BRACING REQUIREMENTS FOR NETWORK AND DATA EQUIPMENT ON RAISED FLOOR SYSTEM

1. GENERAL

1.01 This section is issued to provide guidelines for the securing of network equipment and data equipment installed on a conventional raised floor system. The guidelines shall be applied to all equipment installed in the Central Office, Data Centers, Operator Service Centers and administrative areas.

1.02 Document re-released as merged practice and renumbered from PBS-000-104PT to BSP 800-000-104MP incorporating requirements for Nevada Bell/Pacific Bell/Southwestern Bell.

1.03 The guidelines shall apply to all new installations of equipment and for retrofit to existing equipment in the environments described above.

1.04 Equipment secured as described within this document will reduce risk for overturning or displacement in locations where there are risks of earthquakes. These guidelines are minimum installation requirements for equipment installed in Central Office, Data Centers,

Operator Service Centers and administrative areas in **High Seismic Risk** locations (Zones 3,4). Equipment not designed and manufactured for shock and vibration of earthquakes may still risk loss of service. Equipment manufacturer should be contacted to verify if the equipment has been designed and tested for conformance to earthquake design criteria such as described in Bellcore Publication GR-63- CORE, NEBS. In **Low Seismic Risk** locations (Zones 0,1,2) it is recommended that equipment on floor systems be secured, however, overturning risks may not be as great and securing requirements may not need to be as stringent.

1.05 Equipment manufacturer may have recommendations on securing methods for their specific product. These manufacturer's recommendations shall be applied when available.

2. FLOOR SYSTEM

2.01 Raised floor system is described as an elevated floor erected above the building floor with an area under the floor panel for routing of interconnecting cable. This type of floor system is also known as "Access Floor". The floor typically consists of pedestals secured to the building floor in square patterns and floor tiles attached to the pedestals. Stringer tubes may be used between the pedestal tops for interconnecting the pedestals and permit floor panels to bed into the area formed by the stringers.

2.02 The equipment securing methods in this document are intended for use on conventional raised floor systems. For the modular raised floor system designed specifically for equipment secured to floor panels, see requirements in BSP 800-000-103MP. Equipment secured to the modular floor system requires no additional bracing. It is recommended for equipment considered essential and service loss risks to be minimized, a modular floor portion be installed to existing floor and equipment secured as described in BSP 800-000-103MP.

2.03 A variety of floor heights and styles of floor systems are installed in our company facilities. Floor system performance may not be consistent due to design and installation methods. It is recommended that floor systems be inspected prior to equipment installation. The floor performance can be affected by the following:

1.) Poor pedestal design

- Insufficient attachment of tube to base, i.e. broken spot welds, resistance weld joint
- Inadequate securing of base to building floor, i.e. mastic only, no mechanical anchors, base secured with powder actuated anchors
- Head lift out from tube due to short thread length

2.) Lack of stringer or poor stringer fastening

- Floor system should have stringers between pedestals, i.e. stringerless floor will have no connection between pedestals
- Insufficient attachment of stringers to pedestal heads, i.e. stringers must be attached to heads with screws
- Floor tile play between stringers, i.e. incorrect length stringers

3.) Weak floor tiles

- Floor tiles are not level or flush with adjacent tiles, i.e. within 1/16 inch
- Bowed or dented tiles, i.e. tile surface should not be bowed more than 1/16 inch over total width of floor tile
- Cable openings have sharp edges exposed
- Floor tile loaded beyond manufacturer rating, i.e. concentrated load should not exceed 1000 psi
- Too large of a cutout in tile, i.e. hole size more than 1/3 area of tile

2.04 If inspection of floor system determines one or more of the above conditions exist, it is recommended that the floor system be corrected prior to installing equipment.

2.05 Floors pedestals 16 inches or taller not mechanically anchored to building floor requires pedestals be anchored prior to installing equipment. Two Hilti Kwik-Bolt II 1/4 inch anchors shall be installed at each pedestal base. Do not use powder actuated anchors in equipment buildings.

2.06 Equipment shall never be secured directly to the floor system unless the floor system has been designed for carrying live loads. Typical floor systems are designed principally for vertical load of the equipment. Securing equipment to the floor panel can cause floor and equipment failure if the floor has not been designed for that application.

2.07 Commercially available retrofit upgrades for floor systems include pedestal bracing kits that provide lateral strengthening of the pedestals. The kits typically include a diagonal bracing assembly attached to the pedestal tube with diagonal legs to the building floor as shown in Fig. 1. This kit can locally overcome floor weaknesses due to poor pedestal design or pedestals not mechanically anchored to floor. However, it should be noted that stiffening one area of the floor system may result in transfer of floor loads to that area. The floor system must be strengthened equally to avoid localized failures.

3. EQUIPMENT PREPARATION

3.01 Prior to securing equipment on floor systems, determine the appropriate securing method to be applied. Consult with equipment manufacturer for recommended securing methods, locating brace attachment points, instructions for removal of casters or feet. If manufacturer information is not available, methods described within this document may be applied. The equipment engineer should verify all procedures with manufacturer prior to start.

3.02 Secure brace to equipment frame where it will adequately support equipment weight. All attachment points must be to structural members of the equipment housing.

3.03 Equipment shall have all weight of cabinet off casters or rollers. Leveling feet shall be lowered to remove weight from casters.

3.04 Equipment housing may require stiffeners to reduce sway. By securing the equipment to the floor, the equipment housing is stressed with more lateral loads than when unsecured. The housing shall be tested by pushing on sides and back of housing after securing. Deflection greater than 1" by leaning on the side or back indicates flexible housing. Stiffening may be accomplished by adding blank plates or cross bracing with 1 inch straps to vertical mounting rails. Where mounting rails are not used, the housing may require corner gussets.

3.05 Equipment manufacturers may have established policies that discourage rigid attachment of their equipment with the purpose of reducing the transfer of ground motions. While this problem in theory may be of concern, there is far greater risk in not securing equipment or allowing equipment to be secured with non rigid methods that permit rocking and bouncing. Rocking and bouncing introduces shock of greater intensity and cycles at levels known to be detrimental to electronics. Manufacturer's should be consulted prior to installing securing methods.

4. EQUIPMENT BRACING

A. Equipment Framework

4.01 Bracing methods are proposed to accommodate various floor systems, floor clearances and equipment type. The methods proposed may require modification to fit a specific installation.

4.02 For this document three types of equipment will be used as examples. Example closest to the particular application shall be applied to actual installation.

- Unequal flange/angle base channel type frameworks as applied in network equipment areas
- KS-20018, L15, data cabinets
- Minicomputer and disk drive cabinets

4.03 Equipment weights of 500 pounds and vertical height of 7 feet are assumed for each cabinet or framework for securing methods described. For equipment weights greater than 500 pounds or taller than 7 feet, additional bracing may be required. Equipment housings that are less than 5 feet tall may be adequately supported to 750 pounds.

4.04 Equipment installed adjacent to other equipment shall be junctioned to prevent pounding. The junction shall be made with hardware through cabinet sides and top. Where attachment to adjacent equipment is not possible or not desirable, the equipment shall have 6 inches minimum space between equipment to prevent pounding.

4.05 In some cases, the number of floor braces may be reduced by applying a common brace to junctioned equipment. However, before reducing the number of braces the design shall be approved by the company Seismic Protection Engineer.

4.06 All equipment that are equipped with sliding drawers, roll out compartments, swinging doors must be secured with locks or stops to prevent inadvertent movement during earthquakes. A roll out compartment or drawer will upset balance of equipment and overturn equipment even with bracing attached.

B. Components

4.07 Components placed on shelves or on top of equipment may be thrown and cause personal injury and equipment damage. Components may include data communications units. modems, PC computers, monitors, data storage drive units, printers and other equipment that mounts in data cabinets. Components shall be secured with nylon straps, adhesive backed fasteners, adhesive backed strapping latches or other hardware. Use of these securing products must be applied within limitations of product.

4.08 Thumb Lock Safety Fasteners are recommended as a source for approved fastening products to secure equipment as shown in Fig. 2 and 2A. Eastman Office Products are a company contracted source for the Thumb Lock Products. Or equal products may be applied if reviewed and approved by the company Seismic Protection Engineer.

4.09 Hook and loop securing products such as Velcro shall be applied to equipment that will not be removed on regular basis. Hook and loop fasteners lose retention value with every cycle of being pulled apart and reapplied. Replace the hook and loop securing product every 6 months where the component being secured is removed regularly.

4.10 As a general rule, securing devices must resist at a minimum the load equivalent to 75% of the weight of equipment to be secured. **Example:** a 50 pound monitor must have securing device with 37.5 pound pull up and shear resistance.

4.11 Components that are identified as essential elements shall be secured with specific designed securing methods. The equipment manufacturer shall be contacted for recommended securing methods or contact company Seismic Protection Engineer for design recommendations.

4.12 Shelves within equipment cabinets must be secured to cabinet with positive attachment. Pins, clips or other shelf support hardware that are not positively attached to cabinet shall have additional attachment to cabinet to prevent shelf falling, i.e. screws, clamps, nylon straps.

5. TOGGLE BAR METHOD

5.01 The toggle bar method secures equipment by threaded rods from equipment base to the building floor. Equipment secured by this method resists overturning and sliding by bending resistance and tension of the rods. The term "toggle bar" comes from action of threaded rod under equipment load. Lateral movement results in rod traveling in arc and shortening, thus toggling or clamping down the cabinet to floor tile. Rods anchor to building floor directly beneath equipment. For low floor height, there may be difficulty in installing anchors under equipment using this method.

5.02 Materials required:

- 1/2 inch diameter hardened steel threaded rod, coarse thread, 30 inch length cut to size in field
- 1/2 -13 hex nuts
- 1/2 inch large diameter washers
- Auxiliary framing channel or 1-1/2 x1-1/2 x1/4 inch angle, 28 inch length, if required
- Hilti 1/2 inch HDI drop in expansion anchor
- 1 inch diameter floor bushing or floor cap

5.03 The nut should be tightened to remove any slack in the rod to effectively clamp the equipment housing to the floor panel. Preload of 20 ft. lb. on the nut is required to remove slack.

5.04 The threaded rods are secured to embedded floor anchors installed in the building floor. The anchor to be used are Hilti 1/2 inch HDI anchors. The threaded rod may also be anchored to Unistrut channel. The Unistrut channel shall be placed parallel to equipment lineup.

5.05 A minimum of two rods shall be used with each equipment housing. For heavier equipment, additional threaded rods are required.

5.06 Attach threaded rods to equipment housing or frame at base through existing holes or drilled holes. For many equipment housings, the threaded rod shall be used with channel, angle or other clamping beam member. A clamping beam is used when the equipment base is open or if base is less than 16 gauge thick sheet metal and unreinforced. The ends of the beam shall straddle across the width of the base.

5.07 The threaded rod extends past the floor tile through an oversized hole. The opening shall be closed with flexible bushing or covered with top plate to prevent objects from falling through hole and to prevent air leakage.

6. WIRE ROPE METHOD

6.01 The wire rope method uses steel cables as tension members to resist uplift and lateral movement. The wire rope attaches to the equipment base and the building floor. The cables are anchored to building floor away from center of equipment to provide resistance for lateral loads. Anchorage away from equipment provides clear space under equipment for cables and permits installation of floor anchors for lower height floor systems.

6.02 Materials required:

- Wire rope, 3/16 inch cable dia., 1/4 inch finished dia., 7x19 strand, 3700 lb. min. tensile strength, nylon or vinyl coated

- Jaw and welded eye turnbuckle, 3/8 inch bolt diameter, drop forged steel
- Floor bracket, Unistrut Part P-1546 or equal.
- Hilti 10mm HSL anchor
- Wire rope end thimble, type 316 stainless steel
- Wire rope crimping bands with crimping tool

6.03. The cable ultimate strength shall be at least 4 times greater than service load. For heavier equipment such as UPS Power equipment or motor alternators, larger diameter cables or greater number of cables shall be used.

6.04 Cable passing through floor tile must not contact hole edge. Bore hole diameter large enough to clear cable, approximately 1-1/2 inch diameter when cable is at 60 degree as shown in Fig. 3. Cable against hole may fray or transfer lateral load to floor.

6.05 Cable ends shall be looped and crimped using properly sized dies in crimping tools. The looped ends shall be protected from fraying with thimbles.

6.06 The cable shall attach to the equipment base through an eye or wrapped around base. The cable shall attach to floor with an angled bracket anchored to the building floor. The bracket shall be secured with a Hilti 10mm HSL anchor. A turnbuckle or other tightening device shall be installed in series with the cable to remove slack. Cable shall be pretensioned to about 10 pounds.

6.07 A minimum of two cables shall be used for each equipment housing. The cables shall run in opposing directions from front and back of the equipment. Cable shall be secured to building floor at approximately 60 degree angle away from center of equipment as shown in Fig. 3A. Cables shall never be run crossed under equipment. For stand alone equipment, two additional cables shall be used to restrain equipment in the side axis. Equipment placed in a lineup with sides junctioned shall require side axis cables for two end housings only.

7. EQUIPMENT ATTACHMENT - DATA CABINET

A. Toggle Bar

7.01 Data cabinets such as KS-20018, L15 shall be secured at the base to the building floor using a minimum of two threaded rods. For open base cabinets, straddle a beam across base channels as shown in Fig. 4 and 4A. Auxiliary frame channels or angle iron cut to length to fit across the base are used as beams. Drill a 9/16 inch diameter hole in the center of the beam for threaded rod and 1/4 inch diameter holes at each end of the beam. Drill four 1/8 inch diameter hole into the equipment base for attaching beam to cabinet with #12 self tapping screws. Bore a 1 inch diameter hole through the floor tile for the threaded rod. Use a large diameter washer and hex nut on top of beam. Threaded rod length above nut should not exceed 1 inch after tightening, torque approximately 20 ft.lbs..

7.02 Data cabinets with solid base shall be secured with two threaded rods attached to the base as shown in Fig. 4B. Drill two 9/16 inch diameter holes through the base and 1 inch diameter hole through the floor panel to pass the 1/2 inch threaded rod to the building floor. Use a large diameter washer and hex nut on threaded rod to clamp equipment. Excess length of threaded rod should not exceed 1 inch after tightening.

7.03 External threaded rod attachment points is provided by attaching angles to front and back of base as shown in Fig. 4C and 4D. The angle shall be secured to base with 3/8 inch diameter cap screw and nut at 8 inch intervals. 3/8 inch self tapping screws may be used to secure angle to base if inside of base is not accessible. Area behind base must be clear of equipment and cables to use self tapping screws. Drill a 9/16 inch diameter hole in the center of the angle and a 1 inch hole in the floor tile for the threaded rod.

7.04 Data cabinets with threaded leveling feet may be secured by using the feet as attachment point if following conditions exist.

(a) Diameter of threads on feet assembly is at least 3/8 inch

(b) Equipment base is reinforced at point where feet attaches to base

(c) Length of feet assembly threads does not exceed 2 inch out from cabinet

7.05 Equipment attachment at leveling feet may require reinforcement to reduce risk of leveling feet failure. Leveling feet with 3/8 inch diameter threaded adjuster and threads exposed more than 1 inch, shall be strengthened with outer steel tube as shown in Fig. 5. Larger diameter threaded adjuster will not require reinforcement.

7.06 Where the leveling feet assembly is used to secure equipment, the feet must be restrained from vertical lift at threads, not at pads of feet. Shear and bending loads shall be limited to avoid breaking thread assembly. The threaded portion of feet shall extend from cabinet only as much as necessary for brace attachment and locking nuts.

7.07 The leveling feet shall be braced in pairs to reduce bending load on adjusting threads. The feet assembly shall be secured to channel. Drill holes in channel to match location of feet. Replace the feet in equipment base after inserting feet through channel. Nuts placed below and above channel secure channel to feet assembly. The channel may be attached to feet without removing feet from cabinet if installation contractor develops channel assembly to trap and secure feet.

7.08 In the center of the installed channel, provide a 9/16 inch diameter hole for threaded rod. Bore a 1 inch diameter hole in the floor tile. The threaded rod passes through the channel and the floor tile. For equipment width greater than 36 inches, two threaded rods will be required per channel as shown in Fig. 4E.

B. Wire Rope

7.09 For data cabinets with open base, the cable is secured to beams straddled across the base. The beams shall be constructed as described in Paragraph 7.01. The cable will attach to an eyebolt installed on beam. Provide a 1 inch diameter hole in the floor tile for the cable. Secure the cable to floor anchor or to eye in floor mounted Unistrut as shown in Fig 6.

7.10 For data cabinets with solid base, two 3/8 inch threaded eyes shall be attached to the bottom of the base as shown in Fig. 6A.

7.11 Some equipment may have rails at the base where cable can wrap around. Wrap cable around rail and secure loop with crimp band.

7.12 Stand alone cabinets or end cabinets of lineup shall have additional cables to secure equipment in the two side axis as shown in Fig. 6B.

8. EQUIPMENT ATTACHMENT - FRAMEWORK

A. Toggle Bar

8.01 Unequal flange frameworks and angle base channel type frameworks shall be secured with threaded rods through each of the four anchor holes of the frame base as shown in Fig. 7, 7A, 7B and 7C. Nuts and large diameter washers shall be provided on threaded rod under floor tile and on top of the frame base. The nut under the floor tile shall be tightened against tile bottom following the tightening of the top nut.

8.02 The frames shall use base hardware supplied with the frames. The hardware may include electrical isolation shims, bushings, washers. Threaded rod hole of 1 inch diameter shall be bored through floor panel. Anchor threaded rod to embedded anchor in building floor or to floor mounted Unistrut.

8.03 All framework shall be junctioned at their uprights to adjacent frames using conventional junctioning hardware details provided by manufacturer.

B. Wire Rope

8.04 The wire rope method is not recommended as means of securing upright framework to raised floor systems. Cables will not provide sufficient stiffness from frame rocking. Use toggle bar method for securing framework to floor systems.

9. EQUIPMENT ATTACHMENT - COMPUTER CABINETS

A. Toggle Bar

9.01 Equipment cabinets of computer equipment shall be secured to base of equipment in manner described in paragraphs 7.01 through 7.03.

9.02 For external brace attachment where angle cannot attach to face of base, alternative attachment points shall be located under the base as shown in Fig. 8 and 8A. Inspect the base for existing holes or locate area on base where attachment holes may be made.

9.03 Computer cabinets with threaded leveling feet may be used for brace attachment point if all conditions of paragraph 7.04 are applicable.

9.04 Equipment attachment at leveling feet may require reinforcement to reduce risk of leveling feet failure. Leveling feet with 3/8 inch diameter threaded adjuster and threads exposed more than 1 inch, shall be strengthened with outer steel tube as shown in Fig. 5. Larger diameter threaded adjuster will not require reinforcement.

9.05 Where the leveling feet assembly is used to secure equipment, the feet must be restrained from vertical lift at threads, not at pads of feet as shown in Fig. 8B and 8C. Shear and bending loads must be limited to avoid breaking thread assembly. The threaded portion of feet shall be extended out from cabinet only enough for brace attachment and nut.

9.06 The leveling feet shall be braced in pairs to reduce bending load on adjusting threads. The feet assembly shall be secured to channel. Drill holes in channel to match location of feet. Replace the feet in equipment base after inserting feet through channel. Nuts placed below and above channel secure channel to feet assembly. The channel may be attached to feet without removing feet from cabinet if installation contractor develops channel assembly to trap and secure feet. Secure channel to building floor with a single threaded rod or double rod if cabinet is 36 inch or wider as shown on Fig. 8B.

B. Wire Rope

9.07 The cables shall attach at computer cabinet to existing structural members or by attaching anchor point to the cabinet. Where cabinets have exposed rail or channel under the base, they may be used to wrap cable around. A minimum of two attachment points are required.

9.08 Where rails or channels are not available, eyes shall be installed in cabinet base. Locate an area in the base where eyes can be placed. A minimum of two eyes shall be installed.

9.09 Eyes may be placed on vertical surface of base when bottom access is not possible. The cables may protrude into aisle space because of the outward pitch from equipment.

9.10 For stand alone cabinets or end cabinets of a lineup, additional brace points are required for restraint in the side axis as shown in Fig. 8D.

9.11 Leveling feet shall not be used as attachment points for wire rope bracing. The feet assembly can be overloaded due to movement allowed by cables.

C. Casters

9.12 Equipment cabinets that are equipped with casters shall have weight removed from casters. Casters do not permit cabinet to be level and result in excessive rocking. Securing cabinets with weight on caster could overload securing hardware.

9.13 Equipment equipped with casters but no leveling feet shall have all weight removed from casters by placing a section of channel under the cabinet as shown in Fig. 8A. The channel shall be sized to elevate cabinet off casters. Secure the channel to the bottom of cabinet with cap screws or machine screws to available holes. Minimum of two screws are required to prevent channel rotation. The channel in turn is secured to building floor with threaded rods.

9.14 Casters may be removed to rest cabinet base directly on floor tile. The cabinet shall be secured to building floor using methods described within this document. If cooling fans or air intake grilles are located on bottom of cabinet, this procedure shall not be applied unless an elevated base platform is provided.

9.15 Casters shall not be used as attachment points for equipment securing. Caster swivels typically do not permit stable installation due to play in swivel bearings.

10. ALTERNATIVE BRACING METHODS

A. Adhesive Bonding

10.01 For equipment housings that cannot be moved, lifted or drilled, adhesive technology may be considered to attach brace to equipment. Close inspection of installation is required to assure proper application because cleanliness of surface, temperatures and surface to be applied can affect adhesive strength.

10.02 Adhesive shall be 3M type VHB sheet form removable pads or approved equal technology. Minimum pad size shall be 24 square inches for fastening a brace to a cabinet up to 5 feet tall and weighing no more than 400 pounds. Two braces per cabinet minimum shall be provided for use with any of the floor attachment methods described.

10.03 The adhesive joint shall not have continuous tension or shear load placed on it. Wire rope attachment to the bonded brace may not work with this technology. Continual load on the adhesive results in creep or bond failure.

B. Grouping

10.04 Securing similar dimensioned equipment cabinets together to create a larger footprint can be effective in reducing overturning risks. Displacement may still be problem as grouped units can walk across floor system. This method of equipment securing shall be applied only where equipment displacement can be restrained and equipment is tolerant of some vibration and shock loads.

10.05 For this bracing method, equipment footprint of width and depth must be at least equal to height of housings.

C. Tethering

10.06 Tethering is the securing of equipment by means of a single or multiple cable attached on one end to the equipment base and to the building floor on the other. The cable is designed to have slack for equipment movement. The equipment is allowed to achieve a velocity and then abruptly stopped at end of tether. The abrupt stop can result in overturning of cabinet or extreme shock load. This method is not recommended for securing equipment against earthquakes.

D. Floor Stops

10.07 Floor stops attached to the floor tile and surrounding leveling feet or caster are meant to limit travel of cabinet across floor. Equipment cabinet is usually not restrained against vertical displacement. The method is not effective under severe earthquake conditions as cabinets can overturn or jump floor stops. Leveling feet may be subjected to excess lateral loads and bend or break. This method is not recommended as a primary means of securing equipment in **High Seismic Risk** locations.

E. Overhead Bracing

10.08 Equipment bracing at the top of cabinets to a building supported overhead structure is provided to prevent overturning. This method of bracing has been applied to telecommunications network equipment. The attachment of equipment to an overhead structure is not desirable. Overhead structure follows building motions and experiences greater excursion than the building due to its non rigid design. Equipment attached to the overhead structure will be pulled with the structure. This bracing method is not recommended for equipment on a floor system.

11. INSTALLATION REQUIREMENTS

A. Concrete Floor Drilling

11.01 All precautions shall be taken when drilling building floor to prevent concrete dust from spreading to other areas of the room. An approved vacuum system shall be deployed to remove all dust as the holes are drilled. The vacuum system shall have filtration system that traps all concrete dust without leakage.

11.02 Floor systems that use under floor area as air plenum for equipment cooling requires additional protection from dust spread by using a boot around the drill bit area. The boot shall seal around the floor surface and have a vacuum hose attachment for dust removal.

11.03 Holes for concrete embedded anchors are to be drilled with rotary hammer drill and masonry bits. Core drill devices are not to used unless permitted by telephone company facilities and equipment engineer for situations where rebar is encountered or other special reasons. Core drilling shall be conducted with minimal amount of water used. The water shall be extracted with a vacuum system having capacity for removal of water at rate greater than applied.

11.04 Rebar and embedded conduit embedded in building floor is never to be cut without prior approval by telephone company facilities engineer. If shallow rebar or conduit is suspected in area to be drilled, it is recommended the area be surveyed for obstructions and chalk lined prior to drilling. Use methods such a Pacometer, eddy current locators or magnetic imaging devices to locate obstructions.

11.05 Do not drill hole to greater depth than required for anchor. Where drilling holes greater than 3-1/2 inch in depth, the hammer drill shall be used in the rotary mode only beyond 3-1/2 inch depth. This prevents spalling of bottom of hole on overhead floors.

11.06 Embedded anchor shall not be installed within 2 inches of concrete floor edge such as corner of floor trench. Drilling holes close to edge may fracture concrete and provide inadequate securing of embedded anchor.

B. Unistrut Channel

11.07 Secure equipment to Unistrut channel in place of embedded anchors when larger floor anchors are not desired or when equipment is moved often as shown in Fig. 9 and 9A.. Unistrut P-1000T slotted channel shall be secured to floor with Hilti 3/8" Kwik-Bolt II anchors embedded to 2-1/2 inch depth. Anchor on 12 inch centers across span of Unistrut channel. Anchors used to secure floor pedestals should not be used to secure Unistrut.

11.08 Where multiple equipment cabinets are to be secured within a common lineup, a single length of Unistrut parallel to lineup is recommended. At junctions between Unistrut lengths, splice plate shall be used to connect ends.

C. Cutting Floor Panels

11.09 Floor tiles shall be removed from floor and modified away from the equipment area for openings greater than 2 inches in size. Sawing or cutting of floor tile is not permitted near equipment to reduce noise, steel filings generated and vibration around equipment area.

11.10 Where floor tiles are drilled or cut for smaller openings, the operation shall be performed with tile in place and precautions in place for collecting all filings, cuttings. For floor systems using the under floor area as an air plenum, the area where work is performed is to be isolated from other floor areas.

11.11 Cut floor tiles shall have sharp edges removed and protected with edging material to prevent chafing of cable insulation and personnel injury. There shall be no sharp edges exposed on top or bottom of floor tile.

11.12 Final finish of top surface of floor tile shall be flat and level within 1/16 inch. Any tiles that are warped or not flat shall be replaced with tile conforming to requirements.

D. Equipment In Service

- Install securing hardware to equipment removed from service, whenever possible. Coordinate with the telephone company equipment engineer to remove equipment from service. If equipment cannot be removed from service, precautions must be taken to prevent service outage:

- Assure all power cables and communications cables have adequate slack to prevent disconnection of leads from connectors.

- Assure all floppy disk drives, hard drives or tape drives are parked or secured prior to moving equipment.

- Any drawers, doors, loose equipment in shelves must be secured prior to moving equipment.

- Where equipment housings require holes to be drilled through sheet metal or structural members, shut off equipment cooling fans within housing.

- Telephone company equipment engineer shall have backup plan in place for possible outage

11.14 Where equipment housings are required to be elevated, use lifting techniques that will safely lift equipment without cabinet damage. The lifting equipment shall not load floor tile beyond design limits, typically 1000 psi. The equipment shall not be lifted on one side to angle greater than 15 degrees. All cooling vents shall be protected against damage during lifting. Avoid blocking vents for extended periods.

11.15 Avoid abrupt shock loads greater than 2.0 g on the equipment housings. For operations that generate continuous vibration such as drilling, the vibration level shall not exceed 1 mil and .15 g.

11.16 Do not drill into equipment housing without assuring clearance on the inside from equipment, power cables, transmission cables. Protect equipment or cables from drill bit with sheet metal guards.

11.17 Use insulated and properly grounded tools to avoid electrical shock hazard.

E. Hardware Quality

11.18 All hardware used to secure equipment shall be made of materials suitable for the conditions. All hardware shall have plated or painted surfaces for protection from moisture and corrosion.

11.19 All hardware products and materials shall be provided in conformance to Pacific Bell document BSP 800-000-100MP, Central Office - Hardware Products and Material Specifications. Threaded rod used for toggle bar restraints shall be hardened for increased tensile strength. Commercial grade non-hardened rods are not to be used.

11.20 Threaded rods or wire rope that may come into contact with cable jackets shall be protected with sleeves or coating to prevent chafing of jackets. Threaded rods shall be sleeved with plastic tubing on all exposed surfaces. Plastic materials shall be flame resistant conforming to UL Standard 94 V-1 or better. Wire rope shall be purchased with nylon or plastic coating over cable. Brackets, turnbuckles, channels shall not have sharp edges to cut or fray cable insulation.

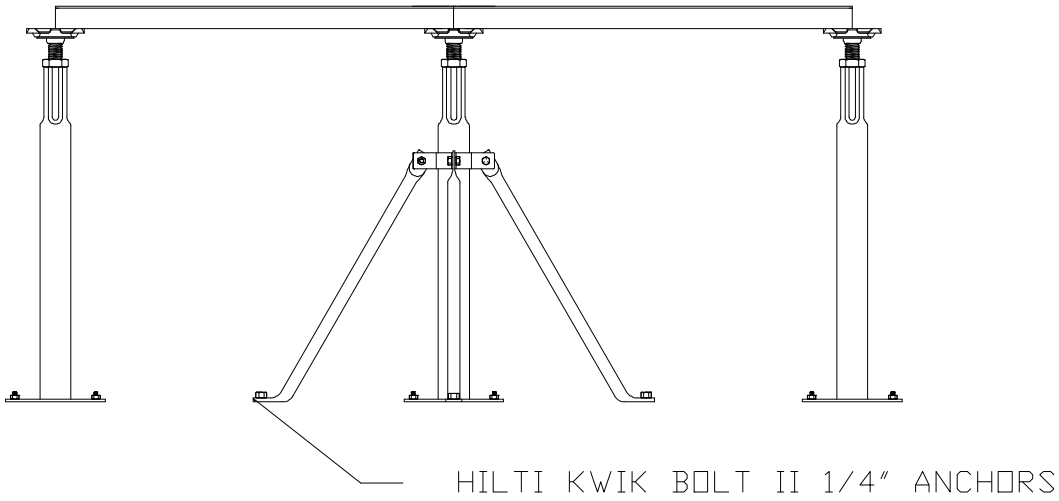
12. SUPPLEMENTAL INFORMATION AND REFERENCES

BSP 800-000-000MP	Central Office - Hardware Products and Materials Specifications
BSP 800-000-103MP	Technical Requirements for Raised floor Systems - Network Equipment Application
TP76300	Central Office Equipment Installation and Job Acceptance Handbook

13. FIGURES

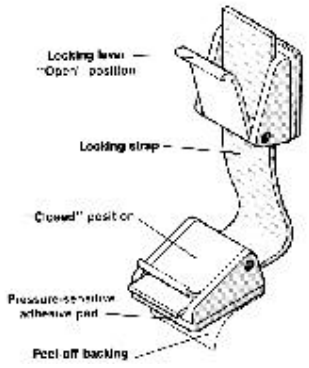
PEDESTAL BRACE PROVIDED TO STRENGTHEN FLOOR WHEN CRITICAL EQUIPMENT IS INSTALLED OR WHEN FLOOR IS DETERMINED TO BE MARGINAL

BRACE PROVIDED AT EVERY 6 FEET OF TOTAL FLOOR AREA



FLOOR PEDESTAL BRACING

FIG. 1

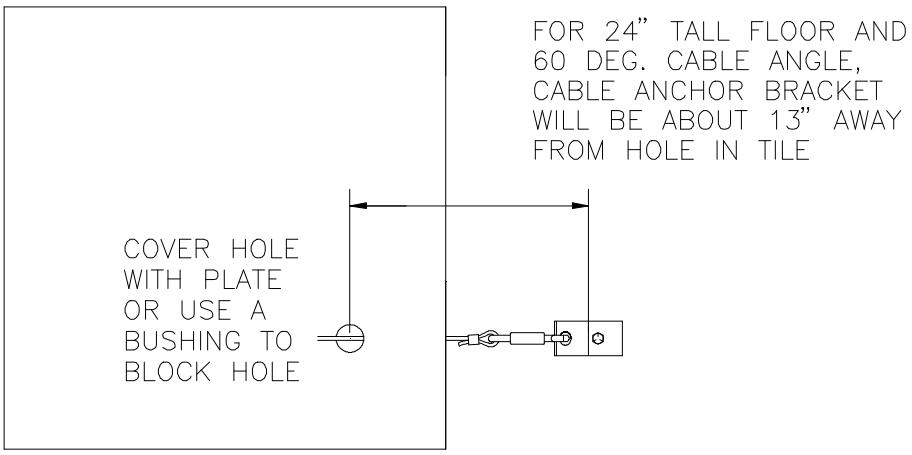


THUMB LOCK FASTENER

FIG. 2

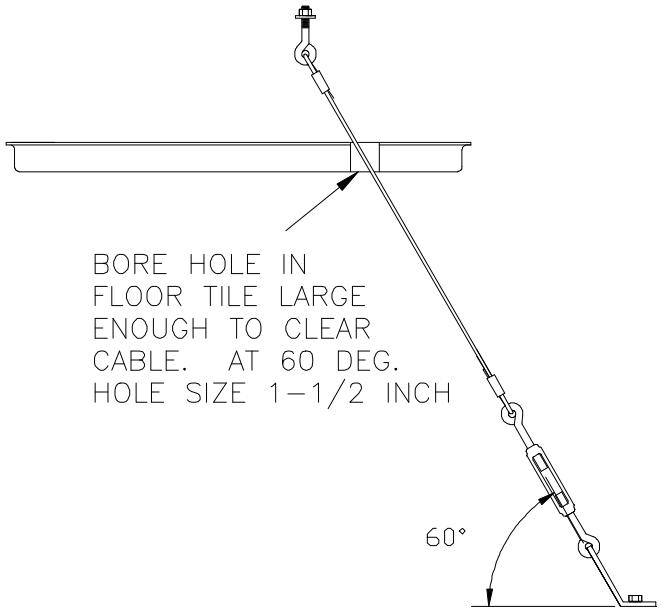
THUMB LOCK FASTENER TYPICAL APPLICATION

FIG. 2A



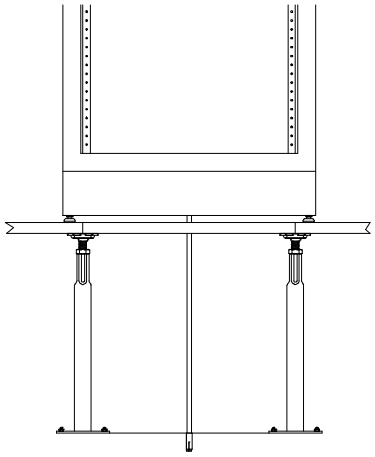
WIRE ROPE PATH THROUGH
FLOOR TILE

FIG. 3

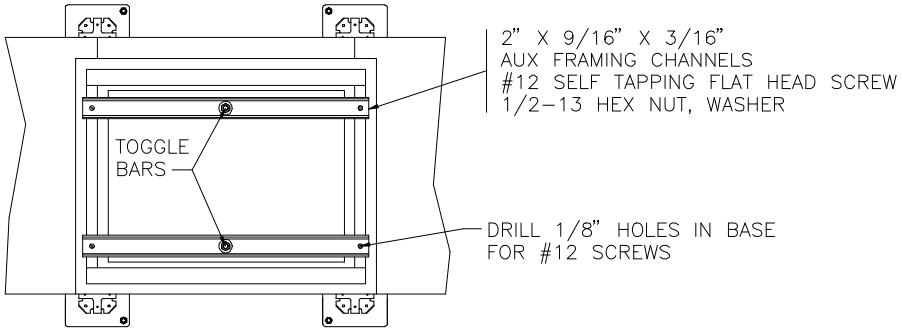


WIRE ROPE ANGLE FROM
EQUIPMENT BASE

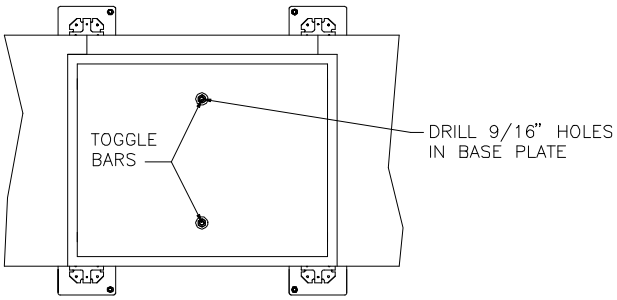
FIG. 3A



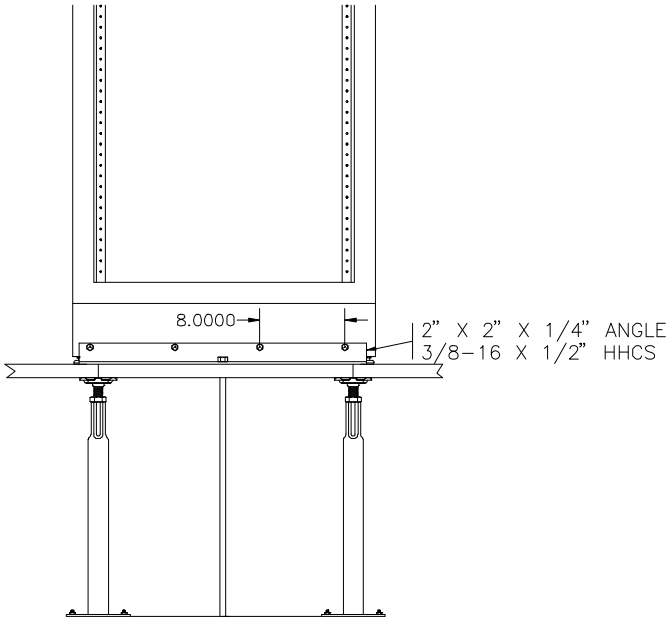
KS-20018, L15 DATA CABINET SECURED WITH TOGGLE BARS
FIG. 4



DATA CABINET WITH OPEN BASE
SECURED BY STRADDLED BEAM
FIG. 4A

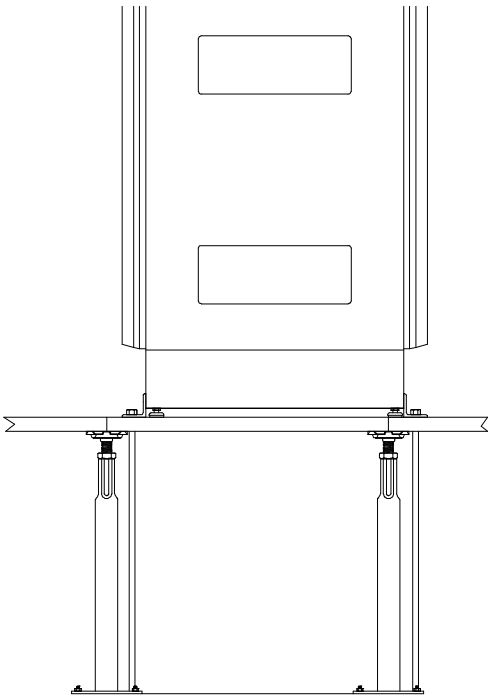


DATA CABINET WITH SOLID BASE
SECURED BY ATTACHING TOGGLES TO BASE
FIG. 4B



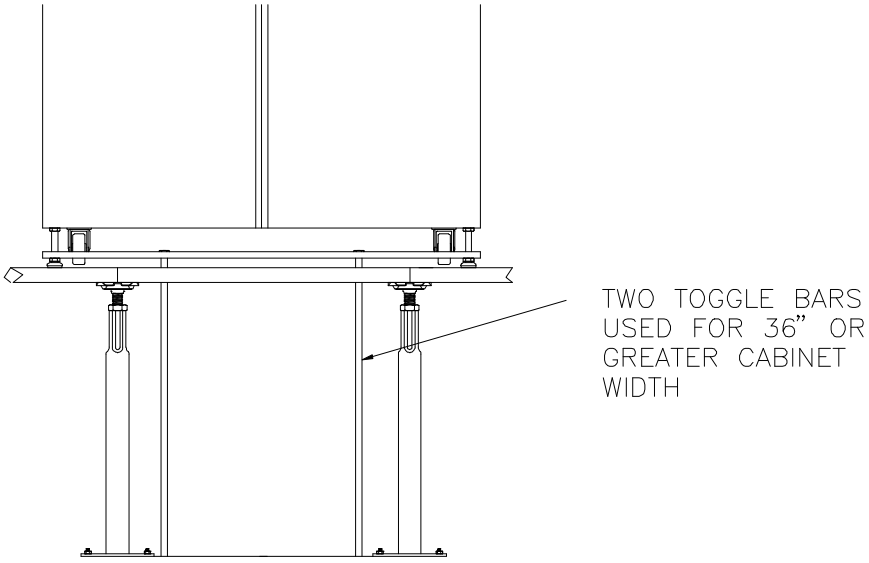
DATA CABINET WITH TOGGLE BAR
BRACED WITH EXTERNAL ANGLE

FIG. 4C



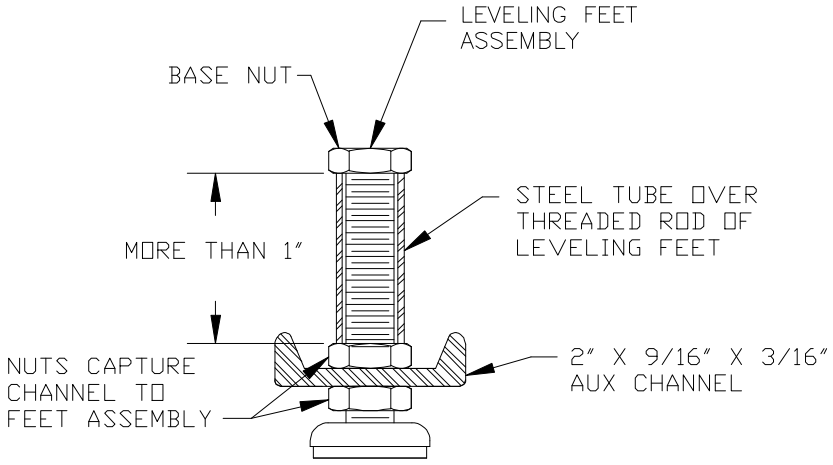
EXTERNAL ANGLES POSITIONED
FRONT AND BACK OF BASE

FIG. 4D



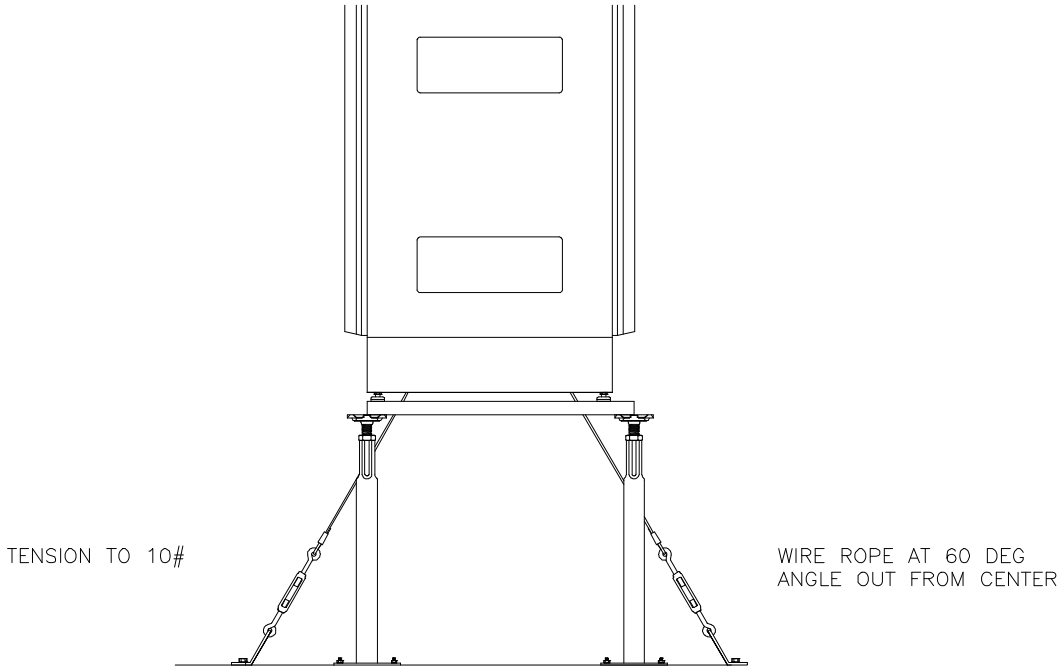
SECURED BY ATTACHMENT TO LEVELING FEET

FIG. 4E



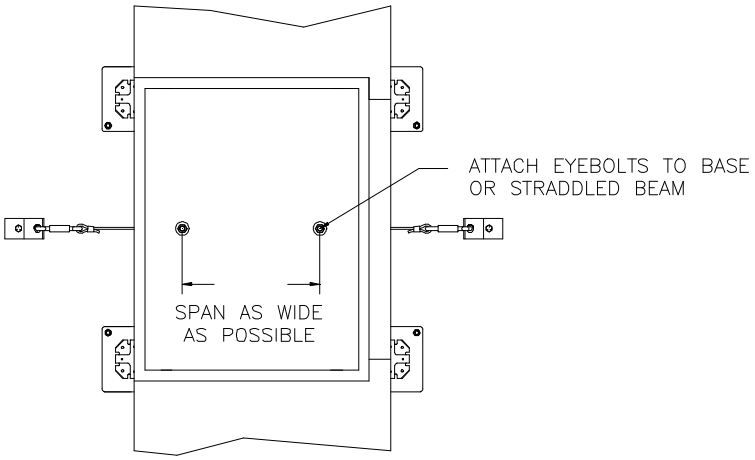
LEVELING FEET CHANNEL
ATTACHMENT DETAILS

FIG. 5



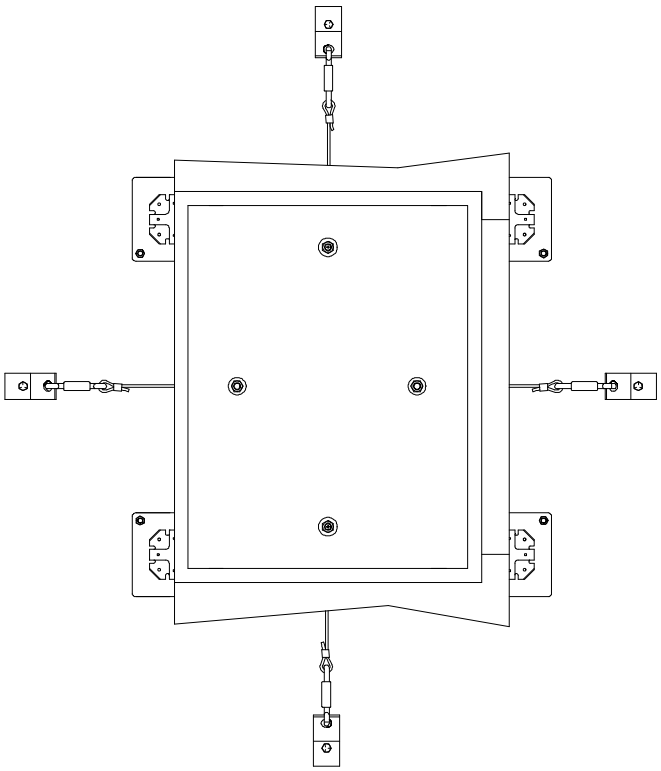
KS-20018, L15 DATA CABINET SECURED WITH WIRE ROPE

FIG. 6



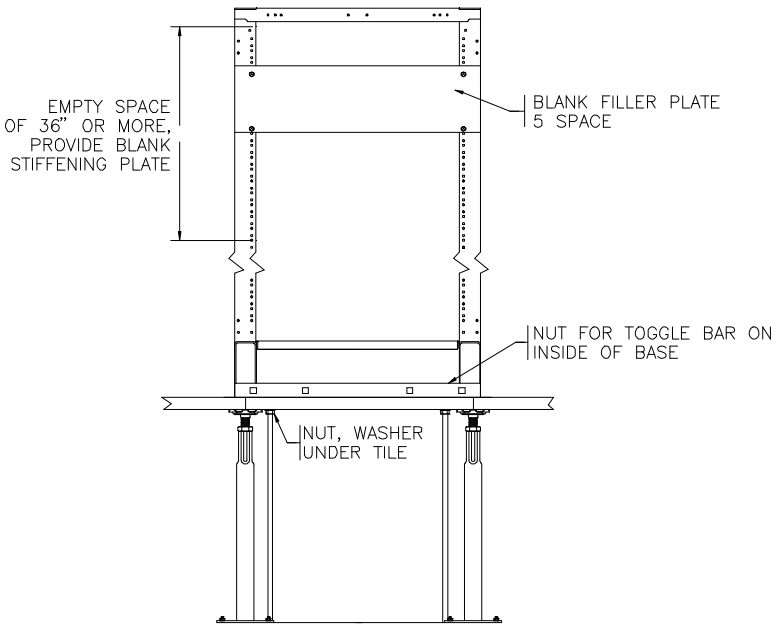
WIRE ROPE ATTACHMENT POINTS

FIG. 6A



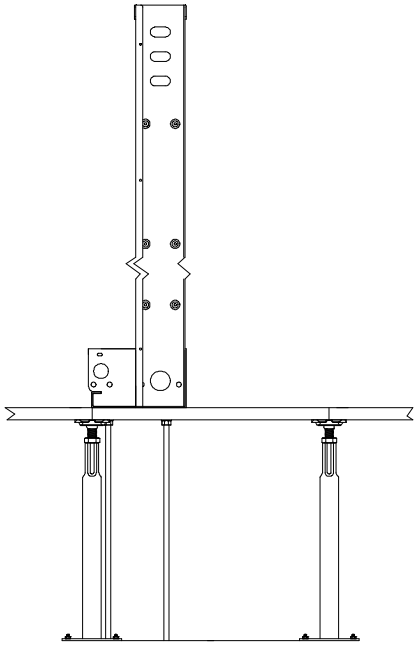
STAND ALONE CABINET AND
END UNITS SECURED IN FRONT/BACK
AND SIDE/SIDE AXIS

FIG. 6B



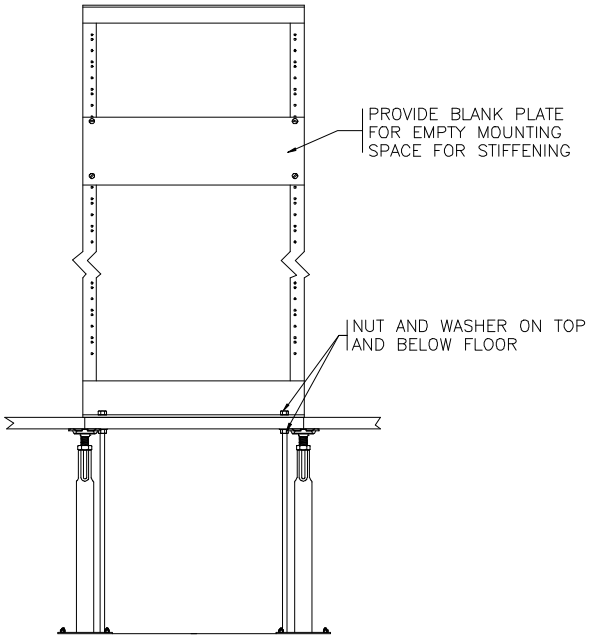
UNEQUAL FLANGE FRAME SECURED
TO FLOOR WITH TOGGLE BARS

FIG. 7



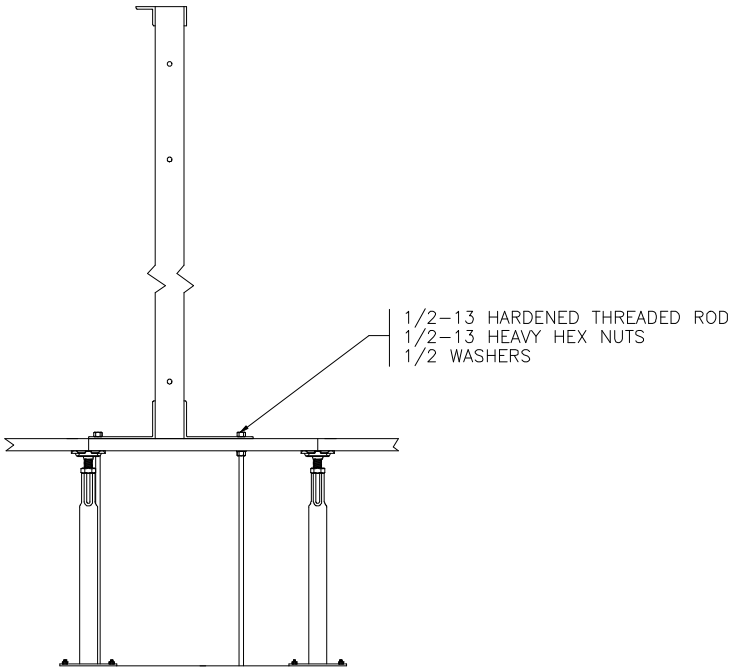
UNEQUAL FLANGE FRAME SECURED
TO FLOOR WITH TOGGLE BARS

FIG. 7A



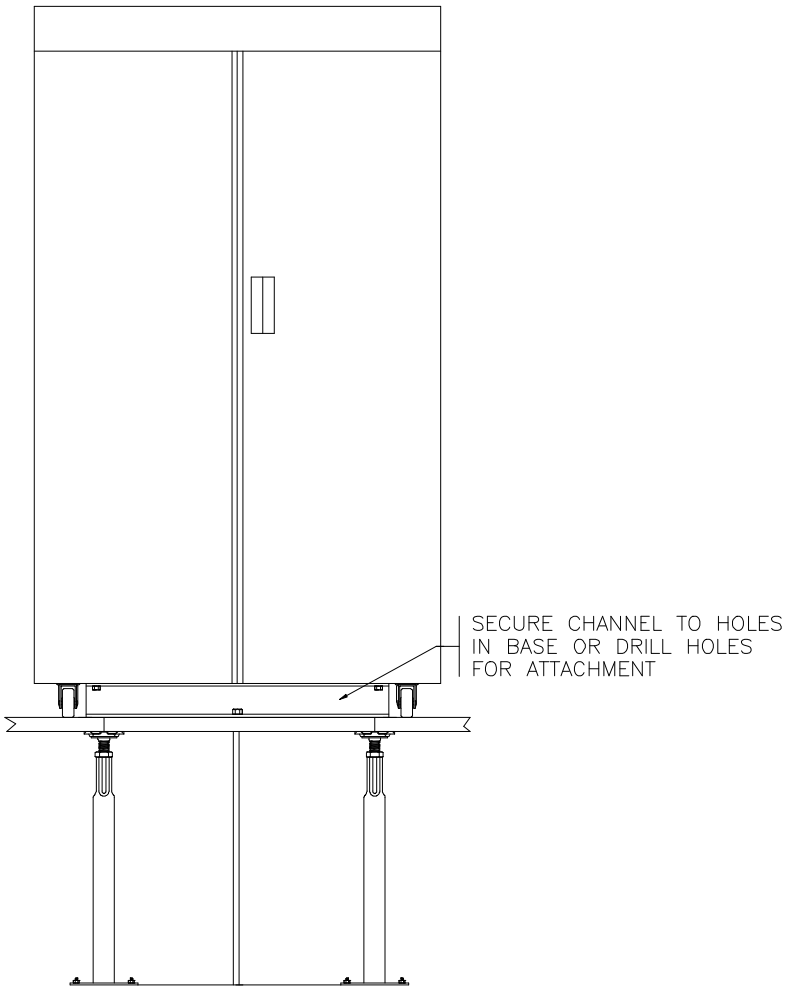
CHANNEL FRAME SECURED TO FLOOR
SYSTEM WITH TOGGLE BARS

FIG. 7B



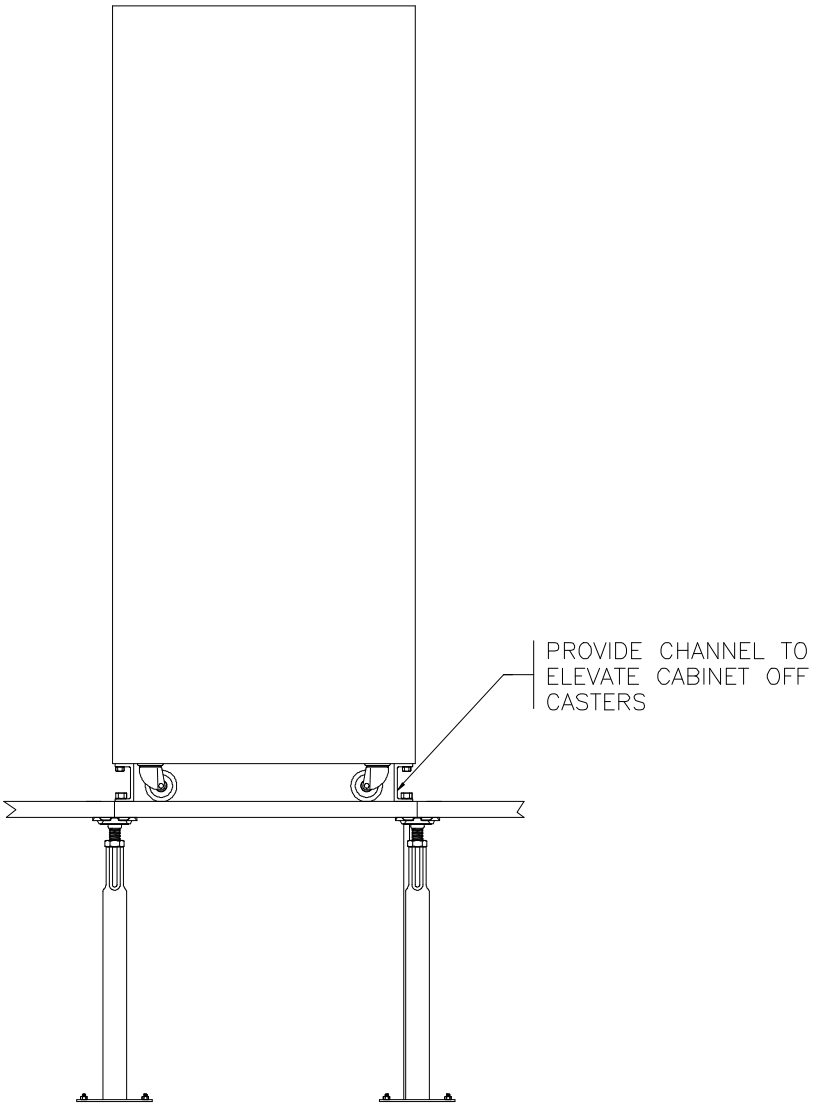
CHANNEL FRAME SECURED TO FLOOR
SYSTEM WITH TOGGLE BARS

FIG. 7C



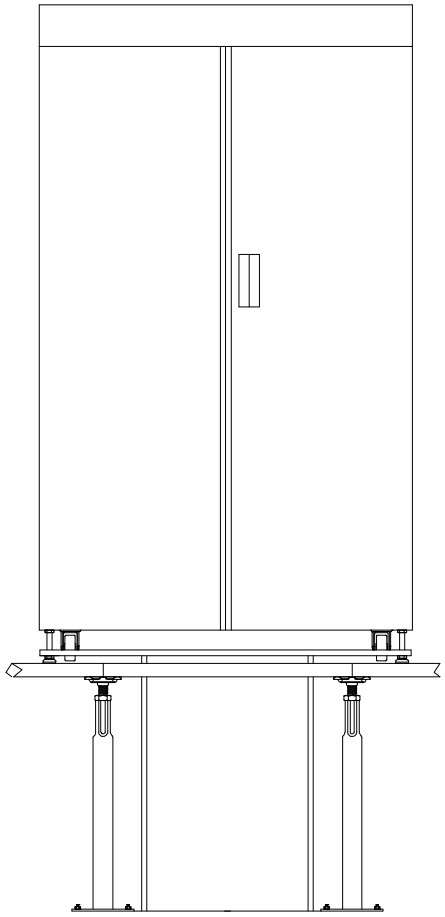
COMPUTER CABINET WITH EXTERNAL
ATTACHMENT OF TOGGLE BARS

FIG. 8



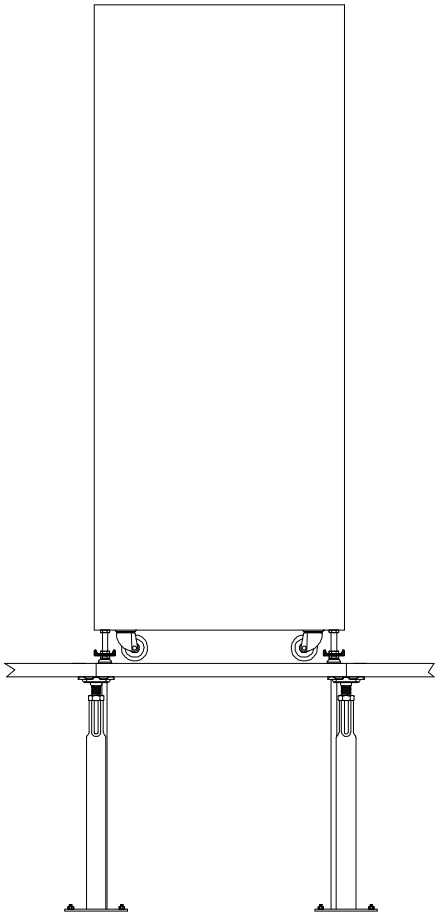
COMPUTER CABINET WITH CHANNELS
FRONT AND REAR OF BASE

FIG. 8A



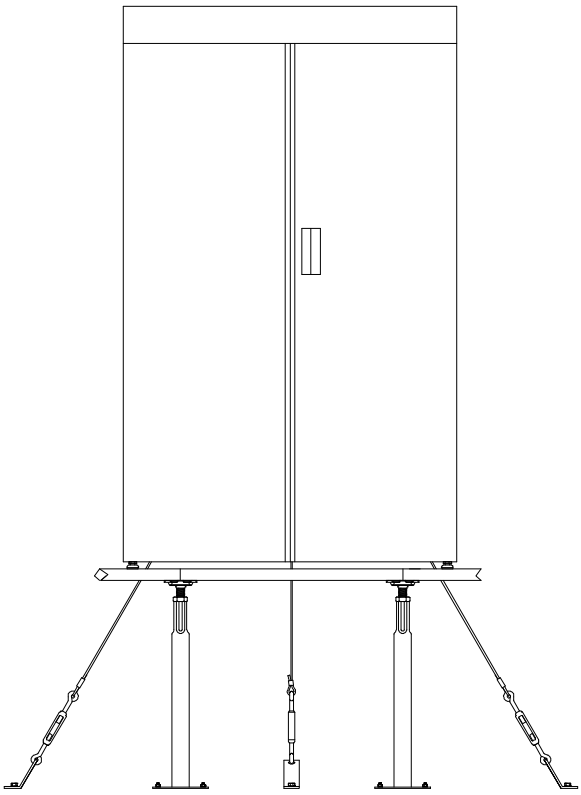
COMPUTER CABINET SECURED BY ATTACHMENT TO LEVELING FEET

FIG. 8B



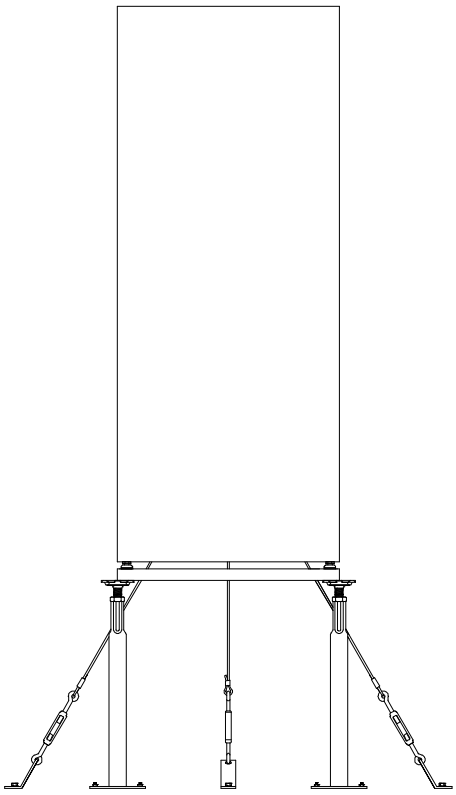
COMPUTER CABINET SECURED WITH TOGGLE BARS TO LEVELING FEET

FIG. 8C



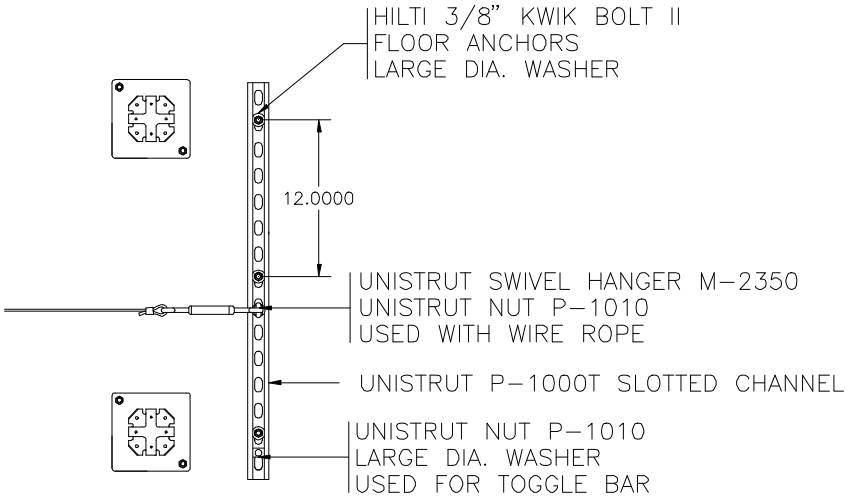
COMPUTER CABINET SECURED BY
WIRE ROPE ATTACHMENT TO BASE

FIG. 8D



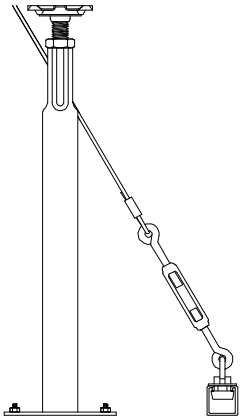
COMPUTER CABINET SECURED BY
WIRE ROPE IN FOUR DIRECTIONS

FIG. 8E



FLOOR MOUNTED UNISTRUT CHANNEL
FOR EQUIPMENT BRACING

FIG. 9



UNISTRUT CHANNEL ANCHOR
FOR WIRE ROPE

FIG. 9A