

SECURING CABLE AND WIRE

BASIC INFORMATION

CONTENTS

1.	GENERAL	5.	CABLE ARRANGEMENTS
1.1	Scope of Section	5.1	On Cable Racks
1.2	General Information Pertaining to Arrangement of Tools, Precautions, Verifications, Specs and Drawings and Figures	5.2	At Turns From Cable Racks
2.	INSTALLING EQUIPMENT	5.3	Radii of Cable Bends
2.11	Tools	6.	VERIFICATIONS
2.12	Supplies	6.1	Arrangement of Switchboard Cable and Wire on Racks
3.	PRELIMINARY PLANNING FOR THE SECURING OF CABLES	6.11	Regular Runs
3.1	General	6.12	Miscellaneous Runs
3.2	Cable Clips	6.13	Bending Radii
4.	SECURING CABLE AND WIRE	6.2	Securing of Switchboard Cable and Wire on Cable Racks
4.1	Bar-Type and Modified Ladder Type Cable Rack	6.21	Bar Type Cable Rack
4.2	Ladder-Type Cable Rack		
4.3	Ladder-Type Cable Rack with Snap-On Brackets		

1.	<u>GENERAL</u>	2.11	<u>Tools</u>
1.1	<u>Scope of Section</u>	R-2195	Pliers, Side Cutting 8" (See Note 1)
1.11	This section covers the basic information concerning the securing of cable and wire to all types of cable racks. For detailed information, see other sections of this handbook.	R-2542	Remover, Clip, Cable
1.2	<u>General Information Pertaining to Arrangement of Tools, Precautions, Verification, Specs and Drawings and Figures</u>	R-3208	Screwdriver, Cabinet, 3" (See Note 2)
1.21	Refer to Section 1 of this handbook for information pertaining to these items.	R-2118	Strap, Trunk
2.	<u>INSTALLING EQUIPMENT</u>	R-6443	Cutter, Diagonal
2.1	The tools and supplies generally used for operations covered in the 300 Series are as follows:	R-3209	Needle, Insulated, Cable Sewing
		R-2712	Strap, Web.
		NOTE 1:	For cutting excess from clips when disposing of projecting ends.
		NOTE 2:	For mounting anchor clips.
		2.12	<u>Supplies</u>
		R-2916	Twine
		R-3359	Tape, Gray Plastic Adhesive, 1/2"
		R-3428	Tape, Gray Plastic Adhesive, 3/4"
		RM-583101	Fiber Sheet, Gray, 1/64"
		P-409474	Protection Detail, Fiber Gray (See Note)
		KS-5370	Cable Clips

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SYSTEM EXCEPT UNDER WRITTEN AGREEMENT

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- A-1 Anchor Clips
- SA-S Start Clips
- SD-S Start Clips
- RA-S Regular Clips
- RB-S Regular Clips

NOTE: Gray fiber details P-409474 are furnished on equipment. If necessary, these details may be made of 1/64" gray fiber, RM-591862, or requisitioned from Installation Stockkeeping.

Purchase: Strap Iron for supporting cables, Locally 1/8" x 1" per Figure 8, Section 320.

Purchase: Carpenter's Aprons (See Note) Locally

NOTE: Aprons used to carry clips, clip remover, bolts, nuts and similar items.

3. PRELIMINARY PLANNING FOR THE SECURING OF CABLES

3.1 General

3.11 Plans for securing of cable must be made before cables are run so that anchor clips or cable retaining brackets may be assembled on the racks.

3.2 Cable Clip (KS-5370)

3.21 Cable Clips per KS-5370 are to be obtained prior to the Installation start date.

3.211 Cable Clips can be obtained from Installation Stockkeeping by forwarding an Installer's Requisition.

3.22

The Installer will be responsible for ordering cable clips for existing office additions and new offices.

NOTE: The Installer is required to provide cable clips for securing vertical cable runs in systems designed to have unsecured cable runs (No. 5 Crossbar, etc.).

3.23

The Installer can obtain the required amount of cable clips in either of two ways:

- (a) Kit 86 contains enough clips to secure 120,000 feet of cable.
- (b) When the quantity of cable to be secured does not require a complete 86 Kit or exceeds 120,000 feet, the Installer can compute the approximate amount of cable clips needed by referring to Table A, B, C, and D.

TABLE A

Width Cable Rack	No. of A-1 Anchor Clips Required Per Stock Length of Cable Rack	
	Horizontal	Vertical
5	15	24
10	27	44
12	31	53
15	34	63
20	50	84
25	60	101
30	70	121

TABLE B

RA-S, RD-S CLIP		
NUMBER OF FEET	CLIPS FOR OLD CABLE RACK	CLIPS FOR NEW CABLE RACK
1 to 4,000	100	100
5,000	200	200
12,000	200	200
13,000	200	300
17,000	200	300
18,000	300	400
22,000	300	400
23,000	400	500
27,000	400	500
28,000	400	600
29,000	400	600
30,000	500	600
32,000	500	600
33,000	500	700
35,000	500	700
36,000	600	700
37,000	600	700
38,000	600	800
42,000	600	800
43,000	700	900
46,000	700	900
47,000	700	1,000
49,000	700	1,000
50,000	800	1,000

TABLE B (Cont'd)

RA-S, RB-S CLIP		
NUMBER OF FEET	CLIPS FOR OLD CABLE RACK	CLIPS FOR NEW CABLE RACK
52,000	800	1,000
53,000	800	1,100
57,000	800	1,100
58,000	900	1,200
62,000	900	1,200
63,000	1,000	1,300
67,000	1,000	1,300
68,000	1,000	1,400
69,000	1,000	1,400
70,000	1,100	1,400
72,000	1,100	1,400
73,000	1,100	1,500
74,000	1,100	1,500
75,000	1,200	1,500
76,000	1,200	1,600
77,000	1,200	1,600
82,000	1,200	1,600
83,000	1,300	1,700
87,000	1,300	1,700
88,000	1,300	1,800
92,000	1,300	1,800
93,000	1,500	1,900
95,000	1,500	2,000

TABLE C

SA-S CLIP		
NUMBER OF FEET	CLIPS FOR OLD CABLE RACK	CLIPS FOR NEW CABLE RACK
1 to 9,000	100	100
10,000	100	200
16,000	100	200
17,000	200	200
18,000	200	300
25,000	200	300
26,000	200	400
27,000	200	400
28,000	300	400
33,000	300	400
34,000	300	500
38,000	300	500
39,000	400	500
42,000	400	500
43,000	400	600
49,000	400	600
50,000	500	700
57,000	500	700
58,000	500	800
60,000	500	800
61,000	600	800
65,000	600	800
66,000	600	900
72,000	600	900
73,000	700	900
74,000	700	1,000
81,000	700	1,000
82,000	700	1,100
83,000	700	1,100
84,000	800	1,100
88,000	800	1,100
89,000	800	1,200
94,000	800	1,200
95,000	900	1,200
96,000	900	1,300

TABLE D

SB-S CLIP		
NUMBER OF FEET	CLIPS FOR OLD CABLE RACK	CLIPS FOR NEW CABLE RACK
1 to 14,000	100	100
15,000	100	200
19,000	100	200
20,000	200	200
24,000	200	200
25,000	200	300
34,000	200	300
35,000	200	400
39,000	200	400
40,000	300	400
44,000	300	400
45,000	300	500
54,000	300	500
55,000	300	600
57,000	300	600
58,000	400	600
64,000	400	600
65,000	400	700
74,000	400	700
75,000	500	800
84,000	500	800
85,000	500	900
89,000	500	900
90,000	600	900
94,000	600	900
95,000	600	1,000

4. SECURING CABLE AND WIRE4.1 Bar-Type and Modified Ladder Type Cable Racks

4.11 The cable on Bar-Type, modified ladder type (P33B202), and wide cable rack (841210065), is unsecured and shall be placed in an orderly manner so there will be adequate capacity for all cables. The cables will lie reasonably flat and shall not be pulled to one side of the rack at turns or bends.

4.12 The wires run with unsecured cable shall be banded with two strands of twine approximately every 36 inches.

4.2 Ladder-Type Cable Rack

4.21 Cables are secured to ladder-type cable racks usually by clipping. See Section 310 for details covering clipping.

4.22 There are several conditions where cable is secured to ladder-type cable rack by sewing. See Section 320 in this handbook for details covering sewing.

4.3 Ladder-Type Cable Rack with Snap-On Cable Brackets

4.31 The high and low level transmission leads in carrier systems shall not be secured except to help the cable lay reasonably flat on the rack or at turn off points.

4.32 See Section 140 of this handbook covering detailed information concerning cable rack brackets.

4.33 A more detailed description of the various cable rack types can be found in Handbook 30.

5. CABLE ARRANGEMENTS5.1 On Cable Racks

5.11 The arrangement of the cables on the cable racks will have been predetermined and the cable located in their proper relative position when run in.

5.12 Cables in regular runs are given a predetermined arrangement in the cross-sectional views on the job cabling plan drawings.

5.121 Place oval and flat cables on edge or flat depending on their position as indicated in the cross-sectional views on the cabling drawings. Oval cables will normally be placed on edge unless they terminate in switch-board or desks.

5.13 Cables in miscellaneous runs are not ordinarily given a predetermined arrangement on the job drawing. They are installed in complete layers across the width of the cable rack, except when other arrangements are indicated on the drawings.

5.14 On No. 5 Crossbar break off cables from the cross-aisle racks through both the cross-aisle and over-frame cable rack to the frame upright. Where the cross-aisle racks are continuous as shown in Section 13A, Handbook 30, it is not permissible to run cables on the over-frame racks under the cross-aisle racks as they would interfere with the cables breaking through the over-frame racks.

5.2 At Turns From Cable Racks

5.21 The turning of cables from the cable rack, either through or off the side, is determined when the cables are run, as covered in other sections of this handbook.

5.22 Cables are turned through the cable racks when, under certain specific conditions, the racks are directly over the frames. Figure 1 illustrates the method of arranging and grouping cables brought from the cable rack in this manner.

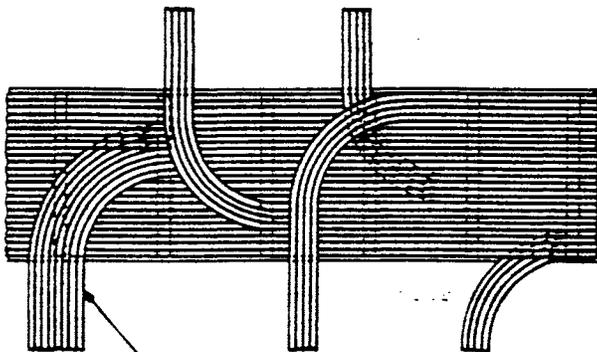
5.23 Cables turned off the side of the cable rack are to be arranged as follows:

5.231 Make square turnoffs as illustrated in Figures 2 and 3. Square turnoffs as illustrated, result in a good appearance with minimum effort.

5.232 Taper the cables across the cable rack, as shown in Figure 4, where cables can be arranged to break off the rack in a uniform manner from the near side of the rack. Tapering the cables across the cable rack at turn-offs results in a good appearance, economical use of cables and a minimum of blocking.



FIG. 1 CABLES TURNED THROUGH CABLE RACK (PAR. 5.22)



CABLES TURNING OFF THE RACK FROM ANY GIVEN LAYER SHOULD PASS OVER THE CABLES OF THE SAME LAYER RATHER THAN UNDER THEM.

RP-11096

FIG. 2 CABLES TURNED OVER SIDE OF CABLE RACK (PAR. 5.231)

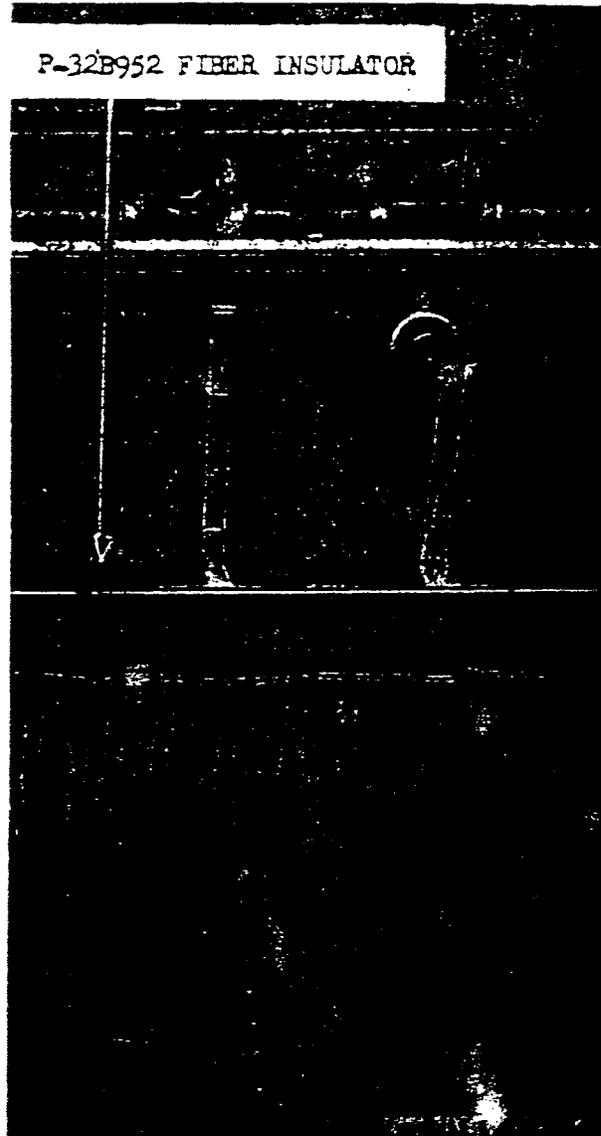
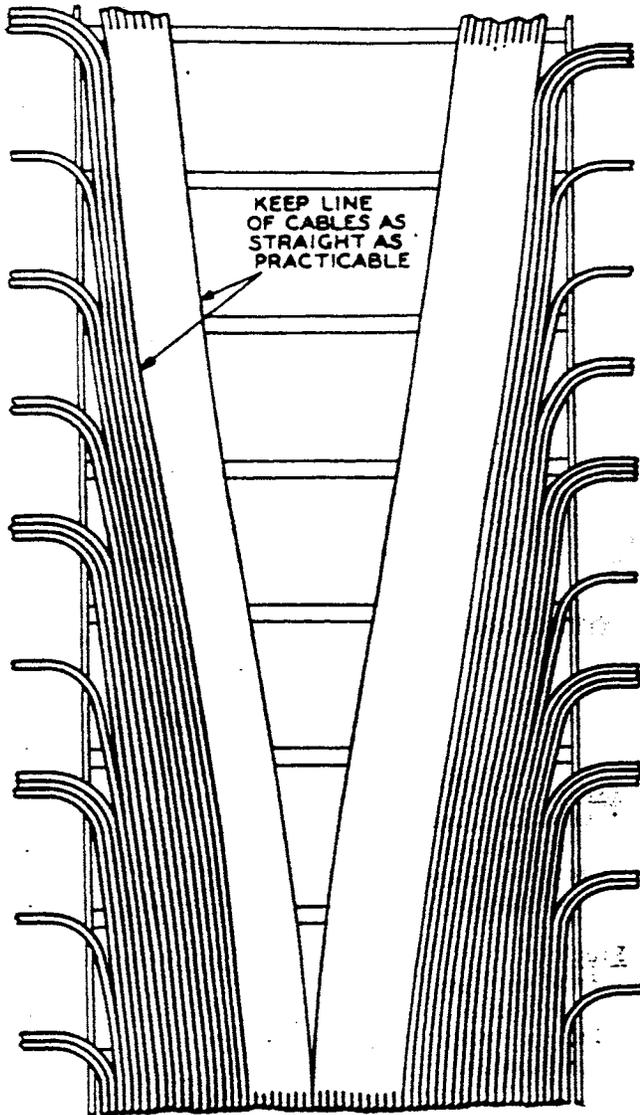
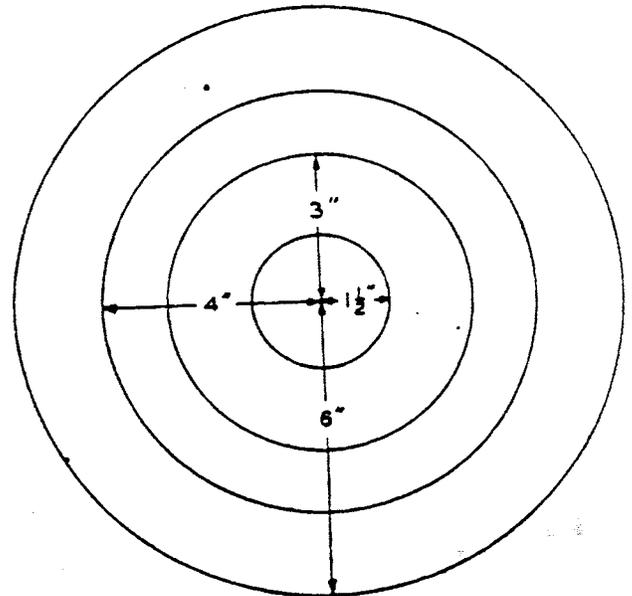


FIG. 3 CABLES TURNED FROM CABLE RACK AT DISTRIBUTING FRAMES (PAR. 5.231)



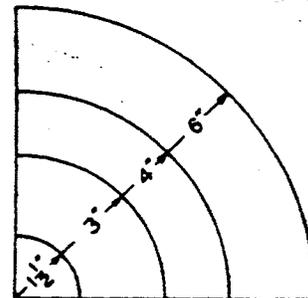
RP-9904

FIG. 4 TAPERED TURNOFF
(PARS. 5.231, 5.232)



RP-12420A-L

FIG. 5 TEMPLATE LAYOUT
(PAR. 5.3311)



RP-12400B-L

FIG. 6 TEMPLATE
(PAR. 5.3312)

5.24 Cables to be turned upward as they leave the cable rack are turned off horizontally and then up so as not to interfere with running other cables.

5.3 Radii of Cable Bends

5.31 Uniformity at all bends, turns and offsets is to be maintained.

5.32 Bends are to be formed gradually by hand so no excessive strain is placed on the cable at any one point.

5.33 Cable Bending Radii Template

5.331 Too sharply bending or twisting a cable during a forming operation will injure the insulation. Install cables so that bends are made on radii that are equal to or greater than the minimum bending radii permitted. A template made of fiber or similar material, (cut to form a quadrant, a quarter of a circle, with its radius equal to the minimum bending radius requirements of the cable) may be used for laying out and measuring bends. Bend the in-

side cable of a run (or the cable having the sharpest bend) to conform to, or fall outside of, the curvature of the template.

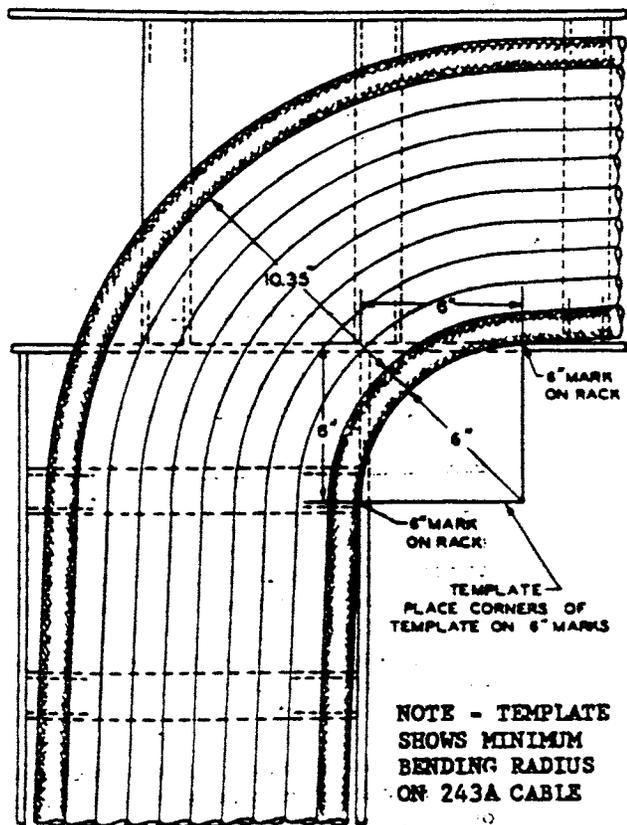
→ 5.3311 To make a template for 243A and smaller cable, cut out a circle with a 6" radius on a piece of fiber or cardboard, as illustrated in Figure 5. At the same time draw circles using the same center point with 4", 3" and 1-1/2" radii.

5.3312 Cut out one-quarter of the circle as illustrated in Figure 6.

→ 5.3313 Now for example, if 243A cable is to be bent around a 90° turn, measure 6" each way from the corner junction point of the cable racks and mark the rack as shown in Figure 7. Then place the template in position, as shown, to form the arc which will be the radius of the cable at the bend.

5.3314 Where the first cable to be laid is on the far side of the 90° angle, add to the minimum bending radius of one cable the width of the other cables which are to go on the rack. Thus if ten 243A cables are to be laid, each cable being 1.1" diameter, add 9 x 1.1" or 9.9" to the 6" template. This will give the location of the inside of the first cable on the far side of the turn.

5.34 All requirements are met when the bending radii shown in Table E are established. If necessary to use smaller radii, reference to Section 100 of this handbook may indicate some leeway on some codes of cables.



TYPE OF CABLE	DIAM	BENDING RADIUS
Round	Up to 1/2"	3"
	Over 1/2" to 1"	4"
	Over 1"	6"
Oval	Bend on Flat of Cable	2"
	Bend on Edge of Cable	3"
Flat	Bend on Flat of Cable	3"
	Bend on Edge of Cable	Less than 1" 6" 1" to 1-1/2" 8" 1-1/2" and Over 12"

TABLE E NORMAL BENDING RADII FOR SWITCHBOARD CABLES (PAR. 5.34)

RP-12419-L

FIG. 7 USING TEMPLATE TO CONTROL BENDING RADIUS (PAR. 5.3313)

6. VERIFICATIONS

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS		REFERENCE	
		Par.No.	Fig.No.
6.1	<u>ARRANGEMENTS OF SWITCHBOARD CABLE AND WIRE ON RACKS</u>		
	6.11 <u>Regular Runs</u>		
(P)	6.111 Cables arranged according to predetermined arrangement in cross-sectional views on job cabling drawings.	5.12	
(P)	6.112 Oval cables normally placed on edge unless they terminate in switchboards or desks.	5.121	
	6.113 Cables on cross-aisle racks run over the over-frame cable rack.	5.14	
	6.12 <u>Miscellaneous Runs</u>		
(P)	6.121 Installed in complete layers across width of rack, except when other arrangement is indicated on cable drawings.	5.13	
	6.13 <u>Bending Radii</u>		
	6.131 Proper bending radii used and uniformity maintained at all bends, turns and offsets.	5.31 5.32 5.34	8
	6.2 <u>Securing of Switchboard Cable and Wire on Cable Racks</u>		
	6.21 <u>Bar Type and Modified Ladder Type Cable Rack</u>		
	6.211 Wires run with unsecured cable are banded with two strands of R-2916 Twine every 36 inches.	4.12	

→ Indicates new or changed information

[Vertical line at side of paragraphs indicates requirements.

Engineering Planning Manager
(Installation)

Reason for Reissue:

Change to reflect Installer furnishing
all cable clips.

SECURING CABLE AND WIRE
MANNER OF SECURING CABLE AND WIRE

CONTENTS

1. GENERAL
 - 1.1 Scope of Section
 - 1.2 General Information Pertaining To Arrangement of Tools, Precautions, Verification, Specs and Drawings, and Figures
2. INSTALLING EQUIPMENT
3. MANNER OF SECURING CABLE
 - 3.1 Clipping on Ladder Type Cable Racks
 - 3.2 Clipping on Vertical or Inverted Cable Racks
 - 3.3 Sewing on Cable Racks
 - 3.4 Securing Switchboard Cable in Power Rooms
 - 3.5 Securing Cable Splices
 - 3.6 Securing Cable To Spiral Turns
4. CLAMPING ON CABLE RACKS
 - 4.1 Clamping on Spiral Turns
- 4.2 Inverted Horizontal Runs By Auxiliary Supports
- 4.3 Vertical Runs By Auxiliary Supports
5. SECURING ON CABLE RACKS WITH CABLE RETAINING BRACKETS
6. SECURING BETWEEN CABLE RACK AND BUTT LOCATION
7. SECURING AT VERTICAL SIDE OF DISTRIBUTING FRAMES
8. SECURING AT HORIZONTAL SIDE OF DISTRIBUTING FRAMES
 - 8.1 Along Transverse Arms With R-4265 Cable Ties
 - 8.2 Under Transverse Arms With U Clips
9. MANNER OF SECURING WIRES RUN WITH SWITCHBOARD CABLE
10. VERIFICATION

-
1. GENERAL
 - 1.1 Scope of Section
 - 1.11 This section contains general basic information, requirements and methods, and reference to the complete information, concerning the manner of securing switchboard cable and wire on cable racks by clipping or sewing.
 - 1.12 All cables on ladder type cable racks, except short multiple cables in switchboards and desks and cables supported by fanning rings or distributing rings, shall be adequately secured to supports, either by means of cable clips or twine.
 - 1.2 General Information Pertaining To Arrangement of Tools, Precautions, Verification, Specs and Drawings and Figures
 - 1.21 Refer to Section 1 of this handbook for information pertaining to these items.
 2. INSTALLING EQUIPMENT
 - 2.1 The tools and supplies normally required for the operations covered in this section are covered in Section 300 of this handbook.
 3. MANNER OF SECURING CABLE
 - 3.1 Clipping on Ladder Type Cable Rack
 - 3.11 Secure cable on cable racks with adjustable flat type clips KS 5370-01 type when furnished, except where special methods of securing are specified.
 - 3.12 Where it is uneconomical to clip because of irregular size of the cable or access to the cable rack is too limited to permit damage to the cable cover, sewing is permitted.
 - 3.2 Clipping on Vertical or Inverted Cable Racks
 - 3.21 Complete groups of cable on all new vertical or inverted racks are to be clipped. Arrange to obtain clips for these racks if they have not been furnished.
 - 3.22 Incomplete groups, except the bottom layer, shall be securely fastened with approved twine.
 - 3.23 Incomplete groups in the first layer of cable on new vertical racks must be clipped.
 - 3.3 Sewing On Cable Racks
 - 3.31 Cable shall be secured by sewing under the following conditions:
 - (a) On additions to runs previously sewed or clipped where the amount of cable to be added, the size, and length of the run or the formation of the present cables would make clipping uneconomical or result in a poor appearance of the finished run.
 - (b) On incompleting groups of cables in vertical and inverted horizontal runs except the layer resting against the cross strap.
 - (c) Where cables turn through the rack, cables are to be sewed to the last cable rack strap, except on clipped runs where this strap is a normal clip location.

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(d) Where cables are not at right angles to supports and the angle is such to make clipping impracticable.

(e) Where cables are fastened to the underside (Flange side) of the rack straps.

(f) At intersections of cable racks where cables meet or cross (sewing permits spreading and arranging cables to prevent excessive piling).

(g) Where no 0 or larger armored cables and runs containing various sizes of armored cables are fastened to the cable racks.

(h) where access to cable racks is considered too limited to permit installing clips with sufficient insurance against incorrect assembly and consequent possible damage to cables.

3.4 Securing Switchboard Cable in Power Rooms

3.41 Secure switchboard cable in power rooms by sewing.

3.42 In rooms containing combinations of Power Equipment Bays and Frames and other than Power Equipment Bays and Frames clipping is not permitted over such equipment where a service hazard exists. Using clips over generator set rectifiers with open tops, generator control bays, batteries etc. is considered hazardous to service. Consideration should be made for future power equipment; these cables should be sewed to reduce the possibility of service hazard in the future.

3.5 Securing Cable Splices

3.51 On the portion of cable runs where present or future cable splices are specified sewing is required.

3.6 Securing Cable To Spiral Turns

3.61 Sewing is required on all spiral and 90-degree double turns.

4. CLAMPING ON CABLE RACKS

4.1 Clamping on Spiral Turns

4.11 Clamps per ED-91987-30 should be provided for spiral cable runs as follows.

4.12 If the vertical cable run turns to a horizontal position near the ceiling of the floor below the one on which the spiral is located in Figure 1, View A, one clamp should be placed immediately above the spiral.

4.13 If the vertical cable run turns to a horizontal position immediately above the spiral the clamp should be placed below the spiral as shown in Figure 1, View B.

4.14 If the spiral is placed in a straight vertical run, so that the run continues the distance between two adjacent floor lines or more beyond the spiral in both directions, a clamp should be placed directly above and below the spiral as shown in Figure 1, View C.

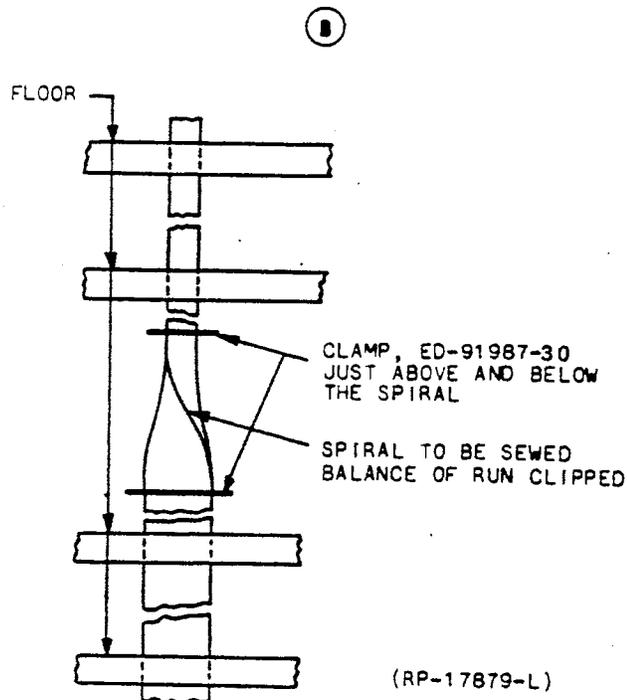
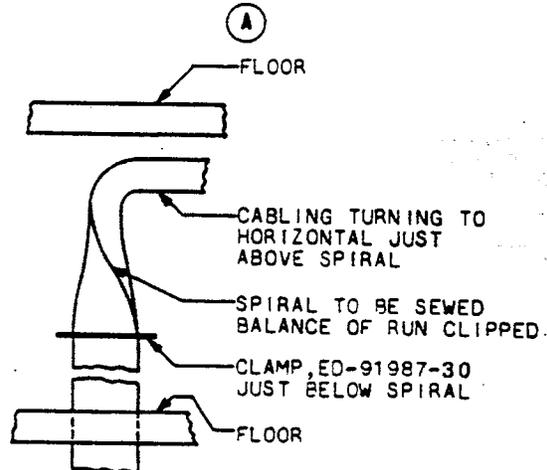
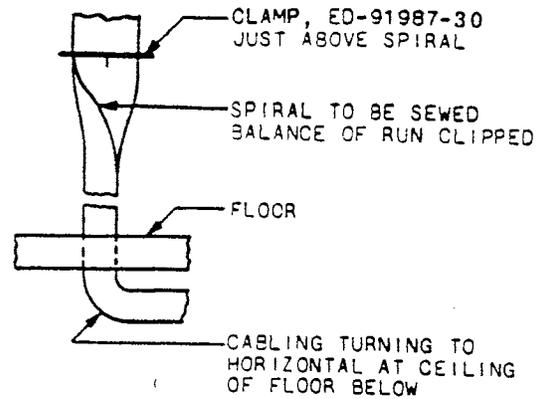


FIG. 1 ARRANGEMENT OF CLAMPS ON SPIRAL CABLE (PARS. 4.11 to 4.14)

1.15 Supplementary clamps are not required on horizontal spirals or 90° double turns.

4.2 Inverted Horizontal Runs by Auxiliary Supports

4.21 Inverted horizontal cable runs are to be equipped with auxiliary supports as shown in Figure 2. These auxiliary supports are to clamp the cables firmly but should not be so tight as to distort the cables.

4.22 Place supports on all underhung sewed runs and on all underhung clipped runs or portions thereof which are three or more clips in depth.

4.23 Space the supports along the run at approximately 10'-0" intervals for runs less than 100 square inches in approximate cross-sectional area and at approximately 6'-0" intervals for larger runs

4.3 Vertical Runs by Auxiliary Supports

4.31 Place auxiliary supports on vertical runs as indicated on cable plan drawings, when furnished in the job specifications. See Figure 2.

4.32 On additions to existing sewed vertical runs, clamps per ED-91987-30, when furnished in the job specification, should be added wherever the pileup including the addition exceeds approximately 4".

4.33 Inverted horizontal cable runs which are three or more clips in depth should be equipped with auxiliary supports.

5. ON CABLE RACKS WITH CABLE RETAINING BRACKETS

5.1 Cables are secured with cable retaining brackets on horizontal cable racks only when called for in the job specifications. Cables placed in cable retaining brackets are not to be otherwise secured except in certain locations such as at turns and intersections where they are to be sewed. See Section 330 of this handbook.

6. BETWEEN CABLE RACK AND BUTT LOCATION

6.1 Cables between the cable rack and the butt location, are to be secured to the supports at frames, bays, racks and switchboards. See Section 340 of this handbook for detail information.

7. AT VERTICAL SIDE OF DISTRIBUTING FRAMES

7.1 Cables on the vertical side of all distributing frames are to be secured with R-4265 Nylon Cable Ties.

8. AT HORIZONTAL SIDE OF DISTRIBUTING FRAMES WITH NYLON CABLE TIES AND U CLIPS

8.1 Along Transverse Arms With R-4265 Nylon Cable Ties

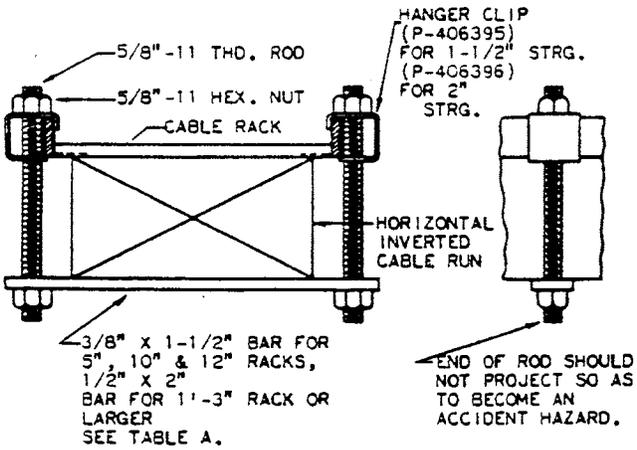
8.11 Cables passing from the vertical side of distributing frames to the terminal strips on the horizontal side are, ordinarily, to be secured to and along the transverse arms with R-4265 Nylon Cable Ties. Refer to Section 340 of this handbook.

8.2 Under Transverse Arms With U Clips

8.21 Cables passing along the horizontal side of distributing frames are, ordinarily, to be secured under the transverse arms with U clips. Refer to Section 340 of this handbook.

9. MANNER OF SECURING WIRES RUN WITH SWITCHBOARD CABLES

9.1 Secure wires run with switchboard cables in the same manner as the switchboard cable with which they are run.



SIZE OF RACK	PIECE PART NUMBER
10"	P-401760
12"	P-411735
1'-3"	P-401761
1'-8"	P-401762
2'-1"	P-401763

TABLE A

FIG. 2 AUXILIARY SUPPORTS (PARS. 4.2, 4.3)

2707E
FZ

10. VERIFICATION

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS	REFERENCE	
	PAR. NO.	FIG. NO.
10.01 Incomplete groups on vertical and inverted horizontal runs secured with approved twine (except bottom layer)	3.22	
10.02 Incompleted groups on the bottom layer of vertical and inverted horizontal runs secured with clips in regular manner using start or regular clips ascending to the size of the group.	3.23	
10.03 Cables at splices are to be secured with twine.	3.5	
10.04 Sewing is required on all spiral and 90° double turns.	3.6	
10.05 If the vertical cable run turns to a horizontal position near the ceiling of the flow below the one on which the spiral is located one clamp should be placed immediately above the spiral.	4.12	1A
10.06 If the vertical cable run turns to a horizontal position immediately above the spiral the clamp should be placed below the spiral.	4.13	1B
10.07 If the spiral is placed in a straight vertical run, so that the run continues the distance between two adjacent floor lines or more beyond the spiral in both directions a clamp should be placed directly above and below the spiral.	4.14	1C
10.08 On inverted horizontal runs equipped with supports cables will be firmly clamped but not distorted.	4.21	
10.09 Supports will be placed on all underhung sewed or clipped runs three clips or more in depth.	4.22	
10.10 Supports will be placed at 10 feet intervals for runs less than 100 square inches in cross-sectional area and at 6 feet intervals for longer runs.		
10.11 Auxiliary supports on vertical runs will be placed as indicated on cable plan drawings.	4.31	2
10.12 On additions to existing sewed vertical runs, clamps will be added whenever pile up including addition exceeds approximately 4".	4.32	
10.13 Inverted horizontal cable runs three or more clips in depth will be equipped with auxiliary supports	4.33	
10.14 Cables are secured with cable retaining brackets on horizontal cable racks only when called for in the job specifications.	5.1	
10.15 Cables between the cable rack and the butt location are to be secured to the supports at frames, bays, racks and switchboards.	6.1	
10.16 Cables on the vertical side of all distributing frames are to be secured with R-4265 Nylon Cable Ties.	7.1	

→ Arrowed lines indicate new or changed information.

[Vertical line at side of paragraphs indicates requirements.

Assistant Manager
Common Installation Engineering

Reason for Reissue:
Extensive change