ATT-TP-76402

Internet Services Equipment On Access Floor Engineering and Installation Requirements

This practice provides guidelines and requirements for engineering equipment framework on access floors in the Internet Services environment.

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1. INTRODUCTION

This practice defines and establishes requirements for installation of access floors in the AT&T Internet Services facilities. An access floor is installed over a building floor to provide under floor space for room cooling air and/or space for routing building services. Equipment frameworks are installed on top of floor panels.

The following is a list of terms and their meanings as used in this document:

Access Floor — A floor system installed elevated above the building floor providing open space under equipment. Sometimes called a raised floor system.

Building Floor — The structural floor of the building usually of reinforced concrete slab tied back to building structural members such as columns, walls, beams.

Dead Load — Is the weight of permanent and fixed components of a structure. Term used in this document means the equipment frame attached directly to the floor system through bolted to the floor panel resulting in a fixed weight to the floor panel.

Equipment Framework — Open frames or closed frames such as relay racks, cabinets or enclosures used for housing electronics shelves. Usually designed for rack mounting of equipment to mounting rails or uprights by vertical stacking of shelves.

Heavy Duty Floor — Floor design with pedestal design of captured head preventing the pedestal head from lifting out of tube. The captured head becomes important when equipment frames are directly secured to floor panels.

Light Duty Floor — Floor design with pedestal design of non-captured head allowing the pedestal head to lift out of tube. The pedestal design may also be less resistant to lateral loads.

Live Load — Is the non-permanent and movable load on a structure. Term used in this document means any component or equipment framework on top of the floor system not directly secured to the floor panel and allowing framework weight to slide across floor panel.

2. GENERAL

2.1 Description

2.1.1 Floor systems consists of 2 feet by 2 feet square steel floor panels, either hollow or filled, supported by an understructure of pedestals and stringers. The floor system is designed to be engineered and installed in modular sections using floor panels, pedestals and stringers

covering the space designated to have the elevated floor. Unless the floor space was originally designed for an elevated floor with the building floor recessed for finished floor height of the floor system, there shall be a ramp and steps to transition from the building floor up to the access floor.

3. PLANNING

3.1 Floor Layout

3.1.1 Layout of floor system shall consider location of equipment lineups with focus of maximizing number of lineups, avoidance of building element obstructions, maintaining aisle clearances and providing proper cooling airflow around equipment as shown in **Figure 1**. The starting point of the first full floor panel in relation to a building reference will determine floor pattern throughout equipment space and should be examined thoroughly for best space use.

3.1.2 Planning floor layout along with equipment framework requirements is essential and close coordination between floor installation personnel and equipment engineers shall exist.

3.1.3 Floor layout shall include ramps or steps for transitioning from building floor to access floor finish height. Ramps shall be placed where equipment can be wheeled onto floor from nearest building entry or equipment staging area. Steps or another ramp is required in another part of the floor space for at minimum two entrances into the area.

3.1.4 Area immediately facing ramp shall be clear of equipment lineups for up to 12 feet to avoid obstructing movement of equipment or foot traffic.

3.1.5 Final floor finished height shall be 24 inches from building floor to top surface of floor panel. Alternative floor heights shall only be considered if site conditions prevent floor height to be 24 inches. The vertical clearance under a 24 inch height floor is necessary for air movement and underfloor services.

3.1.6 Overall ceiling clearance required will be determined by the sum of the following components:

a) 24 inches (2 feet) access floor height

b) 84 inches (7 feet) for equipment frames

c) 16 inches (1 feet – 4 inches) for each vertical level of cable rack, usually two minimum

d) 24 inches (2 feet) free vertical clearance for air circulation above equipment

e) 36 inches (3 feet) for building services items, i.e. air ducts, pipes, lighting.

Add applicable components for total room height. Some components are mandatory and cannot be eliminated such as a), b), d). Other components may have multiple units such as c).

3.2. Room Ventilation And Power Equipment

3.2.1 The floor space may have room cooling equipment in floor area to cool electronic equipment. The room cooling equipment shall be positioned to best distribute cool air to cold aisles and a return path for warm air from hot aisles back to cooling equipment. This may require the installation of multiple room cooling units spaced throughout the floor area. Locating the cooling units against outer walls provides greatest open space for equipment lineups.

3.2.2 Room cooling equipment shall be supported by a steel stand independent of the access floor system. The steel stand must be capable of supporting the full weight of the cooling equipment with stand lateral stiffness equal or greater than the access floor system. Stand height should be same height as the access floor final finished height.

3.3.3 Runs of pipes carrying fluids shall be routed away from locations where leaks can impact operation of electronic equipment. Underfloor placement of pipes shall be limited to a few grouped runs in straight paths to avoid interfering with other use of floor space. Diagonal runs are not permitted. All pipes shall be supported off building floor and secured at no more than 6 feet spans as shown **Figures 2** and **3**.

3.3.4 Equipment lineups with aisles in a straight path back to cooling equipment provides most direct route for warm air back to room cooling equipment.

3.3.5 Hot and cold aisle configuration for equipment lineups is required for thermal management. The front aisle shall be designated a cold aisle where cool conditioned air shall be introduced for equipment intakes. Rear aisle shall be the hot aisle where exhausted warm air from equipment shall be discharged.

3.3.6 Equipment lineups shall be configured with front face to front face cabinets in cold aisles and rear face to rear face cabinets in hot aisle in paired alternating aisles.

3.3.7 Minimum aisle widths shall be 4 feet for front cold aisle between opposing face of cabinets and minimum 3 feet for rear hot aisles. At minimum, one full floor panel shall be available along any aisle length to allow access to underfloor area.

3.3.8 Power distribution and power storage equipment may be located on floor system to power electronic equipment in the room. This power equipment may be large and heavy requiring an independent stand for support. The steel stand must be capable of supporting the full weight of the equipment with lateral stiffness equal or greater than the access floor system. The stand shall have provisions for access floor panels supported up to the stand edge. Stand height should be the same height as the access floor final finished height.

3.3.9 Larger footprint power equipment shall be located against room walls to provide greatest open space for equipment lineups. Power storage equipment such as flooded cell batteries may require ventilation needs and spill control more suited away from main equipment areas.

3.3.10 Smaller power distribution equipment such as fuse or breaker cabinets may be placed away from walls in equipment lineups as required. These cabinets may be supported by the access floor and secured in similar manner as lineup equipment.

3.3.11 Conduit runs, power cables, wiring and outlet boxes shall be provided and routed to the immediate underfloor area where required in direct, straight and grouped runs to avoid interfering with other use of floor space. Crossing paths of cable runs shall be avoided.

4. GENERAL ENGINEERING REQUIREMENTS

4.1 Local Code Requirements

4.1.1 Installation of access floors require building permits and approvals by the local buildings inspection jurisdiction. General contractor and/or consulting engineer retained for the project shall assure the proper submittals have been filed and approvals have been received prior to construction.

4.1.2 The floor system shall be designed for the local conditions and may need to include earthquake loads as required by code requirements.

4.1.3 All electrical work shall be conducted and installed in strict conformance to National Electrical Code requirements.

4.1.4 The equipment room where the access floor is to be installed shall be provided fire suppression systems only if required by local fire code requirements. See other company references on fire suppression policy.

4.1.5 Under floor space used for air handling shall require all cables and wiring placed in the under floor space to be rated for plenum duty or enclosed in conduit.

4.2 Room Preparation

4.2.1 Building floor must be smooth, level and free of floor protrusions. Floor coverings, such as tiles, linoleum sheeting shall be removed completely when torn, broken or unfit for use. Caution must be taken when removing asbestos floor coverings and adhesives. Use only company approved methods and disposal procedures. All remaining floor covering adhesive shall be stripped to bare concrete.

4.2.2 Where abandoned anchors obstruct floor system pedestals or anchors, they shall be removed or leveled flush with floor surface. Anchor removal must be accomplished with methods that will not harm concrete integrity, methods such as core drilling may be used. Direct extraction of anchors is permitted only if anchors are embedded less than 2" and are low strength anchors, ie. lead alloy expansion, sleeve or wedge type anchors. Following anchor removal, holes shall be filled with epoxy mortar filler and finished flush to floor surface. For anchors 1/2" diameter or smaller the anchor may be ground flush and left in place if doing so does not interfere with new anchor installation.

4.2.3 Concrete floors with cracks greater than 1/32" wide shall be filled and leveled with an approved epoxy mortar or crack injection product, such as Hilti RM700EP, Epoxy Repair Mortar.

4.2.4 Concrete surface shall be sealed with urethane, epoxy or acrylic based product against surface dusting, collection of dust on concrete, reduce moisture seepage and limit water penetration. Sealant may be sprayed or roller applied. Sealant shall be clear or light in color.

4.2.5 Identify and relocate electrical power outlets, telephone jacks, electrical switches, pipe valves, etc. to area above floor system level. Service devices are not to be hidden under floor system. Relocate electrical switches or outlets to location above new floor height level.

4.2.6 Windows, doors or other openings to room shall be moved or resized to new floor height prior to installation of floor system.

4.2.7 Prior to floor system installation, all permanent partitioning walls are to be installed and fastened to building floor and ceiling. Partitioning walls shall not be installed with wall materials supported on top of elevated floor system nor secured to floor system.

5. FLOOR COMPONENTS

5.1 Floor Panel

5.1.1 Access floor panels are the most visible component of the floor system. The floor panel surface is where equipment frameworks are placed. The floor panels are designed to be removable by lifting them upward and out of the stringer grid revealing the space under the floor.

5.1.2 Floor panels used in equipment space shall be rated at minimum 1250 pounds compression strength and concrete filled. The panels shall be 24 inch by 24 inch steel construction and covered with plastic laminate of white with gray swirl pattern as shown in **Figure 4**.

5.1.3 Perforated airflow floor panels are provided in front (cold) aisles. The airflow panels shall be rated 1250 pounds and will be hollow. The panels shall be 24 inch by 24 inch steel construction and covered with matching plastic laminate to the solid floor panels. The airflow panels are more vulnerable to top load damage and requires more precautions when moving equipment over these panels. Installation of these airflow panels should be delayed until completion of all movement of equipment into area.

5.1.4 The floor panels shall have drilled holes with countersunk top surface at each corner for fastening the panel to the pedestal head with a threaded screw. Fastener head should be below floor surface when tightened.

5.2 Stringers

5.2.1 Stringers shall be rectangular shaped steel construction designed to be secured to each pedestal head with ¼ inch threaded screw with screw head recessed into stringer. The stringers shall be provided in 4 feet lengths for majority of floor area. Shorter stringer lengths are acceptable along perimeter of floor area, against building structural component and against equipment on their own platform stand.

5.2.2 Stringers are used to interconnect pedestals in 2 feet by 2 feet grid for greater stability and to provide support for floor panels along their four sides.

5.2.3 The stringers are integral to the grounding of the floor system as they provide a metallic path from one pedestal to the next. The stringers shall always be secured to the pedestal heads.

5.3 Pedestals

5.3.1 Floor pedestals are the most critical component of the floor system. The design of the floor pedestals determine the overall performance of the floor and how the floor system could be applied as far as equipment installation.

5.3.2 Pedestal designs fabricated with square tubes spot welded to a stamped steel base shall not be used in any floor system intended for equipment frame installations. See **Figure 5** for example of square tube pedestal. The square tube pedestal is not designed for carrying equipment loads. Round tube pedestals of minimum1 inch diameter welded to a steel base shall be used in equipment environments.

5.3.3 Light duty floor systems as defined in this document are floor systems with pedestals that do not have captured pedestal heads and have pedestal tubes of lighter gauge materials as shown in **Figure 6**. The pedestal tube is 1 inch diameter or less. The pedestal head inserts into the tube without a means to prevent head lift out. A nut is provided in the threaded portion of the head for height adjustment only.

5.3.4 Heavy duty floor systems as defined in this document are floor systems with pedestals that have captured pedestal heads and larger diameter tubes, 1-3/4 inch or greater, and/or heavy walled steel or aluminum tube as shown in **Figure 7**. The heavy duty pedestal head is prevented from upward lift by threaded connection or a locking pin. The head is adjustable for vertical height and a nut to lock the head to that height.

5.3.5 Floor pedestals are installed in 2 feet by 2 feet grid pattern. The base shall be secured to the building floor with mechanical anchors or bonded to floor with an adhesive. Adhesive bonding is not acceptable for heavy duty floor systems. It should not be used for light duty floor systems because of the limited strength of adhesive and the reduction of performance with aging.

5.3.6 Floor height is determined by length of the pedestal tubes with overall floor height measured from surface of building floor to top surface of access floor panel. The standard floor height will be 24 inches. Other floor heights may be found, however, the 24 inch provides best underfloor clearance for airflow and usable space for conduit, pipes and other services.

5.4 Floor Anchors

5.4.1 Floor anchors securing the pedestals to the building floor are an important component of the floor system as they determine the ability of the floor pedestals to tolerate lateral loads. In most situations the floor system loads will primarily be vertical loads from weight of equipment frames, foot traffic or rolling loads. Lateral load on floor may result from overturning forces of equipment frames, building wall pressure on floor or ground motions.

5.4.2 Floor anchors shall be embedded concrete anchors such as Hilti Kwik Bolt III anchors embedded into the concrete building floor.

5.4.3 Adhesive bonded pedestals are not recommended because of inconsistent performance, loss of strength from aging, lower hold down values and environmental concerns of adhesive solvents.

6. ACCESS FLOOR INSTALLATION REQUIREMENTS

6.1 Light Duty Floor

6.1.1 Light duty floors shall not be used for support of dead load of equipment. Dead loads on the floor system would be when equipment frames are directly secured to the floor system. Equipment frames placed on the access floor surface and attached to the building floor will be considered a live load on the floor system. Live loads do not transfer great enough lateral load to access floor to affect the floor systems performance.

6.1.2 Pedestal designs on light duty floors are typically thin walled steel or aluminum tubing welded to a square base. Base thickness is of 1/8 inch to ¼ inch and minimum 8 inch by 8 inch dimension. Tubing should be welded to base with full bead weld around the circumference of the tubing.

6.1.3 Pedestals are secured to the building floor with embedded concrete anchors. Floor anchors shall be Hilti Kwik Bolt III style of 1/4 inch diameter embedded to 2 inch depth. Two anchors shall be positioned at opposite diagonal corners per pedestal. Tighten anchor nut to 10 ft.lbs. Exposed thread length shall not protrude more than 3/8 inch above nut. Any anchors with exposed threads exceeding 3/8” or anchors with sharp edges shall be covered with plastic caps.

6.1.4 Pedestal heads of light duty floors are typically drop-in design with height adjusting nut at the base of head. The threaded rod of the pedestal head shall be of adequate length at final height adjustment for minimum 4 inches length inside tube.

6.1.5 Pedestal shall be installed vertical within 0.5 degree, shimmed under base if necessary with minimum 1 inch wide and 1 inch long shim stock of high-compression material such as metals or high density composites. Shim stack should not exceed 0.5 inch height. Any greater height shimming shall be one piece shim or bonded together shims and located under anchor centerline.

6.1.6 Stringers shall be installed in 4 feet lengths whenever possible and secured at every pedestal head with fastener. Stringers shall be formed steel or aluminum and have electrical continuity to pedestal tubes. Placement of stringers where front aisles of equipment lineups are 4 feet or greater shall have full length of stringer removable or swung aside for access to floor area with no length under equipment panels.

6.1.7 Floor panels shall nest into stringers and firmly fit between adjacent panels with minimum need to force panels flush with stringers. All panel joints must be flat and level between panels with no more than 1/32 inch height difference.

6.1.8 Floor panels designed to be corner locked shall be secured to pedestal heads with fastener and tightened so there can be no lift of panel. Fastener shall be installed with head below panel finished surface and floor panel covered with matching laminate color cap over fastener.

6.1.9 Cuts made to floor panels shall be done outside of building or away from main equipment area. All dust, metal filings shall be removed from panel prior to installing. Panels with greater cut surface than remaining panel surface shall require additional understructure support where there will be foot traffic or equipment load placed on panel.

6.1.10 Under floor coolant pipes, condensate drain pipes, electrical wiring passing through floor space shall not be directly attached to pedestals. Services for the immediate floor panel above may have items such as junction boxes, power outlets, attached to the pedestal serving that floor panel.

6.1.11 All conduit, power cables, wiring and outlet boxes shall be supported off building floor and positively secured to maintain runs on supports. Pedestal bases are not considered adequately supported off floor and supports attached to pedestal tubes shall not cause pedestal tubes to deform, be nicked or compress. Clamps placed on pedestals shall be of design to avoid deforming pedestal and not require drilling or modifying pedestal tube for their attachment.

6.1.12 Completed floor surface shall be level within 1/8 inch over 24 feet and panel joints flat within 1/32 inch. Underfloor area shall be clean of all debris, dust or loose hardware. Laminate shall be free of all markings, scratches, scuffs, cuts. Cut edges shall be trimmed with protective materials so sharp edges are not exposed.

6.2 Heavy Duty Floor

6.2.1 Heavy duty floor designs are more suitable for carrying dead load of typical Internet Services equipment frames and can have equipment framework attached direct to floor panels. HVAC equipment, larger AC power equipment and battery stands shall have their own pedestal stand independent of the access floor system. The weight of heavier HVAC and power equipment will not be supported by the access floor pedestals.

6.2.2 HVAC and power equipment stands shall be secured to the building floor with same floor anchor type as used for floor pedestals in high seismic risk locations (Zones 3,4). Battery stands for UPS or backup power systems shall be anchored to building floor in all areas. At minimum the anchors shall be Hilti Kwik Bolt III ½ diameter embedded to 2-1/4 inch depth. HVAC and Power Equipment manufacturer's securing requirements shall be followed unless those requirements are less stringent than those stated within this document.

6.2.3 Pedestals of heavy duty floors should have heavy walled pipe of larger diameter and heavier base design for stability. The pedestal tube will be welded to base with full bead weld around tube.

6.2.4 Pedestals are secured to the building floor with embedded concrete anchors. Floor anchors shall be Hilti Kwik Bolt III style of 1/2 inch diameter embedded to 2-1/4 inch depth. Tighten anchor nut to 10 ft.lbs. Exposed thread length shall not protrude more than 3/8 inch

above nut. Any anchors with exposed threads exceeding 3/8" or anchors with sharp edges shall be covered with plastic caps.

Quantity of anchors for securing pedestals as shown in **Figure 8**:

Zones 0,1,2 2 anchors in diagonal pattern

Zones 3,4 4 anchors

6.2.5 Pedestal heads of heavy duty floors are captured by tube so they will not withdraw unless they are unthreaded from pedestal. The pedestal head is provided for height adjusting by threaded in or out of tube and a nut locks head in place. The threaded rod of the pedestal head shall be of adequate length at final height adjustment with minimum 4 inches length remaining in tube.

6.2.6 Pedestal shall be installed vertical within 0.5 degree, shimmed under base, if necessary, with minimum 1 inch wide and 1 inch long shim stock of high-compression material such as steel or high density composites. Shim stack should not exceed 0.5 inch height. Shim stack of greater height shall be one piece shim or bonded shims and located under anchor centerline.

6.2.7 Stringers shall be installed in 4 feet lengths whenever possible and secured at every pedestal head with fastener. Stringers shall be formed steel or aluminum and have electrical continuity to pedestal tubes. Placement of stringers where front aisles of equipment lineups are 4 feet or greater shall have full length of stringer removable or swung aside for access to floor area with no length under equipment panels.

6.2.8 Floor panels shall nest into stringers and firmly fit between adjacent panels with minimum need to force panels flush with stringers. All panel joints must be flat and level between panels with no more than 1/32 inch height difference.

6.2.9 Floor panels shall be corner locked to pedestal heads with screw fastener and tightened to about 2 ft. lbs. Fastener shall be installed to where head is below panel surface and hole covered with matching laminate color cap over fastener.

6.2.10 Cuts made to floor panels shall be done outside of building or away from main equipment area. All dust, metal filings shall be removed from panel prior to installing. Panels with greater cut surface than remaining panel surface shall require additional understructure support where there will be foot traffic or equipment load placed on panel.

6.2.11 Under floor coolant pipes, condensate drain pipes, electrical wiring passing through floor space shall not be directly attached to pedestals. Services for the immediate floor panel above may have items such as junction boxes, power outlets, attached to the pedestal serving that floor panel.

6.2.12 All conduit, power cables, wiring and outlet boxes shall be supported off building floor and positively secured to maintain runs on supports. Pedestal bases are not considered adequately supported off floor and supports attached to pedestal tubes shall not cause pedestal

tubes to deform, be nicked or compress. Clamps placed on pedestals shall be of design to avoid deforming pedestal and not require drilling or modifying pedestal tube for their attachment.

6.2.13 Completed floor surface shall be level within 1/8 inch over 24 feet and panel joints flat within 1/32 inch. Underfloor area shall be clean of all debris, dust or loose hardware. Laminate shall be free of all markings, scratches, scuffs, cuts. Cut edges shall be trimmed with protective materials so sharp edges are not exposed.

6.2.14 Heavy duty floor pedestals may not fit around perimeter of floor where building wall may interfere with it's placement. Lighter duty pedestals may be used at perimeter or at building columns where no equipment frames are placed directly above these pedestals. These pedestals are typically not located at 2 feet centers from last full floor panel, more likely at end of a shortened section of floor panel.

7. GROUNDING REQUIREMENTS

7.1 Grounding Floor System

7.1.1 Grounding requirements for floor system shall be in accordance to AT&T grounding guidelines. Those requirements may be found documented in other references as well as in the following paragraphs. As a minimum, the installer shall follow the grounding methods described.

7.1.2 All components of a raised floor system are considered part of the common bonding network. When required by equipment vendor specifications, insulation as described in TP-76400 Section 4.7.6, shall be installed between the surface of the raised floor panel and underside of equipment enclosures.

7.1.3 When equipment is installed in an isolated bonding network, equipment framework securing hardware that penetrates the raised floor panel shall be furnished with nylon bushings or other adequate insulating hardware so that there is no electrical continuity between securing hardware and equipment enclosure.

7.1.4 The preferred design for a raised floor support system uses metal stringers between adjacent pedestals. The raised floor support system shall be equipped with a ground system that consists of:

a) Bare or insulated copper main conductors, sized at #4 AWG minimum

b) A main conductor routed around the perimeter of the raised floor area

c) Main conductors bonded to pedestals and formed into a grid system consisting of squares with sides no longer than 20 feet bonded to the perimeter conductor at each end with a #6 AWG bonding conductor.

d) Intersecting main conductors shall be bonded with a #6 AWG bonding conductor.

e) The grid system shall be bonded to an IS POP/VHO GRD or OPGP bus bar with a #2/0 AWG conductor. The conductor shall be connected to the approximate center of the grid.

f) A minimum #6 AWG bond from the grid system to metal conduits entering the grid area if no MGB, IS POP/VHO GRD, or OPGP bus bar is available

7.1.5 The preferred design for a raised floor system uses metal stringers between adjacent support pedestals. If metal stringers are not used, the following shall be installed in addition to the ground system described in **Paragraph 7.1.4**:

a) Intermediate bonds between the grid system main conductors and support pedestals at 4-foot intervals

b) A minimum #10 AWG branch conductors connected, at intervals not exceeding 4 feet, between parallel #4 AWG main conductors forming the sides of a 40-foot grid square - the branch conductors shall be bonded to every other pedestal so that every floor panel is in contact with at least one bonded pedestal.

7.1.6 There are no restrictions on contact between the grid assembly and conduits, ducts, pipes and other conductive materials installed under the floor, or extended through the floor that are part of the common bonding network.

7.1.7 Bonding conductors shall not be run over building service components or floor system components as shown in **Figure 11**. The conductors shall rest on building floor.

8. SEISMIC ZONE REQUIREMENTS

8.1 Access Floor Design

8.1.1 Access floor design in high seismic risk locations requires designing floor system in conformance to building code requirements for earthquake loads.

8.1.2 Floor systems shall be designed to handle dead load of equipment loads up to 1000 pound weight per frame, 7 feet height with center of gravity at mid-height. Several frames of equipment at these weights will be configured in lineups across the floor system.

8.1.2 AT&T establishes two seismic risk scenarios across all serving areas. Low Seismic Risk locations are Zones 0,1 and 2. High Seismic Risk locations are Zones 3 and 4. Floor systems should be designed for one of the two risk scenarios using appropriate AT&T design requirements and UBC requirements.

8.2 Equipment Securing

8.2.1 The proper method of securing of equipment framework on access floor requires the framework be secured from any overturning possibilities and horizontal walking across the floor.

8.2.2 The level of securing required will be dependent on risks of the particular site. The risks result from natural environmental conditions, building conditions, foot traffic through the area and amount of construction at the site. The unbalanced loads of the equipment framework poses the greatest overturning risks for equipment.

8.2.3 Equipment frames are required to be secured in some measure back to the building floor in all cases in low and high seismic risk locations.

8.2.5 When light duty floor systems are used, the equipment frames shall be secured to the building floor by threaded rods.

9. SECURING EQUIPMENT FRAMEWORKS ON ACCESS FLOOR

9.1 Equipment On Light Duty Floor

9.1.1 Equipment frameworks installed on light duty access floors with non-captured heads requires equipment to be secured to the building floor. The equipment framework shall never be secured direct to the light duty access floor or by securing to a channel straddled under floor stringers.

9.1.2 Equipment framework shall be side junctioned to all adjacent equipment to avoid pounding and to maintain alignment of lineup. A minimum of top and mid-height attachment shall be provided to adjacent equipment. For equipment frames of deep sides such as cabinets, junctioning hardware required at top corners and front and back points at mid-height. Hardware shall be minimum Grade 5 materials of minimum ½" diameter if through bolting. Junctioning details using flat plate between frames may require smaller hardware of greater quantity.

9.1.3 Where equipment frames are not side junctioned, a space of 5 inch minimum shall be provided between frames. Framework placed near building walls, columns or other structural member shall have 5 inch space from building member.

9.1.4 The equipment frames shall be secured to floor anchors or floor mounted channel by way of threaded rod through cut hole in floor panel down to building floor as shown on **Figure 13**. Each frame shall be secured at each corner to building floor. A single unspliced length of threaded rod shall be used for each anchor.

9.1.5 Holes in floor panels shall avoid being located within 2 inches of floor panel edges to avoid weakening floor panel and interference from stringer. Move to alternate hole location in equipment frame or in worst case do not install anchor blocked by panel and stringer. Equipment frame with deleted anchor(s) must be junctioned to adjacent properly secured frame to permit the deletion of anchor(s).

9.1.6 Framework shall be secured to embedded concrete anchors equal to Hilti HDI (drop-in) style of anchors of ½ inch diameter. The anchors shall be embedded to 2 inch depth. Anchor shall be set with hammer set tool. All anchors shall be installed flush or below concrete surface.

9.1.7 Threaded rod shall be inserted into floor anchor to at least 5 full turns (0.375 inch). An outer nut is not required at anchor to secure rod.

9.1.8 For long lineups of similar dimensioned equipment frames, an anchoring channel secured to the building floor may replace individual anchors. Two channels installed under the floor system parallel to the lineup can serve as anchoring points as shown in **Figure 14**. The U-shape channel shall be equal to Unistrut P-1000T. The channel shall be secured to the building floor with U-Bracket and embedded anchors at approximately 36 inch centers. Anchors shall be equal to Hilti HDI ½ inch diameter.

9.1.9 Position ½" channel nuts in U-shaped channel for equipment frame securing rod.

9.1.10 Elevated channels secured to building floor can provide anchor positions for equipment frames blocked by under floor components such as pipes, conduit or cables by bridging channel over components as shown in **Figure 15**. The length of channel shall be secured to building floor at minimum at two points.

9.1.11 Equipment frame shall be secured to building floor with ½" diameter hardened threaded rod and nuts of minimum Grade 5 standard. A large diameter heavy washer shall be placed between securing hardware and base of equipment frame to prevent pull through base hole. For equipment requiring electrical isolation, a dielectric shoulder washer is placed under the large diameter steel washer.

9.1.12 The anchor nut shall be tightened to approximately 10 ft. lbs.. Do not over tighten or equipment frame and floor panel could be deformed.

9.1.13 Equipment frames not secured to building floor requires supplemental support overhead to prevent overturning risks as shown in **Figure 16A** and **16B**. The supplemental support is required in addition to bolting base of cabinets to floor panel. Equipment frames fastened to light duty floor system are not considered secured to the building floor.

9.1.14 Equipment frames shall never be braced to ceiling suspended overhead cable rack or auxiliary framing.

9.1.15 Supplemental overhead support shall be with rigid cross aisle member between every two opposing lineups at 5-6 feet span. For odd number of lineups, the supplemental support may need to be extended over to a third lineup of equipment frames. The connector shall be equal to a U-Shape channel such as Unistrut P-3300. The cross aisle member shall fasten to the top of the cabinet at two places with minimum ½" Grade 5 hardware. All frameworks in the lineup shall be side junctioned to form a rigid assembly.

9.1.16 Cable racks supported on top of cabinets per SBC-TP-76401-001, Internet Services Cabinet Supported Cable Rack Requirements, have U-Shape channels positioned perpendicularly under cable rack. The cable rack supporting channel, if extended across the aisle to the adjacent lineup can be used as supplemental support for cabinets in place of a separate run of channel.

9.2 Equipment On Heavy Duty Floor

9.2.1 Equipment frameworks can be secured directly to the floor panel by through-bolts on heavy duty floor systems. Securing of equipment frameworks down to building floor will not be necessary. It is imperative that access floor system is designed to accept the live load condition of equipment weight secured to the floor system.

9.2.2 The hardware required for securing equipment frameworks to the access floor panel shall be a 1/2" - 13 hex head Grade 5 capscrew, 2" x 2" x 1/4" square washer, 1/2" flat round washer (min. 1-1/4" O.D., 0.112 thick), 1/2" - 13 heavy hex nut as shown in **Figure 17**. The capscrew length required is calculated from height of top surface of cabinet base to floor panel plus another 2" length for thickness of floor panel and washers. For example if the distance of cabinet base to floor panel is 3-1/4", the length of the capscrew will be 5-1/4" long (3-1/4 + 2 = 5-1/4).

9.2.3 The 2" x 2" square washer is necessary to straddle the inverted cones of the underside of the floor panel as shown in **Figure 18**. Drilled holes not centered in a cone are acceptable and the square washer will end up not being flat on bottom of the panel.

9.2.4 Tighten through-bolt nut to 10-15 ft.lbs.. Do not over-tighten or floor panel may be crushed by through-bolt. For equipment frame base not sitting directly on floor panel surface over-tightening may also deform equipment frame base. Stacking washers under base to eliminate space between base and floor surface would prevent base deformation.

9.2.5 When drilled hole is required within 1-3/4" from edge of floor panels, the underside ridge may prevent washer from seating flat. Any holes positioned within 1/2" from edge of a floor panel may also be interfered by the floor stringer. Anchoring holes very close to panel edges may require alternate hole location or in worst case leaving those anchors out. Deletion of some anchors shall only be permitted where cabinets are junctioned to adjacent properly supported cabinets.

9.2.6 Hole in floor panel for through-bolt shall be 5/8 inch diameter for clearing through-bolt. Through-bolt should not be in contact with floor panel.

9.2.7 Equipment frameworks requiring electrical isolation shall have non-conductive shoulder washer placed under head of capscrew through-bolt. The isolation washer should provide insulation between capscrew and equipment base. Isolation pad or shims under the cabinet shall be provided to insulate cabinet base from floor panel.

9.2.8 Equipment framework shall be junctioned to all adjacent equipment to avoid pounding and to maintain alignment of lineup. A minimum of top and mid-height attachment shall be provided to adjacent equipment. For equipment frames of deep sides such as cabinets, junctioning hardware required at top corners and front and back points at mid-height.

9.2.9 Where equipment frames are not side junctioned, a space of 5 inch minimum shall be provided between frames. Framework placed near building walls, columns or other structural member shall be provided 5 inch space from building member.

10. WORK ACTIVITIES ON COMPLETED FLOOR

10.1 Protection Of Floor

10.1.1 Movement of heavy equipment on top of access floor requires protection of floor with minimum ½ inch thick plywood sheets along full length of path. Rolling loads of wheeled dollies, hand trucks, carts, high-lifts shall always have wheels on top of the plywood sheets. Perforated air flow panels shall be protected with minimum ¾ inch thick plywood due to lower compression strength surface.

10.1.2 For normal non-installation service movement of light duty carts, the floor will not require plywood sheet protection. However, any signs that floor panel surface may be deforming under cart load requires discontinuing use of the cart until floor has been protected with plywood..

10.1.3 There is never to be dragging, sliding or rocking of equipment, boxes, pallets or any other products across floor surface without first protecting floor from scratches and catching of joints. Hardboard sheets shall be placed over floor where product will be moved across floor.

10.1.4 Lifting of floor panels shall always be with suction cup puller. Screw drivers used to pry floor panels is never permitted.

10.1.5 Lifting of perforated air flow floor panels shall be with hook puller. Screw drivers shall never be used to pry panels up.

10.1.6 It is highly recommended that floor panels be removed for under floor access in a pattern of every other panel to maintain alignment of floor system. Mark one corner of panel matched to adjacent panel for returning panel to original position and direction to ease reinstallation. Removal of full aisle length of floor panels may require realignment of floor starting at one end of aisle.

10.1.7 It is recommended that stringers are not removed when accessing under floor space. Removal of stringers will result in misalignment of floor system and difficulty in reinstalling floor components.

10.1.8 Floor panels shall never be dropped, stomped or otherwise forced back into place when reinstalling floor panels. Floor panels that do not go back into place easily may be because of misalignment of adjacent panels.

10.1.9 Corner locked floor panels shall be re-secured at all four corners to the pedestal heads when reinstalling floor panels.

10.1.10 Cuts made to floor panels shall be completed with floor panel removed and taken outside of equipment area. The size of cut shall never exceed 50 percent of total panel surface. All cut edges shall be covered with trim or floor grommet to eliminate sharp edges. See other paragraphs in this document for cuts of greater dimension.

10.1.11 Floor system intended for under floor air handling of room cooling air requires all floor openings to be fitted with opening grommet to minimize air leakage. The grommet shall have

adjustable opening to restrict air escape around cables and other service items from under the floor. Grommet shall not protrude above floor panel surface more than 1/8 inch. Grommet height shall be deep enough to protect opening from all cut surfaces of opening.

10.2 Maintenance Requirements

10.2.1 Following installation of access floor there may be activities requiring floor panels be removed for access to under floor areas. After several cycles of removal and reinstallation of panels and stringers the floor panels may no longer be level, aligned or appearing to be as new. Adjustments and realignment of floor system may be required to be performed by original installation contractor.

10.2.2 Panels that have experienced severe abuse leaving chipped, broken or scuffed surfaces may require replacement. All exposed floor panels in this condition shall be replaced or repaired. Spare panels are normally provided at all sites for such purpose. All other panels shall be cleaned with a damp mop to remove stains following completion of equipment installation. All precautions must be taken to avoid water dripping below floor.

11. FIGURES

FIGURE 1. Planning Access Floor Layout

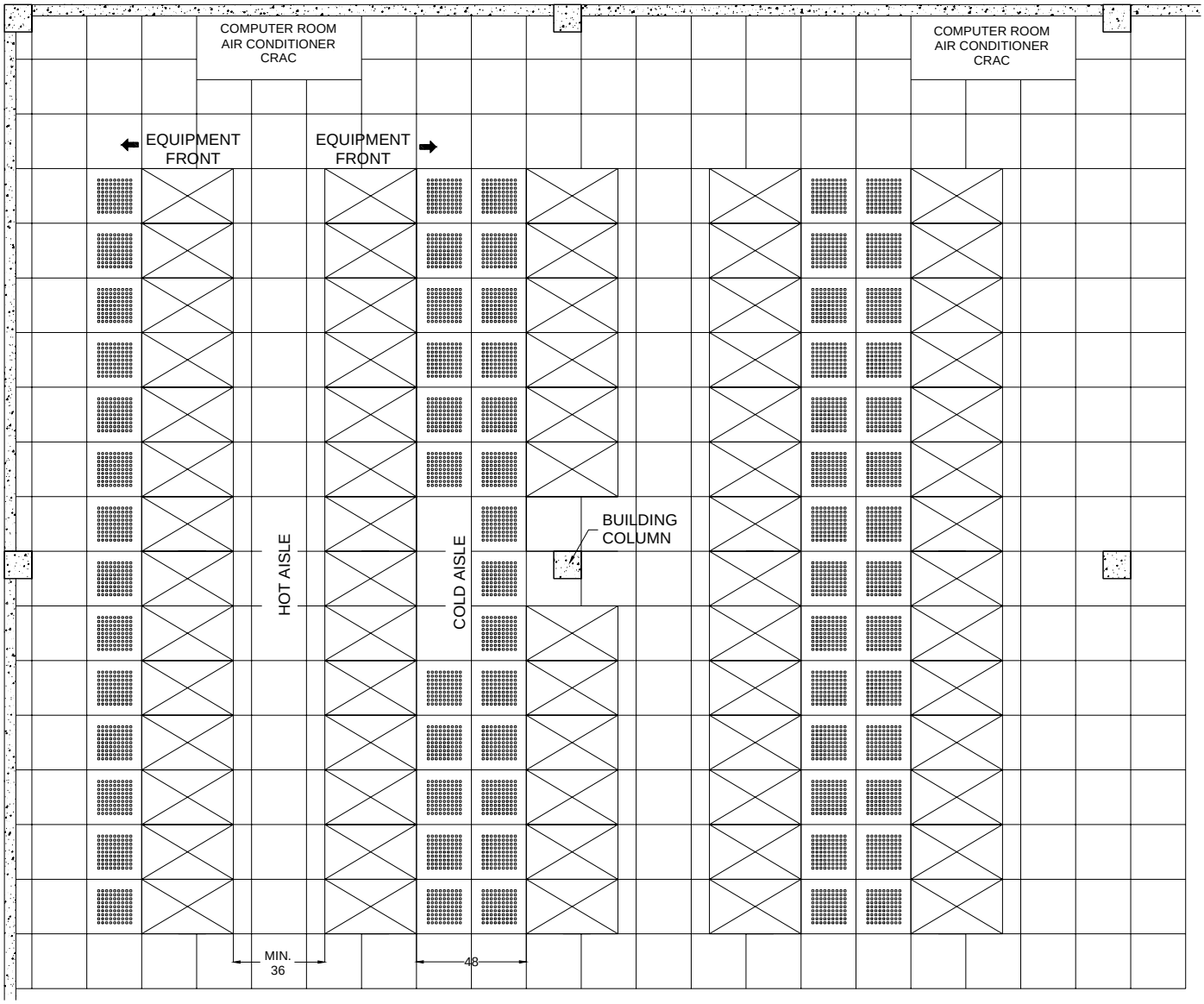


FIGURE 2. Support of Components Off Floor

FIGURE 3. Support of Components Off Floor

FIGURE 4. Access Floor Components

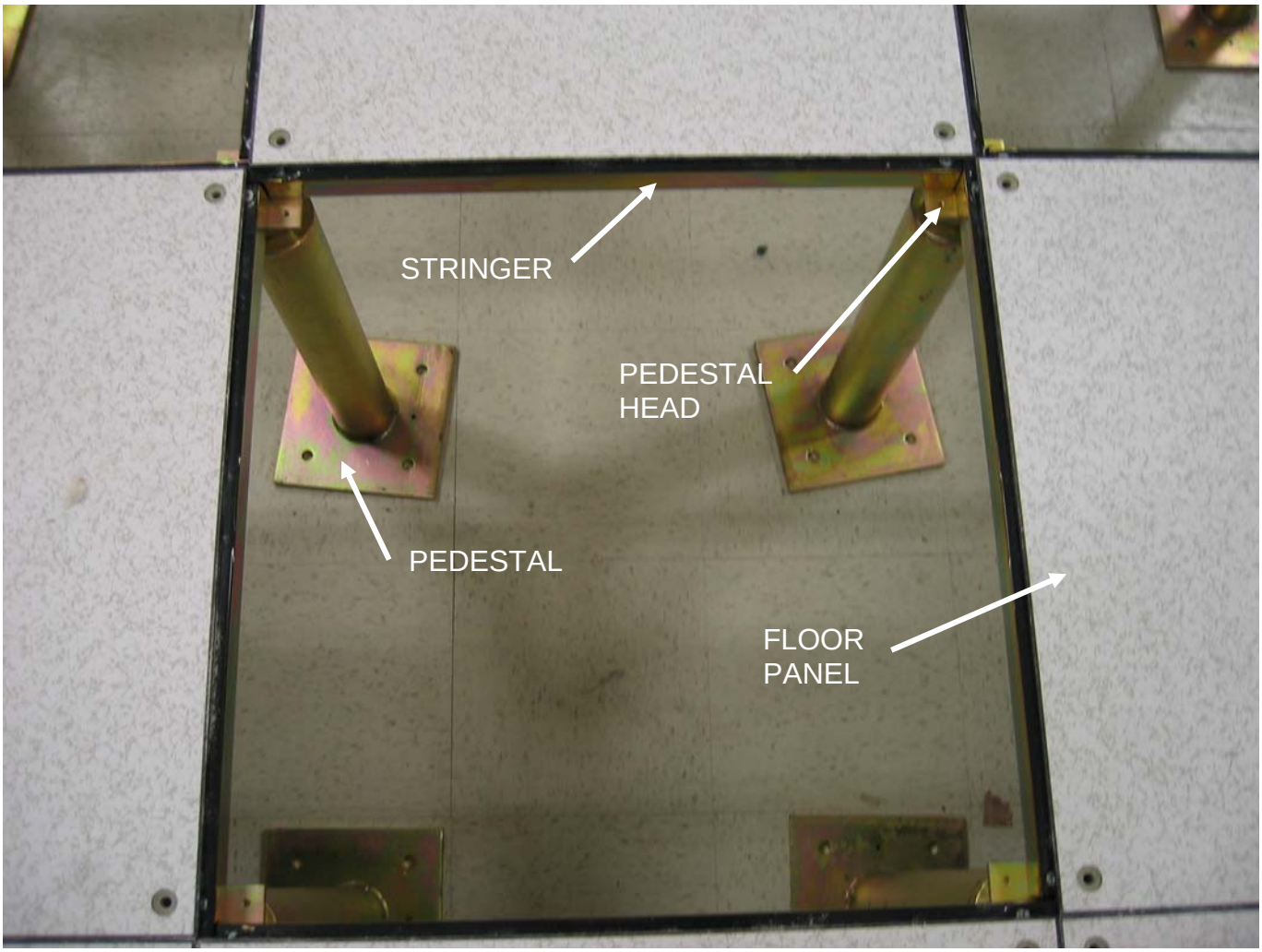


FIGURE 5. Square Tube Pedestal

The square tubed pedestal shall not be used
for equipment framework applications in any
AT&T equipment building or AT&T controlled space.

FIGURE 6. Non-Captured Pedestal Head – Light Duty Floors

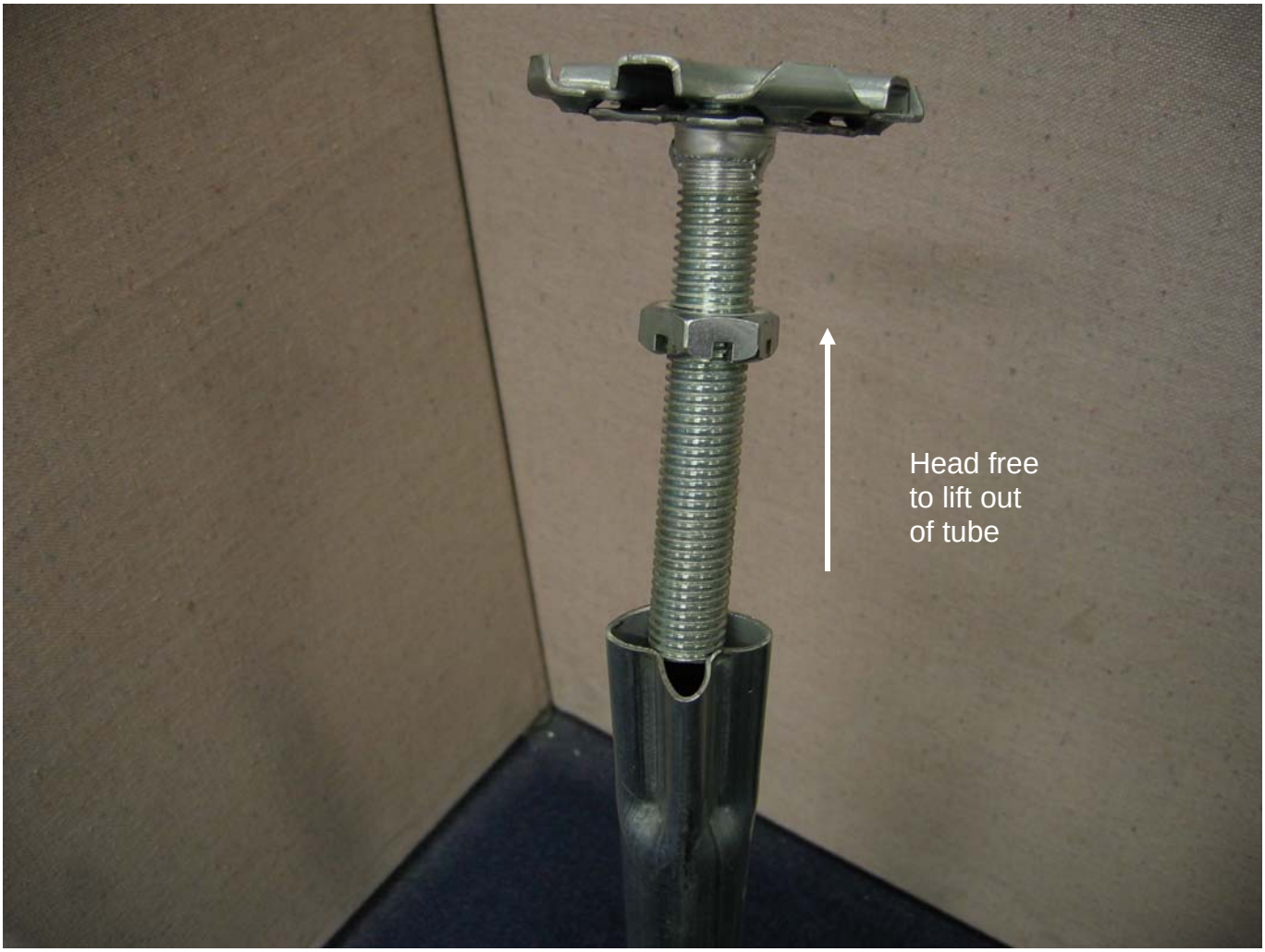


FIGURE 7. Captured Pedestal Head – Heavy Duty Floors

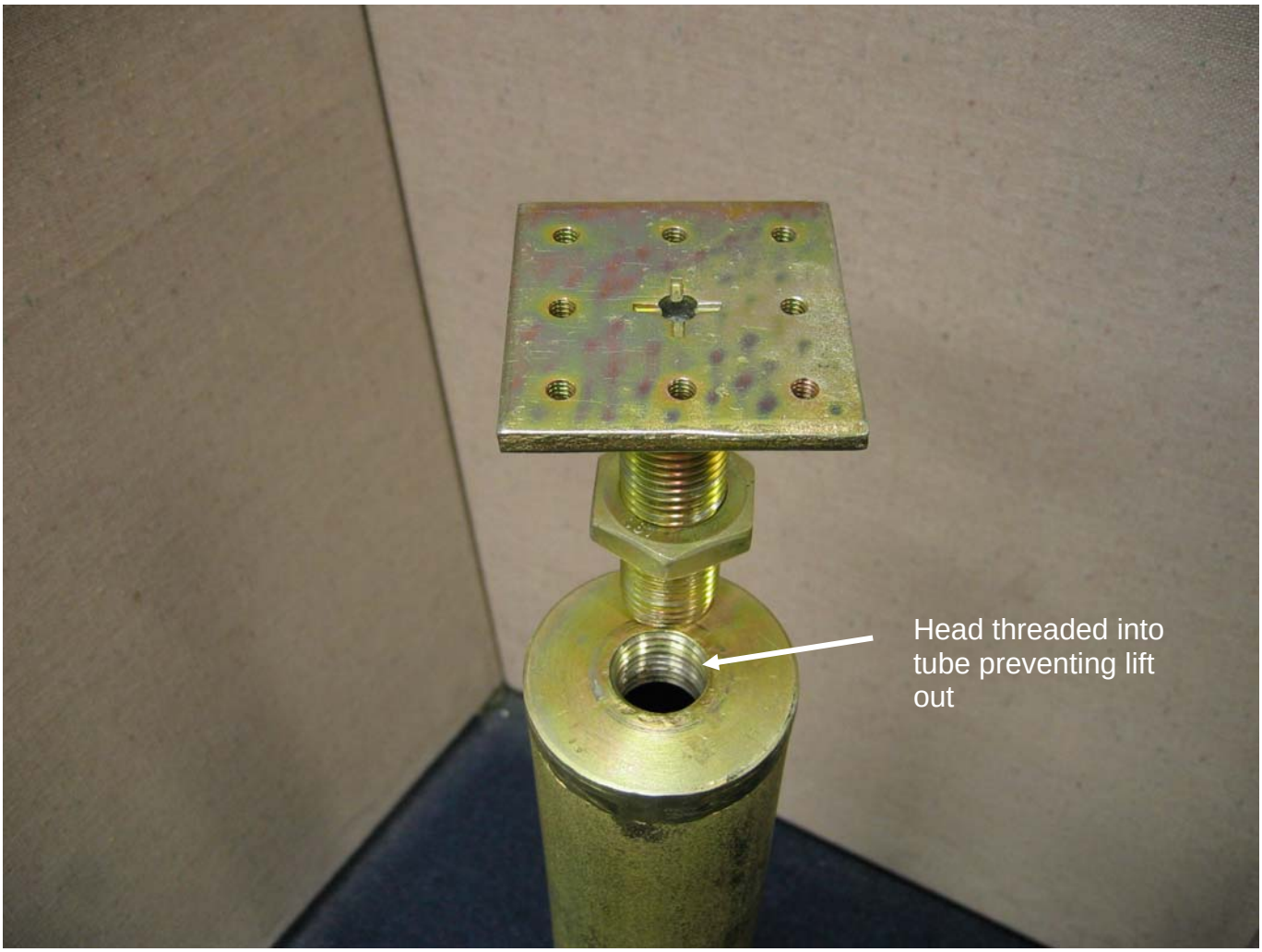


FIGURE 8. Anchor Pattern For 2 Anchor Applications (Low Seismic Risk Locations)

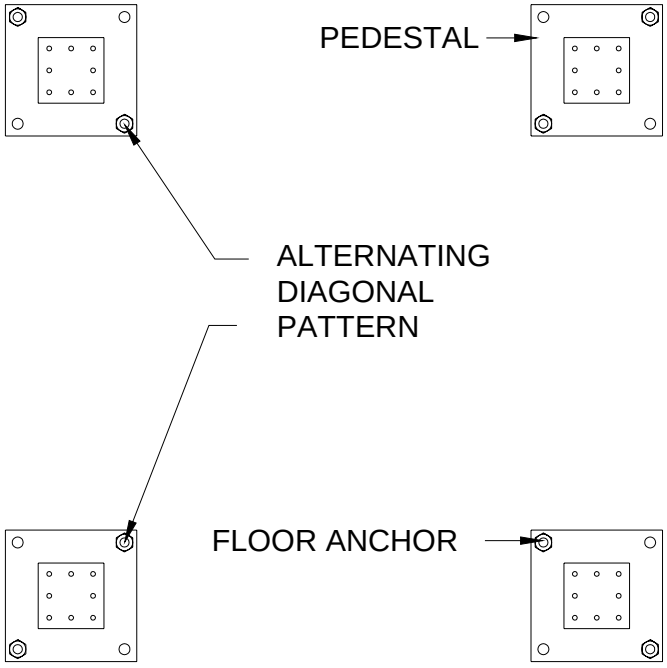


FIGURE 9. Access Floor Grounding Grid

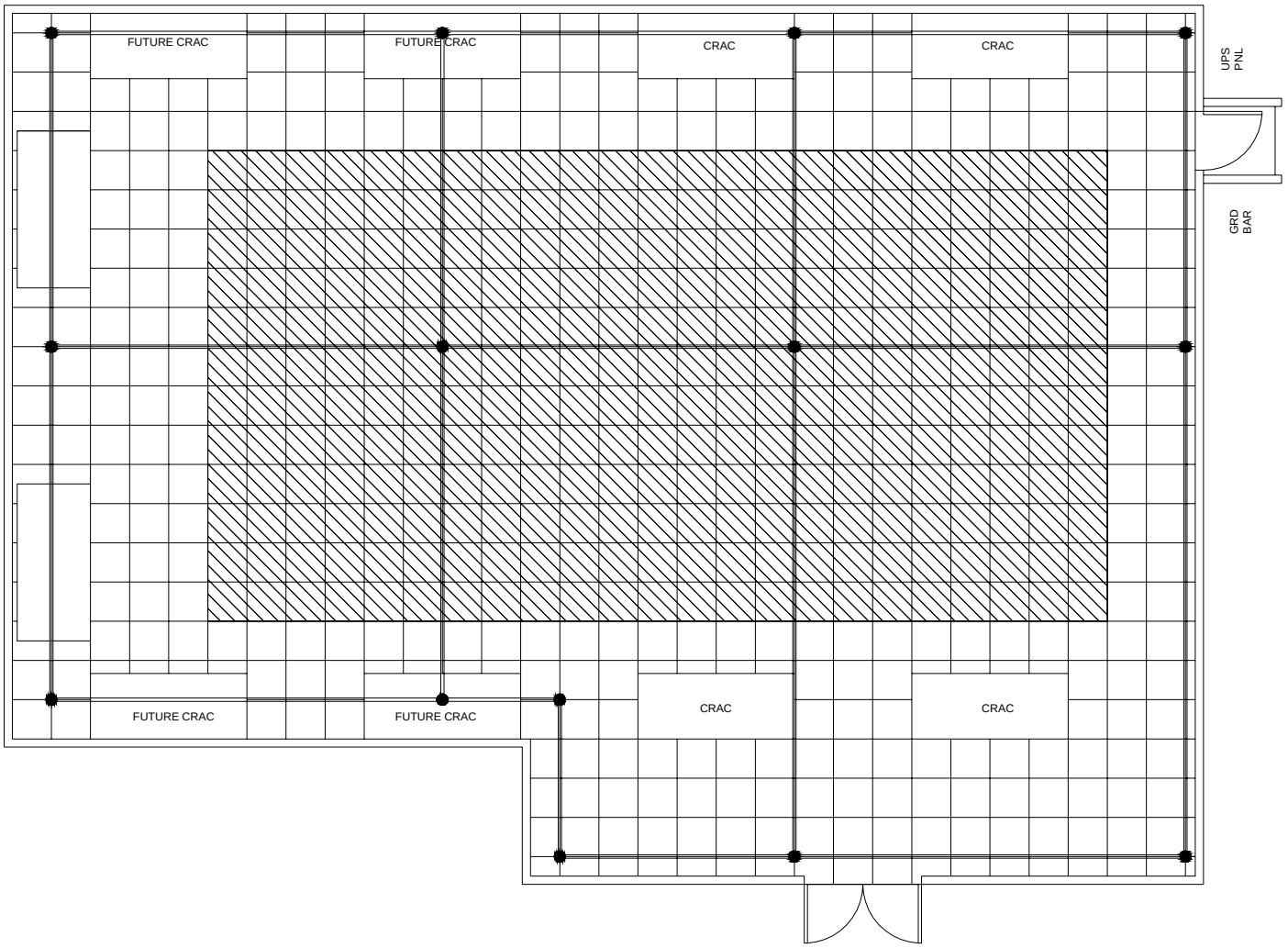


FIGURE 10. Ground Conductor Bonding Hardware

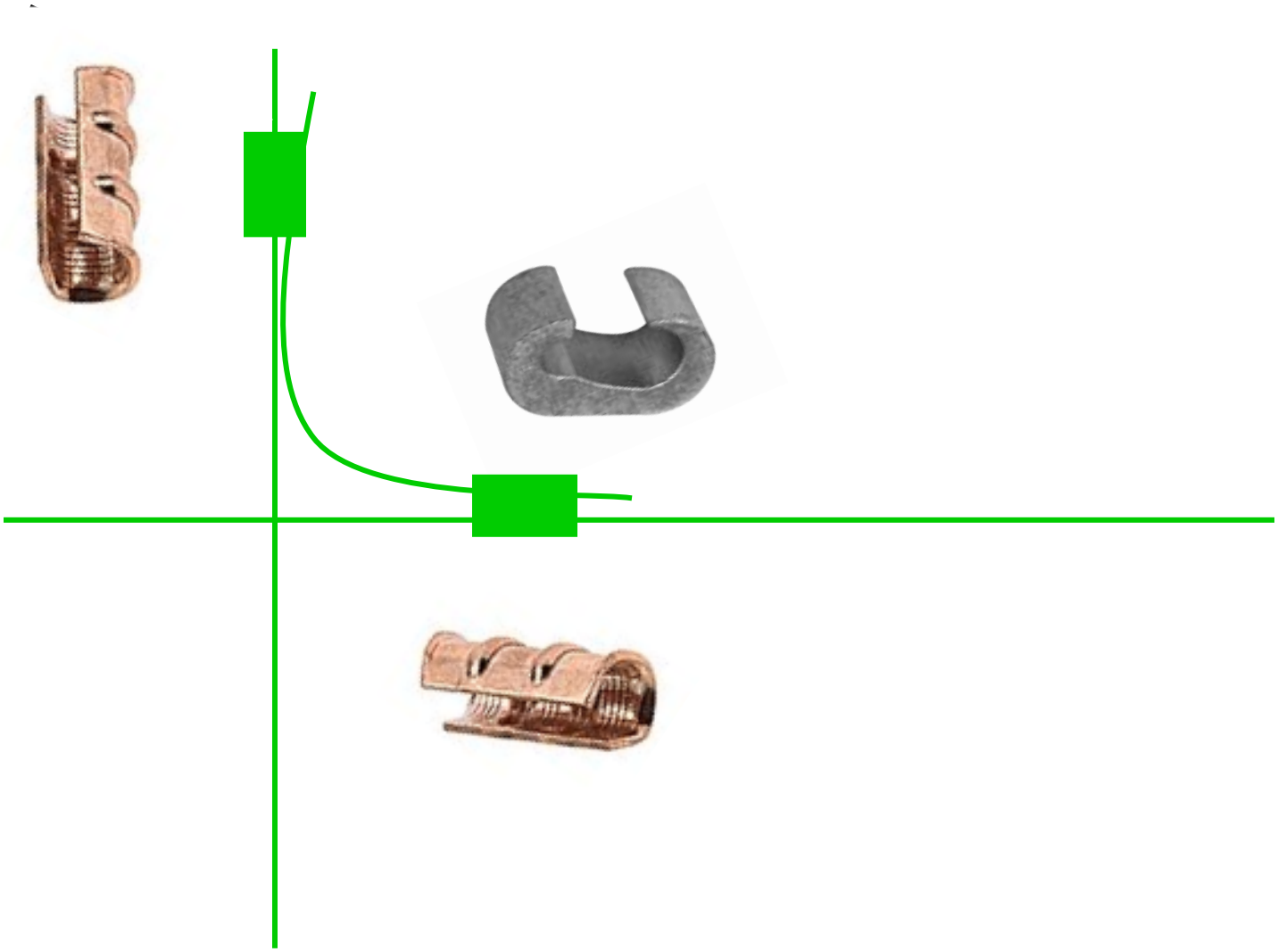


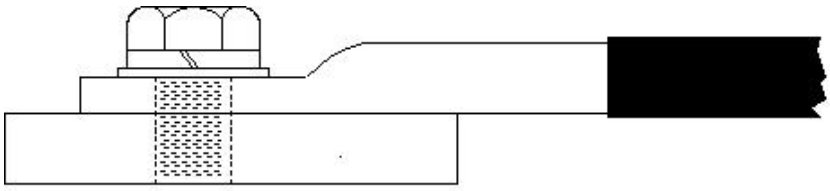
FIGURE 11. Locating Ground Conductor

ROUTE GROUNDING CONDUCTOR AT FLOOR LEVEL,
NOT SUSPENDED ABOVE CONDUITS

FIGURE 12. Grounding - Bond To Pedestal

Single hole lug crimped to stranded bare #6 AWG conductor.

½” long bolt, split washer, then flat washer



Then C-Tap other end to grid.

FIGURE 13. Equipment Framework Secured To Light Duty Floor

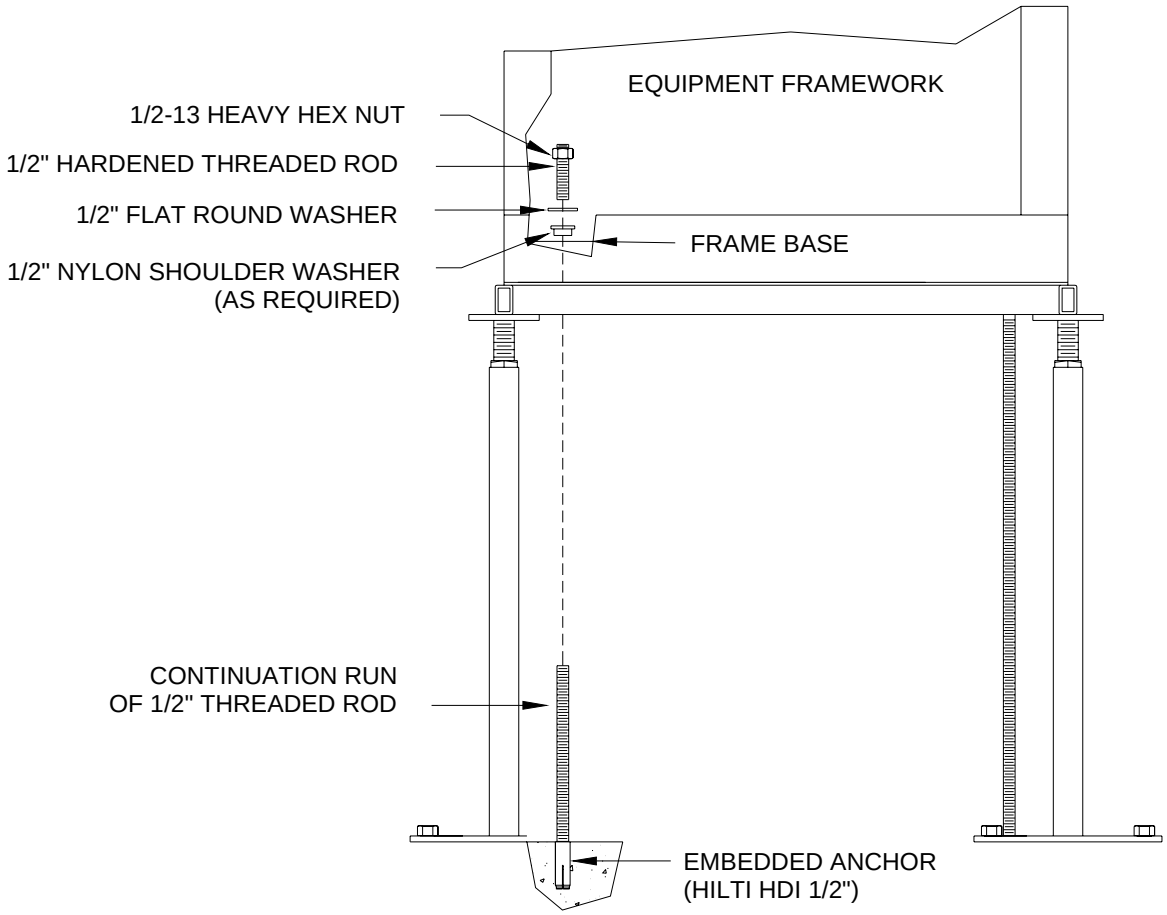


FIGURE 14. Floor Channel Anchoring Method

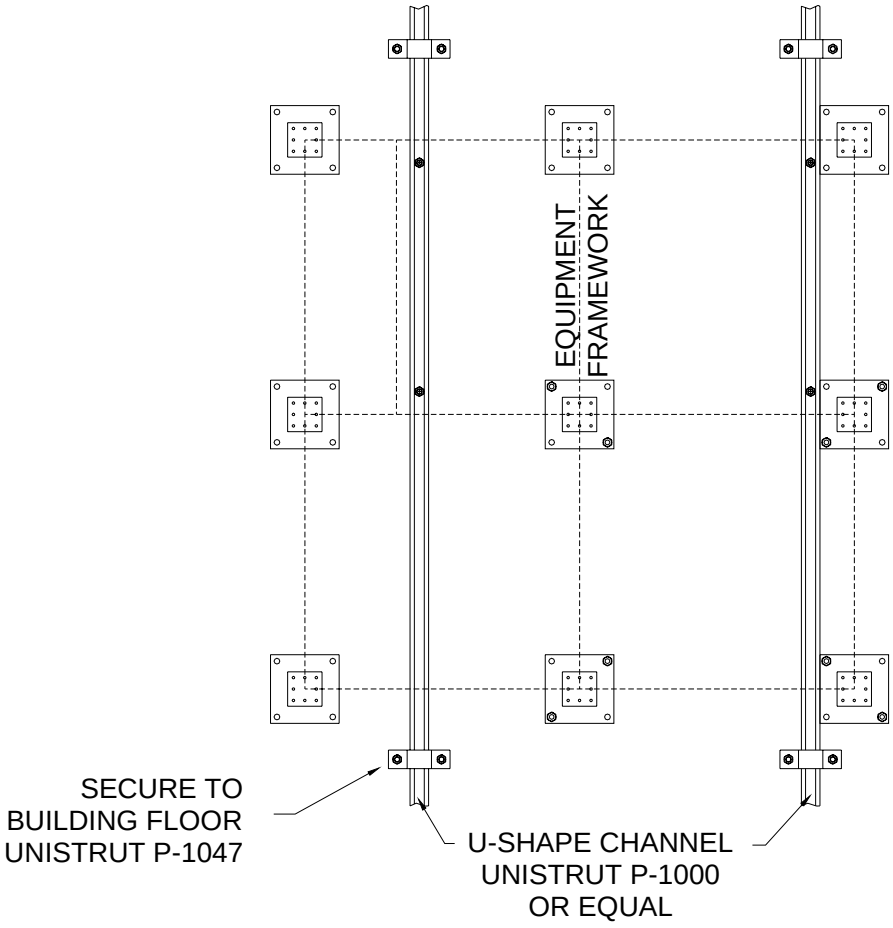


FIGURE 15. Bridging Floor Obstructions

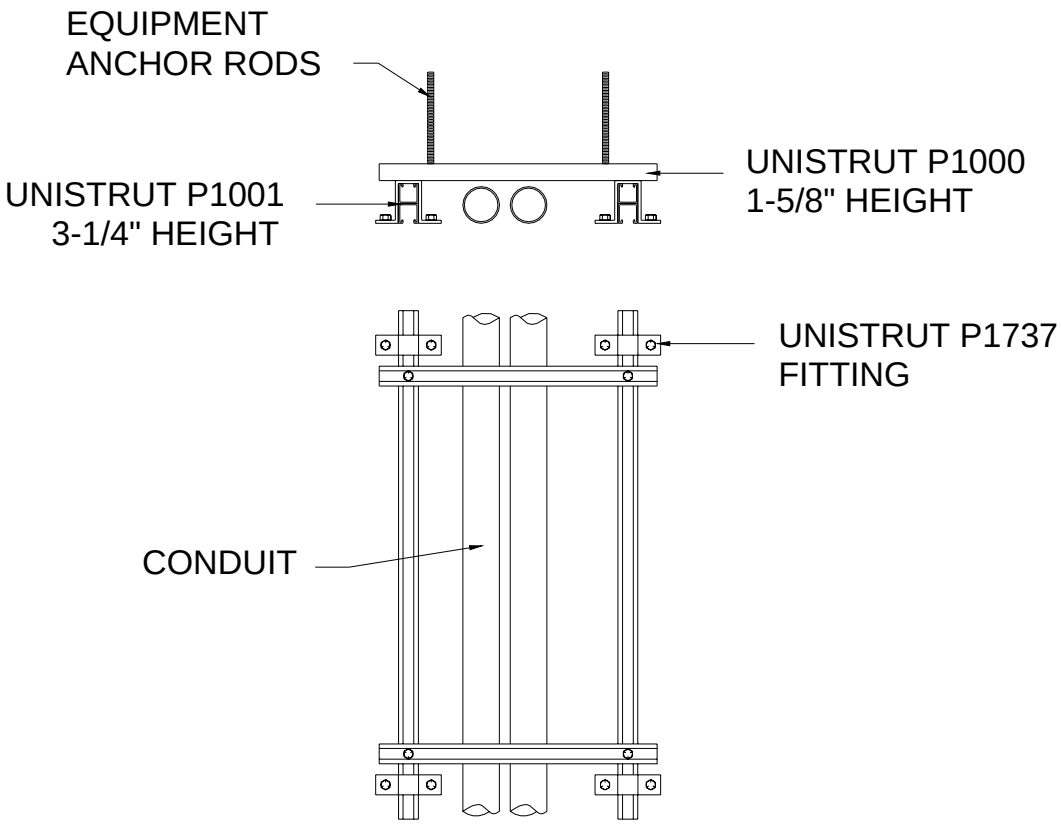
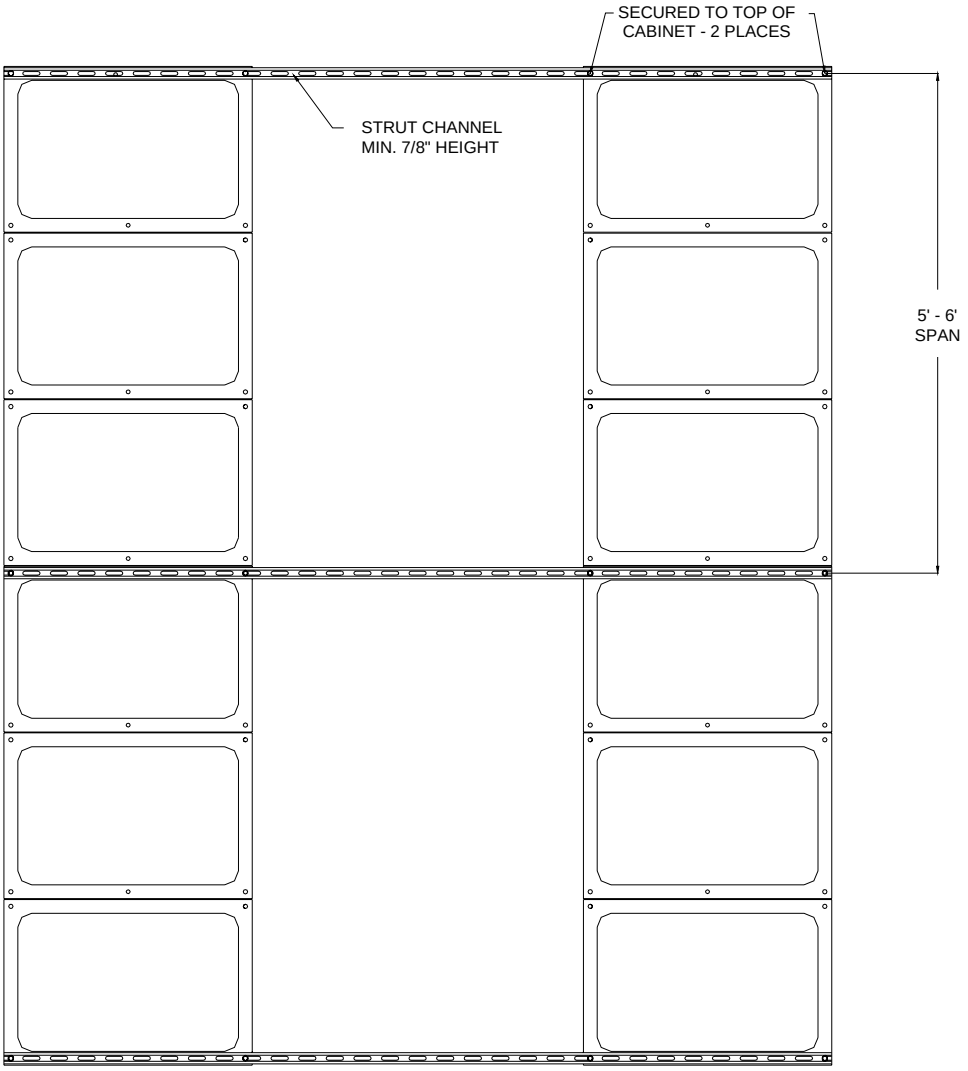


FIGURE 16A. Cross Aisle Bracing



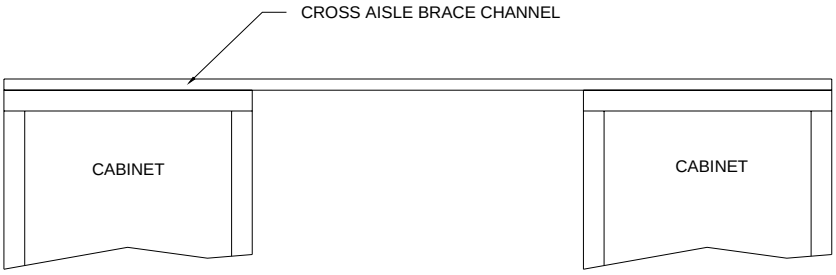
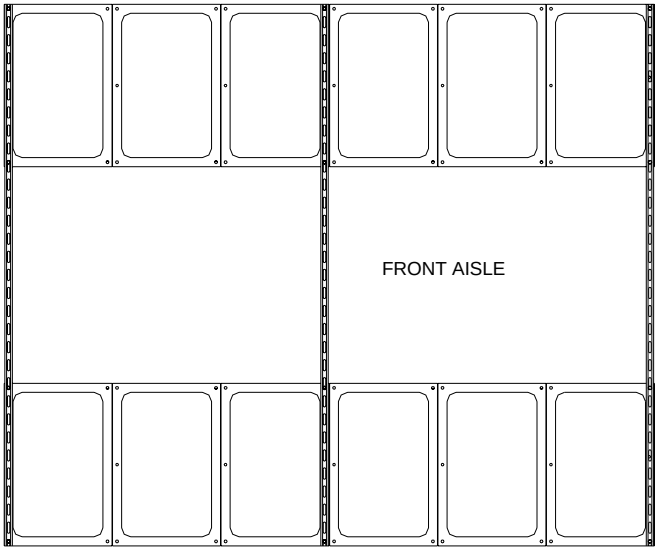


Figure 16B. Cross Aisle Bracing



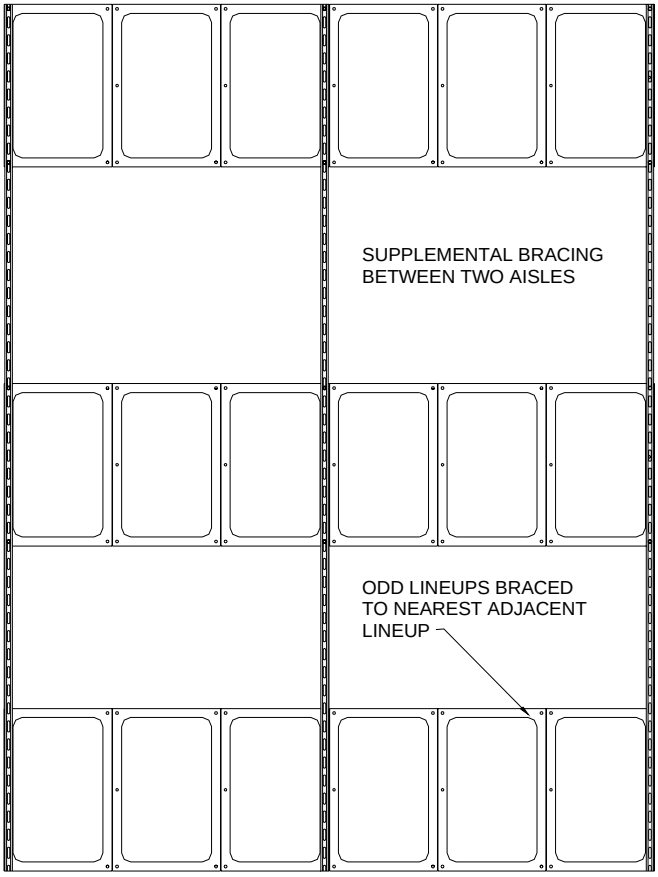


FIGURE 17. Equipment Framework Secured To Heavy Duty Access Floor

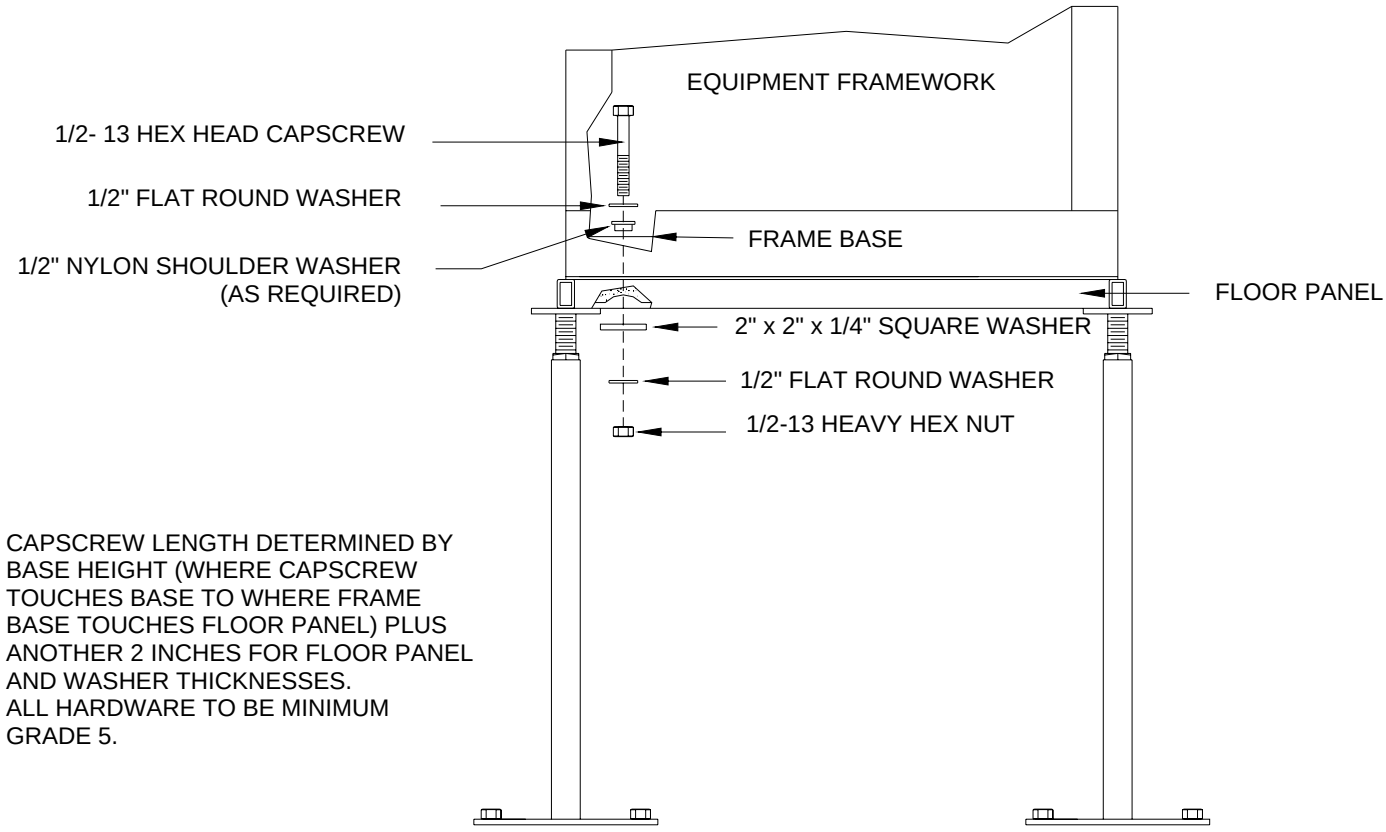


FIGURE 18. Panel Underside Washer And Nut Assembly