

**Customer  
Data Center Construction Project**

**Computer and Telecommunications Program  
Requirements For the**

**Architect  
General Contractor  
Electrical Engineer  
Mechanical/Plumbing Engineer**

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For  
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## Foreword

### General

This document has been prepared by the Computer, Network and Telecommunications Consultants to provide Architects and Engineers essential information about the planning and design requirements for the computer and telecommunications facilities for the Customer's new data center project. This document further describes these facilities and explains how they will be used.

The specifications of this document were developed in accordance with the following standards:

1. EIA/TIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
2. EIA/TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
3. NFPA 70 - 1996 National Electrical Code.
4. Building Industry Consulting Service International (BICSI) - Telecommunications Distribution Methods Manual, Release 8.
5. Vendor specifications.

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## **Section 1 General Design and Operating Features**

The following general design and operating features are either noted for information purposes, required in the design of the new building or highly desirable to achieve certain operating and performance objectives.

### **1.0 Description of Computer and Network Operations**

The data center for which requirements are forthcoming in this document is the primary computing operation for the Customer. It is critical to the smooth operations of the Customer but does not meet the requirements for and "essential services site" as described in Title 24 of the State of California code.

### **1.1 Hours of Operation**

All computer and telecommunications facilities must operate 24 hours a day, 7 days a week. All systems must be on UPS and emergency generator support.

### **1.2 Uptime Reliability of Computer/Network Systems**

The design of the computer room and network facilities and environmental systems must include the necessary operations performance and backup/redundancy to ensure that all computer, network and telecommunications equipment are available to the Customer 99.5% of the time.

### **1.3 General Site Features**

1. Loading dock with dock levelers.
2. 48" or larger width aisleways from loading dock to computer room and paper storage areas.
3. Freight elevator with no less than 6,000 lb. capacity.

### **1.4 General Architectural Features**

The following briefly describes general architectural features. Detailed explanations are contained in this document.

1. Premises

- A. One contiguous raised floor area housing all computer, server and network equipment. Adjacent to or within this area, there must be an enclosed command console area.
- B. One contiguous raised floor area housing all printer-related equipment. This room may adjoin the computer room but must be separated by slab-to-slab walls to contain the dispersion of printer toner and paper dust.
- C. Other rooms as described in this document.

2. Equipment Room Walls

2-hour fire-rated walls are recommended for certain equipment rooms that are described in this document.

3. Equipment Room Doors

The main computer room, printer room, and storage room, shall have at least one double door for large equipment. The recommended size is 72" wide and 90" high. It must have no doorsill or centerpost. All other doors for all equipment rooms shall be a minimum of 36" wide and 80" high.

4. Exterior Windows

No exterior windows on equipment rooms described in this document.

5. Raised Floor System

1. A depressed grade slab for the raised floor system should be explored.
2. Raised floor system with bolted stringer system. Depth to be 18.
3. Raised floor tiles in Computer/Server/Network Room to be no less than 1,250 lb. minimum concentrated static load and 300 psf minimum uniform load. Static dissipative floor finish.
4. Raised floor tiles in Printer Room to be no less than 1,500 lb. minimum concentrated static load and 350 psf minimum uniform load. Rolling load to be no less than 600 psf. Static dissipative floor finish.

## 1.5 General Structural Features

1. 150 psf live load requirements for floors supporting certain equipment rooms described in this document.
2. 250 psf live load recommendations for floors supporting UPS/battery, emergency diesel generators, motor generators and other equipment with comparable weight, weight loading and live load ratings.

## 1.6 General Electrical Features

1. Dual main conduit entrances and conduit systems from two different directions into the Main Entrance/PBX room.
2. Electrical environmental systems that are dedicated solely to computer and network operations. Monthly testing of the UPS and emergency generator systems must be permitted to occur without disruption to any electrical services to the remainder of the building.
3. Dual main electrical panels with maintenance bypass to avoid any disruption of main service.
4. Two identical UPS systems with a common battery system. The sizing of the UPS systems shall be based on calculating the load for a single system. The second system will be redundant.

### System One

- A. Two times the projected electrical load for all equipment rooms.

### System Two

- A. System two is redundant to System One.
5. One common battery system for the two UPS systems. Capacity of battery to be sized to provide 15 minutes support for UPS One at 90% capacity.
6. One battery monitoring system with remote dial-in access.
7. Two identical emergency stand-by generators with paralleling switch gear. The sizing of the generator systems shall be based on calculating the load for a single system. The second system will be redundant.

### System One

- A. Two times the projected electrical load for all equipment rooms.

#### System Two

- A. System two is redundant to System One.
- 8. Automatic Transfer Switches should be designed as necessary to separate the equipment rooms from the remainder of the building.
- 9. Generator fuel tanks to keep the generators running for 72 hours. Assume 180 gallons per hour for both generators.
- 10. Assume 75 watts/sq.ft. for the design of the Computer/Server/Network Room.
- 11. Assume raised floor grounding and a signal reference grid under the raised floor systems.
- 12. Leak detection system for all raised floor areas. Other areas may be required pending design.
- 13. One duplicate (mimic) generator panel to be installed in the Command Console room.
- 14. One graphics enunciator panel that displays the status of the UPS/battery and generator systems. This panel is to be installed in the Command Console Room.
- 15. Absolutely no transformers in any of the equipment rooms.

### **1.7 General Mechanical/Plumbing Features**

- 1. Dedicated HVAC for all raised floor areas and the Telecommunications Closets for the building. HVAC must be available 7/24.
- 2. 24-hour backup water supply for building chilled water systems (if applicable).

### **1.8 General Fire Detection Features**

- 1. Ionization or photoelectric detection.

### **1.9 General Fire Suppression Features**

- 1. Provide a pre-action system sprinkler system for the raised floor areas. System must be dual-interlocking. Sprinkler pipes over the raised floor areas to be dry.



2. Sprinkler heads in equipment rooms to be equipped with the highest thermal links possible under code
3. Provide FM-200 clean agent gas suppression system. Assume underfloor flooding only. Assume multiple zones

## **Section 2 Program Requirements - Architect**

### **2.0 Description of Computer and Telecommunications Facilities**

The new data center project being planned for the Customer will require the following eight types of computer and telecommunications facilities;

1. Main Entrance Room/PBX Room
2. One large raised floor area that will house the computer, server and network equipment
3. One enclosed printer room
4. Individual Telecommunications Closets for each floor of the building
5. Two storage/work rooms for the MIS and Network departments
6. Paper and forms storage area

Space requirements must be adequate to handle either existing or new technologies. For example, we must provide adequate space in the telecommunications closets to support fiber to the desktop even if we don't install it initially.

The storage/work rooms must be built to our stated space requirements. Reducing the space will cause MIS and network staff to store significant inventories of computer and network components in their cubicles, along walls and in any available space.

#### **2.0.1 Main Entrance Room/PBX Room**

The Main Entrance Room/PBX Room is the main communications facility for the entire building. For the CCSF building, it will house the following:

1. Two diverse and separate main entrance conduit systems for telecommunications copper and fiber optic cables from outside suppliers. These two conduit systems entering the building from two different systems will terminate in this room.
2. Two copper demarcs. One from each of the two different entrances. Includes backboard space for the protector blocks and MPOE.
3. Two fiber demarcs. One from each of the two different entrances. Includes floor space for fiber optics racks and cabinets from the two different entrances.
4. The PBX system for the site. Includes space for an expansion cabinet
5. Battery for the PBX system
6. Voice mail cabinet
7. Wall-mounted paging system
8. Termination hardware on the backboard for all voice copper backbone cables.
9. Termination hardware for all user copper voice station cables
10. Overhead cable tray system
11. One table to support CRT monitors for the PBX and voice mail systems

12. Electrical panels for the equipment in this room only. No transformers to be located in this room.
13. Grounding busbar for equipment and cable trays.

#### 2.0.2 Computer/Server/Network Room

The Computer/Server/Network room is an environmentally conditioned, raised-floor area that will house the following systems and components:

1. Primary mainframe computer and connected peripherals for the Customer
2. Large Sun Microsystem servers
3. LAN servers for the site
4. Cabinets containing data modems and other telecommunications equipment that interface the incoming data lines with the computer and LAN equipment.

A separately enclosed Command Console Room is required. It must adjoin the Computer/ Server/Network Room.

#### 2.0.3 Printer Room

One printer room will be required. This room will house the mainframe printers, bursters, decollators, other equipment and immediate high-volume paper storage.

#### 2.0.4 Individual Telecommunications Closet for Each Floor

Each floor of the building will have at least one Telecommunications Closet. It is possible, depending on the square footage of the floors, for the basement to be served from the first floor Telecom Closet and the roof or any mechanical room just under the roof, to be served from the highest Telecom Closet serving the general office area. The Telecommunications Closets are projected to house the following equipment:

1. Termination racks and hardware for data copper cables from the user areas
2. Racks containing the data hubs and routers for the site
3. Possible terminations for CATV
4. Grounding busbar

#### 2.0.5 Storage Work Areas for the MIS and Network Departments

The MIS and Network departments must have premises that permit the following:

1. Storage of spare, backup and obsolete computer and network components
2. At least two large workbench areas in each storage room with superior lighting over the workbenches to setup or repair components

3. Space to receive and/or stage components arriving and leaving the site

Most of the area would be equipped with heavy-duty shelving systems along the walls to store the components

#### 2.0.6 Paper and Forms Storage Area

One large area for paper and forms storage.

### 2.1 Space Requirements for the Computer and Telecommunications Facilities

The following are preliminary space requirements for the Computer and Telecommunications facilities:

1. Main Entrance Room/PBX Room

One room rectangular in shape. Recommended size is 18' x 30' (540 sq.ft.)

2. Computer/Server/Network Room

Approximately 10,000 sq.ft. of raised floor will be needed for the Computer/Server/Network Room and the Command Console. Space for the following areas and operations would need to be planned and are included in this square footage total:

- A. Computer/Server/Network room. No less than 8,000 square feet; preferably 10,000. All would be on raised floor. This space would include the following:
  - 400 sq.ft. for the mainframe and mainframe consoles.
  - 200 sq.ft. for the 3745.
  - 400 sq.ft. for DASD
  - 1,000 sq.ft. for Tape Ops
  - 1,200 sq.ft. for the network cabinet area.
  - 1,200 sq.ft. for the server cabinet area.
  - 200 sq.ft. for the controller area.
  - 300 sq.ft. for A/C CRUs.
  - 300 sq.ft. for PDUs
  - 2,000 sq.ft. clearance and circulation space
  - 200 sq.ft. for ramps.
  - 1,000 sq.ft. unusable along walls, in front of doorways and around columns.
  - 300 sq.ft. to serve as a staging area.

- 800 sq.ft. contingency.
- B. Command Console area. Approximately 300-400 square feet and preferably enclosed. A two-level command console is recommended. This room would adjoin the main computer room.
3. Printer Room and Warrant Storage. No less than 2,300 sq.ft. on raised floor to house the following:
- A. No less than 2,000 sq.ft. for the printers, bursters, delcollators, and immediate high-volume paper storage. This room would be totally enclosed and either adjoin, or be in very close proximity to the computer room.
  - B. Warrant Room or Cage. No less than 300 sq.ft. This area must be secure. It must either be enclosed or in a cage. If enclosed, the Warrant Room must immediately adjoin the printer room. This Warrant Room must have only one door opening into the Printer Room. If in a cage, the cage can be installed in a 2,300 sq.ft. printer room. The cage must have four sides, a ceiling and one secure door. The false ceiling in the printer room cannot and must not serve as the ceiling for the cage (security issue).
- The raised floor inside an enclosed Warrant Room or under a Warrant Cage must be screwed in all four corners to the pedestals.
4. Individual Telecommunications Closet. One closet with recommended dimensions of 12' x 16' (192 sq.ft.) on the same floor and the Computer/Server/Network Room.
5. Storage Rooms for MIS and Network Departments. Two storage rooms (one each for the MIS and Network Departments. Recommended dimensions are 16' x 24').
6. Secondary Paper Storage. No less than 800 square feet for paper and forms storage.
7. Summary of Space Requirements

Main Entrance / PBX / Demarc (18'x30')	540 sq.ft.
Computer/Server/Network Room	10,000 sq.ft.
Printer and Warrant Room Storage	2,300 sq.ft.
Telecommunications Closet (12' x 16')	192 sq.ft.
MIS & Network Storage/Work Rooms (16'x24')	384 sq.ft. each
Secondary Paper Storage	<u>800 sq.ft.</u>

Total Recommended MIS/Network/ Telecom Requirements	14,600 sq.ft.
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Dimensions are subject to change based on final design of the building and on final equipment requirements.

## 2.2 Site Considerations for Computer and Telecommunications Facilities

1. Avoid locations that are restricted by building components that limit expansion. It is not uncommon for computer rooms and telecommunications facilities to expand.
2. Telecommunications closets are very susceptible to electrical magnetic interference (EMI) and especially so with gigabit data speeds (1 billion bits per second).
3. All equipment rooms described in these requirements shall be at least 10 feet away (one entire floor vertically or at least 10 feet horizontally) from mechanical and electrical areas, including elevator shafts, mail conveyers, mechanical rooms, microwave ovens, generators, transformers, and copier rooms. Where this is not possible, provide electromagnetic interference and radio frequency interference (EMI/RFI) shielding between the rooms. This requirement does not apply to Power Distribution Units (PDUs) and Air Handling Units (AHUs) that support the these equipment rooms.
4. These rooms shall be located away from sources of EMI/RFI at a distance which will reduce the interference to 3.0 Volt/meters throughout the frequency spectrum. If this is not possible, provide EMI/RFI shielding for the equipment rooms to reduce EMI/RFI to these levels.
5. All equipment room walls will include foil-backed sheet rock in their construction to provide shielding. All foil sections will be properly grounded.
6. If the square footage for the floor does not exceed 30,000 sq.ft., only one Telecommunications Closet per floor is necessary. This closet must be placed in or near the middle of the floor so that any area on the floor can be reached with a wiring run that will not exceed 90 meters. Ideally, the closet can be designed as part of the core. However, the closet can be adjacent to the primary firewalls. In general, if the square footage is under 10,000 sq.ft. and, the space is square or close to square, there can be discretion in placing the Telecommunications Closet away from the core area. This does not apply to irregularly shaped buildings.

If the square footage for the floor exceeds 30,000 sq.ft., more than one Telecommunications Closet may be required. These closets will need to be strategically placed so that any cabling runs from any of the closets will not exceed 90 meters.

### **2.3 Computer and Telecommunications Adjacencies**

1. The enclosed Command Console room must immediately adjoin the Computer/Server/Network Room. It must be on raised floor.
2. The Printer Room does not need to immediately adjoin the Computer/Server/Network Room but it does need to be very close by. This room must have clear and unrestricted access to the loading dock for the building and the secondary paper storage areas. Paper supplies and printed material arrives and leaves daily. The Printer Room must be on a raised floor system that is stronger than the raised floor system in the other equipment rooms (see raised floor requirements).
3. The Warrant Room must immediately adjoin the Printer Room with single door access between the two rooms. As stated above, the Warrant Room can be an enclosed cage.
4. The secondary paper storage must be in close proximity to the Printer Room. It should not be on raised floor. Careful consideration must be given to the floor loading in this area. There will be a high concentration of paper and forms on pallets. Weights can be as high as 200 lbs/sq.ft. on a fully loaded pallet.

### **2.4 Telecommunications Closet on Same Floor as Computer/Server/Network Room**

The Telecommunications Closet on the same floor as the Computer/Server/Network Room must be part of the overall Telecom Closet system for the building. This closet does not need to be on raised floor but may need to be if co-located near the other raised floor systems.

### **2.5 Vertical Alignment of Telecommunications Closets**

Telecommunications Closets must be vertically stacked and aligned so that backbone voice and data cables can be run in a straight vertical line to serve all floors. If there are more than one Telecommunications Closet per floor, all must be vertically stacked.

### **2.6 Water Lines Over the Main Computer Room**

If possible, water lines not involved in the support of the main computer room should not run over the main computer room. This includes boiler lines, rain drains, restroom drains, etc.

## **2.7 Ceiling Materials**

It is recommended that 2x4 lay-in vinyl covered acoustical tiles be installed in all raised floor areas.

## **2.8 Ceiling Height**

### Main Entrance Room/PBX Room

The minimum ceiling height without obstructions such as lighting fixtures, ducts, conduits, etc. in the Main Entrance Room/PBX Room must be no less than 9 feet. A minimum of 10 feet is preferred. No false ceiling should be provided.

### Computer/Server/Network Room

The minimum ceiling height from the finished surface of the raised floor to the false ceiling in the Computer/Server/Network Room must be no less than 9 feet. A minimum of 10 feet is preferred. A false ceiling is appropriate.

### Telecommunications Closet

The minimum ceiling height without obstructions, like lighting fixtures, ducts, conduits, or sprinklers, should be no less than 9 feet. No false ceiling should be provided.

If sprinklers are installed in this closet, drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto equipment. These troughs should have water sensors to detect leaks before they become a problem.

### Paper Storage and Storage Work Areas

The ceiling height from the top of the finished floor to the false ceiling should be no less than 9 feet. A false ceiling is appropriate.

## **2.9 Doors**

### Main Entrance Room/PBX Room

The door to the Main Entrance Room/PBX Room shall be no less than 42" wide to permit easy entry of large pieces of equipment. The door shall be full-opening and self-



closing. Height of the door to be 8 feet. Door is to meet all fire codes relevant to its location. A second door is not required. A secure key or other secure system on the door is required.

#### Computer/Server/Network Room

The main door to the Computer/Server Room must be no less than 72" wide and 8' in height. Note the height. It must have not doorsill or centerpost. Any other doors, as may be necessary, shall be a minimum of 36" wide and 7' feet in height. All doors shall be full-opening and self-closing. All doors must meet all fire codes relevant to its location. All doors must be equipped with security systems.

#### Printer Room

The main door to the Printer Room must be no less than 72" wide and 7' in height. The width is required for the entry and egress of palletized materials. It must have not doorsill or centerpost. Any other doors, as may be necessary, shall be a minimum of 42" wide and 7' feet in height. All doors shall be full-opening and self-closing. All doors must meet all fire codes relevant to its location. If Printer Room is not contiguous with the main Computer Room, all doors must be equipped with security systems.

#### Warrant Room

The door to the Main Entrance Room/PBX Room shall be no less than 42" wide. The door shall be full-opening and self-closing. Height of the door to be 7 feet. Door is to meet all fire codes relevant to its location. A second door shall not be installed. Door and video security systems will be required.

#### Paper Storage Area

The door to the Paper Storage Area must be no less than 72" wide and 7' in height. The width is required for the entry and egress of palletized materials. It must have not doorsill or centerpost. A security system will need to be built into the door. Any other doors, as may be necessary, shall be a minimum of 42" wide and 7' feet in height. All doors shall be full-opening and self-closing. All doors must meet all fire codes relevant to its location.

#### Telecommunications Closet

The door to the Telecommunications Closet shall be no less than 42" wide. The door shall be full-opening and self-closing. Height of the door to be 7 feet. Door is to meet all fire codes relevant to its location. A second door shall not be installed. This door must be equipped with a security system.

### Storage/Work Area

The door to the Storage/Work Area shall be no less than 42" wide. The door shall be full-opening and self-closing. Height of the door to be 7 feet. Door is to meet all fire codes relevant to its location. A second door shall not be installed. This door must be equipped with a security system.

## **2.10 Lighting**

### Main Entrance/PBX Room

1. Assume that no false ceiling will be installed in this room.
2. Provide a minimum of 540 lux (50 foot-candles) measured 1 meter (3 feet) above the finished floor level.
3. Every attempt should be made to locate the ceiling light fixtures in such a manner that they are not installed directly over the cable tray system. Cable trays at up to 9' can block the light from hanging lights at 9'6" to 11'0". Additionally, copper cables can be subject to EMI from closely placed fluorescent lighting systems.

### Computer/Server/Network Room

1. Provide a minimum of 540 lux (50 foot-candles) measured 1 meter (3 feet) above the finished floor level.
2. Recessed lighting in the false ceiling is highly recommended for this room. If hanging fluorescent lighting is selected, the bottom of the lighting system must not be lower than 9'. This will permit an 18" separation from network cabinets and large server systems that are typically 7'-7-1/2' in height which is required to avoid EMI interference.

### Telecommunications Closets

1. Assume that no false ceiling will be installed in these closets.
2. Provide a minimum of 540 lux (50 foot-candles) measured 1 meter (3 feet) above the finished floor level.
3. Every attempt should be made to locate the ceiling light fixtures in such a manner that they are not installed directly over the cable tray system. Cable trays at up to

9' can block the light from hanging lights at 9'6" to 11'0". Additionally, copper cables can be subject to EMI from closely placed fluorescent lighting systems.

#### Printer Room

1. Provide a minimum of 540 lux (50 foot-candles) measured 1 meter (3 feet) above the finished floor level.
2. Either recessed lighting or hanging lighting systems can be employed in this room.

#### Storage/Work Area Room

1. Assume that a false ceiling will be installed in this room.
2. Assume that shelving systems will be installed around the a good portion of periphery of the room.
3. Assume that two large work benches will be installed in each room.
4. Provide a minimum of 540 lux (50 foot-candles) measured 1 meter (3 feet) above the finished floor level.
5. Provide additional specialized lighting over the two workbenches. These can be hanging direct lights.

### **2.11 Equipment Room Walls**

1. The interior finish of the rooms should be of a light color to enhance room lighting. The interior walls should be painted with two coats of fire-retardant paint. The paint may be either gloss or flat latex.
2. The Printer Room shall be isolated from the other equipment rooms by walls that reach from the slab below the raised floor to the bottom of the slab above. This will prevent the intrusion of paper, toner, and dust into the other equipment rooms.
3. Slab-to-slab walls are required for the Main Entrance/PBX Room and the Telecommunications Closet.

### **2.12 Wall Fire Ratings**

It is highly recommended that 2-hour fire-rated walls be constructed around the following areas:

1. Main Entrance/PBX Room
2. Computer/Server/Network Room
3. Printer Room

Walls systems should be slab-to-slab to achieve these ratings. Doors to these areas need only meet 1-hour or local code requirements.

### **2.13 Floor Materials**

VCT tile with anti-static qualities is the required floor material for the Main Entrance Room/PBX Room, paper storage areas and the storage/work areas. The Computer/Server/Network Room will be on raised floor with laminated tiles.

### **2.14 Floor Loading**

1. Concrete floors supporting the following areas shall have a distributed floor load rating of no less than 150 lbs/sq.ft.
  - A. Main Entrance/PBX Room
  - B. Computer/Server/Network Room
  - C. Printer Room
  - D. Paper Storage Area

If UPS/battery, emergency generator systems, motor generators or other systems of comparable weight loading and live load ratings are included, the distributed floor loading shall be  $\geq 12$  kPa (250 lb/sq.ft.). The concentrated floor loading shall be  $\geq 4.4$  kN (1000 lb).

2. Concrete floors supporting the Telecommunications Closets in the building must have a floor rating sufficient to bear both the distributed and concentrated load of the installed equipment. A minimum of 2.4 kPa (50 lbf/sf) is required.

### **2.15 Raised Floor System**

A raised floor system shall be installed for the Computer/Server/Network Room and the Printer Room. The system shall have the following minimum specifications:

1. 18" in height
2. Bolted stringer system. A clipped system is not acceptable
3. Maximum-size pedestals

4. Heavy-duty pedestals
5. All materials to have anti-static qualities

All floor tile cuts shall have smooth edges to avoid cable damage. If the floor tiles are metal, the floor tile cuts shall have plastic edging.

Where concrete floor tiles are used, the concrete must be injected with light-weight concrete. We prefer that concrete floor tiles only be used where we will be moving paper. Also, do not use concrete tiles for cut floor tiles.

## 2.16 Equipment Room Shielding

1. The equipment rooms listed in this section must be at least 10 feet away (one entire floor vertically or at least 10 feet horizontally) from mechanical and electrical areas, including elevator shafts, mail conveyers, mechanical rooms, microwave ovens, generators, transformers, and copier rooms. Where this is not possible, provide electromagnetic interference and radio frequency interference (EMI/RFI) shielding between the rooms. This requirement does not apply to Power Distribution Units (PDUs) and Air Handling Units (AHUs) that support these rooms.
2. The equipment rooms listed in this section shall be located away from sources of EMI/RFI at a distance which will reduce the interference to 3.0 Volt/meters throughout the frequency spectrum. If this is not possible, provide EMI/RFI shielding for the equipment rooms to reduce EMI/RFI to these levels.
3. All equipment rooms walls listed in this section will include foil-backed sheet rock in their construction to provide shielding. All foil sections will be properly grounded.
4. Listed Equipment Rooms
  - A. Main Entrance/PBX Room
  - B. Computer/Server/Network Room
  - C. Printer Room
  - E. Telecommunications Closet

## 2.17 Security

Access to the all Computer and Telecommunications facilities must be restricted. Both video surveillance and proximity-type systems will be required.

1. Proximity or other comparable systems are required at the entry door to the following areas:

- A. Main Entrance/PBX Room
  - B. Computer/Server/Network Room
  - C. Printer Room
  - D. Telecommunications Closet
  - E. Paper Storage Area
  - F. Storage/Work Areas
2. Video surveillance systems are required at all entry doors from public hallways to the following areas:
    - A. Computer/Server/Network Room
    - B. Printer Room

The video monitors for all video cameras shall be in the Command Console Room.

## **2.18 Equipment Room Windows**

1. Exterior Windows  
To the extent possible, there shall be no exterior windows in the following equipment rooms:
  - A. Main Entrance/PBX Room
  - B. Computer/Server/Network Room
  - C. Printer Room

Should it not be possible to avoid windows, these windows should be covered from the inside with drywall system.

If exterior windows are incorporated as part of the design, the following specifications are required:

- A. Insulating glass that incorporates a security glazing: two layers 1/4" heat-strengthened glass with 0.060 PVB interlayer between.
  - B. Glass break sensors mounted to a wall or ceiling inside the building for monitoring all glass panes.
2. Interior Windows
    1. Interior windows onto public hallways from all equipment rooms are highly discouraged. 2-hour rated walls are recommended.
    2. Interior windows between adjoining equipment rooms are acceptable.

## 2.19 Fire Detection & Suppression

1. Main Entrance and Computer/Server Room
  - A. The Main Entrance and Computer/Server Rooms shall be equipped with a code-compliant smoke detection system, preferable ionization or photoelectric. This smoke detection system shall not be attached to an emergency power-off switch.
  - B. The raised floor areas shall be equipped with an overhead sprinkler system for fire suppression. A dual-interlocking pre-action sprinkler system shall be part of the overall system. The overhead sprinkler piping must be dry.
  - C. If a pre-action sprinkler system is not used, the standard system used in the other parts of the building is satisfactory with one exception. Drip pans are required over the PBX equipment including the battery and the fiber demarc.
  - D. Use the highest thermal link temperature permitted by code on all sprinkler heads installed over the raised floor areas.
  - E. Where sprinkler heads are placed in open ceiling areas (no false ceiling), wire cages must be installed over the sprinkler heads.
  - F. Sprinkler heads may be the pop-down type.
2. Main Entrance/PBX Room / Telecommunications Closet
  - A. The Main Entrance/PBX Room and the Telecommunications Closet shall be equipped with a sprinkler system for fire suppression. The standard system used in the other parts of the building is satisfactory except for the thermal link temperature.
  - B. Use the highest thermal link temperature permitted by code.
  - C. Sprinkler heads may be the pop-down type.
3. Additional Warning Systems

An additional visual warning system consisting of a flashing yellow light for first alarm and a flashing red light for second alarm shall be installed in at several locations in the raised floor areas. The actual locations are dependent on the design.

**2.20 Vibration Design Limits**

The equipment rooms shall be designed to meet EIA/TIA-569 vibration specifications:

**VIBRATION DESIGN LIMITS**

Frequency (Hertz)	Vibration Amplitude
5 to 22	0.01 inches double amplitude displacement
22 to 500	0.25 g peak acceleration
500 to 22	0.25 g peak acceleration
22 to 5	0.01 inches double amplitude displacement



### **Section 3 Program Requirements - General Contractor**

#### **3.0 Plywood Backboards for the Main Entrance/PBX Room & Telecommunications Closet**

1. Provide and install plywood backboards on all walls in the following equipment rooms:
  - A. Main Entrance/PBX Room
  - B. Telecommunications Closet

The plywood shall be 3/4" trade-size, fire retardant plywood, preferably void free. The plywood must be rigidly fastened to the wall framing members. The bottom of the plywood shall begin at 15 inches from the finished floor. Electrical wall outlets are to be cut in the plywood. The plywood shall be painted the same color as the room with two coats of non-conductive paint. The paint shall also be free of turpentine. The fire-rating stamp on the plywood shall not be painted over. Cover with masking tape and then paint.

#### **3.1 Elevator Telephones**

1. The General Contractor shall include in his/her scope of work, provisions for the elevator service provider to install one telecommunications cable for each elevator installed in the new building. The cabling contractor will be instructed to deliver the cables to the elevator control room or other location specified by the elevator service provider. The elevator service provider will also need to provide and install a telephone unit suitable for code-compliant installation in an elevator.

#### **3.2 Cleaning and Sealing of Concrete Slab Under the Raised Floor**

1. Treat the concrete slab under the raised floor with a concrete sealer to eliminate dust. The sealer must be put on after the raised floor baseplates have been installed.
2. Clean and vacuum the entire raised floor underspace just before turnover of the building. The timing should be after the installation of both electrical and low voltage interconnecting cables computer and network cables.

#### **3.3 Simultaneous Commissioning of all Environmental Systems**

The General Contractor must include in his scope of work a final commissioning of the computer room environmental systems. Individual commissioning of systems is not

acceptable. It is required that part of the final commissioning of the environmental systems include a test that includes the following:

1. Switch off all main panels where City power enters the facility. Switching of ATS systems or turning off sub-breakers is not acceptable. It must be the main switches.
2. Turning off the switches must achieve the following:
  - A. All electrical systems supporting the computer room go on UPS power.
  - B. The emergency stand-by generators initialize and assume the load.
  - C. The PDU systems and all equipment areas do not lose power.
  - D. All mechanical systems will lose power temporarily but will come up when the generator assumes the load. The mechanical systems will not be on the UPS bus.
  - E. The electrical and mechanical systems for the rest of the building are not disturbed.
3. Run all systems on generator for one hour.
4. Note any problems with the combined running of all systems.

## **Section 4 Program Requirements - Electrical Contractor**

The following are program requirements for the electrical design of the computer and telecommunications facilities for the new building:

### **4.0 Hours of Operation**

All computer and telecommunications facilities must operate 24 hours a day, 7 days a week. All systems must be on UPS and emergency generator support.

### **4.1 Telecommunications Main Entrance**

Provide and install two main building entrances for telecommunications cables. The two main building entrances must come from two different directions and meet on the same wall in the Main Entrance/PBX Room. Initially, only two of the four conduits will be used. The remainder are for future growth. All shall be grounded to a ground bus bar that will be placed in the room or to the Main Building busbar. The Main Building Entrances shall each consist of the following components:

1. Main entrance vaults
2. Main entrance conduits
3. Overhead cable tray system for Main Entrance Room

### **4.2 Main Entrance Vaults**

Two main entrance vaults will be required for the two different main entrances to the building. It is assumed that the vaults will be placed in the concrete sidewalks outside of the building. Telecommunications suppliers will tie into the vault from their street facilities. The size of the vaults should be large enough to run six 4-inch conduits into the building. We suggest Jensen or Christy products.

4.2.1 Design the telecommunications entrance pathways to avoid any additional manholes or pull boxes outside the building. For security, we recommend creating routes that do not require pull boxes or manholes outside the building. If a pull box or manhole is needed outside the building, use a manhole.

4.2.2 If manholes are unavoidable, the manholes shall meet the following specifications:

1. Manholes shall be constructed of pre-cast concrete with a minimum strength of 3,500 PSI.
2. Manhole covers and frames are to be round and capable of supporting vehicular or other traffic.

3. All hardware in manholes must be galvanized. Manholes are to be equipped with cable racks or struts, pulling in-irons, a ladder, sump, an entrance collar, frame, and cover.
4. All floor joints, walls, collars, and cable entry points are to be water tight.
5. The manholes shall be approximately 6 feet wide, 12 feet long, and 7 feet deep.
6. After cables are pulled through manholes, covers shall be permanently secured from unauthorized access, welded if possible.
7. Manholes shall be used for telecommunications cables only.

#### **4.3 Main Entrance Conduit Requirements**

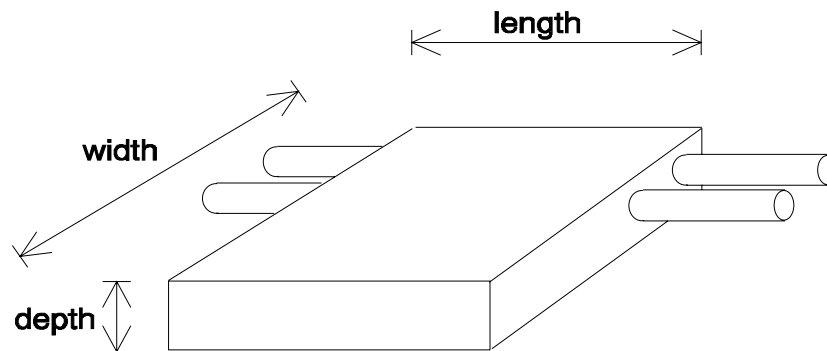
1. The conduits for the telecommunications service entrance pathways must be made of rigid galvanized steel, and have inside diameters of 4 inches.
2. PVC conduits may be acceptable. If used, PVC conduits must be Schedule 40 or better. Under all circumstances, corners, sweeps and bends must be PVC coated metal.
3. Each conduit must have a 12-gauge steel wire or equivalent pull tape, pull rope, or pull wire with a minimum pulling tension of 200 pounds.
4. The conduit runs should be as straight as possible. The entire run from the vault to the MDF must not have more than two 90 bends. Any 90 degree bends without pullboxes must be sweeps. Pullboxes must installed for 90 degree turns.
5. All conduits must be reamed at both ends.
6. All conduits must have grounding bushings at both ends.
7. All conduits must be grounded as required by local codes and ordinances.
8. All conduits must be rigidly installed and properly supported.
9. All conduits must be left clean, dry, and free of debris or other obstructions.
10. The vault should be far enough from the building to permit a minimum 48" sweep as the conduits transition from the underground into the MDF.

11. The top of the conduits must be buried below the frost line, or at least 24 inches below the ground surface, whichever is greater. We suggest a burial depth between 24 inches and 36 inches from the top of the conduit to the ground surface.
12. To provide drainage, there shall be a continuous downward slope of the conduits from the building to the property line of 10 millimeters / meter (0.125 inches / foot) or greater.
13. Conduits for telecommunications service entrance pathways shall not be routed in joint use manholes or share common trenching systems.
14. The conduits shall be separated from power conduits by at least 3 inches of concrete or 12 inches of well-tamped earth. They also shall be separated from water, gas, or oil pipes by at least 6 inches if crossing, or 12 inches if parallel. If feasible, keep routing of all other utilities 20 feet or more from the telecommunications conduits to reduce the probability of disruption caused by an explosion, pipe breakage, or repair work on these other utilities.
15. If feasible, other utilities should not be allowed to cross over or under the pathways of the telecommunications conduits.
16. Seal both ends of all conduits with rubber plugs when the conduits are placed.
17. After cables are placed in the conduits, the ends of the conduits in the building will require seals to prevent water, vermin, or gases from entering the building.
18. Securely fasten the conduits to the building so that they can withstand any cable placing operation by the carriers.
19. Keep the areas around both ends of the conduits free of any construction, storage, or apparatus that might interfere with cable installation.
20. If the conduits enter through the equipment room floor, they shall protrude through the permanent floor by 4 inches.
21. If the conduits enter the equipment room in the ceiling space, terminate the conduits at least 4 inches below the finished ceiling.
21. The end of the conduits at the edge of the property line shall be flagged or clearly identified in some other manner to designate their locations to the carriers. The exact locations shall also be carefully documented on drawings. After the service

- providers complete installation of their conduits, the flags or other identification shall be removed.
22. Do not route conduits adjacent to hot water and steam lines, or through areas where flammable materials may be installed.
  23. Bends in these conduits are undesirable and should be limited to the extent possible. All bends must be long, sweeping bends with an inside bend radius as large as possible. However, the minimum inside bend radius permitted under any circumstances is 42 inches.
  24. Intermediate pull boxes or manholes shall be installed when one of the following conditions is met:
    - A. There are more than two 90 degree bends in the conduit route.
    - B. There is a reverse bend in the conduit route.
    - C. There is a continuous run of conduit longer than 100 feet inside a building.
    - D. There is a continuous run of conduit outside the building, with up to one 90 degree bend, no longer than 492 feet.

#### 4.4 Pull Box Requirements

If pull boxes are required based on the circumstances described above, they shall have the following minimum dimensions, based on BICSI guidelines.



**MINIMUM PULL BOX DIMENSIONS**

Conduit Size (inches)	Box Width (inches)	Box Length (Inches)	Box Depth (inches)	Increase in Width in Inches for Each Additional Conduit After 1st
0.75	4	12	3	2

1.0	4	16	3	2
1.25	6	20	3	3
1.5	8	27	4	4
2.0	8	36	4	5
2.5	10	42	5	6
3.0	12	48	5	6
3.5	12	54	6	6
4.0	15	60	8	8

1. Conduits must be aligned on opposite ends of the pull box.
2. Pull boxes shall be in a straight section of conduit and not used in lieu of a bend.
3. Pull boxes must be enclosed to meet fire codes, because they may be run in plenum spaces.
4. Pull boxes shall be provided with locks and possibly tamper switches which can be monitored by security.
5. Pull boxes for telecommunications cables shall not be used for any other type of cables.
6. Pull boxes with any dimension larger than 72 inches shall have a rack or other facility for securing the cables.
7. We must review all communications conduit route and pull box drawings before final construction documents are issued. We must also be issued a set of as-built drawings after installation is complete.

#### **4.5 Pull Box and Conduit Labeling Requirements**

1. All pull boxes shall be labeled on the exterior of the cover with a pull box number and the name of the conduits that it supports. Pull boxes for each set of conduits shall be labeled in sequence starting with #1 for the pull box closest to the MDF.
2. Legibly label all conduits at both ends.
3. At pull boxes and manholes, each conduit must be labeled on both sides of the pull box or manhole.
4. All labels on conduits and pull boxes shall be made with a black permanent marker.
5. Each conduit shall be labeled on both ends with the name of the rooms at both ends of the conduit and a sequence number. Label the conduits using a wide tip black permanent marker.

#### **4.7 Requirements for Electrical Environmental Systems**

1. All electrical environmental systems must be dedicated solely to computer and network operations. Monthly testing of the UPS and emergency generator systems must be permitted to occur without disruption to any electrical services to the remainder of the building.
2. Dual main electrical panels with maintenance bypass to avoid any disruption of main service.
3. Absolutely no transformers are to be installed in any of the equipment rooms.
4. The equipment in the Computer/Server/Network room is expected to be served by PDU systems in the room.

#### **4.8 Requirements for Emergency Stand-By Generator System**

1. Provide two identical emergency stand-by generators with paralleling switchgear. The sizing of the generator systems shall be based on calculating the load for a single system. The second system will be redundant.

##### System One

- A. Two times the projected electrical load for all equipment rooms.

##### System Two

- A. System two is redundant to System One.



2. Automatic Transfer Switches should be designed as necessary to separate the equipment rooms from the remainder of the building.
3. Generator fuel tanks to keep the generators running for 72 hours. Assume 180 gallons per hour for both generators.
4. Assume 75 watts/sq.ft. for the design of the Computer/Server/Network Room.
5. Assume raised floor grounding and a signal reference grid under the raised floor systems.
6. Provide one duplicate (mimic) generator panel to be installed in the Command Console room.
7. Provide one graphics enunciator panel that displays the status of the UPS/battery and generator systems. This panel is to be installed in the Command Console Room.
8. The PBX system is expected to have its own UPS/battery backup system. The PBX system is not expected to be attached to the main building UPS system. One electrical panel should be installed in the Main Entrance Room to support the PBX system. The panel should have two 2-pole, 60 amp breakers to support the PBX and its expansion cabinet and two 20 amp breakers to support devices associated with the PBX system. This electrical panel should be on the emergency generator bus.

#### **4.9 Requirements for UPS/Battery System**

1. Provide two identical UPS systems with a common battery system. The sizing of the UPS systems shall be based on calculating the load for a single system. The second system will be redundant.

##### System One

- A. Two times the projected electrical load for all equipment rooms.

##### System Two

- A. System two is redundant to System One.
2. Provide one common battery system for the two UPS systems. Capacity of battery to be sized to provide 15 minutes support for UPS One at 90% capacity.

3. One battery monitoring system with remote dial-in access.
4. Battery must be mounted in Zone 4 rated rack system.

#### **4.10 Requirements for Leak Detection System**

1. Provide a leak detection system for all raised floor areas. If the major mechanical systems are located higher than the raised floor areas, a leak detection system must be installed around certain sections of the major water pipes. Other areas may be required pending design.

#### **4.11 Main Entrance/PBX and Telecommunications Closets Cable Tray System**

The Electrical Contractor shall provide and install the overhead cable tray system for the Main Entrance/PBX Room and the Telecommunications Closet. This includes all cable tray segments, connecting pieces, all ceiling supports and fastening components. Cable tray specifications are as follows:

1. The cable tray system shall be a light or medium grade ladder rack interconnecting system.
2. The cable tray depth shall be no less than 4" deep.
3. The distance between ladder rungs shall be no greater than 9".
4. Each support point shall consist of one 3/8" all thread hung on each side of the cable tray from the ceiling. The two pieces of all thread shall be connected underneath the cable tray with a segment of unistrut. Clips onto the tray shall not be used.
5. The base of the cable tray system shall be at least 8' 6" feet from the finished floor.
6. The entire cable tray system must be securely fastened from ceiling supports and to each other. Special 3-way unistrut-type bracing shall be employed at each non-wall termination point of a cable tray segment as well as each major intersection of the cable tray.
7. At the end of each cable tray termination point (non-wall) and at each major intersection, the 3/8" all thread shall be enclosed in 1/2 EMT conduit to provide additional seismic protection. Any connection from the cable trays to the racks must use insulating spacers and fasteners to insure that the cable trays remain electrically isolated from the equipment racks.

8. Grounding lugs and straps must be installed to ground the sections of the cable tray together.
9. In the Main Entrance and Communications Closets, the Electrical Contractor must ground the cable tray system to the grounding bar in the room.

#### **4.12 Conduit Poke-Throughs**

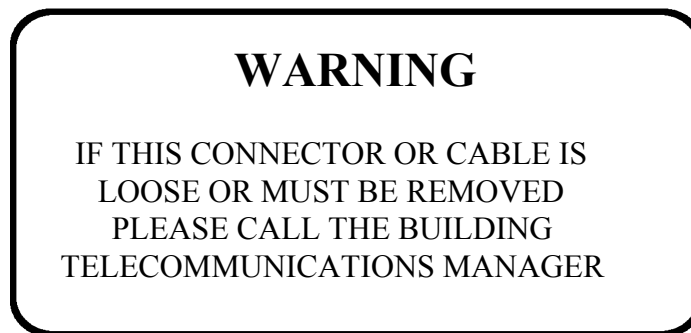
1. Make all poke-throughs were required. Sleeves to be 4” ID EMT conduits. The **Cabling Contractor** will provide the fire-stopping material for their part of the work.

#### **4.13 Specifications for Conduit Sleeves**

1. The conduit sleeves must be made of rigid galvanized steel, and have inside diameters of 4 inches.
2. The conduit sleeves shall protrude 3 to 4 inches past the concrete floor, including bushings.
3. The conduit sleeves shall be grounded.
4. The conduit sleeves shall be reamed and bushed at both ends.
5. Conduit sleeves shall be spaced 6 inches apart at their centers.
6. The conduit sleeves shall be anchored with Unistrut, conduit rings and bolting systems to fasten the rings to the Unistrut.
7. Conduit sleeves shall be firestopped with reusable firestop putty, supplemented as required by ceramic fiber or mineral wool.
8. The firestop putty must meet the following specifications:
  - A. UL Classified for up to and including 2 hours.
  - B. Non-hardening, permanently pliable, to permit removal and reinstallation.
  - C. Dielectric and water-resistant putty.
  - D. No curing required.
  - E. Shall not contain any solvents or inorganic fibers.
  - F. Additional materials, such as ceramic fiber or mineral wool shall be provided and installed as required to install the firestop pillows according to manufacturers specifications and local codes.

#### 4.14 Grounding Requirements

1. General
  - A. The telecommunications grounding system shall be used for telecommunications grounding only.
  - B. All bonding conductors and connectors shall be listed for the purpose intended and approved by Underwriters Laboratories (UL).
  - C. Except where specifically noted otherwise, all bonding conductors shall be insulated copper. The minimum bonding conductor size is 6 AWG (American Wire Gauge). The insulation shall be green.
  - D. Bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit with a 6 AWG or larger conductor.
  - E. The minimum inside bend radii of all bonding conductors shall be eight times their diameter.
  - F. Label all bonding conductors with the following label as close as practicable to their point of termination to be easily readable. Additional labels shall be installed on bonding conductors as specified in this document.



#### 2. Grounding Components

Major components and abbreviations for a telecommunications grounding system that complies with the EIA/TIA 607 standard follows:

Bonding Conductor for Telecommunications.  
TMGB - Telecommunications Main Grounding Busbar.  
TGB - Telecommunications Grounding Busbar.  
TBB - Telecommunications Bonding Backbone.  
TBBIBC - Telecommunications Bonding Backbone Interconnecting  
Bonding Conductor.

Additionally, the raised floor areas will have a Signal Reference Grid (SRG).

A. Bonding Conductor for Telecommunications

1. The Bonding Conductor for Telecommunications bonds the Telecommunications Main Grounding Busbar (TMGB) to the service equipment (power) ground for the complex. Thus, the Bonding Conductor for Telecommunications will run from the power ground for Electrical Entrance Facility to the TMGB in Main Cable Entrance Room.
2. The Bonding Conductor for Telecommunications shall be an insulated stranded copper cable, 3/0 AWG or larger. The bonding conductor shall be continuous in length and as straight as possible. The maximum resistance from the service equipment ground bar to the TMGB shall be 0.005 ohms.
3. If the bonding conductor is enclosed in a metal conduit or other metal enclosure, the conduit or enclosure shall be grounded to the communications ground at both ends, and isolated from other ground sources using insulating spacers.

B. Telecommunications Main Grounding Busbar (TMGB)

1. The Telecommunications Main Grounding Busbar (TMGB) is the dedicated extension of the building grounding system for telecommunications. It serves as the master ground bar or central point for the telecommunications grounding system.
2. The TMGB connects to the building grounding system through the Bonding Conductor for Telecommunications specified in the previous section.
3. All Telecommunications Grounding Busbars in IT equipment rooms and telecommunications closets are bonded to the TMGB through the Telecommunications Bonding Backbone.
4. The TMGB shall be located in Main Cable Entrance Room so as to minimize the length of the Bonding Conductor for Telecommunications.

5. Place the TMGB in Main Cable Entrance Room as close as practicable to one side of the plywood panelboard that serves that room, while maintaining clearances required by applicable electrical codes. Place the TMGB on an accessible wall no more than 12" above the slab. We will need to coordinate the exact placement of the TMGB.
6. The TMGB shall be an electrotin plated copper busbar with rounded edges. It shall be at least 6 mm thick and 100 mm high. Its length shall be adequate for all planned connections. It shall have predrilled holes with standard NEMA spacing and sizing for the type of connectors to be used.
7. The TMGB shall be sized to handle a minimum of 31 connections.
8. Insulate the TMGB from its support with a separation of 50 mm (2 inches).
9. All connections to the TMGB shall use two hole lugs and silver epoxy. Connecting hardware shall be equivalent to and at a minimum, 6 mm bolts and nuts, made of copper or copper alloy, and tin plated.
10. The TMGB also serves as the Telecommunications Grounding Busbar (TGB) for Main Cable Entrance Room. Connections, which would be made to the TGB for this room, shall be made to the TMGB instead.

C. Telecommunications Grounding Busbars

1. The Telecommunications Bonding Backbone (TBB) starts at the TMGB and extends to all of the IT equipment rooms and telecommunications closets. The TBB connects to the Telecommunications Grounding Busbar (TGB) in each equipment room or telecommunications closet.
2. Each telecommunications closet and equipment room will have a Telecommunications Grounding Busbar (TGB). The TGB is the central point for telecommunications grounding in the closet or room.
3. The TBB may be spliced provided that all other applicable requirements are met. However, splices shall be kept to the

minimum number necessary. Where splices are necessary, they shall be accessible and located in telecommunications spaces. Use electrotin plated copper compression-type connectors and exothermic welding to join segments of a TBB. Adequately support all joints and protect them from damage.

4. Install the TBB where it will be protected from physical and mechanical damage.
5. If the TBB is enclosed in a metal conduit or other enclosure, the conduit or enclosure shall be grounded to the communications ground at both ends, and isolated from other ground sources using insulating spacers.
6. The TBB shall be consistent with the design of the backbone telecommunications cabling system to the extent possible.
7. Label each TBB segment using the TBB names listed above. Install the label on each end of the TBB, and at every location where it is tapped or spliced.
8. An insulated stranded 3/0 AWG copper cable shall be installed from each of the TGBs to the Telecommunications Bonding Bus (TBB) running through the room. The bonding conductors shall be continuous in length and as straight as possible. The interior water piping system shall not be used as a TBB. Use electrotin plated copper grounding clamps and exothermic welding to tap the TBB. An electrotin plated copper compression tap and exothermic welding is an acceptable substitute.
9. The TGBs shall be predrilled electrotin plated copper busbars with rounded edges. They shall be at minimum 6 mm thick and 50 mm high. The length of the TGBs shall be adequate for the number of planned connections. The TGBs shall have predrilled holes with standard NEMA spacing and sizing for the type of connectors to be used.
10. Insulate the TGB from its support with a separation of 50 mm (2 inches).
11. Mount the TGBs no more than 12" above the slab, near the AC power panel for the room. If any TGB is on a raised floor system, we will require floor tile cuts below the TGBs.

12. All connections to the TGB shall use two hole lugs and silver epoxy. Connecting hardware shall be equivalent to and at a minimum, 6 mm bolts and nuts, made of copper or copper alloy, and tin plated.
13. Bond the TGBs to the nearest building steel column using an insulated stranded conductor no smaller than 6 AWG. If there is no steel column nearby, a horizontal steel member is an acceptable substitute if the horizontal steel member is permanently electrically bonded to a vertical column member.
14. At both cable entrance areas, install a 1 AWG insulated stranded copper grounding conductor from the TGB to each frame on which primary and secondary protectors will be located. These conductors shall run directly between the TGB and frames without any taps or splices. These cables shall use two hole lugs and silver epoxy. Connecting hardware shall be equivalent to and at a minimum, 6 mm bolts and nuts, made of copper or copper alloy, and tin plated. These cables are intended to conduct lightning and AC fault currents. Thus, these cables shall be separated by a minimum of 300 mm (1 ft) from any DC power cables, communications cables, or high frequency cables, even when isolated by metallic conduit or EMT.
15. In Telecommunications Closets, all metallic raceways and conduits for telecommunications cabling shall be bonded to the TGB for the closet using 6 AWG stranded insulated conductors.
16. In Telecommunications Closets, all cabinets and racks that will support telecommunications equipment shall be bonded to the TGB for the closet using 6 AWG stranded insulated conductors. Each rack and cabinet shall have its own 6 AWG conductor to the TGB.
17. In Telecommunications Closets, all riser cable shields or metallic strength members shall be grounded to the ground bar using a 14 AWG insulated braided copper conductor or greater.
18. In equipment rooms where a Signal Reference Grid is installed, bond the SRG to the TGB for the room using a 1 AWG or larger stranded insulated conductor.



D. Additional TGBs In Any Equipment Room

Where the number of connections to a TGB in a room or closet are large, additional TGBs may be installed to provide the desired number of connections. Additional TGBs must be individually bonded to the TBB and adhere to the requirements as described above.

E. Cable Gauge Sizes for Bonding TGBs to Other Grounding Components

In any raised floor area or Telecommunications Closet containing a TGB, the following ground cable sizes are required for bonding the TGB to other Grounding components:

1. AWG 3/0 conductor to Telecommunications Bonding Backbone (TBB).
2. AWG 6 conductor to the metal frame of the building.
3. Open position for possible future AWG 6 conductor (as specified in the EIA/TIA-607 standard).
4. AWG 1 conductor to the Signal Reference Grid should one be installed in the room.

F. Cable Gauge Sizes for Bonding Ground Cables in the Main Cable Entrances

In the Main Cable Entrance Areas, plan for the following:

1. An AWG 1 conductor to every frame used for primary protectors or secondary protectors on entrance cables.
2. At least two spare connections.

G. The TGB for the Antenna Electronics Room, if any, will also be used for grounding antenna wave guides and conduits to the roof. The grounding conductors shall be at minimum AWG 6.

H. In addition to all other labels specified, label conductors attached to a TGB or TMGB with the name of the object at the other end of the cable (e.g. TBB name, steel column name, SRG, cable name, rack name).

I. Signal Reference Grid

1. The following IT equipment rooms shall have a Signal Reference Grid (SRG):
  - a. Computer/Server/Network Room
2. Where there are no walls between rooms, the SRGs between the rooms shall be joined into a single SRG.
3. The Signal Reference Grid shall be manufactured from 2" wide by 26 AWG thick copper strips on 2 foot centers (for example, the Cadweld SRG system from Erico Products). All crossovers shall be joined by welding. 1 AWG copper wire is an acceptable alternative to copper strips, although copper strips are preferred because they have lower impedance.
4. The SRG shall cover the entire room.
5. Install 6 AWG insulated stranded copper grounding cable from the SRG to the ground bus for each PDU serving equipment in the room. This cable shall use a two hole lug and silver epoxy. Connecting hardware shall be equivalent to and at a minimum, 6 mm bolts and nuts, made of copper or copper alloy, and tin plated.
6. Install a 1 AWG stranded copper grounding conductor or equivalent bonding strap from the SRG to the Telecommunications Grounding Busbar for the room. This cable shall use a two hole lug and silver epoxy. Connecting hardware shall be equivalent to and at a minimum, 6 mm bolts and nuts, made of copper or copper alloy, and tin plated.
7. Each equipment cabinet, rack, or frame shall be bonded to the SRG using a 6 AWG braided copper cable or braided copper bonding strip. The connections on the equipment cabinets, racks, and frames shall use lugs and silver epoxy. The ground lugs shall be tin plated copper or tin plated copper alloy. The connections on both ends shall be welded.
8. Never connect equipment, cabinets, racks, or frames to the strip closest to an outside wall. Each equipment cabinet, rack, or frame must be individually grounded, not grounded serially.

9. Cable ladders in the room shall be bonded to the SRG using 6 AWG braided copper cables. Every other ladder may be grounded serially using a 6 AWG braided copper cable or bonding strip to a ladder that has a direct connection to the SRG. The connections on the equipment ladders shall use lugs and silver epoxy. The ground lugs shall be tin plated copper or tin plated copper alloy. The connections on both ends shall be welded.
10. Every 6th raised floor pedestal in each direction shall be connected to the SRG using a 6 AWG concentric copper conductor. The connections on both ends shall be welded.
11. All columns, conduits, water pipes, and ducts entering the Equipment Room shall be bonded to the SRG, at each end if these are horizontal. Use a 6 AWG copper bonding conductor.

J. Telecommunications Closet Grounding

1. Each Telecommunications Closet shall have a Telecommunications Grounding Busbar (TGB). Each equipment rack will need to be individually bonded to this ground bar using separate 6 AWG insulated copper grounding conductors. The racks shall not be grounded serially.
2. All conduits and ladders in Telecommunications Closets shall be bonded to the TGB for the closet using 6 AWG insulated copper grounding conductors. The ladders and conduits may be grounded serially. Sections of ladders will need grounding straps to effectively bond adjoining sections of ladders.
3. The metallic cable sheaths or strength members for any riser cables in the closet shall be bonded to the TGB for the closet using 14 AWG insulated copper grounding conductors.

**4.15 Electrical Receptacles**

All electrical receptacles for 20-amp circuits in the computer and telecommunications facilities are to be 20-amp. 15-amp receptacles are not acceptable.

## **Section 5 Program Requirements - Mechanical/Plumbing Contractor**

The following are program requirements for the mechanical and plumbing design for computer and telecommunications facilities:

### **5.0 Dedicated Mechanical for Computer and Telecommunications Areas**

- A. All mechanical systems serving all equipment rooms must be dedicated and separate from other systems. All must be electrically separate from other systems.

### **5.1 Ventilation, Cooling and Exhaust Requirements**

- A. All computer and telecommunications facilities are 24 hour/7 day operations. They are expected to be on the stand-by generator. Thus, these rooms must be ventilated, cooled and exhausted at all times, including those periods when normal power is not available.
- B. The rooms shall be free of water or drain pipes not directly required in support of the equipment in the IT equipment rooms.
- C. Floor drains shall be provided within the rooms. Water sensors shall be installed under the raised floor around all rest rooms, air conditioners, water pipes, and any water-cooled computers.
- D. Routing of electrical conduits and water pipes should avoid interference with communications cable routes and air flow.
- E. The air in the equipment rooms shall be maintained in the temperature range between 64 to 75 degrees Fahrenheit (18 to 24 degrees Celsius) and with a relative humidity of 40% to 55%. Make these measurements 5 feet above the finished floor in the center of an equipment aisle after the equipment is in operation. Maintain positive pressure differential from the equipment rooms with respect to surrounding areas. Provide additional ventilation for areas where batteries are located. Air-conditioning and positive pressure shall be maintained 24 hours per day, 7 days per week.

### **5.2 Water Lines Over the Main Computer Room**

If possible, water lines not involved in the support of the main computer room should not run over the main computer room. This includes boiler lines, rain drains, restroom drains, etc.

### **5.3 Fire Detection & Suppression**

#### **1. Main Entrance and Computer/Server Room**

- A. The Main Entrance and Computer/Server Rooms shall be equipped with a code-compliant smoke detection system, preferable ionization or photoelectric. This smoke detection system shall not be attached to an emergency power-off switch.
- B. The raised floor areas shall be equipped with an overhead sprinkler system for fire suppression. A dual-interlocking pre-action sprinkler system shall be part of the overall system. The overhead sprinkler piping must be dry.
- C. If a pre-action sprinkler system is not used, the standard system used in the other parts of the building is satisfactory with one exception. Drip pans are to be installed over the PBX equipment including the battery and the fiber demarc.
- D. Use the highest thermal link temperature permitted by code on all sprinkler heads installed over the raised floor areas.
- E. Where sprinkler heads are placed in open ceiling areas (no false ceiling), wire cages must be installed over the sprinkler heads.
- F. Sprinkler heads may be the pop-down type when used in false ceilings.

#### **2. Telecommunications Closets**

- A. The Telecommunications Closets shall be equipped with a sprinkler system for fire suppression. The standard system used in the other parts of the building is satisfactory except for the thermal link temperature.
- B. Use the highest thermal link temperature permitted by code.

### **5.4 Seismic Stands for Raised Floor CRUs**

All CRUs placed on the raised floor must be placed on stands rated for seismic Zone 4.