

SEWED FORMS

COMMON SEWING REQUIREMENTS AND METHODS

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1.	<u>GENERAL</u>	1.13	Each figure in this section illustrates only conditions to which reference is made in the text of this section and is not to be considered as requirements for other conditions that may be involved or illustrated. For instance, the figure that illustrates stitching conditions should not be used for determining the type of form to be used.
1.1	<u>Scope of Section</u>		
1.11	This section covers the general requirements and methods of sewing local cable forms, switchboard cable forms, main forms, branch arms, superimposed wiring, and superimposed forms. The requirements covered in this section shall be followed, except as modified by applicable specifications and drawings.	1.2	<u>Precautions Against Personal Injury, Equipment Damage and Service Interruptions</u>
1.12	It is permissible to use either the manually applied nylon cable ties (R-4265) or the pneumatically applied nylon ties (using tools R-4411-L1 or L2) to sew (band) switchboard or local cable forms. However, refer to Section 205 for requirements, methods, and size of form restrictions prior to application of ties.	1.21	The specific precautions to be taken against personal injury, equipment damage, and service interruptions are covered in this section with the associated method. General precautions are covered in Handbook 0 and are to be observed at all times as they apply to the operations being performed.
1.121	Where cable ties are being applied either manually or pneumatically, the spacing requirements of the nylon ties shall be the same as those used for sewing with approved twine (refer to FIG. 16).	1.3	<u>Arrangement of Tools</u>
		1.31	Prior to starting operations covered in this section, the tools and other items required should be arranged at the work location so as to minimize fatigue and inconvenience of handling.

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1.4 Verification

- 1.41 Items for the verification of operations covered in this section are listed in PAR. 6.
- 1.411 Items in PAR. 6 may also be used as a self-check guide while performing operations covered in this section.

2. INSTALLING EQUIPMENT

The tools and supplies required for the operations covered in this section are listed below:

2.1 Tools

R-4411-L1, L2	Pneumatic Banding Tools
*284	Needle, Chicago
*R-59237	Needle, Sack
*R-2434	Scissors, 8"
*R-1102	Spudger, Plastic
R-4266	Fastener, Cable Tie
R-4630	Wire Threading Tool

*Indicates tools normally on job in tool kits.

2.2 Supplies

R-4412	Tape, Nylon
R-4412B	Cartridge, Cable Ties
R-4412A	Closure Blocks
R-3455	Shellac, White
R-3428	Tape, Gray Plastic Adhesive, 3/4"
R-2916-L8	Twine
R-4265	Ties, Nylon Cable

3. SEWED FORMS - GENERAL3.01 Sewing - Common Requirements and Methods

- 3.011 All switchboard and local cable forms (and superimposed wiring thereon) shall be sewed with approved twine or banded with nylon ties, as covered in FIG. 16. The requirements in this figure apply only to forms made by the Installer.
- 3.012 Wind the twine around the cable forms in a clockwise direction, where practicable, facing along the form toward the butt end of the form.

- (a) Where, due to the location of the equipment or personal characteristics, it is unhandy to wind the twine in a clockwise direction, it is permissible to wind it in a counter-clockwise direction.

3.013 Sew all cable forms tightly enough to prevent the stitches from sliding out of place by the pull of the wires (perpendicular to the form) but not so tightly as to damage the insulation of the wires or to cause curling and/or a reduction in the intended length of the form.

3.014 The Sack Needle, R-59237, attached to the end of the twine, as shown in Figure 1, will facilitate passing the twine around and through forms when sewing.

3.0141 Where a sack needle is not available, attach the sewing twine to a piece of twisted No. 18 or larger gauge wire, about 5" long, as shown in Figure 2.

3.015 Avoid the use of metal tools when sewing cables or forms at live fuse panels, or where forms and wiring are so congested and close to the inside of cabinets, covers or mounting details as to make it difficult to sew without operating a fuse or damaging the wiring. Sewing needles may be made of fibre where metal type cannot be used.

3.016 A single stitch or nylon tie shall be applied at each point where wires are brought out of the form except where a large number of wires or large gauge wires are brought out, in which case, two or more stitches may be used. An extra stitch or tie may also be used where necessary to facilitate making up the forms as on small forms where there may be tendency for stitches to slip during the skinning operation.

3.02 Splicing Twine

3.021 Sewing twine may break if given a quick snap or if one strand is pulled tighter than the other. Always tighten stitches with a steady pull,

keeping both strands even and bear in mind the proximity of tools, adjacent apparatus or nails in the forming board. Guide the direction of pull away from these objects.

NOTE: Protect your hands, when necessary, with 1" compress or adhesive tape.

- 3.022 When a single twine breaks, splice as shown in Figure 3.
- 3.023 When double strand of twine breaks or needs to be lengthened, splice as shown in Figure 4.
- 3.03 Types of Stitches Used For Sewing Cable Forms
- 3.031 Starting Stitch - Make starting stitches as shown in Figures 5 and 6.
- 3.032 Regular Lock Stitch - Make the lock stitch as shown in Figure 6.
- 3.033 Winding Stitch - Wind the twine around the cable form in either a clockwise or counter-clockwise direction. Make the winding stitch as shown in Figure 7.
- 3.034 Ending Stitch - The ending stitch consists of two lock stitches taken close together in place of the regular single lock stitch located at the point where the last skinners breakout of the form as shown in Figure 16, except as indicated in Paragraph 4.0131.
- 3.035 Cross Stitch - On large diameter forms where additional rigidity is required, cross stitches are used at the breakout of each branch arm as shown in Figure 8.
- 3.036 Chain Stitch - The chain stitch shown in Figure 9 may be used to conveniently segregate groups of wire as in the case of 227-type terminal strips.
- 3.037 Broom Stitch - Where several cables are formed into a single arm and it is necessary to keep a portion of this form near the cable butt to a given thickness or where necessary to keep a portion of the local cable in a flat formation, it may be necessary to use the broom stitch, as shown in Figure

10. The broom stitch is made by sewing between the groups of wire of adjacent cables or between the wires or a local cable. In cases where this stitching is necessary, care should be exercised to avoid damaging the insulation of the wires.

3.038 Double Lock Stitch - Consists of two regular lock stitches positioned immediately adjacent to each other as shown in Figure 14.

3.04 The Use of "F" Stitches

3.041 The "F" stitch is a supplementary regular lock stitch (Figure 11) placed as close as possible to the regular lock stitch and each other. This stitch is used to separate duplicate colored wires connecting to different terminals of the same apparatus or component. The wiring diagram indicates which of colored leads should be formed out under the "F" stitch.

(a) "F" stitches are not required on switchboard cable forms because no color designation is shown for these leads on the wiring diagram and the use of an "F" stitch would serve no purpose for maintenance identification. Extra stitches, not identified by the symbol "F" on the wiring diagram, are sometimes used on switchboard cable forms as a convenient method of separating leads where desired for manufacturing (or installation) reasons.

3.042 "F" stitches shall be located adjacent to the regular stitch toward the tip of the form on both vertical and horizontal forms, as shown in Figure 11. If more than one "F" stitch is used the leads shall be designated "F", "F1", "F2" starting with the one nearest the regular stitch. Use a separate stitch for each like numbered "F" designation.

(a) On ladder-type forms where a cable arm has neither a tip or a butt; the "F" stitches shall be located on the right side of the regular stitch facing the wiring side of the apparatus.

3.043 Number of "F" Stitches - It should be possible to limit the number of "F" stitches at a given point to one, by a proper selection of different colored wires. More than one "F" stitch, however, is permissible where it would be impracticable to select wires with different colors to avoid duplications.

3.044 Where two or more leads of the same color approach a stitch and are to be connected to different terminals of the same piece of apparatus or when one wire of a pair is to be cut and the ends connected to different terminals of the same piece of apparatus, one of the wires is brought out at the regular stitch and each of the other wires at an extra or "F" stitch. Locate the extra stitch or stitches as close as possible to the regular stitch for the wires brought out at this point. (See FIG. 11)

3.05 Fastening Forms to Brackets

3.051 Where cables or local cable forms are to be fastened to crossbars or brackets, the "Chicago" or "Kansas City" stitches, shown in FIG. 12 and 13 shall be used. Use the "Kansas City" stitch wherever secure fastening is of primary importance. Nylon cable ties may be used to fasten forms over 1/2" in diameter to all brackets of a bay (refer to SEC. 205 for requirements and methods for applying nylon cable ties).

3.052 Forms composed of polyvinyl chloride (PVC) insulated wires (such as types BW, BG, BH, BU and BY), polyethylene (PE) insulated wires (such as type BF and shielded pairs in 750 and 760 type cables), teflon (TFE) insulated wires (such as those in KS-19195 and KS-19224 Cables) and double acetate, cotton braid, lacquered (DACBL) insulated wires, (such as type M), shall be protected against contact with metalwork when secured to cable brackets, wiring supports, or other parts of the framework not provided with an approved protective finish such as No. 483. (Refer to Section 225 for methods of providing protection).

4. SEWING FORMS

4.01 Sewing Local Cable Forms

4.011 The starting stitch shall, when possible, consist of a lock stitch as shown in Figures 6 and 15 located at the point of greatest diameter. The sewing shall proceed in both directions from the starting stitch toward the tips of the forms, branches, or arms. Where this is impracticable, use the starting stitches as shown in Figure 5.

4.012 Regular Stitches: Sew all local forms throughout with the lock stitch. Where practicable the stems of the stitches should be located on the side of the form where the skimmers or arms break out as shown in Figure 14.

4.013 Ending stitches for terminating the sewing at the tip of the form should be located at the point where the last skimmers at the tip of the form break out, as shown in Figure 16.

4.0131 Locate the ending stitches at the next to the last breakout point on forms where only one skimmer breaks out at the tip of the form, except where such forms contain stiffening wires carried to the end of the form or spare wires doubled back at the tip of the form.

4.02 Sewing Switchboard Cable Forms

- 4.021 The starting stitch on switchboard cable forms shall be made as follows:
- 4.0211 For forms sewed entirely with the lock stitch and for cable forms sewed with both the lock and winding stitches where the lock stitches precede the winding stitches, the starting stitch should be made as shown in FIG. 5.
- 4.0212 Where two or more cables are formed out as a single round form, place the starting stitch around the wires of only one of the outside cables (regardless of the number of layers) as indicated in FIG. 15.
- 4.0213 Round or oval cable forms sewed with the winding stitch shall have the starting stitches made as shown in FIG. 7.
- 4.022 The regular stitches on switchboard cable forms shall be made as follows:
- 4.0221 In sewing switchboard cable forms, a variation of 1/8" plus or minus from the dimension specified for the distance between the butt of the switchboard cable and the first skinner or set of skinners in the sewed form is allowable.
- 4.0222 The lock stitch shall be used on all forms where the spacing of skinners is more than 1/2"; for resistance forms where the resistances are mounted on 7/16" centers; for forms at 1, 2, and similar type banks; and for all sewed fuse panel forms regardless of the spacing of the fuse posts. Wherever practicable, locate the stems of lock stitches on the side of the form where the skinners or arms break out.
- 4.0223 The winding stitch, as shown in FIG. 7, shall be used on all forms where the spacing of leads is 1/2" or less, such as forms to strip jacks or strip lamp sockets in the face of switchboards or on rack mounted equipment, except as otherwise specified.
- 4.0224 On forms sewed with the winding stitch, the distance between stitches shall be equal to the spacing of the groups of skinners as shown in Figure 7. Portions of the form where no skinners break out shall have the same spacing of stitches as that portion from which the skinners break out.
- 4.0225 Sew loop leads with the type of stitch that would normally be used for other skinners breaking out of the form at that point.
- 4.0226 Where it is necessary to keep down the thickness of a cable form as in the case of the flat-type short multiple forms, sew through the form as shown for multiple cables in Section 235, for those portions of the form which would otherwise be too thick.
- 4.0227 Stitches between the starting stitch and the first set of skinners shall be of the same type as those used for sewing the form where the skinners are brought out, except that where the winding stitch is used and the distance from the butt to the first set of skinners is 1-1/2" or greater the lock stitch should be used between the starting stitch and first set of skinners. The short multiple cable form in switchboards, is an exception to this requirement.
- 4.023 The ending stitch on switchboard cable forms sewed with the lock stitch shall be made as shown in Figures 7 and 8. Where the winding stitch is used the ending stitch should be made as shown in Figure 7.
- 4.03 Sewing Superimposed Wiring to Main Form
- 4.031 The requirements for the number of strands of twine and the spacing of stitches when superimposing wiring (either loose wires or sewed forms) on main forms are shown in Figure 16. The requirements in this figure apply only to sewed forms and superimposed wiring by the installer (which requires less handling than wiring superimposed by the shop.)
- 4.032 "C" wiring forms shall be attached to the main form in accordance with the requirements shown in Figure 16 for superimposed forms.

4.04 Sewing PVC Insulated Wires

4.041 PVC insulated wires (such as BG, BW, BU and DM1) should be sewed into forms in the same manner as textile insulated wires.

4.05 Sewing PE Insulated Wires

4.051 Refer to Section 710 of this handbook for the proper methods of sewing "PE" insulated wires.

4.06 Sewing Rubber-Covered Wires

NOTE: This includes flexible cordage such as KS-15141 and KS-15143 (formerly known as Tirez Wire).

4.061 Where a few rubber and/or neoprene covered wires are to be sewed into a form made up of textile or PVC insulated wires, the rubber-covered wires shall be embedded in the form so that the sewing twine or nylon ties will not cut into the rubber insulation.

4.0611 Where this is impracticable, as at points where the rubber and/or neoprene covered wires leave the main form, two layers of plastic tape shall be applied half-lapped, around the main form and the arm to protect the insulation from the twine or nylon ties.

4.062 Where cable forms that would normally be sewed are made up principally of rubber and/or neoprene covered wires, tape the form completely with two layers of plastic tape lapped, instead of sewing the form with twine.

4.063 Secure superimposed cables of rubber and/or neoprene covered wire to other sewed cables with bands of plastic tape (min. 1-1/4" turns) spaced not farther apart than five times the diameter of the larger cable. At bends, the tape shall extend completely around the bend.

4.064 Where a cable form or rubber and/or neoprene covered wire is to be secured to switchboard cables, cable brackets, or other supports, the cable form may be secured with twine or nylon ties. In such cases, the wires at each stitch or tie shall be protected with 1/64 inch fiber strips about 1 inch wide, placed centrally under the stitch or tie, and wrapped completely around the cable form.

5. ADDING WIRES TO FORMS5.01 Except at Keyshelves and "C" Wiring

5.011 When wires other than the various types of "C" wiring are to be added to existing sewed cable forms, except those in keyshelves, the additional wires may be sewed or nylon tied into a separate form and superimposed on the existing forms, provided that a satisfactory appearance is obtained. Otherwise the additional wires shall be distributed uniformly around the existing forms and secured by means of twine in the usual manner. Refer to Paragraphs for sewing requirements and methods.

→ 5.0111 When adding only a few wires to an existing cable form, it is usually more economical to slide the added wires under the existing stitches instead of resewing or rebanding the form. The quickest way to do this is to slide the tip of the R-4630 Wire Threading Tool under the stitch or tie and passing the added wire through the groove in the tool. This method should not be attempted when adding wires to forms with old, very brittle insulation and twine. In such a case, re sew or reband the form area where the leads are added.

NOTE: The R-4630 has a pointed end and requires a certain amount of precaution to avoid personal or cable form insulation damage.

5.0112 The R-4630 Wire Threading Tool will also facilitate removal of twine stitches or nylon ties from cable forms and/or bundles. Slide the R-4630 Tip under the stitch or tie and cut with an R-4633 Diagonal Cutter.

- 5.012 Where the original forms are not protected and the addition of the added wires necessitates the placing of protection, the protection shall be placed as covered in Section 225.
- 5.013 Where wires are added to forms serving double row fuse panels and they break out intermittently along the entire form, sew the wires either along the top or bottom of the form to agree with the skinner breakouts. Where the wires serve fuse posts numbered consecutively, distribute them uniformly around the existing form.
- 5.014 Wiring superimposed on existing sewed cable forms shall not cover up any of the various types of "C" wiring already superimposed on these forms. Refer to Section 201 of definitions covering the various types of "C" wiring.
- 5.015 Where cable forms are provided with fire detection wire, care shall be taken to see that no wiring added to or superimposed on such cable forms is fastened in such a way as to cover either the LA fire detection wire or the red, type AM, wire of the fire detection loop.
- 5.0151 The fire detection loop return wire (type AM) on the main vertical portion of a bay local cable may be crossed at right angles if only a few wires or the horizontal arms of a supplementary local cable are involved.
- 5.02 At Keyshelf (Except "C" Wiring)
- 5.021 When wires other than type AM wires or "C" wiring of any type as defined in Section 201 are to be added to existing sewed forms in keyshelves, the additional wires shall be distributed uniformly around the outside of the forms and secured with twine or nylon ties in the usual manner. Refer to Paragraphs for sewing requirements and methods. The necessary protection material should then be added in accordance with Section 225.
- 5.0211 When adding wiring to keyshelf forms, and it is difficult to place fiber and tape protection completely around the local cable form in the area under the cord shelf, the added wiring may be protected with fiber and tape as a separate form and secured to the existing form.
- 5.022 When type AM wires, other than "C" wiring of any type as defined in Section 201, are to be added to existing sewed forms in keyshelves they may be sewed into a separate form and superimposed on the existing form or distributed uniformly around the existing form, whichever is more practicable. If the added wires can be placed on the original form so that they are not subject to damage due to raising and lowering of the keyshelf, no additional protection is required.
- 5.023 When the added wires as covered in Paragraphs 5.021 and 5.022 require protection, which, in addition to the protection material on the existing form, would make the cable so bulky that it would rub against the key pan, apron or other metal work resulting in broken wires and improper closing of the keyshelf, (due to the main form extending into the space of and coming in contact with the individual key forms), remove the protection material, on the original cable form and sew all wires into one form, adding the necessary protection required, as covered in Section 225.
- 5.024 Supplementary keyshelf local cables which are formed by the shop and installed in the field, shall be superimposed on the existing form in the usual manner, i.e., a separate form sewed or nylon tied to the regular form.
- 5.025 Wires added to keyshelf local cable forms should be placed within the metal strap or clamp at the position of the keyshelf bracket and within all other form supporting details.
- 5.026 When nylon cable ties are used to form or superimpose leads to the keyshelf, the heads of the cable ties shall be placed in such a manner so as to eliminate any possible rubbing or chafing of the keyshelf form.

6. VERIFICATION ITEMS

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS		REFERENCE	
		Par. No.	Fig. No.
6.01	<u>General</u>		
6.011	Manual or pneumatically applied nylon cable ties may be used to sew (band) switchboard or local cable forms.	1.12	
6.012	Nylon cable ties shall be applied with the same spacing requirements as twine.	1.121	
6.02	<u>Sewing - Common Methods and Requirements</u>	3.01	
6.021	All form (local, switchboard) should be sewn with twine or banded with nylon cable ties (installer made forms).	3.011	16
6.022	Wind twine in clockwise direction, except where not practicable.	3.012	
6.023	Sew forms tight enough to prevent stitches from sliding, however, not enough to damage insulation or cause curling.	3.013	
6.024	At least one stitch or nylon tie shall be taken where wires break out of the form, however, depending upon the amount of wires breaking out of the form two or more stitches may be required.	3.016	
6.03	<u>Splicing Twine</u>	3.02	
6.031	Splice single strand twine correctly.	3.022	3
6.032	Splice double stranded twine correctly.	3.023	4
6.04	<u>Types of Stitches Used for Sewing</u>	3.03	
6.041	Starting stitches made correctly.	3.031	5, 6
6.042	Lock stitches made correctly.	3.032	6
6.043	Winding stitches made correctly.	3.033	7
6.044	Ending stitches made correctly.	4.023 3.034	7
6.045	Cross stitches made correctly.	3.035	8
6.046	Chain stitches made correctly.	3.036	9
6.047	Broom stitches made correctly.	3.037	10
6.05	<u>The Use of "F" Stitches</u>	3.04	
6.051	The "F" stitch should be used to segregate two leads of the same color breaking out of the form at the same place but connecting on different terminals.	3.041 3.044	11
6.052	The "F" stitches should be located adjacent to the regular stitch locking from butt to tip on wire side.	3.042	11

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS		Reference	
		Paragraph Number	Figure Number
6.053	The "F" stitches on ladder type forms should be located adjacent and to the right side of the regular stitches facing the wiring side.	3.042a	
6.06	<u>Fastening Forms to Brackets</u>	3.05	
6.061	Forms secured to brackets, crossbar, etc., should be secured with "Kansas City" or "Chicago" stitches, nylon ties may be used. SEC. 205.	3.051	12, 13
6.062	PVC, PE, TFE, and DACL insulated wires require protection when fastened to brackets, wiring supports, etc., not having an approved finish.	3.052	
6.07	<u>Sewing Local Cable Forms</u>	4.01	
6.071	The starting stitch should be located at the point where the diameter is the largest and then proceed in both directions toward the tips, branches, or arms of the form.	4.011	5
6.072	Sew forms throughout with lock stitch.	4.012	14
6.073	Ending stitches should be located at the tip of the form where last skinner breakout, except where stiffening wire was used.	4.013	16
6.08	<u>Sewing Switchboard Cable Forms</u>	4.02	
6.081	Forms sewed with lock stitches or lock stitches and winding stitches should be preceded by a starting stitch.	4.0211	5
6.082	Where two or more cables are formed into one round form, the starting stitch should only be placed around the wires of one cable.	4.0212	15
6.083	(+ or -) 1/8" is the allowable distance of variation for stitches between the butt and the first skinners.	4.0221	
6.084	Lock stitches should be used on forms where the breakout spacing is over 1/2" - stems of the stitches to be located on the skinner side of the form.	4.0222	
6.085	Winding stitches should be placed on forms where the breakout spacing is less than 1/2", such as, jack strips, lamp strips, etc. The spacing should be equal for the entire length of the form.	4.0223 4.0224	
6.086	Sew loop leads with normal stitch being used for the skinner breakouts of the form.	4.0225	
6.087	Lock stitches may be followed by winding stitches.	4.0227	
6.09	<u>For Superimposing Wiring to Main Form - See Figure.</u>	4.031	16
6.091	For superimposing "C" wire form to main form - See Figure.	4.032	16

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS		REFERENCE	
		Par. No.	Fig. No.
6.092	Sew PVC (BG, BW, BU or DM1) wires the same as the textile covered wires.	4.041	
6.093	Where a few rubber and/or neoprene covered wires are in the same form with textile covered wires, they should be imbedded in the form to prevent cutting the insulation. Where imbedding is impossible, protect with 3/16" lapped gray friction tape.	4.061 4.0611	
6.094	Where form is principally rubber and/or neoprene covered wire, the form should be taped and if superimposed to another form, use bands of the tape spaced not farther apart than five times the diameter of the largest cable form.	4.062 4.063	
6.095	Where rubber and/or neoprene covered cable form has been secured to brackets, supports, or other forms, use bands of twine or nylon ties, but protect forms with fiber strips.	4.064	
6.10	<u>Adding Wires to Forms (Except Keyshelf and "C" Wiring)</u>	5.01	
6.101	Wires should be distributed around the form evenly sewed or nylon tied into form and superimposed neatly.	5.011	
6.102	When adding wires into old cable form cause stitches to break, resew entire form.	5.0111	
6.103	Adding wires or forms may require added protection.	5.012	
6.104	Where form serves double row fuse panels and wires break out intermittently along form, distribute the wires evenly around form and sew.	5.013	
6.105	Wiring superimposed on existing form should not cover up various "C" wiring previously superimposed.	5.014	
6.106	Superimposed wires should not cover fire detection or loop return wiring, except on vertical portion of form where only a few wires may cross.	5.015 5.0151	
6.11	<u>At Keyshelves (Except "C" Wiring)</u>	5.02	
6.111	Wires other than "AM" & "C" should be distributed evenly around the existing form and sewed or nylon tied in the usual manner.	5.021	
6.112	"AM" wiring other than "C" type should be sewed into a separate form and superimposed or distributed evenly around the form and sewed.	5.022	
6.113	Add necessary protection to avoid rubbing against key panel or other metalwork.	5.023	
6.114	Supplementary shop formed local cables should be superimposed to existing keyshelf form.	5.024	
6.115	Wires added to the keyshelf local cable should be placed within the metal clamp or strap.	5.025	
6.116	When nylon cable ties are used, position tie heads to eliminate possibility of chafing.	5.026	

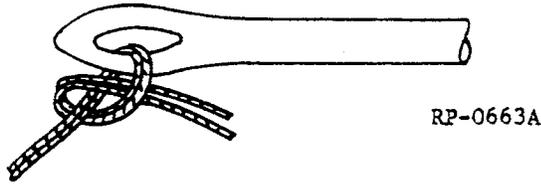


FIG. 1 SECURING TWINE TO SACK NEEDLE
R-59237 (Par. 3.014)

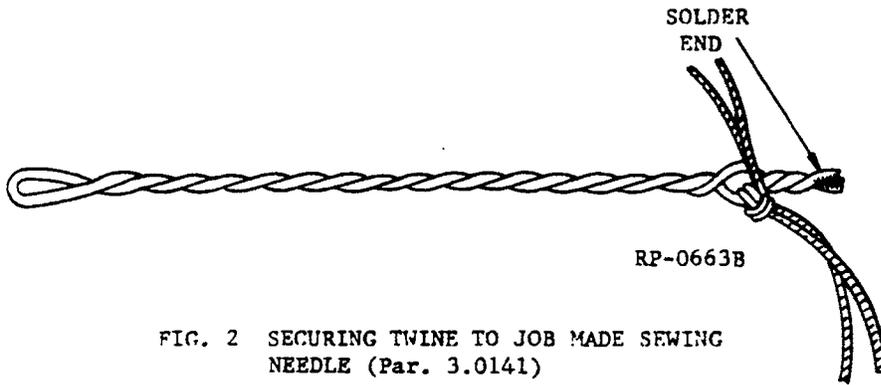


FIG. 2 SECURING TWINE TO JOB MADE SEWING
NEEDLE (Par. 3.0141)

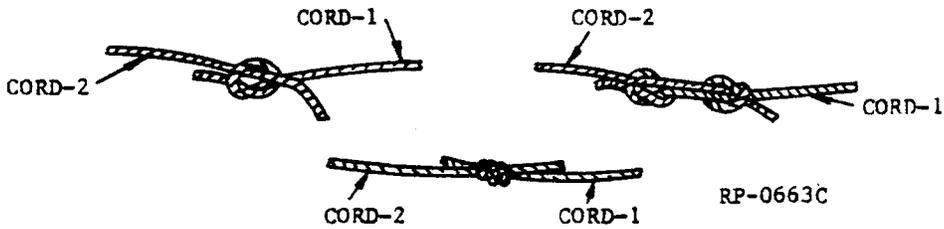
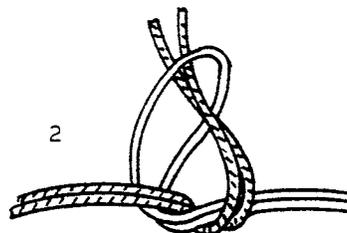
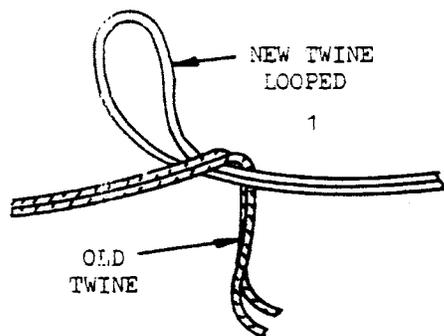
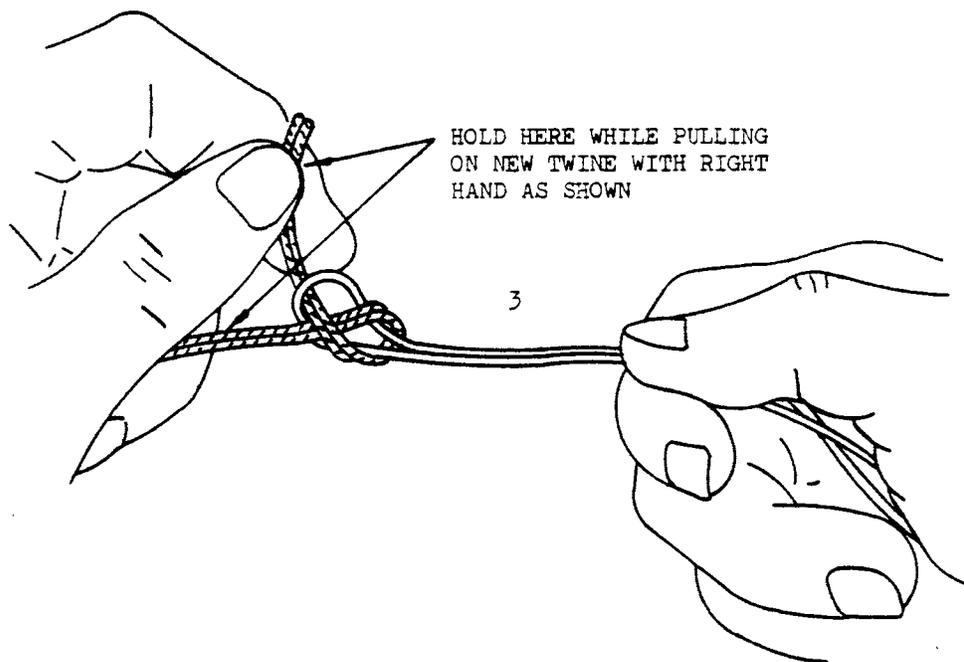


FIG. 3 SPLICING SINGLE TWINE
(Par. 3.022)

LOCATE SPLICE SO IT WILL NOT INTERFERE WITH THE MAKING OF STITCHES

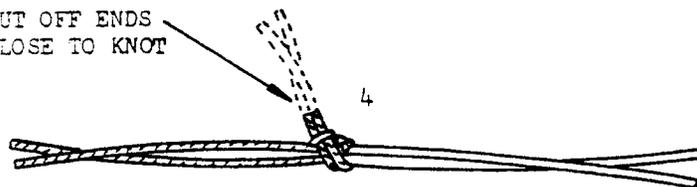


PASS ENDS OF OLD TWINE THRU LOOP OF NEW TWINE



HOLD HERE WHILE PULLING ON NEW TWINE WITH RIGHT HAND AS SHOWN

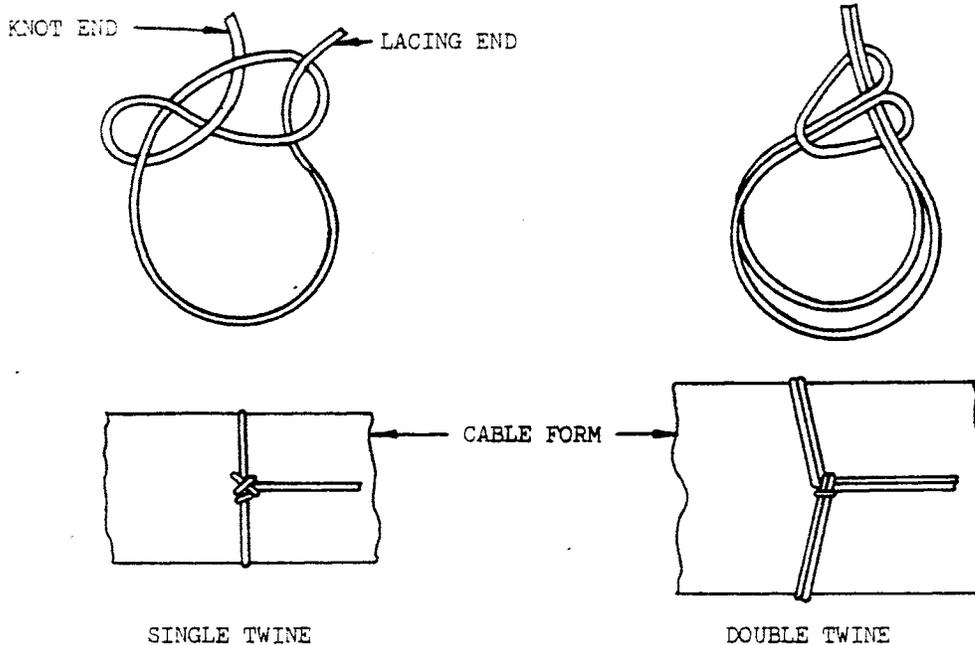
CUT OFF ENDS CLOSE TO KNOT



THE COMPLETED KNOT

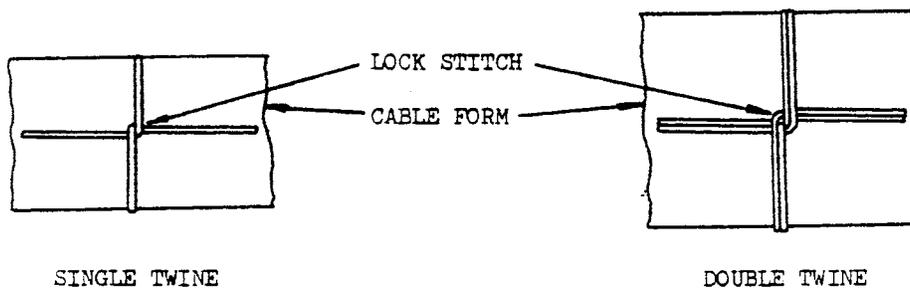
RP-0663D

FIG. 4 SPLICING DOUBLE TWINE (PAR. 3.023)



RP-0663E

FIG. 5 STARTING STITCHES FOR CABLE FORMS SEWED IN ONE DIRECTION ONLY (PARS. 3.031, 4.011, 4.0211)



RP-0663F

FIG. 6 STARTING STITCHES FOR CABLE FORMS SEWED IN BOTH DIRECTIONS (PARS. 3.031, 3.032, 4.011)

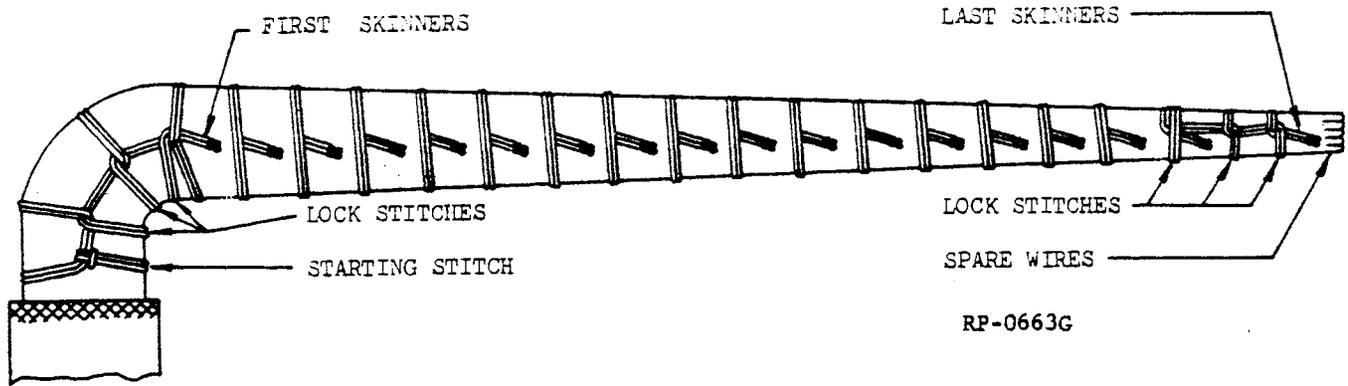


FIG. 7 SINGLE LEG CABLE FORM AT RIGHT ANGLES TO BUTT SEWED WITH WINDING STITCH (PARS. 3.033, 4.0213, 4.0223, 4.0224, 4.023)

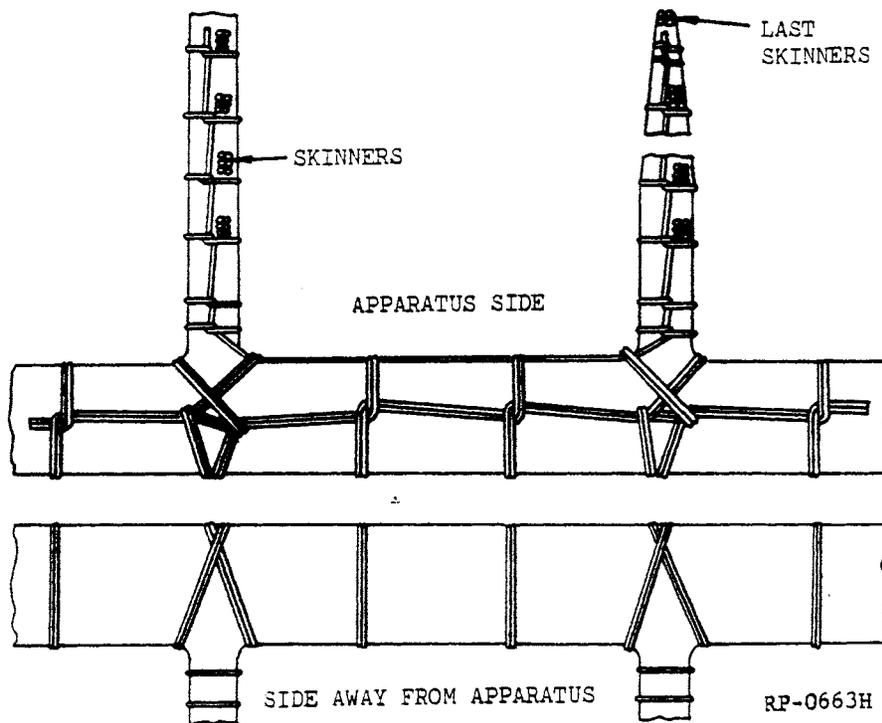
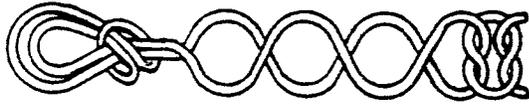


FIG. 8 CROSS STITCHES ON LARGE DIAMETER FORMS (PARS. 3.035, 4.023)



RP-0663J

FIG. 9 CHAIN STITCHES (PAR. 3.036)

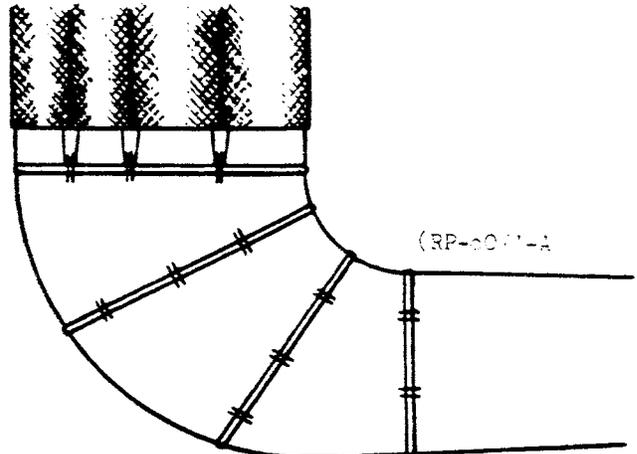
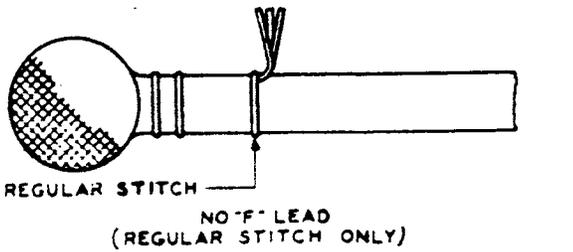
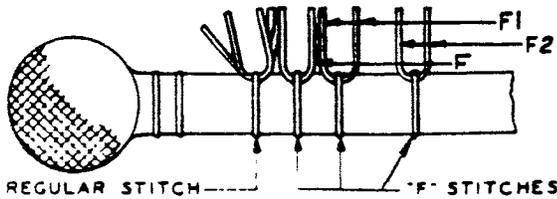


FIG. 10 BROOM STITCHES (PAR. 3.037)



REGULAR STITCH

NO "F" LEAD (REGULAR STITCH ONLY)



REGULAR STITCH

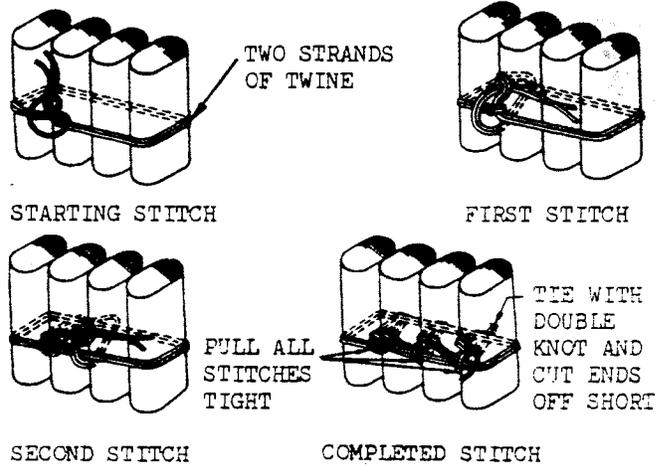
"F" STITCHES

THREE "F" LEADS - TWO APPROACHING IN THE SAME DIRECTION AND THE OTHER IN THE OPPOSITE DIRECTION (TWO "F" STITCHES)

RP-0663K

NOTE: "F" STITCHES SHALL BE PLACED AS CLOSE AS PRACTICABLE TO THE REGULAR STITCH, AS WELL AS CLOSE TO EACH OTHER.

FIG. 11 "F" LEADS AND "F" STITCHES (PARS. 3.041, 3.042, 3.044)



TWO STRANDS OF TWINE

STARTING STITCH

FIRST STITCH

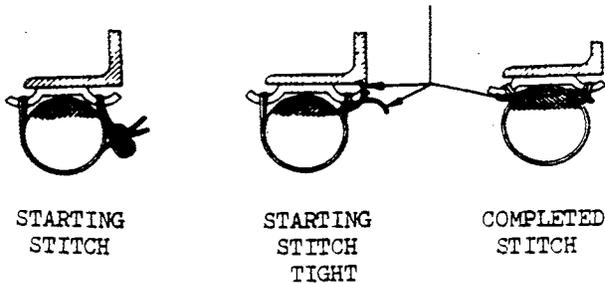
PULL ALL STITCHES TIGHT

SECOND STITCH

COMPLETED STITCH

TIE WITH DOUBLE KNOT AND CUT ENDS OFF SHORT

ENDS OF TWINE WRAPPED ONCE AND IN OPPOSITE DIRECTIONS AROUND TWINE AT REAR OF CABLE AND TIED WITH DOUBLE KNOT



STARTING STITCH

STARTING STITCH TIGHT

COMPLETED STITCH

RP-0663L

FIG. 12 "CHICAGO" STITCHES (PAR. 3.051)

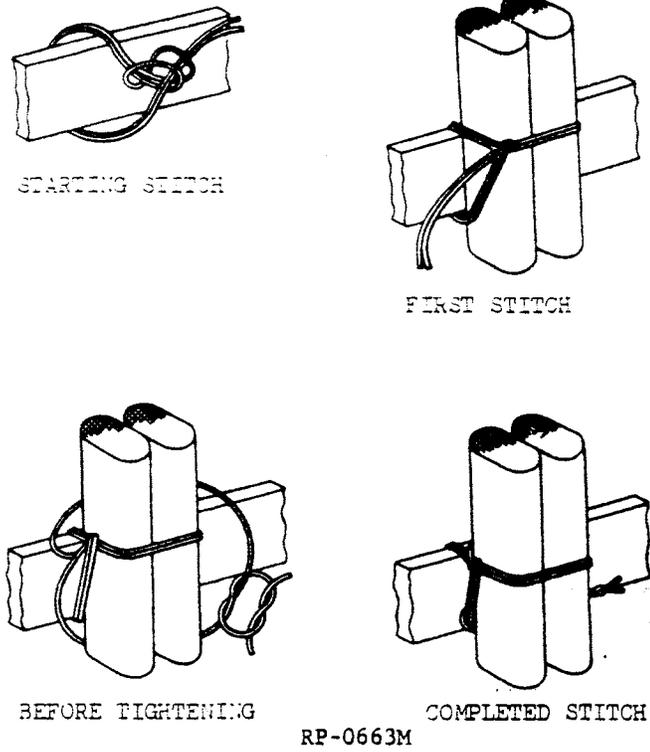


FIG. 13 "KANSAS CITY" STITCHES
(PAR. 3.051)

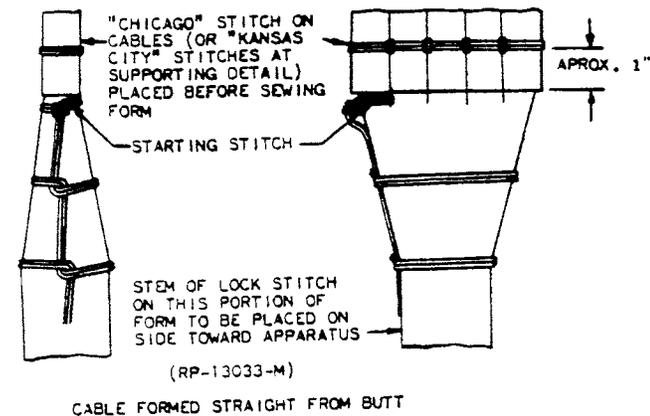
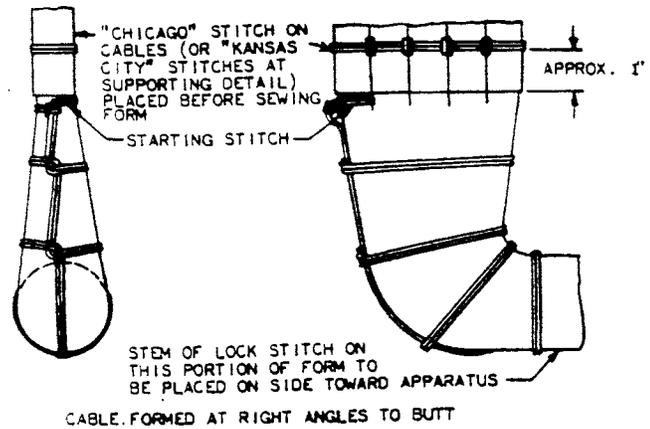
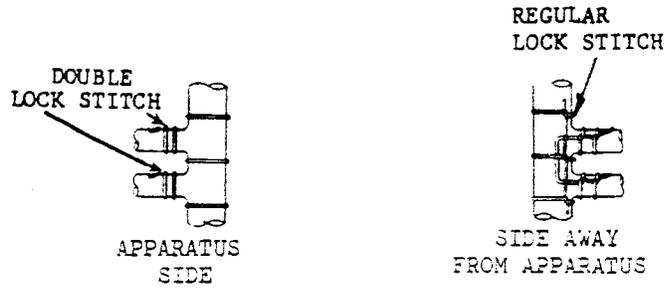
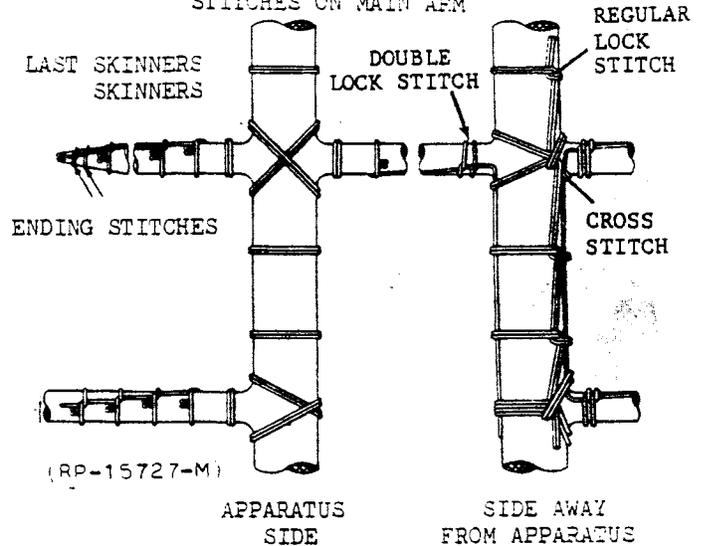


FIG. 15 SEVERAL CABLES IN RECTANGULAR FORMATION FORMED OUT AS A SINGLE ROUND CABLE ARM
(PARS. 4.011, 4.0212)



SMALL DIAMETER FORM HAVING SPACING OF ARMS EQUAL TO OR LESS THAN SPACING OF STITCHES ON MAIN ARM



NOTE: THE DOUBLE LOCK STITCH SHALL BE LOCATED AS CLOSE AS PRACTICABLE TO THE MAIN FORM.

FORM HAVING SPACING OF ARMS GREATER THAN SPACING OF STITCHES ON MAIN FORM

FIG. 14 SEWING LOCAL CABLE FORMS
(PARS. 3.038, 4.012)

SPACING OF STITCHES (SEE NOTES 1 AND 2)							
Main Form Without Branch Arm or Skinner Breakout	Main Form With Branch Arm Or Skinner Breakouts			For Superimposed Wire			For Superimposing Forms
Place stitch every 2 inches on main form where it is not necessary to conform to the spacing of branch arms or skinner breakouts.	Space between breakouts of branch arms or skinner.	Break-Out	Mid-Point	2" Spacing	Break-Out	Mid-Point	2" Spacing
	1/2" or less	X			X		
	Over 1/2" to 2"	X			X		
	Over 2" to 4"	X	X		X	X	
	Over 4" to 8"	X		X	X		X
Over 8"	X		X	X		X	
See A	See A B C D E					See F G H	

NUMBER OF STRANDS OF TWINE FOR ORIGINAL FORMS

In determining the number of strands of twine to use for sewing original forms, the maximum diameter of each separate part (main form or branch arm, straight or tapered) is the controlling dimension for that part.

- (a) Use 1 strand of approved twine for all sewing on forms (main form and branch arms) where the maximum diameter of the forms is not greater than 1-1/2".
- (b) Use 2 strands of twine for sewing the entire main form and all branch arms of the main form where the maximum diameter of the forms is greater than 1-1/2".
- (c) Where cable forms are to be protected with tape, it is permissible to double space stitches, providing the space between stitches does not exceed 3".

BANDS OR TIES

Where bands or ties are specified in the handbook or on the drawing for tying forms, use bands of 2 strands of twine, made as a starting stitch and ended with a square knot, for the entire form. Place the bands at approximately 8" intervals on Horizontal Forms, and approximately 14" on Vertical Forms unless otherwise specified. The requirements of this paragraph should not be considered as those requirements necessary for securing forms to cable brackets, supports, etc.

EXCEPTION: Where a specific handbook section specified size of twine different from the above, the specific handbook section shall be followed.

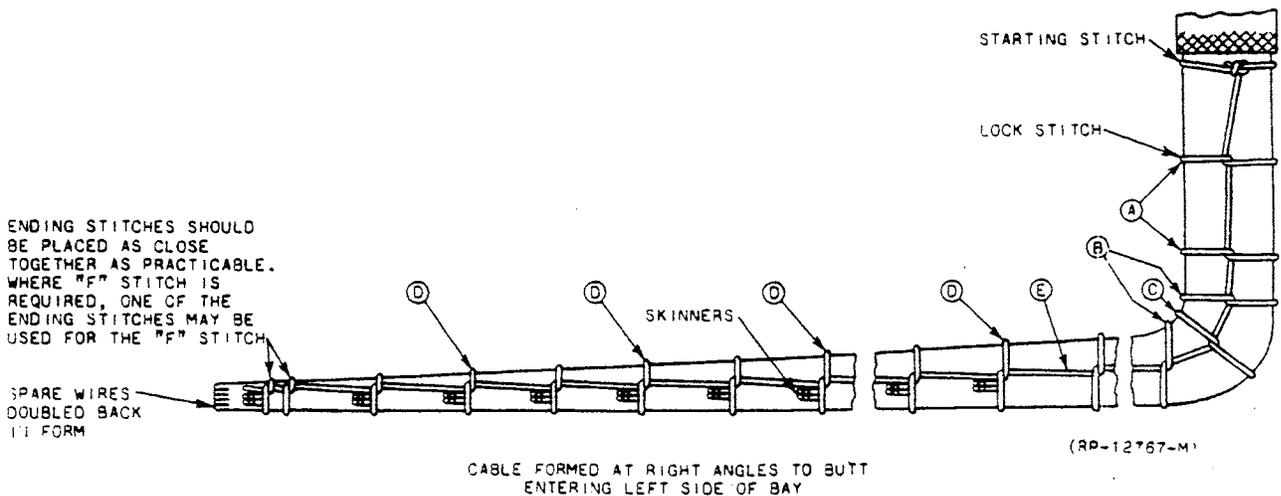


FIG. 16 SEWING REQUIREMENTS FOR SEWED FORMS AND SUPERIMPOSED WIRING (PARS. 3.011, 3.034, 4.013, 4.031, 4.032)

(Continued on next page)

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**NUMBER OF STRANDS OF TWINE FOR
SUPERIMPOSED WIRING AND FORMS**

(a) When superimposing wires around a form, or superimposing one form on another; if the maximum diameter of the original form and superimposed wires together is not greater than 3", use 1 strand of twine; if it is greater than 3", use 2 strands of twine.

- A Place stitch every 1-3/4" (2" max.) on that part of form not having branch arm or skinner breakouts.
- B Place stitch at beginning and end of each bend and at beginning of branch arms.
- C Place intermediate stitches at bends so that stitch spacing does not exceed 2" on the outside radius.
- D Place stitch at each branch arm and skinner breakout and at midpoints to maintain equal spacing as nearly as practicable but not to exceed 2".
- E Place stem of stitches on side of form adjacent to apparatus. On single leg forms at double row fuse panels use the stem of the lock stitch to separate the upper and lower sets of skimmers. (Shop forms may have the skimmers separated by an extra stitch.)
- F Space stitches on that portion of a form which is to be superimposed and which is not controlled by branch arm or skinner breakouts, every 4 inches.
- G Place stitches used for superimposing one form on another midway between each stitch of the superimposed form except, as covered in H.
- H Where shop formed cables are to be superimposed place superimposing stitches every 4 inches. Place additional stitches at breakouts of branch arms or skimmers as required to prevent the superimposed form pulling away from the main form at these locations.

NOTE 1: Place additional stitches where F stitches are specified on the drawing as covered in Paragraphs 3.041 to 3.044 and Figure 12; where an extra stitch as covered in Section 220 is required; where large gauge wires are involved or where additional rigidity is required on large diameter forms as covered in Paragraph 3.035.

NOTE 2: Forms serving 286, 287 and similar type multi-contact relays or 218-type terminal strips mounted on 2-1/8" centers, should have stitches spaced 2-1/8" apart on that portion of the form where the vertical branch arms for these equipments break out.

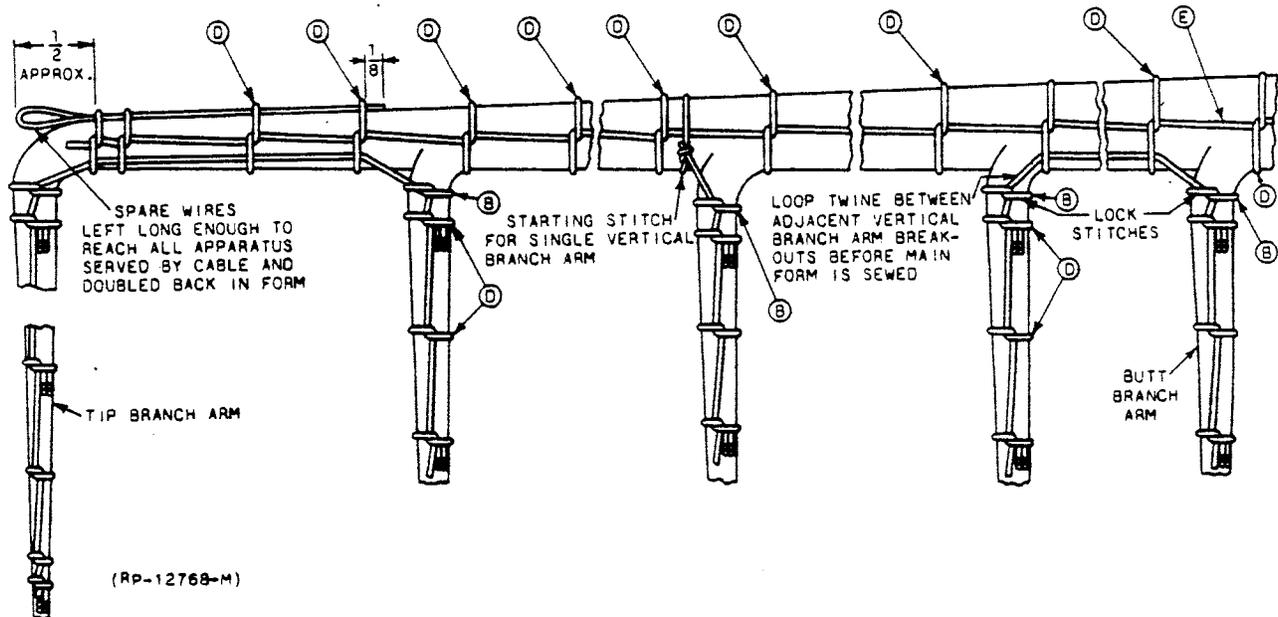


FIG. 16 SEWING REQUIREMENTS FOR SEWED FORMS AND SUPERIMPOSED WIRING
(PARS. 3.011, 3.034, 4.013, 4.031, 4.032)

(Continued on next page)

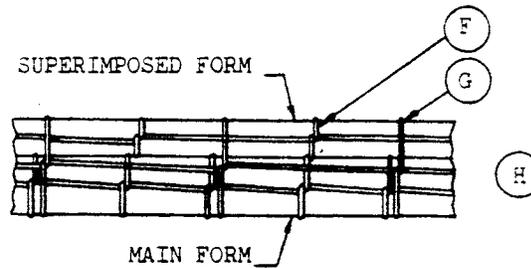


FIG. 16 SEWING AND BANDING (NYLON TIE) REQUIREMENTS FOR SEWED FORMS AND SUPERIMPOSED WIRING
(PARS. 3.011, 3.034, 4.013, 4.031, 4.032)

(continued from preceding page)

→ Indicates new or changed information.

[Brackets at side of paragraphs indicate
a requirement.

Engineering Planning Manager
(Installation)

REASON FOR REISSUE:

To remove reference to varnished cotton cloth.
To introduce use of R-4630 Tool for cutting
ties.