NETWORK EQUIPMENT BUILDING SYSTEM (NEBS) IN NEW BUILDINGS

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1. GENERAL

1.01 This section provides a summary of the Network Equipment—Building System (NEBS) and provides standards 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, "NEBS—General Equipment Requirements." The information provided by this section revises and supersedes that information originally provided in Section 760-100-030. This section contains information on building planning only and excludes equipment space planning standards. This exclusion of equipment space planning standards follows the organizational separation of these functions.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

2. CENTRAL OFFICE BUILDING STANDARDS

2.01 To gain flexibility and to realize specific cost savings, all telephone central office buildings shall be built to system standards. Buildings will vary in many ways, such as overall size, physical appearance, and architectural details, but a few features are identical. These standard features, which

are listed below, are the basis of the new standard central office buildings.

Top of floor slab to bottom of lowest structural member	12-1/2 feet
Equipment systems floor live load (including transient load)	150 pounds per square foot (psf)
Building bay size	20 × 20 feet
Maximum column size	2 feet 2 inches × 2 feet 4 inches
Cable holes	Three between each pair of columns in all column rows parallel to equipment frame lineups

A. Floor-to-Ceiling Height

2.02 Within the space between the top of the slab and the bottom of the lowest structural member, a 10-foot clearance is reserved for equipment frames and cable. The remaining 2-1/2 foot height is primarily for the cooling system air ducts or plenum.

2.03 Floor-to-ceiling heights are given in Table A. Refer to Section 760-210-150, "Ceiling Heights for Equipment Buildings," for further information.

B. Floor Loading

2.04 In general, structural floors for equipment areas should be designed to support a uniformly distributed live load of 150 psf. Floor loadings for the various central office equipment areas are given in Table A. Refer to Section 760-200-021, "Design Loads for Telephone Buildings," and Section 760-200-021, "Floor Design Loads," for further information.

C. Building Bay Dimensions

2.05 Optimum building column spacing is a compromise between wide spacing, which results in less interference with the equipment, and close spacing which permits lighter floor construction and more slender columns (see Section 760-200-100). Studies have shown that with floor live loads of 150 psf, minimum costs occur with column spacing ranging between 15 and 25 feet for concrete construction and below 25 feet for steel construction (Fig. 1).

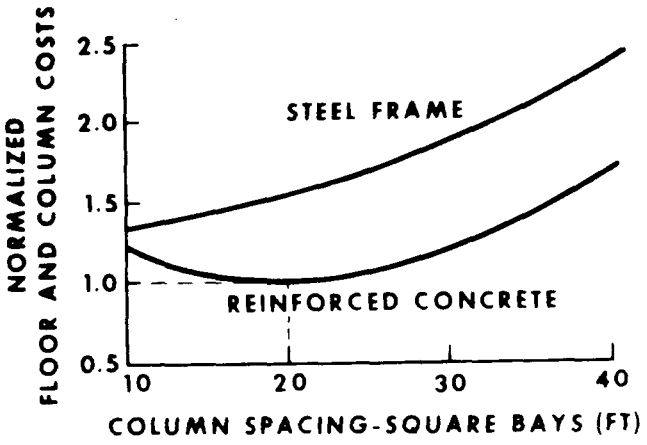


Fig. 1—Building Cost as a Function of Column Spacing

2.06 Modular dimensions recommended by the American National Standards Institute are 4 feet and 4 inches. The use of these dimensions, or multiples of them, increases the adaptation of standard commercial building construction techniques to telephone equipment buildings and enables the use of standard materials and components.

2.07 Equipment aisle widths and frame depths also influence the selection of building bay dimensions. Equipment systems must fit reasonably within the standard building space. Floor plans developed for the full variety of equipment intended for central office installation show that 20-foot-square building bays are entirely acceptable.

2.08 Building bay size is measured center-to-center of columns and center-to-surface of peripheral walls. Refer to Section 760-200-152, "Column Spacing in Equipment Rooms."

D. Column Size

2.09 The maximum column size (cross-sectional area) that can be used in the standard floor plan is 2 feet 2 inches (parallel to the frame lineups) by 2 feet 4 inches. This size allows at least a 3-inch clearance between the column and adjacent frames, and a minimum 1-foot 8-inch wiring aisle between the columns and cross-aisle frames. The 1-foot 8-inch aisle width allows sufficient access for most frames and rolling test equipment. If larger columns are necessary in the lower stories of a very tall building, a

TABLE A

SUMMARY OF NEBS EQUIPMENT VERTICAL SPACE ASSIGNMENT AND UNIFORM FLOOR LOADINGS

EQUIPMENT	VERTICAL SPACE	FLOOR LOAD (psf)
EQUIPMENT FRAME AREA		
Frames	Floor to 7 ft*	115*
Cable distribution system and installation clearances (includes allocation of 5 psf for via cable at 9 to 10 feet)	7 to 10 ft	25
POWER AREA		
All equipment, cable, and installation clearances	Floor to 10 ft*	140
DISTRIBUTING FRAME AREA		
All equipment, cable (including via cable), and installation clearances	Floor to 10 ft*	140
CABLE ENTRANCE AREA		
All equipment, cable, and installation clearances	Floor to 10 ft	140
CONVENTIONAL COOLING SYSTEM (CCS)		
Overhead ducts and diffusers	10 to 12-1/2 ft	†
MODULAR COOLING SYSTEM (MCS)		
Raised deck and supportwork	Floor to 1-1/2 ft	10
Supply, return, and drain piping	Floor to 1-1/2 ft	†
Process coolers	1-1/2 to 11-1/2 ft	115
Suspended ceiling (air plenum and lights)	11-1/2 to 12-1/2 ft	†
Transient loads	—	10

* The following apply in equipment areas where the MCS and/or raised deck is used:

- Vertical space dimensions from the floor are increased 18 inches, since equipment is placed on top of an 18-inch high raised deck.
- Floor load allocations include the weight of process coolers, raised deck, and supportwork.

† The weights of these items are considered "dead load."

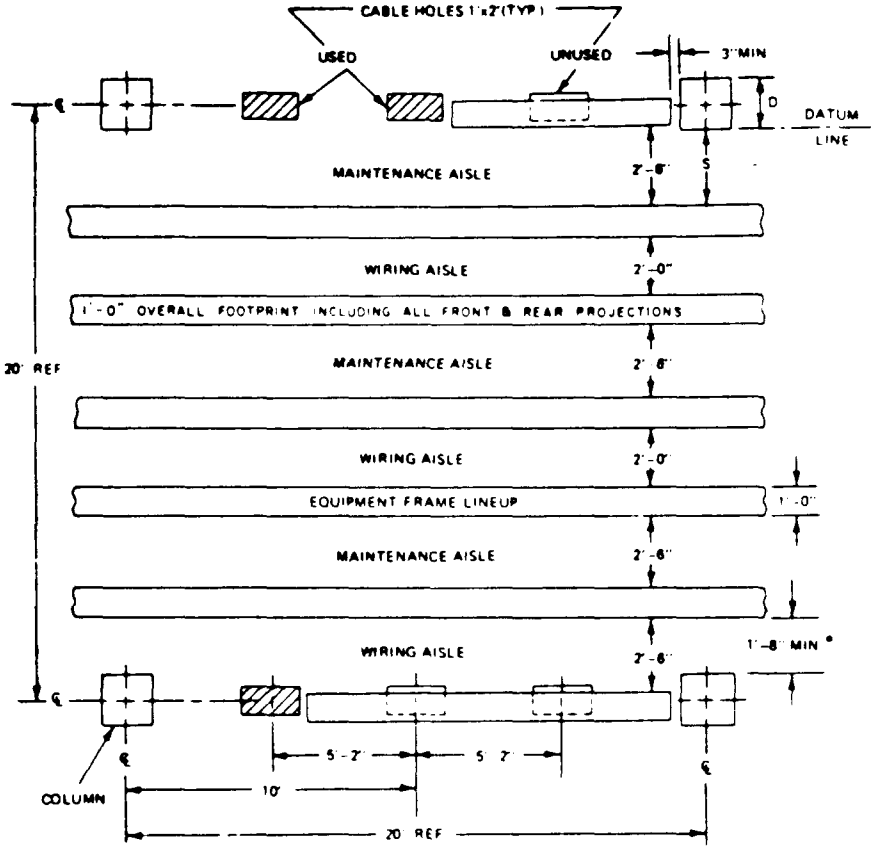
few frames must be omitted from the cross-aisle lineup.

E. Cable Holes

2.10 A cable hole pattern suitable for use with flatslab floor construction (see Section 760-200-100) is recommended as standard. The cable hole size and spacing (Fig. 2) will provide clearance between vertical cable runs and either 18-inch wide cross-aisle troughs located on 5-foot centers (Fig. 3), or 12-inch wide cross-aisle cable troughs located at 1-foot 1-inch increments along standard Electronic Switching System (ESS) lineups. Refer to Section 760-200-032, "Cable Openings—Design Standards."

3. CENTRAL OFFICE EQUIPMENT AREAS

3.01 The spatial features of a functional and efficient central office are presented in the following material. This description of the central office is divided into four parts corresponding to the main subdivisions of the total equipment area: the equipment frame, power, distributing frame, and cable entrance areas.



COLUMN DEPTH D	SPACE AT COLUMN FACE S
1'-10" OR LESS	2'-6"
2'-0"	2'-4"
2'-2"	2'-2"
2'-4" OR GREATER*	2'-0"

*FOR COLUMN DEPTHS GREATER THAN 2'-4" IT MAY BE NECESSARY TO OMIT SOME FRAMES IN THE EQUIPMENT LINEUP OPPOSITE COLUMNS (WIRING AISLE SIDE)

Fig. 2—Typical Standard Floor Plan for Principal Depth (12-Inch) Frame

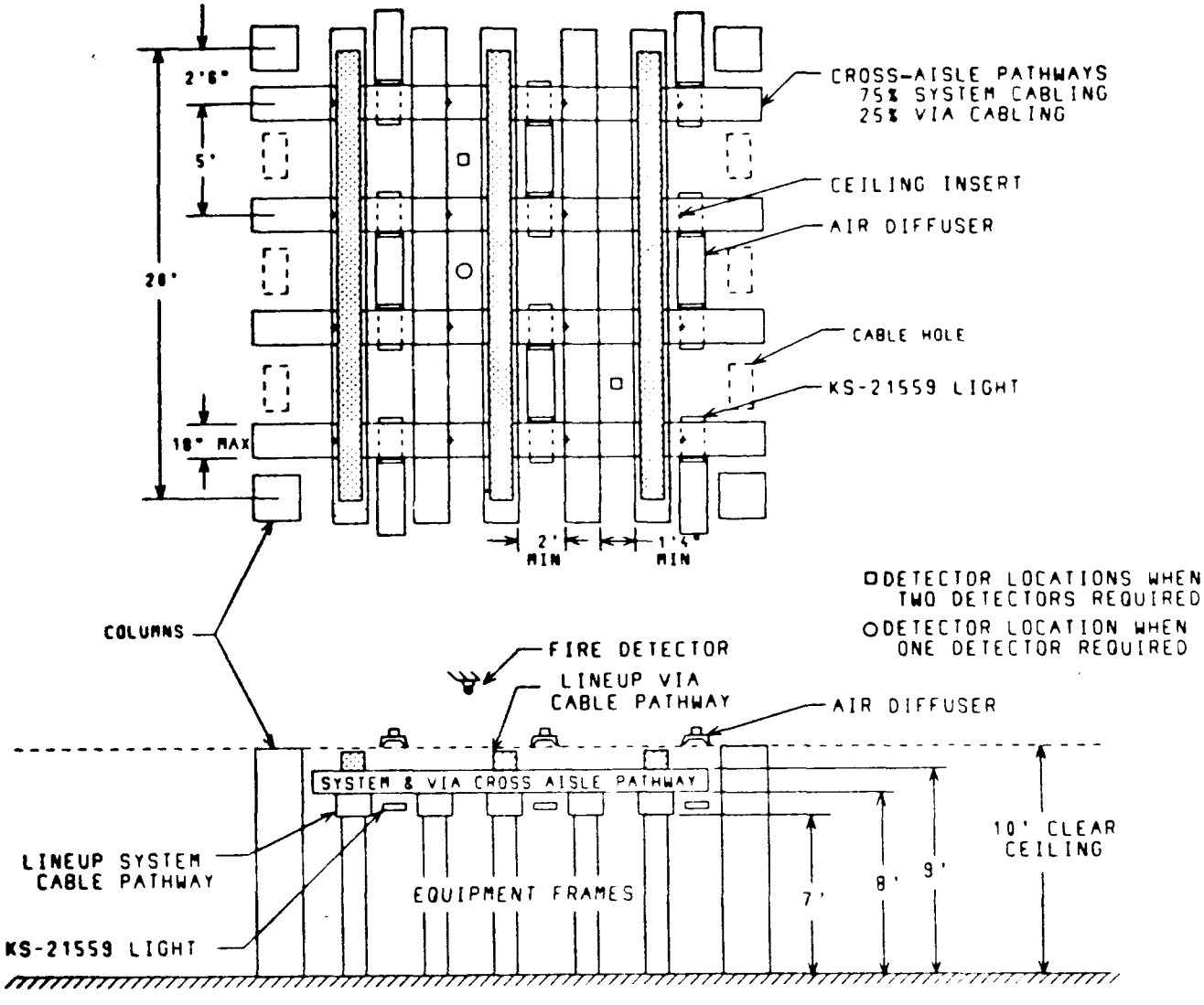


Fig. 3—Cable Pathways Plan for 12-Inch Deep Frame Areas

A. Equipment Frame Area

3.02 Elevation views of the two standard configurations in typical equipment frame areas are shown in Fig. 4. One configuration features a Conventional Cooling System (CCS), and the other, the Modular Cooling System (MCS). The CCS is an all-air system which employs central fan rooms, overhead ducts, and diffusers for air distribution. The MCS incorporates a raised floor, water-cooled fan-coil units (process coolers) located near the equipment frames, a suspended ceiling or ductwork for local distribution of cooling air, an underfloor chilled-water distribution system, some telephone cable and electrical conduit, condensate and humidifier piping, smoke detectors, and an air-return system for the process coolers. The MCS is intended for use in areas where the equipment-heat dissipation over large areas averages from 25 watts/square foot to 100 watts/square foot. Refer to Section 760-230-100, "Modular Cooling System."

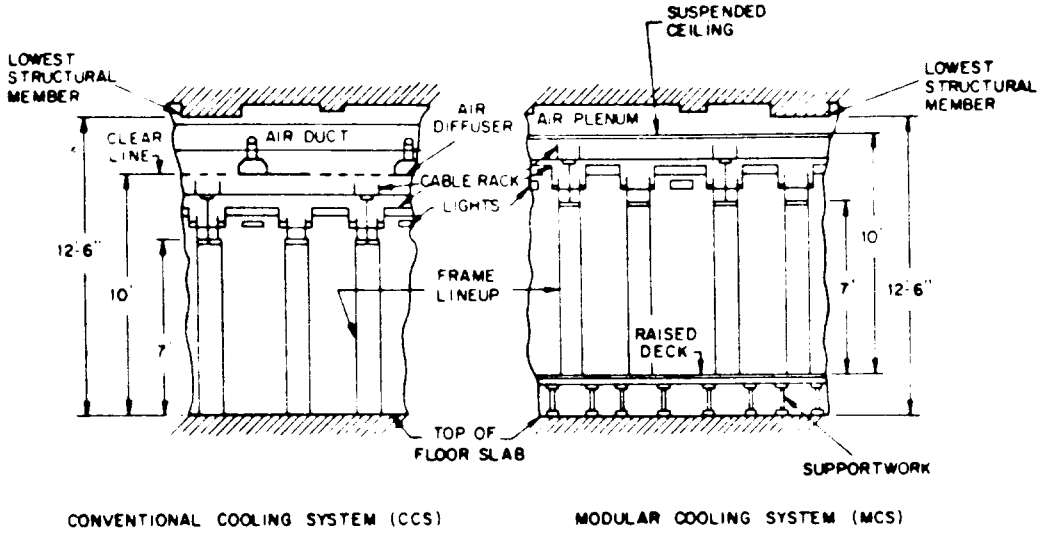


Fig. 4—Typical Equipment Frame Areas

3.03 The vertical space in the equipment frame area is allocated as follows:

FOR THE CCS

Floor to 7-foot level	Equipment frames
7- to 10-foot level	Cable and lights
Over 10 feet	Cooling air ducts and diffusers

FOR THE MCS

Floor to 1.5-foot level	Raised floor
1.5- to 8.5-foot level	Equipment frames
8.5- to 11.5-foot level	Cable and lights
Over 11.5 feet	Suspended ceiling air plenum

3.04 The floor is designed for a basic live load of 150 psf. In general, a uniform floor load allowance of 115 psf is allocated to equipment, 25 psf to cable distribution systems, and 10 psf to transient loads such as personnel, portable or rolling test equipment, and equipment being transported. These maximum uniform floor load allocations are related to the total of the actual weights of various equipment distributed nonuniformly across a floor area, divided by that area. The process-cooler and raised floor load is included with the equipment frame load.

3.05 All equipment frames are 7 feet high and are floor supported. They may be connected at the top to adjacent frames, but cross-aisle support at the top or connection to the ceiling is not required unless specified for earthquake bracing. Refer to Section 760-200-041, "Equipment Supports," and Section 800-610-155, "Earthquake and Disaster Bracing for Central Office Equipment."

3.06 The overhead interframe cable and associated cable racks, which together are called Cable Distribution Systems (CDSs), are divided into two main categories: system CDSs and via CDSs.

3.07 System CDSs feature racks designed for and dedicated to a single equipment system such as No. 4 ESS. All cabling interconnecting frames within this equipment system are included within these racks. All other cabling which originates outside a particular equipment system and passes over or terminates in it is called via cabling and is carried in the via CDS. Via racks include all vertical cable runs in multistory buildings.

3.08 The 7- to 10-foot space is allocated between system and via cable racks, lights and passages for cooling air, and installer access according to the plan shown in Fig. 3. This allocation, known as the Cable Pathways Plan, coordinates these elements and eliminates possible conflicts throughout the life of the equipment-building system. Cable racks and lights are located as required in the pathways (Fig. 3) and according to the following rules:

(a) System cable racks running parallel to equipment lineups are located between 7 to 8 feet above the floor and directly over the lineups. A minimum spacing of 2 feet in the maintenance aisle and 1 foot 4 inches in the wiring aisles is maintained between system lineup racks.

(b) System cable racks running transverse (cross-aisle) to equipment lineups are located within the cross-aisle cable pathways situated 8 to 9 feet above the floor on 5-foot centers across the equipment area (Fig. 3) to avoid cable holes and columns, to provide for installer access to cable racks, and to maintain unobstructed "windows" for cooling air. The maximum width of these cable racks is 18 inches. No more than 75 percent of the total cross-aisle pathways capacity per building is used for cross-aisle system cable racks.

(c) Via cable racks running parallel to equipment lineups are located within the cable pathways situated 9 to 10 feet above the floor and directly over the lineups. These racks should be 1 foot wide or less and located over, at most, three equipment lineups per building bay.

(d) Via cable racks running perpendicular (cross-aisle) to equipment lineups shall be located within the cross-aisle cable pathways situated 8 to 9 feet above the floor on 5-foot centers across the equipment area. These via cable racks share the cross-aisle pathways with the system cable racks. A minimum of 25 percent of the cross-aisle pathway capacity shall be reserved for via cable racks.

(e) Lights shall be located over maintenance aisles between 7 feet 3 inches and 8 feet above the floor and on the same 5-foot centers as the cross-aisle cable pathways. This places them directly below the cross-aisle pathways and thus below any cable racks.

(f) With a CCS, the air diffusers are located at the 10-foot level directly over the "windows" between cross-aisle cable pathways to provide an unobstructed flow of cooling air into the equipment aisles. The air diffuser support can be provided by the building engineer or by the equipment engineer. In the latter case, a superstructure is suspended from the ceiling inserts (Fig. 3) to support air diffusers, and via cable racks, if necessary.

3.09 The floor load from overhead cable distribution systems and lights does not exceed 25 psf. This is allocated 20 psf for system CDSs and 5 psf for via CDSs. In nonearthquake areas, system and via CDSs and lights are generally supported by the frames below. Over partially equipped lineups, they shall be supported by floor-mounted stanchions. Over unequipped areas, via CDSs shall be supported by stanchions or from the ceiling. In Zone 4 earthquake areas, via cabling may be ceiling supported and braced. All system CDSs in earthquake areas are frame supported, as in nonearthquake areas.

3.10 The principal floor plan for the equipment frame area is shown in Fig. 2. The majority of equipment in the area is designed to be maintained and operated in this or similar floor layouts. If an MCS is used in the area, process coolers are to be located in the column rows over an unused cable hole. If an MCS is not used, that space is available for other telephone equipment.

3.11 Nonstandard equipment or exceptional operating requirements will occasionally dictate exceptional floor plans in the equipment frame area. Such plans should be avoided because they tend to complicate and disrupt central office planning and design and often result in wasteful use of space and services. Therefore, most equipment frames will be located in such lineups as shown in Fig. 2.

B. Power Areas

3.12 ***Telephone Power:*** A typical telephone power equipment area is shown in Fig. 5. This area is primarily for dc electrical power equipment that is not installed in lineups with communications equipment. However, newer cable-type power plants are often placed next to or between associated communication systems. Power equipment located in these areas has a maximum height requirement of 10 feet, which includes the necessary overhead clearance for installation, operation, or maintenance of the equipment. As in the communication equipment areas, the power equipment may be on the structural floor or on a raised floor that is part of the MCS. In

either case, the vertical space allotment is 10 feet. This maximum height includes all equipment, cable and supports, bus bars, lighting, and room for top access. When the power plant is located on the same floor with the communication equipment, provision for via cabling should be included in the space allotment of 10 feet. Floor Plan Data Sheets show equipment layouts that result in average live floor loads of 140 psf or less. This does not preclude the provision of dedicated areas with higher floor loads, such as large engine generators and battery plants. The NEBS layouts of DC power plant are discussed in Section 790-100-662, "Layout."

3.13 ***Building Power:*** A typical building power equipment area is shown in Fig. 6. This type of equipment area is primarily devoted to the main building ac switchgear or to substations for distributing ac power within the building.

3.14 Main ac switchgear and transformer equipment is likely to be located on the base slab where high average floor loads impose no economic penalty. However, substations or ac load centers located on upper building floors can be arranged to meet the 140-psf average live load and 10-foot clear ceiling height criteria. The ac busduct and cable may run above the floor-mounted switchgear. Refer to Section 760-400-100, "General Considerations for Planning, Designing, and the Construction of AC Power Distribution Systems in Telephone Equipment Buildings," for further information.

3.15 ***Engine-Alternator Plant:*** Engine plants of less than 100 kilowatt (kW) require no special provisions with respect to 140-psf floor loading and 10-foot clear ceiling height criteria. However, the megawatt-size engine-alternators (100 kW or greater) may require an increased floor loading. A typical large capacity engine plant area is shown in Fig. 7. The megawatt engine plant is shown without a dropped ceiling air-conditioning system for installation under a 12-foot 6-inch structural ceiling height. In these plants, most air and exhaust ducts, electrical busduct, and cable are floor supported. Refer to Section 790-100-659, "AC Emergency Power."

C. Distributing Frame Area

3.16 A typical modular distributing frame (MDF) area is shown in Fig. 8. This illustrates connecting frames not usually included in equipment frame lineups. The MDFs are the most common example of such frames. These frames, together with all cable racks, are generally limited to 9 feet in height. As with equipment frames and power equipment, the distributing frames may be on the floor or on the raised deck of an MCS; in which case, the 10-foot vertical space allotment is simply raised 18 inches. The overhead cable and associated racks rest on

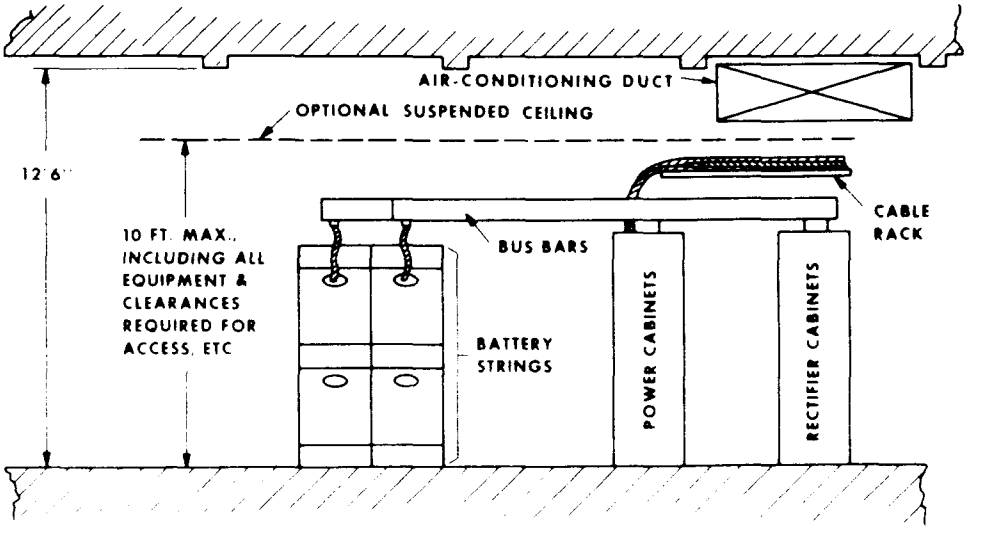


Fig. 5—Typical Telephone Power Equipment Area

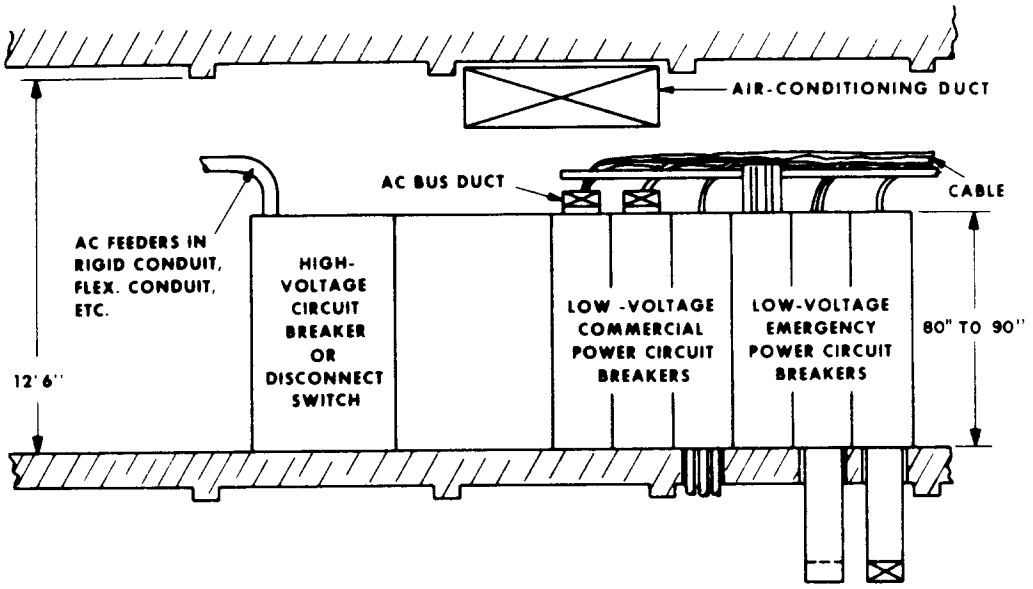


Fig. 6—Typical Building Power Equipment Area

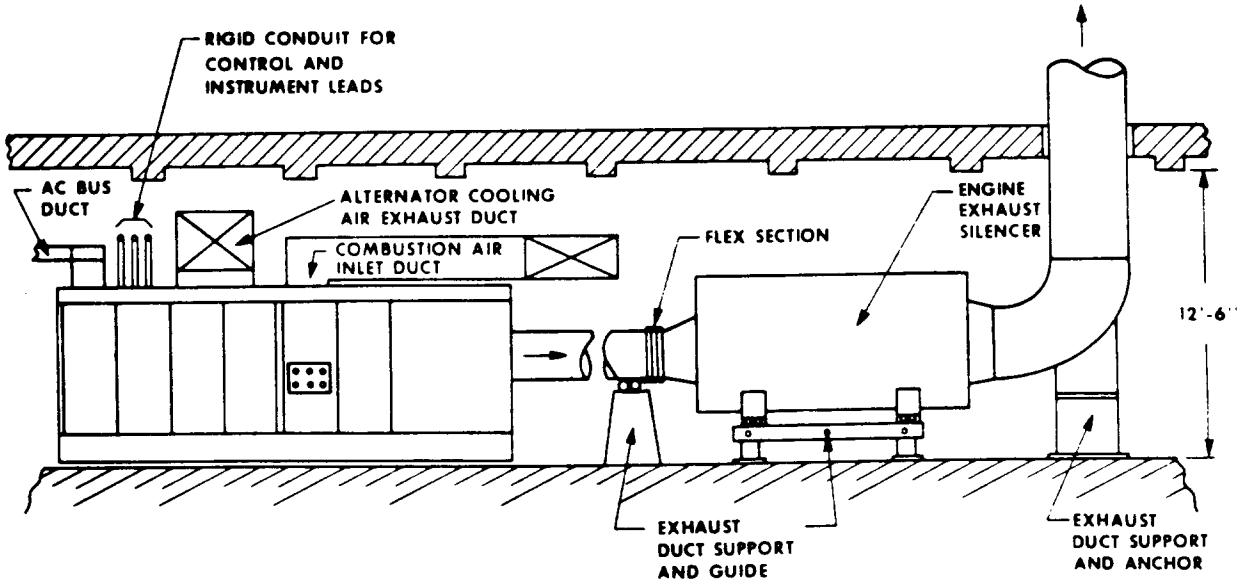


Fig. 7—Typical Megawatt Engine Plant Equipment Area

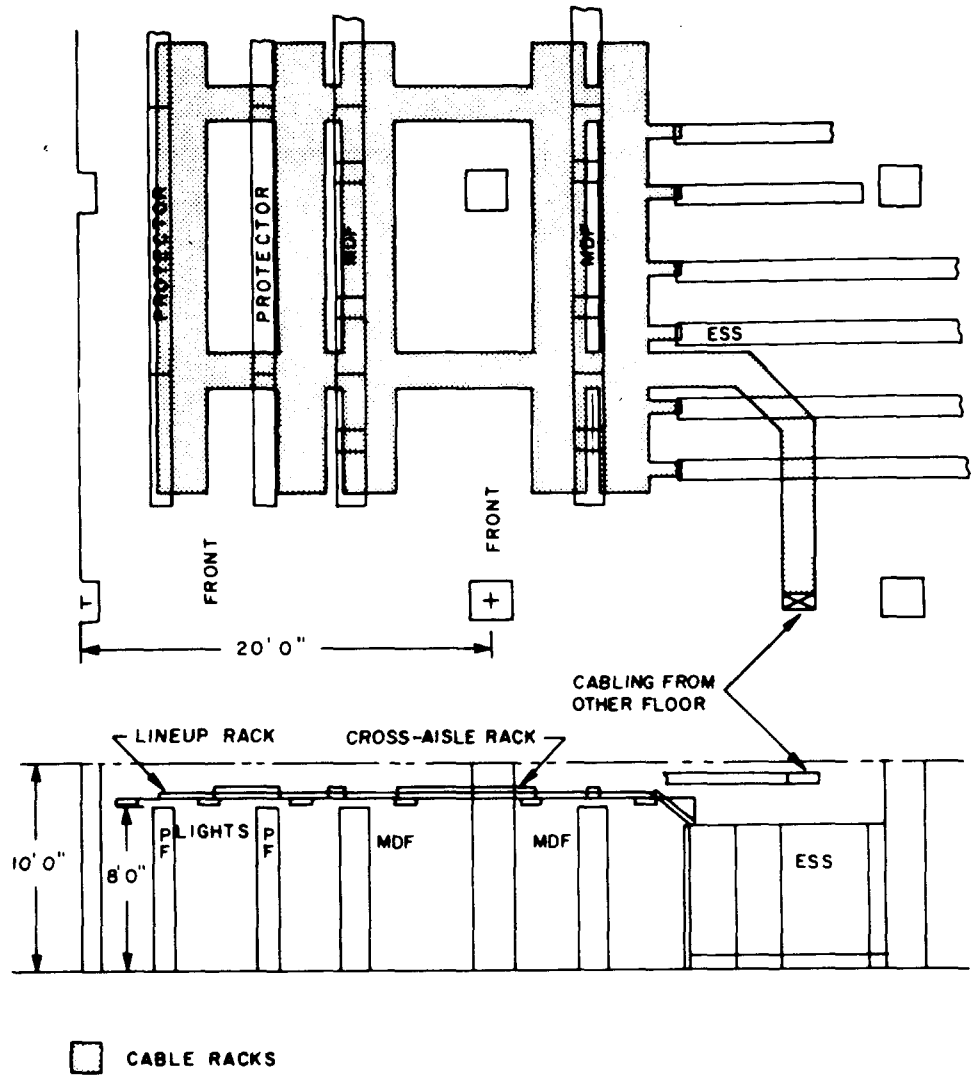


Fig. 8—Typical Modular Distributing Frame Area

the frames below. The floor load allocation is 140 psf for all distributing frame equipment in this area, including cable.

3.17 In very large (greater than 280,000 outside plant pair terminations) wire centers, multilevel cable racks may be required to provide an orderly cabling arrangement because of the very large cross section of cable installed over the MDF. In this area of low heat load, space allocated to cooling air distribution may be reallocated to cabling; however, additional engineering will be required to coordinate plans for cabling and cooling air distribution. Refer to Section 760-100-090, "Distributing Frame Systems and Interconnecting Cabling."

D. Cable Entrance Area

3.18 The Cable Entrance Facility (CEF) (formerly called cable vault) and associated equipment is subject to the same standards as other central office space. A vertical clearance of 10 feet is allocated to equipment, and the maximum floor load is 140 psf for all equipment and cable. Environmental features and requirements, such as temperature, illumination, air quality, etc, are maintained as in other

equipment areas, except that no provision is made for the MCS. Refer to Section 760-200-030, "Cable Entrance Facility."

E. Equipment Hoisting Area

3.19 Equipment frames that are to be installed in a central office building are to be brought in their horizontal crated position to the equipment hoisting area. Equipment hoisting areas are located adjacent to the building access opening on each floor. The area is used to rotate equipment frames to an upright position using hoists or an A-type gantry crane supplied by Western Electric. Once frames have been rotated upright, they are transported by dolly trucks to their installation locations in lineups.

3.20 The hoisting area should be at least 12 by 20 feet in plan. In central offices with the CCS, areas not limited by overhead air ducts should be utilized. In central offices equipped with the MCS, vertical clear space is obtained by the removal of modular ceiling panels (temporarily or permanently), which will provide 11 feet above a raised floor surface or 12 feet 6 inches above the permanent concrete floor.

3.21 Hoists suspended from ceiling anchors provide more vertical space than is available with a gantry hoist. This is because such hoist units are located above the room's 10-foot clear area.