CHAPTER

20

STANDARD PRACTICES (AIRFRAME)

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* Asterisk indicates pages revised, added, or deleted by the current revision. The portion of the text affected by the current revision is indicated by a vertical line in the outer margin of the page.

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STANDARD AIRFRAME PRACTICES - DESCRIPTION AND OPERATION

1. DESCRIPTION

A. Standard airframe practices include procedures, practices and processes which are not specifically covered in other chapters of this manual.

B. Illustrations have been provided to aid in performing general maintenance practices on the aircraft.

SEALANTS - DESCRIPTION AND OPERATION

1. Description

A. Sealing of the aircraft is required to eliminate leakage of air pressure, water, fuel, dust, and heat.

B. This section provides sealing procedures necessary for performing maintenance on the aircraft. It does not include structural repair sealing.

C. There are basically three types of sealing used on the aircraft. Weather sealing is used to protect equipment from rain and dust. Pressure sealing is used to prevent loss of cabin pressure during high altitude flight. Fuel sealing is used to restrict fuel to the areas where it is least subject to combustion.

2. Tools and Equipment

NOTE: The following materials have been found to be the most efficient in their applications and must not be interchanged:

NAME	PART NUMBER	MANUFACTURER	USE
Sealant (Brushable)	Pro-Seal 890 (Class A)	Products Research & Chemical Co. Glendale, CA	Sealing
	PR 1440 (Class A)	Products Research & Chemical Co. Glendale, CA	Sealing
Sealant (Extrusion Gun)	Pro-Seal 890 (Class B-1/2, 1/2 hr work life)	Products Research & Chemical Co. Glendale, CA	Fillet
	(Class B-2, 2 hr work life)		
	(Class B-4, 4 hr work life)		
Sealant (Faying Surface)	Pro-Seal 890 (Class C-24, 24 hr squeeze-out life)	Products Research & Chemical Co. Glendale, CA	Faying Seals
	(Class C-48, 48 hr squeeze-out life)		
	(Class C-80, 80 hr squeeze-out life)		
Methyl-Ethyl-Ketone (MEK)	Spec. TT-M-261	Commercially Available	Solvent

NAME	PART NUMBER	MANUFACTURER	USE
Nylon Lacing Cord (Wax Impregnated)	Spec. MIL-T-713, Type P, Class 2 or MIL-T-43435,Type I, Finish B, Size 3	Commercially Available	Wire bundle Tying
Aliphatic Naptha	Spec. TT-N-95 (Type II)	Commercially Available	Solvent
Toluene	Spec. TT-T-548	Commercially Available	Solvent
Clean, White, Cotton Cloth		Commercially Available	General
Lubricant	BOELUBE	Orelube Co. College Point, NY	Drilling Lubricant
Lubricant	LPS-1	LPS Research Labs Inc., Los Angeles, CA	Drilling Lubricant
Vinyl Tape	CT-93	Borden Chemical Co.	Masking
Masking Tape		Commercially Available	Masking
Parting Agent	Rezolin 8300	Hexcel Co., Rezolin Div.	Parting Seals
Firewall Sealant	Dapcocast 18-4	D Aircraft Products Anaheim, CA	Sealing Firewall
Firewall Primer	Dapco 1-100	D Aircraft Products Anaheim, CA	Primer for 18-4
Topcoat Sealing Compound	444R	Products Research & Chemical Co. Glendale, CA	Seal Topcoat
Topcoat Sealing Compound	EC-776 SR	3M Co. St. Paul, MN	Seal Topcoat
Topcoat Sealing Compound	PR-1005L	Products Research & Chemical Co. Glendale, CA	Seal Topcoat

NAME	PART NUMBER	MANUFACTURER	USE
Soft Bristle Brush (Not Nylon)		Commercially Available	General
Stiff Bristle Brush (Not Nylon)		Commercially Available	General
Sealing Gun	250	Semco	Applying Sealant
Nozzle (Polyethelene)		Commercially Available	Sealant Gun
Cartridge (Polyethelene)		Commercially Available	Sealant Gun
Sealant Fairing Tools	See Figure 1	Locally Manufactured	Fairing Sealant
Sealant Removal and Cutting Tools	See Figure 1	Locally Manufactured	Removing and Cutting Sealant
Squirt Bottle (Polyethelene)		Commercially Available	Applying Solvent
Scales (± 2% accuracy)		Commercially Available	Measuring Chemicals
White Cotton Gloves		Commercially Available	Protect Surfaces
Abrasive Paper (Aluminum Oxide)	180 Grit or Finer	Commercially Available	Prepare Surface
Mixer	Model 1394	Semco	Mixing Sealant
Roller		Commercially Available	Applying Sealant

3. **Preparation for Sealing**
   A. Accomplish the following prior to starting work on any sealant application.
      (1) Determine whether any structural repair is necessary and if so, repair in accordance with standard structural repair practices.
      (2) Examine sealing in area of leakage and determine seal level and seal plane in adjacent structure.

      NOTE: The seal plane is defined as being the boundary plane through any assembly of structural items which presents a continuous barrier to the flow of fluids or gases.

      (3) Identify type of sealant used in area of defect.
      (4) Determine type of seal (fillet, faying surface, etc.) which will be required to carry out repair.

      NOTE: Do not interchange sealing compounds. The material originally used has been found to be the most efficient for sealing the area.

      (5) Completely remove or notch sealant in affected area to produce a solid residual material. Cutting tools shall be of hardwood material. Metal cutting tools may cause structural damage. Sealant cutting tools may be locally manufactured. (See figure 1.)
      (6) Examine rework area for clean cuts and adequate notching and for access. Loose chunks or flaps of sealant on cut areas shall be removed.
      (7) Immediately prior to sealant application, remove grease, oil, dirt, and chips from all surfaces to which sealant compound is to be applied. (Refer to 4. Cleaning.)
   B. Prepare fiber reinforced polyester and epoxy laminates that are not severely contaminated as follows:
      (1) This procedure includes laminates which do or do not have the "parting-film (Tedlar)" or "peel-ply (Nylon)" still intact.

      NOTE: If laminate still has "parting-film"or "peel-ply" still intact, do not remove these protective surfaces until absolutely necessary for installation.

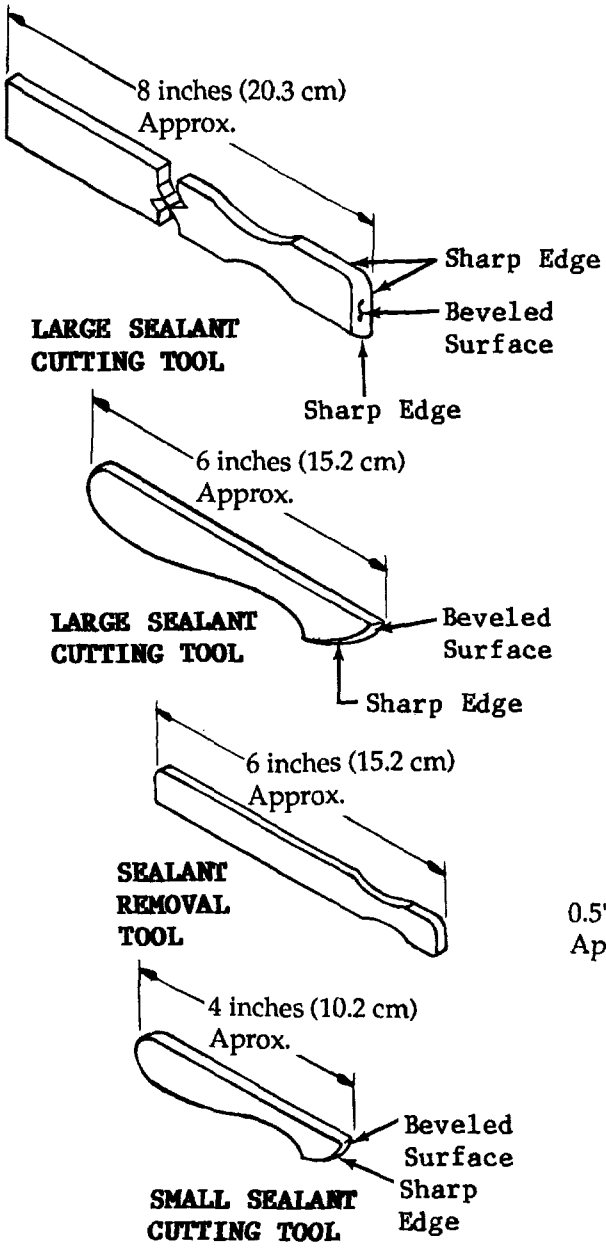
      (2) Wear clean, white cotton gloves, strip "parting-film" or "peel-ply" from surface (if present).

      CAUTION: DO NOT SAND INTO THE FIBER REINFORCEMENT IN THE NON-METALLIC MATERIAL. DO NOT EXPOSE FIBERS.

      (3) Carefully, lightly sand areas with 180 grit, or finer, abrasive paper.

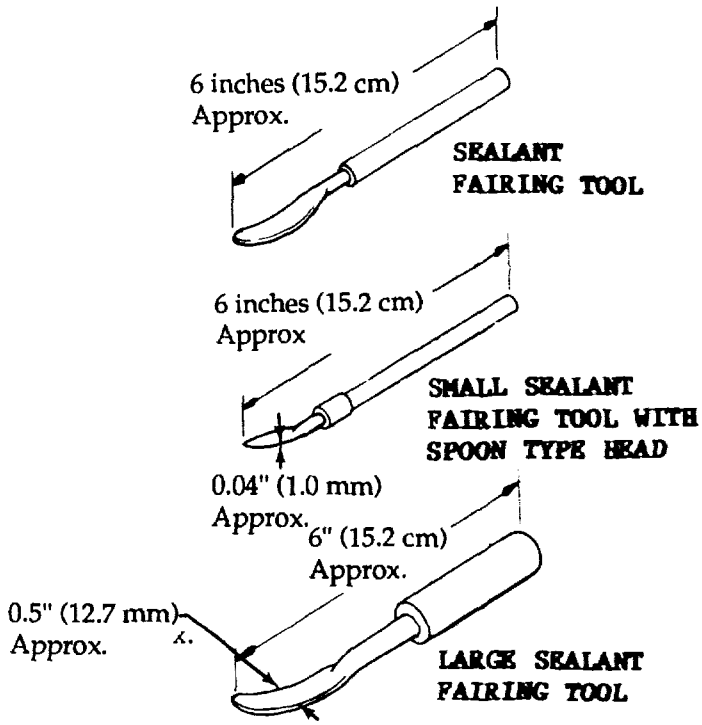
      CAUTION: WIPE OR BRUSH SANDING RESIDUE AWAY FROM CENTER OF SANDED AREA TO PREVENT CONTAMINATING FRESHLY SANDED AREA. DO NOT ATTEMPT TO REMOVE ANY RESIDUE WITH SOLVENT OR COMPRESSED AIR.

      (4) Remove sanding residue completely by vibrating, brushing with a clean brush, wiping with a clean cloth, or any combination of these methods.
   C. Prepare fiber reinforced polyester and epoxy laminates that are severely contaminated as follows:
      (1) This procedure includes laminates which do or do not have the "parting-film (Tedlar)" or "peel-ply (Nylon)" still intact.



NOTE: These tools should be made of hardwood to reduce the possibility of structural damage.

Sealant Cutting Tools



NOTE: These tools may be made of 1/4 inch (0.635 cm) diameter bronze or steel welding rod and may be plated to improve smoothness.

Sealant Fairing Tools

Sealant Cutting and Fairing Tools
Figure 1

NOTE: If laminate still has "parting-film" or "peel-ply" still intact, do not remove these protective surfaces until absolutely necessary for installation. Any contamination should be removed as best possible by wiping with dry cotton cloth. Do not wipe with solvent if "parting-film "or "peel-ply" are still intact.

(2) Hand strip "parting-film" or "peel-ply" from surface (if present).
(3) Thoroughly scrub the laminate with Toluene and clean, white, dry, cotton cloth to remove all contamination. Use another clean, white, dry, cotton cloth, in the other hand, to dry the laminate surface. The solvent must be wiped from the surface before it dries. Continually turn the cloth being used to remove the solvent and contamination so that contamination is not wiped back over the cleaned area. The clean wipe should be made from an already cleaned area onto the cleaning area so as to prevent contamination of an already cleaned area.
(4) Repeat the above procedure until there is no discoloration on the clean drying cloth. Remove all wax or grease pencil markings.

NOTE: •All surfaces shall be thoroughly cleaned prior to sealant application.

•Workers handling cleaned surfaces shall wear clean, white, cotton gloves.

(5) Perform step B. prior to application of sealant.

4. CLEANING
A. Cleaning shall be accomplished immediately prior to sealant application as follows:
(1) Fold cotton cloth in such a manner as to eliminate raw edges to reduce the possibility of lint.
(2) Dampen cloth with cleaning solvent from a polyethylene squirt bottle. The cloth should not be saturated to a point where the solvent drips.

WARNING: SPECIAL PRECAUTIONS SHOULD BE OBSERVED DURING CLEANING. CLEANING SOLVENTS ARE TOXIC AND FLAMMABLE. FRESH AIR MASKS AND/OR ADEQUATE VENTILATION SHOULD BE AVAILABLE IN ALL CLOSED AREAS.

NOTE: Never pour or spray cleaning solvent on aircraft structure. If this is done, the solvent may run back between structure layers, then creep back out again after cleaning operations are completed, bringing contamination to surface previously cleaned.

(3) Thoroughly scrub area to be sealed. Extreme care should be exercised to clean hard-to-reach corners, gaps, etc. A small paint brush or pipe cleaners may be used for these areas. Always clean an area larger than that required for the sealant.
(4) Before solvent has evaporated, wipe area dry with a clean, dry, white, lint-free cotton cloth.
(5) Repeat steps (3) and (4) until no discoloration is evident on drying cloth.

NOTE: If some primer is removed during cleaning, exposed metal surface need not be further treated provided cleaning is accomplished per steps (3), (4), and (5). However, if primer is completely removed, reprime surface after completion of all sealing.

(6) After surfaces are thoroughly cleaned, personnel should wear clean, lint-free, white, cotton gloves to prevent surface contamination.

B. Clean acrylics as follows:

CAUTION:
- **EXTREME CAUTION MUST BE USED TO ENSURE THAT THE ACRYLIC SURFACE IS ABSOLUTELY DRY BEFORE BEGINNING SEALING.**
- **DO NOT USE SOLVENT OTHER THAN ALIPHATIC NAPTHA (FEDERAL SPECIFICATION TT-N-95, TYPE II). CRAZING MAY OCCUR.**

(1) Clean acrylic surfaces in accordance with step A.

5. TYPES OF SEALS

A. Fillet Sealing (See figure 2.)
   (1) Fillet sealing is the application of a bead of sealant to cover seams or joints. The dimensions shown represent typical finished fillet shapes for various applications. Fillets should conform to the dimensions as near as possible since the shape of a fillet determines its service life.

B. Injection Sealing (See figure 3.)
   (1) Injection sealing is the filling of holes or channels by forcing sealant through the void or cavity. Injection seals may be applied to provide continuity where fillet seals are interrupted by structure. Holes, joggles, and channels along seams which are to be fillet sealed are also injected full of sealant to provide a backup seal to support the primary fillet seal. Injection sealing acts to force air out of a cavity and to fill the vacant space with a solid block of sealant.

C. Faying Surface Sealing (See figure 4.)
   (1) Faying surface sealing is the sealing of two flat surfaces fastened together, one on top of the other, before the parts are assembled. This type of sealing is used especially to seal areas that are hard or impossible to seal after assembly.

D. Pre-Pack Sealing
   (1) Pre-pack seals are used to fill voids in structure which cannot be reached by the injection method. These voids are packed with sealant before they are closed by the assembly of structure.

E. Fastener Sealing (See figure 5.)
   (1) Fastener sealing is the application of a fillet seal over fasteners such as rivets, bolts, nuts, nutplates, and rivets.

F. Hole and Slot Sealing
   (1) Tooling and coordination holes are closed with soft rivets except when one side is not accessible; in that case, they are sealed. Sealant is also used for plugging joints, gaps, joggles, and holes provided their size does not exceed the specification limits shown. All sealing is done on the pressure side. This ensures that pressure will hold the seal in place.

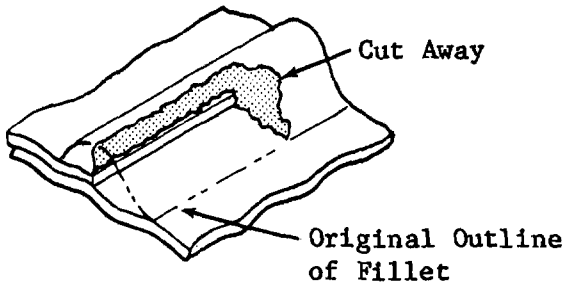
6. GENERAL APPLICATION REQUIREMENTS

A. Sealant shall not be applied at temperatures below 60°F (15.6° C)or to structure that is below 60°F (15.6° C).

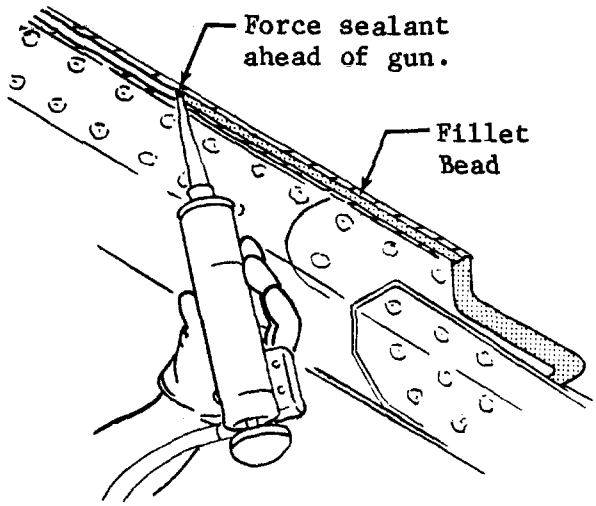
B. As a general rule, repair sealant shall not be added to areas or parts which were not originally sealed. If the source of a leak appears in an area which was not originally sealed, the cause of the leak is probably failure of a prepack or faying surface seal that is not visible. Application of additional sealant would only temporarily stop the leak. A study of the surrounding structure should be made for hidden seals. As an option to replacing a failed pre-pack, injection, or faying surface seal, the failed seal may be isolated by raising (relocating) the seal plane. Raising the seal plane can involve an extensive amount of sealant addition; so, in many cases, structure removal and replacement of the failed seal will be the best action.

C. Sealant in the integral fuel tanks shall be applied over epoxy primer finish. Do not apply epoxy primer over sealant.

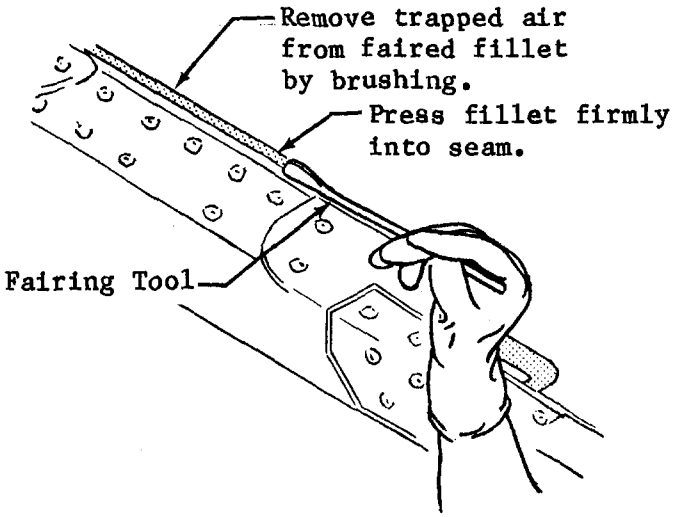
D. Do not move or handle sealant structure, other than faying surface seals, until the sealant is tack free.



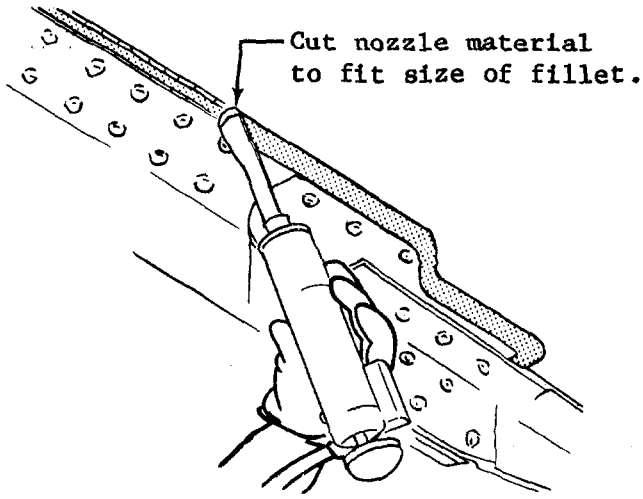
Fillet Seal Removal



Application of First Fillet

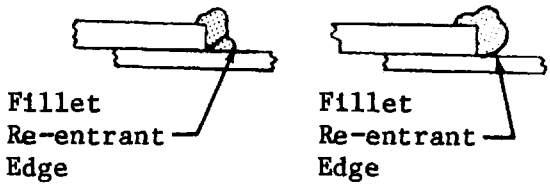


Pressing First Fillet Into Seam

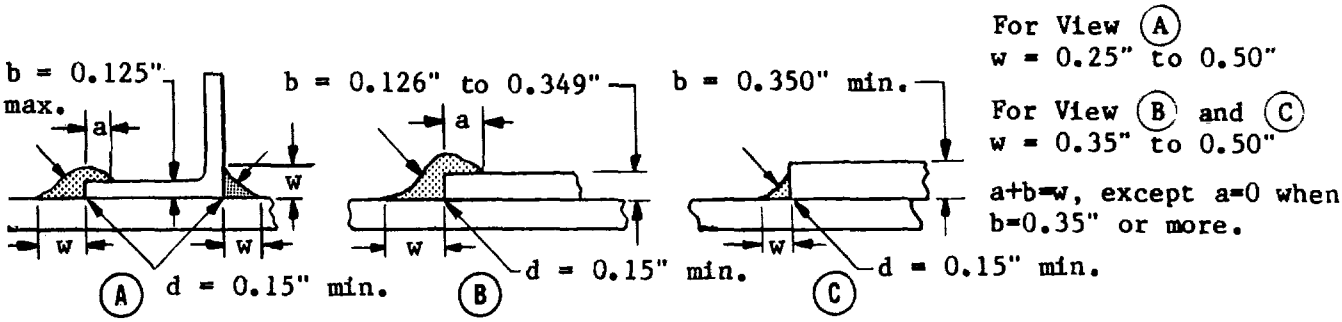


Application of Final Sealant

Fillet Sealing
Figure 2 (Sheet 1 of 2)

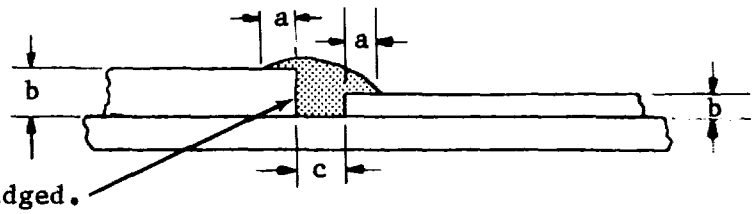


Re-Entrant Fillet



Fillet Dimensions

a=0.15" min., except
a=0 when b and c=0.35"
or more.



Gap must be filled, not bridged.

Butt Joint Fillet Dimensions

Fillet Sealing
Figure 2 (Sheet 2 of 2)

E. Sealing compounds must be properly prepared and applied. Application of sealant is a noninspectable item as the quality of work cannot, in most instances, be immediately determined upon completion. Therefore, close attention to details and faithful accomplishment of the functional steps of the repair in the proper order are most essential.

F. Directions for mixing sealing compounds, sealant work life, and the time it takes for the sealant to cure must all be carefully supervised.

G. It must be remembered that if all preparation work is done properly and then the sealant is applied to a surface that is not properly cleaned, the sealing will not be satisfactory as the sealant will never adhere to a dirty surface.

H. Repair of failed sealant is not a speedy operation. Less manhours will be expended in the long run if ample time is allowed to properly examine and repair the sealant. Effective original repairs will alleviate repetitions and prevent sealing difficulties.

7. SEALANT MIXING

A. Brushable sealant Pro Seal 890 (Class A) can be mixed in any quantity desired but, unless refrigeration facilities are available for storage, mix only as much as required for the work at hand. A balance scale with graduated weights should be available for mixing unless the small kits with the proper amount of accelerator and sealant in one package are used. All equipment used in the mixing process must be clean.

(1) Place approximate amount of base compound to be used on scale and balance with weights.

(2) Add additional weights to give accelerator-to-base compound ratio as called out on manufacturer's sealant container.

(3) Balance scale by adding accelerator, placing accelerator on top of base compound.

CAUTION: **USE CARE TO AVOID INCORPORATING AIR INTO SEALANT DURING MIXING PROCESS. BE SURE THAT THE SEALANT IS MIXED UNTIL NO STREAKS OR AREAS OF NON-UNIFORM COLOR REMAIN.**

(4) Thoroughly mix accelerator and base (minimum of 5 minutes) until sealant of solid uniform color is obtained.

NOTE: Always use accelerator with base compound from same repair kit. Do not mix accelerator from one repair kit with base compound from another kit.

(5) Place sealant in tube or can which has been cleaned with methyl ethyl ketone. Sealant is now ready for use.

B. Extrusion gun or faying sealant, Pro Seal 890 (Class B or C), can be mixed in any quantity desired but, unless refrigeration facilities are available for storage, mix only as much as required for work at hand. All equipment used in the mixing process must abe clean.

(1) Mix sealant in accordance with manufacturer's instructions.

C. Firewall sealant, Dapcocast 18-4, can be hand mixed in any quantity desired. But, unless refrigeration facilities are available for storage, mix only as much as required for work at hand.
   (1) Add accelerator to base at the ratio of seven parts accelerator, by weight, to 100 parts base, by weight.
   (2) Thoroughly mix accelerator and base until sealant is uniform in color and viscosity.

   NOTE: Always use accelerator with base compound from the same repair kit. Do not mix accelerator from one kit with base compound from another kit.

8. METHOD OF APPLICATION
   A. Sealant material may be applied with a brush, an extrusion gun, or a spatula. Each method works best in a particular situation. The following paragraphs describe these methods and the situations in which they are used.
      (1) A stiff-bristled brush (not nylon) is used to apply the precoat of class A sealant. Sealant should be brushed thoroughly onto the surface and into the joint which is to be sealed.
      (2) Fillet, faying surface, and pre-pack seals may be applied with an extrusion gun. Injection seals must be applied with an extrusion gun. The extrusion gun uses air pressure to force the sealant material through a nozzle onto the surface or into the cavity to be sealed. Nozzles are available in different sized beads of extruded sealant. The nozzle tips may be shaped locally to produce a bead of sealant with the shape and dimensions to fit a specific job.
      (3) A spatula is used to spread sealant material for faying surface and pre-pack seals. Small repair fillet seals may be applied with a spatula if an extrusion gun is not available.

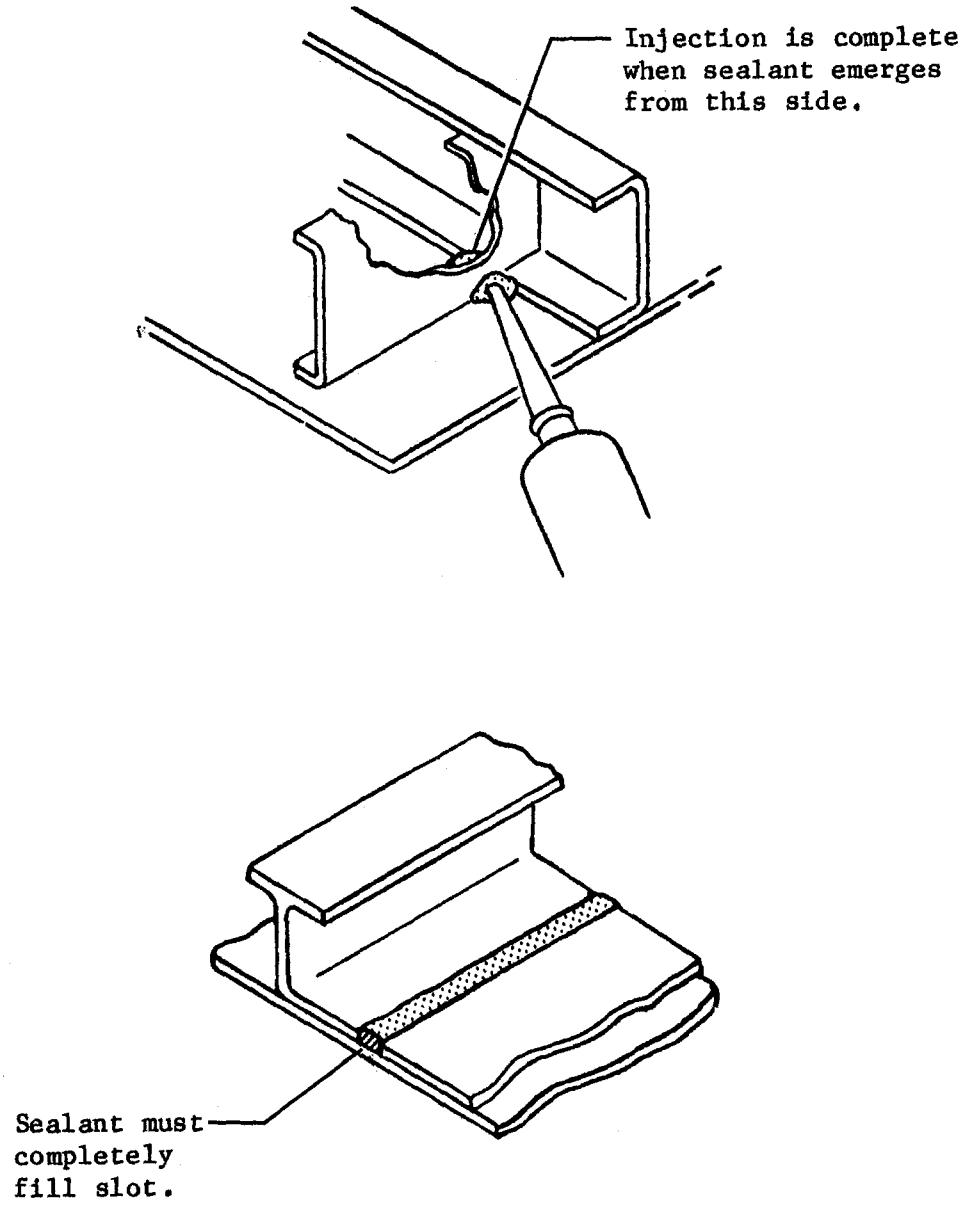
9. FILLET SEALING
   A. Repair Fillet Seal (See figure 2.)
      (1) Use sealant cutting tools similar to those shown in figure 1.
      (2) Cut fault section from fillet. Slope cuts at ends of section so that new sealant will lap remaining portions of old fillet in these areas. Avoid abrupt changes in cross section.

      NOTE: Remove enough sealant on both sides of defective area to be sure that remaining material is satisfactory.

      (3) Examine all cut surfaces. Remove loose cuts or flaps. Make sure that no faulty sealant remains. If fillet adhesion is good, it is not necessary to cut sealant down to bare metal.
      (4) Refinish damaged surface, if necessary.
      (5) Clean surface to be sealed.

      NOTE: If epoxy finish is removed in the fuel area during cleaning operation, it is permissible to seal directly over the bare metal. Touch up exposed areas after the sealant has been applied. Epoxy finish is not to be applied over sealant.

      (6) Apply new fillet seal.
   B. Repairing Fillet Sealed Fasteners
      (1) Leaking fastener fillet seals are repaired by replacing the faulty sealant. Proceed as follows.
      (2) Using a sealant cutting tool, cut around seal at base of fastener to separate sealant from structure.
      (3) Grasp seal with pliers and pull up away from fastener end. Most of seal should be removed by this process.
      (4) Cut away remaining sealant with cutting tool. Small quantities of sealant which adhere firmly to fastener need not be removed.



Injection Sealing
Figure 3

NOTE: Tightening fasteners during or after sealing destroys sealant effectiveness.

(5) Clean fastener and surrounding area with cleaning solvent.
(6) Using an extrusion gun or spatula, apply a coat of Type B sealant around and over fastener.
(7) Work sealant with fairing tool until fillet seal dimensions given in figure 2 are obtained.
(8) Use extreme care to eliminate any visible voids or bubble areas around the fastener base.

C. Apply New Fillet Seal (See figure 2.)
(1) Prior to fillet sealing, all fasteners in the area to be sealed must be installed. All bolts must be torqued to their respective values as retorquing is not permitted after sealing. The proper nozzle for the sealing gun must also be used. If a small fillet is to be applied, use a small nozzle; a large fillet requires a large nozzle.
(2) With extrusion gun, apply a small fillet of Class B sealant as shown in figure 2.
(3) When a nozzle tip is used, point it into the seam and maintain nearly perpendicular to the line of travel.

CAUTION: SEALANT MUST BE APPLIED CAREFULLY TO AVOID TRAPPING AIR IN FILLET. OPERATE GUN SO THAT A BEAD OF SEALANT IS CONTINUALLY FORCED AHEAD OF NOZZLE TIP IN THE DIRECTION OF NOZZLE TRAVEL.

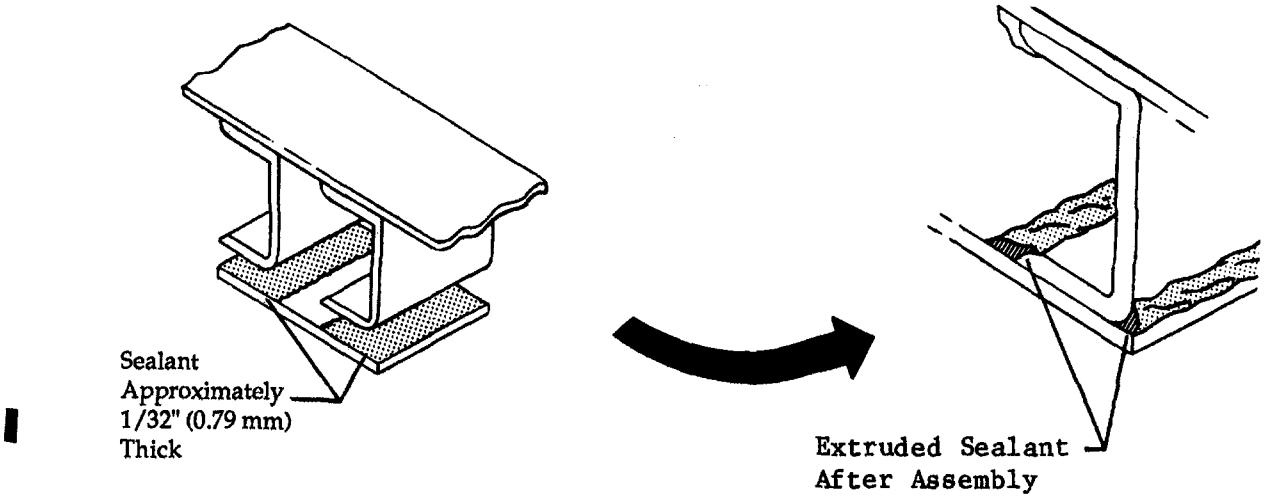
(4) Using a fillet fairing tool, press the first fillet firmly into position as shown. Work the entire beaded section.

CAUTION: CHECK THAT THE FAIRING TOOL IS ABSOLUTELY CLEAN. USE NO SOLUTION OR LUBRICANT TO MAKE IT SLIDE SMOOTHLY OVER THE SEALANT. WIPE THE TOOL WITH CLEAN GAUZE FREQUENTLY TO AID IN THE FAIRING OPERATION.

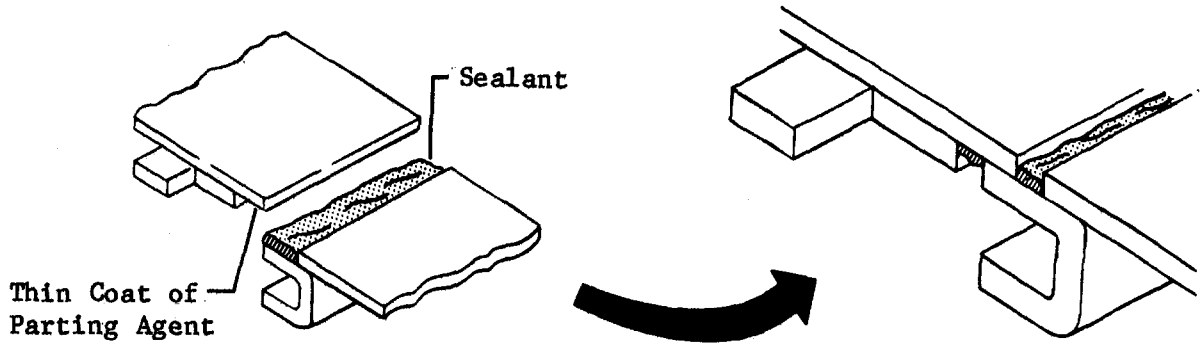
(5) If the first fillet has cured but is not clean, then it must be cleaned before the application of the second fillet.
(6) Apply the second application of Class B sealant to produce a full bodied fillet as shown. A larger nozzle will be required than was used for the first fillet. If an extruded nozzle head is used, make cuts in nozzle to fit fillet and make it conform to the dimensions given in figure 2. If extruded head nozzle is not used, use a fairing tool as required to make sealant conform to the full-bodied fillet dimensions.

NOTE: Keep the sealing gun nozzle right on the work to prevent inclusion of air bubbles between fillets. Do not hurry. Good sealant application requires patience as well as proper technique. If a fillet extrusion head is used, the head shall be pressed firmly against the part in such a position that the maximum thickness of the fillet will be directly over the edge.

(7) Work out any evident air bubbles.
(8) Fillet re-entrant edges are not acceptable.
(9) A typical finished fillet seal with dimensions is shown in figure 2.

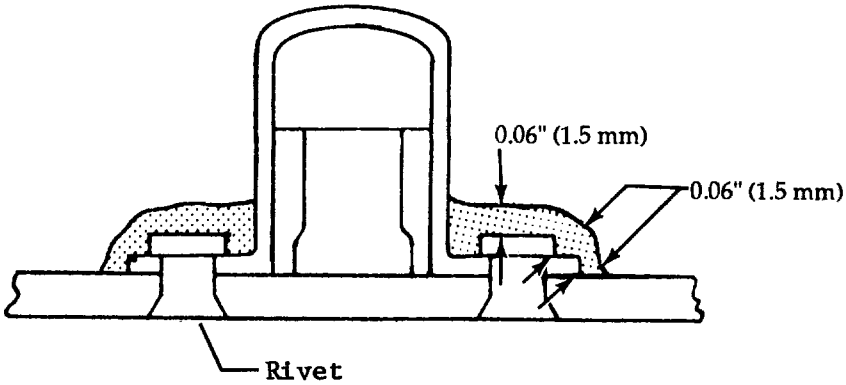


PERMANENT SEAL

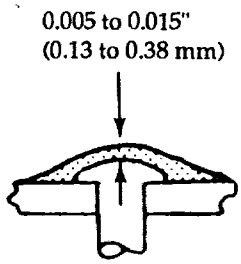


REMOVABLE SEAL

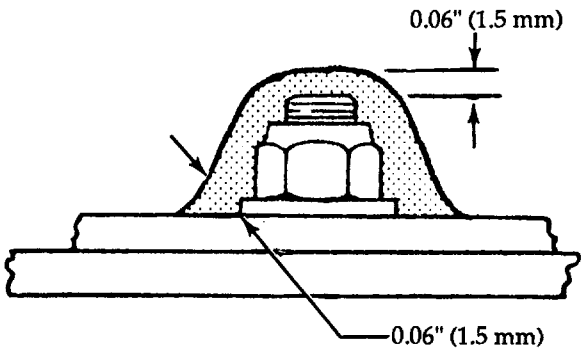
Faying Surface Sealing
Figure 4



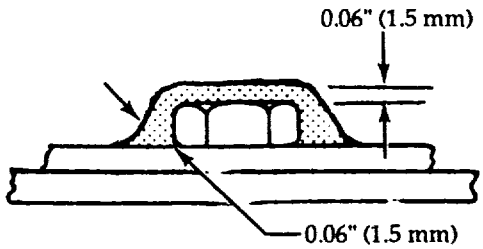
Dome Type Nutplate



Rivet



Nut and Thread



Bolt Head

Fastener Sealing
Figure 5

10. Injection Sealing

A. Repair Injection Seal

(1) Remove sealant from short injection channels with a hooked wire and small cutting tools. Longer injection channels require disassembly of structure.

(2) Clean injection channel all the way through since trapped air will prevent complete filling of the channel with sealant.

(3) Exercise care so that structure is not damaged during the removal process.

(4) Clean channel with cleaning solvent and pipe cleaners.

(5) Apply solvent with saturated pipe cleaner or brush. Wipe surface dry with pipe cleaner. Repeat until drying cleaner remains clean.

(6) Clean channel at least once more after visible evidence of impurities has been removed and the surfaces are thought to be clean.

(7) Apply new injection seal.

B. Apply New Injection Seal (See figure 3.)

(1) To apply a new injection seal, a fairing tool, pipe cleaners, and an extrusion gun with an injection nozzle attached are required.

(2) Ensure that channel is thoroughly cleaned.

(3) Inject channel full from one end only with Class B sealant until sealant emerges from all other openings. Completely fill joggles and channels that require continuity of seal or block off seal.

CAUTION: **BE SURE GUN HAS ENOUGH SEALANT TO MAKE COMPLETE SEAL AT ONE INJECTION WITHOUT ANY BREAK. STOPPING AND STARTING WILL CAUSE AIR BUBBLES IN SEAL AND IS CAUSE FOR REJECTION OF JOB.**

(4) Remove excess sealant with fairing tool and smooth out ends of seal.

(5) Inspect finished job, checking for poor adhesion and air bubbles. Any air bubble is cause for rejecting a seal. Rework only area that has bubbles.

(6) Check that the area where the sealant protrudes into the fillet seal area has no abrupt changes in section. Sealant must be faired out gradually into the area that is to be fillet sealed.

11. Faying Surface Sealing

A. Repair Faying Surface Seal (See figure 4.)

(1) Disassemble structure surrounding seal.

(2) Remove all sealant from faying surfaces with sealant cutting tools and suitable plastic scrapers.

(3) Refinish damaged surface.

(4) Complete all preassembly operations such as hole drilling and burr removal prior to sealing.

NOTE: Drilling, reaming, and countersinking through uncured faying surface sealing is allowed provided parts are **adequatly clamped** together to keep chips and burrs out of mating surfaces.

(5) Clean faying surfaces with cleaning solvent.

(6) Apply a coat of Class B sealant to one faying surface with a roller, an extrusion gun, or a spatula. Spread the sealant over the entire surface to obtain a uniform coating.

(7) Removable seals shall be applied with the use of a parting agent. The parting agent shall be applied to one surface. Paint shall be omitted from this surface. When the parting agent is dry to the touch, the parts may be assembled with a faying surface seal. If the part is removed, the sealant shall be removed, new parting agent applied, and resealed.

(8) Assemble parts within sealant work life.

NOTE: Sufficient sealant must be applied to ensure a continuous extrusion on both sides of the joint after assembly of the faying surfaces.

12. Pre-pack Sealing

A. Failed pre-pack and faying surface seals are normally repaired by raising the seal plane to isolate the failed seal from fuel. As an option, the structure surrounding the faulty seal can be disassembled, a new seal applied, and the structure reassembled. To replace a failed pre-pack seal, proceed as follows:

(1) Disassemble structure surrounding seal.

(2) Remove all sealant from pre-packed cavity with sealant cutting tools and suitable plastic scrapers.

(3) Complete all preassembly operations such as hole drilling and burring. Use only BOELUBE or LPS-1 lubricants for preassembly drilling or burring operations.

(4) Clean parts with cleaning solvent.

(5) Apply a coat of Class B sealant to one of the parts. Shape sealant with a fairing tool to the general contours of the cavity.

NOTE: Sufficient sealant must be applied to ensure complete filling of the cavity.

(6) Assemble parts within sealant work life.

13. Fastener Sealing

A. Seal nutplates, nuts, bolts, and rivets as follows: (See figure 5.)

(1) Clean fastener and area around fastener.

(2) Using an extrusion gun or spatula, apply Class B sealant around fastener. When sealing nutplates, ensure that attaching rivets are sealed.

(3) Work sealant with a fairing tool to obtain fillet seal dimensions shown.

(4) Use extreme care to eliminate any visible voids or bubble areas around base of fastener.

14. Firewall Sealing

A. Seal firewall with Dapcocast sealant as follows:

(1) Clean surfaces to be sealed in accordance with paragraph 4.

(2) Brush a uniform, thin coat of Dapco (1-100) primer on all surfaces to receive firewall sealant. Allow primer to air dry for at least one hour at room temperature or until a dull red color develops.

NOTE: Primer containers should be kept tightly sealed when not in use.

(3) Apply Dapco sealant to primed surfaces with extrusion gun or spatula. Allow sealant material to air dry at least 72 hours before applying heat.

15. Fastener Sealing - Wet-to-Wet Areas

A. Seal fasteners in wet-to-wet areas as follows:

(1) Clean surfaces to be sealed in accordance with paragraph 4.

(2) Apply topcoat sealing compound with a soft bristle brush. Sealing compound shall cover both ends of fastener protrusion plus 0.25 inch (0.635 centimeter) all around fastener onto surrounding structure.

16. **Protection of Sealing Material**

CAUTION: **SEALING MATERIALS SHALL BE KEPT FREE OF CONTAMINATION BY DIRT, METAL CHIPS ETC., WHILE TACKY.**

NOTE: For pressure and weather sealing only, sealant may be kept free of contamination by coating with epoxy primer.

17. **Curing - Class B Sealants**

A. Application time, tack-free time, and cure time for Pro Seal 890 (Class B) sealants are as given below:

Military Specification	Class	Application Time (In Hours)	Tack Free Time (In Hours)	Cure Time (In Hours)
BMS 5-44	B-1/2 B-2	1/2 2	4 24	6 48
MIL-S-8802	B-1/2 B-2 B-4	1/2 2 4	10 40 48	30 72 90

NOTE: The times listed above are for "standard" conditions of 77° (± 2°)F (25°, ± 1.1° C) and 50% (± 5%) relative humidity. Times will be extended by reduced temperature and/or reduced humidity. Times will be reduced by increased temperature and/or increased relative humidity.

18. **Accelerated Curing**

A. Curing of sealants may be accelerated by circulating warm air over the sealant and adjacent structure (not to exceed 140°F [60° C] sealant temperature) and/or increasing the relative humidity of the air.

1. Application of Adhesives

A. Classification
- (1) Class I - Synthetic Type Adhesive
  - (a) Used for cementing rubber, flexible plastics, and fabrics.
- (2) Class II - Epoxy Type Adhesive, Structural, Room Temperature Cure
  - (a) Used for cementing rigid plastics, woods, and metals.
- (3) Class III - Silicone Type Adhesive
  - (a) Used for cementing silicone rubber.
- (4) Class IV - High Strength Silicone Type High Temperature Adhesive (Red)
  - (a) Used for cementing silicone rubber for high temperature and high strength applications.
- (5) Class V - High Strength Silicone Adhesive (Gray)
  - (a) Used for cementing silicone rubber where gray color is desired.
- (6) Class VII - Epoxy Type Adhesive, Non-structure, Room Temperature, Fast Cure
  - (a) Used for cementing plastics, woods, and metals.

B. Adhesives
- (1) Class I - Adhesives

EC-776	EC-847
EC-1300	EC-1359
EC-1368	EC-1781
EC-4500	EC-5034
No. 88	EC-1357 - 8 oz. Screw-Top Can with Brush-Top

- (2) Class II - Adhesives
  EC-2216; Mfg.: 3M
  EA 9330.3; Mfg.: Hysol Division, The Dexter Corp., Pittsburg, Ca
- (3) Class III - Adhesives
  Silastic 732 RTV (White,Translucent, or Black); Mfg.: Dow Corning Corp., Midland, Mich.
  Silastic 737 RTV - Clear; Mfg.: Dow Corning Corp., Midland, Mich.
  Silastic 739 RTV - White or Black; Mfg.: Dow Corning Corp., Midland, Mich.
  RTV-102 - White; Mfg. General Electric, Waterford, NY
  RTV-103 - Black; Mfg.: General Electric, Waterford, NY
  RTV-108 - Translucent; Mfg.: General Electric, Waterford, NY
  RTV-106 - Red; Mfg.: General Electric, Waterford, NY
  Rhodorsil CAF 410 - White or Clear; Dist.: Thomas B. Moore Co., Inc., Maryland Heights, MO
  Primer
  1200 Primer; Mfg.: Dow Corning Corp.,Midland, Mich.
- (4) Class IV - Adhesives
  RTV-156 or RTV-159 (Red); Mfg.: General Electric, Waterford, NY
  Rhodorsil CAF 430T (Red); Dist.: Thomas B. Moore Co., Inc., Maryland Heights, MO
- (5) Class V - Adhesives
  RTV-154 or RTV-157 (Gray); Mfg.: General Electric, Waterford, NY
  3145 RTV - Gray; Mfg.: Dow Corning Corp., Midland, Mich.
- (6) Class VII - Adhesives
  3501 B/A (Gray); Mfg.: 3M Company

C. Precautions
- (1) In almost every case involving an unsatisfactory bond, the cause of the failure can be attributed to one or more of the following errors:
  - (a) Use of wrong adhesive.
  - (b) Use of old or contaminated adhesive.
  - (c) Improper cleaning or lack of cleaning.

(d) Mating surfaces placed together too quickly. (Class I adhesives)
(e) Improper cure.
(f) Improper fixturing.
(g) Slipshod or poor technique.

(2) Use care to ensure that the preceding errors are avoided and that the following procedures are followed explicitly.

D. Surface Preparation

(1) All non-metallic and non-porous surfaces shall be roughened with sandpaper or buffed with a fine wire wheel, except on materials where sanding or buffing is detrimental.

(2) All surfaces to be cemented shall be thoroughly cleaned, free of oil, grease, soapstone, dirt, chips, etc., by means of a clean cloth which has been dampened with MEK or other suitable cleaning solvent. When all contaminates have been removed and while the surface is still wet with solvent, wipe the surface dry with a clean cotton cloth.

(3) Zinc chromate primer must be removed from the surface to be cemented except in areas particularly inaccessible because of structure or if the bond is supplemented with a mechanical type fastener. Use a clean cloth dampened with cleaning solvent to remove the primer. Clean areas after removing primer.

(4) Epoxy primer need not be removed from the surface to be cemented. To improve adhesion, the epoxy may be lightly scuffed with 400 grit abrasive paper. Clean area per paragraph C.(2).

(5) Do not remove primer or chemical surface treatment from magnesium parts to be cemented. Do not wire brush, sand, or otherwise mechanically clean in any way that will remove the protective finishes from magnesium parts. Cleaning of the primer surface with a clean cloth dampened with cleaning solvent followed by a dry wipe before solvent evaporation will ensure adequate adhesion.

E. Application of Class I Adhesive

(1) Apply a spray or brush coat of the proper adhesive per Table I to each clean, dry surface to be bonded.

NOTE: Be sure and check manufacture data sheet prior to spray application; all adhesives are not recommended for spray application.

Material	Adhesive
Chloroprene or Neoprene Rubber	EC-1300 or EC-1368
Buna N Rubber	EC-776 or EC-1368
Chloroprene or Neoprene Coated Fabrics	EC-1300 or EC-1368
Buna N Coated Fabrics	EC-776 or EC-1368
Vinyl Coated Fabrics	EC-1359 or EC-847
Flexible Plastics	EC-847 or EC-1368
Leather and Fiberglass Parts	EC-847 or EC-1368
Flexible Foams	EC-4500
Water Base General Purpose	EC-5034
Vinyl Fabric (When non-staining is required)	EC-1781

TABLE 1 - REQUIRED CLASS 1 ADHESIVE FOR VARIOUS MATERIALS

NOTE: 3M No. 88 Adhesive may be substituted for EC-1368 when aerosol spray is desired.

(2) Fabric or fibrous materials may require more than one coat of adhesive because of porosity. If more than one coat of adhesive is required allow the first coat to dry tack-free at least 30 minutes before the second coat is applied.

(3) The cemented surfaces shall be permitted to air dry until most of the solvent has evaporated and the adhesive exhibits an aggressive tack. This requires from five to ten minutes or longer depending upon temperature and humidity. However, this point can be determined by the touch of a clean knuckle against the cement. If the adhesive adheres to the knuckle, but there is no transfer of adhesive to the knuckle, the bond can then be made.

(4) Place mating surfaces together and effect the bond under a firm, even pressure, using a metal roller or similar tool. Care should be taken to ensure that no air is trapped between mating surfaces. The bond is greatly improved by clamping or weighting during drying period.

(5) Cemented assemblies shall be air-dried at room temperature for a minimum of 24 hours before removing clamps or weights.

F. Application of Class II Adhesive

(1) Adhesive (EC-2216) shall be mixed as follows:

(a) Add 100 parts by weight of EC-2216B (White) to 140 parts by weight of EC-2216A (Gray) and thoroughly mix until the components blend to a uniform medium gray paste.

(2) Adhesive (EA 9330.3) shall be mixed as follows:

(a) Add 33 parts by weight of EA 933.3 Part B (Light Yellow) to 100 parts by weight of EA 9330.3 Part A (Gray) and thoroughly mix until the components blend into a uniform gray paste.

(3) The potential life of mixed adhesive is approximately two hours at room temperature (77° F [25° C]).

(4) Ensure that adhesive is in 100% contact with both surfaces to be bonded. The adhesive can be applied to cleaned surfaces with a spatula, trowel, or other suitable equipment. Place bonding surfaces together and clamp as required to prevent movement of parts. Parts may be handled after bond has cured at room temperature for 24 hours. Full cure is achieved at room temperature in 7 days. An accelerated full cure can be achieved by heating for two hours at 180°F (82.2° C) or one hour at 250°F (121.1° C).

(5) Minimum bond line thickness shall not be less than 0.002 inches (0.051 mm).

G. Application of Class III Adhesives

(1) Thoroughly clean the surface to be primed. Brush a uniform thin coat of primer on the non-silicon rubber surfaces to be bonded and allow primer to air-dry for at least 30 minutes at room temperature.

(2) Thoroughly clean the silicon rubber surfaces to be bonded. Spread a uniform layer of adhesive 0.001 to 0.002 inch (10 to 20 mils [0.0254 to 0.0508 millimeter]) thick on one of the surfaces to be bonded. Press surfaces together. Use enough pressure to displace the air, but not so much that the adhesive is forced out of the joint. Maintain at least a 0.01 inch (10-mil [0.254 millimeter]) thickness of adhesive for best results.

(3) Parts may be handled after bond has cured at room temperature for 24 hours. The cure continues for several days after adhesive has become dry and rubbery to the touch. The odor of acetic acid will be present until the cure is complete. Bond strength continues to increase until acetic acid odor disappears. Parts shall not be heated to accelerate cure.

NOTE: Because adhesive cures on exposure to air, the tube must be kept tightly closed when not in use. A plug of cured material may form in the tip of the tube during storage. This is easily removed and does not affect the remaining adhesive.

H. Application of Class IV Adhesives

(1) Thoroughly clean the surfaces to be bonded. Spread a uniform layer of adhesive 0.007 to 0.015 inch (7 to 15mils [0.178 to 0.381 millimeter]) thick on one of the surfaces to be bonded. Use enough pressure to displace the air, but not so much that the adhesive is forced out of the joint. Maintain at least a 0.005 inch (5 mil [0.127 mm]) thickness for best results. Parts may be handled after the bond has cured at room temperature for at least 24 hours. The cure continues for several days after the adhesive has become dry and rubbery to the touch, and the odor of acetic acid will be present until the cure is complete. Bond strength continues to increase until acetic acid odor disappears. Higher temperature and humidity may be used to accelerate the cure.

I. Application of Class V Adhesives
(1) Thoroughly clean surfaces to be bonded. Spread a uniform layer of adhesive 0.007 to 0.015 inch (7 to 15 mils [0.178 to 0.381 millimeter) thick on one surface to be bonded. Use enough pressure to displace air, but not so much that adhesive is forced out of joint.
(2) Maintain at least a 0.005 inch (5 mil [(0.127 millimeter]) thickness for best results. Parts may be handled after the bond has cured at room temperature for 24 hours. The cure continues for several days after the adhesive has become dry and rubbery to the touch, and the odor of acetic acid will be present until cure is complete. Bond strength continues to increase until acetic acid odor disappears.
(3) Higher temperature and humidity may be used to accelerate cure.

NOTE: Because adhesive cures on exposure to air, the tube must be kept tightly closed when not in use. A plug of cured material may form in the tip of the tube during storage. This is easily removed and does not affect the remaining adhesive.

J. Application of Class VII Adhesives
(1) Add 10 parts by volume of 3501 Part B (White) to 10 parts by volume of 3501 Part A (Black) and thoroughly mix until the components blend into a gray paste.
(2) Add 10 parts by weight of 3501 Part B (White) to 11 parts by weight of 3501 Part A (Black) and thoroughly mix until the components blend into a gray paste.
(3) The pot life of 0.71 ounce (20 grams) of mixed 3501 B/A is approximately 7 minutes at 75° (23.9° C) room temperature. Any combination of higher temperature, excessive mixing agitation, and/or greater mass of material will lessen the work life.
(4) The adhesive should be applied to 100% of both surfaces to be bonded that have been properly cleaned. Materials may be applied with spatula, notched trowel, or other suitable equipment.
(5) Place the adhesive coated surfaces together and fixture as required to prevent movement of the bond joint.
(6) Handling strength will be obtained in approximately 20 to 30 minutes at room temperature. Full cure will be obtained in approximately 24 hours at room temperature.
(7) Minimum bond line thickness shall not be less than 0.005 inch (5 mils [0.127 millimeter]).

FOAM AND FIRE RETARDANT - MAINTENANCE PRACTICES

1. **Removal/Installation**
   A. Tools and Equipment

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Froth-Pac	FP-12.0	Insta-Foam Products Joliet, IL	Thermal and sound insulation.
Fire Retardant Coating, Water Borne	998-501	Pratt & Lambert Inc. Wichita, KS	Coat foam.
Methyl-Ethyl-Ketone (MEK)	Spec. TT-M-261	Commercially Available	Cleaning.
White or Clean Cotton Cloth		Commercially Available	Cleaning.
Brush (Stiff Bristled)		Commercially Available	Cleaning.
Brush (Soft Bristle, Throw-away)		Commercially Available	Applying fire retardant.
Trowel		Commercially Available	Trimming foam.
Vacuum Cleaner		Commercially Available	Removing foam chips, etc.

B. Apply Foam to Door Areas

NOTE: All surfaces that are to receive foam shall be primed. (Refer to 20-55-00.) Areas in which the primer has been removed shall be touched up before foam application.

(1) Clean area to be foam insulated with MEK and clean cotton cloth. Dry thoroughly.
(2) Apply foam to area according to manufacturer's instructions.
   (a) Fill area being sealed to depth of surrounding foam, 3/4 (±1/4) inch, on doors. Foam shall not interfere with door mechanisms.
(3) After foam has hardened, trim excess foam with trowel.
(4) Thoroughly clean area of foam chips, etc. with a vacuum cleaner and stiff bristle brush.

C. Apply Fire Retardant Coating
(1) Using a soft bristle brush, evenly coat new foam with as thin a coat of retardant as possible, ensuring all pin holes are filled. Allow fire retardant coating to air dry for one (1) hour.

NOTE:
- Fire retardant coating seals foam, preventing it from absorbing oil, water, and etc.
- Areas which show pin holes may be touched up.

(2) Return aircraft to normal.

SOLVENT CLEANING - MAINTENANCE PRACTICES

1. **Cleaning/Painting**
   A. Solvent Cleaning (See Tables 201, 202, and 203.) *(1239M)*

      NOTE: Solvent cleaning shall be accomplished immediately prior to the process for which the cleaning is required.

      This section establishes the requirements and procedures applicable to hand-wipe solvent cleaning of metals and non-metals.

      (1) Acquire necessary tools and equipment.

      NOTE: The following materials have been found to be the most effective in their application and must not be interchanged.

NAME	PART NUMBER	MANUFACTURER	USE
Methyl Propyl Ketone (MPK)		Eastman Chemical Kingsport, TN	See Tables 201 and 202.
Isopropyl Alcohol (IPA) TT-I-735 Grade A or B		Commercially Available	See Tables 201 and 202.
Naphtha (Aliphatic) TT-N-95 Type II		Commercially Available	See Tables 201 and 202.
Acrysol		Kent Industries Cleveland, OH	See Tables 201 and 202.
Denatured Ethyl Alcohol AMS 3002		Commercially Available	See Tables 201 and 202.
Desoclean 110		Courtaulds Aerospace Glendale, CA	See Table 201.
FCC-55		Van Waters & Rogers Kirklan, WA	See Table 201.
Mineral Spirits TT-T-291 Type I		Commercially Available	See Table 201.
AVL Electro Contact Cleaner		Aviation Laboratories Houston, TX	See Table 201.
No Flash Electro Contact Cleaner		LPS Laboratories Tucker, GA	See Table 201.
Electro 140 Contact Cleaner		LPS Laboratories Tucker, GA	See Table 201.
Super 140 Cleaner/Degreaser		LPS Laboratories Tucker, GA	See Table 201.

NAME	PART NUMBER	MANUFACTURER	USE
A-151 Cleaner/Degreaser		LPS Laboratories Tucker, GA	See Table 201.
Axarel 2200 Cleaner		Micro Care Corp. Bristol, CT	See Table 201.
F-104° Fast Dry Cleaner/Degreaser		LPS Laboratories Tucker, GA	See Table 201.
Rymple Cloth	No. 200, 201, 300, or 301	American Fiber & Finishing Westford, MA	See Table 203.
Cheese Cloth	No. 10, 20, or 40	American Fiber & Finishing Westford, MA	See Table 203.
	No. 9017	DeRoyal Textiles Camden, SC	See Table 203.
Woven Cotton Hermitex	No. 300 or 400	DeRoyal Textiles Camden, SC	See Table 203.
Gauzesponges	No. 9405	DeRoyal Textiles Camden, SC	See Table 203.
Gauzesponges	No. 582556	American Fiber & Finishing Westford, MA	See Table 203.
AMS 3819 Grade A Type 1 (Cotton)		Commercially Available	See Table 203.
AMS 3819 Grade A Type 2 (Synthetic)		Commercially Available	See Table 203.
Cloth, White, Lint-Free (100% Rayon)	Kamen 900	Kamen Wiping Materials Co. Inc. Wichita, KS	See Table 203.
Scottpure Wiping Cloths (Synthetic)	Fabric Code No. 8425	Dupont Old Hickory, TN	See Table 203.
Sontara, White (Synthetic)		Dupont Non Woven Div. Old Hickory, TN	See Table 203.
Brush, Non-Metallic Bristle		Commercially Available	General cleaning.
Swab, Cotton		Commercially Available	General cleaning.
Gloves, White, Lint-free Cotton		Commercially Available	Handling clean parts.

(2) Clean metal, non-metal, and coated surfaces as follows:

NOTE: For electrical cleaning steps, proceed to step A.(3).

(a) Wipe off excess oil and grease.
(b) Use Table 201 to determine acceptable solvents for metals and coated surfaces.
(c) Use Table 202 to determine acceptable solvents for non-metals.
(d) Use Table 203 to determine acceptable cleaning fabrics for type of cleaning operation.

WARNING: PERSONNEL SHALL BE FAMILIAR WITH THE MATERIAL SAFETY DATA SHEET (MSDS) OF EACH SOLVENT USED AND WEAR THE APPROPRIATE PROTECTIVE CLOTHING WHEN HANDLING.

SOLVENTS SHALL BE PROPERLY MARKED AND STORED IN APPROPRIATE CONTAINERS.

ENSURE ADEQUATE VENTILATION FOR SOLVENT VAPORS AND/OR USE APPROVED RESPIRATORS.

KEEP SOLVENTS AWAY FROM SOURCES OF HEAT AND SPARKS AS MOST SOLVENTS HAVE A LOW FLASHPOINT.

PROPERLY DISPOSE OF ALL SOLVENTS AND CLEANING MATERIAL USED TO APPLY AND WIPE SOLVENTS.

CAUTION: SOLVENTS SHALL NEVER BE POURED OR SPRAYED DIRECTLY TO PARTS WITH FAYING SURFACES OR ENTRAPMENT AREAS. APPLY ONLY ENOUGH SOLVENT TO DAMPEN THE CLOTH. DO NOT SATURATE CLOTH. USE CLEAN, COMPRESSED AIR TO REMOVE TRAPPED SOLVENT.

DO NOT ALLOW PROLONGED CONTACT OF SOLVENTS WITH NON-METALLIC MATERIALS TO PREVENT CRAZING, SOFTENING, OR MATERIAL DEGRADATION.

PAINTED AND PRIMED SURFACES SHALL BE FULLY CURED PRIOR TO SOLVENT CLEANING.

(e) Apply approved cleaning solvent to an approved clean cloth and scrub surface. If necessary, use a non-metallic bristle brush to loosen soil. Be careful not to damage surface coatings when cleaning coated metal surfaces.
(f) Repeat application of cleaning solvent and scrubbing, as needed, to prepare surface for next operation.

CAUTION: DO NOT ALLOW THE CLEANING SOLVENT TO DRY ON SURFACE. REMOVE CLEANING SOLVENT, WHILE STILL WET, WITH A CLEAN, DRY COTTON CLOTH.

(g) Dry surface with a clean, white, lint-free cotton cloth before solvent has a chance to dry.

NOTE: After the surface is thoroughly cleaned, personnel should wear clean, white, lint-free cotton gloves to prevent surface contamination.

Application	Approved Solvents
GENERAL CLEANING Cleaning of soils prior to inspection, heat treating, localized etching, part marking, alkaline cleaning, application of corrosion inhibitive compounds, and other processes not identified for final cleaning.	MEK, MPK, IPA, Naptha, Acrysol, Mineral Spirits, Desoclean 110, FCC-55, Super 140 Cleaner/ Degreaser, A-151 Cleaner/Degreaser, Electro 140 Contact Cleaner, F-104° Fast Dry Cleaner/ Degreaser, Denatured Ethyl Alcohol
FINAL CLEANING Cleaning prior to sealing, welding, adhesive bonding, chemical filming, priming, wash priming, and painting.	MEK, MPK, Desoclean 110, FCC-55
ELECTRICAL CLEANING [1] Cleaning for electrical applications and components, prior to soldering, and prior to electrical bonding.	IPA, Axarel 2200, Electro 140 Contact Cleaner, AVL Electro Contact Cleaner [2], No Flash Electro Contact Cleaner [2], MEK [3]

NOTE: Some paints and primers are considered to be "solvent resistant", such as epoxy and urethane coatings. These coatings may be cleaned with any solvent listed without material degradation. Paints, primers, and other finishes which are not known to be solvent resistant, shall be cleaned only with isopropyl alcohol or naptha.

[1] Does not apply to flux removal and post-soldering cleaning.

[2] This solvent has no flash point and shall be used only when it is necessary to clean near operating electrical equipment or other flammability hazards.

[3] The only electrical application for MEK shall be cleaning metal surfaces prior to electrical bonding.

Solvents For Cleaning Metals and Coated Surfaces
Table 201

Non-Metallic Material	Common Trade Names	Approved Solvents
Acrylic	Lucite, Plexiglas	Naphtha, Acrysol
Acrylic Polyvinyl Chloride	Kydex 100	Naphtha
Acrylonitrile Butadiene Styrene (ABS)	Royalite (50 series), Cycolac	Naphtha, IPA, Denatured Ethyl Alcohol
Aramid	Nomex, Kevlar	Naphtha, IPA
Cellulose Acetobutyrate (CAB)	Tenite II	Naphtha
Fiberglass, Epoxy Resin	—	Naphtha, MEK, MPK
Graphite Fiber, Epoxy Resin	—	Naphtha, MEK, MPK
Melamine, Phenolic Resin	Formica	Naphtha
Phenolic	Micarta	Naphtha, IPA
Polyacetal	Delrin	Naphtha
Polyamides	Nylon 6, 6/6, 6/10, 6/12; Zytel 101	Naphtha, MEK, MPK
Polyimides	Vespel, Duratron	Naphtha, IPA, MEK, MPK
Polycarbonate	Lexan, Hyzod	Naphtha, IPA, Denatured Ethyl Alcohol
Polyester	Vibrin, Mylar, Dacron	Naphtha, IPA, MEK, MPK, Denatured Ethyl Alcohol
Polyphenylene (PPO)	Noryl	Naptha, IPA
Polysulfone	Royalite (520 series)	Naphtha
Polyurethane Thermoplastics	ABCO 2449, Estane, RTP	IPA
Polytetrafluoroethylene (PTFE)	Teflon	Naphtha, IPA, MEK, MPK, Denatured Ethyl Alcohol
Polyvinyl Chloride (PVC)	Boltaron	Naphtha
Polyvinyl Fluoride (PVF)	Tedlar	Naphtha, IPA, MEK, MPK, Denatured Ethyl Alcohol
Rubber / Vulcanized Elastomers	—	IPA, Denatured Ethyl Alcohol
Silicone Rubbers	RTV, Silastic	IPA, Denatured Ethyl Alcohol
Vinyl	—	Naphtha

Solvents For Cleaning Non-Metals
Table 202

(h) Perform the following steps if the next operation involves applying sealant, welding, adhesive bonding, chemical filming, applying primer, or wash priming for painting.

CAUTION: DO NOT ALLOW THE CLEANING SOLVENT TO DRY ON SURFACE. REMOVE CLEANING SOLVENT, WHILE STILL WET, WITH A CLEAN, DRY COTTON CLOTH.

1) Wipe cleaned surface with fresh solvent and a clean, white, lint-free cotton cloth. Examine the cloth and the surface. The cleaned surface shall not produce any residue or discoloration.
2) Dry surface with a clean, white, lint-free cotton cloth before solvent has a chance to dry.

NOTE: After the surface is thoroughly cleaned, personnel should wear clean, white, lint-free cotton gloves to prevent surface contamination.

(i) If the surface being cleaned is a metal coated surface which has deteriorated to the point that the metal surface is visible, and the next operation requires the metal coated surface to be in good condition, repair the coated surface as required prior to the next operation.
(j) All metal surfaces which require touch-up or repair of the coated surface must be recleaned prior to the next operation.

(3) Clean electrical components and electrical applications as follows:

NOTE: Does not apply to flux removal and post-soldering cleaning.

(a) Wipe off excess oil and grease.
(b) Use Table 201 to determine acceptable solvents for electrical cleaning.
(c) Use Table 203 to determine acceptable fabrics for type of cleaning operation.

Approved Repairs	General Cleaning	Final Cleaning and Electrical Cleaning
Shop Rags (blue)	X	
Clean Cotton Cloths	X	
Rymple Cloth No. 200, 201, 300, or 301	X	X
Cheesecloth No. 10, 20, 40, or 9017	X	X
Hermitex No. 300 or 400	X	X
Gauze Sponges No. 582556 or 9405	X	X
Kamen 900 (100% Rayon)	X	X
Scottpure No. 8424	X	X
Sontara	X	X
Material conforming to AMS 3819 Grade A Types 1 or 2	X	X

Cleaning Fabrics
Table 203

WARNING: **PERSONNEL SHALL BE FAMILIAR WITH THE MATERIAL SAFETY DATA SHEET (MSDS) OF EACH SOLVENT USED AND WEAR THE APPROPRIATE PROTECTIVE CLOTHING WHEN HANDLING.**

SOLVENTS SHALL BE PROPERLY MARKED AND STORED IN APPROPRIATE CONTAINERS.

ENSURE ADEQUATE VENTILATION FOR SOLVENT VAPORS AND/OR USE APPROVED RESPIRATORS.

KEEP SOLVENTS AWAY FROM SOURCES OF HEAT AND SPARKS AS MOST SOLVENTS HAVE A LOW FLASHPOINT.

USE SOLVENTS WITH NO FLASHPOINT WHEN CLEANING NEAR OPERATING ELECTRICAL EQUIPMENT OR OTHER FLAMMABLE HAZARDS.

PROPERLY DISPOSE OF ALL SOLVENTS AND CLEANING MATERIAL USED TO APPLY AND WIPE SOLVENTS.

CAUTION: **SOLVENTS SHALL NEVER BE POURED OR SPRAYED DIRECTLY TO PARTS WITH FAYING SURFACES OR ENTRAPMENT AREAS. APPLY ONLY ENOUGH SOLVENT TO DAMPEN, NOT SATURATE CLOTH. USE CLEAN, COMPRESSED AIR TO REMOVE TRAPPED SOLVENT.**

DO NOT ALLOW PROLONGED CONTACT OF SOLVENTS WITH NON-METALLIC MATERIALS TO PREVENT CRAZING, SOFTENING, OR MATERIAL DEGRADATION.

PAINTED AND PRIMED SURFACES SHALL BE FULLY CURED PRIOR TO SOLVENT CLEANING.

(d) Apply approved cleaning solvent to an approved clean cloth and scrub surface. If necessary, use a non-metallic bristle brush to loosen soil. Be careful not to damage surface coatings when cleaning coated metal surfaces.

(e) Repeat application of cleaning solvent and scrubbing, as needed until there is no soil residue on cloth.

CAUTION: **DO NOT ALLOW THE CLEANING SOLVENT TO DRY ON SURFACE. REMOVE CLEANING SOLVENT, WHILE STILL WET, WITH A CLEAN, DRY CLOTH OR COTTON SWAB.**

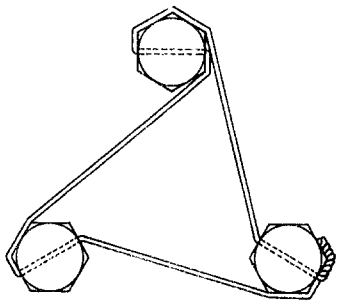
(f) Dry surface with a clean, cloth or cotton swab before solvent has a chance to dry.

NOTE: After the surface is thoroughly cleaned, personnel should wear clean, white, lint-free cotton gloves to prevent surface contamination.

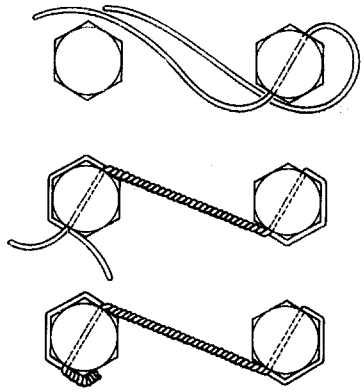
1. USE OF SAFETY WIRE
   A. Safety wiring is utilized throughout the aircraft to secure parts which might possibly work loose in service.
   B. Two methods of safety wiring are used; single wire and double wire. Inconel safety wire, 0.032 inch (0.812 millimeter) diameter, is most commonly used. When safetying emergency equipment, a soft copper wire, 0.020 inch (0.508 millimeter) diameter, is generally used. Extra high strength safetying requires a corrosion resistant steel wire which is 0.062 inch (1.57 millimeter) diameter. Whenever removing an assembly which is safety wired, note the method in which it is safety wired as well as routing, size, and type of wire. Safety wire is not used in fuel tanks due to the possibility of static discharge.
   C. The most common use of the single wire method is on emergency equipment. The wire in this application is strong enough to safety the part, yet is easily broken when use of the emergency equipment is required. The single wire method is also used when a series of three or more parts, usually small screws or bolts, are in a geometric pattern (square, rectangle, triangle or circle). A third application of the single wire method is safetying hard-to-reach parts which are impractical to double wire.
   D. Double wire safety wiring is the most common method used on the aircraft. When double wire safetying in a series, the direction of twist must be reversed at each unit. When safetying widely spaced series using this method, the maximum number of units is 3. Wire twisting pliers are used to obtain a uniformly tight twist in the wire.

2. SAFETY WIRING PRECAUTIONS
   A. The following precautions shall be observed when safety wiring.
      (1) When removing safety wire ensure that all pieces are removed.
      (2) Use only new safety wire of the same type, temper, and diameter as that which was removed. Never reuse safety wire.
      (3) Handle safety wire in a manner that it will not become kinked, nicked, scraped, or flattened.
      (4) Do not grip too tightly with tools or over-twist wire.
      (5) Avoid pulling wire around sharp corners.
      (6) Install safety wire so that it tends to tighten the part.
      (7) Do not loosen or overtorque parts to improve safety wire hole location.
      (8) Do not drill unspecified safety wire holes.
      (9) When cutting the end of the safety wire, leave approximately 6 twists of wire. Never twist off end of wire.
      (10) Bend final end toward part in a manner that will not cause injury to hands or interfere with moving parts.
      (11) Never safety wire more bolts or screws in a series than can be done with a 24-inch (60 centimeter) length of wire.

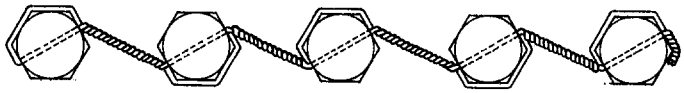
3. SAFETY WIRING
   A. See figure 1 for safety wire applications.



SINGLE WIRE SAFETYING

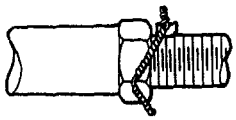


DOUBLE TWIST SAFETYING

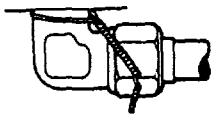


DOUBLE TWIST SAFETYING
MULTIPLE GROUPS

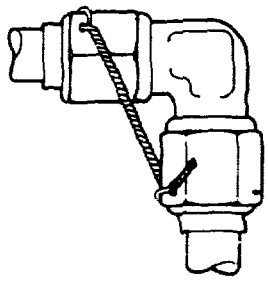
Safety Wiring
Figure 1 (Sheet 1 of 2)



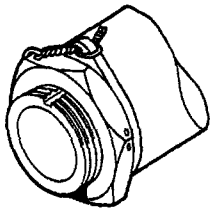
ROD END AND KEY LOCK



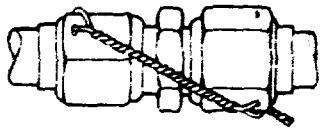
SINGLE "B" NUT CONNECTION TO ELBOW



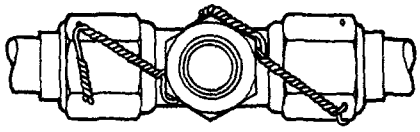
ELBOW FITTING



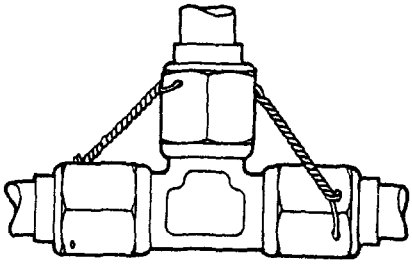
SAFETY LOCK WASHER



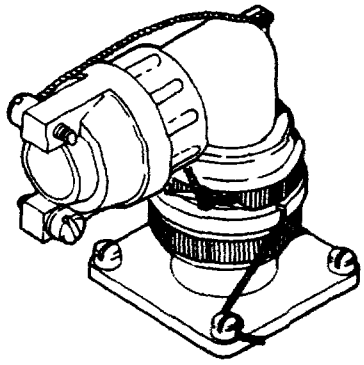
UNION FITTING



TOP VIEW



TEE FITTING



ELECTRICAL CONNECTION

Safety Wiring
Figure 1 (Sheet 2 of 2)

LOCTITE - MAINTENANCE PRACTICES

1. **Applying Loctite** *(1075L)*
   A. Cleaning Surface

NOTE: Cleaning shall be accomplished immediately prior to applying Loctite.

Always add solvent to the cloth.

(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
White Cleaning Cloths (Oil-Free, Absorbent)		Commercially Available	Cleaning.
Isopropyl Alcohol Grade A or B	TT-I-735	Commercially Available	Cleaning.
Lint-Free Cotton Gloves		Commercially Available	Handling cleaned parts.

(2) Clean all parts to which Loctite is to be applied. Surfaces must be clean and free of dust, grease, condensation, moisture, and other contaminants.
   (a) Apply isopropyl alcohol from safety cans with clean, oil-free, absorbent cloths. Scrub surface with a clean cloth, as necessary, to loosen all the surface contaminants.

(3) Repeat applications of clean solvent, as necessary, to remove all surface contaminants.

NOTE: Expose fresh cloth surfaces, as necessary, until all contamination has been removed.

(4) Wipe off solvent with a clean, absorbent cloth.

NOTE: Do not allow solvent to air dry on the surface.

Solvent cleaned surfaces shall be dry and free of all visible contaminates. Iridescent surfaces are evidence of improper cleaning. These surfaces shall be recleaned.

CAUTION: AVOID CONTAMINATING CLEANED SURFACES.

(5) Handle cleaned surfaces/parts only with clean, white, cotton gloves.

B. Loctite Selection

NOTE: Loctite is used on the aircraft when it is impossible to safety wire a fastener or if a safety wire is impractical.

Use Table 201 as an aid in determining the kind of Loctite to use in a given application. Use only the recommended compounds in their given applications.

The listed Loctite materials have no designated maximum shelf life when stored at room temperature in a closed container. These materials are acceptable for use provided there is no contamination or jelling of the material. Suspect material shall be scrapped or sent to the manufacturer for certification testing.

Application of Loctite should be accomplished at temperatures above 60°F [15°C] to ensure proper curing.

Parts that are plated, hardened, anodized, or passivated must be treated with Locquic primer grade T 747 or 7471 prior to applying Loctite sealant or compound. The Locquic primer odor must be completely gone before applying Loctite.

C. Application of Loctite to Bearings
(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
White Cleaning Cloths (Oil-Free, Absorbent)		Commercially Available	Cleaning.
Isopropyl Alcohol Grade A or B	TT-I-735	Commercially Available	Cleaning.
Lint-Free Cotton Gloves		Commercially Available	Handling cleaned parts.
Adhesive	See Table 201	Loctite North America Newington, CT	Secure parts.
Press		Commercially Available	Installing bearings.

(2) If Loctite type has not been specified, selection shall be made from Table 201.
(3) Clean mating surfaces. (Refer to Cleaning Surface, this section.)

NOTE: Do not allow solvent to air dry on surface. Wipe clean with absorbent cloth.

CAUTION: CARE MUST BE TAKEN TO ENSURE THAT ADHESIVE DOES NOT PENETRATE THE BEARING OR CONTACT THE BALL SURFACE.

(4) Apply Loctite evenly to both mating surfaces. Exercise care to keep Loctite out of the bearing.
(5) Press bearing into bearing housing and keep aligned until Loctite cures.
(a) Excessive Loctite may be wiped off with a cloth moistened in isopropyl alcohol.
(6) Allow Loctite time to cure. (See Table 201.)

NOTE: Cure may be accelerated by baking for 30 minutes at 245° to 265°F [118° to 130°C].

(7) After Loctite has cured, conduct bearing axial proof load test. (Refer to Adjustment/Test, this section.)

APPLICATION	LOCTITE PRODUCT	PRODUCT COLOR	GAP FILLING ABILITY	VISCOSITY (cP) MEAN	TORQUE IN/LB BREAKAWAY	STRENGTH psi SHEAR	TEMPERATURE RANGE	
							°F	°C
Screw Locking ▷1	222 Screw lock K E EV HV	Purple	0.002 in. [0.051 mm]	5,000	53	870	-65 to 300	-54 to 149
Nut Locking ▷2	242 Nutlock CV	Blue	0.002 in. [0.051 mm]	5,000	110	1,600	-65 to 300	-54 to 149
Stud Locking ▷3	271 Stud lock A AV AVV	Red	0.002 in. [0.051 mm]	500	250	2,600	-65 to 300	-54 to 149
▷4	277 Stud lock	Red	0.002 in. [0.051 mm]	7,000	275	2550		
Wicking Grade	290	Green	0.002 in. [0.051 mm]	12	85	—	-65 to 300	-54 to 149
Bearing and Bushing Retention	RC 680 Bushing Mount Bearing Mount RC 635 RC 40	Green	0.002 in. [0.051 mm]	1,250	—	Steel 2,800 Aluminum 600	-65 to 300	-54 to 149
Plastic Gasket	504 Gasket Eliminator Plastic Gasket ISPC	Orange	0.030 in. [0.762 mm]	500,000 to 1,200,000	—	1,200	-60 to 300	-51 to 149

▷1 Suggested fastener diameter for Threadlock 222 is No. 2 to 0.5 inch [1.27 cm]. Removable, low locking strength.

▷2 Suggested fastener diameter for Nutlock 242 is 0.25 to 0.75 inch [0.635 to 1.91 cm]. Removable, medium locking strength.

▷3 Suggested fastener diameter for Studlock 271 is 0.375 to 1.0 inch [0.953 to 2.54 cm]. Permanent, high locking strength.

▷4 Suggested fastener diameter for Studlock 277 is 0.625 to 1.0 inch [1.59 to 2.54 cm] and greater. Permanent, high locking strength.

Application of Loctite
Table 201 (Sheet 1 of 2)

APPLICATION	LOCTITE PRODUCT	CURE SPEED AT ROOM TEMP. ON STEEL, NO PRIMER		CURE SPEED AT ROOM TEMP. ON STEEL, WITH PRIMER		RECOMMENDED PRIMER
		Fixture	Full	Fixture	Full	
Screw Locking	222 Screw lock K E EV HV	20 Minutes	24 Hours	5 Minutes	24 Hours	T7471 (Optional)
Nut Locking	242 Nutlock CV	20 Minutes	24 Hours	5 Minutes	24 Hours	T747, 7471 (Optional)
Stud Locking	271 Stud lock A AV AVV	20 Minutes	24 Hours	5 Minutes	24 Hours	T747, 7471 (Optional)
	277 Stud lock	20 Minutes	24 Hours	5 Minutes	24 Hours	T747 (Optional)
Wicking Grade	290	20 Minutes	24 Hours	5 Minutes	24 Hours	T747, 7471 (Optional)
Bearing and Bushing Retention	RC 680 Bushing Mount Bearing Mount RC 635 RC 40	10 Minutes	24 Hours	5 Minutes	24 Hours [5]	T747, 7471 (Optional)
Plastic Gasket	504 Gasket Elimination Plastic Gasket ISPC	90 Minutes	12 Hours	Not Required		None

[5] Alternate cure: 245°F to 265°F [118°C to 129°C] for 30 minutes.

Application of Loctite
Table 201 (Sheet 2 of 2)

D. Application of Loctite to Threaded Fasteners
(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
White Cleaning Cloths (Oil-Free, Absorbent)		Commercially Available	Cleaning.
Isopropyl Alcohol Grade A or B	TT-I-735	Commercially Available	Cleaning.
Lint-Free Cotton Gloves		Commercially Available	Handling cleaned parts.
Adhesive	See Table 201	Loctite North America Newington, CT	Secure parts.
Brush		Commercially Available	Applying adhesive.

(2) If Loctite type has not been specified, selection is to be made from Table 201.
(3) Clean threaded surfaces with isopropyl alcohol Grade A or B. (Refer to Cleaning Surface, this section.)
(4) Wipe surface clean with absorbent cloth.

NOTE: Do not allow isopropyl alcohol to air dry on surface.

(5) Apply Loctite to threads by brushing, dipping, tumbling, or running applicator over the threads.

NOTE: Loctite may be applied to either the nut or bolt; however, for blind hole applications, coat the sides of the blind hole and the first two threads of the male fastener.

(6) Assemble parts and torque using normal torque.
(7) Excessive Loctite may be removed using a cloth moistened with isopropyl alcohol.

2. **Inspection/Check** *(1075L)*
A. Bearing
(1) A pushout test shall be performed on all bearing (except those in a counterbore, against a spacer, or against any type of shoulder) installed with Loctite.

CAUTION: PUSHOUT TESTS SHALL ONLY BE PERFORMED ON BEARING SURFACES THAT ARE BONDED.

(2) If the inner bearing race has been bonded to a shaft, the pushout test shall be performed only between the inner race and the shaft.
(3) If the outer bearing race has been bonded into a housing, the pushout test shall be performed only between the outer bearing race and the housing.
(4) Bearings with a nominal diameter of 0.75 inch [19.05 mm] or greater shall pass a minimum "push-out" test of 300 pounds [136 kg].

(5) Bearings with a nominal diameter of 0.25 to 0.75 inch [6.35 to 19.05 mm] shall pass a minimum "pushout" test of 150 pounds [68 kg].
(6) Bearings with a nominal diameter of less than 0.25 inch [6.35 mm] shall pass a "pushout" test applied by hand force only.
(7) Bearing installations that fail the "pushout" test shall be processed as follows:
    (a) Remove bearing from the shaft or housing.
    (b) Remove loose Loctite. Tightly adhering Loctite need not be removed.
    (c) Apply new Loctite to bearing. (Refer to Application of Loctite to Bearings, this section.)
    (d) Repeat steps 2.A.(2) thru 2.A.(7)(c) until bearings pass the "pushout" test.

BEARING STAKING - MAINTENANCE PRACTICES

1. Removal/Installation

A. Bearing Removal When Modified Ring Staked (See Figure 201.)

(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Press (5000 lb [2268 kg] Capacity)		Commercially Available	Remove bearing.
Push-Out Tool		Commercially Available	Remove bearing.

(2) Remove the part that contains the damaged bearing from the aircraft.

(3) Inspect the part containing the bearing. If over 80% of staking area is staked on both sides of part, discard part and bearing. If one (1) side of part has 48% or less of staking area staked, bearing can be replaced.

(4) Position part containing bearing in press with part side containing staked area of 48% or less opposite push-out tool and press bearing out.

(5) Discard bearing.

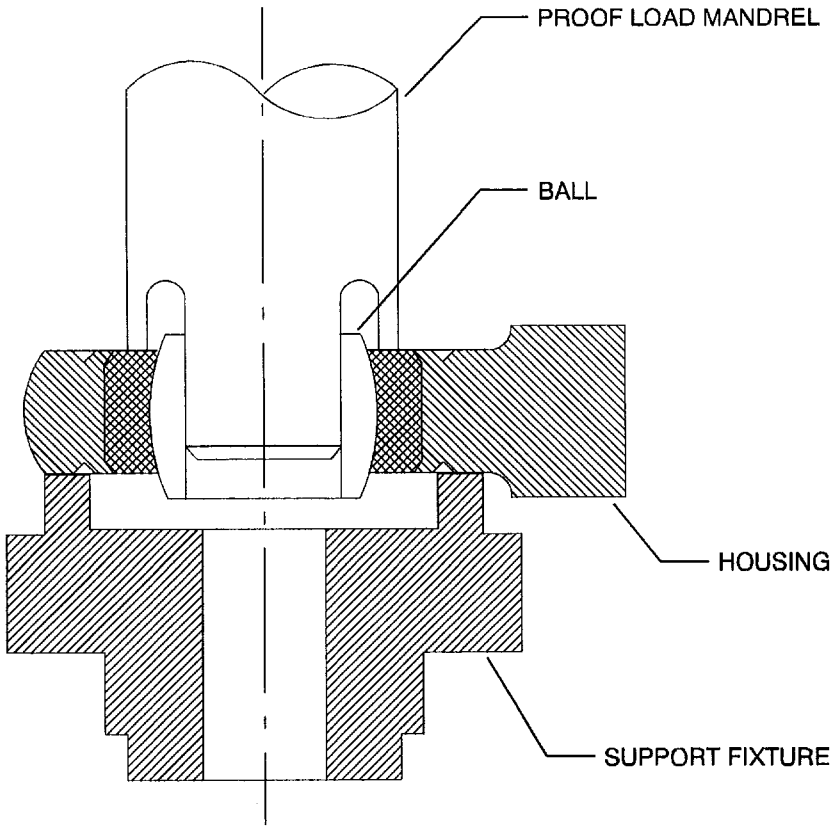
B. Bearing Installation Using Modified Ring Stake Method *(1019)* (See Figure 202.)

NOTE: Modified ring staking is not permitted as a method of retaining thin-walled needle bearings.

(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Press, (5000 lb [2268 kg] Capacity)		Commercially Available	Staking and proof load testing.
Adhesive Epoxy Primer		Refer to 20-55-00.	Coating stake impressions and securing bearing.
Loctite	RC 680	Loctite North America Newington, CT	Securing bearing.
Modified Ring Staking Tool with at Least Eight (8) Stakes			Staking bearing part.



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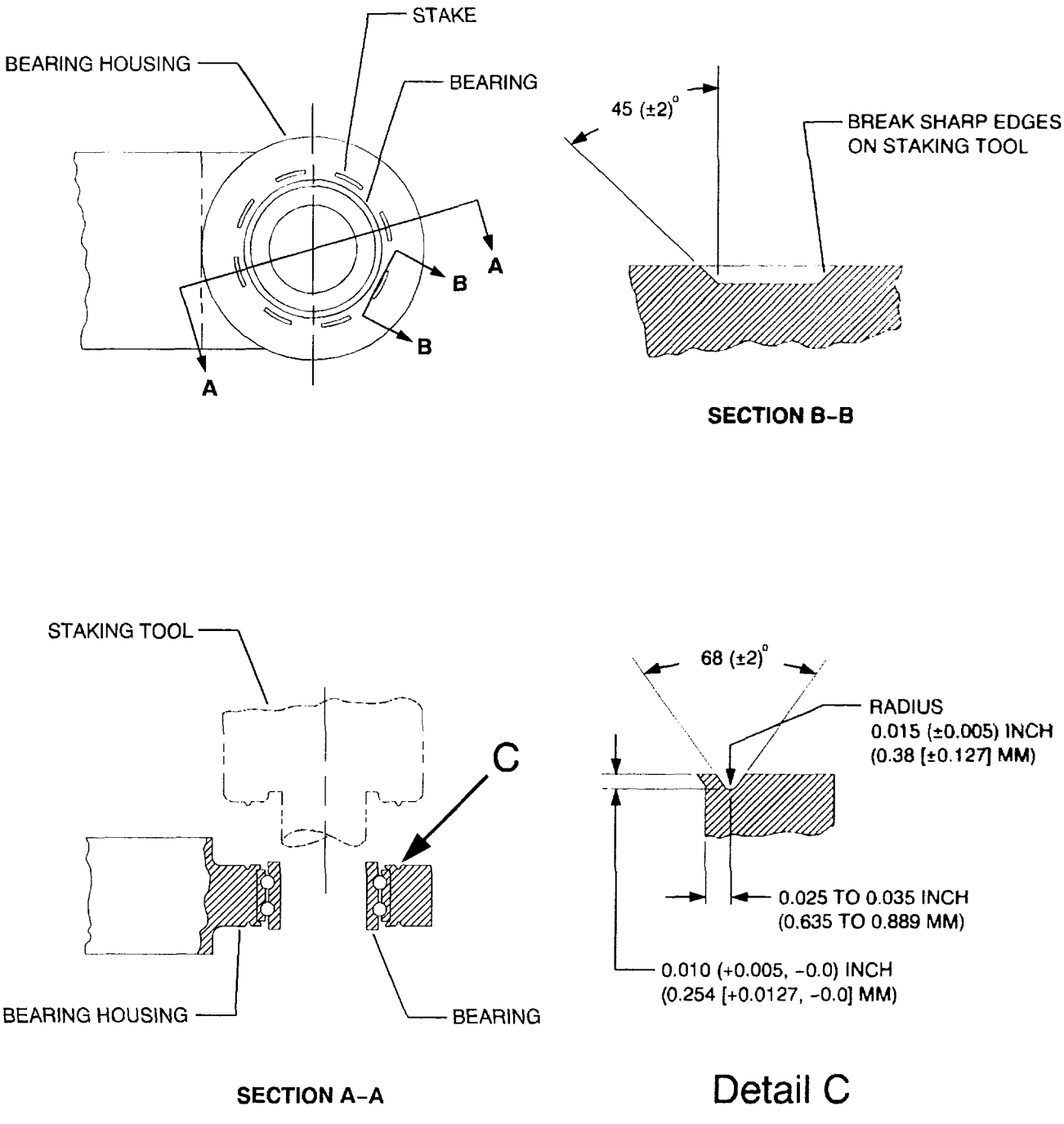
Staked Bearing Removal
Figure 201



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Modified Ring Staked Bearing Installation
Figure 202

(2) Prior to installation: Ensure bearing is free of damage, corrosion, metal chips or other contamination. Reject a bearing if its rolling elements bind or catch when inner race is rotated. Relubricate bearings with lubrication dates exceeding six (6) years.
(3) Ensure old Loctite, if used, is removed from bearing O.D. and part I.D. (Refer to 20-21-00.)
(4) Install staking tool into press. Ensure staking tool pilot fits bearing to be staked.
(5) Apply epoxy primer to bearing O.D. and part I.D., unless part repair calls for the use of Loctite. For epoxy primer application, refer to 20-55-00. For Loctite application, refer to 20-21-00.

CAUTION: WHEN WIPING OFF EXCESS ADHESIVE, ENSURE IT IS NOT WIPED INTO BEARING ROLLING ELEMENTS.

(6) Slip bearing into bearing part from push-out side and carefully wipe off excess adhesive.
(7) Ensure bearing outer race is centered between bearing part two faces.
(8) Position and secure part with bearing on press with bearing insertion side toward staking tool.
(9) Ensure bearing is centered in part bearing bore.
(10) Align staking tool with staked areas on part, then center staking tool between staked areas on part, and stake part.

CAUTION: WHEN WIPING OFF EXCESS ADHESIVE, ENSURE IT IS NOT WIPED INTO BEARING ROLLING ELEMENTS.

(11) Carefully wipe off excess adhesive.
(12) Coat stake impressions on part with epoxy primer.
(13) Proof load test bearing if not installed in a counterbore, against a spacer, or against any type of shoulder. (Refer to 20-25-01.)
(14) Inspect installed bearing and part. (Refer to 20-25-01.)

2. Inspection/Check

A. Inspect Bearing Installation
(1) Ensure bearing, within bonded outer race, is free to rotate by hand with no catching, binding, or seizing.
(2) Ensure bearing outer race is flush with bearing part.
(3) Ensure bearing is centered within part.
(4) Ensure stake impressions are coated with epoxy primer.

3. Adjustment/Test

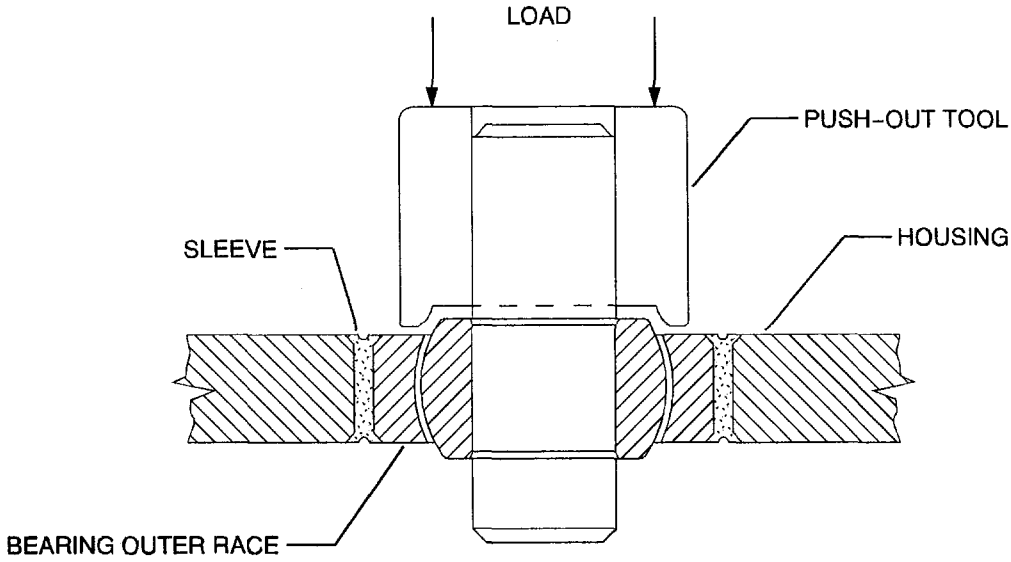
NOTE: Bearings installed in a counterbore, against a spacer, or against any type of shoulder do not require the axial retention proof load test.

A. Axial Retention Proof Load Test (See Figure 203.)
(1) Acquire necessary tools and equipment.

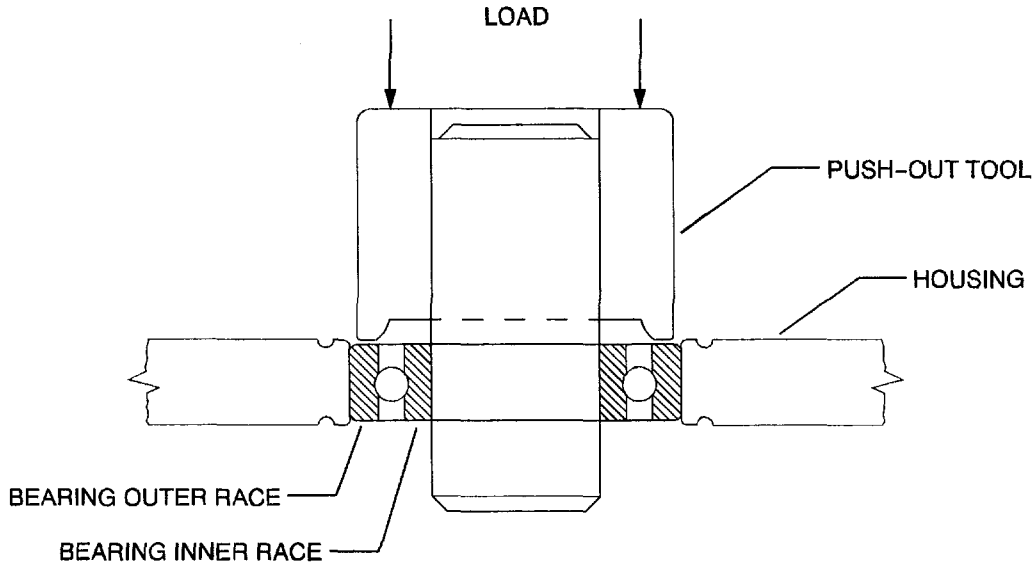
NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Press (5000 lb [2268 kg] Capacity)		Commercially Available	Staking and proof load testing.
Push-Out Tool		Commercially Available	Proof load testing.

(2) Testing modified ring staking of bearing.
  (a) Mount bearing and part in press and apply pressure to outer race of bearing with push-out tool.
    1) For bearings installed in aluminum parts, apply 150 psi [1034 kPa] to the outer race of bearing.
    2) For bearings installed in steel parts, apply 300 psi [2068 kPa] to the outer race of bearing.
  (b) Bearing shall not shift or become loose in part during test.



SLEEVE STAKED BEARING



HOUSING STAKED BEARING

A20-2018
M45-202501-206-01

Bearing Retention Proof Load Test
Figure 203

CUSHION SUPPORT CLAMPS - DESCRIPTION AND OPERATION

1. General
   A. Cushion support clamps are required to provide support of hydraulic lines, tubing, and wiring to prevent movement or interference with other lines, structure, or components, and prevent chafing or cracking due to vibration or thermal expansion and contraction.

   B. Proper use and identification of cushioned support clamp shall be known prior to installation of any clamp due to possible incompatible materials, temperature ranges, and fluid contamination.

   C. This section provides procedures for identification and use of cushioned support clamps and is not intended to conflict with the Illustrated Parts Catalog if a cushioned support clamp is listed.

2. Types of Clamps
   A. MS 21919 clamp is a loop type cushioned support clamp for standard use with aluminum or corrosion resistant steel band material.
      (1) Identification
         (a) Part number example: MS 21919WDG8
            1) MS 21919 - Identifies the type of clamp.
            2) W - Identifies the cushion has a wedge added to overlap the split of the clamp. This is a MIL-SPEC requirement and the use is determined by clamp size.
            3) DG - Identifies the band and cushion material. Available materials and codes are listed as follows with maximum recommended temperature:
               a) DE - Aluminum band with ethylene propylene cushion (212°F) [100°C].
               b) DF - Aluminum band with nitrile cushion (212°F) [100°C].
               c) DG - Aluminum band with chloroprene cushion (212°F) [100°C].
               d) CE - CRES band with ethylene propylene cushion (275°F) [135°C].
               e) CF - CRES band with nitrile cushion (212°F) [100°C].
               f) CH - CRES band with silicone cushion (400°F) [204°C].
               g) CG - CRES band with chloroprene cushion (212°F) [100°C].
               h) CJ - CRES band with fluorosilicone cushion (450°F) [232°C].
            4) The number value shown at the end of the part number indicates size in 1/16 inch increments. For example: the 8 has a diameter of 1/2 inch.
      (2) Cushion Application and Color Identification
         (a) Ethylene Propylene
            1) Color shall be solid purple. Used in areas contaminated with phosphate ester hydraulic fluid and other synthetic fluids. Do not use where material will be exposed to petroleum based fluids, as ethylene propylene has no resistance to this type of fluid. Ozone resistance is excellent.
         (b) Nitrile
            1) Color shall be solid yellow. Do not use on titanium tubing. Used primarily in areas of fuel immersion and fuel vapors. Nitrile has good ozone resistance. Nitrile is not resistant to phosphate ester based fluids.
         (c) Chloroprene
            1) Color shall be black with a blue identifier. Do not use on titanium tubing. Used primarily for general purpose in areas contaminated with petroleum based hydraulic fluids and occasional fuel exposure. No resistance to phosphate ester based fluids. Ozone resistance is excellent.
         (d) Silicone
            1) Color shall be natural white. For use in areas of elevated temperature where phosphate ester and other synthetic fluids are present. Unaffected by ozone. Not resistant to petroleum based fluids.

(e) Fluorosilicone

1) Color shall be solid blue. Used primarily in areas of elevated temperature, contaminated with petroleum based hydraulic fluids. Unaffected by ozone. Not resistant to phosphate ester based fluids.

CUSHION SUPPORT CLAMPS - MAINTENANCE PRACTICES

1. Removal/Installation

A. Installation of Cushion Support Clamps (See Figure 201.) *(1023,1382D)*

CAUTION: WHEN REPLACING A CLAMP, REFER TO THE ILLUSTRATED PARTS CATALOG FOR PART NUMBER. IF CLAMP IS NOT LISTED REPLACE CLAMP WITH ORIGINAL TYPE AND VERIFY THAT CLAMP IS COMPATIBLE WITH TUBING AND ENVIRONMENT IT IS TO BE INSTALLED IN.

WHEN INSTALLING A CLAMP IN A NEW LOCATION VERIFY TUBING TO CUSHION MATERIAL COMPATIBILITY AND ENVIRONMENT THAT CLAMP IS TO BE USED IN.

PROPER USE AND IDENTIFICATION OF CLAMP SHALL BE KNOWN PRIOR TO INSTALLATION OF ANY CLAMP DUE TO INCOMPATIBILITY OF SOME CUSHION AND TUBING MATERIALS.

APPROPRIATE SEPARATION OF ALL FLAMMABLE FLUID LINES AND WIRING SHALL BE MAINTAINED.

(1) For clamps used in nacelle tubing installation and areas where high temperature may exist such as bleed air lines and high pressure hydraulic lines, verify the proper clamp and cushion material is being used.
   (a) MS 21919 clamps are permitted for use if cushion material and tubing to be supported are compatible. Cushion and band material must be rated for the temperature range of the application.
   (c) Verify that the cushion material used is compatible with fluids found in those areas (petroleum based or phosphate ester based fluids).

   NOTE: If cushion is contaminated or shows signs of deterioration, replace the clamp.

(2) For applications other than in the nacelle and pylon areas, use the appropriate clamp while always observing the temperature range, materials, and fluid environment that will be present where the clamp is installed.
(3) Spacing between clamps shall be as specified in Table 201 and Table 202.
(4) Clearance requirements for plumbing lines are as follows:

   NOTE: A supported section of tubing shall be defined as that portion of tubing which extends four (4) inches [10.16 cm] on either side of the clamp.

   An unsupported section of tubing shall be defined as that portion of tubing which extends beyond four (4) inches [10.16 cm] on either side of the clamp.

   (a) There shall be a minimum of 0.125 inch [3.2 mm] between any unsupported section of the tube and adjacent structure, other tubes or equipment provided the tube is sufficiently rigid to prevent chafing.
   (b) There shall be a minimum clearance of 0.06 inch [1.5 mm] between any supported section of the tube and the adjacent structure or equipment.
   (c) There shall be a minimum of 0.50 inch [1.3 cm] between any unsupported section of the tube and any operating mechanisms such as control cables, push-pull rods, pulleys, etc.

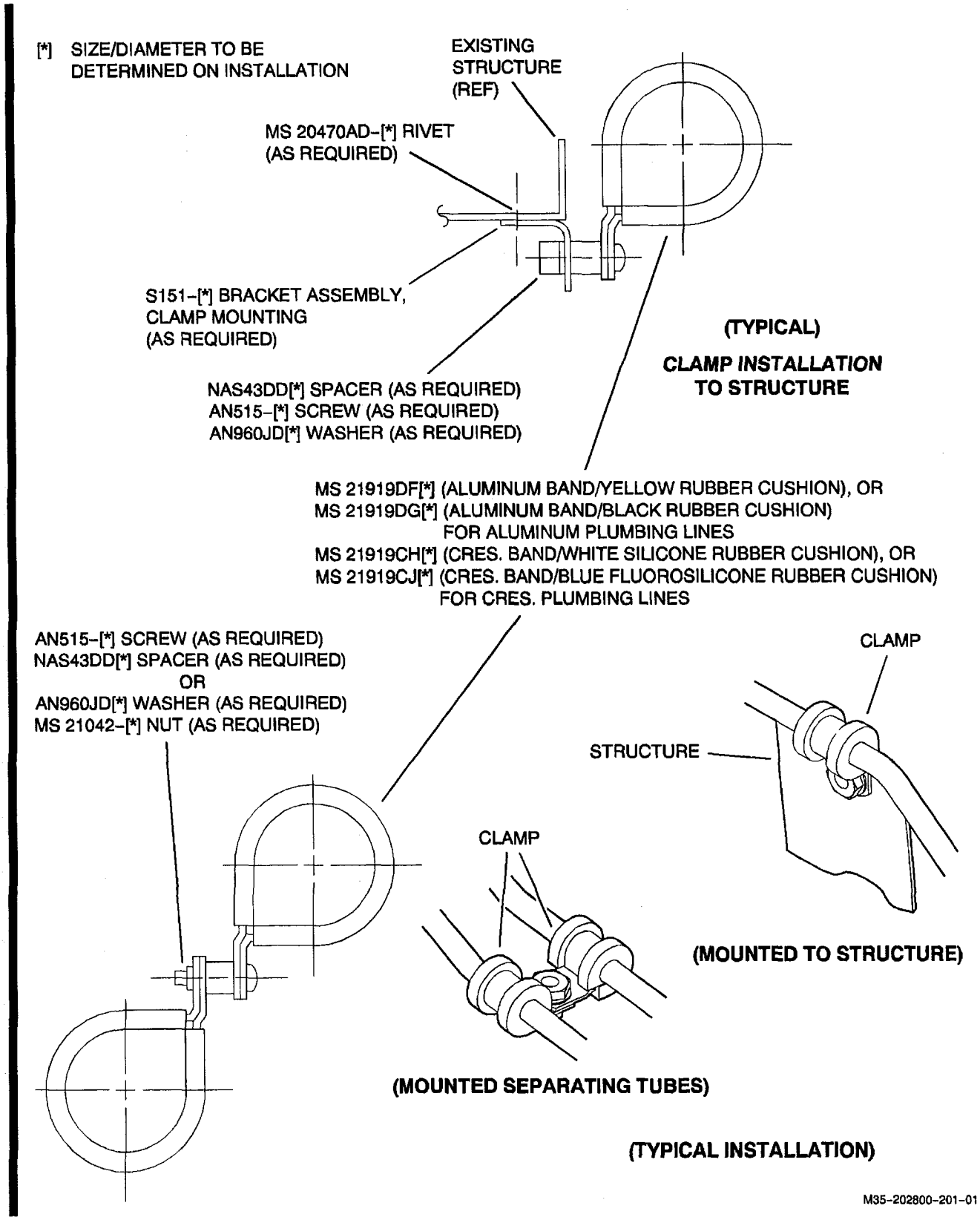
(d) There shall be a minimum clearance of 0.25 inch [6.4 mm] between any supported section of the tube and any operating mechanisms such as control cables, push-pull rods, pulleys, etc.
(e) Plumbing lines carrying flammable fluid shall be separated at least six (6) inches [15.24 cm] from all electrical wiring and conduits in the aircraft. When a six (6) inch [15.24 cm] clearance cannot be maintained, a clearance of two (2) inches [5.08 cm] will be acceptable provided the plumbing lines and wire bundles are securely clamped so that there will be no relative motion between them.
(f) When a minimum of two (2) inches [5.08 cm] cannot be maintained, a separation of between two (2) inches [5.08 cm] and 0.5 inches [1.3 cm] shall be acceptable provided the plumbing lines and wire bundles are so rigidly clamped that there is a positive standoff of the minimum dimension. A separation of less than 0.5 inch [1.3 cm] will not be acceptable.
(g) Wire bundles shall not be attached to plumbing lines unless approved by the manufacturer.
(h) Electrical connections shall not be made directly below a flammable fluid line or plumbing connection unless provisions have been made to prevent a fluid leak from coming in contact with the electrical wiring and its connections.
    1) Wiring must be at least two (2) inches [5.08 cm] above the lowest point where flammable fluids may collect in the event of a fluid leak.

Recommended Spacing Between Clamps for Tubing **Without** In-Line Components (inches)				
Tube OD (in.)	Except High Vibration Areas		High Vibration Areas	
	Aluminum Alloy	Steel	Aluminum Alloy	Steel
1/4	13.5	16.0	10.5	12.0
3/8	16.5	20.0	12.0	15.0
1/2	19.0	23.0	14.0	17.0
5/8	22.0	25.5	16.5	19.0

Tubing Without In Line Components
Table 201

Recommended Spacing Between Clamps for Tubing **With** In-Line Components (inches)				
Tube OD (in.)	Except High Vibration Areas		High Vibration Areas	
	Aluminum Alloy	Steel	Aluminum Alloy	Steel
1/4	11.0	13.0	8.5	10.0
3/8	13.0	16.0	10.0	12.0
1/2	15.0	18.5	11.0	14.0
5/8	17.5	20.5	13.0	15.5

Tubing With In Line Components
Table 202



Typical Cushion Support Clamp Installations
Figure 201

FLARED TUBING - MAINTENANCE PRACTICES

1. Description

A. The flared tubing maintenance practices include removal/installation, inspection, and fabricating.

B. From time to time, as inspection dictates or if damage occurs, it may be required to fabricate new flared tubing assemblies. This section outlines standard acceptable methods for fabricating flared tubing assemblies.

C. Whenever a tube has been damaged and needs replacing, the cause of the damage must be determined and corrected.

D. It is recommended that the flared tubing be replaced and not repaired. When replacing the aircraft tubing, the replacement tubing must be of the same diameter, wall thickness, and material as the old tubeing.

E. As a general rule, Learjet aircraft tubes are fabricated from either 5052-0, aluminum alloy, ASI 304 stainless steel or type 321 corrosion resistant steel. These tubes are usually fabricated from the following sizes of tubing: 0.500 inch O.D. X. 0.035 inch wall [12.7 MM O.D. x 0.89 mm wall], 0.500 inch O.D. x 0.065 inch wall [12.7 mm O.D. x 1.65 mm wall], 0.375 inch O.D. x 0.049 inch wall [9.53 mm O.D. x 1.24 mm wall], 0.250 inch O.D. x 0.035 inch wall [6.35 mm O.D. x 0.89 mm wall] and 0.750 inch O.D. x 0.035 inch wall [19.05 mm O.D. x 0.89 mm wall]. Additional tubing sizes may be found on the aircraft and it is imperative that the new tubing size matches the old tubing size.

F. When fabricating a new tube, the old tube, if not severely damaged, may be used as a template. If the old tube is too damaged for use as a template, then a template can be made using soft iron wire.

G. All bends in the tubing are to start at a reasonable distance from the end of the tube. This allows the nut and sleeve to be slipped back far enough on the tube to aid in flaring.

H. Tubing and fittings generally consist of an AN819 sleeve inside an AN818 nut. When assembling the end fittings on a tube, it is very important that dissimilar metals not be used. The use ot dissimilar metals will cause corrosion. Make sure that the correct fittings and sleeves are used.

I. Aluminum alloy tubing which is 0.375 inch [9.53 millimeter] outside diameter or less must be double flared. All other tubing shall be single flared.

J. Make sure that only a 37° aviation flare is used. The use of an automotive flare will give improper flare angle and shape, causing misfit, leakage, stress, and probable failure.

2. Removal/Installation

A. Remove the Flared Tubing

(1) When removing the flared tubing from the aircraft, the tubing ends and related fittings must immediately be capped. When removing several tubes from the same area at one time it is helpful il the tubing ends are tagged.

B. Installation of the Tubing (Excludes Oxygen Lines)

NOTE: All detached tubing and openings in a fluid system must be protected from contaminates with plastic caps. Caps must remain installed until just prior to installation.

Before installation, all tubing must be inspected for cleanliness. Tubing to be installed must be free of dirt, grease, and oil.

(1) Installing the Tubing with the Tapered Pipe Threads Fittings
   (a) All tubing with male tapered pipe threads must be treated with teflon thread sealant or compound thread sealant. If using the teflon thread sealant, continue with step (1)(b). If using a compound thread sealant, continue with step (1)(c).
   (b) Apply the teflon thread sealant as follows:
      1) Apply the teflon thread sealant so that the first 1.5 threads of the fitting are not covered.
      2) The tape must be stretched and wrapped in a clockwise direction
      3) Apply 1.5 turns of tape to the fitting.
      4) Continue with step (1)(c).
   (c) Position the tubing and loosely connect the supporting clamps as required.
   (d) Check the tubing for alignment with the fitting as follows (See Figure 201):
      1) The tubing must be parallel to within 2 degrees of the fitting.
      2) The tubing must be in line with the fitting to within 0.0312 in [0.793 mm] per 10 inches [25.4 cm] of tube length.
      3) The tubing must match the fitting lengthwise to within 0.0312 in [0.793 mm] per 10 inches [25.4 cm] of tube length.
      4) If the tubing cannot be adjusted to meet these requirements, it must be replaced.
   (e) Install the fitting hand tight to a minimum thread engagement of 1.5 turns.
   (f) If compound thread sealant is to be used, apply an even coat, sparingly, to the remaining threads. See Figure 202 for approved thread compounds.
   (g) Torque the fitting as follows:

      NOTE: Elbow and tee fittings must not be backed-off to align with tubing. If alignment adjustments are required, align by further tightening or replace with another fitting.

      1) Torque all 0.125 inch fittings 50 to 175 in-lb [5.65 to 19.78 Nm].
      2) Torque all 0.25 inch fittings 85 to 300 in-lb [9.60 to 33.90 Nm].
   (h) Tighten all the clamps.
   (i) Inspect the tubing installation and make sure that the tubing minimum clearance is maintained. See clearance requirements for tubing lines, this section.
   (j) Make sure that the tubing has the correct identification markings.
(2) Installing the Flared Tubing with Straight Threads Fittings
   (a) Set the tubing at its correct location and loosely connect the supporting clamps as required.
   (b) Align the tubing so that the flare nest evenly to the fitting cone without applying external force.
   (c) With the clamps loose and without forcing the tubing into alignment, it must be possible to hand-tighten the nuts until the tubing flare bottoms out against the fitting. If this cannot be done, check the alignment as follows (See Figure 201):

1) Tighten and, with a wrench, lightly apply torque to the nut on one end of the tubing.
2) Loosen the nut on the other end of the tubing and slide the nut down the tubing until the flare is clearly visible.
3) The tubing must be parallel to within 2 degrees of the fitting.
4) The tubing must be in line with the fitting to within 0.0312 in [0.793 mm] per 10 inches [25.4 cm] of tube length.
5) The tubing must match the fitting lengthwise to within 0.0312 in [0.793 mm] per 10 inches [25.4 cm] of tube length.
6) If the tubing cannot be adjusted to meet these requirements, it must be replaced.

(d) Back the fitting completely away from the tubing threads.

(e) Press the tubing firmly against the fitting and hand tighten the nut 1/2 to 1 turn.

NOTE: Thread compound must be used to prevent galling or seizure of the threads

Thread compound must not be allowed on the fitting ends, cone surfaces, inside the flare surface, bore of fitting interior of tubes, or inside any system components.

(f) Apply thread compound, sparingly, to the remaining exposed male threads. See Figure 202 for approved thread compounds.

(g) Tighten and torque the fittings. (See Figure 203.)

(h) Tighten all the clamps.

(i) Inspect the tubing installation and make sure that the tubing minimum clearance is maintained. See the clearance requirements for tubing lines, this section.

(j) Make sure that the tubing has the correct identification markings.

3. Inspection/Check

A. Inspect the tubing prior to installation as follows:

(1) Replace any steel tubing which has a nick or scratch deeper than 10 percent of the tubing wall thickness.

(2) Replace any aluminum tubing which has a nick or scratch deeper than 20 percent of the tubing wall thickness.

(3) Replace any pressure or return line which has a dent deeper than 5 percent of the tubing outside diameter.

(4) Replace any pressure or return line which has a dent in the heel of the bend radius deeper than 2.5 percent of the tubing outside diameter.

(5) Replace any suction line which has a dent deeper than 10 percent of the tubing outside diameter.

(6) Replace any suction line which has a dent in the heel of the bend radius deeper than 5 percent of the tubing outside diameter.

(7) Replace any tubing which has evidence of the metal being stretched thin on the heel of the bend radius.

(8) Polish out burrs or scratches on the inside of the tubing flare. Begin with fine emery and oil and finish with crocus cloth and oil.

(9) Inspect the flare and replace as indicated in Figures 206 and 207.

4. Repairs

A. Bend and flare the tubing as follows:

(1) Remove the old or damaged tube from the aircraft. (Refer to 20-30-00)

(2) If the old tube is too damaged to use as a template, use soft iron wire and form it into a shape which will match the fittings on the aircraft.

NOTE: Always select a path for the tubing which will require bends in the tubing. Bends are necessary to relieve mechanical strain, permit temperature expansion and contraction and to absorb vibration.

(3) Determine the outside diameter, wall thickness, and material of the old tube.

(4) Select a new piece of tubing with the same specifications as the old tubing.

(5) Cut the new tubing approximately 10% longer than the tube being replaced. This will provide for variations in bending.

NOTE: It is important, when cutting tubing, that the ends be cut square within 30 minutes to the centerline of the tube.

(6) Deburr the tube end. Exercise care that all burrs are removed and a minimum amount of material is removed.

(7) Using one of the following methods and tube bending data in Figure 205, bend the new tubing to match the template.

(a) *Hand bending without tools - This method is not recommended but may be used on tubing with* an outside diameter of less than 0.25 inch (6.4 mm). The minimum bend radius table must be used as a guide. Bend the tube carefully to avoid excessive flattening, kinking, or wrinkling. Slight flattening is acceptable if the flattened portion is not less than 75% of the original outside diameter.

(b) Hand bending with hand bender - To bend tubing with a hand tube bender similar to that shown in Figure 204, proceed as follows. Insert the tubing into the bender by raising the slide bar handle as far as it will go. Hook the clip over the tube and make sure that the full length of the slide bar groove is in contact with the tubing. With the zero marks aligned, turn the handle until the desired bend is obtained.

(c) Tube bending machine - Power tube bending machines are manufactured for all types of tubing. On large diameter and hard material tubing, a power tube bender is necessary. Power bending machines work on the same principle as the hand bender.

NOTE: Tubes must be formed in such a manner so that when the tube is installed it will not have to be pulled or deflected into place by tightening the fitting.

(8) Slide the nut, followed by the sleeve, onto the end of the tube and move them down the tube far enough to allow for flaring.

(9) Using the appropriate flaring tool and the specification found in Figures 206 thru 209, flare the tube ends.

5. Cleaning/Painting

A. Newly fabricated tubing assemblies must be cleaned, capped and painted, if required. Tubing which has been stored in unclean conditions must also be cleaned prior to installation.

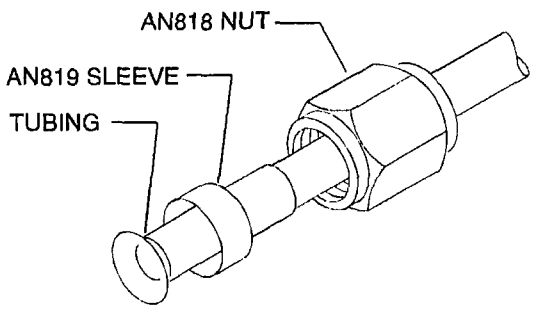
B. Tubing cleaning equipment must consist of a metal tank with a solvent reservoir, a pump, a filtration unit (25 micron nominal) and a rack or screen which will prevent immersion of tubing into solvent. The pump nozzle must have a pressure high enough that it will remove chips, oil, and other foreign matter from the tube.

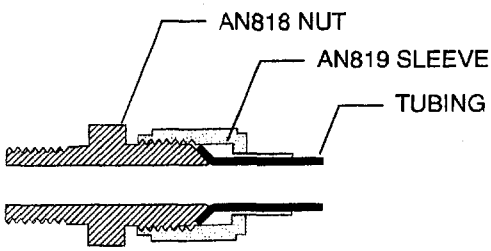
C. New tubing shall be painted the same as the old tubing. Usually, aluminum tubing located in the wheel well area and in the wet portion of the wing is painted with epoxy primer. Aluminum tubing located inside of structure is usually coated with zinc chromate primer. Stainless steel tubing requires no finish.

D. The interior surface of the fire extinguisher and oxygen tubes must be kept free of all finish.

E. Clean the tubing as follows:
   (1) Thoroughly flush the outside and inside of the tubing. Make sure that the flare, nut, and sleeve are thoroughly cleaned.
   (2) Allow the excess solvent to drain from the tube.
   (3) Using clean, dry, compressed air, blow all remaining solvent from tube exterior, interior, and fittings.
   (4) Immediately cap the tubing using clean hardware.
   (5) Paint the tubing if required.

F. Paint the tubing as follows:
   (1) With the nut and sleeve both seated against the flare, mask 0.75 inch (19 mm) back from the back face of the nut.
   (2) Determine the type of finish which was on the old tube. In most cases, the aluminum tubing will have been chemically cleaned and then chemical film treated followed by either zinc chromate or epoxy primer.

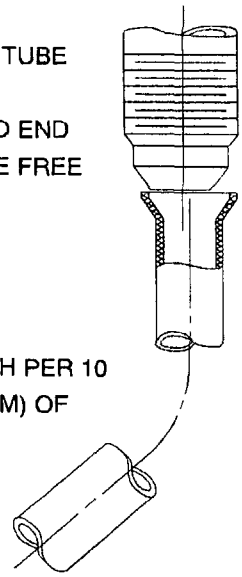




RADIAL MISMATCH

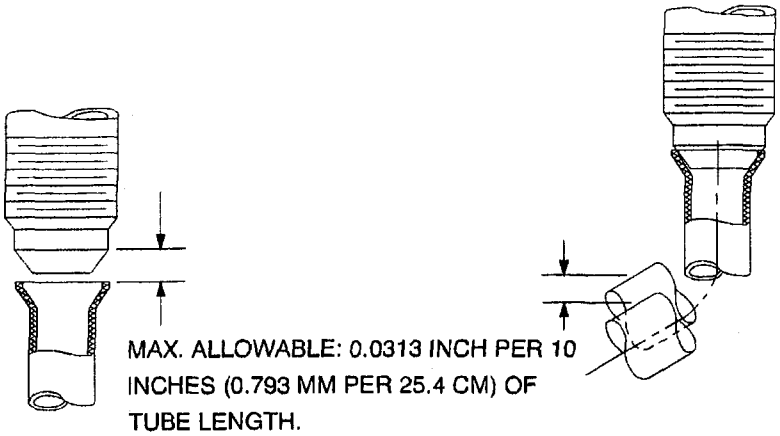
MEASURE MISMATCH WITH THE FREE TUBE END CLEAR OF THE FITTING.

IF NECESSARY, PUSH NEAR THE FIXED END OF THE TUBE ASSEMBLY SO THAT THE FREE END IS CLEAR.

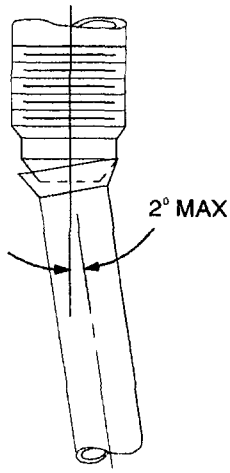


MAX. ALLOWABLE: 0.0313 INCH PER 10 INCHES (0.793 MM PER 25.4 CM) OF TUBE LENGTH.

RADIAL MISMATCH



MAX. ALLOWABLE: 0.0313 INCH PER 10 INCHES (0.793 MM PER 25.4 CM) OF TUBE LENGTH.



ANGULAR MISMATCH

LENGTH MISMATCH

IF TUBE ASSEMBLY IS TOO SHORT, MEASURE THE GAP.

IF TUBE ASSEMBLY IS TOO LONG, EITHER:

1. REMOVE THE FITTING, AND MEASURE THE CHANGE IN POSITION OF THE FREE END; OR
2. PUSH NEAR FIXED TUBE END, AND MEASURE THE DISTANCE TO JUST UNSEAT AND FREE THE FLARE.

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Flared Tubing Installation
Figure 201

COMPOUND	SYSTEMS					
	HYDRAULIC	EMERGENCY AIR	HOT AIR 1000 °F [538 °C] MAX CRES ONLY	FUEL	PITOT-STATIC	ALL OTHER (EXCEPT OXYGEN)
RECTOR SEAL 100-W OR 100 VIRG	X	X			X	
LIQUI-MOLY NV THREAD COMPOUND ANTI-SEIZE	X	X		X	X	X
VV-P-236 PETROLATUM	X	X			X	
MIL-H-5606 HYDRAULIC OIL	X					
ENGINE OIL MIL-L-23699 OR MIL-L-7808				X		
C5-A ANTI-SEIZE THREAD COMPOUND			X			

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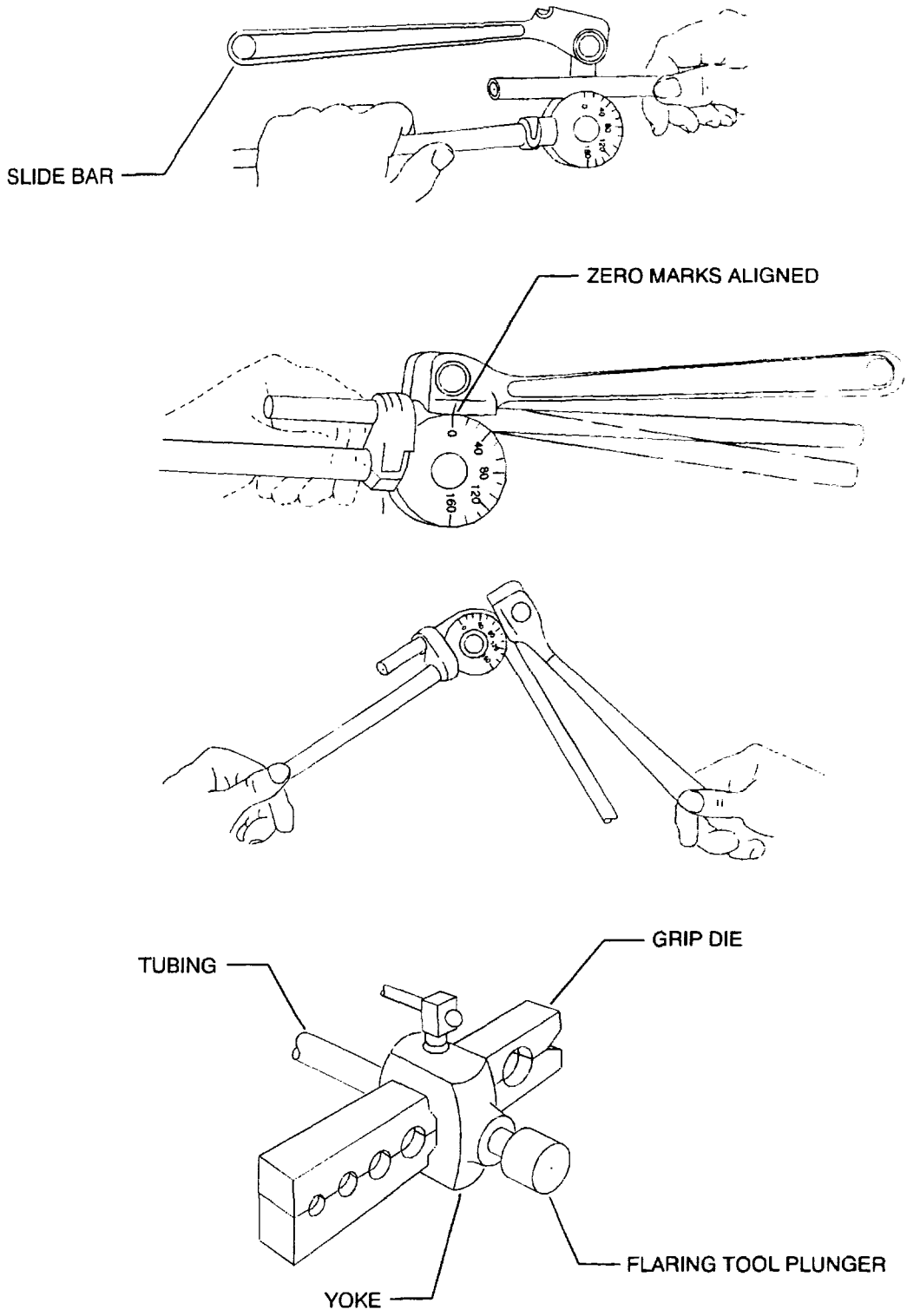
Thread Compound for Straight Threaded Fittings
Figure 202

DASH NO. REF.	TUBING O.D. INCHES	INSTALLATION WRENCH TORQUE LIMITS AN818 NUT INCH-POUNDS (Nm)				HOSE END FITTINGS & HOSE ASSEMBLIES INCH-POUNDS (Nm)	
		ALUMINUM ALLOY TUBING FLARE MS33583 or MS33584		STEEL TUBING FLARE MS33584		FITTING END MS24587 or EQUIVALENT	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
-2	1/8	20 (2.26)	30 (3.39)	75 (8.48)	85 (9.6)		
-3	3/16	25 (2.82)	35 (3.40)	95 (10.74)	105 (11.86)		
-4	1/4	50 (5.66)	65 (7.34)	135 (15.24)	150 (16.93)		
-5	5/16	70 (7.90)	90 (10.16)	170 (20.34)	200 (22.58)		
-6	3/8	110 (12.42)	130 (14.68)	270 (30.48)	300 (33.87)		
-8	1/2	230 (25.97)	260 (29.35)	450 (50.80)	500 (56.45)	▷1 ▷2	▷1 ▷2
-10	5/8	330 (37.25)	360 (40.64)	650 (73.38)	700 (79.03)		
-12	3/4	460 (51.93)	500 (56.45)	900 (101.61)	1000 (112.90)		
-16	1	500 (56.45)	700 (79.03)	1200 (135.48)	1400 (158.06)		
-20	1-1/4	800 (90.32)	900 (101.61)	1520 (170.60)	1680 (189.67)		
-24	1-1/2	800 (90.32)	900 (101.61)	1900 (214.51)	2100 (237.09)		
-32	2	1800 (203.40)	2000 (226.00)	2660 (300.58)	2940 (332.22)		

▷1 When the hose fitting (nipple and nut) is aluminum, the minimum and maximum values for aluminum alloy tubing shall apply.

▷2 When the hose fitting (nipple and nut) is steel, the minimum and maximum values for steel alloy tubing shall apply.

Tubing Torque Limits
Figure 203



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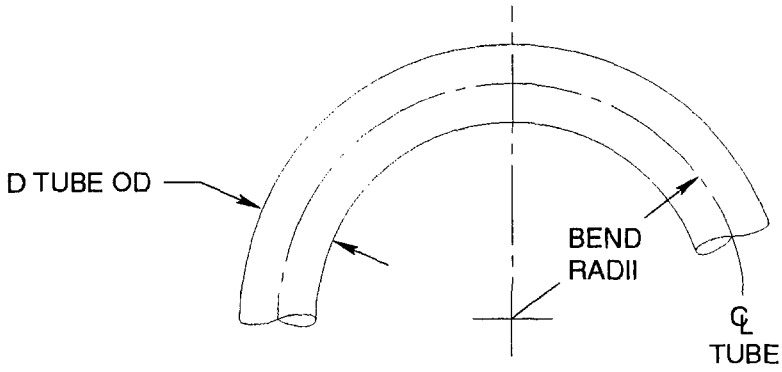
Tubing Fabrication Tools
Figure 204



TUBE OD	SPECIAL RADII		RECOMMENDED BEND RADII		ADDITIONAL BEND RADII
	1-1/2 D	2 D	3 D	4 D	6 D
1/8	.188	.250	.375	.500	.750
3/16	.281	.375	.563	.750	1.125
1/4	.375	▷1◁ .500	.750	1.000	1.500
5/16	.469	▷1◁ .625	.938	1.250	1.875
3/8	.563	▷1◁ .750	1.125	1.500	2.250
7/16	.656	.875	1.312	1.750	2.625
1/2	.750	1.000	1.500	2.000	3.000
5/8	.938	1.250	1.875	2.500	3.750
3/4	1.125	1.500	2.250	3.000	4.500
7/8	1.312	1.750	2.625	3.500	5.250
1	1.500	2.000	3.000	4.000	6.000
1-1/8	1.688	2.250	3.375	4.500	6.750
1-1/4	1.875	2.500	3.750	5.000	7.500
1-3/8	2.063	2.750	4.125	5.500	8.250
1-1/2	2.250	3.000	4.500	6.000	9.000
1-5/8	2.438	3.250	4.875	6.500	9.750
1-3/4	2.625	3.500	5.250	7.000	10.500
1-7/8	2.813	3.750	5.625	7.500	11.250
2	3.000	4.000	6.000	8.000	12.000
2-1/4	3.375	4.500	6.750	9.000	13.500
2-1/2	3.750	5.000	7.500	10.000	15.000
3	4.500	6.000	9.000	12.000	18.000

NOTE: 1 INCH = 2.54 CM = 25.4 MM
▷1◁ WHERE SPECIAL BEND RADIUS IS REQUIRED, 2 D PLUS 0.0625 INCH MAY BE USED.

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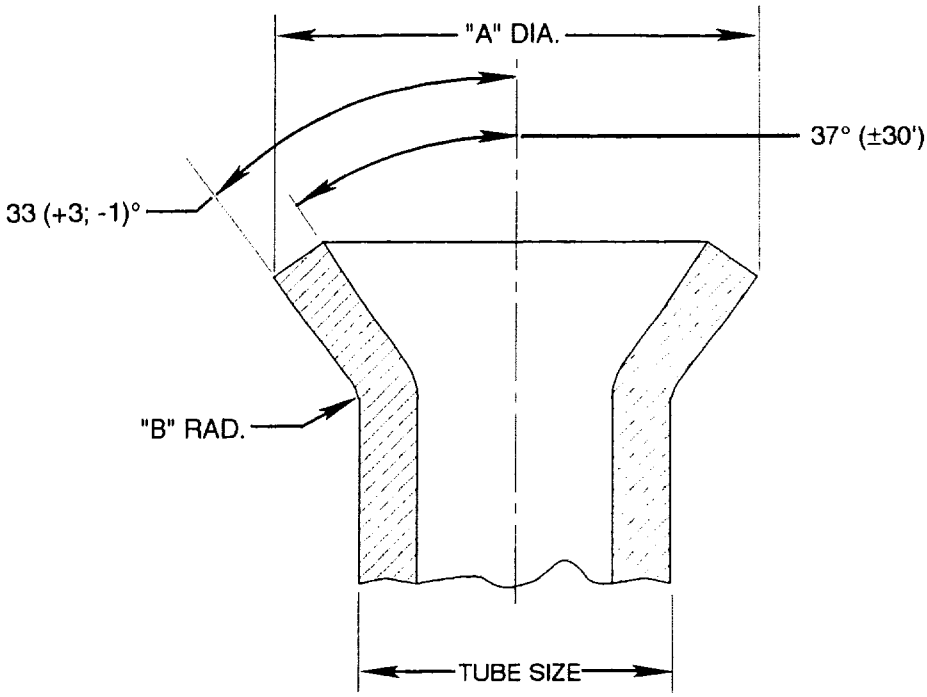
Tube Bending Data
Figure 205



TUBE SIZE NOMINAL O.D.	"A" DIA. AL ALLOY TUBING		"A" DIA. STEEL TUBING		"B" RAD. ± .010
1/8	0.200		0.200		
3/16	0.302		0.302		0.032
1/4	0.359		0.359		
5/16	0.421	+0.000	0.421	+0.000	
3/8	0.484	-0.010	0.484	-0.010	0.046
1/2	0.656		0.656		
5/8	0.781		0.781		0.062
3/4	0.937		0.937		0.078
1	1.187		1.187		
1-1/4	1.500		1.500		0.093
1-1/2	1.721	+0.000	1.721	+0.000	
1-3/4	2.106	-0.015	2.106	-0.015	
2	2.356		2.356		0.109
2-1/2	2.856		2.856		
3	3.356		3.356		

NOTE: 1 INCH = 2.54 CM = 25.4 MM

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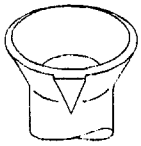
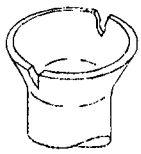
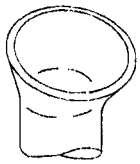
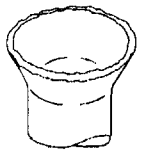
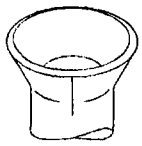
Single Flare Specifications
Figure 206

 **EXTRUDED FIN**	WEDGE RAISED ABOVE SURFACE OF FLARE. TWO MARKS DIAMETRICALLY OPPOSITE. CAUSED BY WORN THROAT ON CLAMPING DIE. BASIS FOR REJECTION AS IT PREVENTS SLEEVE FROM SEATING PROPERLY.
 **CRACKED FLARE**	CRACKS USUALLY LONGITUDINAL IN FLARED PORTION. CAUSED BY TOO GREAT AN ECCENTRIC SETTING ON ROTARY MANDREL. TOO MUCH PRESSURE ON RAM MANDREL. FLAW IN MATERIAL. NOT ACCEPTABLE.
 **ANGLED/ECCENTRIC FLARE**	FLARE IS ECCENTRIC WITH TUBE. TIP NOT PERPENDICULAR TO CENTER LINE OF TUBE. THICKNESS OF FLARE VARIES. CAUSED BY LOOSE CLAMPING OR MANDREL OR DIES OUT OF ALIGNMENT. ALSO ANGLE CUT TUBE. NOT ACCEPTABLE.
 **ROUGH EDGE**	LIP OF FLARE HAS JAGGED OR UNEVEN EDGE. CAUSED BY IMPROPER CUTTING OR BURRING OR TOO MUCH MANDREL PRESSURE. NOT ACCEPTABLE.
 **DIE CREASE**	SLIGHT LONGITUDINAL FIN ALONG FLARE OR TUBE. CAUSED BY SLIGHTLY LARGER THAN NOMINAL TUBE. CREASE MUST BE MORE THAN 0.004 INCH HIGH ON FLARE. ACCEPTABLE IF SLEEVE PASSES FREELY ONTO FLARE.
 **SCRATCHES/GROOVES – INTERNAL ANGULAR**	MARKS APPROXIMATELY PARALLEL TO FLARE TIP. CAUSED BY METAL CHIP PICKUP ON MANDREL. ACCEPTABLE UNLESS DEPTH EXCEEDS 10% OF FLARE THICKNESS.

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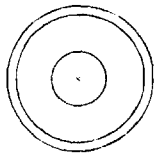
Single Flare Acceptance Limits
Figure 207 (Sheet 1 of 2)

SCRATCHES/GROOVES-INTERNAL LONGITUDINAL OR SPIRAL

MARKS PERPENDICULAR OR SPIRALLING TO FLARE TIP CAUSED BY SCORED MANDREL OR METAL CHIP PICKUP.

NOT ACCEPTABLE IF MARKS ARE ON OUTER 30% OF FLARE.

ACCEPTABLE IF MARKS ARE ON INNER 70% OF FLARE AND DEPTH DOES NOT EXCEED 10% OF FLARE THICKNESS.



TUBE CLOSURE

TUBE ID DECREASED BY FLARING.

CAUSED BY TOO GREAT AN ECCENTRIC ON ROTARY MANDREL.

ACCEPTABLE IF ID IS NOT SMALLER THAN DIMENSION BELOW.

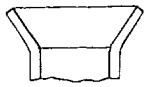
TUBE SIZE	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	1
A MIN.	.049	.112	.150	.221	.284	.378	.471	.506	.820

CLAMPING DIE MARKS

SMALL IRREGULAR MARKS IN CLAMPING AREA OF TUBE.

CAUSED BY DIE CLAMPS.

ACCEPTABLE IF DEPTH DOES NOT EXCEED 5% OF WALL THICKNESS.



SHARP INNER EDGE

SHARP EDGE AT JUNCTION OF INNER FLARE AND TUBE DIAMETER.

ACCEPTABLE.

ABRASIVE SCRATCHES

SMOOTH ABRASIVE AREA ON FLARE TIP.

CAUSED BY CLEANUP POLISHING.

ACCEPTABLE IF DEPTH DOES NOT EXCEED 5% OF WALL THICKNESS.

SCRATCHES/DINGS

SCRATCHES OR DINGS ON TUBING AND/OR FLARE SURFACE.

CAUSED BY STORING AND HANDLING.

ACCEPTABLE IF DEPTH DOES NOT EXCEED 5% OF WALL THICKNESS.

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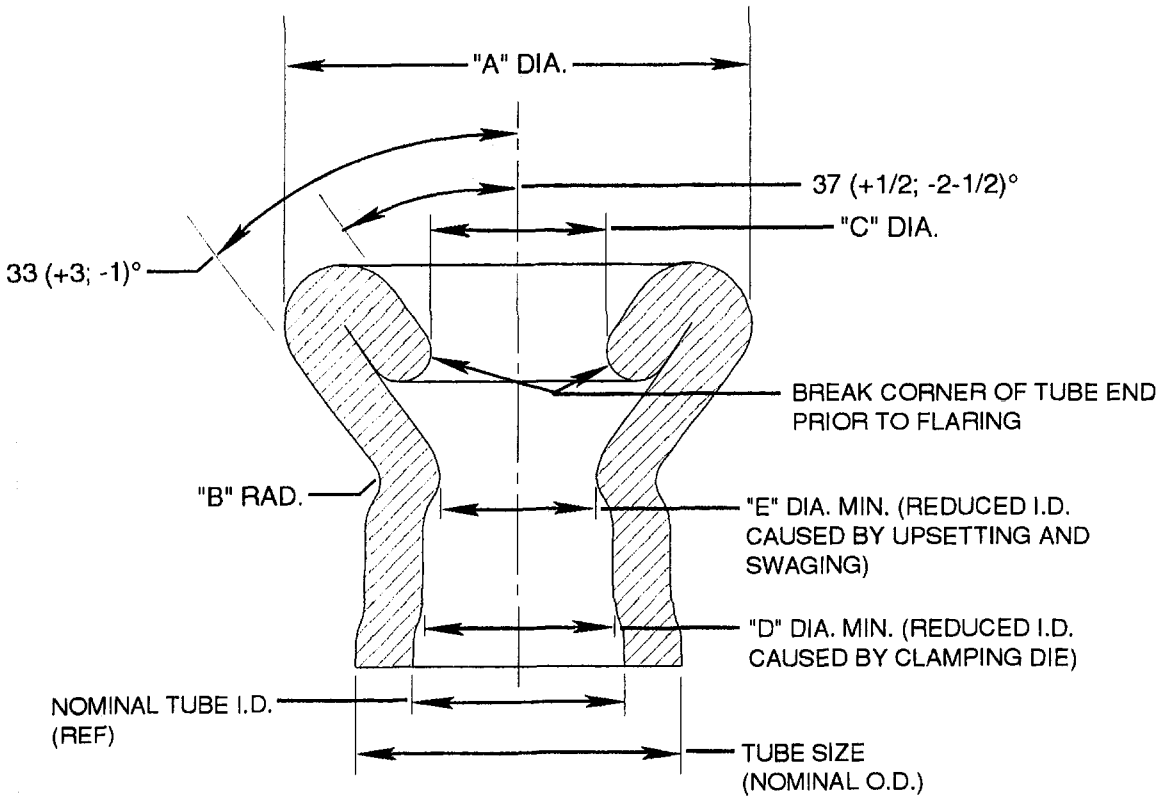
Single Flare Acceptance Limits
Figure 207 (Sheet 2 of 2)



TUBE SIZE NOMINAL O.D. (REF)	WALL THKNS. (REF)	NOMINAL TUBE I.D. (REF)	"A" DIA. +.000; -.010	"B" RAD. ±.010	"C" DIA.		"D" DIA. MIN.	"E" DIA. MIN.
					MAX.	MIN.		
1/8	.028	.069	.200	.032	.096	.062	.062	.056
	.035	.055			.086	.048	.048	.041
3/16	.028	.132	.302		.168	.124	.124	.117
	.035	.118			.158	.110	.110	.102
1/4	.028	.194	.359		.230	.187	.187	.176
	.035	.180			.219	.173	.173	.160
5/16	.035	.243	.421		.281	.235	.235	.221
	.049	.215			.259	.205	.205	.189
3/8	.028	.319	.484	.046	.354	.312	.312	.299
	.035	.305			.344	.298	.298	.284
	.049	.277			.322	.268	.268	.254

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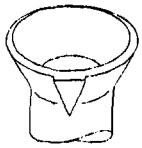
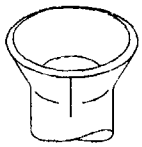
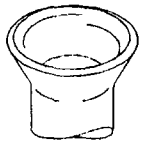
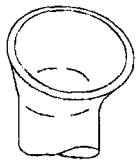
Double Flare Specifications
Figure 208

 **EXTRUDED FIN**	WEDGE RAISED ABOVE SURFACE OF FLARE. TWO MARKS DIAMETRICALLY OPPOSITE. CAUSED BY WORN THROAT ON CLAMPING DIE. BASIS FOR REJECTION AS IT PREVENTS SLEEVE FROM SEATING PROPERLY.
 **DIE CREASE**	SLIGHT LONGITUDINAL FIN ALONG FLARE OR TUBE. CAUSED BY SLIGHTLY LARGER THAN NOMINAL TUBE. CREASE MUST BE MORE THAN 0.004 INCH HIGH ON FLARE. ACCEPTABLE IF SLEEVE PASSES FREELY ONTO FLARE.
 **SCRATCHES/GROOVES – INTERNAL ANGULAR**	MARKS APPROXIMATELY PARALLEL TO FLARE TIP. CAUSED BY METAL CHIP PICKUP ON MANDREL. ACCEPTABLE UNLESS DEPTH EXCEEDS 10% OF FLARE THICKNESS.
 **SCRATCHES/GROOVES– INTERNAL LONGITUDINAL OR SPIRAL**	MARKS PERPENDICULAR OR SPIRALLING TO FLARE LIP. CAUSED BY SCORED MANDREL OR METAL CHIP PICKUP. NOT ACCEPTABLE IF MARKS ARE ON OUTER 30% OF FLARE. ACCEPTABLE IF MARKS ARE ON INNER 70% OF FLARE AND DEPTH DOES NOT EXCEED 10% OF FLARE THICKNESS.
 **CRACKED FLARE**	CRACKS USUALLY LONGITUDINAL IN FLARED PORTION. CAUSED BY TOO GREAT AN ECCENTRIC SETTING ON ROTARY MANDREL. TOO MUCH PRESSURE ON RAM MANDREL. FLAW IN MATERIAL. NOT ACCEPTABLE.
 **ANGLED/ECCENTRIC FLARE**	FLARE IS ECCENTRIC WITH TUBE. TIP NOT PERPENDICULAR TO CENTER LINE OF TUBE. THICKNESS OF FLARE VARIES. CAUSED BY LOOSE CLAMPING OR MANDREL OR DIES OUT OF ALIGNMENT. ALSO ANGLE CUT TUBE. NOT ACCEPTABLE.

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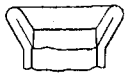
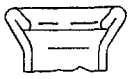
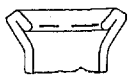
Double Flare Acceptance Limits
Figure 209 (Sheet 1 of 3)

 **CLAMPING DIE MARKS**	SMALL IRREGULAR MARKS IN CLAMPING AREA OF TUBE. CAUSED BY DIE CLAMPS. ACCEPTABLE IF DEPTH DOES NOT EXCEED 5% OF WALL THICKNESS.
 **ABRASIVE SCRATCHES**	SMOOTH ABRASIVE AREA ON FLARE TIP. CAUSED BY CLEANUP POLISHING. ACCEPTABLE IF DEPTH DOES NOT EXCEED 5% OF WALL THICKNESS.
 **SCRATCHES/DINGS**	SCRATCHES OR DINGS ON TUBING AND/OR FLARE SURFACE. CAUSED BY STORING AND HANDLING. ACCEPTABLE IF DEPTH DOES NOT EXCEED 5% OF WALL THICKNESS.
 **EXTRUDED FLARE**	FLARE EXTENDS INTO ID OF TUBE. CAUSED BY TUBE BEING TOO FAR OUT OF CLAMPING DIE BEFORE FLARING. TOO MUCH PRESSURE. CONE MANDREL WITHOUT STOP. ACCEPTABLE IF FLARE DOES NOT EXTEND PAST MINIMUM TUBE ID.
 **INDENTATION - INNER TUBE**	MARK ON TUBE ID BELOW FLARE. CAUSED BY SECOND OPERATION PILOT WHEN MANDREL IS MISALIGNED WITH CLAMPING DIE. NOT ACCEPTABLE.
 **FLATTENED LIP**	FLATTENED OR RINGED FLARE OUTER LIP. CAUSED BY VARIOUS MACHINE SETTINGS. ACCEPTABLE PROVIDING FLARE IS PERPENDICULAR TO TUBE CENTER LINE AND IS NOT CRACKED AT BEND.

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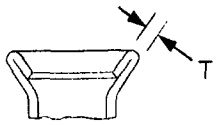
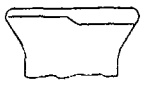
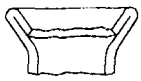
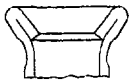
Double Flare Acceptance Limits
Figure 209 (Sheet 2 of 3)

 **THIN FLARE**	FLARE THICKNESS UNUSUALLY THIN. CAUSED BY CONE MANDREL WITHOUT STOP. ACCEPTABLE IF THICKNESS "T" IS NOT LESS THAN 1.5 TIMES TUBE WALL THICKNESS.
 **VARYING FLARE THICKNESS**	FLARE THICKNESS VARIES. CAUSED BY DIE MISALIGNMENT. ACCEPTABLE IF VARIATION DOES NOT EXCEED 0.004 INCH
 **WAVY EDGE**	UNEVEN FLARE INNER EDGE. CAUSED BY TOOLING VARIABLES. ACCEPTABLE IF FLARE DOES NOT EXTEND PAST MINIMUM TUBE ID.
 **SLEEVE INDENTATION**	TUBE INDENTED AT OUTSIDE BASE OF FLARE. CAUSED BY WORN TOOLING. ACCEPTABLE IF INDENTATION IS NOT MORE THAN 12% OF NOMINAL THICKNESS.

A20-0007
M45-203000-204-03

Double Flare Acceptance Limits
Figure 209 (Sheet 3 of 3)

WIGGINS CONNECTORS - MAINTENANCE PRACTICES

1. Tools and Equipment

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Petrolatum	VV-P-236	Commercially Available	Lubricate MS29513 O-rings.
Torque Wrench		Commercially Available	Torque Wiggins connectors sealed with MS29513 O-rings.
Spanner Adapter		Commercially Available	Used with torque wrench.
Torque Putty	EC-1252	3M Co. St. Paul, MN	Mark torqued couplings.
Safety Wire	MS20995C32	Commercially Available	Safetying threaded Wiggins connectors.
Safety Wire	MS20995C20	Commercially Available	Safetying hinged Wiggins or Hydraflow connectors.

2. Removal/Installation

A. Installation of Threaded Wiggins Connector (See Figure 201.) (114G)

(1) Slide body over one tube end and nut over its mating tube end.
(2) Install washer on each tube end.
(3) Lubricate and install the proper O-rings on each tube end.

NOTE: Threaded connectors used in the fuel system have MS29513 O-rings and are to be lightly lubricated with petrolatum (VV-P-236) prior to installation.

Threaded connectors used in the bleed air system have silicone O-rings or RCF seals and are not lubricated.

(4) With nut, body, washers, and O-rings slid down the tubes far enough to expose tube ends, install retainer over mating tube ends.
(5) Slide nut and body into position.

(6) Carefully align tube and connector.

NOTE: Angular mismatch is not to exceed (±) 4°.

Radial mismatch is not to exceed 1/16 inch [1.58 mm].

The gap between the tubes shall be 0.13 (± 0.3) inch [3.30 (± 7.62) mm] for fuel system and 0.19 (± .03) inch [4.8 (± 0.762) mm] for the bleed air system.

(7) After aligning tubes and connector, engage threads and tighten hand tight.
(a) Connectors which are sealed with silicone O-rings are to be tightened hand tight only.
(b) Connectors which are sealed with RCF seals are to be tightened hand tight and backed-off 1/4 turn. These connectors shall not be retightened since the seals will swell upon exposure to heat.
(c) Connectors which are sealed with MS29513 O-rings shall be torqued per Table 201. Torquing of applicable connectors is accomplished with a spanner adapter attached to the torque wrench.

CAUTION: DO NOT APPLY THIS STEP TO COUPLINGS INSTALLED INSIDE A FLUID SYSTEM, EXAMPLE: INSIDE WING TANKS.

DO NOT APPLY THIS STEP TO COUPLINGS USED IN THE BLEED AIR SYSTEM.

(8) Apply torque-putty and torque stamp to coupling.

NOTE: This step is to applied by the person doing the torquing.

(9) After connectors have been properly tightened, safety wire body and nut together using double twist method.

B. Installation of Hinged Wiggins or Hydraflow Connector (See Figure 202.) *(1241AD)*

WARNING: DO NOT SAFETY WIRE WIGGINS CONNECTORS USED INSIDE THE FUEL CELL. SAFETY WIRE PROVIDES STATIC DISCHARGE POINTS AND CAN PUNCTURE FUEL BLADDER.

CAUTION: WIGGINS W900 AND W901 SERIES CONNECTORS HAVE A SINGLE LEVER TYPE LATCH WHICH CAN UNLATCH IF NOT PROPERLY CLOSED.

ALL WIGGINS W900 AND W901 SERIES CONNECTORS IN THE FUEL DISTRIBUTION AND EXPANSION SYSTEM PLUMBING IN THE KEELBEAM AND TAILCONE AREAS MUST BE SAFETY-WIRED.

(1) Lubricate and install proper O-ring on each ferrule or, in bleed air high-temperature installations, install proper unlubricated high-temperature seal on each ferrule.
(2) Install body on one ferrule.
(3) Align mating ferrule and pull body over second ferrule. Ensure that body covers flange on both ferrules.
(4) Open hinged retainer assembly and install over body. Ensure that retainer assembly captures body and ferrule flange on each tube.

CAUTION: FAILURE OF HINGED RETAINER ASSEMBLY TO ROTATE FREELY IS AN INDICATION THAT TUBE ALIGNMENT IS BEYOND ALLOWABLE LIMITS.

AFTER VISUAL INSPECTION OF LATCH FOR COMPLETE ENGAGEMENT AND COMPLETE ROTATION, ROTATE HINGED RETAINER ASSEMBLY OUT OF THE WAY. THIS WILL PREVENT ANY INADVERTENT UNLATCHING OF THE W991 OR HYDRAFLOW SERIES CONNECTOR.

(5) Engage latch assembly.

NOTE: On hinged Wiggins W900 and W901 Series connectors, ensure that safety spring locks.

(6) Rotate hinged retainer assembly completely around the tube connection and visually inspect for complete engagement of the spring latches. (See Figure 203.)
(7) Rotate hinged retainer assembly so the latch cannot be inadvertently unlatched.
(8) Safety wire using the external single-twist method (Refer to 20-20-00, Safety Wiring.) Run safety wire underneath hinge and through the stamped cutout in the latch assembly.

NOTE: Hinged Wiggins W991 or Hydraflow Series connectors do not require safety wire.

C. Installation of 6300 Series Connector (See Figure 204.) *(1241AD)*
(1) Slide body over one tube end and nut over its mating tube end.

NOTE: Body and nut will slip over ferrules.

(2) Install washer on each tube end over ferrules.
(3) Lubricate and install proper O-ring on each tube end over the ferrule.

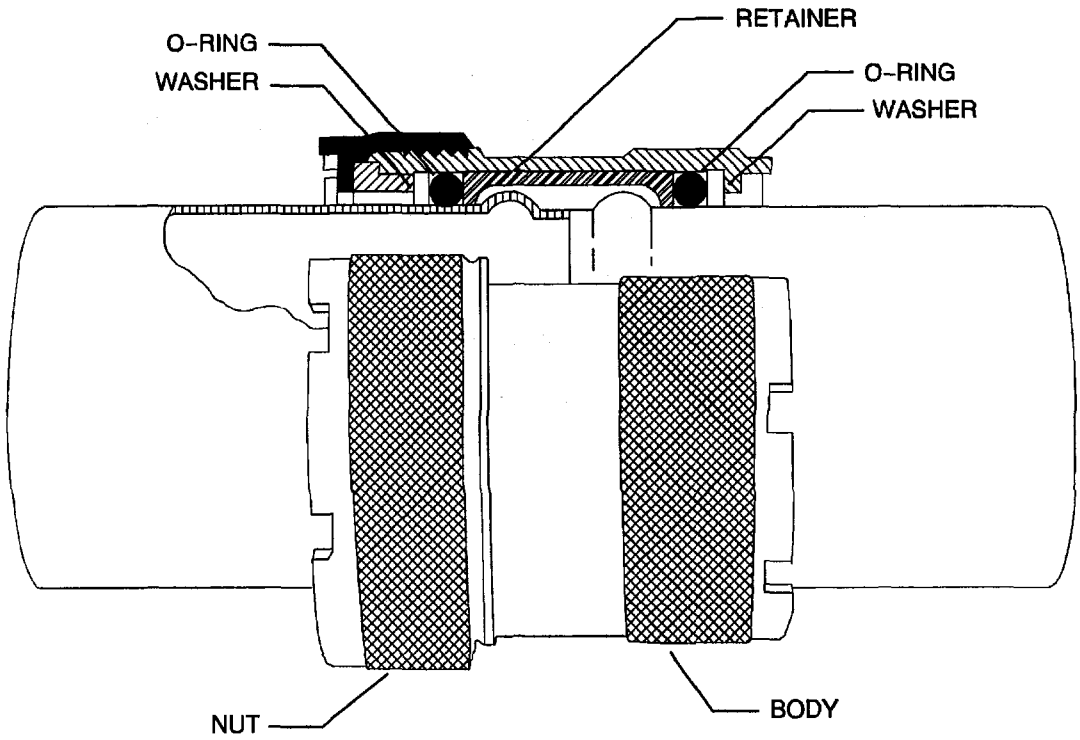
NOTE: Threaded connectors used in the fuel system have MS29513 O-rings and are to be lightly lubricated with petrolatum (VV-P-236) prior to installation.

(4) Install snap retainer securing the ferrule on both tube ends simultaneously.
(5) Position tube body against washer and ensure the following:
(a) The washer is flush against the O-ring.
(b) The O-ring is flush against the snap retainer.
(6) Slide nut and body into position and engage the threads.
(7) Tighten hand tight.
(8) Safety wire body and nut together using double twist method.

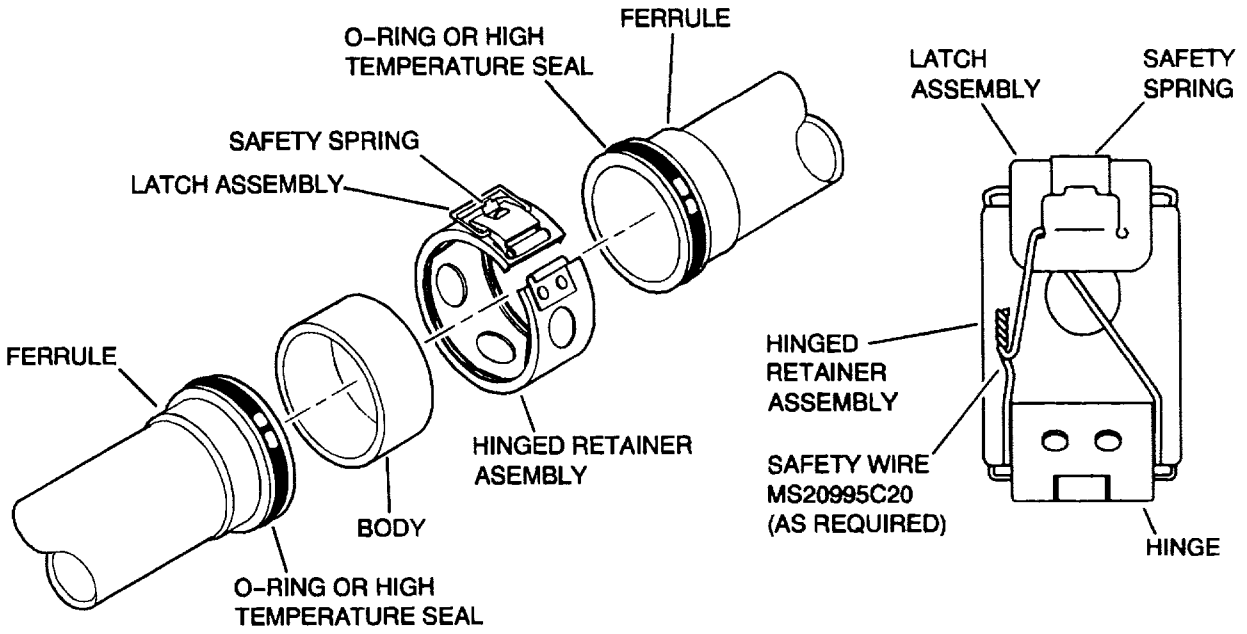
Connector Size	Torque Value inch-pounds [Nm]		Connector Size	Torque Value inch-pounds [Nm]	
	Min.	Max.		Min.	Max.
-12D	60 [6.77]	85 [9.60]	-40D	385 [43.47]	420 [47.42]
-16D	125 [14.11]	155 [17.50]	-48D	705 [79.59]	740 [83.55]
-20D	185 [20.89]	215 [24.27]	-56D	925 [104.43]	960 [108.38]
-24D	325 [36.69]	360 [40.64]	-64D	1045 [117.98]	1080 [121.93]
-28D	350 [39.52]	385 [43.47]	-72D	1165 [131.53]	1200 [135.48]
-32D	360 [40.64]	395 [44.60]	-80D	1285 [145.08]	1320 [149.03]

NOTE: Torque values are for connectors sealed with MS29513 O-rings. Connectors with silicone O-rings shall be tightened hand tight.

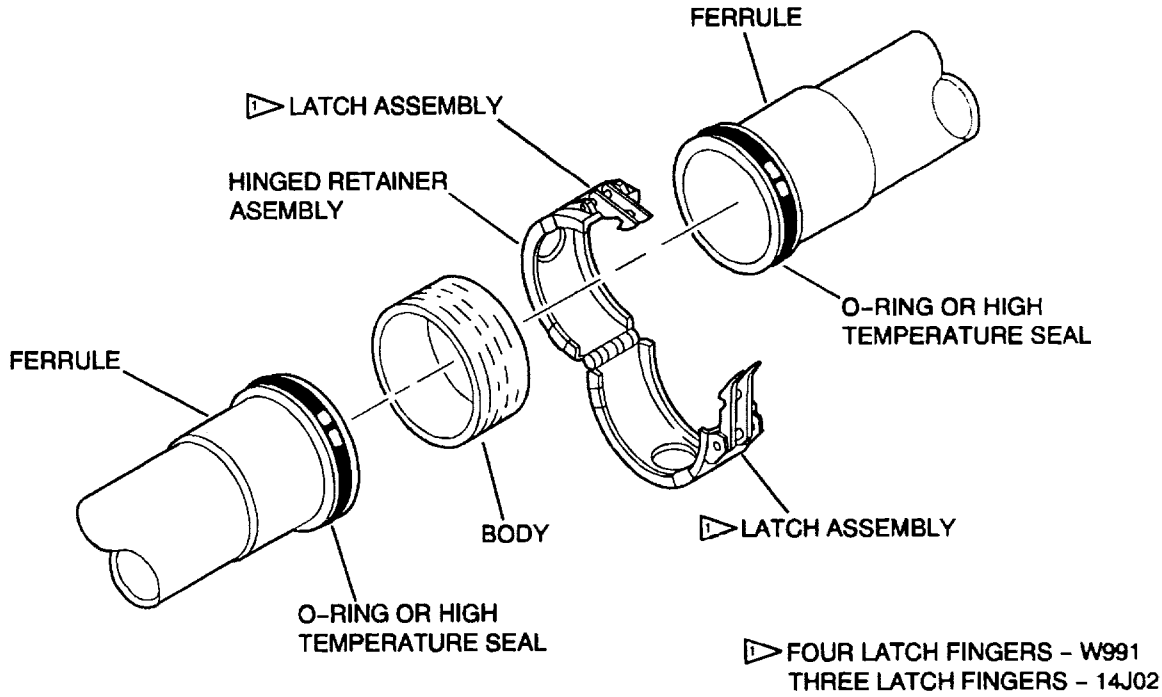
Wiggins Threaded Connector Torque Values
Table 201



Wiggins Connector Installation
Figure 201



(WIGGINS W901 SERIES HINGED CONNECTORS)



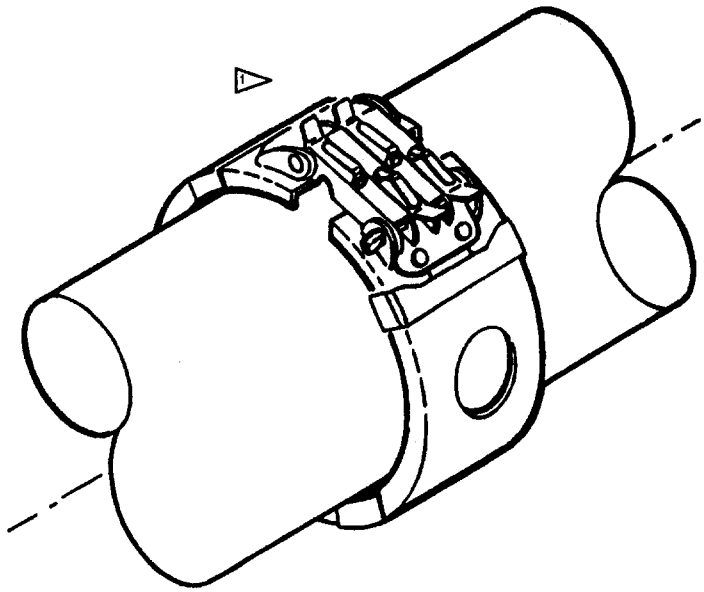
(NO SAFETY WIRE REQUIRED)

(WIGGINS W991 AND HYDRAFLOW 14J02 CONNECTORS)

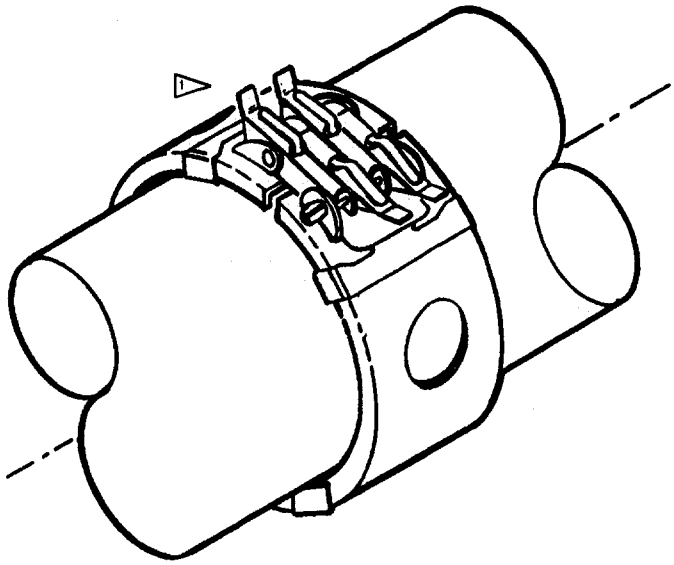
M35-203100-202-01

Hinged Wiggins/Hydraflow Connector Installation
Figure 202

EFFECTIVITY: AIRCRAFT EQUIPPED WITH HINGED WIGGINS AND HYDRAFLOW CONNECTORS



(NOT LATCHED)



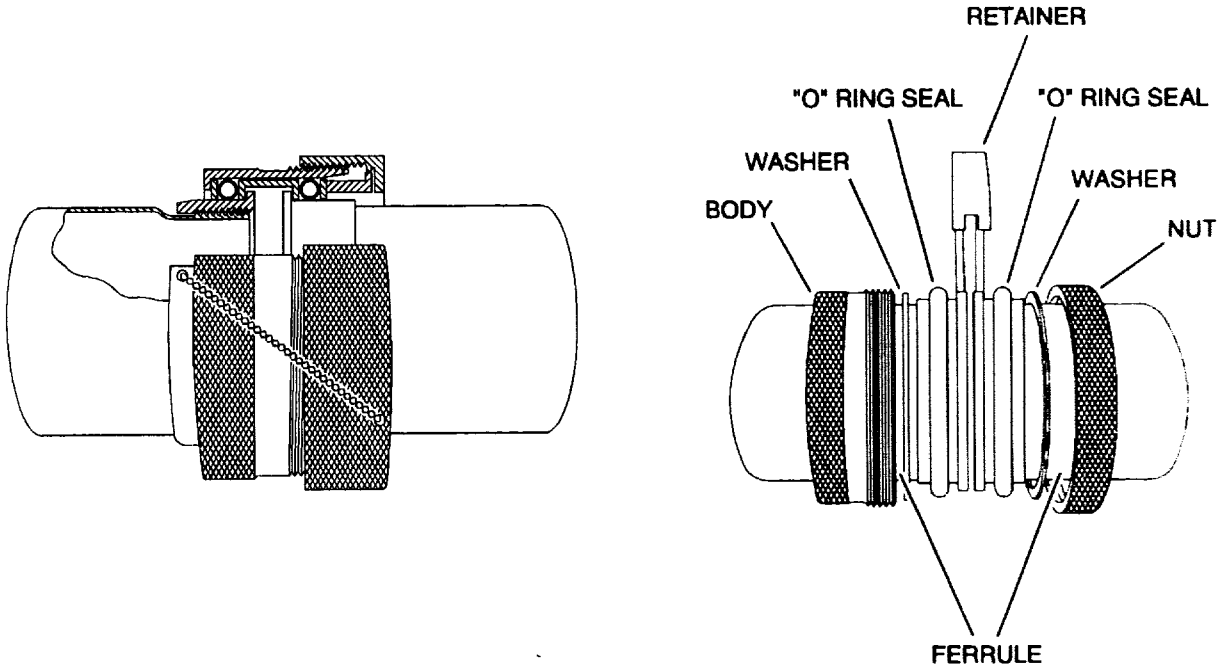
(LATCHED)

1 FOUR LATCH FINGERS - W991
THREE LATCH FINGERS - 14J02

M35-203100-203-01

Hinged Wiggins/Hydraflow Connector Latching
Figure 203

EFFECTIVITY: AIRCRAFT EQUIPPED WITH HINGED WIGGINS AND HYDRAFLOW CONNECTORS



6300 Series Connector Installation
Figure 204

EFFECTIVITY: AIRCRAFT EQUIPPED WITH 6300 SERIES CONNECTORS

BOLT TORQUE DATA - MAINTENANCE PRACTICES

1. Removal/Installation *(1036R)*

CAUTION: AVOID USING GRAPHITE LUBE OR GRAPHITE LUBRICATED HARDWARE WITH ALUMINUM PARTS. GRAPHITE ON ALUMINUM IS POTENTIALLY CORROSIVE.

DO NOT USE TORQUE PUTTY OR DECALS TO MARK FITTINGS OR THREADED FASTENERS INSIDE A FLUID SYSTEM.

DO NOT USE TORQUE PUTTY TO MARK FITTINGS IN THE OXYGEN SYSTEM.

DO NOT USE TORQUE PUTTY TO MARK PLASTIC FITTINGS. THE SOLVENT IN THE PUTTY MAY ADVERSELY AFFECT THE MATERIAL.

A. Maintenance personnel shall familiarize themselves with the following torquing information:
   (1) Torquing of bolts is required to provide security of installation and prevent overstressing of components during installation.
   (2) Wrench torques are for clean, non-lubricated parts. Accumulations of lubricant on threads shall be removed by suitable means.
   (3) Special torque values for specific installations are given in maintenance practices and installation instructions of the various components.
   (4) Torquing is not required for bolts, nuts, and screws installed in the control systems or other installations where torque would interfere with proper operation of parts. On such applications, the assembly shall be firm, but not tight enough to cause binding.
   (5) When drag torque is referred to, it is defined as the torque required to turn a self-locking nut on the threads of a bolt. Drag torque is normally added to the required torque value.
   (6) Torque tightening of bolted assemblies involving non-captive nuts shall be accomplished by torquing nut. Bolts in close ream or interference fit holes shall, under no circumstances, be installed by torquing from head side. When it is necessary to torque the fastener from head end, increase maximum torque value by an amount equal to the shank friction. The shank friction shall be measured by a torque wrench. When shank friction is referred to, it is defined as the torque required to turn a bolt within a snugly fitting hole.
   (7) Do not use anti-seize compounds or lubricants unless specified in the specific instructions. When threads are greased, torque values shall be decreased by 10%. Threads that are cadmium plated or lubricated with graphite or molybdenum disulfide, shall have their torque values decreased by 15%.
   (8) Bolt and nut threads must be free from grime or dirt. An approved solvent may be used to remove temporary corrosion preventatives from non pre-lubricated fasteners. (Refer to 20-13-00, Solvent Cleaning.)
   (9) Bolt length and thickness of washer must be such that nut will not engage the first incomplete thread next to bolt shank. Grip length of a bolt shall not interfere with threads of a threaded insert.
   (10) All plumbing fittings shall be torqued. Torque putty and torque stamp shall be applied by the mechanic making the installation.

B. Installing Bolts
   (1) Bolts 1/4 inch [6.35 mm] diameter or less which are drilled for cotter pins, should not be installed using self-locking nuts.
   (2) Bolts or screws, which do not have the nut accessible, or are installed in nutplates, or have threads not included in Table 201 need not be torqued but shall be drawn down tight.

C. Installing Nuts
(1) When torquing nuts, use the standard torque values listed in Table 201 unless otherwise specified.

NOTE: Table 201 does not include all of the applicable part numbers for tension and shear type nuts. The part numbers listed are provided as examples only.

(2) Nut reuse.
(a) Ordinary, thin, slotted, and castle nuts may not be torque tightened more than three (3) times.
(b) Self-locking nuts may not be torque tightened more than twice, unless it can be demonstrated that prevailing or run-down torque required to overcome locking device lies within the range given in Table 202.
(3) Castellated nuts.
(a) When installing castellated nuts for use with safety wire or cotter pin, align bolt hole and nut castellations by tightening nut to low torque range (10% below required torque value) and continue to tighten until bolt hole and nut castellations align.
(b) If hole and nut castellations cannot be aligned without exceeding the maximum torque value, a washer of different thickness may be used or another washer added. If tightening nut to align bolt hole and nut castellations resulted in a torque level greater than 10% of required value, both nut and bolt must be replaced.
(4) Self-locking nuts.
(a) In securing self-locking nuts, standard torque shall be added to that torque necessary to run down nut to the material (drag torque). (Refer to Table 202.)
(b) The run-down torque of a nut or insert must not be altered by "crimping" the locking device, or by easing it by use of a thread tap.
(c) When installing self-locking nuts, always use the same type nut as removed.
(d) Self-locking nuts should not be substituted for castellated nuts secured by safety wire or cotter pin.
(e) Fiber or nylon self-locking nuts should not be used in areas subject to high temperature.
(5) Straight threaded connections.
(a) Flared tube and hose end fitting connectors shall be installed with wrench torques. (Refer to 20-30-00, Removal/Installation.)
(b) Fitting ends on which it is impossible to get a torque wrench shall be torqued in accordance with good aircraft practice.

D. Installing Washers (See Figure 201.)
(1) When installing a lockwasher against aluminum alloy, a cadmium-plated flat washer should be installed between lockwasher and aluminum alloy to prevent damage to the aluminum alloy. On magnesium alloys, use an NAS1252 flat washer under the lockwasher to prevent corrosion between dissimilar metals.
(2) The use of wrong type or number of washers may result in improper preloading of the bolts when torqued.
(3) When bolts are used which have a radius under bolt head, a countersunk washer must be used with the countersink next to the radius under the bolt head. Reversing a countersunk washer or installing a standard washer can result in bolt failure.

E. Torquing Sequence *(904)*
(1) Insert and start all fasteners by hand, engaging first few threads.

NOTE: For self-locking nuts, size 10 or above, it shall be impossible to fully engage locking device by finger tightening. The end of bolt shall not protrude through nut when tightening as hard as possible with fingers; otherwise, self-locking torque will be unsatisfactory, and nut must be replaced.

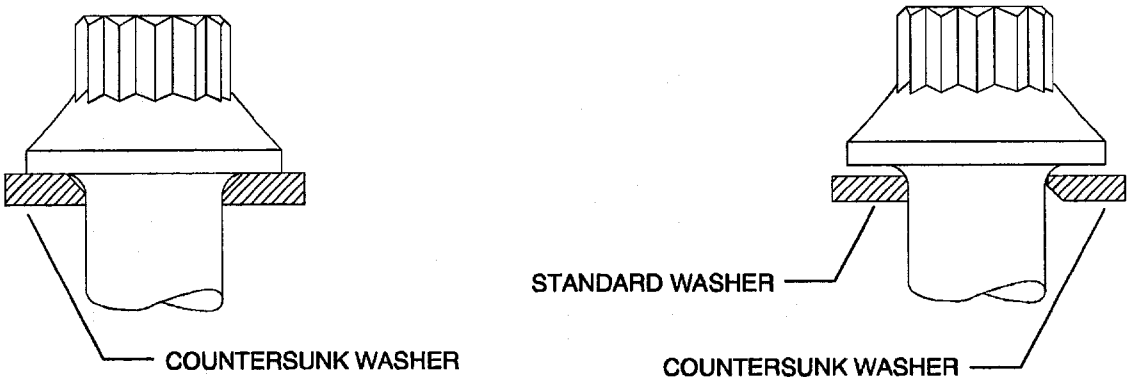
SIZE OF NUT, BOLT, OR SCREW	TORQUE RANGE - Inch-Pounds					
	Tension-Type Nuts 220 ksi UTS & Above	Tension-Type Nuts 180-220 ksi UTS Example: NAS1804	Tension-Type Nuts 125-179 ksi Typical Examples: MS20365 & MS21045	Shear-Type Nuts 125-179 ksi Typical Examples: MS20364 & MS21245	Shear-Type Nuts 71-124 ksi Example: AN316	Shear-Type Nuts 70 ksi UTS & Less Aluminum, Copper
4-40	-	-	6-8	4-6	3-5	2-4
6-32	-	-	10-13	5-7	4-6	3-5
8-32	-	-	12-15	7-9	6-8	5-7
10-32	-	-	20-25	12-15	9-12	7-11
1/4-28	90-125	70-90	50-70	30-40	20-30	15-25
5/16-24	180-250	140-205	100-140	60-85	50-65	45-50
3/8-24	300-500	190-350	160-190	95-110	80-90	75-85
7/16-20	510-840	500-755	450-500	270-300	220-280	90-130
1/2-20	870-1300	690-990	480-690	290-410	240-370	120-145
9/16-18	1300-1800	1000-1400	800-1000	480-600	420-550	210-300
5/8-16	-	-	1100-1300	660-780	-	-
3/4-16	-	-	2300-2500	1300-1500	-	-
7/8-14	-	-	2500-3000	1500-1800	-	-
1-14	-	-	3700-5500	2200-3300	-	-
1-1/8-12	-	-	5000-7000	3000-4200	-	-
1-1/4-12	-	-	9000-11000	5400-6600	-	-

SIZE OF NUT, BOLT, OR SCREW	TORQUE RANGE - Nm					
	Tension-Type Nuts 220 ksi UTS & Above	Tension-Type Nuts 180-220 ksi UTS Example: NAS1804	Tension-Type Nuts 125-179 ksi Typical Examples: MS20365 & MS21045	Shear-Type Nuts 125-179 ksi Typical Examples: MS20364 & MS21245	Shear-Type Nuts 71-124 ksi Example: AN316	Shear-Type Nuts 70 ksi UTS & Less Aluminum, Copper
4-40	-	-	0.67-0.90	0.45-0.67	0.34-0.56	0.23-0.45
6-32	-	-	1.13-1.47	0.56-0.79	0.45-0.67	0.34-0.56
8-32	-	-	1.35-1.69	0.79-1.01	0.67-0.90	0.56-0.79
10-32	-	-	2.25-2.82	1.35-1.69	1.01-1.35	0.79-1.24
1/4-28	10.16-14.11	7.90-10.16	5.64-7.90	3.38-4.51	2.25-3.38	1.69-2.82
5/16-24	20.32-28.23	15.80-23.14	11.29-15.80	6.77-9.59	5.64-7.34	5.08-5.64
3/8-24	33.87-56.45	21.45-39.52	18.06-21.45	10.72-12.41	9.03-10.16	8.47-9.59
7/16-20	57.58-94.83	56.45-85.24	50.80-56.45	30.48-33.87	24.84-31.61	10.16-14.68
1/2-20	98.22-146.77	77.90-111.77	54.19-77.90	32.74-46.28	27.10-41.77	13.55-16.37
9/16-18	146.77-203.22	112.90-158.06	90.32-112.90	54.19-67.74	47.42-62.10	23.71-33.87
5/8-16	-	-	124.19-146.77	74.51-88.06	-	-
3/4-16	-	-	259.67-282.25	146.77-169.35	-	-
7/8-14	-	-	282.25-338.70	169.35-203.22	-	-
1-14	-	-	417.73-620.95	248.38-372.57	-	-
1-1/8-12	-	-	564.50-790.30	338.70-474.18	-	-
1-1/4-12	-	-	1016.10-1241.80	609.66-745.14	-	-

Torque Values
Table 201

UNF Thread Size	RUN-DOWN TORQUE (Drag Torque) (Maximum/Minimum Prevailing Torque)			
	Minimum		Maximum	
	Inch-Pounds	Nm	Inch-Pounds	Nm
No. 6-32	1.0	0.11	6.0	0.68
No. 8-32	1.5	0.17	12.0	1.36
No. 10-32	2.0	0.23	17.0	1.92
0.2500-28	3.5	0.39	35.0	3.95
0.3125-24	6.5	0.73	72.0	8.13
0.3750-24	9.5	1.07	96.0	10.80
0.4375-20	14.0	1.58	120.0	13.60
0.5000-20	18.0	2.03	180.0	20.30
0.5625-18	24.0	2.71	240.0	27.10
0.6250-18	32.0	3.62	360.0	40.70

Run-Down Torque Values
Table 202



INSTALL WASHER WITH COUNTERSUNK FACE NEXT TO BOLT HEAD RADIUS.

CORRECT INSTALLATION

CAUTION: NEVER INSTALL STANDARD WASHER OR COUNTERSUNK WASHER IN REVERSE WHEN USING BOLTS WITH RADIUS UNDER THE HEAD.

INCORRECT INSTALLATION

Washer Installation
Figure 201

(2) Pre-torque all fasteners to approximately 75% of the specified final torque value.

NOTE: Removable parts that are to have formed-in-place gaskets shall be torqued to 30% of specified torque value at time of installation and final torqued to specified value after 24 hours.

(a) Torque fasteners arranged in a linear pattern in a criss-cross fashion, beginning at the middle of pattern and working toward the ends. (See Figure 202.)
(b) Torque circular patterns (flanges, access panels, etc.) in a criss-cross fashion, alternately torquing opposite fasteners. (See Figure 202.)
(c) Apply force in a slow, steady manner to torque wrench handle and in a direction perpendicular to handle, and in its plane of rotation. The lay of the wrench shall be parallel to mating surface.

CAUTION: IF USING A PRESET TORQUE WRENCH (WHICH SLIPS ONCE REQUIRED TORQUE IS EXCEEDED), EXERCISE CARE TO PREVENT VIOLENT RECOIL AS IT RETURNS TO ITS ORIGINAL POSITION. IF VIOLENT RECOIL OCCURS, FASTENER WILL BE OVERTORQUED.

(3) Final torque all fasteners, using same sequence as for pre-torquing, to 100% of specified torque value.

NOTE: All nut threads shall be engaged, and the complete chamfer on end of bolt shall protrude beyond the nut.

If wrench is of preset variety (which slips once required torque is exceeded), exercise care to prevent violent recoil as it returns to its original position. If violent recoil occurs, slacken fastener and retighten.

Inadvertent over-tightening to greater than 10% in excess of stipulated torque requires that both nut and bolt are discarded and replaced with new parts.

(4) Fully torque sealed parts at least twice within assembly life of sealant.

NOTE: This is because such compounds exude slowly under pressure, and bolt load can fall off considerably under such conditions.

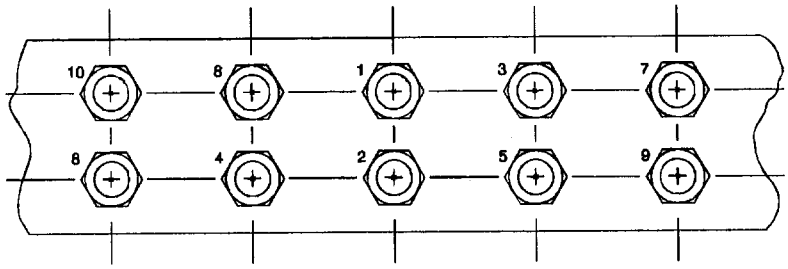
Allow a minimum time of five (5) minutes and a maximum time of ten (10) minutes between these torquing operations.

Allow a lapsed time of not less than 50% and not greater than 100% of sealants working life for joints incorporating a polysulphide sealants between clamped faces.

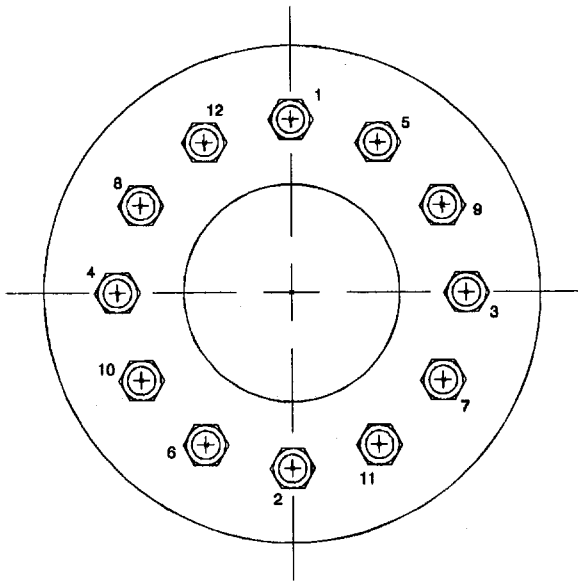
2. Inspection/Check

A. Inspect Nuts and Bolts

(1) Bolts should extend through the self-locking portion of self-locking nuts. Rounded or chamfered ends should extend at least full round or chamfer through nut. Flat end bolts should extend at least 1/32 inch [0.79 mm] through nuts.
(2) Drilled hole in bolts for use with castellated nuts should not extend more than 1/2 the diameter of hole above nut.



TYPICAL LINEAR PATTERN TORQUING SEQUENCE



TYPICAL CIRCULAR PATTERN TORQUING SEQUENCE

Torquing Sequence
Figure 202

(3) When reusing self-locking nuts, ensure that gripping power is sufficient so as not to loosen in service. A nut which threads onto a bolt easily shall be discarded. Gripping power of a bolt is sufficient if a minimum of three threads are exposed past the nut. Attach a torque wrench to nut and determine torque necessary to run down the nut. Standard torque shall be added to the drag torque (that torque necessary to run down the nut) for the total torque to be applied.

3. **Using Torque Wrenches**

A. Standard Torque Wrench Practices When Torquing Nuts and Bolts (See Figure 203 and Table 203.)

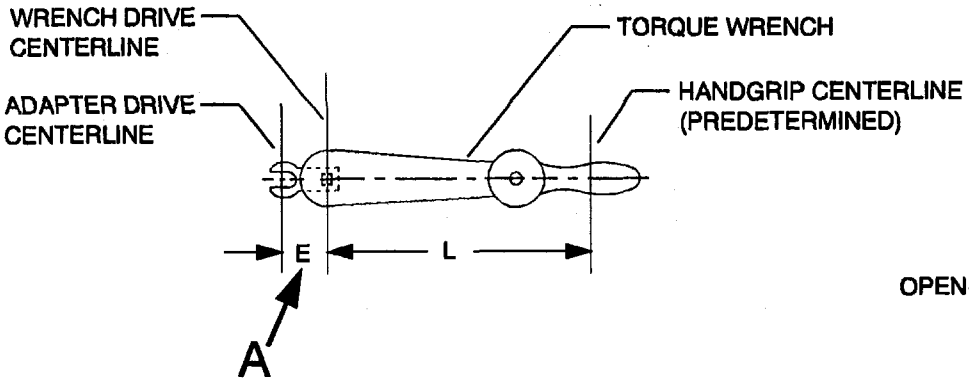
(1) Whenever possible, the nut should be torqued. When it is necessary to torque the bolt head, the bolt should be torqued to the high torque value plus shank friction, if any.

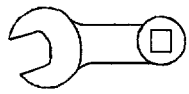
(2) Calibrate torque wrenches periodically to ensure accuracy. Torque wrenches shall be calibrated so their accuracy is within the tolerances in Table 203.

(3) Take final torque readings while nut is rotating. If highest torque value is reached without rotating nut, the nut must be backed off and retorqued.

(4) When torquing requires the use of an adapter, the torque value must be computed using Figure 203.

(5) When using a "pre-set" torque wrench, the load shall be applied gradually until the wrench gives its indicating snap. The load must be immediately removed at this time. The snapping of the wrench does not prevent additional torque being applied if more pressure is applied to the handle.





OPEN-END WRENCH ADAPTER

SHORT OPEN END ADAPTER

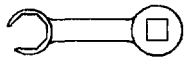
FORMULA $\frac{T \times L}{L + E} = Y$

EXAMPLE (WITH "E" AS PLUS DIMENSION)

T = 135 IN.LB.
Y = UNKNOWN
L = 10.0 IN.
E = 1.5 IN.

$Y = \frac{135 \times 10}{10 + 1.5} = \frac{1350}{11.5} = 117.39$

Y = 117 IN.LB.



FLARE NUT WRENCH ADAPTER

METRIC EXAMPLE OF FORMULA

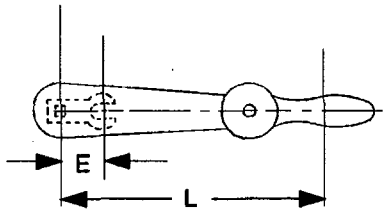
T = 15.24 Nm
Y = UNKNOWN
L = 25.4 CM
E = 3.81 CM

$Y = \frac{15.24 \text{ Nm} \times 25.4}{25.4 + 3.81} = \frac{387.09}{29.21} = 13.25$

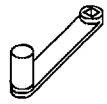
Y = 13.25 Nm

SPANNER WRENCH ADAPTER

SETSCREW ADAPTER



Detail A



HOSE CLAMP ADAPTER

NOTE: IF IT IS NECCESSARY TO ATTACH ADAPTER DRIVE 180° AS SHOWN IN DETAIL A, THEN "E" BECOMES A NEGATIVE NUMBER.

M35-204000-203-01

Torque Wrench Adapter Formulas
Figure 203 (Sheet 1 of 3)

APPROX. LENGTH OF TORQUE ARM	ADAPTER LENGTHS						
	1" thru 1-5/8"	Over 1-5/8" thru 2-3/8"	Over 2-3/8" thru 3-1/8"	Over 3-1/8" thru 3-7/8"	Over 3-7/8" thru 4-5/8"	Over 4-5/8" thru 5-3/8"	Over 5-3/8" thru 6"
7"	.85	.77	.71	.66	.61	.57	.54
9-1/2"	.89	.83	.78	.74	.69	.67	.64
13-1/2"	.91	.87	.83	.79	.76	.73	.70
24"	.95	.92	.90	.87	.85	.83	.81

NOTE: Multiply the required torque by the decimal figure given in this table to obtain the actual wrench reading.
1 inch = 2.54 cm = 25.4 mm

IN. OR FT. LBS. CONVERSION TORQUE DATA FOR USE WITH UNIVERSAL SOCKETS

TO OBTAIN A TORQUE OF IN. OR FT. LBS.	DIAL MUST READ - WITH UNIVERSAL HELD AT THESE ANGLES						
	10°	20°	30°	40°	45°	50°	60°
10	10.2	10.7	11.5	13.1	14.1	15.6	20.0
20	20.4	21.4	23.0	26.2	28.2	31.2	40.0
30	30.6	32.1	34.5	39.3	42.3	46.9	60.0
40	40.8	42.8	46.0	52.4	56.4	62.4	80.0
60	61.2	64.2	69.0	78.6	84.6	93.6	120.0
80	81.6	85.6	92.0	104.8	112.8	124.8	160.0
100	102.0	107.0	115.0	131.0	141.0	156.0	200.0
120	122.4	128.4	138.0	157.2	169.2	187.2	240.0
140	142.8	149.8	161.0	183.4	197.4	218.4	280.0
180	183.6	192.6	207.0	235.8	253.8	253.8	360.0
200	204.0	214.0	230.0	262.0	282.0	312.0	400.0
220	224.4	235.5	243.0	288.2	310.2	243.5	440.0
240	244.4	256.8	276.0	314.4	338.4	374.4	480.0
260	265.2	278.2	299.0	340.6	366.6	405.6	520.0
280	385.6	299.6	312.0	366.8	394.8	436.8	560.0
300	306.0	321.0	345.0	392.0	423.0	468.0	600.0
320	326.4	342.4	368.0	419.2	451.2	499.2	640.0
340	346.8	363.8	391.0	445.4	479.4	530.4	680.0
360	367.2	385.2	414.0	471.6	507.6	561.6	720.0
380	387.6	406.6	437.0	497.8	535.8	592.8	760.0
400	408.0	428.0	460.0	524.0	564.0	624.0	800.0
420	428.4	449.4	483.0	550.2	602.2	655.0	840.0
440	448.8	470.8	506.0	576.4	620.4	686.4	880.0
460	469.2	492.2	529.0	593.6	648.6	717.6	920.0
480	489.6	512.6	552.0	628.8	676.8	748.8	960.0
500	510.0	535.0	575.0	655.0	705.0	780.0	1000.0

Torque Wrench Adapter Formulas
Figure 203 (Sheet 2 of 3)

Nm CONVERSION TORQUE DATA FOR USE WITH UNIVERSAL SOCKETS

TO OBTAIN A TORQUE OF Nm	DIAL MUST READ - WITH UNIVERSAL HELD AT THESE ANGLES						
	10°	20°	30°	40°	45°	50°	60°
1.12	1.15	1.20	1.29	1.47	1.59	1.76	2.25
2.25	2.30	2.41	2.59	2.95	3.18	3.52	4.51
3.38	3.45	3.62	3.89	4.43	4.77	5.28	6.77
4.51	4.60	4.83	5.19	5.91	6.36	7.04	9.03
6.77	6.90	7.24	7.79	8.87	9.55	10.56	13.54
9.03	9.21	9.66	10.38	11.83	12.73	14.08	18.06
11.29	11.51	12.08	12.98	14.78	15.91	17.61	22.58
13.54	13.81	14.49	15.58	17.74	19.10	21.13	27.09
15.80	16.12	16.91	18.17	20.70	22.28	24.65	31.61
20.32	20.72	21.74	23.37	26.62	28.65	31.70	40.64
22.58	23.03	24.16	25.96	29.57	31.83	35.22	45.16
24.83	25.33	26.57	28.56	32.53	35.02	38.74	49.67
27.09	27.63	28.99	31.16	35.49	38.20	42.26	54.19
29.35	29.94	31.40	33.75	38.45	41.38	45.79	58.70
31.61	32.24	33.82	36.35	41.41	44.57	49.31	63.22
33.87	34.54	36.24	38.95	44.36	47.75	52.83	67.74
36.12	36.85	38.65	41.54	47.32	50.94	56.35	72.25
38.38	39.15	41.07	44.14	50.28	54.12	59.88	76.77
40.64	41.45	43.48	46.74	53.24	57.30	63.40	81.28
42.90	43.76	45.90	49.33	56.20	60.49	66.92	85.80
45.16	46.06	48.32	51.93	59.15	63.67	70.44	90.32
47.41	48.36	50.73	54.53	62.11	66.85	73.97	94.83
49.67	50.66	53.15	57.12	65.07	70.04	77.49	99.35
51.93	52.97	55.56	59.72	68.03	73.22	81.01	103.86
54.19	55.27	57.98	62.32	70.99	76.41	84.53	108.38
56.45	57.57	60.40	64.91	73.94	79.59	88.06	112.90

Torque Wrench Adapter Formulas
Figure 203 (Sheet 3 of 3)

TORQUE WRENCH TOLERANCES Inch-Pounds (Nm)			
Applied Torque	**Tolerance**	**Applied Torque**	**Tolerance**
5 (0.56)	4 - 6 (0.45 - 0.67)	350 (39.51)	337 - 368 (38.05 - 41.55)
10 (1.12)	9 - 11 (1.01 - 1.24)	400 (45.16)	380 - 420 (42.90 - 47.42)
15 (1.69)	14 - 16 (1.58 - 1.80)	450 (50.80)	438 - 472 (49.45 - 53.29)
20 (2.25)	19 - 21 (2.14 - 2.37)	500 (56.45)	475 - 525 (53.63 - 59.27)
25 (2.82)	24 - 26 (2.70 - 2.94)	600 (67.74)	570 - 630 (64.35 - 71.13)
30 (3.38)	29 - 31 (3.27 - 3.49)	700 (79.03)	665 - 735 (75.08 - 82.98)
40 (4.40)	38 - 42 (4.29 - 4.74)	750 (84.67)	714 - 787 (80.61 - 88.85)
50 (5.64)	48 - 53 (5.42 - 5.98)	800 (90.32)	760 - 840 (85.80 - 94.84)
60 (6.77)	57 - 63 (6.44 - 7.11)	900 (10.61)	855 - 945 (96.53 - 106.69)
70 (7.90)	67 - 74 (7.56 - 8.35)	1000 (112.90)	950 - 1050 (107.26 - 118.55)
80 (9.03)	76 - 84 (8.58 - 9.48)	1100 (124.19)	1045 - 1145 (117.98 - 129.27)
90 (10.16)	86 - 95 (9.71 - 10.72)	1200 (135.48)	1140 - 1260 (128.71 - 142.25)
100 (11.29)	95 - 105 (10.73 - 11.85)	1300 (146.77)	1235 - 1365 (139.43 - 154.11)
125 (14.11)	119 - 132 (13.44 - 14.90)	1400 (158.06)	1330 - 1470 (150.16 - 165.96)
150 (16.93)	143 - 158 (16.14 - 17.84)	1500 (169.35)	1425 - 1575 (160.88 - 177.82)
200 (22.58)	190 - 210 (21.45 - 23.71)	1600 (180.64)	1520 - 1680 (171.61 - 189.67)
250 (28.22)	238 - 262 (26.87 - 29.58)	1700 (191.93)	1615 - 1785 (182.33 - 201.53)
300 (33.87)	285 - 315 (32.18 - 35.56)	1800 (203.22)	1710 - 1890 (193.06 - 213.38)

NOTE: Tolerances for ft-lbs (Nm) shall be plus or minus 5% plus 2 ft-lbs (2.71 Nm) for all ranges.

Torque Wrench Tolerances
Table 203

EXTERIOR PAINT - MAINTENANCE PRACTICES

1. Cleaning/Painting

A. Paint Removal *(1128J)*

(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Aluminum Tape	#425 (Foil Tape)	3M Co. St. Paul, MN	Mask the aircraft.
Plastic Tape	#226 (Polyethylene)	3M Co. St. Paul, MN	Mask the aircraft.
Plastic Tape	#471 (Black Plastic)	3M Co. St. Paul, MN	Mask the aircraft.
Plastic Tape	#470 (Polyester)	3M Co. St. Paul, MN	Mask the aircraft.
Protex Tape	20V	Commercially Available	Mask the windows.
Vapor Proof Masking Paper (Grade A, Type 2, Class 1)	MIL-B-121C	Commercially Available	Vapor proof masking material.
Abrasive Paper (80 grit or finer)		Commercially Available	Mechanical stripping.
Paint Stripper	Turco 5351	Turco Products, Inc. Marion, OH	Chemical stripping.
Paint Stripper	Turco 6776LO	Turco Products, Inc. Marion, OH	Chemical stripping.
Paint Stripper	B & B 4411	B & B Tridech, Inc. Miami, FL	Chemical stripping.
Paint Stripper	Oakllite EPA 332	Oaklite Products, Inc. Berkeley Heights, NJ	Chemical stripping.
Paint Stripper	Turco 6017	Turco Products, Inc. Marion, OH	Chemical stripping.
Paint Stripper	Stingray 874B	Gage Products Co. Ferndale, MI	Chemical stripping.
Hose (approved for paint stripper use)		Commercially Available	Spray equipment.
Spray Wand		Commercially Available	Spray equipment.
Air-Water Rinse Gun		Commercially Available	Spray equipment.

NAME	PART NUMBER	MANUFACTURER	USE
Rubber Gloves		Commercially Available	Spray equipment.
Rubber Boots		Commercially Available	Spray equipment.
Face Shield and Helmet		Commercially Available	Spray equipment.
Aprons		Commercially Available	Spray equipment.
Scrub Brush		Commercially Available	Miscellaneous equipment.
Brush (Soft bristles)		Commercially Available	Miscellaneous equipment.
Cleaning Solvent		Refer to 20-13-00.	
Air Motor	Dotco 10L2752C01	Dotco, Inc. Hicksville, OH	Paint removal.
Wheel Brush (Nylon filament with 320 grit Aluminum Oxide filler)	Anderson DM3-22363-B0222320	Vic DeWhitt Co, Inc. Wichita, KS	Contamination removal.
Thickness Gage	Nova Model 201	NDT Industries Huntington Beach, CA	Measure skin thickness.

(2) Mechanical stripping of metallic surfaces:

NOTE: Mechanically stripping is most commonly performed when small areas need to be stripped for rework.

(a) If the entire aircraft, or a large portions of the aircraft, are to be mechanically stripped, mask the following areas as required:
   1) Mask windshield with precut Protex tape 20V. Cover Protex tape 20V with vapor proof film, securing edges of film to aircraft with vapor proof tape.
   2) Mask windows with vapor proof film and cover edges with vapor proof tape.
   3) Using vapor proof film and vapor proof tape, mask the engine intakes and exhausts, main and nose landing gear, antennas, horizontal stabilizer anti-ice blanket, static pressure port, and pitot/static probe.
   4) Plug all air vent system openings on wings, fuselage, and tip tanks using vapor proof film and vapor proof tape.
   5) Mask recognition lights, anti-collision beacons, navigation lights, aileron brush seals, and static ports using vapor proof film and vapor proof tape.

(b) On small areas, mask off the area not to be stripped.

CAUTION: THE MAXIMUM ALLOWABLE BASE METAL REMOVAL DURING MECHANICAL SANDING SHALL NOT EXCEED 0.001 INCH (1 MIL).

IT IS EMPHASIZED THAT THE REPAINTING PROCEDURE FOR AIRCRAFT SHOULD MINIMIZE ANY SANDING ACTIVITY ON THE PRESSURE CABIN

SKIN. THE SMALLEST GRIT SIZE POSSIBLE (LARGEST NUMBER) SHOULD BE USED.

(c) Use abrasive paper or other suitable methods, remove the paint film from the metallic surface.
(d) If sanding is done in the pressurized cabin area, measure the aircraft skin thickness. (Refer to Chapter 5.)
(e) Using cleaning solvent, clean the stripped area. (Refer to 20-13-00.)
(f) If the reworked area is 1.5 sq. inches [9.67 sq. cm] or less and has been sanded down to the bare metal, no chemical treatment or primer is required.
(g) If the reworked area is larger than 1.5 sq. inches [96.77 sq mm] but less than 0.5 sq ft. [464.51 sq. cm] and has been sanded down to the bare metal, no chemical treatment is required. A primer coat is required.
(h) If the reworked area is larger than 0.5 sq ft. [464.51 sq. cm] and has been sanded down to the bare metal, a chemical treatment and a primer coat is required.
(i) If the rework area is sanded only into the primer coat, no chemical treatement or primer coat is required.
(j) If necessary, apply anti-corrosion chemical film treatment to the reworked area. (Refer to 20-72-00.)
(k) If necessay, apply corrosion primer and intermediate primer to the reworked area. (Refer to 20-50-00.)
(l) Paint the reworked area. (Refer to 20-50-00.)

(3) Chemical Stripping of the Metallic Surfaces
(a) Cut a piece of Protex Tape 20V (elephant hide) approximately 0.5 inch [12.7 mm] smaller than window or windshield being masked.
(b) Attach paper to window or windshield with plastic tape (with outer edge of tape barely touching metal around window). Roll or press edges of tape down to ensure complete contact.
(c) Wash area around window thoroughly using approved cleaner. (Refer to 20-12-00.)
(d) Apply a piece of vapor proof masking paper cut to size of window or windshield.
(e) Apply plastic tape to paper and allow at least 0.25 inch [6.35 mm] overlap of tape on metal around window or windshield.
(f) Rub all edges of plastic tape to ensure complete contact.
(g) Apply aluminum tape over plastic tape, overlapping 0.25 inch [6.35 mm] on metal around window or windshield.
(h) Using masking materials, mask gaps around doors and access openings. An overlap of 0.25 inch [6.35 mm] adjacent to door gaps is sufficient.
(i) Using masking materials, mask sealed joints. An overlap of 0.25 inch [6.35 mm] adjacent to sealed joints is sufficient.
(j) Fill tooling holes and openings with rubber stoppers or suitable materials that resist stripper.
(k) Using polywrap paper and plastic tape, mask all engines, antennas, landing gear, pitot heads, aileron brush seals, rubber materials, wiring, and fiberglass parts.

NOTE: Lap masking materials in a manner that will shed stripper and not collect it.

If Turco 6776LO or Stingray 874B stripper is to be used, use polywrap paper and plastic tape to mask all magnesium parts in flight control surfaces and wheel as-

semblies, all polished aluminum, and all polysulphide seal material that will contact stripper. If polysulphide seal material is not protected from contact with Turco 6776LO or Stingray 874B stripper, it will have to be replaced.

WARNING: **SAFETY EQUIPMENT (FACE-SHIELD AND HELMET, APRON, RUBBER GLOVES, BREATHING APPARATUS, AND RUBBER BOOTS) MUST BE WORN BY PERSONNEL USING SPRAY PAINT STRIPPERS.**

PAINT STRIPPING MUST BE DONE IN A WELL VENTILATED AREA.

DO NOT APPLY STRIPPER HEAVY ENOUGH TO RUN OFF AIRCRAFT.

KEEP WATER AVAILABLE IN CASE OF SKIN CONTACT.

IF STRIPPER ACCIDENTALLY CONTACTS SKIN, FLOOD AREA WITH WATER AND IF BURNING OCCURS, CONTACT FIRST AID.

ALWAYS APPLY STRIPPER IN A MANNER THAT WILL NOT REQUIRE OPERATOR TO WALK IN DROP-OFF MATERIAL. IF ANY STRIPPER HAS DRIPPED ONTO THE FLOOR, SQUEEGEE AND RINSE FROM FLOOR BEFORE WALKING IN THAT AREA.

CAUTION: **PAINT STRIPPERS ARE HIGHLY CAUSTIC, SO EXTREME CARE SHALL BE TAKEN TO ENSURE THAT THEIR USE PRESENTS SATISFACTORY RESULTS AND NOT COSTLY DAMAGE.**

STRIPPER SHALL BE THOROUGHLY MIXED PRIOR TO USAGE.

SPRAY EQUIPMENT FOR STRIPPERS SHALL BE THOROUGHLY FLUSHED WITH WATER EACH TIME PRIOR TO USING A DIFFERENT STRIPPER.

STRIPPERS TURCO 6776LO AND STINGRAY 874B WILL REACT STRONGLY WITH OTHER STRIPPERS.

DO NOT MIX STRIPPERS WITH SOLVENTS.

PAINT STRIPPERS SHALL BE STORED IN AREAS THAT ARE MAINTAINED AT A TEMPERATURE OF 40° TO 100°F [4° TO 38°C].

(l) Spray or brush, as required, a continuous heavy coat of stripper on the aircraft.
(m) Start at top aft end and work forward.
(n) After reaching aft side of wings, apply stripper to bottom side of wings and fuselage.
(o) Continue applying a heavy coat of stripper on top side of wings and rest of aircraft.
(p) Allow stripper to set on aircraft until paint has blistered and lifted.
(q) Starting at top of aircraft and working down, use a squeegee to remove loose paint and stripper.

(r) If some paint still adheres to the aircraft, repeat steps (m) thru (q).

CAUTION: AVOID DIRECTING STREAM OF RINSE WATER AT THE EDGES OF MASKING MATERIALS AS THE HIGH PRESSURE MAY LIFT TAPE.

(s) Rinse aircraft with high pressure and high volume water, brushing surface with soft bristle push-type brush.
(t) After aircraft has been thoroughly rinsed, remove all masking materials.
(u) Inspect the areas under the masking tape.

CAUTION: MAXIMUM ALLOWABLE BASE METAL REMOVAL DURING MECHANICAL SANDING SHALL NOT EXCEED 0.001 INCH (1 MIL).

IT IS EMPHASIZED THAT THE REPAINTING PROCEDURE FOR AIRCRAFT SHOULD MINIMIZE ANY SANDING ACTIVITY ON THE PRESSURE CABIN SKIN. THE SMALLEST GRIT SIZE POSSIBLE (LARGEST NUMBER) SHOULD BE USED.

(v) Remove any remaining paint and/or any tape residue, that was under the masking tape, by applying stripper with a small paint brush or sanding with 180 or finer grit sandpaper.
(w) Within four (4) hours after chemical stripping operations are complete, wash the aircraft with an alkaline solution as follows:
  1) Mix the alkaline solution per the manufacturers instructions.
  2) Spray all surfaces of aircraft with alkaline wash solution.
  3) Allow the alkaline wash to set for a few minutes.
  4) Thoroughly scrub all surfaces with very fine aluminum oxide abrasive paper.
  5) Thoroughly rinse the aircraft with tap water to remove the alkaline wash.
  6) The rinse water must form a continuous sheet over the surface for all of the alkaline wash to be removed.
(x) Apply anti-corrosion chemical film treatment to the reworked area. (Refer to 20-72-00.)
(y) Apply corrosion primer and intermediate primer to the reworked area. (Refer to 20-50-00.)
(z) Paint the reworked area. (Refer to 20-50-00.)

(4) Mechanical Stripping for Non Metallic (fiberglass) Surface

NOTE: For rework procedures on the radome, refer to 53-50-01.

The fiberglass components (defog nozzle, dorsal fin, or the horizontal stabilizer gap fairing) may be removed from the aircraft for stripping.

(a) Mask off the area around the component or the area of the component to be reworked.

CAUTION: DO NOT SAND INTO THE FIBER REINFORCEMENT IN THE FIBERGLASS MATERIAL.

(b) Using 180 or finer aluminum oxide abrasive paper, carefully remove the paint from surface of the component.
(c) Using cleaning solvent, clean the sanded area. (Refer to 20-13-00.)
(d) Inspect the surface to make sure that it is free of all paint and solvent.
(e) Inspect the surface for any pin holes.
(f) If the surface has any pin holes, do the steps that follow:
  1) Mix the filler putty or paste material to be used per the manufacturers instructions.
  2) Using the filler putty or paste material, fill all the visible pin holes.
  3) Allow the filler putty or paste to dry.
  4) Using a fine abrasive paper, sand the surface smooth.
  5) Mix the surface primer per the manufacturers instructions.
  6) Using several layers, apply the surface primer to a thickness of 10 mils.
  7) Allow the surface primer to dry for 2 to 6 hours.
  8) After the primer is dry, lightly scuff sand the surface.
  9) Using cleaning solvent, clean the surface.
(g) Apply conductive coating to the component. (Refer to 20-73-00.)
(h) Paint the reworked area. (Refer to 20-50-00.)

B. Painting of the Aircraft
  (1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
White Cotton Cloths (Clean, Lint-Free)		Commercially Available	Cleaning.
Tack Rags	Detroit Tack or	Wheeler Benigus, Inc. Wichita, KS	Cleaning before paint application.
	Anti-Static Tack Cloth	Gerson Co. Inc. Middleboro, MA	Cleaning before paint application.
Cleaning Solvent		Refer to 20-13-00.	Clean aircraft surface.
Corrosion Primer	Base: 484-900 Curing Agent: 120-777 or 120-888 Thinner: 110-588	Sherwin Williams Wichita, KS	Priming aircraft surface.
Corrosion Primer	Base: 484-950 Curing Agent: 120-802 Thinner: 110-588	Sherwin Williams Wichita, KS	Priming aircraft surface.

NAME	PART NUMBER	MANUFACTURER	USE
Intermediate Primer	Base: 560-563 or 560-566 Curing Agent: 120-888 Thinner: 110-588	Sherwin Williams Wichita, KS	Priming aircraft surface.
Intermediate Primer	Base: G8005 Converter: G3001 Thinner: T0003	U.S. Lacquer & Chemical Co. St Louis, MO	Priming aircraft surface.
Urethane Enamel (Jet Glo)	Base: 57X-XXX Series Catalyst: 578-520 Thinner: 110-755, 110-821, or 110-701 Retarder: 110-830 Accelerator: 100-975 Anti-Crater: 110-808	Sherwin Williams Wichita, KS	Paint aircraft surface.
Urethane Enamel (Alumigrip)	Base: AA-92 Series Catalyst: AA-92-C-39 Thinner: T732A Accelerator: AA-92-C-34 Anti-Crater: AA-92-C-24	U.S. Lacquer & Chemical Co. St Louis, MO	Paint the aircraft surface.
Urethane Enamel (Imron)	Base: Imron Series Catalyst: Imron 192S Thinner: Imron 8485S Retarder: Imron 2979S Anti-Crater: Imron 259S	E.I. DuPont DeNemours & Co. Wilmington, DE	Paint the aircraft surface.
Conventional Urethane Enamel (Acry-Glo)	Base: 571-000 Series Catalyst: 571-081 Retarder: 110-755 or 110-701	Sherwin Williams Wichita, KS	Paint the aircraft surface.
High Solids Urethane Enamel (Acry-Glo)	Hardner (B): 830-081 Activator (C): 830-A18 Slow-Medium Reducer: 100-977 Fast Reducer: 110-978	Sherwin Williams Wichita, KS	Paint the aircraft surface.
Urethane Enamel (Metallic)	Metallic Base Coat Base: 571-000 Series Catalyst: 571-081 Stabilizer: 571-085 Accelerator: 120-975 Reducer (High Temp): 110-821 Reducer (Normal Temp): 110-701	Sherwin Williams Wichita, KS	Paint the aircraft surface.

NAME	PART NUMBER	MANUFACTURER	USE
Urethane Enamel (Metallic)	Clear Coat Base: 571-080 Reducer (High Temp): 110-821 Reducer (Normal Temp): 110-701 Retarder: 110-830	Sherwin Williams Wichita, KS	Paint the aircraft surface.
Abrasive Paper (Aluminum Oxide, 320 Grit or finer)		Commercially Available	Cleaning.
Vinyl Film	#3470	3M Co. St. Paul, MN	Masking the aircraft.
Vinyl Tape (Black)	#471	3M Co. St. Paul, MN	Masking the aircraft.
Vapor Proof Masking Paper (Grade A, Type 2, Class 1)	MIL-B-121C	Commercially Available	Masking the aircraft.
Aluminum Tape	#425 (Foil Tape)	3M Co. St. Paul, MN	Masking the aircraft.

(2) If the entire aircraft or large portions of the aircraft are to be painted, mask the following areas as required:
   (a) Mask windshield with precut Protex tape 20V.
   (b) Cover Protex tape 20V with vapor proof film, securing edges of film to aircraft with vapor proof tape.
   (c) Mask windows with vapor proof film and cover edges with vapor proof tape.
   (d) Using vapor proof film and vapor proof tape, mask recognition lights, anti-collision beacons, navigation lights, oxygen bottle indicators, aileron brush seals, static ports, pitot heads, and fire bottle indicators.
   (e) Using vapor proof film and vapor proof tape, mask the engine intakes and exhausts, main and nose landing gear, antennas, horizontal stabilizer anti-ice blanket, static pressure port, and pitot/static probe.
   (f) Plug all air vent openings on wings, tip tanks, and fuselage.

CAUTION: TO PREVENT CONTAMINATION FROM TAPE ADHESIVES ONTO SURFACES BEING CLEANED, ALWAYS DRY TOWARD OR PARALLEL TO TAPED EDGE OF MASKED AREA. DO NOT DRY FROM TAPED SURFACE TOWARD ADJACENT SURFACES WHICH ARE TO BE PAINTED.

(3) Using cotton cloths dampened with cleaning solvent, lightly wipe the entire area to be painted.
(4) Wipe dry with lint-free cloths.
(5) Inspect lower surfaces of aircraft for water, fuel, or oil drips.

(6) Remove water drips by blotting with clean, dry, lint-free cloths.
(7) Remove fuel or oil drips by blotting with clean, lint-free cloths damp with cleaning solvent. (Refer to 20-13-00.)
(8) Wiped dry with clean, dry, lint-free cotton cloth. Do not smear into adjacent areas.
(9) Mix the corrosion primer in accordance with the manufacturers instructions.

NOTE: Primers and topcoats used are two-part catalyzing materials. When mixing, be certain to use the proper catalyst with the right base.

Catalyst is moisture sensitive. Tightly seal catalyst immediately after use. Catalyst should always be clear. If it becomes cloudy, non-uniform in appearance or gelled, it must be discarded.

When mixing partial kits, use a graduated container to accurately measure components.

All painting must be done from 65° to 90°F [18.3° to 32.2°C]. Temperature of the surfaces to be painted shall be in the same range.

WARNING: SUITABLE RESPIRATORS SHALL BE WORN BY SPRAY OPERATORS.

ALL SAFETY PRECAUTIONS FOR HANDLING FLAMMABLE MATERIALS SHALL BE OBSERVED.

BREATHING OF CATALYST SHALL BE AVOIDED.

SAFETY DEPARTMENT APPROVAL IS REQUIRED BEFORE PAINTING IN AN AREA NOT PREVIOUSLY APPROVED BY THE FIRE DEPARTMENT.

CAUTION: PAINT BUILDUP AT ENDS OF BOUNDARY LAYER ENERGIZERS SHALL NOT EXCEED ONE-HALF THE HEIGHT OF THE BOUNDARY LAYER ENERGIZER. (SEE FIGURE 201.)

TOP COATING THE CENTER 0.375 INCH [9.52 MM] WIDE AREA OF THE DAYTON-GRANGER LIGHTNING DIVERTER STRIPS AT ANY POINT ALONG THE FULL EXPOSED LENGTH OF THE STRIPS WITH ANY KIND OF PROTECTIVE OR DECORATIVE MATERIAL IS PROHIBITED. ALUMINUM LIGHTNING DIVERTER STRIPS ARE NOT TO BE PAINTED.

(10) Immediately before application of corrosion primer, very lightly, but thoroughly, tack-rag entire surface. Do not use heavy pressure.
(11) Turn the tack-rag frequently to ensure residual pick-up.

(12) Apply corrosion primer in one (1) full hiding coat or two (2) light cross coats to achieve a dry film thickness of 0.0006 to 0.0012 inch (0.6 to 1.2 mils [0.015 to 0.030 mm]).

NOTE: Primer may be recoated or top coated in approximately 45 minutes at room temperature.

If corrosion primer is not recoated or top coated within 48 hours of application, it shall be thoroughly abraded with 320 grit (or finer) aluminum oxide abrasive paper or Scotch-Brite pads.

Dry time to sand will be approximately 8 to 10 hours at room temperature or 2 to 4 hours at 110° to 130°F [43.3° to 54.4°C].

(13) Mix the intermediate primer in accordance with the manufacturers instructions.

NOTE: This is a limited-usage material and need be used only as required for aesthetic surface improvement.

(14) Apply intermediate primer in full wet coats to achieve a dry film thickness of 0.001 to 0.002 inches (1 to 2 mils [0.025 to 0.05 mm]).
(15) Dry sand primer to a maximum dry film thickness of 0.0005 inches (0.5 mils [0.013 mm]) with 320 grit or finer aluminum oxide abrasive paper before the top coat is applied.
(16) Mix the applicable paint per the manufacturers instructions.

NOTE: Recommended application of urethane enamel is three (3) coats.

(17) Apply first coat in an even wet coat.
(18) Apply second "complete hiding" coat as soon as first coat has become tacky.
(19) Allow 20 to 30 minutes (approximately) dry time and apply third coat in an even, wet manner.

NOTE: Total dry film thickness of top coat is 0.0030 to 0.0050 inches (3 to 5 mils [0.076 to 0.127 mm]) for normal colors, 0.0040 to 0.0060 inches (4 to 6 mils [0.102 to 0.152 mm]) for low hiding colors, and 0.0050 to 0.0070 inches (5 to 7 mils [0.127 to 0.178 mm]) for metallic colors (including clear top coat).

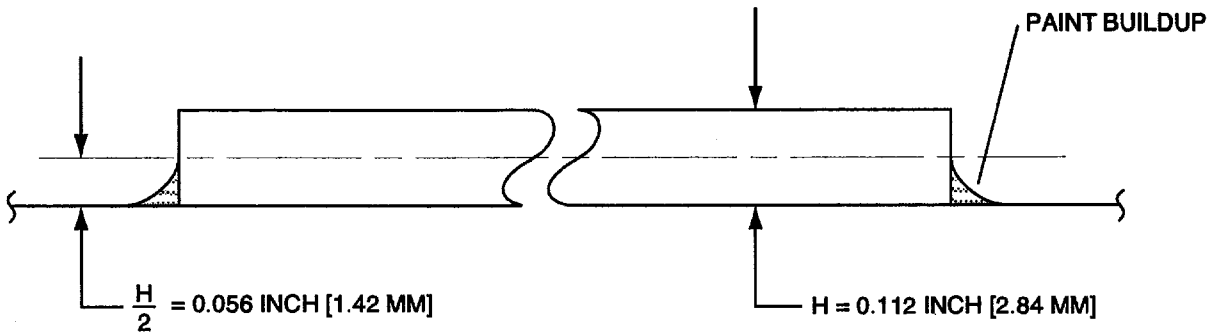
(20) Allow approximately 2 hours at room temperature prior to oven drying cure.
(21) Cure urethane enamel for 24 hours at room temperature or oven cure for 12 hours at 110° to 130°F [43.3° to 54.4°C].
(22) Apply striping and or color markings as follows:
  (a) Mask the area where the striping or color markings are to be added.
  (b) Using 320 to 400 grit aluminum oxide abrasive paper, lightly sand the area.
  (c) Using a lint-free cloth cloth, clean the area of all dust and lint.
  (d) Apply two (2) layers of the required color paint to obtain the desired gloss.
(23) If aircraft has been completely repainted, reweigh aircraft prior to putting aircraft back into service. (Refer to Chapter 8.)

(24) After aircraft finish has cured for a minimum of 7 days, apply a protective coat of wax to the entire finished surface.

(25) The painted area of the aircraft should be polished at periodic intervals to remove chalking paint and restore its gloss.

(26) *On Aircraft 35-002 thru 35-278, 36-002 thru 36-044 modified per AAK 79-10 or AMK 83-5, 35-279 and Subsequent, and 36-045 and Subsequent,* inspect the paint thickness at the ends of the boundary layer energizers (BLEs).

(27) The maximum paint thickness at the end of the boundary layer energizers (BLEs) must not be greater that one-half the height of the BLEs. (See Figure 201.)



H = HEIGHT OF BLE

Maximum Paint Buildup at Ends of Boundry Layer Energizers (BLEs)
Figure 201

EPOXY PRIMER - MAINTENANCE PRACTICES

1. Application of the Epoxy Primer *(1091AR)*

NOTE: The Aerospace National Emissions Standard for Hazardous Air Pollutants (NESHAP) effective 9/01/98 mandates the use of high solids primers. Those affected by the NESHAP shall be responsible to abide by NESHAP requirements.

These maintenance practices define procedures for applying epoxy primer to aluminum or aluminum alloy surfaces.

Before you apply epoxy primer, maintenance personnel must read, thoroughly understand, and carefully adhere to instructions in this section.

WARNING: SUITABLE VENTILATION AND SAFETY PRECAUTIONS MUST BE PROVIDED IN THE WORK AREA.

CAUTION: CLEAN AND PROPER EQUIPMENT MUST BE USED.

THE COATING MATERIAL SHALL BE UNIFORM, FREE OF SKINS, LUMPS, GELLED, OR COARSE PARTICLES.

THE FINISH AREA MUST BE FREE OF DUST AND SEVERE TEMPERATURE CHANGE WHICH WILL ADVERSELY AFFECT THE APPLICATION AND CURE OF THE COATING.

THE THICKNESS REQUIREMENTS LISTED FOR THE COATING SHALL BE STRICTLY MAINTAINED.

EVERY ATTEMPT MUST BE MADE TO PRODUCE A LINT-FREE, SMOOTH, GOOD QUALITY FINISH.

A. Aluminum Surface Preparation
   (1) Treat the bare aluminum surfaces with the anti-corrosion chemical film. (Refer to 20-72-00.)
   (2) Touch-up scratched or slightly impaired aluminum surfaces with the anti-corrosion chemical film. (Refer to 20-72-00.)
   (3) Treat welded (spot or fusion) assemblies with open or unsealed faying surfaces, assemblies with parts that were not chemical filmed, anodized parts over 4 days old, parts which are inconvenient to chemical film treatment, or parts and assemblies that might trap solution with pretreatment primer. (Refer to 20-75-00.)

      NOTE: The epoxy primer must be applied within 4 hours after pretreatment primer application.

B. Primer Mixing

(1) Get the necessary tools and equipment.

NOTE: You can use equivalent alternatives for these items:

NAME	PART NUMBER	MANUFACTURER	USE
Conventional Epoxy Primer Corrosion Resistant Primer, Light Green	515K011 Primer Base 910-012 Curing Solution	PRC Desoto International Berkley, CA	Treatment of aluminum surfaces.
Conventional Epoxy Primer Corrosion Resistant Primer, Light Green	10-P4-2 Primer Base EC-117 Curing Solution (Normal Temperature 90°F [32.2°C] or lower.) EC-117S Curing Solution (High Temperature 90°F [32.2°C] or higher.) TR-19 Reducer	AKZO Nobel Aerospace Coating Inc. (ANAC) Waukgan, IL	Treatment of aluminum surfaces.
Conventional Epoxy Primer Corrosion Resistant Primer, Light Green	463-6-78 Primer Base X-515 Curing Solution TL-164 Thinner	AKZO Nobel Aerospace Coating Inc. (ANAC) Waukgan, IL	Treatment of aluminum surfaces.
High Solids Epoxy Primer Corrosion Resistant Primer, Green	10P30-5 Primer Base EC-275 Cure Agent TR-115 Thinner	AKZO Nobel Aerospace Coating Inc. (ANAC) Waukgan, IL	Treatment of aluminum surfaces.
Methyl Propyl Ketone (MPK)		Commercially Available	Thinner for 515K001.
No. 2 Zhan Cup		Commercially Available	Measure viscosity of mixed material.
Water Reducible Aircraft Epoxy Primer	Deft 44-GN-60 Component I - Pigmented Base Compound Component II - Clear Catalyst Compound Thinner - Water Distilled or Deionized	Deft Inc. Irvine CA	Treatment of aluminum surfaces.

(2) Thoroughly mix the curing solution into the primer and let it stand a minimum of 30 minutes before it is applied or thinned.

(a) Mix the conventional light green corrosion resistant primer by PCR Desoto as follows:

1) Completely mix one volume of 910-012 curing solution to one volume of 515K011 primer base.
2) Thorough stirring with a paddle is sufficient agitation after mixing the base and curing solution.
3) The primer may be thinned up to 10% (by volume) for sprayability with MPK solvent.

(b) Mix the conventional light green corrosion resistant primer by AKZO Nobel Aerospace Coating as follows:

1) Mix one volume of curing solution EC-117 or EC-117S into one volume of primer base 10-P4-2.
2) Thorough stirring with a paddle is sufficient agitation after mixing base and curing solution.
3) The primer can be reduced using TR-19 as necessary for sprayability.

(c) Mix the conventional light green corrosion resistant primer by AKZO Nobel Aerospace Coating as follows:

1) Mix one volume of curing solution X-515 into one volume of 463-6-78 primer base.
2) Thorough stirring with a paddle is sufficient agitation after mixing base and curing solution.
3) The mixed material can be thinned up to 25% maximum (by volume) for sprayability using TL-164 thinner.

(d) Mix the high solids light green corrosion resistant primer by AKZO Nobel Aerospace Coating as follows:

1) Thoroughly mix one part by volume of EC-275 cure agent into three parts by volume of 10P30-05 primer base.
2) Thorough stirring with a paddle is sufficient agitation after mixing the base and cure agent.
3) The primer can be thinned up to two parts by volume with TR-115 thinner.

(e) Mix the water reducible epoxy primer by Deft Incorporated as follows:

1) Mix one volume of Component II clear catalyst compound into two volumes of Component I pigmented base compound.
2) Thorough stirring with a paddle is sufficient agitation after mixing base and catalyst solution.
3) Transfer the catalyzed material into a clean container and add 1.5 parts distilled or deionized water and mix thoroughly.
4) Repeat step 3) two more times for a total of 4.5 parts of the distilled or deionized water.
5) For sprayability, the viscosity of the mixed material must be 18 to 22 seconds using a No. 2 Zahn cup.
6) Any unused mixed material over 8 hours old must be discarded.
7) All surfaces must be completely dry before applying the primer.

C. Spray or Roll Application of the Epoxy Primer

(1) Get the necessary tools and equipment.

NOTE: You can use equivalent alternatives for these items:

NAME	PART NUMBER	MANUFACTURER	USE
Masking Tape	No. 250	3M Co, St. Paul, MN	Masking.
Micrometer		Commercially Available	Measure primer thickness.
Paint Roller Handle		Commercially Available	Apply primer.
Paint Roller	Mohair #9426	Bestt Liebco Fond du Lac, WI	Apply primer.
Paint Roller Tray		Commercially Available	Hold primer.
Spray Painting Equipment		Commercially Available	Apply primer.

(2) For spray application, apply a spray coat of mixed primer to give a dry film thickness of 0.0003 to 0.0012 inch (0.3 to 1.2 mils [0.0076 to 0.0305 mm]).

NOTE: The film thickness can be measured by masking and test painting a bare piece of aluminum and measuring the difference in thickness between the bare and the painted areas with a precision micrometer.

Adjust the spray pattern or the primer viscosity to adjust the dry film thickness.

(3) For rolled application, apply a rolled coat of mixed primer to give a minimum dry film thickness of 0.0008 inch (0.8 mil [0.0203 mm]).

NOTE: The film thickness may be measured by masking and test painting a bare piece of aluminum and measuring the difference in thickness between bare and painted areas with a precision micrometer.

Epoxy primer, when rolled on, is exempt from the 0.0012 inch [1.2 mil (0.0305 mm)] maximum film thickness requirement.

(4) Let the primer air dry a minimum of 2 hours before the top coat is applied.

NOTE: As an aid to parts handling, the primer can be baked at 130 to 150 °F [54.4 to 65.5 °C] for approximately 30 minutes after a minimum of 20 minutes at room temperature to let the solvent flash-off.

(5) Inspect the primer appearance. (Refer to 20-55-00.)

2. Inspection/Check

A. Inspection of the Primer Appearance

(1) The cured primer must be continuous and have a smooth and uniform appearance, free from soils and contamination, sags, runs, blisters, over spray, and orange peel when visually inspected without magnification.

NOTE: When the corrosion resistant primer is applied at ambient temperatures of 90 °F [32.2 °C] or higher, surface roughness caused by too rapid drying of the primer can be eliminated by using a high temperature reducer or curing solution.

(2) Slight roughness, silking, beads, runs, sags, or orange peel are not causes for rejection on the surfaces where appearance is not a factor. The thickness in local area of such beads, runs, or sags must not be 0.001 inch [1 mil (0.025 mm)] more than the maximum allowable film thickness.

3. Repairs

NOTE: The finish has a functional purpose which is impaired by rough, dirty, and broken paint films. Repair operations must restore the paint film to a smooth, unbroken film having tight adhesion.

All scratches through the finish to the substrate must be repaired.

Every attempt must be made to restore the paint to its original film thickness. Paint buildup to a maximum of 0.003 inch [3 mils (0.0762 mm)] is permissible only in overlapped areas.

A. Repair of the Epoxy Primer Finish

(1) Get the necessary tools and equipment.

NOTE: You can use equivalent alternatives for these items:

NAME	PART NUMBER	MANUFACTURER	USE
Cleaning Solvent		Refer to 20-13-00.	Cleaning.
Cleaning Cloth		Commercially Available	Cleaning.
Abrasive Paper 220 Grit (or finer)		Commercially Available	Repair damaged surfaces.

(2) Smooth all the rough, dirty, or broken paint films by lightly sanding with 320 grit or finer abrasive paper. Feather the repaired areas into the adjoining areas.

(3) Clean the area with solvent. (Refer to 20-13-00.)

(4) Do the surface preparation procedures. (Refer to 20-55-00.)

(5) Do the application of the epoxy primer procedure. (Refer to 20-55-00.)

RAIN EROSION COATING - MAINTENANCE PRACTICES

1. Description

A. Rain erosion coating maintenance practices cover the preparation and application of the Gaco N-79 coating system that is used to coat the leading edge of the external defog nozzles to prevent erosion of paint.

B. The Gaco coating system is manufactured by Gates Engineering Company, Wilmington, Delaware. Kits are available through Learjet Spares Department.

2. Tools And Equipment

NOTE: The following materials have been found to be the most efficient in their applications and must not be interchanged:

NAME	PART NUMBER	MANUFACTURER	USE
Primer	Gaco N-15	Gates Engineering Co. Wilmington, DE	Prepare Surface
Primer	Bostich 1007	USM Co.	Prepare Surface
Coating Kit	Gaco N-79 Top Coat Cement: N-700-9 Accelerator: N-300-9 Thinner: N-450-9	Gates Engineering Co. Wilmington, DE	Rain Erosion Coating
Top Coat (Anti-Static)	Gaco N-81	Gates Engineering Co. Wilmington, DE	Anti-Static
Thinner	Gaco N-450-12	Gates Engineering Co. Wilmington, DE	Thin N-81 Top Coat (Anti-Static)
Methyl-Ethyl-Ketone (MEK)	Spec. TT-M-261	Commercially Available	Cleaning
Abrasive Paper (Aluminum Oxide) 180 Grit		Commercially Available	Prepare Surface
Masking Tape		Commercially Available	Masking
Stiff Bristle Brush		Commercially Available	General
Clean, White, Cotton Cloth		Commercially Available	General

3. Coating Cleaning
   A. Mask along the edge of the old coating being replaced.
   B. Remove the old coating using toluene-soaked rags and a stiff bristle brush.
   C. After old coating is removed, sand surface with 180-grit abrasive paper and wash area with toluene and wipe dry.

4. Primer Application
   A. Stir primer thoroughly. Gaco N-15 needs no thinning prior to spray application. Bostich 1007 may be thinned with three parts MEK , by volume, to one part primer, by volume, if necessary for spray application. Bostich 1007 may be thinned with two parts MEK , by volume, to 1 part primer, by volume, if necessary for brush application.
   B. Apply sufficient coats of primer to give a dry-film thickness of 0.001 to 0.002 inch (1 to 2 mils [0.025 to 0.051 millimeter]).
   C. Allow a minimum of five minutes drying time between each coat of primer.
   D. Allow at least 20 minutes dry time for the Bostich 1007 and one hour for the Gaco N-15 before applying erosion coating.

5. Erosion Coating Application
   A. Using the coating kit, thoroughly stir the accelerator. Mix accelerator with top coat at a ratio of two fluid ounces of accelerator to one quart of undiluted top coat. Stir thoroughly.

      NOTE: Once top coat is mixed, discard after eight hours or if mixture gells.

   B. For spray application, thin top coat mixture (step 5) with 2 parts N-450-9 thinner by volume to 1 part by volume of the topcoat mixture, if necessary.
   C. For brush application, thin top coat mixture (step 5) with 1 part N-450-9 thinner by volume to 4 parts volume of the topcoat mixture, if necessary.
   D. Apply top coat in multiple coats by either spraying or brushing. Allow each coat to dry from 10 minutes to 1 hour prior to application of the next coat. Coating thickness shall be 0.007 to 0.010 inch (7 to 10 mils [0.178 to 0.254 millimeter]) when cured.

      NOTE:
      - Air bubbles may be removed by spraying with a fine mist of a 1 to 1 mixture of MEK and toluene after each application.
      - Normally 4 brush coats or 8 spray coats will give the sufficient cured thickness for the topcoat.

   E. After top coat has been applied, the N-81 anti-static top coat must be applied within a minimum of 10 minutes and a maximum of 30 minutes.

6. Anti-Static Top Coat Application
   A. When N-81 anti-static top coat is being applied with a brush, no thinning is required. If N-81 anti-static top coat is to be sprayed on, the anti-static top coat can be thinned with a maximum of 2 parts by volume of N-450-9 or N-450-12 thinner to 1 part, by volume, of anti-static topcoat.
   B. Apply anti-static top coat in multiple coats by either spraying or brushing. Allow enough time between coats for the shiny, wet appearance to disappear (approximately 10 minutes). Apply coats to a total thickness of 0.001 to 0.002 inch(1 to 2 mils [0.025 to 0.051 millimeter]).

      NOTE: Normally 2 or 3 coats will give the specified thickness for the anti-static topcoat.

   C. Full cure of the erosion coating will be attained in 4 days under normal temperature. Full cure may be reduced to 4 hours using a temperature of 150° (± 10°)F (65.6° [± 5.6°] C).

FUEL TANK CORROSION REPAIR - MAINTENANCE PRACTICES

1. DESCRIPTION

A. The following maintenance practices are provided as an aid in repairing fuel tanks if bacterial growth and/or corrosion is evident.

2. TOOLS AND EQUIPMENT

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Chemical Film Coating	Alodine 1200	Amchem Prod Inc. Ambler, PA	Chemical Coating
Epoxy Coating	Base 454-4-1 Catalyst CA-109 Thinner TL-52	Akzo Coatings Inc. Sikkins Coating Div. Torrance, CA	Protective Coating
Methyl-Ethyl-Ketone (MEK)	Spec. TT-M-261	Commercially Available	Cleaning
Paint Brushes (Soft Natural or Polyester Bristle)		Commercially Available	Surface Preparation
White Cotton Cloth		Commercially Available	Cleaning
Scrub Brush (Stiff Bristle)		Commercially Available	Surfaces Preparation
Vacuum Source & Suction Hose		Commercially Available	Removing Residue
Nitric Acid	Spec. O-A-451, Type 1	Commercially Available	Adjust PH of Coating Solution
AbrasivePaper (Aluminum Oxide) 320 or 400 Grit		Commercially Available	Surface Preparation
Kerosene		Commercially Available	Solvent

3. FUEL TANK CLEANING AND REPAIR

A. Remove Bacterial Growth

(1) Using the vacuum source, vacuum up all residue from the tank bottoms. In hard-to-reach areas, flush out residue using a squirt bottle or similar device filled with kerosene.

(2) Wipe tanks dry. Allow bacterial growth and tank to thoroughly air dry. Drying may be accelerated by use of air movers.

(3) Clean bacterial growth from tanks using a soft bristle scrub brush and clean cloth.

(4) After cleaning, inspect area for evidence of coating degradation or corrosion.

B. Corrosion Repair

NOTE:
- The following procedures cover minor corrosion (depth of 0.005 inch [0.127 millimeter] or less). If corrosion area depth exceeds this limit, contact Learjet Field Service for disposition.
- Any equivalent chemical film treatment for aluminum alloy may be used providing it complies with MIL-C-5541, Class 1 metal finish.

(1) Corrosion pits of a minor depth (0.005 inch [0.127 millimeter] or less) within the tip tank and wing tank areas are removed by lightly sanding with 320 or 400 grit aluminum oxide abrasive paper.

(2) Sand an area large enough to ensure that all corrosion has been removed.

(3) Clean the area with MEK and wipe dry.

WARNING:
- **CHEMICAL FILM SOLUTION AND ACID ARE INJURIOUS TO EYES, AND SKIN. IF SPILLED, NEUTRALIZE AT ONCE WITH A WATER SOLUTION OF SODIUM BICARBONATE (BAKING SODA). CONSULT A PHYSICIAN.**
- **PROTECTIVE CLOTHING SUCH AS RUBBER GLOVES, APRON, AND FACE SHIELD SHOULD BE WORN.**
- **WHEN MIXING SOLUTION, ALWAYS POUR ACID INTO WATER WHILE SLOWLY AND CONTINUOUSLY STIRRING. DO NOT POUR WATER INTO ACID.**

(4) Prepare Alodine chemical film solution by mixing 3.0 ounces (88.7 milliliters) of Alodine 1200 with deionized water per each gallon (3.79 liters) of final solution. Stir well until powder is dissolved. Disregard any small amount of settled-out insoluble material. Allow solution to stand at least 24 hours before use. If required, adjust pH to a range of 1.50 to 1.90 with nitric acid.

(5) Apply Alodine solution as follows:

(a) Apply solution from a plastic container to a clean cloth or sponge.

(b) Apply solution evenly and liberally, maintaining a wet surface. Repeat applications until a yellow color begins to appear. The solution should be applied around the periphery of the stripped area to ensure that a continuous chemical film is produced.

(c) Rinse area with 60° to 100° F (15.6° to 37.8° C) water.

(d) Air dry at a temperature not to exceed 140°F (60° C). Do not wipe dry.

CAUTION: **AVOID HANDLING TREATED PART AS FINGERPRINTS WILL HAVE A DETRIMENTAL EFFECT ON CONDUCTIVE COATING ADHESION.**

(e) Visually inspect treated area to determine if protective film is continuous, free from breaks, scratches, and other damages.

NOTE:
- If other chemical film solutions are used, follow manufacturer's instructions.
- Coat with epoxy primer immediately after area is dry.

(6) Prepare epoxy finish by mixing three (3) parts of base and one (1) part of catalyst.
(7) Epoxy finish may be thinned if necessary by adding one (1) part thinner to one (1) part epoxy.
(8) Allow material to set 45 minutes before using.

NOTE: Material over eight (8) hours old must be discarded.

(9) Do not apply material when temperature is below 60°F (15.6° C) or over 85% relative humidity.
(10) Apply a thin brush coat of epoxy to treated area, using a soft natural or polyester bristle brush to obtain a continuous smooth coat.
(11) Allow epoxy finish to cure for a minimum of 24 hours above 73°F (22.8° C) before returning the aircraft to service.

CORROSION REPAIR - MAINTENANCE PRACTICES

1. INSPECTION/CHECK

NOTE: The following maintenance practices are provided as an aid in inspection/repair of corrosion .

A. Inspect aircraft for Corrosion (See figure 201.)
(1) Using a dial indicator depth gauge (or equivalent), determine the extent of corrosion. (See figure 202.)

NOTE:
- Light Corrosion: Structure is discolored or pitted to a depth of approximately 0.001 inch (0.0254 millimeter) maximum.
- Moderate Corrosion: Structure has blisters, scaling, flaking, and pitting at depth from 0.001inch (0.0254 millimeter) to 0.010 inch (0.254 millimeter).
- Severe Corrosion: Structure has severe blisters, exfoliation, scaling, and pitting of depth greater than 0.010 inch (0.254 millimeter).

(a) If light or moderate corrosion is found, rework area per 3. Approved Repairs.
(b) If severe corrosion is found, contact Learjet Field Service Department for disposition.

2. TOOLS AND EQUIPMENT

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Chemical Film Coating	Alodine 1200	Amchem Rod Inc. Ambler, PA	Chemical Coating
Methyl-Ethyl-Ketone (MEK)	Spec. TT-M-261	Commercially Available	Cleaning Solvent
White , cotton Cloth		Commercially Available	Wiping
Scrub Brush (Stiff Bristle)		Commercially Available	Cleaning Surfaces
Primer	Curing Solution 910-350 Base 515-344	Desoto Inc. Garland, TX	Protective Paint
Primer	Catalyst CA-116 Base 463-12-8	Sikkins Coatings Div. AKZO Coatings Inc. Torrance, CA	Protective Paint
Nitric Acid	Spec. O-A-451 Type 1	Commercially Available	Adjust pH of Coating Solution

NAME	PART NUMBER	MANUFACTURER	USE
Abrasive Paper (Aluminum Oxide) 240 Grit or Finer		Commercially Available	Remove Corrosion
Abrasive Paper (Aluminum Oxide) 400 Grit		Commercially Available	Remove Corrosion
Soft Natural or Polyester Bristle Paint Brush		Commercially Available	Apply Primer

3. APPROVED REPAIRS

A. Rework light or moderate corroded areas on structure as follows: (See figures 203 and 204.)

CAUTION: DO NOT USE STEEL WOOL OR STEEL WIRE BRUSHES OR SEVERE ABRASIVES WHEN REWORKING STRUCTURE FOR CORROSION. USE 240 GRIT OR FINER ALUMINUM OXIDE ABRASIVE PAPER. FINISH WITH 400 GRIT PAPER.

(1) Sand corroded areas using 240 grit or finer aluminum oxide abrasive paper.

(2) Blend out pits in structure as shown.

WARNING:

- WEAR PROTECTIVE MASK AND ENSURE AREA IS WELL VENTILATED WHILE CLEANING STRUCTURE WITH METHYL-ETHYL-KETONE (MEK).
- ENSURE THAT MANUFACTURER'S PUBLISHED INSTRUCTIONS ARE FOLLOWED WHEN USING CLEANING AGENTS AND METAL FINISHES.

(3) Clean sanded surfaces with a Methyl-Ethyl-Ketone (MEK) dampened cloth. Wipe surfaces dry using a clean dry cloth.

WARNING:
- **CHEMICAL FILM SOLUTION AND ACID ARE INJURIOUS TO EYES AND SKIN. IF SPILLED, NEUTRALIZE AT ONCE WITH A WATER SOLUTION OF SODIUM BICARBONATE (BAKING SODA). CONSULT A PHYSICIAN.**
- **PROTECTIVE CLOTHING SUCH AS RUBBER GLOVES, APRON AND FACE SHIELD SHOULD BE WORN.**
- **WHEN MIXING SOLUTION, ALWAYS POUR ACID INTO WATER WHILE SLOWLY AND CONTINUOUSLY STIRRING. DO NOT POUR WATER INTO THE ACID.**

CAUTION: **TAKE PRECAUTIONS TO PROTECT AREAS WITH GOOD PAINT FROM THE CHEMICAL TREATMENT.**

NOTE: Any equivalent chemical film treatment for aluminum alloy may be used providing it complies with MIL-C-5541, Class 1 metal finish.

(4) Prepare Alodine chemical film solution by mixing 3.0 ounces (88.7 milliliters) of Alodine 1200 with deionized water per each gallon (3.79 liters) of final solution. Stir well until powder is dissolved. Disregard any small amount of settled-out insoluble material. Allow solution to stand at least 24 hours before use. If required adjust pH to range of 1.50 to 1.90 with nitric acid.

(5) Apply Alodine solution as follows:
   (a) Apply solution from a plastic container to a clean cloth or sponge.
   (b) Apply solution evenly and liberally, maintaining a wet surface. Repeat applications until a yellow color begins to appear. The solution should be applied around the periphery of the stripped area to ensure that a continuous chemical film is produced.
   (c) Rinse area with 60° to 100°F (15.6° to 37.8°) water.
   (d) Air dry at a temperature not to exceed 140°F (60° C). Do not wipe dry.

   CAUTION: **AVOID HANDLING TREATED PART AS FINGERPRINTS WILL HAVE A DETRIMENTAL EFFECT ON CONDUCTIVE COATING ADHESION.**

   (e) Visually inspect treated area to determine if the protective film is continuous, free from breaks, scratches, and other damages. If the finish is powdery, the area must be stripped in accordance with step (2) and reprocessed.

(6) Apply a brush coat of epoxy primer on chemically treated surfaces as follows:

NOTE:
- Use either of the primer systems described below:
- Thoroughly mix one volume of base primer 515-344 and one volume of curing solution 910-350.
- Thoroughly mix one volume of primer base 463-12-8 and one volume of Catalyst CA-116.

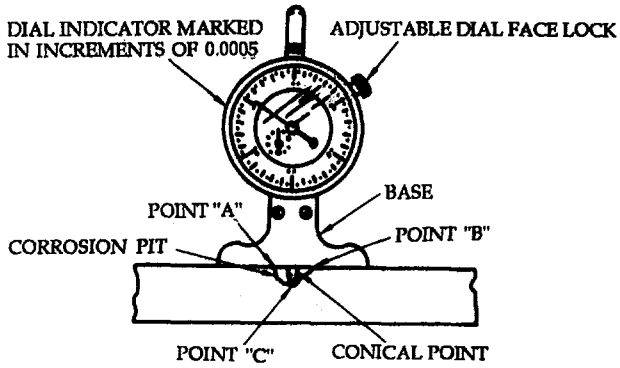
(a) After one of the primer systems described above has been thoroughly mixed, allow to stand a minimum of 30 minutes, and apply a brush coat over the prepared surfaces.
(b) Allow primer to dry at room temperature for a minimum of two hours.

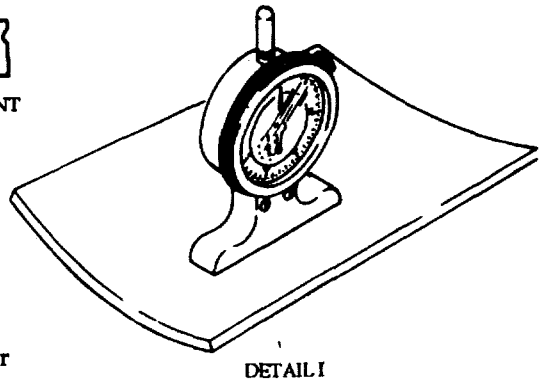
NOTE: Unused mixed material over eight hours old shall be discarded.

(7) Replace liner.

NOTE: The liner backing can be reused providing the backing is thoroughly washed with soap and water.

(a) Install compartment liner.
(b) Reinstall aircraft equipment, furnishings, carpeting, and interior panels as required to restore aircraft to normal.



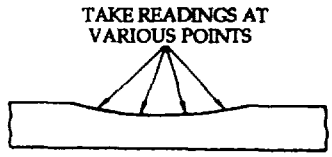


DETAIL I

NOTE:

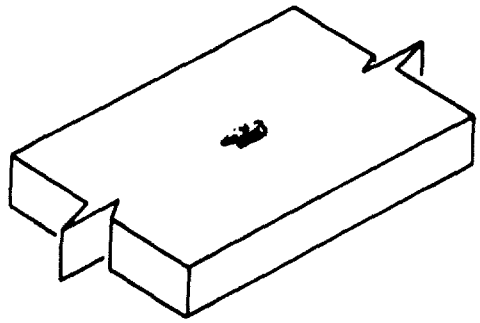
- Depth dial gage 0 to 0.500 inch (0 to 12.7 millimeter) range.
- Take measurement readings permindicular to the radius of concave or convex surfaces.
- Take measurement readings on edges adjace4nt to corrosion damage or blended depression (points A and B). Take several readings around center of corrorsion damage or blended depression (See detail II) and consider the deepest reading to be point C. Determine depth as follows:

$$\text{Depth} = C - \frac{(A + B)}{2}$$



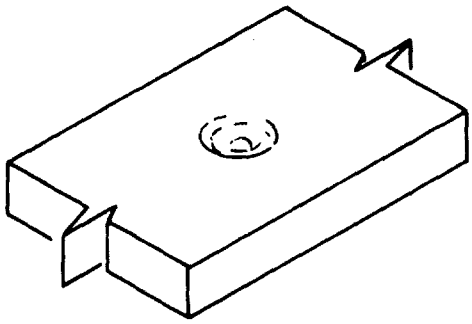
DETAIL II

Corrosion Damage and Rework Measurement
Figure 201



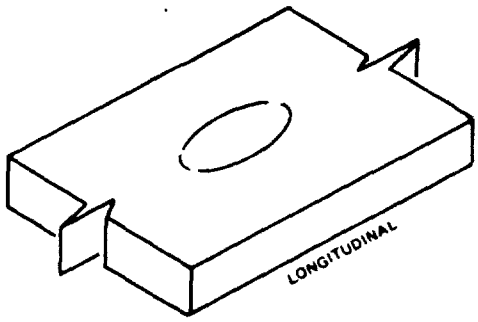
PIT HAS BEEN CLEANED UP TO THE EXTENT THAT ALL LOOSE CORROSION PRODUCTS HAVE BEEN REMOVED.

CORROSION DAMAGE BEFORE REWORK



ROUGH EDGES HAVE BEEN SMOOTHED AND ALL CORROSION HAS BEEN REMOVED. HOWEVER, DEPRESSION HAS NOT BEEN SHAPED.

DEPRESSION AFTER CORROSION REMOVAL

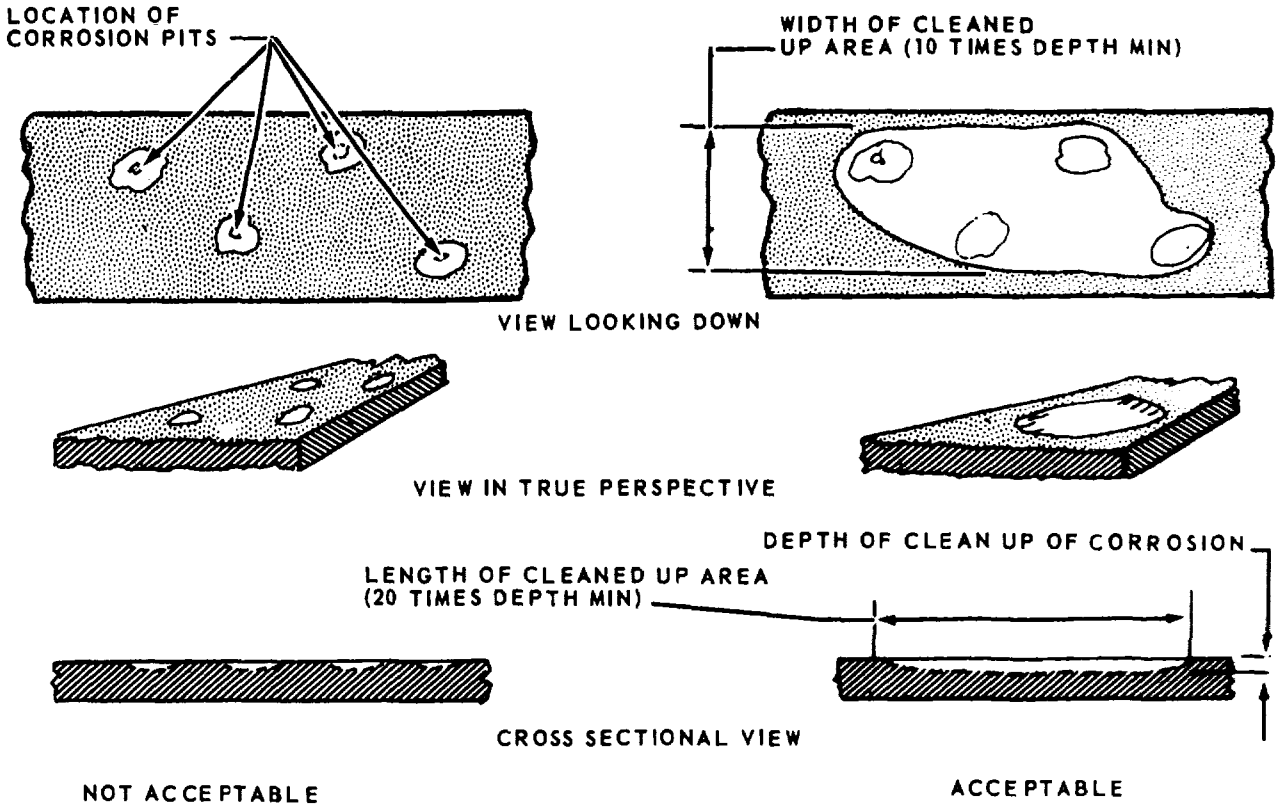


BLENDING HAS BEEN ACCOMPLISHED

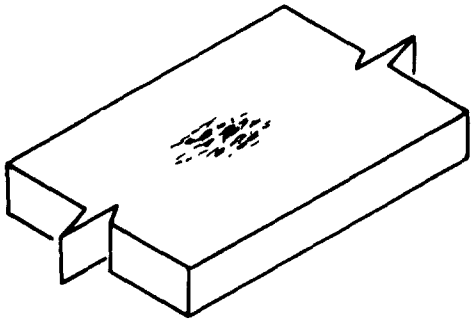
DISH-OUT AFTER BLENDING

Blendout of Corrosion of Single Depression
Figure 202

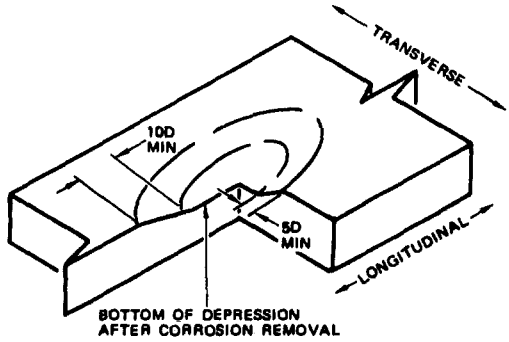
CAUTION DO NOT USE STEEL WOOL OR STEEL WIRE BRUSHES OR SEVERE ABRASIVES WHEN REWORKING STRUCTURE FOR CORROSION. USE 240 GRIT OR FINER ALUMINUM OXIDE ABRASIVE PAPER. FINISH WITH 400 GRIT PAPER.



Blendout of Multiple Pits in Corroded Area
Figure 203 (Sheet 1 of 2)



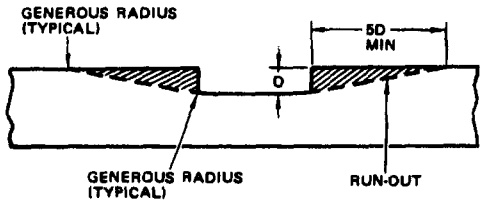
CORROSION DAMAGE
BEFORE REMOVAL



DAMAGE REMOVED AND SURFACE SMOOTHED
WITH SHALLOW ELLIPTICAL DISH-OUT

NOTE

- D = DEPTH OF DEPRESSION
- REFER TO SPECIFIC ALLOWABLE DAMAGE LIMITS FOR MAXIMUM ALLOWABLE DEPTH.
- SINCE MAXIMUM DEPTH VARIES AT DIFFERENT LOCATIONS, MAXIMUM SIZE OF DISH-OUT WILL ALSO VARY.
- THE BLENDING RATIO SHALL BE MAINTAINED AT ALL TIMES UNLESS OTHERWISE SPECIFIED IN A SPECIFIC REPAIR.
- SEE DETAIL I FOR EXAMPLE OF BLENDING.



EXAMPLE OF 1:5 BLENDING RATIO
DETAIL I

Blendout of Multiple Pits in Corroded Area
Figure 203 (Sheet 2 of 2)

ANTI-CORROSION CHEMICAL FILM TREATMENT - MAINTENANCE PRACTICES

1. *Cleaning/Painting*

NOTE: For chemical film treatment of small areas or electrical bonding, refer to paragraph 1.B.

WARNING: ALODINE CONTAINS CHROMIUM WHICH IS A KNOWN CARCINOGEN.

A. Application of the Anti-Corrosion Chemical Film Treatment *(1320V, 1047AG)*

NOTE: *The work area shall be free of dust and have a temperature above 65°F [18°C].*

Alodine 1200 chemical film treatment solution shall be used at room temperature.

Alodine 600 chemical film treatment solution shall be used at 70° to 100°F [21° to 38°C].

(1) Make sure that all areas to receive chemical film treatment have been thoroughly cleaned.

NOTE: *If the areas have been alkaline cleaned, make sure that the surface has a water* break-free surface.

(2) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Vapor Proof Film (Vinyl Film)	#3470	3M Co. St. Paul, MN	Masking material.
Vapor Proof Tape (Black Vinyl)	#471	3M Co. St. Paul, MN	Masking material.
Deionized Water		Commercially Available	Film solution ingredient.
Nitric Acid	O-N-350	Commercially Available	Control film solution pH.
Ammonium Hydroxide (Type 1)	O-A-451	Commercially Available	Control film solution pH.
Chemical Treatment	Alodine 1200	Parker Amchem Madison Heights, MI	Surface protection.
	Alodine 600	Parker Amchem Madison Heights, MI	Surface protection.
	Alodine Toner 22	*Parker Amchem* Madison Heights, MI	*Mix with Alodine 600.*

NAME	PART NUMBER	MANUFACTURER	USE
Mixing Tank (Stainless Steel or Acid Resistant Material)		Commercially Available	Mixing film solution.
Plastic Containers (Acid Resistant)		Commercially Available	Holding film solution for application.
Scotch-Brite Pads (Very Fine) (Type A - Aluminum Oxide)	7447	3M Co. St. Paul, MN	Stripping off defective chemical film.
Rimple Cloth (Purified)	Kendall 301	American Fiber & Finishing Inc. Colrain, MA	Testing chemical film coating.
Sponge, Cellulose		Commercially Available	Applying film solution.
Tap Water		Commercially Available	Rinsing.

(3) If necessary, mask off areas not to receive the chemical film treatment using vapor proof masking materials.

NOTE: Parts or assemblies having joints or crevices (partial or intermittent welds, riveted, bolted, or other type of mechanical fastened joints, honeycomb panels, etc.) or any other type of configuration that will entrap solution shall not receive chemical film treatment unless those areas are positively masked off.

(4) Mix anti-corrosion chemical film treatment solution.
  (a) Fill mixing tank half full of deionized water.
  (b) Turn on clean air agitation.
  (c) When using Alodine 1200, mix 1.2 ounces [35.5 ml] of Alodine 1200 per gallon [3.785 liters] of deionized water.
  (d) When using Alodine 600, mix 2 ounces [59.15 ml] of Alodine 600 per gallon [3.785 liters] of deionized water and add 1 gallon [3.785 liters] of Alodine Toner 22 per 100 gallons [378.5 liters] of solution.
  (e) Finish filling mixing tank to operating level with deionized water.
  (f) Stir well until chemical treatment is dissolved.
  (g) Disregard any insoluble material.
(5) Allow solution to stand at least 24 hours before using.
(6) Maintain anti-corrosion chemical film treatment solution.
  (a) Maintain solution concentration. When using Alodine 1200, solution shall be maintained at a concentration of 1 to 2 ounces [29.6 to 59.1 ml] Alodine 1200 per gallon [3.79 liters] of water. When using Alodine 600, solution shall be maintained at a concentration of 1.8 to 2.2 ounces [53.2 to 65.1 ml] Alodine 600 per gallon [3.79 liters] of water.
  (b) Maintain a pH level of 1.5 to 2.0.

1) When using Alodine 1200, and pH cannot be maintained with the addition of required Alodine 1200, solution pH shall be raised by adding required amount of ammonium hydroxide, or lowered by adding required amount of nitric acid.
2) When using Alodine 600, solution pH shall be lowered by adding required amount of nitric acid or raised by adding required amount of ammonium hydroxide.

(7) Fill plastic containers with chemical film solution.
(8) Wet the surface to receive the chemical film treatment with tap water.
(9) Before application of chemical film treatment, make sure that provisions for catching chemical film treatment solution runoff are in place. Allow runoff to be pumped into a disposal unit.

WARNING: ENSURE THAT THE WORK AREA IS PROPERLY VENTILATED. OBSERVE ALL SAFETY PRECAUTIONS IN THE WORK AREA TO PRECLUDE FUME BUILDUP AND EXPLOSIONS.

PERSONNEL SHALL BE FAMILIAR WITH THE MATERIAL SAFETY DATA SHEET (MSDS) OF ALL HAZARDOUS MATERIALS USED AND WEAR APPROPRIATE PROTECTIVE CLOTHING WHEN HANDLING THESE MATERIALS.

ALODINE CONTAINS CHROMIUM WHICH IS A KNOWN CARCINOGEN.

(10) Using sponge or clean cloth, apply chemical film treatment evenly and liberally, maintaining a uniform wet surface.
(11) Solution shall be applied from lower side of aircraft in an upward motion to make sure that a continuous chemical film is produced without streaking or spotting.
(12) Repeat application until a yellow color begins to appear.

NOTE: The surface being treated shall not be allowed to dry until the beginning of a yellow color has been achieved. Reapply solution as necessary to maintain a wet solution on surface.

CAUTION: DO NOT ATTEMPT TO WIPE DRY OR DISTURB CHEMICAL FILM FOR 2 HOURS AFTER APPLICATION.

(13) Using a sponge, immediately rinse area with clean tap water when proper color has been achieved.

CAUTION: WHEN RINSING FRESHLY APPLIED CHEMICAL FILM, CARE SHALL BE TAKEN TO NOT REMOVE OR DAMAGE FILM. FILM IS STILL SOFT AT THIS TIME.

(14) Allow the chemical film to air dry to an iridescent appearance.
(15) Visually inspect treated area to determine that the protective film is continuous, free from breaks, scratches, and other damage. Any area of surface not having an iridescent appearance shall be

recleaned. (Refer to 20-13-00 for solvent cleaning and to 20-50-00 for alkaline cleaning.) If the finish is powdery or blotchy, the area must be stripped with an abrasive pad and retreated.

NOTE: The presence of a powdery coating is determined by wiping with a rimple cloth 1/2 to 2 minutes after drying.

(16) Do not disturb chemical film coating for a minimum of 2 hours.
(17) The treated areas shall be heated to 110° to 130°F [43° to 54°C], for a minimum of 8 hours, to make sure that all moisture is remove from joints, seams, and chemical film.

CAUTION: AVOID CONTAMINATION OF SURFACE WITH FINGERPRINTS PRIOR TO PAINTING.

(18) Apply required primer to aircraft within 4 days. (Refer to 20-50-00.)

B. Application of the Anti-Corrosion Chemical Film Treatment (Alodine 1132 with Touch and Prep Pen Method)

NOTE: If the area or part has been cleaned and is ready for the chemical film treatment, refer to step B.(6).

Application of chemical film treatment, using the Alodine 1132 Touch and Prep Pen is for repair purposes and for electrical bonding purposes.

Use of this chemical film treatment is limited to 30 sq. in [193.55 sq. cm] of surface area for part repair or 30 sq. in [193.55 sq. cm] for electrical bonding.

Usable shelf life of solution in touch and prep pen is 24 months from date of receipt.

(1) Acquire necessary tools and equipment.

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Chemical Treatment Touch and Prep Coating Pen	Alodine 1132	Parker Amchem Madison Heights, MI	Repair to surface protection areas.
Scotch-Brite Pads (Very Fine) (Type A-Aluminum Oxide)	7447	3M Co. St. Paul, MN	Removing oxides.
Sponge, Cellulose		Commercially Available	Rinsing.
Tap Water		Commercially Available	Rinsing.

(2) Solvent clean area to be treated of any trace of oil, grease, or tape residue. (Refer to 20-13-00.)
(3) Using Scotch-Brite, remove oxides by carefully manually abrading surface area to be coated. Use care to minimize removal of cladding, if present.
(4) Using a sponge, rinse area with clean tap water. A break-free surface must be obtained.
(5) If a break-free surface is not obtained, repeat the following steps as often as needed to obtain a break-free surface.
    (a) Solvent clean area to be treated of any trace of oil, grease, or tape residue. (Refer to 20-13-00.)
    (b) Using Scotch-Brite, remove oxides by carefully manually abrading surface area to be coated. Use care to minimize removal of clad plating, if present.
    (c) Using a sponge, rinse area with clean tap water. A break-free surface must be obtained.
(6) Activate tip of touch and prep pen by pressing against a firm surface until tip appears wet with solution.
(7) Apply the solution to work surface in even, overlapping strokes in one (1) direction, taking care that solution does not puddle on work surface.

CAUTION: DO NOT RINSE OR WIPE WORK SURFACE DRY.

(8) Let chemical film coating dry.
(9) Repeat application of solution to work surface at right angles to previous direction in even, overlapping strokes in one direction, taking care that solution does not puddle on work surface.

CAUTION: DO NOT RINSE OR WIPE WORK SURFACE DRY.

(10) Let chemical film coating dry.

NOTE: The area or part may be oven dried at a temperature not to exceed 140°F [60°C].

CONDUCTIVE COATING - MAINTENANCE PRACTICES

1. DESCRIPTION

NOTE:
- Application of the conductive coating to the outside surface of plastic laminated and aluminum surfaces is accomplished to aid in static discharge. (Refer to Chapter 53 for conductive coating of the radome.)
- Conductive coating is applied over entire surface of the part including the attaching rivets and screws. This provides a conductive path for static electricity (gathered on the outer surface of the aircraft) to be discharged to the aircraft structure (ground).

2. TOOLS AND EQUIPMENT

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Filler Putty (Cat-A-Lac)	Base 467-9 Catalyst CA-41B	AKZO Coatings Inc. Sikkins Coating Div. Torrance, CA	Fill Porous Surfaces
Pin Hole Filler (Magna Static Conditioner Filler)	28-C-1	Dexter Corp. Midland Div. Hayward, CA	Fill Pin Holes
Primer (Super Koropon Fluid Resistant, Green)	Base 515X344 Curing Solution 910X350 Reducer 020X324	Desoto Inc. Garland, TX	Prepare Surface
or			
Primer (Corrosion Resistant, Green)	Base 463-12-8 Catalyst CA-116 Reducer TL-52 (below 90°F [32.2° C]) TL-65 (above 90°F [32.2° C])	AKZO Coatings Inc. Sikkins Coatings Div. Torrance, CA	Prepare Surface
Abrasive Paper (Aluminum Oxide) 220 Grit or Finer		Commercially Available	Smoothing Surface
Methyl-Ethyl-Ketone (MEK)	Spec. TT-M-261	Commercially Available	Solvent
Surfacer (Off-White)	Base 66-C-28 Hardener 50-C-3	Dexter Corp.	Prepare Surface

NAME	PART NUMBER	MANUFACTURER	USE
Epoxy Sanding Surfacer	Base 482-300 Catalyst 120-900 Thinner 110-655 (Jet Glo)	Pratt and Lambert Wichita, KS	Prepare Surface
Anti-Static Conductive Coating (Black)	Base 463-6-14 Catalyst CA-97 Reducer TL-52	AKZO Coatings Inc. Sikkins Coatings Div.	Coating Surfaces
Very Fine Abrasive Pad (type A-Aluminum Oxide)	Scotch-Brite 7447	3M St. Paul, MN	Smoothing Surfaces
Abrasive Paper (Aluminum Oxide) 180 Grit or Finer		Commercially Available	Smoothing Surfaces
Cheesecloth		Commercially Available	Wiping
White or Clean Cotton Cloth		Commercially Available	Wiping
Toluene (Toluol)	Spec. TT-T-548	Commercially Available	Cleaning Solvent
Naptha, Petroleum Aliphatic	Spec. TT-N-95, Type 1	Commercially	Cleaning Solvent
Squeegee		Commercially Available	Putty Application
Teflon or Polyolifin Material		Commercially Available	Masking
Gram Balance		Commercially Available	Weighing Materials
Gloves (White Knitted Lightweight)	890	Wiggins	Protect Surface
Wrapping Paper	Spec. MIL-P-17667 Type 1	Commercially Available	Masking
Curing Solution	Super Koropon 910-006	Desoto Aerospace	Conductive Coating
Conductive Coating	Super Koropon 528T202	Desoto Aerospace	Conductive Coating

3. APPLICATION TO LAMINATED SURFACES

A. Application of conductive coating to laminated surfaces other than the radome is as follows: (Refer to Chapter 53 for conductive coating of the radome.)

WARNING: ENSURE THAT THE WORK AREA IS PROPERLY VENTILATED. OBSERVE ALL SAFETY PRECAUTIONS IN THE WORK AREA TO PRECLUDE FUME BUILD-UP AND EXPLOSIONS.

CAUTION: THE PART TO BE PROCESSED MUST BE INSPECTED FOR CONDITION PRIOR TO STARTING THIS PROCEDURE. CONDUCTIVE COATING IS NOT TO BE APPLIED TO TRANSPARENT SURFACES SUCH AS WINDOWS, LENSES, ETC.

NOTE: Spraying equipment shall be clean and air for spraying shall be clean and dry. The finish area shall be above 65°F (18.3° C) and free of dust.

(1) Inspect part to determine condition.
   (a) If the part is smooth without pin holes or other defects, lightly hand sand entire primed surface with 320 grit abrasive paper and proceed with step (5).
   (b) If the part has paint removed and is uneven, proceed to step (4). If the part has pin holes, proceed with step (3).
   (c) If a replacement part from the factory is to be installed:
      1) Prior to installing on aircraft paint all countersunk holes with a light coat of conductive coating, mixed in accordance with step (6).
      2) Install attaching parts while conductive coating is wet.

(2) Prepare surface to be filled as follows:
   (a) Thoroughly scrub surface with MEK, toluene, or naptha using clean cotton cloth. Dry area.

      CAUTION: USE EXTREME CARE NOT TO SAND THROUGH OUTER RESIN COAT INTO THE FIBERGLASS CLOTH WHEN PREPARING SURFACE.

   (b) Uniformly abrade cleaned area using 180 grit abrasive paper.
   (c) Thoroughly scrub surface with MEK, toluene, or naptha using clean cotton cloth until all sanding residue is removed. Wipe surface dry with a clean cotton cloth.

      NOTE: Do not allow solvent to air dry. Air dried solvent will leave a residue.

(3) If surface to be recoated has pin holes, proceed as follows:
   (a) Clean area in accordance with step (2).

      NOTE: Top coat areas, where pin hole filler has been applied, with surfacer 2-24 hours after application of pin hole filler.

   (b) Apply pin hole filler at package consistency directly to surface. Force filler into pin holes using a circular hand rubbing motion or with a squeegee.
   (c) Allow approximately 15-45 minutes filler dwell time or until it turns chalky white.

      CAUTION: DO NOT USE ANY SOLVENT TO REMOVE EXCESS PIN HOLE FILLER. SOLVENT MAY DISSOLVE PIN HOLE FILLER.

(d) Remove excess filler with a clean cotton cloth. Move in a circular direction. Scotch-Brite or 180 grit or finer aluminum oxide abrasive paper may also be used.

NOTE: Since parts cannot be degreased following pin hole filling, all parts handling shall be with clean white cotton gloves. All parts removed from immediate work area shall be protected by wrapping in paper or by transporting in clean cardboard boxes.

(e) Examine surface to ensure that all pin holes and surface defects have been filled. If necessary, repeat step (b) through (d).
(f) Apply surfacer in accordance with paragraph (4).

(4) If the surface to be recoated is uneven and rough, proceed as follows:
(a) Clean area in accordance with step (2).
(b) Mix filler putty in the ratio of 0.102 ounce (2.9 grams) of catalyst to 3.527 ounces (100 grams) of base. Stir thoroughly after mixing.

NOTE: The mixed filler putty will have a pot life of eight hours at room temperature.

(c) Apply the mixed putty to the laminated surface with a squeegee. Work filler putty over the entire surface to fill in holes, etc. Remove excess filler putty from the laminated surface with a squeegee.
(d) Filler putty will cure in 24 hours at room temperature. It can be force cured in an oven for 20 to 30 minutes at 250° F (121° C).
(e) Ensure that the filler putty is fully cured prior to sanding. Sand surface by hand with 320 grit abrasive paper until smooth.
(f) Clean surface with MEK or acetone using cheesecloth or cotton swabs. Wipe dry.

NOTE: Do not allow solvent to air dry. Air dried solvent will leave a residue.

(g) Inspect surface for pin holes and other defects. Repeat step (4) as required.
(h) Apply primer to surface in accordance with (5).

(5) Apply primer as follows:
(a) Application of primer is for the purpose of sealing the surface, promoting adhesion of the conductive coating, and for minor cosmetic surface improvement. Use any of the primers depending on surface requirements - Super Koropon fluid resistant green primer from Desoto Inc. and corrosion resistant green primer from AKZO Coatings Inc. will build the least film thickness and be the hardest to sand. Surfacer from Dexter Corp. will build a thicker film and be somewhat easier to sand. Epoxy sanding surfacer from Pratt and Lambert will build the thickest film and be easiest to sand.
(b) Prepare either the Super Koropon or the corrosion resistant green primer as follows:
1) Mix 1 part base with 1 part appropriate catalyst or curing solution.
2) Stir thoroughly with paddle to mix.
3) Below 90°F (32.2° C), Super Koropon primer may be thinned with up to 10% MEK for sprayability. Above 90°F (32.2° C), Super Koropon primer may be thinned with up to 10% applicable reducer for sprayability. Corrosion resistant primer may be thinned with up to 10% applicable reducer for sprayability.

NOTE:
- All surfaces must be clean and thoroughly dry before receiving primer.
- Unused mixed primer over eight hours old must be discarded.

(c) Apply Super Koropon or corrosion resistant green primer mixture to the plastic laminated surface evenly, without interruption 0.0006 to 0.0012 inches (0.6 to 1.2 mils [0.0152 to 0.0304 millimeter]) thickness.
(d) Allow Super Koropon or corrosion resistant green primer to air dry a minimum of two hours before applying top coat.
(e) Prepare surfacer primer from Dexter Corp., as follows:
1) Mix 1 part by volume of hardener into 4 parts by volume of base. Mix thoroughly and allow 15 minutes minimum sweat-in dwell time.
2) Add 1 to 3 parts by volume of either MEK or appropriate reducer for sprayability.

NOTE:
- All surfaces must be clean and thoroughly dry before receiving surfacer.
- Unused mixed surfacer over six hours old, at room temperature, must be discarded.

(f) Prepare Epoxy Sanding Surfacer Primer, as follows:
1) Mix 1 part, by volume, of catalyst into 1 part, by volume, of base. Mix thoroughly and allow 30 minutes minimum sweat-in dwell time.
2) Add 10 to 25%, by volume, of appropriate thinner for sprayability. Mix thoroughly.

NOTE:
- All surfaces must be clean and thoroughly dry before receiving surfacer.
- Unused mixed surfacer over eight hours old, at room temperature, must be discarded.

(g) Spray apply uniform cross coat of surfacer primer as required to fill voids and depressions. Additional coats of surfacer can be applied approximately 30 minutes after application. Limit application to maximum of three coats of material.
(h) Surfacer primer cures to a sandable condition in approximately four to eight hours. Surfacer primer can be force cured by allowing 15-30 minutes flash-off time at room temperature plus 2 hours at 120° (±10°) F (48.9° C).
(i) Sand surfacer primer to maintain minimum thickness required for cosmetic improvement. Use 220 grit or finer abrasive paper.
(j) Inspect surface to ensure that all surface imperfections, blemishes, the weave of the fabric, pin holes, etc. are completely obscured. Repeat step (5) as necessary.
(k) After application of primer, apply conductive coating as given in step (6).

(6) Apply conductive coating as follows:
(a) Prepare surface as follows:
1) Hand sand primed surface with 320 grit abrasive paper.
2) Clean surface with MEK, toluene, or naptha using clean cotton cloth or cheesecloth.
3) Dry area with clean cotton cloth or cheesecloth. Do not air dry.

NOTE: Do not allow solvent to air dry. Air dried solvent will leave a residue.

(b) Mix conductive coating as follows:

1) Mix one part by volume catalyst into three parts by volume of base. Stir thoroughly. Mixed material can be thinned by up to 10% reducer for sprayability.
2) Mix thoroughly and allow a minimum of 20 minutes sweat-in time before using material.

NOTE:
- After mixing, material will have a slightly gelled appearance. Do not mistake this as premature gelation.
- Pot life of mixed coating is eight hours at 70° (±5°) F (21.1°, ± 2.8° C). Material older than that must be discarded.

(c) Apply conductive coating as follows:
1) Spray conductive coating evenly. Apply two coats at 90° to each other over surface to achieve a 0.0012 to 0.0018 inch (12 to 18 mils [0.030 to 0.046 millimeter]) dry film thickness. Use 35 to 45 psi (241.3 to 310.3 kPa) on a suction spray gun or a line pressure of 35 to 45 psi (241.3 to 310.3 kPa) on a pressure pot gun with approximately 5 psi (34.5 kPa) fluid line pressure.

NOTE: The effectiveness of the conductive coating is diminished if it does not come into contact with the attaching parts. The attaching parts (screws or rivets) provide a conductive path from the conductive coating to the airframe structure (ground).

(d) Allow conductive coating to cure for minimum of four hours at 75° (±5°) F (23.9° C). Conductive coating may be force cured at 150°F (65.6° C). for one hour.
(e) Install laminated part on aircraft.

NOTE: Prior to installing part on aircraft, paint all countersunk holes with a light coat of conductive coating. Install attaching parts while conductive coating is wet.

(f) Prime and finish top coat in accordance with procedures in 20-50-00.

4. APPLICATION TO ALUMINUM SURFACES
A. Application of conductive coating to aluminum surfaces as follows:
(1) Prepare surface and apply anti-corrosion chemical treatment in accordance with 20-72-00.
(2) Apply conductive coating in accordance with step (6).

CAUTION: MASK OFF AREAS ADJACENT TO THE PROCESSED AREA TO PROVIDE PROTECTION OF PAINT FROM OVERSPRAY.

POLISHING ALUMINUM SURFACES - MAINTENANCE PRACTICES

1. Description

NOTE: All aluminum surfaces which have been stripped down to the bare metal require an anti-corrosion chemical film treatment.

2. Tools and Equipment

NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	PART NUMBER	MANUFACTURER	USE
Buffing Compound (Red)	T-3	Lea Manufacturing Waterbury, CT	Buffing aircraft's outer skin.
Buffing Compound (White)	339E	Lea Manufacturing Waterbury, CT	Buffing aircraft's outer skin.
Aluminum Polish	Formula 1187	DARS MET-ALL Ind. Inc. Long Island City, NY	Polishing aircraft's outer skin.
Aluminum Polish	Flitz Multi-Purpose	Flitz Intn'l Ltd. Waterford, WI	Polishing aircraft's outer skin.
Aluminum Polish	Phase 1	Phase Products Inc. Strong City, KS	Polishing aircraft's outer skin.
Aircraft Polish	Iosso	Iosso Marine Products Elk Grove Village, IL	Polishing aircraft's outer skin.
320 Grit Aluminum Oxide		Commercially Available	Sanding.
500 Grit Aluminum Oxide		Commercially Available	Sanding.
Vapor-Proof Film (With PSA)	Spot-Stick 5-X-N	St. Regis Laminated & Coated Product Div. Boston, MA	Protect surface.
Polishing Grease (Yellow)	Bruko G-6	Bruce Prod. Corp. Howell, MI	Polishing grease.
20-ply Loose Cotton Buffing Wheel (64/68), 12 in. (30.48 cm) dia. x 1/2 in. (1.27 cm) dia. arbor hole		Garfield, Ind. Fairfield, NJ	Buffing aircraft's outer skin.

NAME	PART NUMBER	MANUFACTURER	USE
Open Coat, Free-Cut Paper Abrasive Disks (Aluminum Oxide)	TRI-M-ITE 320 & 500 Grit	3M Company St. Paul, MN	Sanding aircraft's outer skin.
Sanding Pad 5 in. (12.7 cm) dia. x 5/16 in. (7.94 mm) Thr'd Arbor	Stikit Disc 05575	3M Company St. Paul, MN	Sanding aircraft's outer skin.
Wheel Rake 2 x 5 inch (5.1 x 12.7 cm) Buffer		Mathew Tool Chicago, IL	Clean buffing wheels.
Cheesecloth (Commercial Grade)		Commercially Available	Cleaning and wiping skin.
Vapor Proof Film (Vinyl)	3470	3M Company St. Paul, MN	Protective film cover.
Vapor Proof Tape	471	3M Company St. Paul, MN	Protective film cover fastener.
Very Fine Abrasive Pad (Type A- Aluminum Oxide)	Scotch-Brite 7447	3M Company St. Paul, MN	Cleaning heavy residue.
Mild Detergent (Commercial Grade)		Commercially Available	Cleaning heavy residue.
Pneumatic Motor (1.7 hp)	Series 10-40	Dotco, Inc. Hicksville, OH	Polishing motor.
Pneumatic Sander (Dual Action)	Model DA-Q	National Detroit, Rockford, IL	Finishing aircraft's outer skin.
Methyl Ethyl Ketone (MEK)	TT-M-261	Commercially Available	Cleaning solvent.

3. Cleaning/Painting

CAUTION:
- USE EXTREME CARE WHEN WORKING WITH WING LEADING EDGE. DUE TO THE CRITICAL NATURE OF THIS WING LEADING EDGE, ABSOLUTELY NO DAMAGE IS ALLOWED.
- IF POLISHING OF WING LEADING EDGE IS REQUIRED TO REMOVE SMALL SCRATCHES OR NICKS, THE POLISHING SHALL NOT EXCEED THOSE LIMITS AS SPECIFIED.

NOTE:
- When sanding, buffing, or polishing wing leading edge to remove pitting and minor damage, the following limitations shall be followed:
  (1) Minimum thickness of wing leading edge after polishing is 0.040 inch (1.02 millimeter).
  (2) Polishing shall be blended such that surface is smooth and uniform and without visual evidence of surface ridges or waves.
- These limitations apply for both removal of minor damage and anytime excess polishing for appearance is suspected.

A. Polish Aircraft Skin and Exterior Surfaces as follows:
   (1) Using protective vapor proof film and tape, mask around area to be polished.
   (2) Remove any heavy oil or grease contamination, in area to be polished, with MEK cleaning solvent and a clean, lint-free cloth.
   (3) Remove any other forms of heavy contamination by hand using an abrasive pad and a mild detergent solution. Thoroughly rinse affected area with room temperature tap water when detergent solution is used.
   (4) Prepare aircraft skin, exterior surface for buffing as follows:

CAUTION: THE SANDING PAD SHALL BE HELD IN A PLANE PARALLEL TO THE SURFACE BEING SANDED AND SHALL BE KEPT IN CONSTANT MOTION. TILTING FROM PARALLEL OR A SUBTLE MOVEMENT MAY CAUSE AN UNWANTED RIPPLED APPEARANCE.

(a) Using a pneumatic sander, a sanding pad, a 320 grit abrasive disc and polishing grease, lightly and uniformly sand aircraft skin.

NOTE: Use generous amounts of polishing grease to prevent excessive heat generation.

(b) Continue sanding procedure only until the area has been uniformly abraded or smoothed.
(c) Replace used 320 grit abrasive disc with a 500 grit abrasive disc and continue sanding (also continue using generous amounts of polishing grease) until once again a uniform surface exists.
(d) Use a clean, lint-free cloth to remove sanding residue from finished area.

   (5) Prepare aircraft skin, exterior surface for polishing as follows:

CAUTION: A CONSTANT MOTION AND PRESSURE SHALL BE MAINTAINED TO PREVENT EXCESSIVE HEAT GENERATION.

(a) Using a pneumatic motor, buffing wheels and red buffing compound, lightly and uniformly buff aircraft skin.

NOTE: Use generous amounts of buffing compound. Do not allow buffing compound to build up or harden on the buffing wheels. Use wheel rake to maintain clean, soft buffing wheels.

(b) Continue buffing procedure only until the area has acquired a uniform surface appearance. Use white buffing compound and continue buffing procedure.

(c) Replace or clean buffing wheels.

NOTE: Continue to use generous amounts of white buffing compound. Do not allow white buffing compound to build up on or harden on the buffing wheels. Use wheel rake to maintain clean, soft buffing wheels.

(d) Continue buffing procedure only until the area has once again achieved a smooth, uniform appearance.

(e) Replace or clean buffing wheels using wheel rake.

(6) Polishing procedures for aircraft skin, exterior surfaces is as follows:

(a) Using a pneumatic motor, clean buffing wheels and aluminum polish, lightly and uniformly polish aircraft skin.

CAUTION: DO NOT TOUCH POLISHED AREAS WITH BARE HANDS.

NOTE: Use generous amounts of aluminum polish to prevent excessive heat generation.

(b) Continue polishing procedure only until the area has an aesthetically acceptable uniform appearing polished surface.

(7) Remove protective vapor proof film and tape from aircraft.

(8) Remove any remaining polishing residue using only a clean, dry, lint-free cloth and aluminum polish, if required. Do not use any cleaning solvent after polishing has been completed. Black oxidation residue after polishing may be removed by rubbing with dry cornstarch or wheat flower sprinkled on a clean, soft cloth.

(9) Apply vapor-proof film (Spot Stick or equivalent) over polished area to protect area until application of additional coating.

PRETREATMENT PRIMER - MAINTENANCE PRACTICES

1. General
   A. These maintenance practices define the procedures for applying pretreatment primer to aluminum surfaces.

      NOTE:
      - Chemical film is the preferred treatment for all aluminum detail parts and for all other aluminum parts that do not have faying surfaces or pockets that would trap solution.
      - Welded (spot or fusion) assemblies with exposed or unsealed faying surfaces, assemblies with parts that were not chemical filmed, anodized parts over 24 hours old, parts which are inconvenient to chemical film treatment, or parts and assemblies that might trap solution shall be pretreatment primed per this procedure.

   B. Prior to applying pretreatment primer, maintenance personnel shall read, thoroughly understand, and carefully adhere to instructions in this section.
   C. All surfaces shall be clean and dry at the time of primer application.
   D. Air system shall be filtered and have adequate separators to remove oil and water when used to operate spray guns.
   E. All materials shall be thoroughly agitated and mixed before and after adding thinner.

2. Pretreatment Primers
   A. Primer; Mfg.: Crown Metro Aerospace Coatings, Inc., Greenville, SC
      (1) 40-P1-2 Primer Base
      (2) AC-100 Curing Agent
      (3) TR-29 Reducer
   B. Primer; Mfg.: Akzo Coatings, Inc., Orange, CA
      (1) 37.427 Metaflex FCR Primer Base
      (2) 91.028 Metaflex FCR Hardener
      (3) C 25/90 S Thinner

3. Application of Pretreatment Primer
   A. Mix pretreatment primer.
      (1) Primer manufactured by Crown Metro Aerospace Coatings, Inc.
         (a) Mix one (1) volume of curing agent into four (4) volumes of primer base.
         (b) Stir thoroughly.
         (c) Allow mixed material to stand 15 minutes, minimum.
         (d) Reducer may be used as a thinner. Thin up to 40% (by volume) and stir thoroughly.
         (e) Work life of material is approximately four (4) hours.
      (2) Primer manufactured by Akzo Coatings, Inc.
         (a) Mix two (2) volumes of hardener into one (1) volume of primer base.
         (b) Stir thoroughly.
         (c) Allow mixed material to stand 15 minutes, minimum.
         (d) Using thinner, thin up to 25% (by volume) and stir thoroughly.
         (e) Work life of material is approximately six (6) hours.
   B. Pretreatment primer shall have a cured dry film thickness of approximately 0.0003 inch.

      NOTE:
      - Film thickness may be measured by masking and test painting a bare piece of aluminum and measuring the difference in thickness between bare and painted areas with a precision micrometer.
      - Adjust spray pattern or primer viscosity to adjust dry film thickness.