

**SWITCHBOARD, POWER, AND LOCAL POWER CABLES,
AND LIGHTGUIDE CABLES
INSTALLATION
GENERAL EQUIPMENT REQUIREMENTS**

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AT&T TECHNOLOGIES—PROPRIETARY

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1.04 The AT&T practices listed below contain supplementary cabling requirements and, where applicable, are referred to in other parts of this practice.

- 800-610-164—New Equipment-Building Systems (NEBS) General Equipment Requirements (See also, PUB51001)
- 800-612-153—Forming, Fanning, Sewing, and Skinning Wiring and Cabling
- 800-612-156—Placing, Securing, and Supporting Cable Forms Including Unequipped Forms
- 800-612-162—Selection of Standard Copper and Lightguide Central Office Cables
- 800-612-164—Forming, Grounding, Splicing, and Terminating Shielded Wiring and Coaxial and Twin-Conductor Shielded Office Cable
- 800-614-157—Cable Racks
- 800-614-158—Cable Clips
- 800-614-164—Switchboard Multiple Cabling
- 800-006-151—Cable Hole Sheathing
- 800-006-158—Cableway Systems for Electronic Offices Using 7-Foot Frameworks Equipment Design Requirements—Common Systems
- 800-801-155—Lineup Cable Racks and Cross Aisle Troughs for 7-Foot Framework
- 800-801-182—General Engineering Information—Cable Distribution Systems and Systems Assembly in Electronic Offices Using 7-Foot Frameworks
- 800-001-180—Protective Grounding Systems—General Grounding Requirements for Communication Systems in Central Offices, Radio Stations and Other Structures
- 800-005-180—Assembly and Installation of Power Plant Bus Bar and Wiring

1.05 Cabling associated with 7-foot high equipment that meets NEBS standards should be installed in accordance with AT&T Practice 801-801-182, covering the general engineering information for cable distribution systems and systems assembly in electronic offices using 7-foot frameworks. The Cable Pathways Plan covered in AT&T Practice 801-801-182 coordinates the locations of cabling, lighting, cooling air diffusers/slots, fire detectors, and various building elements over the life of the equipment building system. To achieve the full benefits of this plan, it should be incorporated into the early stages of planning an office and the path-

ways should be indicated on central office record drawings.

1.06 In the layout of cable racks and the routing of cables, critical lead length and cable segregation requirements for the equipment systems involved shall be satisfied. Congestion of the cable racks shall be avoided and cable length shall be minimized. To control fire and smoke propagation in the event of a fire, interfloor cable holes must be properly closed and fire stopped, and consideration shall be given to minimizing the number of cable holes opened during the installation intervals, consistent with any established plan that may exist for cabling the office. The following guidelines apply to the layout of cable distribution systems and to the routing of cables in both new offices and additions:

- (a) Equipment system requirements governing critical lead length and cable segregation shall be met.
- (b) Congestion of cable racks shall be avoided.
- (c) Cable distribution systems shall be installed in agreement with any established plan for the offices. In particular, for offices meeting NEBS standards per AT&T Practice 800-610-164, the Cable Pathways Plan shall be followed as described in Section 801-801-182.
- (d) When making additions to existing central offices, the adjustable ceiling closure plate (ED-92116-73), if ordered, shall be installed in the cable holes opened during the installation.
- (e) The cable pileup on all vertical cable runs shall be limited so that it is not closer than 3 inches to the side of the cable hole, thus providing the clearance necessary to properly pack the hole with KS-5048 bags. See AT&T Practice 800-006-151.
- (f) In additions to existing central offices, cables shall be routed so as to minimize the number of cable holes to be opened, consistent with items (a) through (e) above. Rerouting of cables, at the expense of extra cable length up to the limits tabulated on Table A, is cost-effective.
- (g) In new offices, the planning and layout of the cable distribution system, including vertical cable runs for the ultimate office, should include provision for growth and seek to minimize

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the number of holes required to be opened during a single installation job, consistent with the requirements of items (a) through (e) above.

TABLE A

CABLE LENGTH LIMITS

[See paragraph 1.06(f)]

TYPE OF CABLE RUN	ADDITIONAL CABLE FOR INSTALLATION* (FEET)
Switchboard	75
Power	30

2. ARRANGEMENT OF CABLE AND WIRE

2.01 Regular cable runs consist of a large group of cables or wires, usually of the same code and for a particular group of circuits. The individual cables or wires are arranged on the cable rack in a predetermined order as indicated by cross-section on the cable plan drawing.

2.02 Semiregular cable runs are runs where groups of cables or wires on a cable rack are given a predetermined location on the rack as shown by a cross-section on the job cabling drawing. A semiregular run may consist of regular groups (shown by a cross-section giving individual cable arrangements) and miscellaneous groups (described in paragraph 2.03), or the groups may consist of cables or wires for a particular group of circuits and miscellaneous cables as shown in a cross-section without individual cable arrangements.

2.03 Miscellaneous cable runs consist, in general, of cables or wires that are run one layer at a time (or one clip in height) completely across the cable rack before the next layer is started, without regard to code, shape, or size of the cables or wires.

*It is economical to increase the total amount of cable in a run by this amount to avoid opening a cable hole. For example, for a switchboard cable run of 5 cables, it is economical to increase the length of the runs up to 75 feet (15 cable feet/5 cables) to avoid opening a cable hole equipped with an adjustable cover.

3. HANDLING AND PROTECTION OF CABLE AND WIRE

3.01 Cables and wires shall be handled carefully so as not to alter their normal shape and condition.

3.02 Cables and wires shall not be twisted or bent in such short distances so as to injure the cable or wire covering. See 4.01

3.03 Lightguide cables shall not be pulled, twisted, or kinked, Minimum bending radii, covered in AT&T Practice 800-612-162, shall be adhered to throughout the entire run. Lightguide cables that are kinked or otherwise damaged during handling or installation shall be replaced. Damaged cables should be discarded promptly to avoid accidental use.

3.04 Cables and wires shall be protected where they bend around or come in contact with sharp edges or corners of supports, cable rack straps, stringers, threaded rods, or other framework parts. Cables and wires shall also be protected where they may ultimately come in contact with the corners of rack feet at cable holes and the tops of rack horns at intersections.

(a) Gray, vulcanized, 1/64-inch thick sheet fiber, COMCODE 995831011 shall be used for protecting the wire or cable from contact with the metal work. The fiber is applied, where practicable, to the framework parts rather than to the cables or wires.

(b) Where the protection is to be applied to the cables or wires, split rigid polyvinyl chloride (PVC) tubes per AT&T Practice 800-612-156 may be used instead of sheet fiber.

3.05 Cable or wire runs shall be protected at all outside turns and offsets where the radius of the turn or offset at the points of contact with the cabling is 5 inches or less.

3.06 *Cables resting on the edge of auxiliary framing bars, channels or cable rack stringers, and cables offset over the edge of cable rack stringers less than 3 inches* do not require protection except as covered in paragraphs 3.08 and 3.09.

3.07 Cable or wire runs 4 inches or more in ultimate depth shall be protected at points of contact with the underside (flange side) of the cross-straps of inverted sections of the cable rack. This shall also apply to vertical runs where the cable is in contact with the flange of the cable rack strap.

3.08 Cables or wires turning off ladder-type cable rack shall be protected with P-32B952 insulators as shown in Fig 1. The U-shaped insulator fits over the length of stringer between cross-straps with a flap extending to cover the stringer at the cross-strap. The insulator requires no tying.

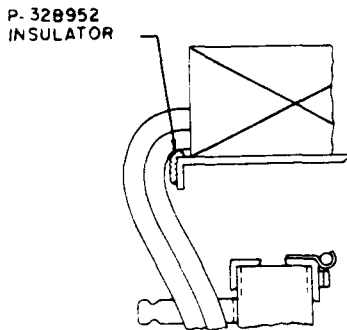


Fig 1—Typical Application of Fiber Insulator for Protection of Wire and Cable Turning Off Ladder-Type Cable Rack

3.09 Cables or wires turning off bar-type cable racks shall be protected by U-shaped insulator P-40B642 placed over the cable rack stringer between the upright bars at points where cables or wires turn off the rack. The insulator is also required on over-aisle and over-frame cable rack stringers that pass under cable runs turning into cross-aisle cable racks at the same level. The insulator P-40B642, being self-retaining when mounted, requires no tying.

- (a) Insulators are not required over the tops of cable rack stringer splices or clamps.
- (b) Insulators are not required over the tops of power cable brackets having an insulating finish.
- (c) Insulators are not required over stringers of over-aisle and over-frame cable racks that

pass under cable runs turning into cross-aisle racks that are raised 2 inches.

3.10 Gray, vulcanized, 1/64-inch thick sheet fiber COMCODE 995831011, shall be provided on ladder- and bar-type cable racks as follows:

(a) **On the ladder-type cable rack**, the sheet fiber protection shall be provided on the cross-straps when the bottom layer of cables or wires bends over the cross-straps and drops through the rack.

(b) **On the bar-type cable rack**, the sheet fiber protection or R-4254 PVC insulators shall be provided on the end of the plate at intersections of over-aisle and cross-aisle racks when the bottom layer of cables or wires bends over the end of the plate and drops through the rack.

3.11 Switchboard cable splices on cable racks made with 710- or 711-type connectors shall be protected in accordance with ED-94964-10 or ED-2C531-10, respectively. Such splices shall be staggered to avoid pile-ups on cable racks. The splices shall be located near the outer edge of racks, where practicable, so that they are accessible for maintenance.

3.12 Rubber- or neoprene-insulated power wire (such as the KS-15141, KS-15143, and KS-20195 types) and KS-20291 hypalon-insulated wire sewed or clipped on the ladder-type cable rack, shall be wrapped with gray, vulcanized, 1/64-inch thick sheet fiber to prevent the twine or the clips from cutting into the wire. Rubber-insulated power wire and cable having a fabric jacket (such as the KS-5482-01 and KS-20189 types), and hypalon-insulated power cable (such as the KS-21155 type) shall be wrapped with fiber only when they are clipped.

3.13 The PVC-insulated conductors of KS-13385 and similar type wire need not be protected when tied or bonded together with twine or cable ties. However, in power systems applications where such wire is to be secured to metalwork, it shall be protected from contact with the metalwork and twine or cable tie by wrapping 1/64-inch thick sheet fiber around the wiring.

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4. MINIMUM RADII FOR BENDING CABLE AND WIRE

4.01 The minimum radii for bending cable and wire shall be as specified in the applicable AT&T Practice listed below. Wherever possible, cables and wires should be bent on radii larger than the minimums specified in the practices.

Switchboard and Lightguide Cables	800-612-162
Shielded Wire, and Coaxial and Twin-Conductor Shielded Office Cables	800-612-164
Power Wire and Cable	802-005-180

5. PLACING, SECURING, AND SUPPORTING CABLE AND WIRE

A. Placing and Securing Cable and Wire

5.01 All cables and wires shall be installed and positioned so that they will not interfere with future equipment additions.

5.02 Single fiber and duplex lightguide cables run on cable racks shall be segregated from copper central office cables (switchboard cables) to avoid placement of copper cables on top of lightguide cables. Quaded lightguide cables, such as the 1802A type need not be segregated from switchboard cables.

5.03 Unsecured cables or wires on bar-type cable racks shall be placed in an orderly manner so there will be adequate capacity for all cables planned for the run. The cables and wires shall lie reasonably flat on the rack and shall not be pulled all to one side of the racks at turns and bends.

5.04 The storing of excessive lengths of cable or wire on the rack shall be avoided, as such excesses increase the height of the pileup, represent a waste of cable, and have a tendency to block the run and prevent adding cables on additions.

5.05 Slack storage of lightguide cables run on cables racks shall be as follows.

(a) For single or duplex fiber lightguide cables run on ladder-type cable racks, the excess cable shall be coiled onto a slack storage reel mounted on the cable rack as indicated on drawing ED-97868-11. Where required, the storage reel may be similarly mounted on the cable horn brackets of bar-type cross-aisle racks.

(b) Storage of fiber optic cable slack for 5ESS* cable racks shall be in accordance with drawing ED-50518-10.

(c) Quad-fiber lightguide cables, such as the 1802-type which are run on cable racks with switchboard cables, may be coiled in the rack to take up the slack.

5.06 *Paired telephone leads and power wiring* shall be installed in accordance with the requirements of AT&T Practice 802-005-180 and this practice.

5.07 *Type AM or DH wire, and shielded wire in the form of sewed local power cables, small groups of loose wires, or single wires* shall, where run with switchboard cables, be secured in the same manner as those cables. They may be fastened under the same clips or stitches as the cables, or separately, as required.

5.08 Loose wire and shielded wire run with switchboard cable shall, as far as practicable, be placed in the interior of the run.

5.09 Except as noted in 5.10 through 5.14, all cables and wires shall be adequately secured to supports either by means of cable clips or by sewing with twine (see **6. SEWING CABLE AND WIRE**). Where cable clips are used, they shall be installed in accordance with AT&T Practice 800-614-153.

5.10 Multiple cabling of switchboards and desks shall be treated as specified in AT&T Practice 800-614-164.

5.11 Cables or wires supported by distributing rings or fanning rings do not require additional support.

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5.12 *In general, coaxial cables and twin-conductor shielded office cables* (balanced pairs) shall not be tied or clipped to the cable racks or frameworks to preserve the transmission characteristics of the cables and their separation as much as possible. Where they must be tied or clipped to hold them in place, they shall not be tied or clipped so tightly as to deform the cables and, thus, adversely affect their electrical characteristics. Ties or clips shall be spaced as widely apart as possible, consistent with holding the cables in place.

5.13 Lightguide cables shall not, generally, be tied or clipped to cable racks, cable brackets, or other framework details. Where it is necessary to secure the cables in order to hold them in place or in formation, they may be taped to adjacent cabling, or they may be tied with twine to the cable rack or framework details. However, where the cables are to be tied, they shall be protected from contact with the twine and the metalwork by wrapping the cables with RM-583101, 1/64-inch thick sheet fiber. Although protected, the cables shall not be tied so tightly as to cause the fiber protection to deform the cables since deformation of the cables could adversely affect the transmission characteristics of the glass fibers.

5.14 *Cables or wires on horizontal resting runs on bar-type cable racks* (including inclined runs up to 45 degrees), and on cable racks with snap-on cable brackets (such as those used to separate high- and low-level transmission leads in carrier systems) shall not be otherwise secured, except at turn-off points where the cables or wires shall be sewed to other cables or wires or to the uprights on the rack to hold them in place if they cannot otherwise be made to lay reasonably flat on the rack.

B. Supporting Cable and Wire

5.15 All cables and wires shall be securely supported so that there will be no appreciable sag in the cabling, or undue strain on skinners, connections, or apparatus.

5.16 *Flexible steel conduit and KS-5497-01 and KS-20785 armored cable* shall be supported in accordance with AT&T Practice 802-005-180.

5.17 *At turns or junctions of horizontal resting runs* where the turn of the cables

or wires is such that proper support for the cables or wires is not provided by the cable rack straps, 1/8-inch by 1-inch bars are placed diagonally across the rack in a manner to support the cables. These bars shall be fastened securely to the cable rack by sewing with twine.

5.18 *Cables or wires leaving cable racks and entering switchboards, frames, racks, and other equipment* shall be supported so that there will be no appreciable sag in the cabling. Cables or wires shall not be unsupported for a distance greater than 2 feet measured along the shortest cable between the last support on the cable rack and the first support on the switchboard, frame, rack, or other equipment, except as follows:

- (a) *Where cabling or wiring to a distributing frame passes through a floor slot immediately under the frame*, an unsupported length of not more than 4 feet measured along the shortest cable is permissible.
- (b) *Cabling or wiring entering a distributing frame from a cable rack at the top of the frame* may be unsupported at the turn for a distance not exceeding 3 feet.
- (c) *Vertical cables or wires in slots or holes, where the rack does not extend through but is terminated at the floor and ceiling*, do not require support within the slot or hole.
- (d) *Installer-run cables entering the cable duct of duct-type bays* do not require support within the duct.
- (e) *Power cables No. 00 or larger turning from one horizontal rack to another, or into a frame or bay*, may be unsupported at the turn for a distance not exceeding 3 feet.
- (f) *Where power cables or wires drop from cable racks onto battery posts, counter electromotive force (CEMF) cells, and details at battery stands and racks*, support is not required.

5.19 *Power cables No. 00 and larger turning upward from a horizontal to a vertical rack* shall be installed on a rack having a

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45-degree section at the turn. If the uninterrupted rise exceeds two floors, the cross-straps shall be removed from the angle section. The first strap in the horizontal portion of the run shall be covered with a P-68616 fiber insulator.

5.20 Cables that are run parallel to the transverse arms at the horizontal side of the distributing frames shall be secured to the transverse arms with cables ties or twine as follows:

- (a) On arms 5 inches or less in length, place a tie at the cable butt.
- (b) On arms over 5 inches but less than 9 inches in length, place a tie midway between the butt and turn of the cable. Where fanning rings or distributing rings are not provided, also place a tie at the butt.
- (c) On arms 9 inches to 1 foot 6 inches in length, place a tie as near to the turn of the cables as practicable and another close to the butt. Where fanning rings or distributing rings are provided, also place a tie at the butt.
- (d) On arms longer than 1 foot 6 inches, place a tie as near to the turn of the cable as practicable, either on the horizontal or vertical side of the upright; place a second tie midway between the butt and turn; and place a third tie close to the butt. Where fanning rings or distributing rings are not provided, also place a tie at the butt.

C. Auxiliary Supports for Cable and Wire Runs

5.21 Inverted horizontal cable or wire runs shall be equipped with auxiliary supports as shown in Fig 2. These auxiliary supports shall clamp the cables or wires firmly, but shall not be so tight as to distort the cables. The supports shall be placed on all underhung sewed runs and on all underhung clipped runs or portions thereof, which are three or more clips in depth. The supports shall be spaced along the run at approximately 10-foot intervals for runs less than 100 square inches in approximate cross-sectional area, and at approximately 6-foot intervals for larger runs.

5.22 Vertical switchboard cable runs extending through more than two floors shall be clamped in accordance with ED-91987-30. All clamps shall be installed to accommodate the max-

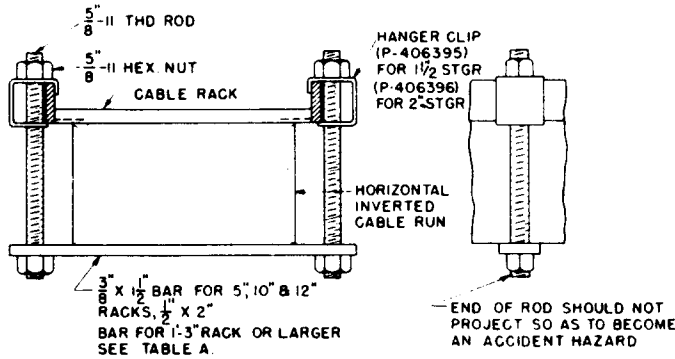
imum pileup of cable or wire. Where it is necessary to install additional cables or wires on an existing sewed vertical cable run, the runs shall be reinforced with cable clamps per ED-91987-30 if the cable or wire pileup, including the additions, exceeds 4 inches. The cable clamps are made to fit various widths of racks and depths of cable and shall be installed as specified on ED-91987-30.

5.23 Vertical power cable or wire runs extending through more than two floors (in excess of the distance from the basement ceiling to the second floor ceiling, or equivalent) shall be clamped in accordance with ED-91127-70 or ED-91129-70. Such runs shall be secured as follows:

- (a) Where the runs are in exposed locations (for example, through cable slots in terminal or switchrooms), one set of clamps shall be installed per floor located near the ceiling in each case, as shown in Fig 3. In addition, the cables or wires shall be sewed or clipped at each alternate cable rack strap.
- (b) Where the runs are located in shaftways or other enclosures, two sets of clamps shall be installed per floor, one just above the cable hole sheathing and the other about halfway up to the ceiling, but, in no case, less than 7 feet above the floor as shown in Fig 4. No sewing or clipping will be required in the vertical portion of the run for this condition.

5.24 Exposed vertical power cable or wire runs from unsecured horizontal runs shall be supported with power cable clamps in accordance with ED-91127-70 or ED-91129-70, in addition to the regular clipping or sewing, if the run passes through one or more floors. The power cable clamps shall be located as shown in Fig 3 and 4 for exposed and enclosed runs, respectively.

5.25 Vertical power cable or wire runs shall be limited to three floors. If the runs exceeds three floors, a horizontal section at least 20 feet long shall be introduced at intervals not exceeding three floors. This may be accomplished by using offset vertical shafts in the general direction of any horizontal travel or by using a horizontal loop if the same shaft must be used. The horizontal section between vertical sections shall be sewed or clipped in accordance with standard procedures.



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 for Inverted Horizontal Cable Runs

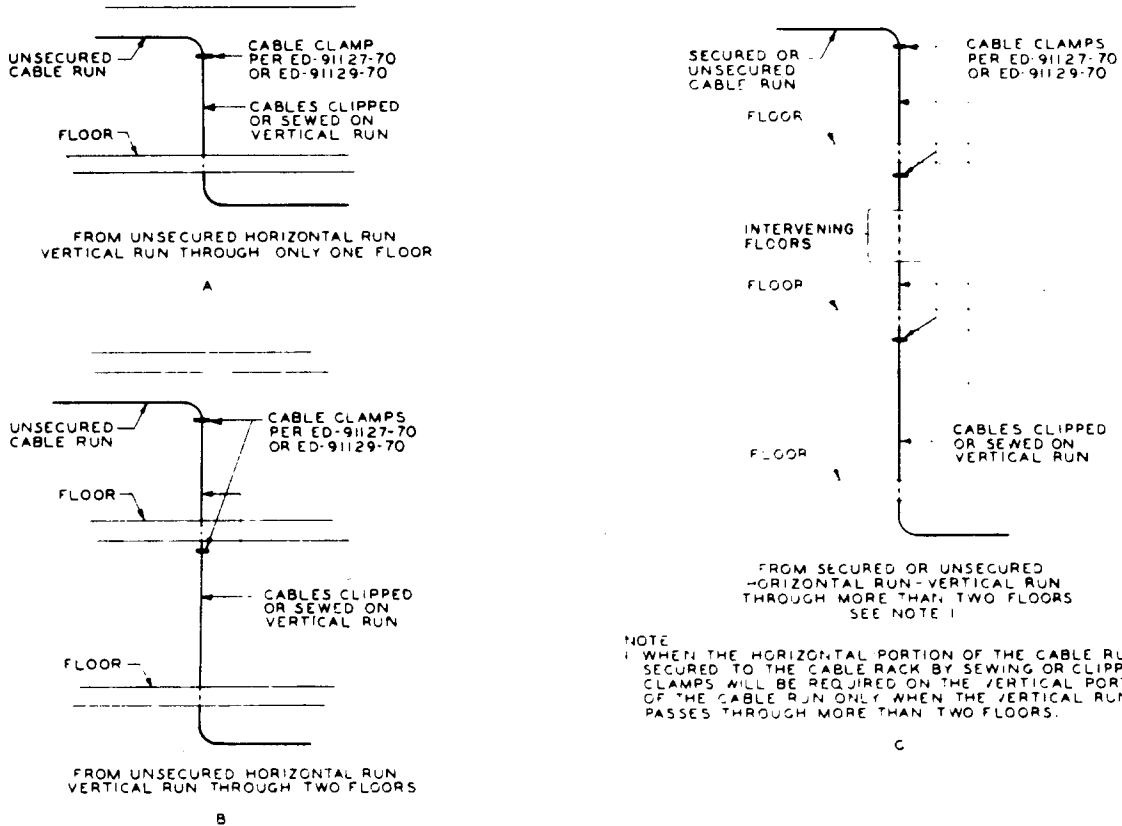
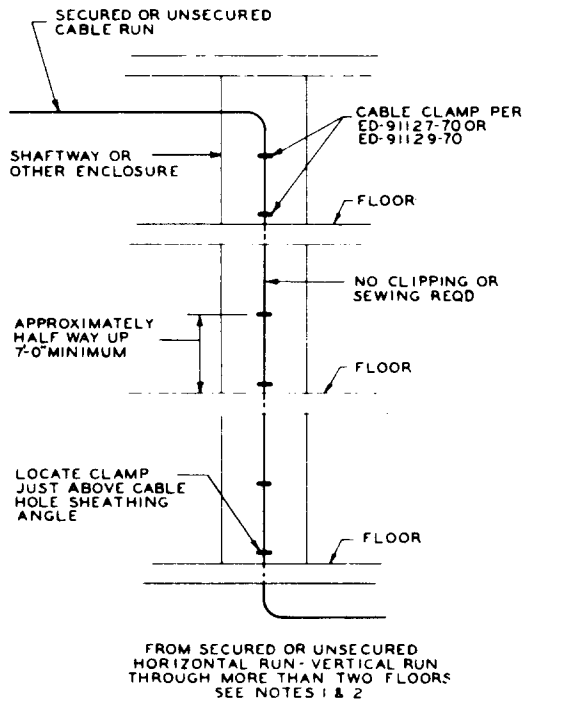


Fig 3—Vertical Power Cable Runs in Exposed Locations—Location of Clamps

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- NOTES:
1. WHEN THE HORIZONTAL PORTION OF THE CABLE RUN IS SECURED TO THE CABLE RACK BY SEWING OR CLIPPING, CLAMPS WILL BE REQUIRED ON THE VERTICAL PORTION OF THE CABLE RUN ONLY WHEN THE VERTICAL RUN PASSES THROUGH MORE THAN TWO FLOORS.
 2. WHERE THE HORIZONTAL PORTION OF THE CABLE RUN IS UNSECURED, CLAMPS, AS SHOWN, WILL BE REQUIRED ON THE VERTICAL PORTION OF THE RUN IF THE RUN PASSES THROUGH ONE OR MORE FLOORS.
 3. SEWING OR CLIPPING AT EVERY CABLE RACK STRAP IS REQUIRED ON VERTICAL PORTION OF THE CABLE RUN IF THE RUN PASSES THROUGH ONE OR TWO FLOORS AND IS NOT CLAMPED.

Fig 4—Vertical Power Cable Runs in Shaftways or Other Enclosures—Location of Clamps

6. SEWING CABLE AND WIRE

A. General

6.01 Cables and wires shall be secured to ladder-type cable racks by sewing, as specified in this part of the practice, or where practicable, by clipping in accordance with AT&T Practice 800-614-158. Paragraph 6.03 gives the conditions where clipping would be impracticable, and the cables shall be sewed.

6.02 Cables or wires may be clipped to cable brackets and similar type wiring supports when such parts are suitable for the attachment of clips. In some cases, it is permissible to band the cables or wires to the cable brackets or supports

with KS-20986 L1, L2, or L3 nylon cable ties. These applications are covered in 7. **BANDING AND SECURING CABLE OR WIRE WITH CABLE TIES.**

6.03 Applications in which the cable or wire runs shall be sewed rather than clipped are specified below:

- (a) Where the runs are not at right angles to the supports and the angle is such as to make clipping impractical.
- (b) In that part of the run where present or future cable splices are specified.
- (c) Along irregular runs where the number and irregular size of the cables or wires make it impractical to obtain a satisfactory clipping arrangement.
- (d) On incomplete groups of cables or wires in vertical or inverted horizontal runs, other than in the layer resting against the cross-strap.
- (e) At intersections of cable racks where the runs meet or cross. (Sewing permits spreading and arranging the cables to prevent excessive piling.)
- (f) On additions to runs previously sewed or clipped, where the amount of cable or wire to be added, the size and length of the run, or the formation of the existing run would make clipping impractical or result in a poor appearance of the finished run.
- (g) At certain locations, such as turns and intersections, where the cables or wires are placed in cable brackets.
- (h) Where the cable or wire runs turn through the rack. The runs shall be sewed to the last cable rack strap, except on clipped runs where this strap is a normal clip location.
- (i) Where cables or wires are fastened to the underside (flange side) of the cable rack straps.
- (j) For original installations of small private branch exchanges (PBXs), dial, and No. 11 switchboards involving fewer than 500 lines; for No. 12 switchboards; and for other installations (such as automatic message accounting centers

and radio relay equipments) where the small number of cables or wires or the irregular size of the cables or wire makes clipping impractical.

(k) Where the butt location of a cable or wire is between brackets or where the cable or wire is inadequately supported by brackets. The cable or wire shall be secured at the butt by sewing it to adjacent cables or wires.

(l) Where fanning rings are used at butt locations on frames other than at distributing frames where the cable butt is placed within the ring (such as on shelves in step-by-step systems). The butt shall be secured to the inside of the fanning ring.

(m) Where cables or wires are butted inside a U-shaped bracket. They may be sewed with twine to the bracket at the butt.

(n) Where groups of cables or wires of varying sizes are fastened to the transverse arms of distributing frames, or to the outside of cable brackets on line distributing frames (LDFs) and traffic register distributing frames (TRDFs).

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

(p) In power rooms or over power equipment (such as open-type battery stands and racks, rectifiers, etc), where such equipment is located in other than power rooms.

6.04 Nine-ply waxed polyester twine per Material Specification 59092 shall be used for sewing installer-run cables and wires.

6.05 When cables or wires are to be secured by sewing them to the cable rack or other supports, the following requirements shall be met:

(a) The cable or wires shall be sewed compactly so that they will not occupy a greater space than is allotted for the particular cable run.

(b) The Kansas City stitch (shown in Fig 5) shall be used when sewing cables or wires to cable rack straps, cable supports, cable brackets, or fanning rings.

(c) The Chicago stitch (shown in Fig 6) shall be used at unsupported turns and also on groups of cables or wires between the cable rack and the first support where the distance between the points or the fan arrangement of the cables or wires is such that they would tend to spread and result in a poor appearance.

(d) Where small groups of cables or wires, or local power cables are fastened to brackets or other supports and restricted to a specific area or form (such as at the transverse arms of distributing frames) the Chicago stitch (Fig 6) shall be used.

(e) Wire run with unsecured cable on bar-type cable racks shall be banded together or to an adjacent cable with two strands of 9-ply twine made as a starting stitch and ending in a square knot at intervals of approximately 6 feet to hold them in place and to prevent their spreading over the cable rack.

(1) Intermediate ties shall be applied to secure the loose wires where it appears that the wires might have a tendency to curl, droop, or spread, or where the wires tend not to stay reasonably parallel to the cable or cables with which they are run.

(2) Ties shall also be applied at those points where the wires change direction, such as at turns, or where they enter or leave the cable rack.

(3) On short runs of loose wire where one tie would normally be used to secure the straight portion of the run, the tie shall be approximately centrally located between the turnoffs.

(f) Where cables or wires are of different sizes and break off a miscellaneous run on bar-type cable racks, they shall be secured with a modified Chicago stitch using only one pass through the cables or wires with 9-ply twine as shown in Fig 7. The cables or wires shall be split into two equal groups when coming from one direction. When the cables or wires feed from both directions, they shall be split into two groups according to the direction from which they are run.

(g) When performing cables or wires before a frame is in position, a Chicago stitch shall be

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placed around the entire group approximately 1 inch above the butt, as shown in Fig 6. When securing preformed groups of cables or wires at butt locations, a Chicago stitch shall be placed around the cables or wires and cable bracket, as shown in Fig 8.

(h) The ending stitch for the Kansas City stitch is generally the Hawthorne knot, except where a single group of cables or wires requires a more secure fastening, in which case a square knot shall be used, as shown in Fig 5.

(i) The ending stitch for the Chicago stitch is the square knot shown in Fig 6.

B. Sewing Horizontal Switchboard Cable Resting Runs

6.06 When cables or wires or horizontal resting runs are to be sewed, they shall, in general, be sewed at every third strap, except at turns where they shall be sewed at such intervals as will insure that the cables retain their proper positions. The outer layers of cables or wires of small diameter, which may tend to bulge and sag, shall be sewed at closer intervals. Use two strands of 9-ply twine for sewing cables or wires on horizontals resting runs.

6.07 Table B gives the maximum number of switchboard cables of the same size to be included under one stitch in sewing horizontal resting runs.

C. Sewing Vertical Switchboard Cable Runs or Inverted Horizontal Switchboard Cable Runs

6.08 When it is impractical to clip cables on vertical runs or inverted horizontal runs, the cables shall be sewed to the rack at every strap. Two strands of 9-ply twine shall be used for sewing inverted horizontal runs, which will be less than 8 inches in ultimate depth, and for all vertical runs.

6.09 Four strands of twine shall be used in sewing inverted horizontal cable runs which will be 8 inches or more in ultimate depth. In no case shall the total depth of cabling, including any added cabling whether sewed or clipped, be such that the sewing at any point in the run will be required to support a greater depth of cable than that set up for such sewing.

TABLE B
SEWING SWITCHBOARD CABLES IN HORIZONTAL
RESTING RUNS

KIND OF CABLE AND ARRANGEMENT ON CABLE RACK	SIZE OF CABLE	NO. OF CABLES UNDER ONE STITCH
Round, see Fig. 9(A)	Up to 1/2 in. diam.	6
Round see Fig. 9(B)	Over 1/2 in. to 3/4 in. diam.	5
Round, see Fig. 9(C)	Over 3/4 in. to 1 in. diam.	3
Round see Fig. 9(D)	Over 1 in. diam.	2
Oval cables sewed in groups on edge, see Fig. 9(E)	All	6
Oval cables sewed in groups on flat, see Fig. 9(F)	All	10

6.10 Vertical cable runs from unsecured horizontal cable runs shall be clamped or clipped in accordance with the requirements of AT&T Practice 800-614-158, or sewed at every cable rack strap with two strands of 9-ply twine.

6.11 Vertical cable runs at distributing frames shall be sewed at every transverse arm when such arms are 13 inches or more apart. When transverse arms are less than 13 inches apart, the cables shall be sewed at alternate transverse arms.

6.12 Cables shall be sewed securely where they turn off or are butted.

6.13 Vertical cable runs on the outside of the cable brackets on the LDF or the crossbar TRDF shall be sewed to the brackets. The several holes provided in the brackets may be used, if it facilitates sewing various sized groups of cables.

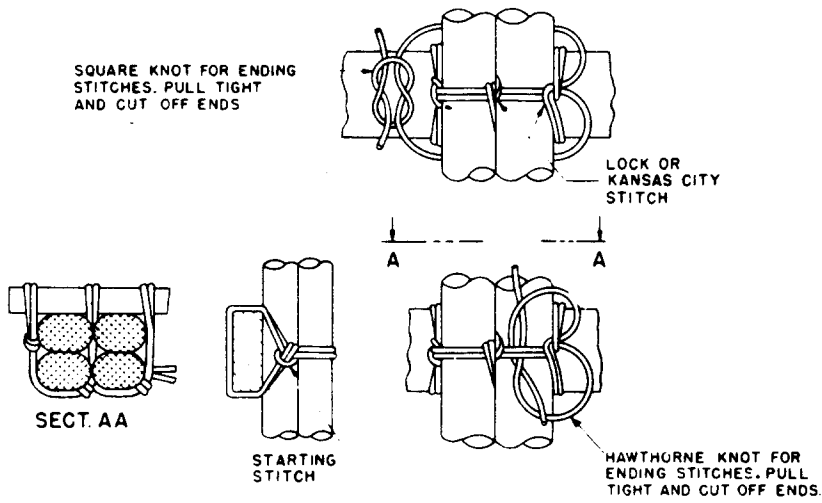


Fig 5—Lock Stitch or Kansas City Stitch

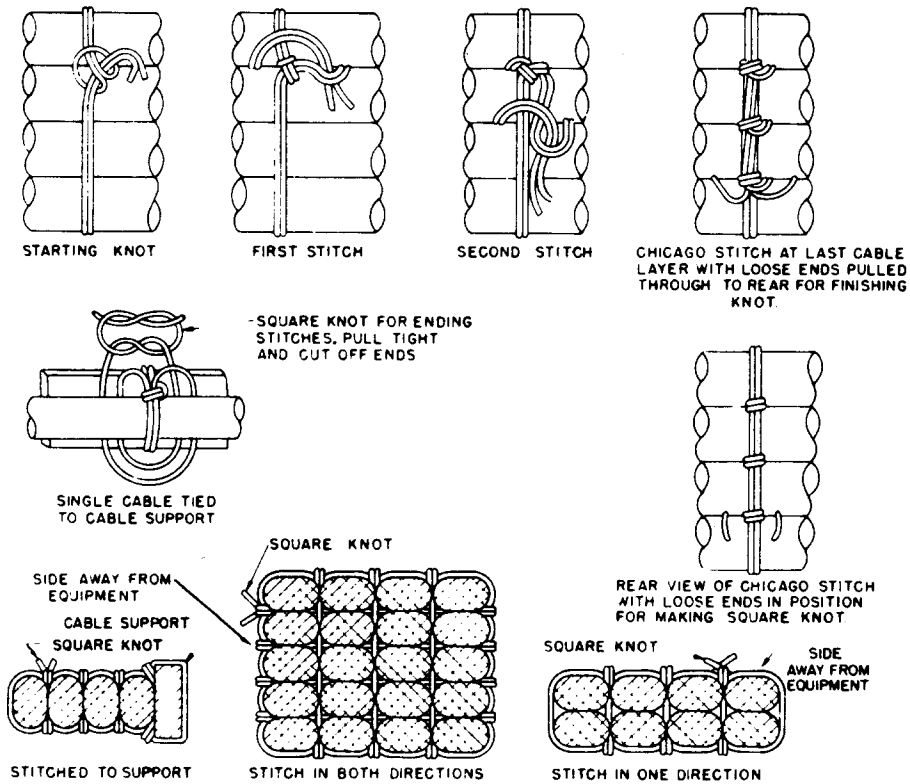


Fig 6—Chicago Stitch

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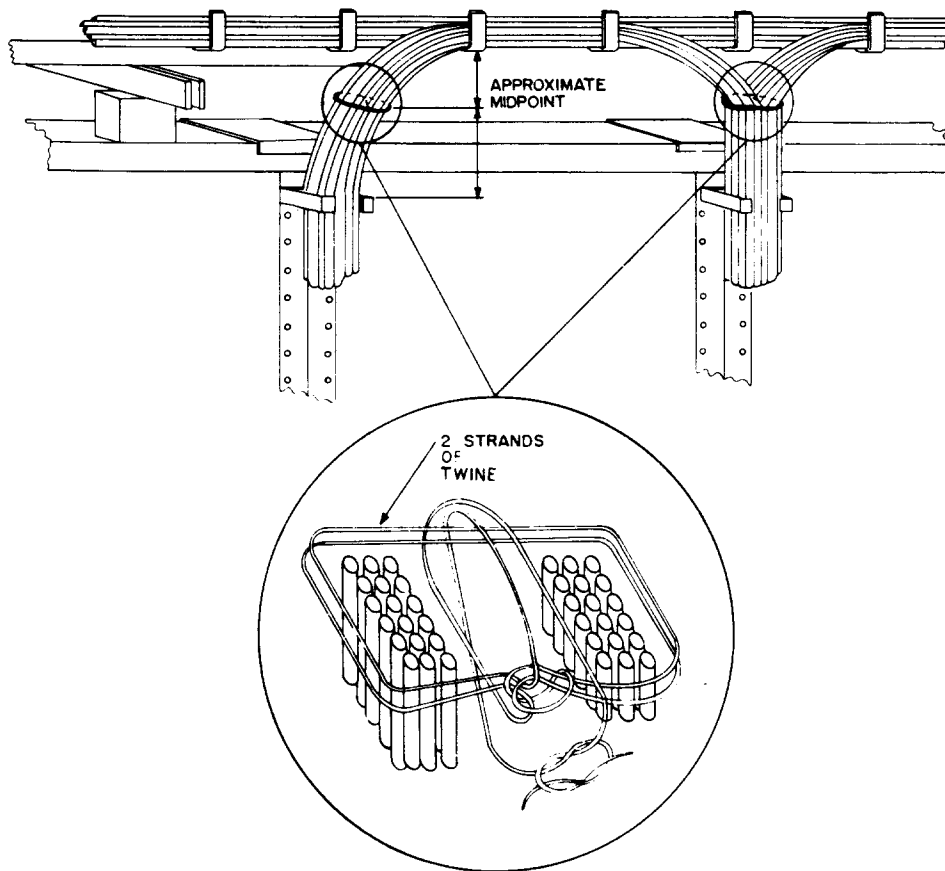


Fig 7—Cables From Miscellaneous Run Secured Together Between Bar-Type Cable Rack and First Support With Modified Chicago Stitch

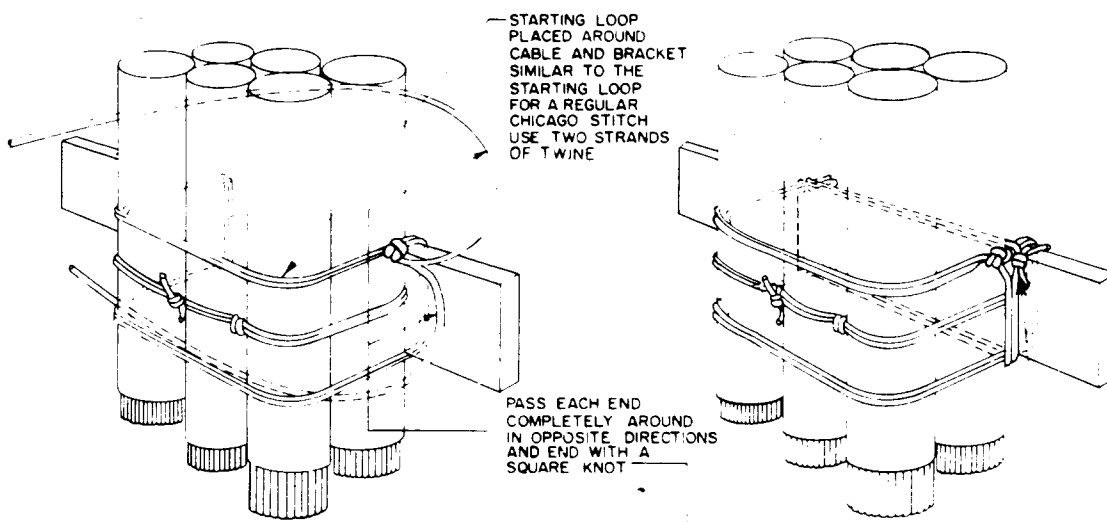


Fig 8—Sewing Preformed Groups of Cables at Support With Chicago Stitch

See proprietary notice on cover page.

6.14 Table C gives the maximum number of switchboard cables of the same size to be included under one stitch in sewing vertical runs and inverted horizontal runs on cable racks.

TABLE C
SEWING SWITCHBOARD CABLES IN VERTICAL AND INVERTED HORIZONTAL RUNS

KIND OF CABLE AND ARRANGEMENT ON CABLE RACK	SIZE OF CABLE	NO. OF CABLES UNDER ONE STITCH
Round, see Fig. 10(A)	Up to 1/2 in. diam.	5
Round, see Fig. 10(B)	Over 1/2 in. to 3/4 in. diam.	2
Round, see Fig. 10(C)	Over 3/4 in. diam.	1
Oval cables sewed in groups on edge, see Fig. 10(D)	All	3
Oval cables sewed in groups on flat, see Fig. 10(E)	All	5

D. Sewing Irregular Switchboard Cable Runs

6.15 Where cables in a run are of different sizes and shapes, the number of cables placed under one stitch shall not exceed the maximum number shown in Fig 9 and 10 for the largest size of cable of a given type in the group. In the case of an oval cable, the greatest dimension shall be used in determining the size of the cable.

E. Sewing Spirals

6.16 All spirals and 90-degree double turns shall be sewed, since clipping has a tendency to cut into the cables especially as the pileup increases. In addition, clamps per ED-91987-30 shall be placed as reinforcement at each spiral as follows:

- (a) If the vertical run turns to a horizontal position near the ceiling of the floor below the one on which a spiral is located, the clamp shall be placed immediately above the spiral as shown in Fig 11(A).
- (b) If the vertical run turns to a horizontal position immediately above the spiral, the clamp shall be placed below the spiral as shown in Fig 11(B).
- (c) If the spiral is in a straight vertical run, so that the run continues the distance between two or more adjacent floor lines beyond the spiral in both directions, a clamp shall be placed directly above and another clamp directly below the spiral as shown in Fig 11(C).
- (d) Supplementary clamps are not required on horizontal spirals or 90-degree double turns.

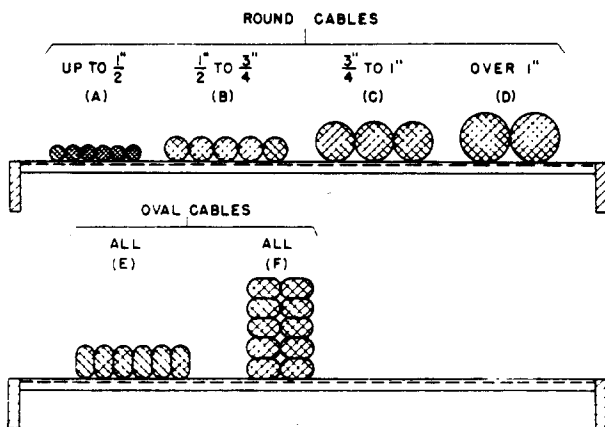


Fig 9—Number of Cables Under One Stitch on Horizontal Resting Runs on Cable Racks

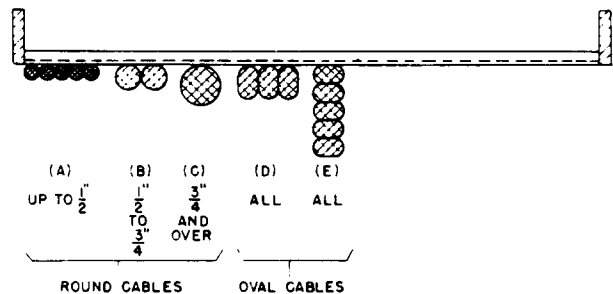


Fig 10—Number of Cables Under One Stitch on Vertical Runs and Inverted Horizontal Runs on Cable Racks

See proprietary notice on cover page.

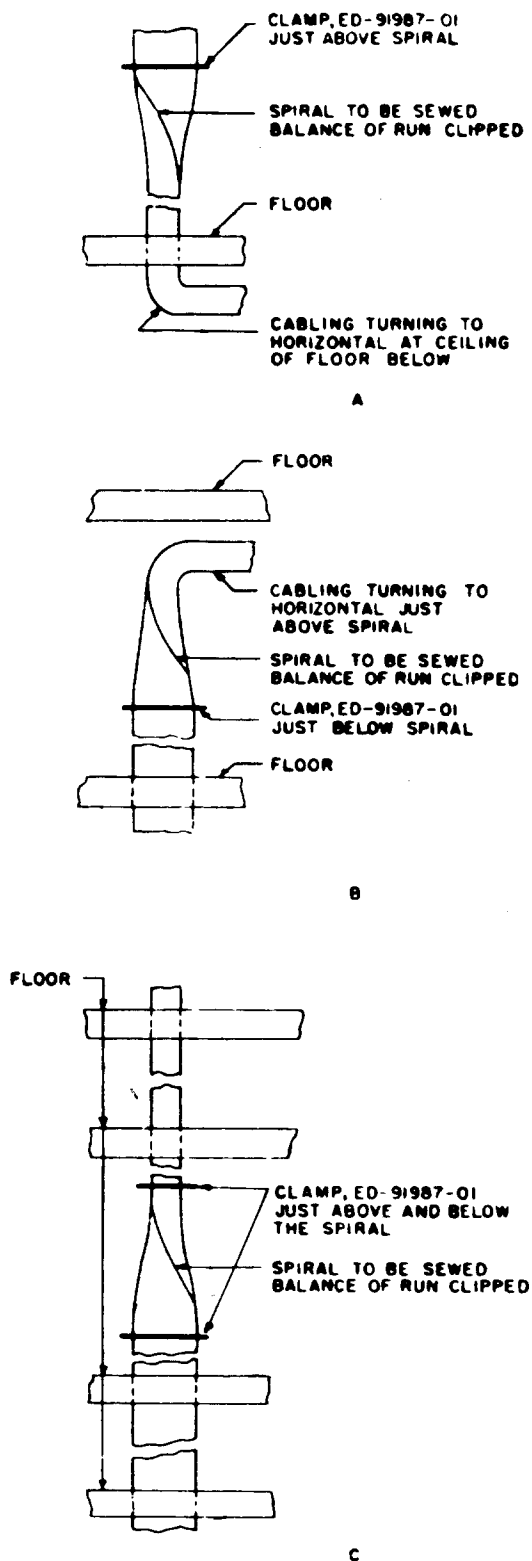


Fig 11—Clamping Spiral Cable Runs

F. Sewing Power Cables

6.17 Table D covers the requirements for sewing power cables varying in size from 800,000 cm to No. 14, and 1- to 4-conductor armored cables of No. 1 to 14 conductor size. Armored cables of No. 0 and larger shall be sewed. The requirements apply to uniform size leads. Varying sizes shall be sewed individually (for example, one 300,000 and one No. 0), or the smaller sizes shall be bundled to equal about the size of the larger and sewed as two of equal size (for example, five No. 14 and one No. 0). Requirements on pairing and separation in AT&T Practice 802-005-160 shall be met.

7. BANDING AND SECURING CABLE OR WIRE WITH CABLE TIES

7.01 KS-20986 L1, L2, or L3 nylon cable ties, when used in accordance with the requirements of AT&T Practice 800-612-153, may be used instead of twine for:

- Securing switchboard cable to the transverse arms of distributing frames as indicated in Fig 12, 13, and 14.
- Banding together switchboard or power cable including flexible power cordage such as the KS-15141, KS-15143, KS-20195, and KS-20921 types. The protection that is required when tying the flexible cordage with twine is not required when banding the cordage with cable ties. However, care should be exercised to assure that the cable tie tensioning tool is properly adjusted so that the ties will not be overtensioned around the cordage.
- Banding together shielded wire, or coaxial or twin-conductor shielded office cables except KS-21112, KS-19589, and similar type coaxial cables which shall be treated as specified in AT&T Practice 800-612-153.
- Banding together groups of cables on ESS cable racks except in the Shield 3 compartment.
- Securing vertical switchboard cable, power cables, shielded wiring, or coaxial or twin-conductor shielded office cables (except KS-21112 and KS-19689 types) to cable brackets (per AT&T Practice 800-612-156), except at the topmost bracket. Cables shall be sewed to the topmost brackets with twine.

Note: When securing cable to a bracket, the criss-cross of the cable tie shall be located on the cable.

TABLE D

POWER WIRE AND CABLE SEWING REQUIREMENTS

SIZE OF CABLES	SEW AT STRAP*	NO. OF TWINE STRANDS	NO. OF LAYERS	CABLE PER STITCH		
Horizontal Resting Runs						
800,000-400,000	Copper	4†	Any number	2		
350,000-No. 0				2		
No. 1-No. 6				2		
No. 8-No. 14				2	Any number bundled, not formed	
750,000-600,000	Aluminum	4	Any number	2		
500,000-No. 00				2		
No. 0-No. 6				2		
No. 8-No. 14				2	Any number bundled, not formed	
Vertical Runs or Inverted Horizontal Runs						
1- to 4-Conductor Armored Cable (No. 1 to 14 Conductor Size)	Every‡	2	Any number	2		
1- to 4-Conductor Armored Cable (No. 0 to 500,000 Conductor Size)	Alternate	4	Any number	2		
800,000-300,000	Copper or Aluminum	4†	Any number	1		
No. 0000-No. 1				Every §	Over 3	1
No. 0000-No. 1				Every §	3	1
No. 2-No. 6				Every §	Any number	2
No. 8-No. 14				Every §	Any number	Any number bundled, not formed
1- to 4-Conductor Armored Cable (No. 1 to 14 Conductor Size)	Every‡	4	Any number	2		
1- to 4-Conductor Armored Cable (No. 0 to 500,000 Conductor Size)	Every‡	4	Any number	2		

* All cables at turns shall be sewed at such intervals as to insure that they retain the proper position.

† Where superimposed on cable runs sewed with two strands, two strands may be used.

‡ A single armored cable or one layer of armored cables in the same run with other cables shall be sewed with the same frequency of stitches as required for the other cables in the run.

§ Clamping and sewing shall be in accordance with paragraphs 523 and 524.

See proprietary notice on cover page.

7.02 Nylon cable ties *shall not* be used for:

(a) Banding or securing cable or wire run on cable racks except as indicated in paragraph 7.01(d).

(b) Securing vertical cabling or wiring to horizontal cabling or wiring, or at any location where wiring and/or cable intersect.

(c) Banding or securing lightguide cables. See paragraph 5.13. in place so that it cannot be stretched further.

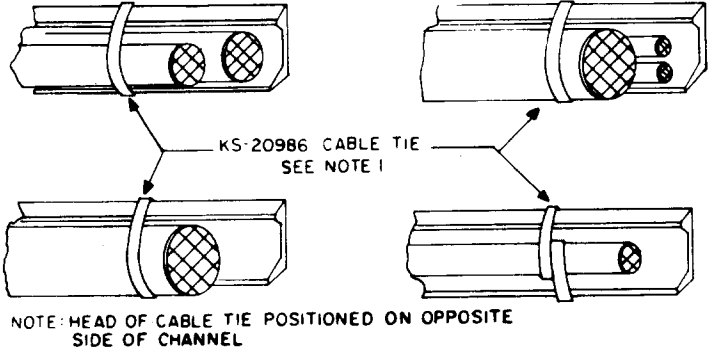


Fig 12—Securing Horizontal Cable to Transverse Arms of Distributing Frame Using KS-20986 L1, L2, or L3 Nylon Cable Ties

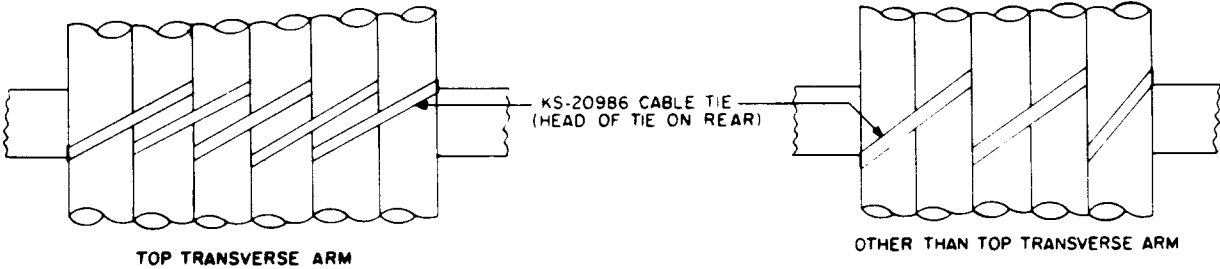


Fig 13—Securing First Layer of Cable on Vertical Side of Distributing Frame Using KS-20986, L1, L2, or L3 Nylon Cable Ties

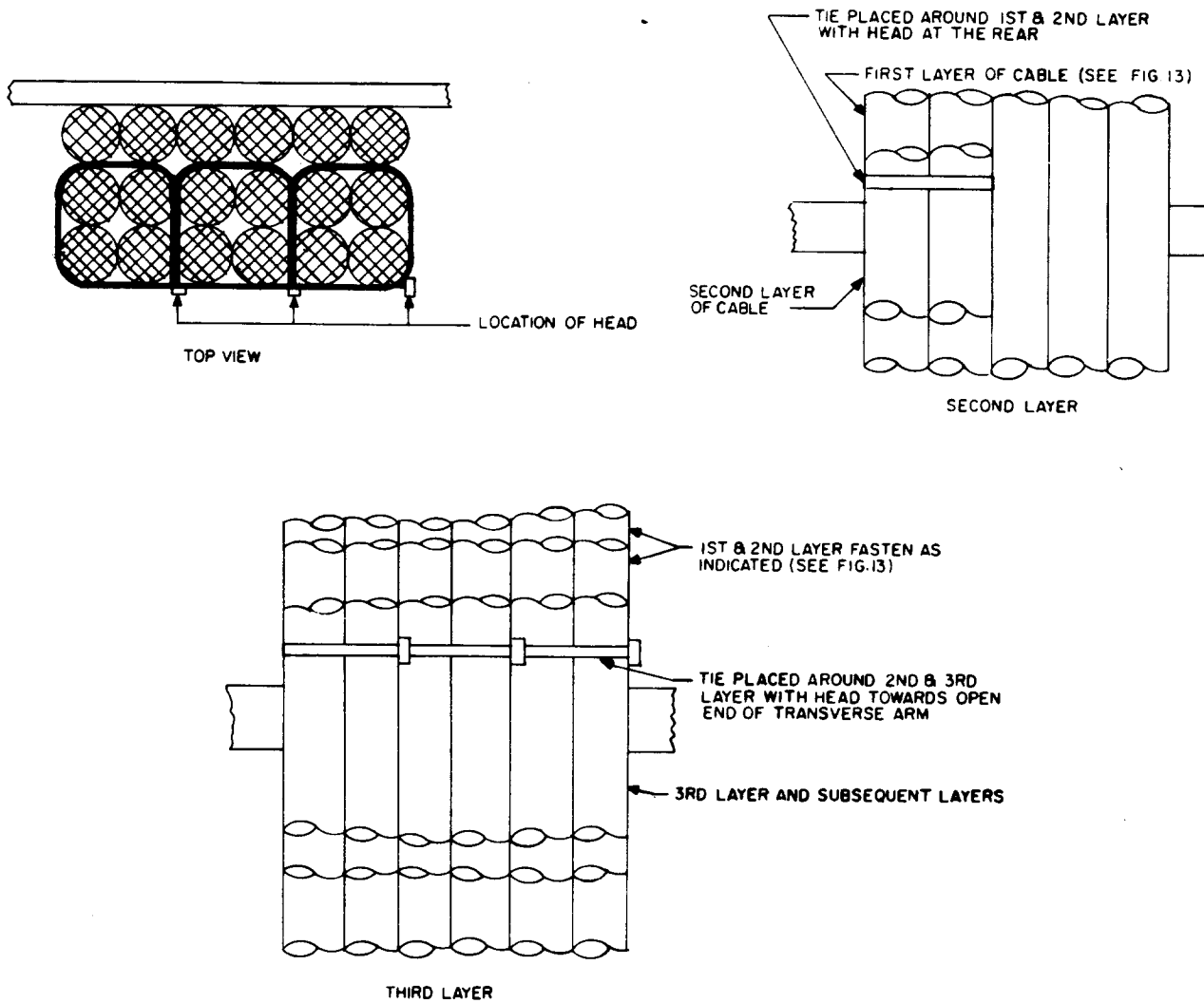


Fig 14—Securing Second and Subsequent Layers of Cable on Vertical Side of Distributing Frames Using KS-20986 L1, L2, or L3 Nylon Cable Ties

See proprietary notice on cover page.

8. REPAIR OF DAMAGED CABLE INSULATION

A. Repair of Damaged Fabric-Covered Switchboard Cable

8.01 The covering of switchboard cable shall be repaired if it has been snagged, torn, or similarly damaged if the cable is not otherwise defective.

Caution: The cellulose acetate lacquer, shellac, and cements specified for repairing textile insulations contain flammable solvents. Therefore, when making such repairs, provide adequate ventilation and keep the container closed when not in use. Do not use these materials near heat, sparks, or open flames.

8.02 Where the outer braid is only slightly damaged and the cable is in a location exposed to view, the frayed covering shall be treated with cellulose acetate lacquer, COMCODE 996447439, pressed in place. If cellulose acetate lacquer is not available, DuPont household cement or equivalent may be used.

8.03 Where the outer braid is more seriously damaged, but the inner tape is intact, the tape shall not be disturbed. Where the cable is exposed to view, the damaged part of the covering shall be replaced with a sound covering obtained from a similar cable glued on with cellulose acetate lacquer, COMCODE 996447439, DuPont household cement, COMCODE 400485827, or equivalent as shown in Fig 15. The covering shall be given a coat of shellac. If a similar covering is not available, the damaged area shall be wrapped with friction tape, COMCODE 995911278, put on with at least a half lap and given a coat of shellac. Gray plastic adhesive tape per KS-14090 may be used instead of friction tape provided that the plastic tape will not be subjected to heat or pressure. Shellac shall not be applied to plastic tape.

8.04 Where the inner tape is badly damaged, the damaged tape shall be removed to check for defects in conductors and replaced with tape taken from a similar cable. If a similar tape is not available, the cable may be wrapped with friction tape, COMCODE 995911278, put on with at least a half lap and given a coat of shellac. Gray plastic adhesive tape per KS-14090 may be used as an

alternative if it will not be subjected to heat or pressure. Shellac shall not be applied to plastic tape. The outer braid shall also be replaced as outlined in paragraph 8.03.

8.05 An alternate method of repairing the cable is to wrap the exposed portion with gray plastic tape or friction tape, with at least a half lap, with the adhesive surface outward; then wrapped again, with at least a half lap, with the adhesive surface inward. Shellac shall be applied to the friction tape after completing application.

8.06 In the case of flat-type cable, such as 232, 241, 242, and similar CL or M types, if the press-board core is so broken that the cable is stretched out of its proper shape, the cable, if a short multiple cable, shall be replaced. Where the cable is in a cable run, it shall be secured in place so that it cannot be stretched further.

B. Repair of Damaged Plastic-Jacketed Switchboard Cable

8.07 Where the outer jacket of the plastic-covered (PVC) cable is cut, torn, or otherwise broken open, the opening shall be closed and wrapped with one layer of gray plastic adhesive tape per KS-14090.

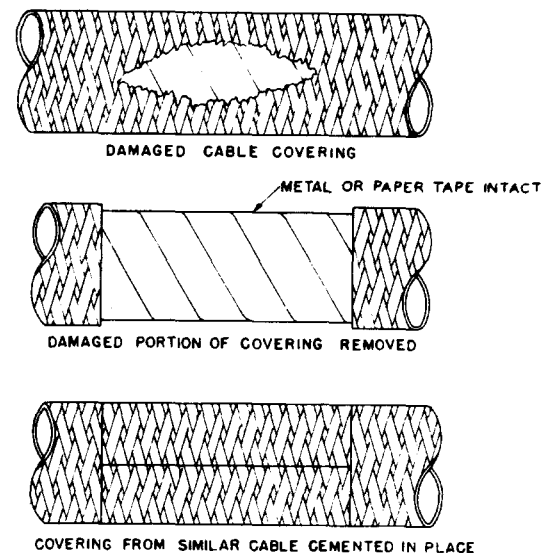


Fig 15—Repair of Damaged Switchboard Cable Fabric Covering

8.08 An alternate method of repairing the outer jacket of the PVC-covered cable that is cut or torn and exposed to view at the time of installation, but where no material has been removed, is to close the opening and wrap the cable neatly with transparent acetate fiber tape per KS-13979. If the outer jacket is exposed to view at the time of installation and has been seriously damaged, the damaged portion of the covering shall be replaced with a sound covering obtained from a similar cable and wrapped neatly with transparent acetate fiber tape per KS-13979.

8.09 In the case of flat-type cable, such as 232, 241, 242, and similar CL or M types, if the press-board core is so broken that the cable is stretched out of its proper shape, the cable, if a short multiple cable, shall be replaced. Where the cable is in a cable run, it shall be secured

C. Repair of Damaged Power Leads

8.10 The insulation of rubber-covered power leads shall be repaired if frayed or torn but not damaged sufficiently to make the cable otherwise defective. (See *Caution* in paragraph 8.01).

8.11 Where the outer braid is only slightly damaged and the cable is in a location exposed to view at the time of installation, the frayed covering shall be treated with cellulose acetate lacquer, COMCODE 996447439, pressed in place, and, when dry, painted with an approved cable paint. If cellulose acetate lacquer is not available, DuPont household cement or equivalent, or library paste may be used. In unexposed places, friction tape, COMCODE 995911278, and one coat of shellac shall be applied.

8.12 When insulation is badly damaged in exposed locations, the inner layer of insulation shall be built up to the equivalent thickness with rubber tape and the outer braid shall be replaced with a section of sound braid from the same size lead. In unexposed locations, the insulation shall be built up to the equivalent of the original with rubber and friction tape and given one coat of shellac.

8.13 Repaired insulation of gray cable in exposed places shall be touched up with cable filler paint, COMCODE 996441531. Touch-up paint for other cables shall closely match the cable.

REASONS FOR REISSUE

1. To change "BSP Section" to "AT&T Practice" where referred to throughout the practice.
2. To change 1.06(d) to indicate that closure plates should be installed only if ordered by the telephone company.
3. To revise 3.02 to delete reference to flat-type cables (rated Mfr Disc).
4. To add 3.03 information for handling lightguide cables.
5. To revise 3.04(a) [formerly 3.03(a)] to add COMCODE 99583101 number for 1/64-inch sheet fiber.
6. To delete former 3.07 covering protection for vertical and inverted runs of flat-type cables (rated Mfr Disc).
7. To revise 3.08 to remove reference to P-40B642 "fiber" insulators, which are now PVC insulators.
8. To include in 3.10, "RM-583101" for 1/64-inch thick sheet fiber.
9. To add 5.02 to specify segregation guidelines for lightguide cables run on cable racks.
10. To add 5.05 to specify treatment for excessive slack in lightguide cables on cable racks.
11. To add 5.10 to reference AT&T Practice 800-614-164 for installing multiple cabling in switchboards and desks.
12. To add 5.13, concerning the securing of lightguide cables.
13. To add to 5.16 the reference to KS-20785 armored cable.
14. To add 5.20 and 5.20(a) through (d) covering requirements for securing cables on the horizontal side of distributing frames.
15. To revise 5.22 (formerly 5.16) to indicate that clamps should be provided on all vertical switchboard cable runs extending through more than two floors, regardless of the height of the cable pileup.

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16. In Part 6 and Fig 7, to remove reference to 8-ply and 10-ply twines and specify 9-ply twine for all installation sewing and tying applications.
17. To revise 6.05(e) to permit 6-foot stitching intervals for stitching loose wire on bar-type racks and to specify exceptions as listed in 6.05(e) (1) through (3). Tying interval was formerly 36 inches.
18. In Tables B and C, and Fig 9 and 10, to delete information on flat-type cables (rated Mfr Disc).
19. To revise 7.01 (b) to indicate that protection is not required when banding flexible power cordage with nylon cable ties.
20. To add to 7.01(c) the reference to KS-19689 type coaxial cables.
21. To revise 7.01(d) to permit the use of cable ties in all *ESS* cable rack compartments except compartment 3.
22. To revise 7.01 (e):
 - (a) To permit the use of cable ties on cabling under 1/2-inch in diameter.
 - (b) To permit the use of cable ties for securing coaxial cables to cable brackets (except for KS-21112 and KS-19689 type cables).
 - (c) To permit the use of cable ties for securing the butt of cables to cable brackets except at the topmost bracket.
23. To omit former 7.02(b) restriction on supporting of cables using cable ties since 7.01(e) adequately describes permitted applications.
24. To include 7.02(c) restriction on the use of cable ties for securing lightguide cable.
25. To omit 7.02(d) restriction on securing power cable to brackets.
26. To omit 7.02(e) restriction on securing coaxial cable to brackets.