EO 05-1-3/10

ROYAL CANADIAN AIR FORCE

CABLE INSPECTION SWAGING AND SPLICING

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LIST OF RCAF REVISIONS

DATE	PAGE NO	DATE	PAGE NO
19 Jan 62	13		
19 Jan 62	14		
19 Jan 62	14A		
27 Sep 62	11		

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CABLE INSPECTION SWAGING AND SPLICING

GENERAL

1 Control cables are mainly of extra-flexible, preformed, corrosion-resistant steel. Tinned steel cable is also used interchangeably. Preformed cable (Item 7) has almost entirely replaced the earlier non-preformed type. Control cables vary from 1/16 to 3/8" in diameter. Cables of 1/8" and larger are composed of seven strands of nineteen wires each. Cables 1/16 and 3/32" in diameter are composed of seven strands of seven wires each.

INSPECTION OF CABLES

2 Tests have shown that control cables may have broken wires and still be capable of carrying the design load of the cable. Watch for frayed cables at each regular inspection period. Inspect cables for broken wires by passing a cloth along the length of the cable. Broken wires will be indicated where the cloth is snagged. Replace any 7 x 19 cable that shows more than six wires broken in any 1" length, see Figure 1 or any 7 x 7 cable that shows more than three wires broken in any 1" length. Watch particularly for breakages occurring in that length of a cable normally passing over a pulley or through a fairlead. Pay particular attention to inspection for corroded or badly worn cable. If corroded, badly worn or kinked, replace the cable even though the number of broken wires is less than that specified for replacement. Because of the number of wires in 7 x 19 cables (133) and in 7 x 7 cables (49), their failure is never abrupt but is progressive over periods of extended use. Some broken wires show up soon after placing the cable in service, probably due to being under greater tension or being much harder than the rest. After these overstressed or overhard wires have broken, few additional broken wires will be encountered in normal service for considerable time. Test show that the loss in cable strength due to broken wires depends upon their concentration at any point rather than on the total number in the cable.

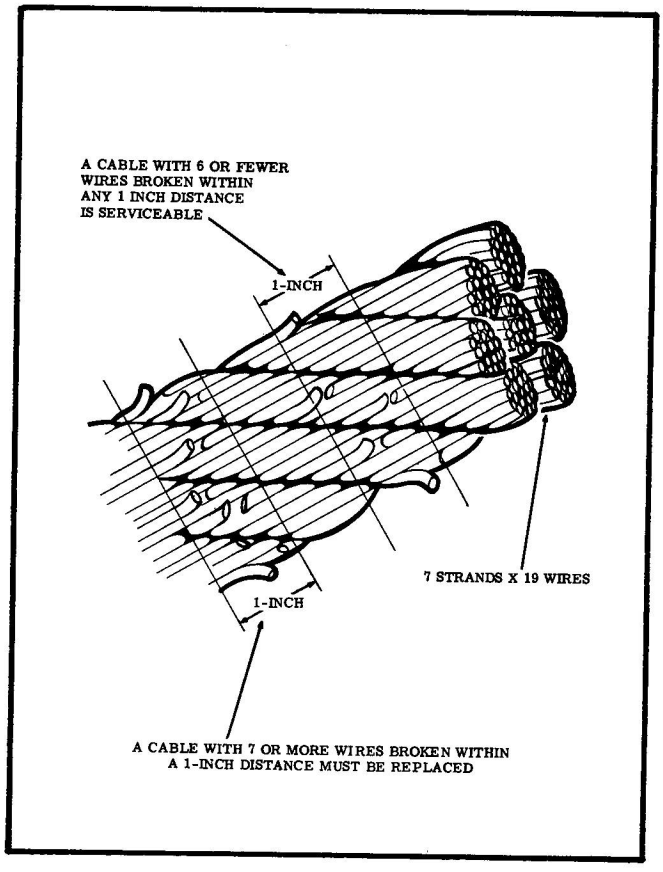


Figure 1 Cable with Broken Wires

CABLE REPLACEMENT

3 Wherever possible, use duplicate spare cables for replacements. If spare replacement cables are not available, fabricate replacements from preformed cables (Item 7) and swaged terminals (Item 8). If this is not possible and immediate replacement is imperative, prepare replacements using thimbles (Item 9), bushings (Item 10) and turnbuckles (Item 11) in place of original terminals, see Figure 2. When this is done, cables having a diameter of 3/32" or over may be woven spliced by means of the five-tuck method, and cables less than 3/32" in diameter may be wrap soldered or sweat soldered.

CUTTING CABLES

4 Cut cables by any method, except a torch, depending upon the tools and machines available. If a cable tends to unravel or fray when cut, sweat solder (Item 1) or wrap a strip of masking tape (Item 2), cellulose

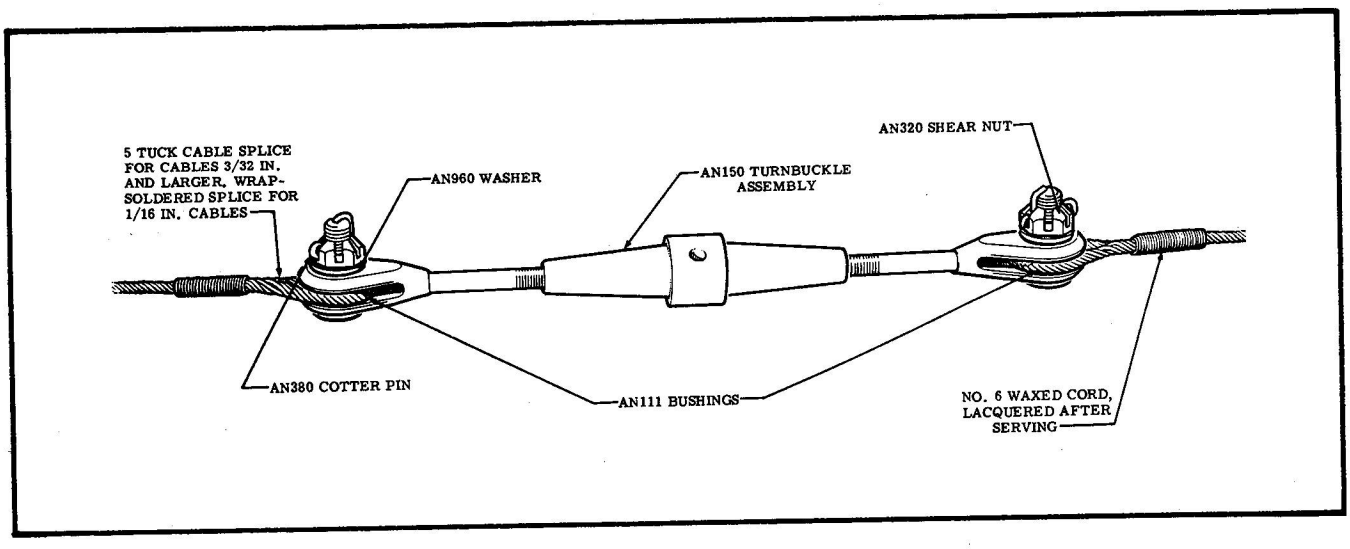


Figure 2 Turnbuckle and Splice

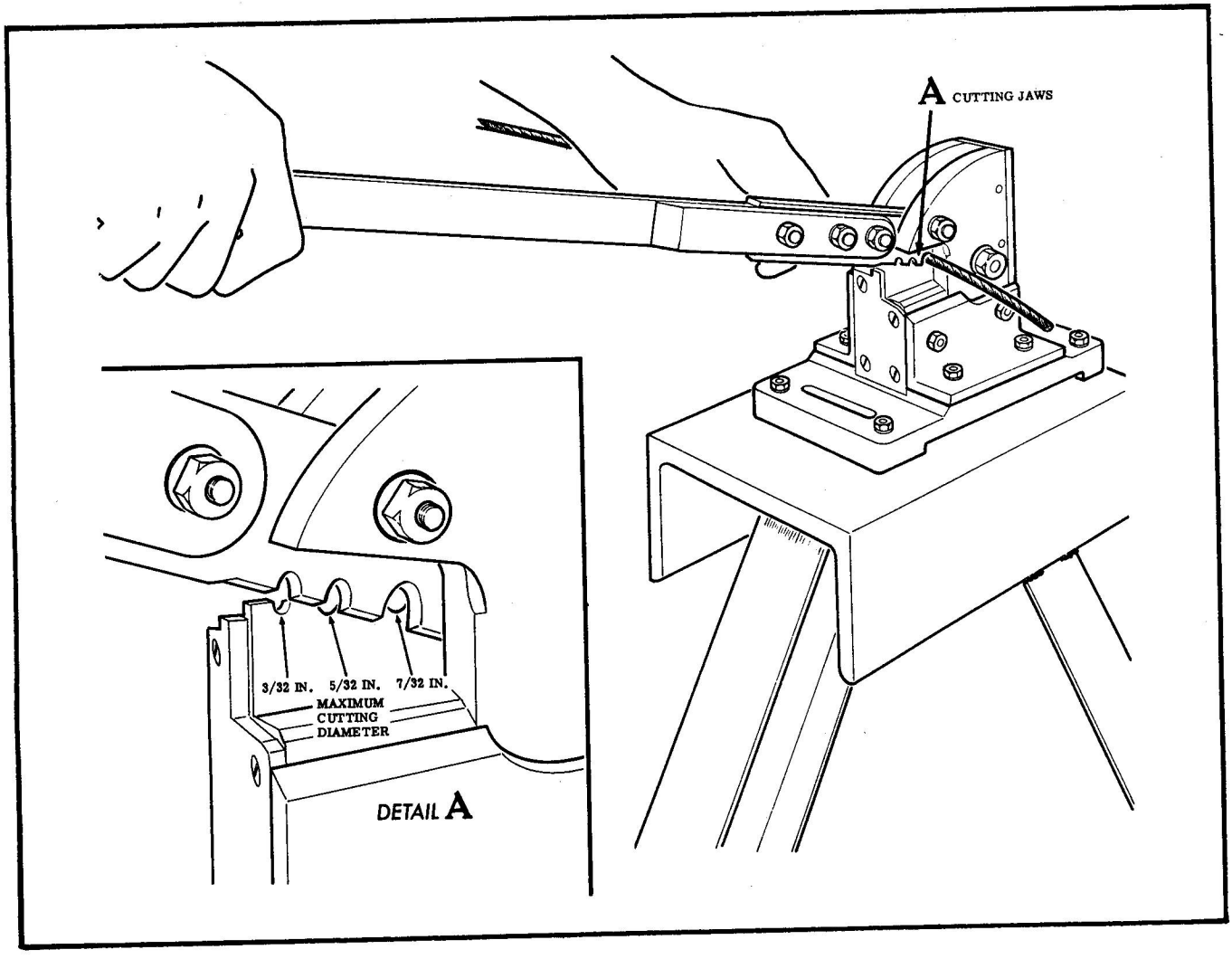
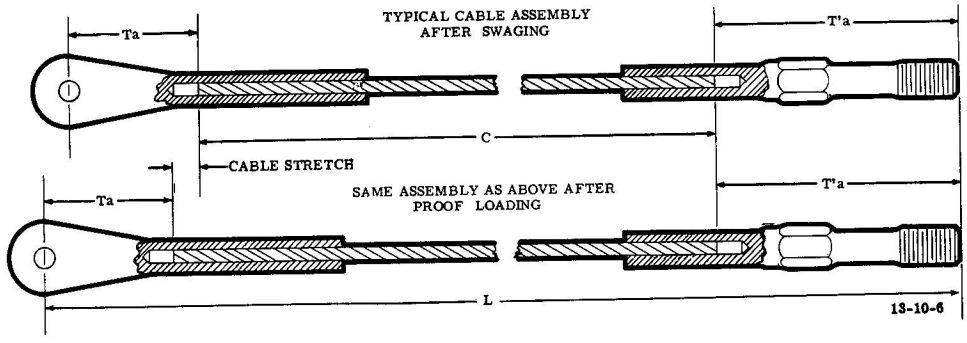


Figure 3 Cable Cutting Machine

(Item 3), or friction tape (Item 4) over the cut so that half the soldered or taped width will remain on each end after cutting. Cut small diameter cables with a pair of heavy-duty diagonal cutters, side cutters, or with a pair of wire nippers. Best results are obtained if the cutting jaws are held perpendicular to the cable during the cutting operation. Cables up to 3/32" diameter may be cut in one operation by this method while larger cables will require two or more cuts. When cutting large diameter cables in this manner, use the end of the cutting blade and cut a few strands at a time. A cold chisel, used in conjunction with a soft metal block, may be used for cutting cables. Hold the chisel straight up and place the cutting blade at right angles to the cable. Use a heavy hammer and strike the chisel with a hard sharp blow to effect a clean, square cut. The most satisfactory method of cutting cables is with a cable-cutting machine having special jaws to accommodate cables of various diameters, see Figure 3. Position the cable in the proper diameter groove and hold the cable firmly within 2" of the cutting blades. Hold the cable at right angles to the cutting blades and pull the operating handle down sharply. Large cables (3/16 and 7/32") should be cut with an abrasive cut-off wheel, if available.

PREPARATION OF CABLE AND TERMINAL

5 Cut the cable (Item 7) to length according to formula, see Figure 4. Cable stretch must be found by trial, when proof loaded in accordance with paragraphs 27, 28 and 29 following. Terminal allowance (Ta) is the difference between the length of the terminal after swaging and the amount of cable inserted into the terminal. For recommended terminal allowances, see Figure 5. Insert the cable into the terminal until it bottoms, see Figure 6.



C - Length cable is cut (swaging does not change this length).

L - Length of cable assembly after swaging and proof loading. (Finished length required.)

Ta, T'a - Terminal allowances.

C - L - (Ta + T'a) - Cable Stretch.

C - L - (Terminal allowances) - Cable stretch.

Figure 4 Determination Of Terminal Allowance

NOTE

If the cable does not enter the hole to the point marked, examine the fitting to ensure that no foreign matter is present. If cleaning of the fitting fails to admit the cable to the full extent, reject the fitting. In terminals which are bored through, insert the cable so that the end is even with the end of the hole before swaging.

6 Mark the cut cable at a distance from the end equal to the proper depth of insertion, using red paint (Item 17) or red grease pencil (Item 18), to ensure that the terminal bore is filled and that no slippage takes place during swaging and proof loading, see Figure 7. Open-end type terminals (Item 8) do not require this marking.

7 Insert the cable approximately 1" into the terminal and then bend toward the terminal so that a bend or kink results at the point of insertion. This bend provides sufficient friction to hold the terminal in place until the swaging operation can be performed, and also tends to separate the strands of the cable inside the barrel, thereby reducing the strain on them. After kinking, push the cable the remaining distance into the barrel.

FABRICATION OF SWAGED ASSEMBLIES

GENERAL

8 For replacement use swaged terminals (Item 8) wherever practicable. After preparing the necessary cable length with allowance made for the fitting elongation under swaging and proof loading, coat the end of the cable with lubricating oil (Item 5).

NOTE

Swaging may be performed on preformed cable only.

SWAGING TERMINALS

9 To swage the terminal onto the cable end, proceed as follows:

(a) Ascertain that all strands are clipped so the entire cable end will go inside the terminal barrel, see Figure 8.

Cable Size	1/16	3/32	1/8	5/32	3/16	7/32	1/4
AN669 (short)	1.7	1.8	1.9	2.0	2.1		
AN668	.65	.9	1.0	1.2	1.3	1.4	1.5
AN667	.5	.7	.9	.9	1.0	1.1	1.1
AN669 (long)	2.6	2.6	2.8	2.9	2.9	3.0	3.1
AN666	1.5	1.7	1.9	2.0	2.2	2.5	2.6

Figure 5 Table Of Terminal Allowances

(b) Insert cable into the terminal as instructed in paragraph 7, preceding.

(c) Ascertain that the proper size swaging dies are in the swaging machine, see Figure 9.

(d) With a micrometer, check the terminal barrel diameter after swaging, see Figure 10. If, after swaging, the terminal has more than the allowable 1/2° bend, secure in a vise and straighten with as few applications of pressure as possible.

10 If swaged terminals are to be used on both ends of the cable, perform the following operations prior to the second swaging:

(a) Measure the over-all cable length and trim the cable as required.

(b) Ensure that all additional fittings are slipped onto the cable in proper sequence.

(c) Slip the end of the cable through the swaging dies and swage the terminal.

2

TRU-LOC CABLE TERMINAL SWAGING MACHINE

GENERAL

11 This hand-operated machine applies pressure by a combined lever and cam acting through a pair of suitably shaped dies, the action being repeated at close intervals along the length of the cable terminal.

Dash No. of Terminal	Cable Diameter	Depth of Hole in Terminal
2	1/16	1-3/64
3	3/64	1-17/64
4	1/8	1-33/64
5	5/32	1-49/64
6	3/16	2-1/64
7	7/32	2-17/64
8	1/4	2-33/64
9	9/32	2-49/64
10	5/16	3-1/64
12	3/8	3-33/64

Figure 6 Table of Terminal Hole Depth

LAYOUT OF MACHINE

12 A sectional view of the swaging machine is shown in Figure 11. The steel frame has a recess, guarded by side plates, in its upper surface in which a cam is rocked by its operating lever. The forward end of the cam is cylindrically shaped to engage a concave recess in the rear die against which it exerts a horizontal, forward thrust when the operating lever is pressed. The reaction to this thrust is taken by a roller which is held against the rear face of the cam by a flat spring, a roller backing-block, and a rotatable adjusting lever. The front die, held in position by a die backing cap-screw and prevented from rotating by a set-screw, meets the swaging face of the rear die in a recess in the frame through which the work can be introduced. A spring-loaded die return plunger, in an inclined cylindrical bore at the forward end of the frame, presses against the rear die and ensures that it returns with the cam after the working stroke is completed.

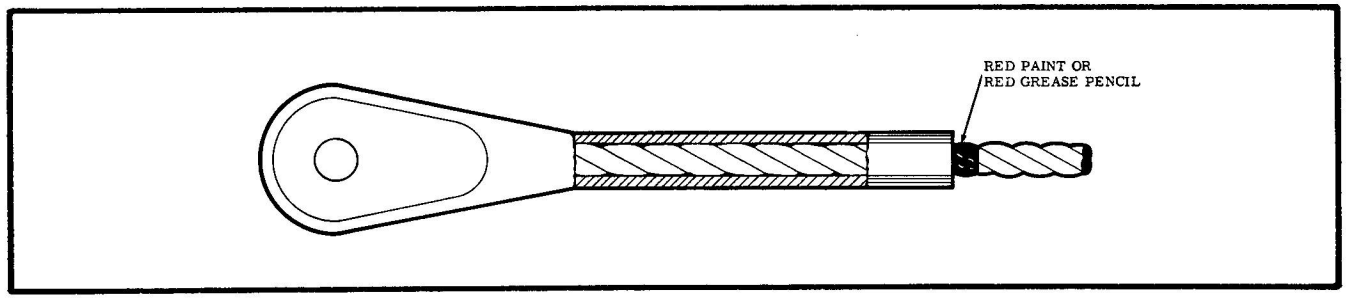


Figure 7 Preparation of Cable Before Swaging

INTERCHANGEABLE DIES

13 A set of front and rear dies to suit cables of various diameters is provided with each swaging machine, see Figure 12.

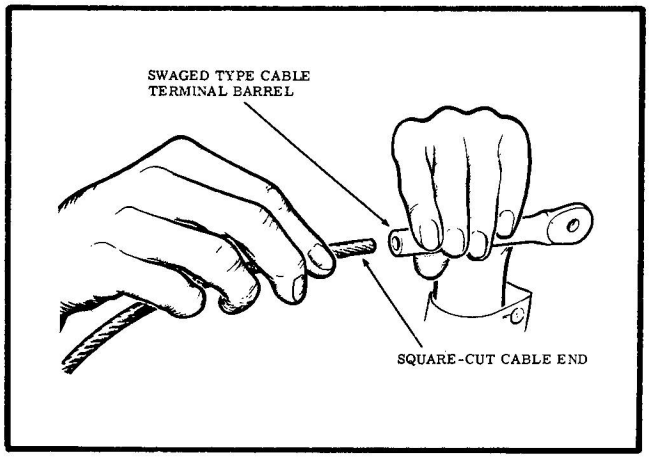


Figure 8 Inserting Cable in Terminal

GAUGES

14 To guard against excessive squeezing of the cable and terminal, a pair of plate gauges is supplied for each size of die. These gauges are marked GO and NOT GO and must be used during the operation of the machine.

SETTING UP

15 Place the swaging machine so as to enable the operator to apply the weight of his body on the lever to full advantage. The operating lever should be parallel with the edge of the bench, the frame with the dies being at the operator's left hand. This will bring the dies into the correct position for introducing and feeding the terminal to be swaged. The

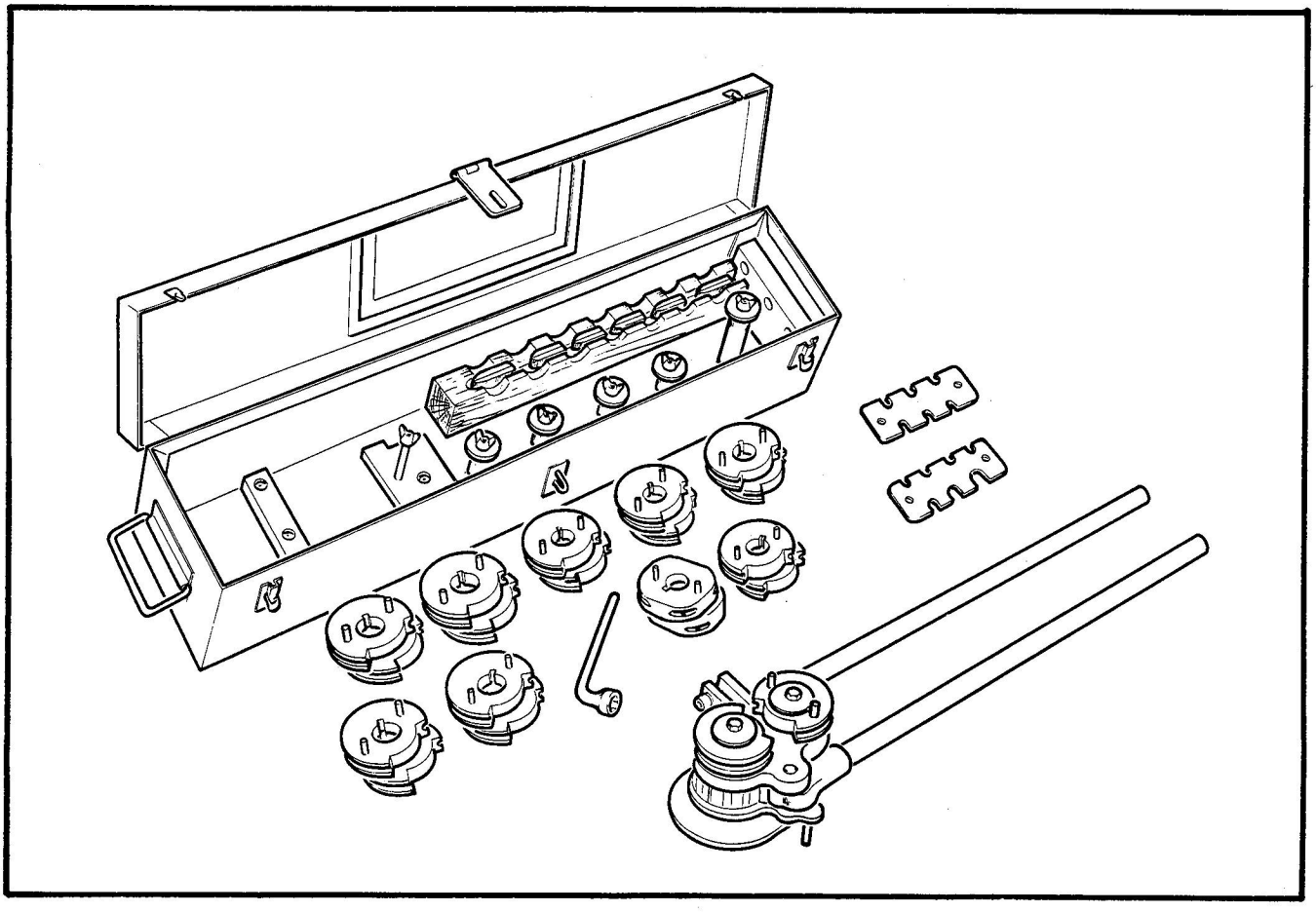


Figure 9 Hand Swaging Machine with Dies

speed of operation can be increased if two operators are engaged, one to feed and rotate the terminal between the dies, the other to operate the handle.

16 The amount of squeeze transmitted to the dies is important. Clockwise rotation of the adjusting lever forces the roller against the cam, lifting the operating lever and causing the dies to be brought together earlier in the downward or operating stroke. Conterclockwise rotation of the adjusting lever allows the cam to settle lower and the dies to meet later in the operating stroke. The correct adjustment is obtained when, with the dies together, a gap of 5-1/2" exists between the ends of the operating lever and the adjusting lever, see Figure 11.

CABLE LENGTH

17 During the swaging operation an elongation of the cable terminal occurs. This should be taken into account when cutting the cable for existing conditions. Refer to paragraph 5, preceding, for determination of terminal allowance.

INSERTING DIES

18 Use the following sequence of operations when inserting dies in machine:

Dash No. of Terminal	Diameter Cable	Barrel Diameter after Swaging
2	1/16	.138 +.000 -.005
3	3/32	.190 +.000 -.005
4	1/8	.219 +.000 -.005
5	5/32	.250 +.000 -.005
6	3/16	.313 +.000 -.005
7	7/32	.375 +.000 -.007
8	1/4	.438 +.000 -.007
9	9/32	.500 +.000 -.008
10	5/16	.563 +.000 -.008

Figure 10
Table of Swaged Terminal Diameters

(a) Remove die-backing capscrew and bracket from front end of machine frame, see Figure 11.

(b) Apply heavy coating of extreme pressure grease (Item 6) to the outer surface and cam-end of rear die.

(c) Insert the rear (long) die into the hole vacated by the die backing capscrew, making sure that the flat is on the underside.

(d) Insert the front (short) die with the setscrew, the flat face being uppermost and the plunger groove downwards.

(e) Align the setscrew and the flat on the front die. Tighten setscrew.

(f) Ensure that the die-return plunger and spring are in the inclined hole under the front die, then replace the bracket on the front end of the swaging machine.

(g) Screw in and tighten the die-backing capscrew in front of the machine.

(h) Rotate the adjusting lever until the operating and the adjusting levers are 5-1/2" apart at their extreme ends, see Figure 11.

EXAMINATION OF PARTS BEFORE SWAGING

19 Examine the cable and end-fitting before swaging as follows:

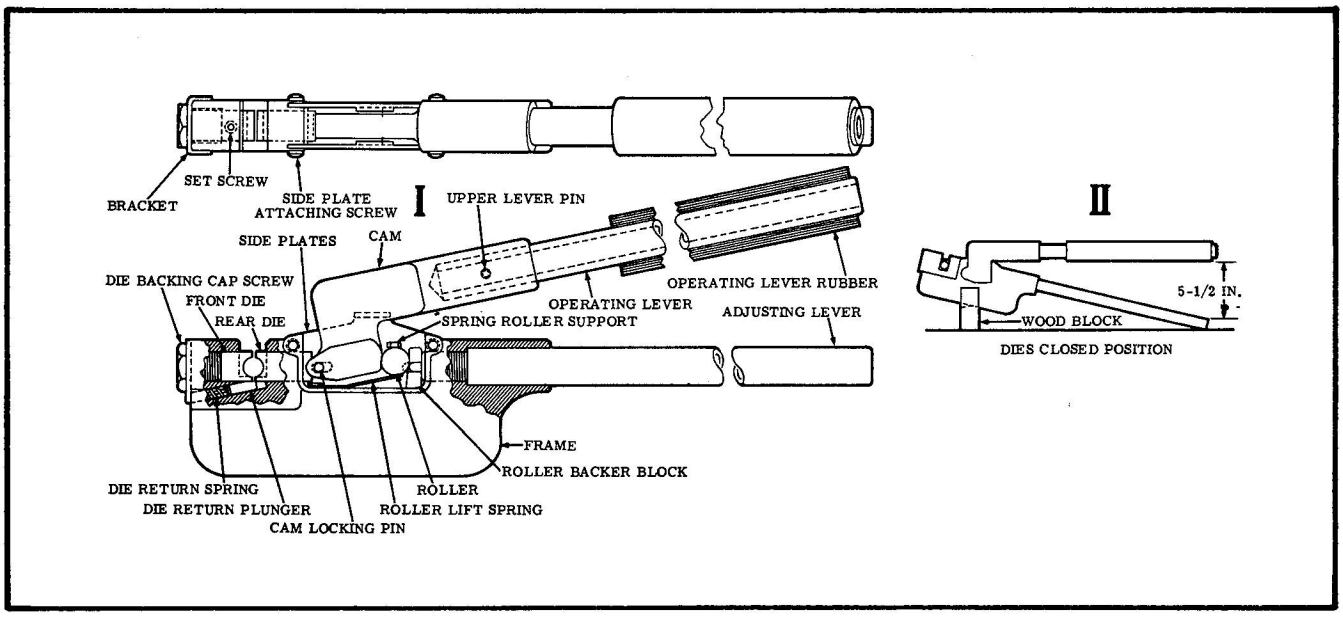


Figure 11 Tru-Loc Cable Terminal Swaging Machine

(a) Check if any preliminary stretching of flexible cable has been effected.

(b) Measure the external diameter of the terminal shank, its length, the depth of hole and ensure that each connection is correctly mated to its particular cable.

(c) Check that the ends of the cable have been squarely cut and that the correct allowance has been made for stretching of the terminal during swaging, refer to paragraph 5, preceding.

SWAGING

20 With the swaging machine set up and the dies in position, proceed as follows:

(a) Insert the cable into the terminal.

(b) Apply a few drops of oil (Item 5) to the cable and to the terminal to be swaged.

(c) Open the dies by raising the operating lever.

Dia. of cable	Die number
1/16	24-M/25-M
3/32	26-M/27-M
1/8	28-M/29-M
5/32	30-M/31-M
3/16	32-M/33-M

Figure 12 Table of Tru-Loc Dies

(d) Place the terminal and cable in the front die recess so that the end of the terminal is centered in the die, see Figure 13.

NOTE

Always insert the terminal into the bell-mouthed side of the dies.

(e) Squeeze the terminal by pushing down the operating lever until the dies are completely closed.

(f) Open the dies by raising the operating

lever sufficiently to rotate the terminal one-quarter of a revolution and feed it 1/16" into the dies, see Figure 13.

NOTE

Where possible, rotate the terminal the opposite way to the lay of the cable. Otherwise, rotate the terminal one-quarter of a revolution, in alternate directions, to each 1/16" feed. Do not overfeed the terminal into the dies; to do so would call for a pressure in excess of the power range of the cam and lever.

(g) Repeat sub-paragraphs (e) and (f) until the correct length of shank has been swaged. Terminals marked Class A and D, see Figure 13, are swaged as far as the shoulder. The swaging lengths for Class B and C terminals are tabulated in Figure 14.

(h) To finish the swaged tapered portion of the terminal, rotate and swage several times without feeding movement.

(j) When the swaging operation is completed, gauge the diameter of the cable terminal with the GO and NOT GO gauges supplied.

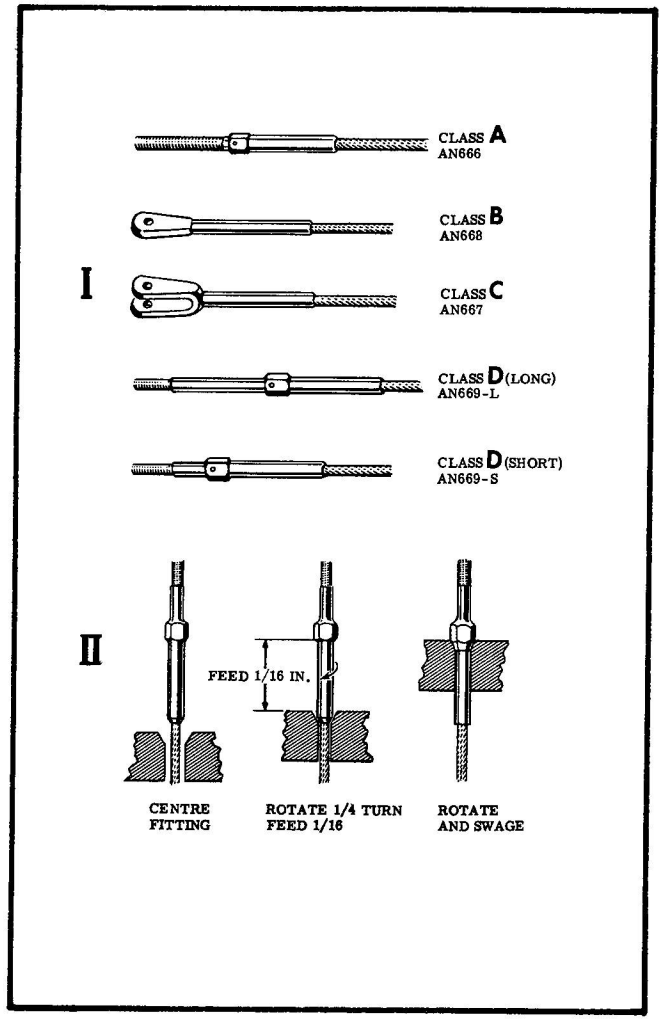


Figure 13 Terminal for Swaging

EXAMINATION OF PARTS AFTER SWAGING

21 Examine the cable and terminal after swaging, as follows:

(a) If the shank of the fitting fails to enter the GO gauge, the amount of swaging is insufficient and further application of the swaging machine should be made.

(b) If the NOT GO gauge slips easily over the shank, it indicates excessive swaging and consequent crushing or fracturing of the cable. In severe cases of excessive swaging, reject both the cable and terminal.

(c) Measure the increase in length of the terminal. This dimension will give an additional indication of the amount of swaging that has been applied. An insufficient increase in length suggests incomplete swaging; undue increase in length suggests excessive swaging.

(d) Ensure that the length of the cable in engagement with the shank is as originally intended. For blind-hole terminals, use the locating mark on the cable for this purpose.

(e) Notice that the lay of the cable is correct, and that the angle of the lay has not slipped during the swaging operation.

(f) Measure the overall length of the cable assembly when tensioned by a load of 20

pounds. This must be to the length required in the installation.

(g) Where possible, subject the complete cable and terminal to a proof loading test of the strength of the cable. Refer to Paragraphs 27, 28 and 29 following.

REMOVAL OF DIES

22 In order to remove the dies, turn the adjusting lever in a counterclockwise direction until the operating lever and the adjusting lever come together, then remove the die-backing nut and bracket from the front of the machine. Loosen the setscrew above the front die and push both dies out of the machine with the die push-out rod provided.

SERVICING

23 The dies are the parts principally subjected to wear. Make periodic examination for scoring, pitting or corrosion of the working surface. Use the plate gauges to show up any appreciable change that may take place in the profile of the dies.

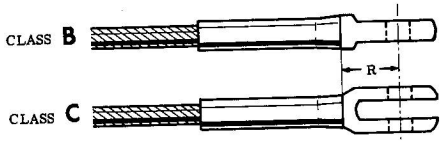
LUBRICATION

24 It is important to keep the working surfaces of the rear die heavily coated with grease (Item 6). Grease the rear surface of the cam which contacts the roller periodically and ensure that all working parts are kept clean and free in operation.

POWER SWAGING MACHINE, ROTARY DIE REDUCING METHOD

GENERAL

25 Procure dies from authorized manufacturers. When this is not possible, machine and heat treat to manufacturer's design drawings.



Cable dia.	Dimension R	
	Class B	Class C
1/16	21/32	5/8
3/32	7/8	3/4
1/8	29/32	29/32
5/32	1	31/32
3/16	1 3/32	1 1/8

Figure 14 Swaging Lengths

OPERATING INSTRUCTIONS

26 When operating the power swaging machine, observe the following points:

(a) Shim, when required, sufficiently to force the dies of the swaging machine firmly together and to produce swaged fittings of the required diameter. Avoid heavy shimming.

(b) Check the swaging machine spindle to make certain that it rotates in the same direction as the lay or twist of the cable to be attached to the fitting so that it will not tend to unlay the cable.

(c) Do the swaging operation as quickly as practical to avoid cracking of the terminal.

(d) Lubricate the outside of the terminals with machine oil (Item 19) or light grease (Item 20) before and during swaging, to lessen friction with the dies.

Type of Cable	Nominal Diameter of Cable	Strands by Wires per Strand	Minimum Breaking Load (Lbs)	Proof Load (Lbs) (Approx. 60% of Min. Breaking Load)
Carbon Steel Cable to Specification MIL-C-1511	1/16	7 x 7	480	288
	3/32	7 x 7	920	552
	1/8	7 x 19	2000	1200
	5/32	7 x 19	2800	1680
	3/16	7 x 19	4200	2520
	7/32	7 x 19	5600	3360
	1/4	7 x 19	7000	4200
	9/32	7 x 19	8000	4800
	5/16	7 x 19	9800	5880
	11/32	7 x 19	12500	7500
	3/8	7 x 19	14400	8640
Corrosion Resistant Steel Cable to Specification MIL-C-5424	1/16	7 x 7	480	288
	3/32	7 x 7	920	552
	1/8	7 x 19	1,760	1,056
	5/32	7 x 19	2,400	1,440
	3/16	7 x 19	3,700	2,220
	7/32	7 x 19	5,000	3,000
	1/4	7 x 19	6,400	3,840
	9/32	7 x 19	7,800	4,680
	5/16	7 x 19	9,000	5,400
	3/8	7 x 19	12,000	7,200

Figure 15 (Issue 1) Table of Proof Loads for Swaged Cable Assemblies

Revised 27 Sep 82

(e) With cable in place hold terminals manually to resist rapid rotation. Terminals may be allowed to rotate slowly.

(f) After feeding the correct length of terminal into the swaging dies, ensure that terminal is concentric before withdrawing, a few extra blows being all that is necessary. Feed terminals into the swaging dies positively and uniformly.

(g) Dimensions after swaging must conform to the standard drawings or special drawings for non-standard terminals.

(h) When installing ball type terminals at the end of a cable, 1" of cable must protrude for trimming after swaging.

PROOF LOADING

GENERAL

27 Proof load all swaged assemblies, as specified in the applicable drawing or in Figure 15, for a period of not less than one minute. Apply load gradually and continually until the full value is attained. Release load evenly and gradually. Reject any assembies showing any evidence of slipping or failure.

BALL OR BALL WITH SHANK ASSEMBLIES

28 Proof load assemblies, having a ball or ball with shank terminal swaged between the end terminals, between the ball and one end in addition to the end-to-end test.

BALL-BEARING SWAGED FITTINGS

29 Proof load by means of a jig which allows a straight pull on the outer face of the casing. A typical jig is shown in Figure 16.

IDENTIFICATION OF CABLE

30 Colour code each control cable in accordance with the applicable practice for the aircraft. Mark the cable assemblies by applying the specified code marking to each cable terminal and turnbuckle. Where it is impractical to apply the marking tape (Item 21) to the cable terminal, apply the tape to the cable approximately 1/4" from the terminal.

TENSIONING OF AIRCRAFT CONTROL CABLE

31 For information regarding tensioning of cables, refer to EO 05-1-2AK.

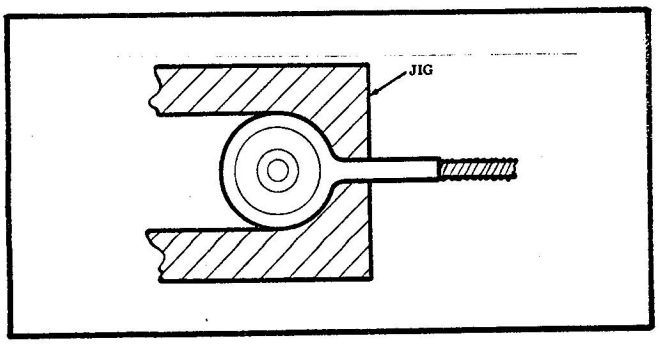


Figure 16 Proof Loading Jig

RUST PREVENTION

32 Remove dirt, oil or grease from the terminal by wiping with a clean cloth moistened with Trichloroethylene (Item 22). If the cables are made from tinned steel, use a rust-preventive compound to coat the cable. Use exterior surface corrosion preventive (Item 23). Dip the cable into a tank of the compound at 77° (± 5°)C (170° (± 10°)F) for 30 seconds. Wipe off all excess oil. Corrosion-resistant steel cables do not require this treatment.

CLEANING

33 To remove Parkeltone from coated cables, use a clean cloth lightly moistened with cleaner (Item 24).

NOTE

Under no circumstances are cables to be immersed in solvent for cleaning. Such a procedure removes the internal lubrication and reduces the endurance capability of the cable.

TOLERANCES

34 Cable to pulley alignment, see Figure 17, is subject to the following tolerances:

(a) The maximum fixed misalignment tolerance between a cable and the pulley or pulleys through which it runs is 2° each side of the centre.

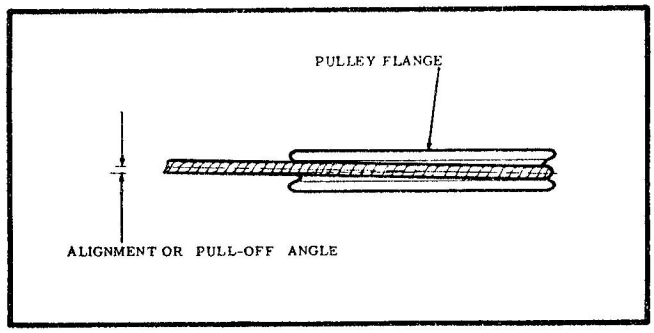


Figure 17 Alignment Angle Measurement

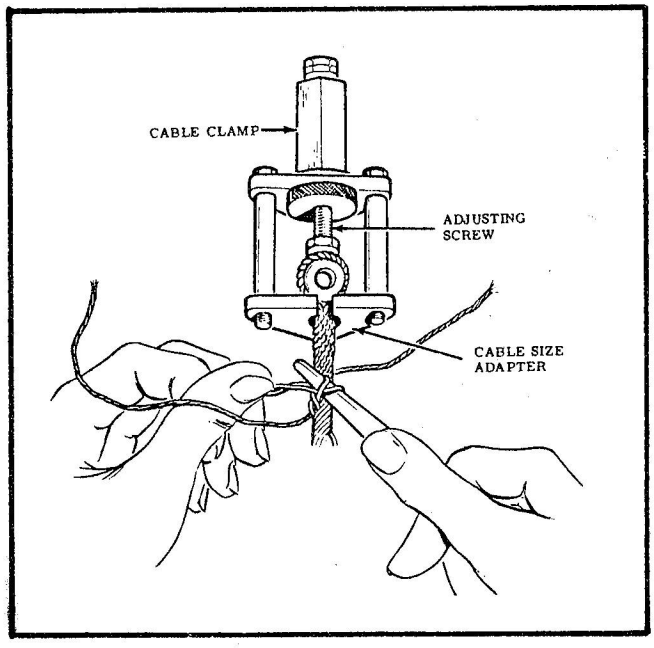


Figure 18 Cable Clamp for Woven Splice

(b) Where a control cable has an angular motion with respect to the plane of the pulley, the maximum variable misalignment resulting from this motion must not exceed 2° each side of centre for neutral position of controls and 3° each side of centre for any position of the control between one-half and full movement.

(c) All main control cables and all other cables rigged in excess of 125 pounds must not rub against the pulley flange. If the cable has paper clearance (approximately .002") at the point of tangency of the outer radius of the flange, and the inner surface of the groove, it may be considered as not rubbing on the flange.

SPLICING

WOVEN SPLICE

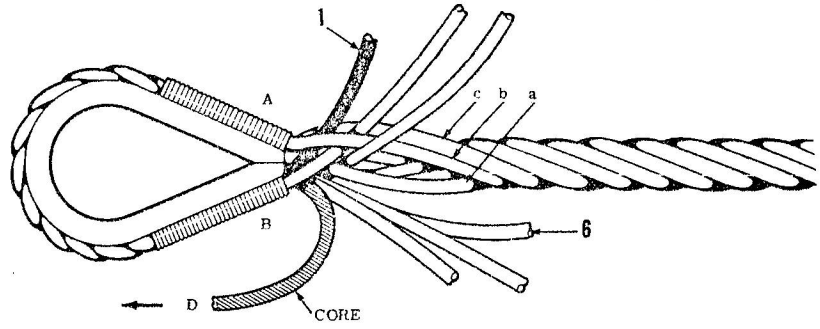
35 In place of swaged terminals use the five-tuck woven spliced terminals on cables of 3/32" diameter or greater where facilities are limited and immediate replacement is imperative. In some cases it will be necessary to splice one end of the cable on assembly. For this reason, investigate the original installation for pulleys and fairleads that might restrict the passage of the splice. The procedure for the fabrication of a woven splice is shown in Figures 18 and 19.

ALTERNATE METHOD - US NAVY SPLICE

36 Perform the US Navy splice as follows, see Figure 20:

(a) Secure the cable around a bushing or thimble by means of a cable clamp, see Figure 18, leaving 8" or more of free end. Secure the cable clamp in a vise with the free end to the left of the standing wire and away from the operator. If a thimble is used as the end fitting, turn the points outward approximately 45°.

NOTE: STRANDS NUMBERED COUNTERCLOCKWISE VIEWED FROM END OF CABLE.



SERVE CABLE AT A AND B WITH WAXED THREAD

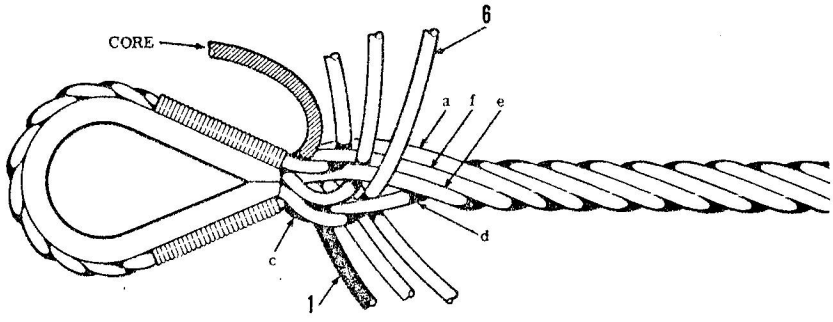
BEND CABLE AROUND THIMBLE WITH CORE TURNED BACK IN DIRECTION OF ARROW D.

THREAD NO. 3 STRAND UNDER a.

THREAD NO. 1 STRAND UNDER b and c.

THREAD NO. 2 STRAND UNDER b.

1st HALF OF NO.1 TUCK



THREAD NO. 4 STRAND UNDER f.

THREAD NO. 5 STRAND UNDER e.

THREAD NO. 6 STRAND UNDER d.

ONE TUCK IS COMPLETED WHEN EACH STRAND HAS BEEN THREADED ONCE.

2nd HALF OF NO.1 TUCK

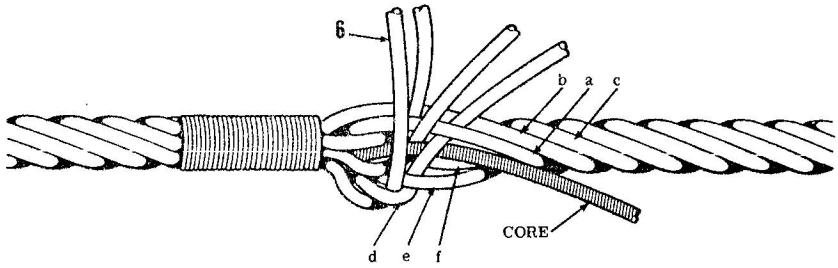
IN THE 2ND, 3RD, 4TH AND THE HALF TUCKS, LAY THE CORE ALONG THE CABLE AND TAKE IT UNDER A SUITABLE STRAND (IN ILLUSTRATION, NO. 6 STRAND), THUS FORCING THE CORE INTO THE CENTRE OF SPLICE.

IN THE 2ND, 3RD AND 4TH TUCKS, TAKE STRANDS 1, 2, 3, 4, 5 AND 6 OVER AND UNDER ONE STRAND (a, b, c, d, e, f)

e.g. IN 2ND TUCK, TAKE NO. 3 STRAND OVER b AND UNDER c.

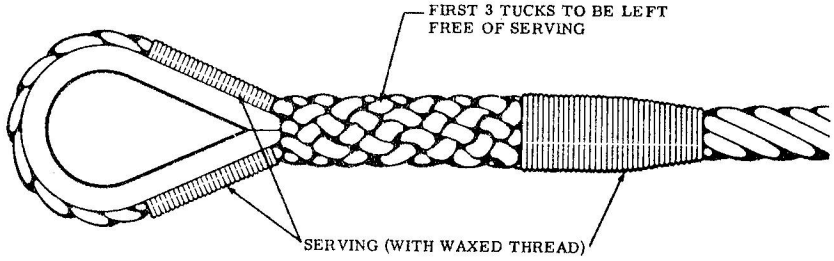
IN 3RD TUCK, TAKE NO. 3 STRAND OVER d AND UNDER c.

IN 4TH TUCK, TAKE NO. 3 STRAND OVER 1 AND UNDER a.



COMMENCEMENT OF 2nd TUCK SHOWING CORE TUCKED IN

MAKE HALF A TUCK BY THREADING ALTERNATE STRANDS ONCE.



A COMPLETE SPLICE CONSISTS OF 4-1/2 TUCKS.

AT COMPLETION OF SPLICE, CUT OFF AND SERVE LOOSE ENDS.

COMPLETED SPLICE

Figure 19 Woven Splice - Preferred Method

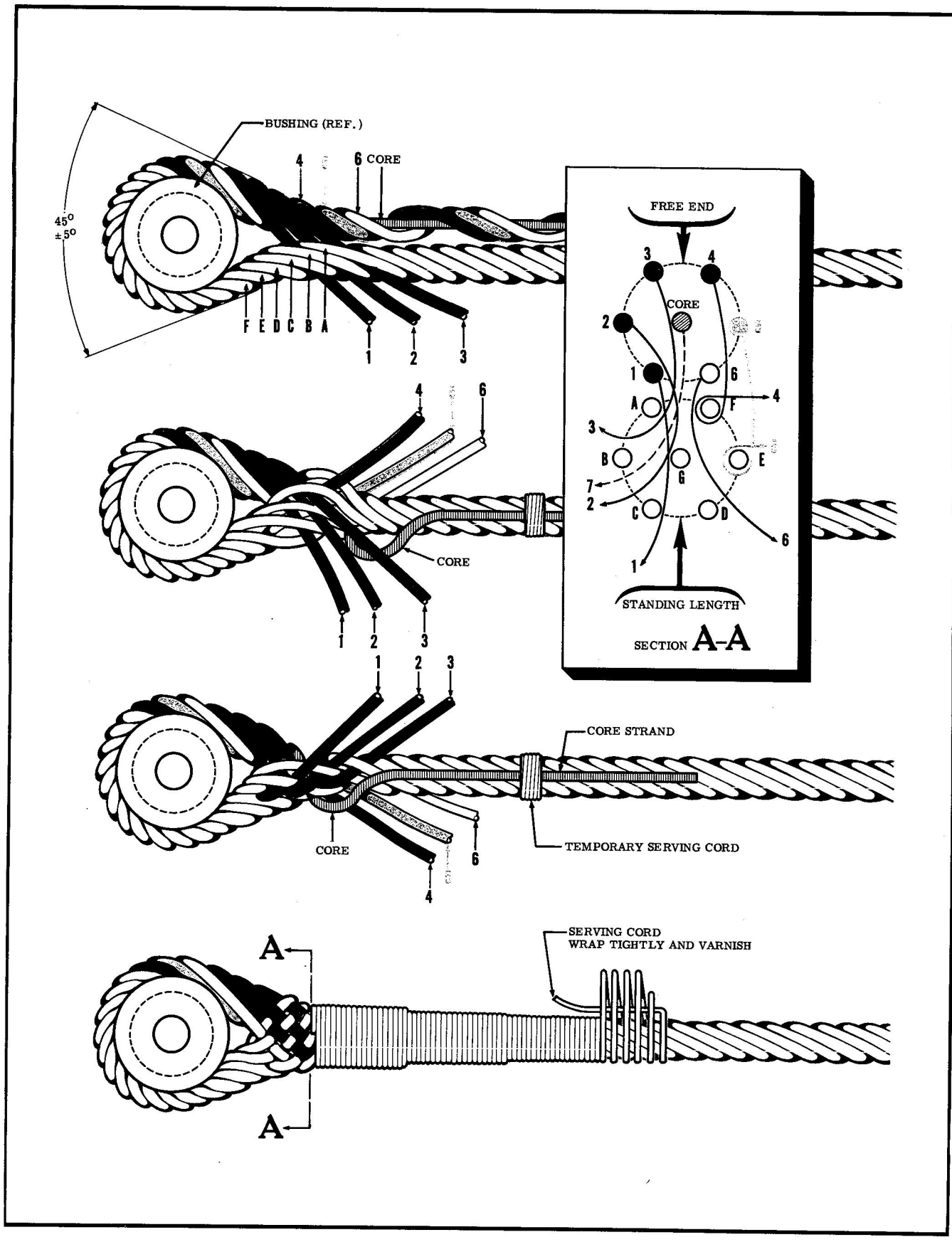


Figure 20 Woven Splice - Alternate Method

(b) Select the free strand (1) nearest the standing length at the end of the fitting and free this strand from the rest of the free ends. Insert a marlinspike under the first three strands (A, B and C) of the standing length nearest the separated strand of the free end and separate them temporarily by twisting the marlinspike. Insert the free strand (1) under the three separated strands through the opening created by the marlinspike. Pull the free end taut by means of pliers.

(c) Unlay a second strand (2) located to the left of the first strand tucked, and insert this second strand under the first two standing strands (A and B). Loosen the third free length strand (3), located to the left of the first two, and insert it under the first standing strand (A) of the original three, see Detail A.

(d) Remove the centre or core strand (7) from the free end and insert it under the same standing strands (A and B). Temporarily secure the core strand to the body of the standing cable, see Detail B. Loosen the last free strand (6) located just to the right of the first (1) and tuck it under the last two strands (E and F) of the standing cable. Tuck the fifth free end (5) around the fifth standing strand (E). Tuck the fourth free end (4) around the sixth standing strand (F). See Details B and E. Pull all strands snug toward the end fitting with the pliers. This completes the first tuck.

(e) Begin with the first free strand (1) and work in a counterclockwise direction, tucking free strands under every other standing strand. After the completion of every tuck, pull the strands tight with pliers. Pull toward the end fitting, see Detail C. After the completion of the third complete tuck, cut off half the number of wires in each free strand. Make another complete tuck with the wires remaining. At the completion of the fourth tuck, again halve the number of wires in the free strands and make one final tuck with the wires remaining. Cut off all protruding strands and pound the splice with a wooden or rawhide mallet to relieve the strains in the wires. Serve the splice with waxed linen cord, see Detail D. Start 1/4" from the end of the splice and carry the wrapping over the loose end of the cord and along the tapered splice to a point between the second and third tucks. Insert the end of the cord back through the last five wrappings and pull snug. Cut off the end, and if a thimble is used as an end fitting, bend down the points. Apply two coats of shellac (Item 26) to the cord, allowing two hours between coats. Carefully inspect cable strands and splices for local failure. Weakness in a woven splice is made evident by separation of the strands of serving cord.

SPLICING INSTRUCTIONS

37 The following instructions must be followed during splicing:

(a) When cables are cut, precautions must be taken to prevent unlaying by firmly soldering the cable for a length of 2 or 3". Cold cut in the centre of the soldered portion, or use an approved electric cutter or arc. Blow torches or oxy-acetylene torches must not be used.

(b) The cable should be snugly fitted and secured to the thimble by either a serving of waxed cord or an approved type of splicing clamp, see Figure 18. When a reel type of thimble is used, extend the serving beyond the reel into the apex of the splice.

(c) The splice should be hammered taut after each tuck. A hardwood or rawhide mallet and a hardwood anvil are to be used and the splice rotated while being hammered so that all strands are equally tautened. Do not hammer to such an extent that strands and/or individual wires are damaged or broken.

(d) The correct number of tucks must be used and the splice finished off by serving with waxed cord (Item 13). The serving must finally receive two coats of orange shellac. (Item 26).

INSPECTION OF SPLICING

38 When inspecting the final splice, check the following:

(a) That the splice is symmetrical, of good appearance and that the strands and wires lie close together. No light should show between the strands when the splice is held before a light.

(b) That the splice is stiff and, when bent, the strands and wires remain close together. A poor splice is quite flexible and, when bent, the strands and wires become slack, although before bending it may appear acceptable.

(c) That the thimble is tight in the loop and of proper size.

(d) That the lay of the cable is maintained as far as possible.

(e) That the serving is applied satisfactorily. It should be even and tight with ends properly secured. Check that two coats of shellac or approved substitute have been applied as protection against moisture.

(f) That each cable has been given a proof load of 60% of its specified strength. See Figure 15.

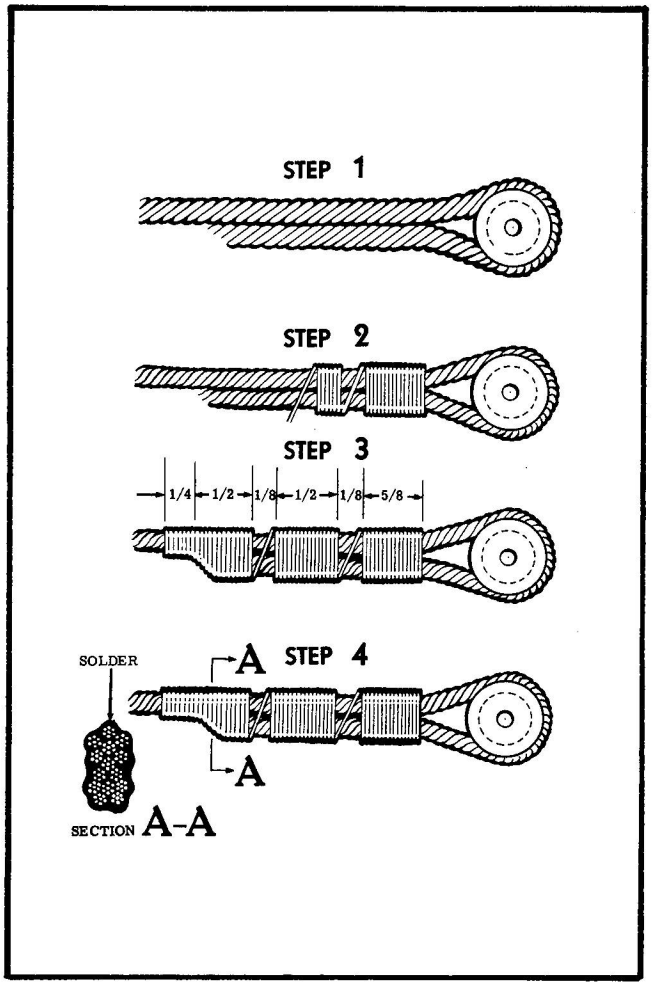


Figure 21 Wrapped Soldered Splice

WRAP-SOLDERING TERMINALS

39 On cables of 1/16" diameter only, employ the wrap-soldered splice to fabricate end fittings. To replace an eye-type fitting, use a cable bushing (Item 16). To replace a clevis-type fitting, use a cable thimble (Item 9) and a cable shackle (Item 29). Proceed as follows:

(a) Arrange the cable and the fittings, allowing approximately 2-1/4" of free end. Before wrapping the cable around a thimble, place the cable shackle in position, as this cannot be done after the splice is completed.

(b) Clamp the assembly in a cable clamp or similar holding device, and secure in a vise.

(c) Starting as close as practicable to the end fitting, press the free end and standing length of the cable together tightly and wrap with a single layer of monel wire, (Item 27), leaving a space of approximately 1/8" between every 1/2" of wrapping. Allow the wrapping to extend approximately 1/4" beyond the free end. See Figure 21.

NOTE

Be careful to prevent the standing length from twisting during this operation.

(d) Thoroughly apply flux (Item 28) to the entire splice. (Refer to EO 05-1-3/20).

(e) Remove the splice from the cable clamp and dip the wrapping in solder (Item 1). Carefully sweat the solder into the cable about the wrapping and apply the solder until the wrapping wire is barely discernible, making certain that the open spaces between the wrapped sections are thoroughly impregnated with molten solder. If a solder pot is not available, a soldering torch may be used. Be careful to thoroughly impregnate the entire splice with solder.

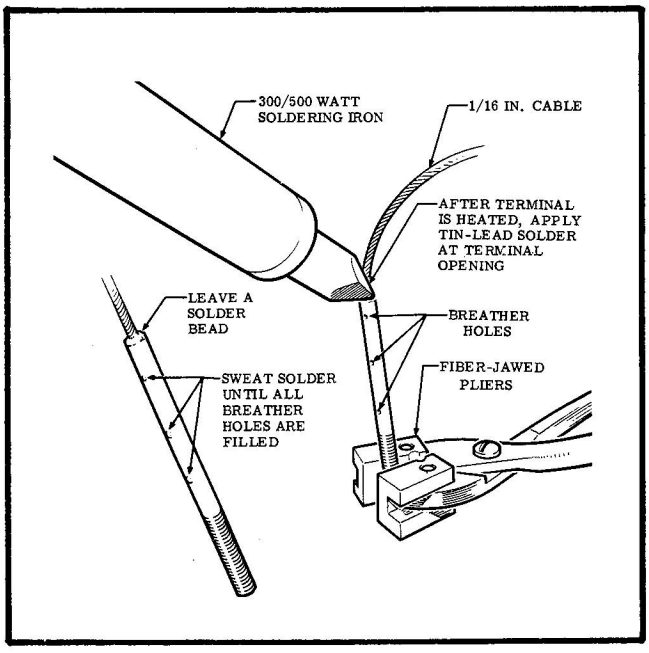


Figure 22 Sweat Soldering

(f) Allow the splice to cool. Do not quench.

(g) After the splice has cooled, thoroughly wipe clean and wash away all soldering flux from the splice and adjacent cable with hot water.

(h) Dry the splice and impregnate the spliced section with a corrosion preventative (Item 23).

(j) Carefully inspect the splice. A wrap-soldered splice which can be easily bent with the fingers is unsatisfactory because of poor solder penetration. Cracks in the solder, between the wrapping wire and the short space provided between wraps, are a positive indication of slippage in the wrap-soldered splice.

Item No.	Material	RCAF Reference	Specification	Manufacturer
1	Solder	30B/40, 404	SS-S-571B Comp SN50	
2	Tape, Masking	33G/ 99, 100, 101	UU-T-106A (US)	
3	Tape, Cellulose	33G/ 63, 64, 65, 66, 67	L-T-101	
4	Tape, PVC, 3/4 inch wide	33G/ 136, 137		Commercial grade.
5	Oil, Lubricating No. 10SAE	34A/35	3-GP-45	
6	Grease, Extreme pressure	34A/207	MIL-G-7118	
7	Cables, Preformed		AN-RR-C-43	

Figure 23 (Sheet 1 of 2) Table Of Material Specifications

Item No.	Material	RCAF Reference	Specification	Manufacturer
8	Terminals, Swaged	28/	C-28-71	
9	Thimbles	28/	MIL-T-5677	
10	Bushing AN3420	28/		
11	Turnbuckle AN150	28/	MIL-T-5685	
12	Shear Nut AN320	28/	MIL-N-6034	
13	Cord, Waxed, Linen, No. 6 Barbour	32B/	MIL-C-2520	
14	Washer AN960	28/		
15	Cotter Pin AN380	28/	FF-F-386	
16	Bushing AN111	28/		
17	Paint, Red	33A	1-GP-28	Commercial grade
18	Grease Pencil, Red			Commercial grade
19	Oil, Machine	34A/124	3-GP-335a	
20	Grease, Light	34A/192	3-GP-683a	
21	Tape, Identification, Cellulose	33G/83,82,81, 87,88,86,85,84	L-T-101	
22	Trichloroethylene	33C/163	MIL-T-7003	
23	Corrosion Preventative	40D/585	31-GP-1	
24	Cleaner	33C/182	3-GP-8	
25	Deleted			
26	Shellac	33A/93	1-GP-16a	
27	Wire, Monel	30B/	AMS 4730B	
28	Flux, Paste or Liquid Non-Corrosive	33C/68		Canada Metal Co., 721 Eastern Ave., Toronto.
29	Shackle	28/	ANS 23	

Figure 23 (Sheet 2 of 2) Table Of Material Specifications

SWEAT-SOLDERING TERMINALS

40 Sweat-soldered terminals are employed only on lightly loaded cables. Use this type of terminal for replacement of similar types only. Sweat-soldered terminals can be easily distinguished from swaged terminals by the air holes in the barrel of the terminal, which allow the molten solder to permeate the strands of the cable with no entrapped air bubbles. To attach sweat-soldered terminals to cables, proceed as follows: See Figure 22.

(a) Select the proper size and type terminal and place, barrel up, in a suitable clamping device. Use a clamping device with jaws of fibre or some other non-conductive material that will not dissipate heat readily.

(b) Apply heat to the terminal barrel with a soldering torch or a high-wattage soldering iron.

(c) After the terminal is thoroughly heated, insert a small amount of soldering flux (Item 28) into the barrel. (Refer to EO 05-1-3/20).

(d) Apply soldering flux to the end of the cable and insert into the barrel of the terminal. On clevis-type terminals, allow the cable to extend through the barrel a short distance, free the end strands of the cable and allow them to fray. Pull the cable back into the barrel until the end is flush with the clevis.

(e) Apply solder (Item 1) around the cable at the terminal opening and thoroughly sweat solder into the cable barrel until solder appears at the opposite end of the barrel and fills each breather hole. Avoid overheating the solder.

(f) Leave a solder bead around the cable at the terminal opening and allow the terminal to cool in air. Do not quench.

CAUTION

Do not use sweat-soldered terminals on control cables of corrosion resistant steel.

MATERIAL SPECIFICATIONS

41 For table showing item numbers, materials, specifications and manufacturers, see Figure 23.