

FANNED FORMS
METHODS AND REQUIREMENTS

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1. GENERAL

1.1 Scope of Section

1.11 This section covers the methods and requirements for fanning cable lead conductors and bulk wire at terminal strips, connector/protector units and similar types of equipment furnished with fanning strips, fanning rings and other types of fanning devices. The fanning of leads through such forming devices without sewing, is considered a fanned form.

1.12 The requirements covered in this section shall be followed, except when modified, by the job specification or application drawing.

1.13 Each figure in this section illustrates only conditions referenced in the text of this section and should not be considered as covering other conditions or requirements that may be illustrated.

1.2 Precautions

1.21 Specific precautions to be taken against personal injury, equipment damage, or service interruptions are covered in this section along with the associated methods. General precautions are covered in Handbook 0 and are to be observed at all times.

1.3 Installing Equipment

1.31 The tools and supplies listed below, are those which are normally required, when performing fanning operations.

Tools

R-1682	5" Electrician Scissors
R-2434	8" Wire Scissors
R-2257	Loop Wire Puller
R-4666	Wire Hook Puller

NOTE: Tools listed above are in addition to the Installers 168 Kit Tools.

Supplies

R-2916	Twine
R-3412	Wire Markers
R-3694	Wire Markers

2. FANNED FORMS

2.1 General Requirements

2.11 The fanned form shall be used for switchboard cable leads terminating at terminal strips, connector/protector units, or other apparatus furnished with fanning strips, fanning rings, or other wire retaining devices. Local cable forms terminating at this type of apparatus or equipment may also be fanned out without sewing providing the fanned form method is practicable.

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2.111 In the fanned form, wires shall be run directly from the cable butt, or from the breakout point of the loose wire cable form to the fanning strip. The wires shall be run without slack but not so taut as to cause insulation breakdown.

PRECAUTION: At FANNED FORMS, TAUTNESS IN THE LEADS IS GENERALLY RELAXED BY THE DRESS APPLIED AT THE POINT OF CONNECTION. WHEN THE CONDUCTORS ARE REQUIRED TO BEND AROUND FANNING RINGS, CABLE BRACKETS OR OTHER WIRE RETAINING DEVICES, MAKE SURE THAT THE CONDUCTORS ARE RELAXED AND ARE NOT TIGHTLY DRAWN AROUND THE BENDS. THIS IS PARTICULARLY IMPORTANT WHEN PVC INSULATED CONDUCTORS ARE INVOLVED.

2.112 Avoid twisted, bunched or loose fans. This is caused by excessive crossing of the wires in the fanned form.

2.113 The regular twist in pairs, triples and quads shall be maintained in the area between the cable butt and the fanning strip. Where the wires in a pair, triple or quad enter different holes in the fanning strip, the wires shall be untwisted only to the extent necessary to permit fanning as required.

2.12 Where switchboard cables (one or more) serve a single piece of apparatus having a fanning strip and the cables are butted at the associated apparatus location, the conductors shall be run directly from the butt to the fanning strip as illustrated for the terminal strip shown in Figure 1.

2.121 Where switchboard cables (one or more) serve two or more pieces of apparatus having fanning strips, each group of conductors serving single pieces of apparatus shall constitute a fanned form starting at the butt location or the point on a sewed or loose wire cable form that will permit the conductors to fan directly into the fanning strip.

2.122 When fanning rings, enclosed cable brackets, or other wire retaining devices are provided at the second and succeeding apparatus locations (away from the butt), the conductors shall be run loose through these devices as loose wire forms. Generally, bands of twine or nylon ties are not required unless necessary to avoid contact between conductors and uninsulated metalwork. See Figures 2 and 3.

2.13 When cable supports or unenclosed cable brackets are provided at the second and succeeding apparatus locations (away from the butt), the conductors shall be run loose from the butt to the breakout points. The loose wire forms may be secured to the cable bracket or supports using a double strand of twine with either a Kansas City or Chicago stitch, or a nylon cable tie. Where wires may come in contact with uninsulated cable supports or transverse arms, provide protection by taping the metalwork or using 1/64" sheet fiber (RM-583101).

2.14 Where several terminal strips are mounted in a horizontal row, as used on various frames, and no cable supports are provided for the support of the horizontal portion of the wiring, run the wires as a single fan across all the terminal strips in the same horizontal row. Loose bands of twine or nylon cable ties, as illustrated in Figure 4, shall be applied to confine the wires. In general, it will be satisfactory to use one loose band for each terminal strip 8" or longer, or one loose band for each two terminal strips less than 8" in length.

2.2 Distributing Frames

2.21 At Distributing Frames - Where distributing rings or other wire retaining devices are not provided, protection shall be provided between the cable butt and the transverse arm. Refer to Section 225 of this handbook for protection methods.

2.22 When 15A and 16A fanning rings are furnished, they shall be located on the transverse arms behind the terminal strips as shown in Figures 2 and 3.

2.221 The fanning rings should be mounted by first engaging the end of the clip (wide end) farthest from the fanning strip over the transverse arm and then snapping the opposite end into place.

CAUTION: THE BLADE OF A SCREW-DRIVER, OR OTHER METAL TOOL, SHOULD NOT BE USED TO ENGAGE THE CLIP OVER THE TRANSVERSE ARM, BECAUSE OF RESULTING DAMAGE TO THE INSULATING FINISH.

2.222 When there are too many wires to be accommodated by the fanning rings, it is permissible to run the leads outside the rings. The excess wires should be run behind the other wires and secured as necessary to maintain their position. The use of twine or cable ties may be used for securing in place.

CAUTION: IF THE WIRE RUN OUTSIDE THE RINGS COME IN CONTACT WITH UNINSULATED METALWORK OR SHARP EDGES - PROTECTION IS REQUIRED. (See Section 225.)

2.3 Spare-Unused Wires

2.31 Terminal Strips - Where one or more cables serve a terminal strip, and the cable(s) contain spare-unused leads, the leads shall be pulled through the farthest fanning strip hole away from the cable butt. (The outside hole is preferred.) The leads should be cut off about 1-1/2" beyond the front edge, bent back along the inside edge of the fanning strip toward the cable butt and passed through a hole that will allow approximately 1/2" in the rear, fold the leads over at the rear side. Where many leads are involved, use two or more holes to avoid congestion.

2.32 Where several cables serve one long terminal strip, and because of the closeness of the butt location, it is impossible to bring the leads back toward the butt. It is permissible to bend away from the cable butt.

2.33 D and Well Type - Spare wires serving D and 224 type terminal strips located on relay rack units shall be left long enough to reach the terminal of the farthest terminal strip they serve. These leads should be pulled back to the cable or form and looped back and forth on the side nearest the framework. Band with twine or ties to hold them in place.

2.34 Connector/Protectors - Spare leads serving connectors mounted on the distributing or protector frame shall be left long enough to reach the farthest possible termination point. They should be cut off 1-1/2" beyond the front edge of the connector, and then disposed of as described in Paragraph 2.31.

2.35 Fuse Panels - Spare leads that serve fuse panels equipped with fanning strips shall be run out to the last fanning strip hole, left long enough to serve the farthest fuse position, and then doubled back on the fanning strip. Be sure ends of wire do not contact the rivet assembly used to hold the fanning strip in place.

2.36 Where fuse panels do not utilize fanning strips, the spare leads should be left long enough to reach the farthest possible fuse position, and then doubled back and secured on the form or cable.

2.37 Apparatus - Spare and unused leads serving various types of apparatus, should in general, be left long enough to reach the farthest termination point served by the individual cable. These leads should either be doubled back on the fanning strip, when provided, or back on the form, or cable and secured in place when no fanning strip is furnished.

2.4 Unequipped Wires

2.41 When a cable is unequipped at one end and has apparatus termination points at the opposite end, these leads shall be terminated in the normal manner when the fanned form is utilized. This general requirement may be changed by the individual application drawing for any specific apparatus or equipment.

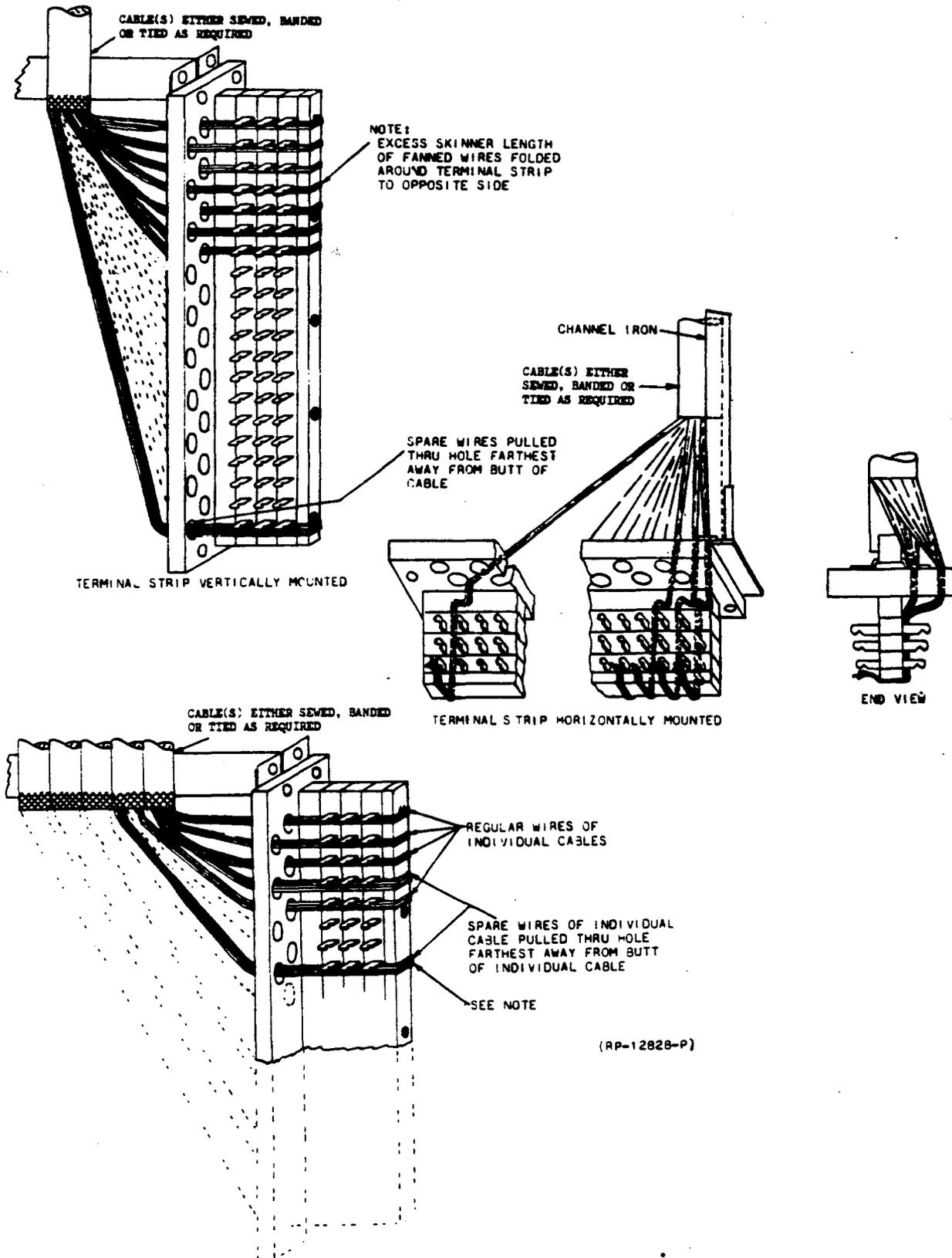
2.5 Lead Duplication

2.51 When fanning one or more cables into a fanning strip, etc., and a duplication of colored leads in any given fanning hole is encountered, the duplicate colored leads should be identified by using a series of knots in the wires or by using the adhesive backed wire markers.

3. VERIFICATION

VERIFICATION ITEMS AND A BRIEF STATEMENT OF THE REQUIREMENT		REFERENCE	
		PAR. NO.	FIG NO.
3.01	Fanned forms should be used for all switchboard cable leads terminating at terminal strips, protectors, etc.	2.11	
3.02	Fanned form wires should be run direct from butt or breakout point to the fanning strip. Wires should not be slack but not taut.	2.111	
3.03	Forms should not be twisted, bunched or loose fanned.	2.112	
3.04	Pairs, triples and quads shall maintain the regular twist as far as possible.	2.113	
3.05	Cable(s) serve single piece of apparatus with a fanning strip run direct from butt to strip.	2.12	1
3.06	When cables serve two or more pieces of apparatus having terminal strips, each group serving single pieces of apparatus should constitute a fanned form.	2.121	
3.07	When fanning rings, enclosed brackets, etc., are provided at the second and succeeding apparatus locations, the cable conductors should be run as loose wire forms. To protect uninsulated metalwork use tape or 1/64" sheet fiber.	2.122	2,3
3.08	When cable supports or unenclosed cable brackets are provided at second and succeeding apparatus locations, run conductors loose from butt to breakout point. Provide protection and secure where required.	2.14	
3.09	Terminal strips mounted in a row having no cable supports - run as a single fanned form - provide bands at each 8" interval or (1) band/each short terminal strip.	2.14	4
3.10	Distributing frame terminal strips with no wire retaining device - wires protected at butt and transverse arms.	2.21	
3.11	Locate 15A and 16A rings behind terminal strips.	2.22	2,3
3.12	Too many leads for fanning rings - run outside and band to maintain their position.	2.222	
3.13	Provide protection from sharp edges and uninsulated metalwork as required/Section 225.	CAUTION	
3.14	Spare-Unused Wire - (1) or more cables serving a terminal strip should run leads thru last fanning strip hole and doubled back.	2.31	
3.15	"D" and "well" type terminal strips, - leave spare-unused leads long enough to reach farthest termination point then loop back and secure to form or cable.	2.33	

VERIFICATION ITEMS AND A BRIEF STATEMENT OF THE REQUIREMENT (Cont'd)		REFERENCE	
		PAR. NO.	FIG. NO.
3.16	Connector/protector units - leave spare-unused leads long enough to reach farthest termination point and dispose of per item 3.14.	2.34	
3.17	Fuse panels with fanning strip - leave spare-unused leads long enough to reach farthest fuse position - double back on fanning strip - no contact of ends on metal rivets.	2.35	
3.18	Fuse panels without fanning strip - Leave spare unused leads long enough to reach farthest fuse position - double back on form or cable and secure in place.	2.36	
3.19	Apparatus - spare-unused leads in general should reach farthest termination point.	2.37	
3.20	Unequipped leads at one end having termination points at opposite end should be terminated.	2.41	



SEVERAL CABLES BUTTED AT ONE TERMINAL STRIP

FIG. 1 FANNED FORM FOR A SINGLE TERMINAL STRIP (PAR. 2.12)

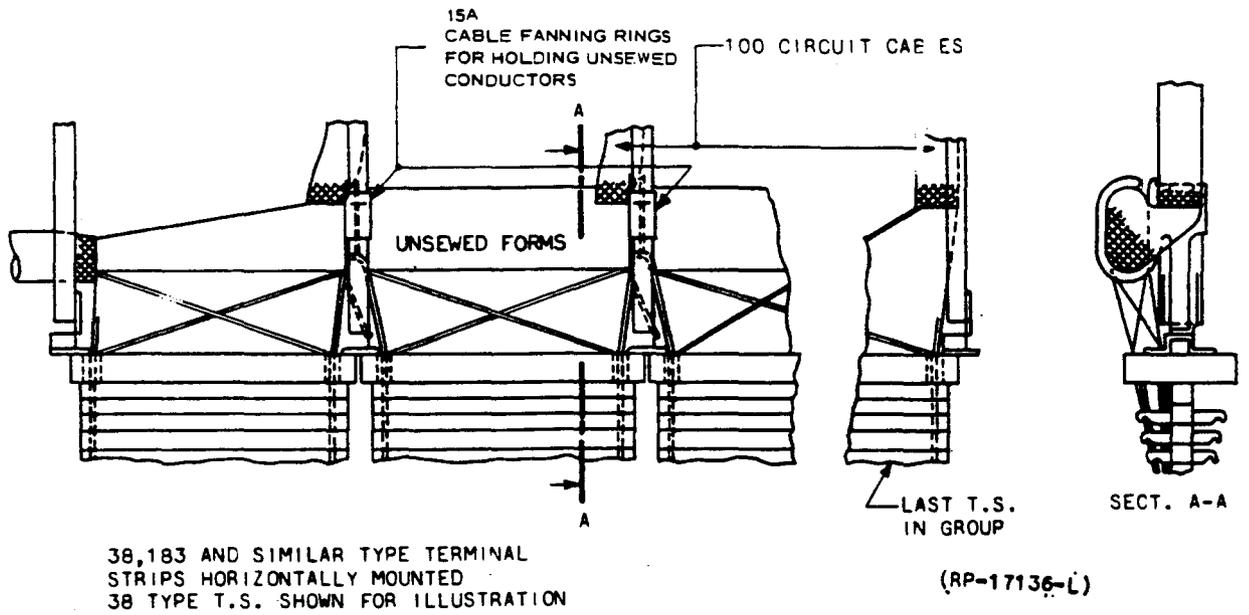


FIG. 2 HORIZONTAL FANNED FORM FOR MORE THAN ONE TERMINAL STRIP - WITH FANNING RINGS (PARS. 2.122, 2.22)

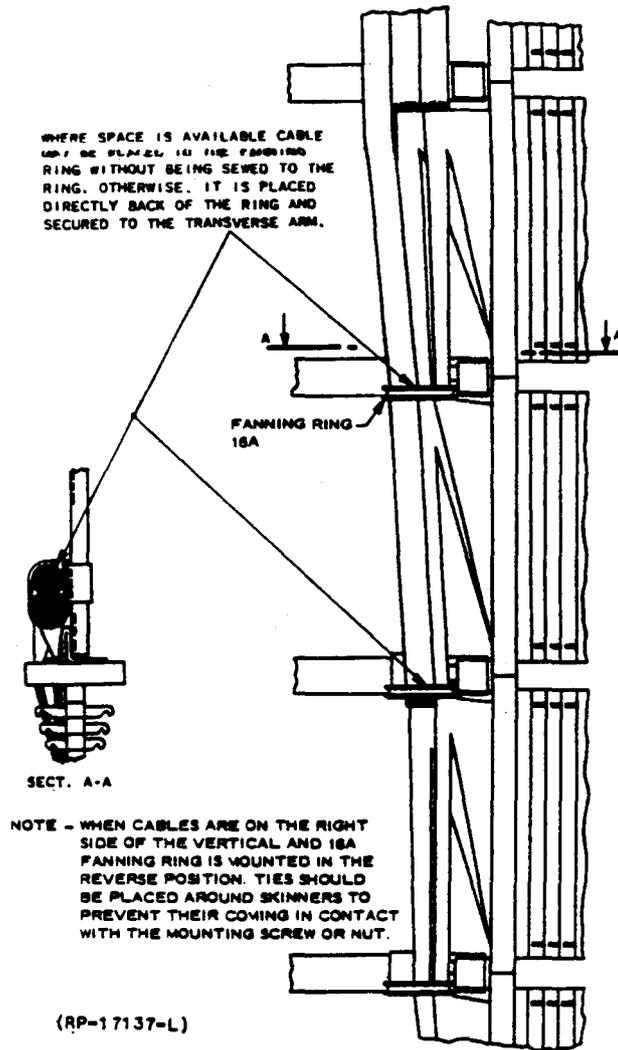


FIG. 3 VERTICAL FANNED FORM FOR MORE THAN
ONE TERMINAL STRIP - WITH FANNING RINGS
(PARS. 2.122, 2.22)

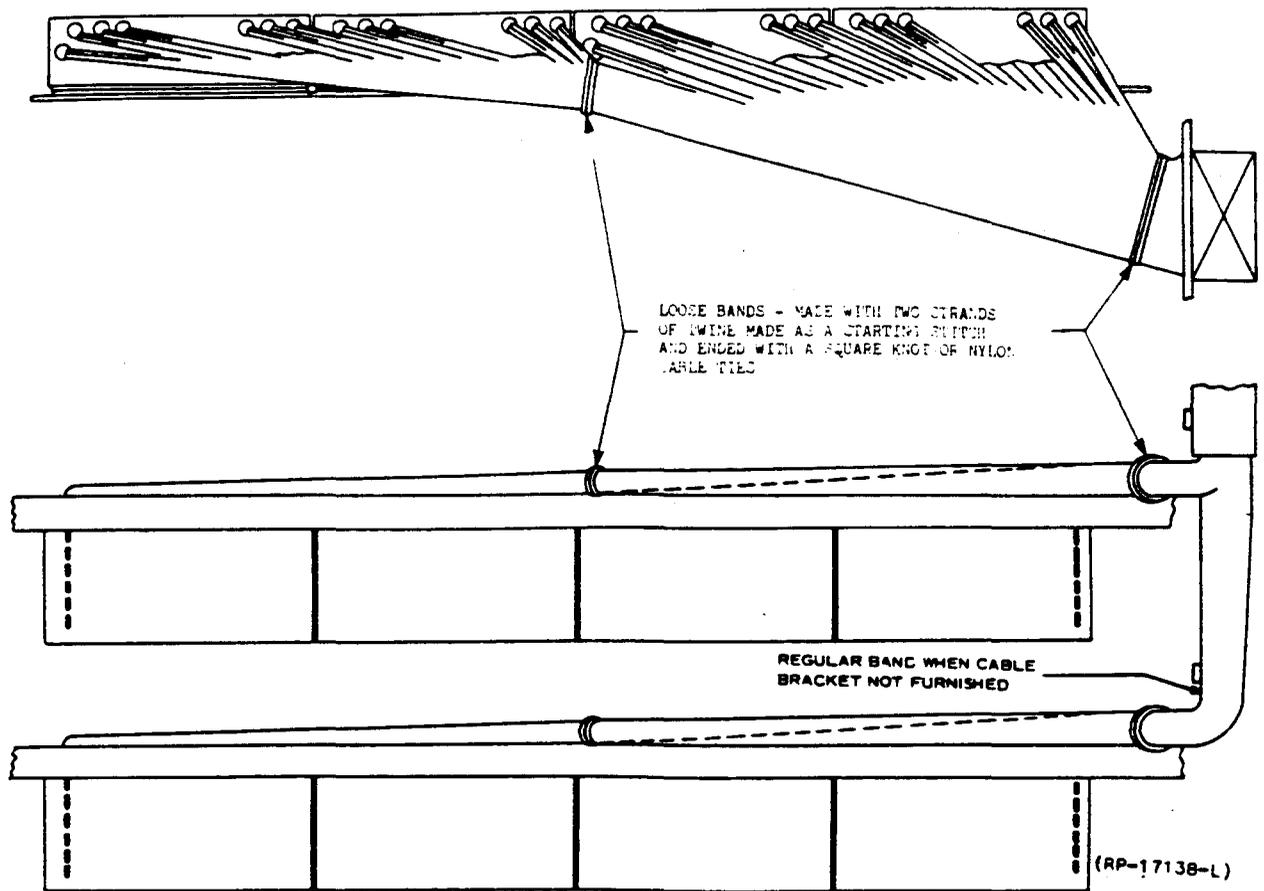


FIG. 4 MULTIPLE TERMINAL STRIPS - WIRING
(PAR. 2.15)

No arrowed lines due to extensive changes.

[Bracket indicates a requirement.

Engineering Planning Manager
(Installation)

Reason for Reissue:
Update information and combine
Sections 210 and 211.