLE. BE SURE LUG IS LOCATED TO KEEP SHANK NUT FROM TURNING.



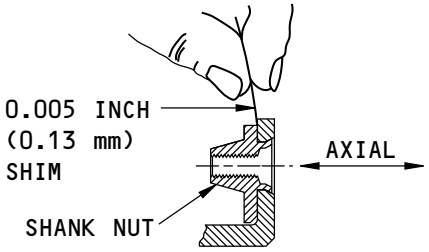
3 POSITION FLARING TOOL SO THAT PILOT HOLE IS LOCATED ON SHANK NUT.



4 APPLY PRESSURE TO KEEP SHANK NUT SEATED WHILE SCREWING FLARING TIP INTO PLACE.



5 FLARE THE SHANK NUT UNTIL AXIAL MOVEMENT IS 0.005 INCH (0.13 mm) OR LESS. SHIM MAY ENTER TIGHTLY.



6 THREAD A BOLT COMPLETELY THROUGH THE SHANK NUT. REMOVE THE BOLT.

7 INSPECT THE SHANK NUT PER SHANK NUT INSPECTION LIMITS.

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Shank Nut Repair
Figure 801/70-48-13-990-801-H00

ROSAN STUDS REPLACEMENT - MAINTENANCE PRACTICES

1. General

A. This procedure has two tasks:

(1) The removal of a rosan stud

(2) The installation of a rosan stud.

TASK 70-48-16-000-801-H00

2. Rosan Studs Removal

(Figure 201 and Figure 202)

A. General

(1) This procedure contains one task, the removal of a defective rosan stud.

(2) You must have the correct size replacement stud and the correct tools for this task.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-48-16-480-001-H01

(1) Measure the stud to get the correct size replacement stud.

SUBTASK 70-48-16-020-001-H01

(2) Do these steps to remove the stud:

(a) Carefully align the axis of the stud with the drill press spindle.

(b) Use a clamp to hold the part to the drill press table.

(c) Install the removal tool into the chuck of the drill press.

(d) Set the spindle speed at 300-700 rpm.

(e) Lower the removal tool on the top of the stud shank before you start the drill.

(f) Start the drill.

NOTE: Do not retract the spindle.

(g) Mill the lockring.

NOTE: Do not mill fully through the lockring.

1) Mill only through the flange of the insert with serrations.

NOTE: Do not mill through the second flange.

2) Lift the drill from the part frequently to let the metal particles clear from the cutting teeth.

(h) Turn the stud counterclockwise until the threads push on the lower surface of the lockring.

(i) Continue to turn the stud until the lockring is pushed out.

(j) If you milled the lockring completely through and could not lift it out with the stud, do these steps:

1) Break the lockring with a punch.

2) Remove the lockring.

——— END OF TASK ———

STANDARD STUD SIZES		ROSAN TOOL PART NUMBER		
STUD END DIAMETER INCH (mm)	NUT END DIAMETER INCH (mm)	REMOVAL TOOL	WRENCH	DRIVE TOOL
0.190 (4.83)	0.164 (4.17)	SM81-16	R1103W	S81D10
0.250 (6.35)	0.164 (4.17)	SM81-16	R1103W	S81D10
0.250 (6.35)	0.190 (4.83)	SM91-16	R1104W	S91D10
0.3125 (7.94)	0.190 (4.83)	SM91-16	R1104W	S91D10
0.3125 (7.94)	0.250 (6.35)	SM101-18	R1105W	S101D12
0.375 (9.53)	0.250 (6.35)	SM101-18	R1105W	S101D12
0.375 (9.53)	0.3125 (7.94)	SM111-20	R1106W	S111D12
0.4375 (11.11)	0.3125 (7.94)	SM111-20	R1106W	S111D12
0.4375 (11.11)	0.375 (9.53)	SM121-22	R1107XW	S121D12
0.500 (12.70)	0.4375 (11.11)	SM131-24	R1108W	S131D14
0.5625 (14.29)	0.500 (12.70)	SM141-25	R1110W	S141D14

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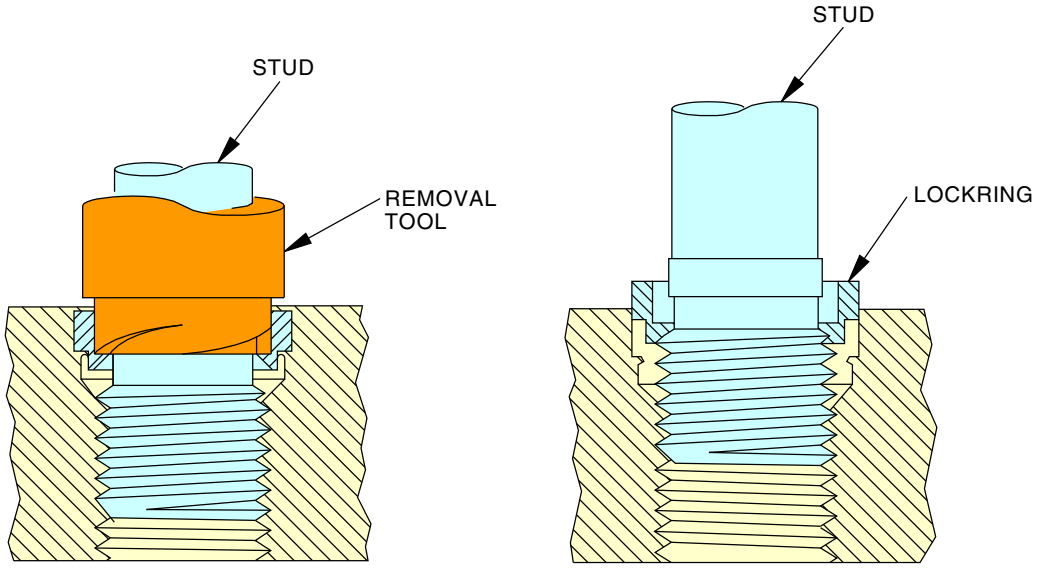
Rosan Stud Sizes and Tools
Figure 201/70-48-16-990-801-H01



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Rosan Stud Removal
Figure 202/70-48-16-990-802-H01

TASK 70-48-16-400-802-H01

3. Rosan Studs Installation

A. General

(1) This procedure contains one task, the installation of a rosan studs.

B. References

Reference	Title
70-43-07-900-801-H01	Chemical Touch Up for Aluminum (P/B 201)

C. Consumable Materials

Reference	Description	Specification
C00941 [C03-001]	Primer - Zinc Chromate	TT-P-1757, Type 1 or 2, Class C or Class N, AMS 3110 Color Y
C00943 [C03-006]	Coating - Chemical Conversion - Bonderite M-CR 1200S Aero (Formerly Alodine 1200S)	

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-48-16-210-001-H01

(1) Make sure that the hole with the threads is clear and is not damaged.

(a) It is permitted for a maximum of one full thread to be missing.

SUBTASK 70-48-16-320-001-H01

(2) Put a new finish on the hole with Bonderite M-CR 1200S Aero coating, C00943 [C03-006](TASK 70-43-07-900-801-H01).

SUBTASK 70-48-16-370-001-H01

WARNING

DO NOT GET ZINC CHROMATE PRIMER IN YOUR MOUTH, OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM ZINC CHROMATE PRIMER. MAKE SURE THAT YOUR WORK AREA HAS SUFFICIENT AIRFLOW. YOU MUST WEAR PROTECTIVE SPLASH GOGGLES, AN APRON, LONG SLEEVES, AND GLOVES. IF YOU USE A GALLON OR MORE OF THE ZINC CHROMATE PRIMER, YOU MUST ALSO USE A RESPIRATOR. KEEP ZINC CHROMATE PRIMER AWAY FROM SPARKS, FLAME AND HEAT. ZINC CHROMATE PRIMER IS POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONS. IF THE ZINC CHROMATE PRIMER TOUCHES YOUR SKIN, CLEAN THE AREA WITH SOAP AND WATER. IF IRRITATION CONTINUES, GET MEDICAL AID. THIS PRIMER CONTAINS CHROMATES. MAKE SURE THAT YOU FOLLOW THE APPROVED WASTE DISPOSAL PROCEDURES.

(3) Put a layer of the primer, C00941 [C03-001] on the stud end threads.

SUBTASK 70-48-16-420-001-H01

CAUTION

MAKE SURE THAT YOU KNOW THE LOCATION OF THE FLANGE WHEN YOU INSTALL THE HYDRAULIC RING LOCKED STUDS. MAKE SURE THAT THE DRIVE TOOL FOR THE LOCK RING WILL NOT TOUCH THE SURFACE A. DO NOT HIT OR PUT PRESSURE ON THE SURFACE. YOU CAN CAUSE DAMAGE TO THE THREADS IN THE MATERIAL OR MAKE THE PART LOOSE.

(4) Do these steps to install the rosan stud (Figure 203):

NOTE: Replace the rosan studs and the lock ring with the same size parts as those removed. Make sure that you install the parts in the same manner as the original installation.

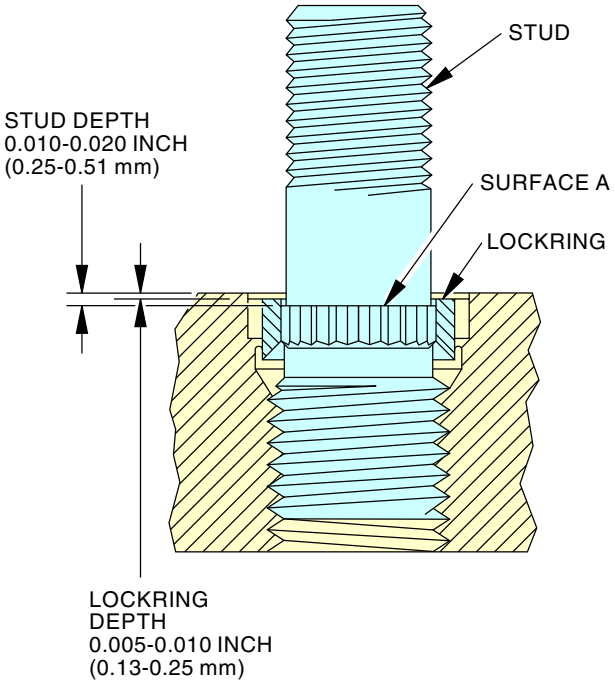
(a) Make sure that you do not hit or cause pressure on the surface A.

(b) Install the stud to the correct depth with the applicable wrench before the primer dries.

(c) Make sure that the external serrations do not align with the serrations in the parent material. You can turn the new lock ring to prevent this position.

(d) Install the lock ring to the correct depth with the applicable drive tool.

END OF TASK



002C7P-297700
M06330 S0004285424_V2

Rosan Stud Installation
Figure 203/70-48-16-990-804-H01

ROSAN RING LOCKED INSERT REPLACEMENT - MAINTENANCE PRACTICES

1. General

A. This procedure has six tasks:

(1) A removal of a rosan ring locked insert

(2) An alternate removal procedure of a rosan ring locked insert

(3) An installation of a rosan ring locked insert

(4) An alternative installation procedure of a rosan ring locked insert

(5) A second alternative installation procedure of a rosan ring locked insert

(6) Repair of an aluminum part with damaged internal threads.

TASK 70-48-19-000-801-H01

2. Rosan Ring Locked Insert Removal

A. General

(1) This procedure contains one task, the removal of a defective rosan ring locked insert.

(2) The ring locked inserts are installed on the gearbox and the accessories.

(3) You can replace the insert without damage to the threads of the parent material. Rosan inserts use a ring with serrations to tighten and lock the insert in its position. You must use over-sized parts for the replacement of the insert only if there is very bad damage.

(4) This procedure refers to the rosan ring locked insert as the insert.

B. Consumable Materials

Reference	Description	Specification
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-48-19-020-001-H01

(1) Do these steps to remove the insert.

(a) Use a plug, or Scotch Flatback Masking Tape 250, G00270 to seal the openings in the assembly to prevent contamination.

(b) Get the correct dimension drill bit (Figure 201).

(c) Use a clamp to hold the part to the drill press table.

(d) Install the drill bit into the chuck of the drill press (Figure 201).

(e) Carefully align the drill with the centerline of the insert.

(f) Set the spindle speed at 300-700 rpm.

(g) Drill through the lockring and the neck of the insert to break the serration interlock Figure 201 and (Figure 202).

NOTE: Make sure that you do not drill more than the depth of the counterbore in the parent material.

(h) Use a drill stop to stop the drill at or before the depth of the counterbore.

(i) Put a square screw extractor into the insert.

NOTE: When you turn the insert, the sides of the insert will lift up the lockring. The lockring will lift up when you continue the turn the insert. You can then remove the insert.

(j) Turn the extractor to remove the insert (Figure 202).

(k) Do these steps if you drilled the lockring through and could not lift it with the insert:

1) Break the lockring with a punch.

2) Remove the lockring.

(l) Remove the burrs in the counterbore area and clean the hole.

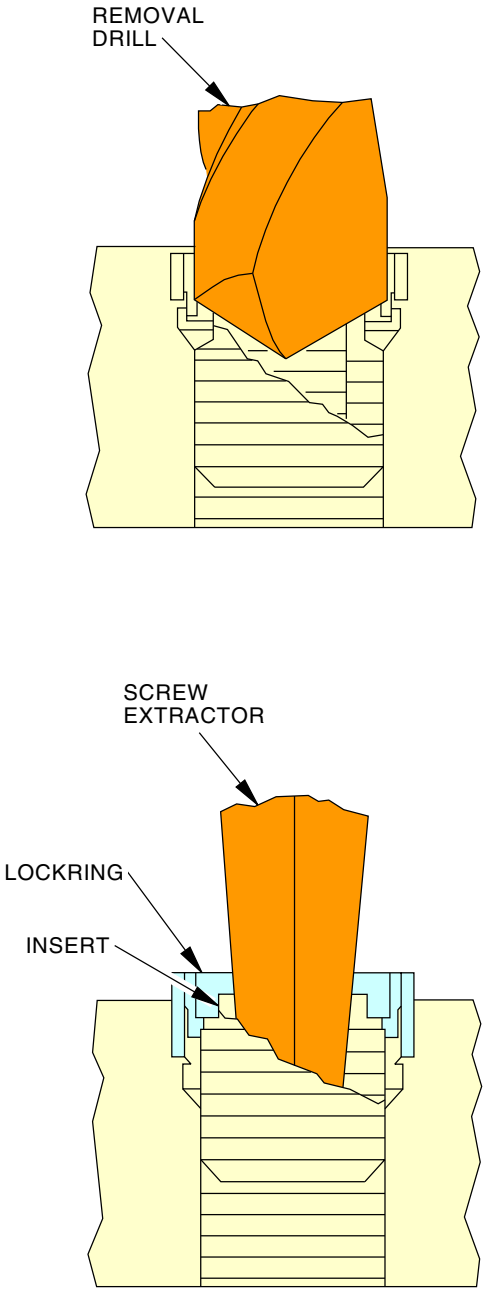
——— END OF TASK ———

INSERT DASH NUMBER MSS7997	STEP DRILL		WRENCH	LOCKRING DRIVE TOOL	REMOVAL DRILL SIZE (INCH)
	ALUMINUM	MAGNESIUM			
-102 -202	RCADC16-149 RDADC16-149	RCADC16-149 RDADC16-149	R1102W R1102W	R102D R102D	7/32
-103 -203	RCADC18-177 RCADC18-177	RCADC18-177 RCADC18-177	R1103W R1103W	R103D R103D	1/4
-104 -204	RCADC21-201 RCADC21-201	RCADC21-201 RCADC21-201	R1104W R1104W	R104D R104D	19/64
-105 -205	RCADC24-257 RCADC24-257	RCADC24-257 RCADC24-257	R1105W R1105W	R105D R205D	F
-106 -206	RCADC28-312 RCADC28-312	RCADC28-312 RCADC28-312	R1106W R1106W	R106D R206D	5/16
-107 -207	RCADC33-422 RCADC33-422	RCADC33-422 RCADC33-422	R1107XW R1107XW	RA107D RA207D	V
-108 -208	RCADC38-484 RCADC38-484	RCADC38-484 RCADC38-484	R1108W R1108W	R108D R208D	29/64
-109 -209	RCADC47-531 RCADC47-531	RCADC47-531 RCADC47-531	R1110W R1110W	R109D R209D	9/16
-110 -210	RCADC56-641 RCADC56-841	RCADC56-641 RCADC56-641	R1111W R1111W	R110D R210D	11/16
-311	RCADC64-796	RCADC64-796	R1112W	R211D	25/32
-312	RCADC72-921	RCADC72-921	R1113W	R212D	57/64
-312.1	RCADC72-906	RCADC72-906	R1113W	R212D	57/64
-313	RCADC82-1031	RCADC82-1031	R1114W	R213D	1-1/32
-314	RCADC90-1156	RCADC90-1156	R1115W	R214D	1-11/64
-315	RCADC100-1281	RCADC100-1281	R1116W	R315D	1-9/32

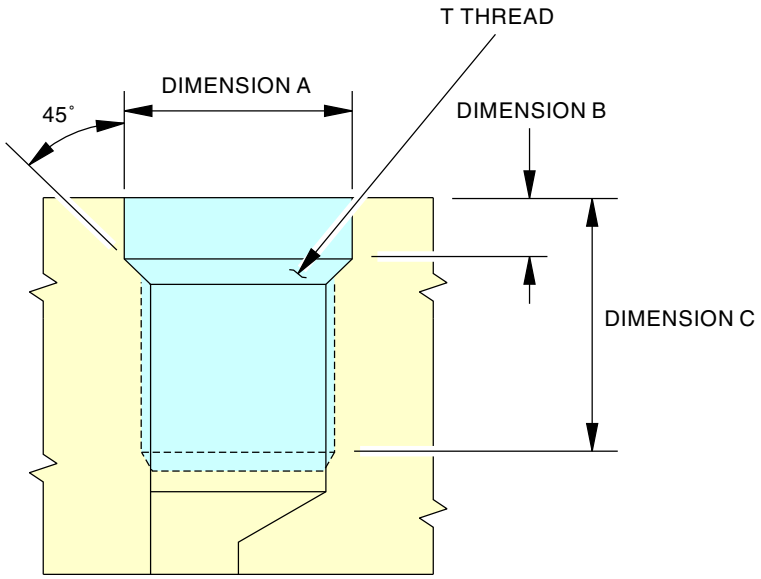
TOOLING FOR MS51991 INSERTS

M06331 S0004285425_V2

MS51991 Inserts Tool
Figure 201/70-48-19-990-801-H01



Insert Removal
Figure 202/70-48-19-990-802-H01



M06333 S0004285427_V2

Insert and Hole Preparation
Figure 203/70-48-19-990-803-H01 (Sheet 1 of 2)

MS INSERT PART NUMBER	THREAD T NATIONAL CLASS 3	COUNTERBORE DEPTH +0.030 INCH (+0.76 mm) -0.000 INCH (-0.00 mm) DIMENSION B	COUNTERBORE DEPTH +0.030 INCH (+0.76 mm) -0.000 INCH (-0.00 mm) DIMENSION A
MS51991E202	#10(.190)-24 NC	0.094 INCH (2.39 mm)	0.250 A11 0.258 MAG.
MS51991E203	#12(.216)-24 NC	0.109 INCH (2.77 mm)	0.281 A11 0.291 MAG.
MS51991E204	1/4(.250)-20 NC	0.109 INCH (2.77 mm)	0.328 A11 0.337 MAG.
MS51991E205	5/16(.3125)-18 NC	0.141 INCH (3.58 mm)	0.375 A11 0.381 MAG.
MS51991E206	3/8(.375)-16 NC	0.156 INCH (3.96 mm)	0.437 A11 0.448 MAG.
MS51991E207	1/2(.500)-13 NC	0.172 INCH (4.37 mm)	0.515 A11 0.526 MAG.
MS51991E208	9/16(.5625)-12 NC	0.172 INCH (4.37 mm)	0.593 A11 0.601 MAG.
MS51991E209	5/8(.625)-11 NC	0.218 INCH (5.54 mm)	0.734 A11 0.747 MAG.
MS51991E210	3/4(.750)-10 NC	0.203 INCH (5.16 mm)	0.875 A11 0.888 MAG.

MS INSERT PART NUMBER	MINIMUM FULL THREAD DIMENSION C
MS51991E202	0.285 INCH (7.24 mm)
MS51991E203	0.345 INCH (8.76 mm)
MS51991E204	0.415 INCH (10.54 mm)
MS51991E205	0.475 INCH (12.07 mm)
MS51991E206	0.535 INCH (13.59 mm)
MS51991E207	0.595 INCH (15.11 mm)
MS51991E208	0.655 INCH (16.64 mm)
MS51991E209	0.725 INCH (18.42 mm)
MS51991E210	0.785 INCH (19.94 mm)

STANDARD DIMENSION FOR HOLE PREPARATION

M06334 S0004285428_V2

Insert and Hole Preparation
Figure 203/70-48-19-990-803-H01 (Sheet 2 of 2)

TASK 70-48-19-000-802-H00

3. Rosan Ring Locked Insert Removal (Alternate Procedure)

(Figure 204 and Figure 205)

A. General

(1) This task provides the instructions on how to remove the rosan ring locked insert with an alternate procedure.

(2) The rosan ring locked insert is referred to as the insert.

B. Procedure

SUBTASK 70-48-19-030-001-H00

(1) Do these steps to remove the insert:

(a) If required, carefully remove the sealant to expose the lockring.

(b) Select the proper size removal tool.

NOTE: There is more than one removal tool. Make sure to use the correct tool (Figure 205).

(c) Spread the puller halves apart and retract the sleeve from the tool until the pin bottoms in the groove of the sleeve.

1) Hold the puller halves apart and place the protruding adapter so that the nylon pad rests on the top surface of the adapter.

2) Release the puller halves and locate in the groove of the lockring.

a) Adjustment up or down can be done by rotation of the bolt head.

3) Put the sleeve over the puller halves.

a) Examine for correct engagement of the puller halves in the lockring groove.

(d) Put the wrench on the bolt head of the removal tool.

1) Turn the wrench in a clockwise direction and hold the sleeve with the other hand.

NOTE: This step will cause the lockring to be jacked out of the port counterbore.

2) The rotation of the wrench can be stopped when the external serrations of the lockring are clear of the boss surface.

3) Remove the tool from the adapter.

a) Loosen the bolt and lift the sleeve to free the puller halves.

(e) Select the proper size wrench or combination wrench and drive tool.

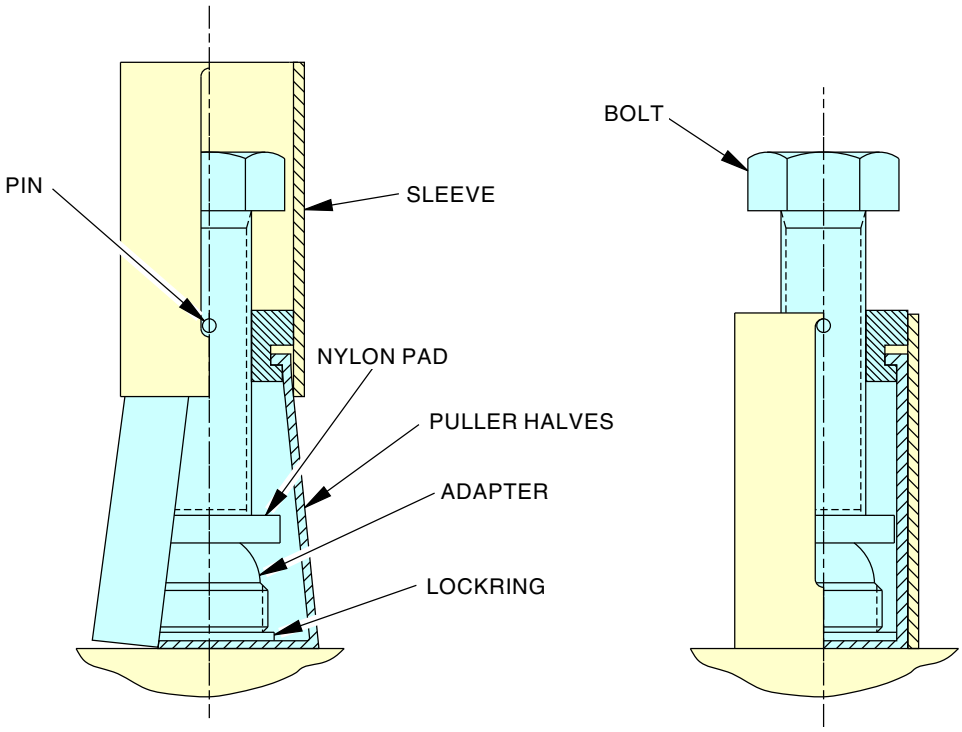
NOTE: There is more than one wrench, combination wrench and drive tool. Make sure you use the correct tool (Figure 205).

1) Engage the serrations of the wrench with those of the lockring.

2) Use an open end or socket wrench over hex on wrench and turn in a counterclockwise direction to disengage the adapter from the port.

3) Plug the port minor diameter when you clean out the cavity to avoid contamination of the system fluid.

——— END OF TASK ———



SLEEVE RETRACTED, PULLER HALVES READY TO BE LOCATED IN LOCKRING GROOVE

SLEEVE OVER PULLER HALVES READY FOR TORQUING BOLT

1257628-00
1394132 S0000252929_V2

Spreader Tool Installation
Figure 204/70-48-19-990-810-H00

ADAPTER PART NUMBER	PORTING TOOL	BASIC BROACH TOOL IMPACT TYPE 2	O-RING TOOL	WRENCH	LOCKING DRIVE TOOL	REMOVAL TOOL	COMBINATION WRENCH AND DRIVE TOOL	INSTALLATION TORQUE LBS. IN. (Nm)
RFGA9804-19	RPT04	RF0PB5004	ORT312	RF6904W	RF9804DEK	RF04LPDE	RF9804DW	50-65 (5.65-7.35)
RFGA9805-19	RPT05	RF0PB5005	ORT375	RF6905W	RF9805DEK	RF05LPDE	RF9805DW	100-125 (11.3-14.13)
RFGA9806-19	RPT06	RF0PB5006	ORT437	RF6906W	RF9806DEK	RF06LPDE	RF9806DW	140-200 (15.82-22.6)
RFGA9808-19	RPT08	RF0PB5008	ORT562	RF6908W	RF9808DEK	RF08LPDE	RF9808DW	270-375 (30.51-42.38)
RFGA9810-19	RPT10	RF0PB5010	ORT687	RF6910W	RF9810DEK	RF10LPDE	RF9810DW	620-700 (70.06-79.10)
RFGA9812-19	RPT12	RF0PB5012	ORT812	RF6912W	RF9812DEK	RF12LPDE	RF9812DW	855-945 (96.62-106.79)
RFGA9816-19	RPT16	RF0PB5016	ORT1125	RF6916W	RF9816DEK	RF16LPDE	RF9816DW	1140-1260 (128.82-142.38)

1393172 S0000252928_V1

Removal Tool Size Chart
Figure 205/70-48-19-990-811-H00

TASK 70-48-19-400-801-H01

4. Rosan Ring Locked Insert Installation

A. General

(1) This procedure contains one task, the installation of a rosan ring locked insert.

(2) The rosan ring locked insert is referred to as the insert.

B. Consumable Materials

Reference	Description	Specification
C00941 [C03-001]	Primer - Zinc Chromate	TT-P-1757, Type 1 or 2, Class C or Class N, AMS 3110 Color Y

C. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

D. Procedure

SUBTASK 70-48-19-210-001-H01

(1) Get the same dimension and type of insert and lockring as the ones that you remove.

NOTE: Rosan part numbers are interchangeable to the MS part numbers in the illustration.

(a) Use the last two numbers of the insert number to find the applicable lockring.

NOTE: If the insert part number is MS51991E206, use the lockring part number MS51990E106P.

SUBTASK 70-48-19-320-001-H01

(2) Prepare the hole in the parent material as specified in the data sheet table (Figure 206).

NOTE: The tap drill and counterbore must be concentric to 0.003 inch (0.008 mm) total indicator reading (TIR).

SUBTASK 70-48-19-320-002-H01

(3) If the parent material surface is not flat or is not normal to the axis of the hole, you must machine a spotface for correct lockring entry.

SUBTASK 70-48-19-480-001-H01

(4) Get the correct wrench (Figure 201).

SUBTASK 70-48-19-390-001-H01

WARNING

DO NOT GET ZINC CHROMATE PRIMER IN YOUR MOUTH, OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM ZINC CHROMATE PRIMER. MAKE SURE THAT YOUR WORK AREA HAS SUFFICIENT AIRFLOW. YOU MUST WEAR PROTECTIVE SPLASH GOGGLES, AN APRON, LONG SLEEVES, AND GLOVES. IF YOU USE A GALLON OR MORE OF THE ZINC CHROMATE PRIMER, YOU MUST ALSO USE A RESPIRATOR. KEEP ZINC CHROMATE PRIMER AWAY FROM SPARKS, FLAME AND HEAT. ZINC CHROMATE PRIMER IS POISONOUS AND FLAMMABLE, AND CAN CAUSE INJURIES TO PERSONS. IF THE ZINC CHROMATE PRIMER TOUCHES YOUR SKIN, CLEAN THE AREA WITH SOAP AND WATER. IF IRRITATION CONTINUES, GET MEDICAL AID. THIS PRIMER CONTAINS CHROMATES. MAKE SURE THAT YOU FOLLOW THE APPROVED WASTE DISPOSAL PROCEDURES.

(5) If the part is aluminum, apply primer, C00941 [C03-001] to the external threads of the insert.

NOTE: You must install the insert while the primer is wet.

SUBTASK 70-48-19-420-001-H01

CAUTION

MAKE SURE THAT YOU KNOW THE LOCATION OF THE FLANGE WHEN YOU INSTALL THE HYDRAULIC RING LOCKED STUDS. MAKE SURE THAT THE DRIVE TOOL FOR THE LOCK RING WILL NOT TOUCH THE SURFACE A. DO NOT HIT OR PUT PRESSURE ON THE SURFACE. YOU CAN CAUSE DAMAGE TO THE THREADS IN THE MATERIAL OR MAKE THE PART LOOSE.

(6) Install the insert into the machine.

(a) Make sure that you do not hit or put pressure on the surface A.

(b) Tap the cavity to the depth as shown in the illustration (Figure 207).

SUBTASK 70-48-19-420-002-H01

(7) Do these steps to install the lock ring.

(a) Get the correct drive tool (Figure 201).

(b) Install the lock ring to the correct depth with the applicable drive tool (Figure 207).

(c) If it is necessary, turn the new lockring to align the serration on the lockring with the serration of the parent material from the previous lockring.

——— END OF TASK ———

MS* PART NUMBER	ROSAN* PART NUMBER
MS51991-102	RJ102SB4
MS51991-103	RJ103SB5
MS51991-104	RJ104SB6
MS51991-105	RJ105SB7
MS51991-106	RJ106SB8
Ms51991-107	RAJ107SB9
MS51991-108	RJ108SB10
MS51991-109	RJ109SB11
MS51991-110	RJ10SB12
MS51991E102	RJ102SU4
MS51991E103	RJ103SU5
MS51991E104	RJ104SU6
MS51991E105	RJ105SU7
MS51991E106	RJ106SU8
MS51991E107	RAJ107SU9
MS51991E108	RJ108SU10
MS51991E109	RJ109SU11
MS51991E110	RJ110SU12

MS* PART NUMBER	ROSAN* PART NUMBER
MS51991-202	RJ202SB4
MS51991-203	RJ203SB5
MS51991-204	RJ204SB6
MS51991-205	RJ205SB7
MS51991-206	RJ206SB8
MS51991-207	RAJ207SB9
MS51991-208	RJ208SB10
MS51991-209	RJ209SB11
MS51991-210	RJ20SB12
MS51991E202	RJ202SU4
MS51991E203	RJ203SU5
MS51991E204	RJ204SU6
MS51991E205	RJ205SU7
MS51991E206	RJ206SU8
MS51991E207	RAJ207SU9
MS51991E208	RJ208SU10
MS51991E209	RJ209SU11
MS51991E210	RJ210SU12

MS* PART NUMBER	ROSAN* PART NUMBER
MS51991-311	RJ311SB14
MS51991-312	RJ312SB16
MS51991-312.1	RJ312SB16F
MS51991-313	RJ313SB18
MS51991-314	RJ314SB20
MS51991-315	RJ315SB22F
MS51991E311	RJ311SU14
MS51991E312	RJ312SU16
MS51991E312.1	RJ312SU16F
MS51991E313	RJ313SU18
MS51991E314	RJ314SU20
MS51991E315	RJ315SU22F

* ADD LETTER "L" TO "MS" PART NUMBER AND ROSAN PART NUMBER FOR INTERNAL THREAD LOCKING FEATURE. EXAMPLE: MS51991-102L = RJ102SB4L

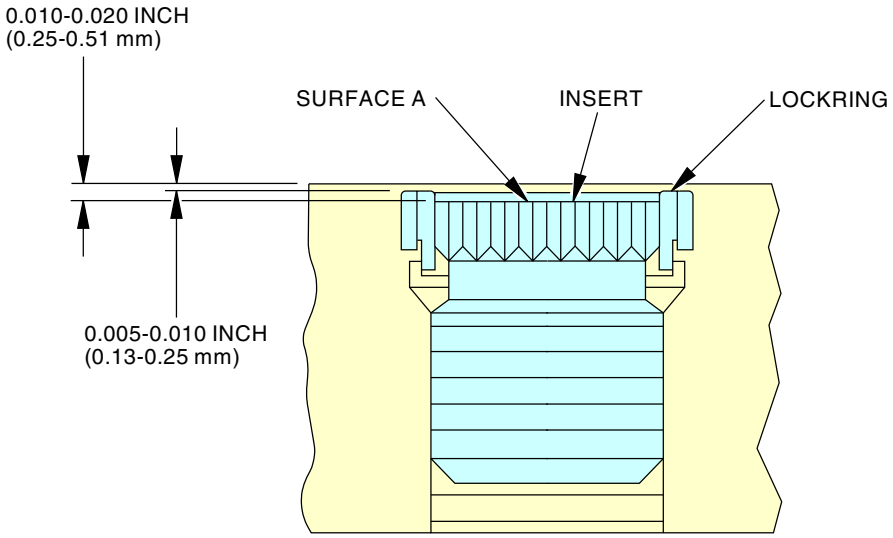
INTERCHANGEABILITY TABLES, MS VERSUS ROSAN
MS51991 INSERTS

MS INSERT PART NUMBER	MS LOCKRING PART NUMBER	ROSAN LOCKRING PART NUMBER
MS51991E202	MS51990E102P	RLRR16SU5
MS51991E203	MS51990E103P	RLRR18SU6
MS51991E204	MS51990E104P	RLRR21SU6
MS51991E205	MS51990E105P	RLRR24SU7
MS51991E206	MS51990E106P	RLRR28SU8
MS51991E207	MS51990E107P	RLRR33SU9
MS51991E208	MS51990E108P	RLRR38SU9
MS51991E209	MS51990E109P	RLRR47SU10
MS51991E210	MS51990E110P	RLRR56SU11

LOCKRING PART NUMBERS

M06335 S0004285429_V2

Insert and Lockring Part Numbers
Figure 206/70-48-19-990-808-H01



M06336 S0004285430_V2

Insert and Lockring Installation
Figure 207/70-48-19-990-809-H01

TASK 70-48-19-400-802-H00

5. Rosan Ring Locked Insert Installation (Alternate Procedure #1)

(Figure 208, Figure 209, Figure 210 and Figure 211)

A. General

(1) This procedure provides the instructions on how to install the rosan ring locked insert.

(2) The rosan ring locked insert is referred to as the insert.

B. Consumable Materials

Reference	Description	Specification
C00941 [C03-001]	Primer - Zinc Chromate	TT-P-1757, Type 1 or 2, Class C or Class N, AMS 3110 Color Y

C. Procedure

SUBTASK 70-48-19-430-001-H00

(1) Put the O-ring tool on the small thread of the adapter.

NOTE: There is more than one O-ring tool. Make sure to use the correct tool. Use the adapter that corresponds to the correct O-ring tool (Figure 211).

(a) Put the adapter, O-ring tool and O-ring in the fluid to be used in the system or a lubricant compatible with the system fluid and all components.

(b) Slide the O-ring on the O-ring tool and onto the adapter.

(c) Make sure that the O-ring is not twisted and is properly in place in the groove of the adapter.

SUBTASK 70-48-19-090-001-H00

(2) Remove the O-ring tool.

SUBTASK 70-48-19-490-001-H00

(3) Install the adapter assembly into the port.

SUBTASK 70-48-19-640-001-H00

(4) Lubricate the internal surfaces of the port and the entire adapter assembly.

(a) Use the same fluid used in the system or a lubricant compatible with the system fluid and all components.

(b) Scratches, dings or rough spots are not allowed in the O-ring contact area on the adapter or in the port.

SUBTASK 70-48-19-430-002-H00

(5) Insert the smaller thread of the adapter into the port by hand.

(a) Use a clockwise rotation until the adapter is in place.

(b) To avoid possible O-ring damage, the adapter should not be rotated in a counterclockwise direction.

SUBTASK 70-48-19-869-001-H00

(6) With the applicable wrench, engage the serrations of the tool with the external serrations of the adapter lockring.

(a) Put a torque wrench of the correct dimension on the hex of the wrench and apply a torque equal to the minimum value specified.

(b) Note the relationship of the lockring serrations with respect to the prebroached serrations in the port.

1) If they match, proceed to the next subtask.
2) If the lockring serrations do not match the prebroached serrations in the port, continue to slowly torque the adapter toward the maximum value allowed until the serrations match.
   a) This will normally take 3° and 8° of rotation.
3) The maximum torque value does not need to be reached if the serrations align before that value.
   a) Do not exceed maximum torque values.

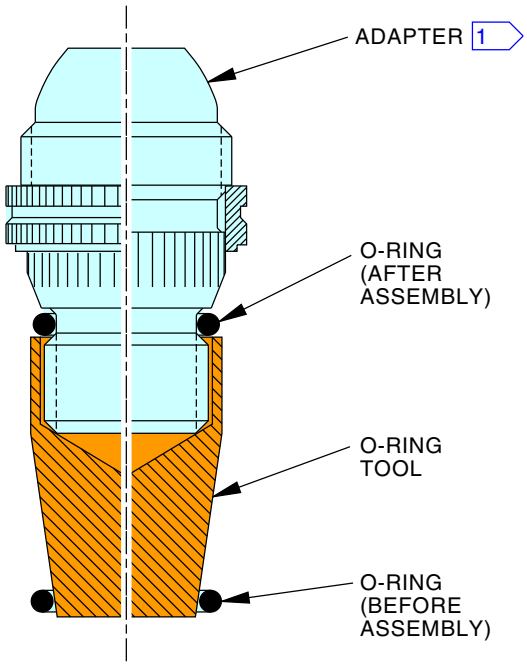
SUBTASK 70-48-19-620-001-H00

(7) Apply enough primer, C00941 [C03-001] with a brush or small syringe to the counterbore area of the port and below the adapter lockring.
   (a) Enough primer should be applied so that it will extrude out between the external serrations of the lockring and the serrations in the port when the lockring is installed.

SUBTASK 70-48-19-490-002-H00

(8) While the primer, C00941 [C03-001] is still wet, place the applicable size drive tool over the tube end of the adapter.
   (a) When it is properly located, it will rest on the lockring.
   (b) A hammer, arbor or hydraulic press may be used to press the lockring into the boss.
   (c) Installation is complete when the tool bottoms on the surface of the boss.

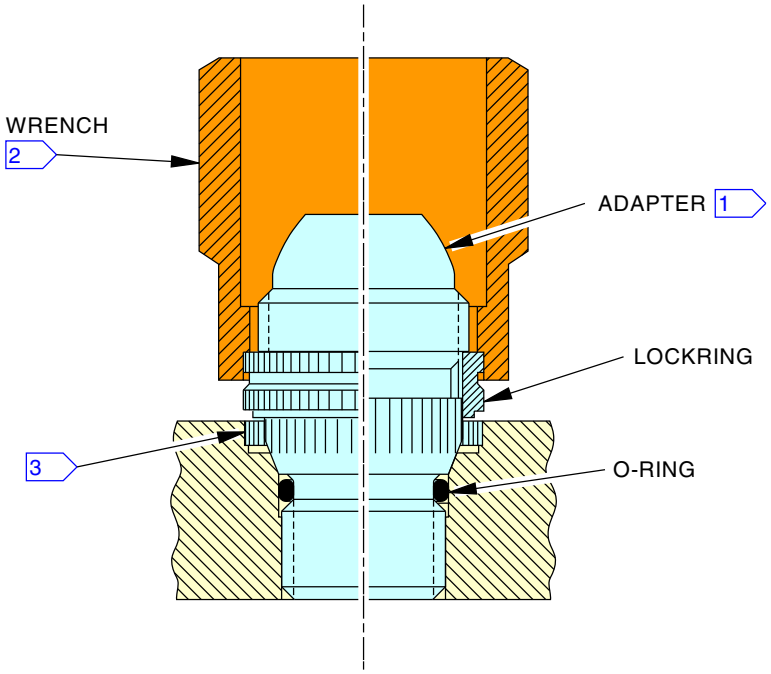
——— END OF TASK ———



1 P/N RFGA98XX-19

1393602 S0000252845_V2

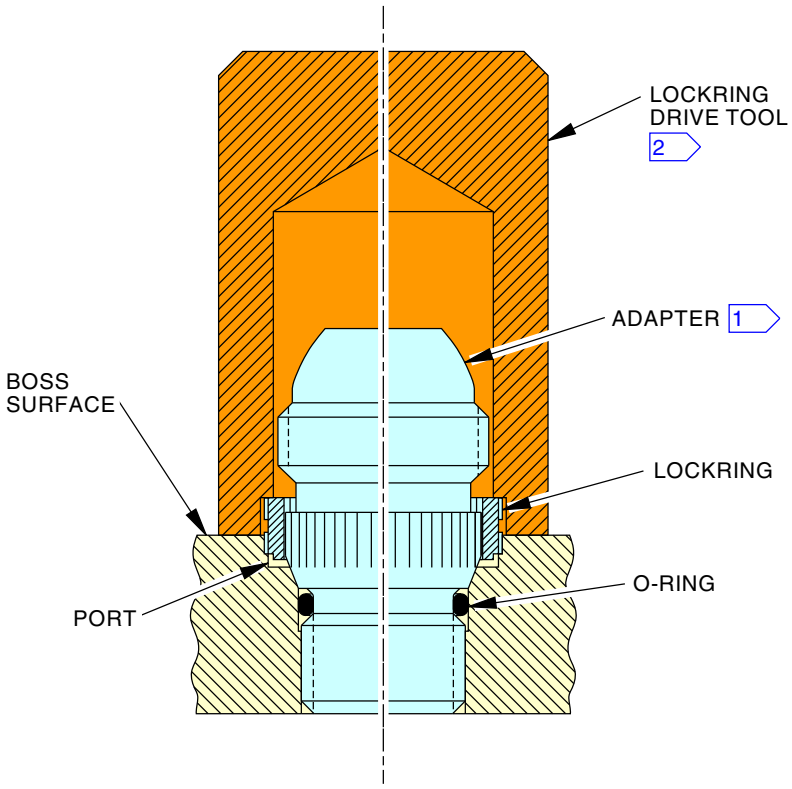
Adapter Installation
Figure 208/70-48-19-990-812-H00



1 P/N RFGA98XX-19
2 P/N RF69XXW
3 APPLY ZINC CHROMATE HERE AFTER ADAPTER IS TIGHTENED IN PLACE.

1393780 S0000252920_V2

Tool With the Adapter Lockring Installation
Figure 209/70-48-19-990-813-H00



1 P/N RFGA98XX-19
2 P/N RF98XXDEK

1393861 S0000252925_V2

Drive Tool With the Adapter Installation
Figure 210/70-48-19-990-814-H00

ADAPTER PART NUMBER	PORTING TOOL	BASIC BROACH TOOL IMPACT TYPE 2	O-RING TOOL	WRENCH	LOCKING DRIVE TOOL	REMOVAL TOOL	COMBINATION WRENCH AND DRIVE TOOL	INSTALLATION TORQUE LBS. IN. (Nm)
RFGA9804-19	RPT04	RF0PB5004	ORT312	RF6904W	RF9804DEK	RF04LPDE	RF9804DW	50-65 (5.65-7.35)
RFGA9805-19	RPT05	RF0PB5005	ORT375	RF6905W	RF9805DEK	RF05LPDE	RF9805DW	100-125 (11.3-14.13)
RFGA9806-19	RPT06	RF0PB5006	ORT437	RF6906W	RF9806DEK	RF06LPDE	RF9806DW	140-200 (15.82-22.6)
RFGA9808-19	RPT08	RF0PB5008	ORT562	RF6908W	RF9808DEK	RF08LPDE	RF9808DW	270-375 (30.51-42.38)
RFGA9810-19	RPT10	RF0PB5010	ORT687	RF6910W	RF9810DEK	RF10LPDE	RF9810DW	620-700 (70.06-79.10)
RFGA9812-19	RPT12	RF0PB5012	ORT812	RF6912W	RF9812DEK	RF12LPDE	RF9812DW	855-945 (96.62-106.79)
RFGA9816-19	RPT16	RF0PB5016	ORT1125	RF6916W	RF9816DEK	RF16LPDE	RF9816DW	1140-1260 (128.82-142.38)

1393172 S0000252928_V1

Removal Tool Size Chart
Figure 211/70-48-19-990-815-H00

TASK 70-48-19-400-803-H00

6. Rosan Ring Locked Insert Installation (Alternate Procedure #2)

(Figure 208, Figure 212, Figure 213, Figure 211 and Figure 214)

A. General

(1) This procedure provides the instructions on how to install the rosan ring locked insert.

(2) The rosan ring locked insert is referred to as the insert.

B. Consumable Materials

Reference	Description	Specification
C00941 [C03-001]	Primer - Zinc Chromate	TT-P-1757, Type 1 or 2, Class C or Class N, AMS 3110 Color Y

C. Procedure

SUBTASK 70-48-19-430-003-H00

(1) Put the O-ring tool on the small thread of the adapter.

NOTE: There is more than one O-ring tool. Make sure to use the correct tool. Use the adapter that corresponds to the correct O-ring tool (Figure 211).

(a) Put the adapter, O-ring tool and O-ring in the fluid to be used in the system or a lubricant compatible with the system fluid and all components.

(b) Slide the O-ring on the O-ring tool and onto the adapter.

(c) Make sure that the O-ring is not twisted and is correctly in position in the groove of the adapter.

SUBTASK 70-48-19-090-002-H00

(2) Remove the O-ring tool.

SUBTASK 70-48-19-490-003-H00

(3) Install the adapter assembly into the port.

SUBTASK 70-48-19-640-002-H00

(4) Lubricate the internal surfaces of the port and the entire adapter assembly.

(a) Use the same fluid used in the system or a lubricant compatible with the system fluid and all components.

(b) Scratches, dings or rough spots are not allowed in the O-ring contact area on the adapter or in the port.

SUBTASK 70-48-19-430-004-H00

(5) Insert the smaller thread of the adapter into the port by hand with a clockwise rotation until the adapter is in place.

(a) To avoid possible O-ring damage, the adapter should not be rotated in a counterclockwise direction.

SUBTASK 70-48-19-869-002-H00

(6) With the applicable wrench and drive tool, engage the serrations of the tool with the external serrations of the adapter lockring.

(a) Put a torque wrench of the correct dimension on the hex of the wrench and apply a torque equal to the minimum value specified.

(b) Examine the relationship of the lockring serrations with respect to the prebroached serrations in the port.

1) If they match, proceed to the next subtask.
2) If the lockring serrations do not match the prebroached serrations in the port, continue to slowly torque the adapter toward the maximum value allowed until the serrations match.
   a) This will normally take 3° and 8° of rotation.
3) The maximum torque value does not need to be reached if the serrations align before that value.
   a) Do not exceed maximum torque values.

SUBTASK 70-48-19-620-002-H00

(7) Apply sufficient primer, C00941 [C03-001] with a brush or small syringe to the counterbore area of the port and below the adapter lockring.
   (a) Sufficient primer should be applied so that it will extrude out between the external serrations of the lockring and the serrations in the port when the lockring is installed.

SUBTASK 70-48-19-490-004-H00

(8) While the primer, C00941 [C03-001] is still wet, install the lockring.
   (a) Rotate the threaded end of the combination wrench and drive tool clockwise onto the adapter assembly until it touches the lockring.
   (b) Use an open end or socket wrench on the tool to turn the tool in a clockwise direction until it bottoms on the boss surface.
      1) Make sure that the tool bottoms on the boss surface.
   (c) If a sudden increase in torque occurs, do the steps that follow:

      NOTE: A sudden increase in torque before the tool bottoms on the boss surface can indicate that the lockring serrations and the port serrations are not aligned.

      1) Remove the combination wrench and drive tool.
         a) Turn the combination wrench and drive tool counterclockwise.
      2) Lift the lockring and tighten the adapter clockwise until the serrations in the port and the external serrations on the lockring are aligned.
      3) Re-install the lockring and remove the excess primer from the surface of the port and lockring.

SUBTASK 70-48-19-869-003-H00

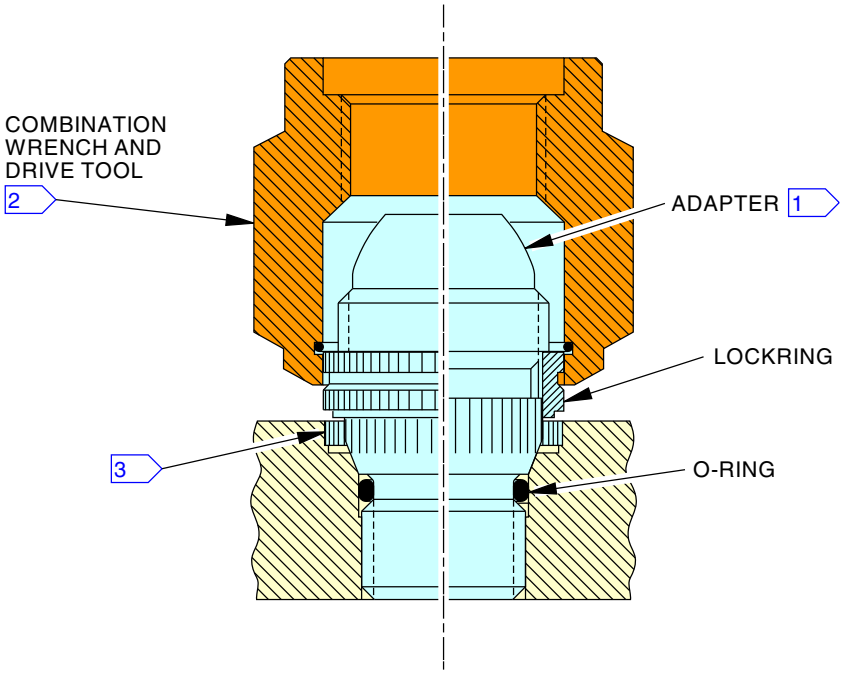
(9) If required, do these steps to retract the lockring.
   (a) Select the proper size removal tool.
   (b) Spread the puller halves apart.
      1) Retract the sleeve from the tool until the pin bottoms in the groove of the sleeve.
      2) Hold the puller halves apart and place the tool over the protruding adapter so that the nylon pad rests on the top surface of the adapter.
      3) Release the puller halves and locate in the groove of the lockring.
      4) Adjustment up or down is achieved by rotation of the bolt head.
      5) Slide the sleeve on the puller halves and check for proper engagement of the puller halves in the lockring groove.
   (c) Put the wrench on the bolt head of the removal tool, turn the wrench in a clockwise direction and hold the sleeve with the other hand.
      1) This step will cause the lockring to jack out of the port counterbore.

2) The rotation of the wrench can be stopped when the external serrations of the lockring are clear of the boss surface.

3) Remove the tool from the adapter.

   a) Loosen the bolt and lift the sleeve to free the puller halves.

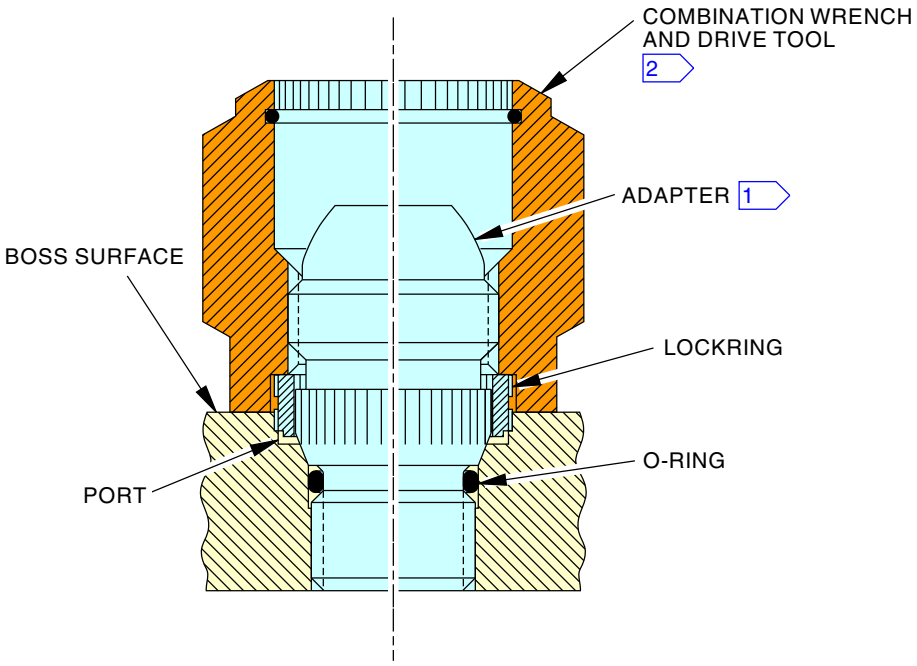
——— END OF TASK ———



1 P/N RFGA98XX-19
2 P/N RF98XXDW
3 APPLY ZINC CHROMATE HERE AFTER ADAPTER IS TIGHTENED IN PLACE.

1393891 S0000252926_V2

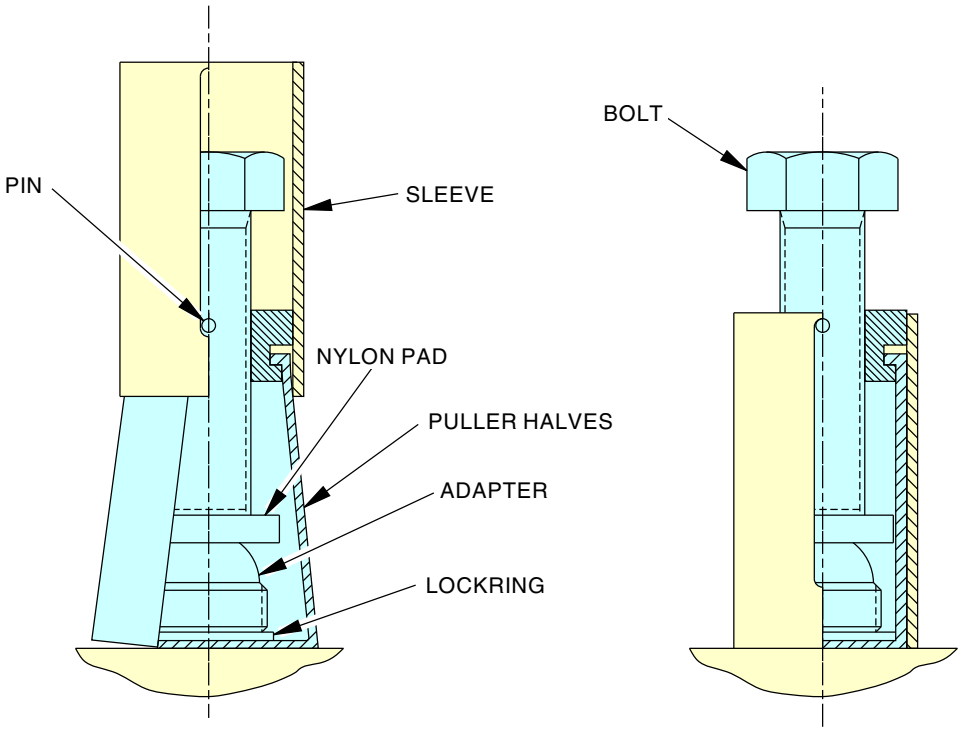
Tool to the Adapter Lockring Installation
Figure 212/70-48-19-990-816-H00



1 P/N RFGA98XX-19
2 P/N RF98XXDW

1393915 S0000252927_V2

Lockring Installation
Figure 213/70-48-19-990-817-H00



SLEEVE RETRACTED, PULLER HALVES READY TO BE LOCATED IN LOCKRING GROOVE

SLEEVE OVER PULLER HALVES READY FOR TORQUING BOLT

1257628-00
1394132 S0000252929_V2

Spreader Tool Installation
Figure 214/70-48-19-990-818-H00

TASK 70-48-19-300-801-H01

7. Repair of an Aluminum Part with Damaged Internal Threads

A. General

(1) This procedure contains one task, the repair of an aluminum part with damaged internal threads in the parent material.

B. References

Reference	Title
70-48-09-900-801-H01	Repair of Blind Threaded Holes in Aluminum Castings (P/B 201)
70-48-10-900-801-H01	Repair of Threaded Through-Holes in Aluminum Castings (P/B 201)

C. Consumable Materials

Reference	Description	Specification
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Procedure

SUBTASK 70-48-19-320-003-H01

(1) Do these steps to repair an aluminum part with damaged internal threads in the parent material.

(a) Use a plug or Scotch Flatback Masking Tape 250, G00270 to seal the openings in the assembly to prevent contamination.

(b) Drill out the damage and install a threaded plug (TASK 70-48-09-900-801-H01) or (TASK 70-48-10-900-801-H01).

1) To machine the boss on the centerline of the original hole, do these steps:

a) Drill a pilot hole through the center of the threaded plug before you install the threaded plug, or

b) Keep the center of the boss below the spindle after you remove the damage with the drill. Install the threaded plug, then center drill a pilot hole.

(c) Machine the boss at the original hole location to fit a standard size insert (Figure 215).

NOTE: The cutter tools shown in the list in the illustration will help when you machine the internal cavity. After you tap drill 0.015-0.030 inch (0.380-0.760 mm) undersize, use the contour cutter to complete the thread minor diameter and all other properties in one operation. Then tap the part.

1) Tap drill the internal cavity (Figure 215).

2) Make the counterbore L diameter 0.225± 0.005 inch (5.710± 0.130 mm) in depth.

3) Make the counterbore K diameter to the depth shown (flat bottom).

4) Make a counterbore 20 degree angle (40 degree, included) on the L diameter to the depth shown in the illustration (Figure 215).

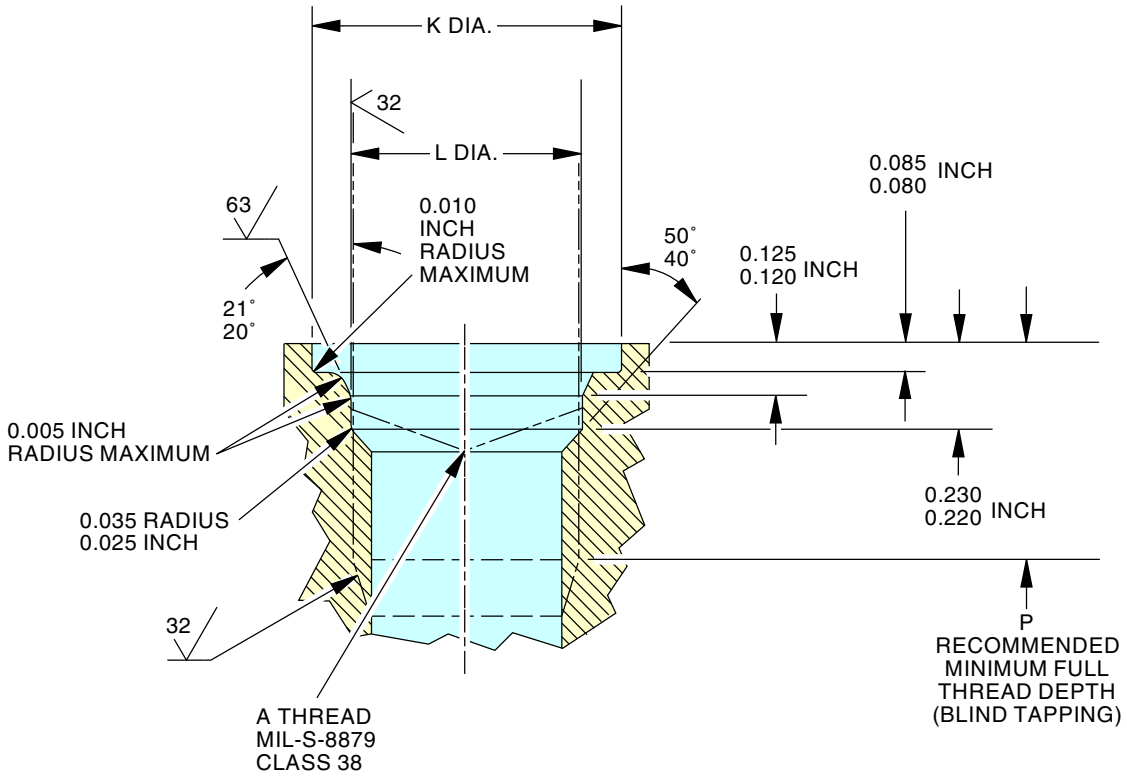
5) Tap the A thread to the P minimum full thread depth.

NOTE: The thread pitch diameter and L diameter must be concentric to the K diameter within 0.003 inch (0.08 mm), full indicator reading (FIR). The thread pitch diameter must be concentric to the L diameter within 0.002 inch (0.050 mm), (FIR).

SUBTASK 70-48-19-420-003-H01

(2) If it is necessary, install a new insert (Figure 216) (TASK 70-48-19-400-801-H01).

——— END OF TASK ———



INSERT THREAD SIZE		A THREAD (MIL-S-8879) (INCHES)	K DIAMETER +0.005 -0.000 (INCH)	L DIAMETER +0.002 -0.000 (INCH)	P MINIMUM (INCH)
EXTERNAL	INTERNAL				
9/16-24	7/16-20	0.5625-24UNJEF-38	0.795	0.603	0.610
5/8-24	1/2-20	0.6250-24UNJEF-38	0.858	0.666	0.610
11/16-24	9/16-18	0.6875-24UNJEF-38	0.905	0.728	0.660
15/16-20	3/4-16	0.9375-20UNJEF-38	1.155	0.958	0.795
1-1/16-18	7/8-14	1.0625-18UNJEF-38	1.280	1.083	0.885

M06337 S0004285431_V2

Machining Requirements for Threaded Hole Repair
Figure 215/70-48-19-990-806-H01

INSERT THREAD SIZES		INSERT REMOVAL DATA		INSTALLATION TOOLING		INSTALLATION TORQUE	PORT CONTOUR
EXTERNAL	INTERNAL	DRILL DIAMETER (INCH)	REMOVAL COUNTER-BORE TOOL	WRENCH	LOCKRING DRIVER	POUND-INCHES	CUTTER TOOL
9/16-24	7/16-20	17/32	RF8504R	RF8504WA	RF8504DA	80-105	RPT9504
5/8-24	1/2-20	19/32	RF8505R	RF8505WA	RF8505DA	120-150	RPT9505
11/16-24	9/16-18	21/32	RF8506R	RF8506WA	RF8506DA	145-185	RPT9506
15/16-20	3/4-16	7/8	RF8508R	RF8508WA	RF8508DA	350-400	RPT9508
1 1/16-18	7/8-14	1	RF8510R	RF8510WA	RF8510DA	500-600	RPT9510

FLUID FITTING (ROSAN)

NOTE:

THE PARTS CAN BE OBTAINED FROM:

- THE ROSAN, INC.
  2901 WEST COAST HIGHWAY
  NEWPORT BEACH, CA.

M06338 S0004285432_V2

Insert Replacement Data
Figure 216/70-48-19-990-807-H01

FUEL PUMP MOUNTING STUDS REPAIR - MAINTENANCE PRACTICES

1. General

A. This procedure has one task:

(1) The replacement of the accessory gearbox/main fuel pump mounting studs.

TASK 70-48-20-900-801-H00

2. Accessory Gearbox/Main Fuel Pump Mounting Studs Replacement

(Figure 201, Figure 202, Figure 203, Figure 204, Figure 205, Figure 206, Figure 207 and Figure 208)

A. General

(1) This task provides the instructions on how to remove and replace the Accessory Gearbox (AGB)/Main Fuel Pump (MFP) mounting studs.

B. References

Reference	Title
24-11-06-000-801	IDG Fuel/Oil Heat Exchanger Removal (P/B 401)
24-11-06-400-801	IDG Fuel/Oil Heat Exchanger Installation (P/B 401)
36-11-01-000-806-004	Engine Duct Removal (P/B 401)
36-11-01-400-806-004	Engine Duct Installation (P/B 401)
70-48-16-400-802-H01	Rosan Studs Installation (P/B 201)
71-00-00-700-802-H01	Test No. 2 - Dry Motor leak Check (P/B 501)
71-00-00-700-805-H01	Test No. 6 - Part-Power Leak Check (P/B 501)
71-00-00-700-815-H01	Test No. 16 - Engine Electronic Control (EEC) Test (MAT Initiated Test) (P/B 501)
72-41-01-000-802-H01	Center Combustion Skirt Panel Removal (P/B 401)
72-41-01-000-803-H01	Right Combustion Skirt Panel Removal (P/B 401)
72-41-01-400-802-H01	Center Combustion Skirt Panel Installation (P/B 401)
72-41-01-400-803-H01	Right Combustion Skirt Panel Installation (P/B 401)
72-60-00-200-801-H01	Accessory Gearbox and Transfer Gearbox Inspection (P/B 601)
73-11-01-000-801-H01	Main Fuel Pump Removal (P/B 401)
73-11-01-400-801-H01	Main Fuel Pump Installation (P/B 401)
73-21-14-000-801-H01	Hydromechanical Unit Removal (P/B 401)
73-21-14-400-801-H01	Hydromechanical Unit Installation (P/B 401)
79-21-01-000-803-H00	Main Fuel/Oil Heat Exchanger Removal (P/B 401)
79-21-01-400-801-H01	Main Fuel/Oil Heat Exchanger Installation (P/B 401)

C. Tools/Equipment

Reference	Description
STD-6617	Equipment - Vibro-engraving

D. Consumable Materials

Reference	Description	Specification
D50043 [C02-058]	Compound - Antiseize, Acheson GP460 (For Threaded Fasteners 0.250 Inches Diameter Or Larger, C02-079 Is An Alternative)	GE A50TF201 Class A
D50072 [C02-023]	Oil - Engine Lubricating	MIL-PRF-23699

E. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

F. Prepare for the Replacement

SUBTASK 70-48-20-211-001-H00

(1) Do this task: Accessory Gearbox and Transfer Gearbox Inspection, TASK 72-60-00-200-801-H01.

SUBTASK 70-48-20-010-002-H00

(2) Do this task: Hydromechanical Unit Removal, TASK 73-21-14-000-801-H01.

SUBTASK 70-48-20-010-003-H00

(3) Do this task: Main Fuel Pump Removal, TASK 73-11-01-000-801-H01.

SUBTASK 70-48-20-010-004-H00

(4) Do this task: Main Fuel/Oil Heat Exchanger Removal, TASK 79-21-01-000-803-H00.

SUBTASK 70-48-20-010-005-H00

(5) Do this task: IDG Fuel/Oil Heat Exchanger Removal, TASK 24-11-06-000-801.

G. Accessory Gearbox/Main Fuel Pump Mounting Studs Replacement

SUBTASK 70-48-20-010-006-H00

(1) Remove the HP duct (TASK 36-11-01-000-806-004).

SUBTASK 70-48-20-010-007-H00

(2) Remove the LPT cooling duct [32] as follows (Figure 201):

(a) Remove the two bolts [52], two bolts [50], clamp [51] and clamp [49] that attach LPT cooling duct [32] to the brackets.

(b) Remove the V-band coupling [53].

(c) Hold the LPT cooling duct [32] and remove the V-band coupling [56].

(d) Remove the LPT cooling duct [32] from the engine.

(e) Remove and examine the seal ring [54] and seal ring [55] for damage.

1) Replace the seal rings for the installation if there is damage.

(f) Put protective covers on the open ports.

SUBTASK 70-48-20-010-008-H00

(3) Remove the HPT cooling duct [31] as follows (Figure 201):

(a) Remove the two bolts [48] that attach the clamp [47] and the HPT cooling duct [31] to the support bracket.

(b) Remove the V-band coupling [45] that attaches the oil eductor valve to the HPT cooling duct [31].

(c) Disconnect the HPT cooling duct [31] from the oil eductor valve.

(d) Remove and examine the seal ring [46] for damage.

1) Replace the seal ring for the installation if there is damage.

(e) Remove the two bolts [33], two bolts [36], bolts [39], clamp [34], clamp [35], and clamp [40] that attach the HPT cooling duct [31] to the brackets.

(f) Remove the V-band coupling [38].

(g) Remove the V-band coupling [44].

(h) Hold the HPT cooling duct [31] and remove the V-band coupling [42].

(i) Remove the HPT cooling duct [31] from the engine.

(j) Remove and examine the seal ring [37], seal ring [41], and seal ring [43] for damage.

(k) If the seal rings are damaged replace them in the installation procedure.

(l) Put protective covers on the open ports.

SUBTASK 70-48-20-010-009-H00

(4) Remove the AGB heat shield middle and right skirt panels (TASK 72-41-01-000-802-H01 and TASK 72-41-01-000-803-H01).

SUBTASK 70-48-20-010-010-H00

(5) Remove the heat shield bracket [74] as follows (Figure 202):

(a) Remove the bolt [71] and dampening bushing [72] that attaches the heat shield bracket [74] to the heat shield assembly.

(b) Remove the three bolts [75] and three nuts [73] that attach the heat shield bracket [74] to the combustion case.

(c) Remove the heat shield bracket [74] from between the heat shield assembly and the combustion case.

SUBTASK 70-48-20-010-011-H00

(6) If necessary remove the support bracket [78] and support bracket [81] as follows:

(a) Remove the two bolts [77] that attach the support bracket [76] to the support bracket [78].

(b) Remove the two bolts [80] that attach the support bracket [78]to the support bracket [79]and remove the support bracket [78].

(c) Remove the two bolts [84] that attach the bracket [85] to the support bracket [81].

(d) Remove the four bolts [82] that attach the support bracket [83] to the support bracket [81].

(e) Remove the support bracket [81].

SUBTASK 70-48-20-020-001-H00

(7) Remove the fuel adapter from the AGB as follows:

(a) Remove the nuts and the washers that attach the fuel adapter to the AGB.

(b) Remove the screw that attaches the fuel adapter to the AGB.

(c) Remove the bolts and the washers that attach the fuel adapter to the AGB.

(d) Remove the fuel adapter with the MFP and HMU gear shafts from the AGB.

(e) Remove and discard the preformed packings.

(f) Apply a masking tape or plugs to the AGB to prevent burr contamination during the stud replacement procedure.

SUBTASK 70-48-20-020-002-H00

(8) Remove the studs as follows:

NOTE: If at least one long MFP or HMU stud is unserviceable, then you must replace all the long studs (six MFP long studs and three HMU long studs).

WARNING WEAR SAFETY GLASSES WITH SIDE SHIELDS WHEN YOU CUT THE MATERIALS. IF YOU DO NOT, YOU CAN CAUSE INJURY TO YOUR EYES.

(a) Cut the stud off approximately 0.2 inch (5.0 mm) above the AGB housing surface.

(b) If necessary, make the drilling guide fixture.

(c) Drill a pilot hole in the center of the stud as follows:

1) Install a drilling guide fixture on the center of the stud.
2) Use the No. 1 removal drill bit.
3) Drill to the specified depth.
4) Remove the drilling guide fixture.
5) Drill a second hole in the center of the stud.
6) Use the No. 2 removal drill bit.
7) Use the pilot hole as a guide.
8) Drill to the specified depth.

NOTE: This will cut the engagement between the stud serrations and the internal serrations of the lockring.

(d) Remove all the lockring fragments.

SUBTASK 70-48-20-100-001-H00

(9) Clean the AGB housing stud recess.

SUBTASK 70-48-20-420-001-H00

(10) Install the new AGB housing studs (TASK 70-48-16-400-802-H01).

SUBTASK 70-48-20-930-002-H00

(11) If you replace all long MFP and HMU studs, identify the AGB casing again as soon as possible as follows (Figure 208):

NOTE: Replacement of all long MFP and HMU studs is equivalent to the steps in GE SB 72-0326. To record the SB accomplishment, you must identify the AGB casing as soon as possible. The AGB casing identification marking is located on a plate on the casing aft side, adjacent to starter pad.

(a) Use a vibro-engraving equipment, STD-6617 and make a mark through the old part number to a maximum depth of 0.006 (0.15 mm).

NOTE: Make sure that you can still read the number after you make the mark.

(b) Put the new part number from the table below next to the old part number.

NOTE: Make sure that you can read the new part number.

Old Part Number	New Part Number
2206M14G02	2206M14G06
2206M14G03	2206M14G06
2206M14G04	2206M14G05

SUBTASK 70-48-20-420-002-H00

(12) Install the fuel adapter as follows:

WARNING DO NOT GET OIL ON YOUR SKIN. REMOVE THE OIL FROM YOUR SKIN IMMEDIATELY. IF YOU LET THE OIL STAY ON YOUR SKIN, IT CAN CAUSE INJURIES TO YOUR SKIN.

(a) Lubricate the new preformed packing [21] and preformed packing [23] with engine lubricating oil, D50072 [C02-023].

(b) Install the preformed packing [21]in the HMU gearshaft [24] flange of the fuel adapter [1].

(c) Install the preformed packing [23] in the MFP gearshaft [22] flange of the fuel adapter [1].

(d) Lubricate the roller bearing outer races in the AGB with engine lubricating oil, D50072 [C02-023].

(e) Align the bolt holes in the fuel adapter with the bolt holes and studs in the AGB.

(f) Install the fuel adapter onto the AGB.

(g) Make sure that the gears turn without resistance.

(h) Lubricate the fastener threads with engine lubricating oil, D50072 [C02-023].

(i) Attach the fuel adapter [1] to the AGB housing with screw [6], washer [5], nut [4], washer [10], bolt [9], washer [7], bolt [8], nut [3] and washer [2].

(j) Tighten the bolt [8] and bolt [9] to 190 - 230 pound-inches (21.5 - 26.0 Newton-meters).

(k) Tighten the screw [6] to 55-70 pound-inches (6.3-7.9 Newton-meters).

(l) Tighten the nut [4] to 191-230 pound-inches (21.5-26.0 Newton-meters).

(m) Tighten the nut [3] to 55-70 pound-inches (6.3-7.9 Newton-meters).

SUBTASK 70-48-20-410-003-H00

(13) Install the heat shield bracket [74] as follows:

(a) Apply Acheson GP460 compound, D50043 [C02-058] on the three bolts [75] and three nuts [73].

(b) Put the heat shield bracket [74] into position between the heat shield assembly and the combustion case flange.

(c) Install the three bolts [75] and three nuts [73] that attach the heat shield bracket [74] to the combustion case flange.

(d) Tighten the nuts [73] to 380-420 pound-inches (42.9-47.4 Newton-meters).

(e) Install the bolt [71] and dampening bushing [72] that attaches the heat shield bracket [74] to the heat shield assembly.

(f) Tighten the bolt [71] to 109-127 pound-inches (12.3-14.3 Newton-meters).

SUBTASK 70-48-20-410-004-H00

(14) If necessary install the support bracket [78]] and support bracket [81] as follows:

(a) Put the support bracket [81] into position on the support bracket [83].

(b) Install the four bolts [82] that attach the support bracket [81] to the support bracket [83].

(c) Tighten the four bolts [82] to 109-127 pound-inches (12.3-14.3 Newton-meters).

(d) Put the bracket [85] into position on support bracket [81].

(e) Install the two bolts [84] that attach the bracket [85] to the support bracket [81].

(f) Tighten the two bolts [84] to 109-127 pound-inches (12.3-14.3 Newton-meters).

SUBTASK 70-48-20-410-005-H00

(15) Install the support bracket [78] as follows:

(a) Put the support bracket [78] into position on the support bracket [79] and support bracket [76].

(b) Install the two bolts [80] that attach the support bracket [78] to the support bracket [79].

(c) Tighten the two bolts [80] to 109-127 pound-inches (12.3-14.3 Newton-meters).

(d) Install the two bolts [77] that attach the support bracket [76] to the support bracket [78].

(e) Tighten the two bolts [77] to 109-127 pound-inches (12.3-14.3 Newton-meters).

SUBTASK 70-48-20-410-006-H00

(16) Install the AGB heat shield middle and right skirt panels (TASK 72-41-01-400-802-H01 and TASK 72-41-01-400-803-H01).

SUBTASK 70-48-20-410-007-H00

(17) Install the HPT cooling duct [31] as follows:

(a) Remove the protective covers from the ports.

(b) Install the seal ring [37], seal ring [41] and s seal ring [43] on the HPT cooling duct [31].

(c) Put the HPT cooling duct [31] in position between the compressor module port and the two stage 2 HPT nozzle ports.

(d) Loosely install the V-band coupling [38], V-band coupling [42] and the V-band coupling [44].

(e) Tighten the V-band coupling [38] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(f) Tighten the V-band coupling [42] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(g) Tighten the V-band coupling [44] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(h) Do these steps to make sure the V-band couplings are correctly installed on the flanges.

1) Hit lightly around V-band coupling [38], V-band coupling [42] and V-band coupling [44] with a rubber mallet.

2) Tighten the V-band coupling [38], V-band coupling [42] and V-band coupling [44] again to 109-127 pound-inches (12.3-13.3 Newton-meters).

(i) Install the two bolts [33] that attach the HPT cooling duct [31] and the clamp [34] to the bracket.

(j) Tighten the two bolts [33] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(k) Install the two bolts [36] that attach the HPT cooling duct [31] and the clamp [35] to the bracket.

(l) Tighten the two bolts [36] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(m) Install the two bolts [39] that attach the HPT cooling duct [31] and the clamp [40] to the bracket.

(n) Tighten the two bolts [39] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(o) Connect the HPT cooling duct [31] to the oil eductor valve as follows:

1) Put the seal ring [46] in position on the oil eductor valve.

2) Connect the oil eductor valve and the HPT cooling duct [31] with the V-band coupling [45].

3) Tighten the V-band coupling [45] to 57-67 pound-inches (6.4-7.5 Newton-meters).

4) Install the two bolts [48] that attach the clamp [47] and the HPT cooling duct [31] to the support bracket.

5) Tighten the two bolts [48] to 109-127 pound-inches (12.3-13.3 Newton-meters.

SUBTASK 70-48-20-410-008-H00

(18) Install the LPT cooling duct [32] as follows:

(a) Remove the protective covers from the ports.

(b) Install the seal ring [55] and seal ring [54] on the LPT cooling duct [32].

(c) Put the LPT cooling duct [32] into position between the compressor module port and the air tube.

(d) Loosely install the V-band coupling [56] and the V-band coupling [53].

(e) Tighten the V-band coupling [56] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(f) Tighten theV-band coupling [53] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(g) Do these steps to make sure the V-band couplings are correctly installed on the flanges.

1) Hit lightly around V-band coupling [56] and V-band coupling [53] with a rubber mallet.

2) Tighten the V-band coupling [56] and V-band coupling [53] again to 109- 127 pound-inches (12.3-13.3 Newton-meters).

(h) Install the two bolts [50] that attach the LPT cooling duct [32] and the clamp [49] to the bracket.

(i) Tighten the two bolts [50] to 109-127 pound-inches (12.3-13.3 Newton-meters).

(j) Install the two bolts [52] that attach the LPT cooling duct [32] and the clamp [51] to the bracket.

(k) Tighten the two bolts [52] to 109-127 pound-inches (12.3-13.3 Newton-meters).

SUBTASK 70-48-20-410-009-H00

(19) Install the HP duct (TASK 36-11-01-400-806-004).

H. Put the Airplane Back to its Usual Condition

SUBTASK 70-48-20-410-010-H00

(1) Do this task: IDG Fuel/Oil Heat Exchanger Installation, TASK 24-11-06-400-801

SUBTASK 70-48-20-410-011-H00

(2) Do this task: Main Fuel/Oil Heat Exchanger Installation, TASK 79-21-01-400-801-H01

SUBTASK 70-48-20-410-012-H00

(3) Do this task: Main Fuel Pump Installation, TASK 73-11-01-400-801-H01.

SUBTASK 70-48-20-410-013-H00

(4) Do this task: Hydromechanical Unit Installation, TASK 73-21-14-400-801-H01

SUBTASK 70-48-20-210-002-H00

(5) Do a visual inspection of the AGB for correct assembly.

SUBTASK 70-48-20-790-001-H00

(6) Do this task: Test No. 2 - Dry Motor leak Check, TASK 71-00-00-700-802-H01.

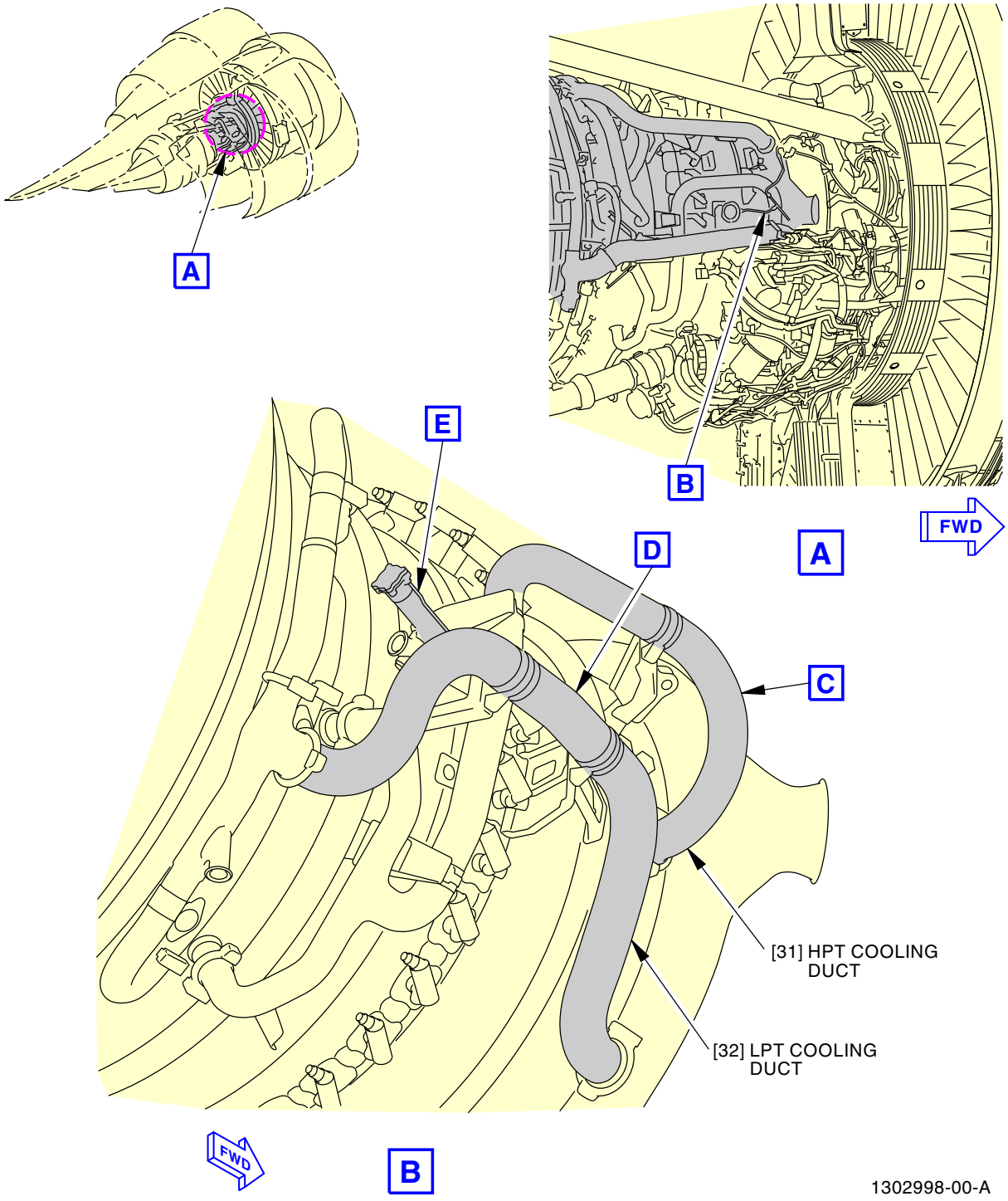
SUBTASK 70-48-20-790-002-H00

(7) Do this task: Test No. 6 - Part-Power Leak Check, TASK 71-00-00-700-805-H01.

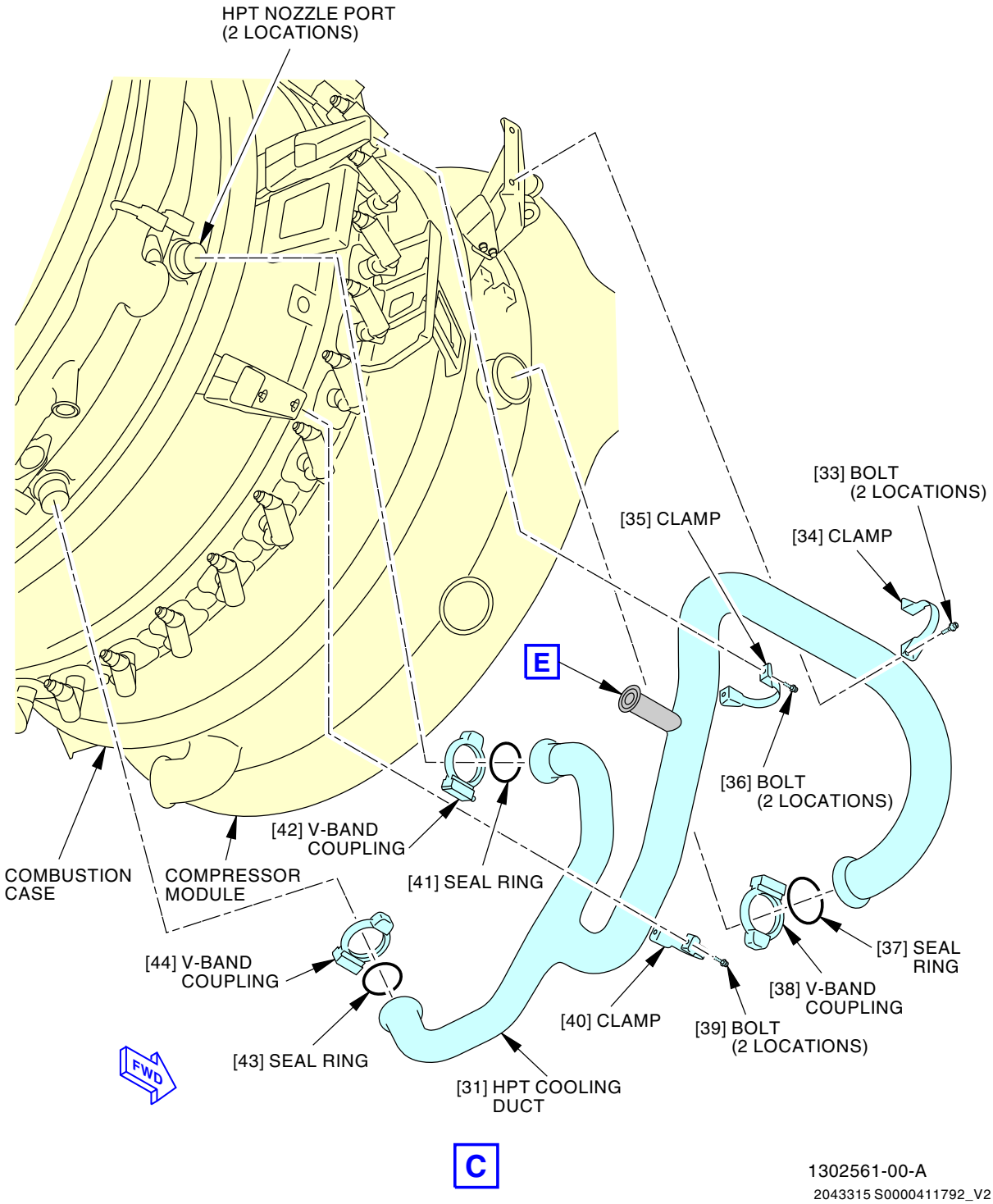
SUBTASK 70-48-20-730-001-H00

(8) Do this task: Test No. 16 - Engine Electronic Control (EEC) Test (MAT Initiated Test), TASK 71-00-00-700-815-H01.

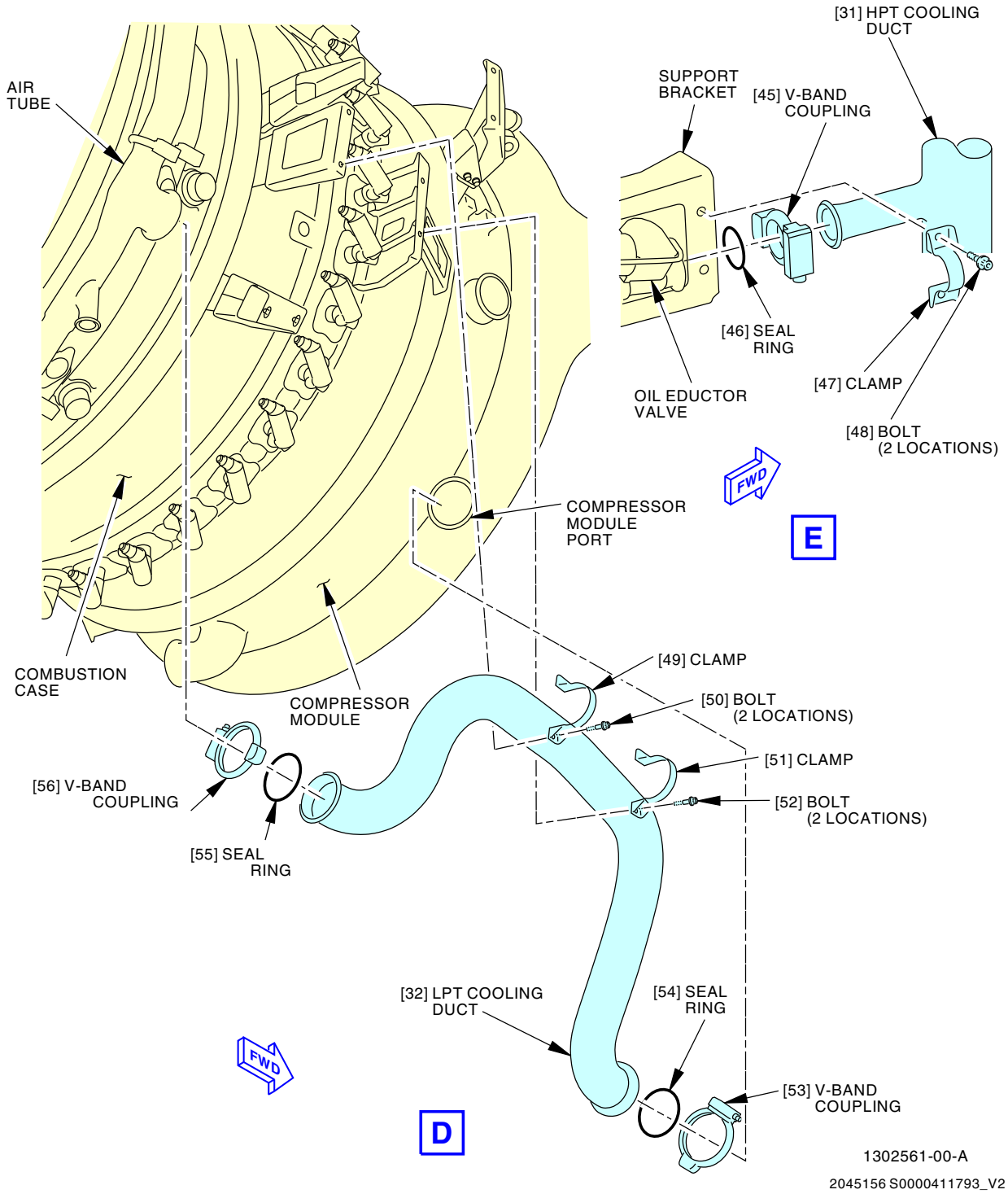
END OF TASK



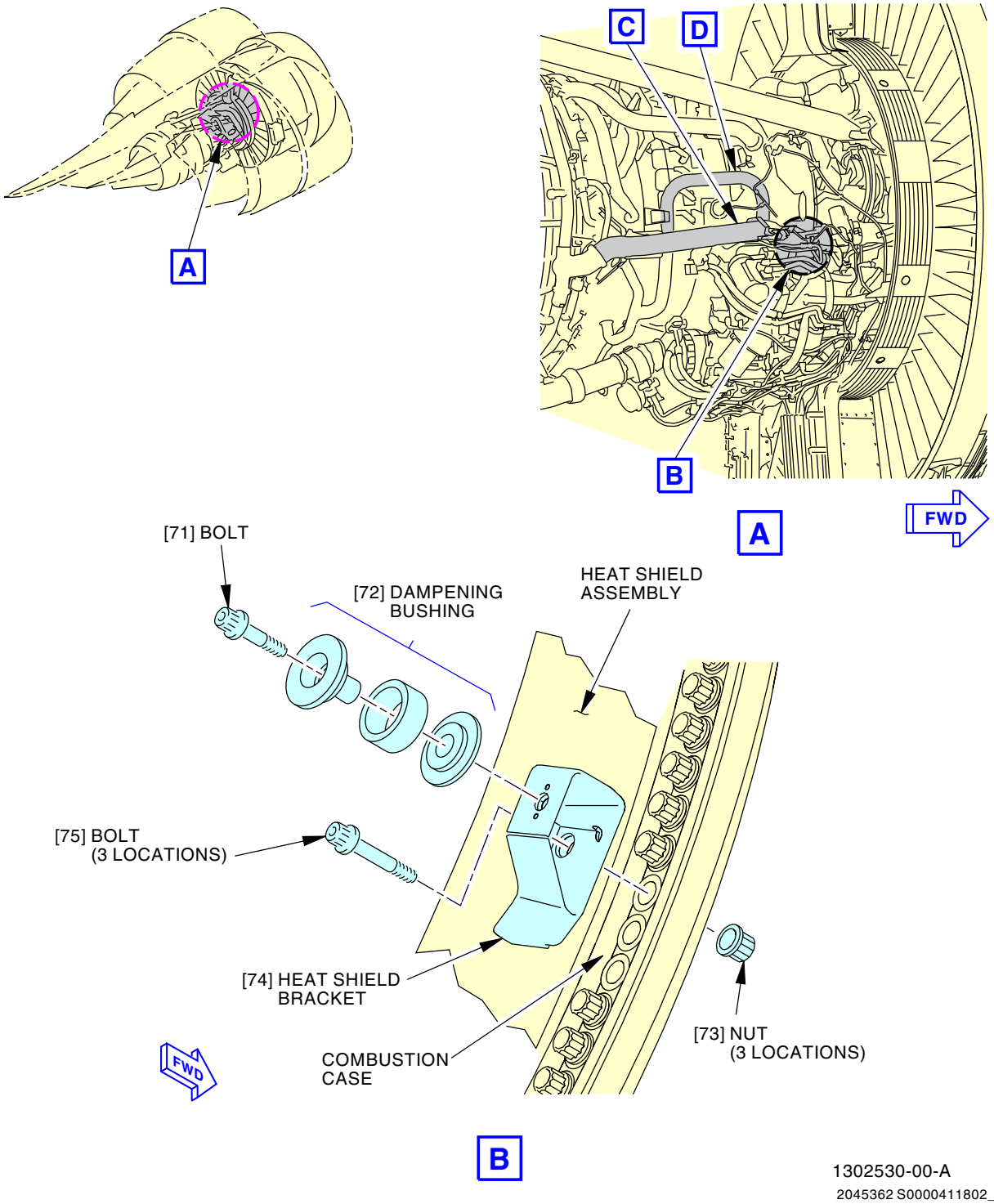
HPT and LPT Cooling Duct Installation
Figure 201/70-48-20-990-808-H00 (Sheet 1 of 3)



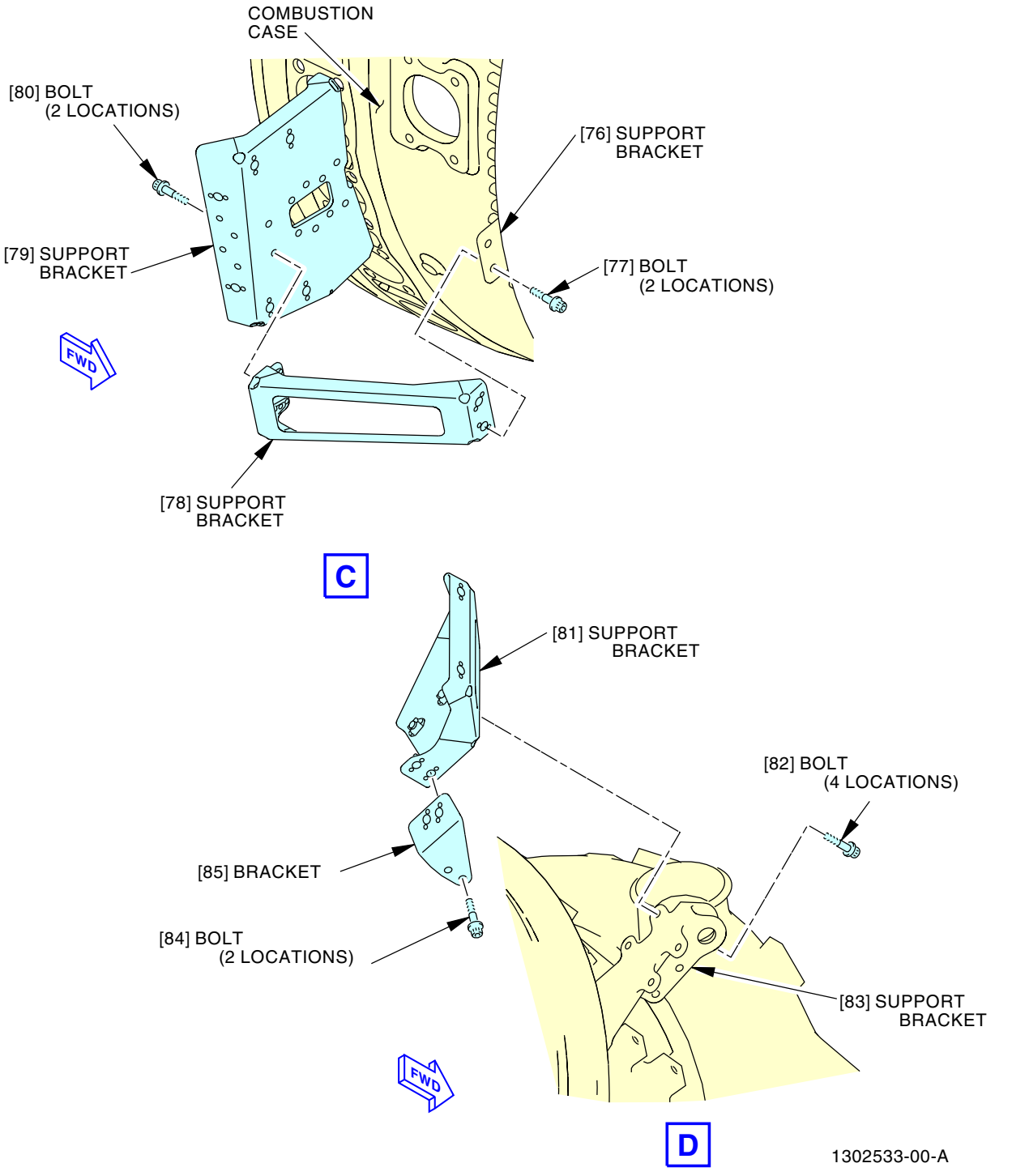
HPT and LPT Cooling Duct Installation
Figure 201/70-48-20-990-808-H00 (Sheet 2 of 3)



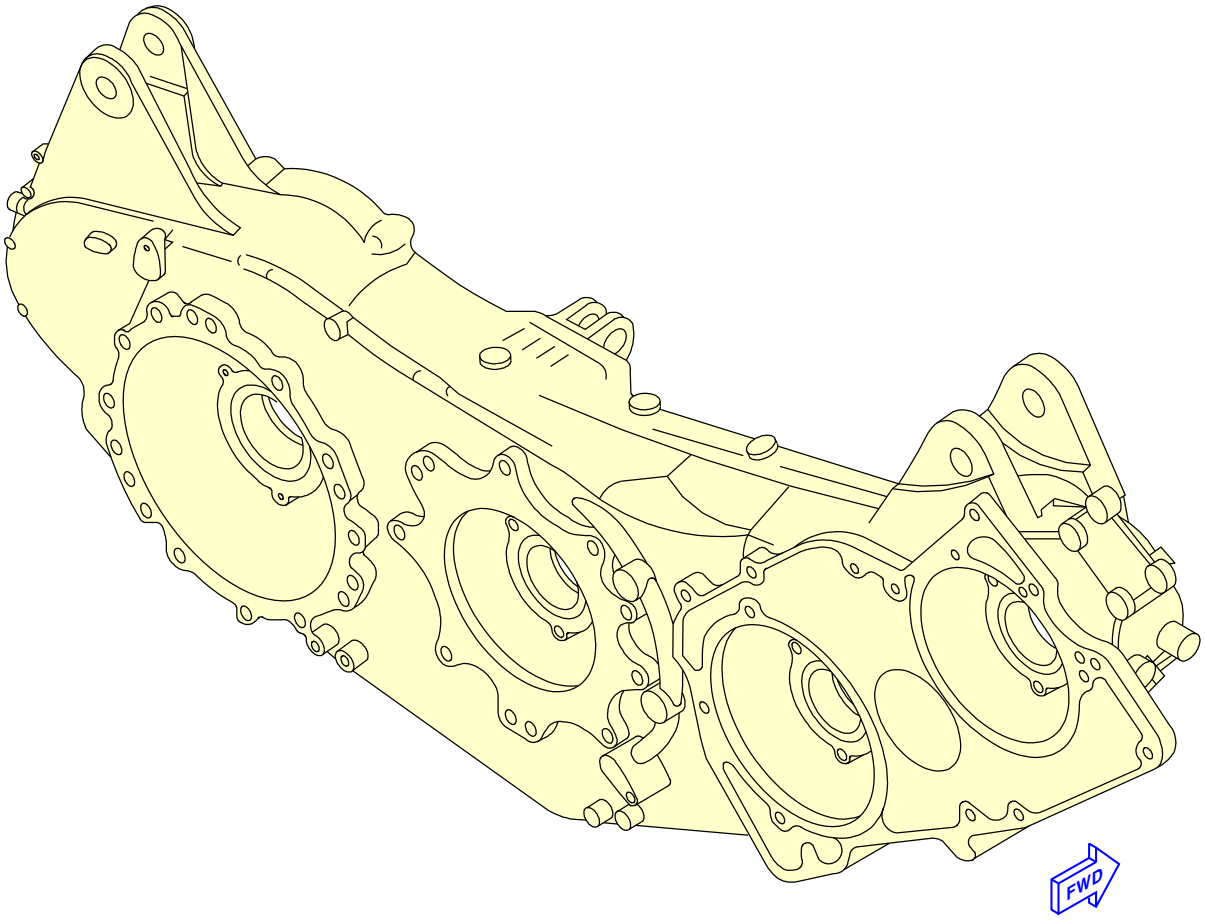
HPT and LPT Cooling Duct Installation
Figure 201/70-48-20-990-808-H00 (Sheet 3 of 3)



Heat Shield Bracket Installation
Figure 202/70-48-20-990-809-H00 (Sheet 1 of 2)



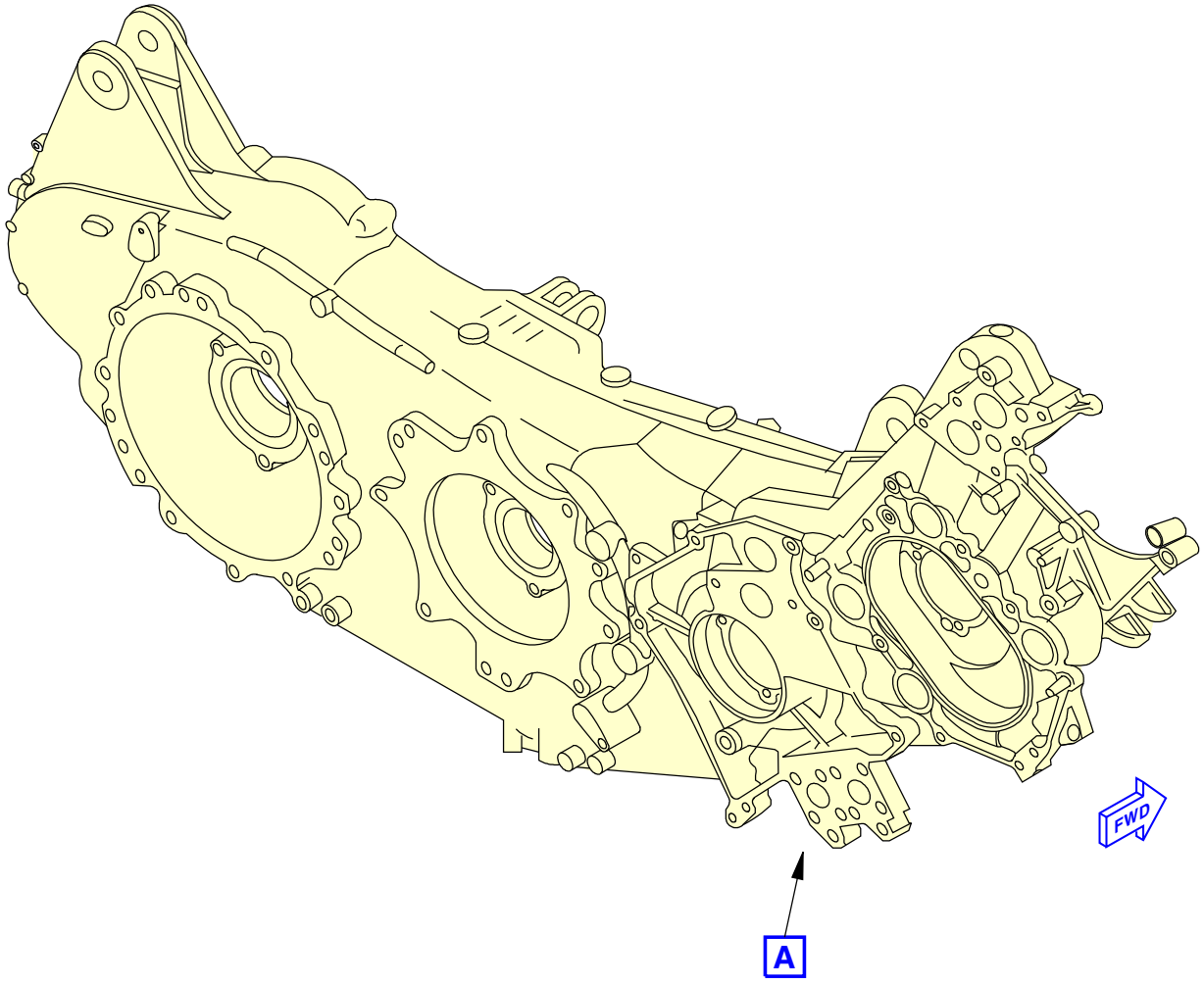
Heat Shield Bracket Installation
Figure 202/70-48-20-990-809-H00 (Sheet 2 of 2)



MATERIAL:
A357 ALUMINUM ALLOY

PAGE-913-RD032-432-S1
1933939 S0000364948_V2

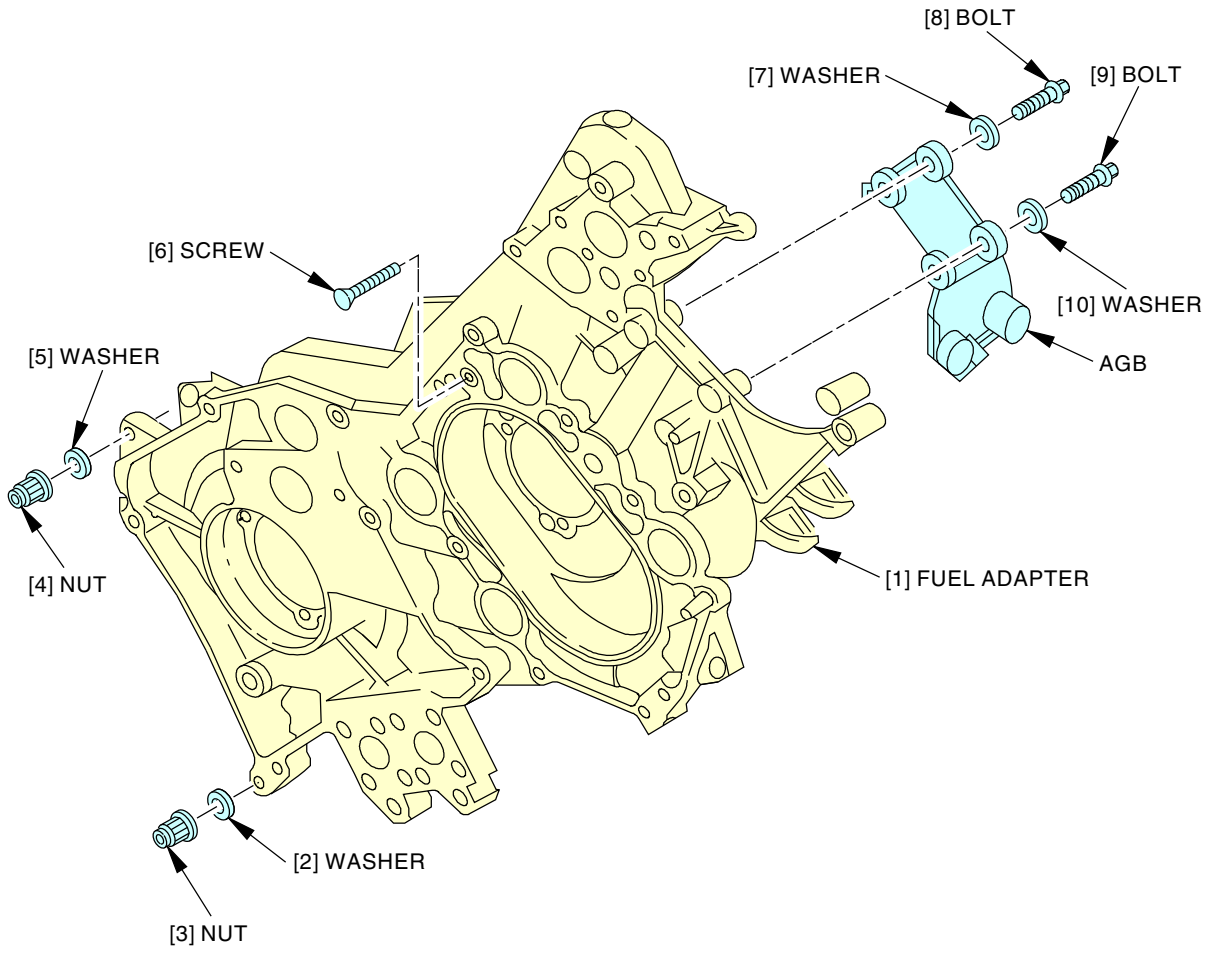
Accessory Gearbox Housing Installation
Figure 203/70-48-20-990-801-H00



PAGE-916-RD032-432-S1

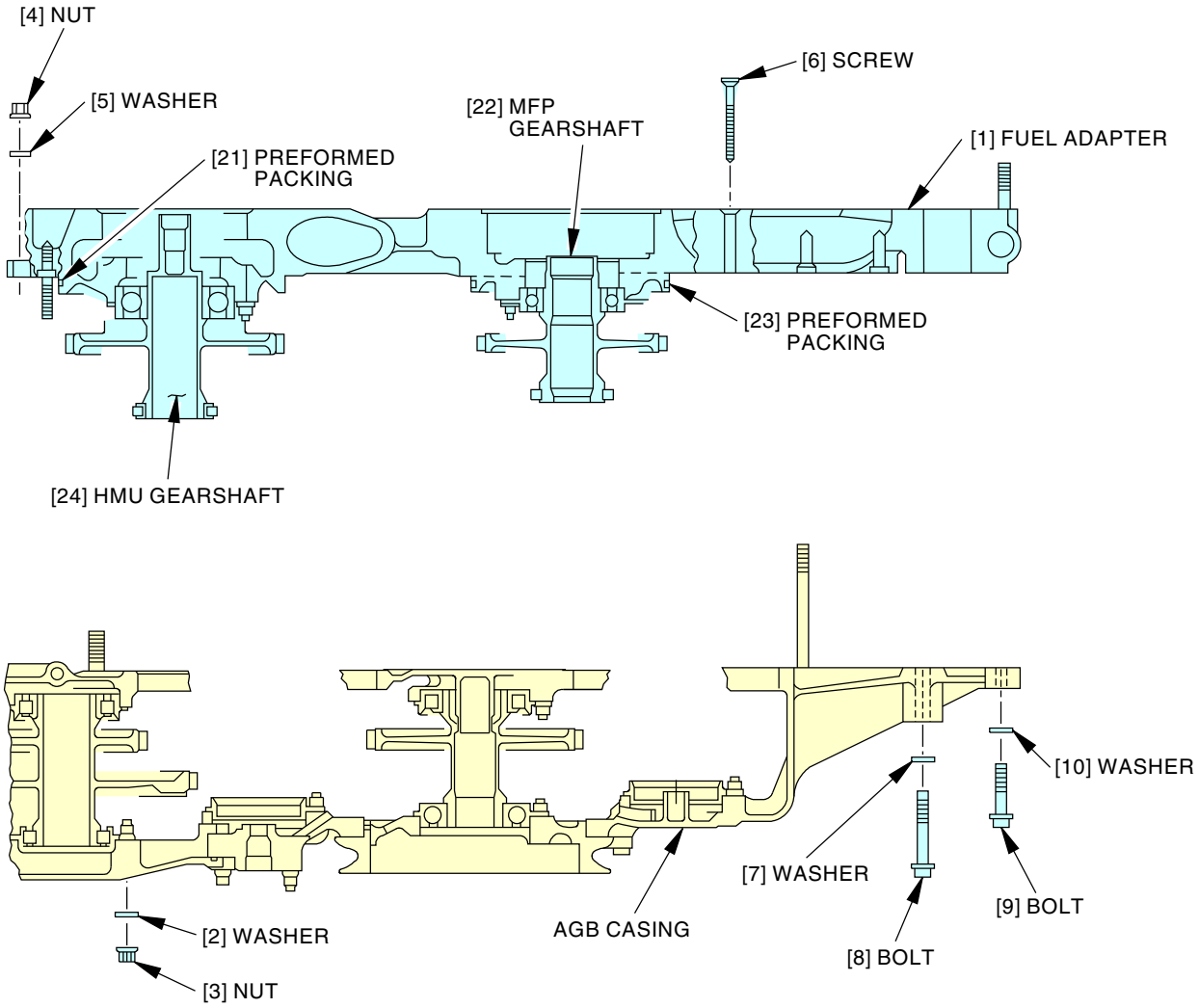
1935688 S0000364953_V2

MFP/HMU Gearshafts Face Seals and Mating Rings Installation
Figure 204/70-48-20-990-802-H00 (Sheet 1 of 3)



PAGE-917-RD032-432-S1
1935689 S0000364954_V2

MFP/HMU Gearshafts Face Seals and Mating Rings Installation
Figure 204/70-48-20-990-802-H00 (Sheet 2 of 3)



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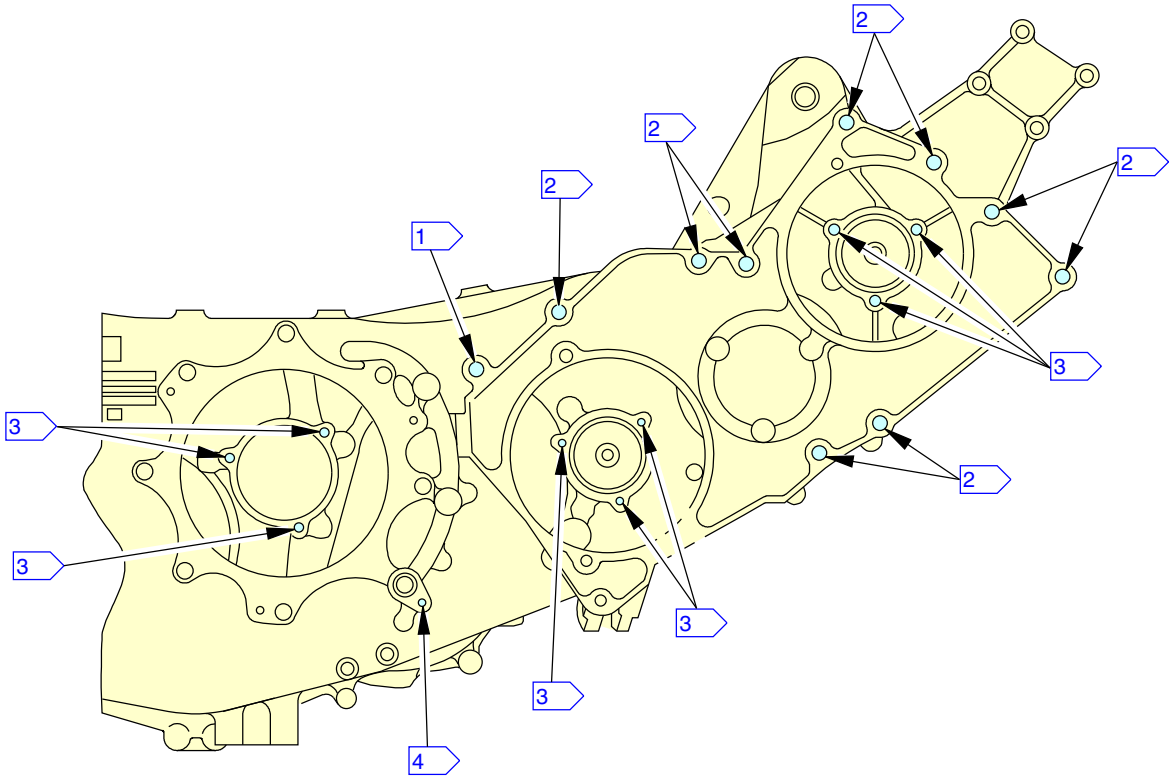
1935696 S0000364955_V2

MFP/HMU Gearshafts Face Seals and Mating Rings Installation
Figure 204/70-48-20-990-802-H00 (Sheet 3 of 3)



ACCESSORY GEARBOX HOUSING (AGB)

A

1 STUD: P/N MS51992C645-19
LOCKRING: P/N MS51997E105P

2 STUD: P/N SLSF5902D645-56 OR SF5902D645-56
LOCKRING: P/N MS51997E105P

3 STUD: P/N MS51551C205-9
LOCKRING: P/N MS51990E105P

4 STUD: P/N MS1551C205-11
LOCKRING: P/N MS51990E105P

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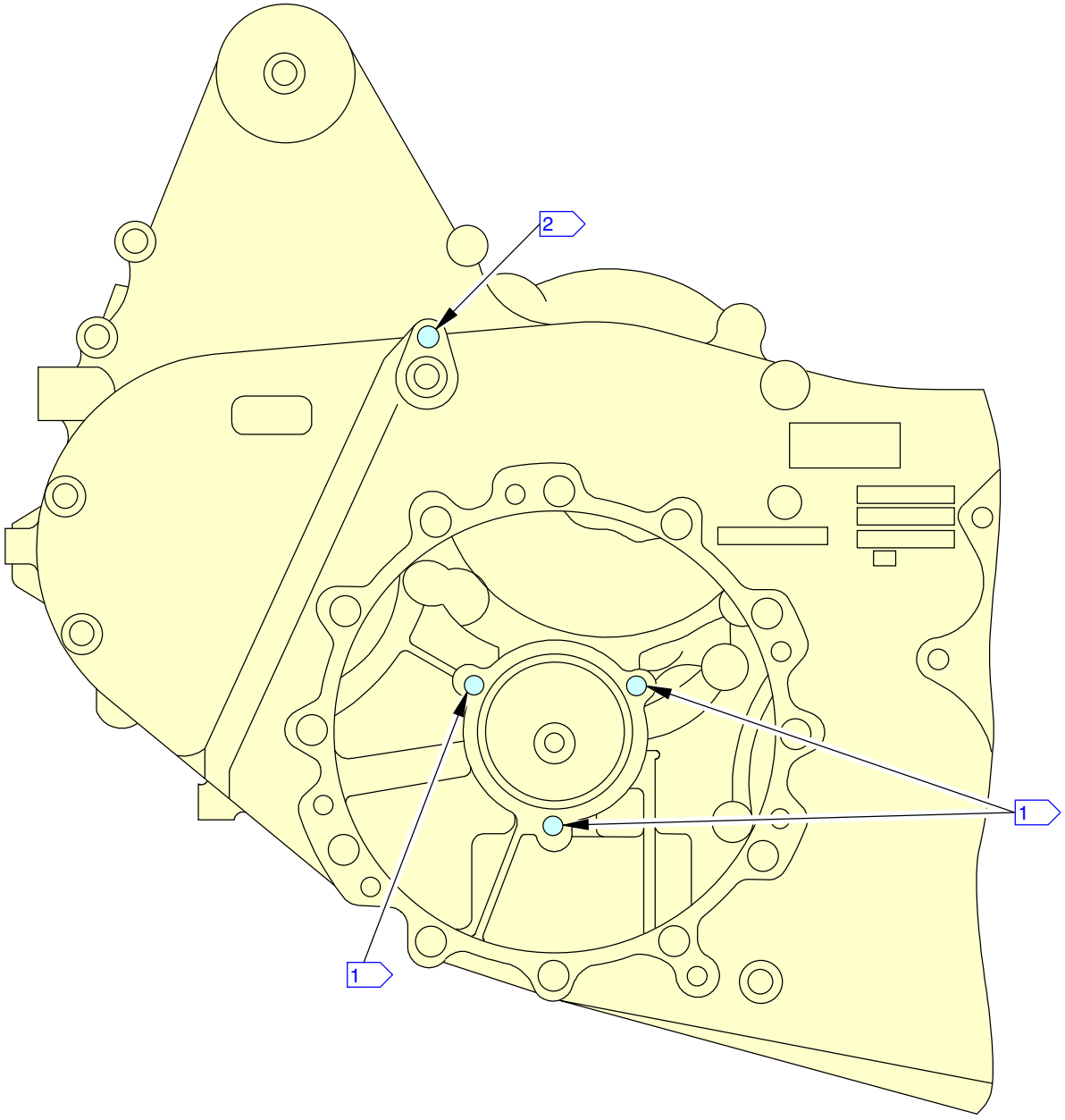
1935719 S0000364956_V3

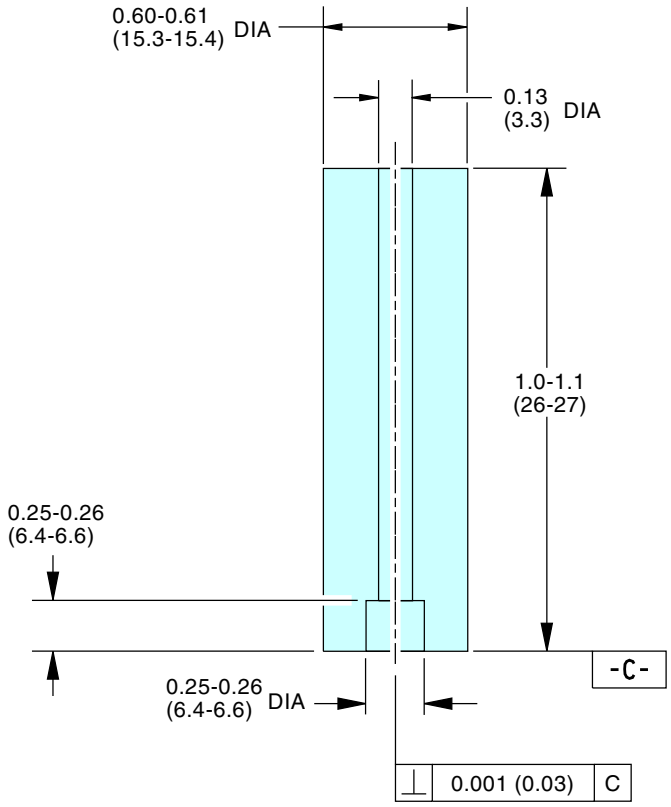
Accessory Gearbox Housing Stud Location
Figure 205/70-48-20-990-803-H00 (Sheet 1 of 2)



PAGE-920-RD032-432-S1
1935734 S0000364959_V2

Accessory Gearbox Housing Stud Location
Figure 205/70-48-20-990-803-H00 (Sheet 2 of 2)

DRILLING GUIDE FIXTURE #1



MATERIAL:

AISI 4130-4142 TT STEEL (BLACK OXIDE)

NOTE:

1. DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN PARENTHESES.
2. TO USE WITH MS51551C205-9 AND MS51551C205-11.

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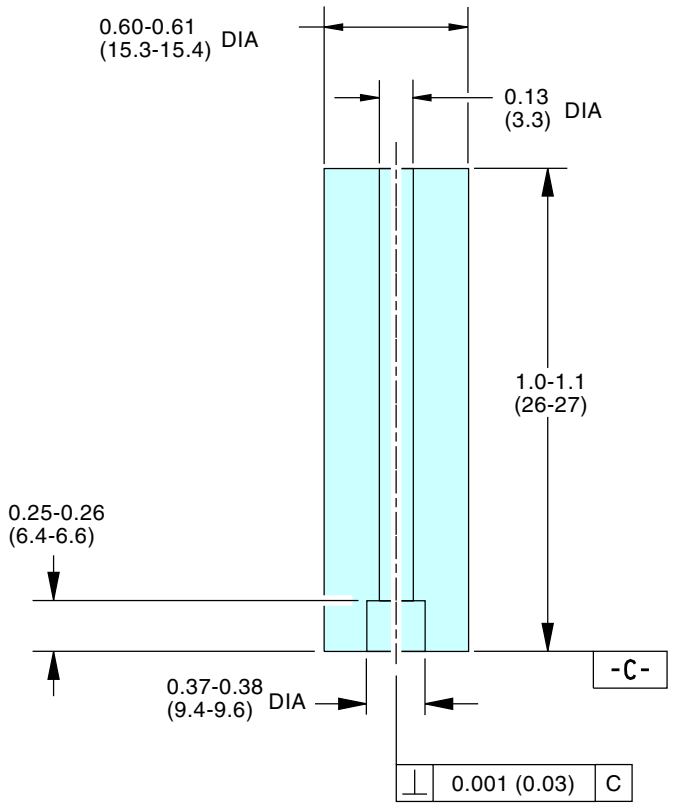
1935739 S0000364960_V2

Drilling Guide Fixture
Figure 206/70-48-20-990-804-H00 (Sheet 1 of 2)

DRILLING GUIDE FIXTURE #2



MATERIAL:

AISI 4130-4142 TT STEEL (BLACK OXIDE)

NOTE:

1. DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN PARENTHESES.
2. TO USE WITH MS51992C645-19 AND MS51992C645-56/SLSF5902D645-56 AND SF5902D645-56, SLSF5902D645-56 AND SF5902D645056

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1935760 S0000364961_V3

Drilling Guide Fixture
Figure 206/70-48-20-990-804-H00 (Sheet 2 of 2)

PART NUMBER	NUT THREAD DIAMETER	STUD THREAD DIAMETER	NO. 1 REMOVAL DRILL BIT		NO. 2 REMOVAL DRILL BIT	
			DIAMETER	MINIMUM DEPTH	DIAMETER	MINIMUM DEPTH
MS51551C205-9 AND MS51551C205-11	0.2500-28	0.3126-24	0.125 (3.18)	0.25 (6.4)	0.297 (7.54)	0.25 (6.4)
MS51992C645-19 AND MS51992C645-56 SLSF5902D645-56 AND SF5902D645-56	0.3752-24	0.5000-20	0.125 (3.18)	0.42 (10.7)	0.406 (10.31)	0.42 (10.7)

NOTE:

ALL DIMENSIONS ARE IN INCHES
(MILLIMETERS ARE IN PARENTHESES).

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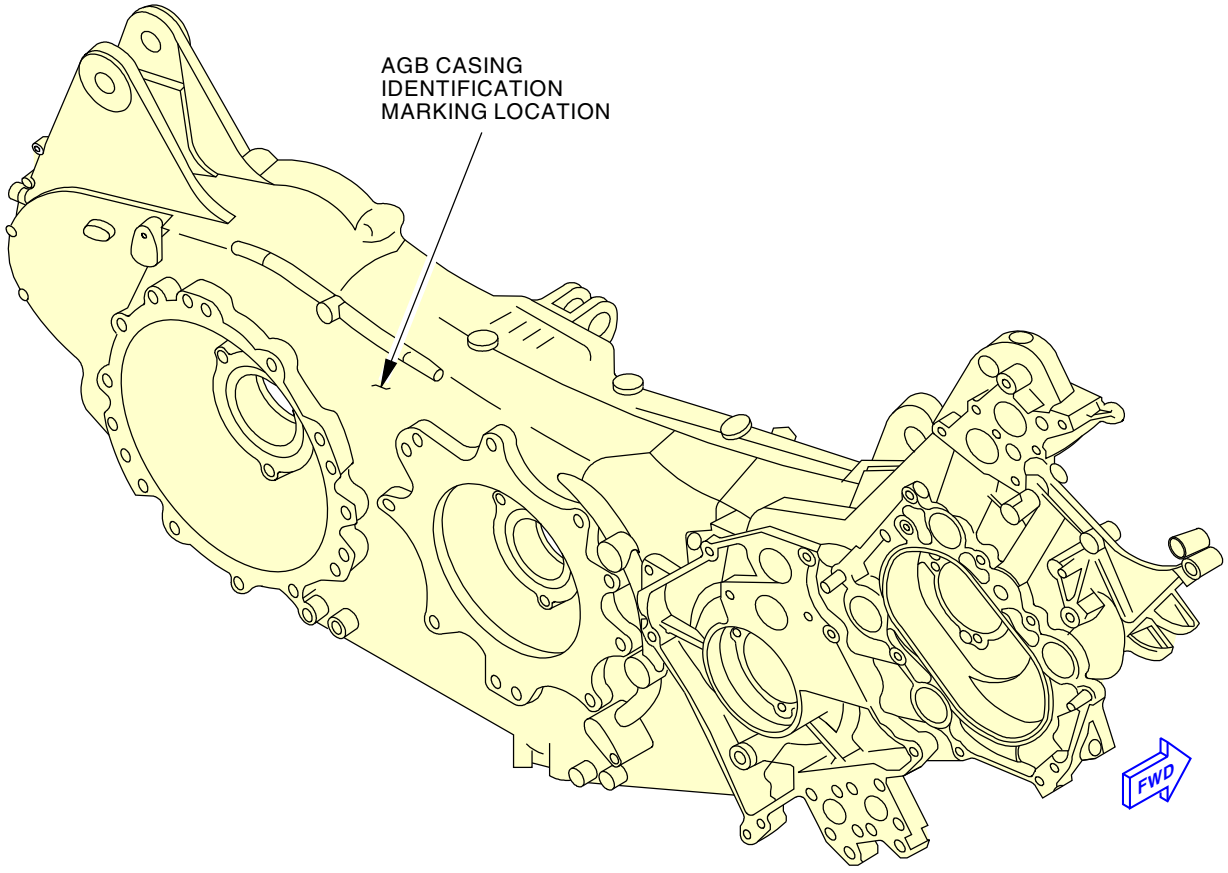
1935796 S0000364962_V3

Stud Removal Drilling Guide
Figure 207/70-48-20-990-805-H00



ACCESSORY GEARBOX HOUSING (AGB)

PAGE-916-RD032-432-S1
2169047 S0000477573_V2

AGB Casing Identification Marking Location
Figure 208/70-48-20-990-810-H00

TIGHTENING TECHNIQUES AND TORQUE VALUES

1. General

A. This procedure contains two tasks:

(1) The instructions to torque and tighten fasteners.

(2) The instructions to use the wrench arc procedure to torque a fastener (does not apply to the fuel manifold).

B. This procedure gives the instructions to torque and to tighten bolts, nuts, and fittings.

C. You torque a fastener when you install a part.

(1) The units of torque are pound-inches (lb-in) or Newton-meters.

(2) You use a specified value of torque to attach a part correctly.

(3) The torque applied to the fastener must not be more than the strength of the fastener material in tension. The torque must also not be more than the strength of the fastener thread in shear.

(4) Torque is the result when you multiply a force by the length of a lever.

(5) One pound-inch of torque is the force of one pound applied to a lever with a length of one inch.

NOTE: Torque values have units of pound-inches or Newton-meters (lb-in or N.m). This is different from work, that applies a force in a straight line for a distance.

TASK 70-51-00-910-801-H01

2. Instruction for Torque

A. General

(1) These are the names and property definitions of a part.

(a) Bolt

1) A bolt is a fastener with an external thread.

(b) Breakaway-Torque

1) The breakaway torque is the torque necessary to start the removal of a nut without an axial load on the nut.

(c) Gross Torque

1) The gross torque is the torque value that the torque wrench applies. Gross torque includes the run-on torque and the seated torque.

(d) Installed Nut

1) The nut is installed when the chamfer plus a minimum of 1.5 threads extend through the nut and the correct torque is applied.

2) It is not necessary for the bolt to extend through the top of the locknuts with a middle-length nylon lock (or other locks).

a) Make sure that the chamfer and 1.5 bolt threads extend through the lock.

(e) Maximum Installation Torque

1) The maximum installation torque is the highest torque value specified for the bolt or nut.

(f) Minimum Prevailing Torque

1) The minimum prevailing torque is the minimum removal torque of a fastener, during the second full turn.

(g) Removed Nut

1) A self-locking nut is removed when the locking section is disengaged from the bolt. The nut can stay on the bolt.

(h) Run-On Torque

1) The run-on torque is the torque necessary to turn a fastener before it is tightened against the seat.

(i) Seated Nut or Bolt

1) The seated nut or bolt is one with the correct torque applied to tighten it.

a) A seated nut or bolt will apply the correct compression force on a spacing element. It will also apply the correct axial load to a bolt.

(j) Spacer or Spacing Element

1) The spacer or spacing elements are the parts that the fasteners hold together.

(k) Unseated Nut or Bolt

1) An unseated nut or bolt is a nut or a bolt that is not in the seated position.

a) An unseated nut or bolt does not apply an axial load on the fastener.

(l) Unseating Torque

1) The unseating torque is the torque necessary to remove a fastener from the bearing surface of a spacer.

a) There will be no axial load on the fastener after the unseating torque is applied.

(m) Seating Torque

1) The seating torque is the torque necessary to put the bearing surface of the fastener into the seated position.

a) You measure the seating torque in the direction used to tighten the fastener.

(n) Acceptance Torque

1) The acceptance torque is the torque that is necessary for the final assembly. This includes the torque that is necessary to overcome the friction between the mating surface or the locking device.

a) You measure the acceptance torque in the direction used to tighten the fastener.

(o) V-band Clamp

1) V-clamps are used to join two flanges together forming a V-clamp joint.

a) The clamp is tightened by applying torque to a nut, which tightens a circumferential band or an integral retainer and lugs exerting an inward radial force onto V-shaped retainer segments.

b) These retainer segments then exert an axial clamping force onto the flanges, joining or pressing them together.

2) Most V-clamps have bolt latches consist of a T-bolt or eyebolt, trunnion, and locknut.

a) T-bolts can only be replaced on quick-release latches; it cannot be replaced on the basic T-bolt latch.

b) Eyebolts cannot normally be replaced.

3) Safety latches are in common use on V-retainer clamps and occasionally on V-band clamps.

a) This is a redundant latch system and maintains joint integrity in the event of primary latch failure.

4) Most V-clamps are tightened with an all-metal locknut.

a) These locknuts have a limited number of installations and removal cycles on a bolt before thread galling and seizure occurs.

b) The follow guidelines will promote successful use of all-metal locknuts on V-clamp bolts.

<1> The follow guidelines will promote successful use of all-metal locknuts on V-clamp bolts.

<a> Nuts should be dry film lubricated with anti-seize compound, D50067 [C02-001] to prevent thread galling and seizure.

<2> Installation of the locknut should not exceed 2 revolutions per second or 120 RPM.

<a> Installation of the locknut should not exceed 2 revolutions per second or 120 RPM.

<b> Excessive nut rotation speed causes frictional heat, which promotes thread galling.

<3> The running torque of the locknut shall be between 6.5 and 40.0 Pound-inches (0.7 and 4.5 Newton-meters).

5) V-clamps are used on two different kinds of flanges, solid machined flanges and flexible sheet metal flanges.

a) All solid machined flanges in pneumatic systems require a seal to make sure that there is no leakage from the flanges.

b) Flexible sheet metal flanges do not use a separate seal.

c) These flanges are made so that they effectively seal themselves on finely machined face surfaces.

6) Prior to the assembly, check the clamp part number to make sure that the correct clamp is being used.

B. References

Reference	Title
71-00-00-800-835-H00	Engine Start (Selection) (P/B 201)
71-00-00-800-837-H00	Usual Engine Stop (P/B 201)
71-11-04-010-814-H00	Open the Fan Cowl Panel (Selection) (P/B 201)
71-11-04-410-814-H00	Close the Fan Cowl Panel (Selection) (P/B 201)
78-31-00-010-816-H00	Open the Thrust Reverser (Selection) (P/B 201)
78-31-00-040-806-H00	Thrust Reverser Deactivation For Ground Maintenance (P/B 201)
78-31-00-410-816-H00	Close the Thrust Reverser (Selection) (P/B 201)
78-31-00-440-805-H00	Thrust Reverser Activation After Ground Maintenance (P/B 201)

C. Consumable Materials

Reference	Description	Specification
B00679 [C04-035]	Alcohol - Isopropyl	
C50124 [C05-117]	Lacquer	
D50067 [C02-001]	Compound - Anti-seize	AMS 2518

(Continued)

Reference	Description	Specification
D50072 [C02-023]	Oil - Engine Lubricating	MIL-PRF-23699
D50194 [C02-004]	Lubricant - Sprayable Air Drying	
G02348 [C10-010]	Pad - Abrasive - Scotch-Brite 7447	
G50631 [C05-061]	developer powder - Zyglo ZP-14A or Zyglo ZP-4B	
G50650 [C10-071]	Wire - Safety, 0.020 or 0.032 inch (0.508 or 0.813 mm) Diameter	SAE AS5685, AMS 5687, AMS 5689, AMS 5690

D. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

E. Tightening Procedures

SUBTASK 70-51-00-910-001-H01

CAUTION

WHEN YOU INCREASE OR DECREASE THE TEMPERATURE OF AN ASSEMBLY, THE TORQUE VALUES CAN CHANGE. APPLY THE FINAL TORQUE AFTER THE PART TEMPERATURES ARE EQUAL TO THE ROOM TEMPERATURE. A FASTENER CAN BECOME LOOSE WHEN A HOT PART BECOMES COOL. A FASTENER CAN BECOME TOO TIGHT WHEN A COOL PART BECOMES HOT.

(1) Follow these steps when you tighten a part.

(a) Turn the fastener at a constant rate until you get the necessary torque.

1) If the torque compresses a gasket or a part after you install it, then apply the torque again.

(b) When you install a part, do these steps:

1) Tighten the parts to a torque value that is less than the necessary torque.

a) If you do not apply equal tension, you can cause a distortion or unwanted load.

2) Tighten the fasteners together, until the part touches the seat.

a) Tighten the opposite fasteners in pairs.

3) Loosen one fastener at a time.

4) Tighten the fastener to the necessary torque.

5) Do not tighten the fasteners to a value that is larger than the specified torque.

SUBTASK 70-51-00-910-002-H01

(2) Torque wrench selection

(a) This procedure does not include torque multipliers for higher torques.

1) You can find the data for torque multipliers in the manufacturer's instructions.

(b) Use the Table 201 to make a selection of the correct torque wrench.

(c) Use the correct size wrench for the work you will do. A torque wrench that is too large will have a tolerance too large to torque the fastener accurately.

Table 201/70-51-00-993-802-H01

Torque Wrench	Torque Limits	Tolerances
30 lb-in (3.39 N.m)	0-25 lb-in (0.000-2.82 N.m)	± 1 lb-in (0.11 N.m)
150 lb-in (16.94 N.m)	26-140 lb-in (2.93-15.82 N.m)	± 5 lb-in (0.56 N.m)
600 lb-in (67.79 N.m)	141-550 lb-in (15.83-62.14 N.m)	± 20 lb-in (2.26 N.m)
1800 lb-in (203.37 N.m)	360-1680 lb-in (40.87-189.81 N.m)	± 60 lb-in (6.78 N.m)
3000 lb-in (338.95 N.m)	1692-2880 lb-in (189.82-325.39 N.m)	± 120 lb-in (13.56 N.m)
12000 lb-in (1355.00 N.m)	2892-12000 lb-in (325.40-1355.00 N.m)	± 240 lb-in (27.12 N.m)

SUBTASK 70-51-00-910-003-H01

(3) These are the instructions to use an offset extension wrench (Figure 201)

(a) When you use an offset extension wrench (for example, a crowfoot extension), you can change the effective length of the torque wrench.

1) The change to the effective length can cause the torque wrench to show an incorrect torque value.

(b) Do these steps to calculate the correct torque indication for the extension wrench:

1) The illustration shows the effective length of the torque wrench (L) and the effective length of the extension (E) (Figure 201).

2) The manufacturers instructions contain the effective length (L) of the torque wrench.

3) Measure the effective length of an extension from the center of the drive opening to the center of the wrench opening.

4) Calculate the total effective length.

a) When the extension points 90° from the torque wrench, the extension has no effect on the effective length of the torque wrench.

b) When the extension points in the same direction as the torque wrench, add the effective lengths of the extension and the torque wrench together (L + E).

c) When the extension points to the handle of the torque wrench, subtract the effective length of the extension from the effective length of the torque wrench (L - E).

5) Do these steps if the effective length of the torque wrench is changed by the extension.

a) Multiply the necessary torque (T) by the effective length of the torque wrench (L).

b) Divide this result by (L + E) or (L - E).

c) This value is the indication of torque (Y) on the torque wrench, that gives the necessary torque on the fastener (Figure 202).

F. Standard Torque Values

SUBTASK 70-51-00-910-004-H01

(1) Steel nuts and bolts

(a) Use Table 202 for the standard torque limits for steel nuts and bolts.

NOTE: Use one half of the limits in the table for these fasteners. (1) Thin steel hexagonal nuts with a height that is less than 0.6 the pitch diameter for a nut without a lock. (2) Thin steel hexagonal nuts with a height of less than 0.8 the pitch diameter for a locknut. (3) Nuts and bolts of nonferrous alloys.

Table 202/70-51-00-993-801-H01

Nominal Size	UNC and -8 Series		UNF and -12 Series	
	Threads per Inch	Torque	Threads per Inch	Torque
No. 4	40	3 - 5 lb-in (0.339 - 0.565 N.m)	---	-------- ----------
No. 6	32	8 - 10 lb-in (0.904 - 1.130 N.m)	40	10 - 12 lb-in (1.130 - 1.356 N.m)
No. 8	32	13 - 16 lb-in (1.469 - 1.808 N.m)	36	16 - 19 lb-in (1.808 - 2.147 N.m)
No. 10	24	20 - 25 lb-in (2.260 - 2.825 N.m)	32	33 - 37 lb-in (3.728 - 4.180 N.m)
No. 12 (1/4 ")	20	40 - 60 lb-in (4.520 - 6.780 N.m)	28	55 - 70 lb-in (6.215 - 7.910 N.m)
5/16	18	70 - 110 lb-in (7.910 - 12.430 N.m)	24	100 - 130 lb-in (11.300 - 14.690 N.m)
3/8	16	160 - 210 lb-in (18.080 - 23.730 N.m)	24	190 - 230 lb-in (21.470 - 25.990 N.m)
7/16	14	250 - 320 lb-in (28.250 - 36.160 N.m)	20	300 - 360 lb-in (33.900 - 40.680 N.m)
1/2	13	420 - 510 lb-in (47.460 - 57.630 N.m)	20	480 - 570 lb-in (54.240 - 64.410 N.m)
9/16	12	575 - 720 lb-in (48 - 60 lb-ft) (64.975 - 81.349 N.m)	18	660 - 780 lb-in (55 - 65 lb-ft) (74.580 - 88.140 N.m)
5/8	11	840 - 960 lb-in (70 - 80 lb-ft) (94.920-108.480 N.m)	18	985 -1140 lb-in (82 - 95 lb-ft) (111.300 - 128.820 N.m)
3/4	10	1620-1860lb-in (135 - 155 lb-ft) (183.035 - 210.152 N.m)	16	1800 - 2240 lb-in (150 - 170 lb-ft) (203.373 - 230.489 N.m)
7/8	9	2460 - 2820 lb-in (205 - 235 lb-ft) (277.980 - 318.617 N.m)	14	2820 - 3180 lb-in (235 - 265 lb-ft) (318.660 - 359.340 N.m)
1.000	8	3600 - 4080 lb-in (300 - 340 lb-ft) (406.800 - 461.040 N.m)	14	4200 - 4800 lb-in (350 - 400 lb-ft) (474.600 - 542.400 N.m)

Table 202/70-51-00-993-801-H01 (Continued)

Nominal Size	UNC and -8 Series		UNF and -12 Series	
	Threads per Inch	Torque	Threads per Inch	Torque
1-1/8	7	5000 - 5720 lb-in (415 - 480 lb-ft) (565.000 - 646.360 N.m)	12	5820 - 6780 lb-in (485 - 565 lb-ft) (657.660 - 766.140 N.m)
1-1/4	7	7200 - 8400 lb-in (600 - 700 lb-ft) (813.600 - 949.200 N.m)	12	8280 - 9600 lb-in (690 - 800 lb-ft) (935.640 -1084.800 N.m)
1-3/8	6	9600 - 11100 lb-in (800 - 930 lb-ft) (1084.800 -1254.300 N.m)	12	10800 - 12720 lb-in (900 - 1060 lb-ft) (1220.400 -1437.360 N.m)
1-1/2	6	12000 - 14400 lb-in (1000 - 1200 lb-ft) (1356.000 -1627.200 N.m)	12	14400 - 16800 lb-in (1200 - 1400 lb-ft) (1627.200 -1898.400 N.m)
1-1/8	8	5280 - 6120 lb-in (440 - 510 lb-ft) (596.640 - 691.560 N.m)	---	------ ----------
1-1/4	8	7500 - 8700 lb-in (625 - 725 lb-ft) (847.500 - 983.100 N.m)	---	------ ----------
1-3/8	8	10100 - 12000 lb-in (840 - 1000 lb-ft) (1138.872 -1356.000 N.m)	---	------ ----------
1-1/2	8	13800 - 16200 lb-in (1150 - 1350 lb-ft) (1559.400 -1830.600 N.m)	---	------ ----------
		POUND-INCHES * 0.113 OR POUND-FEET *1.356 = N.m		

SUBTASK 70-51-00-910-005-H01

(2) Aluminum or magnesium bolts, studs, or a stepped stud

(a) Use Table 203 for the standard torque limits for the aluminum or magnesium bolts and studs, or stepped studs.

NOTE: You must tighten a stud with a different diameter on opposite ends to the torque limit of the smaller diameter.

Table 203/70-51-00-993-807-H01

Bolt or Stud Size	Pound-inches	Newton-meters
3/16 - 24	35 - 40	(3.955 - 4.520)
1/4 - 20	75 - 80	(8.475 - 9.040)

Table 203/70-51-00-993-807-H01 (Continued)

Bolt or Stud Size	Pound-inches	Newton-meters
5/16 - 18	135 - 145	(15.255 - 16.385)
3/8 - 16	240 - 250	(27.120 - 28.250)
7/16 - 14	370 - 380	(41.810 - 42.940)
1/2 - 13	580 - 600	(65.540 - 67.800)

SUBTASK 70-51-00-910-006-H01

(3) Flared Tubing and Hose Fittings

(a) Use Table 204 for the standard torque limits for flared tubing and hose fittings.

NOTE: (1) Use these limits when the internal seal surface is aluminum. The external connector and nut can be steel or aluminum.

NOTE: (2) Use these limits, when the brazed ferrule on a flared tube and its connector are steel. The external fitting and the nut can be steel or aluminum.

Table 204/70-51-00-993-805-H01 LEGACY TABLE-T-G-70-51-00-2-TABLE12

Tube OD (inch)	Thread Size (inch)-(No.)	All Aluminum Parts (Note 1)	Steel Tube Aluminum/Steel Nuts (Note 2)
1/8	5/16 - 24	----------	40 - 50 lb-in (4.520 - 5.650 N.m)
3/16	3/8 - 24	35 - 45 lb-in (3.954 - 5.084 N.m)	90 - 100 lb-in (10.170 - 11.300 N.m)
1/4	7/16 - 20	50 - 60 lb-in (5.649 - 6.779 N.m)	135 - 155 lb-in (15.253 - 17.513 N.m)
5/16	1/2 - 20	65 - 75 lb-in (7.344 - 8.474 N.m)	175 - 205 lb-in (19.772 - 23.169 N.m)
3/8	9/16 - 18	95 - 105 lb-in (10.734 - 11.863 N.m)	265 - 305 lb-in (29.941 - 34.460 N.m)
1/2	3/4 - 16	165 - 185 lb-in (18.642 - 20.902 N.m)	460 - 540 lb-in (51.973 - 61.012 N.m)
5/8	7/8 - 14	230 - 270 lb-in (25.986 - 30.506 N.m)	665 - 775 lb-in (75.135 - 87.563 N.m)
3/4	1-1/16- 12	330 - 385 lb-in (28 - 32 lb-ft)(37.285 - 43.499 N.m)	940 - 1100 lb-in (78 - 92 lb-ft)(106.206 - 124.283 N.m)
1.000	1-5/16- 12	555 - 645 lb-in (46 - 54 lb-ft)(62.707 - 72.875 N.m)	1325 - 1555 lb-in (110 - 130 lb-ft)(149.705 - 175.561 N.m)
1-1/4	1-5/8 - 12	720 - 840 lb-in (60 - 70 lb-ft)(81.349 - 94.907 N.m)	1550 - 1800 lb-in (130 - 150 lb-ft)(175.126 - 203.373 N.m)
1-1/2	1-7/8 - 12	720 - 840 lb-in (60 - 70 lb-ft)(81.349 - 94.907 N.m)	1900 - 2200 lb-in (158 - 183 lb-ft)(214.700 - 248.600 N.m)

SUBTASK 70-51-00-910-007-H01

(4) Plugs and Tube Fittings

(a) Use Table 205 for the standard torque limits for plugs and tube fittings:

Table 205/70-51-00-993-806-H01 LEGACY TABLE-T-G-70-51-00-2-TABLE13

Fitting Size	Thread Size (inch) (pitch)	Torque Limits	Torque Unit
-2	5/16 - 24	40 - 50 (4.514 - 5.643)	lb-in (N.m)

Table 205/70-51-00-993-806-H01 LEGACY TABLE-T-G-70-51-00-2-TABLE13 (Continued)

Fitting Size	Thread Size (inch) (pitch)	Torque Limits	Torque Unit
-3	3/8 - 24	90 - 100 (10.158 - 11.387)	lb-in (N.m)
-4	7/16 - 20	135 - 155 (11.25 - 12.92) (15.253 - 17.513)	lb-in (lb-ft) (N.m)
-5	1/2 - 20	155 - 175 (12.91 - 14.66) (17.513 - 19.772)	lb-in (lb-ft) (N.m)
-6	9/16 - 18	175 - 205 (14.58 - 17.08) (19.772 - 23.162)	lb-in (lb-ft) (N.m)
-8	3/4 - 16	265 - 305 (22.08 - 25.42) (29.941 - 34.460)	lb-in (lb-ft) (N.m)
-10	7/8 - 14	350 - 410 (29.17 - 34.17) (39.545 - 46.324)	lb-in (lb-ft) (N.m)
-12	1-1/16- 12	555 - 645 (46.25 - 53.75) (62.607 - 72.875)	lb-in (lb-ft) (N.m)
-16	1-5/16- 12	720 - 850 (60.00 - 70.00) (81.349 - 94.907)	lb-in (lb-ft) (N.m)
-20	1-5/8 - 12	885 - 1035 (73.75 - 86.25) (99.992 - 116.939)	lb-in (lb-ft) (N.m)
-24	1-7/8 - 12	995 - 1035 (82.92 - 97.08) (112.420 - 131.627)	lb-in (lb-ft) (N.m)

G. Plugs and Tube fittings

SUBTASK 70-51-00-910-008-H01

(1) Follow these steps to install these three types of tube fittings (Figure 203)

(a) A non-positioning fitting that uses a preformed packing or a compression packing for a seal

(b) A positioning fitting

1) The positioning fitting can use a backup washer.

(c) A universal bulkhead fitting with a locknut.

SUBTASK 70-51-00-910-009-H01

(2) Assembly Procedures

(a) The installation of a preformed packing on a fitting

1) Lubricate the preformed packing as specified in the maintenance manual.

2) Do these steps when the ratio of the diameter to the cross-section of a preformed packing is larger than 20.
   a) Install a conical sleeve on the fitting.
   b) Roll the packing into the groove of the fitting.
      NOTE: This prevents damage to the packing.
3) Do these steps when the ratio is below 20.
   a) Use a conical sleeve to roll the packing over a thread or spline.
   b) Roll the packing into the groove of the fitting.

(b) Lubrication
1) Do not use a lubricant on the threads or on the friction surfaces unless it is specified by the maintenance manual.

(c) Non-positioning Fittings
1) Lightly lubricate the packing as specified in the maintenance manual.
   NOTE: The lubrication can help to prevent damage to packing by the sharp edges of the threads.
   a) Install the packing on the fitting.
      <1> Make sure that the packing is in the groove of the fitting
   b) Install the fitting into the boss.
   c) Tighten the fitting to the specified torque limits.

(d) Positioning Fittings (without backup washers)
1) Install the locknut through the first section of the threads on the fitting.
   a) Continue through the packing groove.
   b) Continue to the second section of the threads on the fitting.
2) Lubricate the packing as specified in the maintenance manual.
3) Carefully install the packing over the first section of the threads and into the packing groove.
   a) The packing must be adjacent to the second section of the threads.
4) Turn the locknut until it touches the packing.
5) Install the fitting in the boss until the packing touches the countersunk surface.
6) Turn the fitting counterclockwise (not more than one turn) to get the necessary position.
7) Hold the fitting while you tighten the locknut to the specified torque limit.

(e) Positioning Fittings (with backup washers)
1) Install the locknut through the first section of the threads on the fitting.
   a) Continue through the packing groove.
   b) Continue to the second section of the threads of the fitting.
   c) The washer recess must point in the direction of the packing groove.
2) Tightly hold the backup washer by its outer edge to turn the fitting into the backup washer.
   a) Do not use a lubricant.

b) Continue to turn the washer on the fitting until the washer is free in the packing groove.

c) Remove the pieces of plastic material that the fitting cut from the washer.

d) Push the edge of the washer into the recess in the locknut.

<1> Make sure that the washer is fully seated in the locknut.

<2> Make sure that the threads of the fitting do not keep the washer from its seat in the locknut.

3) Lubricate the packing as specified in the maintenance manual.

NOTE: The lubrication can help to prevent damage to packing by the sharp edges of the threads.

4) Carefully install the packing over the first section of the threads and into the packing groove.

a) The packing must be adjacent to the washer.

5) Install the fitting in the boss until the packing touches the countersunk surface.

6) Hold the locknut in its position with a wrench.

a) Turn the fitting into the boss 1.5 turns.

7) Turn the fitting a maximum of one more turn into its correct position in the boss (total of 1.5 to 2.5 turns).

8) Hold the fitting while you tighten the locknut to the specified torque limit.

(f) Universal Bulkhead Fittings

1) Attach the bulkhead fitting to a bulkhead with the locknut.

a) Hold the fitting with a wrench and tighten the locknut to the specified torque limit.

2) Connect the tube nuts or the hose nuts to the bulkhead fitting.

a) Hold the fitting with a wrench and tighten the tube nuts to the specified torque limit.

(g) Tube, manifold, and hose (0.75 in. (19 mm) and smaller in diameter) coupling nuts triple tightening procedure.

1) Tighten the coupling nut to applicable torque identified in Standard Torque Values.

2) Break the torque on the coupling nut and then tighten to the torque value identified.

3) Check joint by tightening the coupling nut again to the torque value identified.

H. Net Torque

SUBTASK 70-51-00-910-010-H01

(1) The maintenance manual will give a net torque value when the axial force that you apply to a fastener is important.

(a) Make sure that you use the net torque limits when they are specified.

SUBTASK 70-51-00-910-011-H01

(2) Net torque is equal to the gross torque minus the run-on torque.

(a) The steps that follow give an example to show how you find the net torque.

1) You must tighten a nut on a bolt to a net torque of 20-40 pound-inches (2.46-4.52 Newton-meters).

2) Turn the nut on the bolt.

a) Find the torque that turns the nut before it touches its seat.

3) Record this value as the run-on torque.

4) Add the run-on torque value to the minimum and maximum specified torque values .

I. Torque Check for the Re-Use of Self Locking Nuts

NOTE: This data does not apply to nuts that you must use one time only (refer to the maintenance manual).

SUBTASK 70-51-00-910-012-H01

(1) To reuse a self locking nut, the nut must have a specified minimum breakaway torque.

SUBTASK 70-51-00-910-013-H01

(2) Do the breakaway torque check as follows:

CAUTION

DO NOT BEND A SELF-LOCKING NUT TO GET THE NECESSARY SELF-LOCKING TORQUE. FAILURE OF THE NUT CAN OCCUR.

(a) Install the nut on a bolt until 2 to 5 threads show through the nut.

1) Measure the torque that is necessary when you turn the nut on the bolt.

(b) Use Table 206 for the minimum breakaway torque for self locking nuts that are silver plated, have a dry film coating, or have a dry film lubricant.

(c) Use Table 206 for the minimum breakaway-torque for the self locking nuts that do not have an axial load limit.

(d) Replace all the nuts that do not meet the minimum torque values.

Table 206/70-51-00-993-804-H01 LEGACY TABLE-T-G-70-51-00-2-TABLE14

Thread Size	Threads/Inch	Minimum Breakaway Torque
0.136 (6)	32/40	1.0 lb-in (0.11 N.m)
0.164 (8)	32/36	1.5 lb-in (0.17 N.m)
0.190 (10)	32	2.0 lb-in (0.22 N.m)
1/4	28	3.5 lb-in (0.40 N.m)
5/16	24	6.5 lb-in (0.73 N.m)
3/8	24	9.5 lb-in (1.07 N.m)
7/16	20	14.0 lb-in (1.58 N.m)
1/2	20	18.0 lb-in (2.03 N.m)
9/16	18	24.0 lb-in (2.71 N.m)
5/8	18	32.0 lb-in (3.62 N.m)
3/4	16	50.0 lb-in (5.65 N.m)
7/8	14	70.0 lb-in (7.91 N.m)
1.0	14	92.0 lb-in (10.39 N.m)
1-1/8	12	117.0 lb-in (13.22 N.m)
1-1/4	12	143.0 lb-in (16.16 N.m)

J. V-Clamp Installation procedure

SUBTASK 70-51-00-910-014-H01

(1) Examine all of the V-clamp components for cleanliness, the correct assembly, and correct operation.

(a) You must clean, repair or replace the V-clamp if necessary before the assembly.

(b) Slip the V-clamp over the flanged tube end.

1) Avoid overspreading the band on sheet metal clamps (Figure 210)

(c) Install the seal in the male flange.

CAUTION MAKE SURE THAT THE SEAL STAYS IN THE GROOVE WHEN YOU SET THE FLANGES. IF THE SEAL IS NOT IN THE GROOVE, DAMAGE TO THE SEAL AND THE FLANGES COULD OCCUR.

(d) Put the mating flange into its position.

(e) Align the components to be joined.

NOTE: The weight of the component bearing assembled should not be supported by the V-clamp.

1) Align the tubes or tubing components to be joined to within the minimum permissible gap (Figure 211).

a) To prevent the misalignment, all adjacent support clamps or brackets should stay loose until the installation of the V-clamp has been completed.

b) The correct alignment of the flanges prior to the V-clamp installation is necessary to achieve good joint performance.

2) V-clamps that secure gearbox mounted components or the Starter Air Valve to the Starter should mount flush with no visible gaps in the mating flanges.

(f) Verify V-clamp lubrication..

1) Most V-Channel clamps are coated with sprayable air drying lubricant, D50194 [C02-004] on the inside surface.

a) Repair sprayable air drying lubricant, D50194 [C02-004] if necessary.

2) Clamps in external air systems are not coated with sprayable air drying lubricant, D50194 [C02-004].

a) Coat the inside surface with a thin film of engine lubricating oil, D50072 [C02-023] prior to installation.

(g) Place the V-clamp on the mated flanges and tighten the nut.

1) On quick release type V-clamps the bolt is to be fully seated in the latch (Figure 207)

a) On T-bolt quick release latches, insert the widest part of the T-bolt head into the latch so that the latch resists rotation of the bolt.

b) The incorrect orientation can cause failure of the quick release latch.

2) Orient clamp, if it is necessary (Figure 210).

3) Tighten the nut to at least 50% of the required torque.

a) Do a check to make sure that the clamp has seated over flanges equally around the periphery.

b) Do a check for correct flange alignment.

<1> The radial flange alignment can be checked visually between adjacent retainers by visually examine the flange O.D. through the gaps in the retainer.

4) Lightly tap the clamp around its circumference with a fiber mallet to distribute band tension.

NOTE: Do not hit the latch.

5) Slowly increase torque to 100%.

a) While increasing torque to 100% of the specified value, lightly tap around the outer periphery as necessary to prevent unequal loading.

6) After the specified torque has reached 100%, retap around the band and retorque once more to the specified value.

a) No additional tightening should be required.

7) Examine the V-clamp latch gap and retainer gap.

NOTE: Make sure that there is no contact in the V-clamp latch gap and retainer gap. Contact in these areas can decrease joint performance.

8) The latch gap for V-Retainer clamps should not be less than the values in the

a) If the latch gap is less than the values in the table, replace the clamp and examine the flanges for wear.

Table 207/70-51-00-993-808-H00 V-Retainer Clamp Minimum Installed Latched Gaps

Tube O.D	Latch Gap
1.50 inches (38.10 mm)	0.150 inch (3.81 mm)
1.75 inches (44.50 mm)	0.150 inch (3.81 mm)
2.00 inches (50.80 mm)	0.175 inch (4.45 mm)
2.25 inches (57.20 mm)	0.175 inch (4.45 mm)
2.50 inches (63.50 mm)	0.190 inch (4.83 mm)
2.75 inches (69.90 mm)	0.190 inch (4.83 mm)
3.00 inches (76.20 mm)	0.190 inch (4.83 mm)
3.25 inches (82.60 mm)	0.190 inch (4.83 mm)
3.50 inches (88.90 mm)	0.190 inch (4.83 mm)
4.00 inches (102.00 mm)	0.250 inch (6.35 mm)
4.50 inches (114.00 mm)	0.250 inch (6.35 mm)
5.00 inches (127.00 mm)	0.300 inch (7.62 mm)
5.50 inches (140.00 mm)	0.300 inch (7.62 mm)
6.00 inches (152.00 mm)	0.400 inch (10.20 mm)
6.50 inches (165.00 mm)	0.400 inch (10.20 mm)
7.00 inches (178.00 mm)	0.450 inch (11.40 mm)
7.50 inches (191.00 mm)	0.450 inch (11.40 mm)

9) Safety wire hex nuts that have safety wire holes.

10) Mark the nut and bolt assembly for inspection purposes with lacquer, C50124 [C05-117].

11) Adjust and tighten tubing supports if necessary after the V-clamp installation.
    a) Avoid introduction of high bending loads from misaligned supports.
12) Complete the assembly of all adjacent support clamps and brackets in the tube assembly per instructions.

SUBTASK 70-51-00-910-022-H00

(2) V-clamp Inspection Procedures.

NOTE: Some V-clamps designed for different applications may appear to be of the same size and could be physically interchanged. It is possible that a lighter duty V-clamp could be accidentally installed in an application requiring a higher-strength clamp, or a clamp made from materials intended only for noncritical temperature applications may be incorrectly used in an elevated temperature installation. Be careful of installation of the incorrect clamp. Even though the fit may be good, the operating conditions require the correct V-clamp installations. Thus, make sure that the specified part number V-clamp is used.

(a) Do these steps to examine the V-clamp (Figures 212 and 213).

NOTE: Replace any V-clamp that is deficient.

1) Kinks or permanent twist due to overspreading.
2) Crown or bend over the apex of the retainer due to over tighten.
3) Installation instructions and torque markings missing from the clamp.
4) Evidence of permanent deformation to the retainers, such as overspreading of an angle to 44 degrees or greater (Figures 206 and 208).
5) The tool marks and cracks on the retainer inside corner radii.
6) Deformation and damaged threads to the bolts.

   NOTE: Some of the small diameter V-band clamps are design with curved T-bolts.
7) Evidence of overloading or binding to trunnion or latch parts with the strap.
8) Incorrect nut.

   NOTE: Most V-clamps use a locknut.
9) Damaged nut.

   NOTE: Nut is to be clean and free of chips and burrs with no damaged or galled threads.
10) Broken welds and rivets on the joint holding sheet metal band to the retainer.

(b) Do these steps to examine the flanges to be joined by the V-clamp (Figure 214).

1) Compatibility with each other and with the seal to be used.
   a) Make sure that you use the correct V-clamp flanges and seal.
2) Scratches, dirt, or grease.
   a) Clean surface contamination with Scotch-Brite 7447 pad, G02348 [C10-010] and alcohol, B00679 [C04-035] or replace the flange.
3) Cracks, tool marks, nicks, or dings on the machined inner corners of solid machined flanges that could cause interference or failure.
   a) Any nicks and dings that could cause interference should be blended smooth.
4) Surface wear on flange interface surfaces that could cause interference with the V-band retainer limiting proper installation.

a) Replace worn flanges.

(c) Do these steps to examine the seal (Figure 214).

1) The correct part number.

2) Clean and serviceable.

a) Do not reuse seals.

SUBTASK 70-51-00-910-023-H00

(3) V-band Clamp Leak Test Procedures.

(a) There are two leak test procedures to find the location of a pneumatic joint air-leak.

NOTE: One procedure uses aluminum foil and the other uses dry developer, G50631 [C05-061].

1) Do the steps that follow to complete the leak test using aluminum foil .

a) Make one wrap of the aluminum foil around the joint.

b) Twist the end of the seam tight as shown.

c) Make the wrap as tight as possible on the tube but do not cause damage to the wrap.

d) Attach the wrap with safety wire, G50650 [C10-071] at the sides of the joint.

2) Do the step that follows to complete the leak test using dry developer, G50631 [C05-061].

a) Apply dry developer, G50631 [C05-061] around the fitting or fittings being tested for leaks.

b) Do the step that follows to complete the leak test using dry developer, G50631 [C05-061].

<1> Apply dry developer, G50631 [C05-061] around the fitting or fittings being tested for leaks.

c) Do these steps to close access.

<1> Make sure that the work area is clean and clear of tools and other items.

<2> Make sure that the thrust reverser cowl doors are closed.

<3> Make sure that the fan cowl panels are closed (TASK 71-11-04-410-814-H00).

<4> Remove all the access platforms.

d) Do these steps to test the engine.

<1> Make sure that the thrust reverser is serviceable TASK 78-31-00-440-805-H00.

<2> Do this task: Engine Start (Selection), TASK 71-00-00-800-835-H00.

<a> Keep the engine at idle for 5 minutes.

<3> Do this task: Usual Engine Stop, TASK 71-00-00-800-837-H00.

WARNING DO THE DEACTIVATION TASK FOR THE THRUST REVERSER HALF TO PREVENT THE OPERATION OF THE THRUST REVERSER HALF. THE ACCIDENTAL OPERATION OF THE THRUST REVERSER HALF CAN CAUSE INJURY TO PERSONS OR DAMAGE TO THE EQUIPMENT.

e) Get Access.

<1> Do this task: Open the Fan Cowl Panel (Selection), TASK 71-11-04-010-814-H00.

<2> Make sure that the thrust reverser is unserviceable Thrust Reverser Deactivation For Ground Maintenance, TASK 78-31-00-040-806-H00.

<3> Do this task: Open the Thrust Reverser (Selection), TASK 78-31-00-010-816-H00.

<4> Put an adjustable access platform in its position.

f) Do the visual inspection.

<1> Make sure that there are no leaks at the ducts that being tested.

<a> For the leak test with aluminum foil, a leaking clamp will cause the foil to balloon or burst.

<b> For the leak test with dry developer, G50631 [C05-061] a leaking clamp will displace the dry developer, G50631 [C05-061].

<2> Remove all the leak test materials.

g) Do these steps for close-up.

<1> Make sure that the work area is clean and clear of tools and other items.

<2> Do this task: Close the Thrust Reverser (Selection), TASK 78-31-00-410-816-H00.

<3> Make sure that the thrust reverser is serviceable (TASK 78-31-00-440-805-H00).

<4> Do this task: Close the Fan Cowl Panel (Selection), TASK 71-11-04-410-814-H00.

<5> Remove all the access platforms.

K. Acceptability Limits and Acceptance Torques

NOTE: These are the torque values you use to verify the parts that are assembled to the engine before the engine test.

SUBTASK 70-51-00-910-021-H01

(1) You use these torque values during the inspection or audit to make sure that the correct torque was applied.

(a) Use Table 208 for the acceptability limits.

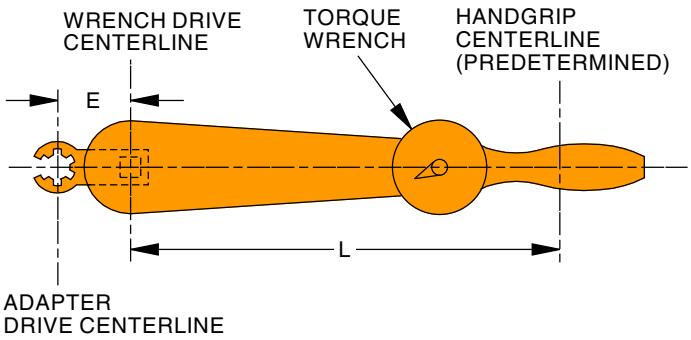
Table 208/70-51-00-993-803-H01 LEGACY TABLE-T-G-70-51-00-2-TABLE15

Thread Size	Seating Torque lb-in (N.m)	Acceptance Torque lb-in (N.m)
0.190-32	24-27 (2.71-3.05)	21-39 (2.37-4.41)
0.190-32	33-37 (3.73-4.18)	30-46 (3.39-5.20)

Table 208/70-51-00-993-803-H01 LEGACY TABLE-T-G-70-51-00-2-TABLE15 (Continued)

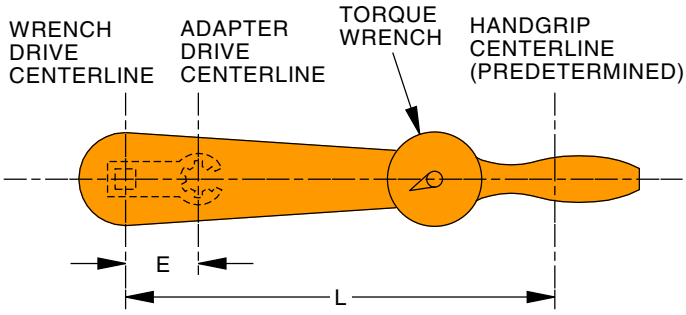
Thread Size	Seating Torque lb-in (N.m)	Acceptance Torque lb-in (N.m)
0.190-32	40-60 (4.52-6.78)	36-78 (4.07-8.81)
0.250-28	28-35 (3.16-3.95)	24-46 (2.71-5.20)
0.250-28	55-70 (6.21-7.91)	50-91 (5.65-10.28)
0.250-28	110-120 (12.43-13.56)	100-156 (11.30-17.63)
0.3125-24	100-130 (11.30-14.69)	91-169 (10.28-19.09)
0.375-24	190-230 (21.47-25.99)	172-299 (19.43-33.78)
0.375-24	380-420 (42.93-47.45)	344-546 (38.87-61.69)
0.375-24	540-560 (61.01-63.27)	489-728 (55.25-82.25)

END OF TASK



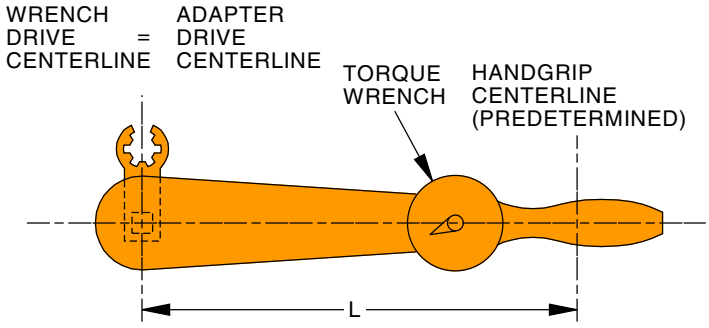
WHEN YOU USE A TORQUE WRENCH ADAPTER, YOU CAN CHANGE THE EFFECTIVE LENGTH OF THE TORQUE WRENCH. YOU APPLY THE FOLLOWING FORMULA TO OBTAIN THE CORRECTED TORQUE READING:

$$Y = \frac{T \times L}{L + E}$$



WHEN YOU USE A TORQUE WRENCH ADAPTER, YOU CAN CHANGE THE EFFECTIVE LENGTH OF THE TORQUE WRENCH. YOU APPLY THE FOLLOWING FORMULA TO OBTAIN THE CORRECTED TORQUE READING:

$$Y = \frac{T \times L}{L - E}$$



IF AN ADAPTER DOES NOT CHANGE THE EFFECTIVE LENGTH OF THE TORQUE WRENCH, A CORRECTED TORQUE READING IS NOT NECESSARY.

LEGEND:

T = ACTUAL (DESIRED) TORQUE
Y = APPARENT (INDICATED) TORQUE
L = EFFECTIVE LENGTH OF TORQUE WRENCH
E = EFFECTIVE LENGTH OF EXTENSION OR ADAPTER

M06339 S0004285433_V2

Use of Offset Extension Wrench
Figure 201/70-51-00-990-803-H01

Given:

Necessary torque (t) = 265 lb-in

Effective length of the torque wrench (L) = 8.4 inches (213.36 mm)

Effective length of the extension (E) = 1.5 inches (38.1 mm)

$$Y = \frac{T \times L}{L + E}$$

Then:

(T) x (L) = 265 x 8.4 = 2226.0 lb-in
(29.94 N.m X 213.36 mm = 6388.00)

(L + E) = 8.4 + 1.5 = 9.9 inches
(213.36 mm + 38.1 mm = 251.46 mm)

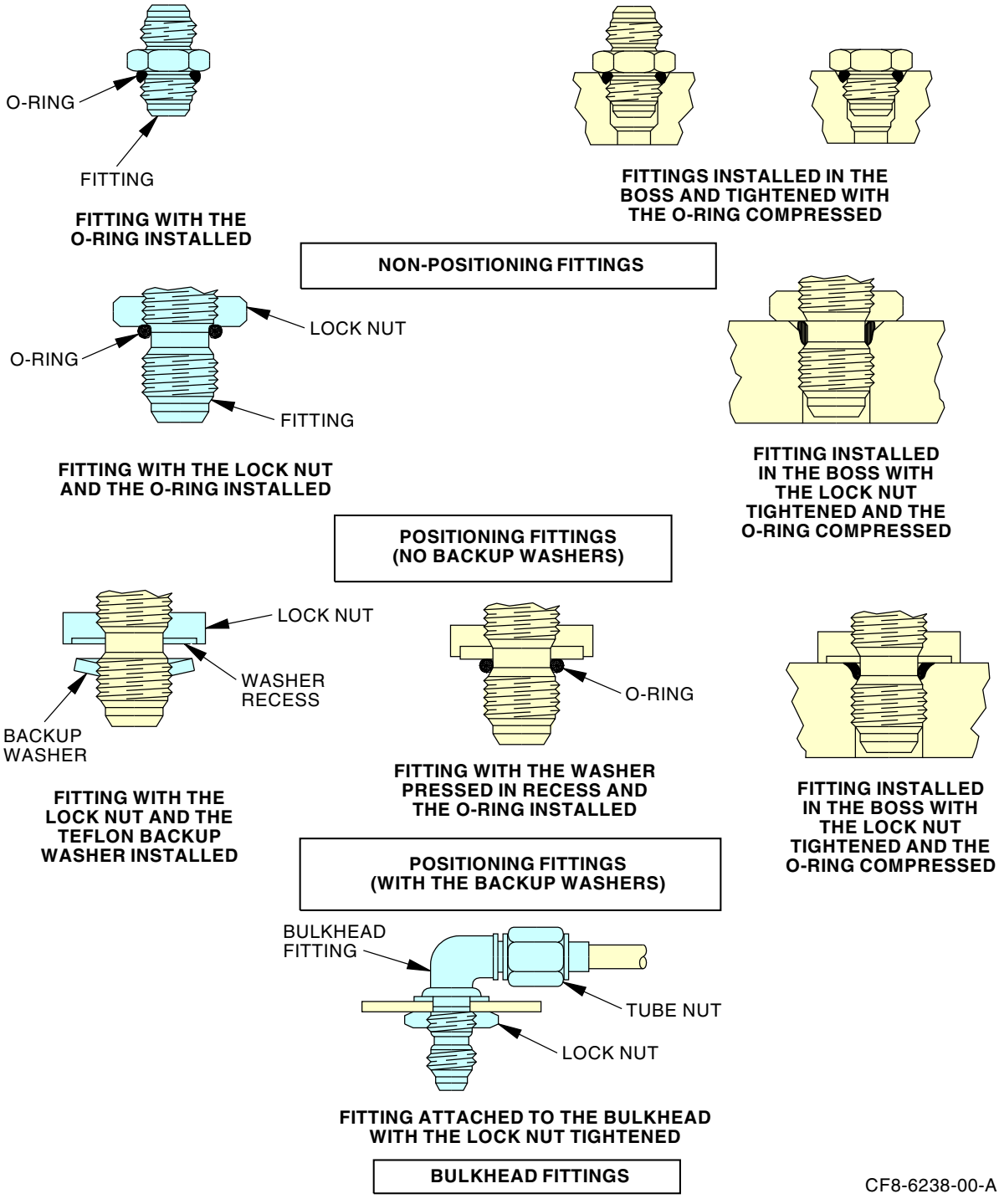
$$Y = \frac{2226.0}{9.9} = 224.85 \text{ lb-in}$$

$$\frac{6388.00}{251.46} = 25.404 \text{ N.m}$$

Thus: An indication of torque on the wrench of 225 lb-in (25.42 N.m) gives the necessary torque of 265 lb-in (29.94 N.m).

M06340 S0004285434_V1

Torque Calculation on the Fastener
Figure 202/70-51-00-990-804-H01



Installation and Tightening of Plug and Tube Fittings
Figure 203/70-51-00-990-805-H01

Example:

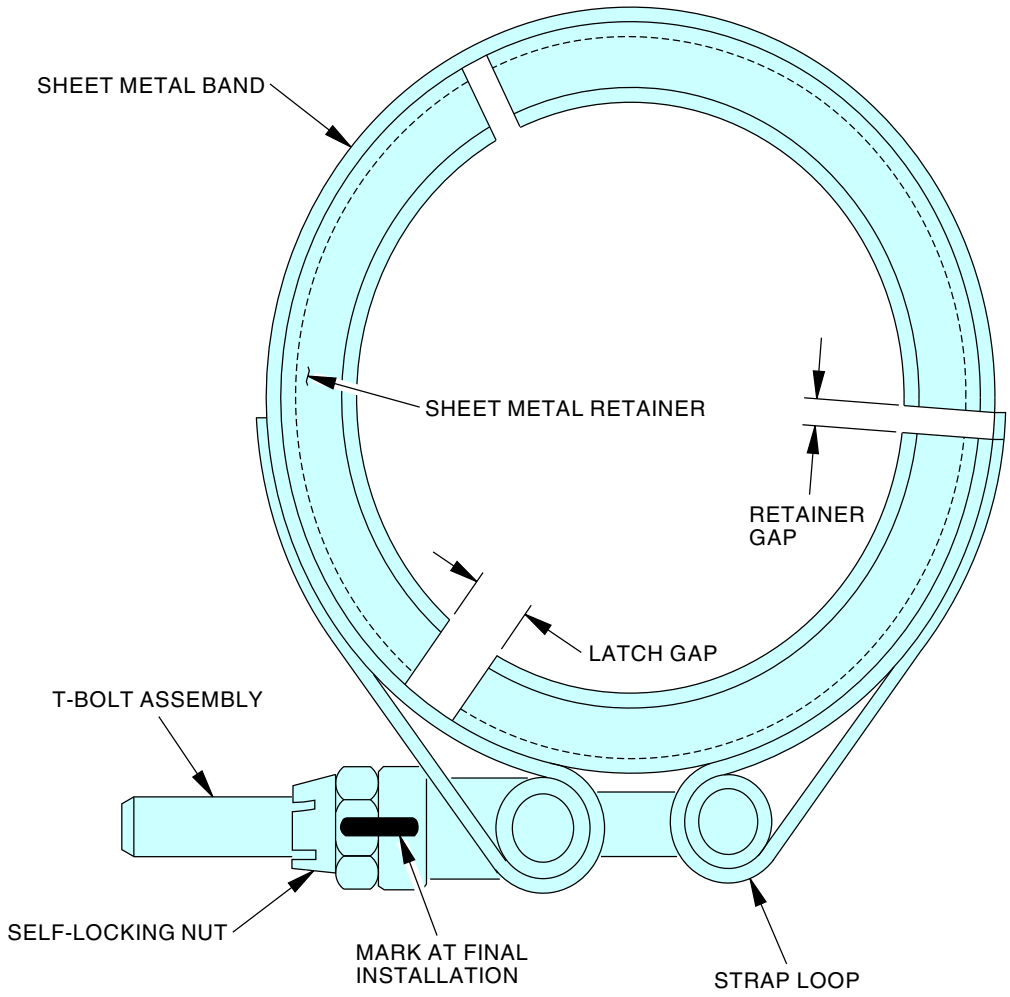
20 lb-in	(2.26 N.m)	
+15 lb-in	(+1.69 N.m)	
35 lb-in.	(3.95 N.m)	

40 lb-in	(4.52 N.m)	
+15 lb-in	(+1.69 N.m)	
55 lb-in.	(6.21 N.m)	

Thus: to get a net torque of 20-40 lb-in. (2.26-4.52 N.m), you must apply a gross torque of 35-55 lb-in (3.95-6.21 N.m) to the nut.

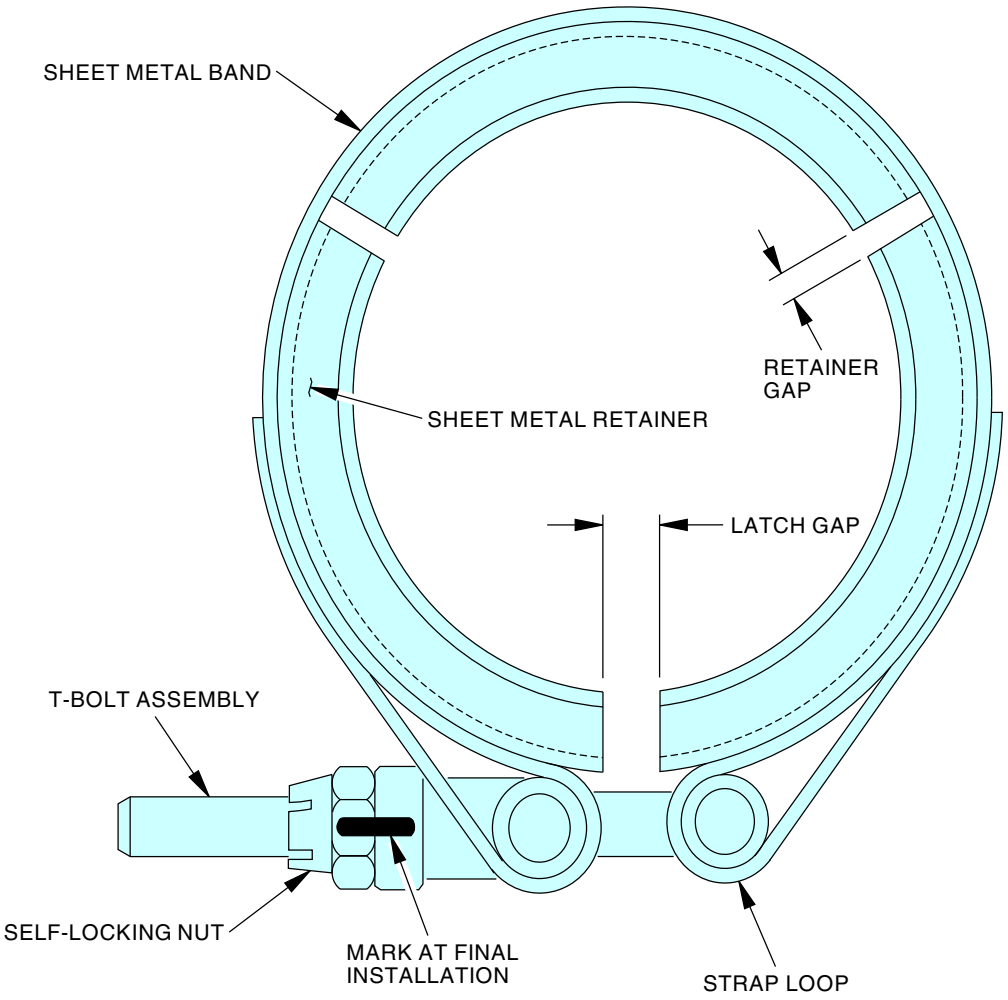
M06342 S0004285436_V1

Net Torque Calculation
Figure 204/70-51-00-990-806-H01



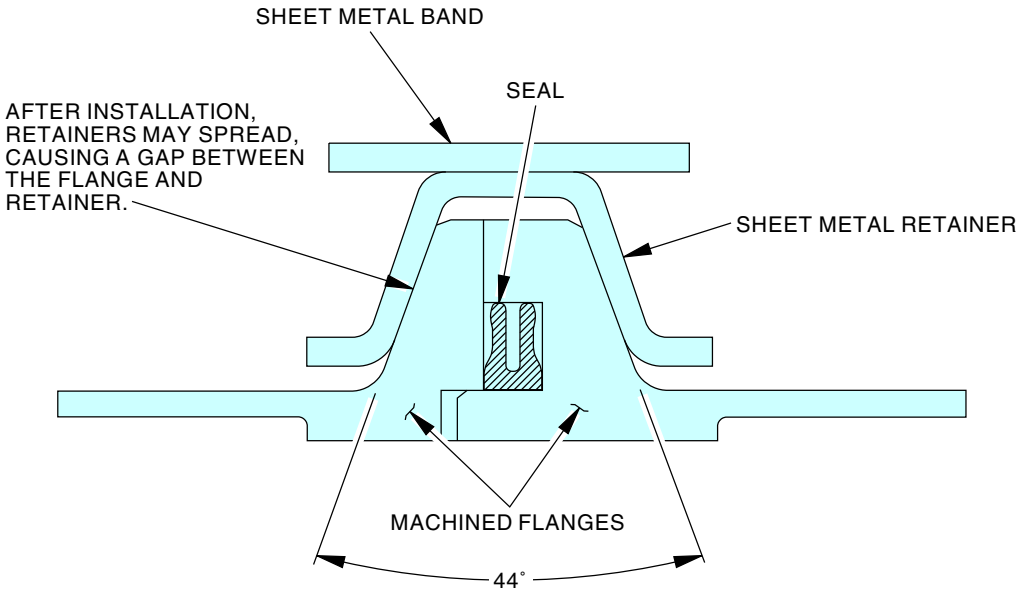
1509576 S0000276796_V2

V-band Clamp
Figure 205/70-51-00-990-807-H00 (Sheet 1 of 2)



1509571 S0000276797_V2

V-band Clamp
Figure 205/70-51-00-990-807-H00 (Sheet 2 of 2)

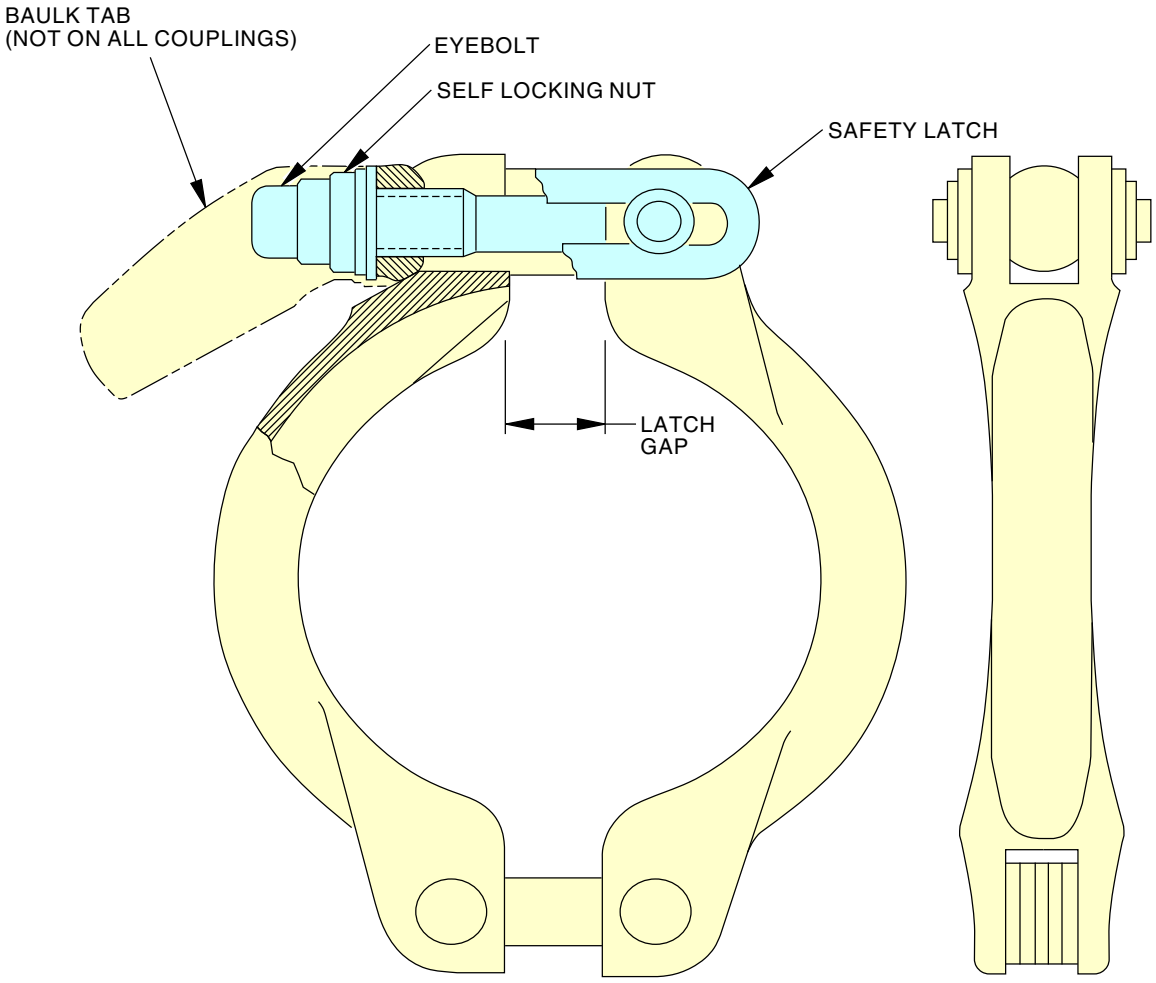


NOTE:

ANGLE SHOULD BE LESS THAN 44 DEGREES.

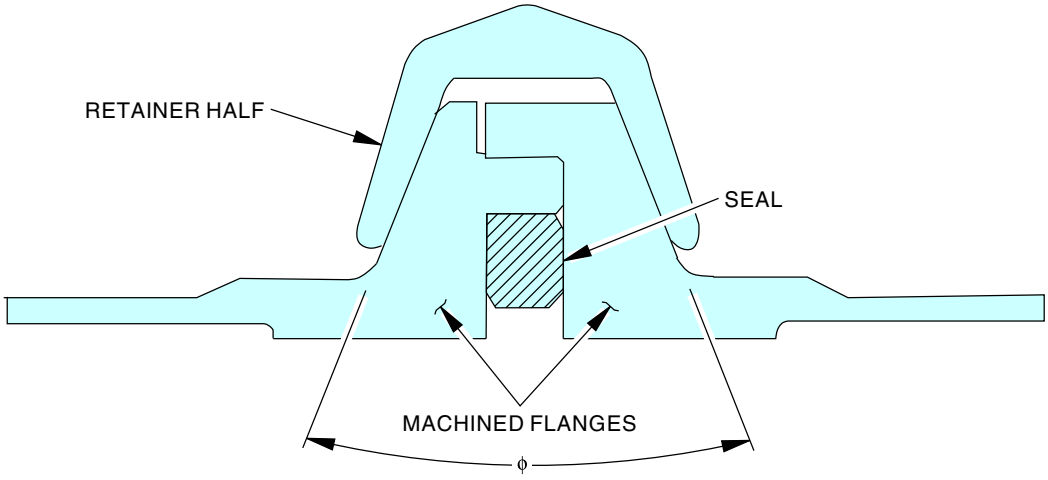
1509577 S0000276798_V2

V-band Clamp Joint
Figure 206/70-51-00-990-808-H00



1509570 S0000276799_V2

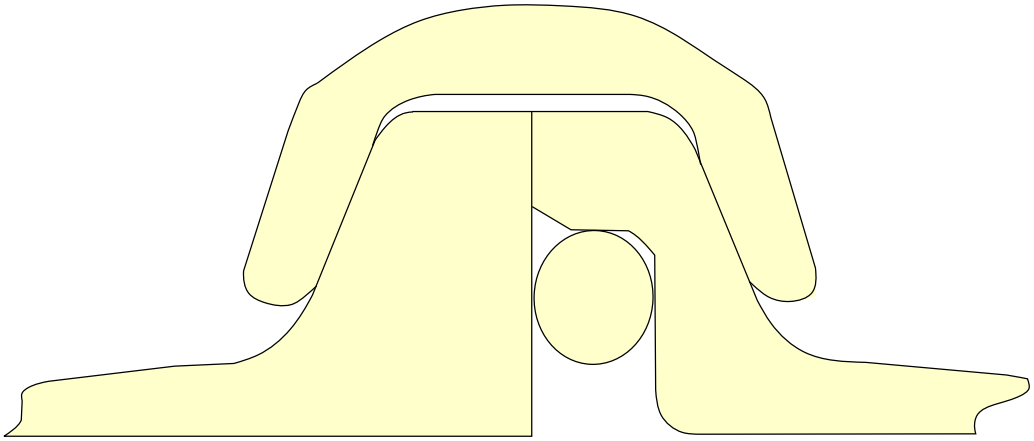
V-retainer Clamp
Figure 207/70-51-00-990-809-H00



TYPICAL TUBING CONNECTION

NOTE:

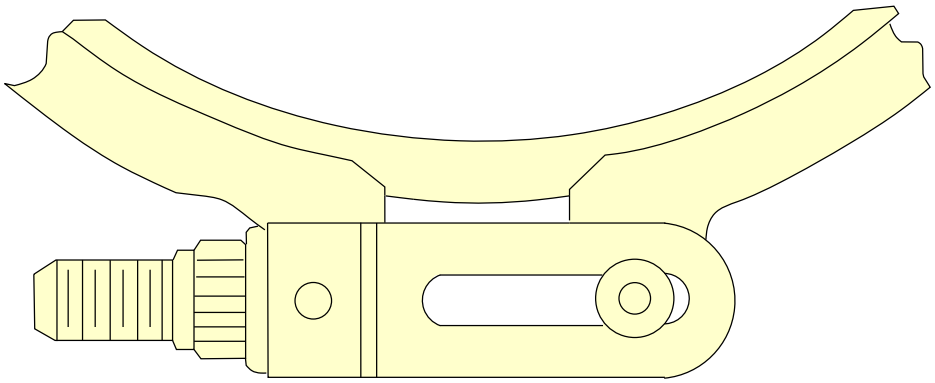
ANGLE SHOULD BE LESS THAN 44 DEGREES.



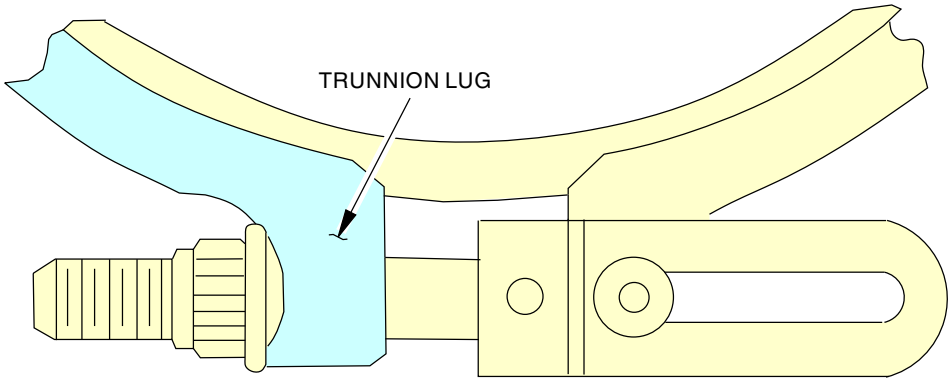
TYPICAL HARDWARE INSTALLATION

1509656 S0000276800_V2

V-retainer Clamp Joint
Figure 208/70-51-00-990-810-H00



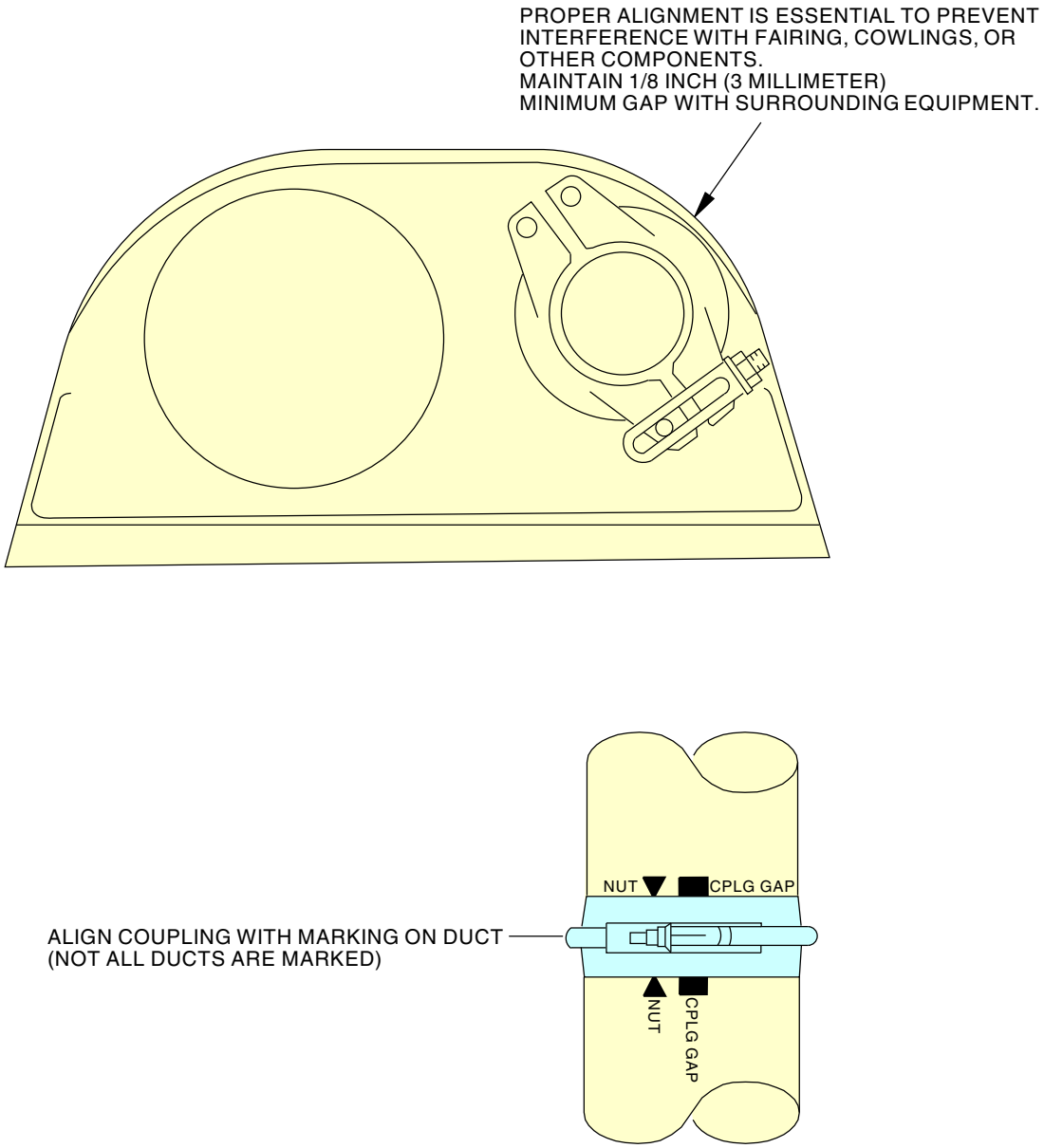
**CORRECT INSTALLATION
SAFETY LATCH IS IN FRONT OF THE
TRUNNION LUG**



**INCORRECT INSTALLATION
SAFETY LATCH IS NOT IN FRONT OF THE
TRUNNION LUG, MAKING IT INEFFECTIVE**

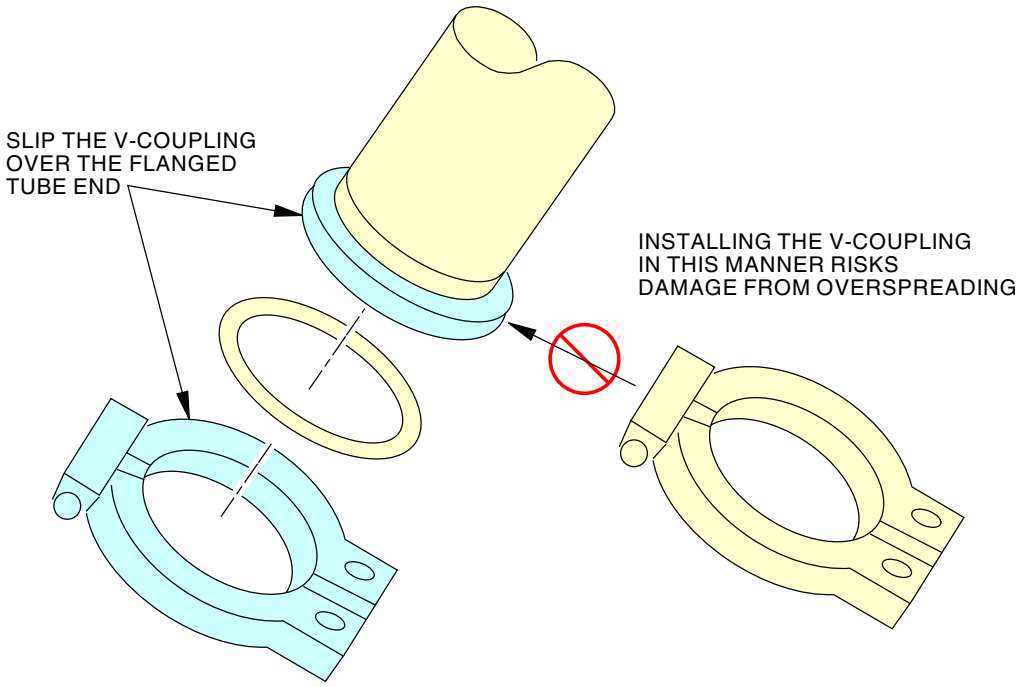
1509689 S0000276802_V3

**Safety Latch Installation
Figure 209/70-51-00-990-811-H00**



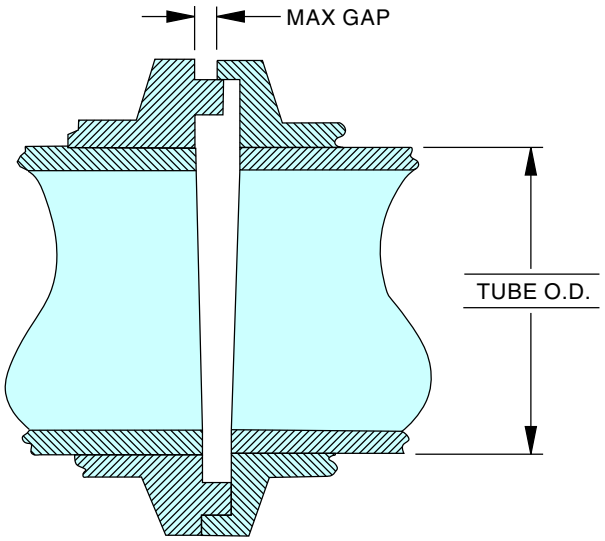
1509672 S0000276804_V2

V-clamp Installation
Figure 210/70-51-00-990-812-H00 (Sheet 1 of 2)



1509673 S0000277119_V2

V-clamp Installation
Figure 210/70-51-00-990-812-H00 (Sheet 2 of 2)



TUBE O.D.	AS1895	9187M73
1.50 (38.1)	.080 (2.03)	.073 (1.86)
2.00 (50.8)	.098 (2.48)	- -
2.50 (63.5)	.115 (2.92)	- -
3.00 (76.2)	- -	.126 (3.20)
4.00 (102)	- -	.161 (4.09)
5.00 (127)	- -	.195 (4.96)
6.00 (152)	- -	.231 (5.87)

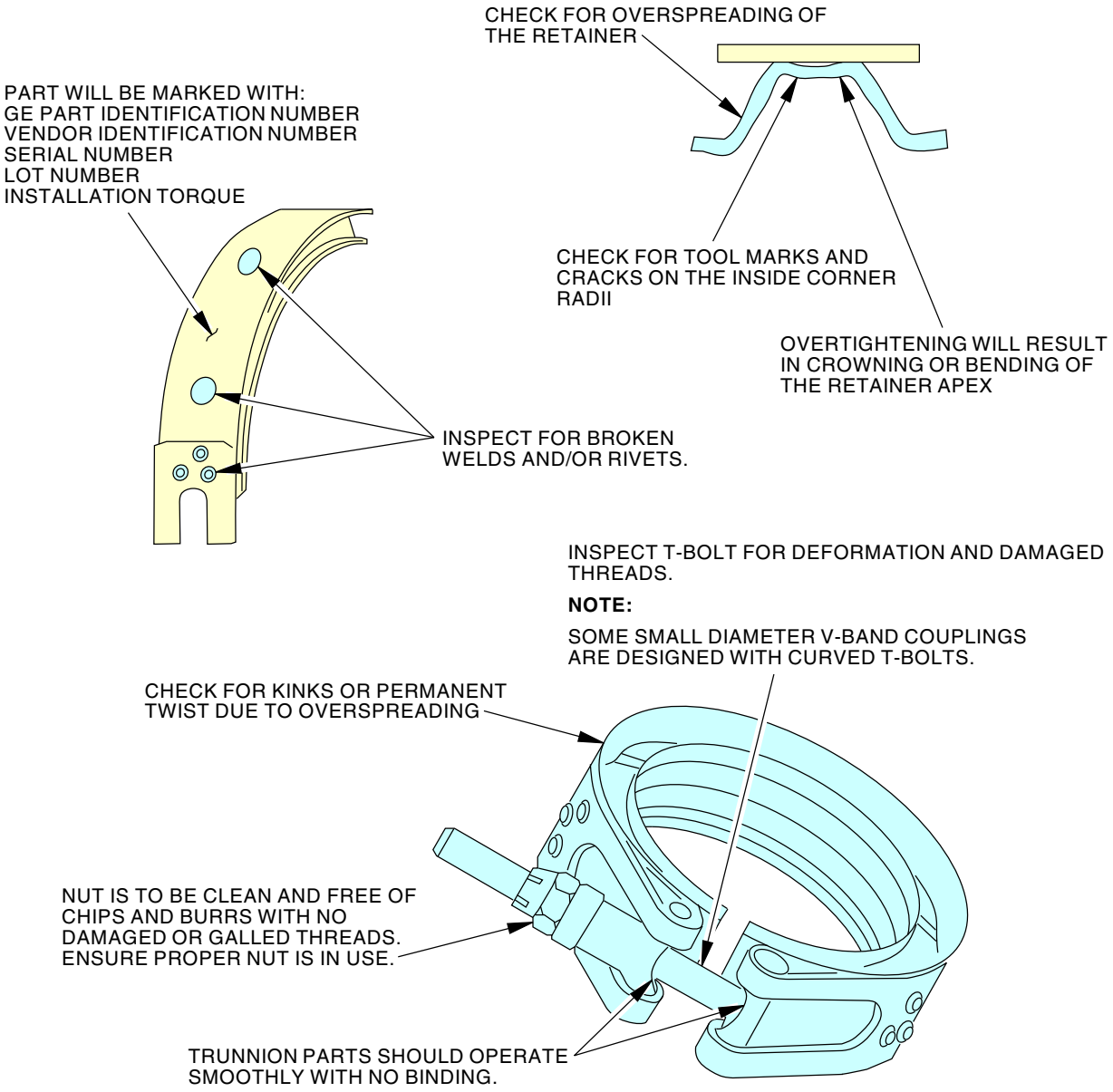
MAXIMUM FLANGE GAP FOR COUPLING ASSEMBLIES, INCH (mm)
FOR PART NUMBERS AS1895 AND 9187M73

NOTE:

DIMENSIONS APPLY PRIOR TO COUPLING INSTALLATION

1509674 S0000277131_V2

Assembly Alignment Check
Figure 211/70-51-00-990-813-H00

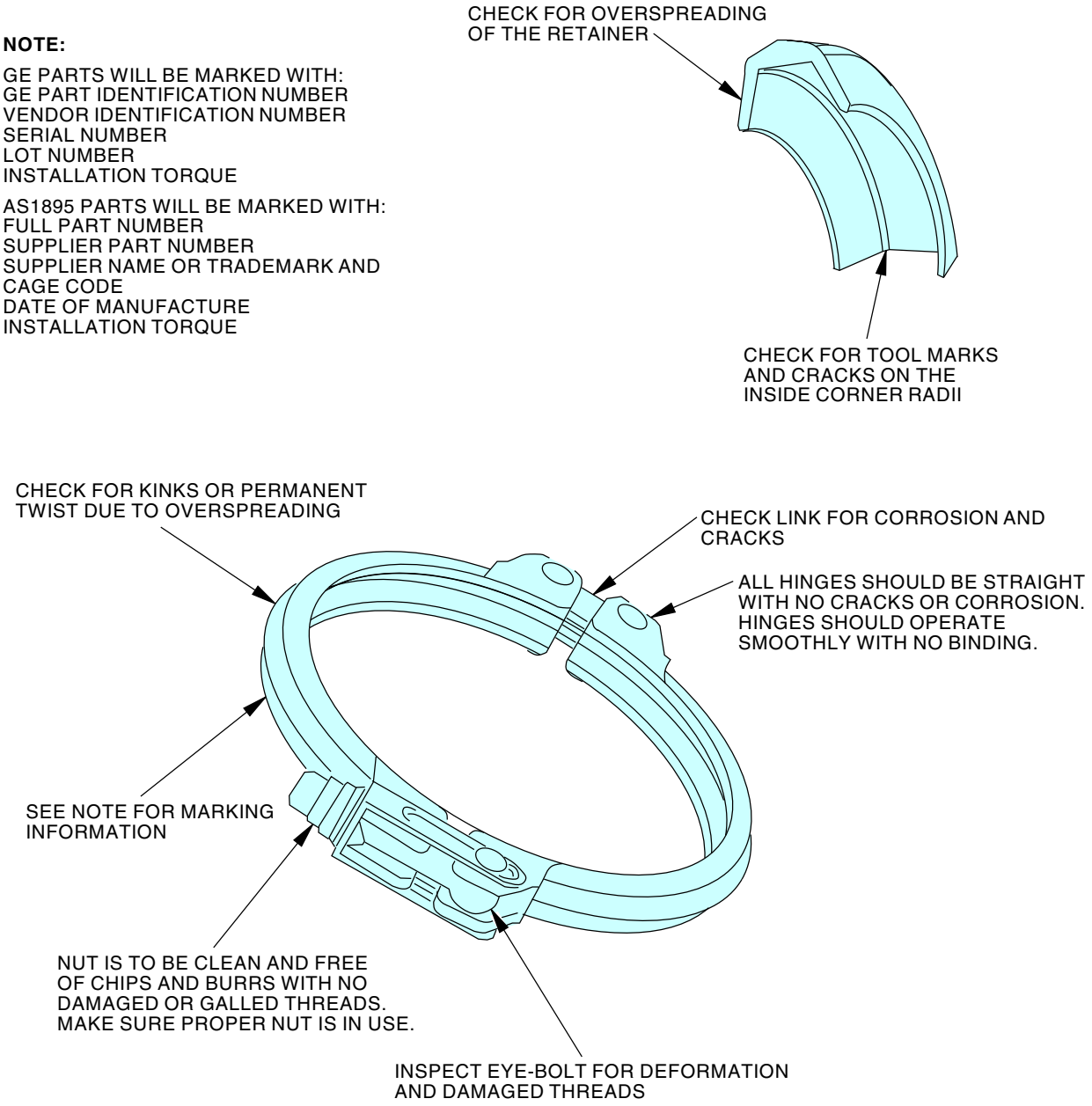


V-band Clamp Inspection
Figure 212/70-51-00-990-814-H00 (Sheet 1 of 2)

NOTE:

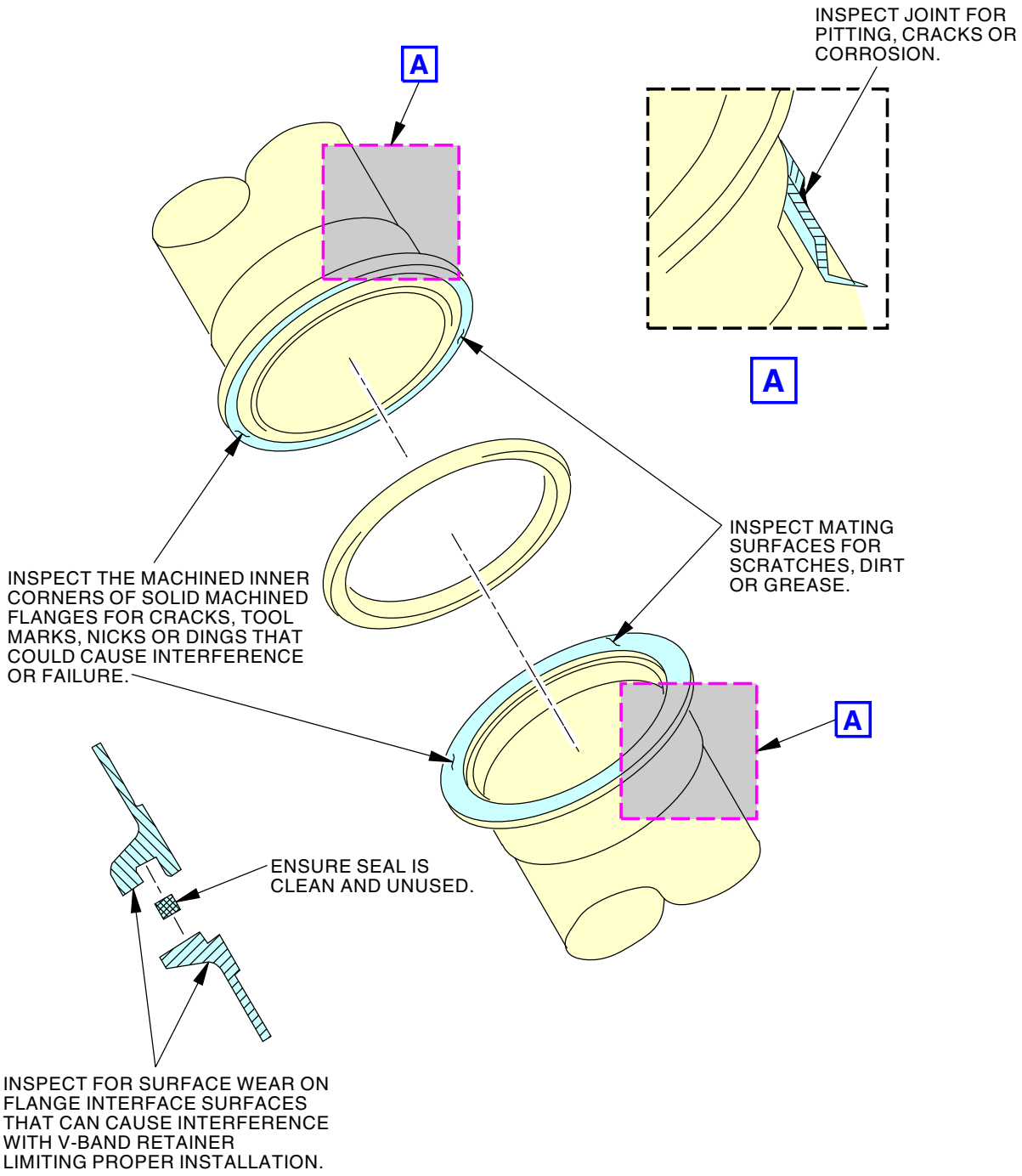
GE PARTS WILL BE MARKED WITH:
GE PART IDENTIFICATION NUMBER
VENDOR IDENTIFICATION NUMBER
SERIAL NUMBER
LOT NUMBER
INSTALLATION TORQUE

AS1895 PARTS WILL BE MARKED WITH:
FULL PART NUMBER
SUPPLIER PART NUMBER
SUPPLIER NAME OR TRADEMARK AND CAGE CODE
DATE OF MANUFACTURE
INSTALLATION TORQUE

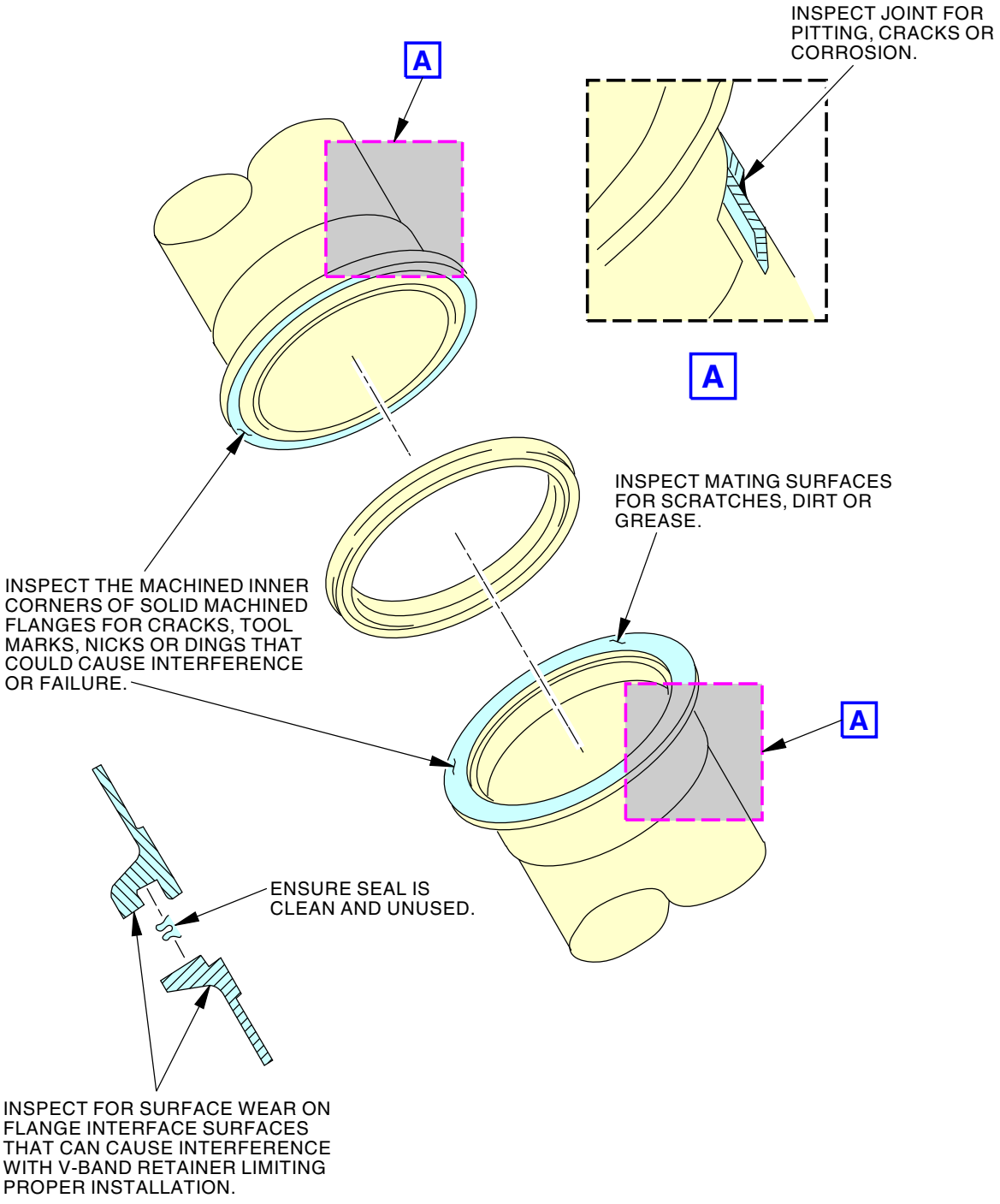


1509675 S0000277132_V3

V-band Clamp Inspection
Figure 212/70-51-00-990-814-H00 (Sheet 2 of 2)

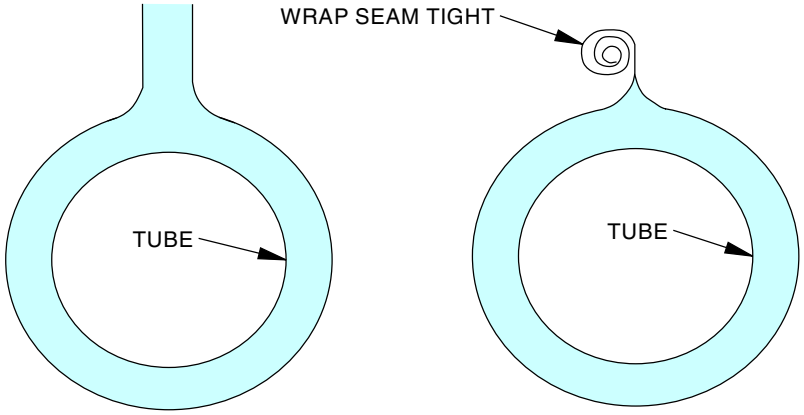


Flange and Seal Inspection
Figure 213/70-51-00-990-815-H00 (Sheet 1 of 2)

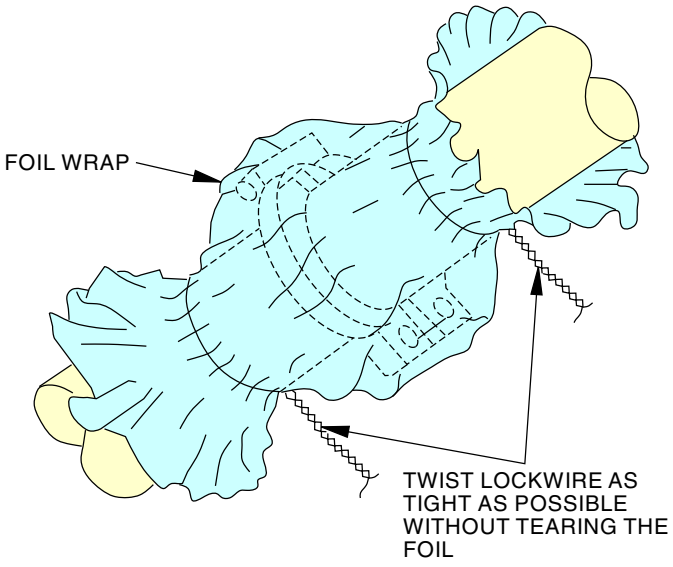


1509677 S0000276809_V2

Flange and Seal Inspection
Figure 213/70-51-00-990-815-H00 (Sheet 2 of 2)



TYPICAL FOIL WRAP CROSS SECTION



1509688 S0000276810_V2

V-band Clamp Installation of Foil Wrap
Figure 214/70-51-00-990-816-H00

TASK 70-51-00-910-802-H01

3. Wrench Arc Method (Except for the Fuel Manifold to Fuel Nozzle B-Nuts)

A. General

(1) You use the wrench arc procedure to tighten the ball-nose fittings on engine components and tubing. The procedure is to get a total angle between the wrenches of 30 degrees. You measure the angular displacement of the wrenches visually as an alternative to a torque measurement. There are two versions of the wrench arc procedure:

(a) The procedure to turn the B-nut. You use an open end wrench, crowfoot or tubing wrench.

(b) The procedure to use line of sight. You use a 15 degree offset open end wrench.

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-51-00-420-001-H01

(1) Prepare to tighten the ball-nose fitting.

(a) Clean the threads and the mating surfaces of the fitting.

(b) Make sure that there are no nicks, burrs, or scratches on the threads or the mating surfaces.

SUBTASK 70-51-00-420-002-H01

CAUTION USE A BACK-UP WRENCH TO MAKE SURE THAT THE HOSE DOES NOT TURN WHEN YOU TIGHTEN THE B-NUT. IF THE HOSE TURNS, DAMAGE TO THE HOSE CAN OCCUR.

(2) Use the procedure to turn the B-nut to tighten the ball-nose fitting (Figure 215).

NOTE: No lubricant is necessary for the ball-nose fitting.

(a) Put the open end wrench, the crowfoot or the tubing wrench on the B-nut.

(b) Turn the B-nut until the resistance increases quickly.

NOTE: The resistance will increase quickly when the mating surfaces touch.

(c) Make sure that the ball-nose fitting is correctly installed and the threads engage correctly.

(d) Make sure that the mating surfaces of the ball-nose fitting are not loose.

(e) Set a reference point on the B-nut coupling.

NOTE: The reference point is always between the B-nut flat and the coupling.

(f) Use the open end wrench to tighten the B-nut through an arc 30 degrees.

NOTE: 1/2 flat turn of the B-nut is 30 degrees of a full arc.

(g) If this is a new part, loosen the B-nut and then tighten again through the 30 degree arc.

SUBTASK 70-51-00-420-003-H01

CAUTION

USE A BACK-UP WRENCH TO MAKE SURE THAT THE HOSE DOES NOT TURN WHEN YOU TIGHTEN THE B-NUT. IF THE HOSE TURNS, DAMAGE TO THE HOSE CAN OCCUR.

(3) Use the line of sight procedure to tighten the ball-nose fitting.

NOTE: No lubricant is necessary for the ball-nose fitting.

(a) Put the open end wrench on the B-nut.

(b) Turn the B-nut until the resistance increases quickly.

NOTE: The resistance will increase quickly when the mating surfaces touch.

(c) Make sure that the ball-nose fitting is correctly installed and the threads engage correctly.

(d) Make sure that the mating surfaces of the ball-nose fitting are not loose.

(e) Look at the position of the 15 degree open end wrench handle.

(f) Set a reference point on the B-nut aligned with the handle.

NOTE: The reference point is always between the B-nut flats and the wrench handle.

(g) Tighten the B-nut 15 degrees.

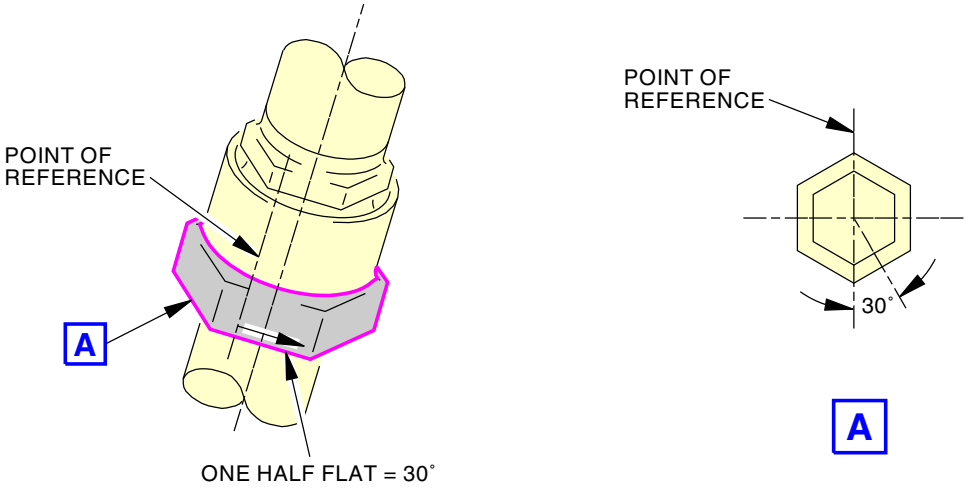
(h) Turn the wrench over.

(i) Put the wrench on the same B-nut flats.

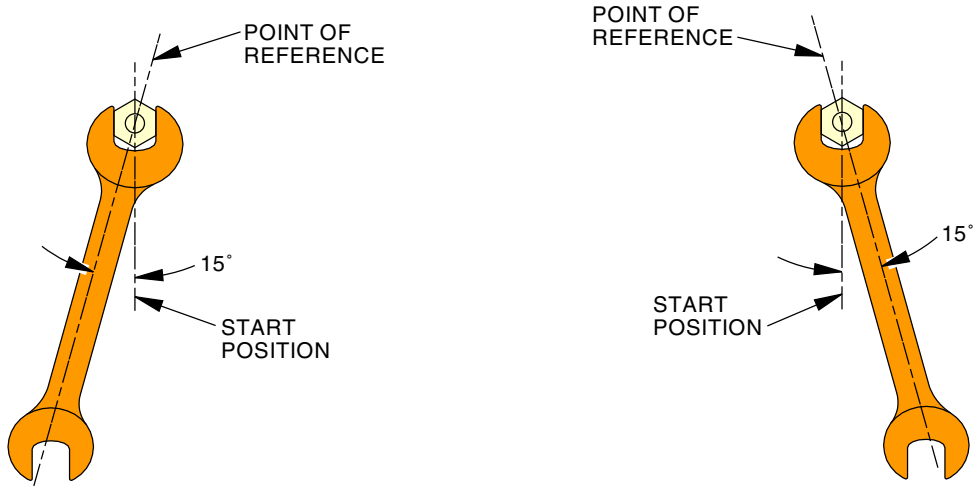
(j) Tighten the B-nut 15 degrees more which aligns the wrench back to the start position.

(k) If this is a new part, loosen the B-nut and then tighten again through the 30 degree arc.

——— END OF TASK ———



TURN OF THE B-NUT METHOD



TURN NUT 15˚ FROM THE START POSITION

TURN WRENCH OVER (INVERT) TURN NUT 15˚ BACK TO THE START POSITION

LINE OF SIGHT METHOD

1120858-01-A

M06343 S0004285437_V2

Tighten Ball-Nose fittings with the Wrench Arc Method
Figure 215/70-51-00-990-801-H01

V-COUPLING - MAINTENANCE PRACTICES

1. General

A. This procedure has one task:

(1) V-Coupling Assembly.

TASK 70-51-01-910-801-H00

2. V-Coupling Assembly

(Figure 201, Figure 202, Figure 203, Figure 204, Figure 205, Figure 206, Figure 207, Figure 208, Figure 209 and Figure 210)

A. General

(1) This task provides the instructions on how to assemble, install and examine V-couplings.

(2) V-couplings are use to attach two flanges together to form a V-coupling joint. You tighten the coupling with the application of torque to a nut, which tightens a circumferential band or an integral retainer and lugs that apply an inward radial force on the V-shaped retainer segments. These retainer segments then apply an axial clamping force on the flanges, which attaches or pushes them together. V-couplings can be either V-band couplings or V-retainer couplings.

(3) V-couplings are used on two different kinds of flanges, solid machined flanges and flexible sheet metal flanges. It is necessary for all solid machined flanges in pneumatic systems to have a seal to make sure there is no leakage from the flanges. Flexible sheet metal flanges do not use a separate seal. These flanges are made so that they can seal themselves on machined face surfaces.

(4) Most V-couplings have bolt latches that are made up of a T-bolt or eyebolt, trunnion, and locknut. T-bolts can only be replaced on quick-release latches; they cannot be replaced on the basic T-bolt latch. Eyebolts cannot usually be replaced.

(5) Safety latches are usually used on V-retainer couplings and occasionally on V-band couplings. This is a redundant latch system and keeps the joint together if the primary latch fails (Figure 207).

(6) You will tighten most V-couplings with an all-metal locknut. These locknuts have a limited number of installation and removal cycles on a bolt before thread galling and seizure occurs.

B. Consumable Materials

Reference	Description	Specification
B00679 [C04-035]	Alcohol - Isopropyl	
C50124 [C05-117]	Lacquer	
D50067 [C02-001]	Compound - Anti-seize	AMS 2518
D50194 [C02-004]	Lubricant - Sprayable Air Drying	
G02348 [C10-010]	Pad - Abrasive - Scotch-Brite 7447	

C. Prepare To Assemble the Coupling

SUBTASK 70-51-01-840-001-H00

(1) Do these steps to prepare the coupling for assembly:

(a) Examine the V-coupling components for cleanliness and correct assembly and operation (Figure 208 and Figure 209).

1) Clean, repair or replace the coupling as necessary before assembly.

(b) Make sure that the locknuts and bolts threads do not have burrs or damaged threads.

(c) Lubricate the nut with anti-seize compound, D50067 [C02-001].

NOTE: This will prevent galling and seizure.

(d) Make sure that when you install the locknut, you use a hand torque wrench and you do not turn the nut more than two revolutions per second (120 RPM).

NOTE: If you turn the nut too fast, it will cause frictional heat that causes thread galling.

(e) Make sure that the running torque of the locknut is between 6.5 in-lb (0.7 N·m) to 40 in-lb (5 N·m).

1) If the running torque is not within the limits, replace the locknut.

(f) Before assembly, examine the coupling part number to ensure that you use the correct coupling (Figure 208 and Figure 209).

NOTE: The couplings should have marks that indicate the part number and bolt torque. If the coupling does not have these marks, replace the coupling.

D. Procedure

SUBTASK 70-51-01-910-001-H00

(1) Assemble the V-coupling as follows:

(a) On single latch V-couplings, open the band just wide enough to put the coupling over the flanged tube end.

NOTE: Make sure that you do not open the band too wide.

(b) Put the V-coupling over the flanged tube end.

CAUTION

MAKE SURE THAT THE SEAL STAYS IN THE GROOVE WHEN YOU SET THE FLANGES. IF THE SEAL IS NOT IN THE GROOVE, DAMAGE TO THE SEAL AND THE FLANGES COULD OCCUR.

(c) Install the seal in the male flange.

(d) Put the mating flange into position.

SUBTASK 70-51-01-820-001-H00

CAUTION

DO NOT USE THE V-BAND OR V-RETAINER COUPLING TO PULL OR ALIGN THE FLANGES. DAMAGE TO THE COUPLING OR FLANGES COULD OCCUR.

(2) Align the components as follows (Figure 206):

(a) Make sure that you do not hold the weight of components that you assemble by the V-coupling.

(b) Make sure that all adjacent support clamps or brackets stay loose until you complete the installation of the couplings.

NOTE: This prevents incorrect alignment of the components. Correct alignment of the flanges before you install the coupling is necessary to get good joint performance.

(c) Make sure that you install flush couplings that attach components to the gearbox and the starter air valve.

NOTE: There should be gaps that you can see in the mating flanges.

(d) Align the tubes or tube components that you attach in or less than the specified minimum gap.

SUBTASK 70-51-01-640-001-H00

(3) Make sure that the coupling has lubricant.

(a) If the lubricant is missing, lubricate the coupling with sprayable air drying lubricant, D50194 [C02-004].

(b) Coat the inside surface with a thin film of engine oil before installation.

NOTE: V-channel couplings are coated with dry film lubricant on the inside surface.

NOTE: Couplings in the external air systems are not coated with dry film lubricant.

SUBTASK 70-51-01-980-001-H00

(4) Put the V-coupling on the mating flanges as follows:

CAUTION

MAKE SURE THAT THE T-BOLT IS IN THE CORRECT POSITION WHEN YOU INSTALL IT. IF IT IS NOT, IT CAN CAUSE DAMAGE TO THE QUICK-RELEASE LATCH.

(a) On T-bolt quick release latches, insert the widest part of the T-bolt head into the latch so that the latch is resistant to movement of the bolt (Figure 201).

NOTE: On quick release type V-couplings, the bolt is to be fully seated in the latch.

(b) Adjust the position of the clamp if necessary.

(c) Visually examine to make sure that the coupling has seated on the flanges an equal amount around the outside surface.

(d) Do a visual inspection of the flange O.D. through the gaps in the retainer.

1) Make sure that the radial flange alignment between the adjacent retainers is correct.

(e) Tighten the nut to 50% of the torque specified on the clamp.

(f) For V-Band couplings, lightly hit the coupling around its circumference with a fiber mallet to apply band tension.

(g) Slowly increase torque to 100% as follows:

1) While you increase torque to 100 percent of the specified value, lightly hit around the outside surface as necessary to prevent a load that is not equal.

(h) After you have 100 percent of specified torque, lightly hit around the outside surface again and tighten again to the specified torque value.

NOTE: It is not necessary to do additional tightening.

(i) After you tighten to the correct torque, examine the V-coupling latch gap and retainer gap (Figure 201, Figure 203 and Figure 205).

1) Make sure that there is no contact in the V-coupling latch gap or retainer gap.

2) If the latch gap is less than the values specified, replace the coupling and do an inspection of the flanges for wear (Table 201).

Table 201/70-51-01-993-801-H00

Tube O.D.	Latch Gap
1.50 in. (38.10 mm)	0.150 in. (3.81 mm)
1.75 in. (44.45 mm)	0.150 in. (3.81 mm)
2.00 in. (50.80 mm)	0.175 in. (4.44 mm)
2.25 in. (57.15 mm)	0.175 in. (4.44 mm)

Table 201/70-51-01-993-801-H00 (Continued)

Tube O.D.	Latch Gap
2.50 in. (63.50 mm)	0.190 in. (4.83 mm)
2.75 in. (69.85 mm)	0.190 in. (4.83 mm)
3.00 in. (76.20 mm)	0.190 in. (4.83 mm)
3.25 in. (82.55 mm)	0.190 in. (4.83 mm)
3.50 in. (88.90 mm)	0.190 in. (4.83 mm)
4.00 in. (101.60 mm)	0.250 in. (6.35 mm)
4.50 in. (114.30 mm)	0.250 in. (6.35 mm)
5.00 in. (127.00 mm)	0.300 in. (7.62 mm)
5.50 in. (139.70 mm)	0.300 in. (7.62 mm)
6.00 in. (152.40 mm)	0.400 in. (10.16 mm)
6.50 in. (165.10 mm)	0.400 in. (10.16 mm)

(j) Complete the installation of all adjacent support clamps and brackets in the tube assembly.

SUBTASK 70-51-01-210-001-H00

(5) Do a final check after assembly of the joint.

(a) Install safety wire on the hex nuts that have the safety wire holes.

(b) Make a mark on the nut and bolt assembly with lacquer, C50124 [C05-117].

(c) Adjust and tighten tube supports as necessary after V-coupling installation to prevent bent tubes from misaligned supports.

(d) If the joint leaks, do these steps:

1) Disassemble the V-coupling.

2) Do the V-coupling inspection procedure in this task.

SUBTASK 70-51-01-210-002-H00

(6) Examine the V-coupling for these conditions:

NOTE: Some V-couplings that are designed for different applications like they are the same size and can be physically interchanged. It is possible that a lighter duty V-coupling could be installed in an application that uses a high strength coupling. You must not install a coupling that is for low temperature application on high temperature application. Make sure that the coupling you will install have the specified part number.

(a) Kinks or permanent twist from a clamp that is opened too wide is not permitted.

(b) Crowned or bent over the apex of a retainer that is tightened too much is not permitted.

(c) Couplings that do not have Installation instructions and torque marks are not permitted.

(d) Retainers that show permanent deformation, such as opened at an angle 0 to 44 degrees or more are not permitted.

(e) Tool marks and cracks on the inside corner radii of the retainer are not permitted.

(f) Bolts with deformation and damaged threads are not permitted.

NOTE: Some small diameter V-bands have curved T-bolts.

(g) Damaged nut is not permitted.

NOTE: The nut must be clean. It must be free of chips and burrs and it must not have damage or galled threads.

(h) Broken welds and/or rivets on the joint that hold sheet metal band to the retainer are not permitted.

SUBTASK 70-51-01-900-001-H00

(7) Repair or replace the V-coupling if it has a condition or conditions that are not permitted.

SUBTASK 70-51-01-210-003-H00

(8) Examine the flanges to be joined by the V-coupling for these conditions (Figure 210):

(a) Compatibility with each other and with the seal that you will use.

NOTE: Make sure that the V-coupling flanges and seal are correct.

(b) Scratches, dirt or grease.

1) Clean the surface contamination with alcohol, B00679 [C04-035] and wetted Scotch-Brite 7447 pad, G02348 [C10-010] or replace the component with the faulty flange.

(c) Cracks, tool marks, nicks or dings on the machined inner corners of solid machined flanges that can hit or can be unsatisfactory.

1) Blend smooth nicks or dings that can cause interference.

(d) Surface wear on the flange interface surfaces that can hit the V-Band retainer and limit correct installation.

1) Replace components with worn flanges.

SUBTASK 70-51-01-210-004-H00

(9) Examine the seal to make sure of these conditions:

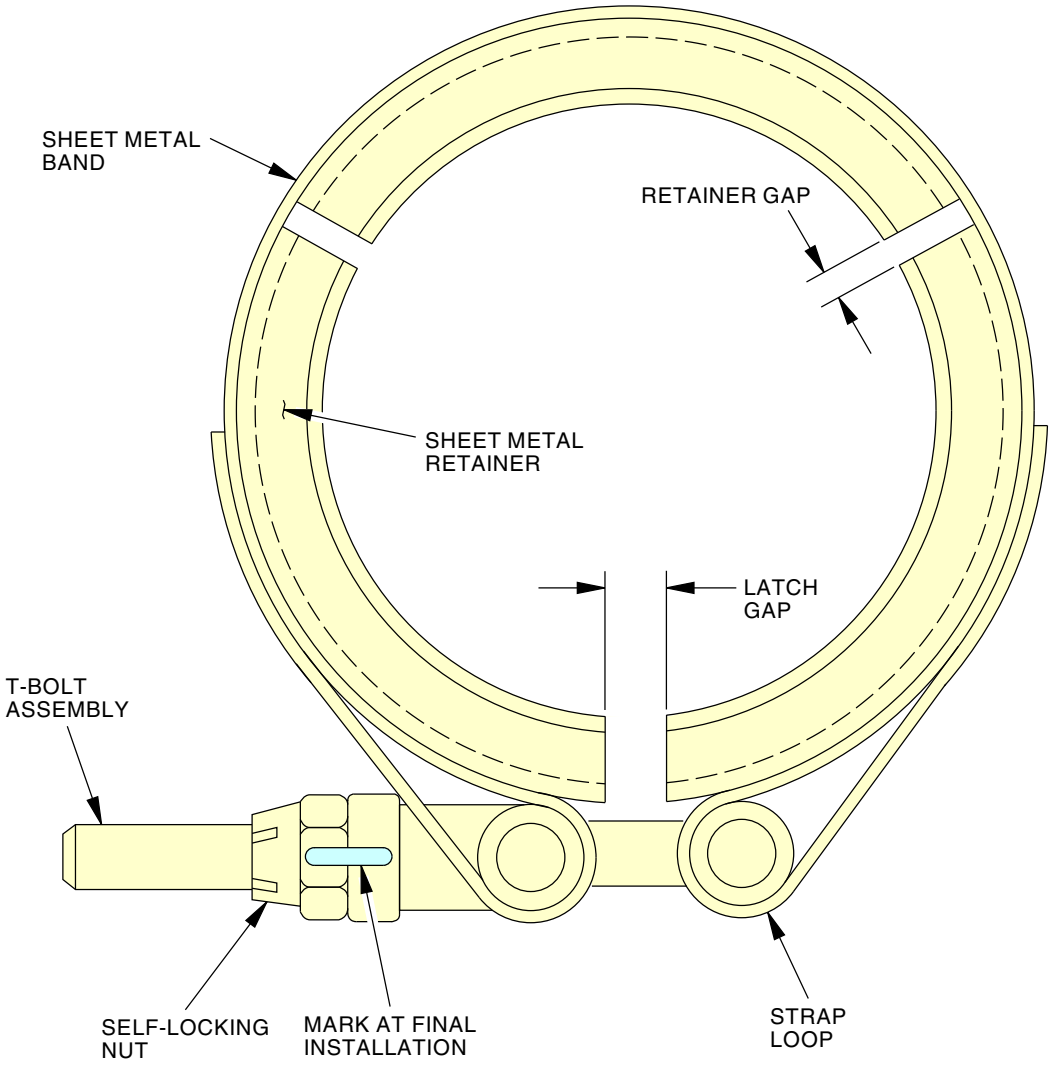
(a) Make sure that you have a correct seal.

(b) Make sure that the seal is clean and new.

NOTE: Do not use old seals.

(c) Make sure that the seal is in the correct position adjacent to the flange seal cavity on installation (Figure 202 and Figure 204).

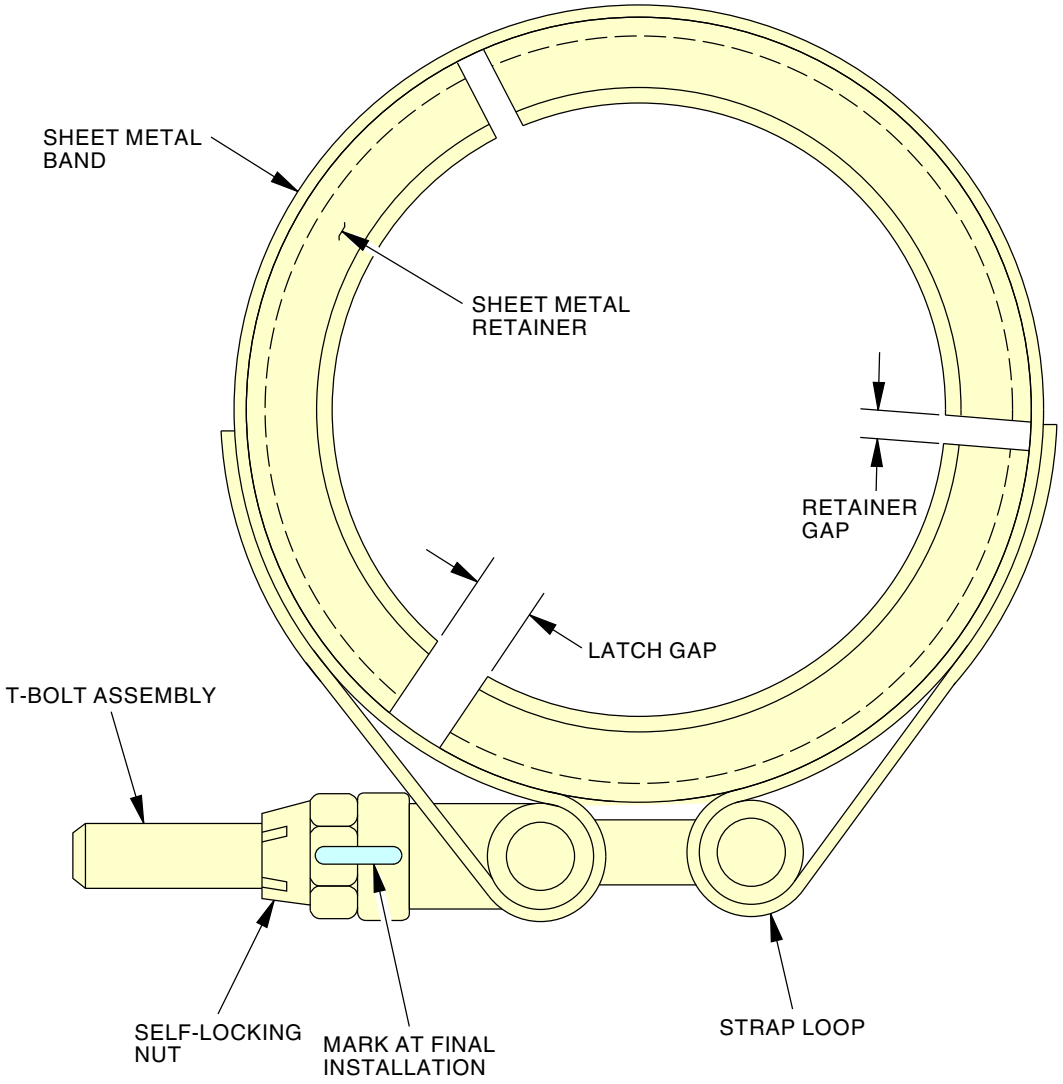
——— END OF TASK ———



(EXAMPLE 1)

1268382-00
2816462 S0000648527_V1

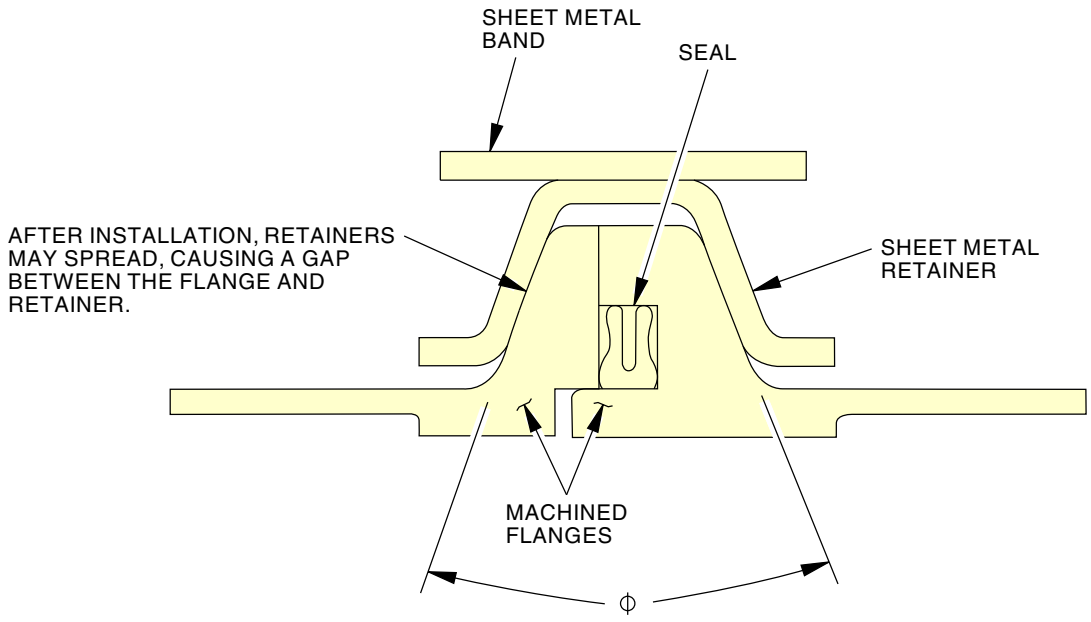
V-Band Coupling Assembly
Figure 201/70-51-01-990-801-H00 (Sheet 1 of 2)



(EXAMPLE 2)

1268383-00
2816465 S0000648528_V1

V-Band Coupling Assembly
Figure 201/70-51-01-990-801-H00 (Sheet 2 of 2)



1268384-00
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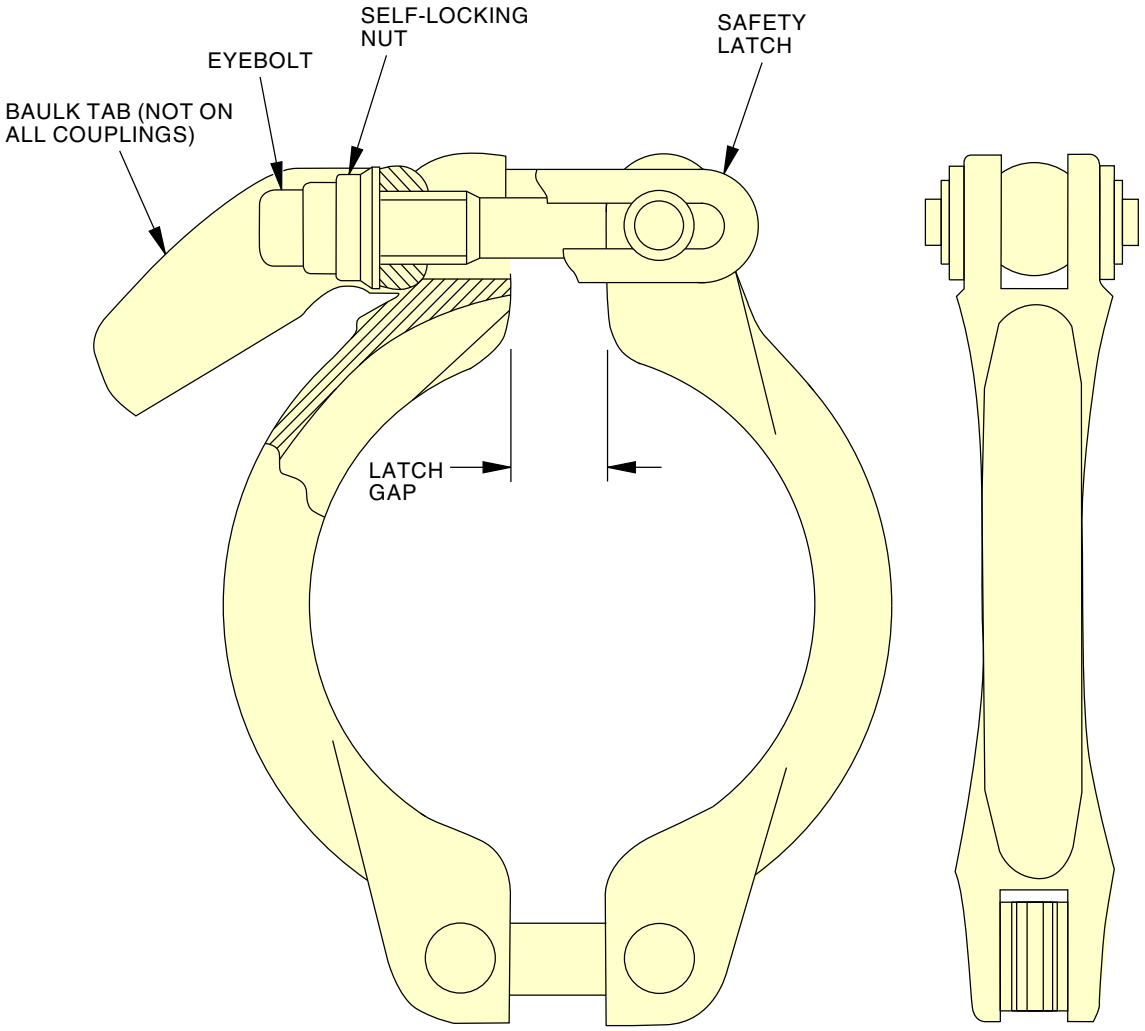
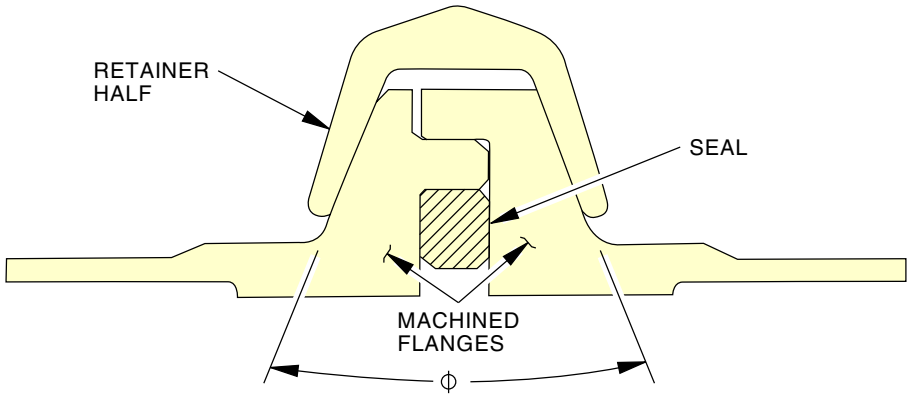
V-Band Coupling Joint
Figure 202/70-51-01-990-802-H00

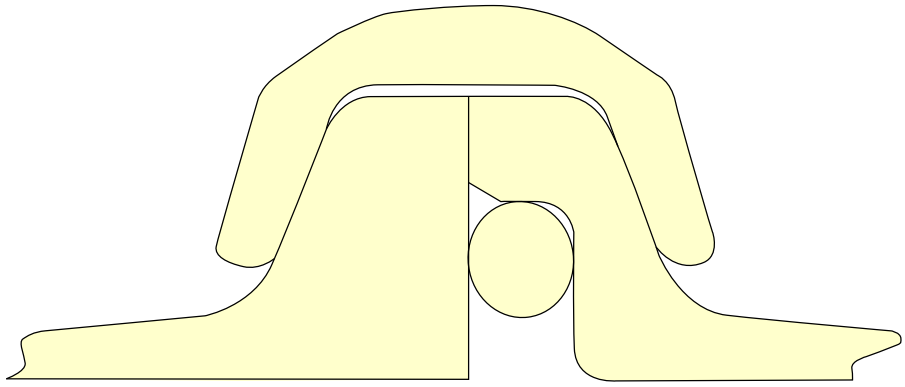


1268385-00
2816498 S0000648530_V1

V-Retainer Coupling Assembly
Figure 203/70-51-01-990-803-H00



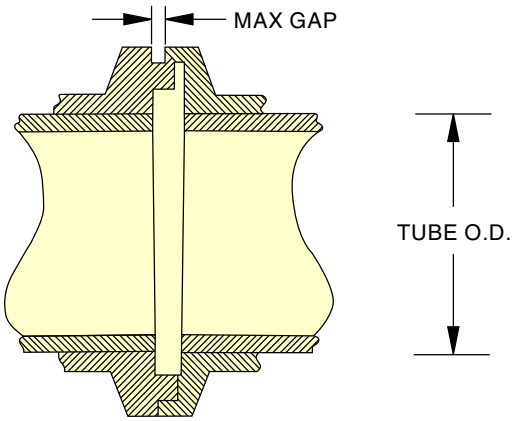
TUBING CONNECTION
(TYPICAL)



HARDWARE INSTALLATION
(TYPICAL)

1268386-00
2816505 S0000648531_V1

V-Retainer Coupling Joint
Figure 204/70-51-01-990-804-H00



TUBE OD	AS1895	9187M73
1.50 (38.1)	0.080 (2.03)	0.073 (1.86)
2.00 (50.8)	0.098 (2.48)	--
2.50 (63.5)	0.115 (2.92)	--
3.00 (76.2)	--	0.126 (3.19)
4.00 (102)	--	0.161 (4.09)
5.00 (127)	--	0.195 (4.97)
6.00 (152)	--	0.231 (5.87)

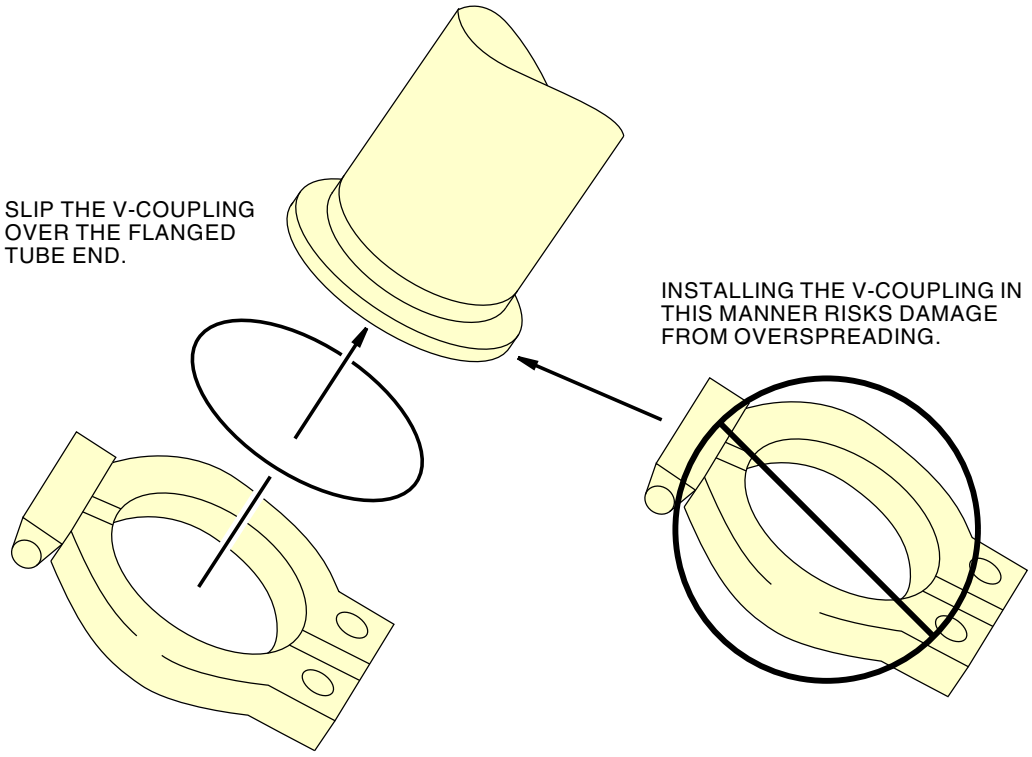
MAXIMUM FLANGE GAP FOR COUPLING ASSEMBLIES

NOTE:

1. DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN PARENTHESES.
2. DIMENSIONS APPLY PRIOR TO COUPLING INSTALLATION.

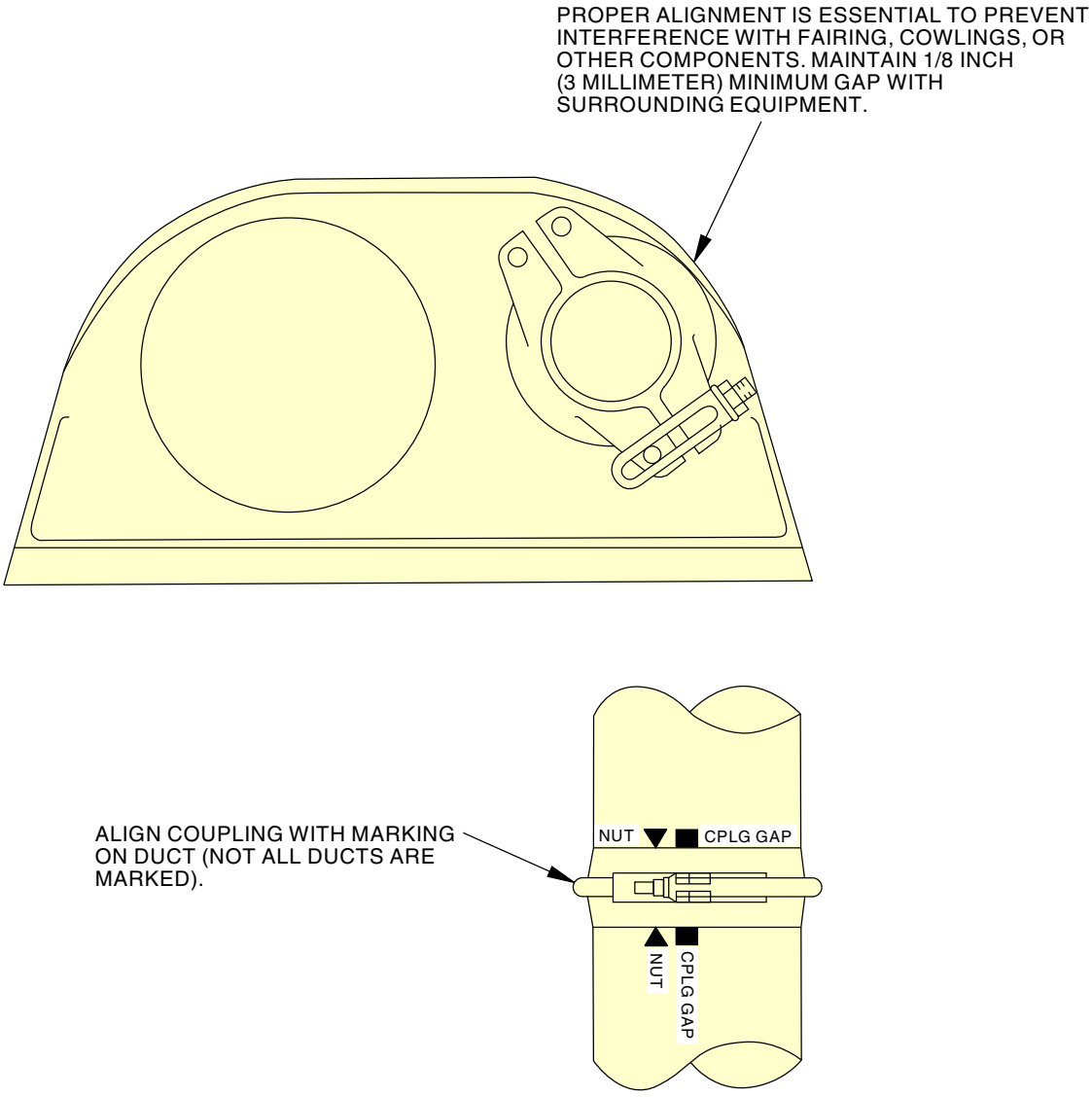
1268387-00
2816611 S0000648533_V1

Assembly Alignment Inspection
Figure 205/70-51-01-990-805-H00



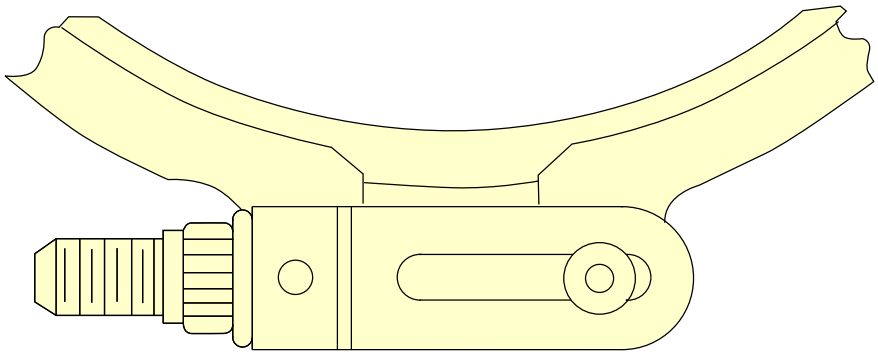
1268388-00
2816522 S0000648534_V1

Correct V-Coupling Installation
Figure 206/70-51-01-990-806-H00 (Sheet 1 of 2)

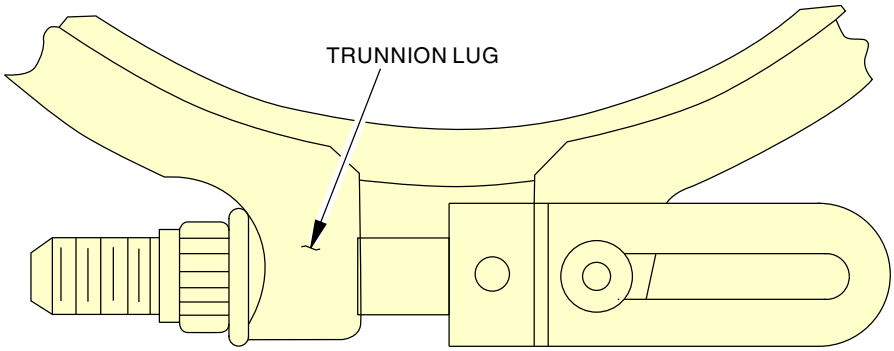


1268389-00
2816608 S0000648535_V1

Correct V-Coupling Installation
Figure 206/70-51-01-990-806-H00 (Sheet 2 of 2)



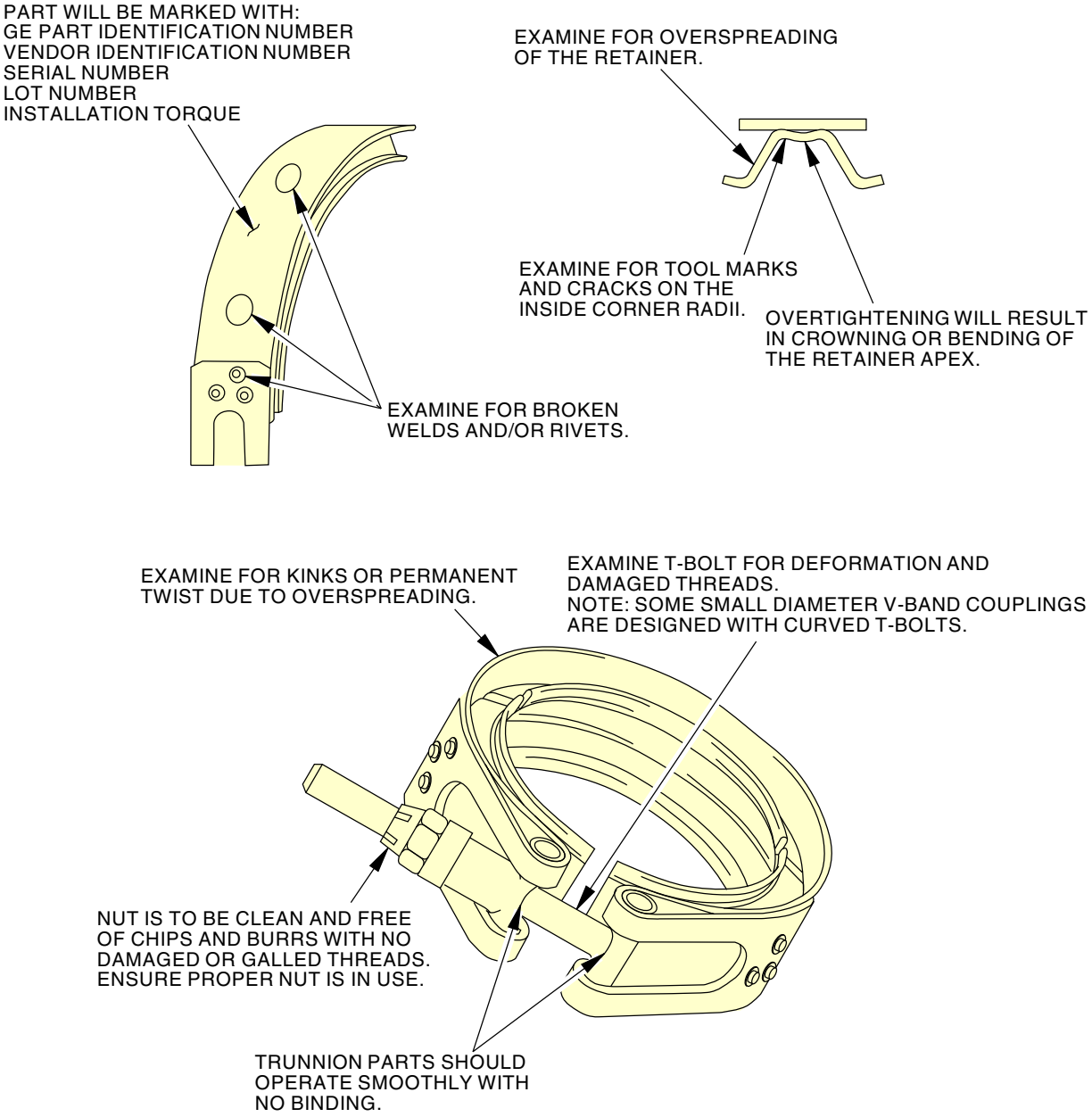
CORRECT INSTALLATION
SAFETY LATCH IS IN FRONT OF THE TRUNNION LUG



INCORRECT INSTALLATION
SAFETY LATCH IS NOT IN FRONT OF THE TRUNNION LUG, MAKING IT INEFFECTIVE

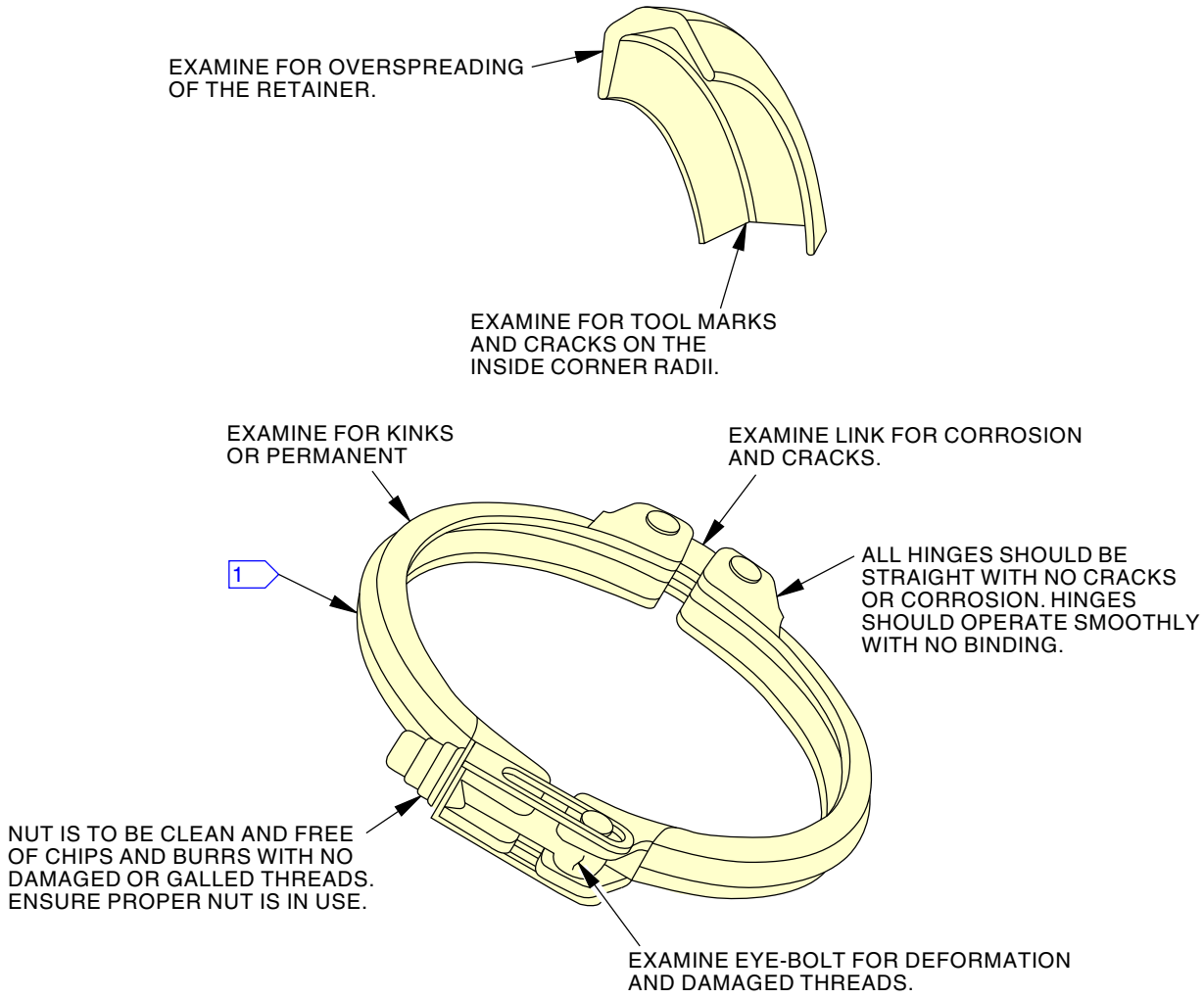
1268390-00
2816612 S0000648536_V1

Safety Latch Installation
Figure 207/70-51-01-990-807-H00



1299391-00
2816619 S0000648537_V1

V-Band Coupling Inspection
Figure 208/70-51-01-990-808-H00



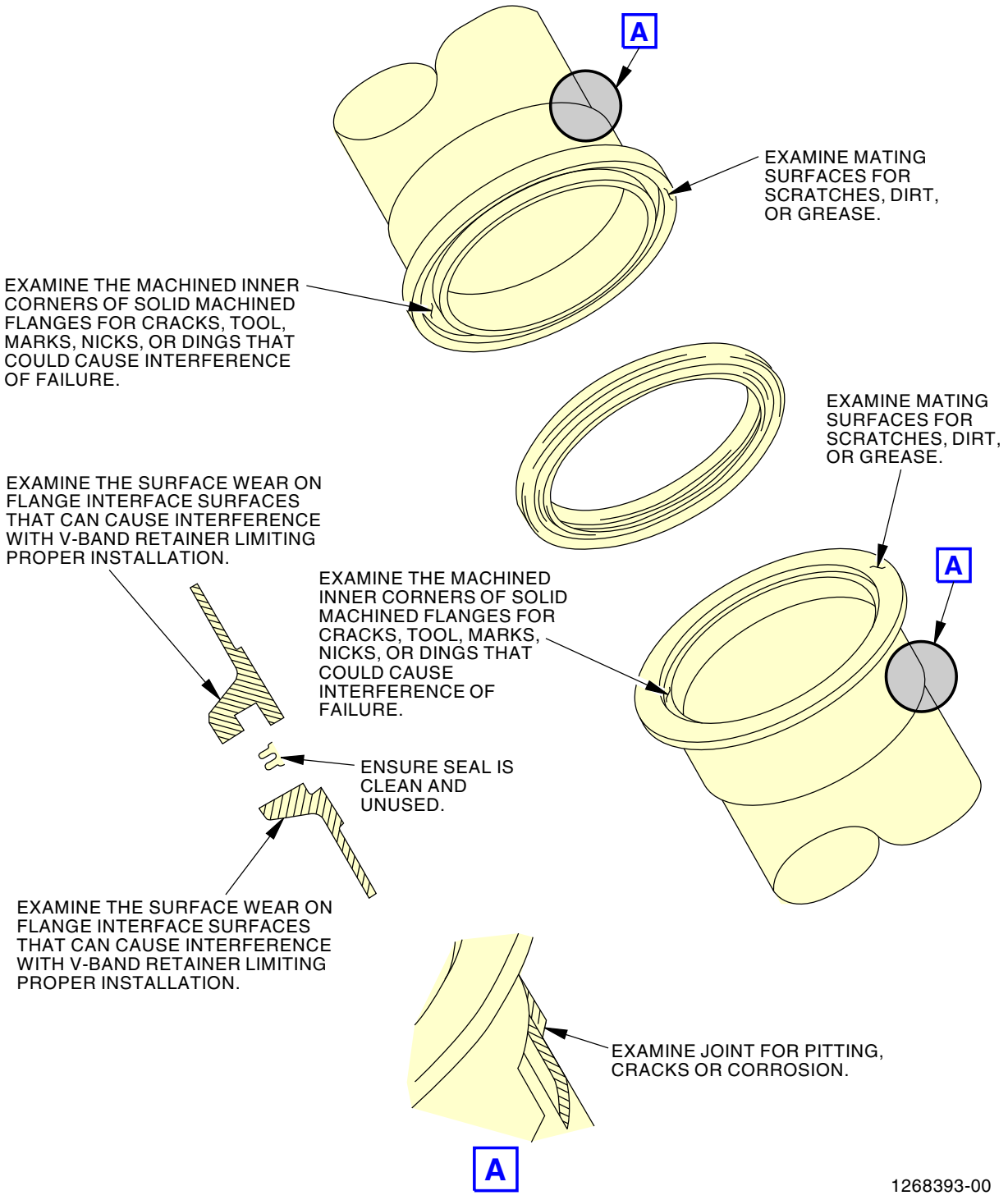
NOTE:

1 GE PARTS WILL BE MARKED WITH:
GE PART IDENTIFICATION NUMBER
VENDOR IDENTIFICATION NUMBER
SERIAL NUMBER
LOT NUMBER
INSTALLATION TORQUE

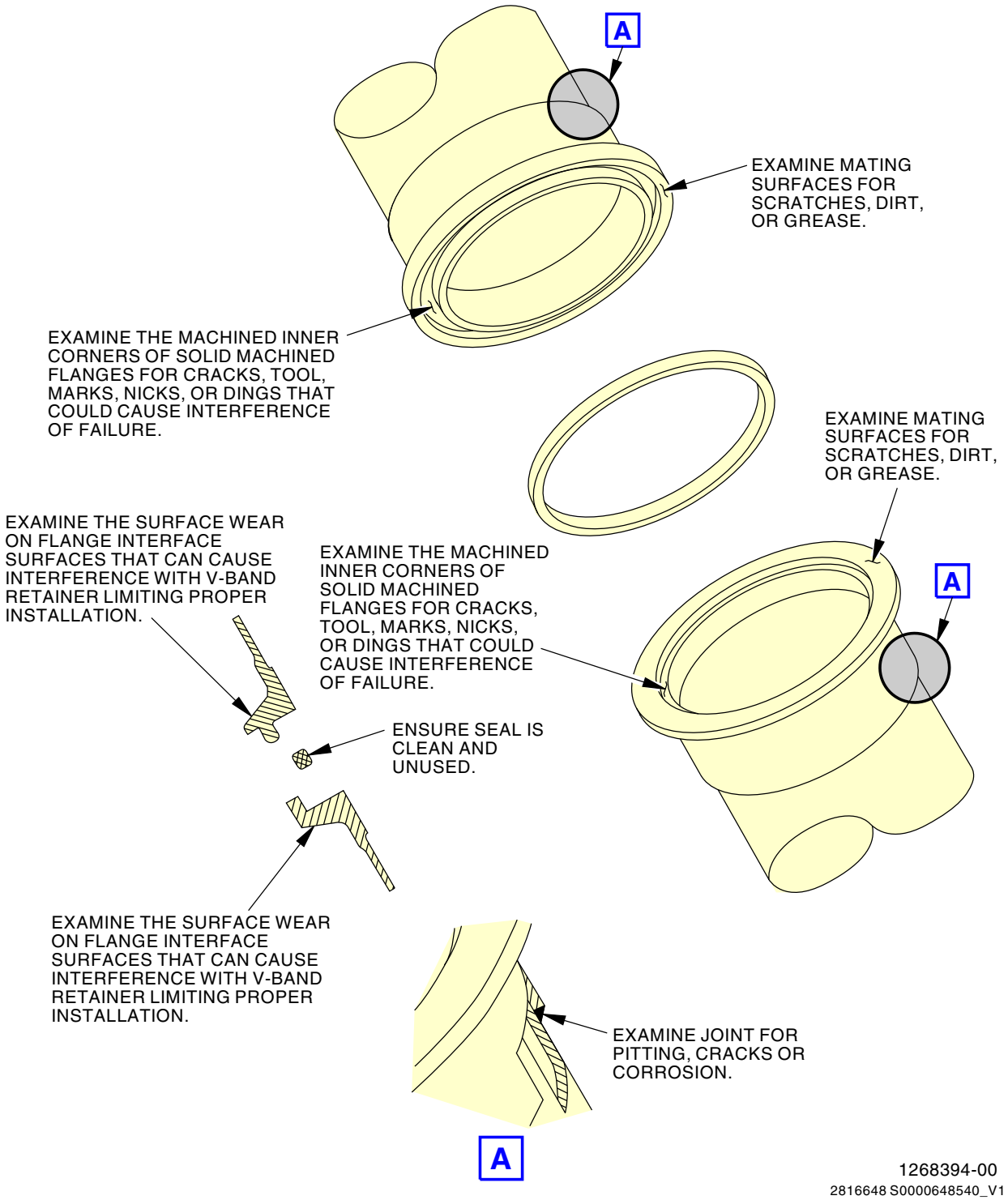
AS1895 PARTS WILL BE MARKED WITH:
FULL PART NUMBER
SUPPLIER PART NUMBER
SUPPLIER NAME OR TRADEMARK AND CAGE CODE
DATE OF MANUFACTURE
INSTALLATION TORQUE

1268392-00
2816642 S0000648538_V1

V-Retainer Coupling Inspection
Figure 209/70-51-01-990-809-H00



Flange and Seal Inspection
Figure 210/70-51-01-990-810-H00 (Sheet 1 of 2)



Flange and Seal Inspection
Figure 210/70-51-01-990-810-H00 (Sheet 2 of 2)

FADEC (EEC) GENERATED MAINTENANCE MESSAGE TROUBLESHOOTING

1. General

A. This procedure contains one task:

(1) Recommended practices to troubleshoot the FADEC (EEC) generated maintenance message.

TASK 70-60-00-810-801-H00

2. FADEC (EEC) generated maintenance message troubleshooting

A. References

Reference	Title
70-00-01-400-806-H01	Electrical Cable Installation (P/B 201)
70-00-01-400-807-H01	Electrical Connector - Disconnect and Connect (P/B 201)
70-11-11-100-802-H00	Electrical Harness and Contact Cleaning (P/B 201)
73-22-00-200-801-H01	Electrical Harnesses Inspection (P/B 201)
73-22-00-200-802-H01	Electrical Harness Connectors Inspection (P/B 201)

B. Location Zones

Zone	Area
411	Engine, Left
421	Engine, Right

C. Procedure

SUBTASK 70-60-00-810-001-H00

(1) Follow the applicable Fault Isolation Manual troubleshooting procedures.

NOTE: An active maintenance message is there at the time the data is taken, recorded or seen. If you use the Maintenance Access Terminal (MAT), the maintenance message is there at the time the mechanic presses the buttons. To be an active maintenance message, the conditions that generate the fault must occur right at the time that the data is taken, recorded or seen. For example, if a wire breaks and causes a sensor out-of-range maintenance message, an active maintenance message indicates that at this given point in time, the wire is broken. For most engine faults, it is necessary for the engine to run for the maintenance message to be generated. With the engine off during normal maintenance activities, few maintenance messages will be active.

NOTE: An inactive maintenance message is not there at the time the data is taken, recorded or seen, but was active before during the flight leg. The maintenance message has cleared and is not there now. For example, suppose that at high power engine operating conditions, the high temperatures of the engine case create stress on a wire and causes an intermittent electrical connection and a sensor out-of-range maintenance message. Then, when the engine is shut down, the engine case is much cooler, the intermittent fault clears and the electrical conduction is restored. An inactive maintenance message indicates that at this time, the wire is OK. An inactive maintenance message does not indicate that no fault occurred, only that at this point in time, the maintenance message is not active. An inactive maintenance message does not indicate that no maintenance action is necessary.

NOTE: A latched maintenance message indicates that the maintenance message occurred before and is latched by the system that generates the maintenance message. The maintenance message will never show as active or inactive. The GE90 FADEC (EEC) does not generate latched maintenance messages; however, many of the airplane Avionics do use latched maintenance messages.

NOTE: For the engines, many faults can only be seen if the engine is running, specific conditions occur, specific initiated tests are done or specific actions are taken. But the CMCF and FADEC (EEC) can be turned on at any time with the engine off and the maintenance messages reviewed. With the engine not running, most maintenance messages will be inactive.

NOTE: Troubleshooting an intermittent fault can be difficult. The Boeing 777 Fault Isolation Manual provides guidance for troubleshooting intermittent faults by using this statement: “NOTE: If you have an intermittent fault, you must use your judgment (and your airline policy) to make a decision if you will replace components, and if so, which components to replace. Then monitor the airplane on the subsequent flight.”

(a) An intermittent fault as used in this statement is intended to refer to a maintenance message, either active or inactive, that occurs on a small number of flight legs.

(b) An intermittent fault must not occur on two or more flight legs, one after the other.

(c) An inactive fault that occurs every flight leg is not an intermittent fault, and maintenance action is needed.

(d) In these cases, troubleshooting may be difficult. Judgment, along with airline policies and experience, must be used to best troubleshoot these types of faults.

SUBTASK 70-60-00-810-002-H00

(2) Before you replace any components, carefully do an inspection of the electrical harnesses for signs of chafing or other damage for the applicable electrical harnesses listed in the Fault Isolation Manual procedure.

(a) Look for chafing on the electrical harness that may have damaged internal wiring.

(b) Look for parts that are in contact with the electrical harness.

(c) Look for loose or missing clamps that support the harness.

(d) Look for water, fuel, oil or hydraulic fluid contamination at the electrical connectors or anywhere on the electrical harness coverings.

(e) Do an inspection of the full routing of the electrical harness from the FADEC (EEC) to the components.

NOTE: AMM Electrical Harnesses Inspection, TASK 73-22-00-200-801-H01 provides the detailed procedures.

NOTE: AMM Electrical Cable Installation, TASK 70-00-01-400-806-H01 provides the detailed procedures.

SUBTASK 70-60-00-810-003-H00

(3) Before you replace any components, carefully do an inspection of each electrical connector for looseness, contamination, bent pins, damaged sockets and backshell tightness for the applicable electrical harness electrical connectors.

SUBTASK 70-60-00-810-004-H00

(4) Make sure to do an inspection of all connectors from the FADEC (EEC) to the components.

NOTE: AMM Electrical Harness Connectors Inspection, TASK 73-22-00-200-802-H01 provides the detailed procedures.

(a) If you see dirty, contaminated, or other debris, clean the electrical connectors. AMM Electrical Harness and Contact Cleaning, TASK 70-11-11-100-802-H00 provides the detailed procedures.

CAUTION

DO NOT USE NEEDLE NOSE PLIERS OR OTHER ITEMS TO STRAIGHTEN BENT PINS. DAMAGE TO THE PIN PLATING AND SURFACES OF THE ELECTRICAL CONNECTOR WILL OCCUR. DO NOT CAUSE NICKS, GOUGES, OR OTHER DAMAGE TO THE CONNECTORS WHEN YOU STRAIGHTEN PINS.

(b) If you see a bent pin or pins, use a slave mating connector to straighten the bent pin or pins.

(c) When you connect the electrical connectors again, use soft jawed pliers to tighten all connectors. AMM Electrical Connector - Disconnect and Connect, TASK 70-00-01-400-807-H01 provides the correct detailed procedures.

NOTE: Loose electrical connectors can cause many of the FADEC (EEC) generated maintenance messages.

NOTE: The electrical continuity or resistance checks defined by the Fault Isolation Manual are important troubleshooting steps that can be difficult to do effectively. For example, to find pin 37 on a 55 pin FADEC (EEC) electrical connector can be difficult.

(d) Two mechanics are recommended for the resistance and continuity checks.

1) While one mechanic measures the resistance or continuity as specified, the other mechanic must shake each electrical harness segment before and after every bracket and clamp and connector interface from the FADEC (EEC) to the component.
   a) Changes in resistance or continuity show an electrical harness problem.
   b) In some cases, the use of cold sprays (compressed air, nitrogen or other sprays) and a heat gun at each connector interface or electrical harness segment can also be used to identify intermittent connections by providing additional stress through heating or cooling.

SUBTASK 70-60-00-810-005-H00

(5) If the electrical continuity or resistance and continuity checks do not identify a problem, there can be wear of the pins and sockets.
   (a) Check the components and electrical harness electrical connectors for loose pins or sockets using the Retention Test of the Electrical Connectors.
      NOTE: AMM Electrical Harness Connectors Inspection, TASK 73-22-00-200-802-H01 provides the detailed procedures.

SUBTASK 70-60-00-810-006-H00

(6) Usually, the most cost-effective procedures are to replace one component at a time and monitor for maintenance messages on later flights.

SUBTASK 70-60-00-810-007-H00

(7) If you have replaced all the components in the applicable maintenance message and the maintenance messages continue or occur again, it can be necessary to replace multiple components at the same time.
   (a) Replace the component and the electrical harness that connects to the component.
   (b) It is possible that wear on a pin on one electrical connector wears with the socket on the mating electrical connector.
   (c) When one part is replaced, the pin is new, but the socket is still worn. Over time, the pin and socket both wear.

——— END OF TASK ———