CEF CONDUIT ENTRANCES, HOLES, AND RISERS

CONTENTS PAGE

1. GENERAL

1.01 This section discusses and provides standards for CEF conduit entrances, risers, and holes. 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 supersedes Section 6.2 of Specification X-74300, "NEBS Building Engineering Standards (BES)." Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The Cable Entrance Facility (CEF) interfaces with the outside plant cable and the main distributing frame equipment. From a structural standpoint, this interface is made at the walls of the CEF and involves conduit entrances, cable riser openings, and cable holes. This section provides a description of these interfaces for above-surface, subsurface, and duplex CEF systems. Space requirements, locations in the CEF, and typical installation options are presented.

2. CONDUIT ENTRANCES

2.01 Conduit entrances to central office buildings fall into two categories: floor entrances and wall entrances. The size and location of these openings depend upon the CEF design, the size of the building (single or multistoried), and the needs of the central office.

2.02 Floor entrances for vertically-racked, above-surface CEF designs can be constructed by either penetrating the floor with the duct itself or using duct couplings. In both methods, the ducts will extend approximately 3-1/2 inches above the finished floor level. The number of ducts and the spacing between the ducts (1-foot minimum) will vary with central office requirements. (See Fig. 1.)

2.03 All conduit entrances, those empty and those containing cable, must be plugged with standard rubber duct plugs. These plugs seal the ends of the ducts and prevent potentially hazardous gases and liquids that may be present in the conduit structures from entering the building. Waterplug and B Duct Sealer can also be used to plug conduit ends.

2.04 To provide additional protection against hazardous gas ingress into a CEF, gas venting chambers shall be employed as part of the conduit system close to the building foundation. A typical chamber consists of a small underground structure of reinforced concrete constructed to accommodate the required duct capacity as shown in Fig. 2. Gas venting chambers for various duct capacities should be designed to meet the imposed soil load requirements at the installation site.

2.05 Plastic duct terminators or ducts directly embedded in concrete can be used at both ends of the gas venting chamber. The number of ducts or terminators and their arrangement in the walls depend upon the size and shape of the conduit structure entering the building. Wall areas containing duct terminators are usually recessed to provide a keyway should concrete encasement be required.

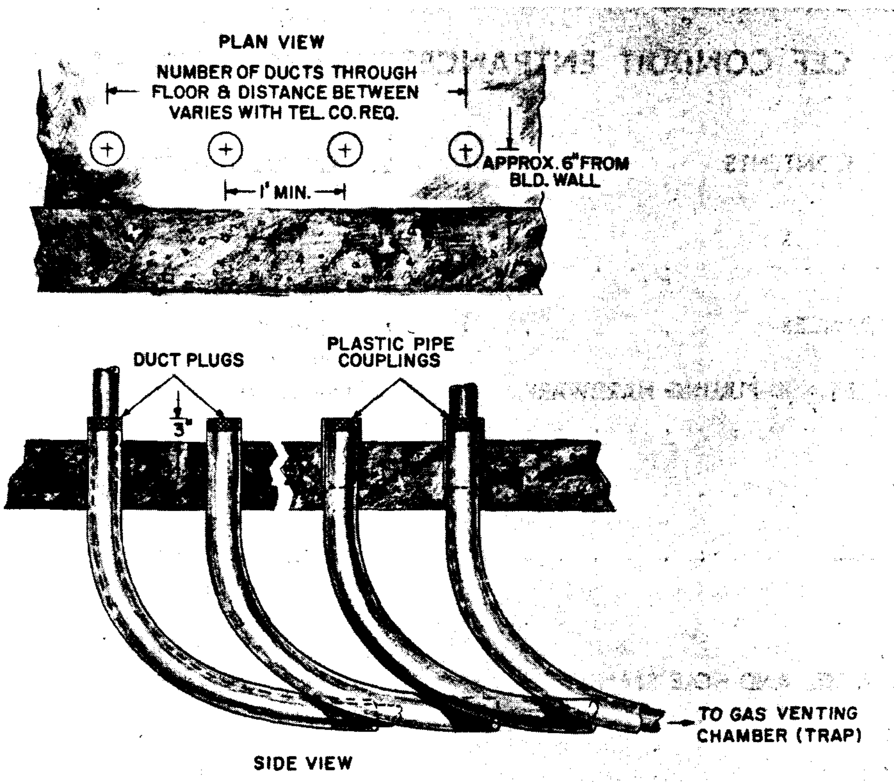

Fig. 1—Above-Surface CEF Duct Entrance

2.06 The gas venting chamber functions as a ventilation chamber through which the plastic ducts pass. Each duct must contain a series of vent holes or notches in its wall section to permit any gas to escape into the chamber. Two 4-inch diameter vent pipes extending either along the outside building wall or inside the wall are required to achieve maximum natural ventilation for heavy and lighter-than-air gases. The vent-pipe opening must not be located in the vicinity of any windows or other ventilation openings.

2.07 Wall-type cable entrances, usually associated with subsurface CEF designs, can be constructed using stop-type duct terminators or ducts enclosed by the wall itself. Terminators should be used with plastic conduit, because concrete adheres to plastic poorly. The number and spacing of ducts will depend on the CEF design and central office needs. Duct plugs are required in both empty and occupied ducts. Terminators have provisions for terminating ducts as well as accommodating duct plugs for sealing.

2.08 Gas venting chambers for wall-type entrances can be constructed integrally with the wall of a subsurface CEF. (See Fig. 3 for a typical installation.) In large buildings requiring many ducts, the type of installation shown in Fig. 3 should be employed. This option permits a uniform wall thickness at the cable entry location and does not compromise the structural integrity of the building.

3. CEF ACCESS HOLES AND PULLING HARDWARE

3.01 Each basic CEF alley should be equipped with an access hole or cable chute located above the duct entrance or at the end of the alley opposite the duct system entrance. The access hole should be centered in the alley. The exterior appearance of the access hole should be located so either a reel trailer or a line truck can be positioned conveniently. The access hole should have a secure cover.

3.02 Pulling irons should be located in the floor and ceiling at both ends of the CEF alley, as well as at each end wall. If the vault arrangement involves bends, pulling bars should be located at each bend to permit changing the pull direction.

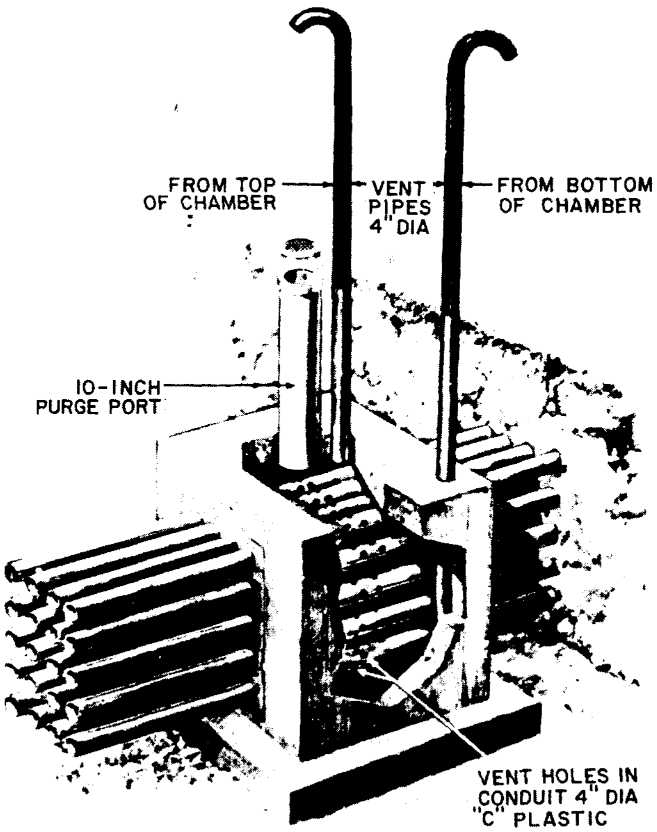

Fig. 2—Gas Venting Chamber (Trap) for Office With Above-Surface CEF

3.03 In an above-surface CEF, ironwork above the duct entrances and an access hole must be provided. The access hole can be located in either end wall of the CEF, depending on the location of the central office manhole and the conduit entrance configuration. Ironwork to support sheaves and other cable placing apparatus must be provided. A minimum load-bearing capability of 2000 pounds is recommended.

3.04 Access holes, all pulling hardware, and ironwork should be reviewed by Outside Plant Engineering. The proposed design should be coordinated with construction forces to resolve any cable-pulling difficulties and with the building designers to assure the adequacy of the building support steel.

4. CABLE HOLES

4.01 Cable holes or slots in the ceiling of a subsurface CEF provide openings through which stub cables reach the main distributing frame or protector frame. They are located in the central areas of building bays away from the column lines. In all cases, discrete holes below each frame vertical, sized to satisfy stub-cable density requirements, should be provided. In forming the holes, enough concrete is eliminated so that the increase in floor slab flexibility must be considered in the design.

4.02 There are three cases to consider in the design of floor openings between the CEF and the distributing frame area:

(a) The modular Protector Frame (PF)

(b) The Double-Sided Protector Frame (DSPF)

(c) The Low-Profile Conventional Distributing Frame (LPCDF).

4.03 In the past, cable holes under the frames were constructed with continuous slots, interrupted slots, or small holes. The supposed advantage of slots is that they provide a large area for cable. However, they are difficult to seal for fire protection and expensive to build. Small holes with a one-to-one correspondence to the frame verticals provide sufficient area for the cables. They need not jeopardize the structural integrity of the floors, constitute the least expensive method, and can be sealed easily before or after cable installation.

4.04 Small individual holes are recommended for openings to frames. A standard longitudinal pattern of holes cannot satisfy all building designs, since frame dimensions differ and frame lineups vary. However, standardization of aisle width and building height should make it possible to select a suitable hole pattern for any one particular frame.

4.05 A series of small holes can meet all cabling, structural, and fire-protection requirements. For the DSPF and LPCDF, 6- by 4-inch holes should be formed into the slab 8 inches on center as shown in Fig. 4. This size is adequate for the cable requirements and allows extra space for bundles of cable that pass through the hole obliquely. When a perforated block is used, 10- by 4-inch holes should be formed to hold the perforated block. The more closely spaced holes for the modular PF should be 6 by 2 inches as shown in Fig. 4. Again the hole area is sufficient for the

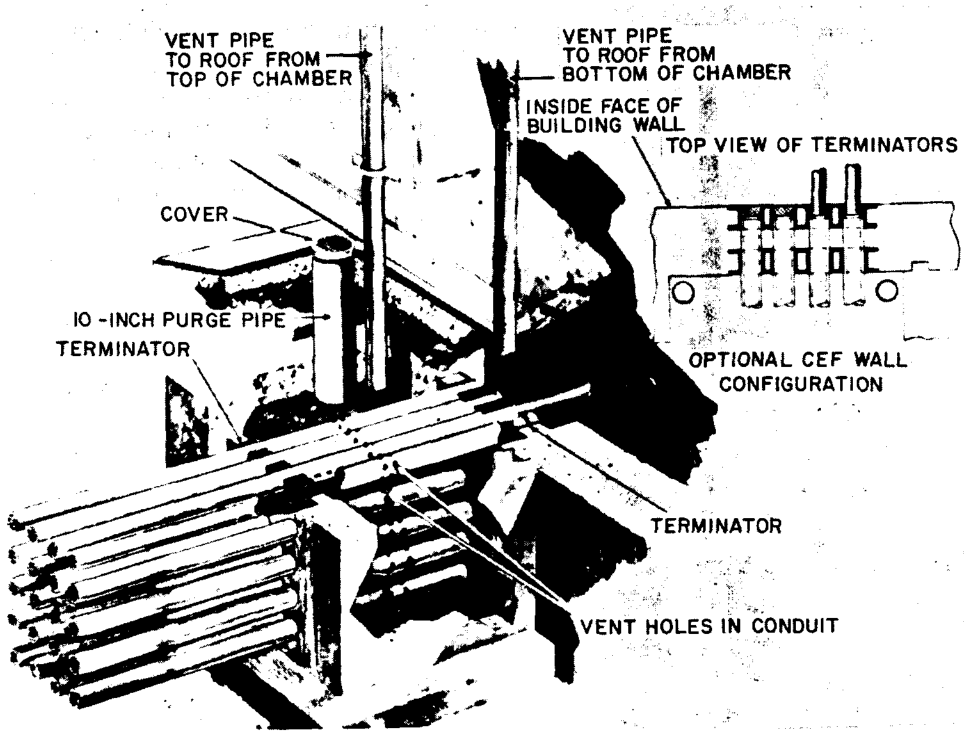

Fig. 3—Gas Venting Chamber (Trap) for Office With Subsurface CEF

cable volume and the smaller size is structurally more desirable for the closely spaced holes.

4.06 It is important that floor design, with the proposed frame opening patterns, be consistent with the structural requirements of New Equipment-Building System (NEBS). Of significance are the 150-psf design live load and the 12-foot 6-inch ceiling height from the slab to the bottom of the lowest projection. The floor in the main frame area must carry the same live loads as the remainder of the building. The floor structure should also be no deeper than the floor structure on the same level in the remainder of the building. Figure 5 shows schematically how this framing might be done for different methods of construction and types of equipment frames.

5. RISER ENTRANCES

5.01 In the duplex CEF system, riser cable spaces will be required to route incoming cable from the CEF to frames located on the upper floors. The riser spaces may simply consist of holes in the floor between columns along an exterior wall, individual conduit, or a line of holes in the floor behind a partition in the building. Shafts are not recommended since they are only slightly more economical to construct than sleeves and the required fire and smoke stopping is at best difficult and costly. (See Sections 760-200-032 and 919-240-610 for fire-protection requirements at floor openings.)

5.02 Riser space for cables is most economically provided, from a structural standpoint, when a series of discrete holes in the floor slab is used. The geometry of the wall-mounted splice closures and the diameter of the cable require 4-inch inside diameter steel sleeves or conduit cast into the concrete on (minimum) 1-foot centers. Because the holes are relatively small, the reinforcing steel in the concrete floor can be diverted around them easily without interrupting any of the bars. However, in forming the holes, enough of the concrete section is eliminated that the increase in floor slab flexibility must be considered in the structural analysis.

5.03 From the viewpoint of utility, structural integrity, and fire safety, the sleeves are best laid out in, or adjacent to, the column line along an exterior wall of the building directly above the CEF. This location distributes the sleeves along the length of the CEF as well as the PF.

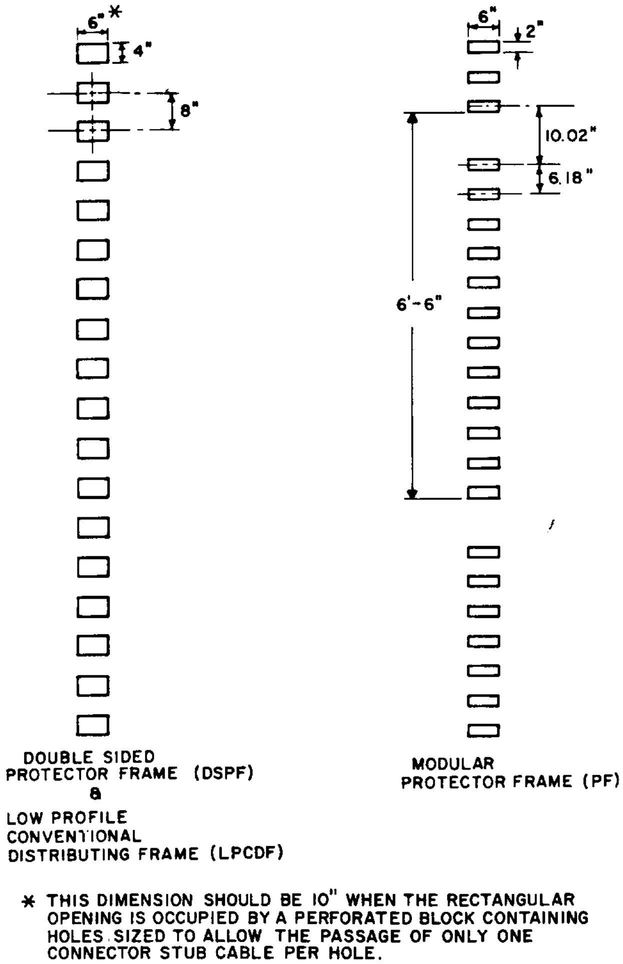

Fig. 4—Cable Hole Patterns for Various Frames

The column line requires some type of framing from the structure of the building itself; this framing can be relatively easily modified to accommodate the sleeves. Any additional framing that may be required is at the edge of the building floor space and, therefore, will not cause any headroom penalties. Figure 6 illustrates how this can be done for two types of framing systems used in building construction.

5.04 The riser area can be enclosed by a fire-rated partition or in a floor-to-ceiling fire-rated shaft, chase, or cabinet. Provisions must be made to keep floor openings in shafts, chases, and cabinets accessible for future cable additions, sealing measures, and fire-fighting access. In most buildings, the intercolumn space will provide walls on the three sides, thus requiring only one additional wall, as shown in Fig. 7, for the construction of a partition. Individual metal conduits can also be used to carry riser cable between floors. With respect to fire protection, in designs without partitions or conduit, individual sleeves and slots should be sealed both before and after cables pass through them. Sections 760-330-150 and 760-200-032 cover requirements for protection at cable slots and sleeves that are fire-stopped at each floor.

5.05 ***Building Design Load Considerations:*** Temporary and permanent riser cable support must be included in riser pathway designs. Temporary or short-term support occurs during initial installation and permanent or long-term support during the service life of the cable.

5.06 ***Temporary Load Considerations:*** When the cable is being installed by hoisting to an upper floor, its entire suspended weight is carried by the pulling winch located on an upper floor. During this operation when the winch is located adjacent to the riser opening, the cable pulling load is transferred to the split spandrel beam structure.

5.07 The magnitude of the load exerted on the spandrel by the winch can range up to 12,000 pounds of concentrated force when two winches are used in tandem. Therefore, spandrels must be designed to handle loads of this magnitude during cable installation.

5.08 ***Permanent Load Considerations:*** There are several acceptable techniques for permanently supporting cables in riser space; however, some of these techniques require minor building design provisions. The three most suitable methods are: (1) supporting strand lashed to the cable at 3-foot intervals, (2) Kellems grips placed every third floor, and (3) cable straps or ties secured to cable racks.

5.09 The strand support method is used for installations of long suspended lengths of cables, especially those enclosed in conduit. One method of supporting the riser strand is to secure the strand to a support bar near the ceiling level of the story on which the cable terminates. The strand can be looped and tied around the bar as illustrated in Fig. 8. In general, the support strand should be designed to support an estimated weight of 10 pounds per linear foot of riser cable. The total load of the specific cable length and number of riser cables, along with the factor of safety

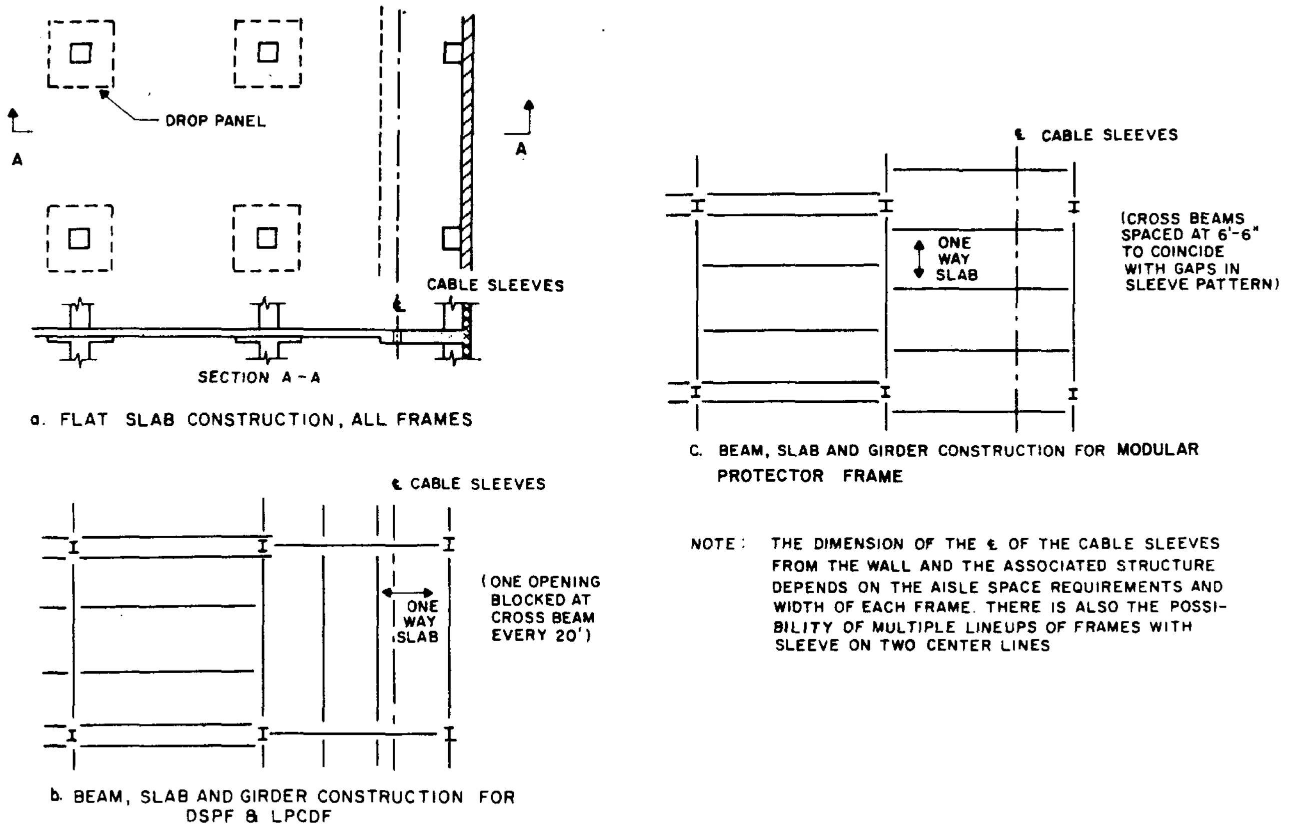

Fig. 5—Framing for Cable Holes Below Main Frames

appropriate to the type of construction*, must be incorporated in the structural member design.

* Live load factors of safety are recommended by codes of the American Concrete Institute and the American Institute of Steel Construction.

5.10 The Kellems cable grip can be used to support cables in sleeves or shafts. The floor sleeve protrusion can serve to hook the cable grips so they can support the cable below the floor. Figure 9 illustrates a cable grip of this type using a split ring to support the grip. If shafts are used, grips may also be attached to a support strand which is in turn attached to a support bar as shown in Fig. 10. In either case, the building members will not generally be heavily loaded by this system because the supporting loads are distributed more equally, usually at every third floor level.

5.11 Wall-mounted racks can also be used, with at least three horizontal members per floor level, to support cables without cable grips or strand. The riser cables are secured at each horizontal support member, thus distributing the cable weight equally on the wall.

5.12 ***Riser Cable Installation:*** Riser cables are usually pulled into place by electric winches which range in power up to 1 horsepower—110 Vac, capable of lifting 6000 pounds at a speed of approximately 5 feet per minute. Two of these cable pullers can be placed in tandem to increase pulling capacity for difficult and/or long cable installations. Raising the cable provides maximum control for long vertical riser pathways; however, when a long length of slack is required on an upper floor, such as on carrier floors, it may be more convenient to lower the cable down the riser space. Positioning of the cable reel and, more importantly, provision of an adequate braking system are problems encountered when lowering riser cables. A height limitation of no more than three or four floors is imposed when using this method. In many cases, the height to which cables can be

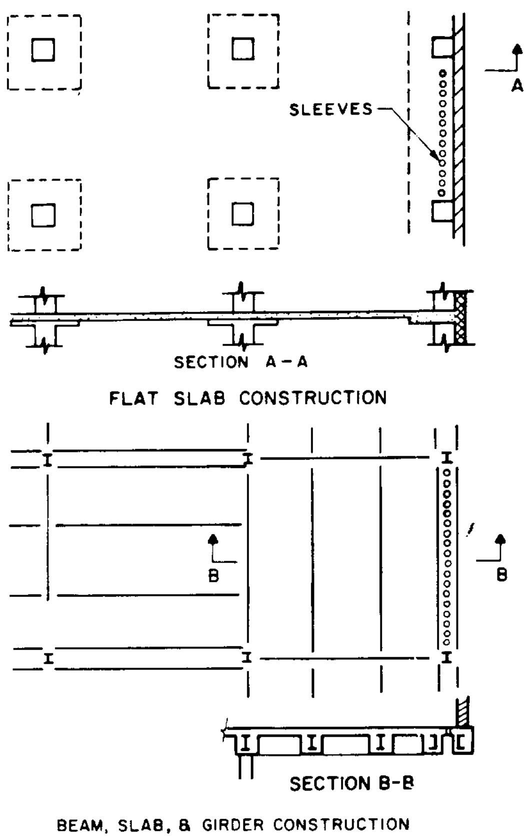

Fig. 6—Construction of Riser Openings

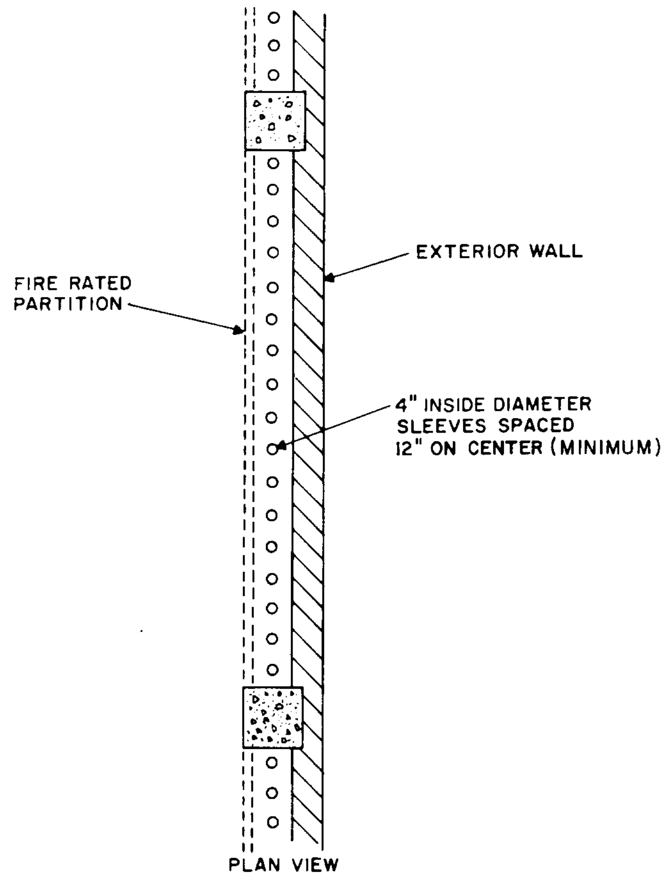

Fig. 7—Riser Space Layout

raised is limited by the size of the cable reel that can be maneuvered into place.

5.13 ***Riser Cable Placement:*** The riser cable installation procedure may be divided into three phases: (1) pulling, usually less than 1 hour; (2) temporary suspension, perhaps lasting over a weekend; and (3) permanent suspension, for the service life of the cable. To raise the cable, a pulling line is attached to a pulling eye, a core hitch, or a cable grip (Kellems grip). With a pulling eye or core hitch, the pulling force is taken directly in tension by the metallic conductors. With the cable grip, the pulling force is transmitted to the core through the sheath by a pinching action and shearing force. For this reason, cable grips may damage the cable sheath on long or difficult pulls.

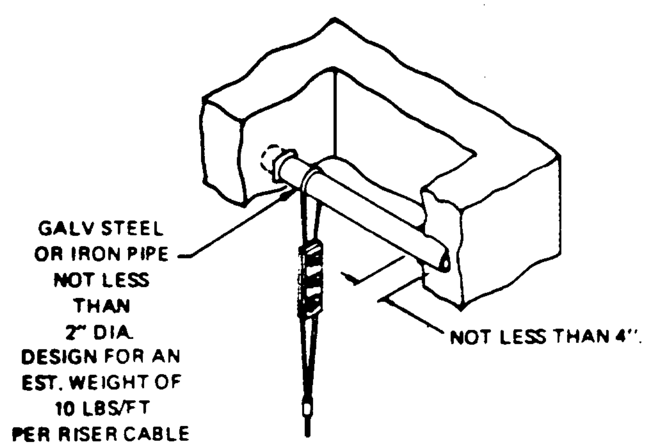

Fig. 8—Cable Support at Ceiling Level

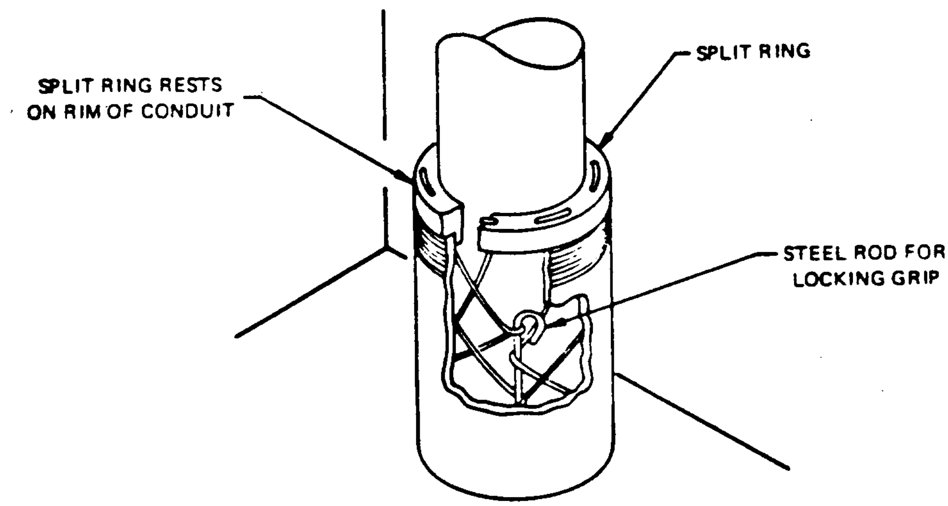

Fig. 9—Kellems Cable Grip With Split Ring Support (Fire Stop Not Shown for Clarity)

6. REFERENCES

1. Section 760-200-032—Cable Openings—Design Standards

2. Section 760-330-150—Cable Openings

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

4. Section 760-620-150—Interior Construction to Restrict Spread of Fire

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

6. Section 919-240-100—Conduit System Design

7. Section 919-240-610—Cable Entrance Facility System Design

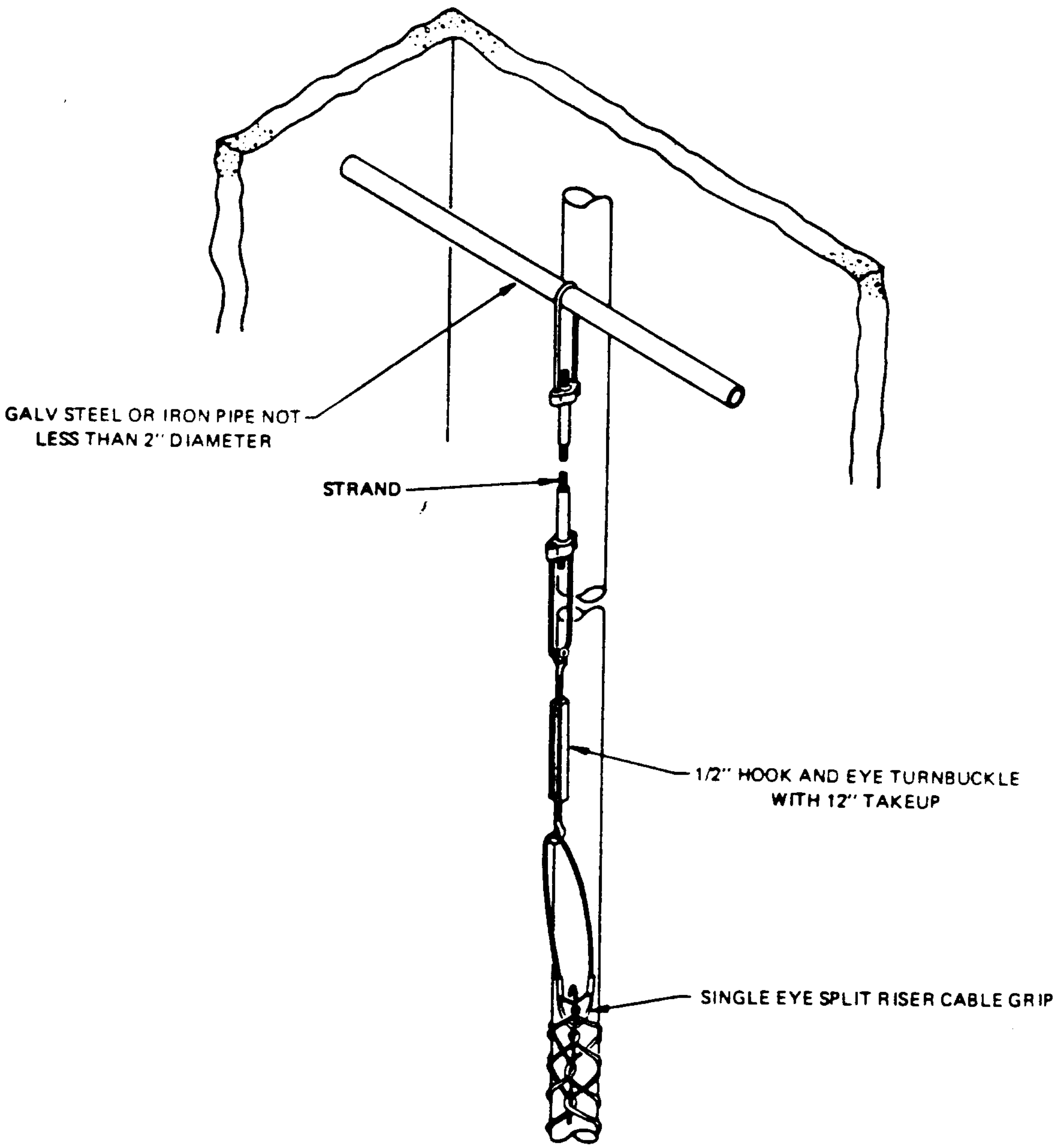

Fig. 10—Intermediate Cable Grip Support

CEF CONDUIT, RISER, AND HOLE STANDARDS

(a) ***Conduit entrances:***

(1) Select conduit formation and spacing between conduits based on central office requirements.

(2) Plug empty and occupied ducts in the conduit entrances with standard rubber duct plugs.

(3) Provide a gas venting chamber that is part of, or is close to, the central office building for all conduit entrances.

(4) Construct the gas venting chamber structure to be consistent with conduit capacity and the imposed soil-load requirements.

(5) Do not route plastic conduit or cables through open below-grade crawl spaces or pits.

(b) ***Cable holes:***

(1) Provide holes sized to satisfy stub- and riser-cable density requirements.

(2) Consider the increase in floor slab flexibility resulting from the removal of concrete for holes.

(3) Observe fire safety practices covering floor openings in a central office.

(c) ***Riser spaces:***

(1) Provide riser spaces to satisfy riser-cable requirements for a duplex CEF design.

(2) Select discrete cable holes based on cable density requirements.

(3) Consider the increase in floor slab flexibility resulting from the removal of concrete for riser openings.

(4) Observe fire safety practices covering floor openings in a central office.