CABLE OPENINGS
DESIGN STANDARDS

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1. GENERAL

1.01 This section discusses and provides design standards for different types of cable openings. These standards are provided for use in the design of ***new buildings or building additions*** that are intended to house telephone equipment that meets the requirements of Section 800-610-164, "New Equipment-Building System (NEBS), General Equipment Requirements."

1.02 This section is reissued to reflect recommendations for use of the KS-21947 modular closure under distributing and protector frames and to provide new recommendations for upper floor risers.

1.03 Cable openings are required at locations where cables must be passed through a floor and walls in a telephone building. The locations of cable openings are determined by the constraints of the cable entrance facility, building floor plan, and equipment layout; and their size is based on the ultimate cable volume anticipated to pass through the portion of the building under study. Cable openings are classified as cable holes, cable sleeves and cable shafts. Of paramount importance in the design and use of cable openings is a concern for fire protection. Minimum fire protection requirements for walls, floors, and partitions in equipment buildings are presented in Section 760-600-151, General Fire Specification Guide for the Bell System.

2. SELECTION OF CABLE OPENINGS

2.01 The location and size of cable openings in floors for riser cables from cable entrance facilities and for switchboard and power cables from switching, transmission, and power areas have been standardized. Simplified central office planning and engineering and reduced administrative and hardware costs are resulting benefits.

2.02 Four standard cable openings are recommended with the choice of opening dependent on the size and quantity of cable to be ultimately accommodated. The four standard types consist of:

(a) Sleeves for riser cable use.

(b) Rectangular precast 10 hole modules or openings, either 2 or 4 inches wide by 6 inches long, for use where holes are to be located beneath protector or distributing frames

(c) Rectangular openings, 12 inches wide by 24 inches long, for all cable holes between columns or in walls or partitions (3 per building bay)

(d) Square openings, 24 by 24 inches, where holes are required for cable risers or shafts.

2.03 Portions of the floor surrounding the holes or modules are to be of fire-resistive Construction-Type B for buildings of steel or concrete construction.

3. CIRCULAR OPENINGS

3.01 Central Office buildings with terminating frames on upper stories are served by feeder cables routed from the CEF by way of riser pathways. The riser originates in the CEF ceiling adjacent to an exterior wall of the building, passes through the various building levels, and terminates at the desired frame floor. Various types of riser construction have been used to provide these pathways—rectangular shafts, individual circular sleeves, or floor-to-ceiling conduits. Regardless of the type of riser, construction modifications to the building framing, load carrying requirements, and cable support details must be considered in the building design. The riser configuration can also influence the architectural design of the building, especially if riser space is achieved by extending portions of an exterior wall.

4. SLEEVES

4.01 In general, sleeves are recommended for riser pathways, although other types of riser construction may be needed for special applications. While shafts have been used in the past, fire and smoke stopping methods are at best difficult and costly. Sleeves, preferably in a single-tier configuration along the building wall, are considered best ensuring easy installation, reliable fire stopping capability, and orderly appearance. In addition, they are standardized for use with all types of feeder, switchboard, or power cable.

CONSTRUCTION

4.02 Riser sleeves may be formed in the floor assembly by casting cylindrical forms or rigid steel sleeves in the concrete floor. A 4-inch inside diameter sleeve will allow the passage of one riser cable with a small surrounding annular space between the cable and sleeve. A grouping or matrix of these sleeves provides riser space equivalent to a large slot, without leaving large open voids or requiring complicated top and bottom closing plates.

4.03 The effect of sleeve penetrations on the building structure is minimal. Figure 1 illustrates a sleeve framing scheme. With this type of framing, sufficient sleeves can be installed to provide high volume riser space.

FIRE PROTECTION

4.04 Sleeve risers require fire protection measures that will not compromise the rating of the floor assembly. Fire stoppage and smoke resistance can be accomplished with ease because of the small annular spaces between the cable and sleeves. For these cable openings, fire stopping is accomplished using ceramic fiber and the fire-retardant caulking compound, AT-8832. The ceramic fiber is available from Babcock and Wilcox as "Kaowool Ceramic Fiber Bulk," from Carborundum Co. as "Fiberfax Bulk Fiber," or from Johns-Manville as "Cerafiber, Bulk #111."

4.05 Recommended construction of a cable sleeve is shown in Fig. 2. Figure 3 shows an assembly of cable in a sleeve with recommended fire and smoke stopping materials.

5. CONDUITS

5.01 The use of continuous conduit is an extension of the sleeve concept. Basically, each cable is routed through continuous floor-to-ceiling lengths of 4-inch inside diameter steel conduit. Conduits can be constructed independently or in conjunction with sleeves. Conduit assemblies in building walls complicate construction and necessitate added cost compared to sleeve designs. They are rarely justified except where riser cables must be protected as they pass through office areas or where ease of cable pulling dictates.

CONSTRUCTION

5.02 Where provisions are required for mounting splice closures on walls that are filled with riser conduits that pass to upper stories, Fig. 4 shows a concept for mounting splice closures on an inner wall. The inner wall is built to provide cable access and support bars for the cables that must pass from the conduit to the selected floor level. The cross-hatched sections of the sketch show where the double beams are located, indicating the suitability of this type of construction for supporting the inner wall as well as framing the conduits.

FIRE PROTECTION

5.03 Riser conduit fire protection is slightly different from sleeve protection. As before, floors must retain their ability to prevent the spread of fire from or between floor levels. Therefore, the spaces between the conduit and the edges of the floor through which the conduit passes, must be fire-stopped. Since access to the conduit interior cannot be easily attained at each floor level, the location at which the conduits terminate or originate and the locations at which the cables enter and leave the conduit must be fire-stopped.

6. RECTANGULAR UNDERFRAME OPENINGS

6.01 When terminating frames are located directly above the cable entrance facility, cable access holes are required to allow the passage of connector stub cables between the CEF and terminating frame. Previously, these access holes were comprised of continuous slots, interrupted slots, or sleeves of various shapes and dimensions. The most commonly used access hole is the continuous slot that extends the entire length of the terminating frame. While the continuous slot provides ample room for cabling requirements, it is difficult to construct and to seal.

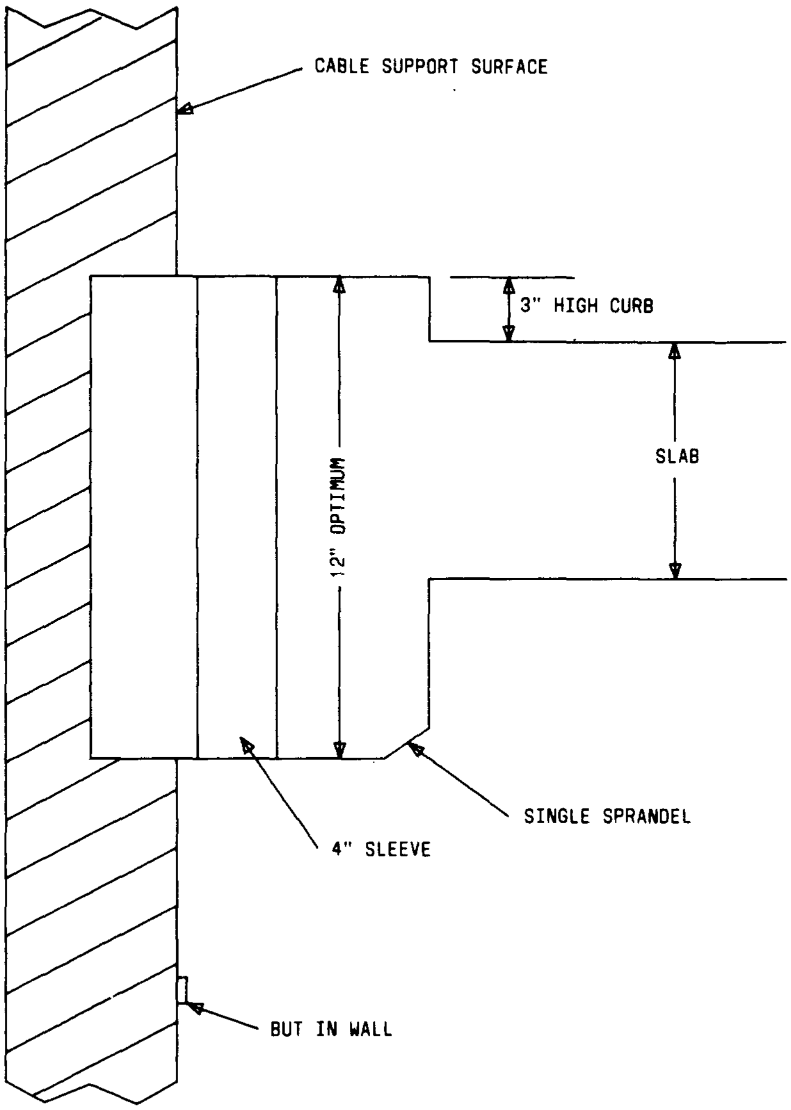

Fig. 1—Typically Upper Floor Riser Construction

6.02 Modular cast-in-place modules (KS-21947) are recommended with one-to-one correspondence per vertical frame member. Each module has the capability of accommodating up to 10 stub cables. Where the modules cannot be used, acceptable fire protection can be provided with rectangular sleeve type openings.

CONSTRUCTION

6.03 The module is sized to accept 1 to 10 type ABAM-100 or ABBM-100 cables, however, if rectangular sleeves are used, the cable opening must be of sufficient dimension to satisfy the cable capacity requirements, correspond with the vertical lineup, and remain compatible with the various terminating frames.

6.04 There are three types of terminating frames that must be considered when designing the underframe openings between the CEF and terminating frame:

- Modular Protector Frame (PF)

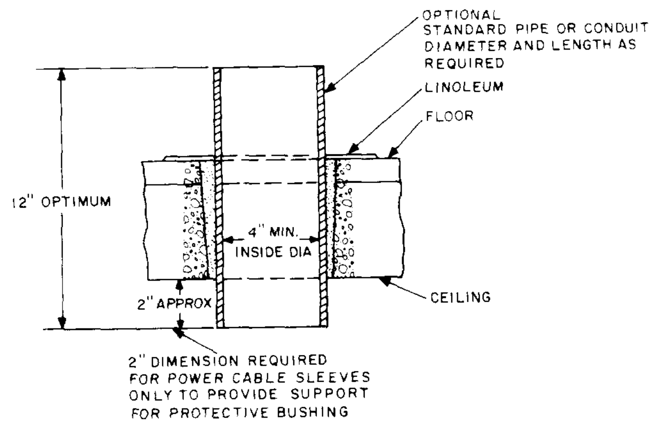

Fig. 2—Cable Sleeves

- Double Sided Protector Frame (DSPF)
- Low Profile Conventional Distributing Frame (LPCDF)

6.05 The available floor space per vertical and the number of connector stub cables that access this space must be considered for the previously mentioned terminating frames. Table A lists characteristics of each type of frame, the number of connector stub cables per vertical, and the dimensions required for the openings in the floor.

6.06 The DSPF and the LPCDF can be served by the KS-21947 modules spaced on 8-inch centers or by 4-inch by 6-inch rectangular access holes spaced 8 inches on center as shown in Fig. 5 and 7. The PF requires the KS-21947 module and 2-inch by 6-inch rectangular access holes to be spaced 6 inches on center as shown in Fig. 6 and 7.

6.07 It is important that the floor and incorporated frame opening pattern be consistent in design with the structural requirements. The NEBS 150-psf design live load and 12 foot, 6 inch ceiling height, from the slab to the bottom of the lowest projection, are two of the factors that must be considered. When forming the underframe pattern, the floor structure should not be depressed greater than any other obstruction at the same floor level. Figure 8 shows schematically how framing can be accomplished for different floor construction methods and terminating frames.

FIRE PROTECTION

6.08 The rectangular holes or KS-21947 modules satisfy the cable access requirements and permit adequate fire and smoke protection. In the KS-21947 module, the cables pass through individual holes in the cast-in-place blocks. On the rectangular holes, connector stub cables from each vertical are bundled together with bands and routed through the individual rectangular openings. The remaining space is appropriately sealed with AT-8832 fire-retardant caulking compound after being packed with ceramic fiber. Typical assemblies of a cable filled opening with fire-stopping materials in place are shown in Fig. 9.

7. RECTANGULAR BETWEEN-COLUMN OPENINGS

7.01 A standard 12- by 24-inch cable-hole pattern that is usable in reinforced concrete floor construction offers planning advantages. This cable-hole size and spacing pattern will allow clearance between vertical cable runs and 18-inch wide cross-aisle cable racks located at uniform increments perpendicular to the direction of standard equipment lineups. Such cable-hole systems incorporate optional-use cable openings with plugs.

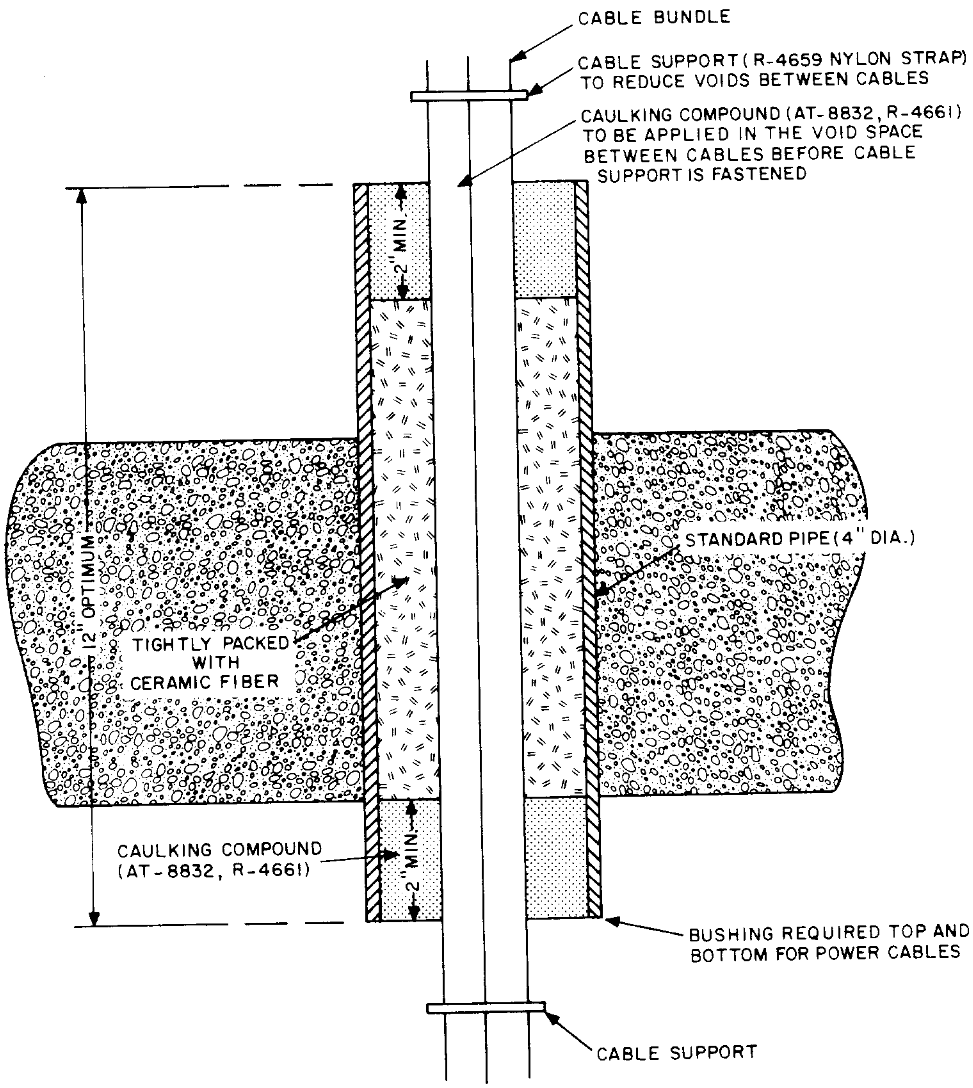

Fig. 3—Fire-Stopping Configuration for Circular Cable Openings

CONSTRUCTION

7.02 During building construction, precast concrete plugs should be placed regularly in column rows parallel to equipment-frame lineups in building bays that eventually could contain equipment. Also, plugged cable openings should be provided where cable runs eventually may pass through nonequipment space. The NEBS plan appears in Fig. 10. All plugs are set in place when the floor slab is poured. When the building is ready for equipment installation, those holes needed for cabling are opened; the others remain covered with floor tile. If additional cable holes are needed later, floor tiles are removed and the plugs are pulled from unused holes to ready them for use. Conversely, holes no longer required are replugged and tiled over.

7.03 The tapered plugs used for cable openings are made of lightweight precast concrete to facilitate handling. Each plug has four 5/8-inch threaded inserts, two cast into the top and two cast into the bottom surface, as in Fig. 11. The concrete plugs, each tightly wrapped in two layers of 0.004-inch thick polyethylene sheeting, are bolted to the formwork of the floor slab. The slab is then poured around the positioned plugs. The two layers of plastic sheeting form a slip plane to

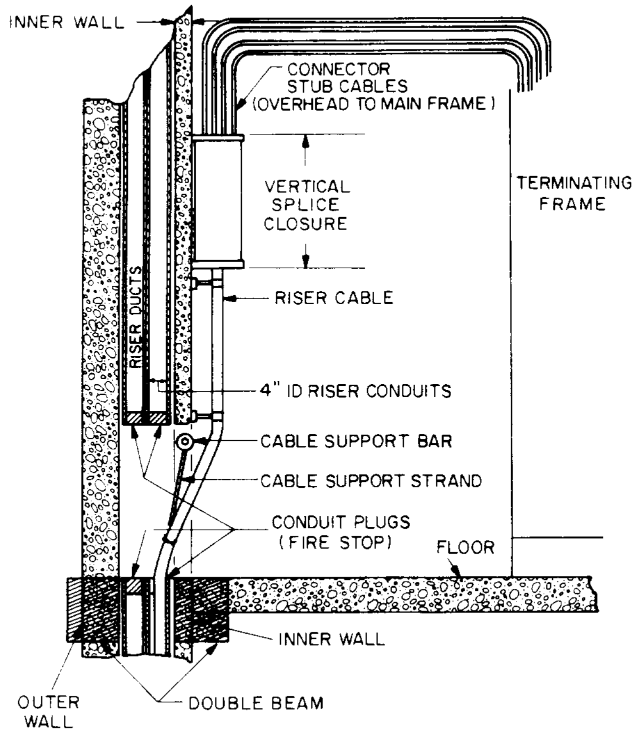

Fig. 4—Riser Cable System

expedite removal of the plug. After the concrete hardens, the plugs are unbolted and the forms are removed. Excess polyethylene sheeting is removed from the top and bottom of the plugs, 5/8-inch flathead screws are installed in the top threaded inserts, and the floor is finished covering over the plugs. When, later on, a plugged cable hole is to be opened, the floor tile is lifted, the flat-head screws that fill the 5/8-inch threaded inserts are removed, and the plug is loosened with a beam and jack screws as shown in Fig. 12. The loosened plug is then pulled out with a chain hoist attached to the beam.

7.04 This sequence of construction requires the contractor to fabricate precast concrete cable hole plugs before the floor can be poured. A simplified procedure using molded plastic forms can be used whereby the cable plugs are formed at the same time that the floor slab is poured. The improved procedure eliminates the problems of scheduling and contractor interfacing associated with the use of precast concrete plugs and also alleviates the difficulties of handling, positioning, and wrapping with polyethylene sheeting prior to pouring around the precast plug.

TABLE A

FRAME CHARACTERISTICS AND CABLE OPENINGS

FRAME TYPE	HEIGHT (FT.)	SPACING OF VERTICALS (IN.)	FRAME SPACE PER VERTICAL (IN.)	CONNECTOR TYPE	CABLES PER VERTICAL	STANDARD CABLE OPENING* (IN.)
Low Profile Conventional Distributing Frame (LPCDF)	8	8	4-3/4 × 14	303	5	4 × 6
				305	10	4 × 6
Double Sided Protector Frame (DSPF)	8	8	6 × 10	302(A2)	10	4 × 6
Modular Protector Frame (PF)	8	6	6-3/8 × 4	302(A1)	5	2 × 6

* 4 × 11 when modular underframe blocks (KS-21947) are used.

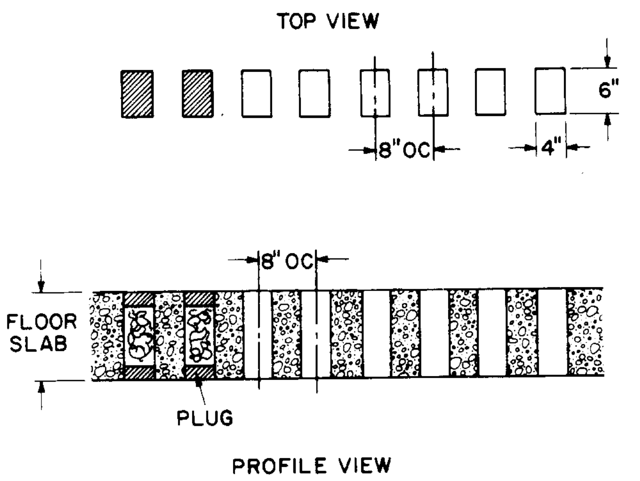

Fig. 5—Rectangular Frame Opening Pattern for the DSPF and LPCDF

7.05 Sheathing for an unplugged cable opening should be ordered in accordance with ED-92116-72. EL 1412 and EL 1732 describe precast plugs and cable installation in greater detail. See ED-92116-72, groups 11 to 42, for details on cable sheathing hardware for 1- by 2-foot holes and floor thicknesses from 4-3/4 to 16 inches.

FIRE PROTECTION

7.06 To restrict the passage of fire through the cable opening, the void space between the faces of the cable opening and the cable bundle should be fire-stopped with noncombustible insulating materials. For the rectangular 12- by 24-inch cable opening, the fire stopping is accomplished using KS-5048 bags of mineral wool and a fire-retardant caulking compound, AT-8832, installed in accordance with EL 4699, Appendix 1. The use of an adjustable ceiling plate (see Fig. 13) provides an economical method for obtaining optimum fire protection for both temporary and permanent closing of the cable opening. This fire stopping configuration is shown in Fig. 14. For the between-column cable holes, sheathing requirements are given on ED-92116-72. Sheathing for use with raised-floor systems is described in Sections 760-200-110 and 801-026-167.

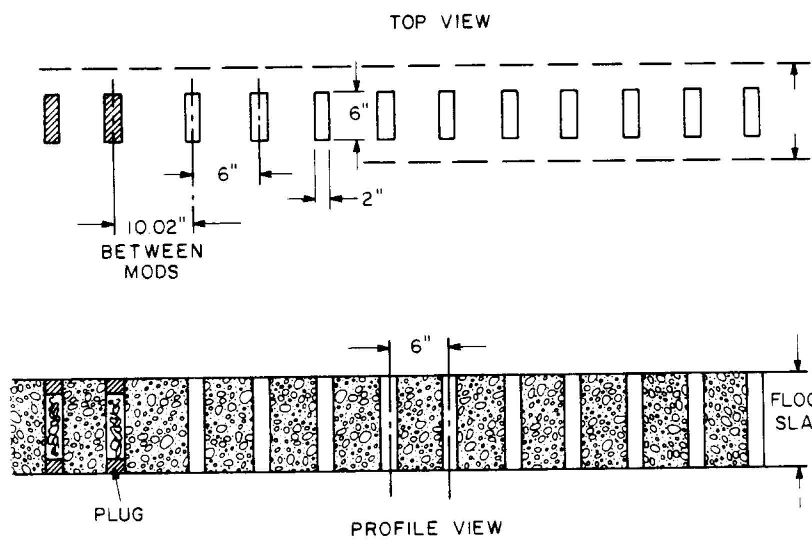

Fig. 6—Rectangular Frame—Opening—Pattern Modular Protector Frames

8. RECTANGULAR WALL OPENINGS

8.01 Openings in walls and partitions are treated similarly to the rectangular between-column openings. Rectangular wall openings are made frequently after initial construction and are sized to accommodate the newly planned cable rack. When associated with racks to be used in a cable

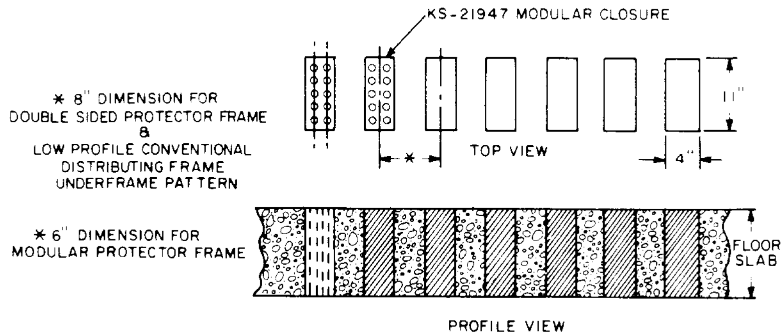

Fig. 7—Frame Opening Pattern for Modular Underframe Blocks

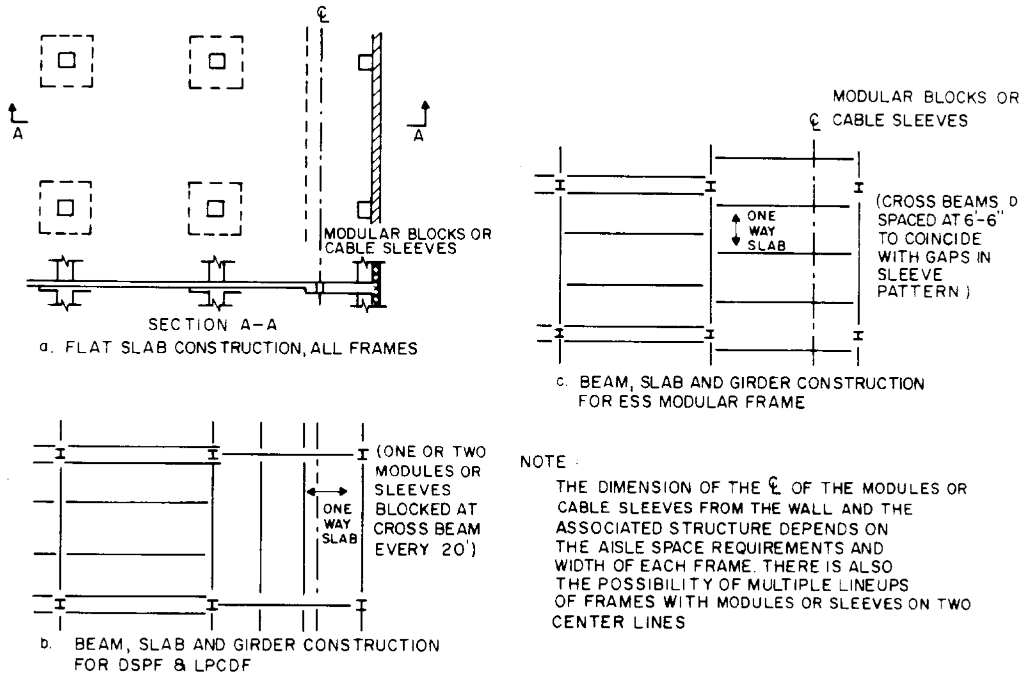

Fig. 8—Framing for Main Frame Openings

pathway plan as described in Specification J90606, openings must permit passage of 12- or 18-inch wide racks. A standard opening, 2 feet wide by 1 foot high, permits passage of all future racks and uses the sheathing details, installation methods, and fire protection practices of the rectangular between-column openings. Requirements for fire stopping wall and partition cable openings are covered in Sections 800-614-153 and 801-006-151.

9. SHAFT OPENINGS

9.01 From the standpoint of construction, the rectangular shaft is considered the simplest

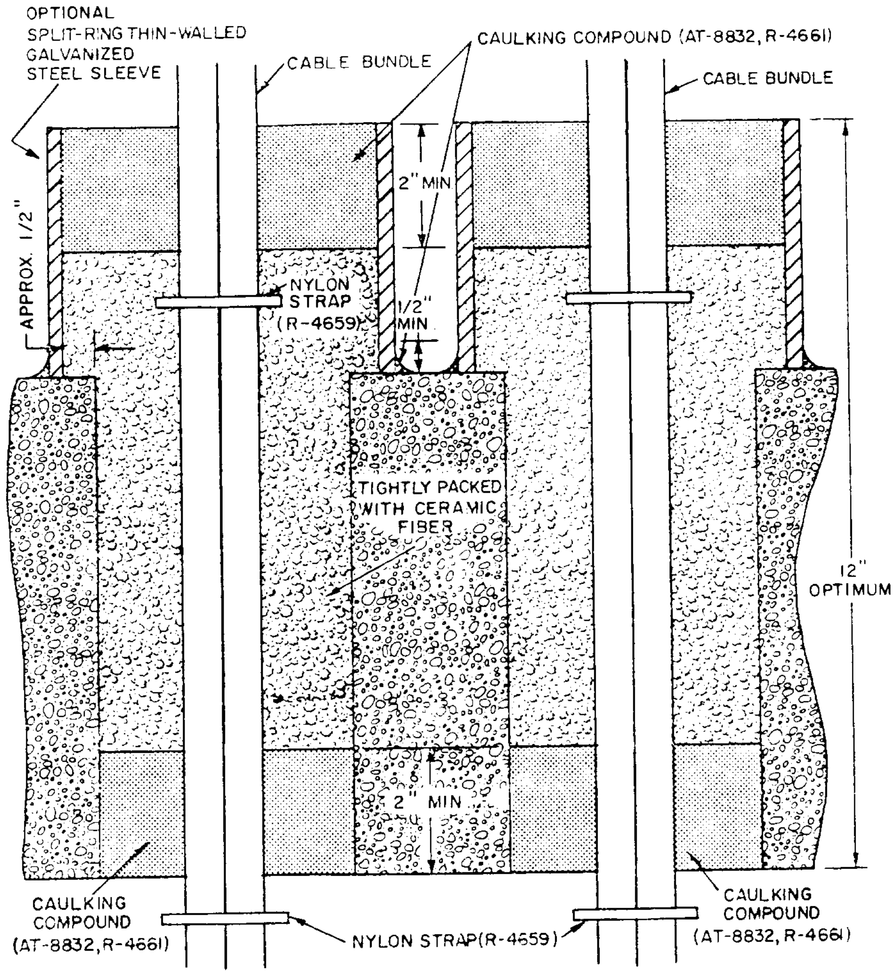

Fig. 9—Recommended Fire-Stopping Configuration for 2- by 6-Inch and 4- by 6-Inch Cable Holes

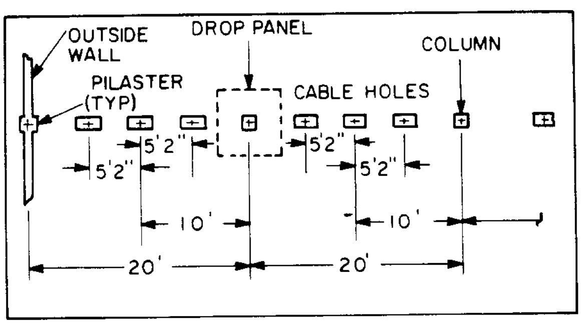

Fig. 10—Plan for Plugged Cable Openings for Future Use

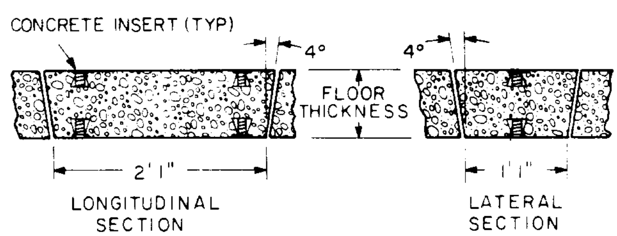

Fig. 11—Tapered Precast Concrete Cable Opening Plug-In Place

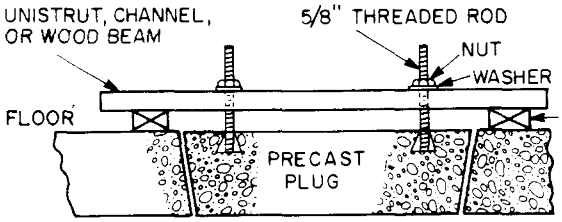

Fig. 12—Removal of Precast Plug with Beam and Jack Screws

kind of riser pathway because it usually can be cast easily into a floor.

CONSTRUCTION

9.02 The two riser shaft designs most commonly used in both steel and in reinforced concrete construction are:

(1) A long narrow shaft that distributes one or more tiers of cable along the exterior wall parallel to the axis of the CEF, interrupted only by columns.

(2) A localized high capacity shaft that clusters the express cables vertically to the upper areas where they are dispersed.

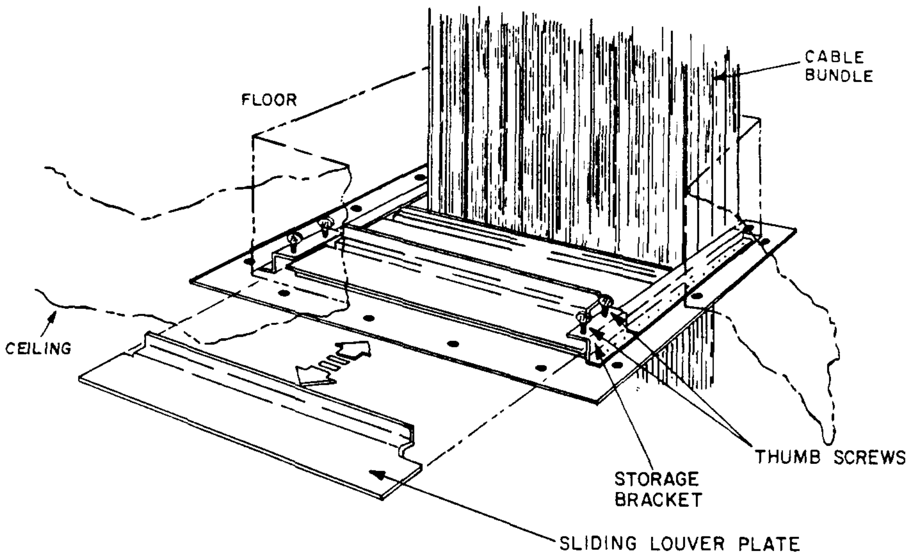

Fig. 13—Adjustable Cable Hole Ceiling Plate for 12- by 24-Inch and 24- by 24-Inch Cable Openings

9.03 Both types of designs present difficulties and extra expense in fire stopping and are not recommended for new construction. Fortunately, these large area shaft designs are not needed in buildings having the multiplicity of 1 foot by 2 feet between column cable holes and lineups of sleeves for CEF riser cables. Where planned cabling requires use of dedicated shafts, the floor openings should be limited to a 2-foot by 2-foot area. Typically, this type of shaft can be easily accommodated when positioned adjacent to columns, in corners of floors, or in the core area of the equipment building.

FIRE PROTECTION

9.04 All shaft openings must be fire stopped at alternate floors, whether or not cables are present, to ensure that the fire resistance requirements are met. This task is not difficult because of the limited and angular void between the cables and

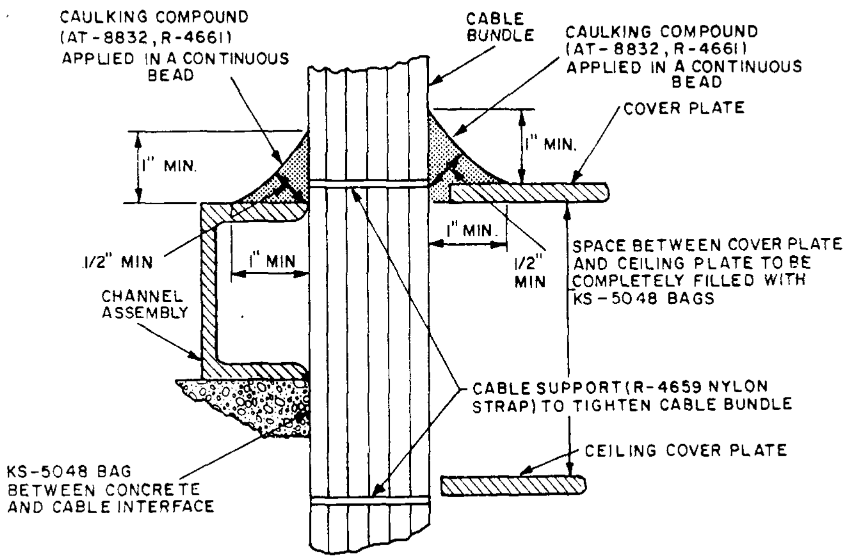

Fig. 14—Fire Stopping Arrangement for 12- by 24-Inch and 24- by 24-Inch Cable Openings

edges of the 2-foot by 2-foot maximum shaft. Fire stopping procedures described for between-column cable holes should be followed in closing square openings that serve as cable shafts except that cable fill should be limited to an 18-inch by 18-inch area. Cable bundles beyond this size cause problems in meeting fire protection requirements. Besides having to meet these fire stopping requirements, riser shafts should also be enclosed with fire rated walls with access doors when they penetrate office space.

9.05 In addition to the standard cable-hole type, size and pattern information is available for other types and sizes of cable holes that may be necessary to meet other service demands. Design standards for cable openings of various sizes and shapes and for various kinds of building construction are described in Section 760-330-150. Equipment design requirements for cable-hole sheathing are covered in Section 801-006-151, while installation requirements appear in Section 800-614-153.

10. REFERENCES

Section 760-330-150—Cable Openings

Section 760-330-151—Core Method of Forming Main Frame Cable Holes

Section 800-614-153—Sheathing for Cable Openings—Installation—General Equipment Requirements

Section 801-006-151—Cable Hole Sheathing—Equipment Design Requirements

Section 801-026-167—Cable Hole Sheathing for Modular Raised Floor Systems

AT&T Floor Plan Data Sheets: Section 7.1, sheets 9, 19, 27, 28, 31, 32; Section 12.4, sheets 3, 3A, 3B, 4

11. CABLE OPENING STANDARDS

GENERAL

11.01 Building personnel shall close all openings with fire-rated material prior to the running of cable.

11.02 During cable installation, forces engaged in work operations shall fire-stop all openings during the final working hour of each day.

11.03 At the completion of the job, all feeder, riser, switchboard, and power cable runs shall be fire-stopped by the forces engaged in work operations.

SLEEVES

11.04 Provide 4-inch I.D. sleeves for riser cables.

11.05 Pack ceramic fiber in void space to fire-stop the opening and seal the top and bottom of the opening with fire retardant caulking compound.

RECTANGULAR UNDERFRAME HOLES

11.06 Provide precast modules or 2- by 6-inch or 4- by 6-inch rectangular holes beneath the protector or distributing frames for stub connector cables.

11.07 Band connector cables, pack ceramic fiber in void space to fire-stop the opening, and seal the top and bottom of the opening with fire retardant caulking compound.

RECTANGULAR BETWEEN-COLUMN HOLES

11.08 Provide three holes, 1 by 2 feet, between columns in equipment space for distributing, switchboard, and power cable.

11.09 Leave a 3-inch minimum space between the cable bundle and the sides of the cable opening.

11.10 Band the cables, fill and tightly pack the void with KS-5048 bags under a pressure of about 50 pounds per square foot, and seal the opening and sheathing cover with fire retardant caulking compound.

11.11 Install an adjustable bottom plate on all new holes and on reworked holes in floors and on wall closures.

RECTANGULAR WALL HOLES

11.12 Provide, as required, 1- by 2-foot holes.

SHAFT OPENINGS

11.13 Provide shaft openings, when required, limited to a maximum size of 2 feet by 2 feet.

11.14 Leave a 3-inch minimum space between the cable bundle and the sides of the cable opening.

11.15 Band the cables, fill and tightly pack the void with KS-5048 bags under a pressure of about 50 pounds per square foot, and seal the top of the opening and sheathing cover with fire retardant caulking compound.