

**CHAPTER**

**70**

**STANDARD  
PRACTICES**

**737-600/700/800/900  
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## AIRCRAFT MAINTENANCE MANUAL

TERMS AND ABBREVIATIONS - MAINTENANCE PRACTICES**1. General**

- A. This procedure gives the terms and abbreviations to use with the power plant procedures of the aircraft maintenance manual.

**TASK 70-00-01-910-801-F00****2. Terms and Abbreviations**

## A. Terms

SUBTASK 70-00-01-910-001-F00

- (1) The use of notes, cautions and warnings are given as follows:

**WARNING:** WARNINGS LOOK LIKE THIS, AND PROVIDE ADDITIONAL SAFETY RELATED DATA TO MAKE YOU THINK ABOUT THE PROCEDURES OR LIMITS. IF YOU DO NOT CORRECTLY OBEY THE INSTRUCTIONS IN A WARNING, YOU CAN CAUSE INJURIES OR DEATH TO PERSONS AND DAMAGE TO THE EQUIPMENT.

- (a) Warnings refer to the step that follows it, just like this example.

**CAUTION:** CAUTIONS LOOK LIKE THIS, AND PROVIDE ADDITIONAL EQUIPMENT RELATED DATA TO MAKE YOU THINK ABOUT THE PROCEDURES OR LIMITS. IF YOU DO NOT CORRECTLY OBEY THE INSTRUCTIONS IN A CAUTION, YOU CAN CAUSE DAMAGE TO THE EQUIPMENT.

- (b) Cautions refer to the step that follows it, just like this example.

- (c) Notes are given to clarify the procedure and follow the step to which it refers.

**NOTE:** Notes look like this, and gives more details to make the task easier or to add to the explanation.

SUBTASK 70-00-01-910-002-F00

- (2) Use these terms to define and specify defects:

Table 201/70-00-01-993-801-F00

TERMS	DEFINITIONS	ASSOCIATED TERMS
Blister	A portion of a surface that is lifted, and is caused by the separation of the outer layers of the parent material, or the material that you applied.	Bubble, Flaking, Oxide formation, Peeling, Scale, Slag inclusion (weld)
Brittle	A change in the elasticity or resilience of the parent material. The defect is usually caused by age, extreme cold, chemical action, or cold-working.	Cold worked hard (like an O-ring)
Buckle	A large scale deformation of the original contour of a part that is usually caused by pressure. Possible causes are impacts with foreign objects, structural stress, excessive localized heat, high pressure differentials, or a mixture of these.	Ballooning, Bend, Bulge, Crease, Curl, Dent (do not confuse with a small area defect), Depression, Distor- tion, Elongation, Fold, Indentation, Kink, Protrusion, Rupture (caused by excessive buckling), Uneven, Warp, or Wrinkle
Burn	A fast, destructive, oxidizing effect that is usually caused by high temperatures or open flame. A change in color is usually associated with this condition	Burn-out, Erosion, Corrosion, Guttered, Heat-check, Heat deterioration, Hole (burnt), Hot Spot, Overheat, or Oxidation

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TERMS	DEFINITIONS	ASSOCIATED TERMS
Burnishing	To make a metal surface smooth by a mechanical action, but without a significant decrease in the material. You can find burnishing on a plain bearing surface. It is possible to find surface discoloration near the outer edges of the burnishing. Burnishing that is caused by the operation of the equipment is not dangerous, if the coverage approximates the load carrying surface and there is no evidence of burns.	Rub, Wear
Burr	A rough edge or a sharp point on the edge or the mating surface of the parent material.	
Chafing	Please see Gall or Scratch.	
Chip	An edge that breaks away from the parent material. A chip is usually caused when a foreign object hits the parent material.	Break, Nick, Notch spalling (a chip broken away from a flat surface)
Corrosion	Many small pits that can grow into a hole. The first sign of corrosion is usually a roughness in the surface of the parent material.	Pit
Crack	A separation or discontinuity of the parent material.	Break, Cold shut (castings), Crater (castings), Fatigue damage, Fissure, Fracture, Lap (forgings), Rupture, Seam, Separation, Slit, Tear
Crazing	Many small thin cracks that are found in a painted, glazed, or baked-on layered surfaces. Crazing is only found in the surface material, not the parent material. The crazing is usually caused by temperature differentials or deformation of the parent material.	
Creep	The slow and continuous distortion (plastic flow) of the parent material. Creep is usually caused by a constant stress that is applied to the parent material.	
Deformation	A change in shape or dimension that can be caused gradually, or suddenly. An impact can cause sudden deformation, creep can cause gradual deformation.	Bend, Creep, Distortion
Dent	A smooth surface depression in the surface of the parent material. A dent is usually caused by impact with a smooth, rounded object. In a dent, the parent material is displaced, but does not form a hole.	Peen
Deviation	A condition that causes the component to be different than the manufacturer's blueprint.	Damage, Defect, Flaw, Imperfection, Irregularity

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TERMS	DEFINITIONS	ASSOCIATED TERMS
Discontinuity	An interruption in the correct physical structure or configuration of a component.	Crack, Hole, Seam, Cold shut, Lap
Distortion	A twist, bend, or permanent strain that causes the shape of the component to change.	Bend, Deformation
Erosion	A surface imperfection that is caused by the slow, continuous wearing away of the parent material. Erosion is usually caused by fine particles that are suspended in a fast moving gas or liquid.	
Fatigue	The sequential fracture of a component that is caused by cyclical stress.	Crystallization, Fretting, Flaking
Flaking	See Spalling	
Fretting	The metal to metal wear that shows on parts, that is caused by low amplitude vibrations (usually associated with close fitting parts).	Wear, Galling
Galling	A defect that is caused when the component wears away. Galling is usually caused by a small quantity of unwanted material that gets between two moving surfaces.	Pickup
Gouge	A large, rough scratch or group of scratches.	
Groove	A long, thin, continuous depression.	If the depression is shallow and smooth, see WEAR. If the depression is rough and sharp, see SCRATCH.
High spot	Local distortions	Blister, Buckle, Bubble, Out- of-round.
High metal	Material that is adjacent to a defect, such as a nick or gouge, and has lifted above the surrounding area.	Burr
Imbalance	The state of being out of balance. An imbalance usually causes vibrations.	
Inclusion	Is an unwanted material that has become a part of the parent material. Inclusions are usually caused by alloy defects or by chemical reaction of the parent material.	
Indication	A defect in the material that you can see, or a tell-tale that you can see that implies that a defect exists.	
Looseness	A component that is not attached correctly.	Backed-out, Excessive play, Backlash, Insufficient torque, Shaky, Sloppy, Not-bottomed, Unpinned, Unwired

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TERMS	DEFINITIONS	ASSOCIATED TERMS
Misalignment	A component that is not installed correctly, or is made in such a way that it cannot align with the parts around it.	Eccentric, Out-of-round, Out- of-square, Mismatched
Nick	A defect in a component that pushed in with sharp corners. A nick is usually caused by the pressure of an impact with a sharp-edged object. The material is displaced, but none is usually broken off.	Chip, Dent, Notch
No apparent depth	This term describes a surface defect that you can see, but you can not feel it with your fingernail or the tip of a scribe point.	
Noise	An unusual sound that can include loose or misaligned components. The change that brings the noise to your attention is usually associated with an increase in volume or a change in pitch.	Bumps, Chatters, Clicks, Grates, Rings, Hums, Rattles, Rubs, Scraping sound, Screech, Thumps, Whistles
Obstruction	Unwanted material the prevents or obstructs the flow of gas or liquid into, around, or through a component.	Clogged, Contaminated, Plugged, Restricted
Oil-canning	A movement that displaces sheet metal that is held at its edges, like a diaphragm. The oil-canning is usually associated with a cyclic noise.	Buckling
Parent metal	The material in a single part that does not include the weld, braze filler, or their heat damaged zones. The heat damage zone is usually in 0.125 inch (3.175 mm) of the fusion line.	
Pinched	A distortion of the surface of the parent material that is caused by pressure.	Bound, Compressed, Flattened, Seized, Smashed, Squashed, Squeezed.
Pit	A small hole that does not have sharp edges. Pits are usually caused by chemical reaction of the parent metal of the components surface.	Corrosion, Crater, Electrolytic cavity, Inclusion, Perforation, Pin- hole, Pock-mark
Porous	An area that is full of pores that fluids, gas, or light can pass through. An area with many pits or pinholes.	Pits, pinholes
Rub	A surface defect that is caused by abrasion. Rubs are usually found on surfaces that touch as they move.	Wear, Scratch
Scale	A layer of metallic oxide that is often found on new metal. Scale is usually formed by chemical action of oxygen while the metal is hot.	Mill scale

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TERMS	DEFINITIONS	ASSOCIATED TERMS
Scratch	A long, thin, sharp cornered impression in the surface of the parent material. Scratch is usually caused as a sharp object is moved across the surface.	Abrasion, Chafe, Furrow, Groove, Score
Seizure	A welding or binding of the components that prevents movement. The welding can be caused by oxidation or heat.	Bound-up, Frozen, Pinched, Tight, Wedged, Welded
Shingling	When one blade mid-span shroud moves over another shroud. Shingling occurs at the blade tip shrouds of the LP turbine rotor (stages 3 and 4). The LP turbine condition is caused by too little twist in the blades, or too much radial movement.	Bound-up, Wedged
Spalling	Small particles of the metal that crack or flake off of the surface. Spalling is usually found in thin layers or confined areas.	Flaking, Fretting, Galling
Unbalance	Please see IMBALANCE	
Varnish film	A hard surface film that is made up of partially carbonized hydro-carbons, such as oil. Varnish is caused when the part is heated above the break-down point of the fluid.	Banded, Discolored, Oxidized, Stained
Wear	The slow removal of the parent material that is caused by the operation of the component.	Abrasion, Attrition, Brinnelled, Chafed, Erosion, Fraying, Fretting, Friction, Galling, Glazing, Grooved, Interference, Oxidation, Rough, Rubbed, Scarfed, Scuffed, Uneven, Weak, Worn

## B. Abbreviations

SUBTASK 70-00-01-910-003-F00

- (1) The abbreviations that follow are used for terms that appear in the power plant procedures of the maintenance manual.

Table 202/70-00-01-993-802-F00

ABBREVIATION	DEFINITION
A's	
AC	Alternating Current
AGB	Accessory Gearbox
APU	Auxiliary Power Unit
AVM	Airborne Vibration Monitoring
B's	
BAT	Battery
C's	

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ABBREVIATION	DEFINITION
CBP	Compressor Bleed Pressure
CDP	Compressor Discharge Pressure
CG	Center of Gravity
CIT	Compressor Inlet Temperature
CONT	Continuous
D's	
DC	Direct Current
DIA	Diameter
E's	
EEC	Electronic Engine Controller
EGT	Exhaust Gas Temperature
ENG	Engine
F's	
FIG	Figure
FLT	Flight
FOD	Foreign Object Damage
FPI	Fluorescent Penetrant Inspection
FWD	Forward
G's	
GND/GRD	Ground
H's	
HMU	Hydromechanical Unit
HP	High Pressure
HPC	High Pressure Compressor
HPT	High Pressure Turbine
I's	
ID	Inside Diameter
IGB	Inlet Gearbox
IGN	Igniter/Ignition
IGV	Inlet Guide Vane
INOP	Inoperative
J's Not Used	
K's	

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ABBREVIATION	DEFINITION
KIAS KPA	Knots, Indicated Air Speed Kilo-Pascal
L's LP LPC LPT LRU LVDT	Low Pressure Low Pressure Compressor (Fan) Low Pressure Turbine Line Replaceable Unit Linear Variable Differential Transformer
M's MAX MIN	Maximum Minimum
N's NGV NLR Nm N1 N2	Nozzle Guide Vane Corrected Fan Speed (Corrected N1) Newton meter Low Pressure % RPM (Fan Speed) High Pressure % RPM (Core Speed)
O's OAT OD OGV	Outside Air Temperature Outside Diameter Outlet Guide Vane
P's PB PC PCR PF PLA	Bypass Pressure Regulated Servo Pressure Regulated Case Pressure High Pressure Fuel (heated) Power Lever Angle
Q's QAD QEC	Quick Attach/Detach Quick Engine Change
R's REF RVDT	Reference Rotary Variable Differential Transformer

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ABBREVIATION	DEFINITION
S's Not Used	
T's  TACH TAI TCCV TC1 TC2 TGB TLA TRA T12 T2	Tachometer Thermal Anti-Ice Turbine Clearance Control Valve Turbine Clearance (stage 5) Turbine Clearance (stage 9) Transfer Gearbox Thrust Lever Angle Thrust Resolver Angle Fan Inlet Temp (electrical sensor) Fan Inlet Temp (hydro-mech sensor)
U's Not Used	
V's  V VBV VCD VSV	Volt Variable Bleed Valve Vortex Control Device Variable Stator Vane
W thru Z Not Used	

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**GENERAL PRECAUTIONS DURING THE REMOVAL AND INSTALLATION OF ENGINE COMPONENTS -  
MAINTENANCE PRACTICES**

**TASK 70-10-02-910-801-F00****1. General Precautions During the Removal and Installation of Engine Components**

## A. General

- (1) You must be careful when you do maintenance operations in the engine critical areas.
- (2) Damage to the engine can occur from unwanted materials that go into the engine (FOD) or from engine parts that are not correctly attached.
- (3) It is very important that all critical areas of the engine be examined for cleanliness before each engine run.
- (4) It is very important that the area around the engine be examined for cleanliness before each engine run.

## B. References

Reference	Title
70-30-01-910-802-F00	Seals (Preformed Packings and O-Rings) and Gaskets (P/B 201)

## C. Location Zones

Zone	Area
410	Subzone - Engine 1
420	Subzone - Engine 2

## D. Precautions During the Removal and Installation of Engine Components

## SUBTASK 70-10-02-910-002-F00

## (1) Engine Critical Areas

- (a) Air inlet cowl.
- (b) Bleed valve compartments.
- (c) Interfaces with engine bleeds.

## SUBTASK 70-10-02-910-003-F00

## (2) General Precautions for Maintenance Tasks

- (a) Make sure that you do these steps before you do the maintenance:
  - 1) Remove the contents from your pockets of your work clothes.
  - 2) The bottom of your footwear is clean.
- (b) Make sure that you do these steps after you complete the maintenance:
  - 1) Remove all tools, materials and engine parts that you do not use.
  - 2) Remove all tools, materials and engine parts from around the engine.
  - 3) Attach all clamps and brackets.
  - 4) Remove all loose (instrumentation and lockwire) wire.
  - 5) Make sure the area of the air inlet cowl and engine bleeds is clear of all unwanted material.
  - 6) Clean areas that are not easy to get to with a vacuum cleaner.
  - 7) Make sure you install the engine covers if you do not operate the engine soon.

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SUBTASK 70-10-02-910-004-F00

**WARNING:** DO NOT TOUCH THE COMPONENTS OF THE OIL SYSTEM IF THE ENGINE IS HOT. THESE COMPONENTS STAY HOTTER THAN OTHER COMPONENTS. HOT COMPONENTS CAN BURN YOU.

**WARNING:** DO NOT OPEN THE OIL SYSTEM UNTIL THE PRESSURE GOES TO ZERO. THE PRESSURE GOES TO ZERO APPROXIMATELY 5 MINUTES AFTER AN ENGINE SHUTDOWN. A PRESSURIZED ENGINE CAN RELEASE A SPRAY OF HOT OIL THAT CAN BURN YOU.

**WARNING:** DO NOT LET HOT OIL GET ON YOU. PUT ON GOGGLES AND OTHER EQUIPMENT FOR PROTECTION OR LET THE ENGINE BECOME COOL. HOT OIL CAN BURN YOU.

**WARNING:** DO NOT LET ENGINE OIL STAY ON YOUR SKIN. USE ENGINE OIL IN AN AREA WITH GOOD VENTILATION. ENGINE OIL IS POISONOUS AND CAN BE ABSORBED THROUGH YOUR SKIN. ENGINE OIL FUMES CAN IRRITATE YOUR RESPIRATORY TRACT.

**CAUTION:** DO NOT LET HOT OIL GET ON THE ENGINE OR OTHER COMPONENTS. IMMEDIATELY CLEAN THE COMPONENT IF OIL FALLS ON IT. OIL CAN CAUSE DAMAGE TO PAINT AND RUBBER.

**CAUTION:** DO NOT LET ALKALINE CLEANING FLUID GET INTO THE ENGINE OIL. VERY SMALL QUANTITIES OF THIS FLUID CAN CHANGE THE ENGINE OIL. DAMAGE TO EQUIPMENT COULD OCCUR.

- (3) Disconnect any and all oil system components.
- (a) You can find the maintenance practices for the seals and the gaskets in this task (TASK 70-30-01-910-802-F00).
  - (b) Do not let the metal tools hit the components and accessories.
  - (c) Use clean covers and caps to prevent damage to the engine openings.
  - (d) Use clean caps to prevent damage to the electrical connections when you disconnect the electrical systems.
  - (e) Use clean covers and caps to prevent damage to all ends of a component that you remove.

**NOTE:** For example: Install covers on the gear shafts and all connections.

SUBTASK 70-10-02-910-006-F00

- (4) Removal of components and accessories.
- (a) Make sure that the nameplate is present before you remove the component or accessory.
  - (b) Make sure that you record the part number and the serial number of the removed component before you send the component for repair.
    - 1) If the nameplate is missing, collect the part number and the serial number through engine records.

SUBTASK 70-10-02-910-005-F00

- (5) Installation of Components and Accessories
- (a) Record the type and serial number before you install a component.
  - (b) Visually examine the general condition of the component.
    - 1) Make sure the component is not damaged before you install it.

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- (c) Make sure the mounting faces and seal grooves are clean and not worn.
- (d) Use only the tools made for the operation.
- (e) Make sure you see a minimum of one thread in the nuts and chambers after you tighten the last torque.

**CAUTION:** USE TWO WRENCHES TO REMOVE, INSTALL AND TIGHTEN THE HOSE AND TUBE COUPLING NUTS. MAKE SURE YOU USE ONE WRENCH TO HOLD THE NIPPLE AND THE OTHER WRENCH TO LOOSEN OR TIGHTEN THE COUPLING NUT. ONE WRENCH CAN CAUSE DAMAGE TO THE HARDWARE.

- (f) Make sure you tighten to the given torque values in the sequence of the procedure of operations.
- (g) Use gloves to hold the bearings and all other parts that can oxidate.
- (h) Do not use the cold-shrink procedure for the installation of bearings.

————— **END OF TASK** —————

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## AIRCRAFT MAINTENANCE MANUAL

TEMPORARY MARKING PROCEDURES - MAINTENANCE PRACTICES**1. General**

A. This procedure contains this task:

- (1) Temporary Marking Procedures

**TASK 70-10-03-910-801-F00****2. Temporary Marking Procedures**

A. General Information

SUBTASK 70-10-03-910-001-F00

- (1) This is general information for the use of temporary markers:

- (a) Use temporary marks for temporary identification only.
- (b) Temporary marks are not intended to remain after engine operation unless you are given other instructions in the task.
- (c) Remove the temporary marks before the operation of the engine unless you are given other instructions in the task.
- (d) The temporary marks must not cause damage or failure of the parts, if you do not remove the marks.
- (e) Temporary marks used to identify parts could go away after an engine run.
- (f) Incorrect materials used to make temporary marks, when subjected to high temperatures, can cause chemical damage to the part and cause possible part failure.
- (g) This procedure refers to the materials that were examined by CFM International, which you can use safely on engine parts.
- (h) If more temporary marking compounds are necessary, refer to CFMI Standard Practices Manual, 70-10-02.

B. Procedure

SUBTASK 70-10-03-910-002-F00

**CAUTION:** WHEN IT IS NECESSARY, MAKE A MARK ON THE ENGINE PARTS. MAKE SURE THAT YOU USE ONLY APPROVED MARKING COMPOUNDS. MARKING COMPOUNDS THAT ARE NOT APPROVED CAN CAUSE DAMAGE TO THE ENGINE PARTS.

**CAUTION:** DO NOT USE A GREASE PENCIL OR A LEAD (GRAPHITE) PENCIL TO MAKE A MARK ON THE COMBUSTION SECTION OR A HOT SECTION PART. THESE MATERIALS AND HEAT CAN CAUSE DAMAGE TO THE COMPONENTS.

**CAUTION:** DO NOT PUT MARKS ON THE MATING SURFACES OF PARTS, ASSEMBLIES, OR CONNECTORS. THE MARKING MATERIALS CAN EFFECT THE CLEARANCES AND CONCENTRICITY OF THE PARTS.

- (1) Temporary marking can be done with 2 methods:
  - (a) Labels can be attached to the part with wires, ties or adhesives.
  - (b) Ink marks can be made on the surface of the part.

SUBTASK 70-10-03-910-003-F00

- (2) Make sure that the markings are legible.

SUBTASK 70-10-03-910-004-F00

- (3) Make sure that the labels will not fall off.

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**AIRCRAFT MAINTENANCE MANUAL****C. Temporary Marking Materials**

SUBTASK 70-10-03-910-005-F00

- (1) These markers are acceptable and are commercially available to make a mark on the parts:
- (a) Marks-A-Lot (black or blue), Carter's Ink Corp, 239 First St, Cambridge, MA 02142 USA
  - (b) Comte 566 (blue, red, white, or green), Le Lys Rouge, 56 Rue Labrouste, 75015 Paris, France
  - (c) Dixon Markers (black or blue), Jos Dixon Crucible Corp, 167 Wayne St, Jersey City, NJ 07303, USA
  - (d) Tiflex Ink (XB824 black, XF160 blue, or XF160 green), Tiflex, 10 Route De Geneve, 01450 Poncin, France
  - (e) Eberhard Faber Colorbrite (silver 2101), Eberhard Faber Inc, Crestwood, Wilkes-Barre, PA 18703, USA
  - (f) Aircraft Marker Ln 9051 (blue or red), Ratioplast, Spitalwald Strasse BE 9, 8540 Schwabach, Germany
  - (g) Marco S-1141 (black), Marking Devices Manufacturing Co, 2708-10 5th St, Philadelphia, PA 19133, USA
  - (h) Action Marker (black or White with tips 33, 44, or 55), Mark Tex Corp, 161 Coolidge Ave, Englewood, NJ 07133, USA
  - (i) Dykem (steel blue DX100), ITW-Dykem Co, 3624 W. Lake Avenue, Glen View, IL 60025-1215

————— **END OF TASK** —————

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## AIRCRAFT MAINTENANCE MANUAL

**SPOT TOUCH-UP OF OXIDE FILM COATING ON ALUMINUM ALLOYS FOR PROTECTION - MAINTENANCE PRACTICES**

**1. General**

A. This procedure has one task:

- (1) A chemical touch-up for aluminum surfaces.

**TASK 70-10-04-380-801-F00**

**2. Spot Touch-Up of Oxide Film Coating on Aluminum Alloys for Protection**

A. General

- (1) This procedure is used to give instructions to touch-up or refinish of an aluminum surface to put back the protective film.
- (2) Aluminum surfaces that have the original anodized protective finish removed must be touched-up or finished to put back the protective film.

B. Tools/Equipment

Reference	Description
STD-1118	Container - Stainless Steel, 1 Gallon (4 Liters)
STD-3939	Air Source - Regulated, Dry Filtered, 0 to 10 psig (0 to 69 kPa)

C. Consumable Materials

Reference	Description	Specification
B00047	Acid, Technical Grade, Nitric (61%-68.2% Purity)	A-A-59105
B00062	Solvent - Acetone (99.5% Grade)	ASTM D 329 (Supersedes O-A-51)
B00683 [CP1008]	Solvent - Stabilized Trichloroethylene	
C00064	Coating - Aluminum Chemical Conversion	BAC5719, Type II, Class A (MIL-C-5541, Class A)
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5
G00291	Tape - Aluminum Foil, Scotch 425	AMS-T-23397 / L-T-80
G02439	Brush - Nylon Bristle	
G50221	Abrasive - Wet/dry Silicon Carbide Sandpaper, 180 grit	

D. Procedure

SUBTASK 70-10-04-100-001-F00

**WARNING:** DO NOT GET THE ACID SOLUTIONS IN YOUR MOUTH, OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ACID VAPORS. PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE ACID SOLUTIONS. THE ACID SOLUTIONS ARE POISONOUS AND CAN CAUSE INJURIES TO PERSONS.

- (1) Do these steps to clean the exposed areas:

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## AIRCRAFT MAINTENANCE MANUAL

**WARNING:** DO NOT GET THE DEGREASING SOLVENTS IN YOUR MOUTH, OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE DEGREASING SOLVENTS. PUT ON PROTECTIVE SPLASH GOGGLES AND GLOVES WHEN YOU USE DEGREASING SOLVENTS. THE DEGREASING SOLVENTS ARE POISONOUS WHICH CAN CAUSE INJURIES TO PERSONS.

**CAUTION:** BE CAREFUL NOT TO LET THE ACID SOLUTIONS TOUCH THE DEGREASING SOLVENTS. THE MIXTURE OF THE ACID AND SOLVENTS IS HIGHLY FLAMMABLE. IF YOU ARE NOT CAREFUL, YOU CAN DAMAGE THE FILM COATING AND OTHER METAL PARTS.

- (a) Use the clean brush, G02439 or cotton wiper, G00034 to clean the surface with solvent, B00683 [CP1008] or solvent, B00062 .

SUBTASK 70-10-04-120-001-F00

- (2) Do these steps to prepare the exposed areas:

- (a) Use the 180 grit wet/dry silicon carbide sandpaper, G50221 to sand the area lightly.
- 1) Remove all scratches, pits or rough areas.
- (b) Flush the area with clear water.

SUBTASK 70-10-04-950-001-F00

- (3) Do these steps to give protection to the area and parts around the refinished area.

**CAUTION:** BE CAREFUL NOT TO SPLASH OR SPRAY THE ACID SOLUTION ON PARTS THAT ARE NOT MADE OF ALUMINUM. THE ACID SOLUTION IS HIGHLY CORROSIVE. PROTECT ALL PARTS THAT ARE NOT MADE OF ALUMINUM. IF YOU ARE NOT CAREFUL, YOU CAN DAMAGE THE FILM COATING AND OTHER PARTS.

- (a) Use Scotch 425 Aluminum Foil Tape, G00291 to attach a mat, acid resistant plastic film, or cardboard to protect these areas:
- 1) The fan blades
  - 2) The abradable parts and areas of the fan case
  - 3) All mounting hardware

SUBTASK 70-10-04-110-001-F00

- (4) Prepare the acid solution as follows:

**NOTE:** These steps are only to prepare one gallon (3.79 liters) of acid solution.

- (a) Mix the solution only in a stainless steel container (1 gal) (4 Liters), STD-1118.
- (b) Put in 12.8 fluid ounces (378.5 ml) of clear hot water at 120-140 degrees F (49-60 degrees C).
- (c) Mix not more than 3.0 fluid ounces (22 ml) of coating, C00064.
- (d) Mix the solution and the hot water until the solution is fully dissolved.
- (e) Mix in not more than 0.57 fluid ounces (4.43 ml) of acid, B00047.
- (f) Stir the mix slowly and carefully while you put in the acid.
- (g) Mix in 3.6 quarts (106.46 ml) of clear hot water at 120-140 degrees F (49-60 degrees C).
- (h) Stir the mix slowly and carefully.
- (i) Put only the quantity of solution you will use into a stainless steel, acid resistant plastic, or rubber container, to apply to the repair area.
  - 1) Make sure you cover the bucket of acid solution.

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SUBTASK 70-10-04-110-002-F00

(5) Do these steps to apply the refinish film coat:

- (a) Rub the surface with stainless steel pliers and a swab which is soaked with the acid solution.

**NOTE:** Do not apply a thick application of solution. This will give a thick powdery non-adherent coating.

- 1) Keep the area wet with the solution until the film coating is fully formed in 1-10 minutes.

**NOTE:** The film coating is a golden iridescent color, although it can vary with different alloys or the conditions of the process. If the film coating is powdery, the treatment time is longer. Remove the powdery film coating and do the procedure again.

**CAUTION:** DO NOT USE WATER AT A HIGH PRESSURE TO FLUSH THE SURFACE. DAMAGE TO THE PROTECTIVE COATING CAN OCCUR.

**CAUTION:** DO NOT PERMIT LIQUIDS TO STAY IN THE CAVITIES OR DEPRESSION IN THE PART. DAMAGE TO THE PROTECTIVE COATING CAN OCCUR.

- (b) Flush the acid solution off fully with a flow of clean water at a temperature of 120-140 degrees F (49-60 degrees C).

**CAUTION:** BE CAREFUL NOT TO SCRATCH OR RUB OFF THE PROTECTIVE COATING WHEN FRESHLY FORMED. DAMAGE TO THE PROTECTIVE COATING CAN OCCUR.

- (c) Dry the part with the dry 0 to 10 psig (0 to 69 kPa) dry filtered regulated air source, STD-3939.

**CAUTION:** DO NOT PAINT THE PROTECTIVE COATING OF THE PART IN LESS THAN 30 MINUTES. DAMAGE TO THE PROTECTIVE COATING CAN OCCUR.

- (d) You can paint the surface after the protective coating dries for a minimum of 30 minutes.

————— **END OF TASK** —————

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## AIRCRAFT MAINTENANCE MANUAL

**APPLICATION OF MOLYBDENUM DISULFIDE AND OTHER LUBRICANTS DISPERSED IN AN INORGANIC BINDER AND NON-FLAMMABLE SOLVENT- MAINTENANCE PRACTICES**

**TASK 70-10-05-600-801-F00****1. Application Of Molybdenum Disulfide And Other Lubricants Dispersed In An Inorganic Binder And Non-Flammable Solvent - Maintenance Practices**

## A. General

- (1) Molybdenum disulfide and other lubricants dispersed in an inorganic binder and non-flammable solvent compose s a dry film lubricant varnish or solid lubricant paste which is applied by an aerosol can or a brush. The lubricant cures at ambient temperature in contact with ambient humidity.
- (2) You must do this procedure in an area with an efficient ventilation system for extracting and neutralizing vapors.

## B. Consumable Materials

Reference	Description	Specification
B00676 [CP1041]	Alcohol - Isopropyl	TT-I-735
B01058 [CP1039]	Solvent - Acetone, Reagent Grade	
B50046	Solvent - Methyl Ethyl Ketone, Technical Grade	ASTM D740 (Supersedes TT-M-261)
D00640 [CP2104]	Lubricant - Molybdenum Disulfide, Solid - Molykote G	
D00641 [CP5062]	Lubricant - Corrosion Inhibiting, Dry Film - Dow Corning 321	
D00673 [CP2569]	Lubricant - Molybdenum Disulfide, Solid - Dow Corning G-n Metal Assembly	
D50019 [CP2444]	Lubricant - Molydisulfide Solid Film, Paste - Molykote G-n Plus	
G00270	Tape - Scotch Flatback Masking 250	ASTM D6123 (Supersedes A-A-883)
G00834	Cloth - Lint-free Cotton	

## C. Procedure

## SUBTASK 70-10-05-840-001-F00

- (1) Process a test piece (strip of sheet metal) along with the part to be dry lubricant coated for quality assurance purposes.

## SUBTASK 70-10-05-840-002-F00

- (2) If the process document specifies thickness of applied lubricant, measure thickness of test piece before you apply the lubricant.

## SUBTASK 70-10-05-110-001-F00

**WARNING:** CLEANING SOLVENTS ARE FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH YOUR SKIN, OR CLOTHING. IF YOU DO NOT OBEY THIS INSTRUCTION, INJURY CAN OCCUR.

- (3) Unless specified in the process document, clean the part and test piece with a lint-free cloth, G00834 saturated with one of the solvents:
  - (a) acetone solvent, B01058 [CP1039]
  - (b) technical grade methyl ethyl ketone, B50046

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- (c) alcohol, B00676 [CP1041]

SUBTASK 70-10-05-640-001-F00

- (4) For spray application, apply one of these lubricants in less than 15 minutes after you clean the part.
- (a) Dow Corning 321 lubricant, D00641 [CP5062]
  - (b) Molykote G lubricant, D00640 [CP2104]
  - (c) Keep the spray nozzle approximately 8 inches (20 cm) from the surface of the part.
  - (d) Unless specified in the process document, the coating thickness shall be approximately 0.0006-0.0012 inch (0.015-0.030 mm).
  - (e) Let the lubricant air cure at ambient temperature for one hour minimum before part installation.
  - (f) If more than one application is required to get the lubricant thickness specified in the process document, apply successive layers as necessary and let air-dry between applications.

SUBTASK 70-10-05-640-003-F01

- (5) For brush application, apply one of these lubricants in less than 15 minutes after you clean the part.
- (a) Molykote G lubricant, D00640 [CP2104]
  - (b) Molykote G-n Plus lubricant, D50019 [CP2444]
  - (c) Dow Corning G-n Metal Assembly lubricant, D00673 [CP2569]
  - (d) Unless specified in the process document, the coating thickness shall be approximately 0.0004-0.0008 inch (0.010-0.020 mm).
  - (e) Bond stress can be improved with by burnishing (leather stroking) or with a sponge, a brush or by rubbing with smooth friction.

SUBTASK 70-10-05-950-001-F00

**CAUTION:** DO NOT TOUCH THE PREPARED AREA OF THE PART WITH YOUR BARE HANDS OR EXPOSE THE PART TO OTHER CONTAMINATION. IF THE LUBRICANT IS NOT APPLIED IN LESS THAN 15 MINUTES OF PREPARATION, THE PART MUST BE PREPARED AGAIN.

- (6) Apply masking to the part per the process document if specified.

SUBTASK 70-10-05-220-001-F00

- (7) If the process document specifies the thickness of the applied lubricant, measure the test piece thickness after application and subtract the initial measurement to make sure you have the correct lubricant thickness.

SUBTASK 70-10-05-110-002-F00

**WARNING:** CLEANING SOLVENTS ARE FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH YOUR SKIN, OR CLOTHING. IF YOU DO NOT OBEY THIS INSTRUCTION, INJURY CAN OCCUR.

- (8) Remove any over-spray or excess lubricant with a lint-free cloth, G00834 dampened with one of the listed solvents.

SUBTASK 70-10-05-950-002-F00

- (9) Remove the masking, if applied.

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**AIRCRAFT MAINTENANCE MANUAL****D. Quality Assurance For Dry Film Lubricant**

SUBTASK 70-10-05-280-001-F00

- (1) Do the tests that follow on the test piece which was processed with the part:
  - (a) Apply a press on a strip of pressure sensitive Scotch Flatback Masking Tape 250, G00270 to test the piece.
    - 1) The coating shall not peel when the tape is pressed on and pulled off.
  - (b) Scratch the coating on the test piece with your fingernail.
    - 1) Scratching shall not remove the coating.

SUBTASK 70-10-05-210-001-F00

- (2) Examine the coating on the processed part.
  - (a) There should be no sags, blisters, flakes, or foreign material and should be smooth and uniform.
  - (b) The coating should be dark gray.

SUBTASK 70-10-05-350-001-F00

- (3) If the coating fails any of these tests or examinations, remove the coating and re-process the part.

**E. Quality Assurance For Solid Lubricant Paste**

SUBTASK 70-10-05-210-002-F01

- (1) Examine the coating on the processed part.
  - (a) It should be smooth and uniform without any foreign material.
  - (b) The coating should be dark gray.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****LOCKING PROCEDURES - MAINTENANCE PRACTICES****1. General**

- A. This procedure gives the usual task to install this lock device:
- (1) The installation of the self-locking, hexagonal and castellated nut
- B. This procedure gives the tasks to lock parts with the use of these devices:
- (1) Cotter Pins
  - (2) Tab Washers
  - (3) Lockwire
  - (4) Safety Cable.
- C. The lock devices are safety devices to keep the fasteners and other parts engaged.
- D. The lock devices prevent all opposite forces that can cause the fasteners to disengage.
- E. Do not use the lock devices to apply or keep a torque.
- F. The lock devices are related to safety and you must install them with the best shop procedures.

**TASK 70-20-01-800-801-F00****2. Self-locking, Hexagonal and Castellated Nut Installation**

(Figure 201)

**A. Procedure**

SUBTASK 70-20-01-910-001-F00

- (1) You must examine the new or used nuts and compare them with the assembly specifications.
  - (a) You must discard the nuts that do not agree with the specification.
  - (b) Make sure the threads of a stud or bolt shank come out of the nuts with a minimum of one thread (unless otherwise specified).
  - (c) Use a torque wrench to apply the correct torque values.

————— **END OF TASK** —————

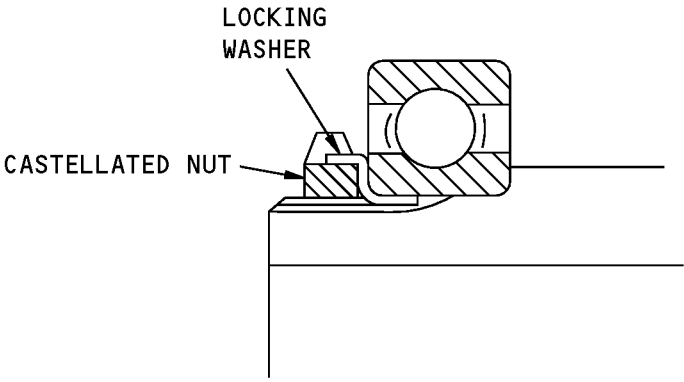
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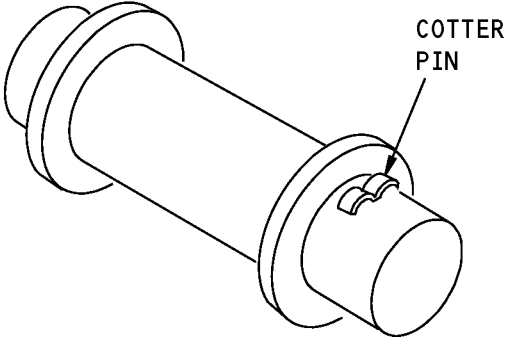
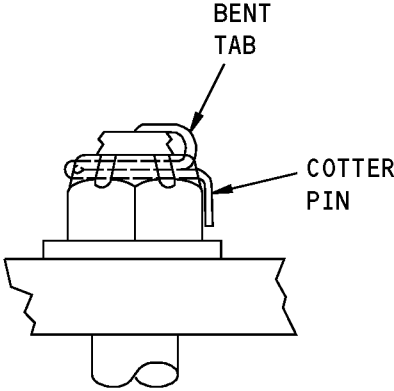
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CASTELLATED NUT INSTALLATION



COTTER PIN INSTALLATION

S-M56-MM-0313-(1)-00-B

Nut and Cotter Pin Installation  
Figure 201/70-20-01-990-801-F00

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## AIRCRAFT MAINTENANCE MANUAL

## TASK 70-20-01-800-802-F00

3. Cotter Pin Installation

(Figure 201)

## A. Procedure

SUBTASK 70-20-01-910-002-F00

**CAUTION:** DO NOT USE THE SAME COTTER PINS AGAIN. USE NEW COTTER PINS FOR EACH ASSEMBLY OPERATION. WHEN YOU TIGHTEN THE FASTENERS, DO NOT USE MORE THAN THE MAXIMUM TORQUE VALUE. DAMAGE TO THE EQUIPMENT COULD OCCUR.

- (1) After you apply the minimum torque to a castellated nut, do these steps:
  - (a) Tighten the castellated nut until the one slot on the nut is aligned with the hole for the cotter pin.
  - (b) If you cannot align the nut and the hole, then loosen the nut by one-half turn.
    - 1) Tighten the castellated nut again.
  - (c) If you cannot correctly align the castellated nut again, then replace the nut.
  - (d) Install the cotter pin with the head engaged tightly in the slot of the nut.
  - (e) Bend the points of the cotter pin until the head and the top point are tightly engaged against the bolt.

————— END OF TASK —————

## TASK 70-20-01-800-803-F00

4. Tab Washer Installation

(Figure 202)

## A. Procedure

SUBTASK 70-20-01-910-003-F00

**CAUTION:** DO NOT USE THE TAB WASHERS AGAIN. USE NEW TAB WASHERS FOR EACH ASSEMBLY OPERATION. DAMAGE TO THE EQUIPMENT CAN OCCUR.

- (1) Install the tab washer in the correct position.
  - (a) Install the lock tab so it cannot get loose.
  - (b) Bend the lock tab tightly against the flat side of the nut.
    - 1) Make sure that the lock tab is correctly bent.

————— END OF TASK —————

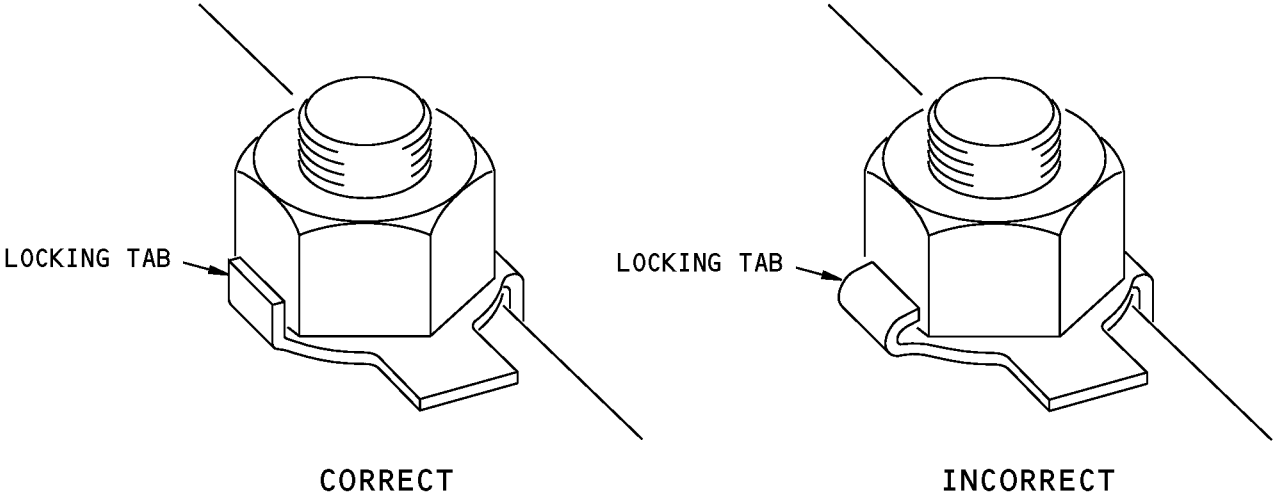
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G-M56-SP-0004(1)-01-C

Tab Washer Installation  
Figure 202/70-20-01-990-802-F00

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## AIRCRAFT MAINTENANCE MANUAL

## TASK 70-20-01-800-804-F00

5. Lockwire Installation

(Figure 203)

## A. Procedure

SUBTASK 70-20-01-400-001-F00

- (1) The lockwire is a safety device to make sure two or more parts stay together.
- If the part starts to become loose, then the lockwire would tighten more to oppose the part in the opposite direction.
  - When you install a lockwire, use the general instructions and the specified procedures that follow.

SUBTASK 70-20-01-400-002-F00

## (2) General Instructions for installing Lockwire.

- Unless specified differently, the lockwire must be a NC15Fe wire with a 0.032 inch (0.81 mm) diameter.
- Twist together the two strands with the double-twist procedure to install the lockwire.
  - You get one twist when you turn the wires through an arc of 180 degrees and is equal to one-half turn.
  - You can use the single-strand procedure only when it is specified.

NOTE: This is illustrated in (View C) (Figure 203).
- Do not install the lockwire to cause the wire to wear, fatigue through vibration or become tighter.

NOTE: Use the lockwire to keep the parts engaged.

- You must install the lockwire only through the holes given.
    - When you do not have a hole, attach the wire to a part adjacent to the wire.

NOTE: Make sure the lockwire does not hit other parts as illustrated in (Views F and G) (Figure 203).
  - The maximum length of the lockwire between tension points is 6 inches (152 mm), unless specified differently.
    - The double twist or single strand method is acceptable if 3 or more fasteners make a group that must be lockwired together.

NOTE: The double twist method is the preferred method unless specified differently in the instructions.
  - A limit in the number of units you can connect with a 24-inch (610 mm) length of wire is the maximum number of units in a sequence.
  - Use the double twist method to lockwire items that are far apart.
- NOTE: Do not install the lockwire to more than three units in a sequence as illustrated in (Views H and I) (Figure 203).

**CAUTION:** DO NOT TURN THE LOCKWIRE MORE THAN 15 TIMES FOR EACH INCH (25.4 MM). IF YOU DO NOT OBEY, DAMAGE TO THE EQUIPMENT CAN OCCUR.

- Pull the lockwire tight while you twist it.
  - The lockwire must have a specific number of twists for the diameter of the wire:
    - 9 to 12 twists for each inch (25.4 mm) for 0.020 inch (0.51 mm) diameter wire

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## AIRCRAFT MAINTENANCE MANUAL

- b) 7 to 10 twists for each inch (25.4 mm) for 0.032 inch (0.81 mm) diameter wire.
- (g) Lockwire the hose and the electrical coupling nuts the same as the tube coupling nuts.

NOTE: This is illustrated in (Views F, G, J, K, L and M) (Figure 203).

- (h) Be careful when you twist the wire.
- 1) Keep the lockwire tight.

NOTE: Do not overstress the wire or permit it to have nicks, kinks or damage.

- (i) Correct and incorrect procedures for lockwire practices are shown (Figure 203).
- (j) Use the twist tools that are recommended and locally available to install the lockwire (Figure 204).

SUBTASK 70-20-01-910-006-F00

- (3) Procedures to Lockwire (Figure 205).

**CAUTION:** DO NOT USE THE SAME LOCKWIRE AGAIN. USE NEW LOCKWIRE FOR EACH ASSEMBLY OPERATION. DAMAGE TO THE EQUIPMENT CAN OCCUR.

- (a) Examine the lockwire holes to the parts to make sure the holes are aligned correctly.
- 1) If a part is tightened to the correct torque value, but is not correctly aligned, replace it with a different part.

NOTE: Install lockwire in holes that are correctly aligned so that the lockwire will not let the part become loose. Do not tighten the part beyond the torque limits to make sure the holes are aligned.

- (b) Put the lockwire through the first part, and bend the top end of the wire along the head of the part or around it.
- 1) If bent around it, the direction and twist of the strands must come around the part and below the strands that point out of the hole.
  - 2) If you do this, the loop will stay down and will not move up and become a loose.

NOTE: This is illustrated in (Steps 1 and 2) (Figure 205).

- (c) Twist the strands while they are tight until the twisted part is near a hole in the subsequent part.
- 1) The end of the twisted wire must be equal to or less than 0.125 inch (3.18 mm) away from the hole in the other part.

NOTE: This is illustrated in (Steps 3 and 4) (Figure 205).

- (d) If you bend the free strand around the head of the second part, put the top strand through the hole in this part.
- 1) Put the lockwire through the first part, and bend the top end of the wire along the head of the part or around it.
    - a) If bent around it, the direction and twist of the strands must come around the part and below the strands that point out of the hole.
    - b) If you do this, the loop will stay down and will not move up and become a loose.
  - 2) If you bend the free strand on the unit, the direction of the twist is not important.
  - 3) If there are more than two units in the sequence, do these steps again.

NOTE: This is illustrated in (Steps 5 and 6) (Figure 205).

- (e) Do these steps after you connect the last part:

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- 1) Continue to turn the wires to make a pigtail which has 3 to 6 twists and is 0.250-0.50 inch (6.4-12.7 mm) in length.
- 2) Cut off the unwanted wire.
- 3) Bend the end of the lockwire into the part to prevent damage.

**NOTE:** The lockwire installations will usually agree with the examples on the illustration; however, not all possible combinations of lockwire are illustrated.

- (f) Make sure that the lockwire is correctly installed:

**NOTE:** These steps will make sure that the lockwire is tight.

- 1) Apply light, finger-pressure to the middle position of the lockwire span.
  - a) Push the lockwire in the two directions.
- 2) Measure the maximum flex of the lockwire at the midpoint and compare the measurement to the limits in (Table 201).

Table 201/70-20-01-993-808-F00

LENGTH OF THE LOCKWIRE (BETWEEN THE PARTS)	MAXIMUM FLEX PERMITTED (AT THE CENTER)
0.5 inch (12.7 mm)	0.125 inch (3.2 mm)
1.0 inch (25.4)	0.250 inch (6.4 mm)
2.0 inches (50.8 mm)	0.375 inch (9.5 mm)
3.0 inches (76.2 mm)	0.500 inch (12.7 mm)
4.0 inches (101.6 mm)	0.750 inch (19.1 mm)
5.0 inches (127.0 mm)	0.750 inch (19.1 mm)
6.0 inches (152.4 mm)	0.750 inch (19.1 mm)

- 3) If the lockwire does not agree with these limits, do these steps:
  - a) Remove the lockwire.
  - b) Install a new lockwire.
- (g) Always cut, rather than break, the lockwire so the lockwire holes are not torn or damaged.

————— **END OF TASK** —————

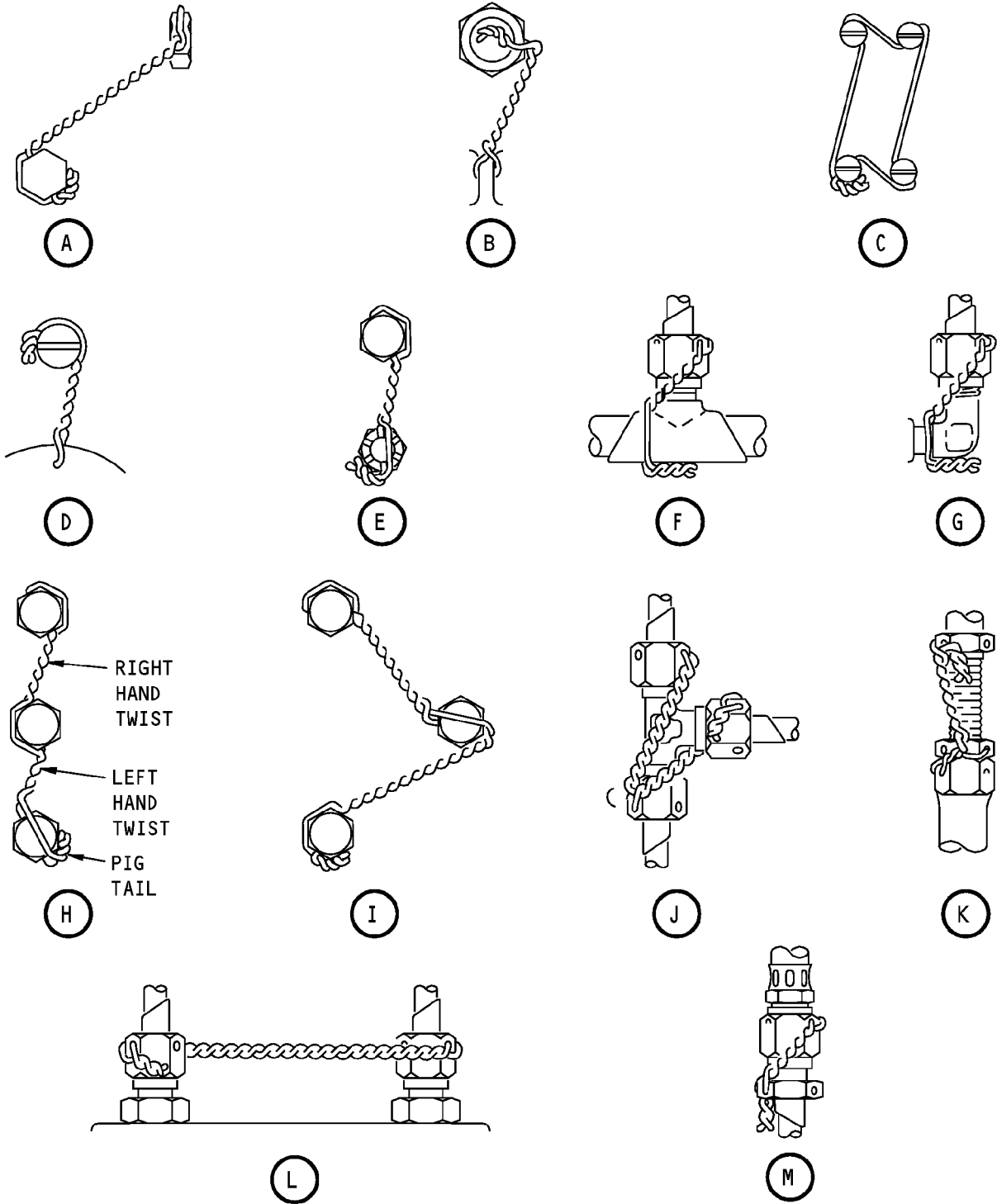
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**Lockwire Installation Examples**  
**Figure 203 (Sheet 1 of 2)/70-20-01-990-803-F00**

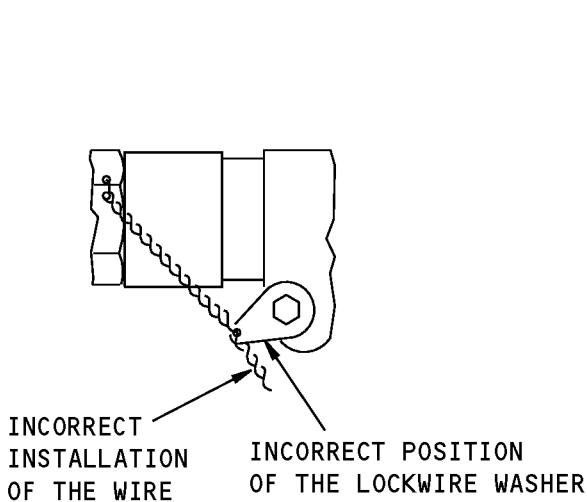
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**HAP ALL**

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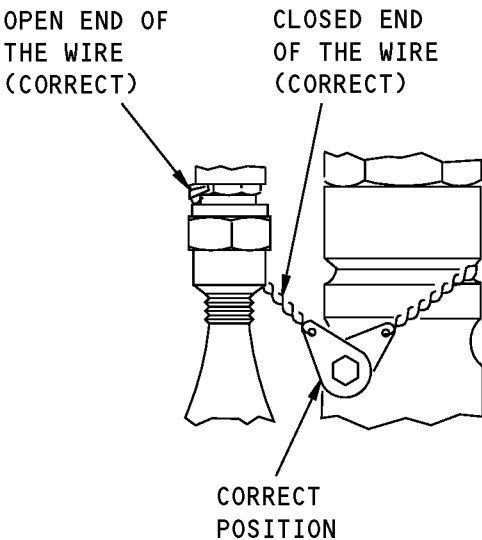
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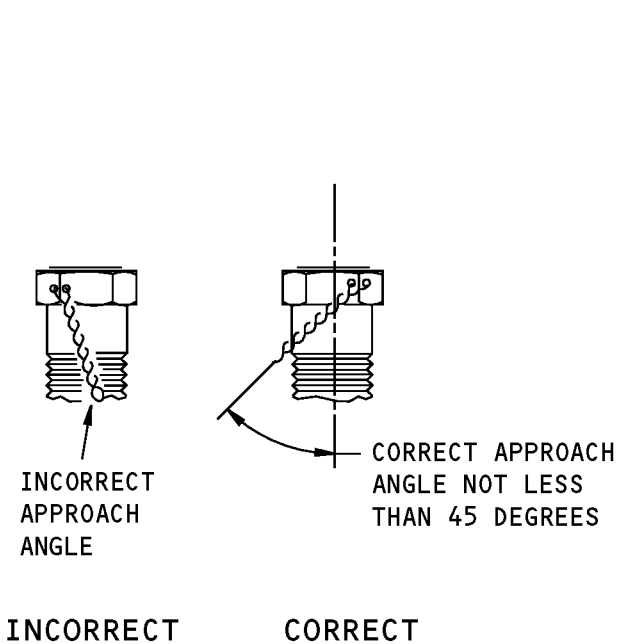
**AIRCRAFT MAINTENANCE MANUAL**



INCORRECT

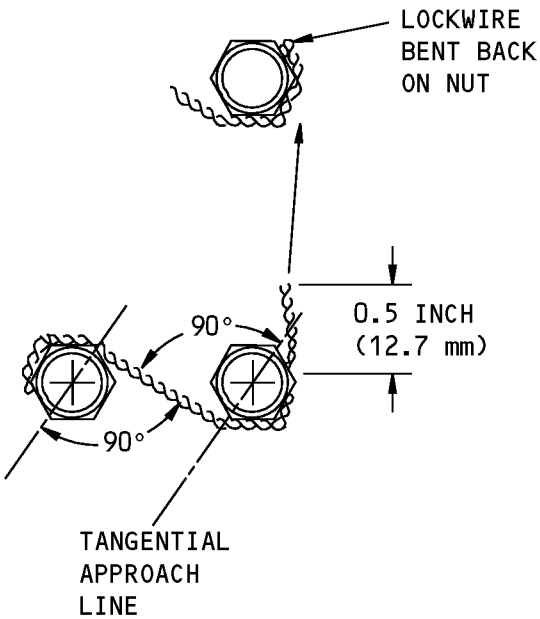


CORRECT



INCORRECT

CORRECT



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**Lockwire Installation Examples**  
Figure 203 (Sheet 2 of 2)/70-20-01-990-803-F00

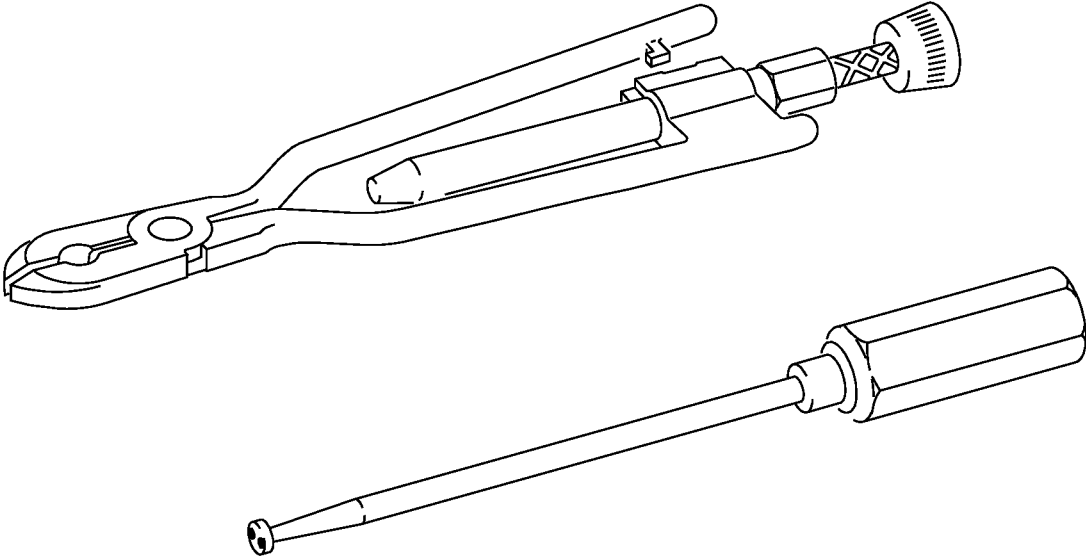
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Lockwire Twisting Tools (Example)  
Figure 204/70-20-01-990-804-F00

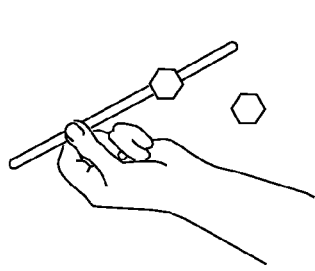
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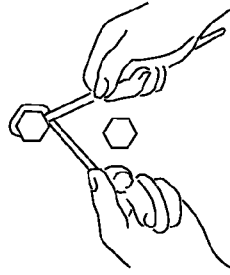
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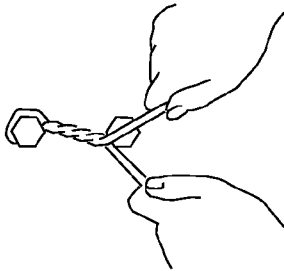
**AIRCRAFT MAINTENANCE MANUAL**



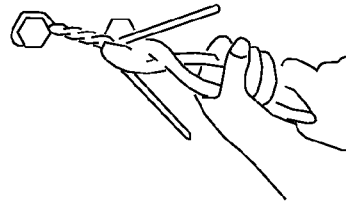
STEP 1



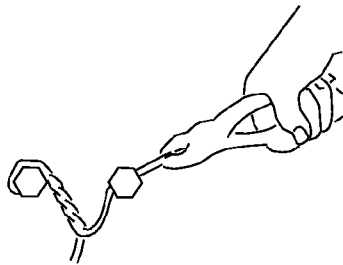
STEP 2



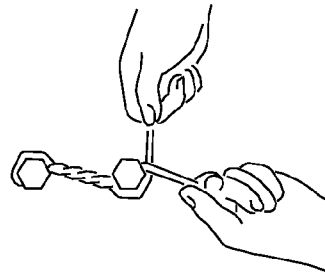
STEP 3



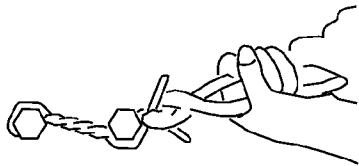
STEP 4



STEP 5



STEP 6



STEP 7



STEP 8

G-M56-SP-0006(1)-00-B

**Lockwire Installation Techniques**  
**Figure 205/70-20-01-990-805-F00**

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**AIRCRAFT MAINTENANCE MANUAL****TASK 70-20-01-800-805-F00****6. Safety Cable Installation**

(Figure 206)

**A. Procedure**

SUBTASK 70-20-01-400-003-F00

**CAUTION:** DO NOT USE THE SAFETY CABLE AGAIN. ALWAYS USE NEW SAFETY CABLE.

- (1) Examine the safety-wire holes of the parts to be safetied for correct alignment.
  - (a) If the component is tightened to the correct torque and is not correctly aligned, replace the component.

SUBTASK 70-20-01-910-008-F00

- (2) Obey these limits, unless specified differently in the engine manual:
  - (a) The maximum length of the safety cable between cabled parts is 6.0 inches (152.4 mm).
  - (b) Do not safety more than three bolts with one safety cable.
  - (c) Do not use safety cable on titanium fasteners.

SUBTASK 70-20-01-910-009-F00

- (3) Do the steps that follow to install the safety cable (Figure 206):

**NOTE:** Correct alignment means that the safety cable holes are aligned so that the installed safety cable will prevent disengagement of the part. Do not exceed torque limits of any part in an attempt to align the holes.

- (a) Put the cable through parts to be safetied (step 1).
- (b) Put the ferrule on the cable (step 2 and step 3).
- (c) Tighten the cable by putting the head of the tool in contact with the last bolt head to be wired (step 4).
- (d) Activate the tool to tighten the assembly to the correct tension and automatically crimp the ferrule at the same time (step 5).
- (e) Cut off the excess wire.
  - 1) The overlap must not exceed 0.06 inch (1.6 mm)
- (f) No notches or no frays are permitted.

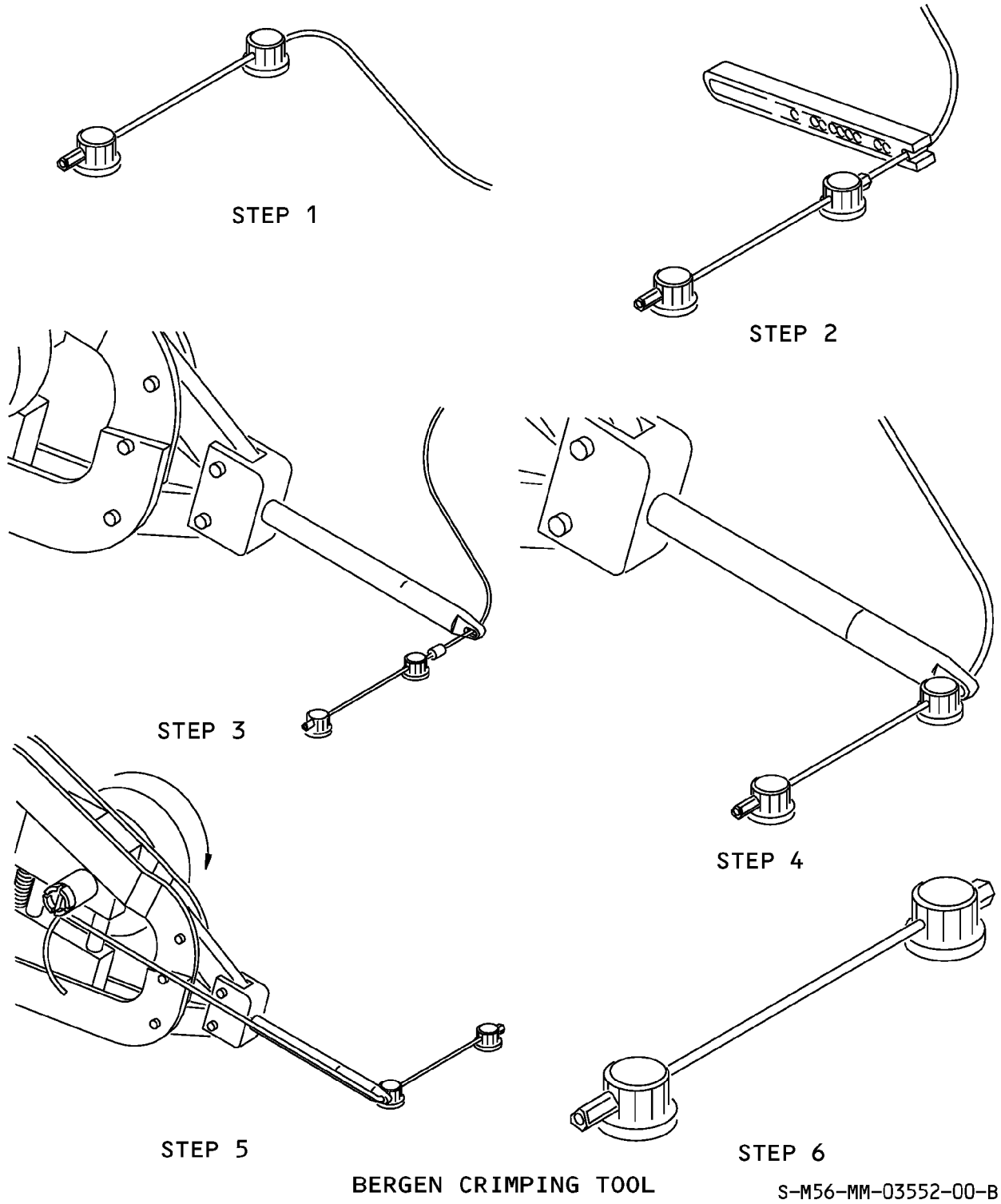
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**Safety Cable Installation**  
Figure 206 (Sheet 1 of 2)/70-20-01-990-806-F00

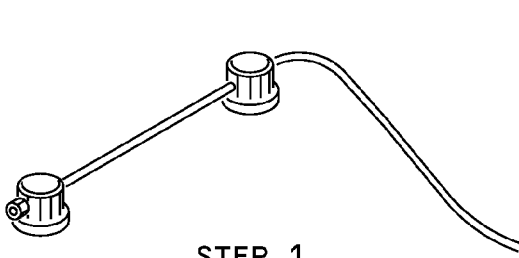
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HAP ALL

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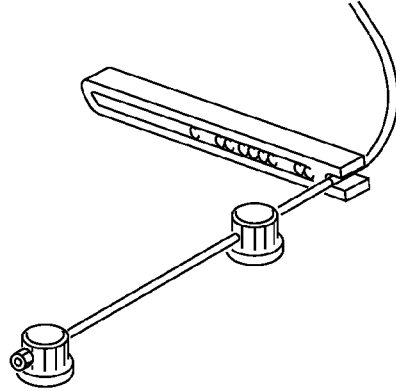
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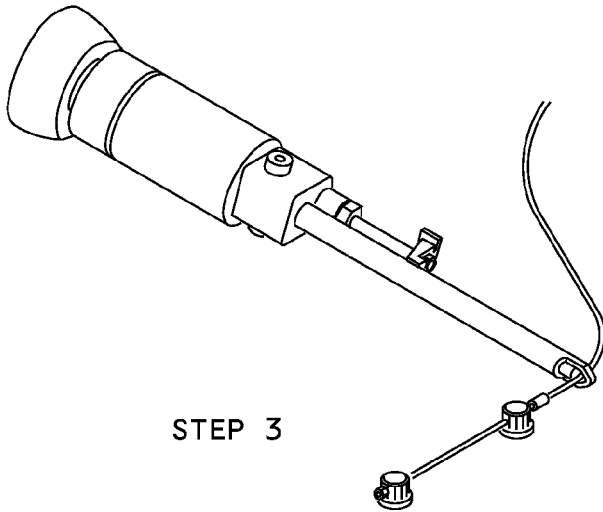
737-600/700/800/900  
AIRCRAFT MAINTENANCE MANUAL



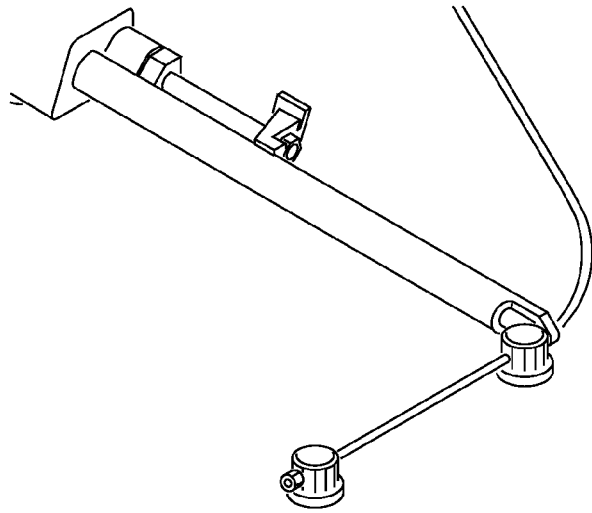
STEP 1



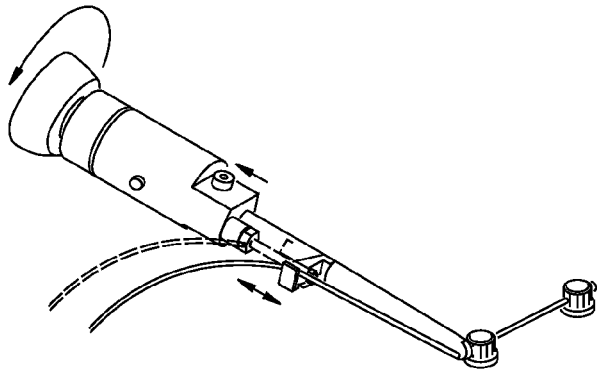
STEP 2



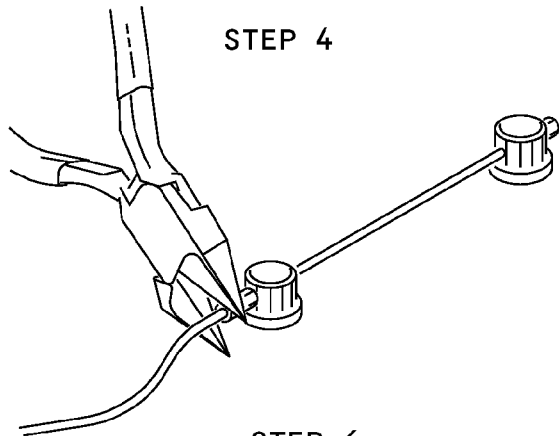
STEP 3



STEP 4



STEP 5



STEP 6

SNAP-ON CRIMPING TOOL

S-M56-MM-03553-00-B

Safety Cable Installation  
Figure 206 (Sheet 2 of 2)/70-20-01-990-806-F00

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## AIRCRAFT MAINTENANCE MANUAL

## TASK 70-20-01-710-801-F00

7. Crimping Tool Verification

(Figure 207)

## A. Procedure

SUBTASK 70-20-01-400-004-F00

- (1) Do a pulloff load test often, to make sure that the crimping tool meets the necessary requirements.

**NOTE:** It recommended you do three pulloff load tests after you install the component.

SUBTASK 70-20-01-910-010-F00

- (2) Do the pulloff load test as follows (Figure 207):

- (a) If it is necessary, set up the test block.

**NOTE:** Refer to manufacturer's instructions for set up information.

- (b) Make sure the pivot joint is in the forward direction.
    - (c) Install the safety cable in the test block:
      - 1) Move the cable stop at the end of the test block.
      - 2) Install the safety cable through the hole that was covered by the cable stop.
      - 3) Pull the safety cable through the hole in the safety block and then put it through the hole in the pivot joint.
      - 4) Pull the cable through the hole in the pivot joint.
    - (d) Use the crimping tool to install the safety cable in the test block.
    - (e) Use light finger pressure at the center of the safety cable to push the center of the safety cable toward the wall on the test block.
      - 1) Make sure that the safety cable does not touch the wall.
    - (f) Do these steps if the safety cable touches the wall.
      - 1) The safety cable is not serviceable, remove it from the test block.
      - 2) Install a new safety cable and start the pulloff load test again.
      - 3) If the cable touches the wall again, the crimping tool is not serviceable.
        - a) Remove the crimping tool from service.
    - (g) Move the torque wrench handle counter-clockwise until the torque wrench clicks or the ferrule moves.
      - 1) If the ferrule moves before you hear the torque wrench click, the crimping tool is not serviceable.
        - a) Remove the crimping tool from service.
    - (h) Use light finger pressure and push the center of the safety cable toward the wall on the test block.
      - 1) If the safety cable does not touch the wall, the crimping tool is serviceable.
      - 2) Do these steps if the safety cable touches the wall:
        - a) Cut and remove the safety cable from the test block.
        - b) Do the pulloff load test again with a new cable.
        - c) If the new safety cable is not in the limits, remove the crimping tool from service.

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SUBTASK 70-20-01-910-011-F00

- (3) Do these steps to find the exact amount of pressure which is necessary to cause the crimped ferrule or safety cable to fail:

NOTE: CFMI recommends that you do this test at least once a month for each of your crimping tools.

- (a) If it is necessary, set up the safety cable tester.  
(b) Use the instruction from the manufacturer of the safety cable tester to do this test.

NOTE: This test can also be used as an alternative to the test block procedure.

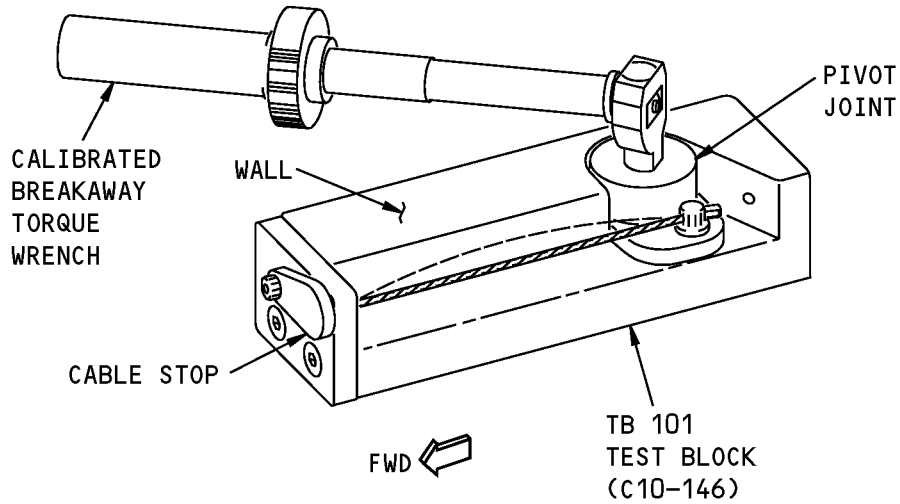
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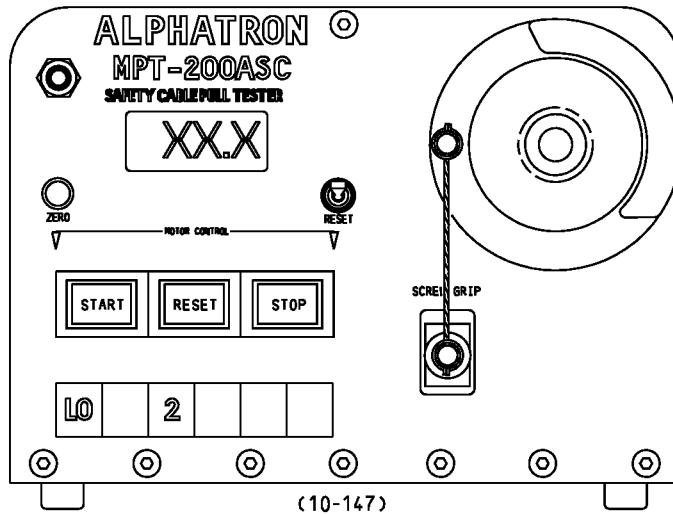
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**NOTE:** WHEN CRIMPED, WIRE CAN NOT TOUCH WALL WITH LIGHT FINGER PRESSURE.



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**Safety Cable Verification**  
**Figure 207 (Sheet 1 of 2)/70-20-01-990-807-F00**

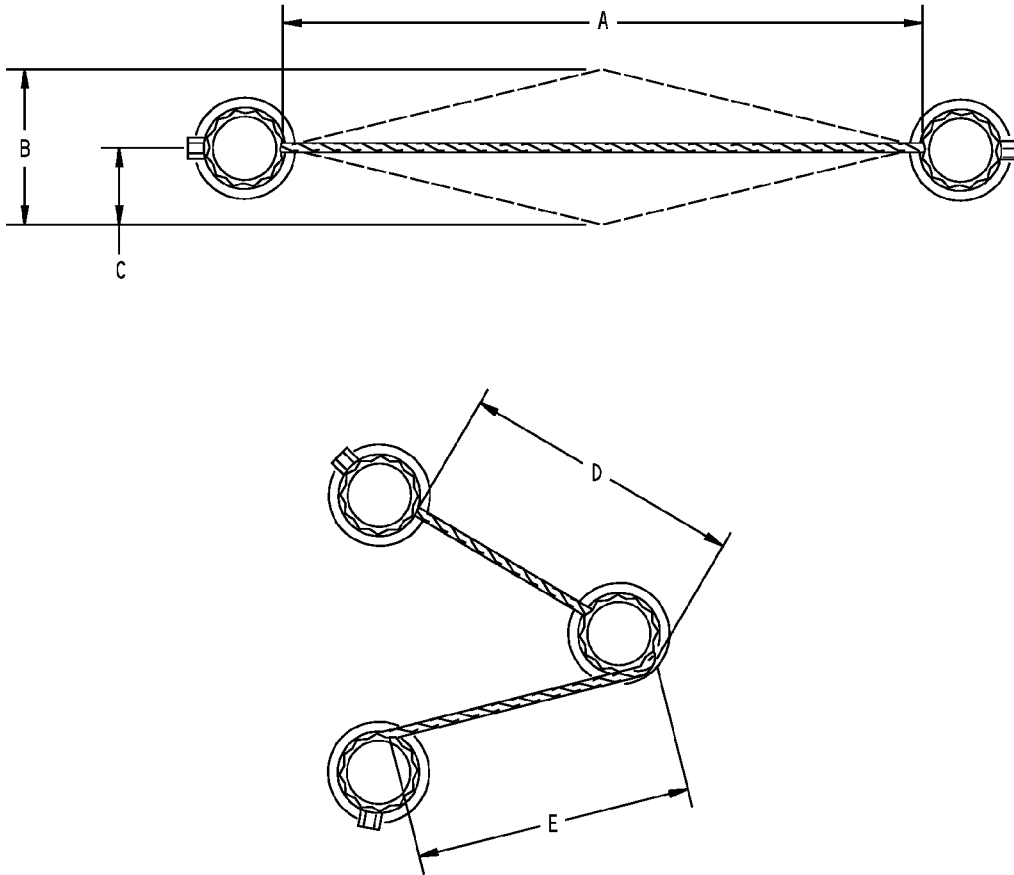
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**NOTE:** FOR THREE BOLT PATTERNS,  
DIMENSION A = DIMENSION D+E

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**

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**Safety Cable Verification  
Figure 207 (Sheet 2 of 2)/70-20-01-990-807-F00**

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## AIRCRAFT MAINTENANCE MANUAL

TIGHTENING PRACTICES AND TORQUE VALUES - MAINTENANCE PRACTICES**1. General**

A. This procedure has one task:

- (1) To give the correct torque tightening assembly instructions.

**TASK 70-20-02-400-801-F00****2. Tightening Practices and Torque Values**

A. References

Reference	Title
20-50-11-910-801	Standard Torque Values (P/B 201)

B. Location Zones

Zone	Area
411	Engine 1 - Engine
421	Engine 2 - Engine

C. General

SUBTASK 70-20-02-910-001-F00

- (1) This procedure gives the instructions to torque and to tighten the fasteners (bolts, nuts, and fittings).

**NOTE:** Use this procedure when you do not see a torque value in the applicable maintenance manual procedure.

- (a) Use this task (TASK 20-50-11-910-801) for the torque values of part numbered fasteners (bolts, nuts, and fittings).

SUBTASK 70-20-02-910-002-F00

- (2) Torque is the turn force that you apply to the fastener to install a part.

- (a) The units of torque are in pound-inches (lb-in) or Newton meters (Nm).  
 (b) This torque correctly attaches the part.  
 (c) This torque is not more than the strength in tension of the material.  
 (d) This torque is also not more than the strength (in shear) of the threads.  
 (e) When you turn a fastener around the axis of the fastener, you cause torque.  
 (f) Use the torque value that the applicable maintenance manual procedure gives you.

SUBTASK 70-20-02-910-003-F00

- (3) This procedure will show you how to tighten and calculate the torque values to apply to the fasteners.

- (a) One pound-inch (lb-in) or one Newton meter (Nm) of torque is the turn force when you apply one pound (one Newton) to a one inch (one meter) lever.  
 (b) Torque is the result when you multiply a force in pounds (kilograms) by the length of a lever in inches (millimeters).

**NOTE:** Torque values have the units of lb-in (Nm). This is different from work, that applies a force in a straight line for a distance. Units of work are the inch-pound (in-lb), foot-pound (ft-lb), or the joule (j). One ft-lb (j) of work is the energy to lift one pound (0.45 kg) through a distance of one foot (0.305 m).

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SUBTASK 70-20-02-910-004-F00

- (4) These are the names or the properties of a part.
- (a) Bolt
    - 1) A bolt is a fastener with an external thread.
  - (b) Breakaway-torque
    - 1) This torque is the necessary torque to start the removal of a nut without an axial load on the nut.
  - (c) Gross torque
    - 1) Gross torque is the actual torque value that the torque wrench applies. Gross torque includes the run-on torque and the seated torque.
  - (d) Installed nut
    - 1) You install a nut, when the chamfer plus a minimum of 1.5 bolt threads extends through the nut.
    - 2) It is not necessary for the bolt to extend above 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) This is the highest torque, when you initially install a nut, and the bolt expands the nut.
  - (f) Minimum prevailing-torque
    - 1) This is the minimum removal torque of a fastener, during the second full turn.
  - (g) Remover nut
    - 1) You remove a self-locking nut, when you disengage the locking section from the bolt (the nut can stay on the bolt).
  - (h) Run-on torque
    - 1) This is the torque that turns a fastener, before you tighten it against the seat.
  - (i) Seated-nut/bolt
    - 1) This is the torque that is necessary to correctly tighten a fastener.
      - a) It must apply a necessary compression force on a spacing element or an axial load or elongation to a bolt.
  - (j) Seating-torque
    - 1) This is the necessary torque the drawing or specification to bring the bearing faces into the seated position.
      - a) This measures only the tighten direction of the fastener.
  - (k) Spacer/spacing elements
    - 1) These are parts of all functions, dimensions, shapes, and materials, that the fasteners with threads hold together.
  - (l) Unseated-nut/bolt
    - 1) This is a nut or a bolt that you removed a one turn minimum from the seated position.

**NOTE:** This removes the axial load from the fastener.
  - (m) Unseated-torque

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- 1) This is the torque that is necessary to remove a fastener from the bearing surface of a spacer.

**NOTE:** This removes the axial load from the fastener.

### D. Tightening Procedures

SUBTASK 70-20-02-910-005-F00

#### (1) Procedure to 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 less torque than the necessary torque.
    - a) Tension that is not equal can cause a distortion or too much 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 more than the specified torque of the maintenance manual.

SUBTASK 70-20-02-910-006-F00

#### (2) Torque-wrench selection

- (a) The table that follows recommends the best torque wrench size for different torque limits (Table 201).
- (b) A larger wrench has a larger tolerance that causes more error.

**NOTE:** Wrench sizes are specified with a combination Newton meter (Nm), pound-inch (lb-in) and pound-feet (lb-ft) torque wrenches.

Table 201/70-20-02-993-803-F00

TORQUE WRENCH SIZE	TORQUE LIMITS	TOLERANCE
30 lb-in (3.5 N.m)	0-25 lb-in (0-3.0 N.m)	± 1 lb-in (± 0.1 N.m)
150 lb-in (17.0 N.m)	25-120 lb-in (3.0-14.0 N.m)	± 5 lb-in (± 0.5 N.m)
600 lb-in (60 N.m)	120-480 lb-in (14-50 N.m)	± 20 lb-in (± 0.1 N.m)
175 lb-ft (230 N.m)	40-140 lb-ft (50-190 N.m)	± 5 lb-ft (± 10 N.m)
250 lb-ft (340 N.m)	140-200 lb-ft (190-280 N.m)	± 10 lb-ft (± 10 N.m)
1000 lb-ft (1360 N.m)	200-1000 lb-ft (280-1360 N.m)	± 20 lb-ft (± 20 N.m)

SUBTASK 70-20-02-910-007-F00

#### (3) Offset Extension Wrench:

- (a) When you use an offset extension wrench (example: crowfoot extension), you change the effective length of the torque wrench.
  - 1) Refer to the illustration (Figure 201) that shows the effective length of the torque wrench (A) and the effective length of the extension (B).
  - 2) When the extension points in the same direction as the torque wrench, add their effective lengths together (A + B).

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- 3) When the extension is pointed to the handle of the torque wrench, subtract the effective length of the extension (A - B).
- 4) When the extension points 90 degrees from the torque wrench, it has no effect on the effective length of the torque wrench.
- 5) The manual of the manufacturer gives the effective length (A) of the torque wrench.
- 6) Measure the effective length of an extension from the center of the drive opening to the center of the wrench opening.
- 7) Multiply the necessary torque (T) by the effective length of the torque wrench (A).
- 8) Divide this result by (A + B) or (A - B).
- 9) This value is the indication of torque (T) on the torque wrench, that gives the necessary torque on the fastener.
  - a) Example:

Table 202/70-20-02-993-809-F00

Example:	Necessary torque = 265 pound-inches (30 N.m) Effective length of torque wrench = 8.4 inches (213mm) Effective length of the extension = 1.5 inches (38mm)
	Then: (Necessary torque) x (A) = 265 x 8.4 = 2226 (30 x 213 = 6390)
	(A + B) = 9.9 inches (251 mm) 2226/9.9 = 225 pound-inches (6390/251 = 25.5 N.m)
	Thus: A gage value of 225 pound-inches makes for a necessary torque of 265 pound-inches. (A gage value of 25.5 N.m makes for a necessary torque of 30 N.m)

## E. Standard Torque Values.

SUBTASK 70-20-02-910-008-F00

## (1) Steel nuts and bolts

- (a) The table that follows shows the standard torque limits for steel nuts and bolts (Table 203):

**NOTE:** Use one half of the limits in the table for these fasteners: (1) Thin steel hexagonal nuts with one of these properties: A height that is less than 0.6 the pitch-diameter for a nut without a lock, or a height of less than 0.8 the pitch-diameter for a locknut. (2) Nuts and bolts of nonferrous alloys.

Table 203/70-20-02-993-804-F00

Nominal Size	Threads per Inch	UNC and -8 Series	Threads per Inch	UNF and -12 Series
		Torque		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 - 23 lb-in. 2.260 - 2.599 N.m	32	33 - 37 lb-in. 3.728 - 4.180 N.m

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Nominal Size	UNC and -8 Series		UNF and -12 Series	
	Threads per Inch	Torque	Threads per Inch	Torque
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 - 685 lb-in. 48 - 57 lb-ft 64.975 - 77.405 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 - 1800 lb-in. 135 - 150 lb-ft 183.060 - 203.400 N.m	16	1800 - 2270 lb-in. 150 - 165 lb-ft 203.400 - 256.510 N.m
7/8	9	2460 - 2750 lb-in. 205 - 230 lb-ft 277.980 - 311.880 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
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	---	-----

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Nominal Size	UNC and -8 Series		UNF and -12 Series	
	Threads per Inch	Torque	Threads per Inch	Torque
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		

(b) For the torque values of reduced head bolts, (TASK 20-50-11-910-801).

SUBTASK 70-20-02-910-010-F00

(2) Aluminum or magnesium bolts, studs, or a stepped-studs

(a) The table that follows shows the standard torque limits for the aluminum or magnesium bolts, studs, or a stepped-studs (Table 204):

**NOTE:** You must tighten the studs with a different thread on opposite ends to the torque limit of the smaller diameter.

Table 204/70-20-02-993-805-F00

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)
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)

**F. Tighten Plugs and Tube Fittings**

SUBTASK 70-20-02-910-011-F00

(1) This procedure gives instructions for the installation of three types of tube fittings (Figure 202).

- (a) You can install a non-positioning fitting that uses a preformed-packing or a compression-packing for a seal.
- (b) You can install a positioning-fittings, that can use a backup-washer.
- (c) You can install a universal bulkhead fitting with a locknut.

SUBTASK 70-20-02-910-012-F00

(2) Assembly Procedures

- (a) Installation of a preformed packing or a O-ring on a fitting

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- 1) When the ratio of the diameter to the cross-section of a preformed-packing is larger than 20, do this:
  - 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.
- 2) When the ratio of the diameter to the cross-section of a preformed-packing is below 20, do this:
  - a) A conic sleeve is not necessary, unless the packing must be rolled over threads or splines.
  - b) Lubricate the preformed-packing with petrolatum to roll it into the groove on the fitting.

NOTE: Make sure you do not get lubrication on the threads or friction surfaces.
- (b) Lubrication
  - 1) Do not use lubricant on threads or friction surfaces, unless it specified by the maintenance manual.
- (c) Non-positioning fittings.
  - 1) Lubricate the packing lightly to prevent damage by the sharp threads.
    - a) Install the packing on the fitting, until 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 (Table 205).
- (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) Then continue to the second section of the threads on the fitting.
  - 2) Lubricate the packing to prevent damage by sharp threads.
  - 3) Install it carefully through the first section of the threads into the packing groove.
    - a) It must be against 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) Then continue to the second section of the threads of the fitting.
    - c) The washer recess must point to the packing-groove.
  - 2) Hold the backup washer tightly 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 on the packing groove.

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- c) Remove the pieces of plastic material that the fitting cut from the washer.
- 3) Push the edge of the washer into the recess in the locknut, until they fully seat.
- 4) Make sure the threads of the fitting do not keep the washer from its seat.
- 5) Lubricate the packing to prevent damage by the sharp threads.
- 6) Install it carefully through the first section of the threads into the packing groove.
  - a) It must be against the washer.
- 7) Install the fitting in the boss, until the packing touches the countersunk surface.
- 8) Hold the locknut in its position with a wrench.
  - a) Turn the fitting into the boss by 1.5 turns.
- 9) Turn the fitting a maximum of one more turn into its correct position in the boss (total 1.5 to 2.5 turns).
- 10) Hold the fitting, while you tighten the locknut to the specified torque limit.
- (f) Universal bulkhead fittings.
  - 1) Attach the bulkhead fitting to the bulkhead with a locknut.
  - 2) Connect and tighten the tube nut or hose nut.
  - 3) Hold the fitting with a wrench and tighten the locknut to the specified torque limit.

SUBTASK 70-20-02-910-013-F00

## (3) Plugs and Tube Fittings Torque Values

- (a) The table that follows shows the standard torque limits for plugs and tube fittings (Table 205):

Table 205/70-20-02-993-806-F00

Fitting Size	Thread Size (inch) (pitch)	Torque Limits	Torque Unit
-2	5/16 - 24	40 - 50 4.514 - 5.643	lb-in. N.m
-3	3/8 - 24	90 - 100 10.158 - 11.387	lb-in. N.m
-4	7/16 - 20	135 - 150 11.25 - 12.50 15.012 - 16.930	lb-in. lb-ft N.m
-5	1/2 - 20	155 - 175 12.91 - 14.66 17.474 - 19.751	lb-in. lb-ft N.m
-6	9/16 - 18	180 - 200 15.00 - 16.66 20.316 - 22.574	lb-in. lb-ft N.m
-8	3/4 - 16	270 - 300 22.50 - 25.00 30.475 - 33.861	lb-in. lb-ft N.m
-10	7/8 - 14	360 - 400 30.00 - 33.32 40.633 - 45.148	lb-in. lb-ft N.m

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Fitting Size	Thread Size (inch) (pitch)	Torque Limits	Torque Unit
-12	1-1/16- 12	540 - 600 45.00 - 50.00 60.950 - 67.722	lb-in. lb-ft N.m
-16	1-5/16- 12	700 - 850 58.31 - 70.80 79.010 - 95.940	lb-in. lb-ft N.m
-20	1-5/8 - 12	900 - 1050 75.00 - 87.56 101.584 -118.515	lb-in. lb-ft N.m
-24	1-7/8 - 12	1000 - 1200 83.30 - 100.00 112.870 -135.445	lb-in. lb-ft N.m

SUBTASK 70-20-02-910-014-F00

## (4) Flared Tubing and Hose Fittings Torque Limits

- (a) The table that follows shows the standard torque limits for the flared tubing and the hose fittings (Table 206).

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 their connector are steel. The external fitting and the nut can be steel or aluminum.

Table 206/70-20-02-993-807-F00

Tube OD (inch)	Thread Size (inch)- (number)	All Aluminum Parts (Note 1)	Steel Tube Aluminum/Steel Nuts (Note 2)
1/8	15/16 - 24	-----	40 - 50 lb-in. 4.520 - 5.650 N.m
3/16	3/8 - 24	30 - 50 lb-in. 3.390 - 5.650 N.m	90 - 100 lb-in. 10.170 - 11.300 N.m
1/4	7/16 - 20	40 - 65 lb-in. 4.520 - 7.345 N.m	135 - 150 lb-in. 15.255 - 16.950 N.m
5/16	1/2 - 20	60 - 80 lb-in. 6.780 - 9.040 N.m	180 - 200 lb-in. 20.340 - 22.600 N.m
3/8	9/16 - 18	75 - 125 lb-in. 8.475 - 14.125 N.m	270 - 300 lb-in. 30.510 - 33.900 N.m
1/2	3/4 - 16	150 - 200 lb-in. 16.950 - 22.597 N.m	450 - 550 lb-in. 50.850 - 62.150 N.m
5/8	7/8 - 14	200 - 300 lb-in. 22.600 - 33.895 N.m	650 - 774 lb-in. 73.450 - 87.450 N.m
3/4	1-1/16- 12	300 - 475 lb-in. 25 - 35 lb-ft 33.900 - 53.667 N.m	900 - 1090 lb-in. 75 - 91 lb-ft 101.700 - 123.170 N.m

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Tube OD (inch)	Thread Size (inch)-(number)	All Aluminum Parts (Note 1)	Steel Tube Aluminum/Steel Nuts (Note 2)
1.000	1-5/16- 12	490 - 700 lb-in. 41 - 58 lb-ft 55.362 - 79.089 N.m	1340 - 1540 lb-in. 112 - 128 lb-ft 151.420 - 174.000 N.m
1-1/4	1-5/8 - 12	600 - 900 lb-in. 50 - 75 lb-ft 67.800 -101.700 N.m	1600 - 1800 lb-in. 133 - 150 lb-ft 180.800 - 203.400 N.m
1-1/2	1-7/8 - 12	600 - 900 lb-in. 50 - 75 lb-ft 67.800 -101.700 N.m	1900 - 2200 lb-in. 158 - 183 lb-ft 214.700 - 248.600 N.m

**G. Net Torque**

SUBTASK 70-20-02-910-015-F00

- (1) Maintenance procedures will give a net torque value, when the axial force that you apply to a fastener is very important.

(a) Make sure that you use these smaller limits for the specified extension or the axial force.

SUBTASK 70-20-02-910-016-F00

- (2) Net torque is equal to the gross torque minus the run-on torque.

(a) Find the net torque as follows:

- 1) You must tighten a nut on a bolt to a net torque of 20-40 pound-inches (2.3-4.5 Newton meters).
- 2) Turn the nut on the bolt.
  - a) Find the torque that turns the nut, before it touches its seat.
- 3) Write this value down as the run-on torque.

**NOTE:** For this example the run-on torque value will be 15 pound-inches (1.7 Newton meters).

- 4) Add the run-on torque value to the minimum and maximum specified torque values.

**NOTE:** Therefore; 20 pound-inches (2.3 Newton meters) + 15 pound-inches (1.7 Newton meters) = 35 pound-inches (4.0 Newton meters) and 40 pound-inches (4.5 Newton meters) + 15 pound-inches (1.7 Newton meters) = 55 pound-inches (6.2 Newton meters).

**H. Torque-Check for the Re-Use of Self-Locking Nuts**

SUBTASK 70-20-02-910-017-F00

- (1) Self-Locking nuts must have a specified minimum breakaway-torque if you use them again.

**NOTE:** This data does not apply to nuts that you must use one time only (refer to the applicable maintenance procedures).

SUBTASK 70-20-02-910-018-F00

- (2) The torque-check procedure follows:

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**CAUTION:** DO NOT BEND A SELF-LOCKING NUT TO GET THE NECESSARY SELF-LOCKING TORQUE. FAILURE OF THE NUT CAN OCCUR.

- (a) To get the minimum breakaway-torque, install the nut on a bolt with 2 to 5 threads through the nut.
- (b) Measure the torque necessary to turn the nut on or off the bolt.
- (c) The table that follows gives the minimum breakaway-torque for the self-locking nuts (Table 207).
  - 1) It applies to self-locking nuts that have a silver plate, a dry-film cover, or a lubricant.
  - 2) The table that follows gives the values for the nuts without an axial load (Table 207).
- (d) Replace all the nuts that do have these minimum torque values.

Table 207/70-20-02-993-808-F00

THREAD SIZE	THREADS PER INCH	MINIMUM BREAKAWAY TORQUE POUND-INCHES (N.m)
NO. 6	32/40	1.0 (0.11)
NO. 8	32/36	1.5 (0.17)
NO. 10	32	2.0 (0.23)
NO. 12 (1/4)	28	3.5 (0.40)
5/16	24	6.5 (0.73)
3/8	24	9.5 (1.1)
7/16	20	14.5 (1.6)
1/2	20	18.0 (2.0)
9/16	18	24.0 (2.7)
5/8	18	32.0 (3.6)
3/4	16	50.0 (5.6)

## I. Torque-Procedure for V-Band Clamps

SUBTASK 70-20-02-910-019-F00

- (1) Install the V-band clamp on the flanges of the duct.

SUBTASK 70-20-02-910-020-F00

- (2) Tighten the V-band nut to 50 percent of the necessary torque.

SUBTASK 70-20-02-910-021-F00

- (3) Make sure V-band clamp has the correct fit on the flange.
  - (a) If you install a seal, make sure that its installation is correct.

SUBTASK 70-20-02-910-022-F00

- (4) Lightly hit the outer surface of the V-band with a plastic mallet to cause equal tension.

SUBTASK 70-20-02-910-023-F00

- (5) While you continue to hit the V-band clamp, tighten the nut to the necessary torque.

SUBTASK 70-20-02-910-024-F00

- (6) Hit (again lightly) the outer surface of the V-band clamp.

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SUBTASK 70-20-02-910-025-F00

(7) Tighten the nut to the necessary torque.

————— **END OF TASK** —————

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$$T_1 = \frac{TA}{A+B}$$

A = LENGTH OF THE TORQUE WRENCH (AND HANDLE EXTENSION IF USED)  
 B = EFFECTIVE LENGTH OF THE ADAPTER  
 T = APPROVED TORQUE (SHOWN IN TORQUE TABLE)  
 T<sub>1</sub> = ADJUSTED TORQUE (SHOWN ON TORQUE WRENCH)

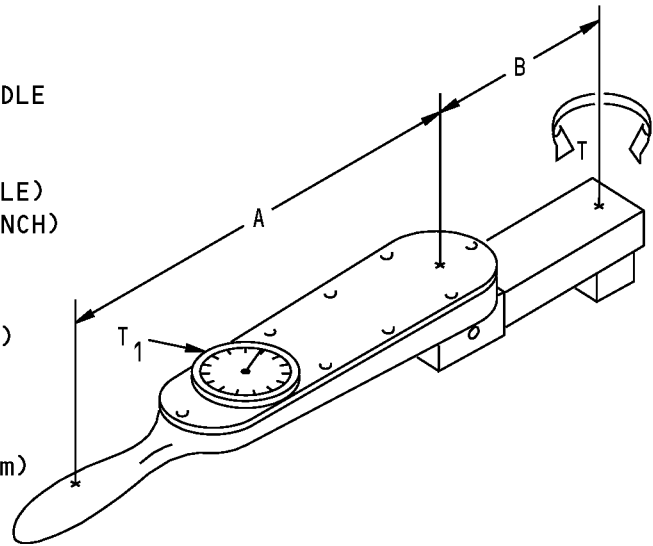
EXAMPLE: A = 12 INCHES (304.8 mm)

B = 3 INCHES (76.2 mm)

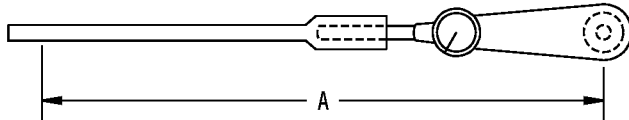
T = 160 POUND-INCHES (18.078 Nm)

$$T_1 = \frac{160 \times 12}{12+3}$$

T<sub>1</sub> = 128 POUND-INCHES (14.462 Nm)

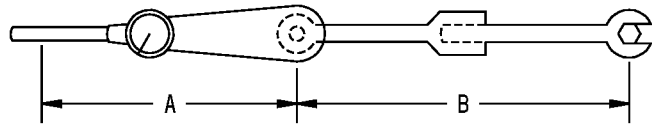


METHOD 1



HANDLE EXTENSION ONLY.  
 NO CORRECTION NECESSARY.

METHOD 2



ADAPTER WITH THE EXTENSION BETWEEN THE ADAPTER AND THE WRENCH. BOTH ARE IN LINE WITH THE WRENCH. INDICATED TORQUE T<sub>1</sub>:

$$T_1 = \frac{TA}{A+B}$$

METHOD 3

Finding Torque Values for a Torque Wrench with an Adapter  
 Figure 201 (Sheet 1 of 2)/70-20-02-990-801-F00

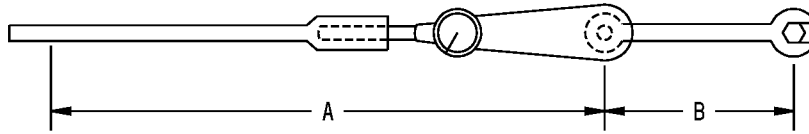
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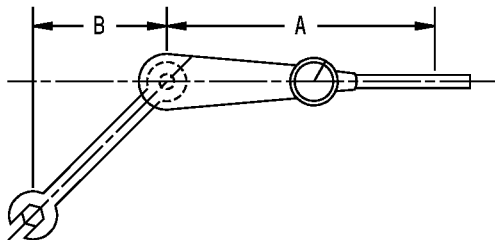
BOTH HANDLE EXTENSION AND ADAPTER,  
INDICATED TORQUE  $T_1$ :

$$T_1 = \frac{TA}{A+B}$$

METHOD 4

IF POSSIBLE, METHODS 5 AND 6 SHOULD NOT BE USED. WHEN IT IS NECESSARY TO USE THESE METHODS, THE CONDITIONS THAT FOLLOW MUST BE APPLICABLE.

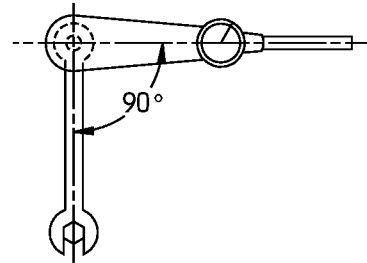
1. THE ADAPTER PLUS ALL EXTENSIONS USED BETWEEN THE WRENCH AND THE ADAPTER MUST NOT BE MORE THAN THE LENGTH OF THE WRENCH.
2. WHEN A FORCE IS APPLIED AT  $90 \pm 3$  DEGREES TO THE HANDLE OF THE WRENCH, IT IS RECOMMENDED THAT A STIRRUP-TYPE HANDLE WITH A POINTER (INDICATING ANGLE OF LOADING) BE USED TO MAKE SURE LOADING IS AT THE CORRECT ANGLE.



ADAPTER AT ANGLE OTHER THAN  
 $90^\circ$ . INDICATED TORQUE  $T_1$ :

$$T_1 = \frac{TA}{A+B}$$

METHOD 5



ADAPTER AT RIGHT ANGLE TO THE  
WRENCH. NO CORRECTION NECESSARY.

METHOD 6

Finding Torque Values for a Torque Wrench with an Adapter  
Figure 201 (Sheet 2 of 2)/70-20-02-990-801-F00

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HAP ALL

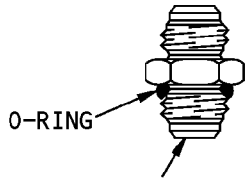
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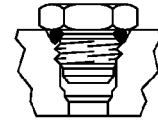
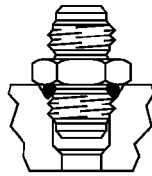
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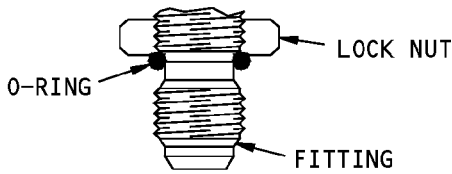


FITTING WITH THE O-RING INSTALLED

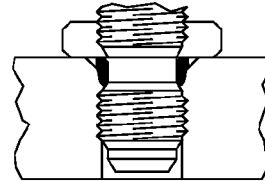


FITTINGS INSTALLED IN THE BOSS AND TIGHTENED WITH THE O-RING COMPRESSED

**NON-POSITIONING FITTINGS**

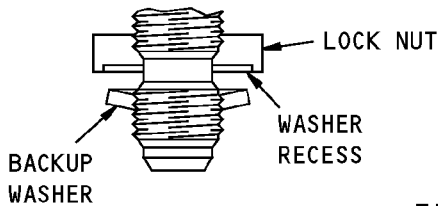


FITTING WITH THE LOCK NUT AND THE O-RING INSTALLED

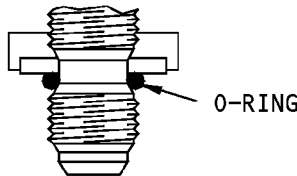


FITTING INSTALLED IN THE BOSS WITH THE LOCK NUT TIGHTENED AND THE O-RING COMPRESSED

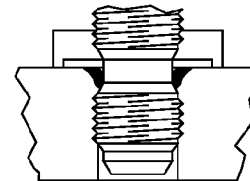
**POSITIONING FITTINGS (NO BACKUP WASHERS)**



FITTING WITH THE LOCK NUT AND THE TEFLON BACKUP WASHER INSTALLED

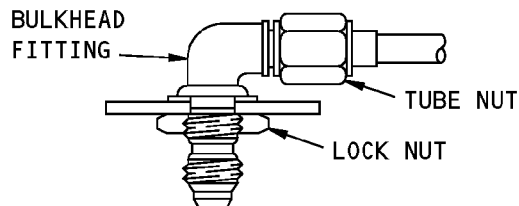


FITTING WITH THE WASHER PRESSED IN RECESS AND THE O-RING INSTALLED



FITTING INSTALLED IN THE BOSS WITH THE LOCK NUT TIGHTENED AND THE O-RING COMPRESSED

**POSITIONING FITTINGS (WITH THE BACKUP WASHERS)**



FITTING ATTACHED TO THE BULKHEAD WITH THE LOCK NUT TIGHTENED

**BULKHEAD FITTINGS**

CF8-6238-00-A

Installation and Tightening of Plugs and Tube Fittings  
Figure 202/70-20-02-990-802-F00

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## AIRCRAFT MAINTENANCE MANUAL

CLAMP - MAINTENANCE PRACTICES**1. General**

A. This procedure has two tasks:

- (1) The installation instructions for the clampshell type of clamps
- (2) The instructions to open and close the hinged type clamps.

**HAP ALL POST SB CFM56-7B-72-062**

- (3) The instructions to replace hinged clamp cushions for wiring harnesses attachment.

**HAP ALL****TASK 70-20-03-910-801-F00****2. Installation of the Clampshell Type Clamp**

A. General

- (1) This task gives the installation instructions for the clampshell type clamps.
- (2) These are the components you attach with clampshell type clamps:
  - (a) Power plant pneumatic tubes
  - (b) Oil tubes
  - (c) Hydraulic tubes
  - (d) Fuel system tubes.

B. Procedure

SUBTASK 70-20-03-200-001-F00

- (1) Do a check of the inner surface of the clamp and the outer surface of each of the two clampshell.
  - (a) Broken clamps are not permitted.
  - (b) A worn area on a component of the clampshell clamp assembly is not permitted
    - 1) Replace the clampshell clamp assembly.

SUBTASK 70-20-03-910-001-F00

- (2) The clampshell clamp assemblies have three parts:
  - (a) Two halves of the same type of clampshell.
  - (b) One of two types of clamps (cushioned or uncushioned).

SUBTASK 70-20-03-020-001-F00

- (3) Use the correct type of the clampshell clamp assemblies:
  - (a) Unplated clampshells
    - 1) Only used in high vibration and temperature environments of 800°F (427°C).  
NOTE: These clamps are used to hold fluid system tubing.
  - (b) Cadmium plated clampshells
    - 1) Only used with aluminum tubing and applies to a temperature limit of 400°F (204°C).

SUBTASK 70-20-03-420-001-F00

- (4) Install a clampshell type clamp (Figure 201):

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**CAUTION:** DO NOT PUT THE CLAMPSHELLS ON A TUBING BEND. CLAMPSHELLS CAN CAUSE DAMAGE TO THE TUBE.

- (a) Attach the clampshell clamp assembly on the tube where the tube is straight and free of bends and damage.
- (b) Connect the clampshells on the tube.
  - 1) Make sure that the two halves of the clampshells are correctly interlocked.

**NOTE:** The clampshell halves are the same.

- a) Install the clamp in the center of the clampshell.
  - b) You can put the clamp between the clampshell shoulders, if the adjacent installations prevent the placement of the clamp.
- (c) Attach the clampshell clamp assembly to the engine with the fastener.

————— **END OF TASK** —————

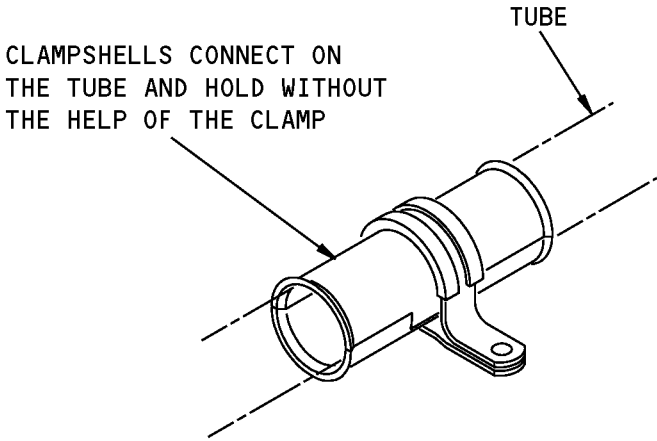
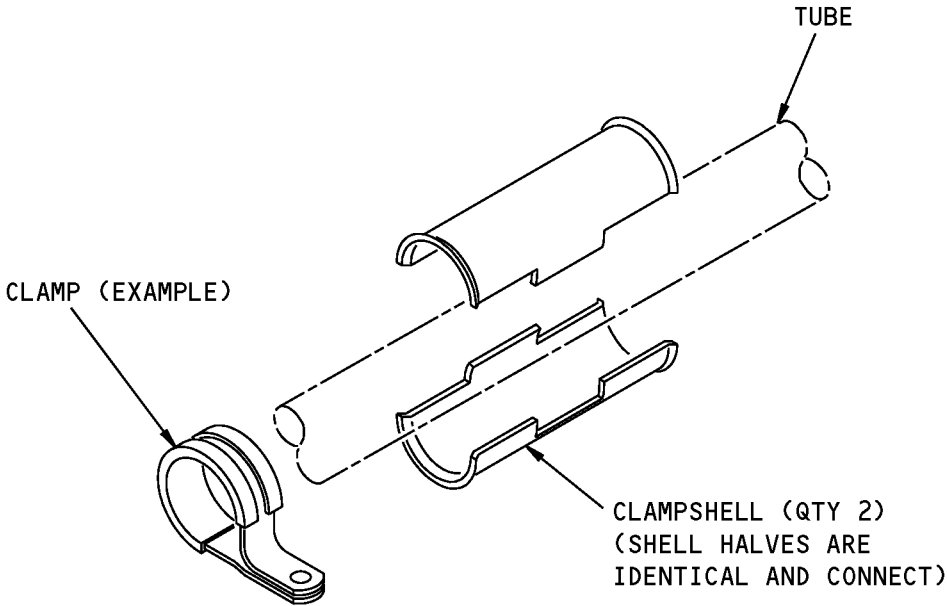
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**Clampshell Type Clamp Installation**  
**Figure 201/70-20-03-990-801-F00**

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## AIRCRAFT MAINTENANCE MANUAL

## TASK 70-20-03-910-802-F00

3. Opening and Closing The Hinged Type Clamp

(Figure 202)

## A. General

- (1) This task gives the instructions for the opening and closing of the hinged type clamps.
- (2) These are the components you attach with hinged type clamps:
  - (a) The power plant wiring harnesses
  - (b) The nacelle wiring harnesses.

## B. Procedure

SUBTASK 70-20-03-200-002-F00

- (1) Do a check of the inner surface of the clamp and the outer surface of each of the two hinged halves.
  - (a) Broken clamps are not permitted.
  - (b) A worn area on a component of the hinged clamp assembly is not permitted.
    - 1) Replace the hinged clamp assembly.

SUBTASK 70-20-03-910-002-F00

- (2) There are five parts of the hinged clamp assembly:
  - (a) Two hinged halves of the clamp with a spring
  - (b) One cushion
  - (c) One special bolt
  - (d) One special nut.

SUBTASK 70-20-03-910-003-F00

- (3) Open the Hinge Type Clamp:
  - (a) Loosen the bolt from the clamp.

**NOTE:** Stop when the square nut is at the end of the bolt.

**CAUTION:** DO NOT APPLY TOO MUCH PRESSURE ON THE BOLT. DO NOT APPLY TORQUE TO LOOSEN THE BOLT WHEN THE NUT STOPS AT THE BOLT END. IF YOU APPLY TOO MUCH PRESSURE TO LOOSEN THE BOLT, DAMAGE TO THE BOLT AND NUT CAN OCCUR.

- (b) Do these steps to disengage the bolt and nut from the lower half of the clamp:
  - 1) Apply sufficient pressure to push the bolt down.

**NOTE:** Only apply sufficient pressure to permit the square nut to turn.

- 2) Turn the bolt 1/4 of a turn to align the square nut with the opening in the lower clamp half.

**CAUTION:** DO NOT OPEN THE HINGED CLAMP BEYOND THE SIZE OF THE HARNESS. OPEN THE HINGED CLAMP SUFFICIENTLY TO REMOVE THE HARNESS. IF YOU OPEN THE HINGED CLAMP TOO WIDE, DAMAGE TO THE CUSHION CAN OCCUR.

- (c) Open the hinged clamp.

SUBTASK 70-20-03-910-004-F00

- (4) Close the Hinged Type Clamp

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**CAUTION:** DO NOT OPEN THE HINGED CLAMP BEYOND THE SIZE OF THE HARNESS. OPEN THE HINGED CLAMP SUFFICIENTLY TO INSTALL THE HARNESS. IF YOU OPEN THE HINGED CLAMP TOO WIDE, DAMAGE TO THE CUSHION CAN OCCUR.

- (a) Close the hinged clamp.
- (b) Do these steps to engage the bolt and square nut into the lower half of the clamp:

**CAUTION:** DO NOT APPLY TOO MUCH PRESSURE ON THE BOLT. DO NOT APPLY TORQUE TO LOOSEN THE BOLT WHEN THE NUT STOPS AT THE BOLT END. IF YOU APPLY TOO MUCH PRESSURE TO LOOSEN THE BOLT, DAMAGE TO THE BOLT AND NUT CAN OCCUR.

- 1) Apply sufficient pressure to move the square nut through the lower half of the clamp.
- 2) Keep sufficient pressure on the bolt.
- 3) Turn the bolt 1/4 of a turn clockwise.
- 4) Release the pressure on the bolt.

**NOTE:** This will set the square nut in the lower clamp half.

- (c) Tighten the bolt.
- (d) Apply the specified torque to the bolt.

————— **END OF TASK** —————

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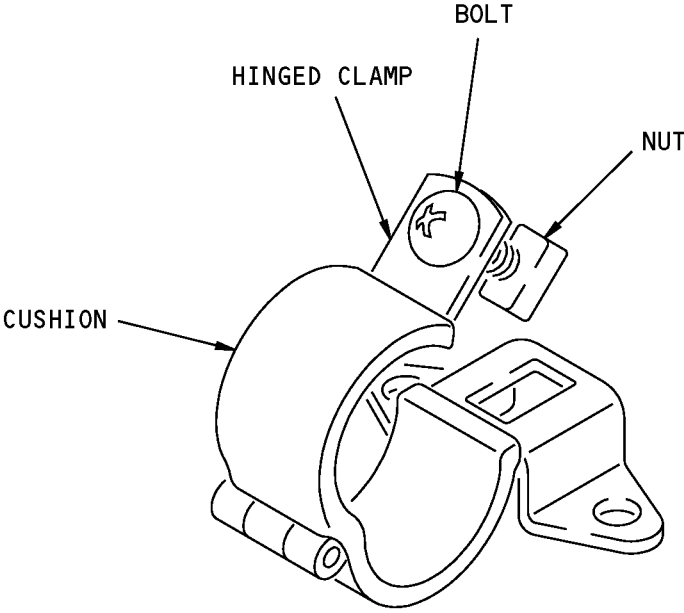
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OPEN POSITION  
(EXAMPLE)

Hinged Type Clamp Installation  
Figure 202/70-20-03-990-802-F00

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## TASK 70-20-03-910-803-F00

4. Replacement of Hinged Clamp Cushions

(Figure 203)

## A. General

- (1) This task gives the instructions to replace the hinged clamp cushions for the wiring harness clamps.

## B. Location Zones

Zone	Area
411	Engine 1 - Engine
421	Engine 2 - Engine

## C. Procedure

SUBTASK 70-20-03-020-002-F00

- (1) Open the hinge type clamp (TASK 70-20-03-910-802-F00).

SUBTASK 70-20-03-020-003-F00

- (2) Remove the wiring harness from the hinged clamp.

SUBTASK 70-20-03-900-001-F00

- (3) Do these steps to replace the clamp cushions:
  - (a) Pull the cushion from the clamp.
  - (b) Open two sides of slot to put the replacement clamp cushion on the hinged clamp.

NOTE: Make sure that the position of the cushion is correct on the clamp.

SUBTASK 70-20-03-420-002-F00

- (4) Put the wiring harness into the hinged clamp.

SUBTASK 70-20-03-020-004-F00

- (5) Close the hinged type clamp (TASK 70-20-03-910-802-F00).
  - (a) Apply 60-65 pound-inches (7-7.5 Newton meters) torque to the bolt.

NOTE: Make sure the harness is not stressed or twisted.

————— END OF TASK —————

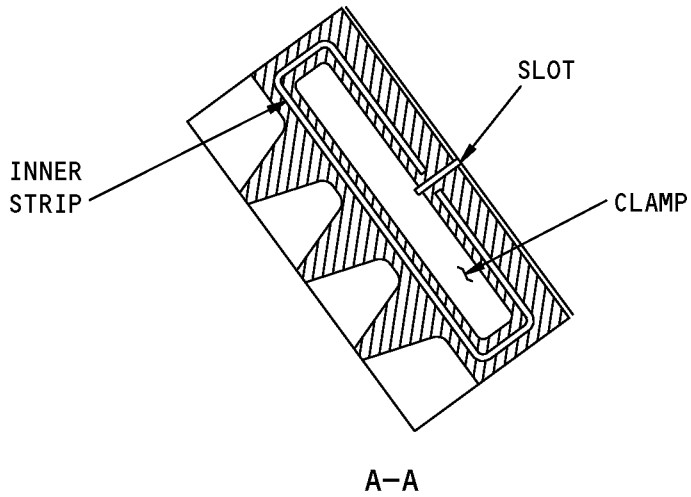
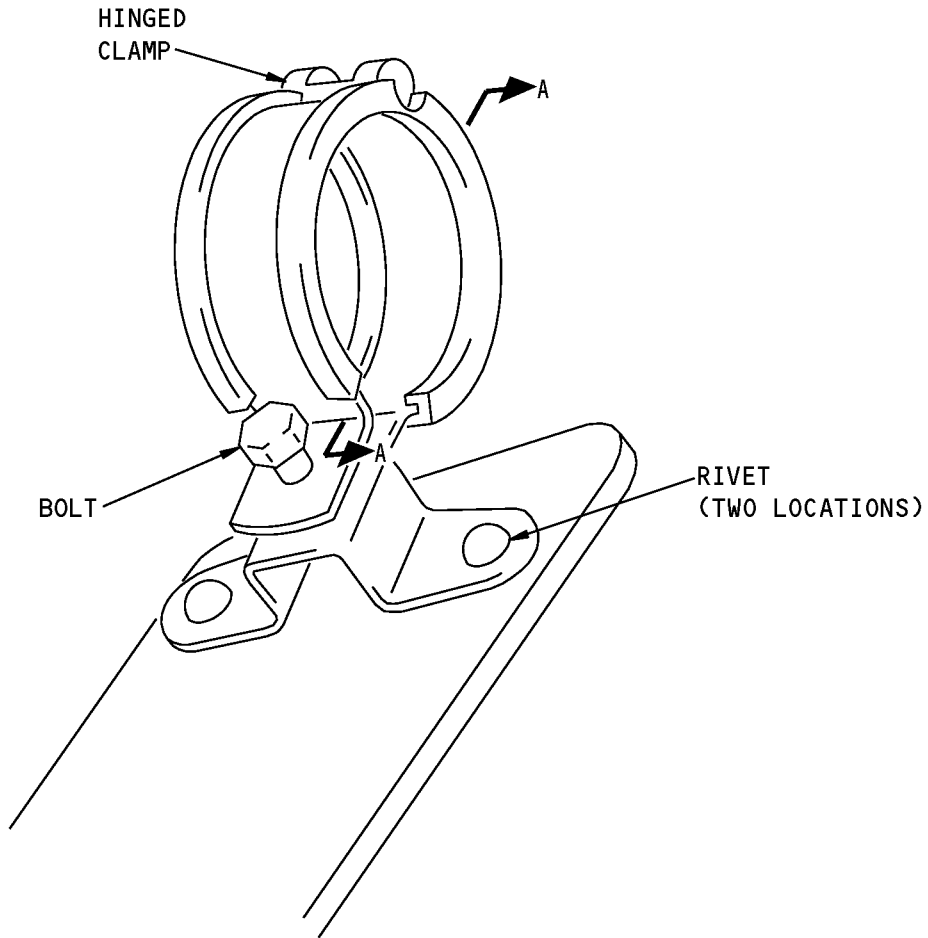
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**Replacement of Hinged Clamp Cushion**  
**Figure 203/70-20-03-990-803-F00**

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## AIRCRAFT MAINTENANCE MANUAL

SPECIFICATIONS AND MATERIALS - MAINTENANCE PRACTICES**1. General**

A. This procedure contains one task:

- (1) Specifications and Materials

**TASK 70-30-00-800-801-F00****2. Specifications and Materials**

A. General

- (1) Specifications and materials sections contain lists of consumable materials that can be necessary during regular maintenance of the engine.
- (2) Whenever possible, consumable materials will be referenced in the Maintenance Manual by a material specification. In many cases the engine manufacturer's consumable product reference number has been provided. Specifications beginning with "CP" followed by a numeric sequence (such as CP2198 or CP05-003) refer to the CFM56 Consumable Products manual. Specifications beginning with "C" followed by a numeric sequence (such as C05-003) refers to the GE Aircraft Engines Commercial Standard Practice Manual (70-80-0 - Consumable Product Section).
- (3) In the event a material is shown with no material specification, the material will be a specific vendor product or it will be commercially available.
- (4) For specific vendor information on a product, you should refer to the U-File or the IPC Specification Cross-reference Index. Or, you should refer to the qualified products list of the applicable material specification.

B. References

Reference	Title
20-30-11-910-801	Adhesives, Cements, and Sealants (P/B 201)
20-30-21-910-801	Lubricants (P/B 201)
20-30-31-910-801	Cleaners and Polishes (P/B 201)
20-30-41-910-801	Finishing Materials (P/B 201)
20-30-51-910-801	Miscellaneous Materials (P/B 201)
20-30-61-910-801	Welding Materials (P/B 201)
20-30-71-910-801	Strippers (P/B 201)
70-30-11-910-801-F00	Adhesives, Cements, and Sealants (P/B 201)
70-30-21-910-801-F00	Lubricants (P/B 201)
70-30-31-910-801-F00	Cleaners and Polishes (P/B 201)
70-30-41-910-801-F00	Finishing Materials (P/B 201)
70-30-51-910-801-F00	Miscellaneous Materials (P/B 201)

C. Procedure

SUBTASK 70-30-00-800-001-F00

- (1) Use these tasks for information on airframe consumable materials:
  - (a) Adhesives, Cements, and Sealers (TASK 20-30-11-910-801)
  - (b) Cleaners and Polishes (TASK 20-30-31-910-801)
  - (c) Finishing Materials (TASK 20-30-41-910-801)
  - (d) Lubricants (TASK 20-30-21-910-801)
  - (e) Strippers (TASK 20-30-71-910-801)
  - (f) Miscellaneous Materials (TASK 20-30-51-910-801)

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(g) Welding Materials (TASK 20-30-61-910-801)

SUBTASK 70-30-00-800-002-F00

(2) Use these tasks for information on General Electric/CFMI engine consumable materials:

- (a) Adhesives, Cements, and Sealers (TASK 70-30-11-910-801-F00)
- (b) Cleaners and Polishes (TASK 70-30-31-910-801-F00)
- (c) Finishing Materials (TASK 70-30-41-910-801-F00)
- (d) Lubricants (TASK 70-30-21-910-801-F00)
- (e) Miscellaneous Materials (TASK 70-30-51-910-801-F00)

————— **END OF TASK** —————

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## AIRCRAFT MAINTENANCE MANUAL

**SEALS (PERFORMED PACKINGS AND O-RINGS) AND GASKETS - MAINTENANCE PRACTICES****1. General**

- A. The data in this procedure is applicable to all installations that use seals or gaskets.
- (1) Seal removal, installation and lubrication instructions are given in this procedure.
  - (2) This procedure tells you when you can continue to use a gasket.

**TASK 70-30-01-910-802-F00****2. Seals (Performed Packings and O-Rings) and Gaskets**

## A. Procedure

SUBTASK 70-30-01-910-001-F00

## (1) Removal of the Seal.

- (a) Do not remove the seals with a sharp or pointed tool (knife-blade or a scriber) which could cause damage to the surface of the parts.

SUBTASK 70-30-01-910-002-F00

## (2) Lubrication of Seals.

- (a) Lubricate the seals with lubricants recommended in the installation procedure.
- (b) Apply a light layer of the lubricant to the O-rings.
  - 1) If you apply too much lubricant, you can prevent the correct seal installation and can cause contamination.

SUBTASK 70-30-01-910-003-F00

## (3) Installation of the Seal.

- (a) Use only new seals and rubber items during installation operations.
- (b) Make sure the seals are in good condition and free from cuts or gouges.
- (c) During the seal installation, be careful to install the seal correctly.
  - 1) Make sure the seal groove (recess) does not have burrs or sharp edges that can cause damage to the seal.
- (d) If an O-ring must be installed over threads or splines, use a conical sleeve to install it.
  - 1) Make sure that the conical sleeve does not have burrs or sharp edges, that can cause damage to the seal.

SUBTASK 70-30-01-910-004-F00

## (4) Continued use of the Aluminum Gaskets.

- (a) If the aluminum gaskets has an imbedded flexible seal material, look for these problems:
  - 1) Look for nicks, cuts, gouges or openings across the surface of the seal material.
    - a) These are not permitted.
  - 2) Look for hard or brittle seal material.
    - a) This is not permitted.
  - 3) Examine the surface of the seal material for deformation that could cause a blockage of the seal.
    - a) These are not permitted.
  - 4) Examine the full length of the seal surface.

SUBTASK 70-30-01-910-005-F00

## (5) Maintenance of the Aluminum Gaskets.

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- (a) Remove the lifted metal in the bolt hole area with a fine polishing stone or equivalent.
  - 1) Be careful not to cause damage to the seal material.
- (b) Cut all thin, lacy seal material that extends beyond the normal seal material on the aluminum surfaces.
  - 1) Be careful not to cut or loosen the bottom of the material.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****ADHESIVES, CEMENTS, AND SEALANTS - MAINTENANCE PRACTICES****1. General**

- A. This procedure lists adhesives, cements, and sealants for General Electric/CFMI engine maintenance. There are no procedural steps in this procedure. Specific CP numbers are listed in the CFMI CFM56 Consumable Products Manual.

**TASK 70-30-11-910-801-F00****2. Adhesives, Cements, and Sealants**

- A. Procedure

SUBTASK 70-30-11-800-001-F00

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****LUBRICANTS - MAINTENANCE PRACTICES****1. General**

- A. This procedure contains a list of lubricants for General Electric/CFMI engine maintenance. There are no procedural steps in this procedure. Specific CP numbers are listed in the CFMI CFM56 Consumable Products Manual.

**TASK 70-30-21-910-801-F00****2. Lubricants**

- A. Procedure

SUBTASK 70-30-21-800-001-F00

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****CLEANERS AND POLISHES - MAINTENANCE PRACTICES****1. General**

- A. This procedure contains a list of cleaners and polishes for General Electric/CFMI engine maintenance. There are no procedural steps in this procedure. Specific CP numbers are listed in the CFMI CFM56 Consumable Products Manual.

**TASK 70-30-31-910-801-F00****2. Cleaners and Polishes**

- A. Procedure

SUBTASK 70-30-31-800-001-F00

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****FINISHING MATERIALS - MAINTENANCE PRACTICES****1. General**

- A. This procedure lists finishing materials for General Electric/CFMI engine maintenance. There are no procedural steps in this procedure. Specific CP numbers are listed in the CFMI CFM56 Consumable Products Manual.

**TASK 70-30-41-910-801-F00****2. Finishing Materials**

- A. Procedure

SUBTASK 70-30-41-800-001-F00

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****MISCELLANEOUS MATERIALS - MAINTENANCE PRACTICES****1. General**

- A. This procedure lists miscellaneous consumable materials for General Electric/CFMI engine maintenance. There are no procedural steps in this procedure. Specific CP numbers are listed in the CFMI CFM56 Consumable Products Manual.

**TASK 70-30-51-910-801-F00****2. Miscellaneous Materials**

- A. Procedure

SUBTASK 70-30-51-800-001-F00

- (1) The data contained in this task has been moved to the Introduction section of the AMM.

————— **END OF TASK** —————

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**AIRCRAFT MAINTENANCE MANUAL****FLUORESCENT PENETRANT INSPECTION - MAINTENANCE PRACTICES****1. General**

- A. This procedure includes two tasks on how to do a fluorescent penetrant inspection (FPI).
  - (1) The first task is a portable post-emulsifiable inspection.
  - (2) The second task is a water washable inspection.
- B. CFMI recommends the operators use the portable post-emulsifiable system because the water washable inspection can remove the penetrant indication if too much water is used.
  - (1) Do the water washable inspection if the portable post-emulsifiable system is not available.
- C. It is permitted to substitute a penetrant system with a higher sensitivity (i.e. - substitute a level 3 or 4 for a level 2 as recommended) if the inspectors that do the inspection have a higher training, knowledge, techniques and experience in the interpretation of indications. The higher sensitivity level gives a higher background fluorescence contrast that can lead to irrelevant indications.

**TASK 70-40-01-230-801-F00****2. Fluorescent Penetrant Inspection (Portable Post-Emulsifiable)****A. General**

- (1) This is a portable post-emulsifiable fluorescent penetrant inspection process intended for inspection at remote locations.
  - (a) Portable fluorescent penetrant inspection is a localized process, limited to small areas or spot inspection of specific areas of parts. It is not intended for normal inspection.
  - (b) It is convenient to use for inspection of welded or other localized repair areas.
  - (c) The penetrant is applied only to a local area that needs to be inspected.
- (2) If visible non-fluorescent color dye penetrant has been used on parts which are to be subsequently inspected with fluorescent penetrants, the contamination by the dye may prevent reliable fluorescent penetrant inspection.
- (3) Any color dye indications evident by white light visual inspection shall be considered valid indications even if not detectable by ultraviolet light.
- (4) Titanium alloy parts are subject to stress corrosion cracking when residues of halogen containing compounds remain on a part that is subsequently subjected to high temperatures typical of welding, heat treating, or engine operation.
  - (a) These parts must be thoroughly cleaned with non-halogen compounds after exposure to any halogen containing compound to prevent cracking and possible failure of parts.
  - (b) When using water for processing parts made of titanium or titanium alloy, deionized water should be used when it is possible.
- (5) Make sure you obey these instructions:
  - (a) Make sure the parts are clean before you start the inspection process.
  - (b) Plug or cap all tubes or holes in parts in the area being inspected to prevent penetrant or other material becoming entrapped.
  - (c) Fluorescent penetrants and developers used together in an inspection system should be products of one manufacturer, except when using solvent (non-aqueous) wet developer. It is permissible to use the approved solvent wet developer, Tracer-Tech D499C, with any product system.

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## 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-4055	Ruler - Pocket, 6 inch (Part #: PMF131, Supplier: 55719, A/P Effectivity: 737-ALL)
STD-123	Brush - Soft Bristle
STD-473	Hood - Black, Prevents Excessive Admission of White Light
STD-560	Lens - Magnifying, 3x, Hand Held
STD-569	Light - Black, Ultraviolet
STD-572	Light - White
STD-1070	Lens - Magnifying, 10X, Hand Held
STD-3940	Air Source - Regulated, Dry Filtered, 0 to 150 psig
STD-3943	Timer - seconds (Stop Watch), Analog or Digital

## C. Consumable Materials

Reference	Description	Specification
B00676 [CP1041]	Alcohol - Isopropyl	TT-I-735
B01058 [CP1039]	Solvent - Acetone, Reagent Grade	
G50182 [CP3405]	Penetrant - Post-emulsified - Britemor 555	
G50183 [CP3404]	Remover - Hydrophilic - Britemor H91-A	
G50184 [CP3401]	Developer - F.P.I. Developer - Britemor PD 3	
G50185 [CP3406]	Developer - F.P.I. Developer - Britemor PD 4	
G50186 [CP3107]	Penetrant - Liquid Fluorescent Penetrant, Oil Soluable - Zyglo ZL 2C	
G50187 [CP2137]	Remover - Hydrophilic Remover Liquid - Zyglo ZR 10A	
G50188 [CP3105]	Remover - Hydrophilic Remover Liquid - Zyglo ZR 10B	
G50189 [CP3102]	Developer - Developer in Powder Form - Zyglo ZP 4B	
G50190 [CP3106]	Developer - Developer Powder - Zyglo ZP 9F	
G50191 [CP3313]	Penetrant - Post-emulsifying Fluorescent Penetrant - Met-L-Chek FP93A	
G50192 [CP3316]	Emulsifier - Hydrophilic Emulsifier - Met-L-Chek E-58D	
G50193 [CP3317]	Developer - Dry Powder Developer - Met-L-Chek D-72	
G50194 [CP3318]	Developer - Non-aqueous Wet Developer - Met-L-Chek D-70	
G50195 [CP3300]	Penetrant - Liquid Fluorescent Post-emulsified Penetrant - Sherwin RC 50	
G50196 [CP3306]	Emulsifier - Hydrophilic Emulsifier Liquid - Sherwin ER 83A	CFM CP3306 / MIL-I-25135
G50197 [CP3307]	Developer - Developer Powder - Sherwin D 90 G	
G50198 [CP3308]	Developer - Non-aqueous Wet Developer - Sherwin D 100	MIL-I-25135
G50199 [CP3206]	Remover - Hydrophilic Remover , Liquid - Fluro-Check E41 LF	
G50200 [CP3203]	Developer - Powder Developer - Fluro-Check DD 2A	

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Reference	Description	Specification
G50201 [CP3204]	Developer - Powder Developer - Fluro-Check DD 2B	
G50202 [CP2146]	Developer - Powder Developer in Aerosol - Fluro-Check NAD-NF	
G50203 [CP3004]	Penetrant - Fluorescent Post-emulsified Penetrant - Ardrex 985 P12	
G50204 [CP3009]	Emulsifier - Hydrophilic Emulsifier - Ardrex 9 PR12	
G50205 [CP3010]	Developer - Developer in Powder Form - Ardrex 9 D4A	

## D. Prepare for the Inspection

SUBTASK 70-40-01-230-009-F00

## (1) Get these tools and equipment before you start the inspection:

- (a) Use an inspection booth or a darkroom or a black hood, STD-473 (for remote locations) which prevents an unwanted quantity of white light.

**NOTE:** If you use too much white light, you can prevent the detection and indication of the size of a bad area. Use a test part that has a known defect to make an analysis of the quality of the white light shield.

- (b) Use a 0 to 150 psig dry filtered regulated air source, STD-3940 to dry the parts.
- 1) The air supply must have filters to remove oil and moisture to prevent the contamination of the parts or inspection materials.
- (c) Use an ultraviolet black light, STD-569 to find the fluorescent indications.
- (d) Use a white light, STD-572 for the visual inspection of the parts.
- (e) Use an analog or digital timer - seconds (stop watch), STD-3943 to measure the time to do the operations.
- (f) You must have these tools to do the inspection:
- 1) A 3x hand held magnifying lens, STD-560 and 10x hand held magnifying lens, STD-1070 to see the fluorescent indications
  - 2) A mixture of adjustable mirrors.
  - 3) A 6 inch pocket ruler, COM-4055 or equivalent gages to measure the dimension of the fluorescent indications.
  - 4) Use a small, fine-hair, soft bristle brush, STD-123 or cotton swabs to apply the solvent to make an analysis of the indications that you are not sure of.

SUBTASK 70-40-01-230-010-F00

## (2) Get these materials before you start the inspection:

**NOTE:** All materials are used at ambient temperature. The materials that follow may be used for this class of inspection.

- (a) Penetrant (Oil Soluble)
- 1) post-emulsified penetrant - Ardrex 985 P12, G50203 [CP3004]
  - 2) post-emulsified penetrant - Britemor 555, G50182 [CP3405]
  - 3) FLUORO-CHECK P21 (CP2150)
  - 4) post-emulsifying penetrant - Met-L-Chek FP93A, G50191 [CP3313]
  - 5) post-emulsified penetrant - Sherwin RC 50, G50195 [CP3300]
  - 6) liquid penetrant - Zyglo ZL 2C, G50186 [CP3107]

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## (b) Hydrophilic Removers

**NOTE:** Hydrophilic remover concentration is 20% maximum value unless otherwise noted for the dip method. Hydrophilic remover concentration is 5% maximum for the spray application method.

- 1) hydrophilic emulsifier - Ardrex 9 PR12, G50204 [CP3009]
- 2) hydrophilic remover - Britemor H91-A, G50183 [CP3404]
- 3) hydrophilic remover - Fluro-Check E41 LF, G50199 [CP3206]
- 4) hydrophilic emulsifier - Met-L-Chek E-58D, G50192 [CP3316]
- 5) hydrophilic emulsifier liquid, G50196 [CP3306]
- 6) hydrophilic remover - Zyglo ZR 10A, G50187 [CP2137] or hydrophilic remover - Zyglo ZR 10B, G50188 [CP3105]

## (c) Dry Powder Developers:

- 1) powder developer - Ardrex 9 D4A, G50205 [CP3010]
- 2) F.P.I. developer - Britemor PD 3, G50184 [CP3401] or F.P.I. developer - Britemor PD 4, G50185 [CP3406]
- 3) powder developer - Fluro-Check DD 2A, G50200 [CP3203] or powder developer - Fluro-Check DD 2B, G50201 [CP3204]
- 4) dry powder developer - Met-L-Chek D-72, G50193 [CP3317]
- 5) developer powder - Sherwin D 90 G, G50197 [CP3307]
- 6) powder developer - Zyglo ZP 4B, G50189 [CP3102]

## (d) Non-Aqueous Wet Developers

**NOTE:** Non-aqueous wet developers are approved for use in aerosol spray only. Tracer-Tech solvent mixed developer 499C is approved for bulk use with any penetrant system. A developer from one manufacturer may be substituted for another manufacturer's developer.

- 1) powder developer - Ardrex 9 D4A, G50205 [CP3010]
- 2) aerosol powder developer - Fluro-Check NAD-NF, G50202 [CP2146]
- 3) wet developer - Met-L-Chek D-70, G50194 [CP3318]
- 4) wet developer - Sherwin D 100, G50198 [CP3308]
- 5) developer powder - Zyglo ZP 9F, G50190 [CP3106]

## (e) Solvents

**NOTE:** It is necessary to use non-halogenated solvents on titanium parts.

- 1) alcohol, B00676 [CP1041]
- 2) acetone solvent, B01058 [CP1039]

## E. Procedure

SUBTASK 70-40-01-100-001-F00

## (1) Prepare the part for the inspection.

- (a) You must clean the parts before the inspection procedure.
- (b) Put a plug or cap on all the tubes holes in the area you examine.

**NOTE:** This will keep the penetrant or other material out.

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SUBTASK 70-40-01-230-011-F00

- (2) Apply the penetrant.

**WARNING:** PENETRANT IS FLAMMABLE. THE FLASH POINT OF PENETRANT IS CONSIDERABLY LOWERED WHEN USED AS A FINE SPRAY. TAKE PRECAUTIONS AGAINST FIRE. IF YOU DO NOT OBEY THESE INSTRUCTIONS, INJURY TO PERSONS CAN OCCUR.

- (a) Apply the penetrant with a spray gun or brush.
- (b) Allow 20 to 60 minutes for penetration.

SUBTASK 70-40-01-230-012-F00

- (3) Remove the excess penetrant (Preferred)

- (a) Remove excess penetrant with a hydrophilic remover provided it belongs to the same family as the penetrant used.
  - 1) Do not exceed 90 seconds contact time.
- (b) If hydrophilic remover is applied manually, do not scrub the surface of the part with the applicator.
- (c) Use applicator only to deliver fluid to the part surface.
- (d) Spray rinse the part with water from a squeeze bottle or spray gun.
  - 1) As an alternate, you can wipe the part with a clean dry cloth or clean cloth dampened with water.
    - a) Removal of excess penetrant done by wiping can remove the penetrant indication if excessive amount of solvent is applied.
    - b) Be careful not to affect the sensitivity of the FPI.

SUBTASK 70-40-01-230-013-F00

- (4) Remove the excess penetrant (Recommended).

- (a) Wipe the excess penetrant with a clean dry cloth.

**WARNING:** CLEANING SOLVENTS ARE FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH THE SKIN, OR CLOTHING.

- (b) Remove background fluorescence by wiping with a clean cloth dampened with solvent.
- (c) Look at the part under ultraviolet light to make sure excess penetrant has been removed.
- (d) If excessive background fluorescence continues, apply solvent as a fine mist while you look under the ultraviolet light.
  - 1) Point the spray at an angle and spray over the area only once.

**NOTE:** Indications of defects can be lost by too much solvent spraying.

SUBTASK 70-40-01-230-014-F00

- (5) Apply the developer.

**WARNING:** AVOID BREATHING OF VAPORS. IF YOU DO NOT OBEY THIS INSTRUCTION, INJURY CAN OCCUR.

- (a) Apply developer by spray only to a dry part at ambient temperature.

**NOTE:** When you use an aerosol container, follow the manufacturer's directions.

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- 1) Hold the spray nozzle about 8-10 inches (200-250 mm) from the part surface and apply a fine thin coating.
  - 2) Normally two passes are adequate.
  - 3) Coverage should be uniform and a metallic background should be visible through the developer.
- (b) Allow ten minutes for developer to absorb penetrant.

SUBTASK 70-40-01-230-015-F00

- (6) Do an inspection of the parts.

**CAUTION:** THE USE OF HIGH INTENSITY (125 WATT) ULTRAVIOLET BULBS WHICH EMIT AN EXCESS AMOUNT OF WHITE LIGHT WILL AFFECT THE SENSITIVITY OF THE FLUORESCENT PENETRANT PROCESS. USE ONLY BULBS CERTIFIED BY THE NDT ORIGINAL EQUIPMENT MANUFACTURER AS HAVING PASSED THEIR IN-HOUSE INSPECTION. IN ADDITION, THESE HIGH INTENSITY BULBS SHOULD BE PERIODICALLY TESTED FOR WHITE LIGHT EMISSION.

- (a) Point the ultraviolet light on the part while in the inspection booth or darkroom.
- (b) Inspect to limits specified for the parts.
- (c) Inspect questionable indications as follows:

**WARNING:** CLEANING SOLVENTS ARE FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED IN ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH SKIN OR CLOTHING.

- 1) Wipe area once with solvent using a cotton swab or fine-hair art brush.
  - 2) Apply developer to suspected area after solvent has dried.
  - 3) Inspect under ultraviolet light.
    - a) Indications that show again in two minutes shall be considered as valid indications.
  - 4) If indications do not show again, inspect the part under white light with a 10-power magnifying lens.
- (d) Identify the location of defects with approved marking method.

SUBTASK 70-40-01-230-016-F00

- (7) Clean the parts after the inspection.

**CAUTION:** ALL RESIDUAL PENETRANTS AND DEVELOPER MATERIAL MUST BE REMOVED FROM PART AS SOON AS POSSIBLE. MATERIAL NOTE REMOVED CAN CAUSE SEVERE CORROSION OF PARTS AT HIGH TEMPERATURES AND PROBLEMS DURING WELDING.

WHEN YOU CLEAN PARTS MADE OF TITANIUM OR TITANIUM ALLOYS WITH SOLVENT, USE ONLY SOLVENTS THAT DO NOT INCLUDE HALOGENS.

WHEN YOU CLEAN PARTS MADE OF TITANIUM OR TITANIUM ALLOYS WITH WATER, USE ONLY DEIONIZED WATER.

IF YOU DO NOT OBEY THESE INSTRUCTIONS, DAMAGE TO THE PARTS CAN OCCUR.

- (a) Remove developer and penetrant by water spray washing or scrubbing the part with brush and water.

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**WARNING:** CLEANING SOLVENTS ARE FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH THE SKIN OR CLOTHING.

- (b) Remove penetrant residue by spraying or by soaking in solvent.
- (c) Make sure that all internal passages and recesses are completely cleaned and dry.
  - 1) Blow out passages and recesses with dry air.

SUBTASK 70-40-01-230-017-F00

- (8) Examine the part under ultraviolet light to make sure all penetrants and developer materials are removed.

SUBTASK 70-40-01-230-018-F00

- (9) Make sure that the residues of processing compounds are completely removed from titanium and titanium alloy parts.

————— END OF TASK —————

### TASK 70-40-01-910-801-F00

#### 3. Fluorescent Penetrant Inspection (Water Washable)

##### A. General

- (1) This procedure is for a water-washable, fluorescent-penetrant inspection procedure at the remote locations.
  - (a) A portable, fluorescent-penetrant inspection is a localized procedure, that is kept to small areas or a spot inspection of specified areas of parts.
  - (b) Use this procedure for the inspection of welded or other confined repair areas.
  - (c) Apply the penetrant only to a local area that must be examined.
- (2) If you use a nonfluorescent, color-dyed penetrant on parts that you will do an inspection with fluorescent penetrants, the contamination by the dye can prevent the correct fluorescent-penetrant inspection.
  - (a) All color-dye indications shown by a white light visual inspection are correct indications, even if they are not found by ultraviolet light.
- (3) Titanium alloy parts can get stress corrosion cracks that are caused by residues that contain halogen compounds.

**NOTE:** The heat from welding, heat treating or engine operation can cause the halogen compounds to combine with the titanium and cause the stress cracks.

- (a) To prevent cracks and possible component failures, use a nonhalogen cleaning compound if you think there was halogen contamination.
- (b) You must use deionized water to process the parts made of titanium or titanium alloy.
- (4) You must clean the parts before the inspection procedure.
- (5) Put a plug or cap on all the tubes or holes in the parts in the area you examine.

**NOTE:** This will keep the penetrant or other material out of the tubes and holes.

- (6) Use the fluorescent-penetrants and developers from the same manufacturer.

**NOTE:** They should be products of one manufacturer, unless you use solvent (nonaqueous) wet developer.

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- (a) It is permitted to use the approved solvent-wet developer, Tracer-Tech D499C, with all product systems.

## 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-4055	Ruler - Pocket, 6 inch (Part #: PMF131, Supplier: 55719, A/P Effectivity: 737-ALL)
STD-123	Brush - Soft Bristle
STD-473	Hood - Black, Prevents Excessive Admission of White Light
STD-560	Lens - Magnifying, 3x, Hand Held
STD-569	Light - Black, Ultraviolet
STD-572	Light - White
STD-1070	Lens - Magnifying, 10X, Hand Held
STD-1104	Bottle - Polyethylene, Capacity 1 Pint, with Polyethylene Screw Cap and Seal
STD-3940	Air Source - Regulated, Dry Filtered, 0 to 150 psig
STD-3943	Timer - seconds (Stop Watch), Analog or Digital

## C. Consumable Materials

Reference	Description	Specification
G00034	Cotton Wiper - Process Cleaning Absorbent Wiper (Cheesecloth, Gauze)	BMS15-5

## D. Prepare for the Inspection

SUBTASK 70-40-01-230-001-F00

- (1) Get these tools and equipment before you start the inspection:

- (a) Use an inspection booth or a darkroom or a black hood, STD-473 (for remote locations) which prevents an unwanted quantity of white light.

**NOTE:** If you use too much white light, you can prevent the detection and indication of the size of a bad area. Use a test part that has a known defect to make an analysis of the quality of the white light shield.

- (b) Use a 0 to 150 psig dry filtered regulated air source, STD-3940 to dry the parts.

- 1) The air supply must have filters to remove oil and moisture to prevent the contamination of the parts or inspection materials.

- (c) Use an ultraviolet black light, STD-569 to find the fluorescent indications.

- (d) Use a white light, STD-572 for the visual inspection of the parts.

- (e) Use an analog or digital timer - seconds (stop watch), STD-3943 to measure the time to do the operations.

- (f) You must have these tools to do the inspection:

- 1) A 3x hand held magnifying lens, STD-560 and 10x hand held magnifying lens, STD-1070 to see the fluorescent indications
- 2) A mixture of adjustable mirrors.
- 3) A 6 inch pocket ruler, COM-4055 or equivalent to measure the dimension of the fluorescent indications.

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- 4) Use a small, fine-hair, soft bristle brush, STD-123 or cotton swabs to apply the solvent to make an analysis of the indications that you are not sure of.

SUBTASK 70-40-01-230-002-F00

- (2) Prepare the Part for the Inspection.

- (a) You must clean the parts before the inspection procedure.  
 (b) Put a plug or cap on all the tubes and holes in the area you examine.

**NOTE:** This will keep the penetrant or other material out.

SUBTASK 70-40-01-230-003-F00

- (3) Apply the Penetrant.

**WARNING:** KEEP THE PENETRANT AWAY FROM SPARKS, FLAME AND HEAT. THE FLASH POINT OF THE PENETRANT IS VERY LOW WHEN YOU USE IT AS A FINE SPRAY. THE PENETRANT IS FLAMMABLE WHICH CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- (a) Apply the penetrant with a brush or with a spray gun.  
 (b) Let the penetrant go into the material for 20 to 60 minutes.

SUBTASK 70-40-01-230-004-F00

- (4) Remove the Unwanted Penetrant.

- (a) Remove the unwanted penetrant with a clean, dry cotton wiper, G00034.  
 (b) Remove the background fluorescence with a clean cloth that is moist with water.  
 (c) Examine the part with the ultraviolet light to make sure you remove the unwanted penetrant.  
 (d) If you continue to get too much unwanted fluorescence, apply the water with a squeeze polyethylene bottle (1 pint), 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.

SUBTASK 70-40-01-230-005-F00

- (5) Apply the Developer.

**WARNING:** DO NOT BREATHE THE FUMES FROM THE DEVELOPER. THE DEVELOPER CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- (a) Apply the developer with a spray, only to a dry part at ambient temperature.  
 1) Hold the spray nozzle approximately 8-10 inches (200-250mm) from the part surface.  
 2) Apply a fine, thin, layer of developer.  
 3) Usually 2 layers are sufficient.  
 4) Apply a constant layer.  
 5) You must see a metallic background through the developer.

**NOTE:** When you use an aerosol container, follow the manufacturer's directions.

- (b) Let the developer absorb the penetrant for 10 to 60 minutes.

SUBTASK 70-40-01-230-006-F00

- (6) Do an Inspection of the Parts.

- (a) Point the ultraviolet light on the part while in the inspection booth or darkroom or below a black-cloth hood.

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- (b) Examine the parts for compliance with the limits.
- (c) Examine all indications you are not sure of as follows:

**WARNING:** DO NOT GET CLEANING SOLVENTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE CLEANING SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THE CLEANING SOLVENT. KEEP THE CLEANING SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. CLEANING SOLVENT IS A POISONOUS AND FLAMMABLE SOLVENT WHICH CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- 1) Use a cotton swab or a fine-hair, art brush to rub the area, one time, with a solvent from the consumable materials shown.
- 2) Let the solvent dry.
  - a) Apply the developer to the area you think is damaged.
- 3) Examine the part with the ultraviolet light.
  - a) Indications that come into view in less than two minutes are correct indications.
- 4) If the indications do not come into view again, examine the part below the white light with a 10-power magnifying lens.
- (d) Identify the location of the defects.
  - 1) Make a mark on the location of the defects with an approved marking procedure.

SUBTASK 70-40-01-230-007-F00

- (7) Clean the Parts after the Inspection.

**CAUTION:** REMOVE ALL THE REMAINING PENETRANTS AND DEVELOPER MATERIAL FROM THE PART WHEN YOU CAN. WHEN YOU CLEAN THE PARTS MADE OF TITANIUM OR TITANIUM ALLOYS WITH SOLVENT, USE ONLY THE SOLVENTS THAT DO NOT CONTAIN HALOGENS. WHEN YOU CLEAN THE PARTS MADE OF TITANIUM OR TITANIUM ALLOYS WITH WATER, USE ONLY DEIONIZED WATER. MATERIAL THAT YOU DO NOT REMOVE CAN CAUSE BAD CORROSION OF THE PARTS AT THE HIGHER TEMPERATURES.

- (a) Clean the part with a water spray or with a brush and water to remove the developer and the penetrant.

**WARNING:** DO NOT GET CLEANING SOLVENTS IN YOU MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE CLEANING SOLVENT. PUT ON A PROTECTIVE SPLASH GOGGLE AND GLOVES WHEN YOU USE THE CLEANING SOLVENT. KEEP THE CLEANING SOLVENT AWAY FROM SPARKS, FLAME AND HEAT. CLEANING SOLVENT IS A POISONOUS AND FLAMMABLE SOLVENT WHICH CAN CAUSE INJURIES TO PERSONS OR DAMAGE TO EQUIPMENT.

- (b) Apply solvent with a spray gun or soak the part in solvent to remove the remaining penetrant.
- (c) Make sure that all the internal areas and recesses are fully clean and dry.
  - 1) Blow out the internal areas and recesses of the part with dry air.

SUBTASK 70-40-01-230-008-F00

- (8) Quality Assurance.

- (a) Examine the part below the ultraviolet light.
  - 1) Make sure you remove all the penetrants and developer materials.

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- (b) Make sure you remove the remaining compounds fully from the parts made of titanium and the titanium alloy.

————— **END OF TASK** —————

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FAN BLADE LEADING EDGE EDDY CURRENT INSPECTION**1. General**

A. This procedure includes one task:

- (1) The Fan Blade Leading Edge Eddy Current Inspection

**TASK 70-40-02-200-801-F00****2. Fan Blade Leading Edge Eddy Current Inspection**

(Figure 201 and Figure 202)

## A. General

- (1) This procedure gives the instructions to do the inspection of the fan blade leading edge with the high frequency MHz manual eddy current.
- (2) The inspection personnel requirements are as follows:
- The personnel who perform this inspection must be certified in accordance with NAS-410, or SNT-TC-1A, or COSAC, or ATA 105 level 2.
  - The personnel who perform this inspection must receive practical training in the use of this procedure and must demonstrate proficiency in the calibration and evaluation routines before accept or reject authority is delegated.
  - Training per this procedure does not imply personnel certification per NAS-410, or SNT-TC-1A, or COSAC, Procedure EN4179.
- (3) The documents that follow shall form a part of this procedure to the extent specified herein. Unless a specific issue is specified, the latest revision shall apply.
- Appropriate equipment instruction manuals.
  - NAS-410, SNT-TC-1A, COSAC, EN4179, or ATA 105.
  - Appropriate Manual procedure.

## 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-8469	Test Instrument - Eddy Current (Part #: ELOTEST B1, Supplier: C3090, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: NORTEC 1000S+, Supplier: 29192, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: NORTEC 2000D+, Supplier: 29192, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ) (Part #: NORTEC WORKSTATION, Supplier: 29192, A/P Effectivity: 737-300, -400, -500, -600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)
SPL-8468	Inspection Kit - Eddy Current (Part #: 856A2682G01, Supplier: 58828, A/P Effectivity: 737-600, -700, -700C, -700ER, -700QC, -800, -900, -900ER, -BBJ)

## C. Consumable Materials

Reference	Description	Specification
B00148	Solvent - Methyl Ethyl Ketone (MEK)	ASTM D740
G02449 [CP2189]	Cloth - Abrasive, Silicone Carbide, 150 Grit - Durite G422	

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Reference	Description	Specification
G02450 [CP2191]	Cloth - Abrasive, Silicone Carbide, 180 Grit - Durite G421	

## D. Location Zones

Zone	Area
411	Engine 1 - Engine
421	Engine 2 - Engine

## E. Prepare for the Eddy Current Inspection

SUBTASK 70-40-02-840-001-F00

## (1) Prepare the leading edge.

- (a) Clean the edge of the blade with solvent, B00148.
- (b) If it is necessary, lightly remove the small surface defects with Durite G422 cloth, G02449 [CP2189] or Durite G421 cloth, G02450 [CP2191].

## (2) Prepare for the calibration.

## (a) The initial calibration:

- 1) Frequency: 3.0 MHz
- 2) Rotation: To be adjusted to have a vertical screen indicator
- 3) Low Pass Filter: 100.0 Hz
- 4) High Pass Filter: Off
- 5) Gain: To be adjusted during calibration procedure (ELOTTEST - 35.0 dB, NORTEC -50 dB).

## (b) Calibration procedure with the 9970 958 389P01 or 9970 958 390P01 probe from eddy current inspection kit, SPL-8468.

- 1) Install the probe on the eddy current test instrument, COM-8469.

**NOTE:** Make sure that the teflon is changed at regular time.

## (c) Apply a new small piece of teflon tape on the coil of each probe.

## (d) Calibration

**NOTE:** You must do the calibration at the beginning and at the end of the inspection, every fifth blade and at any change of any component. You must perform the calibration of the instrumentation when it has been turned off.

- 1) Put the coil away from the notch of the Electro Discharge Machining (EDM) on the "not blended" area.
- 2) Set the EDM to zero.
 

**NOTE:** The point is in the middle of the screen.
- 3) Examine the surface along the "not blended" area with the probe and adjust the gain and rotation to have a peak to peak on full screen with a vertical indication when the coil touches the EDM notch.
- 4) Keep the same parameters and put the coil away from the notch of the EDM.
- 5) Set the EDM to zero on the blended area.
- 6) Examine the bottom of the blended area with the EDM notch.

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- 7) If the indication is equal to or less than a half of full screen, adjust the parameters that follow:
- a) Hand position, movement of examination, gain and rotation to have a full screen indication on the EDM notch of the "not blended" area and more than a half full screen in the "blended" area.

## F. Procedure

SUBTASK 70-40-02-250-001-F00

- (1) Do a first inspection of the leading edge of the blade with the 9970 958 389P01 probe from eddy current inspection kit, SPL-8468.

NOTE: You must perform two inspections with two different probes because of the design of the blade (shape and different thickness), especially in the blended areas.

NOTE: The 9970 958 389P01 probe is included in the eddy current inspection kit.

- (a) Put the probe in position with its coil in contact with the pressure face with the same adjustment than for calibration.

- 1) Make sure that the coil is always in contact with the inspected area.

- (b) Move the probe to examine the surface along the leading edge.

NOTE: You can perform this inspection a second time if it is not sufficient.

- (c) Put the probe in position with its coil in contact with the pressure face with the same adjustment than for calibration.

- 1) Make sure that the coil is always in contact with the inspected area.

- (d) Move the probe to examine the surface along the leading edge.

NOTE: You can perform this inspection a second time if it is not sufficient.

NOTE: You can move the probe three times or more across the blade section to make sure that the indication is not a malfunction.

- (e) Set to zero each time the probe touches a blended area.

SUBTASK 70-40-02-250-002-F00

- (2) Do a second inspection of the leading edge of the blade with the 9970 958 390P01 probe from eddy current inspection kit, SPL-8468.

NOTE: The 9970 958 390P01 probe is included in the eddy current inspection kit.

- (a) Put the probe in position with its coil in contact with the pressure face with the same adjustment than for calibration.

- 1) Make sure that the coil is always in contact with the inspected area.

- (b) Move the probe to examine the surface along the leading edge.

NOTE: You can perform this inspection a second time if it is not sufficient.

- (c) Put the probe in position with its coil in contact with the suction face with the same adjustment than for calibration.

- 1) Make sure that the coil is always in contact with the inspected area.

- (d) Move the probe to examine the surface along the leading edge.

NOTE: You can perform this inspection a second time if it is not sufficient.

NOTE: You can move the probe three times or more across the blade section to make sure that the indication is not a malfunction.

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- (e) Set to zero each time the probe touches a blended area.

SUBTASK 70-40-02-869-001-F00

(3) Inspection Criteria

- (a) If you measure an indication equal to or more than 25 percent of full screen in a blended or non-blended area, you must do the evaluation of the default.
- (b) If you measure an indication equal to or more than 50 percent of full screen in a blended or non-blended area, you must discard the part.

SUBTASK 70-40-02-869-002-F00

(4) Evaluation of the Default

- (a) Make sure that the calibration procedure was done correctly.
- (b) Make sure that two checks were done with the two probes on the suction and pressure faces around the area you examine.
- (c) If the indication is equal to or more than 25 percent of full screen, discard the part.
- (d) If you have no indication or an indication less than 25 percent of full screen, the part is acceptable.

————— **END OF TASK** —————

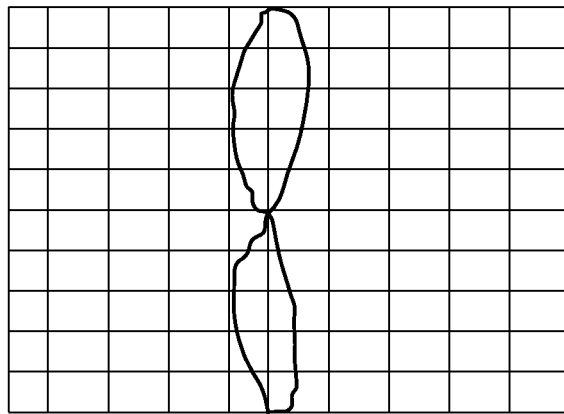
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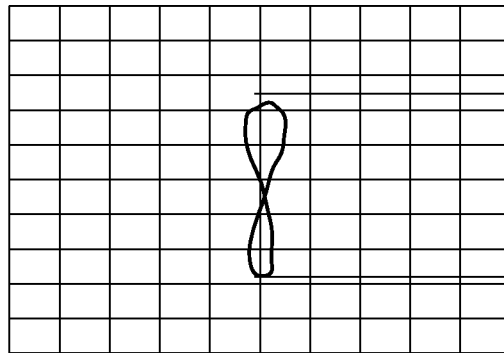
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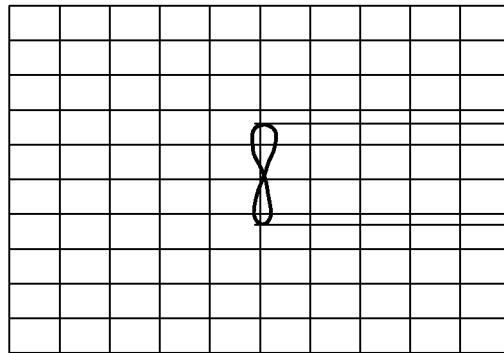
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FULL SCREEN



50% OF FULL SCREEN



25% OF FULL SCREEN

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**Monitor Indications (Typical)  
Figure 201/70-40-02-990-801-F00**

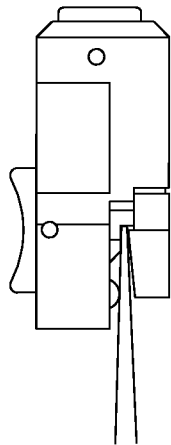
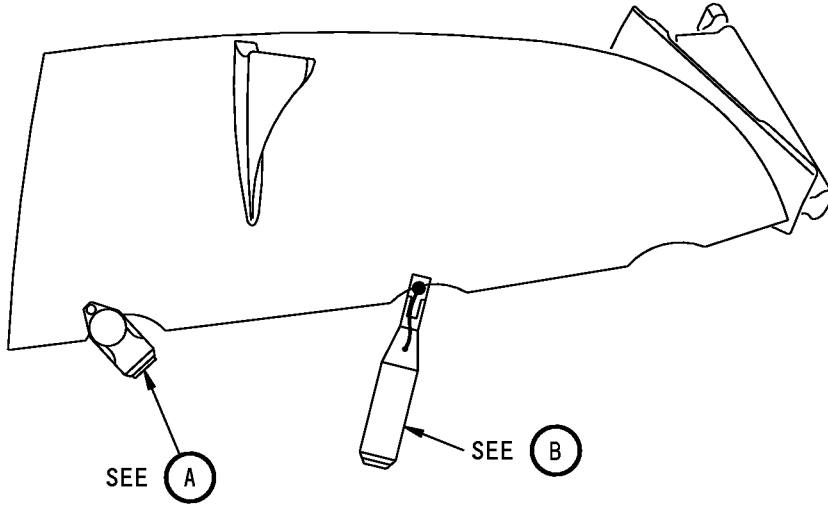
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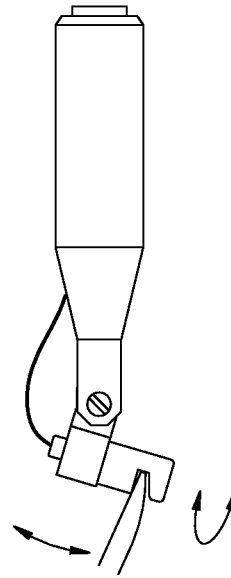
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(A)



(B)

**NOTE:** THE INSPECTION IS DONE ON THE TWO SUCTION AND PRESSURE FACES

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**Probe Position**  
**Figure 202/70-40-02-990-802-F00**

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## AIRCRAFT MAINTENANCE MANUAL

STANDARD TOOLS AND EQUIPMENT - MAINTENANCE PRACTICES**1. General**

- A. This procedure contains the approved tools and equipment you use in the maintenance of the CFM56 engine.

**TASK 70-60-01-910-801-F00****2. Standard Tools and Equipment**

## A. General

- (1) The tools and equipment listed in these steps are in addition to the standard tools listed in the aircraft maintenance manual.

## 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-2477	Tools - Vacuum Cleaner Set (Part #: 44SPEC, Supplier: 0Y8U0, A/P Effectivity: 737-ALL) (Part #: 655406-7M, Supplier: 0Y8U0, A/P Effectivity: 737-ALL) (Part #: BP80, Supplier: \$0373, A/P Effectivity: 737-ALL) (Part #: C-39485-41, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: C-39485-42, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: C-39685-01, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: C-47400-00, Supplier: 16893, A/P Effectivity: 737-ALL) (Part #: R80, Supplier: \$0373, A/P Effectivity: 737-ALL) (Part #: WD80, Supplier: \$0373, A/P Effectivity: 737-ALL) (Opt Part #: 02132B, Supplier: 0A5X2, A/P Effectivity: 737-ALL)
STD-442	Gun - Heat, 180° F (82° C) Maximum Output Temperature
STD-1107	Gauge - Feeler, 0.0 - 0.5 Inch, Readable to 1/1000th
STD-3935	Screwdriver, Phillips ACR PSC-1204-3-R

## C. List of Approved Tools and Equipment

SUBTASK 70-60-01-910-001-F00

## (1) Description and Supplier

- (a) vacuum cleaner tool set, COM-2477 - Local Purchase  
(b) 180° F (82° C) maximum output temperature heat gun, STD-442 - Local Purchase  
(c) 0.0 - 0.5 Inch feeler gauge, STD-1107 - Local Purchase

Table 201/70-60-01-993-801-F00

TOOLS	COMPANY AND ADDRESS
Soft Nose Pliers Model Souriau 8498-03	Souriau Inc. 765 Kester Avenue Van Nuys, CA 91405 USA
Soft Nose Pliers Model Souriau 8498-03	Souriau Et Cie 9-13 Rue Gallieni 92103 Boulogne-Billancourt France
Crowfoot Wrench Model Snap-On TMRX1	Snap-On Tools Company 8049 28th Avenue Kenosha, WI 53140 USA

- (d) Wrench, clawsfoot, AN8508-14A

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(e) Phillips ACR PSC-1204-3-R screwdriver, STD-3935

————— **END OF TASK** —————

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## AIRCRAFT MAINTENANCE MANUAL

STANDARD ENGINE WIRING AND EQUIPMENT CHECK - MAINTENANCE PRACTICES

## TASK 70-70-01-200-801-F00

1. Standard Engine Wiring and Equipment Check

## A. General

(1) This task has four topics:

- (a) The general instructions for the routing of the wiring harnesses
- (b) The visual examination of the wiring harnesses
- (c) A visual check of engine components and harnesses connectors and receptacles.
- (d) The retention test for the connector sockets.

## B. References

Reference	Title
70-70-01-350-801-F00	Engine Wiring Harnesses Repair (P/B 801)
73-21-06-000-801-F00	Fan Wiring Harness Removal (P/B 401)
73-21-06-400-801-F00	Fan Wiring Harness Installation (P/B 401)
73-21-10-000-801-F00	HMU Removal (P/B 401)
73-21-10-400-801-F00	HMU Installation (P/B 401)

## C. Tools/Equipment

Reference	Description
STD-123	Brush - Soft Bristle
STD-127	Brush - Nylon

## D. Consumable Materials

Reference	Description	Specification
B00676 [CP1041]	Alcohol - Isopropyl	TT-I-735

## E. Location Zones

Zone	Area
411	Engine 1 - Engine
421	Engine 2 - Engine

## F. General Instruction on the Routing of The Wiring Harnesses

SUBTASK 70-70-01-210-001-F00

(1) Wire harness routing.

- (a) Make sure that all clamps are in their correct position and installed correctly.
- (b) Make sure that the wire bundle length is equally distributed between the attach parts and is not stressed.
- (c) Make sure that there is no unwanted force that is applied to the wire bundle.
- (d) Harnesses that touch a metal components are not permitted:
- (e) The routing of the different wire bundles can touch each other in some areas.

NOTE: Wire bundles that go across and touch different wire bundles are permitted.

(f) It is permitted to let the wire bundles touch when they are parallel.

- 1) Only if the bundles are of the same flexible conduit.

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## G. Visually Examine the Wiring Harnesses

SUBTASK 70-70-01-210-002-F00

**NOTE:** You must be very careful when you do a visual inspection. Try to not cause more damage to the worn areas.

## (1) Visually examine the wire harness for damage:

## (a) Cuts, abrasions, chafing, rupture or damage to the outer cable sheath.

## 1) If you find one worn area between the two loop clamps or below the loop clamp.

## a) Do this task: Engine Wiring Harnesses Repair, TASK 70-70-01-350-801-F00

## 2) If you find more than one worn area between the two loop clamps, the harness is not serviceable.

## a) Replace the harness.

SUBTASK 70-70-01-210-003-F00

## (2) Look for damage to the engine component receptacles and harness connectors:

## (a) Thread damage.

## 1) One lead-in thread of more than 30 percent damage, or two lead-in threads with 20 percent damage or more:

## a) Chase the threads if they meet the specified limits.

## 2) If the thread damage is more than the specified limits, replace the connector or engine component.

## a) Install a replacement harness or engine component.

## (b) Connector and related receptacle pin damage.

## 1) Make sure that the pin-to-socket connections are satisfactory, and the sockets are tightly attached in the connector or the receptacle.

## a) If the pin-to-socket connections are not tightly attached, do a retention test of the connector socket.

## 2) If the pins or sockets are broken, eroded, bent, or corroded, replace the engine component or connector.

## (c) Contamination inside the connector and receptacle well.

## 1) None permitted.

**WARNING:** DO NOT GET ISOPROPYL ALCOHOL IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ISOPROPYL ALCOHOL. KEEP THE ISOPROPYL ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. ISOPROPYL ALCOHOL IS POISONOUS AND FLAMMABLE, WHICH CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

## a) Clean the area with a soft bristle brush, STD-123 and alcohol, B00676 [CP1041].

## b) This task is permitted on these wiring harness and connectors:

< 1 > J9 WIRING HARNESS, CONNECTOR DP0901 and DP0905  
 CJ9 WIRING HARNESS, CONNECTOR DP0912 and DP0913  
 J10 WIRING HARNESS, CONNECTOR DP1001 and DP1005  
 CJ10 WIRING HARNESS CONNECTOR, DP1012 & DP1013

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<2> Clean the connector socket with a nylon brush, STD-127 (type 81-AY 1.5 mm) and alcohol, B00676 [CP1041].

<a> Do not put the connector fully in the alcohol.

NOTE: Do not use cleaner lubricant. The core wiring harness is in a high temperature (150 degrees to 400 degrees celsius) area. The lubricant can coke and release dangerous particles.

<3> Put the nylon brush in the alcohol momentarily.

<4> Tightly hold the brush near bristles, with the connector in the down position. Fully put and remove the brush in the socket for 10 times at a maximum rate of one removal/second.

<5> To clean the brush, put it in the alcohol momentarily and shake to remove particles.

<a> Do the step to clean the brush again, two more times.

<6> Let the sockets dry for a few minutes before you re-connect them.

NOTE: Do not blow pressurized air in the plug shell or the socket contacts. It can cause damage at the internal ring sockets then socket retention force will be loose.

(d) Fuel wetting and leakage.

1) The fuel wetting at J5 and J6 HMU connectors when you removed or installed.

a) It is serviceable.

NOTE: The wetting is a moderate wet that does not increase in time.

2) The fuel leakage at J5 and J6 HMU connectors when removed.

a) It is serviceable.

<1> Dry connectors with soft air.

<2> Clean the connectors with alcohol, B00676 [CP1041].

NOTE: The leakage is a continuous flow of drops.

3) The fuel leakage at J5 and J6 HMU connectors when installed.

a) It is not serviceable.

b) Do these tasks to remove and replace the cable and HMU.

<1> Do this task: HMU Removal, TASK 73-21-10-000-801-F00.

<2> Do this task: Fan Wiring Harness Removal, TASK 73-21-06-000-801-F00.

<3> Do this task: Fan Wiring Harness Installation, TASK 73-21-06-400-801-F00.

<4> Do this task: HMU Installation, TASK 73-21-10-400-801-F00.

H. Retention Test of the Connector Socket

**WARNING:** DO NOT GET ISOPROPYL ALCOHOL IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ISOPROPYL ALCOHOL. KEEP THE ISOPROPYL ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. ISOPROPYL ALCOHOL IS POISONOUS AND FLAMMABLE, WHICH CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

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(WARNING PRECEDES)

SUBTASK 70-70-01-220-001-F00

- (1) Do a check of the retention of the connector socket:

NOTE: This test is not used for a new connector socket.

- (a) Clean the checking pin tool with alcohol, B00676 [CP1041].

NOTE: No traces of lubricant are permitted.

**CAUTION:** BE CAREFUL WHEN YOU DO A CHECK OF THE CONTACTS. INCORRECT USE OF THE RETENTION TEST TOOL COULD CAUSE DAMAGE TO THE CONNECTORS, CONTACTS OR TEST TOOL.

- (b) Select the applicable tool size (Figure 201) to fit the connector socket.

NOTE: There are two sizes of sockets for the engine connectors; a gage 16 and a gage 20.

- (c) Install the applicable pin of the tool in the connector socket.

- (d) Hold the connector vertically so the socket contacts point to the ground.

- (e) Put the tool into the socket.

- (f) With the connector and tool in this position, the connector socket must not let the tool drop out.

- 1) If the tool drops out, replace the harness.

- (g) Do the steps again for all the other contacts in the connector.

- (h) When the connector test is complete, install the connector to the specified receptacle.

- 1) Tighten the connector with your hand.

- 2) Tighten the coupling nut one-eighth of a turn.

NOTE: With the soft connector pliers.

SUBTASK 70-70-01-810-001-F00

- (2) If this procedure was done as a step from the fault isolation manual, continue with the fault isolation procedure.

————— **END OF TASK** —————

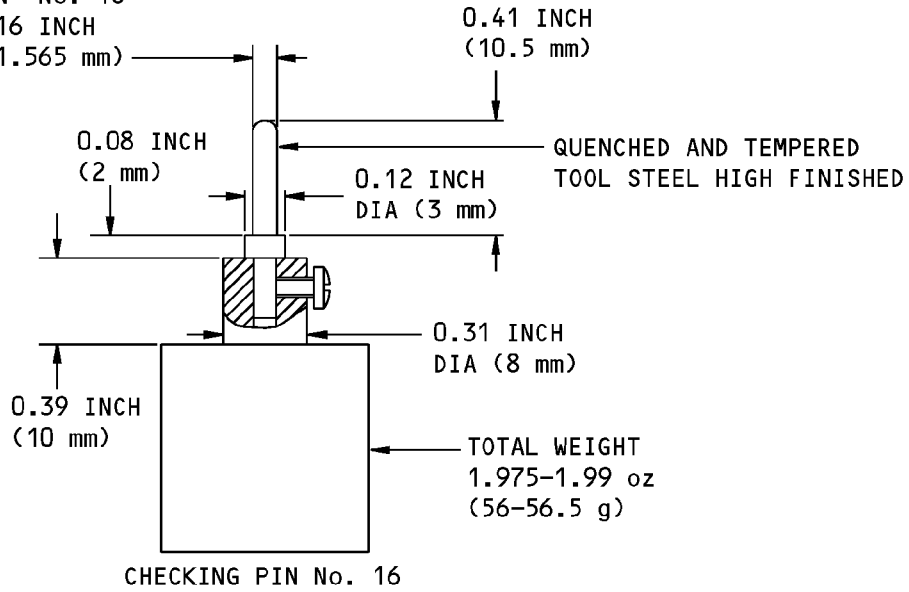
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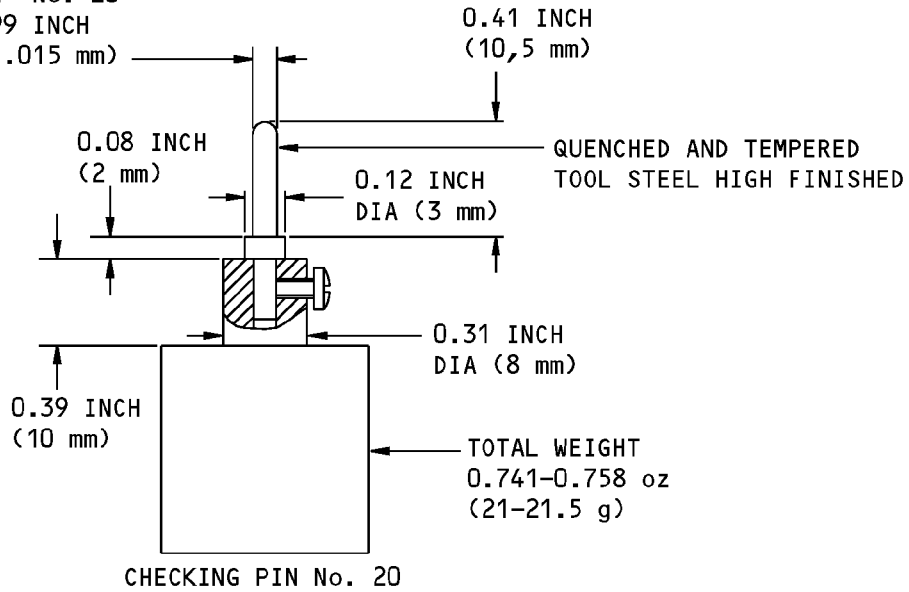
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CHECKING PIN No. 16  
 0.0614-0.0616 INCH  
 DIA (1.560-1.565 mm)



CHECKING PIN No. 20  
 0.0397-0.0399 INCH  
 DIA (1.010-1.015 mm)



S-M56-MM-03695-00-B

**Connector Socket Retention Checking Tools**  
**Figure 201/70-70-01-990-801-F00**

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## AIRCRAFT MAINTENANCE MANUAL

### ENGINE WIRING HARNESES - REPAIR

#### 1. General

- A. This procedure has one task.
  - (1) Repair of the damage wiring harnesses.
- B. To do the repair of the outer sheath of the harnesses, do one of these repairs (operator's convenience):
  - (1) the fiberglass tape and lockwire repair or
  - (2) the silicone tape repair.
- C. This repair procedure is temporary until the next engine shop visit. It is applicable if the damaged area of the harness is in the dimensions of the permitted limits.
- D. It is not permitted to have more than one damaged area between two loop clamps to do this repair procedure.
- E. The repair is permitted for damage under the loop clamp and/or only one damaged area between two loop clamps with the dimensions in the limits.
- F. The fiberglass tape and lockwire repair is applicable for:
  - (1) the fan fire detection harnesses (MW0315 and MW0316)
  - (2) the nacelle wiring harnesses (MW0301, MW0302, MW0303, MW0304, MW0311, MW0312 and MW0313)
  - (3) the fan wiring harnesses (J5, J6, J7 and J8) and , 3:00 o'clock strut harnesses (J9 and J10)
  - (4) the engine core fire detection harnesses (MW0325 and MW0326)
  - (5) the core engine wiring harnesses (CJ9 and CJ10)
- G. The silicone tape repair is applicable for:
  - (1) the engine fan fire detection harnesses (MW0315 and MW0316),
  - (2) the nacelle wiring harnesses (MW0301, MW0302, MW0303, MW0304, MW0311, MW0312 and MW0313)
  - (3) the fan wiring harnesses (J5, J6, J7 and J8), 3:00 o'clock strut harnesses (J9 and J10)
  - (4) This repair is not permitted on the engine core fire detection harnesses (MW0325 and MW0326)and the core engine wiring harnesses (CJ9 and CJ10).
- H. To do this repair procedure, remove fully or partially the wiring harness to get access to the damaged area. Thus, refer to the applicable task to remove and install the wiring harness and to take all precautions necessary to do this repair procedure.

#### **TASK 70-70-01-350-801-F00**

#### 2. Engine Wiring Harnesses Repair

- A. General
  - (1) This procedure gives instructions to repair the wiring harness if it is worn.
  - (2) The fan wiring harnesses are: J5, J6, J7 and J8 (Refer to Fan Wiring Harness Removal, TASK 73-21-06-000-801-F00 and Fan Wiring Harness Installation, TASK 73-21-06-400-801-F00).
  - (3) The 3:00 o'clock strut harnesses are: J9 and J10 (Refer to 3 O'clock Strut Harness Removal, TASK 73-21-06-000-802-F00 and 3 O'clock Strut Harness Installation, TASK 73-21-06-400-802-F00).

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- (4) The core engine harnesses are: CJ9 and CJ10 (Refer to Core Engine Harness Removal, TASK 73-21-06-000-803-F00 and Core Engine Harness Installation, TASK 73-21-06-400-803-F00).
- (a) The silicone tape repair is not permitted on the core engine harness.
- (5) The fan fire detection harnesses are: MW0315 and MW0316 (Refer to Fan Fire Detection Harness Removal, TASK 26-11-02-000-801 and Fan Fire Detection Harness Installation, TASK 26-11-02-400-801).
- (6) The engine core fire detections are: MW0325 and MW0326 (Refer to Core Fire Detection Harnesses Removal, TASK 26-11-02-000-802 and Core Fire Detection Harness Installation, TASK 26-11-02-400-802).
- (a) The silicone tape repair is not permitted on the core engine harness.
- (7) The nacelle wiring harnesses are : MW0301, MW0302, MW0303, MW0304, MW0311, MW0312 and MW0313 (Refer to Nacelle Wiring Harnesses Removal, TASK 71-51-03-000-801-F00 and Nacelle Wiring Harnesses Installation, TASK 71-51-03-400-801-F00).

**NOTE:** To remove the MW0311, do this task: 3:00 O'clock Strut Harness Removal, TASK 73-21-06-000-802-F00.

## B. References

Reference	Title
26-11-02-000-801	Fan Fire Detection Harness Removal (P/B 401)
26-11-02-000-802	Core Fire Detection Harnesses Removal (P/B 401)
26-11-02-400-801	Fan Fire Detection Harness Installation (P/B 401)
26-11-02-400-802	Core Fire Detection Harness Installation (P/B 401)
71-51-03-000-801-F00	Nacelle Wiring Harnesses Removal (P/B 401)
71-51-03-400-801-F00	Nacelle Wiring Harnesses Installation (P/B 401)
73-21-06-000-801-F00	Fan Wiring Harness Removal (P/B 401)
73-21-06-000-802-F00	3 O'clock Strut Harness Removal (P/B 401)
73-21-06-000-803-F00	Core Engine Harness Removal (P/B 401)
73-21-06-400-801-F00	Fan Wiring Harness Installation (P/B 401)
73-21-06-400-802-F00	3 O'clock Strut Harness Installation (P/B 401)
73-21-06-400-803-F00	Core Engine Harness Installation (P/B 401)

## 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
COM-1276	Tester - Insulation Resistance (Output Test Voltage 100/250/500/1000 VDC)

## D. Consumable Materials

Reference	Description	Specification
B00676 [CP1041]	Alcohol - Isopropyl	TT-I-735
G00834	Cloth - Lint-free Cotton	
G50142	Lockwire - .015 Steel Corrosion Resistant	NASM20995~ C15
G50143 [CP2208]	Tape - Glass Cloth with Silicone Adhesive, High Temperature, Abrasive Resistant - 3M 361	

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(Continued)

Reference	Description	Specification
G50145 [CP2628]	Tape - High Temperature Aluminum Foil with Glass Cloth, Silicone Adhesive - 3M 363	
G50651 [CP2682]	Tape - Silicone Rubber (Arlon MOX Tape)	

## E. Prepare for the Repair

SUBTASK 70-70-01-210-006-F00

**NOTE:** It is permitted to have only one damaged area between the two loop clamps with the dimensions in the limits.

**NOTE:** Be careful when you do the visual inspection. Try not to cause more damage to the worn areas of the sheath clamp. The removal can also cause more damage.

## (1) Examine the clamp areas of the worn harness as follows.

- (a) Remove the harness from the clamp locations.

**NOTE:** If you remove fully or partially the wiring harness to get access to the area, refer to the applicable task. Read all precautions necessary to remove and install the wiring harness.

- (b) Examine the harness along the clamp contact areas for damage.

- (c) If the sheath is not worn.

- 1) Replace the clamps.
- 2) Attach the harness with the clamps.

- (d) If you find only one worn area between the two loop clamps, do the repair task.

- (e) If you find more than one worn area between the two loop clamps.

- 1) Replace the electrical harness.

SUBTASK 70-70-01-760-001-F00

## (2) Measure the insulation resistance of the harness as follows.

- (a) Disconnect the connectors at each end of the harness.

**NOTE:** Make sure to disconnect the connector at each end of the harness, If you do not, this can cause unsatisfactory resistance indications and possible damage to the circuits,

- (b) Use a insulation resistance tester, COM-1276 to measure the insulation resistance between each wire.

- 1) The resistance must be equal to or more than 20 Megohms.

- (c) Use a insulation resistance tester, COM-1276 to measure the insulation resistance between each wire and the ground.

- 1) The resistance must be equal to or more than 20 Megohms.

- (d) If the resistance is out of the limits.

- 1) Replace the electrical harness.

## F. Fiberglass Tape and Lockwire Repair

SUBTASK 70-70-01-210-007-F00

**NOTE:** Be careful when you do the visual inspection. Try not to cause more damage to the worn areas of the sheath clamp. The removal can also cause more damage.

## (1) Do this inspection of the worn area before the repair.

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- (a) Make sure that no metallic wire is seen on the outer area of the electrical harness and there is no cutting or burns.
- (b) Measure the damaged area (Figure 801) to make sure that it is less than the maximum defective area Dimension C (Table 801) is 1.25 inch (31.75 mm).
- (c) If the area is more than the maximum defective area Dimension C.
  - 1) Replace the electrical harness.

SUBTASK 70-70-01-110-001-F00

**WARNING:** DO NOT GET ISOPROPYL ALCOHOL IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ISOPROPYL ALCOHOL. KEEP THE ISOPROPYL ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. ISOPROPYL ALCOHOL IS POISONOUS AND FLAMMABLE, WHICH CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

- (2) Clean the outer sheath, in and around the damaged area of the harness with the lint-free cloth, G00834 wet with the alcohol, B00676 [CP1041].

SUBTASK 70-70-01-350-001-F00

**NOTE:** Do not penetrate the harness CU-IN. It can cause an incorrect insulation of the harness.

- (3) Do these steps to repair the harness.
  - (a) Cut off all the loose strands in the damaged area with end-cutting pliers.
 

**NOTE:** This step is for harnesses with metallic sheath.
  - (b) Examine the repair areas of the harness for any penetration into the harness.
  - (c) Do these steps to apply the fiberglass tape to the damaged area (Figure 801).
    - 1) Use the 3M 361 tape, G50143 [CP2208] or 3M 363 tape, G50145 [CP2628].
    - 2) Apply the tape around the braid through the damaged area ((Table 801).

Table 801/70-70-01-993-801-F00 Fiberglass Tape Repair Dimensions

Description	Minimum Finish Dimension	Maximum Finish Dimension
Dimension A	0.5 inch (12.7 mm)	
Dimension B	0.5 inch (12.7 mm)	
Dimension C		1.25 inch (31.75 mm)

- 3) Start at the Dimension A.
  - a) Wind the tape one-half width before the cut away
  - b) Stop one-half width after the cut away area to Dimension B.
- 4) Apply the tape in the same direction with one-half width overlay at each turn.
- 5) Cut the tape with an electrician's scissor.
- (d) Do these steps to install .015 steel corrosion resistant lockwire, G50142 around the outer sheath (Figure 802).
  - 1) Make sure that the length of the wire is sufficient to make an overlap on the tape and outer sheath at each end of the repair.
  - 2) Hold the wire along the length of the worn area that start from the left side.
  - 3) Start the opposite end and apply the wire tightly and equally above the outer sheath to cover the repair area.
  - 4) Make sure that the dimensions are correct.

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- 5) Let the short end of the loop stay exposed when approximately 2/3 of the wound wire length is completed.
  - a) Continue to wind the wire to complete the remaining distance shown as 1/3 X.
- 6) Put the wire A into the loop after the last turn.
- 7) Cut off the end of wire B until its length is approximately 1/3 of the repair length.
- 8) Pull the loop end of wire C until the wire A goes through the wound wire and the wire B goes out of the view below the last turn.
- 9) Cut off the wire end C flush.

SUBTASK 70-70-01-210-008-F00

- (4) Examine the repaired areas of the wire harness for a correct repair.
  - (a) A bad wire wind up is not permitted.
    - 1) Do the repair again.

SUBTASK 70-70-01-970-001-F00

- (5) Record this repair in the engine log-book.

## G. Silicone Tape Repair

SUBTASK 70-70-01-210-011-F00

- (1) Make sure you do the silicone tape repair of the applicable wire harness.
  - (a) This repair is permitted on the fan wire harnesses only.
  - (b) Do the fiberglass and lockwire repair on the core wire harnesses.

SUBTASK 70-70-01-210-009-F00

**NOTE:** You must be very careful that when you do the visual inspection. You must not cause more damage to the worn areas of the sheath clamp. The removal can also cause more damage.

- (2) Do this inspection of the worn area before the repair.

**NOTE:** The silicone tape repair is a temporary repair. Make sure that the wire harness is in the repair limits. If it is not in the limits, you must replace the damaged wire harness. Send the damaged harness to the repair shop.

- (a) Make sure that no metallic wire is seen on the outer area of the electrical harness and there is no cutting or burns.
- (b) Measure the damaged area (Figure 803) to make sure that it is less than the maximum defective area Dimension C (Table 802) is 1.25 inch (31.75 mm) and does not extend 90°.
  - 1) If the area is more than the Dimension C, replace the electrical harness.
- (c) Measure the distance between two adjacent damaged areas to make sure that it is more than 1.0 inch (25.4 mm).
  - 1) If the distance is less than 1.0 inch (25.4 mm), replace the electrical harness.
- (d) Measure the cumulated length of the damaged areas to make sure that it is less than 1.0 inch (25.4 mm) for each 3.0 inch (75 mm) length of the harness.
  - 1) If the cumulated length is more than 1.0 inch (25.4 mm), replace the electrical harness.

SUBTASK 70-70-01-110-002-F00

**WARNING:** DO NOT GET ISOPROPYL ALCOHOL IN YOUR MOUTH, EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ISOPROPYL ALCOHOL. KEEP THE ISOPROPYL ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. ISOPROPYL ALCOHOL IS POISONOUS AND FLAMMABLE, WHICH CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

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(WARNING PRECEDES)

- (3) Clean the outer sheath, in and around the damaged area of the harness with the lint-free cloth, G00834 wet with the alcohol, B00676 [CP1041].

SUBTASK 70-70-01-350-002-F00

**NOTE:** Do not penetrate the harness CU-IN. It can cause an incorrect insulation of the harness.

- (4) Do these steps to repair the harness.
- (a) Cut off all the loose pieces of the outer sheath in the damaged area with end-cutting pliers.

**NOTE:** This step is for harnesses with metallic sheath.

- (b) Examine the repair areas of the harness for a penetration into the harness.
- (c) Do these steps to apply the silicone tape to the damaged area (Figure 803).
- 1) Use the silicone tape, Arlon MOX Tape, G50651 [CP2682].
  - 2) Apply the tape around the sheath through the damaged area (Table 802).

Table 802/70-70-01-993-802-F00 Silicon Tape Repair Dimensions

Description	Minimum Finish Dimension	Maximum Finish Dimension
Dimension A	0.5 inch (12.7 mm)	1.0 inch (25.4 mm)
Dimension B	0.5 inch (12.7 mm)	1.0 inch (25.4 mm)
Dimension C		1.25 inch (31.75 mm)
Angle D		90°

- 3) Start at the Dimension A.
- a) Wind the tape one-half width before the cut away
  - b) Stop one-half width after the cut away area to Dimension B.
- 4) Apply the tape in the same direction with one-half width overlay at each turn.
- 5) Cut the tape with an electrician's scissor.

SUBTASK 70-70-01-210-010-F00

- (5) Examine the repaired areas of the worn harness for a correct repair.
- (a) A bad tape bond on the parent material with lift off is not permitted. Do the repair again.
  - (b) A bad tape wind up with nicks and dents is not permitted. Do the repair again.

SUBTASK 70-70-01-970-002-F00

- (6) Record this repair in the engine log-book.

————— **END OF TASK** —————

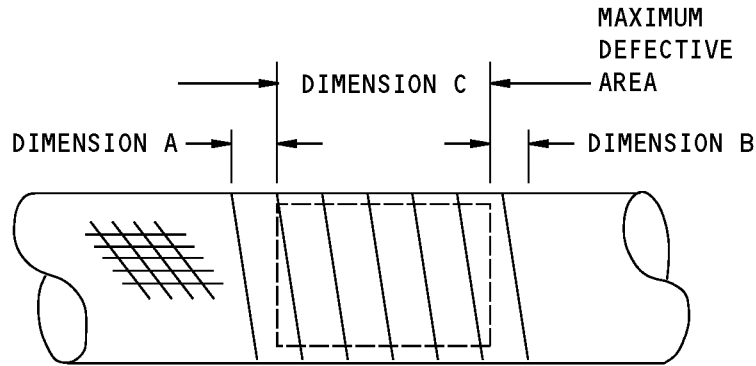
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**Application of the Fiberglass Tape**  
**Figure 801/70-70-01-990-802-F00**

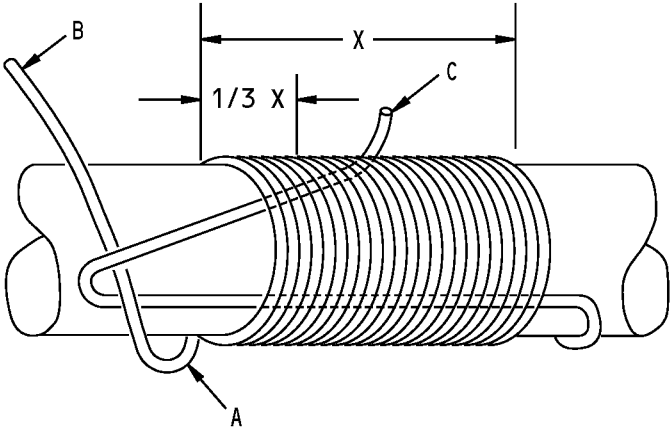
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Winding Up of the Stainless Steel Wire  
Figure 802/70-70-01-990-805-F00

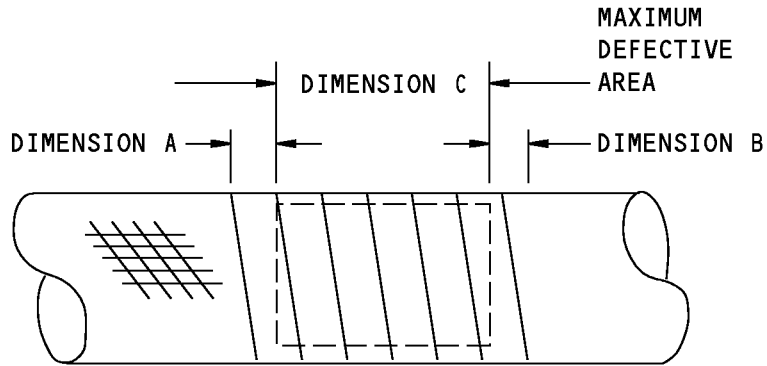
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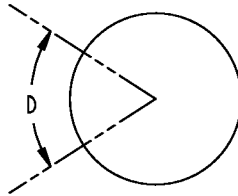
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Application of the Silicone Tape  
Figure 803/70-70-01-990-806-F00

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