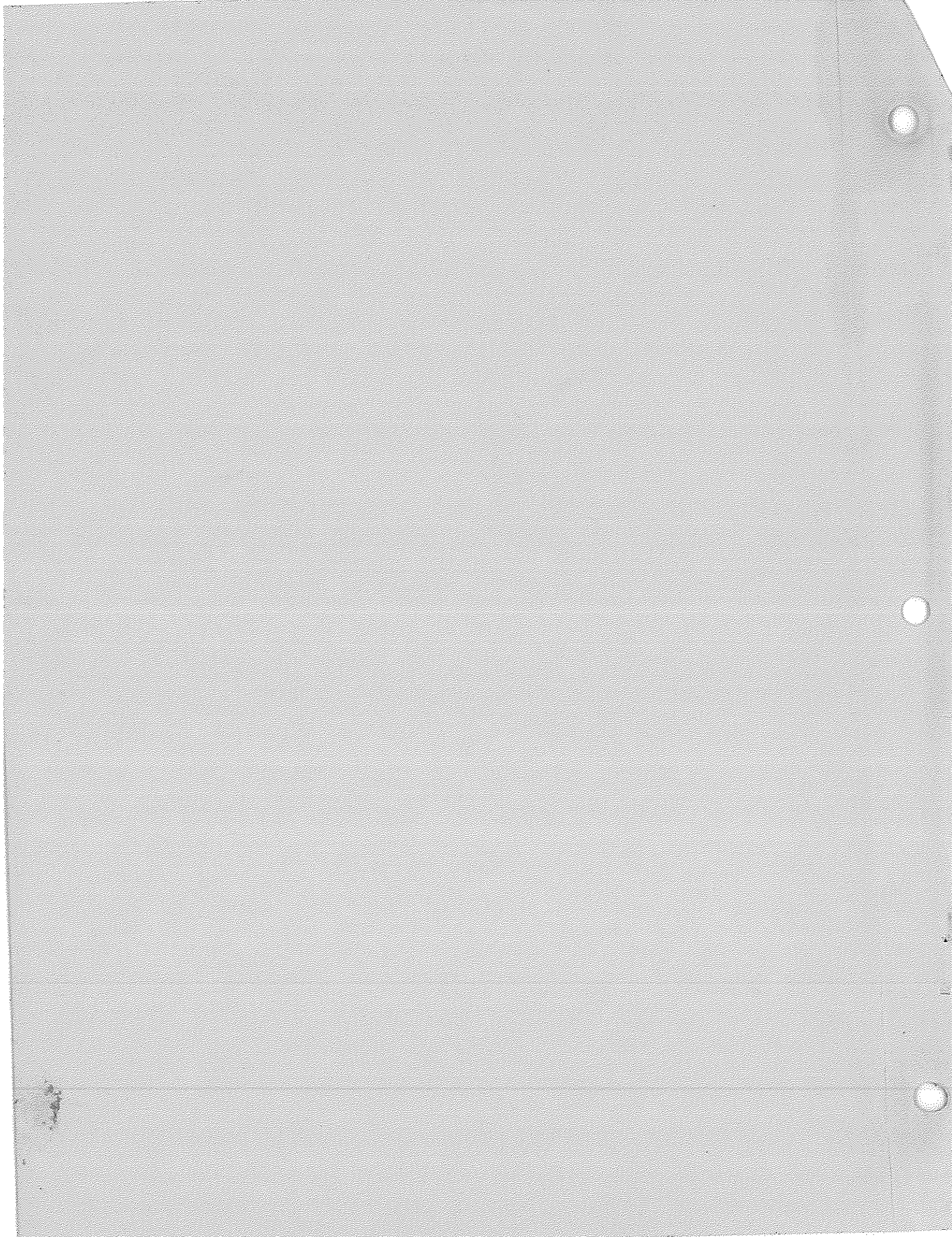


SWOP
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GENERAL
MAINTENANCE
INSTRUCTIONS

SWOP
40-54



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TECHNICAL MANUAL

General Maintenance Instructions

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29 & 30 Deleted	3	94 thru 99	Original		
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33	11				
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35	11				
36 & 37	Original				
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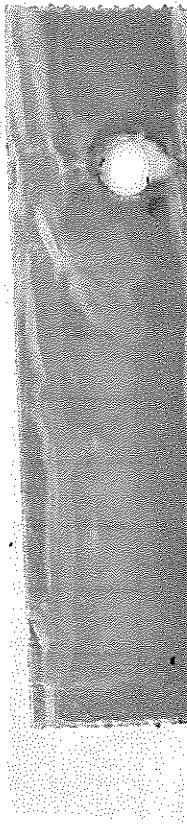
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TABLE I
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NOMENCLATURE	SPECIFICATION OR AEC PART NO.	UNIT OF ISSUE
Rubber Sheet, Cellular	MIL-R-6130B, Type II, Grade B Medium, 1/4 in. by 36 in. by 36 in.	-
Rubber Sheet, Cellular	MIL-R-6130B, Type II, Grade B, Medium, 1/2 in. by 36 in. by 36 in.	-
Rubber Sheet, Solid Cloth Insert	833595-00	Roll, 50 in. W by 90 yd L
Rubber Sheet, Solid (0.06 in. thick)	MIL-R-6855B, Class 2, Grade 80, 1/16 in. by 36 in. by 36 in.	-
Scale, Torque Indicating	870231-00	Ea
Scouring Powder (Glass cleaning)	P-S-320b	-
Seal, Lead (with 0.013 in. dia wire, 8 in. L)	834062-00	Ea
Seal, Lead (with 0.016 in. dia wire, 10 in. L)	839960-00	Ea
Seal, Lead (with No. 23A (Steel)WG galvanized wire, 10 in. L)	834825-00	Ea
Seal, Lead (with No. 23A(Steel)WG wire, 10 in. L)	828446-00	Ea
Seal, Lead (without wire)	835267-00	Ea
Sealant Kit (Epibond 122)	870846-00	2-1/2 oz
Sealant Kit (PR 1221-B 1/2) (6 oz)	169300-00	Ea
Sealant Kit (PR1221-B2)	874449-00	6 oz
Sealant Kit (Pro-Seal 706B2 or PR1321-B2)	870845-00	2-1/2 oz
Sealant Kit (Pro-Seal 890-B2) (12% catalyst) (6 oz)	209832-01	Ea
Sealant Kit (RTV60) (W45)	871761-00	2-1/2 oz
Sealant Kit (RTV60) (W58)	872425-00	2-1/2 oz
Sealant Kit (RTV60/90) (W45)	871760-00	2-1/2 oz
Sealant Kit (RTV60/90) (W56)	872861-00	6 oz
Sealant Kit (RTV630A/630B)	876700-00	Ea

(Continued on next page)

TABLE 1
(Continued)

NOMENCLATURE	SPECIFICATION OR AEC PART NO.	UNIT OF ISSUE
Sealer, Surface	MIL-S-4383B	-
Sealer, Surface (Phenolic)	837818-00	Qt
Sealing Compound, Asbestos	TT-S-222a	-
Sealing Compound, Electrically Conductive (Polysulfide) (kit)	873771-00	1/2 pt
Sealing Compound (MIL-S-7502) (Class B2)	829380-00	Pt
a. Sealing Compound	806314-00*	Pt
Sealing Compound (Buna-N type)	MIL-S-4383B	-
Sealing Compound (EC-750)	829905-00	Pt
a. Sealing Compound (EC-750)	829906-00	Gal
Sealing Compound (EC-1120) (pt kit)	829858-00	Ea
Sealing Compound (Epon 932) (qt kit)	871862-00	Ea
Sealing Compound (Gas tank)	829380-00	Pt
Sealing Compound, Integral Fuel Tanks and Fuel Cell Cavities	MIL-S-7502C	-
Sealing Compound (Kit, Hysol, 13080)	870377-00	35 g
Sealing Compound (Red Loctite, Grade A)	MIL-S-22473D, Grade A	-
Sealing Compound (Loctite, Grade B)	MIL-S-22473D, Grade B	-
Sealing Compound (Loctite, Grade C)	MIL-S-22473D, Grade C	-
Sealing Compound (Loctite, Grade E)	MIL-S-22473D, Grade E	-
Sealing Compound (Loctite, Grade H)	MIL-S-22473D, Grade H	-
Sealing Compound (Loctite, Grade CV)	MIL-S-22473D, Grade CV	-
Sealing Compound (Loctite, Grade EV)	MIL-S-22473D, Grade EV	-
Sealing Compound (Loctite, Grade HV)	MIL-S-22473D, Grade HV	-
Sealing Compound (MIL-S-7916A)	828998-00	Lb
Sealing Compound (Pipette Stik)***	870349-00	Stick, 5 in. L by 11/16 in. dia

(Continued on next page; see footnotes at end of table.)

SECTION 2

MAINTENANCE OPERATION STANDARDS

2-1 GENERAL.

This section includes standard criteria used in conjunction with the maintenance operations given in other sections of this manual. The criteria are to be observed, as applicable, in all maintenance operations.

2-2 SAFETY PRECAUTIONS.

The safety precautions given in this paragraph are to be observed, as applicable, in addition to any other precautions specified in referencing documents.

2-2.1 GENERAL.

2-2.1.1 Adequate safety equipment, such as filter masks, area ventilators, protective clothing, etc, should be available for all operations involving use of toxic, flammable, and epoxy agents. The rules of personnel cleanliness should be observed carefully both before and after use of such agents.

2-2.1.2 Epoxy resins, amines, formulations, and hazardous volatile liquids should be stored in tight sturdy containers, preferably in a separate storage area. Any mixing and layup operations should be confined to a restricted area separate from the general plant area and free of excess through-traffic. Such areas should be kept clean and uncluttered.

NOTE

If adequate exhaust facilities are not available, small amounts of epoxy, vinyl, or other toxic formulations may be mixed in an outdoor area and applied in the work area.

2-2.1.3 To avoid contamination of clothing and work surfaces, disposable paper should be spread on work benches and floor around the work area. Fresh supplies of paper and clean rags should be available daily or for each separate operation.

2-2.2 EXPLOSIVES. Handle units containing high explosives with extreme care to prevent striking or dropping them. Avoid sparks, open flames, and other sources of ignition in the area of high explosives.

2-2.3 HIGH VOLTAGES. The voltages present in certain units are dangerous and may be fatal if contacted by unprotected persons. Provide suitable protection and avoid direct contact with high voltage

sources. Use insulated tools when working in areas adjacent to high voltage sources.

2-2.4 POWER-OPERATED EQUIPMENT. Disconnect (if possible) or turn off power source prior to cleaning, adjusting, or performing any maintenance on power-operated equipment.

2-2.5 SPLASHING LIQUIDS, FLYING CHIPS, ETC. In operations involving eye hazards from flying chips, splashing liquids, hot metals, or other sources, wear appropriate safety equipment.

2-2.6 FLAMMABLE AGENTS. When using flammable volatile materials such as paints, enamels, lacquers, thinners, solvents, etc, provide proper ventilation and exhaust facilities. Do not permit sparks, open flames, or other sources of ignition in the work area. Keep containers closed except when in actual use.

2-2.7 TOXIC AGENTS. When using toxic volatile materials such as paints, enamels, lacquers, thinners, solvents, etc, wear a filter mask as required. Provide proper ventilation and exhaust facilities. Use toxic materials as sparingly as possible. Wash hands thoroughly with soap and warm water after using toxic materials. Keep containers closed except when in actual use.

2-2.8 EPOXY RESINS. Epoxy resins are extremely toxic and may cause severe skin irritations. Observe precautions for toxic agents. Use epoxy resins only in a properly prepared and ventilated area. Mix compounds in ample-sized disposable containers with spouts. Discard contaminated paper and rags in a closed container. Do not clean contaminated tools, rags, etc, in solvent which will be used for other cleaning operations. Observe personal cleanliness precautions and wear proper protective clothing.

2-2.9 VINYL RESINS. Vinyl resins are extremely toxic and flammable. Observe all precautions specified for use of toxic and flammable agents. When mixing vinyl compounds, observe precautions specified for splashing liquids.

2-2.10 TEFLON (TFE) FLUOROCARBON RESINS. Teflon (TFE) fluorocarbon resins, when exposed to sufficiently high temperatures, produce toxic decomposition products. If smoking tobaccos are present during use of these resins, or if the tobaccos are handled directly after use of these resins, the tobaccos may become contaminated with teflon dust or particles; subsequent smoking of the contaminated tobaccos could produce toxic chemical vapors. Insure that tobaccos are not present, and are not handled, during

use of fluorocarbon resins; wash hands thoroughly immediately after use of fluorocarbon resins.

2-3 USE OF HAND TOOLS.

2-3.1 Use tools only for the specific function for which they were designed. Use only serviceable tools of the proper size and type. Failure to observe this could cause personnel injury or equipment damage.

2-3.2 Apply only pulling force to wrenches. Pushing force may be applied to wrenches only if pulling force is not feasible and if proper precautions are taken to avoid injury or damage. Do not use a length of pipe or other extension device on wrenches to gain increased leverage. Do not strike wrenches with a hammer except when using a strike wrench. When using an adjustable wrench, position it on the nut so that the pulling force is applied to the stationary jaw of the wrench. Always tighten the adjusting knurl of the wrench so that the jaws fit snugly on the nut.

2-3.3 A rubber, lead, brass, plastic, or rawhide mallet may be used for tapping loose wing-type nuts, keyed gears, splined unions, keys and keyways, or other similar tight-fitting assemblies.

2-3.4 Do not use slip-joint pliers on hardened surfaces, since the teeth become dulled and the pliers lose their serviceability. Do not use pliers or pipe wrenches for tightening or loosening nuts.

2-3.5 Position a hook or pin spanner so that the hook or pins are securely seated in the slots or holes before applying force to the wrench. Assure that slots of a slotted spanner are seated against pins before applying force to the wrench.

2-4 ABRADING LIMITATIONS.

The abrading limitations in this paragraph apply whenever abrading is specified after machining, for removing burrs and sharp edges, or for surface refinishing. The abrading instrument (file, hard Arkansas stone, abrasive cloth or paper, pumice, steel wool, etc) shall be of the type and coarseness specified.

2-4.1 When dressing an assembled component with an abrasive, care must be taken to prevent abraded particles from entering the equipment. Failure to observe this could cause abrasion between moving surfaces or shorting of electrical components. A drop-cloth may be used to protect equipment from particles. Do not use emery cloth or steel wool when abrading around electrical equipment, since these abrasives are electrically conductive; use kind and grade of abrasive specified.

2-4.2 Parts or surfaces machined to close tolerances can sustain only a minimum of maintenance by filing or abrading.

2-4.3 Corroded structural or other parts may be wire-brushed or abraded only to the extent that they may continue to safely perform their original function.

2-4.4 A fine-cut file or hard Arkansas stone may be used to remove burrs and sharp edges from metal surfaces. Finish-dressing can be accomplished by means of various types and grades of abrasives; choice of abrasive will depend on hardness of material being abraded and degree of smoothness desired.

2-4.5 After completion of abrasion, adjacent areas must be cleaned of all abrasive, metal, or other particles.

2-5 REJECTION CRITERIA FOR ELECTRICAL CONNECTORS.

As required, the visual and dimensional checks furnished in this paragraph are to apply as acceptance or rejection criteria for electrical plug and receptacle connectors. The visual checks apply to all types of electrical connectors. The pin recession dimensional check applies only to AN- and SA-AN-type electrical connectors with pin contacts.

NOTE

In general, an electrical plug connector is a movable connector containing a coupling ring for locking purposes. An electrical receptacle connector is generally a fixed connector containing coupling threads or pins to receive the coupling ring of the mating plug. Plugs and receptacles may contain either pin or socket contacts.

2-5.1 VISUAL CHECKS.

2-5.1.1 On connectors with socket contacts, visually check for insert displacement. If insert is displaced (off center), attempt connection with mating connector; reject if displacement prevents easy connection or causes serious interference.

2-5.1.2 On connectors with pin contacts, visually check for splaying of pins. If pins are splayed, attempt connection with mating connector; reject if splaying prevents easy connection or causes serious interference.

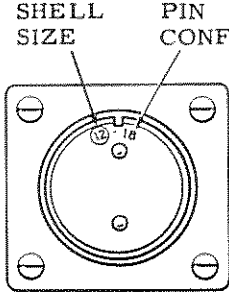
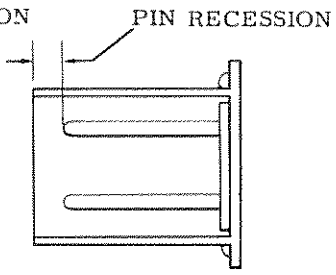
2-5.2 PIN RECESSION CHECK (AN- AND SA-AN-TYPE CONNECTORS WITH PIN CONTACTS). Using

TABLE II
PIN RECESSION TOLERANCES FOR AN- AND SA-AN-TYPE CONNECTORS

CONTACT		SHELL SIZE NO. *	PIN RECESSION**	
Size No.	Dia ±0.001 (Inch)		Maximum (Inch)	Minimum (Inch)
16	0.0625	All except 8S, 10S, 10SL, 12S, 14S, and 16S	0.312	0.250
		8S, 10S, 10SL, 12S, 14S, and 16S	0.125	0.062
12	0.094	All Sizes		
8	0.142	All Sizes		
4	0.225	All Sizes		
0	0.357	All Sizes		

*Shell size is identified by first code number printed on front face of connector insert.

**Pin recession is distance from front face of shell to top of pin.

a depth gauge, check for proper pin recession as specified in table II. Reject connector if pin recession does not fall within maximum and minimum specified.

2-7 SURFACE INSPECTION.

Whenever surface inspection requires the measurement of surface irregularities, observe the requirements and information in paragraph 4-2.

2-6 INSTALLATION/REMOVAL OF THREADED FASTENERS.

Whenever installing or removing bolts, nuts, screws, studs, and other threaded fasteners, observe the requirements and information in paragraph 3-2.

SECTION 3

JOINING OF PARTS

3-1 GENERAL.

All maintenance operations involving the joining of parts (riveting, bonding, sealing, etc) are included in this section, except soldering of electrical connections, which is covered in Section 5. Certain procedures are necessarily general and are to be used in conjunction with procedures in other parts of this manual; e.g., the general procedures for bonding by means of vinyl resin adhesive are given in this section, whereas specific procedures for repair of vinyl sleeving by means of vinyl resin adhesive are included in Section 5. Make reference to other parts of this manual as necessary and as specified. Refer to Section 2 for applicable maintenance standards including safety precautions.

3-2 REMOVAL AND INSTALLATION OF BOLTS, SCREWS, STUDS, AND NUTS.

3-2.1 REMOVAL OF DAMAGED BOLT, STUD, OR SCREW. Damaged bolts, studs, or screws may be removed by any applicable method which will not damage parent material. The following procedures are recommended for general use.

3-2.1.1 Using twist drill of approximately 1/2 to 2/3 dia of damaged bolt or stud, drill into center of bolt or stud.

3-2.1.2 Drive square rod or similar tool into drilled center of bolt or stud as shown in figure 3-1 and screw out damaged bolt or stud.

3-2.2 INSTALLATION OF BOLTS, SCREWS, AND NUTS.

3-2.2.1 GENERAL.

3-2.2.1.1 When the kind of compound and its use is specified by the referencing document, apply compound only to bolts or screw, and use only sufficient compound to fill "V" of threads. After installation of bolt or screw, clean area of excess compound.

3-2.2.1.2 When "finger-tighten" is specified, use only finger force to tighten bolts or nuts. When the bolt or nut is not readily accessible, an extension or adapter may be used and finger force applied to the extension or adapter. An extra extension leverage device is not permitted for this operation. "Finger-tighten" is generally specified in applications where a part is to be held in position until other procedures are performed, after which further tightening is specified.

3-2.2.1.3 When "tighten securely" is specified, use appropriate tools and moderate force to firmly seat

bolt, screw, or nut. A fastener is considered to be tightened securely if it has reached the point where an increase in torque does not result in additional turning of the nut or fastener head. If hardware installation includes a lockwasher, tighten sufficiently to fully compress lockwasher. If doubt exists as to whether or not a fastener is properly tightened, the torque values given in table III may be used as guides.

3-2.2.2 SELF-LOCKING BOLTS AND NUTS. Self-locking bolts and nuts incorporate a fiber or nylon core which is tapped by the threads of the associated piece (bolt or nut, as applicable).

3-2.2.2.1 Use associated hardware having clean full threads; those having unfinished ends as result of cutting, or burred at cotter pin holes, will tear core of self-locking piece. Dress all rough edges. Stripped or worn threads do not provide a satisfactory holding surface for either the metal threads or locking core of the self-locking piece.

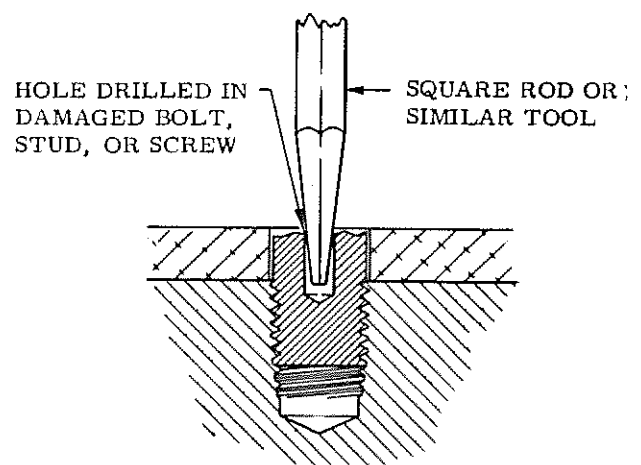


Figure 3-1 Removal of Damaged Bolt, Stud, or Screw

3-2.2.2.2 Whenever possible, use new self-locking bolts or nuts and associated hardware and insure that threads of all pieces are clean and smooth before installation. Check that nuts and bolts are matched as to size and thread; use only corrosion-resistant steel associated hardware with corrosion-resistant steel self-locking hardware.

3-2.2.2.3 If reuse of self-locking hardware is permitted, check that threads are in serviceable condition and that nylon or fiber core is not loose or broken and extends at least to outermost edge or apex of threads. Check that core will insure sufficient friction for locking capability. If these conditions are not met, use new hardware.

3-2.2.2.4 Do not pretap nylon or fiber core. The self-locking action is accomplished by permitting the threads of the associated hardware to perform the tap.

3-2.2.2.5 If the locking feature is at 1 end of the self-locking nut, the nut must be installed metal-threads first; if the locking feature is a nylon or other type core, the nut may be installed either end 1st. Unless otherwise specified, round- or chamfered-end bolts must extend the full round or chamfer through the locking feature of the nut; flat-end bolts, studs, or screws must extend at least 1/32 in. through the locking feature of the nut.

NOTE

The overall height of a self-locking nut is equal to the combined height of a plain nut and lockwasher.

3-2.2.2.6 When installing self-locking bolt, insure that associated nut, when fully tightened, engages locking core of bolt.

3-2.2.2.7 Because of the locking feature of self-locking nuts and bolts, the recommended torque values may not apply; hence, they should be tightened securely (paragraph 3-2.2.1.3). If a torque is specified, insure that the nut or bolt is fully seated before applying measured torque.

3-2.3 USE OF MEASURED TORQUE ON THREADED FASTENERS.

3-2.3.1 GENERAL.

3-2.3.1.1 Whenever a torque value is required for the tightening of any screw, nut, or bolt during the assembly of components, it is usually specified at the appropriate location in the applicable referencing document. When no torque value is specified, the torque values listed in table III may be used as guides. When minimum torque values only are specified, the installation torque indications must not exceed the maximum values listed in table III. Refer to table IV for converting torque values from pound-inches to ounce-inches or pound-feet.

3-2.3.1.2 When torque values are specified, the requirements are considered to be fulfilled when the minimum torque values are present. The maximum torque value is used only as a limit, and must not be exceeded.

3-2.3.1.3 Maximum torque specifications are limited to applications where structural or functional failure may result from overtightening. When the maximum torque value only is specified, the amount of torque applied shall not be less than the minimum allowable as specified in table III.

3-2.3.1.3A In all cases, insure that the nut, bolt, or screw is fully seated before applying the specified torque.

**TABLE III
WRENCH TORQUE FOR STEEL BOLTS AND NUTS***

BOLT SIZE (Fine Thread Series)	TORQUE** (Pound-Inches)	BOLT SIZE (Coarse Thread Series)	TORQUE** (Pound-Inches)
8-36	12-15	8-32	12-15
10-32	20-25	10-24	20-25
1/4-28	50-70	1/4-20	40-50
5/16-24	100-140	5/16-18	80-90
3/8-24	160-190	3/8-16	160-185
7/16-20	450-500	7/16-14	235-255
1/2-20	480-690	1/2-13	400-480
9/16-18	800-1000	9/16-12	500-700
5/8-18	1100-1300	5/8-11	700-900
3/4-16	2300-2500	3/4-10	1150-1600
7/8-14	2500-3000	7/8-9	2200-3000
1-14	3700-5500	1-8	3700-5000
1-1/8-12	5000-7000	1-1/8-8	5500-6500
1-1/4-12	9000-11000	1-1/4-8	6500-8000

*Bolt and/or nut material: steel (cadmium plated). Nut (if used) style: self-locking or castellated
 **For shear nuts (thin, flat nuts), apply approximately 60% of the torque value specified

TABLE IV
TORQUE CONVERSION CHART

OUNCE-INCHES	POUND-INCHES	POUND-FEET
1/4		
1/2		
3/4		
1		
4	1/4	
8	1/2	
16	1	
96	6	1/2
192	12	1
384	24	2
576	36	3
768	48	4
960	60	5
	72	6
	84	7
	96	8
	108	9
	120	10

3-2.3.1.4 For tightening nuts that compress gaskets, seals, or packings, measure and record torque only at the time of installation. Measurement of torque subsequent to assembly is limited to ascertaining that minimum torque exists.

3-2.3.1.5 Holding the torque wrench as shown in figure 3-2, apply force to the torque wrench handle slowly and with steadily increasing magnitude. When checking torque values for bolts installed with non-fixed nuts, restrain the bolt from turning and apply the torque wrench to the nut only.

3-2.3.1.6 During the last stages of rotation, a set or seizure (popping sound) of the threaded fastener sometimes occurs. Break the set by rotating the nut or bolt in a back-off direction, and again apply tightening movement with a steady sweep of the torque wrench, during which time the torque reading shall be taken.

CAUTION

When using a "single acting" torque wrench, i.e., one which gives a torque indication in only 1 direction, insure that the torque wrench is installed properly so that the torque indication is obtained when using the wrench in a clockwise direction for applying torque on right-hand threads, or in a counterclockwise direction for applying torque to left-hand threads.

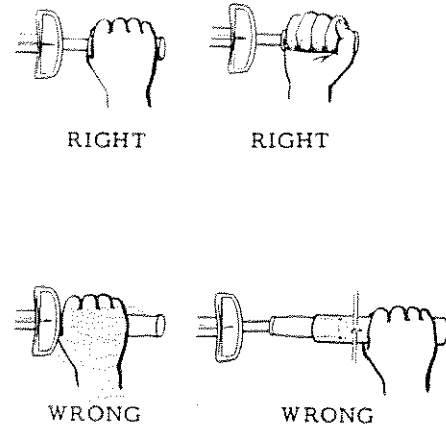


Figure 3-2 Holding the Torque Wrench Handle

3-2.3.1.7 To apply force by pushing on a torque wrench is normally considered dangerous. Pulling is the preferred method of applying force. Use extra caution if pushing is the only way the torque wrench can be used. Use a "single acting" wrench clockwise only when tightening.

3-2.3.2 METHOD I. This method involves use of a standard torque tester to obtain specified (actual) torque when extensions, adapters, crowfeet, etc. are required.

3-2.3.2.1 Attach extension, adapter, etc. as required, to torque wrench.

3-2.3.2.2 Install adapter (if required) on torque tester, size to receive extension, adapter, etc.

3-2.3.2.3 Set specified (actual) torque on torque tester.

3-2.3.2.4 Apply torque wrench with attached hardware to torque tester and operate wrench until desired torque is reached on tester. The torque given on the wrench is the "indicated" torque. Make a repeat tightening operation as a check.

3-2.3.2.5 Note indicated torque on check sheet for that specific torque application. Such torque is valid only when the same torque wrench is used with same attachment(s) and in same relationship with wrench.

3-2.3.3 METHOD II. This method provides for reading actual applied torque directly from torque wrench regardless of use of adapters. When an extension rod and universal joint are attached to the torque wrench (and adapter if required) (figure 3-2A) and the wrench is used as indicated in the figure, the lever length of the adapter and its relation to the lever length of the torque wrench have no effect.

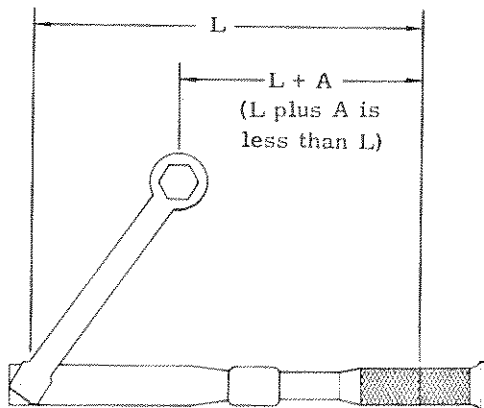
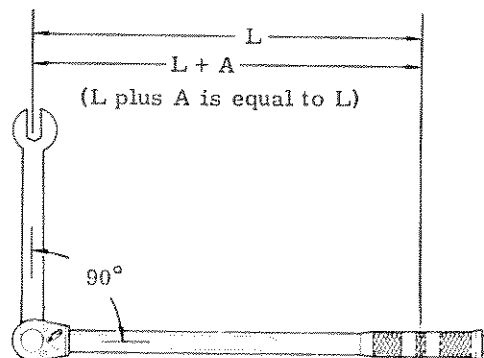
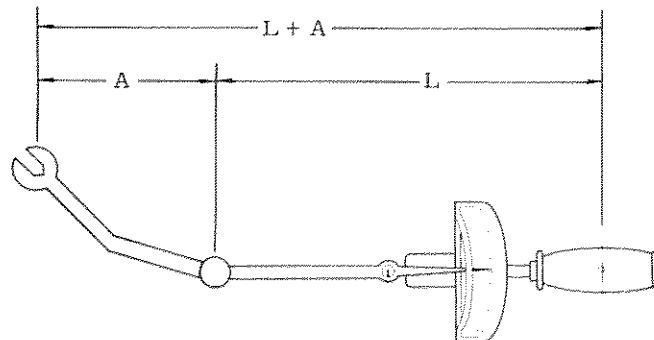
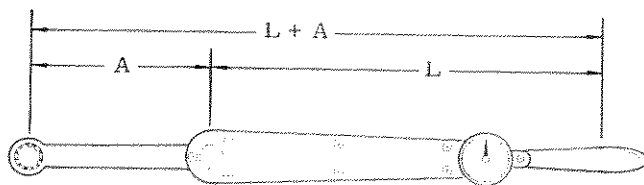
3-2.3.3.1 For best results, the socket extension should be kept perpendicular to the adapter; however, slight angular relationships will not cause significant inaccuracies.

3-2.3.3.2 Apply torque wrench with attached extension rod and universal joint (and adapter if installed), and, supporting end of wrench as shown in figure 3-2A, operate wrench. The torque given on the wrench is the actual torque.

3-2.3.4 METHOD III. This method serves the same purpose as method I except indicated torque is obtained through calculation instead of testing. It utilizes the relationship between indicated torque and applied torque as expressed in the formula:

$$\frac{\text{Torque-indicated}}{\text{Torque-applied}} = \frac{L}{(L+A)}$$

The values of L (lever length) and (L+A) (effective lever length) can be established by taking measurements as shown in figure 3-2B which indicates correct measuring points for various kinds of torque wrenches and torque wrench-adapter combinations. Both measurements are always made along a line parallel to the longitudinal axis of the torque wrench. Use torque indicating scale (P/N 870231-00) to calculate indicated torque in accordance with instructions printed on scale. If scale is not available, indicated torque may be calculated (using the same measurements) by dividing (L+A) into L and multiplying the result by the torque required in the appropriate technical manual (i.e., torque-applied).



3-3 INSTALLATION OF COTTER PINS.

3-3.1 Tighten nut to proper torque requirements until hole in shank aligns with slot in nut, as shown in figure 3-3. If alignment is not proper for insertion of pin, tighten nut (do not back off) until hole appears in slot.

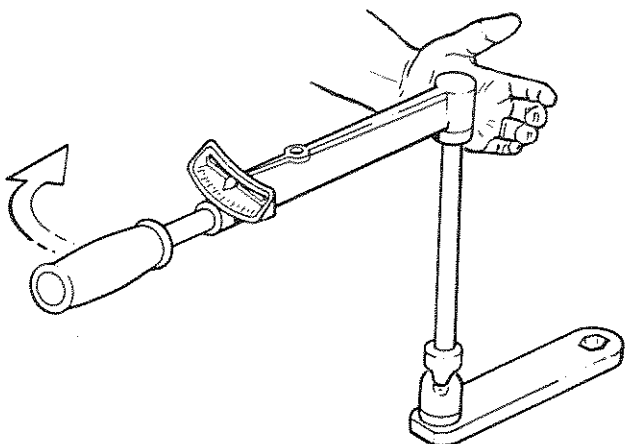


Figure 3-2A Torque Wrench with Extension Rod and Universal Joint

Figure 3-2B Correct Measuring Points on Various Kinds of Torque Wrenches

NOTE

The cotter pin hole is aligned so that no more than one-half the diameter of the pin will protrude above the nut castellation. One or two washers (maximum) may be installed under the nut, if this is necessary to properly locate the cotter pin.

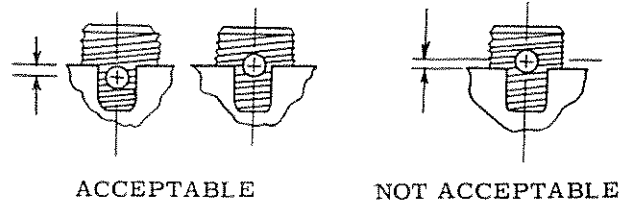


Figure 3-3 Installation of Castellated Nut

3-3.2 Install proper size cotter pin with pin head firmly seated in slot of nut, and with axis of cotter pin eye at 90 degrees to bolt shank, as shown in preferred installation in figure 3-4.

3-3.3 Cut lower prong of pin at point B, figure 3-4. The upper prong may be cut at point A if necessary to provide clearance. Bend both prongs as shown.

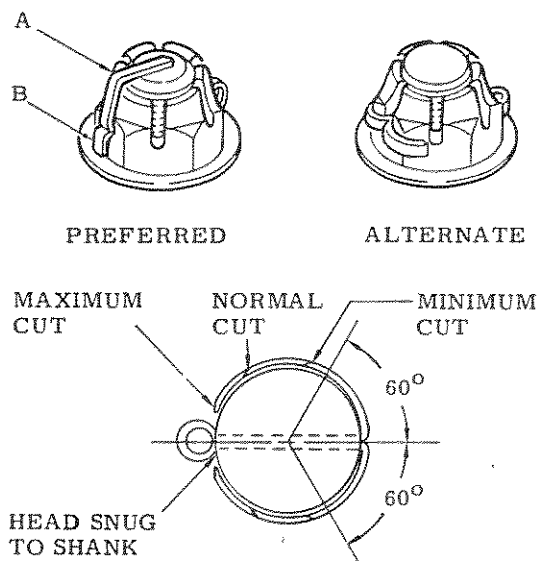


Figure 3-4 Installation of Cotter Pin

NOTE

The alternate installation shown in figure 3-4 may be used to obviate clearance problems when the preferred installation method is not practical. The alternate method is also used for the installation of cotter pins in flat-head pins.

3-3.4 When installing cotter pins in rod end bearings, clevis pins, and similar applications, install pins as shown in figure 3-4, clipping the prongs within the 60-degree and tangent points as shown.

3-4 INSTALLATION OF SAFETY WIRE.

Safety wiring is a method of wiring various types of removable fastenings (other than self-locking types) to prevent loosening by vibration. Two types of safety wiring are employed: The double-twist method, by which two strands of wire are twisted together between each connected unit; and the single-wire method, by which a single strand of wire, connecting a closed group of units, is twisted only at the ends. When practical, the double-twist method is preferred. Use of the single-wire method is limited to groups of similar units in a closed geometrical pattern (square, triangle, rectangle, circle, etc.) on parts in electrical systems or in places where the double-twist method is not practical. The illustrations of various types of safety wiring shown in this section are not intended to be restrictive; i.e., other configurations are acceptable provided they conform to the following general requirements.

3-4.1 GENERAL.

3-4.1.1 Safety wire is always installed in such a manner that any tendency of a unit to loosen will be restricted by an additional tightening of the wire.

3-4.1.2 Unless otherwise specified, wire shall be corrosion-resistant steel, 0.032 in. diameter (MS 20995C32), or 0.020 in. diameter (MS20995C20).

3-4.1.3 When wiring by single-wire method, use the largest nominal size diameter wire of specified material which hole will accommodate.

3-4.1.4 Do not reuse wire after removal from a part.

3-4.1.5 When safety-wiring components in tight assemblies, the wire may end at any convenient location. In all cases, exercise care that wire and wire ends will not interfere with any moving parts.

3-4.1.6 When twisting wire, use the number of twists per inch indicated in table V and twist to within approximately 1/8 in. of each unit. Pull wire sufficiently taut to minimize chafing and fatigue caused by vibration; however, insure that wire is not overstressed. Avoid nicks, kinks, and other abrasions to wire surface, except those caused by commercial wire-twisting pliers. If pliers are used, those with smooth jaws are recommended. Exercise care to avoid damaging adjacent components or electrical wiring with pliers.

3-4.1.7 Always install safety wire through holes provided. In the event no holes are provided, safety-wire to convenient adjacent part, insuring that wire does not interfere with function of part.

3-4.1.8 When safety-wiring widely spaced multiple groups by the double-twist method, 3 units shall be the maximum number in a series. When safety-wiring closely spaced multiple groups by the single-wire method, the maximum number of units in a series shall be the number of units which can be safety-wired by a 24-in. length of wire. The maximum span of wire between units shall be 6 in.

3-4.1.9 After safety-wiring the final unit, twist pigtail approximately 1/2 in. long (3 to 7 twists) and bend pigtail in toward component to prevent snagging.

TABLE V

TWISTS PER INCH OF SAFETY WIRE*

WIRE DIAMETER	TWISTS PER INCH
0.020	9-12
0.032	7-10
0.040	7-10
0.041	7-10
0.047	5-8
0.051	5-8
0.091	4-7

*A "twist" is the rotation of two crossed strands of wire through 180 degrees.

3-4.2 INSTALLATION OF SAFETY WIRE ON THREADED FASTENERS AND ON MINIATURE AND COAXIAL TYPE ELECTRICAL CONNECTORS.

3-4.2.1 Figures 3-5, 3-6, and 3-7 illustrate proper methods of installing safety wire on various types of threaded fasteners and hardware. Figure 3-8 illustrates improper methods of safety wiring. For bolts and screws with left-hand threads, installation of wire using single-wire method will be reverse to that shown.

3-4.2.2 Miniature and coaxial type electrical connectors are safety wired in the same manner as similar types of threaded fasteners (figure 3-6), except that the wire may be passed through only one hole of the coupling ring and is attached to a specified adjacent component or hole.

3-4.2.2A Coaxial electrical connectors are also wired as shown in figures 3-8A and 3-8B. Figure

3-8A illustrates method of installation of safety wire from connector to drilled screws where the connector flange is drilled. Figure 3-8B illustrates method of installation of safety wire from connector to drilled screws where the connector is not drilled for safety wire.

3-4.2.3 Prior to safety wiring castellated nuts, tighten nut until hole in stud aligns with slots in nut, without exceeding maximum and minimum torque requirements, if specified.

3-4.3 INSTALLATION OF SAFETY WIRE ON TURN-BUCKLES (Figure 3-9).

3-4.3.1 Prior to safety wiring, tighten both threaded terminals securely or to specified torque.

3-4.3.2 After turnbuckle has been tightened, pass two safety wires through hole in center of turnbuckle

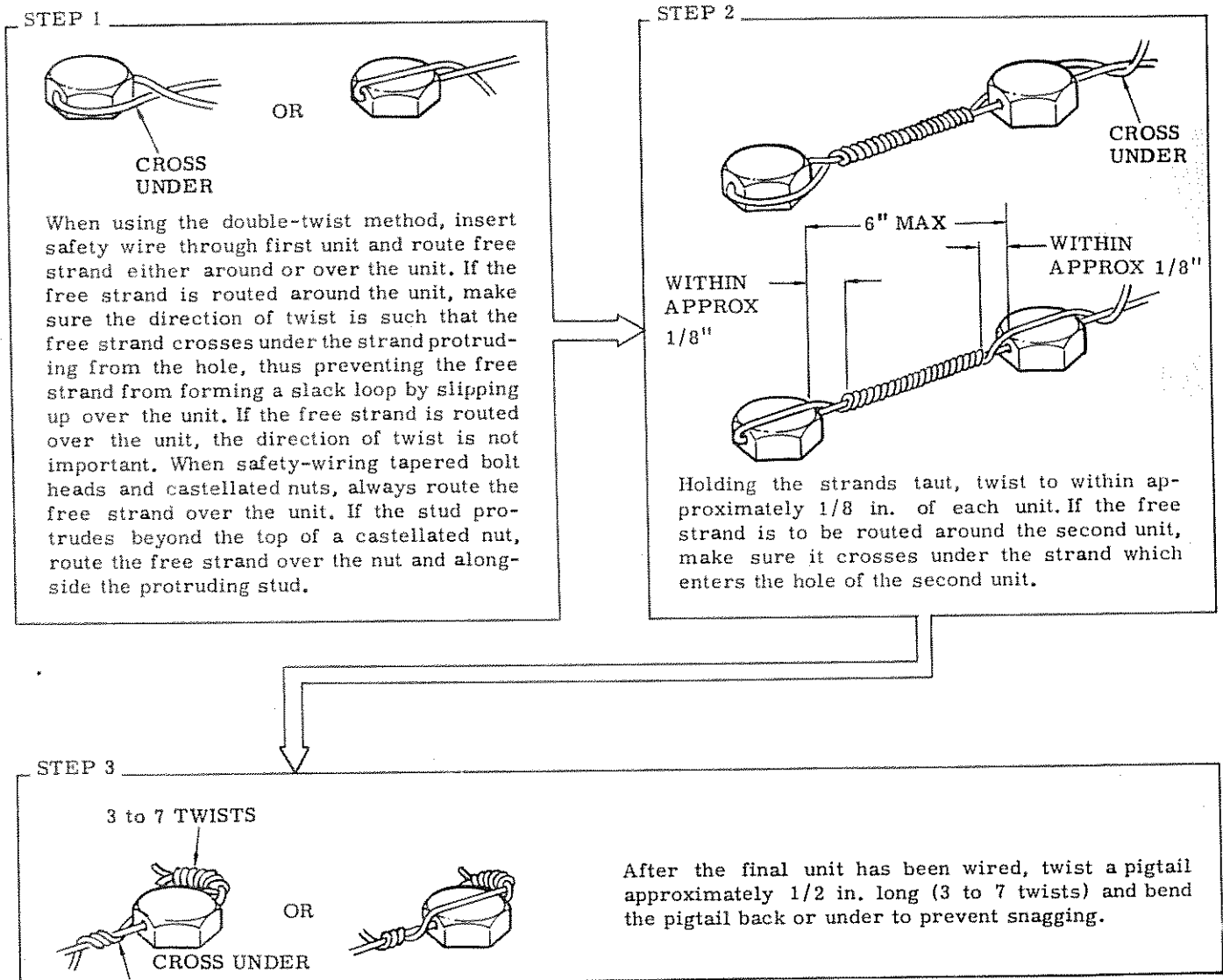


Figure 3-5 Installation of Safety Wire (Double-Twist Method)

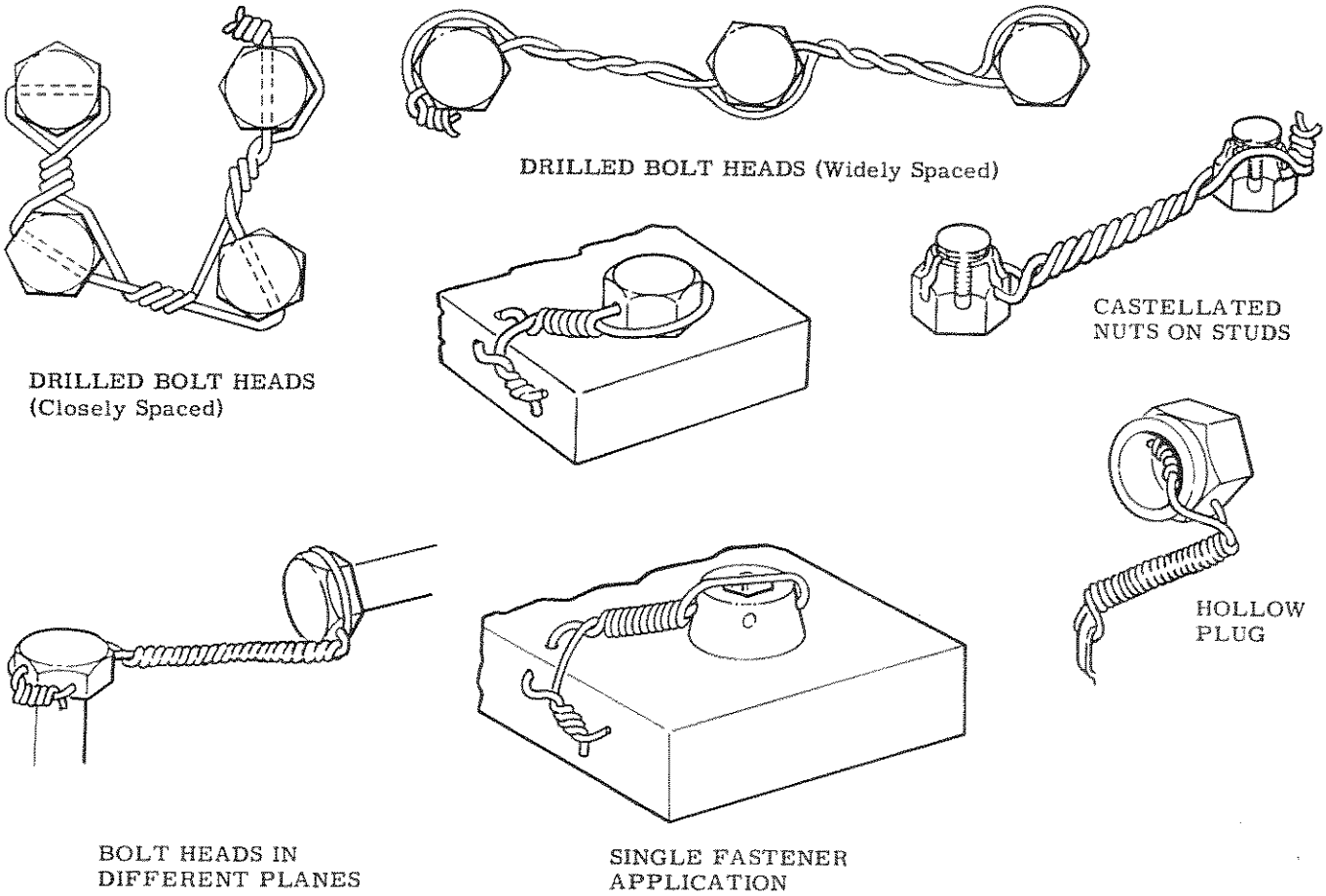
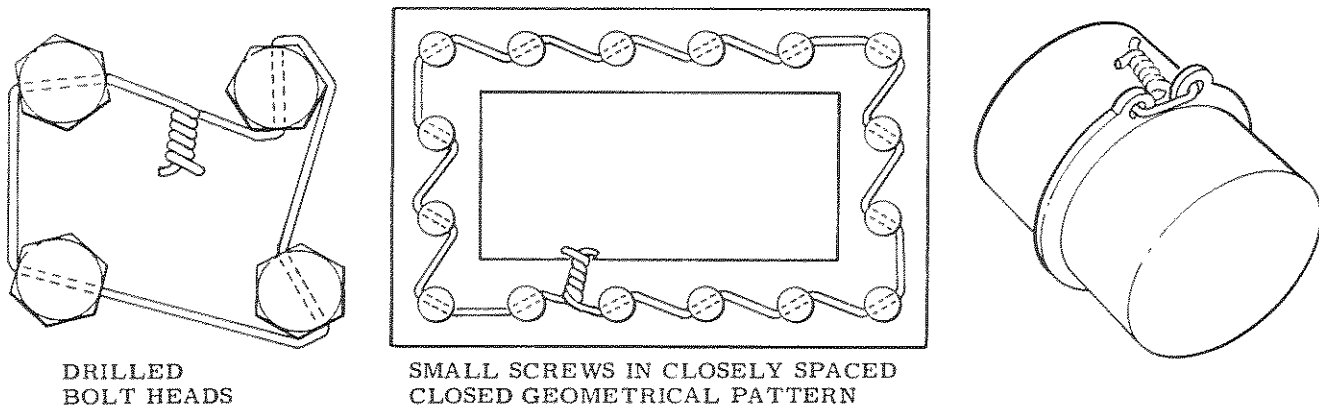


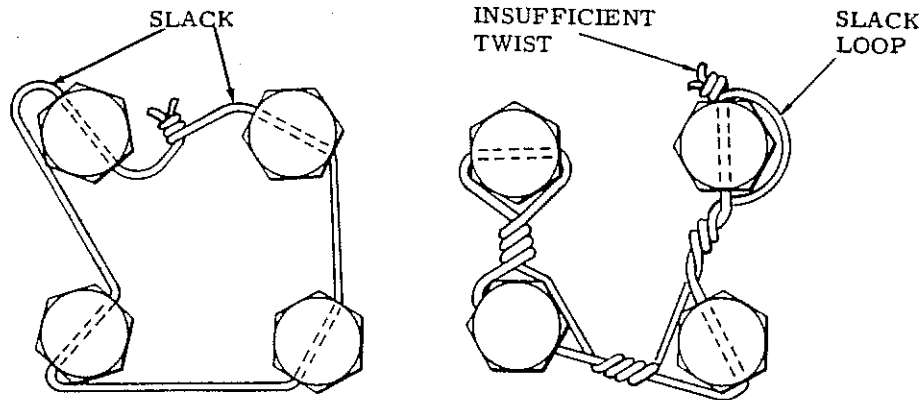
Figure 3-6 Applications of Double-Twist Method Safety Wiring



When using the single-twist method, pass the wire through the series of drilled units, making sure the tension of the wire is applied in the direction of torque of each unit. Form a pigtail at the end the same as specified for the double-twist method.

External snap rings are safety-wired as shown
Internal snap rings are not safety-wired.

Figure 3-7 Installation of Safety Wire (Single-Wire Method)

**CAUTION**

SAFETY WIRING THAT WILL PERMIT THE FASTENING DEVICE TO LOOSEN OR WHOSE PIGTAIL CONSISTS OF LESS THAN 3 TWISTS IS NOT ACCEPTABLE.

Figure 3-8 Incorrect Installation of Safety Wire

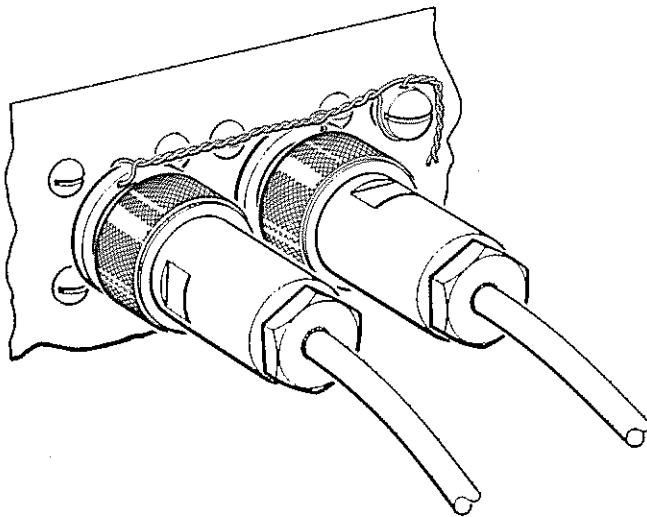


Figure 3-8A Safety Wire of Coaxial Connector (With Drilled Flange)

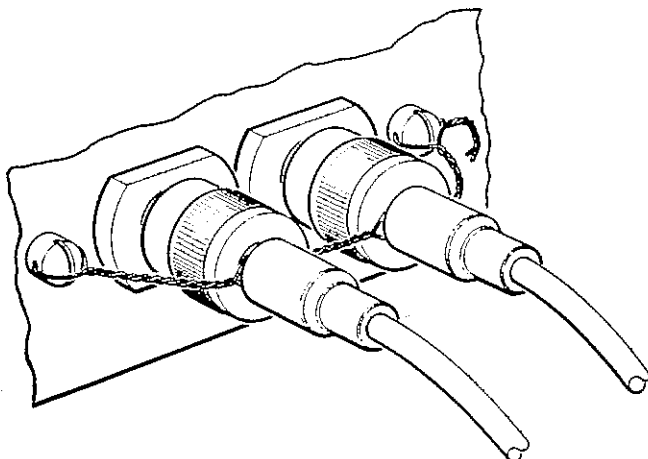


Figure 3-8B Safety Wire of Coaxial Connector (Without Drilled Flange)

barrel. Bend ends of wire 90 degrees toward ends of turnbuckle barrel as shown.

3-4.3.3 Pass ends of wire through hole in turnbuckle eyes, or between jaws of turnbuckle fork, as applicable. Bend wires back toward center of turnbuckle, and wrap each wire 4 times around shank. Bind wrapped wires in place as shown.

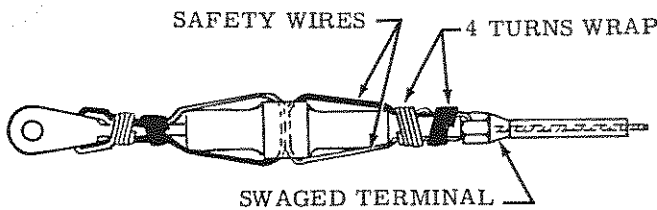
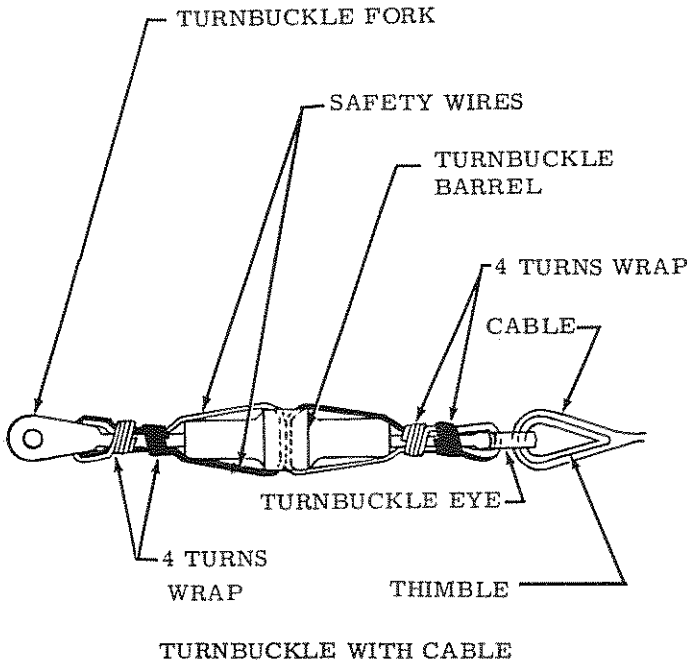
3-4.3.4 When swaged terminal is being safety-wired, pass one wire through hole provided in terminal and loop wire over free end of second wire. Wrap both ends around shank as shown.

3-4.4 INSTALLATION OF SAFETY WIRE ON AN- AND SA-AN-TYPE CONNECTORS. External components of connectors are provided with holes for safety wiring. Prior to safety-wiring connectors, insure that the coupling nut is securely tightened. Safety wire is installed on connectors in such a manner that the drilled coupling nut, cable clamp, and cross-drilled screws are held by the wire in the direction of tightening of the component, giving positive assurance of security of component. Unless otherwise specified, connectors with at least one undrilled hole may be safety-wired. Various methods of safety-wiring connector components are shown in figure 3-10.

3-4.4.1 Wiring of a split-back angle connector is shown in item 1, figure 3-10. Thread wire through screw heads, and cross wire from left to right. Twist wire ends with 3 to 7 twists. Cut off excess wire ends. Bend twisted wire ends back against connector.

3-4.4.2 Safety wiring of an angle connector to a receptacle is shown in item 2, figure 3-10. Lace wire through coupling nut and twist both strands down to point just above receptacle mounting screw. Thread wire through screw head, and twist wire ends with 3 to 7 twists. Cut off excess wire ends. Bend twisted wire ends back against coupling nut.

3-4.4.3 When flange-type mounting plug is used, thread wire through all four screw heads, and twist wire with



TURNBUCKLE WITH SWAGED TERMINAL

Figure 3-9 Safety Wiring of Turnbuckle

3 to 7 twists as shown in item 3, figure 3-10. Cut off excess wire ends. Bend twisted wire ends back against connector shell.

3-4.4.4 Safety-wire connector plug and receptacle approximately as shown in item 4, figure 3-10. Install wire so that all drilled components are held by wire in direction of tightening of component. Draw wire taut and twist wire ends with 3 to 7 twists. Cut off excess wire ends. Bend twisted wire ends down against adapter.

3-4.5 INSTALLATION OF LEAD SEAL ON SAFETY WIRE (Figure 3-11).

3-4.5.1 If plain lead seal (without wire) is to be installed, safety-wire units as specified in previous

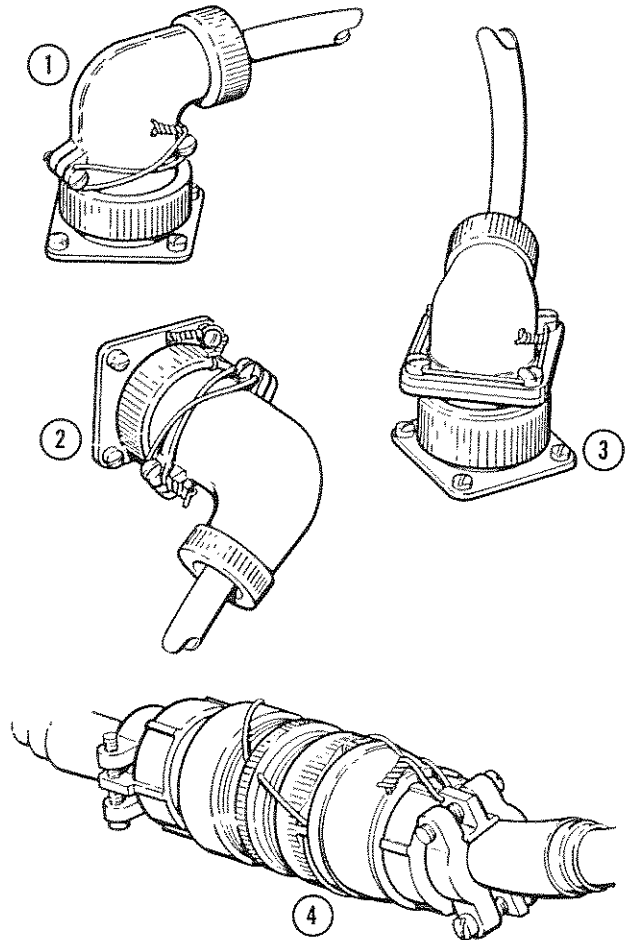


Figure 3-10 Examples of Safety Wiring of AN- and SA-AN-Type Connectors

paragraphs on safety-wiring, except, after wire has been passed through final unit, proceed as follows:

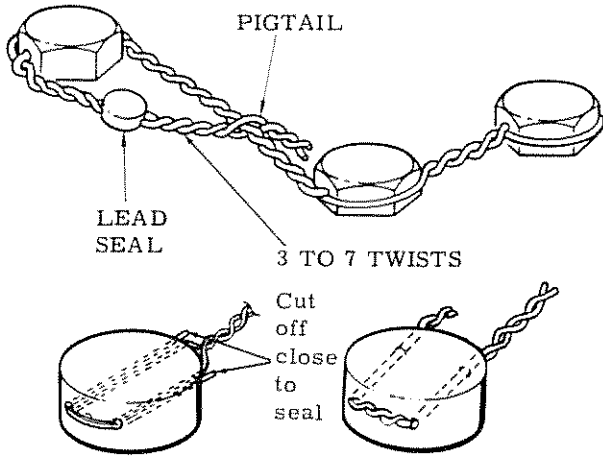
3-4.5.1.1 Twist wire and pass wire ends through lead seal, using a method shown in figure 3-11.

3-4.5.1.2 Compress lead seal with hand crimper.

3-4.5.1.3 Bend wire ends in to prevent snagging.

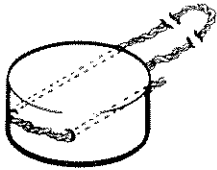
3-4.5.2 If lead seal (with wire) is to be installed, use wire associated with lead seal to safety-wire components as specified in previous paragraphs on safety wiring. Secure lead seal and pigtail in same manner as specified for plain lead seal.

3-5 (Deleted)



SEPARATE SEAL AND WIRE TYPE

(Figure 3-12 deleted)



SEAL WITH WIRE ATTACHED TYPE

NOTE:

If any seal shown has slot between holes, imbed wires in slot before crimping seal.

Figure 3-11 Safety Wire and Lead Seal

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TABLE VI
RIVET AND DRILL SIZES RECOMMENDED FOR
RIVET INSTALLATION

NOMINAL RIVET DIA (Inch)	DRILL SIZE	RIVET HOLE DIA (Inch)
1/16	No. 51(0.067)	0.063 - 0.073
3/32	No. 41(0.097)	0.094 - 0.104
1/8	No. 30(0.128)	0.125 - 0.135
5/32	No. 21(0.159)	0.156 - 0.171
3/16	No. 11(0.191)	0.188 - 0.203
1/4	F (0.257)	0.250 - 0.265
5/16	O (0.316)	0.313 - 0.328
3/8	V (0.377)	0.375 - 0.390

3-6 RIVETING.

Procedures in this paragraph cover the removal, installation, and inspection of conventional round, universal, and flat head rivets (100 degrees countersink). The use of blind rivets in place of conventional rivets should be avoided; however, if their use is necessary, only pull-type blind rivets should be used.

WARNING

Use of explosive rivets is to be governed by applicable service regulations and presumes the observance of normal safety precautions concerning explosives.

3-6.1 REMOVAL. When removing rivets, every effort should be made to prevent enlarging or damaging the original rivet hole. For rivets in dimpled holes, this requirement is mandatory, since these rivets must be replaced with rivets of the same diameter. In all other types of rivet installation, as many as 25 percent of a group of rivets may be replaced, if necessary, with rivets of a larger diameter; or in a group of less than four rivets, one rivet may be replaced by one of a larger diameter.

3-6.1.1 PREFERRED METHOD. Using drill size recommended in table VI, drill through center of rivet head sufficiently deep to sever head from shank. Knock head off rivet shank and tap shank from hole.

3-6.1.2 ALTERNATE METHOD. Using chisel, knock driven or manufactured head from rivet shank. Tap shank from hole.

3-6.2 INSTALLATION.

3-6.2.1 Drill rivet holes, using drill sizes recommended in table VI for plain or countersunk holes, or table VII for dimpled holes. Observe hole patterns, edge margins, and distances between holes as specified, or in accordance with good shop practice. When installing blind pull-type rivets, drill only pilot holes at this time. The holes are to be drilled to final specified diameters (table VII) after dimpling.

3-6.2.2 If countersinking is required, countersink holes to 100 degrees, using stop-countersinking tool whose pilot diameter is equal to hole diameter and so that, after installation, rivet heads will be within flush range of 0.000 in. below to 0.010 in. above surface of sheet. When countersinking for reception of coin-dimpled sheets, countersink so that spacing occurs between sheets as shown in figure 3-13.

NOTE

Shaving of rivet heads will be permitted, after installation, to decrease excessive protrusion, provided rivet head diameter is not decreased more than 5 percent and surface of sheet is not damaged.

3-6.2.3 If dimpling is required, dimple in accordance with good commercial practice, so that, after installation, rivet heads will be within flush range of 0.000 in. below to 0.010 in. above surface of sheet.

NOTE

Coin-dimpling (figure 3-14) is preferred to modified-radius dimpling. A modified-radius dimple may be used only in lower sheets, provided it receives a coin dimple from above. Nesting a modified-radius dimple in a coin dimple or countersink will result in an improper fit.

TABLE VII
HOLE SIZES AFTER DIMPLING

CONVENTIONAL RIVETS (Inch Max)				BLIND RIVETS, PULL TYPE (Inch)
Rivet Diameter	Drill Recommended	Aluminum and Steel	Magnesium	
1/16	51 (0.067)	0.077	0.077	0.128 to 0.132 0.160 to 0.164 0.192 to 0.196 0.256 to 0.261
3/32	40 (0.098)	0.108	0.108	
1/8	30 (0.128)	0.144	0.138	
5/32	20 (0.161)	0.179	0.176	
3/16	11 (0.191)	0.216	0.206	
1/4	1/4 (0.250)	0.288	0.265	
5/16	5/16 (0.312)	0.360	0.327	
3/8	V (0.377)	0.425	0.392	

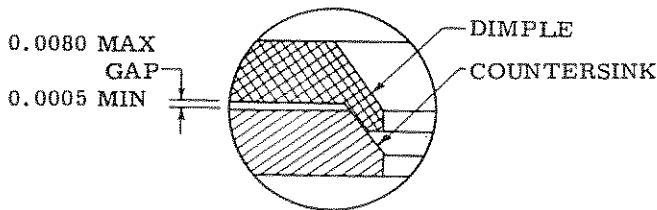


Figure 3-13 Spacing Between Countersunk and Dimpled Sheets

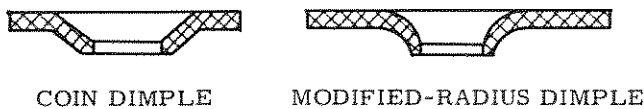


Figure 3-14 Types of Dimpling

3-6.2.4 Clean holes of all foreign material such as dirt, chips, or burrs. Check all plain, countersunk, or dimpled holes for proper diameters (table VI or VII, as applicable) and depths (paragraph 3-6.2.2 or 3-6.2.3, as applicable).

3-6.2.4A Use the appropriate manufacturer's blind rivet gun to install blind rivets.

3-6.2.5 Using recommended rivet gun at manufactured head of rivet and using flat bucking bar of proper weight, install rivets in accordance with good commercial practice, insuring that sheets are pulled together tightly at rivet joints, that rivets are not excessively deformed, and that sheets are not dented around rivet heads. If use of H909 Hand Yoke Riveter is specified, install rivets as shown in figure 3-15.

NOTE

It is recommended that the sheets or parts be held together by means of temporary fasteners until at least half the rivets of a pattern have been installed.

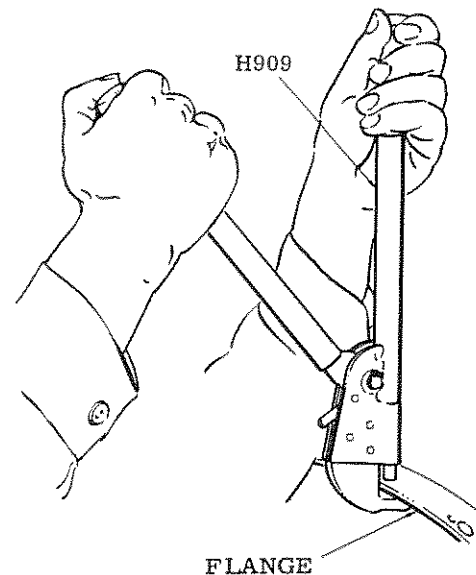


Figure 3-15 Use of H909

3-6.3 INSPECTION.

3-6.3.1 Check that rivet installation is tight and that manufactured head (for round or universal head rivets only) is seated flush against surface. Installation is acceptable if a 0.002-in. shim cannot be slipped under manufactured head to contact rivet shank.

3-6.3.2 Check diameter and height of rivet heads for conformance to dimensions specified in table VIII.

3-6.3.3 For flush-type rivets only, check that manufactured head is within flush range of 0.000 in. below 0.010 in. above sheet surface. If required, rivet heads may be shaved to decrease excessive protrusion provided the diameter of rivet head is not decreased more than 5 percent and sheet surface is not damaged.

TABLE VIII
RIVET LENGTH AND HEAD DIMENSIONS (After Riveting)

RIVET DIA (Inch)	HEIGHT OF MANUFACTURED HEAD (After Riveting) (Inch)		DIAMETER OF DRIVEN HEAD		HEIGHT OF DRIVEN HEAD		LENGTH ALLOWANCE FOR DRIVEN HEAD*	
	Round Head (AN435)	Universal Head (AN470)	Min (Inch)	Recommended Max (Inch)	Min (Inch)	Recommended Max (Inch)	Universal Head (Inch)	Countersunk Head (Inch)
1/16	0.039	0.021	0.081	0.104	0.025	0.040	3/32	1/16
3/32	0.059	0.031	0.122	0.157	0.038	0.050	9/64	3/32
1/8	0.078	0.042	0.163	0.208	0.050	0.063	3/16	7/64
5/32	0.097	0.052	0.203	0.260	0.062	0.077	15/64	1/8
3/16	0.117	0.062	0.244	0.312	0.075	0.095	9/32	9/64
1/4	0.156	0.083	0.325	0.417	0.100	0.127	3/8	7/32
5/16	0.195	0.104	0.406	0.520	0.125	0.158	15/32	15/64
3/8	0.234	0.125	0.488	0.625	0.150	0.190	9/16	21/64

*Obtain total rivet length by adding the grip and the length allowance for driven head.

3-6.3.4 Check that driven head of rivet is approximately barrel-shaped. Check driven head for breaks, cracks, or other deformation; refer to figure 3-16 for acceptance and rejection criteria. Check that no part of hole, counterbore, or dimple is visible beneath rivet heads.

3-6.3.5 If complete circular indentation in manufactured head is present (caused by using rivet set which is too small), reject rivet.

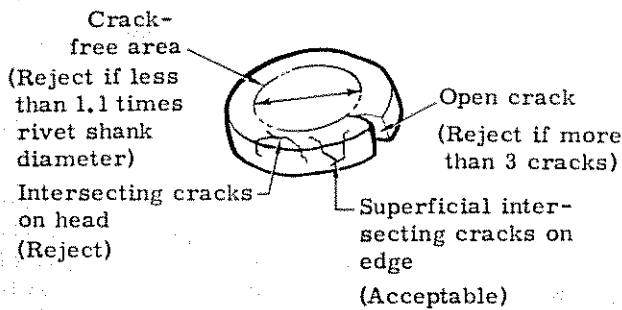


Figure 3-16 Inspection Criteria for Driven Rivet Heads

3-7 (Deleted)

3-8.3 There must be sufficient clearance and a flat seat for the nut. If a flat seat does not exist, spot facing is not permitted.

3-9 REPLACEMENT OF HI-SHEAR RIVETS, LOCKBOLTS, RIVNUTS, STUDS, AND CLINCH BOLTS.

Hi-Shear Rivets, Huck Lockbolts (Huckbolt Stump), Rivnuts, Rosan Studs and Clinch Bolts are removed and installed in accordance with manufacturer's specifications. Obtain such specifications from typical manufacturers indicated in table IX. Replacement of specific hardware is indicated in referencing documents, and AEC part numbers are noted in applicable Illustrated Parts Breakdown listings.

3-10 (Deleted)

3-11 TYING OF COMMON KNOTS.

The method of tying certain common knots used in parachute tying and for other purposes is shown in figure 3-20. If application of an overhand knot is specified to insure that a basic knot does not slip, tie overhand knot to each free end as close as possible to basic knot, after basic knot has been pulled tight.

3-12 SEIZING NYLON ROPE ENDS.

Either of the following two methods may be used to prevent nylon rope ends from fraying.

3-12.1 SEIZING BY MEANS OF TAPE. Cut off rope ends so that strands are approximately flush with each other. Starting 0.06±0.06 in. from end of rope, tightly wrap rope end with two or three layers of electrical insulation tape (black plastic, 0.007 in. thick) so that each layer overlaps previous layer to within 0.06 in. Press tape end firmly to insure adhesion.

3-12.2 SEIZING BY MEANS OF NYLON TWINE. Cut off rope ends so that strands are approximately flush with each other. Using sufficient length of nylon twine, tightly wrap twine around rope end as shown in figure 3-21.

3-8 REPLACEMENT OF FLUSH-TYPE HI-SHEAR RIVET WITH SCREW.

Subject to following limitations, a flush-type Hi-Shear rivet may be replaced with a 7S23 (aluminum) or 7S23C (corrosion-resistant steel) screw. These screws, available in several standard diameters, are similar to a standard AN509 screw except that the head dimensions correspond to those of a Hi-Shear rivet.

3-8.1 The 7S23 screw is an approved substitute for an NAS177 Hi-Shear rivet only. The 7S23C screw is an approved substitute for a 2R7C Hi-Shear rivet only.

3-8.2 The hole and countersink of the original Hi-Shear rivet installation must not be oversized or deformed as the result of rivet removal.

(Figures 3-17, 3-18, and 3-19 deleted)

TABLE IX
TYPICAL MANUFACTURERS

TRADE NAME	MANUFACTURER	ADDRESS
<u>THREADED INSERTS, STUDS, AND CLINCH BOLTS</u>		
Banc-Lok Inserts	Boots Aircraft Nut Corp	537 Newton Tpk, Norwalk, Conn
Heli-Coil Inserts	Heli Coil Corp, Inc	2 Shelter Rock Lane, Danbury, Conn
Kelox Inserts	Keloc Industries	165 Prescott, East Boston, Mass.
Keensert Inserts	Newton Insert Co	6502 Avalon Blvd, Los Angeles, Calif
Nico-Lok Inserts	Newton Insert Co	6502 Avalon Blvd, Los Angeles, Calif
Nylok Inserts	The Nylok Corp	613 Industrial Ave., Paramas, N. J.
Rosan Inserts	Rosan, Inc	Rosan Bldg, Newport Beach, Calif
Rosan Slimserts	Rosan, Inc	Rosan Bldg, Newport Beach, Calif
Tap-Lok Inserts	Groov-Pin Corp	1134-T Hendricks Causeway, Ridgefield, N. J.
Weg Inserts	Roylyn, Inc	626 Paula Ave., Glendale, Calif
<u>QUICK-ACTING FASTENERS</u>		
Airloc Fasteners	Cinch-Monadnock Division of United-Carr	18300 East Valley Blvd, Post Office Box 1222 City of Industry, Calif. 91747
Airloc Fasteners	United-Carr Fastener Corp	238 Main, Cambridge, Mass.
Camloc Fasteners	Camloc Fastener Corp	24 Spring Valley Road, Paramas, N. J.
Dzus Fasteners	Dzus Fastener Co, Inc	127 Union St, West Islip, N. Y.
Presloc Fasteners	Hage Industrial Corp	3700 Roanoke Rd, Toledo, Ohio
Quick-Lock Fasteners	Simmons Fastener Corp	1761 N Broadway, Albany, N. Y.
Shakeproof Fasteners	Illinois Tool Works, Inc	Shakeproof Div, Elgin, Ill.
<u>MISCELLANEOUS</u>		
Hi-Shear Rivets	Hi-Shear Corp	247th St & Crenshaw Blvd, Torrance, Calif
	National Screw & Mfg Co	E 75th at Jenkins, Cleveland, Ohio
	Navan Products, Inc	El Segundo, Calif
Huck Lockbolts	Huck Mfg Co	Detroit, Mich
Rivnuts	B. F. Goodrich Aerospace & Defense Prod.	Akron, Ohio
Rosan Clinch Bolts	Rosan, Inc	Rosan Bldg, Newport Beach, Calif
Rosan Studs	Rosan, Inc	Rosan Bldg, Newport Beach, Calif

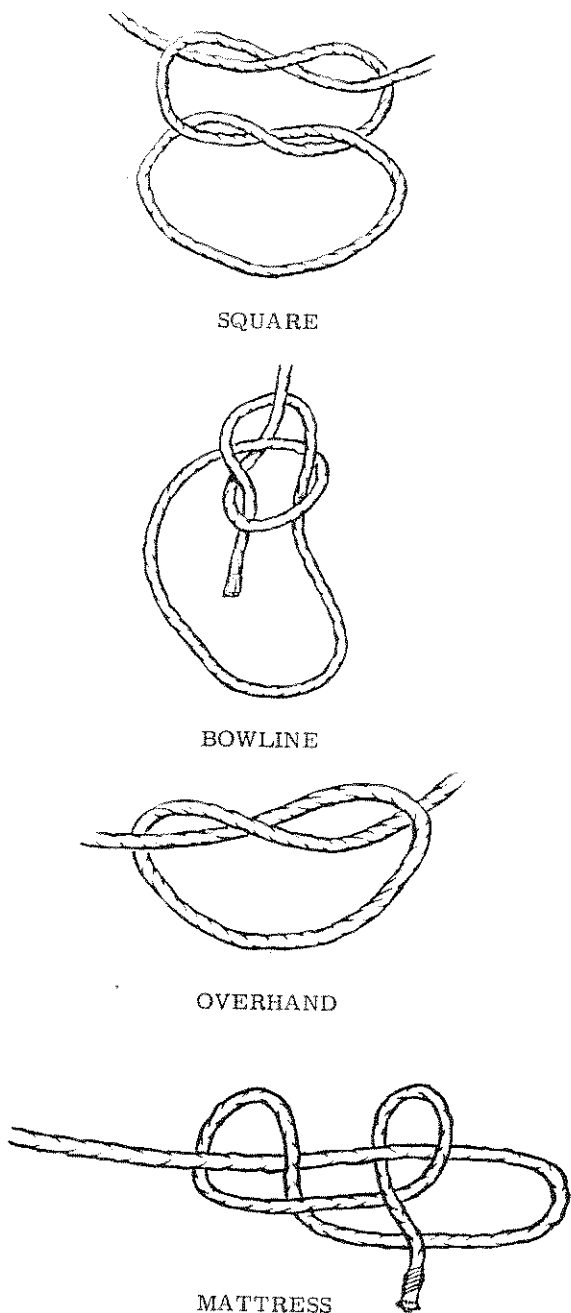


Figure 3-20 Common Knots

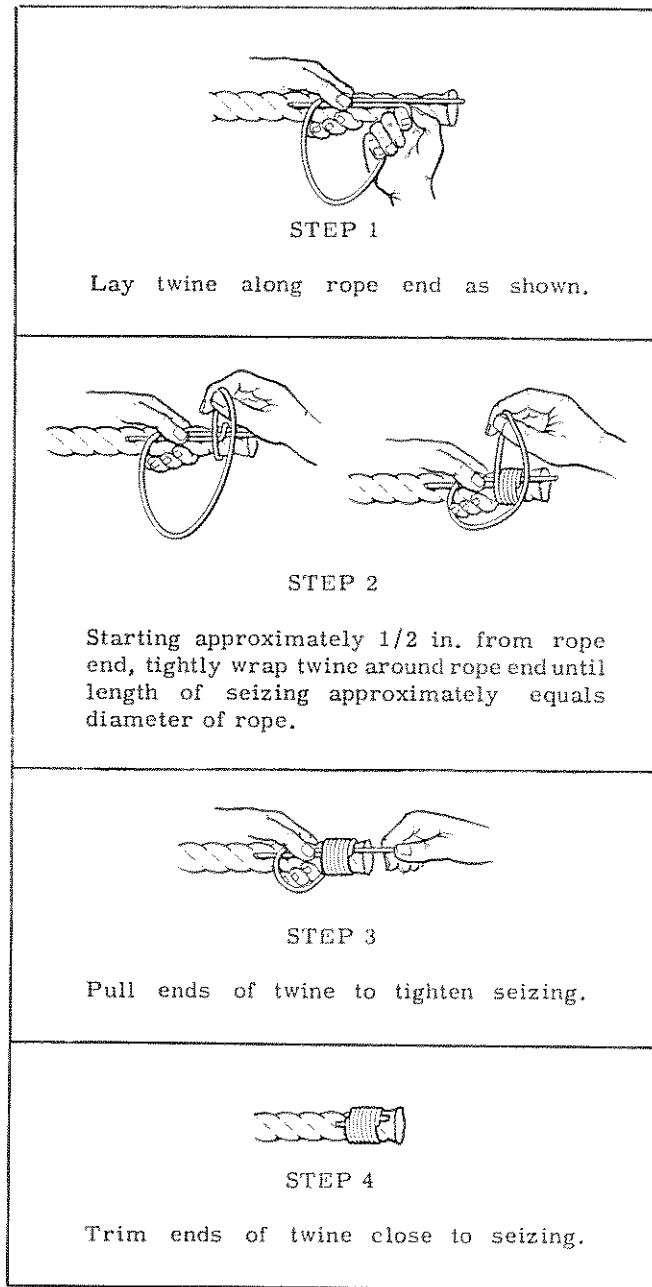


Figure 3-21 Seizing of Rope Ends with Nylon Twine

3-13 REPLACEMENT OF THREADED INSERTS.

3-13.1 GENERAL. Various types and kinds of threaded inserts are removed and installed in accordance with manufacturer's specifications. Obtain such specifications from typical manufacturers indicated in table IX. Replacement of specific threaded inserts are indicated in referencing documents, and AEC part numbers are noted in applicable Illustrated Parts Breakdown listings.

3-13.2 EXCEPTIONS TO STANDARD REMOVAL AND/OR INSTALLATION.

3-13.2.1 GENERAL APPLICATION. When installing threaded inserts, if the maximum specific installation depth is inadvertently exceeded, do not attempt to meet tolerance by backing out insert; in such cases, remove the insert and install a new one.

(Figure 3-22 deleted)

3-13.2.2 HELI-COIL EXTRACTING TOOL (1227-6). When required, the Heli-Coil extracting tool No. 1227-6 is modified in accordance with dimensions in figure 3-24, and used when specified by the referencing document.

3-13.2.3 HELI-COIL INSERTS. When installing notched Heli-Coil inserts, the tang is to be removed only in through-hole operations or in blind-hole applications only if the removed insert had the tang removed. In all cases of tang removal, make sure the broken-off tang is removed from the hole.

3-13.2.3A HELI-COIL GO/NOT-GO GAGES. Before installing replacement insert, check hole for conformance to installation data by means of Heli-Coil

GO/NOT-GO gages. A Class 2B thread fit for Heli-Coil insert replacement is required unless otherwise indicated in the referencing document. Reject assembly if hole accepts NOT-GO gage and installation of larger size or other type insert is not authorized.

3-13.2.4 ROSAN INSERTS. When installing Rosan inserts, the depth of the installation must be such that the top surface of the lock ring is at least 0.005 in. below the surface of the parent material, and no deeper than flush with top of insert. This requires that the insert proper be installed so that serrated collar is 0.010 to 0.020 in. below surface of parent

(Figure 3-23 deleted)

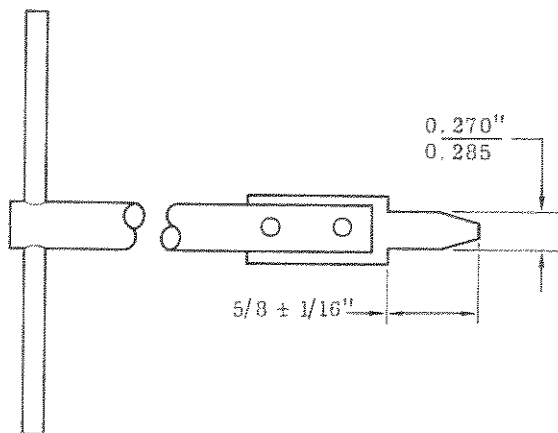


Figure 3-24 Modification of Heli-Coil
Extracting Tool No. 1227-6

(Figure 3-25 deleted)

material. Additionally, a proper size bolt and nut may be used, if desired, in place of the Rosan installation tool. If the bolt and nut are used, wrench torque is applied to the nut only.

3-13.2.5 REPLACEMENT OF OTHER TYPE INSERTS WITH ROSAN "SLIMSERT."

3-13.2.5.1 Remove original insert in accordance with instructions for the particular insert, taking care not to damage parent material during removal. Clean hole of all chips and other foreign matter.

3-13.2.5.2 If insert must be shortened, prior to installation cut insert to required length, using any accepted shop method. Tap drill hole to 1-1/4 times insert length.

3-13.2.5.3 Redrill and retap for size and type of "Slimsert" being installed. If depth of insert installation is critical, tap drill to specified depth (if given) or tap drill as specified by manufacturer. Clean hole of all chips and other foreign material.

NOTE

If insert installation depth is critical, tap drilling and counterboring must be performed as two separate operations, since use of the manufacturer's recommended step drill will result in a deeper hole than desired.

3-13.2.5.4 Install "Slimsert."

3-14 REPLACEMENT OF QUICK-ACTING FASTENERS.

3-14.1 GENERAL. Various types and kinds of quick-acting fasteners are removed and installed in accordance with manufacturer's specifications. Obtain such specifications from typical manufacturers indicated in table IX. Replacement of quick-acting fasteners are indicated in referencing documents, and AEC part numbers are noted in applicable Illustrated Parts Breakdown listings.

3-14.2 REPAIR LIMITATIONS FOR DZUS FASTENER INSTALLATION.

3-14.2.1 DAMAGE LIMITATIONS FOR FASTENER DIMPLES.

a. Circumferentially cracked dimples are not repairable.

b. Radially cracked dimples are repairable if:

(1) There are no more than 3 cracks per dimple.

(2) No crack extends beyond the dimple radius.

(3) No crack is circumferential for any part of its length.

(4) There is no more than one cracked dimple in every five. (This allows repair of two adjacent cracked dimples in the center of a group of 10.)

(Figures 3-26 and 3-27 deleted)

3-14.2.2 REPAIR OF DIMPLE FOR STUD INSTALLATION (Figure 3-28).

3-14.2.2.1 To stop crack, drill one No. 40 (0.098) hole at end of crack.

3-14.2.2.2 Using material of same gauge as material of damaged part, cut 2-1/2-in. dia doubler and dimple to match dimple in damaged part. If damaged dimple is near edge of sheet, cut one side of doubler to match edge contour.

3-14.2.2.3 Position doubler to under side of damaged dimple and spot weld areas shown.

3-14.2.3 REPAIR OF DIMPLE FOR SPRING INSTALLATION (Figure 3-29).

3-14.2.3.1 To stop crack, drill one No. 40 (0.098) hole at end of crack.

3-14.2.3.2 Using 3R4-2 reinforcing for 11/32-in. dia dimpled hole or 3R4-3 reinforcing 29/32-in. dia dimpled hole, cut doubler of approximate shape and size shown in figure 3-29. Drill and dimple center of doubler to sufficient dia to provide support to damaged dimple as shown.

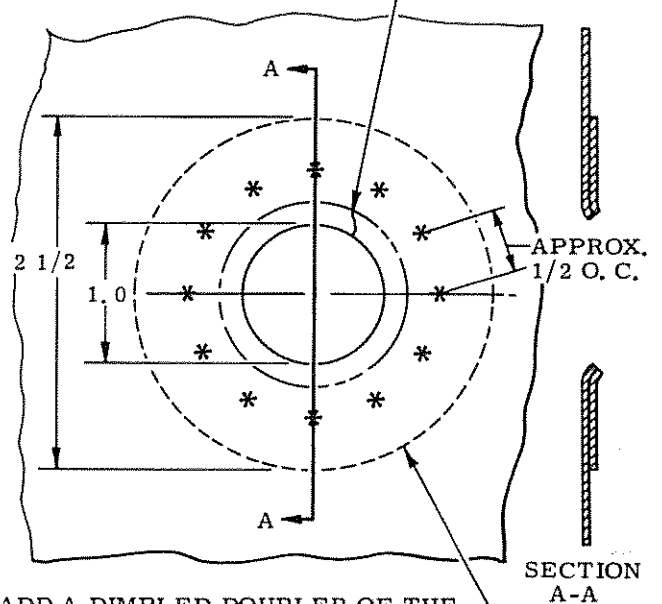
3-14.2.3.3 Rivet doubler and spring beneath damaged dimple as shown.

3-15 BONDING.

The bonding processes described in this paragraph apply to bonding of metals, plastics, rubbers, felts, and cloth to themselves and to each other, utilizing rubber- and vinyl-base adhesives. In all cases, surface preparation prior to bonding is important, since the cleanliness and texture of the bonding surfaces determines to a large extent the strength and durability of the bond.

3-15.1 SELECTION OF MATERIALS. The procedures given here are general and apply only to the specific materials mentioned in the procedures; use of other materials will require adjusting the procedures as necessary, according to Military or manufacturer's specifications, or in accordance with information

STOP CRACKS WITH NO. 40 DRILL (0.098) HOLE.



ADD A DIMPLED DOUBLER OF THE SAME GAUGE MATERIAL AS THE DAMAGED MATERIAL, SPOT-WELD AS SHOWN, MAXIMUM GAP BETWEEN DIMPLED DOUBLER AND SKIN IS NOT TO EXCEED 0.005.

Figure 3-28 Repair of Dimple for Stud Installation



SECTION A-A

REINFORCEMENT
MAXIMUM GAP
BETWEEN DIMPLE
AND REINFORCEMENT
IS NOT TO EXCEED 0.005.

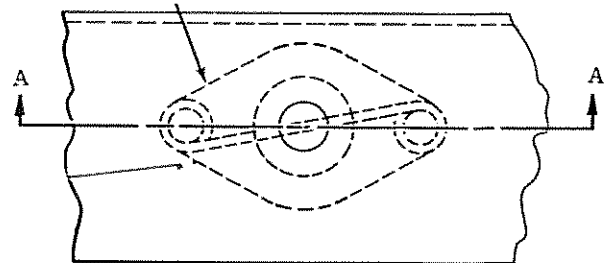


Figure 3-29 Installation of Spring

derived from tests performed previously on sample materials. In all cases, use the bonding material (if any) specified in the applicable manual.

3-15.2 SURFACE PREPARATION.

3-15.2.1 ABRADING. Roughened surfaces tend to bond more satisfactorily than smooth, glossy surfaces. Unless otherwise specified, prior to final cleaning and drying, abrade bare metal surfaces in accordance with limitations specified in paragraph 2-4. Do not abrade plated metal, lead, tin or metal surfaces which have been newly treated, chemically or otherwise, with conversion coatings (alodine, phosphate, etc). Abrade plastic and rubber surfaces (except cellular or expanded rubbers) only sufficiently to roughen the surface and to remove surface gloss.

3-15.2.2 CLEANING AND DRYING. Prior to bonding, clean both bonding surfaces thoroughly of old bonding material, abraded material, dirt, oil, grease, tarnish, and other contaminants in accordance with applicable procedures in TP 35-51. After cleaning, dry both bonding surfaces thoroughly in accordance with procedures in TP 35-51. Perform bonding as soon as possible after surface preparation. Wear clean white gloves for all necessary handling of surfaces after cleaning.

NOTE

The solvent to be used for cleaning should be that recommended by the adhesive manufacturer. If this information is not available, the following solvents are generally effective: Toluene (technical), methyl ethyl ketone (technical), and trichloroethylene (technical) for the rubber-base adhesives; toluene (technical) for the silicone base adhesives (before cure); and acetone for the epoxy base adhesives (before cure). The removal of silicone

and epoxy base adhesives after cure is difficult, although removal can be effected to some extent by soaking in (or repeated applications of) organic coating remover. If specifically permitted, an epoxy bond-line may be left intact after separation of the bonded parts, the old bond material abraded to an even contour, and a new bond effected over the old bonding material.

3-15.3 RUBBER-BASE ADHESIVES. Of the rubber-base adhesives listed in table I, the following are recommended for general use: EC-776, EC-847, EC-2124, EC-1022, Pliobond 30, and buna-N adhesives and their listed alternates. For bonding felt, cloth, and sponge rubber materials, the following are recommended: Adhesive (EC-770) and adhesive (reclaimed rubber). For bonding neoprene rubber and fabrics, the neoprene-base adhesives (EC-847, EC-2124, C-518, Loxite 6000, etc) are recommended.

3-15.3.1 PREPARATION OF ADHESIVE.

3-15.3.1.1 Stabilize bonding surfaces and adhesive at room temperature (approximately 70°F).

3-15.3.1.2 If required, add solvent to adhesive in accordance with manufacturer's instructions.

3-15.3.1.3 Mix adhesive thoroughly to achieve uniform consistency and viscosity.

3-15.3.2 METHODS OF APPLICATION. Depending on the bond strength desired, any of the following three methods may be used; the methods are listed in order of increasing bond strength. The relative thickness of the adhesive film to be applied will depend on the particular adhesive being used, the method of application, and the type and roughness of the bonding surfaces. If required, mask or otherwise protect all adjacent areas which are not to be coated with adhesive.

(All data deleted from page 31)

3-15.3.2.1 OPEN OR WET BONDING. The open or wet bonding method is recommended when one or both bonding surfaces are porous or when a relatively low-strength bond is acceptable.

3-15.3.2.1.1 Apply thin, even film of adhesive to both bonding surfaces. Allow surfaces to air-dry to tacky stage which will allow adherence, but not transfer, to finger when touched lightly. The open drying time may vary from approximately 5 to 20 min.

3-15.3.2.1.2 When surfaces are tacky, complete bond by firmly pressing or rolling surfaces together to insure intimate contact at all points. Wipe off excess adhesive.

3-15.3.2.1.3 Maintain pressure for minimum of 24 hrs.

3-15.3.2.2 SOLVENT REACTIVATION. The solvent reactivation method is recommended for applications requiring a cold bond with maximum solvent release.

3-15.3.2.2.1 Apply thin even film of adhesive to each of prepared bonding surfaces. Allow surfaces to air-dry completely or until no longer tacky or sticky. At room temperature of approximately 75°F, this time may vary from a minimum of 1 to 2 hrs for very thin films; however, a drying period of from 19 to 24 hrs is recommended.

NOTE

If desired, higher temperatures may be utilized to reduce drying time substantially. For example, a drying time of approximately 1 hr is sufficient at a temperature of approximately 120°F.

3-15.3.2.2.2 Using a clean cloth saturated (not dripping) with suitable solvent, moisten adhesive film of one bonding surface (preferably of the denser or heavier part). Immediately press or roll surfaces firmly together to insure intimate contact at all points. Wipe off excess adhesive.

NOTE

For solvent reactivation, always use the same or similar solvent as that used in the basic adhesive mixture. Methyl ethyl ketone (Technical) is a suitable solvent for the following adhesives: EC-847, EC-1022, EC-776, MIL-S-4383, Pliobond 30, and buna-N adhesive. Toluene (technical) is a suitable solvent for the following adhesives: EC-870 and EC-711.

3-15.3.2.2.3 Unless otherwise specified, maintain pressure for minimum of 12 hrs.

3-15.3.2.3 HEAT-REACTIVATION. The heat-reactivation method is recommended when maximum bond strength is desired or when both bonding surfaces are non-porous. This method allows the highest degree of solvent release.

3-15.3.2.3.1 Apply thin, even film of adhesive to each of the prepared bonding surfaces. Allow surfaces to air-dry completely or until no longer tacky or sticky. At room temperature of approximately 75°F, this time may vary from a minimum of 1 to 2 hrs for very thin films of adhesive to approximately 24 hrs for thick films; however, a drying period of from 18 to 24 hrs is recommended.

NOTE

If desired, higher temperatures can be utilized to reduce drying time substantially. For example, a drying time of approximately 1 hr is sufficient at a temperature of approximately 120°F.

3-15.3.2.3.2 Firmly press or roll bonding surfaces together to insure intimate contact of all points and wipe off excess adhesive. Maintain pressure and heat to bond-line temperature of 250° to 275°F for 5 to 15 min, using the longer time schedule for the lower curing temperature.

3-15.3.2.3.3 Allow assembly to cool under pressure.

3-15.4 VINYL RESIN ADHESIVE. Vinyl resin adhesive is obtained by compounding specified amounts of vinyl insulating sleeving with suitable solvent (technical grade tetrahydrofuran and/or cyclohexanone). The adhesive is intended for use in bonding flexible vinyl plastics only and, unless otherwise specified, is not to be used to bond vinyl plastic to other materials. If desired, adhesive (XN-13-9), consisting of a 20 percent solution of cyclohexanone and vinyl plastic, may be used in place of the compounded adhesive.

WARNING

The solvents used in compounding vinyl resin adhesive are toxic and flammable. Observe applicable safety precautions (paragraph 2-2).

3-15.4.1 PREPARATION.

3-15.4.1.1 Before compounding adhesive, prepare surfaces to be bonded in accordance with paragraph 3-15.2.

3-15.4.1.2 Select proper solvent or proper percentages of solvent in accordance with desired drying time as specified in table X.

TABLE X
VINYL ADHESIVE DRYING TIMES

SOLVENT		DRYING TIME* (Minutes)
Tetrahydrofuran	Cyclohexanone	
100%	--	1-1/2
50%	50%	18
35%	65%	21
--	100%	32

*Approximate tack-free drying times determined for film thickness of 0.002 inch at 74°F and 53% relative humidity.

3-15.4.1.3 Compound adhesive in ratio of 15 g of vinyl insulation sleeving to 85 milliliters of solvent. Mix thoroughly to achieve uniform consistency and viscosity. Allow mixture to stand in closed container for approximately 24 hr prior to use to insure thorough compounding of components. Mix thoroughly immediately prior to use.

3-15.4.2 APPLICATION.

CAUTION

Because of the rapid drying time for vinyl resin adhesive, pour off only quantities of adhesive which can be completely utilized within the specified drying time.

3-15.4.2.1 Apply thin, even film of adhesive to bonding surfaces and bring surfaces into contact as soon as practicable.

3-15.4.2.2 Immediately mate bonding surfaces and wipe away excess adhesive. Allow bond to cure for specified drying time. Adjust curing time as required for film thicknesses or temperatures which differ from those specified in table X.

3-15.5 SILICONE RUBBER ADHESIVE. Procedures in this paragraph cover the bonding of silicone rubber materials to themselves or to nonsilicone materials, using silicone rubber adhesive (Silastic 140) or silicone compound (RTV-881, kit). When bonding silicone to nonsilicone, a silicone primer (A-4094) is used to prepare the nonsilicone surface for bonding.

WARNING

The adhesive contains toxic components. Observe applicable safety precautions (paragraph 2-2).

3-15.5.1 SILICONE TO SILICONE.

3-15.5.1.1 Prepare surfaces for bonding as follows:

3-15.5.1.1.1 Clean surfaces in detergent-water solution followed by clear water rinse. Dry at room temperature.

3-15.5.1.1.2 Rinse surfaces in clean acetone (technical) for 5 sec maximum or wipe surfaces with clean lint-free cloth or paper wipes moistened with clean acetone.

3-15.5.1.1.3 Force-dry for approximately 1/2 hr at temperature of 160°±5°F.

NOTE

If the cleaning procedures specified are not feasible, the surfaces may be cleaned by means of a clean cloth moistened with acetone and allowed to air-dry until all traces of acetone have evaporated. If this method is used, care must be taken to prevent acetone from being trapped in recesses.

3-15.5.1.1.4 Lightly abrade surfaces to be bonded and wipe off loose particles with clean lint-free cloth. If possible, avoid handling surfaces after cleaning and abrading. If handling is necessary, take care to prevent contamination of surfaces.

3-15.5.1.2 Apply thin, even film of Silastic 140 adhesive or RTV-881 compound to each surface to be bonded and immediately press surfaces together, insuring intimate and complete contact. Apply sufficient pressure to surfaces to force excess adhesive out of bond line; wipe off excess adhesive, while still wet, with clean lint-free cloth moistened with acetone. Maintain pressure and avoid disturbing bond line until adhesive has air-cured for handling (at least 4 hr at room temperature).

3-15.5.1.3 Oven-cure for additional 8 hr (minimum) at temperature of 200°±10°F; or, if complete air-cure is desired, cure at room temperature for additional 20 hr (minimum) or until bond no longer exudes distinct acetic acid odor (Silastic 140 adhesive only).

3-15.5.2 SILICONE TO NON-SILICONE.

3-15.5.2.1 Prepare silicone surface as specified for silicone to silicone bonding.

3-15.5.2.2 If nonsilicone surface is metal, thoroughly clean surface by degreasing method (TP 35-51) and abrade surface by abrading or sand blasting. After abrading, wipe surface with clean lint-free cloth moistened in suitable solvent (acetone, methyl ethyl ketone, toluene, or trichloroethylene).

NOTE

Freshly machined or plated metal surfaces need not be abraded, but must be thoroughly cleaned with a suitable solvent.

3-15.5.2.3 If non-silicone surface is molded or laminated plastic, abrade surface or sand blast to remove surface gloss and mold release agents, and wipe off loose particles with dry, lint-free cloth or paper wipes.

NOTE

Freshly machined plastic surfaces need not be abraded. However, if a lubricant or coolant was used during machining, the surface must be solvent cleaned.

3-15.5.2.4 Apply thin, even film of silicone primer (A-4094) to all non-silicone surfaces to be bonded. Allow primer to air-dry at room temperature for at least 30 min.

3-15.5.2.5 Apply thin, even film of Silastic 140 adhesive or RTV-881 compound to each surface to be bonded and immediately press surfaces together, assuring intimate and complete contact. Apply sufficient pressure to surfaces to force excess adhesive out of bond line. Wipe off excess adhesive, while still wet, with clean lint-free cloth moistened with acetone. Maintain pressure and avoid disturbing bond line until adhesive has air-cured for handling (at least 4 hrs at room temperature).

3-15.5.2.6 Oven-cure for additional 8 hrs (minimum) at temperature of $200^{\circ} \pm 10^{\circ} \text{F}$; or if complete air-cure is desired, cure at room temperature for additional 20 hrs (minimum) or until bond no longer exudes distinct acetic acid odor (Silastic 140 adhesive only).

3-15.6 EPOXY RESIN (C-4) ADHESIVE. Epoxy resin (C-4) adhesive is supplied in kit form containing the required weight of activator D packaged in a separate container. It is intended for use in nonstructural applications for bonding metal where it is desired to slide or position the rubber surface relative to the metal surface. It is also used for bonding thermo-setting plastics to themselves.

WARNING

Epoxy resin adhesive and activator are toxic. Observe applicable safety precautions (paragraph 2-2).

3-15.6.1 POT LIFE. After addition of activator, pot life of adhesive is approximately 20 min at room temperature of approximately 75°F . Pot life may be increased by maintaining the activated adhesive at temperatures from 40° to 50°F .

3-15.6.2 REMOVAL OF SPILLED OR EXCESS ADHESIVE. Remove any spilled or excess adhesive before it cures, since removal of cured adhesive is

difficult. Remove by wiping with clean cloth moistened with acetone or other suitable solvent. If spilled or excess adhesive has cured, remove in accordance with procedures in TP 35-51.

3-15.6.3 PREPARATION.

3-15.6.3.1 Prior to mixing adhesive, prepare bonding surfaces in accordance with paragraph 3-15.2. If required, mask or otherwise protect any adjacent surfaces or parts not requiring application of adhesive.

CAUTION

When mixing adhesive, prepare only sufficient amounts consistent with the limited pot life of the activated adhesive.

Thorough mixing of adhesive and activator is extremely important.

3-15.6.3.2 Add activator to adhesive in the ratio of 1 part by weight of activator D to 4 parts by weight of C-4 adhesive. Stir thoroughly for several minutes to achieve uniform consistency and viscosity.

CAUTION

Adhesive must be applied to bonding surfaces and surfaces brought into contact within 1 hour after activation of adhesive.

3-15.6.4 APPLICATION AND CURE.

3-15.6.4.1 Apply thin, even film of adhesive to prepared bonding surfaces.

CAUTION

When clamping parts under pressure, exert only sufficient pressure to make assembly immobile. Too high a clamping pressure could cause too thin a bond line, and hence a poor bond.

3-15.6.4.2 Join bonding surfaces and apply uniform and moderate pressure by means of clamps or other devices. Maintain pressure until bond is completely cured.

3-15.6.4.3 Remove any excess adhesive which may have been forced out of bond line by application of pressure.

3-15.6.4.4 Cure bond under pressure in accordance with one of the following minimum time and bond-line temperature schedules:

- a. One to two hr at 150°F to 175°F temperature
- b. Twenty-four hr at 77°F temperature

3-15.7 BONDING RUBBER AND LEAD LINERS.

3-15.7.1 LIMITATIONS. Permissible extent of repair of rubber or lead liner is limited to separations as specified in appropriate TP manuals of -1 and/or -2 series.

3-15.7.2 BONDING RUBBER LINER.

3-15.7.2.1 Prepare surfaces to be bonded in accordance with procedures in paragraph 3-15.2.

3-15.7.2.2 Bond rubber liner in accordance with procedures for rubber-base adhesives in paragraph 3-15.3, using open or wet bonding method.

3-15.7.2.3 When bonding small separations, force nominal amount of adhesive into separation and proceed as specified in paragraph 3-15.3.2.1. Wipe off excess adhesive.

3-15.7.3 BONDING LEAD LINER.

3-15.7.3.1 Fabricate wood block having contour to match inside surface. Fabricate 2nd wood block having a contour to match outside surface.

3-15.7.3.2 Prepare surfaces to be bonded in accordance with procedures in paragraph 3-15.2.

3-15.7.3.3 Bond lead liner in accordance with epoxy resin adhesive procedures in paragraph 3-15.6.

3-15.7.3.4 When bonding small separations, force nominal amount of adhesive into separation and proceed as specified in paragraph 3-15.6.

CAUTION

Care must be taken not to clamp the wood blocks so tightly that the thickness of the lead liner is decreased.

3-15.7.3.5 Position wood blocks opposite each other so that area of separation is between blocks. Clamp blocks together, drawing liner in place.

3-16 STAKING.

3-16.1 MECHANICAL STAKING.

3-16.1.1 STAKING OF BOLT, STUD, OR SCREW THREADS. Position center punch, prick punch, or

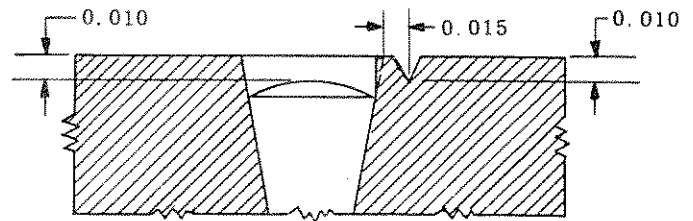


Figure 3-30 Mechanical Staking of Taper Pin, Dowel Pin, or Bushing

similar tool at 45° angle against first exposed bolt thread beneath nut. Using hammer, drive punch to nick and jam thread against nut. If 2-thread staking is required, position punch against second exposed bolt thread and drive both threads against nut.

3-16.1.2 STAKING OF BOLT, STUD, OR SCREW END. Using metal hammer, peen threaded end of bolt beyond bolt thread tips until bolt end forms wedge or cap against nut.

3-16.1.3 STAKING OF DOWEL PIN, TAPER PIN, OR BUSHING (Figure 3-30).

3-16.1.3.1 Check that dowel pin or taper pin is installed so that head is approximately 0.010 in. below surface. Check that head of bushing is approximately flush with surface.

3-16.1.3.2 Impress stake by means of center punch approximately 0.015 in. from edge of hole and approximately 0.010 in. deep as shown. One stake is sufficient.

3-16.1.3.3 For small taper or dowel pins, impress stake in center of pin head, using 60° conical shaped tool.

3-16.1.3.4 If required and accessible, apply stake at opposite end of dowel pin or bushing.

3-16.2 STAKING WITH PAINT. Liberally apply specified paint to exposed threads of bolt or stud, especially at nut juncture. If more than 1 coat of paint is required, allow each coat to dry before application of next coat.

3-16.3 STAKING WITH ELECTRICAL INSULATING COMPOUND (Glyptal).

3-16.3.1 Using trichloroethylene (technical), clean surfaces to which glyptal will be applied.

3-16.3.2 Apply sufficient glyptal to threaded fastener at locations shown in figure 3-31 (for threaded fasteners) or figure 3-32 (for dowel or taper pins) to provide effective seal when parts are joined. Use glyptal sparingly to prevent filling slot or recesses in head of threaded member with excess glyptal. For dowel pins only, repeat application at opposite end of pin if accessible.

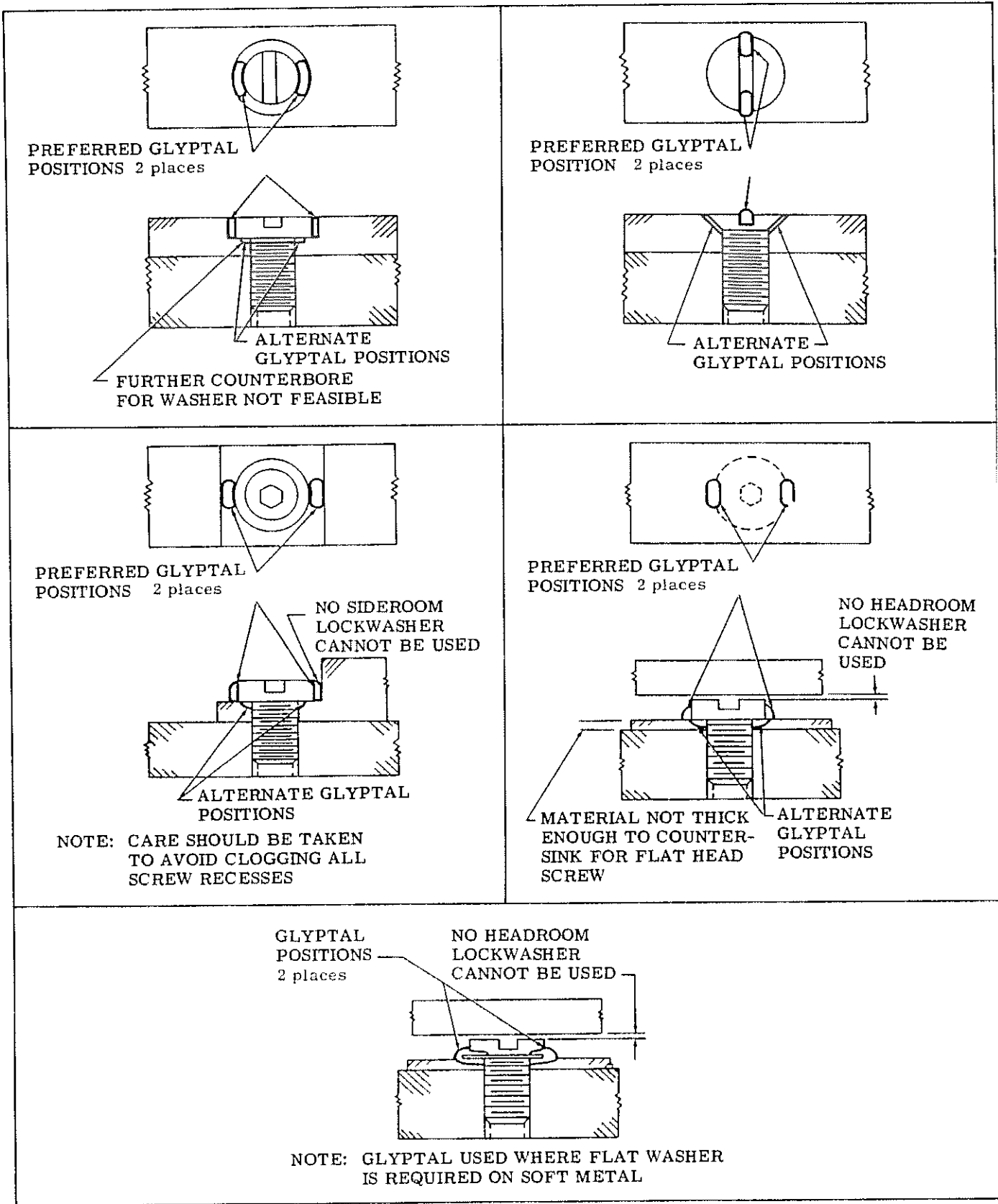


Figure 3-31 Staking Threaded Assemblies with Glyptal

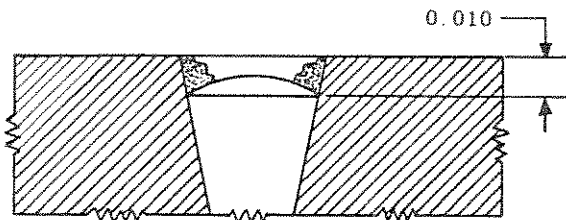


Figure 3-32 Staking Taper or Dowel Pins with Glyptal

3-16.3.3 Remove excess glyptal before it sets. Upon reassembly (if required), clean all surfaces of old glyptal before re-installing part. When removing any fastener to which glyptal has been applied, exercise care to prevent small particles of glyptal from falling into areas where foreign matter is undesirable.

3-16.4 STAKING WITH SEALING COMPOUND (Loctite).

3-16.4.1 Using trichloroethylene (technical), clean surface to which sealant is to be applied.

3-16.4.2 On insert surfaces (zinc plating, cadmium plating and plastics, apply 5-percent solution of activator (Locquic) to surfaces and allow to dry before application of sealant.

3-16.4.3 Apply sufficient amount of sealing compound (Loctite, grade as specified) to each part of metal fastener to provide effective seal when parts are joined.

3-16.4.4 Remove all excess sealant from fastener.

3-16.4.5 When confined between two closely fitted metal surfaces, the sealant converts from a liquid to a solid in less than 10 min. The sealant continues to harden and gain strength on further standing. Strength and hardness reach a permanent steady value within 3 days at room temperature (70°F). More than 50 percent of the final strength is reached in 3 hrs at 90°F, 6 hrs at 72°F, and 12 hrs at 50°F. Hardening can be accelerated by heat and is complete in 15 min at 212°F, or in 5 min at 350°F. Best results are obtained when the treated joint is allowed to set at room temperature for at least 30 min before heating to complete the hardening process.

3-17 WEATHER AND PRESSURE SEALING.

3-17.1 SEALING OF FAYING SURFACES AND JOINTS.

3-17.1.1 CLEANING.

3-17.1.1.1 Surfaces to be sealed must be cleaned after all machining operations have been completed. Surfaces shall be free of burrs, chips, dirt, oil, etc.

3-17.1.1.2 Surfaces to be sealed shall be given a final cleaning by brushing on clean, dry cleaning solvent (Stoddard), or other suitable solvent, and wiping the wet surface with a clean lint-free cloth before the solvent evaporates.

3-17.1.1.3 The sealing compound can be applied over fully dried and cleaned zinc chromate primer, provided the primer is adherent. Nonadherent primer coatings must be removed prior to application of the sealing compound.

3-17.1.1.4 Surfaces to be resealed shall be scraped clean of old sealant prior to application of fresh sealing compound, or may be cleaned by using toluene (technical) or trichloroethylene (technical grade).

3-17.1.2 PREPARATION OF SEALANT. Mix sealing compound (gas tank) in accordance with manufacturer's directions. Since the material has a limited working life, the compound must be applied to parts and the parts assembled within the specified time, to avoid premature curing of the material.

3-17.1.3 SEALING FAYING SURFACES DURING ASSEMBLY.

3-17.1.3.1 Using spatula or similar tool, work material into all areas of one of the faying surfaces to thickness of approximately 1/32 in.

3-17.1.3.2 As soon as possible after application of sealing compound, assemble parts as required.

3-17.1.3.3 After assembly, remove excess compound with toluene (technical) or trichloroethylene (technical).

3-17.1.4 SEALING OF SEAMS AND JOINTS OF ASSEMBLED PARTS.

3-17.1.4.1 Apply bead of sealing compound to joints of fabricated parts by means of pressure gun, spatula, or similar tool.

3-17.1.4.2 Work bead of material into joint as far as possible. Type of bead is shown in figure 3-33. Outer surface and edges of bead shall be smoothed and faired. This may be done by means of a brush, spatula, or similar tool, wet with water.

3-17.1.5 SEALING OF HOLES AND SLOTS.

3-17.1.5.1 Small holes and slots are filled as shown in figure 3-34.

3-17.1.5.2 Openings under joggles, etc, are sealed by completely filling cavity with sealing compound applied by means of pressure gun. All edges shall be smoothed and faired.

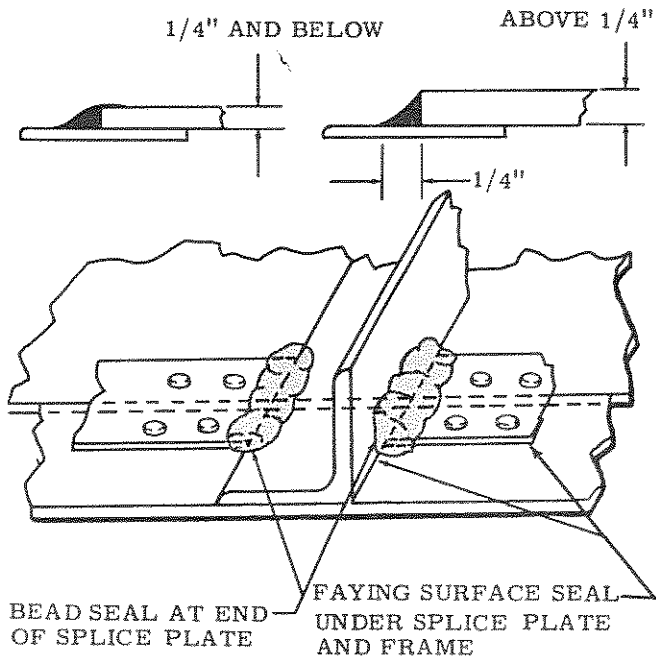


Figure 3-33 Sealing of Seams and Joints

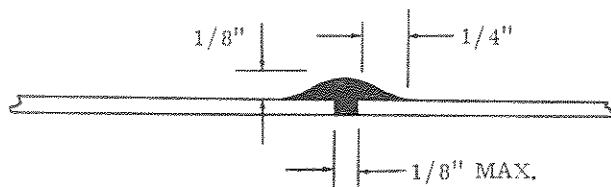


Figure 3-34 Sealing of Small Holes and Slots

3-17.1.6 SEALING OF INSERTS.

3-17.1.6.1 Inserts such as rivets, bolts, fasteners, etc, are sealed by applying sealing compound either to the hole and faying surface, or to the insert before insertion.

3-17.1.6.2 When faying surfaces are sealed during fabrication, it is generally not necessary to further seal the rivets or bolts.

3-17.2 APPLICATION OF SEALING COMPOUNDS (Sealant Kits). Sealant kits covered in this paragraph are listed in table XI.

3-17.2.1 DEFINITION OF TERMS. Terms used in these procedures are defined as follows.

3-17.2.1.1 SHELF LIFE. Shelf life is the length of time, from date of manufacture, that unmixed sealant retains its properties.

NOTE

Sealant kits which have exceeded their shelf life (overage kits) are to be used only if sealant kits which have not exceeded their shelf life (current kits) are not available. Paragraph 3-17.2.4 specifies sampling test to be performed if overage sealant kit is to be used.

CAUTION

Temperatures above 80°F cause degradation of curing agent.

3-17.2.1.1.1 Shelf life of sealant shipped and stored at temperature of 80°F to 41°F is 4 mo.

3-17.2.1.1.2 Shelf life of sealant shipped and stored at temperature of 40°F to 32°F is 8 mo.

3-17.2.1.1.3 Shelf life of sealant shipped and stored at temperatures below 32°F is 12 mo.

3-17.2.1.2 POT LIFE. Pot life is the length of time mixed sealant retains its application characteristics. Pot life specified in table XI is based on exposure of sealant to room temperature (72°F) and 50% RH during mixing and application. Temperatures higher than 72°F or relative humidity greater than 50% tend to shorten pot life and temperatures lower than 72°F or relative humidity lower than 50% tend to increase pot life. As a general rule, pot life has not been exceeded if the sealant can be applied through gun nozzle provided with the kit and the sealant wets the surface being sealed.

3-17.2.1.3 CURE TIME. Cure time is the time within which acceptable sealant achieves Shore A 25 hardness at room temperature (72°F) and 50% relative humidity. The term "tack free" describes that stage of cure at which sealant, when touched lightly, will not adhere to the fingers. Refer to first footnote of table XI for effects of temperature and humidity on cure time.

3-17.2.1.4 HARDNESS CHECK. Hardness check is test that verifies curing properties of sealant by measuring its hardness. This check may be made at any time during cure after sealant has reached tack free stage. When sealant reaches the required hardness (Shore A 25), no further testing is necessary, even if the specified cure time has not elapsed.

3-17.2.2 SHIPPING AND STORING OF SEALANT KITS. Sealant kits must be shipped and stored at temperatures of 80°F or below; otherwise sealant characteristics are affected.

TABLE XI
INFORMATION ON USE OF SEALANT KITS

SEALANT KIT	SHELF LIFE (Mo)	POT LIFE (Hr)	CURE TIME	
			To Tack-Free State (Hr)	To Shore A 25 Hardness* (Hr)
PR1221-B1/2	4 - 12	1/2	10	30
PR1221-B2	4 - 12	2	24	48
Pro-Seal 890-B2	4 - 12	2	24	72
Pro-Seal 890-B2 (12% catalyst)	4 - 12	1-1/2	24	72
Pro-Seal 706-B2	4 - 12	2	24	72
RTV 60	4 - 12	1/2	3 - 6	24
RTV 60/90	4 - 12	1/2	3 - 4	24
Epibond 122	**	1/2	24	**

*Cure time of all above sealants varies with ambient temperature; cure time of all above sealants except Epibond 122 is affected by humidity. It is recommended that all curing be done at room temperature or higher. The following is a guide for adjusting time for conditions of low temperature or low humidity: Double the cure time for each 18 degrees below 72°F; for PR1221, Pro-Seal, and RTV sealants, double the cure time for a 25 percent decrease in RH

**Refer to manufacturer's specifications

3-17.2.3 SAMPLING.

3-17.2.3.1 On receipt of each shipment of sealant kits, one sealant kit from the shipment must be sampled (paragraph 3-17.2.4) to verify mixing, application, and curing properties. If the shipment consists of more than one lot (as evidenced by different lot numbers or packaging dates) one kit from each lot shall be sampled.

3-17.2.3.2 If a lot of sealant kits is used during its shelf life, no additional sampling tests need be performed before the individual kits of that lot are used.

3-17.2.3.3 If it is necessary to use overage sealant kits, a lot sampling test (paragraph 3-17.2.4) must be performed before the individual kits of that lot are used. Successful results on a lot sampling test of overage kits allow for the lot an additional shelf life of 2 mos, to be timed from the date of the test. If the kits exceed the additional shelf life, successful re-

sults on another lot sampling test will provide another 2-mo shelf life for the lot.

3-17.2.4 SAMPLING TEST PROCEDURES.

3-17.2.4.1 MIXING OF SEALANT.

CAUTION

Exercise extreme care to avoid introducing air into sealant. Air mixed into sealant may result in a defective seal and leakage through air bubbles.

Failure to inject catalyst into approximate center of base resin may result in an unbalanced mix.

Turning dasher rod counterclockwise may result in disengaging rod from dasher.

Sealant must be mixed by means authorized. Use of other electrical or mechanical devices may cause sealant to overheat, thereby destroying its curing and adhesion properties.

3-17.2.4.1.1 Move dasher rod to place dasher in approximate center of base resin in cartridge (figure 3-35). Dasher rod contains catalyst.

3-17.2.4.1.2 Without moving dasher rod, insert ram rod (end without cap) into hole in end of dasher rod and force ram rod into dasher rod until it bottoms out, driving catalyst into base resin. The ram rod must bottom out before it is fully inserted. Extract and discard ram rod.

3-17.2.4.1.3 Mix sealant by either of the following methods, using at least 150 strokes. One stroke of rod is defined as movement of rod from fully extended position to fully inserted position, and back to fully extended position. The dasher rod must bottom out against each end of cartridge.

CAUTION

On insertion stroke use care when bottoming dasher against end of cartridge. Excessive force against cup may move cup and introduce air into sealant.

It is permissible to remove the cartridge end cap from the cartridge and to place a suitably shaped object against the cup to prevent movement of the cup.

3-17.2.4.1.3.1 **PREFERRED METHOD - ELECTRIC MIXER** (P/N 874363-00). Install cartridge vertically on mixer (figure 3-36). Turn on mixer. As mixer applies spiral clockwise motion to dasher rod, manually move cartridge up and down for at least 150 strokes. After sealant is mixed, make sure that dasher rod is moved to fully extended position. Grasp cartridge in area of dasher to keep dasher from turning and operate mixer switch to reverse position to unscrew dasher rod. Remove cartridge and dasher rod from mixer. Discard dasher rod.

3-17.2.4.1.3.2 **MANUAL METHOD.** Grasp cartridge in one hand. Using other hand, move dasher rod through base resin with spiral clockwise motion for at least 150 strokes. After sealant is mixed, move dasher rod to fully extended position, then grasp cartridge in area of dasher to keep dasher from turning, and unscrew dasher rod (approximately 3 turns counterclockwise). Discard dasher rod.

3-17.2.4.1.4 Screw nozzle into cartridge. If end cap is installed on cartridge, remove and discard end cap.

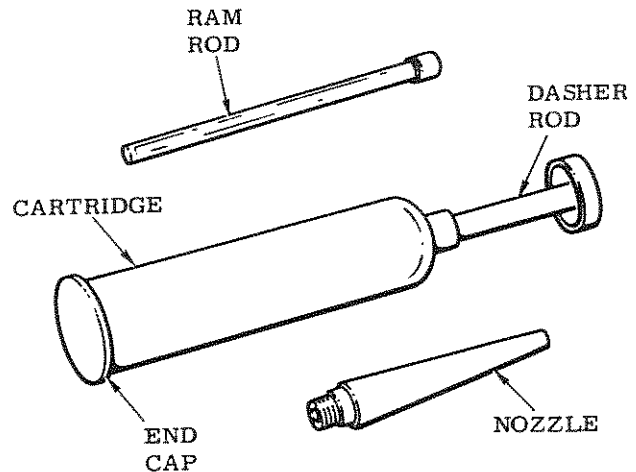


Figure 3-35 Sealant Kit Parts

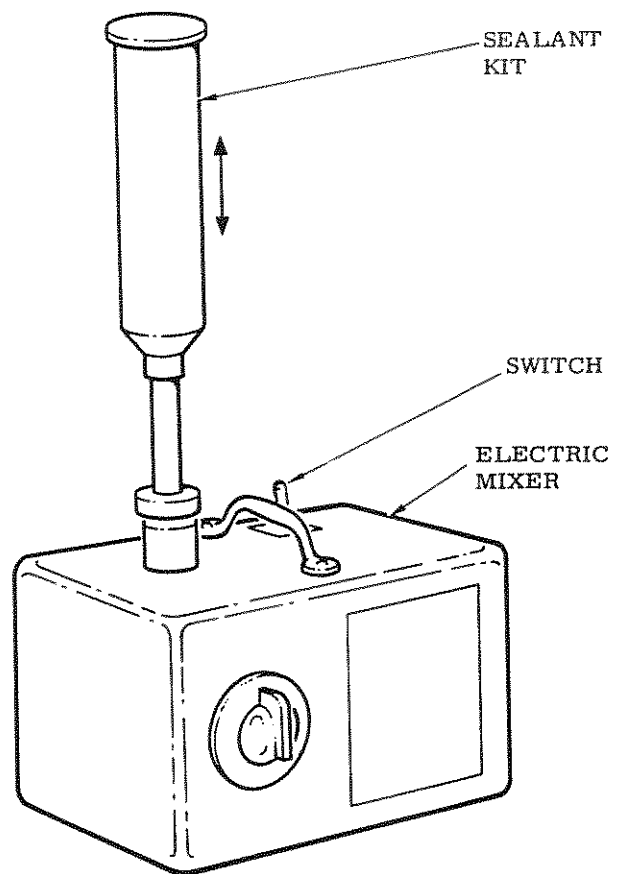


Figure 3-36 Use of Portable Electric Mixer

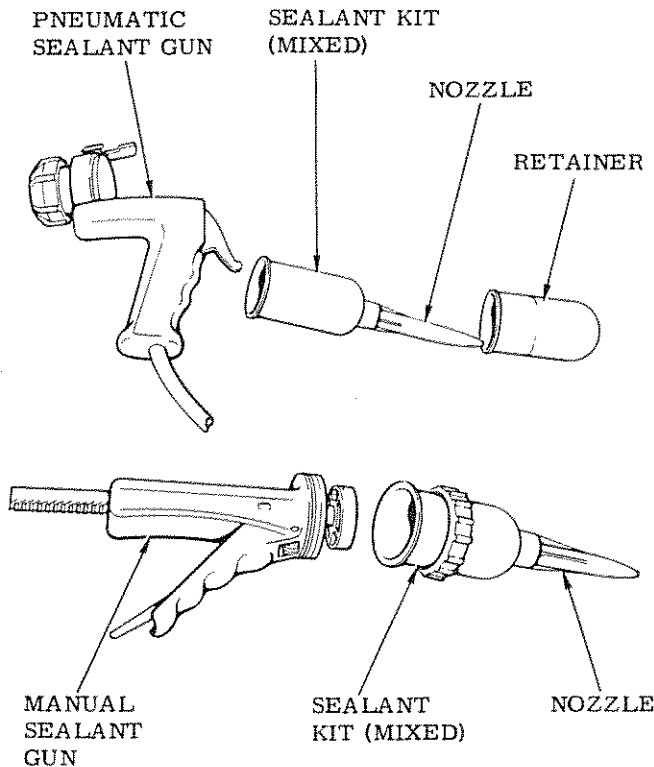


Figure 3-37 Installation of Cartridge in Sealant Gun

NOTE

Pneumatic sealant gun (P/N 839813-00) is supplied with 6-oz retainer. When sealant kit having a 2-1/2-oz cartridge is used, 6-oz retainer must be removed from gun and a 2-1/2-oz retainer (P/N 874433-00) installed. Use 20-ft hose (P/N 839915-00 or equivalent) with pneumatic sealant gun.

3-17.2.4.1.5 Install cartridge in sealant gun (pneumatic sealant gun P/N 839813-00 or manual sealant gun P/N 870904-00) (figure 3-37). If pneumatic gun is being used, connect pneumatic equipment and adjust air pressure source as necessary (100 psi maximum).

3-17.2.4.2 VISUAL INSPECTION OF MIXED SEALANT.

3-17.2.4.2.1 Purge nozzle by extruding 6-in.-long (approx) bead of sealant onto any suitable disposable smooth material. Extrude a second 6-in.-long (approx) bead onto the disposable material; this second bead is to be used for inspection.

3-17.2.4.2.2 Using spatula or similar tool, spread approximately half the second bead into a thin film.

3-17.2.4.2.3 Check that smeared portion of bead is of uniform color and is free of lumps. Nonuniform color and/or the presence of lumps is cause for rejection of complete lot of sealant.

3-17.2.4.3 PREPARATION OF TEST SPECIMENS.

CAUTION

Test specimens must be prepared within pot life of sealant. Use extreme care to avoid introducing air into sealant. Fill dishes carefully to prevent formation of voids.

3-17.2.4.3.1 Fill two analytical balance dishes (P/N 875129-00) with sealant, filling one dish with sealant from the nearly full cartridge, and the second dish with sealant from the back half of the cartridge. Fill dishes to slightly above level of edge of dish.

3-17.2.4.3.2 Procedures in this paragraph do not apply to dishes containing RTV sealant, which is self-leveling; they do apply to dishes containing other sealants. Place pieces of plastic sheet (polyethylene, 0.006 in. thick) or equivalent on flat, hard surface. Invert dishes, which are filled with sealant, and press them onto plastic sheet.

3-17.2.4.3.3 Allow the two specimens to cure, then perform hardness check specified in paragraph 3-17.2.4.4.

3-17.2.4.4 HARDNESS CHECK.

NOTE

Specimens may be checked at intervals shorter than cure time specified in table XI, but lot of sealant should not be rejected for faulty curing properties unless check shows this defect after specified cure time, adjusted for low temperature and/or low humidity, has elapsed.

CAUTION

Failure to check durometer for calibration before each series of measurements may result in inaccurate indications.

Spring block is a precision spring deflection gage; handle it with care and do not disturb the setting of the spring.

3-17.2.4.4.1 Determine that serial number of spring block supplied with durometer (P/N 875130-00) is same as that of durometer.

3-17.2.4.4.2 Check that following areas of durometer and spring block (figure 3-38) are free of dirt, dust, and other contaminants: indenter and bottom surface of durometer, top surface of spring block, and blind hole in which indenter will seat. Clean areas as necessary, using extreme care not to deform spring block or indenter.

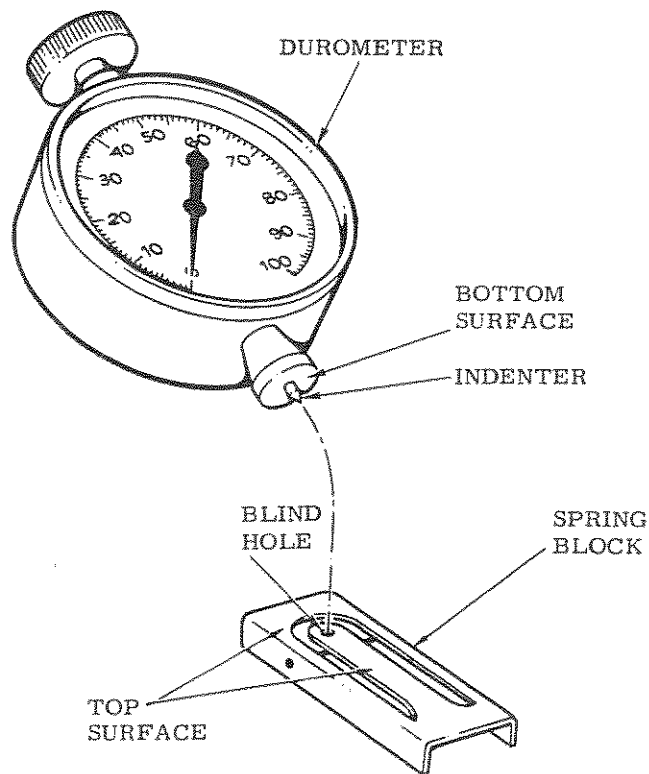


Figure 3-38 Durometer Calibration Check

CAUTION

Failure to place durometer or spring block on flat, hard surface may result in inaccurate indication.

3-17.2.4.4.3 Place durometer, indenter down, on flat, hard surface. Apply downward hand pressure until bottom surface of durometer seats flush on surface. Dial indicates 100 ± 1 while durometer is so positioned. Release hand pressure.

3-17.2.4.4.4 Place spring block on flat, hard surface. Place durometer on spring block, inserting indenter in blind hole. Apply downward hand pressure until bottom surface of durometer seats flush on top surface of spring block. When bottom surface of durometer is flush with surface of spring block, dial indicates ± 1 of number marked on spring block. Release hand pressure.

3-17.2.4.4.5 If dishes containing sealant were inverted onto plastic sheet, turn dishes over and remove plastic sheet.

3-17.2.4.4.6 Place dishes containing sealant on flat, hard surface so that sealant is up.

NOTE

Low reading may result if the indenter penetrates an air bubble. If this is suspected, discard the reading and take another reading.

3-17.2.4.4.7 Position durometer vertically above smooth area on surface of sealant of one test specimen; avoid areas containing gaps or depressions. Apply downward hand pressure until bottom surface of durometer is in contact with sealant; do not impress base of durometer into sealant. After durometer base has rested on sealant for approximately 5 sec, note indication on dial. Remove durometer.

3-17.2.4.4.8 Repeat procedures in paragraph 3-17.2.4.4.7 two more times, using a different area of same specimen for each test.

3-17.2.4.4.9 Calculate average of the three durometer indications. Acceptable average is at least 25.

NOTE

If the average hardness of one test specimen is significantly lower than that of the other, the sealant may have been improperly mixed. Before the complete lot is rejected, perform a sampling test on another kit of that lot. If sampling test of both specimens from the other kit indicates acceptable hardness (Shore A 25), the lot is acceptable.

3-17.2.4.4.10 Perform procedures in paragraphs 3-17.2.4.4.7 through 3-17.2.4.4.9 to check second test specimen.

3-17.2.4.4.11 If either test specimen fails to indicate average hardness of at least Shore A 25 reject complete lot.

3-17.2.5 PREPARATION OF SURFACES FOR SEALANT APPLICATION.

3-17.2.5.1 FOR APPLICATION OF PR1221 AND PRO-SEAL 890 SEALANTS.

3-17.2.5.1.1 Remove sealant residue from surfaces, using putty knife, blunt-edged tool, or other suitable mechanical device. Be careful not to damage surface beneath sealant residue.

3-17.2.5.1.2 If new component is to be installed, lightly abrade sealing surface of that component with fine-grade abrasive.

3-17.2.5.1.3 Wipe sealing surfaces, using clean lint-free cloth or tissue moistened with suitable solvent (toluene, acetone, methyl ethyl ketone). Wipe cleaned surfaces dry, using clean, dry lint-free cloth or tissue. Avoid handling cleaned and dried surfaces.

3-17.2.5.2 FOR APPLICATION OF RTV SEALANTS.

3-17.2.5.2.1 Remove sealant residue from surfaces, using instructions in referencing document.

3-17.2.5.2.2 Clean sealing surfaces with metal polish (Steeluster).

3-17.2.5.2.3 Remove metal polish from sealing surfaces, using clean lint-free cloth or tissue moistened with distilled water. Wipe surfaces dry, using clean, dry lint-free cloth or tissue.

3-17.2.5.2.4 Wipe sealing surfaces with clean lint-free cloth or tissue moistened with acetone or toluene. Allow surfaces to air-dry for at least 10 min before applying primer.

3-17.2.5.2.5 Using clean lint-free cloth, tissue, or soft brush, apply silicone primer (SS-4004) to sealing surfaces until surfaces are uniform pink color (i.e., surfaces are completely coated, with no discontinuities). Avoid excessive application of primer.

3-17.2.5.2.5A Allow surfaces to air-dry for at least 1 hr before applying sealant. If sealant is not applied within 8 hrs after priming, remove primer with methyl ethyl ketone or toluene and recoat sealing surfaces with primer. Wait at least 1 hr before applying RTV sealant to primed surfaces.

3-17.2.5.2.6 After primer has dried, inspect surfaces for uniform pink color. If light or dappled areas are observed, apply more silicone primer as specified in paragraphs 3-17.2.5.2.5 and 3-17.2.5.2.5A and repeat inspection. Do not proceed until uniform pink color is obtained.

3-17.2.5.3 FOR APPLICATION OF PRO-SEAL 706-B2 AND EPIBOND 122. Procedures for preparing surfaces for application of these sealants are specified in applicable referencing documents.

3-17.2.6 MIXING OF SEALANT FOR APPLICATION. Mix sealant as specified in paragraph 3-17.2.4.1.

CAUTION

Sealant must be applied and test specimen prepared within pot life of sealant.

3-17.2.7 VISUAL INSPECTION OF MIXED SEALANT. Inspect mixed sealant as specified in paragraph 3-17.2.4.2, except if sealant is of nonuniform color and/or if lumps are present, reject cartridge of sealant.

3-17.2.8 APPLICATION OF SEALANT AND PREPARATION OF TEST SPECIMEN.

3-17.2.8.1 Make sure that surfaces to be sealed have been prepared as specified in paragraph 3-17.2.5. Apply sealant according to instructions in referencing document. While sealant is curing, perform no operations on assembly except as specified in referencing document.

CAUTION

Extreme care must be exercised to avoid introducing air into sealant. Fill dish carefully to prevent formation of voids.

3-17.2.8.2 Fill one analytical balance dish (P/N 875129-00) with sealant to slightly above level of edge of dish.

3-17.2.8.3 Procedures in this paragraph do not apply to dish containing RTV sealant, which is self leveling; they do apply to a dish containing another sealant. Place piece of plastic sheet (polyethylene, 0.006 in. thick) or equivalent on flat, hard surface. Invert dish, which is filled with sealant, onto plastic sheet.

3-17.2.8.4 Place test specimen in vicinity of assembly to which sealant has been applied so that specimen is exposed to same environment as assembly.

3-17.2.9 HARDNESS CHECK.

NOTE

Specimen may be checked at interval shorter than cure time specified in table XI.

CAUTION

Failure to check durometer calibration before each series of measurements may result in inaccurate indications. Spring block is a precision spring deflection gage; handle it with care and do not disturb the setting of the spring.

3-17.2.9.1 Determine that serial number of spring block supplied with durometer (P/N 875130-00) is same as that of durometer.

3-17.2.9.2 Check that following areas of durometer and spring block (figure 3-38) are free of dirt, dust, and other contaminants: indenter and bottom surface of durometer, top surface of spring block, and blind hole in which indenter will seat. Clean areas as necessary, using extreme care not to deform spring block or indenter.

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CAUTION

Failure to place durometer or spring block on flat, hard surface may result in inaccurate indication.

3-17.2.9.3 Place durometer, indenter down, on flat, hard surface. Apply downward hand pressure until bottom surface of durometer seats flush on surface. Dial indicates 100 ± 1 while durometer is so positioned. Release hand pressure.

3-17.2.9.4 Place spring block on flat, hard surface. Place durometer on spring block, inserting indenter in blind hole. Apply downward hand pressure until bottom surface of durometer seats flush on top surface of spring block. When bottom surface of durometer is flush with surface of spring block, dial indicates ± 1 of number marked on spring block. Release hand pressure.

3-17.2.9.5 If dish containing sealant was inverted onto plastic sheet, turn dish over and remove plastic sheet.

3-17.2.9.6 Place dish containing sealant on flat, hard surface so that sealant is up.

NOTE

Low reading may result if the indenter penetrates an air bubble. If this is suspected, disregard the reading and take another reading.

3-17.2.9.7 Position durometer vertically above smooth area on surface of sealant of test specimen; avoid areas containing gaps or depressions. Apply downward hand pressure until bottom surface of durometer is in contact with sealant; do not impress base of durometer into sealant. After durometer base has rested on sealant for approximately 5 sec, note indication on dial. Remove durometer.

3-17.2.9.8 Repeat procedures in paragraph 3-17.2.9.7 two more times, using a different area of specimen for each test.

3-17.2.9.9 Calculate the average of the three durometer indications. If average is 25 or higher, sealant is considered cured. If average is lower than 25, proceed to following paragraph.

3-17.2.9.10 If hardness check is made before cure time has elapsed and average of durometer indications

is lower than 25, allow sealant to continue to cure, performing harness checks when desired. If sealant has not reached required hardness by the time the cure time has elapsed, proceed to following paragraph.

3-17.2.9.11 If hardness check is made after cure time has elapsed and average of durometer indications is lower than 25, either of 2 courses of action may be taken: (1) Reject sealant. (2) Allow sealant to continue to cure, performing hardness checks when desired until sealant reaches required hardness, or until it becomes apparent that sealant will never reach required hardness and must be rejected.

3-17.3 LUBRICATION OF PREFORMED PACKINGS, O-RINGS, AND OTHER TYPE ELASTOMERIC SEALS. When lubrication of an elastomeric seal by means of polyglycol grease, electrical insulating compound (DC-4), shortening compound, or other material is required, use only the lubricant specified in the applicable referencing document. If polyglycol grease is specified and is not already mixed, prepare grease as follows: Using 15 to 16 parts by weight of silica (Cabosil) to 100 parts by weight of Ucon LB-1800X lubricant, add silica to lubricant in approximately three equal portions, mixing thoroughly by means of spatula or mechanical mixer after each portion is added; warm materials to 50°F to 70°F , if desired, to facilitate mixing.

3-17.3.1 Insure that seal is clean prior to application of lubricant. Refer to TP 35-51 for procedures for cleaning of preformed packings (O-rings) and sealing surfaces.

CAUTION

When applying the lubricant to the seal, care must be exercised not to stretch or damage the seal and to avoid application of excessive amounts of lubricant; do not use a sharp or rough instrument. A suitable method of application is to use a clean cloth saturated with lubricant; remove all excess quantities of lubricant not absorbed by the cloth.

3-17.3.2 Apply sufficient lubricant to coat seal completely with thin film of lubricant and to give adequate lubrication to entire surface over which seal travels; do not allow excess lubricant to contaminate other surfaces or exude excessively from between mating surfaces. Wipe off any excess lubricant.

SECTION 4

REPAIR OF DAMAGED METALS, PLASTICS, WOODS, FABRICS, AND OTHER MATERIALS

4-1 GENERAL.

Procedures in this section cover the inspection (if applicable) and repair of holes, dents, bends, gouges, tears, etc in various types of materials. Where required, other procedures in this manual are to be used in conjunction with the procedures in this section. Whenever material damage will entail surface refinishing after completion of repair procedures, perform refinishing in accordance with applicable surface refinishing procedures in TP 35-51, using the same or equivalent materials and colors as specified for the original part; except in those cases where specific surface refinishing procedures are given in this section. Refer to Section 2 for applicable maintenance standards, including safety precautions.

4-2 MEASUREMENT OF SURFACE IRREGULARITIES.

The following paragraphs describe various techniques for measuring and checking surface irregularities such as dents, protrusions, chips, scratches, scribe lines, etc. In all cases, the measuring equipment and method specified are to be used; if none is specified, any feasible method described here, or any equivalent method, may be used depending on the equipment available (depth gauges, feeler gauges, etc). Refer to table XII for a list of the equipment described and for specific information as to scale graduations and range (if applicable), etc.

4-2.1 STRAIGHTEDGE. A straightedge is used to check depressions or protrusions in a flat or cylindrical-shaped surface. It can also be used, in conjunction with a gap setting gauge, to determine whether the depth of a depression in such a surface is greater or less than a specified maximum.

4-2.1.1 Lay straightedge on surface and compare contour of surface with straightedge. In case of cylindrical surface, lay straightedge parallel to longitudinal axis of cylinder.

4-2.1.2 To check depression depth, select gap setting gauge of same thickness as specified maximum depression depth and insert gauge into depression. If gauge can be routed beneath straightedge without lifting straightedge, depth of depression is greater than specified maximum.

4-2.2 CONTOUR TEMPLATE. The contour template is used to check depressions or protrusions in an

irregularly-shaped or non-linear tapered surface, such as tail or nose sections. It can also be used in conjunction with a gap setting gauge, to determine whether the depth of a depression in such a surface is greater or less than a specified maximum. Fabrication and use of the contour template is as follows:

4-2.2.1 Stand piece of sheet metal (or other suitable material) on edge of surface having contour identical to surface being checked. Block sheet metal on one end so it is firm against contour.

4-2.2.2 Using partially opened dividers, scribe contour onto sheet metal by following contour with one divider point while second point is scribing template.

4-2.2.3 Dress out sheet to scribed line. Remaining part is contour template.

4-2.2.4 Position template on surface to be checked and compare contour of surface to contour of template.

4-2.2.5 To check depression depth, select gap setting gauge of same thickness as specified maximum depression depth and insert gauge into depression. If gauge can be routed beneath edge of template without lifting template, depth of depression is greater than specified maximum.

4-2.3 MACHINIST'S STEEL RULE. The machinist's steel rule (table XII) is used to check surface irregularities in a flat or cylindrical surface in the same manner as with a straightedge (paragraph 4-2.1). The flexibility of the rule allows making length or width measurements in the direction of a cylindrical contour. Depth measurements are made in conjunction with a gap setting gauge.

4-2.4 ADJUSTABLE CURVE DRAFTING RULER. The adjustable curve drafting ruler (figure 4-1 and table XII) is used to check surface irregularities in an irregularly-shaped or non-linear tapered surface, such as tail or nose sections, in the same manner as with a contour template (paragraph 4-2.2). Although the bearing surface of the drafting ruler is not graduated, length and width dimensions can be obtained by marking the ruler, straightening the ruler out, and measuring between the marks with a graduated scale. Depth measurements are obtained in conjunction with a gap setting gauge.

4-2.5 GAP SETTING GAUGE. The gap setting gauge (table XII) is used in conjunction with the straightedge, contour template, steel rule, or drafting ruler for checking the depth of surface depressions.

TABLE XII
GAUGES FOR MEASURING SURFACE IRREGULARITIES

GAUGE	AEC PART NO.	SCALE (If Applicable)		USE	ALSO REQUIRED
		Graduations	Range		
Straightedge	-	-	-	Checking surface contour	-
		-	-	Depth measurements	Gap setting gauge
		-	-	Length and width measurements	Graduated scale
Contour Template	-	-	-	Checking surface contour	-
		-	-	Depth measurements	Gap setting gauge
Ruler, Drafting, Adjustable Curve	870415-00	-	12 in. long adjustable to 4-in. dia. curve	Checking surface contour	-
		-	-	Depth measurements	Gap setting gauge
Rule, Steel, Machinist's	800615-00	-	6 in. long	Length and width measurements	Graduated scale
		-	-	Checking surface contour	-
Gauge, Gap Setting	870450-00	-	Two feelers, 0.010- and 0.012-in. thick	Depth measurements	Gap setting gauge
		-	-	Length and width measurements	-
		-	-	Depth measurements	Straightedge, contour template, drafting ruler, steel rule, etc
Gauge, Depth, Dial Indicating	870451-00	-	Two feelers, 0.040- and 0.054-in. thick	Depth measurements	Straightedge, contour template, drafting ruler, steel rule, etc
		-	-	Depth measurements	-
Magnifier, Measuring	837564-00	-	0.125 in.	Depth measurements	-
		-	-	Radius measurements	-
		-	-	Angle measurements	-
		-	-	Length and width measurements	-
		-	-	Length and width measurements	-
Magnifier, Measuring	870185-00	-	Three standards, 0.001-, 0.002-, and 0.003-in. thick	Line width comparisons	-
		-	-	Line width comparisons	-

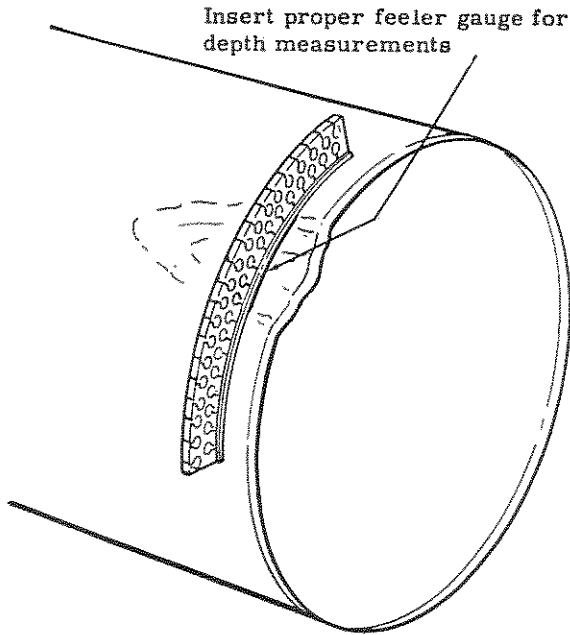


Figure 4-1 Use of Adjustable Curve Drafting Ruler

4-2.6 DIAL INDICATING DEPTH GAUGE. The dial indicating depth gauge (figure 4-2 and table XII) is used for measuring the depth of surface depressions in flat and cylindrical surfaces. The gauge consists of a knife-edge base 2-1/2 in. long, a needle-point plunger, and dial indicator. The dial is the balanced type, adjustable relative to zero. For accurate measurements, the gauge must be held perpendicular to the surface being measured. On cylindrical surfaces, the gauge must be oriented parallel and perpendicular to the longitudinal axis of the cylinder. Suggested method of use is as follows:

NOTE

Unless otherwise specified, the depth limitations given for surface defects apply only to the base material (metal, ablative material, etc), and not to any coatings applied over the base material. Hence, when measuring the depth of a defect in a coated surface, the depth gauge must either be zero-adjusted relative to the bare uncoated surface, or the actual depth measurement must be made with the base of the gauge resting on an uncoated area of the surface. This restriction does not apply to anodic coatings and other type chemical films which are not sufficiently thick to significantly affect the depth measurements.

4-2.6.1 To zero-adjust gauge, set knife-edge base on smooth, hard, flat surface and lightly press down plunger at top of dial. While holding plunger depressed, loosen zero-adjust lock, adjust dial so that needle points to zero, and lock zero-adjust lock. Release plunger.

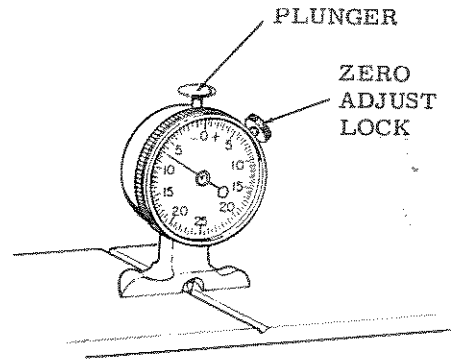


Figure 4-2 Use of Dial Indicating Depth Gauge

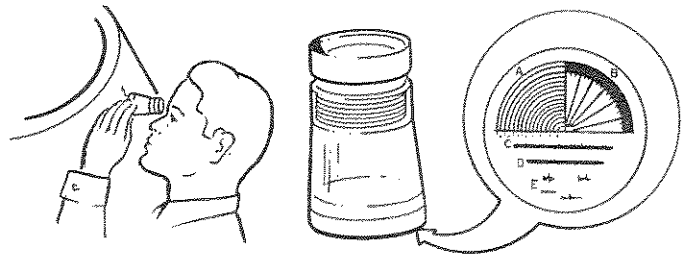


Figure 4-3 Use of Measuring Magnifier

4-2.6.2 Place gauge on surface to be measured so that needle point is centered over depression. Press down plunger and compute depth from zero on dial.

4-2.6.3 Dial indicating depth gauge can be used for depth measurements on aspherical surfaces provided scratch or dent is not over 1/8 in. wide and the depth gauge is zero adjusted on the aspherical surface prior to making the measurement.

4-2.7 MEASURING MAGNIFIER. The measuring magnifier (figure 4-3 and table XII) consists of an adjustable lens, clear plastic body, and separate general purpose scale which attaches to the end of the magnifier body. To focus the magnifier, press the scale against a flat, white surface and turn adjustable lens until the scale comes into focus. For accurate measurements, the scale must be pressed flush against the surface being examined. The magnifier is capable of measuring radii, angles, line lengths, and line widths of surface irregularities in a flat surface.

4-3 DYE PENETRANT INSPECTION.

When specified, this inspection of surfaces of certain materials is performed to determine discontinuities or other defects in surfaces which may be harmful to the particular part. Materials in inspection penetrant kit are used for this inspection.

4-3.1 Remove all paint, primer, products of corrosion, scale, grit, and other foreign matter in accordance with procedures in TP 35-51. Clean surface with remover supplied with the kit or with trichloroethylene (technical). Do not use abrasives. Rinse component thoroughly with cold water, and allow component to dry before proceeding.

WARNING

Materials used in this procedure are extremely toxic and harmful to the skin. Observe applicable safety precautions (paragraph 2-2).

4-3.2 Spray or brush penetrant on component. Use penetrant at full strength, applying wet, even coat. If spray gun is used, adjust pressure to about 10 psi.

NOTE

The brush method requires absolutely clean, soft-bristle paint brushes and wide-mouthed containers which can be sealed when not in use. Use a different brush for each compound. Brushes should be wide enough to give good, even strokes on component.

4-3.3 Allow component to stand for 30 min.

4-3.4 After penetration is assured, remove penetrant from surface by first wiping off excess, then by applying remover by spraying, or wiping with a clean sponge or cloth soaked in remover. Follow by swabbing or hosing with cold, clear water. Thoroughly clean and dry component.

4-3.5 Spray or brush one thin, even coat of developer on component. Adjust spray gun to spray wide fan of developer at about 30 psi. If brush is used, apply developer with single passes in one direction; avoid overlapping. Allow component to dry.

NOTE

Developer must be mixed thoroughly before and during use. If developer does not dry to a smooth white finish, and is pinkish or reddish in appearance, cleaning has not been performed properly, and entire process must be repeated.

4-3.6 After developer has thoroughly dried, inspect component for cracks or other defects, which appear as red marks on white background. A crack appears as a red line or a series of red dots close together in a line. Scattered red dots with no particular pattern indicate pits or porosity. The extent or depth of a crack is indicated by leaving developer on for 30 to 60 min. Any crack is cause for rejection.

4-3.7 Subsequent to satisfactory inspection, thoroughly clean surface with dye-remover compound or with trichloroethylene (technical).

4-3.8 Refinish surface inspected as specified for part.

4-4 REPAIR OF METAL SURFACE DEPRESSIONS.

4-4.1 REPAIR BY FILLING. Procedures in this paragraph cover the filling and smoothing of surface depressions in aerodynamic and other type metal surfaces. Acceptable materials are aerodynamic smoothing compound (EC-1184) (air cure) and the following chemically-cured materials: metal surface dent filler (EC-1328 and Pro-Seal 715) and plastic aluminum modeling compound. After cure, the air cure compound provides a semi-hard flexible surface. Both types of materials can be applied to bare metal surfaces, chemically-treated surfaces, or surfaces primed with zinc chromate primer coating.

4-4.1.1 PROCEDURES.

WARNING

Cleaning and compound materials used in these procedures are volatile and flammable; observe applicable safety precautions (paragraph 2-2).

CAUTION

Pot life of chemical cure compounds after mixing is approximately 3 hrs at room temperature (70° to 80°F). The compound must be used as soon as possible after mixing.

4-4.1.1.1 Clean damaged surface, especially recesses, of all dirt, oil, grease, chips, burrs, etc, in accordance with procedures in TP 35-51. Perform final cleaning by applying solvent by means of brush and wiping dry with clean cloth before solvent evaporates.

NOTE

When cleaning recesses around sealed joints where excess sealing compound has exuded, sealing compound need not be completely removed provided compound is firmly adhered to surface.

4-4.1.1.2 Mix compound in accordance with manufacturer's instructions. Work compound with spatula or other suitable tool to minimize inclusion of air bubbles.

4-4.1.1.3 Using spatula, fill holes, recesses, deep scratches, grooves, laps, etc, with compound as required. Work compound into depressions to completely fill all cavities, taking care to exclude any

air bubbles. If applying air cure compound, apply approximately 25 percent excess to allow for shrinkage during curing. Avoid thicknesses of air cure compound greater than 1/4 in.; if such thicknesses are necessary, apply and cure two layers of compound separately.

4-4.1.1.4 Cure air-cure compound or chemical-cure compound in accordance with manufacturer's instruction for type of compound being used. Do not attempt to smooth or handle surface until compound is completely cured.

4-4.1.1.5 Remove excess of fully-cured compound by means of knife or other suitable tool. Finish with 400-grit abrasive paper until repaired surface fairs with surrounding surface and contours match.

4-4.1.2 INSPECTION. Depressions on surface of part shall be completely filled with compound and the process shall provide a smooth surface faired to match contour of part. Filler material shall be adherent, free of air bubbles, dirt, and foreign material, and shall be adherent to surface to which it was applied

4-4.1.3 REFINISHING OF FILLED SURFACE. Refinish repaired surface in accordance with paint requirements of surrounding area.

NOTE

If EC-1184 was used as the filling compound, application of primer or lacquer over the compound may soften the EC-1184 patch and may cause bubbles or pinholes. The bubbles or pin holes can be minimized by applying only light coats of primer or lacquer. The softened EC-1184 should reharden sufficiently within 48 hrs to permit normal handling.

4-4.2 REPAIR OF MINOR CUTS, DINGS, OR SCRATCHES IN 24S, 61S, and 75S ALUMINUM SHEET. Marks, cuts, scratches, and pits which do not extend through the alclad sheet are acceptable without repair.

NOTE

This repair is satisfactory if damage is a minimum of 2D away from rivet holes.

4-4.2.1. If damage is through alclad, but does not exceed specified depth in table XIII for material thickness, burnish or blend out damaged areas and paint with alodine. Refer to procedures in TP 35-51 for application of brush alodine solution.

4-4.2.2 Wrinkles are satisfactory provided they do not exceed a maximum of 10% of the material thickness.

CAUTION

Do not use set-cut repair on any skin carrying tension loads.

4-4.2.3 If a set cut is one quarter of the sheet thickness or less, burnish or blend in cut. If cut is more than one quarter, but less than one half of the sheet thickness, drill one stop hole No. 40 (0.098) at each end of cut. Smooth out sharp edges of set cut. Coat cut with alodine for corrosion prevention in accordance with procedures in TP 35-51.

4-5 PATCH REPAIR OF SMALL HOLES IN METAL SHEET.

4-5.1 GENERAL. Holes in sheet metal are filled or covered, using any one of several methods, depending on location, accessibility, and finish requirement.

4-5.2 HOLES SMALLER THAN 1/2 IN. IN DIAMETER. In general, smaller holes are usually not greatly detrimental in a structural sense unless they are an appreciable percentage of the width of the sheet, such as the web of a narrow frame. If it is necessary for sealing purposes, small holes may be plugged in a variety of ways.

4-5.2.1 Plug small holes by filling in accordance with procedures in paragraph 4-4.1.

4-5.2.2 Drive a rivet or doweling into the hole, and dress rivet or doweling to match contour of surrounding area. Install rivet in accordance with procedures in paragraph 3-6.

4-5.3 HOLES 1/2 TO 1 IN. IN DIAMETER. The patch repair as specified herein is for the purpose of covering holes, as required. The patch must be made of the same material as the damaged sheet, and must be at least the same gauge.

4-5.3.1 Irregularly shaped or jagged holes must be cleaned out (all burrs and sharp edges removed) to the smallest circular hole which will completely encompass the damage.

4-5.3.2 Refer to table XIV, XV, or XVI for patch diameter, number, size, and type of rivet required for the particular case at hand. Refer to figure 4-4 for types of rivet patterns specified in the tables. If the required hole size is not tabulated, use the table for the next larger size hole.

CAUTION

Where dimpling of rivets is required, do not machine countersink. Countersink by hand to avoid possible additional damage by denting of original material.

TABLE XIII
MAXIMUM DEPTH OF DAMAGE VS SHEET THICKNESS

SHEET THICKNESS (In.)	MAX REPAIRABLE DAMAGE DEPTH	SHEET THICKNESS (In.)	MAX REPAIRABLE DAMAGE DEPTH	SHEET THICKNESS (In.)	MAX REPAIRABLE DAMAGE DEPTH
0.012	0.002	0.051	0.003	0.125	0.006
0.016	0.002	0.064	0.004	0.156	0.009
0.020	0.003	0.072	0.004	0.188	0.008
0.025	0.003	0.081	0.004	0.250	0.015
0.032	0.003	0.091	0.004	0.312	0.017
0.040	0.003	0.102	0.006	0.375	0.020

NOTE

While these repairs apply to circular holes, the patch itself need not necessarily be circular. Square or rectangular patches are acceptable if it is desired to pick up a stiffener or other member with one or more edges of the patch. If square or rectangular patches are used, all corners must be well rounded.

4-5.3.3 If a patch is to be applied to an external surface where appearance is a consideration, a "button" may be tack-riveted or spot-welded to the patch as shown in figure 4-5. When the sheet metal to be repaired is not external skin, the "button" may be omitted and protruding-head rivets of the same size may be substituted for the flush rivets specified.

4-5.3.4 If a patch is to be applied to a curved surface, match contour of patch to surface repaired in accordance with procedures in paragraph 4-6.

4-5.3.5 Install rivets in accordance with procedures in paragraph 3-6.

4-5.4 HOLES LARGER THAN 1 IN. DIAMETER. Larger holes in sheet metal are defined as those that cannot be cleaned out with a remaining 1-in. diameter, or smaller, circular hole. All basic specifications for repairing small holes also apply to larger holes. However, the basic difference is increasing difficulty in restoring original strength of sheet. As size of hole to be repaired increases, difficulty of restoring original strength increases proportionally. Usually, an adequate general repair will be found impractical as hole size increases. Specific circumstances must be taken into consideration: Part to be repaired, its function, and necessity for repair (vs replacement and availability of material). For these reasons, general repair of larger holes has not been presented in this manual.

4-5.5 HOLES IN PRESSURIZED SHEET METAL CONTAINERS. Holes in pressurized sheet metal

containers may be filled with aerodynamic smoothing compound, provided they are 1/4 in. or less in diameter and the container will not be pressurized to more than 16 psig after the holes are filled.

4-5.5.1 Prepare surface and fill hole with compound in accordance with procedures in paragraph 4-4.1.

4-5.5.2 On underside of filled hole (inside of container), apply a coat of sealing compound (gas tank) approximately 3/32 in. thick by twice the diameter of the filled hole. Allow sealing compound to dry thoroughly before pressurizing container.

4-6 REPAIR OF RE-USABLE METAL CONTAINERS.

4-6.1 GENERAL. Immediately upon removal of material from container, markings or tags shall be obliterated in accordance with procedures in TP 35-51. Body, cover, gasket, locking ring, bolt, and nut shall be fastened together to prevent loss.

4-6.2 TYPES OF CONTAINERS.

4-6.2.1 INTERIOR CONTAINERS. Interior shipping re-usable metal drums, with removable head (Military Specification MIL-D-6055) are containers having a 1-piece drawn body.

4-6.2.1.1 Containers having a 2-piece body with soldered seams are not authorized for future procurement.

4-6.2.1.2 Instructions for the repair of these containers are included for those containers already on hand.

4-6.2.2 EXTERIOR CONTAINERS. Exterior steel shipping containers (Military Specification MIL-D-6054) are standard containers ranging in size from 4-gal through the 6-, 7-, 9-, 13-, 15-, and 19-gal sizes.

TABLE XIV
PATCH DATA - 23S-T4 CLAD AND 24S-T4 CLAD ALUMINUM

SHEET GAUGE	PATCH DIA "A"*	RIVET TYPE	NO. RIVETS REQD	RIVET PATTERN TYPE*	MIN EDGE DISTANCE*
1-IN. DIA HOLES					
0.020	2-1/8	AD4/D2	8	3	9/32
0.025	2-1/2	AD5/D2	8	3	3/8
0.032	2-1/2	AD5/D2	8	3	3/8
0.040	2-1/2	AD5/D2	8	3	3/8
0.051	2-3/4	DD6/D2	6	2	7/16
0.064	3	DD6/D2	8	3	7/16
0.072	3-1/4	NAS177-8/DC**	6	2	9/16
0.081	3-1/4	NAS177-8/DC**	6	2	9/16
0.091	3-1/4	NAS177-8/DC**	6	2	9/16
3/4-IN. DIA HOLES					
0.020	1-7/8	AD4/D2	6	2	9/32
0.025	2-1/4	AD5/D2	6	2	3/8
0.032	2-1/4	AD5/D2	6	2	3/8
0.040	2-1/4	AD5/D2	6	2	3/8
0.051	2-1/2	DD6/D2	6	2	7/16
0.064	2-1/2	DD6/D2	6	2	7/16
0.072	3	NAS177-8/C	6	2	9/16
0.081	3	NAS177-8/C	6	2	9/16
0.091	3	NAS177-8/C	6	2	9/16
1/2-IN. DIA HOLES					
0.020	1-5/8	AD4/D2	4	1	9/32
0.025	2	AD5/D2	4	1	3/8
0.032	2	AD5/D2	4	1	3/8
0.040	2	AD5/D2	4	1	3/8
0.051	2-1/4	DD6/D2	4	1	7/16
0.064	2-1/4	DD6/CC	4	1	7/16
0.072	2-1/4	DD6/C	4	1	7/16
0.081	2-1/4	DD6/C	4	1	7/16
0.091	2-1/4	DD6/C	4	1	7/16
*Refer to figure 4-4.					
**Patch must be one gauge heavier than damaged sheet.					

4-6.2.3 NONSTANDARD CONTAINERS. Nonstandard containers are those containers which do not conform to government specification requirements as to size, thickness of material, type of closure, etc. These containers do not have a stock number stamped, stenciled or embossed on them. For the purpose of these repair instructions, nonstandard containers are treated in accordance with instructions for the repair of exterior containers.

4-6.3 REPAIR LIMITATIONS.

4-6.3.1 INTERIOR CONTAINERS (Figure 4-6).

4-6.3.1.1 Dents along the chime seam or the side seam of 2-piece containers shall be cause for

rejection. Dents along the sealing lip are not repairable. All other dents are repairable.

4-6.3.1.2 Dents along the sealing lip of drawn 1-piece containers are not repairable. All other dents are repairable.

4-6.3.2 EXTERIOR CONTAINERS (Figure 4-6). Due to the welded construction of exterior containers, all dents are repairable with the exception of dents along the sealing lip. No repairs shall be attempted where punctures of the body are involved.

4-6.3.3 COVERS. Small dents in the cover or lid of a metal container are repairable, provided they do not distort the cover or impair assembly with

TABLE XV
PATCH DATA - 75S-T6 CLAD ALUMINUM

SHEET GAUGE	PATCH DIA "A"*	RIVET TYPE	NO. RIVETS REQD	RIVET PATTERN TYPE*	MIN EDGE DISTANCE*
1-IN. DIA HOLES					
0.020	2-1/8	AD4/D2	10	4	9/32
0.025	2-1/2	AD5/D2	8	3	3/8
0.032	2-3/4	DD6/D2	6	2	7/16
0.040	2-3/4	DD6/D2	6	2	7/16
0.051	3	DD6/D2	8	3	7/16
0.064	3-1/4	NAS177-8/DC**	6	2	9/16
0.072	3-1/4	NAS177-8/DC**	6	2	9/16
0.081	3-1/4	NAS177-8/DC**	6	2	9/16
0.091	3-11/16	NAS177-8/C	8	3	9/16
3/4-IN. DIA HOLES					
0.020	1-7/8	AD4/D2	8	3	9/32
0.025	2-1/4	AD5/D2	6	2	3/8
0.032	2-1/4	AD5/D2	6	2	3/8
0.040	2-1/4	AD5/D2	6	2	3/8
0.051	2-1/2	DD6/D2	6	2	7/16
0.064	3	NAS177-8/C	6	2	9/16
0.072	3	NAS177-8/C	6	2	9/16
0.081	3	NAS177-8/C	6	2	9/16
0.091	3	NAS177-8/C	6	2	9/16
1/2-IN. DIA HOLES					
0.020	1-5/8	AD4/D2	4	1	9/32
0.025	2	AD5/D2	4	1	3/8
0.032	2	AD5/D2	4	1	3/8
0.040	2	AD5/D2	4	1	3/8
0.051	2-1/4	DD6/D2	4	1	7/16
0.064	2-1/4	DD6/C	4	1	7/16
0.072	2-1/4	DD6/C	4	1	7/16
0.081	2-1/4	DD6/C	4	1	7/16
0.091	2-1/4	DD6/C	4	1	7/16
*Refer to figure 4-4					
**Patch must be one gauge heavier than damaged sheet					

asket or containers. If the removal of an otherwise repairable dent results in distortion, the cover shall be rejected.

-6.3.4 EXTERIOR LOCKING RINGS. Small dents on the locking ring will impair the uniform clamping pressure and subsequent proper sealing, and are cause for rejection of the ring. Any major distortion of the locking ring is not repairable.

-6.3.5 GASKETS. Distortion or deformation of the gasket due to swelling, stretching, pinching, or earing shall be cause for rejection. Since obtaining a moisture-vaporproof seal is dependent on the gasket, determine serviceability of gasket by careful visual inspection.

4-6.4 PROCEDURE.

4-6.4.1 Pound out dents in container or cover to within 1/8 in. of original contour, using proper tools in accordance with good commercial practice.

4-6.4.2 Rust on containers is removed in accordance with applicable procedures in TP 35-51. Immediately after cleaning or repair operations, repaint container cover and locking ring as required in accordance with applicable procedures in TP 35-51.

4-6.5 TESTING. Testing of repaired metal containers prior to reuse is optional, with the exception that tests shall be performed when a doubt exists as to the reusability of a container. Test

TABLE XVI
PATCH DATA - ANNEALED CORROSION-RESISTANT STEEL

SHEET GAUGE	PATCH DIA "A"*	RIVET TYPE	NO. RIVETS REQD	RIVET PATTERN TYPE*	MIN EDGE DISTANCE*
1-IN. DIA HOLES					
0.020	2-1/8	M4/D2	6	2	9/32
0.025	2-1/8	M4/D2	6	2	9/32
0.032	2-1/2	M5/D2	6	2	3/8
0.036	2-1/2	M5/D2	6	2	3/8
0.040	2-3/4	M6/D2	6	2	7/16
0.045	2-3/4	M6/D2	6	2	7/16
0.050	2-3/4	M6/D2	6	2	7/16
0.063	2-3/4	M6/D2	6	2	7/16
3/4-IN. DIA HOLES					
0.020	1-7/8	M4/D2	6	2	9/32
0.025	1-7/8	M4/D2	6	2	9/32
0.032	2-1/4	M5/D2	6	2	3/8
0.036	2-1/4	M5/D2	6	2	3/8
0.040	2-1/2	M6/D2	6	2	7/16
0.045	2-1/2	M6/D2	6	2	7/16
0.050	2-1/2	M6/D2	6	2	7/16
0.063	2-1/2	M6/D2	6	2	7/16
1/2-IN. DIA HOLES					
0.020	1-5/8	M4/D2	4	1	9/32
0.025	1-5/8	M4/D2	4	1	9/32
0.032	2	M5/D2	4	1	3/8
0.036	2	M5/D2	4	1	3/8
0.040	2-1/4	M6/D2	4	1	7/16
0.045	2-1/4	M6/D2	4	1	7/16
0.050	2-1/4	M6/D2	4	1	7/16
0.063	2-1/4	M6/D2	4	1	7/16
*Refer to figure 4-4					

of container is performed only after completion of all repair operations.

4-6.5.1 GENERAL.

4-6.5.1.1 To test container bodies, fit perfect cover of proper size with suitable connection for application of air pressure. Place this cover on container body, using suitable gaskets, locking ring, and bolt.

4-6.5.1.2 To test covers, gaskets, and locking rings, fit container body, of proper size to fit parts being tested, with suitable connection for application of air pressure. Secure cover, gasket, and locking ring properly on prepared container body.

4-6.5.2 PRESSURE TEST.

4-6.5.2.1 Apply air pressure of 3 psi to inside of container being tested. Check container for leaks by submerging in water. If air bubbles are observed

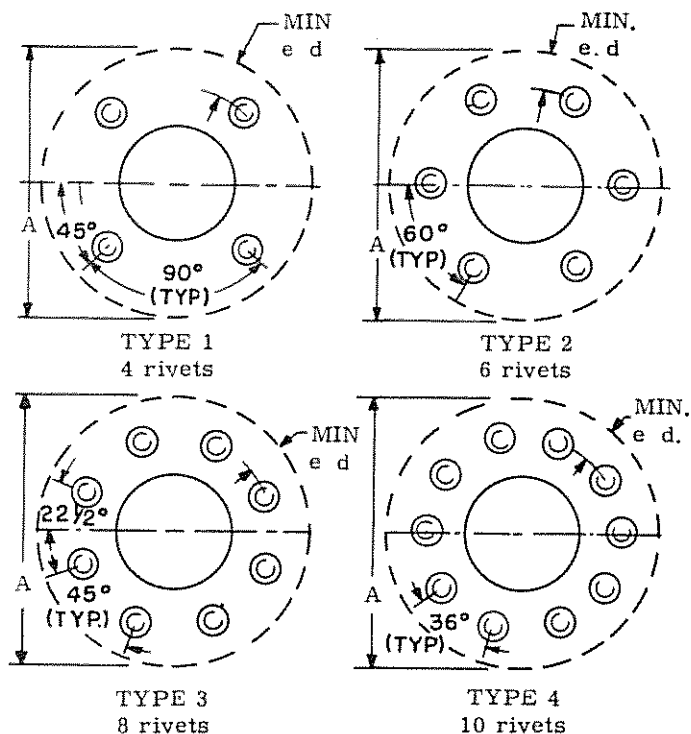
escaping in fairly continuous stream, container is faulty and shall be rejected.

4-6.5.2.2 Leakage from cover or body that has been fitted with air connection shall not be cause for rejection of part being tested.

4-6.5.2.3 If air escaping from part being tested is in form of small intermittent bubbles, hole or leak is too small to cause any damage to items to be preserved in container.

4-7 REPAIR OF TUBULAR STEEL FRAMES.

These procedures detail the repair of tubular frames on H-items whose normal purpose is to support fabric covers, with the exception that no repair is permitted on those members of frames which serve as members of structures designed for lifting by overhead or forklift equipment.



Note: Actual dimensions tabulated in tables XXI, XXII, and XXIII.

Figure 4-4 Rivet Patterns for Patched Sheet

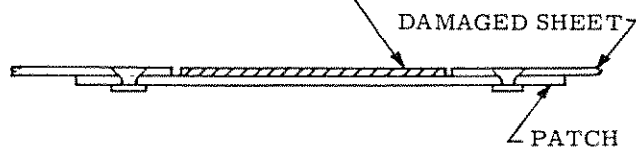
4-7.1 BENT FRAME. When tubular frame is bent, but tube is not cracked or broken, straighten frame by cold working to match contour of similar frame which is known to be undamaged. Tube flattening shall not exceed 15 percent of outside diameter after repair.

4-7.2 FRAME METAL CRACKED OR BROKEN. When a tubular frame is cracked or broken, repair as follows and in accordance with table XVII.

4-7.2.1 Using hacksaw or other cutting device, cut out damaged section not to exceed 20 in. in length. Break all sharp edges.

4-7.2.2 Using similar undamaged frame as template, note dimension of damaged section previously removed.

"BUTTON" FILLER FOR FLUSHNESS. MAY BE EITHER TACK-RIVETED OR SPOT-WELDED TO PATCH.



TYPICAL SECTION

Figure 4-5 Button Filler Attached to Patch

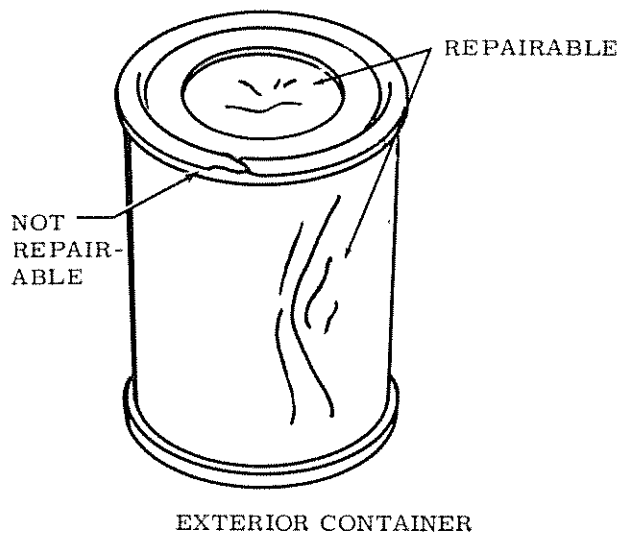
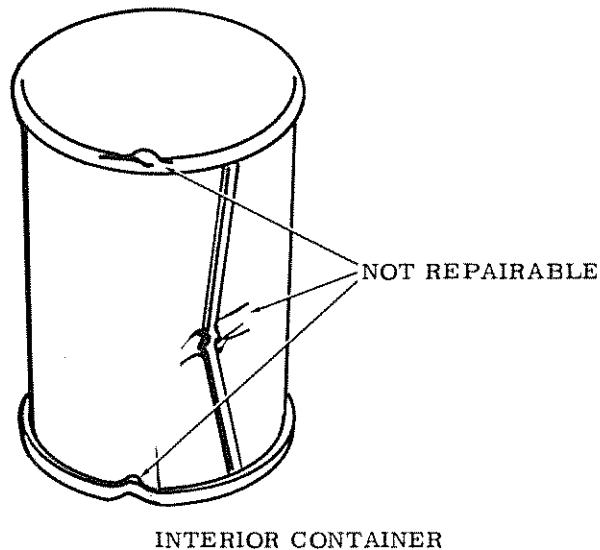


Figure 4-6 Repairable Damage to Containers

4-7.2.3 Cut one piece of round steel bar (outside diameter of which is within +0, -0.030 in. of inside diameter of frame tube) to length equal to previously noted removed area, plus approximately 4 in. If necessary, bend cut piece of bar stock to match contour of section of tubing being replaced.

4-7.2.4 If required, use reamer or drill no larger than nominal inside diameter of tubing to remove burrs and/or weld spatter to facilitate assembly. Press- or drive-fit bar stock piece into two cut ends of frame, inserting each end of bar 2.00±0.25 in. into frame piece.

4-7.2.5 Match dimensions and contour of damaged frame with that of similar frame known to be undamaged.

TABLE XVII
TUBE AND RIVET SIZE

TUBE SIZE (Nom In. Dia)	OD (In.)	THICKNESS (In.)	GAUGE	REPAIR LIMITATIONS	STEEL RIVET SIZE (In.)
1/2	1/2 - 11/16	0.035 - 0.095	20 - 13	Rivet or weld	1/8
3/4	3/4 - 27/32	0.109 up	12 up	No repair of cracked members	
		0.035 - 0.095	20 - 13	Rivet or weld	3/16
1	1 - 1-3/16	0.109 - 0.156	12 - 10	Rivet or weld	3/16
		0.188 up	5/32 up	No repair of cracked members	
		0.035 - 0.095	20 - 13	Rivet or weld	3/16
		0.109 - 0.134	12 - 10	Rivet or weld	1/4
		0.156 - 0.188	5/32 - 3/16	Weld only on cracked members	
1-3/8	1-1/4 - 1-1/2	0.219 up	7/32 up	No repair of cracked members	
		0.035 - 0.095	20 - 13	Rivet or weld	1/4
		0.109 - 0.156	12 - 10	Rivet or weld	1/4
1-3/4	1-9/16 - 1-7/8	0.188 - 0.219	5/32 - 7/32	Weld only on cracked members	
		0.250 up	1/4 up	No repair of cracked members	
		0.060 - 0.095	16 - 13	Rivet or weld	1/4
		0.109 - 0.134	12 - 10	Rivet or weld	1/4
2	1-15/16 - 2-1/8	0.156 - 0.188	5/32 - 3/16	Weld only on cracked members	
		0.250 up	1/4 up	No repair of cracked members	
		0.035 - 0.095	20 - 13	Rivet or weld	1/4
		0.109 - 0.156	12 - 10	Rivet or weld	1/4
		0.188 - 0.219	5/32 - 7/32	Rivet or weld	1/4
		0.250	9/32 up	Weld only on cracked members	
		0.281 up		No repair of cracked members	

WARNING

If the welding process is used, the operation must be performed in an area away from any HE or flammable materials.

NOTE

Either the welding or riveting process (paragraph 4-7.2.6 or 4-7.2.7) may be used to secure bar in place in frame tube.

4-7.2.6 If frame is to be welded, weld cut ends of frame to bar insert in accordance with good commercial practice. Clean off any scale or flux from weld.

4-7.2.7 If frame is to be riveted, rivet bar stock and frame as specified in paragraph 3-6 and table XVII.

4-7.2.7.1 Locate one rivet approximately 1/2 in. from cut end of frame. Locate second rivet approximately 1 in. from first hole, and rotate approximately 90 degrees from first hole. Countersink all holes as specified in paragraph 3-6, so that driven head will not contact security cover fabric.

4-7.2.7.2 Install two flush head rivets in accordance with procedures in paragraph 3-6.

4-7.2.7.3 Rivet opposite cut end of frame in same manner.

4-7.2.8 Refinish repaired area as specified for the part.

4-8 TUBE FORMING.

4-8.1 MEASUREMENT. Route tube as specified. When not specified, arrange tubing to assure that points of interference or other obstructions are avoided, and that tubing will not come in contact with moving parts. Tube measurements are taken on the centerline of the tube.

4-8.1.1 Take measurement from base of machined flare on fitting. Follow measurement along proposed path of tube to include bends and clearances. Mark each point of curve on the tube. For linear measurement purposes, bends are measured as angles.

4-8.1.2 Conclude measurement to base of machined flare on second (receiving) fitting.

4-8.1.3 The sum of measurements taken from the base of the machined flare on the first fitting to

the base of the machined flare on the second fitting will be the total length of tubing required. Mark tube required length.

4-8.2 CUTTING. Use tube cutter's for any standard tubing material except stainless steel. Cut stainless steel with a hacksaw.

4-8.2.1 Position cutter on tubing. Feed cutting wheel downward by turning knurled knob handle while cutter is being rotated. Do not feed cutting wheel too rapidly. Maintain even tension while cutting.

4-8.2.2 Upon completion of cutting operation, check inside of cut edge of tube for burrs. Remove any burrs with three-cornered scraper or similar tool.

4-8.3 FLARING OF TUBING ENDS.

4-8.3.1 GENERAL. These instructions cover hand-operated single flaring and double-lap flaring for forming flares on tubing. Flaring of 74 or 90 degrees is performed on tubing used with ANA or S.A.E. standard flared tube fittings, as required.

4-8.3.2 FLARING TOOLS. Flaring tools may be as indicated in Federal Specification GGG-F-451, Type I (screw-actuated flaring) or Type II (impact-actuated combination), with Class as required, or equivalent, but must meet the requirements of the tools specified. Tools indicated in the Specification are suitable for producing single flaring for all grades of tubing (table XVIII), or double-lap flaring of mild aluminum (table XIX).

4-8.3.3 FLARING OPERATION AND INSPECTION. The flaring operation shall be performed so that workmanship is of the highest quality for flares, and is subject to the following inspections.

4-8.3.3.1 A given flare shall meet the dimensions specified in table XVIII or XIX as required.

4-8.3.3.2 Flare shall be square with centerline of tube.

4-8.3.3.3 Flare shall be concentric with OD of tube within 0.005 full indicator reading.

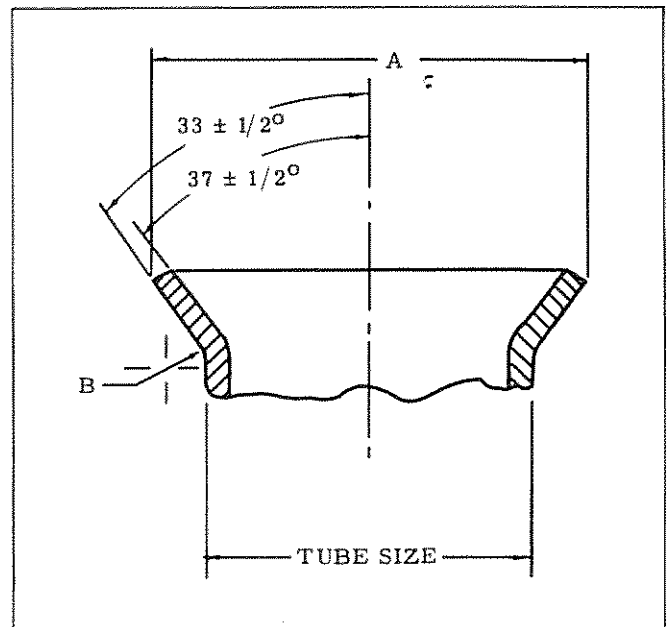
4-8.3.3.4 Flare shall be free of cracks and pit marks.

4-8.4 TUBE BENDING. Either of two tools may be used for bending tubing: (a) a hand bender, which requires a different bender for each size tubing, and (b) a production bender which is used for a range of tube sizes by changing attachments. The use description given is applicable to either tool.

4-8.4.1 Insert tube in bender and align first bend mark on tube with zero point on shieve block of bender, and with mark on slide bar of bender. Swing clip over tube. Proceed to bend tube to desired angle as indicated on shieve block. The shieve block indicator is graduated in increments of 15 degrees to a total of 180 degrees.

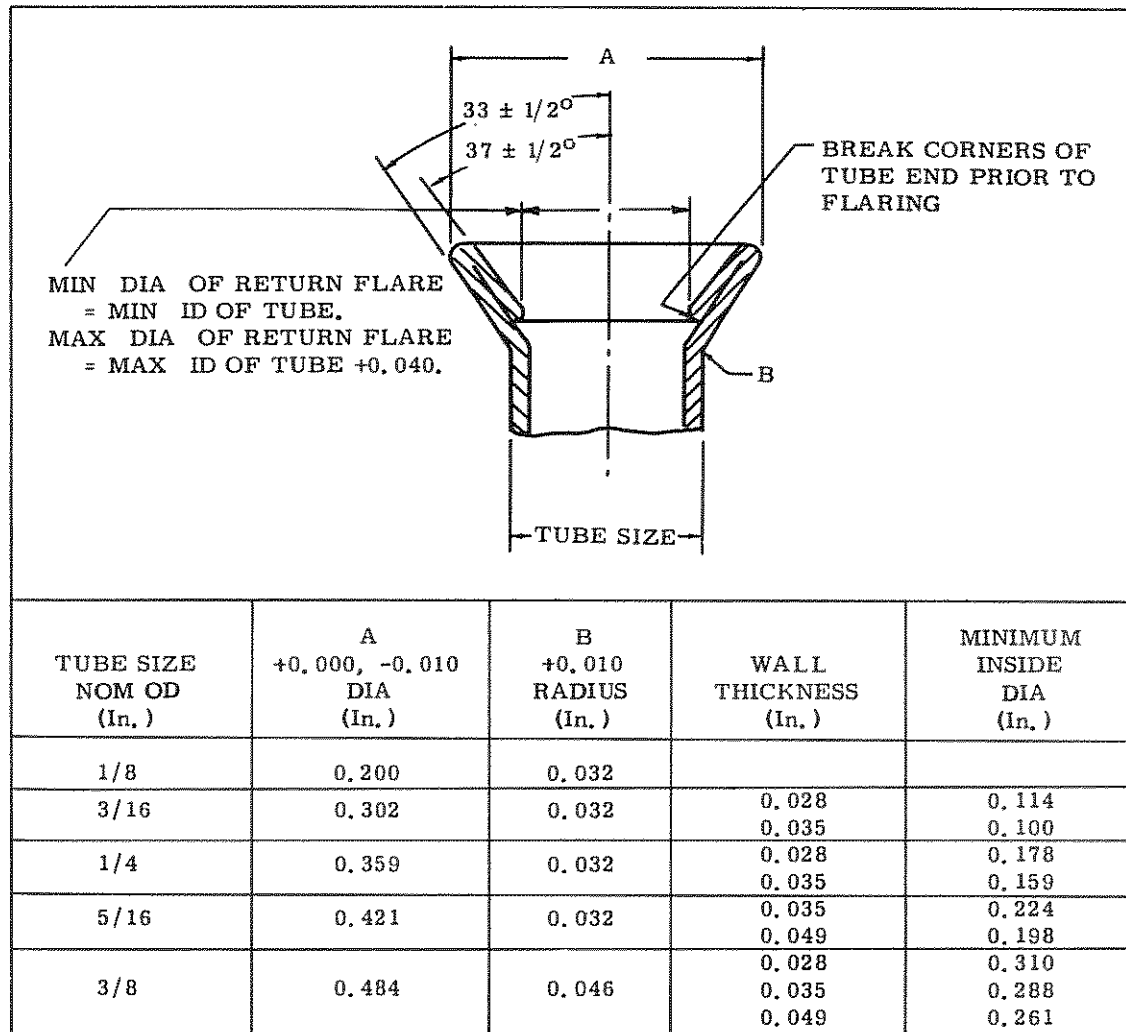
TABLE XVIII

DIMENSIONS FOR SINGLE FLARED TUBING END



TUBE SIZE NOMINAL OD (In.)	A DIAMETER (In.)	B ± 0.010 RADIUS (In.)
1/8	0.200 +0.000 -0.010	0.032
3/16	0.302 +0.000 -0.010	0.032
1/4	0.359 +0.000 -0.010	0.032
5/16	0.421 +0.000 -0.010	0.032
3/8	0.484 +0.000 -0.010	0.046
1/2	0.656 +0.000 -0.010	0.062
5/8	0.781 +0.000 -0.010	0.062
3/4	0.937 +0.000 -0.010	0.078
1	1.187 +0.000 -0.015	0.093
1-1/4	1.500 +0.000 -0.015	0.093
1-1/2	1.721 +0.000 -0.015	0.109
1-3/4	2.106 +0.000 -0.015	0.109
2	2.356 +0.000 -0.015	0.109
2-1/2	2.856 +0.000 -0.015	0.109
3	3.356 +0.000 -0.015	0.109

TABLE XIX
DIMENSIONS FOR DOUBLE LAP FLARED TUBING END



4-8.4.2 Release slide bar handle and remove tube. Repeat operation as required for additional bends.

4-9 REPAIR OF ABLATION SHIELD SURFACES.

4-9.1 METHOD 1.

NOTE

Procedures in paragraphs 4-9.1.1 through 4-9.1.5 are used for resurfacing of repairable material dents and scratches. Procedures in paragraph 4-9.1.5 are used for refinishing of surface nicks and scratches in coating.

4-9.1.1 Prepare area to be repaired by abrading all surfaces of defect with grade 150 to 280 or equivalent

abrasive. Remove all residual dust by wiping with clean lint-free cloth dampened (not dripping) with water, or use compressed air. Wipe abraded area repeatedly using clean areas of cloth until no further discoloration is observed.

4-9.1.2 Prior to mixing, warm materials to room temperature (70°F), prepare filler material, using phenolic molding plastic, asbestos fiber, and triethylenetetramine mixed in following manner.

4-9.1.2.1 Add 7 parts (by weight) of asbestos fiber to 10 parts of phenolic and mix thoroughly. The resin may be warmed to 100° to 120°F to facilitate mixing. After blending mixture, allow it to cool to room temperature.

4-9.1.2.2 Add 1 part of triethylenetetramine. This mixture has a pot life of approximately 30 min after addition of triethylenetetramine.

4-9.1.3 Apply filler material into defect with spatula or trowel. Work filler material completely into defect to prevent voids or air bubbles. Apply material in sufficient amount to build up excess of at least 0.010 in. above shield surface.

4-9.1.4 Allow material to cure for at least 4 hr at room temperature. Abrade excess material to match contour of shield. After curing and abrading, check repaired defect for complete filling and conformance to contour of shield. If any unfilled areas are found, repeat procedures specified in paragraphs 4-9.1.2 through 4-9.1.4.

4-9.1.5 Refinish surface as follows:

4-9.1.5.1 Mask out areas where finishing of surface is not required. If surface was not repaired (paragraphs 4-9.1.1 through 4-9.1.4), clean area to be refinished using toluene (technical).

NOTE

Application of surface sealer (phenolic), as specified in following paragraph, may be omitted if bare plastic is not exposed.

4-9.1.5.2 Spray on 1st coat of surface sealer (phenolic). Allow 1/2 hr for first coat to dry, and apply 2nd coat of sealer. Allow 1/2 hr for 2nd coat of sealer to dry.

4-9.1.5.3 If necessary, white lacquer (heat-reflecting) may be thinned, using dope and lacquer thinner (T-300). Apply 2 coats of white lacquer (heat-reflecting), allowing 1/2-hr drying time between coats. Allow final coat 24 hr to dry.

4-9.2 METHOD 2. Method 2 repair is accomplished by means of the thermal resisting coating kit. The kit consists of a 10-g mixture of Epon 828 epoxy resin and thermal insulation (silica fiber) premixed in proper quantities; and 1.1 g of triethylenetetramine.

4-9.2.1 Prepare area to be repaired by abrading all surfaces of defect with grade 220 abrasive or equivalent. Remove loose particles, residual dust, all oil, grease, etc from defect and adjacent area by wiping with clean, lint-free cloth moistened (not dripping) with toluene (technical).

WARNING

Repair paste used in this procedure is a toxic epoxy compound; observe applicable safety precautions (paragraph 2-2) during mixing and application.

CAUTION

Temperature of mixture must be maintained below 100°F to avoid heat reaction. Pot life of repair paste after mixing is limited. Do not mix compound until immediately prior to use.

4-9.2.2 Using commercial aluminum or nonreactive-cardboard mixing cup, standard glass mixing container or other mixing container, prepare repair paste by thoroughly mixing total contents of bottle containing triethylenetetramine with total contents of bottle containing resin-fiber base.

4-9.2.3 Apply masking tape around ablation shield defect to protect adjacent areas and to provide wall or dam to confine repair paste.

4-9.2.4 Using narrow spatula or similar tool, fill defect with repair paste. Apply sufficient amount of paste to provide slight excess above contour of shield.

4-9.2.5 Cure repaired area for approximately 3 hr as follows: 2 hr at room temperature followed by 1 hr at force-dry temperature. During force-dry period, maintain surface temperature of ablation shield between 140° and 175°F.

4-9.2.6 (Deleted)

4-9.2.7 Remove masking tape if used. Abrade repaired area with abrasive (grade 220) and finish with fine abrasive (grade 320). Abrade repaired surface to match existing contour.

4-9.2.8 Wipe surfaces to be refinished with clean, lint-free cloths moistened with toluene (technical). Change cloths frequently to insure freedom from contamination.

4-9.2.9 Strain well-mixed air-drying enamel (white, gloss, "Jet Dry") through paint cone.

4-9.2.10 Combine 6 parts of enamel with 1 part of aliphatic naphtha (type II) for spraying.

4-9.2.11 Spray on 1 light coat of enamel-naphtha mixture, and immediately apply 1 wet coat at 90° angle to direction of light coat. Regulate wet coat to avoid overspray, runs, and sags. Allow enamel to air-dry for 1 hr.

4-9.2.12 If necessary as final finish, fill pores in enamel coating, using surface primer (Preparakote). Allow primer to air-dry for 1 hr. Abrade area to feather edge using No. 220 grit paper followed by No. 320 grit paper. Wipe surfaces and spray on enamel as specified in paragraph 4-9.2.8 and 4-9.2.11 respectively.

4-10 REPAIR OF PLYWOOD.

These procedures apply to containers having plywood panels and/or flooring.

4-10.1 GENERAL.

4-10.1.1 Type and thickness of plywood used for repair shall be same as damaged part, as specified.

4-10.1.2 Because of construction of plywood, it must be worked carefully to avoid splintering and splitting of the exterior surfaces.

4-10.1.2.1 Prior to sawing plywood, prescore both sides on the marked cutoff lines with a sharp knife, chisel, or other sharp tool. Scoring should be deep enough to separate the top layer of veneer on both sides. This will help prevent splintering and splitting of surfaces. Cut with a fine-tooth saw.

4-10.1.2.2 An alternate method of preventing splintering is to firmly press a strip of cellophane tape over cutoff line on underside of panel. Cut from top with a fine-tooth saw.

4-10.1.2.3 Prior to drilling plywood, clamp a piece of scrap wood tightly to far side of area to be drilled. This will prevent splintering of surface when drilling.

4-10.2 REPLACEMENT OF PLYWOOD PANEL.

4-10.2.1 Remove all hardware including hardware attaching panel to other panels and remove damaged panel.

4-10.2.2 Use removed damaged panel as template for size and location of holes to be drilled in replacement panel. Overlay damaged panel on replacement panel; mark external size and holes to be drilled.

4-10.2.3 Cut and drill replacement panel as required.

4-10.2.4 If wood screws are used in installing replacement panel, drive wooden pegs in screw holes in panel to receive screws, or drill new screw holes offset from original holes in replacement panel.

4-10.2.5 Finish replacement panel to match container in accordance with painting instructions specified for part.

4-10.2.6 Install hardware on panel and install panel on container. Apply any markings which appeared on damaged panel in accordance with instructions in TP 35-51.

4-10.3 PATCH REPAIR OF PLYWOOD. These procedures are used for patch repair of holes in plywood when perimeter of hole is not greater than .30 in. after fractured edges of the wood have been removed.

4-10.3.1 Remove any hardware which might interfere with repair operation.

4-10.3.2 Using any suitable cutting tool, remove fractured wood from around hole.

4-10.3.3 For space filler, cut piece of plywood of same thickness as panel being repaired, and of size and shape to fit hole within +0, -1/4 in.

4-10.3.4 For inside backing panel, cut piece of plywood of same thickness as damaged panel, or not thicker than 1/2 in. and measuring approximately 6 in. larger in diameter than hole.

4-10.3.5 For outside cover plate, cut piece of 24 to 20 gauge (0.020 to 0.040-in. thick) steel sheet, hot or cold rolled, plain or galvanized finish, approximately 5 in. larger in diameter than hole.

4-10.3.6 Position space filler in hole. Locate inside backing panel and outside cover plate in position so that each is centered over hole in damaged panel. Temporarily anchor panel and plate in position.

4-10.3.7 Match drill No. 6 (0.204) holes through cover plate, panel, and backing panel. Locate these holes 1/2±1/8 in. from outside edge of metal cover plate and space them 4 to 5 in. apart around edge of cover plate. Drill two or more holes, as applicable according to hole area, in area of space filler.

4-10.3.8 Mark inside surface of backing panel and remove panel. Drill each of the 0.204-in. diameter holes to 0.234 in. (drill size A).

4-10.3.9 From inside of backing panel insert one plate nut (P/N 833787-00 or 833788-00, as applicable) in each hole and press firmly in place.

NOTE

Plain plate nut (P/N 833787-00) has three prongs measuring 0.203 in. Plate nut (P/N 833788-00) has three prongs measuring 0.312 in. Both plate nuts have 10-32 threads.

4-10.3.10 Place backing panel in position. From outside (metal cover plate side) insert a 10-32 machine screw (pan, round, binder, or fillister head) through each hole. Screws should be just long enough to permit them to be threaded into plate nuts to within approximately 1/16 in. from end of plate nut.

4-10.3.11 As required, reinstall any hardware previously removed. Refinish surfaces of both inside backing panel and outside cover plate as specified for part. Apply any markings which appeared in area of hole in accordance with procedures in TP 35-51.

4-10.4 REPAIR OF GOUGES IN PLYWOOD. Gouges in plywood surfaces no deeper than approximately 2/3 the total thickness of the plywood may be repaired by means of plastic filler.

WARNING

Plastic filler is both flammable and toxic. Observe applicable safety precautions (paragraph 2-2).

4-10.4.1 Thoroughly clean area to be filled and allow to dry. Lightly abrade area to insure firm adhesion of plastic wood.

4-10.4.2 Using small spatula or similar tool, press plastic filler into gouged area, using thin layers to build up thick sections and allowing each layer to dry before application of successive layer. Fill gouged area slightly higher than surrounding surface. Allow plastic filler to dry.

4-10.4.3 Abrade plastic filler flush with surrounding surface. Refinish repaired area as specified for the part.

4-10.5 MISCELLANEOUS PLYWOOD REPAIR.

4-10.5.1 Large splinters may be cemented in place with adhesive (resin base).

4-10.5.2 Edges of plywood which become frayed may be repaired by dressing outer and (if necessary) second layers of plywood to approximately 45° chamfer. Dressing may be done by means of a sharp cutting tool or abrasive.

4-11 MECHANICAL REPAIR OF PLASTICS.

4-11.1 GENERAL. In general, defects occurring in plastics are similar to those occurring in sheet metal, and are repaired essentially in the same manner.

4-11.2 ABRADING. Nicks, burrs and sharp edges may be dressed by abrasion.

4-11.3 REPLACING PORTION OF SHEET. Damaged portions of a sheet are cut out and repaired by making either a lap or butt splice (figure 4-7). The lap splice is preferred. Fasteners need only be a single row, and may have a maximum center-to-center distance of 1-1/2 in. Only AD-type rivets are applicable for plastic sheet materials. Refer to table XX for net edge distance and applicable hole size for specific rivets. Install rivets in accordance with procedures in paragraph 3-6.

4-11.4 DEFECTIVE HOLES. Defective holes are only repaired if specifically required. If it is possible, misaligned or damaged holes are redrilled in another location in the part; otherwise, the addition of a doubler or splicing is applicable.

4-11.4.1 Damaged holes may be redrilled for next larger fastener, if drilling will clean up hole and

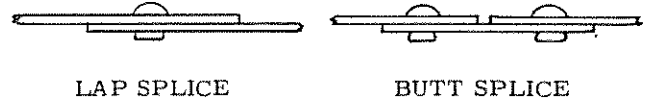


Figure 4-7 Sheet Splice

resulting edge distance is within limits specified in table XX. The use of applicable bushings may be employed where reduction of hole size is required.

4-11.4.2 Where a row of holes is cracked or damaged (from hole to hole), the portion may be repaired by making either a lap or butt splice in accordance with procedures in paragraph 4-11.3.

4-11.4.3 When it is desired to fill holes no longer used, either of the following methods is acceptable.

4-11.4.3.1 Fashion a slightly tapered dowel, preferably of same material as that containing hole, and drive dowel into hole. Dress ends of dowel, as required or accessible, to match contour of the surrounding area.

4-11.4.3.2 Drive a rivet into the hole and, if required, dress rivet to match contour of surrounding area. Install rivet in accordance with procedures in paragraph 3-6.

4-12 REPAIR OF PLASTIC CAP.

CAUTION

Abrade only deep enough to obtain a good featheredge. Do not abrade into fiber-glass surface.

4-12.1 Abrade area to be coated to remove loose sections of coating or slick spots on coating. Use No. 240 emery cloth, or equivalent, and wipe away dust with clean, lint-free cloth.

WARNING

Methyl ethyl ketone is extremely toxic and flammable. Observe applicable safety precautions (paragraph 2-2) when spraying option is used in accordance with the following paragraph.

4-12.2 Apply adhesive (Bostic Primer No. 1007) by brushing on at package consistency or by spraying after adhesive has been thinned with 1-1/2 parts of methyl ethyl ketone (technical). Make primer coat 0.002 in. thick (minimum) and allow to dry for 1 hr.

TABLE XX
EDGE DISTANCE AND HOLE SIZE FOR RIVETING PLASTICS

MINIMUM NET EDGE DISTANCE							
Rivet Size	Total Material Thickness (In.)						
	0.063	0.094	0.125	0.156	0.188	0.219	0.250
3	←	1/4	→	←	→	13/64	→
4	←	5/16	→	←	→	1/4	→
5	←	13/32	→	←	→		→

RIVET HOLE SIZE							
Rivet Size	Total Material Thickness (In.)						
	0.063	0.094	0.125	0.156	0.188	0.219	0.250
3	←	No. 39 (0.0995)	→	←	→	No. 40 (0.088)	→
4	←	No. 29 (0.136)	→	←	→	No. 30 (0.138)	→
5	←	No. 18 (0.169)	→	←	→		→

4-12.3 Prepare mixture of rain erosion resisting coating (kit), mixing only enough to last for use within 8 hrs.

4-12.4 Brush on mixture with small brush, using minimum of brush strokes. Avoid brushing partially dried material. The brush should cover repair area with one stroke, if possible.

4-12.5 Dip brush in toluene (technical) immediately after area has been coated and apply brush lightly over areas where bubbles can be seen. Continue until all bubbles are removed. This brushing will also blend edges of patch into original coating.

4-12.6 Allow 30 min to air-dry. Repeat application of mixture until coating of between 0.010 and 0.014 in., including primer, is obtained. Usually 6 or 7 coats are required. Smooth each coat by brushing with small brush dipped in toluene (technical). Allow 30-min air-drying period between application of each coat.

NOTE

The number of coats applied is governed by amount of original coating removed.

4-12.7 Allow final coat to dry tack-free before handling plastic cap. Curing to usable strength is attained about 72 hrs after application of final coat, at which time coat has darkened. Cure cap in a reasonably dust-free environment, such as used for painting activities.

4-12.8 After patch has cured, patch and surrounding area may be cleaned with toluene (technical). A coat of general purpose wax (solvent type) may be applied to plastic cap to restore luster to coating.

4-12.9 Inspect finished product for bubbles or checks. The patched area shall be reasonably smooth and edges blended with surrounding area.

4-13 PATCH REPAIR OF WATER-VAPORPROOF BAG.

Breaks, tears, or holes in water-vaporproof bags are repaired by patching damaged area with a piece of identical or compatible material. It is preferred that identical material (i.e., material of same type and made by same manufacturer as original material) be used for patching. Manufacturer's identification and sealing instructions are usually marked on reverse side of material. If identical material cannot be obtained or if identity of materials cannot be determined, it will be necessary to perform a material compatibility test prior to patching.

4-13.1 MATERIAL COMPATIBILITY TEST.

4-13.1.1 Obtain approximately 1-in. wide samples of original and patch materials. Sample of original material may be obtained from area of damage or from excess material (if any) around outer edge of bag.

4-13.1.2 With foil sides of samples contiguous, heat-seal samples together in accordance with instructions provided with material or furnished with the sealing

iron. If instructions are not available, seal by means of heat-sealing iron at 450°F using 30 psi pressure and 2.5-sec dwell time. Allow samples to cool at room temperature

4-13.1.3 Pull sample materials apart. Materials are compatible if at least 50% of sealed area delaminates; i.e., if a partial thickness of either material adheres to the other material to an extent of at least 50% of the sealed area when the samples are pulled apart. If samples do not meet this requirement, repeat compatibility test on other patch materials until compatible material is found.

4-13.2 PATCHING PROCEDURES.

4-13.2.1 Cut sufficiently large piece of water-vapor-proof patch material to provide at least 1-in. overlap around damaged area of bag.

4-13.2.2 Lay bag material on flat surface so that patch material can be heat-sealed to bag material, foil side to foil side.

4-13.2.3 Position patch over damaged area of bag and heat-seal patch to bag in accordance with instructions provided with material. If no instructions are available, seal by means of heat-sealing iron at 450°F, using 30 psi pressure and 2.5-sec dwell time. Allow seal to cool at room temperature.

4-14 REPAIR OF FABRICS AND FABRIC-TYPE SECURITY COVERS.

4-14.1 PATCH REPAIR BY STITCHING. Patch repair by stitching a patch on original material is applicable to any cover as specified.

4-14.1.1 Cover entire tear or hole by overlapping patch at least 1 in. on all sides with same materials as original cover (table I).

4-14.1.2 Patch may be sewed to cover by hand or sewing machine, using 5 to 8 stitches per in. in either case. If a sewing machine is used, employ stitch Type 301 in accordance with Federal Standard No. 751. Double-stitch patch with linen or hemp thread.

4-14.2 PATCH REPAIR BY ADHESION. Patch repair by cementing a patch on original material is applicable to any cover as specified.

4-14.2.1 Cut patch of coated cloth or impregnated cloth to size as specified in paragraphs 4-14.2.1.1 through 4-14.2.1.3, as applicable. If tear or hole is closer than 6 in. to an edge, patch may be folded over edge using a 2-in. minimum fold. Trim corners of patch 1 in. minimum at 45°.

4-14.2.1.1 If maximum dimension of hole or tear is not more than 1 in., extend patch approximately 1 in. beyond hole or tear, on all sides.

4-14.2.1.2 If maximum dimension of hole or tear is greater than 1 in. and not more than 6 in., extend patch approximately 3 in. beyond hole or tear, on all sides.

4-14.2.1.3 If maximum dimension of hole or tear is greater than 6 in., extend patch approximately 6 in. beyond hole or tear on all sides.

4-14.2.2 Buff surface of patch and area of cover which patch will cover, using abrasive cloth (Grade 2/0, No. 100 grit).

4-14.2.3 Wash buffed surfaces with toluene (technical) or xylene. Allow surfaces to dry.

4-14.2.4 Apply medium-heavy coat of adhesive to surfaces to be bonded and allow surfaces to air-dry for 15 minutes. Adhesive to be used is as follows:

a. For Hypalon coated cloth (B28F1, B43, W52, B53, B57), use adhesive (EC-870).

b. For neoprene coated cloth, use adhesive (EC-847, EC-870, or Fairprene No. 5128).

c. For vinyl coated cloth, use adhesive (EC-847).

4-14.2.5 Apply second medium-heavy coat of adhesive to surfaces. When this coat has become tacky, position patch on adhesive-covered area of cover so that patch extends equally beyond all edges of tear or hole. Smooth patch to remove air bubbles, and press firmly in place.

4-14.2.6 Exercise care, for period of approximately 24 hrs, to prevent application of tension or extreme change of temperature to area repaired by adhesion.

4-14.3 (Deleted)

4-14.4 ATTACHMENT OF WEBBING.

4-14.4.1 Rings, snaps, or other fasteners are installed on webbing as required, and the webbing stitched in place.

4-14.4.2 Webbing, either strap or with fastener attached, is stitched in place using linen or linen hemp thread and sewed by machine using 5 to 8 stitches per inch. When using sewing machine, employ stitch Type 301 in accordance with Federal Standard No. 751.

4-14.4.3 Stitch webbing in place, using same stitching pattern as used for similar webbing attachment on part.

4-14.5 REPLACEMENT OF WEB BELT END CLIP.

4-14.5.1 Using screwdriver, pry open crimped edges of damaged web belt end clip. Remove clip from strap.

4-14.5.2 Position replacement clip on end of strap. Place strap and clip on solid flat surface. Using hammer, mash clip flat against strap. Assure that all edges of clip are tight against strap.

(Figure 4-8 deleted)

4-14.5A REPAIR OF WEB BELT AND STRAP ENDS. If it is not desired to replace the web belt or strap end clip as specified in paragraph 4-14.5, the ends may be seized as follows:

4-14.5A.1 Trim frayed end of strap as necessary.

4-14.5A.2 Prepare encapsulating compound (resin No. 225) in accordance with manufacturer's instructions or as follows:

a. Firmly punch each flat side of resin pack to rupture barrier which separates resin from catalyst; pull flat sides apart to insure that barrier is completely broken.

b. Squeeze ends of pack to mix contents thoroughly, insuring that separate materials are removed from corners of pack; mix until uniform color is achieved (30 to 40 squeezes may be necessary).

NOTE

If the compound is cold (below 50°F), it will be necessary to warm the pack to room temperature in order to insure adequate mixing.

c. Cut one end of pack and pour mixed compound into receptacle.

CAUTION

The mixed compound will start to gel in approximately 8 min at room temperature.

4-14.5A.3 Dip end of belt or strap in mixed compound to depth of 1/2 to 1 in. Allow compound to cure for 2 hr at room temperature before handling belt or strap.

4-14.6 REPLACEMENT OF INTERLOCKING SLIDE FASTENERS.

4-14.6.1 Remove both halves of fastener from fabric by cutting thread attaching fastener to fabric.

4-14.6.2 Position edges of fabric, on which fastener is to be sewed, parallel to each other. From underside of fabric, pin or otherwise tack closed fastener in place.

4-14.6.3 Fastener is sewed to fabric using 5 to 8 stitches per inch. Use sewing machine stitch Type 301, in accordance with Federal Standard No. 751. Double-stitch fastener in place, using linen or linen hamp thread.

4-14.7 REPLACEMENT OF SNAP AND CURTAIN FASTENERS.

4-14.7.1 Studs, sockets, or eyelets are removed by prying apart. Studs are removed by cutting stud near base and removing stud base and eyelet. Where spur- or prong-type sockets are used, pry spurs or prongs up and remove socket and plate.

4-14.7.2 Unless otherwise specified, fasteners are installed in same location from which damaged fastener was removed. Replacement fastener assembly shall be same type and size as removed damaged one.

4-14.7.3 As required, punch appropriate size hole in fabric. Assemble and install fastener, using hand-lever press or other suitable tool, and dies of appropriate kind and size.

4-14.8 REPLACEMENT OF GROMMETS.

4-14.8.1 Remove grommet and plain washer by prying apart. Remove grommet and prong washer by prying prongs up and prying washer and grommet apart.

4-14.8.2 Unless otherwise specified, a grommet is installed in same location from which damaged grommet was removed. Replacement grommet assembly shall be same type and size as removed damaged one.

4-14.8.3 As required, punch appropriate size hole in fabric. Assemble and install grommet, using hand-lever press or other suitable tool, and dies of appropriate kind and size.

4-15 REPAIR OF AFT PROTECTIVE COVER.

4-15.1 REPAIR LIMITATIONS.

CAUTION

Do not apply any patches closer than 2 in. from outer edge of cover.

4-15.1.1 SMALL HOLES. Holes up to 1/8 in. in diameter are patched, using a patch of solid cloth insert rubber sheet which overlaps the hole at least 9/16 in. on all sides. Shape of patch is optional, but all sharp corners shall be trimmed a minimum of 1/8 in. at a 45-degree angle.

4-15.1.2 LARGER HOLES AND TEARS. Holes over 1/8 in. in diameter and up to 1 in. in diameter, tears up to 12 in. long for a straight tear, and tears up to 12 in. on the side for a right-angle tear are

patched, using a patch of solid cloth insert rubber sheet which overlaps outer diameter of hole at least 2 in. on all sides. Trim corners of patch 1 in. minimum at a 45-degree angle.

4-15.2 PROCEDURE. Lightly buff patch and area of cover on which patch is to be applied. Wipe buffed areas with cloth soaked with toluene (technical). Brush adhesive (Loxite 6000) onto both cleaned surfaces and allow to dry tack free. Apply second coat of adhesive to one surface and join both surfaces immediately. Use roller to squeeze out any air bubbles and assist in making a good smooth bond. Allow 24 hrs for drying at room temperature prior to use of cover.

4-15.3 TESTING. Repaired aft protective covers will be pressure-tested on a weapon as follows.

4-15.3.1 Apply pressure in accordance with normal pressure-check procedures specified in applicable manual. This can be accomplished during normal pressure check.

4-15.3.2 Soap edges of all patches and check for any leaks.

4-15.3.3 If any patch leaks are detected, repair in accordance with procedures in paragraphs 4-15.1 and 4-15.2, and retest, or reject cover.

4-16 REPAIR OF HONEYCOMB PANELS.

4-16.1 GENERAL.

4-16.1.1 Repair of honeycomb panels is applicable only within limits authorized by the referencing document. Procedures given here cover the repair of extensive damage (deformation or puncture) in the skin and/or honeycomb core (figure 4-9). Minor damage is repaired as follows.

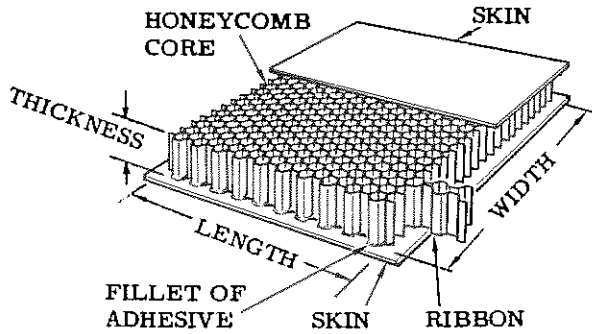
4-16.1.1.1 Minor dents, deformation, and defects in a honeycomb panel which do not involve puncture of the skin material and dents and depressions in metal surfaces adjacent to honeycomb areas are repaired as metal surface depressions by filling (paragraph 4-4.1), using material as specified (EC-1184, plastic aluminum modeling compound, etc).

4-16.1.1.2 Minor holes and breaks in honeycomb panels which involve puncture of the skin material are re-

paired as metal surface depressions by filling (paragraph 4-4.1), using EC-1184; however, before filling, the damaged area must be drilled out to a maximum depth of 0.25 in., using a No. 72 (0.0250-in.-dia) twist drill.

4-16.1.2 Selection of applicable method of repair in following procedures will be as specified in appropriate manuals.

4-16.1.3 In addition to normal organizational equipment allowances, tools and equipment listed in table XXI are required to perform these repairs. A minimum quantity of one of each item is required by each operational team performing the repair.



NOTES:

- 1 Thickness is the depth or cell length.
- 2 Length is in the longitudinal direction of the ribbons.
- 3 Width is in the direction lateral to the ribbons.

Figure 4-9 Cutaway View of Honeycomb Panel

4-16.1.4 Materials required to perform these repairs, exclusive of those required for painting, are listed in table XXII.

4-16.2 REMOVAL OF DAMAGED MATERIAL.

4-16.2.1 Perform following procedures to remove damaged material to depth as specified for pertinent method of repair, but never deeper than fillets of adhesive on undamaged skin.

4-16.2.2 If depth of damage exceeds maximum working depth of longest specified router bit, perform routing to maximum working depth in circle whose area is twice the remaining damaged area; do not exceed 6-in. diameter hole, or smaller diameter hole if otherwise specified.

4-16.2.3 If damaged area in honeycomb core extends beyond maximum permissible circle for repair, but skin damage is within maximum permissible circle, repair may be made providing total projected area of core damage after routing (inside plus

TABLE XXI

TOOLS AND EQUIPMENT REQUIRED FOR REPAIR OF HONEYCOMB PANELS

NOMENCLATURE	AEC PART NUMBER	METHOD REQUIRED FOR			
		Fill A	Fill B	Plug	Patch
Blade, Band-Saw (24 teeth per in.)	871445-00		X	X	X
Cutter, Milling, End (standard, 1/2 in. dia, 3-1/4 in. long)	871437-00	X	X	X	X
Cutter, Milling, End (long, 1/2 in. dia, 4 in. long)	871438-00			X	
Cutter, Milling, End (extra long, 1/2 in. dia, 5 in. long)	871439-00			X	
File, Hand (Flat, single coarse cut)	871446-00	X	X	X	X
Knife, Putty (1-1/4 in. wide)	840859-00	X	X	X	X
Router, Electric (1/2-in.-dia capacity)		X	X	X	X
or					
Router, Air Turbine (1/2-in.-dia capacity)			X	X	X
Saw, Band					
Shears, Metal Cutting, Hand (3-1/2-in. straight cut)	800609-00		X	X	X
Spacer (7-1/8-in.-dia hole)	177614-00***	X	X	X	X
Spring, Helical, Extension (23/64-in.-dia)	871499-00				X
Support, Template (7-in.-dia hole)	177607-00***	X	X	X	X
Support, Template (5-in.-dia hole)	177615-00***	X	X	X	X
Template, Contour Routing (2-1/8-in.-dia hole)*	177609-00***	X	X	X	X
Template, Contour Routing (3-1/8-in.-dia hole)*	177610-00***	X	X	X	X
Template, Contour Routing (4-1/8-in.-dia hole)*	177611-00***	X	X	X	X
Template, Contour Routing (5-1/8-in.-dia hole)*	177612-00***	X	X	X	X
Template, Contour Routing (6-1/8-in.-dia hole)*	177613-00***	X	X	X	X

(Continued on next page; see footnotes at end of table)

TABLE XXI
(Continued)

NOMENCLATURE	AEC PART NUMBER	METHOD REQUIRED FOR			
		Fill A	Fill B	Plug	Patch
Template, Contour Routing (1-1/8-in.-dia hole)**	177617-00***	X	X	X	X
Template, Contour Routing (2-1/8-in.-dia hole)**	177618-00***	X	X	X	X
Template, Contour Routing (2-5/8-in.-dia hole)**	177619-00***	X	X	X	X
Template, Contour Routing (3-1/8-in.-dia hole)**	177620-00***	X	X	X	X
Template, Contour Routing (4-1/8-in.-dia hole)**	177621-00***	X	X	X	X
Template, Contour Routing (5-1/8-in.-dia hole)**	177622-00***	X	X	X	X
*Use with template support (177607-00). To obtain 177609-00, 177610-00, 177611-00, 177612-00, and 177613-00, order 177608					
**Use with template support (177615-00). To obtain 177617-00, 177618-00, 177619-00, 177620-00, 177621-00, and 177622-00, order 177616					
***To be fabricated locally					

TABLE XXII

MATERIAL REQUIRED FOR REPAIR OF HONEYCOMB PANELS

NOMENCLATURE	AEC PART NUMBER	METHOD REQUIRED FOR			
		Fill A	Fill B	Plug	Patch
Acetone	813556-00	X	X	X	X
Adhesive (Epon 907) (Kit)	871440-00		X	X	X
Honeycomb, Expanded Aluminum (Hexcel Military Grade, cell size 1/8 in., alloy 5052, foil thickness 0.0015 in., permeation process P)	873124-00			X	
Paper, Abrasive (Medium grit)	871444-00		X	X	X
Plastic Sheet (Polyethylene, 0.020 in. thick)	871442-00				X
Sealing Compound (Epon 932) (Kit)	871862-00	X	X	X	X
Sheet, Aluminum Alloy, 2024-T3 (0.020 in. thick, QQ-A-355b)	873126-00		X	X	X
or					
Sheet, Aluminum Alloy, 2024-T3 (0.025 in. thick, QQ-A-355b)	873132-00				
or					
Sheet, Aluminum Alloy, 2024-T3 (0.032 in. thick, QQ-A-355b)	873127-00				
or					
Sheet, Aluminum Alloy, 7075-T6 (0.020 in. thick, QQ-A-283)	873128-00				
or					
Sheet, Aluminum Alloy, 7075-T6 (0.025 in. thick, QQ-A-283)	873129-00				
or					

(Continued on next page)

TABLE XXII
(Continued)

NOMENCLATURE	AEC PART NUMBER	METHOD REQUIRED FOR			
		Fill A	Fill B	Plug	Patch
Sheet, Aluminum Alloy, 7075-T6 (0.032 in. thick, QQ-A-283)	873130-00				
Tape, Braided, Nylon	828691-00				X
Tape, Pressure-Sensitive Adhesive (Masking, 2-in. W)	808594-00		X	X	X
Tape, Pressure-Sensitive Adhesive (Transfer) (2-in. W)	871443-00	X	X	X	X

outside the circle) is not greater than area of undamaged core within circle (figure 4-10).

4-16.2.4 Determine depth of damage. Determine diameter of smallest circle that will encompass damaged area. Obtain contour routing template with hole large enough to encompass damaged area.

4-16.2.5 If damaged area is on contoured surface, perform following procedures.

4-16.2.5.1 Obtain template support with hole larger than hole in contour routing template as indicated in Table XXI.

4-16.2.5.2 Using acetone and clean, lint-free cloth, clean surfaces of template, template support, and honeycomb panel in area against which template

support will be placed. Wipe surfaces prior to evaporation of acetone.

4-16.2.5.3 Apply strip of pressure-sensitive adhesive tape (transfer) (2 in. W) along each of two contoured edges of template support (figure 4-11).

4-16.2.5.4 Remove backing from adhesive tape on template support. Position template support over damaged area of honeycomb panel so that contour of template support matches contour of panel, and hole in template is suitably centered over damaged area. Press template support against panel to secure it in place.

4-16.2.5.5 Apply two strips of pressure-sensitive adhesive tape (transfer) (2 in. W) to flat surface of template support as shown in figure 4-11.

4-16.2.5.6 Remove backing from tape on template support. Position template against flat surface of template support so that edges of template approximately match edges of template support, and side of template on which scored lines are located is exposed. Press template against tape to secure template.

4-16.2.6 If damaged area is on flat surface and does not extend closer than 1-1/2 in. to any intersecting surface, perform following procedures.

4-16.2.6.1 Obtain spacer (P/N 177614-00) or over-size contour routing template.

4-16.2.6.2 Using acetone and clean, lint-free cloth, clean spacer, template, and honeycomb panel in area against which spacer will be placed. Wipe surfaces prior to evaporation of acetone.

4-16.2.6.3 Apply two strips of pressure-sensitive adhesive tape (transfer) (2 in. W) along two parallel edges of spacer on same side of spacer.

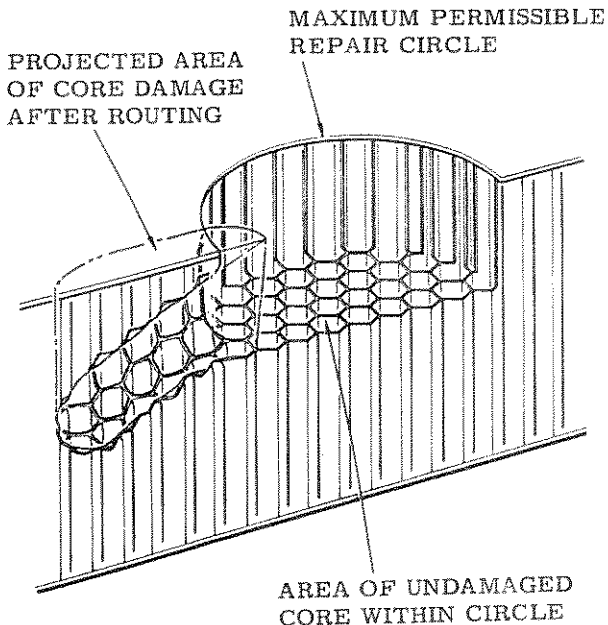


Figure 4-10 Limits of Repairable Damage

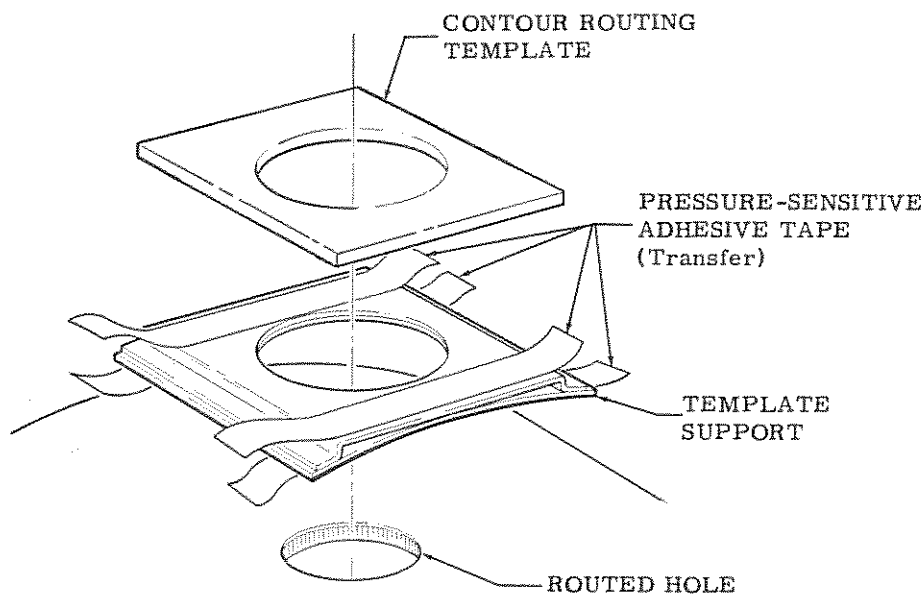


Figure 4-11 Riveted Assembly and Template for Repair of Honeycomb Panel

4-16.2.6.4 Remove backing from tape on spacer. Position spacer against honeycomb panel so that hole in spacer is suitably centered over damaged area, with tape against panel. Press spacer against panel to secure it in place.

4-16.2.6.5 Apply two strips of pressure-sensitive adhesive tape (transfer) (2 in. W) along two parallel edges on exposed surface of spacer.

4-16.2.6.6 Remove backing from tape on spacer. Position template against spacer so that edges of template approximately match edges of spacer, and side of template on which scribed lines are located is exposed. Press template against spacer to secure template.

4-16.2.7 If damaged area is on flat surface and extends closer than 1-1/2 in. to any intersecting surface, perform following procedures.

4-16.2.7.1 Position template over damaged area and determine number of spacers required to raise one edge of template so that it is parallel to one intersecting surface of honeycomb panel (figure 4-12). For spacers, use spacer (P/N 177614-00) and/or contour routing templates, as required.

4-16.2.7.2 Using acetone and clean, lint-free cloth, clean template, spacers, and honeycomb panel in area with which tape will be in contact.

4-16.2.7.3 Using pressure-sensitive adhesive tape (transfer) (2 in. W), secure spacers and template

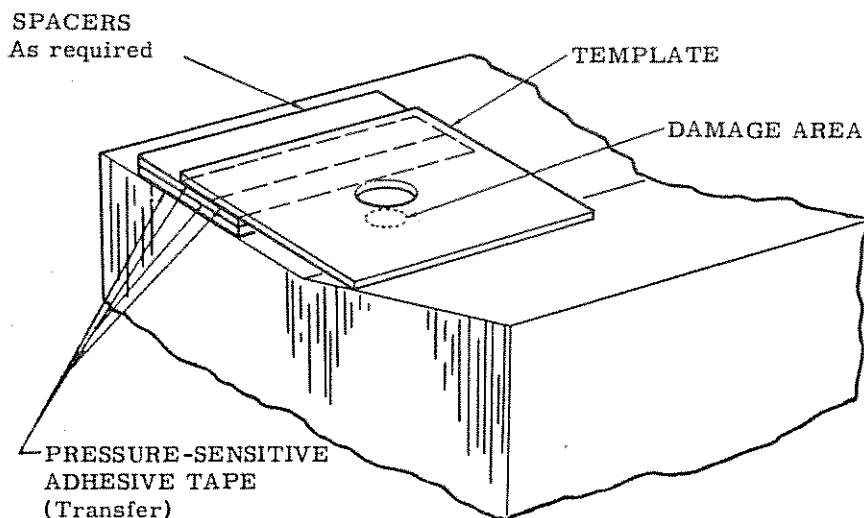


Figure 4-12 Spacers and Template on Intersecting Surfaces of Honeycomb Panel

to honeycomb panel as shown in figure 4-12, so that hole in template is suitably centered over damaged area, with scribed surface of template exposed.

4-16.2.8 Obtain end milling cutter (or cutters) of sufficient length (table XXI) to permit removal of damaged honeycomb core to depth specified in paragraph 4-16.3.1, 4-16.4.1, 4-16.5.1, or paragraph 4-16.6.1, as applicable.

4-16.2.9 Using electric router or pneumatic router and end milling cutter of appropriate length, remove all damaged skin and core to appropriate depth so that bottom of routed hole is flat.

4-16.2.10 Remove template, spacers, template support, and tape, from honeycomb panel, as applicable.

4-16.2.11 Remove all burrs from outer edge of routed hole in skin.

4-16.2.12 Using any suitable method, remove all metal and adhesive chips from routed area.

CAUTION

Use acetone sparingly around existing bonded areas. Wipe surfaces prior to evaporation of acetone.

4-16.2.13 Using acetone and clean, lint-free cloth, clean all surfaces of routed hole.

4-16.3 FILL METHOD A (Figure 4-13).

4-16.3.1 Route skin and honeycomb core to depth as required for removal of damaged material, in accordance with procedures in paragraph 4-16.2.

4-16.3.2 Mix components of sealing compound (Epon 932) (kit) in accordance with manufacturer's instructions.

NOTE

Pot life of sealing compound (Epon 932) at 75°F is 5 to 8 min.

SEALING COMPOUND
(Epon 932)

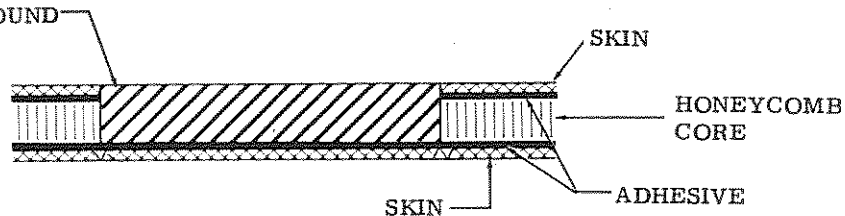


Figure 4-13 Honeycomb Repair - Fill Method A

4-16.3.3 Using putty knife or other suitable tool, fill routed hole with sealing compound (Epon 932). Completely fill all cavities, and apply excess of approximately 1/8-in. depth to allow for shrinkage during curing.

4-16.3.4 Allow sealing compound (Epon 932) to cure for at least 15 min or until hard, assuring that sealing compound does not flow or creep excessively during cure.

4-16.3.5 Using flat hand file or other suitable tool, remove excess sealing compound (Epon 932) so that its surface is in accordance with contour requirements as specified in appropriate manuals for weapon system, and edges of sealing compound (Epon 932) are faired smoothly into adjacent surfaces.

4-16.3.6 Paint surface of sealing compound (Epon 932) and adjacent area in accordance with paint requirements of surrounding area.

4-16.4 FILL METHOD B (Figure 4-14).

4-16.4.1 Route skin and honeycomb core to depth as required for removal of damaged material, but not deeper than 1 in., in accordance with procedures in paragraph 4-16.2.

4-16.4.2 Using 2024-T3 or 7075-T6 aluminum alloy sheet, 0.020-, 0.025-, or 0.032-in. nominal thickness, fabricate disc of diameter equal to or no smaller than 1/8 in. less than diameter of routed hole. Remove all burrs from edges of disc.

4-16.4.3 Using abrasive paper (medium grit), or equivalent, abrade both flat surfaces of disc.

CAUTION

Surfaces must be wiped dry prior to evaporation of acetone. After cleaning, handle disc by its edges.

4-16.4.4 Using acetone and clean, lint-free cloth, clean both flat surfaces of disc.

4-16.4.5 Mix components of adhesive (Epon 907) (kit) in accordance with manufacturer's instructions.

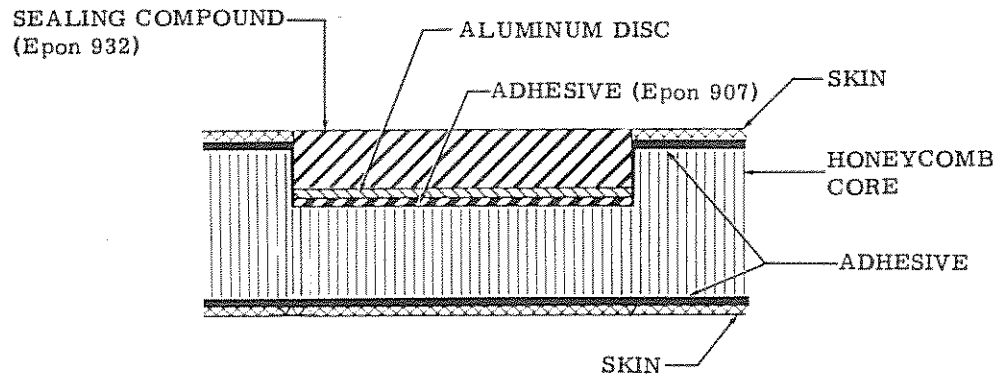


Figure 4-14 Honeycomb Repair - Fill Method B

NOTE

Pot life of adhesive (Epon 907) at 75°F is 40 min.

4-16.4.6 Using putty knife or other suitable tool, apply one coat of adhesive (Epon 907) to one flat surface of aluminum disc.

CAUTION

Care must be taken to prevent damage to honeycomb core by avoiding excessive pressure against disc.

4-16.4.7 Position disc in routed hole with adhesive on disc against bottom of hole. Press firmly against disc to assure contact. Using any suitable method, apply pressure against disc to maintain contact and allow adhesive to cure for at least 24 hrs.

4-16.4.8 Remove pressure from disc.

CAUTION

Use acetone sparingly around existing bonded areas. Wipe surfaces prior to evaporation of acetone.

4-16.4.9 Using acetone and clean, lint-free cloth, clean exposed surfaces of disc and routed hole.

4-16.4.10 Mix components of sealing compound (Epon 932) (kit) in accordance with manufacturer's instructions.

NOTE

Pot life of sealing compound (Epon 932) at 75°F is 5 to 8 min.

4-16.4.11 Using putty knife or other suitable tool, fill routed hole with sealing compound (Epon 932). Completely fill all cavities, and apply excess of approximately 1/8-in. depth to allow for shrinkage during curing.

4-16.4.12 Allow sealing compound (Epon 932) to cure for at least 15 min until hard, assuring that sealing compound does not flow or creep excessively during cure.

4-16.4.13 Using flat hand file or other suitable tool, remove excess sealing compound (Epon 932) so that its surface is in accordance with contour requirements as specified in appropriate manuals for the weapon system, and edges of sealing compound (Epon 932) are faired smoothly into adjacent surfaces.

4-16.4.14 Paint surface of sealing compound (Epon 932) and adjacent area in accordance with paint requirements of surrounding area.

4-16.5 PLUG METHOD (Figure 4-15).

4-16.5.1 Route skin and honeycomb core to depth as required for removal of damaged material in accordance with procedures in paragraph 4-16.2.

4-16.5.2 Using 2024-T3 or 7075-T6 aluminum alloy sheet, 0.020-, 0.025-, or 0.032-in. nominal thickness, fabricate two discs of diameter equal to or no smaller than 1/8 in. less than diameter of routed hole. Remove all burrs from edges of discs.

4-16.5.3 Using Hexcel Military Grade expanded aluminum honeycomb, cell size 1/8 in., alloy 5052, foil thickness 0.0015 in., permeation process P, fabricate honeycomb plug in accordance with following procedures.

CAUTION

Care must be taken to avoid damage and mutilation of honeycomb core while sawing, by using back edge of saw teeth for

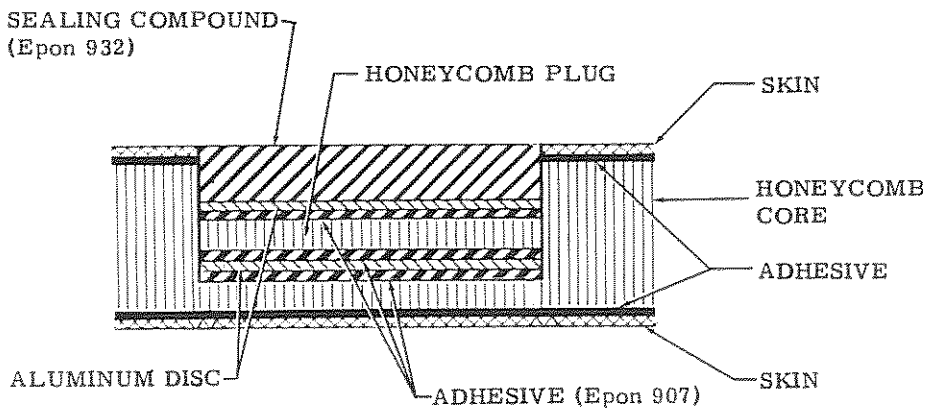


Figure 4-15 Honeycomb Repair - Plug Method

cutting, with saw blade installed in accordance with following paragraph.

4-16.5.3.1 Install band-saw blade, 24 teeth per inch, on band saw so that teeth of blade are oriented in opposite direction in line of travel to their normal orientation (figure 4-16).

4-16.5.3.2 Saw honeycomb core to thickness (cell length) approximately 1/2 in. less than depth of routed hole in damaged panel.

4-16.5.3.3 Apply sufficient pressure-sensitive adhesive tape (crepe, 2 in. W) on one of cell-end surfaces of honeycomb core to permit inscription of circle of same diameter as routed hole.

4-16.5.3.4 Using template or spacer, inscribe circle on tape, with diameter equal to or no smaller than 1/8 in. less than diameter of routed hole.

4-16.5.3.5 Using inscribed circle as circumference, saw honeycomb core to form cylindrical plug.

4-16.5.3.6 Remove tape from end of plug.

4-16.5.4 Using abrasive paper (medium grit), or equivalent, abrade both flat surfaces of each aluminum

disc and ends of honeycomb plug. Using compressed air, blow out chips and dust from plug.

CAUTION

Care must be taken to use acetone sparingly around existing bonded areas. Wipe surfaces prior to evaporation of acetone. After cleaning, handle discs by their edges.

4-16.5.5 Using acetone and clean, lint-free cloth, clean both surfaces of each disc, surfaces of routed hole, and both end surfaces of honeycomb plug.

4-16.5.6 Mix components of adhesive (Epon 907) (kit) in accordance with manufacturer's instructions.

NOTE

Pot life of adhesive (Epon 907) at 75°F is 40 min.

4-16.5.7 Using putty knife or other suitable tool, apply one coat of adhesive (Epon 907) not more than 1/16-in. thick to both flat surfaces of one disc.

CAUTION

Care must be taken to prevent damage to honeycomb core by avoiding excessive pressure against disc.

4-16.5.8 Position disc in routed hole and press it firmly against bottom of hole to assure contact.

4-16.5.9 Position honeycomb plug in routed hole, with end of plug against aluminum disc.

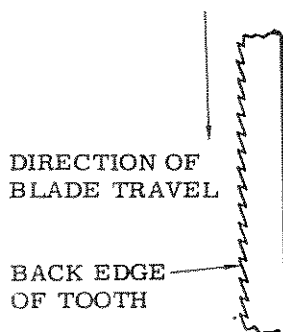


Figure 4-16 Travel Direction of Saw Blade when Sawing Honeycomb

4-16.5.10 Using putty knife or other suitable tool, apply 1 coat of adhesive (Epon 907) not more than 1/16-in. thick to 1 flat surface of remaining disc.

CAUTION

Care must be taken to prevent damage to honeycomb core by avoiding excessive pressure against disc.

4-16.5.11 Position disc in routed hole, with adhesive on disc against top of plug. Press firmly against disc to insure contact. Using any suitable method, apply pressure against disc to maintain contact and allow adhesive to cure for at least 24 hr.

4-16.5.12 Remove pressure from disc.

CAUTION

Care must be taken to use acetone sparingly around existing bonded areas. Wipe surfaces prior to evaporation of acetone.

4-16.5.13 Using acetone and clean, lint-free cloth, clean exposed surfaces of disc and routed hole.

4-16.5.14 Mix components of sealing compound (Epon 932) (kit) in accordance with manufacturer's instructions.

NOTE

Pot life of sealing compound (Epon 932) at 75°F is 5 to 8 min.

4-16.5.15 Using putty knife or other suitable tool, fill routed hole with sealing compound (Epon 932). Completely fill all cavities and apply excess of approximately 1/8-in. depth to allow for shrinkage during curing.

4-16.5.16 Allow sealing compound (Epon 932) to cure for at least 15 min until hard, assuring that sealing compound does not flow or creep excessively during cure.

4-16.5.17 Using flat hand file or other suitable tool, remove excess sealing compound so that its surface is in accordance with contour requirements in referencing documents, and edges of sealing compound are faired smoothly into adjacent surfaces.

4-16.5.18 Paint surface of sealing compound and adjacent area in accordance with paint requirements of surrounding area.

4-16.6 PATCH METHOD (Figure 4-17).

4-16.6.1 Route skin and honeycomb core to depth as required for removal of damaged material in accordance with procedures in paragraph 4-16.2.

4-16.6.2 Mix components of sealing compound (Epon 932) (kit) in accordance with manufacturer's instructions.

NOTE

Pot life of sealing compound (Epon 932) at 75°F is 5 to 8 min.

4-16.6.3 Using putty knife or other suitable tool, fill routed hole with sealing compound (Epon 932). Completely fill all cavities and apply excess of approximately 1/8-in. depth to allow for shrinkage during curing.

4-16.6.4 Allow sealing compound (Epon 932) to cure for at least 15 min until hard, insuring that sealing compound does not flow or creep excessively during cure.

4-16.6.5 Using flat hand file or other suitable tool, remove excess sealing compound so that its surface is no higher than contour and no lower than 1/16 in. below contour at center, and its edges are faired smoothly into adjacent surfaces.

4-16.6.6 Using 2024-T3 or 7075-T6 aluminum alloy sheet, of thickness as specified in appropriate manual of weapon system, fabricate disc of diameter approximately 2 in. larger than diameter of routed hole. Remove all burrs and rolled edges from disc.

4-16.6.7 Using abrasive paper (medium grit), or equivalent, abrade surface of aluminum disc which will be against damaged panel.

4-16.6.8 Form aluminum disc to contour which will match, within approximately 1/32 in., contour of damaged panel around routed hole or filled area.

4-16.6.9 Remove protective finish from damaged panel within perimeter of 2 in. around routed hole in accordance with procedures in TP 35-51.

4-16.6.10 Using plastic sheet (polyethylene, 0.020 in. thick), cut square with each side approximately 4 in. longer than diameter of routed hole.

4-16.6.11 Cut 14-ft length of nylon braided tape. Tie 1 end of tape to 1 end of an extension helical spring. Encircle damaged honeycomb panel adjacent to area being repaired (figure 4-18). Pass free end of tape through open end of spring. Pull tape so that spring is stretched approximately 5 in. Tie tape to spring to retain required extension. Tape any suitable protective material to damaged panel to prevent marring surface by springs.

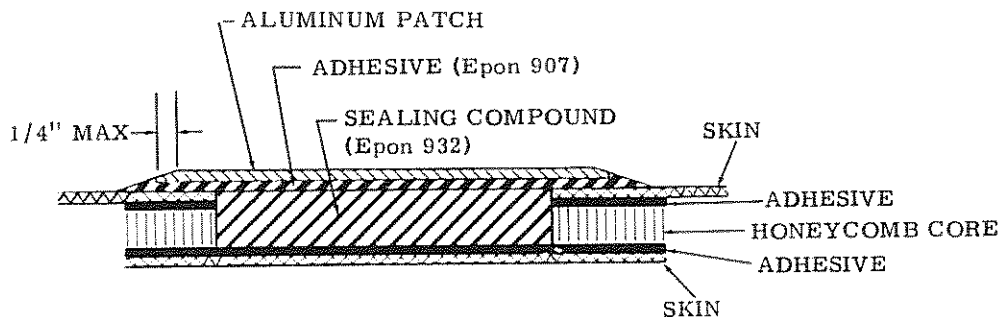


Figure 4-17 Honeycomb Repair - Patch Method

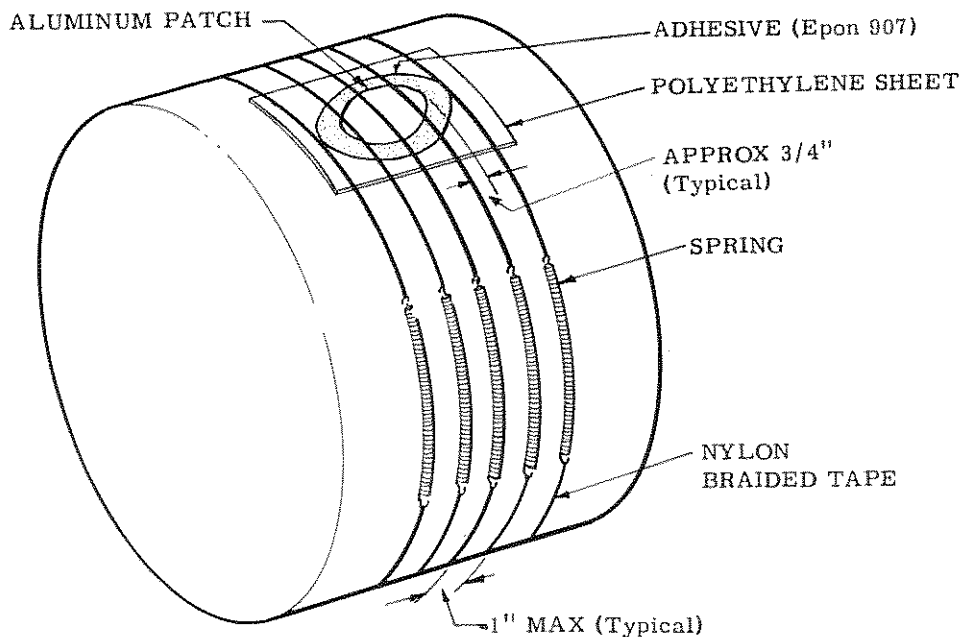


Figure 4-18 Curing Arrangement for Patch Repair

CAUTION

Care must be taken to wipe surfaces prior to evaporation of acetone. After cleaning, handle aluminum disc by its edges.

4-16.6.12 Using acetone and clean, lint-free cloth, clean surfaces of disc, honeycomb panel, and sealing compound (Epon 932) which are to be bonded.

4-16.6.13 Mix components of adhesive (Epon 907) (kit) in accordance with manufacturer's instructions.

NOTE

Pot life of adhesive (Epon 907) at 75°F is 40 min.

4-16.6.14 Using putty knife or other suitable tool, apply 1 coat of adhesive (Epon 907) to abraded surface of aluminum disc and to area on damaged panel and sealing compound to which disc will be bonded. Assure that both surfaces are thoroughly covered with film of adhesive to thickness of 1/32 to 1/16 in.

4-16.6.15 Position aluminum disc against damaged panel, using very light pressure to hold it in place.

4-16.6.16 Place square of plastic sheet over aluminum disc so that it is centered (figure 4-18). While holding square and disc in position, adjust tape assembly so that it is over center of disc.

4-16.6.17 Assemble and install additional tape assemblies in accordance with figure 4-18 and paragraph 4-16.6.11. Install tape assemblies in pairs so that symmetrical pressure pattern is maintained against plastic sheet.

4-16.6.18 Maintain pressure of tape assemblies against plastic sheet and allow adhesive to cure for at least 24 hrs.

4-16.6.19 Remove tape assemblies, plastic sheet, and protective material which is taped to damaged panel.

4-16.6.20 Using flat hand file or other suitable tool, remove excess adhesive so that its surface is no higher than 1/16 in. above contour, and is faired smoothly into adjacent surfaces. File disc to facilitate contouring, if necessary, in area no farther than 1/4 in. from its edge.

4-16.6.21 Paint surfaces of aluminum disc, adhesive, and adjacent area, in accordance with paint requirements of surrounding area.

4-17 REPAIR OF MOCK HE.

These procedures are to be used for repairing damaged mock HE used in Type 3B and Type 3C Trainers.

4-17.1 Clean all loose pieces, chips, flakes, etc from damaged area of mock HE to be repaired.

4-17.2 As necessary, using any suitable material (such as stencil board), cut and shape the material and tape material in place to make a supporting form to complete contour features of damaged area. This form must be rigid enough to support the putty-like mixture while mixture is being applied or curing. Use any suitable pressure-sensitive tape for securing form in place.

4-17.3 Obtain any suitable clean container (such as a sturdy paper cup) of sufficient size to hold volume of paste to be mixed.

4-17.4 Thoroughly mix 1 part by volume of epoxy resin (viscous type) (P/N 876571-00), with 3/4 part by volume of polyamide resin (curing agent) (P/N 876573-00).

NOTE

In the following procedures the inert molding powder may contain large non-soluble granules. These granules may be powdered, if desired, prior to mixing or filed after the mixture cures.

4-17.5 Gradually add to this mixture, while stirring, a sufficient amount of inert molding powder (P/N 876613-00) to obtain a thick putty-like consistency paste that is workable and will hold its shape when worked.

4-17.6 Remove paste from container and fill the damaged area with the paste. Shape paste as required to comply with adjacent surfaces and previous contour of damaged inert HE removed. As required, force paste into cracks, gouges, etc.

4-17.7 Allow paste to cure for 16 to 20 hr at room temperature.

4-17.8 After the mixture has cured, remove form, if used, and carefully file repaired area to blend with the nondamaged surfaces. Finish with any suitable abrasive cloth or paper.

SECTION 5

MAINTENANCE OF ELECTRICAL AND TEST EQUIPMENT

5-1 GENERAL.

This section contains procedures for maintenance, repair, replacement of parts, etc, on various types of electrical and test equipment. The specific paragraphs on maintenance of test equipment are limited to certain types of standard test equipment only. Other procedures to be used in conjunction with procedures in this section are as follows.

5-1.1 Refer to section 2 for maintenance operation standards and general safety precautions.

5-1.2 Refer to section 3 for procedures on joining of parts, such as, bonding, riveting, etc, when specified for use in conjunction with electrical repair.

5-1.3 Refer to TP 35-51 for procedures on cleaning of small areas, identification marking, and surface refinishing when required in conjunction with electrical repair.

5-2 REPAIR OF SOLDERED ELECTRICAL CONNECTIONS.

All soldering is to be performed in general in accordance with MIL-S-6872 or MIL-S-60902. This paragraph provides specific specifications and information for various types of soldered connections in special weapons equipment.

WARNING

All soldering operations must be done in an area away from a weapon and clear of all combustible materials. Soldering in the vicinity of HE is permissible if a remotely heated iron is used. It is permissible to solder strapping wires to load coils without removing the components. Have a fire extinguisher available for immediate use.

5-2.1 MATERIAL AND EQUIPMENT.

5-2.1.1 **SOLDER.** The solder to be used for soldering electrical connections is tin-lead alloy per QQ-S-571, composition Sn60 or higher tin content, unless otherwise specified. Solder containing silver (Sn62) is permissible for soldering silver-plated parts. Cored solders are permissible if they contain rosin flux.

5-2.1.2 **FLUX.** The soldering flux to be used is commercial grade WW rosin, rosin in alcohol, or some other neutral type rosin. Active or corrosive flux is not to be used for soldering electrical connections. If rosin-core solder is used, no additional flux is required.

5-2.1.3 **WIRE.** Unless otherwise specified, wire replaced on components of training units or test equipment during maintenance will be the same type, size, and color as the damaged wire, and will conform to Military Specification MIL-W-16878C (High Temperature Insulated Electrical Wire) or MIL-W-3861(1) (Electrical Wire, Bare Copper), as applicable.

5-2.2 REMOVAL AND CLEANING OF SOLDERED CONNECTION.

5-2.2.1 If necessary, place drop cloth beneath soldered connection to prevent any loose particles or molten solder from falling into equipment.

5-2.2.2 If possible, cut wire or component free from soldered connection prior to application of heat. Leave sufficient length of wire extending from soldered connection to permit grasping wires with pliers.

5-2.2.3 Using well-tinned soldering iron, heat soldered connection and, while solder is molten, work wire or component loose from connection. Brush, wipe, or file old solder from terminal or contact.

5-2.2.4 If necessary, drill wires out of post holes using drill of same diameter as post hole.

5-2.2.5 Using kerosene, methyl ethyl ketone (technical), or toluene (technical), clean terminal or contact of all dirt, oil, grease, or other foreign matter. Do not soak parts; use gentle brushing action.

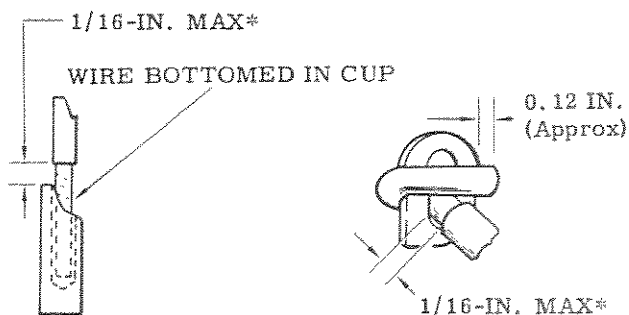
5-2.3 **WIRE STRIPPING AND TINNING.** A pair of standard wire strippers or a sharp knife is required for stripping insulation from single or stranded conductors. Take care, when stripping, not to nick, cut, or otherwise damage the conductor.

NOTE

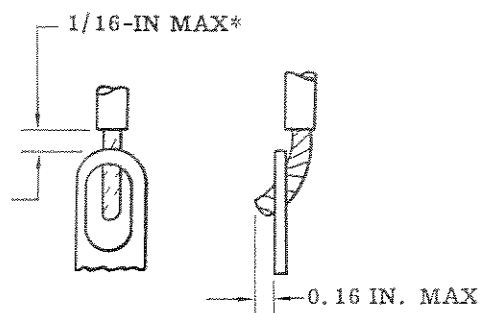
Tinning of conductors to be connected to slotted terminals is optional.

5-2.3.1 LENGTH OF WIRE TO BE STRIPPED AND TINNED.

5-2.3.1.1 Strip sufficient length of wire (figure 5-1) to permit conductor to bottom in solder cup, extend



WIRE SIZE 18 AND SMALLER



WIRE SIZE 16 AND LARGER

*BEFORE SOLDERING

Figure 5-1 Length of Conductor to Be Stripped and Tinned

through post hole, or complete required number of turns around a post, whichever is applicable, while at the same time allowing for:

- a. A 1/16-in. (maximum) gap of bare wire between terminal and wire insulation, and
- b. A 0.12- to 0.16-in. protrusion at end of wire (on wrap-around and twisted connections only).

NOTE

The gap and protrusion specified in a. and b. of preceding paragraph are not applicable to wires carrying radio frequency (RF) currents or where corona may occur, in which cases the connection should be as compact and free from sharp protrusions as possible.

The 1/16-in. (maximum) gap specified in a. of preceding paragraph is applicable

before soldering. This dimension allows for insulation shrinkage during soldering, after which the maximum allowable gap is 1/8-in.

The wire protrusion specified in b. of preceding paragraph is provided to facilitate removal of wire, if required.

5-2.3.1.2 Tin only 1/4 to 3/4 of total area of stripped wire which will seat in, around, or against terminal or contact. Tinning wire beyond soldered connection could result in an inflexible wire subject to breakage.

5-2.3.2 SINGLE CONDUCTOR.

5-2.3.2.1 When stripping Nos. 14, 12, and 10 AWG wire, use next larger size cutting hole of stripper to crack and remove outer insulation. Use same size cutting hole of stripper to cut and remove remainder of insulation.

5-2.3.2.2 When stripping No. 16 AWG wire, first crack insulation (using same size hole of stripper), rotate wire 90 degrees in stripper, then complete stripping operation.

5-2.3.2.3 When stripping Nos. 18 through 22 AWG wire, use same size hole of stripper to crack insulation and use next larger size hole to remove insulation.

5-2.3.2.4 After stripping wires which have braided insulation subject to fraying, apply suitable staking liquid, such as electrical insulating compound (glyptal), to cut ends of insulation.

5-2.3.2.5 Tin stripped wire by means of well-tinned soldering iron, solder, and flux. Tinning is best accomplished by rolling wire on tip of soldering iron and applying small amounts of solder until wire is evenly coated with thin film of solder.

5-2.3.3 STRANDED CONDUCTOR.

5-2.3.3.1 When stripping stranded conductor, remove insulation only partially from conductor (figure 5-2) to prevent strands from separating during tinning. Check that total number of strands damaged during stripping does not exceed allowable maximum as specified in table XXIII.

5-2.3.3.2 After stripping wires which have braided insulation subject to fraying, apply suitable staking liquid, such as electrical insulating compound (glyptal), to cut ends of insulation.

5-2.3.3.3 Using well-tinned soldering iron, solder, and flux, tin area of exposed strands as shown in figure 5-2. Tinning is best accomplished by rolling wire on tip of soldering iron and applying small amounts of solder until wire is evenly coated with thin film of solder.

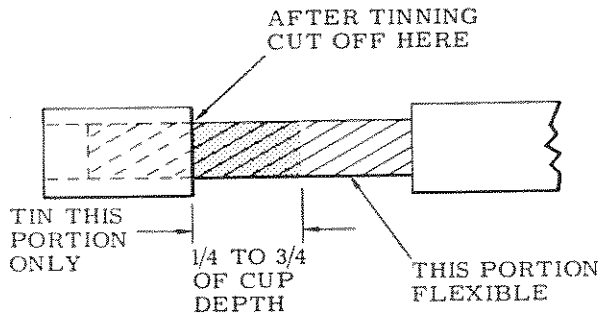


Figure 5-2 Stripping and Tinning of Stranded Conductor

5-2.4 INSULATION SLEEVING FOR WIRES AND TERMINALS. If insulation sleeving (table XXIV) is required, it is placed on wire prior to joining wire to terminal or contact, but is not secured in place until after connection is soldered. Terminals of fuse posts, lamp-holders, uninsulated terminal lugs, and AN-type connectors require vinyl sleeving. Bare wires and bare leads of capacitors, resistors, and other parts require braided glass sleeving. Terminals on relays and short jumper wires may or may not require sleeving, depending on terminal spacing. Generally, rotary-switch terminals of terminal boards do not require sleeving.

5-2.4.1 Select sleeving (table XXIV) having inside diameter which will permit sleeving to fit tightly over soldered connection. Cut sleeving to length which will permit covering soldered connection, bare area of wire, and 1/4 to 1/2 in. of wire insulation. Install sleeving on wire before joining wire to terminal or contact. If more than one wire is to be connected to one terminal, use only one piece of sleeving of sufficient inside diameter and length to accommodate all wires.

5-2.4.2 If vinyl insulation sleeving is used, secure sleeving, after connection has been soldered, as follows.

5-2.4.2.1 Apply thin film of vinyl resin adhesive to area of wire insulation (1/4 to 1/2 in.) which will be covered by sleeving. While adhesive is still wet, slide sleeving over wire and soldered connection, so that sleeving overlaps 1/4 to 1/2 in. of insulated wire.

5-2.4.2.2 If sleeving fits tightly over connection and resists light effort to slide it back along wires, tying is not required. If sleeving is loose or shape of terminal tends to force sleeving back along wires, tie 3 or 4 turns of nylon twine around insulated wire 1/4 to 1/2 in. from end of sleeving. If possible, tie two or more insulated wires, extending from adjacent terminals, together in this manner (figure 5-3).

5-2.4.3 If braided glass or other type insulation sleeving is used, secure sleeving in the same manner as for vinyl sleeving, except either tie sleeving in place without using adhesive, or use adhesive, other than vinyl resin adhesive, as specified.

TABLE XXIII
NUMBER OF PERMISSIBLE BROKEN STRANDS
IN STRANDED CONDUCTOR

TOTAL NUMBER OF STRANDS IN CONDUCTOR	ACCEPTABLE LEVEL OF STRAND BREAKAGE
1 to 6	0
7 to 16	1
17 to 26	2
27 to 36	3
37 to 46	4
more than 46	10% of total

5-2.5 MECHANICAL CONNECTION (Prior to Soldering). Prior to soldering, wrap-around or twist electrical connections must be secured mechanically by means of pliers, crimpers, or other tools. Observe following criteria for making good mechanical connections:

NOTE

Typical examples of good mechanical connections prior to soldering are shown in figure 5-4.

a. Direction of wire wrap or twist around connection is optional.

b. If insulation sleeving is being used, mechanically connect wire in line with terminal or lug to prevent excessive bends in sleeving when installed.

c. Allow 1/16-in. (maximum) gap between wire insulation and terminal and 0.12-in. (approximate) protrusion at end of wire.

d. Make sure wire is in physical contact with terminal before soldering.

5-2.6 SOLDERING.

5-2.6.1 For all soldering operations, observe requirements in paragraphs 5-2.1 through 5-2.5, as specified or as applicable; solder in accordance with MIL-S-6872 and good commercial practice. Check connection for conformity to typical properly soldered connections shown in figure 5-5. When soldering heat-sensitive components, apply suitable heat sink, such as long-nose pliers, between component and point of soldering.

5-2.6.2 If more than one conductor is to be soldered to a single solder cup, make connection as shown in figure 5-6. If the preferred method is followed, use

TABLE XXIV
VINYL AND BRAIDED GLASS (Heat-Resistant) INSULATION SLEEVING

SIZE OF WIRE	MINIMUM ID (In.)	VINYL	BRAIDED GLASS (Heat Resistant)
		MIL-I-7444C, Type I, Class 2*	MIL-I-3190B**
24 AWG	0.020		-
22 AWG	0.026		-
20 AWG	0.032		Class H-C-1
19 AWG	0.036		-
18 AWG	0.040		Class H-A-1
17 AWG	0.045		-
16 AWG	0.051		Class H-A-1
15 AWG	0.057		-
14 AWG	0.064		-
13 AWG	0.072		Class H-A-1
12 AWG	0.081		Class H-C-1
11 AWG	0.091		-
10 AWG	0.102		-
9 AWG	0.114		-
8 AWG	0.129		Class H-A-1, Black
7 AWG	0.144		Class H-C-1
6 AWG	0.162		Class H-A-1
5 AWG	0.182		-
4 AWG	0.204		-
3 AWG	0.229		-
2 AWG	0.258		-
1 AWG	0.289		-
0 AWG	0.325		Class B-A-1, Black
5/16 in.	0.313		-
3/8 in.	0.375		-
7/16 in.	0.438		Class H-A-1, Red
1/2 in.	0.500		Class H-C-1
9/16 in.	0.562		-
5/8 in.	0.625		-
11/16 in.	0.688		-
3/4 in.	0.750		-
13/16 in.	0.812		-
7/8 in.	0.875		-
1 in.	1.000		-
1-1/16 in.	1.062		-
1-1/4 in.	1.250		-
1-1/2 in.	1.500		-
1-3/4 in.	1.750		-
2 in.	2.000		-
2-1/4 in.	2.250		-
2-1/2 in.	2.500		-

*Entire column is Class 2.
**Class and/or color only applicable where specified.

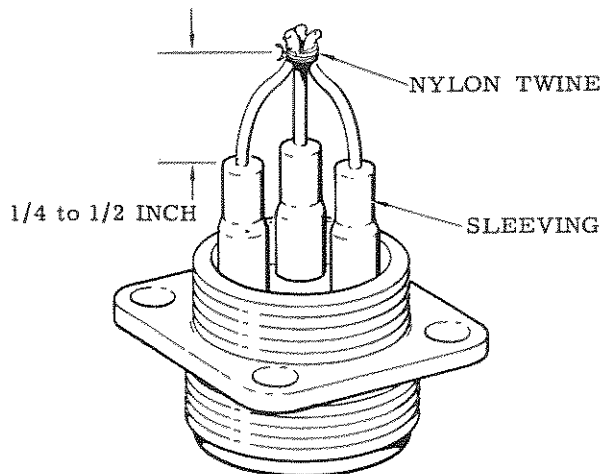


Figure 5-3 Method of Securing Loose Insulation Sleeveing

lugs, crimped with an approved tool, are acceptable without soldering. If approved tool is not used pre-insulated terminal lugs must be crimped and soldered. Noninsulated terminal lugs must be crimped, soldered, and insulated with insulation sleeveing.

5-3.2 TOOLS. Terminals are joined to proper size cables and crimped only by means of correct crimping tool recommended by manufacturer of terminal. Crimping tools for preinsulated terminals are color-coded to match colored terminal for which they are designed, and are of such a type that the jaws will not open until a proper crimp has been made.

5-3.3 PROCEDURES.

5-3.3.1 Strip wire in accordance with procedures in paragraph 5-2.3. Tinning is not required unless the connection is to be soldered.

5-3.3.2 Insert conductor in barrel of lug (figure 5-7 or figure 5-4), taking care that conductor does not extend into fastening area at tongue-end of lug. On insulation-gripping lugs, insert conductor until insulation seats against shoulder of lug barrel (figure 5-7) to provide maximum grip.

CAUTION

Excessive flattening of lug barrel when crimping will result in work-hardened wires subject to easy breakage.

5-3.3.3 Using proper tool, crimp lug barrel so that staking impression is entirely contained on barrel surface, is as concentric to barrel as possible, and is sufficiently deep to compress conductor appreciably while avoiding excessive flattening.

5-3.3.4 Solder connection if required.

5-4 SPLICING OF ELECTRICAL WIRES.

Procedures in this paragraph describe a method of butt-splicing 26- to 22-gauge wire by means of a conductor splice and hand terminal crimping tool (P/N 870452-00). This process eliminates necessity for twisting and soldering wires and provides a connection which is both electrically and mechanically sound.

5-4.1 Using sharp knife or suitable tool, strip back insulation 0.22 in. from ends of two wires to be butt-spliced. Insert one stripped end of wire into one end of suitable conductor splice and halfway through length of conductor splice. Hold wire in position in conductor splice and place conductor splice into open jaws of crimping tool. Operate crimping tool with sufficient pressure to crimp conductor splice and wire firmly. Release crimping tool.

5-4.2 Insert second stripped end of wire into opposite end of conductor splice, butting both wires midway within conductor splice. Hold wire in position in conductor splice and, operating crimping tool with sufficient pressure, crimp second wire and conductor splice. Release crimping tool and remove spliced wires.

5-5 COAXIAL AND SHIELDED CABLE TERMINATIONS.

The method to be used for preparing coaxial or shielded cable terminations will depend on whether the shield is braided or wrapped in spiral fashion around the inner conductors and whether or not the shield is to be formed into a pigtail connection. Figure 5-8 illustrates various methods of preparing terminations with shield pigtails. Figure 5-9 shows two methods of preparing terminations without shield pigtails. Figure 5-10 illustrates typical examples of cable terminations and shield interconnections. Observe the following general criteria for all methods.

5-5.1 Perform all necessary stripping, tinning, and soldering in accordance with applicable procedures in paragraph 5-2. When stripping outer jacket, take care not to damage shield.

5-5.2 Insertion of a piece of heat resistant braided glass sleeveing between shield and inner conductors is specified in illustrations whenever heat is to be applied to shield for soldering or staking. Use of sleeveing is necessary to prevent swelling and burning of inner conductor insulation. Care should also be taken to avoid prolonged application of heat.

5-5.3 All dimensions specified in illustrations are typical, except those listed as minimum lengths.

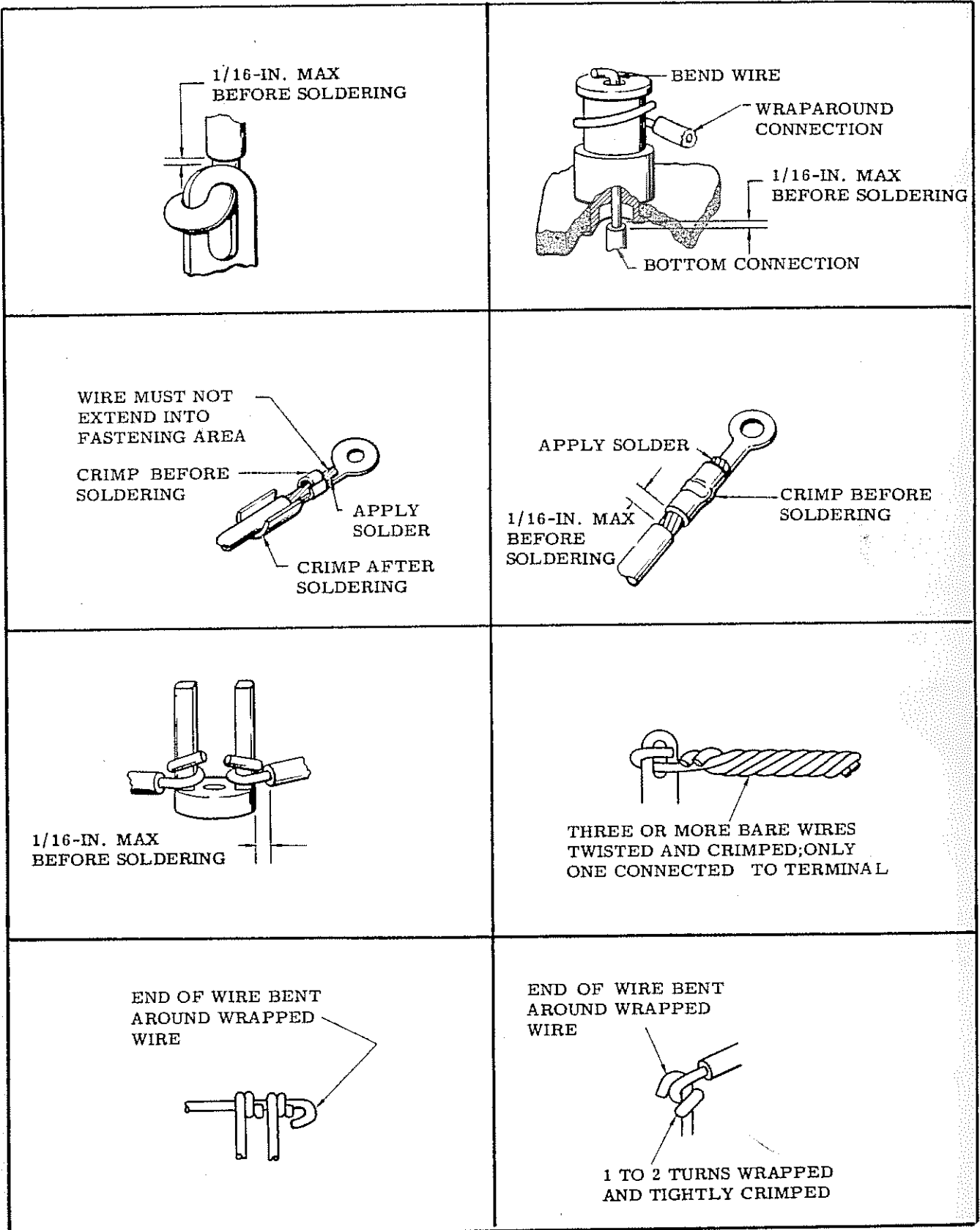


Figure 5-4 Examples of Proper Mechanical Connections

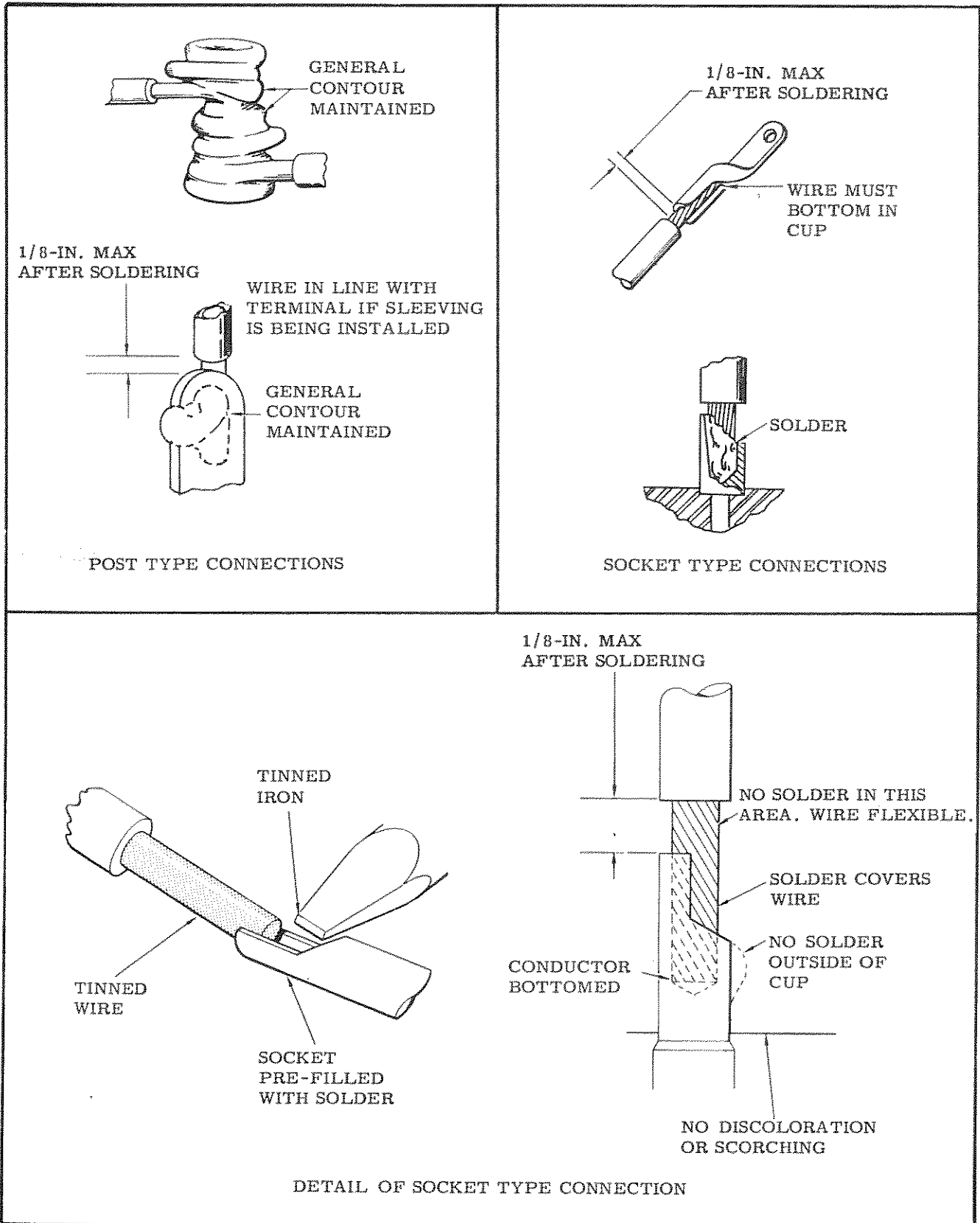


Figure 5-5 Properly Soldered Connections

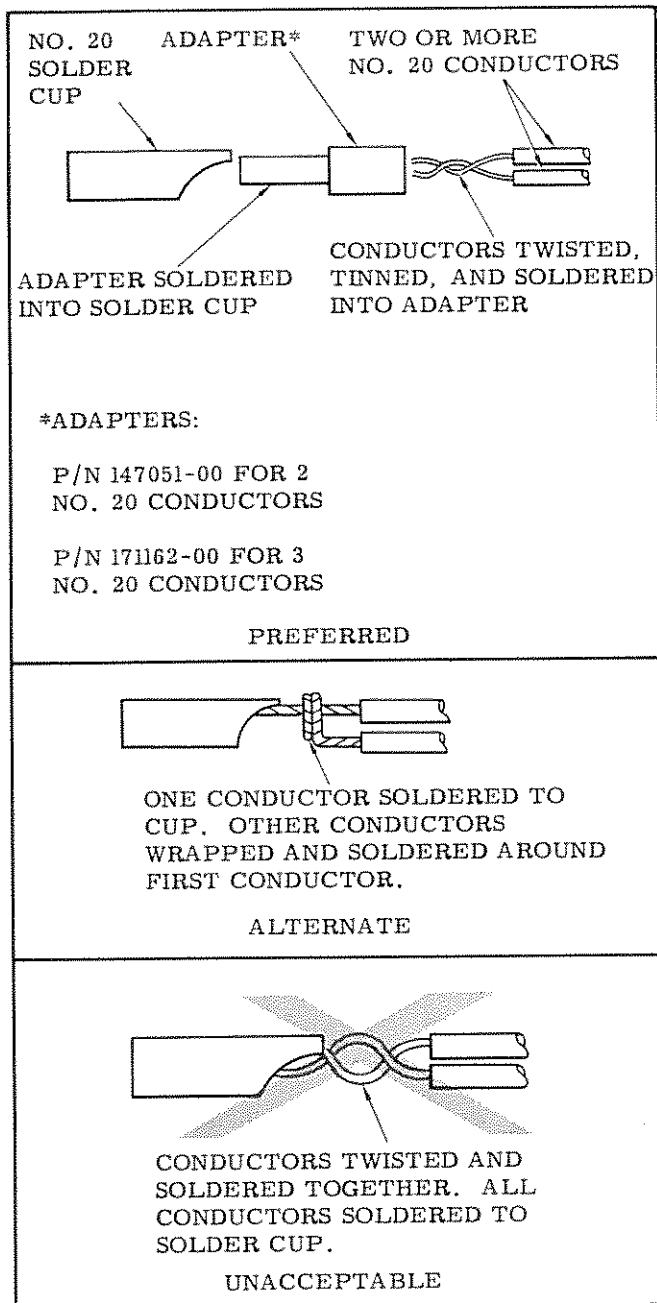


Figure 5-6 Connecting Multiple Conductors to Single Solder Cup

Actual length of conductors, pigtails, etc is dependent on type of connections to be made and other factors.

5-5.4 When vinyl or braided glass sleeving is specified, select sleeving of proper diameter from those listed in table XXIV. When vinyl tape is specified, use electrical insulating tape (vinyl). When vinyl tape or sleeving is specified for final covering of termination, bond sleeving or tape to cable in accordance with procedures in paragraph 3-15.4.

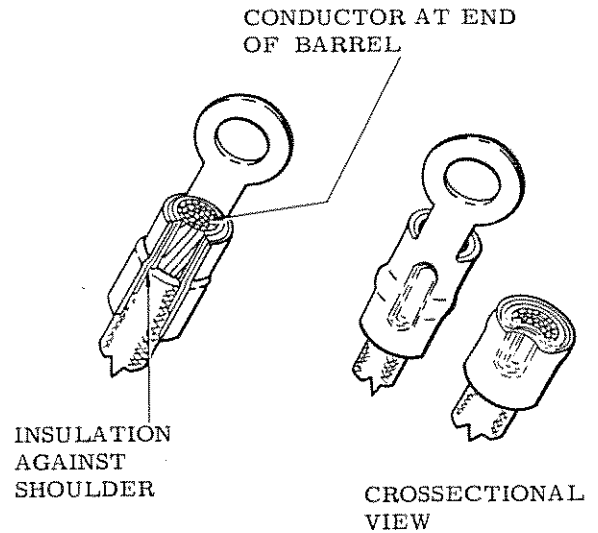


Figure 5-7 Terminal Lug Installation

5-5.5 Where tying with nylon twine is specified, tie sleeving in same manner as when forming cable junctions.

5-6 ELECTRICAL CONNECTORS.

This paragraph provides instructions for replacing various standard types of electrical connectors (plugs and receptacles). The procedures are necessarily general; allowances must be made for minor component differences and variations. In all cases, refer to other areas of this section for procedures on stripping, tinning, and soldering; preparation of cable ends (sleeving and conductor terminations); and installation of insulation sleeving.

5-6.1 STANDARD AN-TYPE AND CERTAIN SA-TYPE CONNECTORS (Figure 5-11).

5-6.1.1 REMOVAL AND DISASSEMBLY.

5-6.1.1.1 Remove two screws and lockwashers and remove compression member(s).

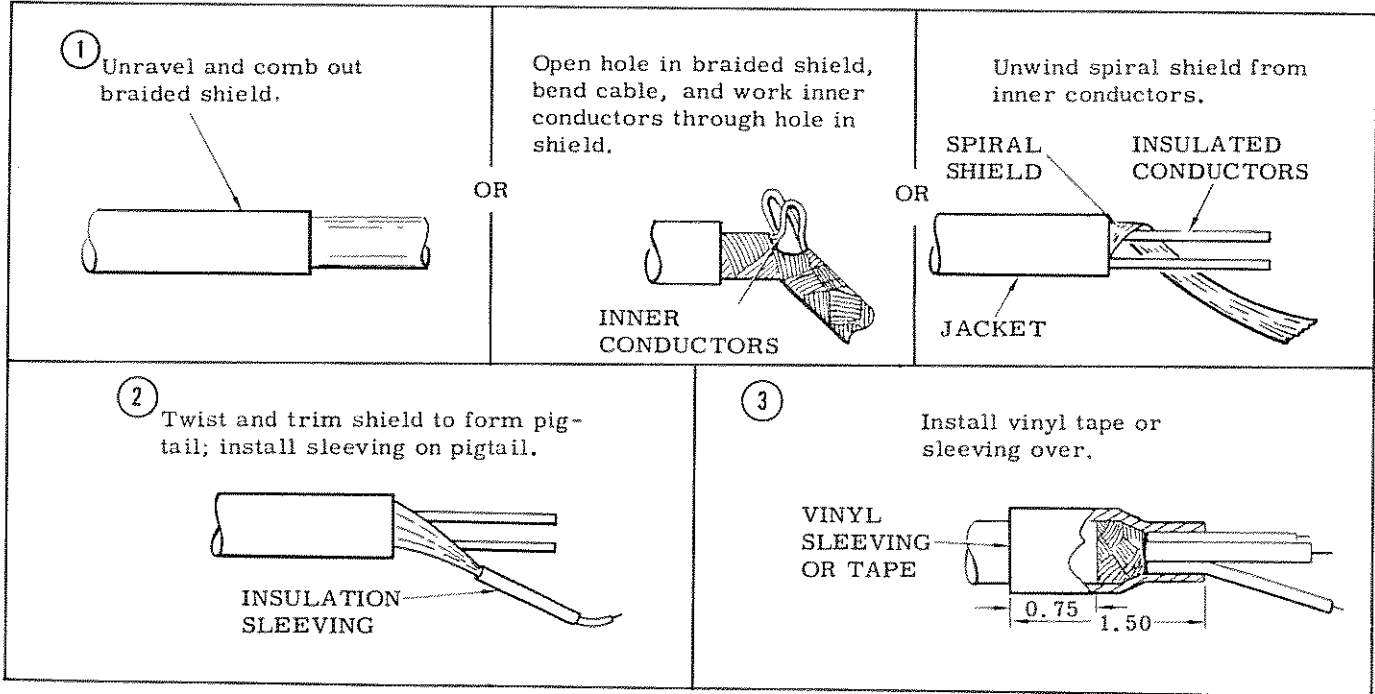
5-6.1.1.2 Free rubber bushing (telescoping sleeve) so that clamp will turn without damaged internal wires of cable.

5-6.1.1.3 Using strap wrench, unscrew cable clamp.

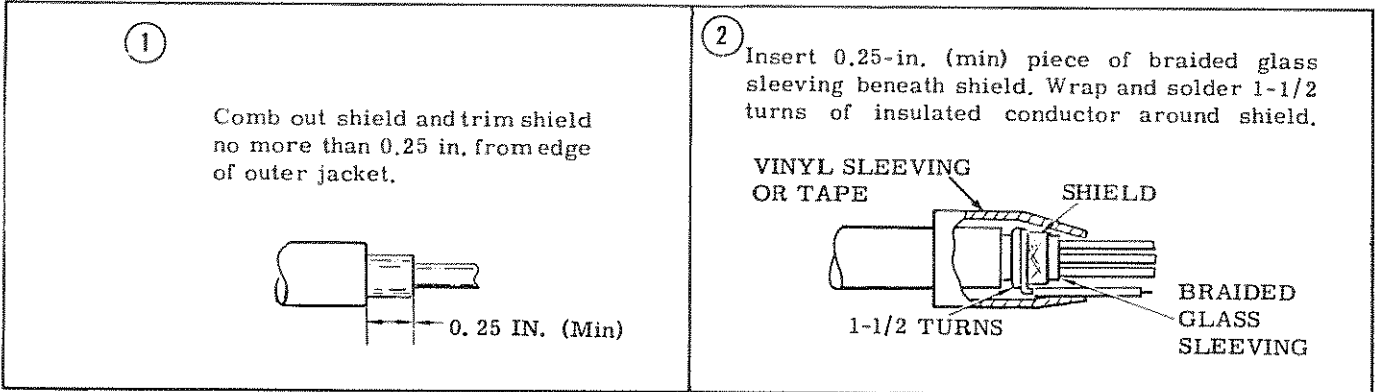
5-6.1.1.4 Slide cable clamp well back on cable.

5-6.1.1.5 Using strap wrench, unscrew clamp adapter and slide it well back on cable. Slip washer, if applicable, back on cable.

PIGTAIL FORMED FROM SHIELD:



PIGTAIL SOLDERED TO SHIELD:



PIGTAIL CRIMPED TO SHIELD:

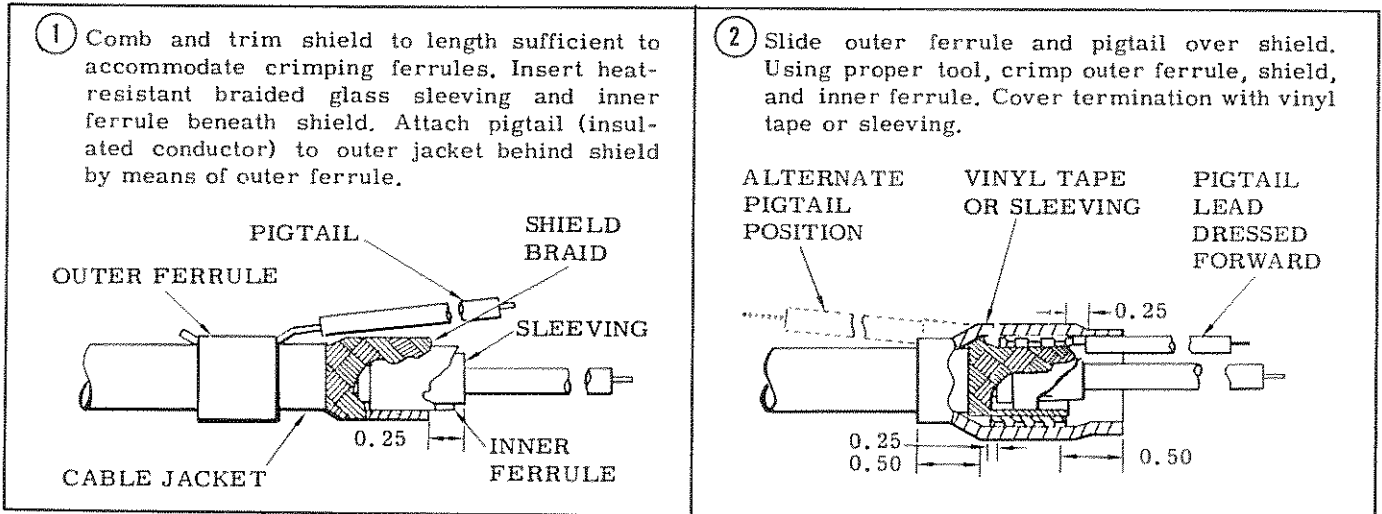


Figure 5-8 Forming Shielded Cable Terminations with Pigtail

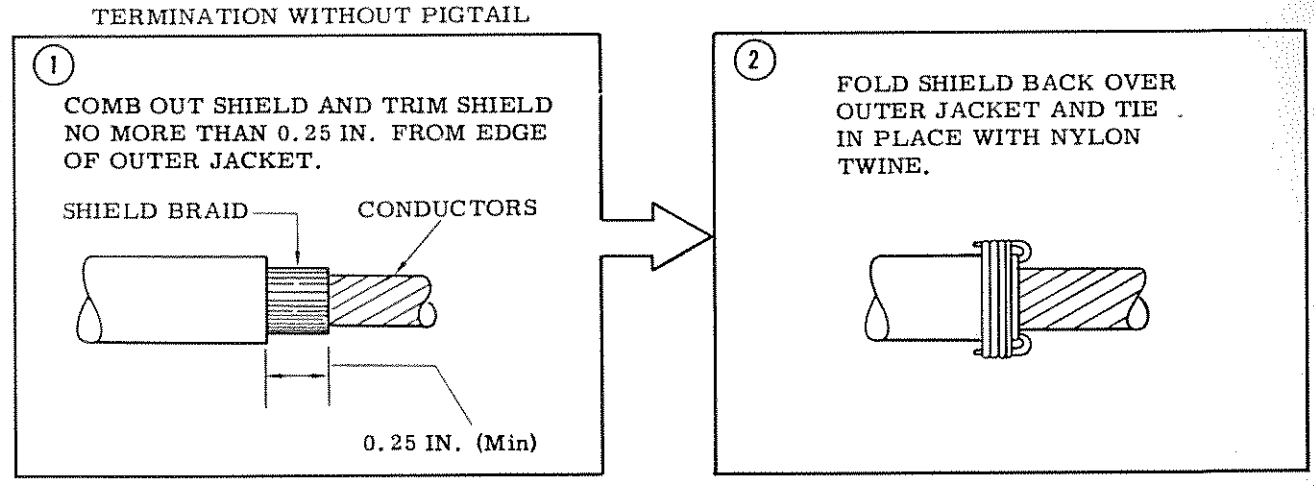
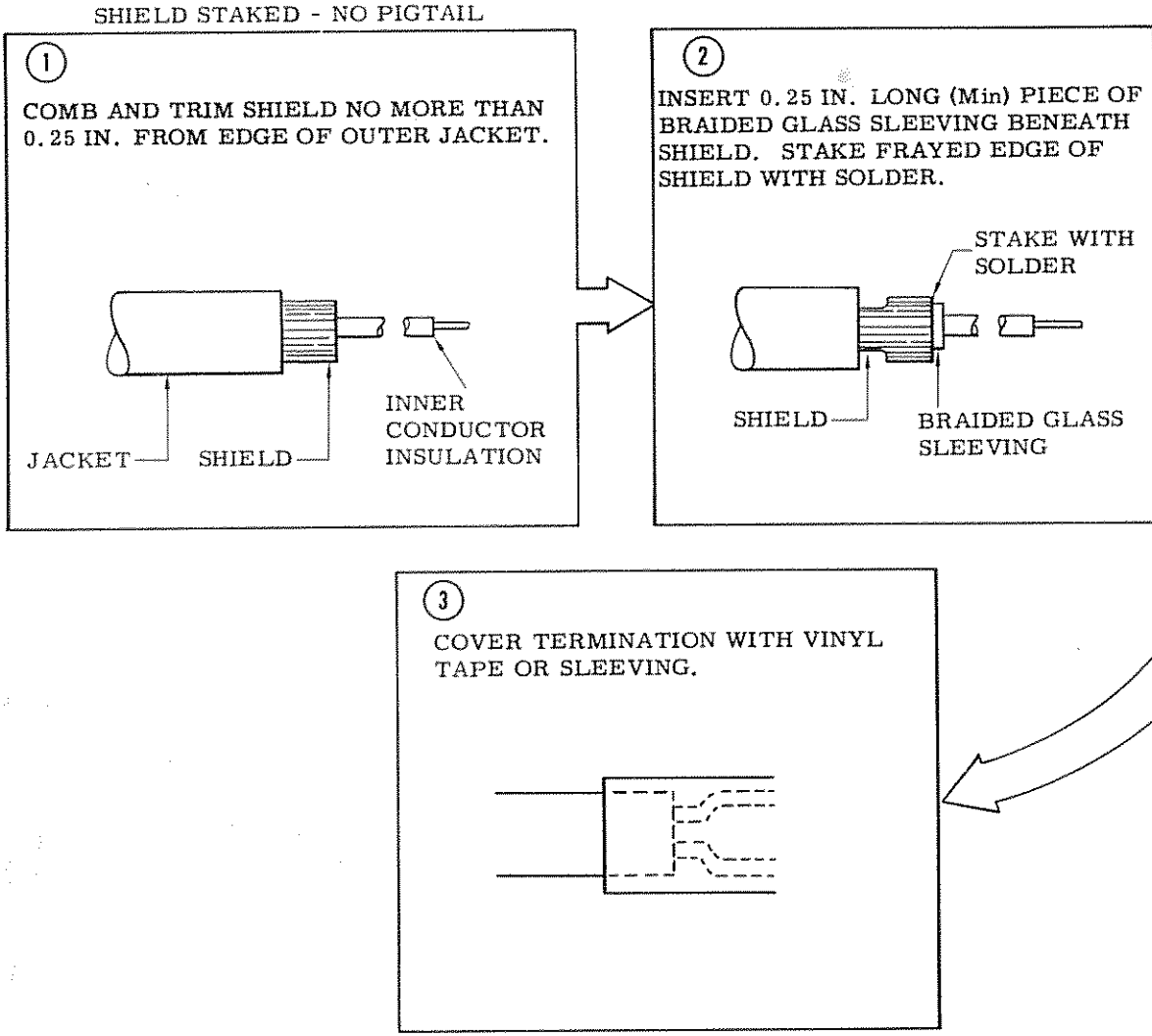


Figure 5-9 Forming Shielded Cable Terminations without Pigtail

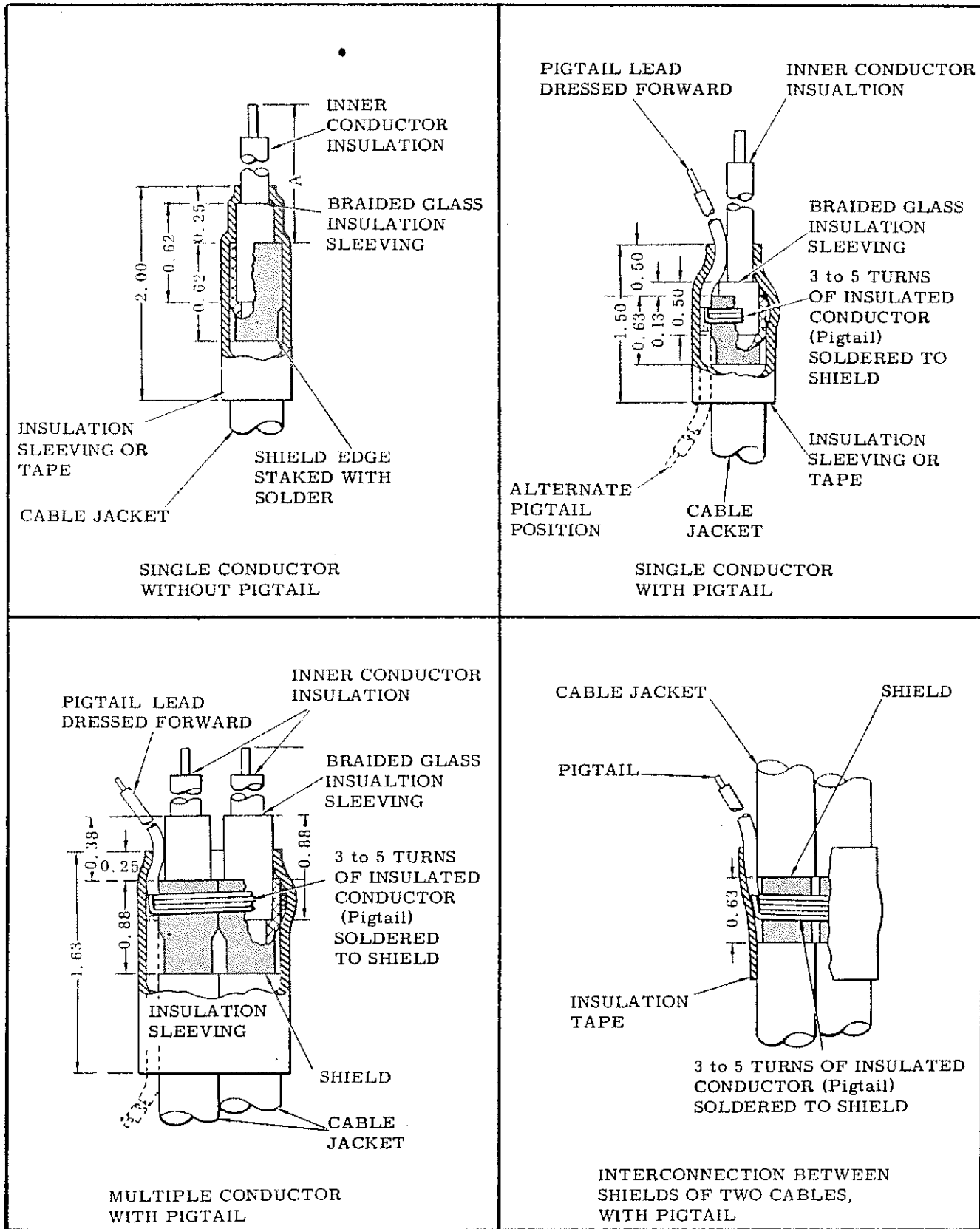


Figure 5-10 Examples of Shielded Cable Terminations with Typical Dimensions

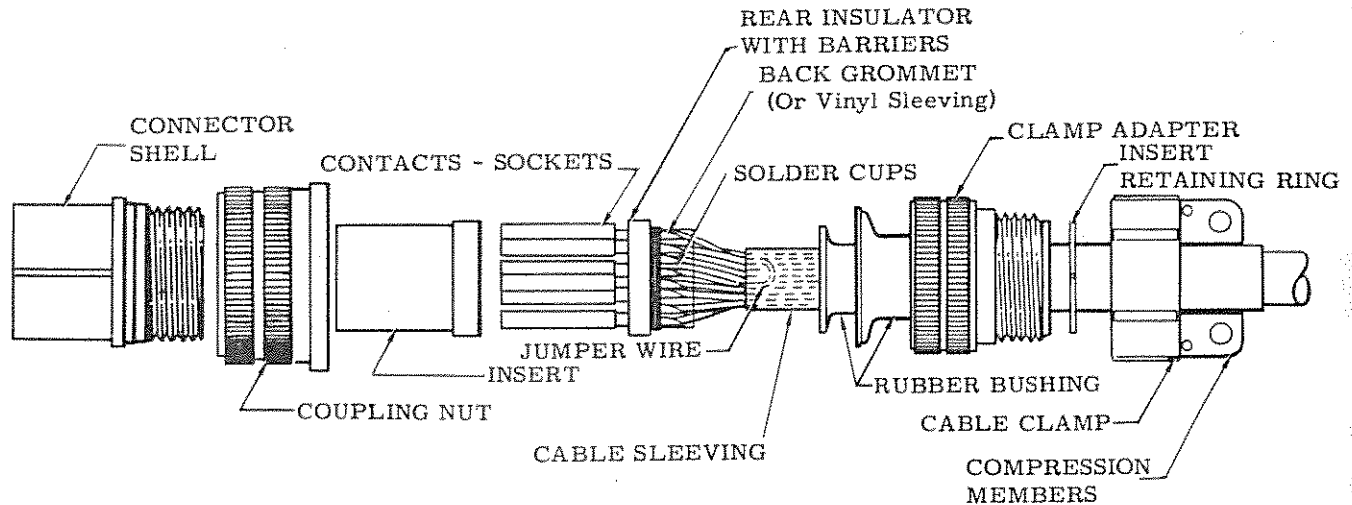


Figure 5-11 Exploded View of Standard AN-Type Connector

NOTE

A matching receptacle (or plug, as applicable) may be installed on connector for holding connector stationary when unthreading clamp adapter from connector shell.

5-6.1.1.6 Lightly brush vinyl sleeving adjacent to rubber bushing with trichloroethylene (technical). Slide bushing well back on cable.

5-6.1.1.7 If end of vinyl sleeving is tied and/or taped in place, cut away tape and/or twine, taking care not to damage vinyl sleeving.

5-6.1.1.8 Work vinyl sleeving back to expose approximately 3 in. of cable conductors.

5-6.1.1.9 On type M connector, remove ring which secures back grommet to rear insulator and slide ring and grommet back on cable. On other type connectors, slide vinyl sleeving, which insulates each connection, back along conductors.

5-6.1.1.10 If wire length is not critical, cut wires from solder cup connections. If wire length is critical, unsolder wires from solder cups, taking care not to overheat connections.

NOTE

When insert is removed, pins or sockets will be free to fall out of rear insulator.

5-6.1.1.11 If desired, remove snap ring which secures insert to rear insulator (not applicable to type M connectors) and remove insert.

5-6.1.1.12 Remove remaining parts of connector from cable.

5-6.1.2 ASSEMBLY AND INSTALLATION.

5-6.1.2.1 Install rear components of connector (cable clamp, insert, adapter, rubber bushing, grommet and ring, etc, as applicable) on cable as shown in figure 5-11.

5-6.1.2.2 Slide vinyl sleeving back to expose approximately 3 in. of wire.

5-6.1.2.3 If type M connector is being installed, thread wires through holes of back grommet. For other type connectors, install vinyl insulation sleeving on each wire of cable.

CAUTION

If the connector insert is removed from rear insulator, contacts will be free to fall out of rear insulator. Take care to prevent contacts from spilling.

5-6.1.2.4 On other than type M connectors, assemble contacts in rear insulator and install insert over contacts.

5-6.1.2.5 Place assembled insert, contacts, and rear barrier in connector shell and clamp shell in vise with contact solder cups facing up.

5-6.1.2.6 With proper pin numbers and wire numbers oriented by means of ohmmeter and as specified on wiring diagram, solder cable wires to connector solder cups and install vinyl sleeving (if applicable) over each connection. Start soldered connections at bottom row and work up, row by row. If jumper wires are required, use insulated wire sufficiently long to

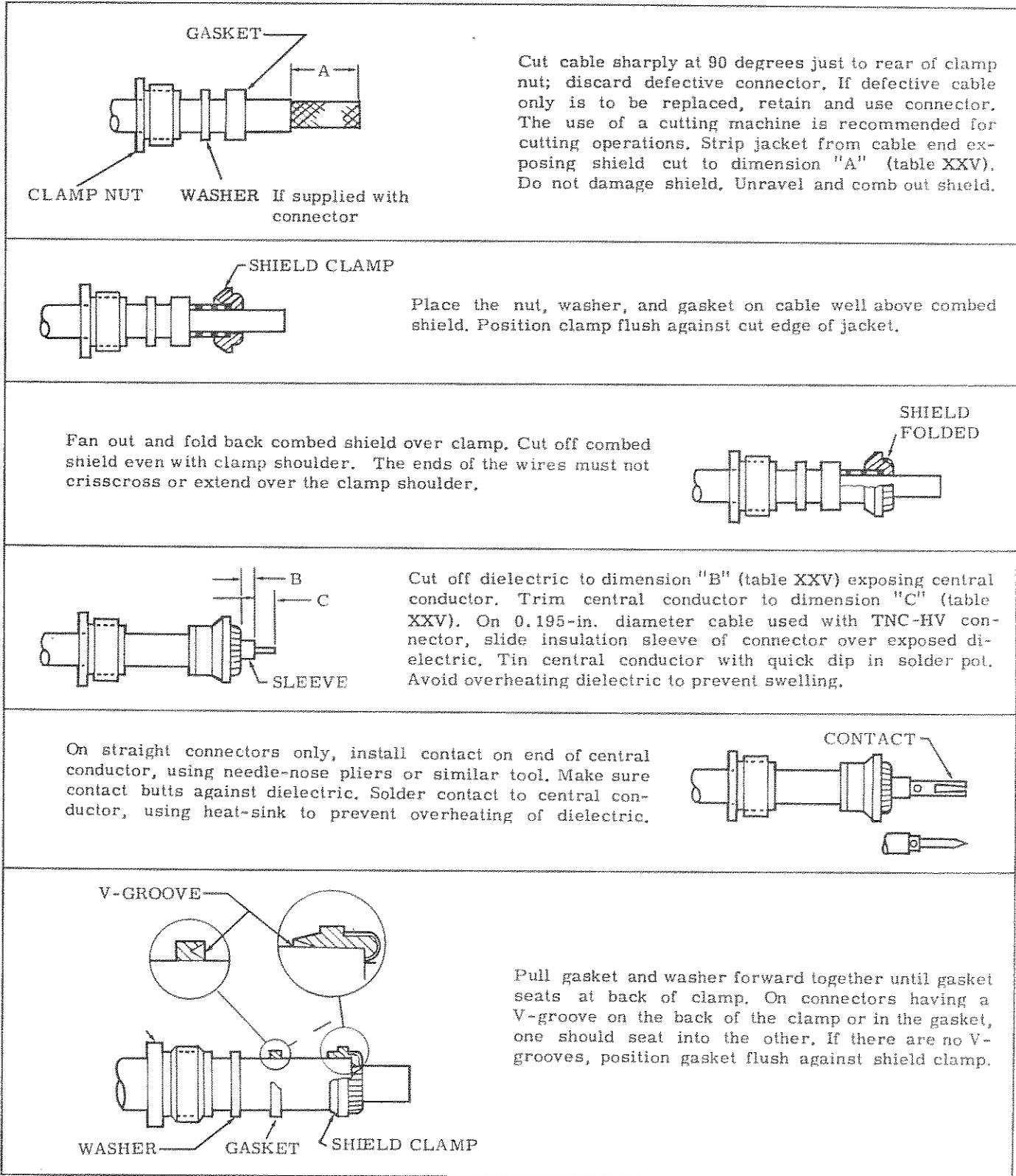
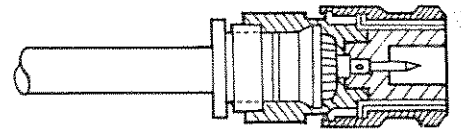


Figure 5-12 Installation and Assembling of Typical Bayonet and Threaded RF Connector (Part 1 of 2)

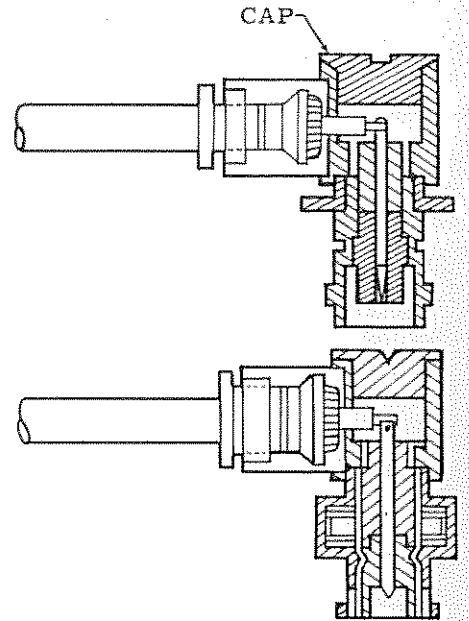
On straight connectors only, insert contact into connector body, keeping contact centered in forward position. Slide washer (if present) and clamp nut forward and thread nut into connector body, taking care not to twist cable. Tighten nut securely.



On angle connectors, insert tinned conductor in connector body. Slide washer (if present) and clamp nut forward and thread nut into connector body, taking care not to twist cable. Tighten nut securely.

If tinned conductor extends beyond solder cup of connector contact, trim conductor flush with contact. Solder conductor to solder cup of contact, avoiding prolonged application of heat.

If desired, apply electrical insulating compound (DC-4) to threads of cap and mating threads of connector body. Install cap and tighten securely.



On the following types of straight connectors only, check for specified contact protrusion or recession (beyond insulator):

TYPE	CONTACT	PROTRUSION (In.)	RECESSION (In.)
BNC	Female	0 max.	0.040 max.
TNC	Male	0 max.	0.040 max.
C and SC	Female	-	0.020 min. to 0.045 max.
	Male	0.015 max.	0.015 max.

NOTE

On all other type straight connectors, the protrusion or recession of the contact is fixed by a shoulder on the contact which butts against the dielectric.

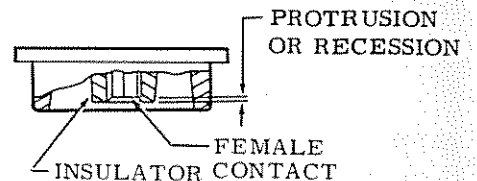
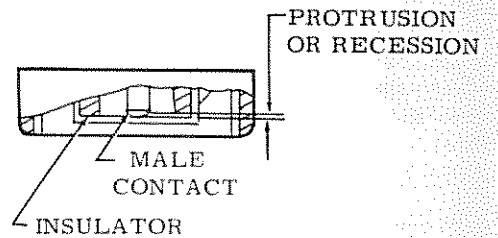


Figure 5-12 Installation and Assembling of Typical Bayonet and Threaded RF Connector (Part 2 of 2)

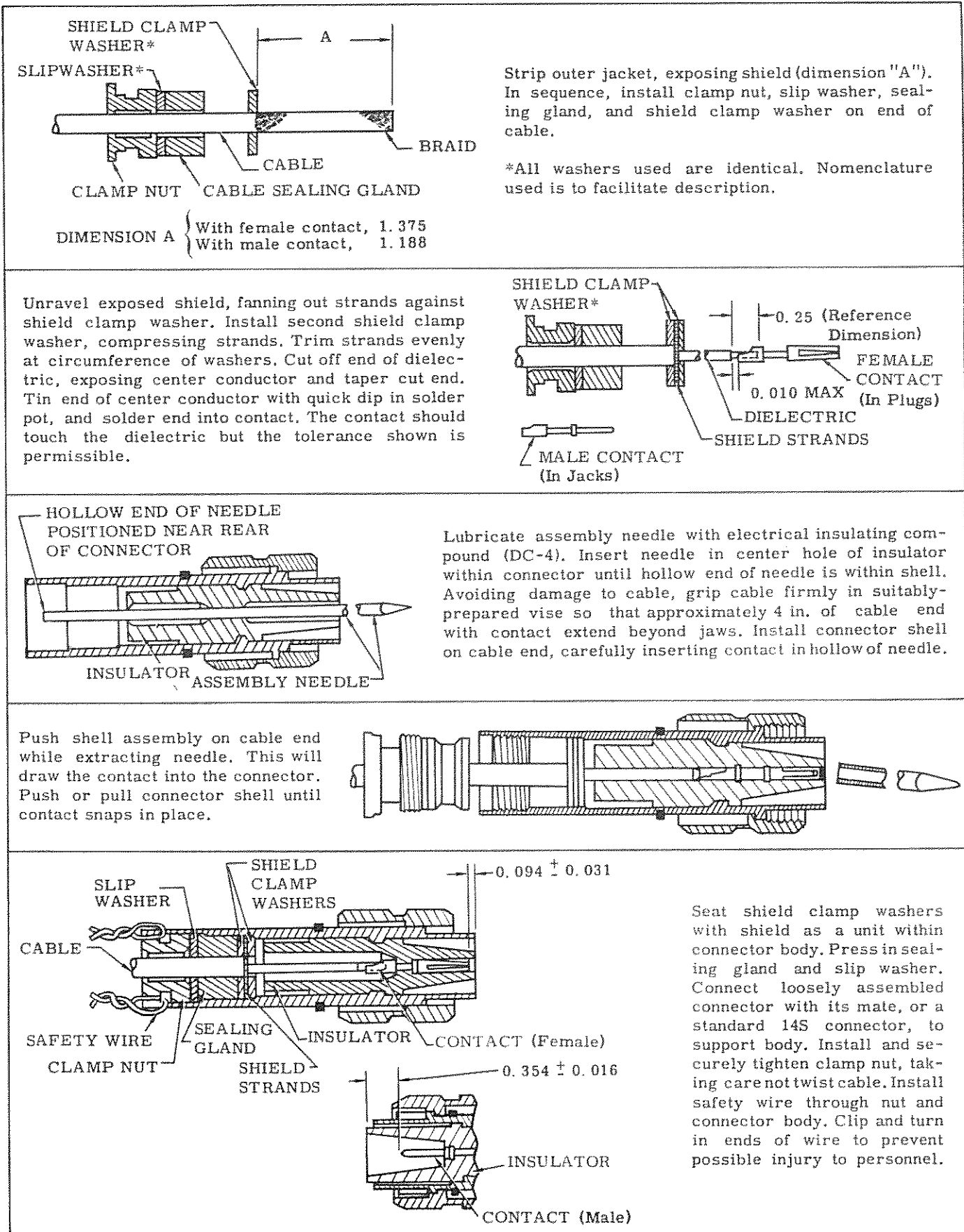


Figure 5-13 Installation of High-Voltage Coaxial Cable Connector with Shield Clamp Washers

TABLE XXVI

HIGH-VOLTAGE CONNECTOR WITHOUT SHIELD CLAMP WASHERS

TYPE	DESCRIPTION	CABLE CUTTING DIMENSIONS		
		A	B	C
Receptacle	Straight	1.17"	0.97"	0.18"
Plug	Straight	1.37"	1.17"	0.18"

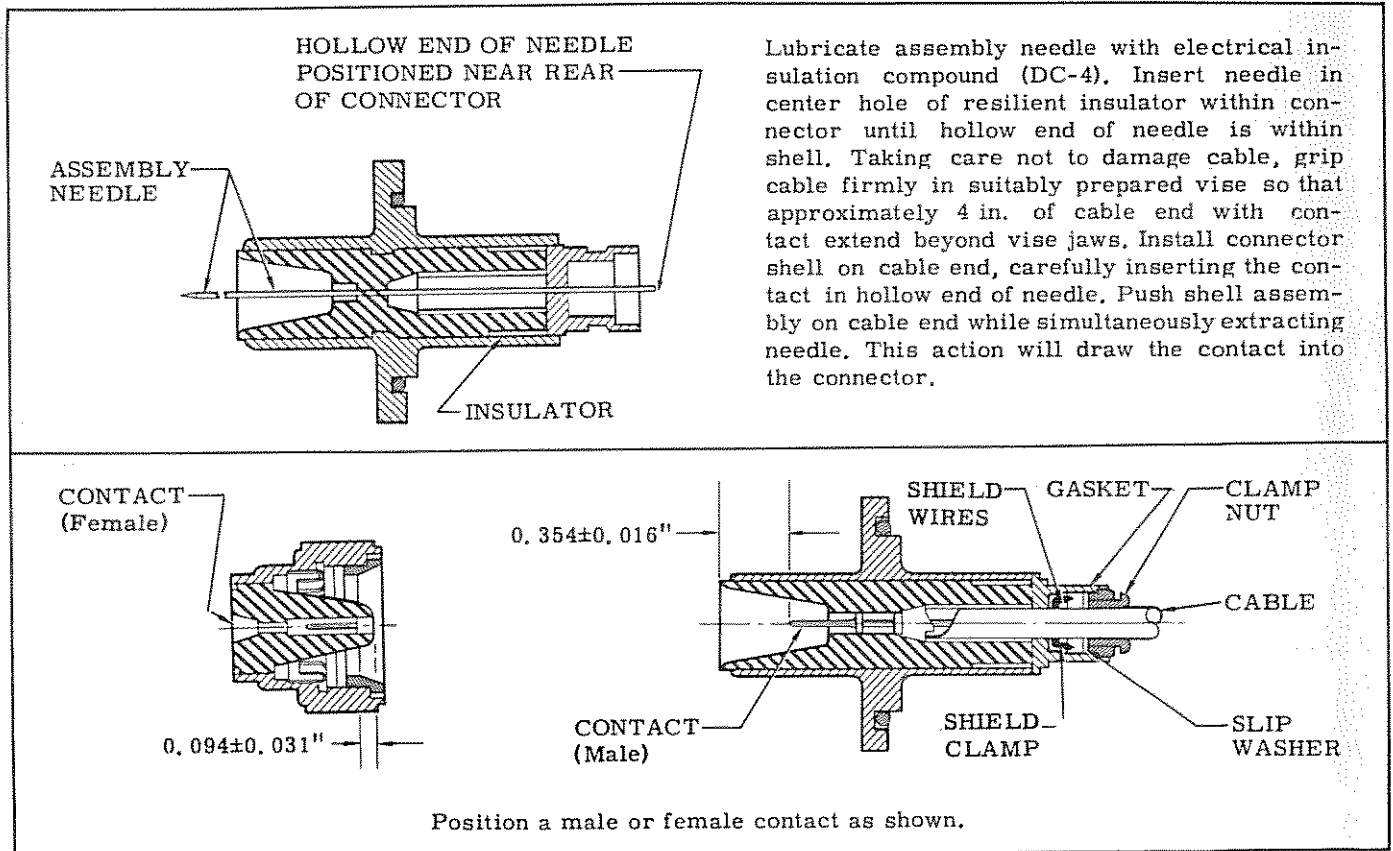


Figure 5-14 Installation of High-Voltage Coaxial Cable Connector Not Employing Shield Clamp Washers

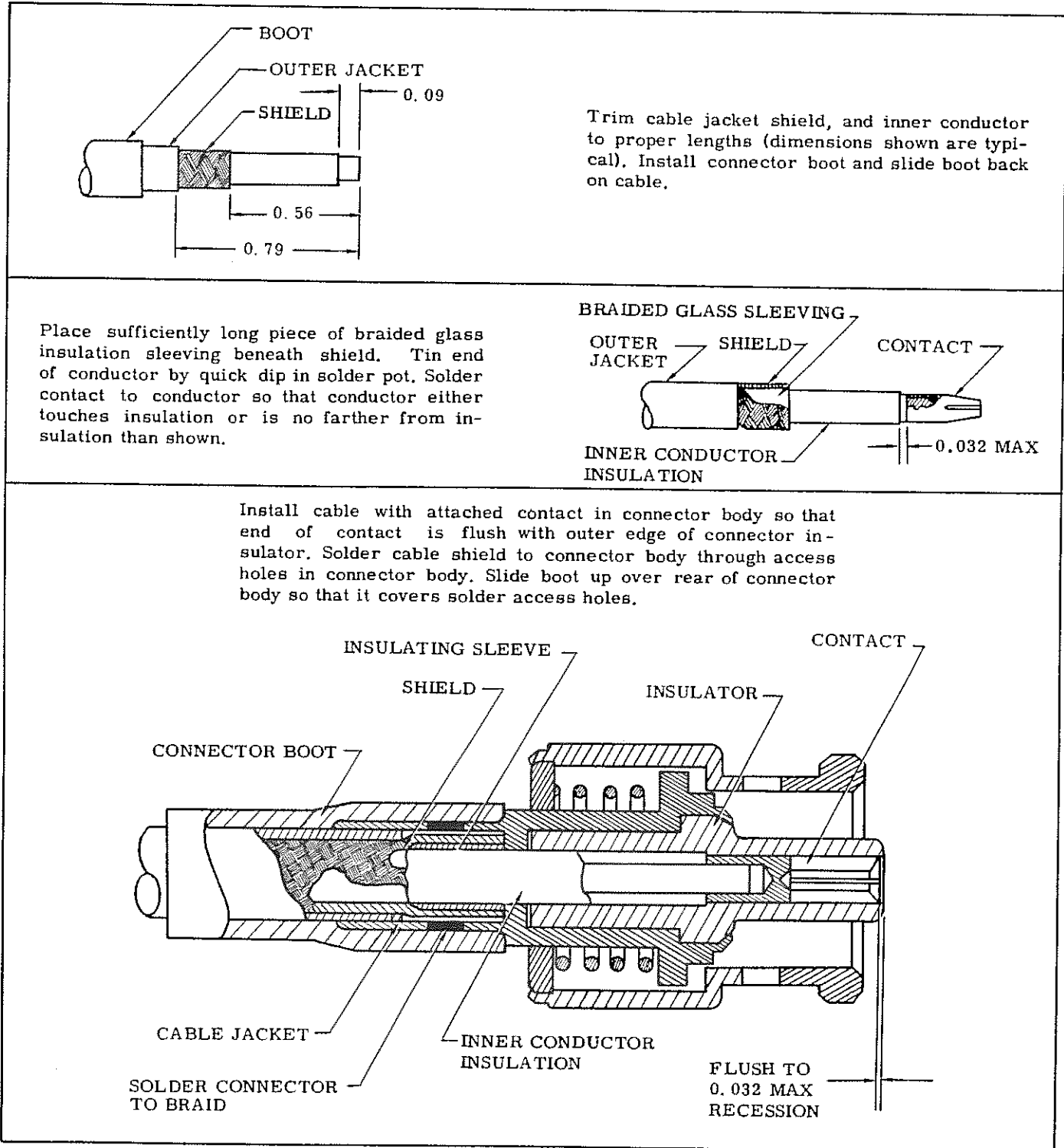


Figure 5-15 Installation of High-Voltage Coaxial Cable Boot Connector

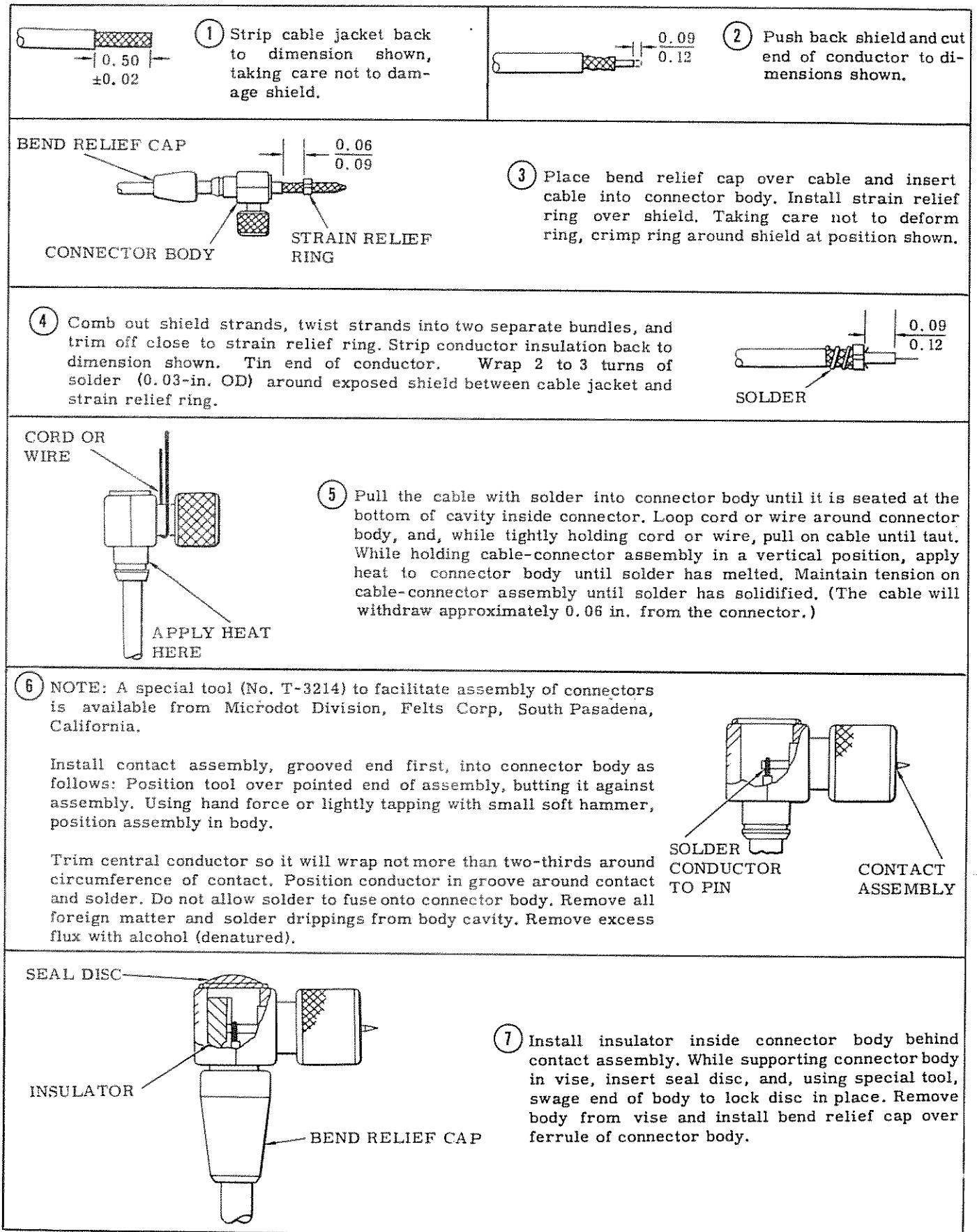


Figure 5-16 Installation of Subminiature RF Connector

a. Damage to sleeving, which also involves damage to wire insulation beneath sleeving, is not repairable.

b. Rips and tears in cable sleeving exceeding 2 in. long are not repairable. Also, circumferential tears, extending over three-fourths of total periphery of sleeving, are not repairable.

c. Damaged areas of sleeving within 6 in. of each other (or within 6 in. of previously repaired areas) are not repairable.

d. Damage which will necessitate cable re-marking is not repairable if no marking facilities are available.

5-7.1.1.1 Using small piece of electrical insulation tape (vinyl), prepare vinyl resin adhesive in accordance with procedures in paragraph 3-15.4.

5-7.1.1.2 Repair rips, tears, breaks, etc, in sleeving as follows: Apply thin film of vinyl resin adhesive to one surface of vinyl insulation tape and to periphery of cable sleeving in area of damage. Starting and ending at least 1/2 in. to either side of damaged area, wrap tape in spiral fashion around sleeving so that each spiral overlaps approximately one half of previous wrap width. If possible, maintain original shape of sleeving by holding damaged area between fingers and wrapping tape as tightly as possible across rip or break.

5-7.1.1.3 Repair sleeving which has pulled loose from cable clamp as follows: Release connector compression members and clamp (paragraph 5-6.1). Apply thin film of vinyl resin adhesive to one surface of vinyl insulation tape and to periphery of sleeving approximately 2 in. back from end of sleeving. Pull sleeving up against gland bushing and, starting approximately 2 in. back from end of sleeving, wrap tape in spiral fashion around sleeving so that each spiral overlaps approximately one half of previous wrap width. Install clamp and compression members over tape and sleeving (paragraph 5-6.1).

5-7.1.1.4 Re-mark cable, if necessary, in accordance with procedures in TP 35-51.

5-7.1.2 MOLDED VINYL CABLES. Procedures for repair of minor cuts and breaks in molded vinyl cable insulation in this paragraph are to be performed on war reserve material only when specifically authorized. Equipment required includes a Variac, capable of at least 80-v output, a 75-w pencil-type soldering iron with wedge-shaped tip, a tempilstik (450°F) or other device for checking temperature of soldering iron tip, and a pumice stone or other device for cleaning soldering iron tip.

5-7.1.2.1 Connect soldering iron to Variac and adjust Variac control to 80 v.

5-7.1.2.2 Taking care not to allow cleaning solution to enter cable interior, clean area of cable damage with clean cloth moistened with methyl ethyl ketone (technical).

CAUTION

Failure to exercise care when cutting cable insulation as specified in following paragraph could cause damage to insulation of inner conductors, resulting in cable rejection.

5-7.1.2.3 Using knife or other sharp instrument, shave damaged area of cable into V-shaped wedge, so that base of wedge is as narrow as possible (approximately 1/64 in.). Save shavings for later use.

5-7.1.2.4 Using 450°F tempilstik or other device, check temperature of soldering iron tip for approximately 450°F. If tempilstik is used, press stick against tip of soldering iron; it will become sticky, but will not melt, if iron is at proper temperature. Adjust Variac setting as necessary until soldering iron tip is approximately at proper temperature.

CAUTION

Attempting to repair cable with an insufficiently hot iron will prevent proper fusion of molding materials. Using an excessively hot iron, or too long a dwell time, will scorch materials (as evidenced by its turning brown and crystalline). Dwell time need be only sufficiently long to effect fusion between shavings and cable insulation. Applying only a small amount of shavings to V-groove of cable for each fusing operation will help prevent scorching.

5-7.1.2.5 Place small amount of shavings in V-groove of cable and fuse shavings to cable insulation in V-groove by means of soldering iron. Repeat operation until V-groove is filled and shaped as closely as possible to cable contour. Clean soldering iron tip repeatedly during fusing operations by use of pumice stone or other means.

5-7.1.3 SILICONE JACKET.

5-7.1.3.1 REPAIR BY MEANS OF SILICONE ADHESIVE. Damaged silicone sleeving is repaired either by bonding the cut surfaces together by means of silicone rubber adhesive (Silastic 140) or silicone compound (RTV-881), or by covering the damaged area with silicone sleeving secured by means of silicone rubber adhesive. If size or shape of cut or tear is such that pressure can be easily applied to insure intimate and complete contact between bonding surfaces until adhesive has cured, damage can be repaired by means of adhesive alone. If this type of repair is not feasible, repair by means of silicone sleeving and silicone adhesive. The following limitations must be observed in all cases:

a. Damage to sleeving which also involves damage to wire insulation beneath sleeving is not repairable.

b. Rips and tears in cable sleeving exceeding 2 in. long are not repairable. Also, radial tears, regardless of length, extending over three-fourths of total periphery of sleeving, are not repairable.

c. Damaged areas of sleeving within 6 in. of each other (or within 6 in. of previously repaired areas) are not repairable.

d. Damage which will necessitate cable re-marking is not repairable if no marking facilities are available.

5-7.1.3.1.1 If damage is to be repaired by adhesive alone, bond cut surfaces together in accordance with procedures in paragraph 3-15.5. The surface may be cleaned by means of a clean cloth moistened with acetone.

5-7.1.3.1.2 If damage is to be repaired by silicone sleeving and adhesive, proceed as follows.

5-7.1.3.1.2.1 Select silicone sleeving of proper diameter and cut to length sufficient to cover damaged area plus 1/4 in. to each side of damaged area. Slit sleeving lengthwise.

5-7.1.3.1.2.2 Bond sleeving to cable over damaged area in accordance with procedures in paragraph 3-15.5. Position braided glass sleeving over damaged area so that it extends approximately 1/4 in. to either side of damaged area and so that lengthwise slit in sleeving is on opposite side of cable to damaged area. Surfaces may be cleaned, prior to bonding, with clean cloth moistened with acetone.

5-7.1.3.1.3 Re-mark cable as necessary in accordance with procedures in TP 35-51.

5-7.1.3.2 REPAIR BY MEANS OF SILICONE TAPE. The tape to be used for repair is silicone rubber fusible tape. Repair limitations are to be as specified in the basic publication; if none are specified, observe repair limitations specified in paragraph 5-7.1.3.1.

5-7.1.3.2.1 If possible, start and end taping at least 1/2 in. to either side of damaged area. Wrap tape in spiral fashion around sleeving so that each spiral overlaps approximately one half of previous wrap width.

5-7.1.3.2.2 Apply second wrap of tape over first wrap in same manner, except spiral tape at cross-angles to first wrap.

5-7.1.3.2.3 Re-mark cable as necessary in accordance with procedures in TP 35-51.

5-7.1.4 REPAIR OF BLACK SYNTHETIC RUBBER (Neoprene) INSULATION. Damaged neoprene insulation is repaired by covering damaged area with electrical insulation tape (black, MMM No. 33). Damage is repairable within following limitations:

a. Damage to insulation, which also involves damage to conductors, is not repairable if the number

of broken or cut conductors exceeds the acceptable limits specified in table XXIII.

b. Rips and tears in insulation exceeding 2 in. long are not repairable. Also, radial tears, regardless of length, extending over three-fourths of total periphery of cable, are not repairable.

c. Damaged areas of sleeving within 6 in. of each other (or within 6 in. of previously repaired areas) are not repairable.

d. Damage which will necessitate cable re-marking is not repairable if no marking facilities are available.

5-7.1.4.1 Clean area to be repaired with commercial detergent and hot water, or with denatured alcohol. Allow time for cleaning material to evaporate so that rubber is thoroughly dry.

5-7.1.4.2 Starting and finishing at least 1/2 in. to either side of damaged area, wrap tape securely in spiral fashion over damaged area so that each spiral overlaps approximately one half of previous wrap width.

5-7.1.4.3 Re-mark cable, if necessary, in accordance with procedures in TP 35-51.

5-7.1.5 REPAIR OF RUBBER CABLE BUSHINGS. Repairable damage to cable bushings includes only those minor cuts, tears, holes, etc in exposed areas of bushings which are not closer than 1/2 in. to connector clamp. Damage beneath clamp or damage which extends to within 1/2 in. of clamp is not repairable.

CAUTION

Tape and adhesive normally used for repair of vinyl sleeving are not compatible with rubber cable bushings and should not be used to repair them.

5-7.1.5.1 Clean area of bushing to which tape will be applied.

5-7.1.5.2 Starting at least 1/4 in. to one side of damaged area, apply electrical insulation tape (black plastic) to bushing, using approximately 3/4 overlap for each wrap of tape and applying overlapping wraps until taped area extends at least 1/4 in. beyond damaged area. If damaged area extends to free edge of bushing, apply tape only up to end of bushing; do not allow tape to contact vinyl sleeving of cable.

5-7.1.6 DETONATOR CABLES. Cuts, tears, breaks, and other types of repairable damage in outer insulation of detonator coaxial cables and split or torn cable connector boots are repaired by means of electrical insulation tape (yellow).

5-7.2 FABRICATION OF VINYL-JACKETED CABLE ASSEMBLY. Procedures in this paragraph are applicable to cables jacketed with vinyl insulation sleeving and containing either shielded or unshielded conductors.

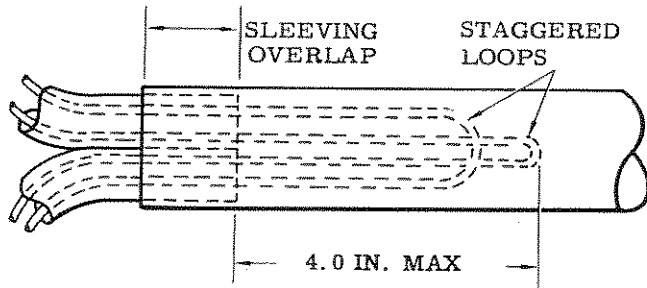


Figure 5-17 Branch-to-Branch Conductors

5-7.2.1 INSTALLATION OF SLEEVING.

5-7.2.1.1 Select vinyl insulation sleeving (table XXIV) of proper diameter to provide tight jacket after installation.

5-7.2.1.2 Pull insulated conductors through sleeving. If lubricant is required, use only purified powdered mica or talc.

5-7.2.1.3 For branch-to-branch conductors, stagger loops as shown in figure 5-17, so that longest loop does not extend more than 4 in. beyond end of branch sleeving.

5-7.2.1.4 Trim sleeving ends to length which will permit sleeving to extend beneath cable adapter (back shell) of connector when connector is installed. Sufficient sleeving length is required to insure adequate clamping of sleeving ends when connector clamps are tightened.

5-7.2.2 FORMING CABLE JUNCTIONS. Form cable junctions as shown in figure 5-18. Refer to figure 5-19 for proper method of tying sleeving ends with nylon twine.

5-7.2.3 SUBSTITUTION OF TAPE FOR RUBBER CABLE BUSHINGS (Figure 5-20). Electrical insulation tape (vinyl) may be used in place of rubber cable bushings which normally are installed under connector clamp. Perform procedures in this paragraph prior to installing connectors.

5-7.2.3.1 Using nylon twine, secure sleeving end to cable with at least 10 turns of twine. Proper method for applying twine is shown in figure 5-19.

5-7.2.3.2 Apply thin film of vinyl resin adhesive to one side of vinyl tape and to periphery of sleeving to be covered with tape. Wrap tape around sleeving.

5-7.2.4 COMPLETION OF CABLE ASSEMBLY. Dress cable termination ends and install connectors in accordance with applicable procedures in paragraphs 5-5 and 5-6.

5-7.2.5 CABLE MARKING. Mark cable, as specified, in accordance with procedures in TP 35-51.

5-7.3 FORMING MOLDED JUNCTIONS (Cables with Black Synthetic Rubber Insulation Only). Procedures in this paragraph are applicable only to cable assemblies which have jacket material of black synthetic rubber per MIL-R-6855, Class II, Grade 60. The general configuration of the molded junction is applicable to two or more junctions. Contours are optional, but the specified dimensions must be maintained. The size of the molded junction must be held to a minimum consistent with the dimensions specified.

5-7.3.1 If necessary, secure sleeving ends with several turns of nylon twine (figure 5-19).

5-7.3.2 Using electrical insulating compound (kit), mold junction as shown in figure 5-21.

NOTE

Junction material shall be as specified, or an equivalent resilient material, which will provide a moisture-sealing bond to cable jacket and which will be compatible with jacket material and wire insulation. Color of an alternate material must be black and have a minimum hardness (Shore A40).

5-7.3.3 Check that junction molding forms water-tight seal between molding and cable jacket. Check adhesion of molded junction to cable branch as follows: Grasp cable body or branch at least two cable diameters from junction interface and flex cable body or branch no more than 60 degrees with respect to molding. If doubt of adhesion exists, repeat molding operation as necessary.

5-8 WIRE HARNESS LACING.

5-8.1 Lacing twine shall be as specified. When not specified, use nylon twine.

5-8.2 If used, insulation sleeving shall be as specified in table XXIV and tape shall be electrical insulation tape (vinyl). Mix vinyl resin adhesive in accordance with procedures in paragraph 3-15.4.

5-8.3 Wires shall be dressed in neat parallel order within harness assembly. Crossing of wires within assembly and at termination points shall be held to a minimum.

5-8.4 Lengths of individual wires within the harness will depend on their routing. Wires shall be routed to follow the most direct path within the harness assembly, consistent with good dressing practice.

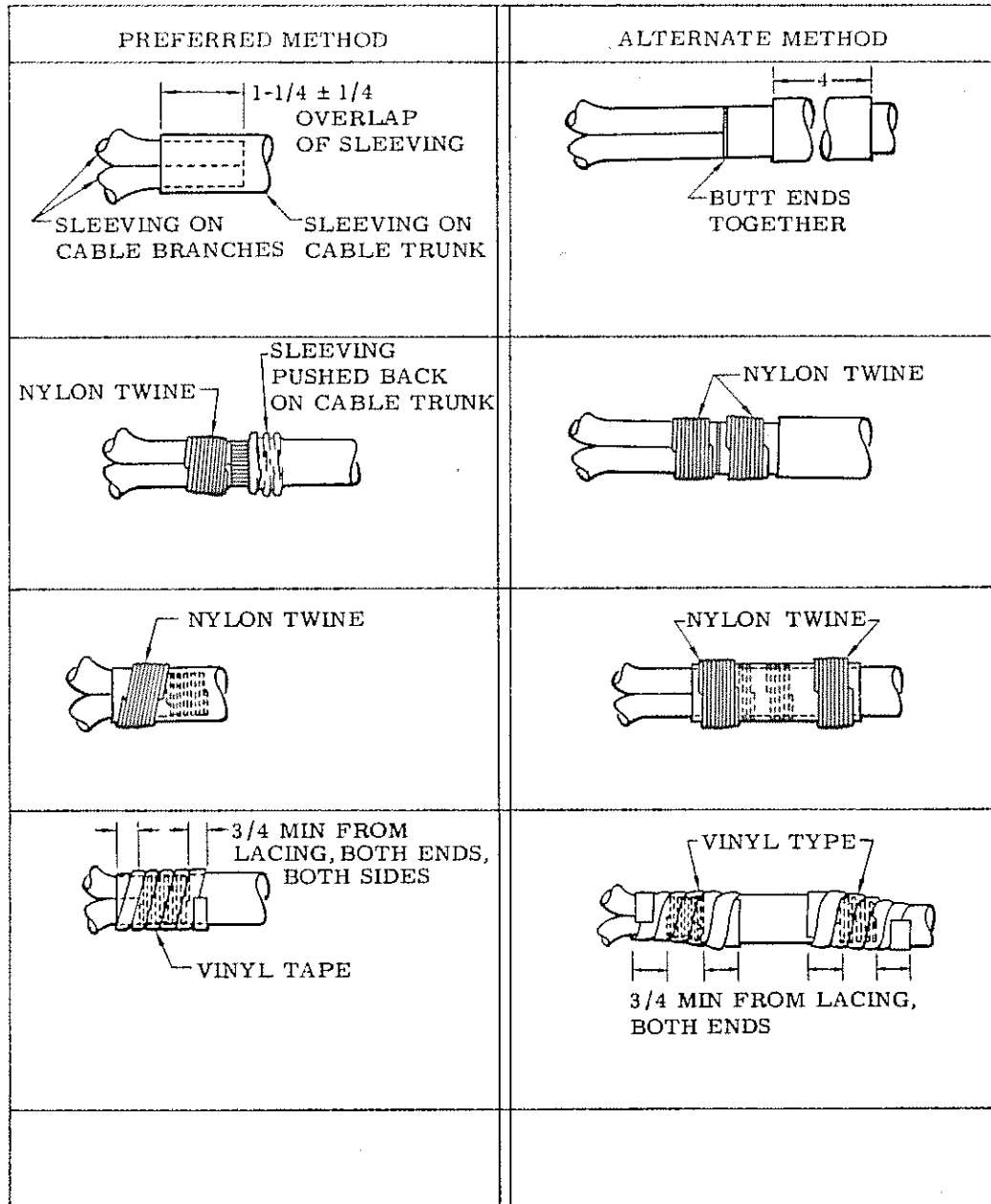


Figure 5-18 Forming Cable Junction

5-8.5 The inside radius of a bend in the harness shall be not less than diameter of harness at point of bend.

5-8.6 Stitches to be used when lacing a harness are shown in figures 5-22, 5-23, and 5-24. Spacing between stitches is dependent upon diameter of harness being laced. Unless otherwise specified, spacing shall be approximately 1-1/2 in. for harnesses larger than 3/4-in. dia.

5-8.7 If specification requires that harness be clamped within assembly, but it is found that specified clamp will not adequately grip harness because of manufacturing variations, sufficient sleeving should be

added to build up harness diameter to size required for clamping. Section of sleeving may be slit longitudinally to facilitate its installation. Electrical insulation tape (vinyl) may be substituted for vinyl sleeving.

5-8.8 Whenever a section of harness must be protected from abrasion, it shall be covered with vinyl tape bonded in place with vinyl resin adhesive.

5-8.9 The ends of woven or twisted lacing cord shall be fixed to prevent raveling. Nylon twine is fixed by fusing the ends with a hot soldering iron.

5-8.10 The completed harness shall be visually inspected for good workmanship and for conformance to these instructions.

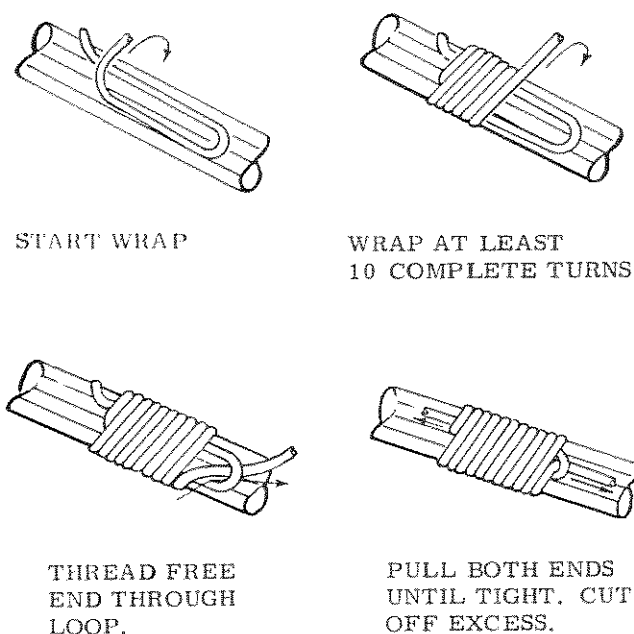


Figure 5-19 Tying Sleeving with Nylon Twine

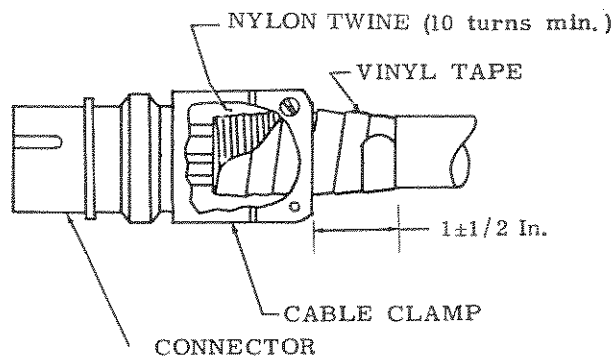
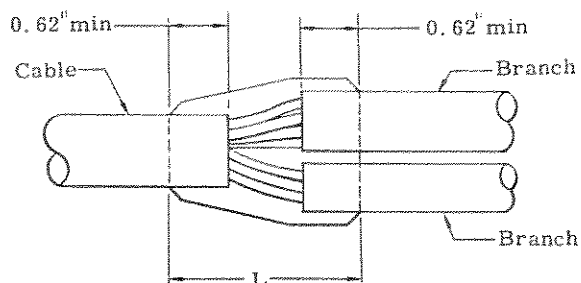


Figure 5-20 Taping of Clamping Area

5-9 TEST EQUIPMENT MAINTENANCE.

5-9.1 GENERAL. Maintenance and parts-replacement procedures in this paragraph are applicable only to various items of test equipment or standard test equipment containers. The maintenance operation standards and safety precautions in Section 2 are to be observed in conjunction with procedures in these paragraphs. Also, refer to other areas of this section for procedures on soldering, wire stripping and tinning, etc, as applicable or as required.

5-9.2 REPAIR OF PRINTED CIRCUITS. A printed circuit is a plastic board with metal foil bonded to form the necessary circuits. Leads of components are inserted in holes in the board and are cut and bent over the metal foil wiring. These are soldered in



Number of branches	L in inches
2 or 3	3.0 max
4 or 5	4.5 max
6 or more	6.0 max

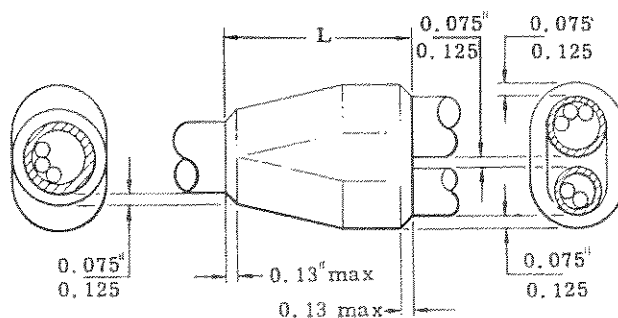


Figure 5-21 Forming Molded Junction

place. A coat of silicone resin varnish is applied to the board to prevent dust or moisture from causing short circuits.

NOTE

The printed circuit repair kit contains the necessary tools and materials to perform authorized repairs on printed circuits.

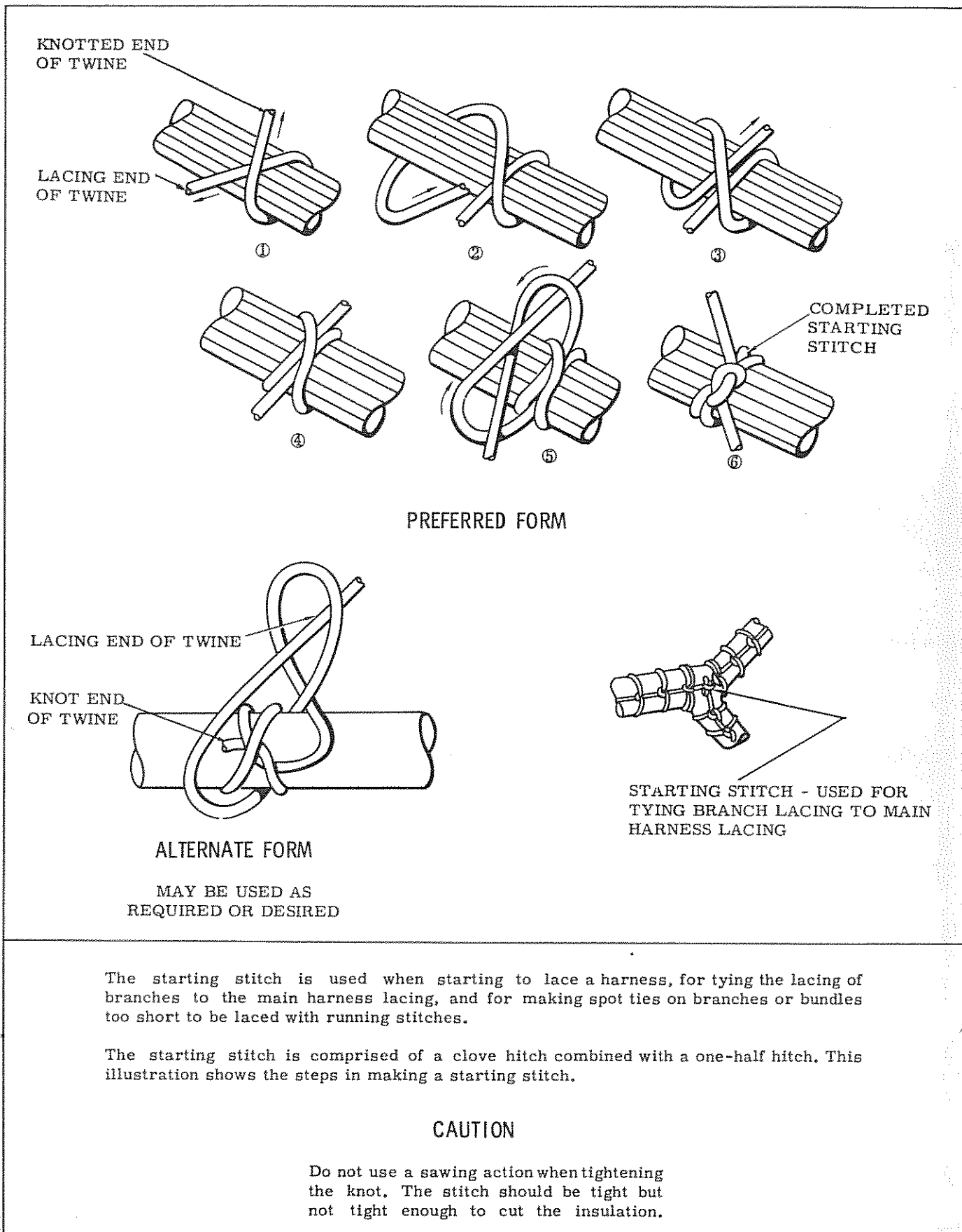
5-9.2.1 HANDLING PRECAUTIONS.

5-9.2.1.1 Rest printed circuit boards on their edges when they are stored; do not stack them.

5-9.2.1.2 Do not handle boards by their components, since this may tear the circuit from the board.

5-9.2.1.3 Do not test solder joints by twisting or pulling components.

5-9.2.1.4 Do not attempt to straighten a warped board. Proper mounting will usually correct the warp.



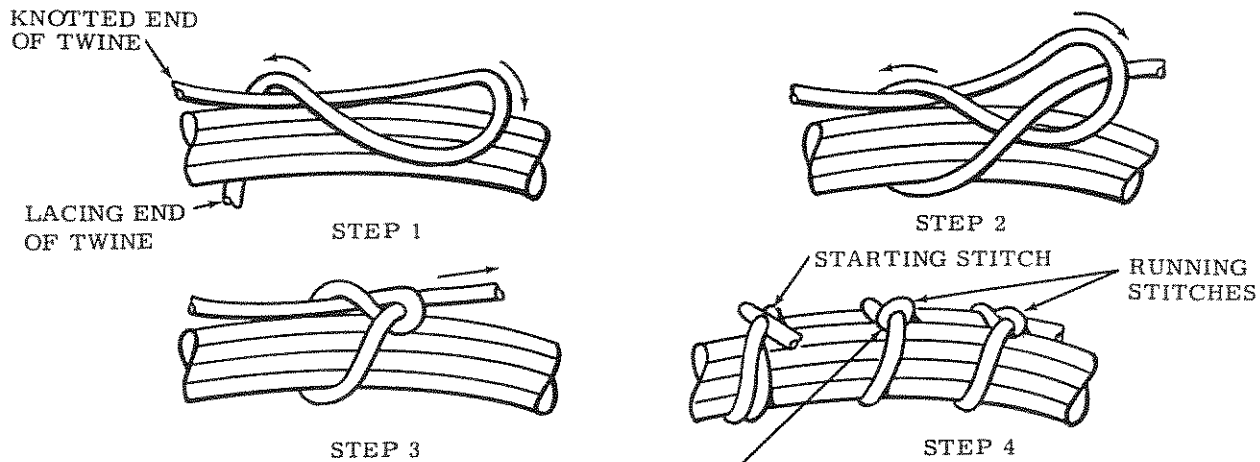
The starting stitch is used when starting to lace a harness, for tying the lacing of branches to the main harness lacing, and for making spot ties on branches or bundles too short to be laced with running stitches.

The starting stitch is comprised of a clove hitch combined with a one-half hitch. This illustration shows the steps in making a starting stitch.

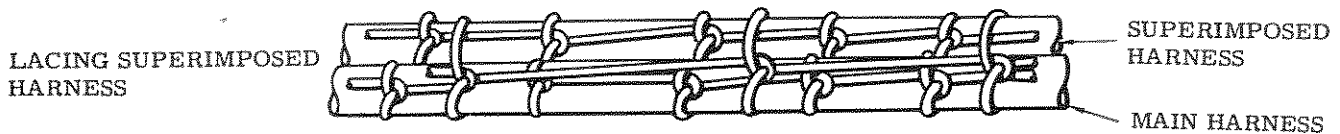
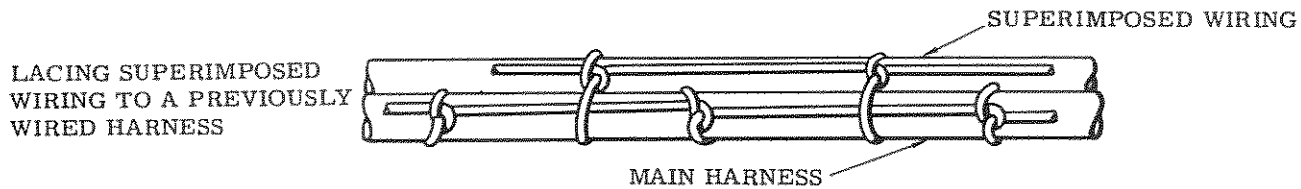
CAUTION

Do not use a sawing action when tightening the knot. The stitch should be tight but not tight enough to cut the insulation.

Figure 5-22 Harness Lacing Starting Stitch



WHEN A BEND IS TO BE LACED, LOCATE THE KNOTS ALONG THE OUTER RADIUS

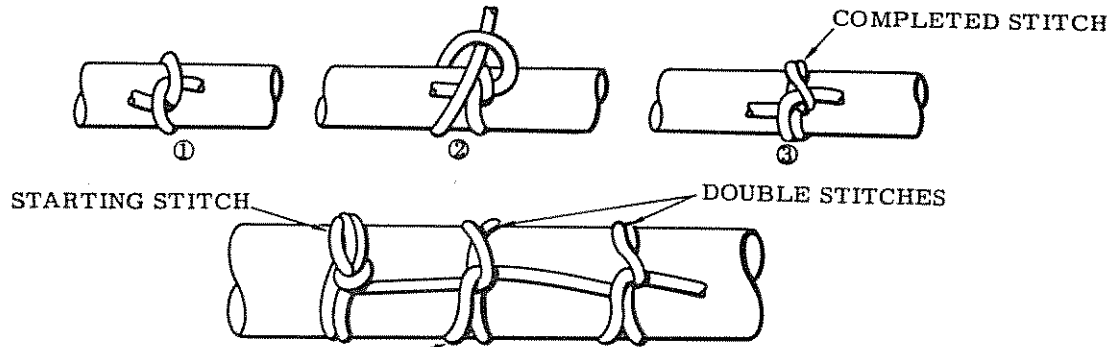


Running stitches are normally used after the starting stitch for lacing a harness and for lacing superimposed wiring or harnesses to a previously laced harness. This illustration shows the steps in making single running stitches. See figure 5-24 for information on double stitches.

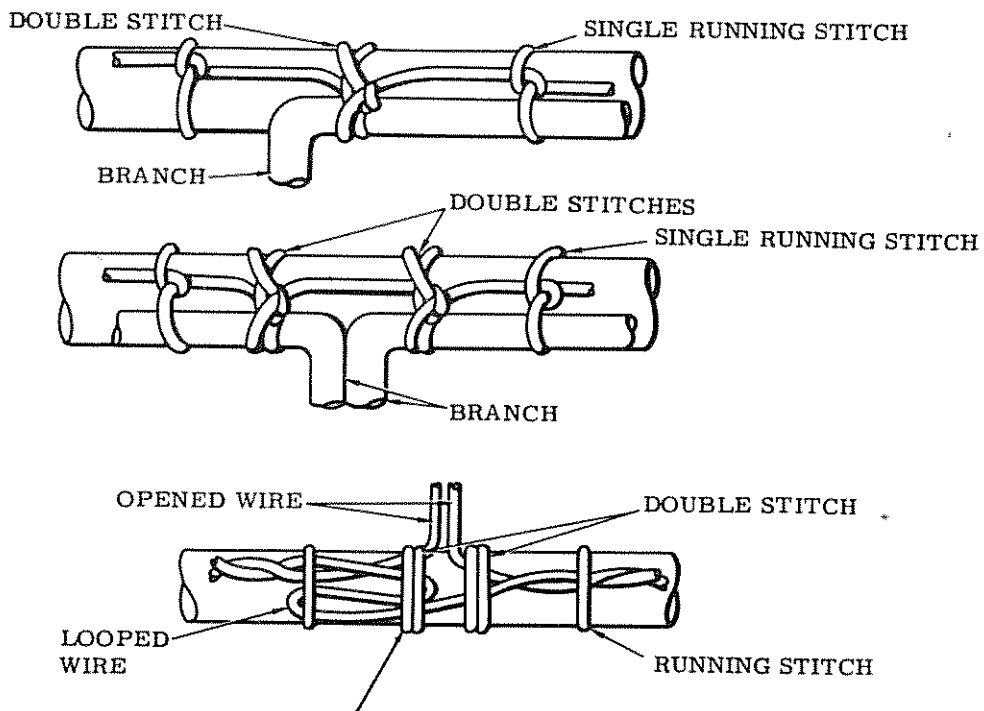
CAUTION

Do not use a sawing action when tightening the knot. The stitch should be tight but not tight enough to cut the insulation.

Figure 5-23 Harness Lacing Running Stitches



WHEN A BEND IS TO BE LACED, LOCATE THE KNOTS OF THE STITCHES ALONG THE OUTER RADIUS OF THE BEND



WHEN ONE OR MORE (But Not All) OF THE WIRES OF A TWISTED PAIR, TRIPLET, OR SEPARATE GROUPING OF WIRES IN A HARNESS MUST BE OPENED FOR BRANCHING, THE REMAINING WIRES OF THE GROUP SHALL BE LOOPED TO TAKE UP THE SLACK, AND DOUBLE STITCHES USED ON BOTH SIDES OF THE OPENED WIRES.

Double stitches are used at branching points of harness, at both ends of a harness bend whenever the bend is approximately 135 degrees or less, as the ending stitch in a series, to lace bundles of wires that are more than 1 in. in diameter, and elsewhere as may be specified.

The double stitch is made by tying a duplicate running stitch directly behind another running stitch. This illustration shows the steps in making the double stitch and some examples of its application. See figure 5-23 for information on making running stitches.

CAUTION

Do not use a sawing action when tightening the knot. The stitch should be tight but not tight enough to cut the insulation.

Figure 5-24 Harness Lacing Double Stitches

5-9.2.2 TROUBLESHOOTING PRINTED CIRCUITS.

5-9.2.2.1 Place a lighted 60-w bulb underneath the board to trace location of connections.

5-9.2.2.2 In some cases, a magnifying glass can be used to locate small breaks in the printed circuits.

5-9.2.2.3 Voltage measurements can be made on either side of the board. However, a needlepoint probe for circuit checking should be used, since a "break-through" of the varnish coating must be made to gain contact.

5-9.2.3 GENERAL MAINTENANCE PRECAUTIONS. Standard components are used, and may be replaced as required. Printed circuit boards are more easily repaired by observance of the following precautions as necessary.

5-9.2.3.1 If the metal foil wiring is damaged, a small piece of wire (No. 22 AWG, solid) may be used to replace the damaged foil. Tin the piece of wire (approximately 1/2 in. longer than the break) at each end and center wire over break. Heat the wire with a soldering iron until solder, in the printed wiring and on the repair wire, flows to make a good joint.

CAUTION

Do not overheat connection as this might cause foil to peel from board.

5-9.2.3.2 Small breaks (1/4 in. or less in length) are repaired with a short piece of No. 22 AWG solid un-insulated bus wire (figure 5-25).

5-9.2.3.3 Large breaks (more than 1/4 in. in length) are repaired with insulated No. 22 AWG solid wire (figure 5-25).

5-9.2.3.4 Lines wider than 1/16 in. should be repaired by means of two or more jumpers, depending on line width. In general, lines between 1/16- and

1/8-in. wide should be repaired by means of two jumpers. Lines wider than 1/8 in. should be repaired by means of at least three jumpers.

NOTE

Protective conformal coating should be removed by scraping from areas to be soldered.

5-9.2.3.5 Do not apply excessive pressure to board or components. When access to components on board is difficult, board may be removed from chassis.

5-9.2.3.6 Remove mounting screws around edges, and unsolder leads that connect between board and chassis.

NOTE

If board is riveted to chassis, and components are inaccessible, replace entire assembly.

5-9.2.3.7 While repairing, hold the board in a vise with protected jaws. Exercise care not to exert excessive pressure against the board with vise jaws. An alternate method for securing the board during repair operations is as follows: Using 2 round-head screws and flat washers, secure 2 diagonally opposite corners of the board to 2 wood blocks spaced apart.

5-9.2.3.8 Avoid excessive deposits of solder when soldering. On some boards, circuits are closely spaced and excessive solder could cause a short or an intermittent trouble which would be difficult to locate.

5-9.2.3.9 Do not overheat components or foil when using a soldering iron. Use a 35-w maximum soldering iron. Excessive heat (e.g., applying soldering iron longer than necessary, using a higher-wattage soldering iron than specified, or using a soldering gun), may cause a break in the bond between the board and foil.

5-9.2.3.10 After soldering a connection, remove excess flux with denatured alcohol to prevent low-resistance paths between components.

5-9.2.4 REPLACEMENT OF DEFECTIVE RESISTOR, CAPACITOR, COUPLATE, AND CERAMIC DISC.

5-9.2.4.1 PREFERRED METHOD (Figure 5-26).

5-9.2.4.1.1 If leads extending from defective component are sufficiently long to allow attaching replacement component to them, cut leads where they enter defective component. If leads are not sufficiently long, obtain extra lead length from inside defective component by cutting component in half and carefully breaking or cutting component away from inner conductor.

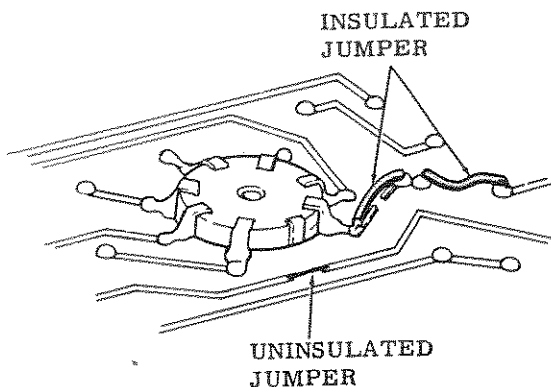


Figure 5-25 Repair of Broken Foil

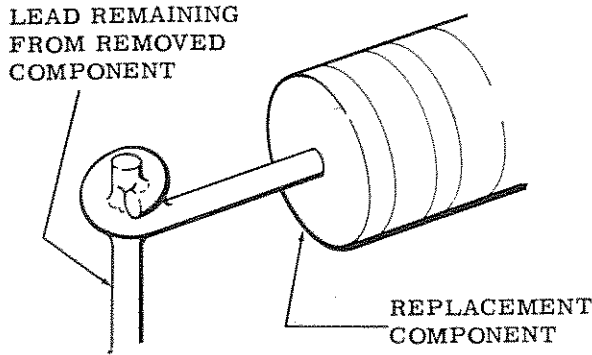


Figure 5-26 Preferred Method of Installing Replacement Component on Printed Circuit Board

remaining from removed component and crimp connection tightly.

CAUTION

Application of excessive heat when soldering could cause foil to peel or original component leads to fall out of board.

5-9.2.4.1.4 Solder connection on each side of replacement component.

5-9.2.4.2 ALTERNATE METHOD (Figure 5-27). Procedures in this paragraph are to be performed only if the preferred method of replacing components is not feasible.

5-9.2.4.1.2 Clean and trim ends of leads from which defective component was removed.

5-9.2.4.1.3 Bend end of each lead of replacement component into small pigtail. Slip pigtails over leads

CAUTION

When unsoldering board components, application of excessive heat could cause

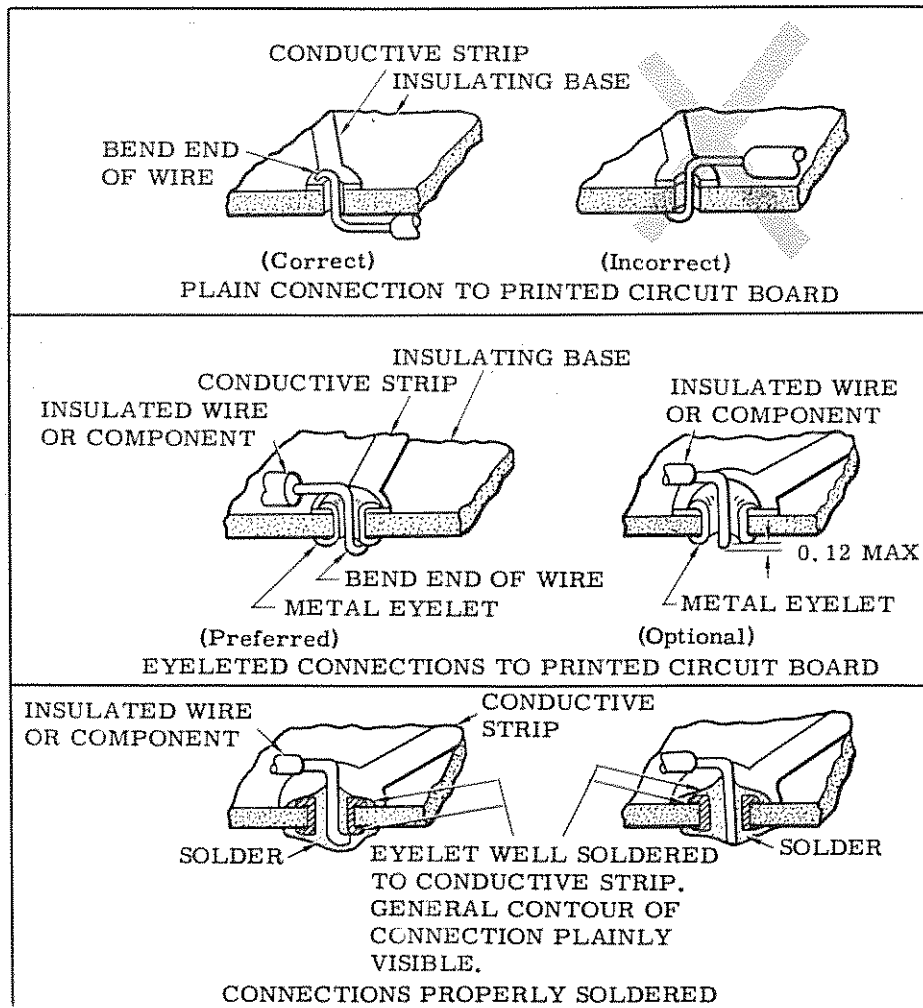


Figure 5-27 Soldered Connection of Printed Circuit Board

foil to peel or could result in loosening of adjacent soldered connections. Excessive heat can be avoided by quickly heating the soldered joint to molten state, removing the hot iron, and immediately brushing molten solder from the joint. Repeated heating and brushing operations may be required to remove all solder.

5-9.2.4.2.1 Heat connection on wiring side of board. When solder becomes molten, brush away solder. While applying soldering iron to connections, wiggle component until it is removed.

5-9.2.4.2.2 Insert scraper tool between foil and "bent over" component lead; bend lead perpendicular to board. If necessary, apply soldering iron to connection to facilitate straightening of bent lead.

5-9.2.4.2.3 Remove any small particles of solder imbedded in varnish coating, using clean, lint-free cloth dipped in solvent.

5-9.2.4.2.4 After removal of the component, a thin film of solder may remain over the hole through the board. Pierce film with lead from replacement component, after heating solder film with soldering iron.

5-9.2.4.2.5 Insert leads of replacement component through holes. Cut to desired length and bend ends over against foil. Resolder connection.

5-9.2.4.2.6 Recoat cleaned area with silicone resin varnish, for protection against shorts. Apply varnish by brush or spray. If spray is used, mask out top of tube sockets and other contact surfaces with masking tape or other suitable means.

5-9.2.5 REPLACEMENT OF COIL. The terminal lugs of this component are not "bent over" against the foil in most cases. Brushing is not necessary.

5-9.2.5.1 Heat one connection until solder becomes molten and wiggle coil back and forth until connection is broken. Continue wiggling component and apply soldering iron to other connections; lift coil from board while solder is still molten.

5-9.2.5.2 Insert replacement coil in same position. Solder connections.

5-9.2.5.3 Cover connection points with one coat of silicone resin varnish.

5-9.2.6 REPLACEMENT OF TRANSFORMERS (Figure 5-28). Some types of transformers have a large number of solder lugs, or leads. Replacement of these components requires more patience and time than is required for other components.

5-9.2.6.1 Apply soldering iron to one connecting lug.

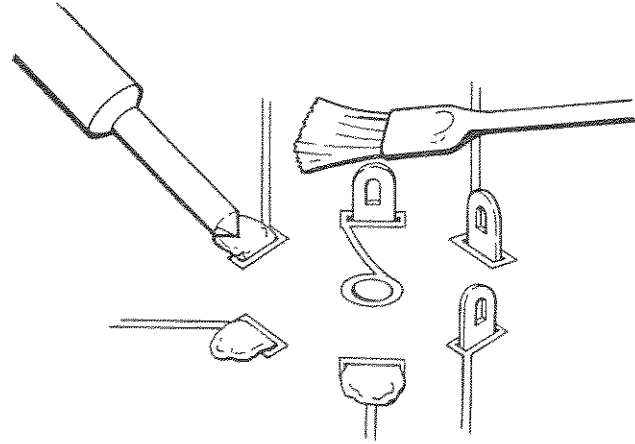


Figure 5-28 Replacement of Transformer

NOTE

On some transformers, it will be necessary to bend mounting lugs perpendicular to board while solder is molten, so as to be able to brush solder away.

5-9.2.6.2 Cut off transformer lugs as close to board as possible.

5-9.2.6.3 Apply soldering iron and remove ends of lugs.

5-9.2.6.4 Clean any specks of solder stuck to board with clean, lint-free cloth moistened with solvent.

5-9.2.6.5 Insert replacement transformer and solder connections.

NOTE

It is not necessary to twist transformer mounting lugs of replacement transformer prior to soldering.

5-9.2.6.6 Recoat cleaned area with silicone resin varnish, applied by brush or spray. If spray is used mask out areas not requiring varnish.

5-9.2.7 TUBE SOCKET REPAIR. Intermittent tube socket pin contacts can usually be repaired by bending contacts so they grasp tube pins more firmly. Use probe tool between socket hole and socket contact (figure 5-29).

5-9.2.8 REPLACEMENT OF TUBE SOCKETS MOUNTED ON WIRING SIDE OF BOARD. Tube sockets are of the miniature type, with an additional grounding lug extending to tubular center shield (center connection) at bottom of socket.

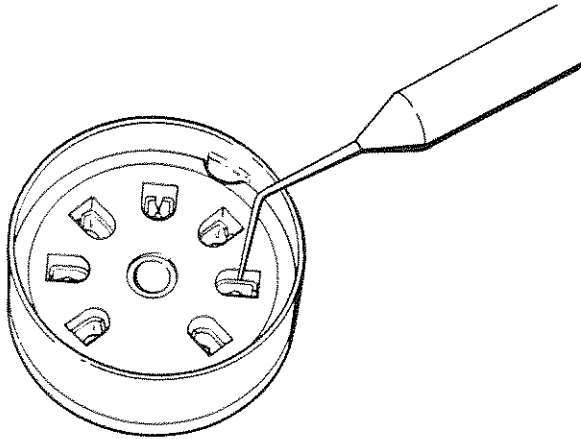


Figure 5-29 Tube Socket Repair

5-9.2.8.1 Heat each lug of tube socket with small soldering iron. Brush away molten solder.

CAUTION

The following operation is not to be performed on grounding lug.

5-9.2.8.2 If entire connection is not broken by brushing, apply soldering iron a second time to each lug. Insert knife blade, or other sharp tool, between wiring foil and socket lug, and bend lug upward from foil.

CAUTION

Ground terminal connections to tube socket are made underneath sockets and wiring foil. When removing tube socket, care must be taken to insure that none of the foil has peeled off between socket lugs and center ground connection. An indentation or dull section will be noticeable on the board if this occurs.

The portion of foil most likely to peel and break when removing socket is the section which is soldered to grounding lug of tube socket. This area should be carefully checked. A mechanical connection may still exist between electrical ground and socket terminals or an intermittent connection could develop which would be difficult to locate. Any missing coil is to be replaced with hook-up wire. This wire may be routed underneath the tube socket, or a jumper may be connected on top of board to necessary tube-socket terminals.

5-9.2.8.3 After all socket lugs have been freed from foil, apply soldering iron to grounding lug on component side.

5-9.2.8.4 Grasp socket and slowly pull it from board. Socket will free itself from board when grounding lug solder has become molten. Remove any thin film of solder that has formed across ground foil connection, or across any of socket foil connections.

5-9.2.8.5 Clean board of any specks of solder with clean, lint-free cloth moistened with solvent.

CAUTION

When installing a replacement socket, it may be difficult to insert the socket lugs through the holes in the board because of very close tolerances.

Take care not to exert too much pressure in attempting to force the socket terminals through the holes. The holes may be enlarged slightly by means of a small reamer so that the socket terminals can be inserted without excessive pressure.

5-9.2.8.6 Insert replacement socket and bend over lugs. Solder all lug connections.

5-9.2.8.7 Recoat cleaned area with silicone resin varnish, applied by brush or spray. If spray is used, mask out areas not requiring varnish.

5-9.2.9 REPLACEMENT OF TUBE SOCKETS MOUNTED ON COMPONENT SIDE OF BOARD.

5-9.2.9.1 Heat each lug of tube socket. Brush away molten solder.

5-9.2.9.2 Apply soldering iron to each lug, including grounding lug, and bend socket lugs upward from foil.

NOTE

On some boards, the socket lugs are folded back.

5-9.2.9.3 Reheat connections and brush away molten solder.

5-9.2.9.4 Cut lugs off socket as close as possible to board. Reheat and rebrush connections if necessary.

5-9.2.9.5 Apply soldering iron to grounding lug (center terminal), and lift socket from board.

5-9.2.9.6 Clean board of any specks of solder with clean, lint-free cloth moistened with solvent.

CAUTION

When installing a replacement socket, it may be difficult to insert socket lugs through holes in board due to very close tolerance. Care must be taken not to exert too much pressure in attempting to force the socket terminals through the holes. The holes may be enlarged slightly by means of a small reamer so that the socket terminals can be inserted without any excessive pressure.

5-9.2.9.7 Insert replacement socket and bend over lugs. Solder connections.

5-9.2.9.8 Recoat cleaned area and connections with silicone resin varnish, for protection against shorts. Apply varnish by brush or spray. If spray is used, mask out areas not requiring varnish.

5-9.3 INSTALLATION OF TERMINAL STUD ASSEMBLY. Install terminal stud assembly as shown in figure 5-30.

5-9.4 PLASTIC POTTING AND SEALING. These plastic potting procedures are used when silastic potting compound is employed for potting, and epoxy resin compound is used as a sealant.

5-9.4.1 REMOVAL OF SILASTIC POTTING AND EPOXY RESIN COMPOUNDS. Break epoxy resin seal by puncturing with pointed instrument. Remove epoxy resin and silastic potting compounds from cavity. As required, clean cavity in accordance with applicable procedures for cleaning of small areas in TP 35-51.

5-9.4.2 MATERIALS REQUIRED.

5-9.4.2.1 Materials for silastic potting are contained in the potting kit (silastic). The material in the kit is sufficient to service approximately three transistors.

5-9.4.2.2 Materials for epoxy resin compound are contained in the potting kit (epoxy resin). The material in the kit is sufficient to service approximately three transistors.

5-9.4.3 MIXING AND LIFE OF COMPOUNDS.

5-9.4.3.1 For silastic potting compound, pour RTV 501 Catalyst into RTV silastic and mix thoroughly. Adjust viscosity of mix by adding DC-200 fluid as required and mixing thoroughly. The work life of silastic potting compound is approximately 2 hrs at a temperature between 60° and 90°F. For best results and longest storage life, store potting kit (silastic) at temperature between 40° and 50°F, which will result in a storage life of approximately 4 months.

WARNING

Epoxy resins are toxic, flammable, and injurious to the skin. Observe the general safety precautions for epoxy resins (paragraph 2-2).

5-9.4.3.2 For epoxy resin compound, pour Hysol Hardener into Hysol No. 6020-101 epoxy mix and mix thoroughly. The work life of the epoxy resin compound is approximately 30 min at a temperature between 60° and 90°F. Storage life is 2 yrs or more.

5-9.4.4 APPLICATION. The silastic potting or epoxy resin compounds are applied by dipping or pouring. Details as to depth, thickness or amounts of material are as specified. Cure silastic potting compound for 2 hrs at temperature of 160±10°F or for 16 to 24 hrs at temperature between 60° and 90°F prior to applying epoxy resin compound. Cure epoxy resin compound for 16 to 24 hrs at temperature between 60° and 90°F.

5-9.5 REPAIR OF STANDARD CARRYING CASE.

5-9.5.1 SHOCK (Or Vibration) MOUNT.

5-9.5.1.1 GENERAL. There are three categories of shock-mount installation, based on the type of case construction. Table XXVII lists the part numbers of shock mounts and associated parts corresponding to the case in which the shock mount and parts are installed. Numbers of standard cases are stenciled in one handle well.

5-9.5.1.2 REMOVAL OF INNER CASE.

5-9.5.1.2.1 Remove unit assembly from inner case.

5-9.5.1.2.2 Remove 10 self-tapping screws from outer case, and remove strips securing screen in place.

5-9.5.1.2.3 Remove eight special screws (or internal-wrenching bolts) from shock-mount adapters. If necessary, hold adapters with pliers to prevent adapters from turning when removing screws.

5-9.5.1.2.4 Obtain one 2- by 12- by 14-in. wood board, and place board on lower shelf of inner case.

5-9.5.1.2.5 Place foot of two minimum 12-in. depth by 8 in. opening "C" clamps against wood board. Place adjusting screw ends of "C" clamps on outside of outer case, using small wood blocks under clamp to protect outside finish of case. Tighten clamps until upper shock-mount adapters (and reinforcing plates, if in case but not welded in place) fall out of shock mounts.

5-9.5.1.2.6 Remove upper adapters (and reinforcing plates, if applicable).

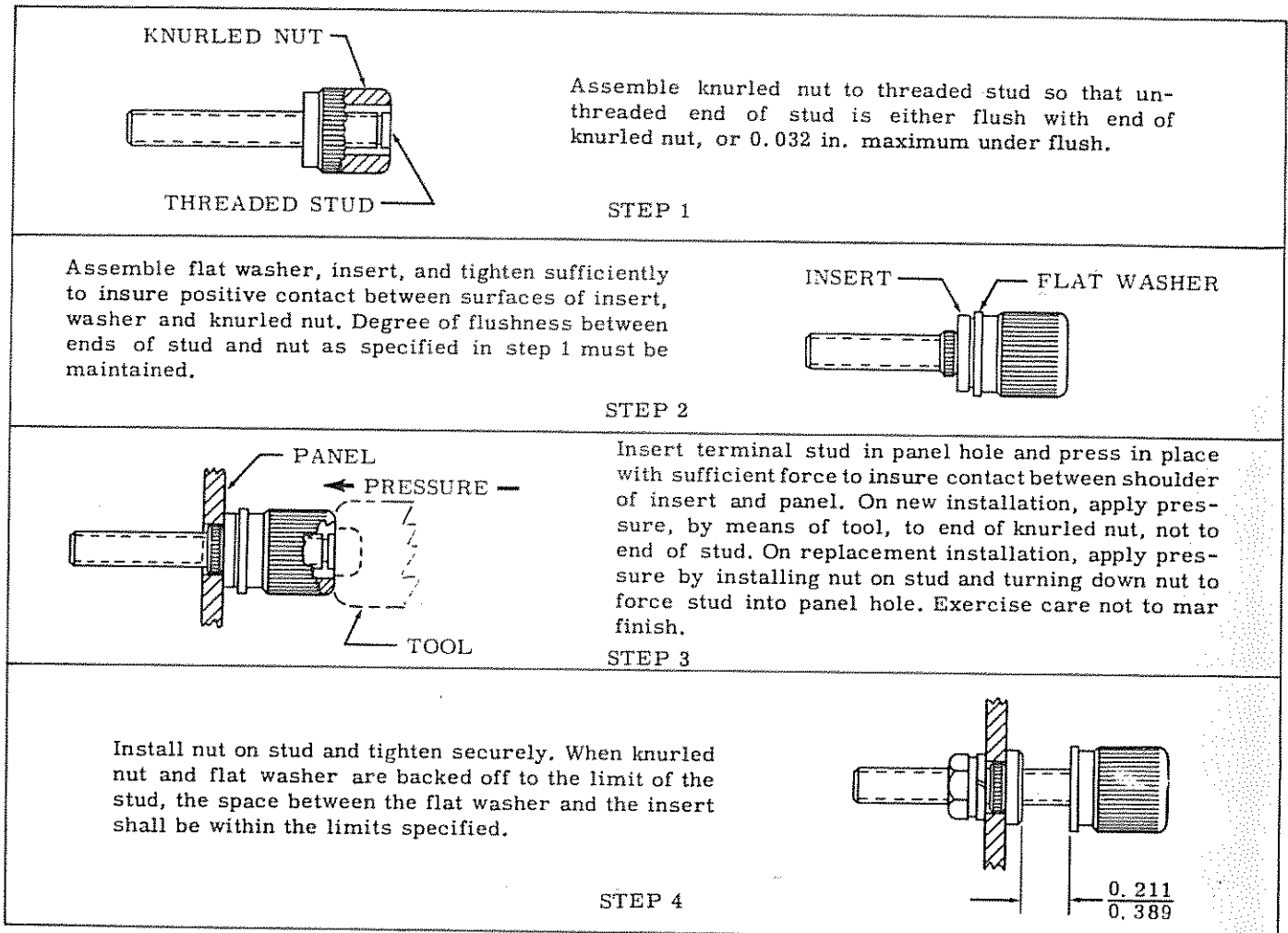


Figure 5-30 Terminal Stud Assembly

5-9.5.1.2.7 Release two "C" clamps and remove wood boards. Carefully withdraw inner case. Remove lower adapters (and reinforcing plates, if applicable).

5-9.5.1.3 CHECK OF SHOCK MOUNT. To locate damaged shock mount, check each of eight shock mounts to determine whether it sticks in the bottom, and whether there is more than 3/16-in. free play laterally, or 1/8-in. vertically.

5-9.5.1.3.1 To check sticking in lower position (assuming case is resting on its base), apply pressure to top of shock mount until shock mount is fully depressed, then release. If shock mount remains in depressed position, it is defective.

5-9.5.1.3.2 To check lateral play, set measuring device with zero in center of stud. Apply pressure to stud in direction of measure, forcing stud assembly to one extreme position, then release pressure. If difference between original center of stud and extreme at-rest position of stud center is 3/16 in. or greater, shock mount is defective.

5-9.5.1.3.3 To check vertical play, set measuring device with zero in center of stud. Apply pressure to stud in direction of measure vertical to stud assembly, then release pressure. If difference between original center of stud and depressed at-rest position of stud center is 1/8 in. or greater, shock mount is defective.

5-9.5.1.4 REMOVAL OF SHOCK MOUNT. Remove four mounting bolts, and remove the shock mount. If shims are present under shock mount, retain shims for possible use when installing replacement shock mount.

5-9.5.1.5 INSTALLATION OF SHOCK MOUNT. Refer to table XXVII and figure 5-31 for information in each category that will insure correct replacement shock mount and associated parts.

5-9.5.1.5.1 CATEGORY I. This category entails direct replacement of a shock mount when the case does not contain reinforcing plates (thin metal discs, either

TABLE XXVII
PARTS FOR STANDARD CARRYING CASES

CASE ASSY NO.	CATEGORY I			CATEGORIES II AND III				
	Shock Mount*			Shock Mount		Adapter No.	Reinforcing Plate No.	Internal Wrenching Bolt No.
	AEC (Part No.)	Mfr's No. **	Special Screw No.	AEC (Part No.)	Mfr's No. **			
103719-00	835922-00	808-7A	105401-00	828025-00	808-7B/C	126866-00	126977-00	126867-00
103720-00	835923-00	808-8A	105401-00	828026-00	808-8B/C	126866-00	126977-00	126867-00
103721-00	835919-00	808-4A	105401-00	828022-00	808-4B/C	126866-00	126977-00	126867-00
103722-00	835917-00	808-2A	105401-00	828020-00	808-2B/C	126866-00	126977-00	126867-00
103723-00	835921-00	808-6A	105401-00	828024-00	808-6B/C	126866-00	126977-00	126867-00
103724-00	835920-00	808-5A	105401-00	828023-00	808-5B/C	126866-00	126977-00	126867-00
103725-00	835918-00	808-3A	105401-00	828021-00	808-3B/C	126866-00	126977-00	126867-00
103726-00	835921-00	808-6A	105401-00	828024-00	808-6B/C	126866-00	126977-00	126867-00
105564-00	835919-00	808-4A	105401-00	828022-00	808-4B/C	126866-00	126977-00	126867-00
105565-00	835918-00	808-3A	105401-00	828021-00	808-3B/C	126866-00	126977-00	126867-00
105566-00	835918-00	808-3A	105401-00	828021-00	808-3B/C	126866-00	126977-00	126867-00
105567-00	835917-00	808-2A	105401-00	828020-00	808-2B/C	126866-00	126977-00	126867-00
105568-00	835920-00	808-5A	105401-00	828023-00	808-5B/C	126866-00	126977-00	126867-00
118679-00	835920-00	808-5A	105401-00	828023-00	808-5B/C	126866-00	126977-00	126867-00

*Part numbers for shock mounts in category I include associated adapters.

**Robinson Aviation Inc., Teterboro, New Jersey.

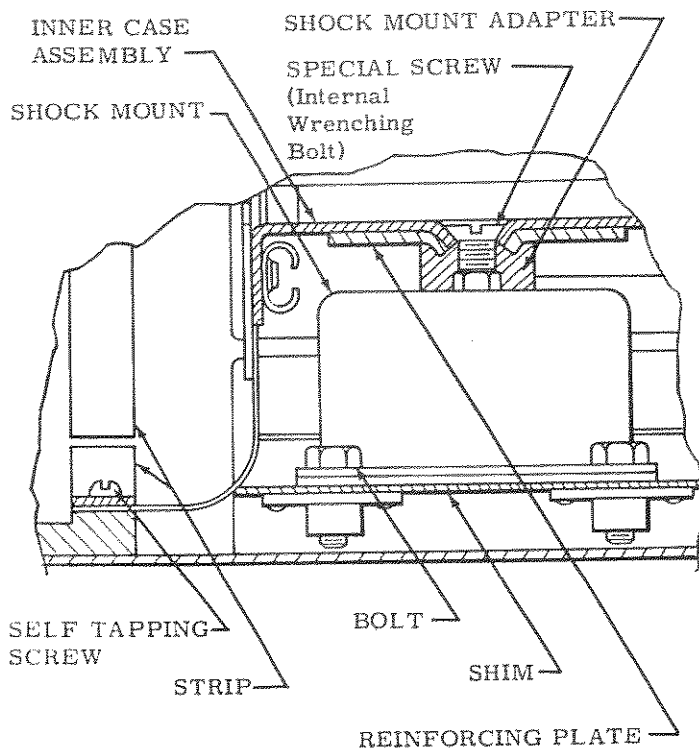


Figure 5-31 Shock Mount Detail

loose or spot welded to inner case). Although the case does not contain reinforcing plates and a direct shock-mount replacement can be accomplished, it is suggested that, if replacement parts as described in paragraph 5-9.5.1.5.2 are available, these parts be obtained and the installation procedures for Category II be followed. If such parts are not available, proceed with installation under Category I.

5-9.5.1.5.1.1 Position replacement shock mount to inside of outer case and align four mounting holes. Install four mounting bolts and tighten bolts securely.

5-9.5.1.5.1.2 Place shock-mount adapters on lower shock mounts and slide inner case into position over adapters. Check that aligning dowels in inside corners of small or medium-size inner cases are positioned toward bottom of outer case. Large-size inner cases fit either way.

5-9.5.1.5.1.3 Hold lower adapters with pliers and install special screws. Tighten screws securely.

5-9.5.1.5.1.4 Place one 2- by 12- by 14-in. wood board on lower shelf of inner case.

5-9.5.1.5.1.5 Place foot of two minimum 12-in.-depth by 8-in.-opening "C" clamps against wood board. Place adjusting screw ends of "C" clamps on outside of outer case, using small wood blocks under clamp

to protect outside finish of case. Tighten clamps to force shock mounts to their lower positions.

5-9.5.1.5.1.6 Install upper adapters, then release "C" clamps and remove wood boards. Hold upper adapter with pliers and install special screws. Tighten screws securely.

5-9.5.1.5.1.7 Stake each special screw two places by means of center punch. Stake screws approximately 1/32 in. deep, 180 degrees apart, and 1/32 in. from circumference of screw threads.

5-9.5.1.5.1.8 Prior to installing and securing the screen in place, check that looseness does not exist between inner case and shock mounts. If looseness does exist, disassemble and add shims under shock mounts. Do not reduce shock-mount travel by using too many shims.

5-9.5.1.5.1.9 Install strips securing screen in place. Install self-tapping screws and tighten screws securely.

5-9.5.1.5.2 CATEGORY II. This category entails the use of a set of shock-mount replacement parts, to be used when the case does not contain reinforcing plates, or has reinforcing plates that are not welded to the inner case. Replacement parts are listed in table XXVII.

5-9.5.1.5.2.1 Position replacement shock-mount to inside of outer case and align four mounting holes. Install four mounting bolts and tighten bolts securely.

5-9.5.1.5.2.2 Place adapters on lower shock mounts.

5-9.5.1.5.2.3 Place reinforcing plates on adapters so that dimples in reinforcing plates mate with countersink in adapters.

5-9.5.1.5.2.4 Carefully slide inner case into position over adapters and reinforcing plates. Check that aligning dowels in inside corners of small or medium size inner cases are toward bottom of outer case. Large-size inner cases fit either way.

5-9.5.1.5.2.5 Apply antiseize compound to threads of internal-wrenching bolts. Hold lower adapters with pliers and install bolts; tighten bolts securely.

5-9.5.1.5.2.6 Place one 2- by 12- by 14-in. wood board on lower shelf of inner case.

5-9.5.1.5.2.7 Place foot of two minimum 12-in.-depth by 8-in. opening "C" clamps against wood board. Place adjusting screw ends of "C" clamps on outside of outer case, using small wood blocks under clamp to protect outside finish of case. Tighten clamps to force shock-mounts to their bottom position.

5-9.5.1.5.2.8 Install upper reinforcing plates and adapters, then release "C" clamps and remove clamps and wood boards.

5-9.5.1.5.2.9 Apply antiseize compound to threads of internal-wrenching bolts to be installed in upper adapters. Hold upper adapters with pliers and install bolts; tighten bolts securely.

5-9.5.1.5.2.10 Prior to installing and securing screen in place, check that looseness does not exist between inner case and shock-mounts. If looseness does exist, disassemble and add shims under shock mounts. Do not reduce shock-mount travel by using too many shims.

5-9.5.1.5.2.11 Install strips securing screen in place. Install self-tapping screws and tighten screws securely.

5-9.5.1.5.3 CATEGORY III. This category entails the use of a set of shock-mount replacement parts to be used when reinforcing plates are welded to the inner case. Replacement parts are listed in table XXVII.

5-9.5.1.5.3.1 Position replacement shock mount to inside of outer case and align four mounting holes. Install four mounting bolts and tighten bolts securely.

5-9.5.1.5.3.2 Place shock-mount adapters on lower shock mounts and slide inner case into position over adapters. Check that aligning dowels in inside corners of small or medium-size inner cases are positioned toward bottom of outer case. Large-size inner cases fit either way.

5-9.5.1.5.3.3 Apply antiseize compound to threads of internal-wrenching bolts to be installed in lower adapters. Hold lower adapters with pliers and install bolts; tighten bolts securely.

5-9.5.1.5.3.4 Place one 2- by 12- by 14-in. wood board on lower shelf of inner case.

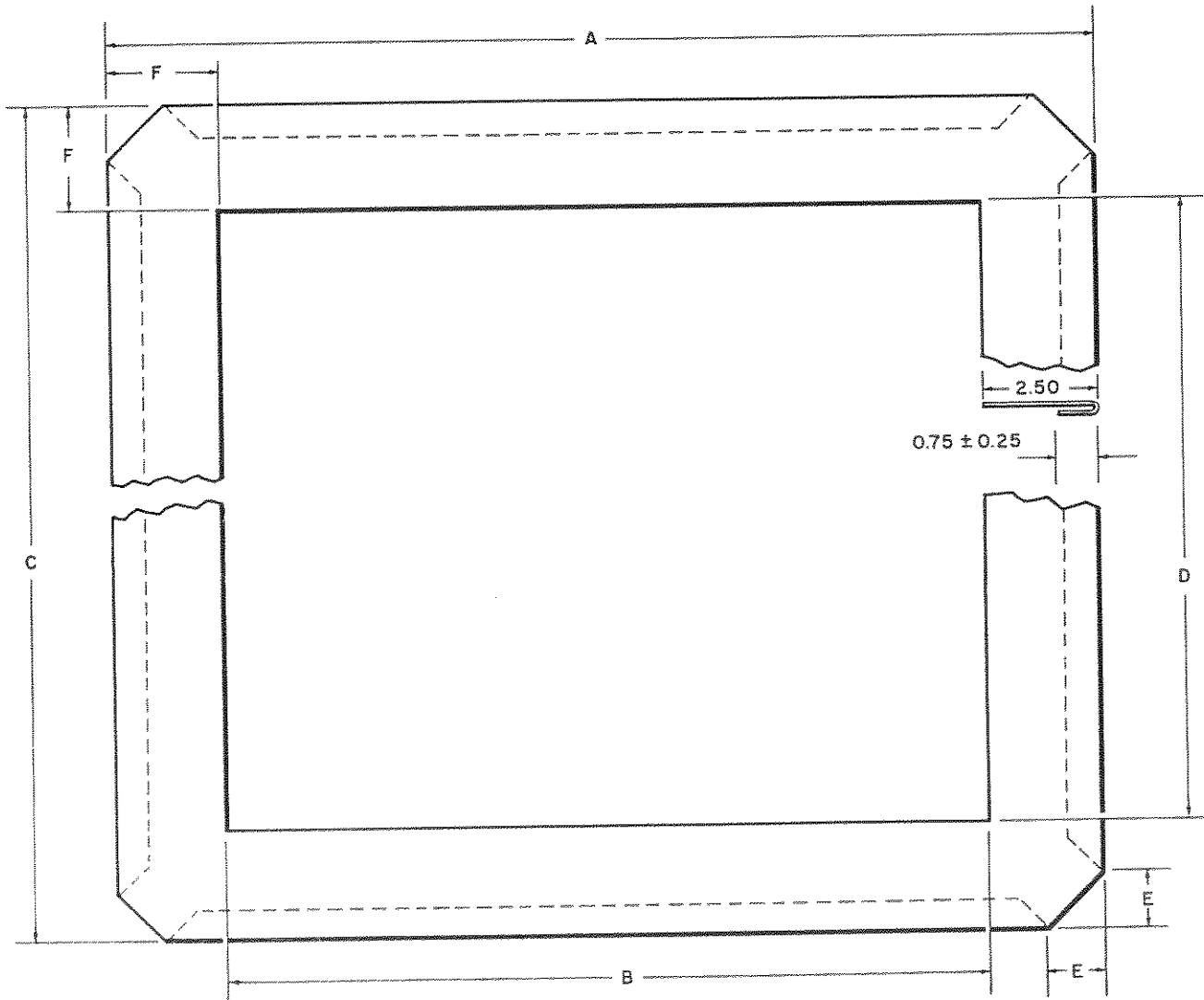
5-9.5.1.5.3.5 Place foot of two minimum 12-in.-depth by 8-in.-opening "C" clamps against wood board. Place adjusting screw ends of "C" clamps on outside of outer case, using small wood blocks under clamp to protect outside finish of case. Tighten clamps to force shock mounts to their bottom position.

5-9.5.1.5.3.6 Install top adapters, then release "C" clamps and remove clamps and wood boards.

5-9.5.1.5.3.7 Apply antiseize compound to threads of internal-wrenching bolts to be installed in upper adapters. Hold upper adapters with pliers and install bolts; tighten bolts securely.

5-9.5.1.5.3.8 Prior to installing and securing screen in place, check that looseness does not exist between inner case and shock mounts. If looseness does exist, disassemble and add shims under shock mounts. Do not reduce shock-mount travel by using too many shims.

5-9.5.1.5.3.9 Install strips securing screen in place. Install self-tapping screws and tighten screws securely.



Size of Screen	Dimensions (Inches)					
Size	A	B	C	D	E	F
Small	22.00±0.25	17.00±0.06	13.93±0.25	8.93±0.06	1.25±0.50	2.50±0.13
Medium	22.00±0.25	17.00±0.06	22.93±0.25	17.93±0.06	1.25±0.50	2.50±0.13
Large	22.00±0.25	17.00±0.06	26.93±0.06	31.93±0.25	1.25±0.50	2.50±0.13

Figure 5-32 Netting Saran Cloth (Lumite Screen) Fabrication Details

5-9.5.2 STRIP. The metal strips securing the screen in place are replaced as required by local manufacture. Use 52S-H32 aluminum alloy (Federal Specification QQ-A-318, Type 1/4H, anodized).

5-9.5.2.1 Using damaged strip as template, place it on replacement material. Scribe around damaged strip and mark screw holes.

5-9.5.2.2 Cut out replacement strip and drill required holes with No. 6 (0.204) drill.

5-9.5.2.3 Dress burrs from cut edge and around holes, as required. Break sharp edges.

5-9.5.3 NETTING SARAN CLOTH (LUMITE SCREEN). To remove screen, remove inner case in accordance with procedures in paragraph 5-9.5.1.2. Fabricate replacement screen as shown in figure 5-32.

WARNING

The solvent used in the following procedure is toxic, flammable, and injurious to exposed portions of the body. Observe applicable safety precautions (paragraph 2-2).

5-9.5.3.1 Remove damaged screen by coating bonded area with methyl ethyl ketone (technical). Clean metal surface of all old cement.

■ 5-9.5.3.2 Using netting saran cloth (lumite screen), cut replacement screen (large, medium, or small as required) as specified in figure 5-32.

5-9.5.3.3 Using spatula or brush, spread sealing compound onto surface to which replacement screen will be bonded.

5-9.5.3.4 Position screen on inner case and press screen into cement; allow to set.

NOTE

Depending on accessibility of cement to air, the setting time is 1 to 3 days at 80°F for maximum hardness. Even though the cement is not fully hardened, parts may be handled within 2 hr.

5-9.5.3.5 Install inner case in outer case. Install strips which secure screen in place. Install self-tapping screws and tighten screws securely.

5-9.5.4 COVER SCREWS.

5-9.5.4.1 To remove cover screw, pull up on screw and turn it counterclockwise.

NOTE

Initially, the screw will resist removal. Exercise a greater pull while turning the screw counterclockwise. Subsequent to thread engagement, the screw may be turned out in the normal manner.

5-9.5.4.2 Insert replacement screw in tapped hole, and turn screw clockwise until unthreaded portion floats free in tapped hole.

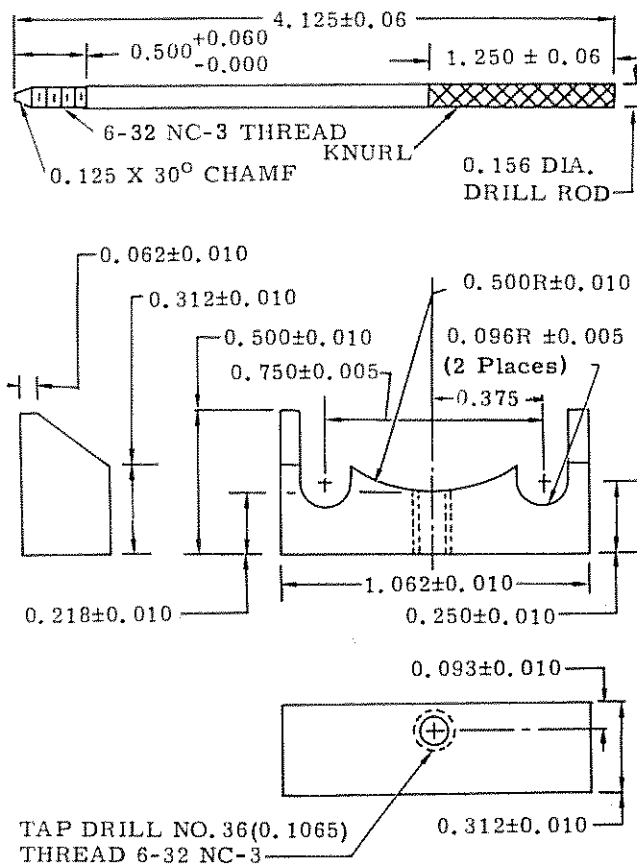
5-9.5.5 PAINTING. If exterior surface of carrying case requires refinishing, apply type I organic finish in accordance with procedures in TP 35-51, followed by 1 or 2 coats of enamel or lacquer, color as applicable.

5-9.6 REPAIR OF STANDARD FIBERGLASS CASE.

5-9.6.1 FABRICATION OF TOOLS AND HANDLES. Fabricate tools and handles as shown in figure 5-33. Eight tools are required for small, intermediate, and medium cases; 12 tools are required for large case. A minimum of three handles is recommended.

5-9.6.2 REMOVAL OF LINER FROM CASE.

5-9.6.2.1 Pry all access covers out of liner. Remove bolts which secure liner to shock mounts.



MATERIAL: 1018 MILD STEEL

Figure 5-33 Shock Mount Removal Tool and Handle

Small, intermediate, and medium cases have 8 shock mounts; the large case has 12 shock mounts. Position case on its back.

5-9.6.2.2 Place one 1- by 4- by 12-in. board on inside of liner so board rests over shock mounts on one side of liner end. Fasten "C" clamp (8-in. opening by 8-in. depth) over board and outside of case. Tighten clamp to hold it in place.

5-9.6.2.3 Slowly tighten "C" clamp while inserting tool (figure 5-34), tapered side up, between heads of 2 screws and flange of spring holder, starting with bottom shock mount.

5-9.6.2.4 After all tools have been inserted on one side, remove handles from tools, remove "C" clamp and board, and repeat procedure on opposite side and end of case. When all tools have been installed and handles removed, withdraw liner from case.

5-9.6.3 INSPECTION AND REPLACEMENT OF SHOCK MOUNTS.

5-9.6.3.1 Remove tools from shock mounts by inserting handles in tools, compressing shock mounts, and withdrawing tools.

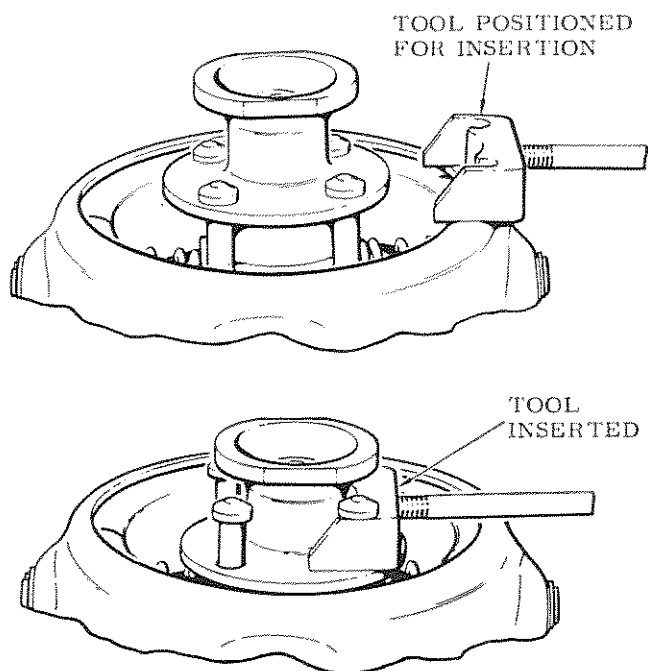


Figure 5-34 Removal of Shock Mount

5-9.6.3.2 Using new shock mount (P/N 131093-00, 131094-00, 131095-00 or 131096-00 as applicable) as comparison standard, inspect condition of shock mounts by manually compressing springs; check for return spring action. Visually inspect for broken springs, excessive wear, and looseness of working parts.

5-9.6.3.3 Remove and replace defective shock mounts. Check that 15/16-in. flats at top of shock mounts are parallel to case front.

5-9.6.4 INSPECTION AND REPLACEMENT OF CAM ACTION FASTENER RECEPTACLES IN LINER.

5-9.6.4.1 There are 2 types of cam action fastener receptacles. They are identified as P/N 829711-00 and P/N 832185-00. The latter is the newer and preferred type and is interchangeable with the former. Receptacle P/N 832185-00 can be distinguished from receptacle P/N 829711-00 by a cap which encloses the body of the part; receptacle P/N 829711-00 is open at the back.

5-9.6.4.2 If inspection of receptacle P/N 829711-00 reveals that the center detent and spring are missing, the defective insert may be replaced with a new one. After removing defective insert, thread new insert into receptacle by means of cam action fastener stud inserted in slot of insert. Install insert so that its degree of engagement in receptacle is comparable to that of inserts in other receptacles in liner. Care must be taken to avoid threading insert into receptacle to the extent that the end plate and spring are forced out the back of the receptacle. After

installation, adjust insert as necessary in accordance with applicable procedures in paragraph 5-9.7.1.

5-9.6.4.3 If a defective receptacle P/N 829711-00 is not repairable or if a receptacle P/N 832185-00 is defective, replace receptacle. To remove receptacle, use drill No. 42 (0.0935) and drill out rivets. Reinstall stiffener plate between receptacle and liner before riveting new receptacle in place. Using 3/32-in. long AN426-AD3 rivets, rivet receptacle in place (paragraph 3-6).

5-9.6.5 INSPECTION AND REPLACEMENT OF TAPERED PINS IN LINER. Check pins (P/N 131974-00) in corners of liner to see that they are mounted tight and are not bent. Replace defective pins as required.

5-9.6.6 INSTALLATION OF LINER IN CASE.

5-9.6.6.1 Reinstall tools in shock mounts; remove handles from tools.

5-9.6.6.2 Stand case in upright position with raised dimples on runners oriented up, and place liner in case. The end of the case with the word BOTTOM stamped on it must be positioned over the lower shock mounts.

5-9.6.6.3 Using new liner bolts (P/N 116197-00), thread bolts into shock mounts 4 or 5 turns. The case may be turned over on its top to facilitate inserting the top mounting bolts.

5-9.6.6.4 Using board and "C" clamp, compress shock mounts. Insert handles in tools and remove tools.

5-9.6.6.5 Tighten liner mounting bolts as follows: Insert open-end wrench through liner access hole to fit flats on shock mount spring holder; hold firmly to keep springs from twisting when tightening bolts. Tighten mounting bolts until heads are seated in dimple and liner is securely held against shock mounts.

5-9.6.6.6 Reinstall access covers in place in liners.

5-9.7 HARDWARE ADJUSTMENTS.

5-9.7.1 CAM ACTION FASTENERS.

5-9.7.1.1 To secure fastener, push in stud and turn clockwise until stud locks into slot in threaded insert (figure 5-35). Continue to turn clockwise until tight.

5-9.7.1.2 If threaded insert is already in too far, so that stud cannot completely engage with slot, push in stud and turn counterclockwise to unscrew threaded insert; repeat engaging procedure. Stud will eject if not properly engaged in insert.

5-9.7.1.3 If stud still does not engage with slot, insert flat-tipped screwdriver into slot in insert and

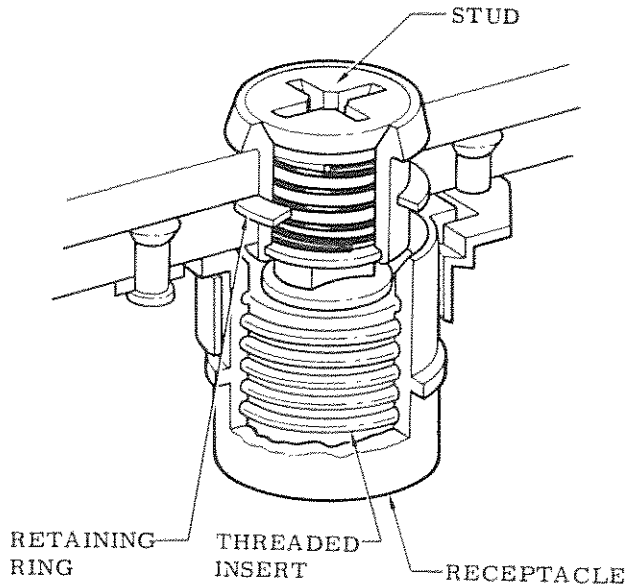


Figure 5-35 Cam Action Fastener

turn counterclockwise approximately 2 turns. This will back insert out far enough so stud can engage with slot in insert.

5-9.7.2 ADJUSTING SHAFTS.

5-9.7.2.1 If it is difficult to remove unit assembly from carrying case, proceed as follows.

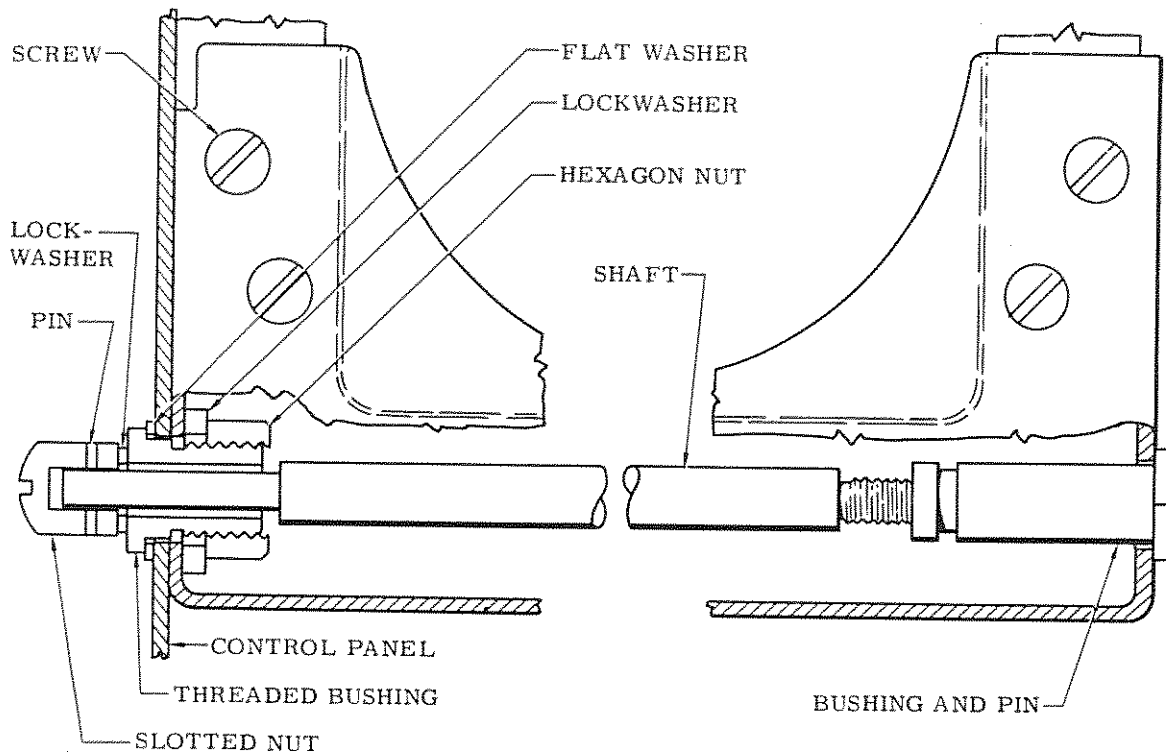


Figure 5-36 Adjustment of Shafts

5-9.7.2.1.1 Make certain cam action fasteners around perimeter of control panel are loose.

5-9.7.2.1.2 Use four adjusting shafts (large slotted nuts on control panel, figure 5-36) to free unit assembly. To do this, turn slotted nuts of each shaft counterclockwise approximately 2 turns in sequence.

NOTE

If the adjusting shaft must be removed completely to free the unit assembly, the bushing and pin on the rear of the shaft has become separated from the shaft and must be reinstalled after the unit assembly is withdrawn from the carrying case.

5-9.7.2.1.3 Withdraw unit assembly.

5-9.7.2.2 If it is difficult to install unit assembly in carrying case, proceed as follows.

5-9.7.2.2.1 Turn four adjusting shafts (large slotted nuts on control panel figure 5-36) 1 or 2 turns counterclockwise to loosen shafts.

5-9.7.2.2.2 Slide unit assembly into carrying case and seat control panel against inner case. Tighten adjusting shafts.

5-9.7.2.2.3 Secure all cam action fasteners around perimeter of control panel.

5-9.8 APPLICATION OF ANTISTATIC COMPOUND. Antistatic and cleaner compound is applied to plastic surfaces on certain test equipment for the purpose of depositing an electrostatic conducting film.

5-9.8.1 Clean plastic surface with clean, soft cloth moistened with water. Wipe surface dry with clean, dry soft cloth.

5-9.8.2 Using absorbent cotton (medical grade), apply antistatic solution to plastic surface. Do not use coarse cloth or chamois.

5-9.8.3 Allow solution to air-dry until haze forms on surface.

5-9.8.4 Using absorbent cotton, gently polish coated surface until haze is barely visible on close inspection.

5-9.9 REPLACEMENT OF CUSHIONING PAD. These procedures cover the replacement of worn or damaged cushioning pads in carrying cases.

5-9.9.1 Remove defective pad by scraping with knife or similar sharp tool. Remove any remaining residue from area by sanding or with steel wool. Clean area thoroughly with acetone.

5-9.9.2 Apply thin, even film of adhesive (EC-847) to pad and to surface to which pad is to be bonded.

NOTE

Do not cement the pad to any surface other than the interior surface of the carrying case from which the worn or damaged pad was removed.

5-9.9.3 Position pad in same location from which worn or damaged pad was removed, and press pad firmly in place. Remove any excess adhesive with acetone. Permit unit to set for 16 to 24 hrs before use.

SECTION 6

MISCELLANEOUS MAINTENANCE OPERATIONS

6-1 GENERAL.

This section contains miscellaneous procedures used for maintenance, repair, and replacement of parts on various assemblies.

6-1.1 Refer to Section 2 for maintenance operation standards and general safety precautions.

6-1.2 Refer to TP 35-51 for procedures on cleaning of small areas, identification marking, and surface refinishing when required in conjunction with procedures in this section.

6-2 REPLACEMENT OF PLUG HUMIDITY INDICATOR AND COMPONENTS.

6-2.1 PLUG HUMIDITY INDICATORS (P/N 128620-00, P/N 812473-00, P/N 826363-00, AND P/N 828462-00 (Figure 6-1). These procedures detail the removal and installation of plug humidity indicators, and/or replacement of card humidity indicators or dial windows, using the H-690 or H-691 Spanner Wrench, as specified (figure 6-2).

6-2.1.1 GENERAL TORQUE REQUIREMENTS. The following torque values are applicable for plug humidity indicators P/N 128620-00, P/N 812473-00, P/N 826363-00, and P/N 828462-00.

6-2.1.1.1 Apply 70-80 lb-in. torque to retaining ring of humidity indicators.

6-2.1.1.2 Apply 13-15 lb-ft torque to the plain hex nut (or indicator housing when nut is not accessible) of humidity indicator P/N 812473-00, in case or container.

6-2.1.1.3 Apply 30-35 lb ft torque to the plain hex nut (or indicator housing when nut is not accessible) of indicators P/N 128620-00, P/N 826363-00, or P/N 828462-00, in case or container.

CAUTION

When humidity indicators are to be torqued by driving the indicator housing rather than the plain hex nut, carefully tighten the hex nut prior to applying

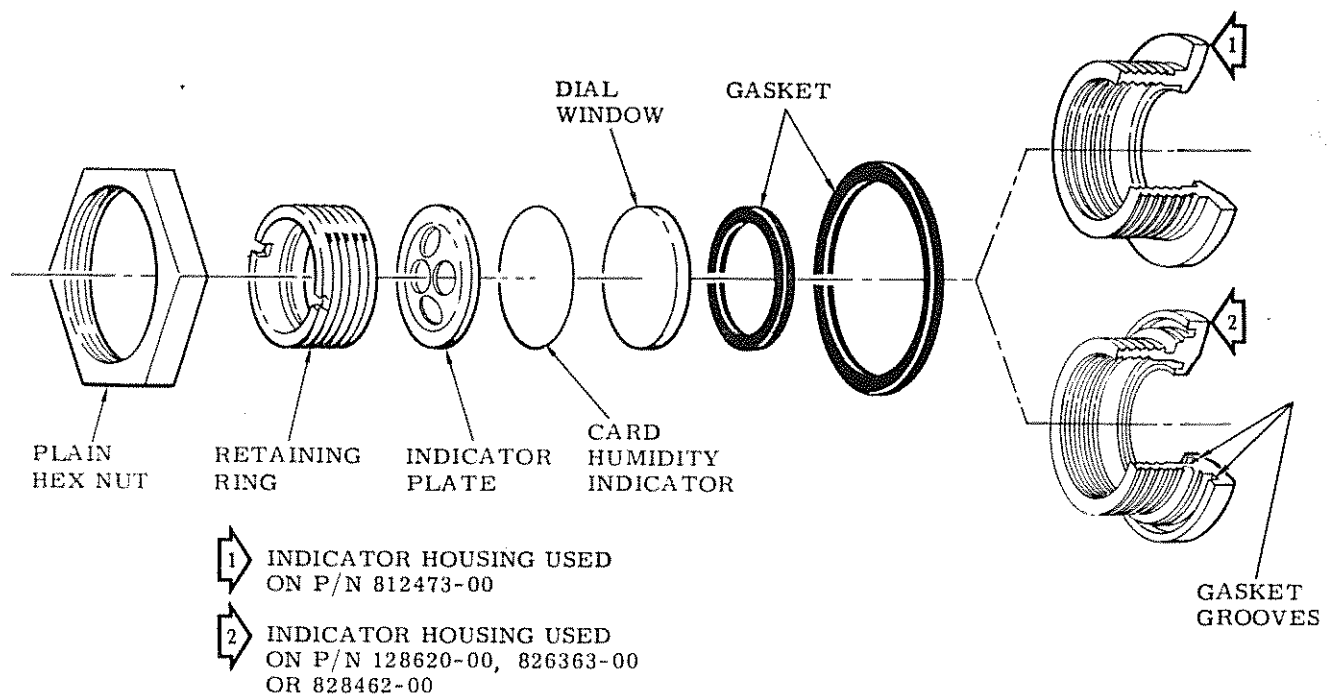


Figure 6-1 Plug Humidity Indicators P/N 128620-00, P/N 812473-00, P/N 826363-00, and P/N 828462-00

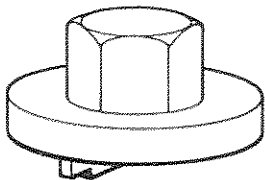


Figure 6-2 H-690/H-691 Spanner Wrench

final setting torque from the outside. This will minimize rotation of the indicator housing and possible damage to the gasket. This CAUTION is also applicable when removing indicators.

6-2.1.2 REMOVAL AND REPLACEMENT OF INDICATOR AND INDICATOR COMPONENTS.

NOTE

For purposes of these procedures, the various plug humidity indicators are considered as alternates to each other, as indicated.

6-2.1.2.1 CHANGE OF CARD HUMIDITY INDICATOR. Grip H690 on flats of plain hex nut. Place H690 face on indicator housing and engage slots in housing. Using H691, engage slots in retaining ring. Remove retaining ring and card humidity indicator. To install a new card humidity indicator, place card in recess and install retaining ring. Torque retaining ring in accordance with values specified in paragraph 6-2.1.1.1.

6-2.1.2.2 CHANGE OF PLUG HUMIDITY INDICATOR (All Types) IN STANDARD METAL CASE. From end of case in which plug humidity indicator is mounted, remove the 2 self-tapping screws from strip securing screen, and remove the strip. Bend screen to clear it for further operations. Grip plain hex nut of indicator (on inside of outer case) with a wrench. Engage slots in indicator housing (on outside of outer case) with H690. Grip H690 with a wrench, and turn wrench to remove indicator. To replace indicator, engage slots in indicator housing with H690, and screw housing in place. Torque indicator housing in accordance with values specified in paragraph 6-2.1.1.2 or 6-2.1.1.3, as applicable. Install strip and self-tapping screws, securing screen in place. Tighten screws securely.

6-2.1.3 CHANGE OF PLUG HUMIDITY INDICATOR IN STANDARD FIBERGLASS CASE. Perform operation in accordance with procedures in paragraph 6-2.1.2.2, with the exception that procedures concerning removal and installation of the strip are not applicable.

6-2.1.4 CHANGE OF CARD HUMIDITY INDICATOR IN DRUM-TYPE CONTAINER AND SPECIAL FIBERGLASS CASE WITHOUT REMOVING INDICATOR HOUSING. Engage slots in retaining ring with H691. Drive H691 with a wrench to remove retaining ring. Remove card humidity indicator, place card in recess, and install retaining ring, using H691. Torque retaining ring in accordance with values specified in paragraph 6-2.1.1.1.

6-2.1.5 CHANGE OF PLUG HUMIDITY INDICATOR IN DRUM-TYPE CONTAINER AND CONTAINERS WITH SIMILAR INDICATOR INSTALLATION. Use a wrench to engage plain hex nut on inside of container. Remove hex nut and remove indicator. If body of indicator turns, use H690 to prevent rotation. To replace indicator, position indicator in container and install hex nut. Torque in accordance with paragraph 6-2.1.1.2 or 6-2.1.1.3, as applicable.

6-2.1.6 CHANGE OF PLUG HUMIDITY INDICATOR IN SPECIAL FIBERGLASS CASE AND CONTAINER. AND FOR OTHER SIMILAR INDICATOR INSTALLATION. As applicable, perform operation in accordance with procedures in paragraph 6-2.1.5.

6-2.2 PLUG HUMIDITY INDICATOR (P/N 828596-00). Plug humidity indicator P/N 828596-00 may be installed in any 5/8-in. diameter hole in a metallic container. This plug humidity indicator is used in special applications also, as stated in paragraph 6-2.2.3.

6-2.2.1 From outside of container, remove hexagon head containing indicator card. Remove flat rubber washer from hexagon head, or if rubber washer is stuck to container, remove it from container.

6-2.2.2 If a replacement plug humidity indicator or parts of a replacement plug humidity indicator are to be installed, disassemble the plug humidity indicator into its three component parts.

6-2.2.3 Remove hexagon-head internally-threaded bushing from inside container, unless plug humidity indicator is being used on an H586 container. If the hexagon-head internally-threaded bushing is to be removed from and/or installed on an H586, perform procedures in paragraphs 6-2.2.4 and 6-2.2.5, as applicable. If the bushing is not being removed or installed on an H586, omit procedures in paragraphs 6-2.2.4 and 6-2.2.5.

6-2.2.4 From inside base of H586, cut lockwire holding hexagon-head internally-threaded bushing and remove lockwire and bushing.

6-2.2.5 From inside base of the H586, place hexagon-head internally-threaded bushing in position

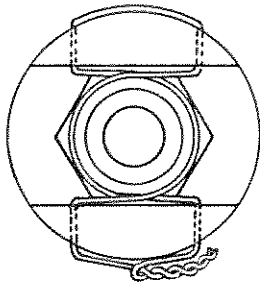


Figure 6-3 Safety Wiring for Plug Humidity Indicator P/N 828596-00 When Used in H-586

on hole in container base, making sure hexagon head seats between the two flats. To prevent bushing from falling out, safety-wire as shown in figure 6-3 and as specified in paragraph 3-4.

6-2.2.6 Make sure flat rubber washer is installed next to head containing indicator. From outside container, install the hexagon head containing indicator and flat rubber washer, aligning it with the hexagon-head internally-threaded bushing, which is positioned on interior of container. Tighten plug humidity indicator securely, but do not overtighten.

6-3 TIRE AND TUBE MAINTENANCE.

These instructions are for general maintenance of rubber tires and tubes for shipping and storage containers, or other assembly equipment.

6-3.1 SOLID RUBBER OR SEMIPNEUMATIC TYPE. These tires are not for high-velocity use, and walking speed should not be exceeded. Continued runs at greater speeds will overheat and damage the tires.

6-3.1.1 When tires are subjected to -20°F temperatures they become hard, and normal deflections are absent. Normal use of the tires under these conditions will not damage them.

6-3.1.2 If equipment is left "standing" on tires, the tires will develop a slight flat side. This condition is temporary and will disappear when tires are warm and in use. Normal use of the tires under these conditions will not damage them.

6-3.1.3 When equipment is not in use for long periods of time, it should be set on blocks so that weight is off the tires. When equipment is located where temperatures are at or below -10°F the equipment should be set on blocks when not in use.

6-3.2 PNEUMATIC TIRES. These are standard high-pressure pneumatic rubber tires and are subject to the same care as other commercial tires of this type.

6-3.2.1 Tires of either size, 6:00x9 or 4:00x8, shall be inflated to a pressure of 60 ± 5 psi.

6-3.2.2 Damaged tires containing breaks through the cord, or tread worn to the first layer of cord, are replaced from spares. To replace a tire, deflate the tube and change the tire as in commercial practice.

6-3.3 TUBES. These are standard rubber tubes and are subject to the same care as commercial tubes of this type.

6-3.3.1 Damaged tubes are repaired with a hot vulcanized patch. Do not use a cold patch. Tubes damaged beyond repair are replaced from spares.

6-3.3.2 Subsequent to repair of tube, fill tube with air sufficient to detect leakage and check repaired damage by immersion in water. Air bubbles indicate patch is not secure, and tube must be repatched and checked.

6-4 REPLACEMENT OF LUBRICATION FITTINGS.

These procedures are for the purpose of replacing damaged pressed-in or threaded lubrication fittings. Use replacement fitting having same body contours as original fitting.

CAUTION

When necessary, remove any hardware which might be affected by the drilling and/or tapping operation. Clean out chips or other foreign matter subsequent to drilling or tapping. Replace hardware.

6-4.1 1/8-IN. FITTING (P/N 801613-00).

6-4.1.1 Remove damaged fitting, using wrench (on flats only), an "easy out" tool, or other square rod.

6-4.1.2 If the hole thread is damaged, drill out hole using an 11/32-in. tap drill to a depth of 15/32-in. minimum.

6-4.1.3 Using a 1/8-27 plug end straight pipe tap, tap threads to a depth of 5/16-in. minimum.

6-4.1.4 Install replacement fitting and tighten fitting securely.

6-4.2 1/8-IN. FITTING (P/N 801340-00, 811094-00, or 812130-00).

6-4.2.1 Using a 21/64-in. drill, drill out damaged fitting to a depth of 5/16-in. minimum.

6-4.2.2 Using a 1/8 NPT taper tap, tap threads to a depth of 5/16-in. minimum.

6-4.2.3 Install replacement fitting and tighten fitting securely.

6-4.3 1/4-IN. FITTING (P/N 853661-00 or 851409-00).

6-4.3.1 Remove damaged fitting, using a wrench (on flats only), an "easy out" tool, or other square rod.

6-4.3.2 If the hole thread is damaged, the all-purpose Alemite Easy Out (No. 315790) is designed to extract damaged fitting, rethread 1/4-28 hole, and to install straight or angle type fittings. Use this tool or equivalent.

6-4.3.3 Install replacement fitting and tighten fitting securely.

6-4.4 1/4-IN. FITTING (P/N 805708-00 or 812188-00).

6-4.4.1 PRESSED-IN FITTING.

6-4.4.1.1 Using a No. 3 (0.213) drill, drill out the damaged fitting to a depth of 1/4 (+1/8, -0) in.

6-4.4.1.2 Using a 1/4-28NF-2 tap, tap threads to a depth of 1/4 (+1/8, -0) in.

6-4.4.1.3 Install replacement fitting and tighten fitting securely.

6-4.4.2 THREADED FITTING.

6-4.4.2.1 Using a No. 733 Morse size No. 1 screw extractor, an "easy out" tool, or other square rod, remove the damaged fitting.

6-4.4.2.2 Install replacement fitting and tighten fitting securely.

6-4.5 3/16- OR 1/4-IN. STRAIGHT DRIVE FITTINGS (P/N 807158-00 or 807159-00).

6-4.5.1 Drill out damaged fitting, using appropriate size tap drill.

6-4.5.2 Replacement fitting may be used in old or slightly oversize holes. Install replacement fitting using a straight drive tool (Alemite No. 5253) or equivalent.

6-4.5.3 If desired, the straight drive fitting may be replaced with a threaded fitting. Tap threads as required.

6-5 PRESSURIZATION, CASE DRYING, PRESSURE TEST, AND LEAK CHECK.

This paragraph provides information on the equipment and systems generally used in pressurization, case drying, and pressure test. Specific procedures on hook-up, use of the equipment, and choice of the system to be used shall be as specified in the appropriate referencing document. Additionally, this paragraph gives procedures for preparation of pressurizing gas (special dry air) cylinders for return shipment.

6-5.1 PRESSURIZING GAS. The pressurizing gas used in the purging and pressurizing of vessels is either compressed air or nitrogen; only the gas specified in the applicable referencing document is to be used. Refer to table I for part number and unit of issue of the applicable pressurizing gas. If compressed air is specified, do not use the final 500 psig of air in each container for purging or pressurizing.

6-5.2 SYSTEM HOOK-UP. The equipment and systems generally used in pressurizing, case drying, pressure testing, and leak checking of vessels are shown in figure 6-4. Alternate equipment and systems, which are at least the functional equivalent of those shown, may be used if all the requirements of the appropriate referencing document are fulfilled.

6-5.3 REGULATION OF PRESSURIZATION AND PURGING SYSTEMS.

6-5.3.1 After system has been assembled and connected, open cylinder valve; regulator gage near cylinder indicates cylinder pressure.

6-5.3.2 Open regulator valve until 2nd regulator gage indicates specified purging or pressurizing pressure. If system contains no globe valves, gas flows through system at this point.

6-5.3.3 If system contains one or more globe valves, open globe valves as required to permit gas to flow through system. Indication of 2nd regulator gage decreases 2 or 3 psig and gradually increases back to initial regulator setting as vessel pressure increases.

6-5.3.4 To check vessel pressure at any point during pressurization, slowly close regulator valve and note point at which gage indication remains stable regardless of further closing of valve. To continue pressurizing, close 1 globe valve (if applicable), reset regulator valve to specified pressure indication on gage, and reopen globe valve.

6-5.3.5 To make accurate check of vessel pressure, close 1 globe valve (or regulator valve if no globe

valves are used), disconnect system from vessel being pressurized, and check vessel pressure by means of T283 or other pressure gage. Add or bleed off gas as required to achieve specified pressure.

6-5.4 PREPARATION OF PRESSURIZING GAS (Special Dry Air Only) CYLINDERS FOR RETURN SHIPMENT.

NOTE

Do not use the final 500 psig of air in cylinder; cylinder is to be considered

empty and returnable when pressure drops to this point.

6-5.4.1 Check cylinder to see if P/N 281438-00 is stencilled with 1.00±0.10 in. high white characters located approximately 22±2 in. from top of cylinder. If not present, stencil using any suitable white enamel, stencilling ink, or lacquer.

6-5.4.2 Check cylinder to see if P/N 178151-00 is stencilled anywhere on cylinder. If present, obliterate P/N 178151-00 using any suitable black enamel.

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6-6 REPAIR AND LUBRICATION OF CASTER ASSEMBLIES.

The procedures in this paragraph are to be observed as applicable to the specific caster assembly, and to the extent that caster inspection, as specified in the referencing document, indicates defective operation.

6-6.1 If lubricant fitting is damaged and is to be replaced by press-in type fitting, remove damaged portion of fitting and drive in replacement fitting by means of hammer and tool which seats against shoulder rather than head of fitting.

6-6.2 If caster assembly contains lubricant fittings (e.g., H532B and H736A), lubricate caster through fittings in wheel hub and in swivel portion of caster frame, using grease gun and aircraft and instrument grease (gear and actuator screw). Recheck wheel and swivel action. If lubrication does not correct problem, continue with following paragraph.

6-6.3 Remove locknut which secures axle and wheel to caster frame and remove wheel and any spacers or seals, as applicable.

6-6.4 Remove bearings (ball, roller, or sleeve type, as applicable) from wheel; check bearings and wheel

ball race or roller path for corrosion, dirt, sand, and other defects.

6-6.5 If evidence of corrosion, dirt, and other contaminants is found, clean parts in accordance with procedures in TP 35-51 for cleaning of small areas or for cleaning of corrosion from unpainted surfaces. If defects cannot be adequately corrected by cleaning, replace items from spares.

6-6.6 Pack bearings and ball races or roller paths with gear and actuator screw grease. Reinstall bearings in wheel; pack additional grease in wheel well as required.

6-6.7 If no additional disassembly of swivel portion of caster frame is necessary, position wheel in caster frame and install seals (if applicable), axle, spacers, and locknut; tighten locknut securely, then back off nut as necessary to permit free rotation of wheel.

6-6.8 If swivel portion of caster is to be disassembled, remove dust cap from caster frame and remove locknut from bolt which secures bearings in frame housing. Remove bolt and separate caster parts.

6-6.9 Check bearings and roller paths or ball races of caster frame for corrosion, dirt, sand, and other defects. If evidence of contamination is found, clean parts in accordance with procedures in TP 35-51 for cleaning of small areas or for cleaning of corrosion from unpainted surfaces. If defects cannot be adequately corrected by cleaning, replace items from spares.

6-6.10 Pack bearings and ball races or roller paths with gear and actuator screw grease; reassemble

bearings, mounting bracket, and caster frame; pack additional grease in bearing well areas as necessary. Install bolt and locknut; tighten locknut securely, then back nut off as necessary to permit unit to swivel freely. Install dust cap over locknut.

6-6.11 Position wheel in caster frame and install seals (if applicable), axle, spacers, and locknut; tighten locknut securely, then back off nut as necessary to permit wheel to rotate freely.

6-7 LUBRICATION OF BERYLLIUM SURFACES.

WARNING

Do not heat the following lubricant solution during or after preparation. Heat could cause it to explode.

6-7.1 LUBRICANT PREPARATION. Mix 1 pint of trichloroethane (technical) with 23 ± 1 grams of cetyl alcohol NF.

6-7.2 LUBRICANT APPLICATION.

6-7.2.1 Clean parts or areas to be lubricated with a clean lint-free cloth moistened with trichloroethane (technical).

6-7.2.2 Allow cleaned surface to dry for at least 15 min before applying lubricant.

6-7.2.3 Apply an even, minimum coating of the lubricating solution by brush to the parts or areas to be lubricated.

REFERENCE NOMENCLATURE FED STK NO.	FEDERAL ITEM NAME	SPECIFICATION OR STANDARD REMARKS
Adhesive (Fairprene No. 5128) (pt kit) 8040-515-2246	ADHESIVE	MIL-A-5540, Class 3, neutral 1 pint can base with catalyst, kit.
Adhesive (Loxite, 6000)		MMM-A-130a See - Adhesive (EC-194)
Adhesive (Reclaimed rubber) 8040-262-9025 8040-262-9026 8040-262-9028 8040-262-9031 8040-281-1972	ADHESIVE	MIL-A-5092B, Type I 4 OZ ½ PT 1 PT 1 QT 1 GL
Adhesive (Resin base) 8040-815-6258	ADHESIVE	MMM-A-181b, Type I, Grade A 1 quart can base with hardener, two part adhesive
Adhesive (Rubber) 8040-053-1271 8040-264-3845 8040-270-8159	ADHESIVE	MMM-A-250b, Type II 1 QT 5 GL 55 GL
Adhesive (Rubber base contact cement)		MMM-A-130a See - Adhesive (EC-194)
Adhesive (Rubber, Buna-N type)		MIL-A-5092B, Type III See - Adhesive (EC-847)
Adhesive (Rubber, natural)		ZZ-C-191a, Type II See - Adhesive (Cold patch)
Adhesive (Synthetic type) 8040-721-9091 8040-819-4015 8040-680-0881	ADHESIVE	MIL-A-25457B 1 PT base with separate catalyst 1 QT base with separate catalyst 1 GL base with separate catalyst
Alcohol, Denatured 6810-201-0906 6810-543-7415 6810-201-0907 6810-201-0904 6810-823-8011	ALCOHOL, DENATURED	O-E-760b, Grade III 1 PT 1 GL 5 GL 54 GL in 55 GL drum Bulk
Antiseize Compound 8030-243-3285 8030-087-8630	ANTISEIZE COMPOUND	MIL-T-5544B 8 OZ 1 LB
Antiseize Compound (Aluminum or aluminum alloy threads) 8030-292-1102	ANTISEIZE COMPOUND	MIL-T-22361 8 OZ
Cloth, Abrasive (Crocus) 5350-221-0872	CLOTH, ABRASIVE	P-C-458c, Class 1 9 in. by 11 in. SH

REFERENCE NOMENCLATURE		SPECIFICATION OR STANDARD
FED STK NO.	FEDERAL ITEM NAME	REMARKS
Coating Kit,Rain Erosion Resisting		MIL-C-7439B,Class 1,Brushable or Spray
8030-506-4030	COATING KIT,RAIN EROSION RESISTING	1 PT coating,2 OZ primer, 1 OZ accelerator,1 QT thinner/KT
8030-527-2510		1 PT coating,1 PT primer, 1 OZ accelerator,1 QT thinner/KT
8030-586-8330		1 QT coating,4 OZ primer, 2 OZ accelerator,2 QT thinner/KT
8030-800-5931		1 GL coating,1 PT primer, 8 OZ accelerator/KT
Compound,Smoothing,Aerodynamic (EC-1184)		MIL-F-52252
8010-058-1036	FILLER,DENT,METAL SURFACE	1 PT
8010-598-4718		1 QT
Cord,Nylon (550 lb)		MIL-C-7515D,Type II,OD 700 YD spool
4020-782-5415	CORD,NYLON	
Corrosion Preventive,Solvent-Cutback		MIL-C-16173D,Grade 1
8030-062-6950	CORROSION PREVENTIVE COMPOUND	1 QT
8030-231-2345		1 GL
8030-244-1299		5 GL
8030-244-1300		55 GL
Filler,Plastic (Natural)		TT-F-00340a
8010-262-9171	FILLER,WOOD,PLASTIC	4 OZ
8010-262-9172		1 LB
Gas,Pressurizing (Nitrogen)		BB-N-411b,Type I,Class 1,Grade B
6830-782-2641	NITROGEN,TECHNICAL	184 cubic foot CY,cylinder is part of item of supply
6830-292-0131		200 cubic foot CY,cylinder is part of item of supply
6830-840-6578		340 cubic foot CY,cylinder is part of item of supply
Graphite,Dry		MIL-G-6711
9620-276-7901	GRAPHITE,DRY	1 LB
Grease,Aircraft and Instrument		MIL-G-23827A
Grease,Aircraft and Instrument (Gear and actuator screw)		
9150-985-7243	GREASE,AIRCRAFT AND INSTRUMENT	1 OZ
9150-985-7245		8 OZ
9150-985-7246		1 LB
9150-985-7248		35 LB
Grease,Rubber-Metal Joints		MIL-G-4343B
9150-273-8633	GREASE,AIRCRAFT	8 OZ
9150-269-8255		1 LB

REFERENCE NOMENCLATURE FED STK NO.	FEDERAL ITEM NAME	SPECIFICATION OR STANDARD REMARKS
Hydraulic Fluid (Petroleum Base) 9150-180-6181	HYDRAULIC FLUID, PETROLEUM BASE	MIL-H-5606B 8 OZ
9150-848-5320		16 OZ spray can
9150-252-6383		1 QT
9150-223-4134		1 GL
9150-265-9408		55 GL
Insulating Compound,Electrical (DC-4) 6850-880-7616	SILICONE COMPOUND	MIL-S-8660B 8 OZ
6850-295-7685		10 LB
Insulating Compound,Electrical (Glyptal) 8010-917-2368	ENAMEL	MIL-E-22118 1 QT
Lubricant,Dry Film (Lubri-Bond,Type A) (with built-in spray) 9150-754-0064	LUBRICANT,SOLID FILM	MIL-L-23398B,Type II 12 OZ spray can
Lubricating Oil,General Purpose Lubricating Oil,General Purpose (Ensis, No. 103) 9150-231-2361	LUBRICATING OIL, GENERAL PURPOSE	MIL-L-3150A 1 QT
9150-231-2356		5 GL
9150-292-9692		55 GL
Lubricating Oil,General Purpose 9150-542-1430	LUBRICATING OIL, GENERAL PURPOSE	MIL-L-7870A 4 OZ
9150-263-3490		1 QT
9150-273-2397		1 GL
9150-281-9438		55 GL
Lubricating Oil,Instrument 9150-664-6518	LUBRICATING OIL, INSTRUMENT	MIL-L-6085A 1½ OZ
9150-257-5449		4 OZ spout can
9150-223-4129		1 QT
Naptha,Aliphatic (Type II) 6810-238-8119	NAPTHA,ALIPHATIC	TT-N-95b,Type II 1 GL
6810-265-0664		5 GL
6810-238-8117		55 GL
Paper,Abrasive 5350-598-6105	PAPER,ABRASIVE	P-P-105b,Class 2,medium grit 9 in. by 11 in. sheet
Paper,Abrasive (Wet) 5350-721-8117	PAPER,ABRASIVE	P-P-101c,180 grit 9 in. by 11 in. sheet
Paper,Abrasive 5350-235-0136	PAPER,ABRASIVE	P-P-105b,Class 1,grit 3/0 9 in. by 11 in. sheet

REFERENCE NOMENCLATURE FED STK NO.	FEDERAL ITEM NAME	SPECIFICATION OR STANDARD REMARKS
Paper, Abrasive 5350-224-7201	PAPER, ABRASIVE	P-P-101d, 400 grit (48 or 80 lb) 9 in. by 11 in. sheet, 48 pound backing
Penetrant Kit, Inspection 6850-826-0981	INSPECTION PENETRANT KIT	MIL-I-25135C, Group I KT consist of the following items in pressurized cans: one 12 OZ can penetrant, four 12 OZ cans penetrant remover, and four 12 OZ cans developer
Putty (Zinc chromate) 8030-664-4968	PUTTY	MIL-P-8116B 10 LB
Remover, Paint 8010-160-5799 8010-597-8234 8010-165-4447	REMOVER, PAINT	TT-R-251h, Type III, Class A 1 QT 1 GL 5 GL
Rubber Sheet, Celluar 9320-641-7084	RUBBER SHEET, CELLULAR	MIL-R-6130B, Type II, Grade B, medium, ¼ in. by 36 in. by 36 in. spec Grade A (oil resistant) SH
Rubber Sheet, Cellular 9320-618-3180	RUBBER SHEET, CELLULAR	MIL-R-6130B, Type II, Grade B, medium, ½ in. by 36 in. by 36 in. spec Grade A (oil resistant) SH
Rubber Sheet, Solid (0.06 in. thick) 9320-261-5806	RUBBER SHEET, SOLID	MIL-R-6855B, Class 2, Grade 80, 1/16 in. by 36 in. by 36 in. SH
Sealer, Surface Sealing Compound (Buna-N-type) 8030-664-4019 8030-664-4954 8030-857-3604	SEALING COMPOUND	MIL-S-4383B 1 PT 1 QT 1 GL
Sealing Compound (Red Loctite) 8030-081-2339 8030-081-2338 8030-844-3821 8030-063-4728	SEALING COMPOUND	MIL-S-22473D, Grade A 10 CC plastic bottle 50 CC plastic bottle 50 CC can 1 PT can
Sealing Compound (Loctite) 8030-081-2335 8030-081-9022	SEALING COMPOUND	MIL-S-22473D, Grade B 10 CC plastic bottle 50 CC bottle
Sealing Compound (Loctite) 8030-081-2333 8030-823-7917 8030-900-4415 8030-964-7537 8030-824-1384	SEALING COMPOUND	MIL-S-22473D, Grade C 10 CC plastic bottle 50 CC plastic bottle 8-1/3 OZ tube 250 CC plastic bottle 1 PT can

DEPARTMENTS OF THE ARMY, NAVY, AND AIR FORCE
Washington, D. C., 21 April 1971

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