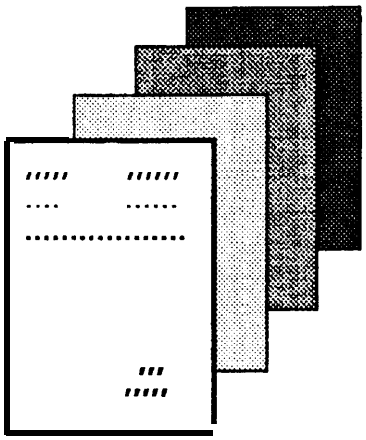
GTE PRACTICES
ENGINEERING-PLANT SERIES
GTE COMMUNICATION SYSTEMS
CORPORATION

SECTION 237-050-204
ISSUE 5, SEPTEMBER 1989

Central Office Erection Methods



GTE
COMMUNICATION
SYSTEMS
CORPORATION
PUBLICATIONS

TABLE OF CONTENTS PAGE

1. GENERAL

1.01 This section describes anchoring and erection procedures for assembling trunkboards, floor and wall angles, channel braces, equipment bay uprights, and distributing frame uprights in electromechanical and electronic/digital exchanges.

1.02 This section is reissued for general updating. Remove the previous issue of this section from the binder or microfiche file and replace it with this issue.

1.03 The installation procedures described in this section are general requirements and do not include detail work information. Refer to the appropriate assembly drawings when performing detail work.

1.04 References to MC (Material Code) in this section indicate the ordering code used by GTE California.

1.05 Cable runway and grid erection procedure are covered in Sections 237-050-206 and -207, respectively.

2. TOOLS AND ANCHORING MATERIALS

Basic Tools

2.01 The following is a list of basic tools required to perform the installation procedures described in this section:

(a) Plumb bob.

(b) Metal tape measure (100-foot).

(c) Linen tape measure (100-foot).

NOTE: Use a linen tape measure in place of a metal tape measure when working around or over equipment where electrical power is present or when adding to an office.

(d) Wrenches (sizes as required).

(e) Screwdrivers (sizes as required).

(f) Marking pencil.

(g) Aluminum level (24-inch)

(h) Framing square.

(i) Portable band saw kit.

(j) Flat file.

(k) Six-foot platform stepladder.

(l) Drill bits.

(m) Bolt cutter.

(n) Electrical tape.

(0) Strap Equipped With (E/W) buckle.

2.02 To avoid a safety hazard, 2 to 4-1/2 foot webbed straps E/W buckle (MC-587390) or equivalent are recommended in place of tie wraps to temporarily secure equipment racks to the secondary. Other uses for these straps would be where temporary securing is required, e.g., to hold power cable in place while sewing.

Drills and Drive Tools

2.03 The following is a listing of various drills and drive tools, or equivalents, that may be required during the anchoring or erection of floor angles, wall angles, and channel braces in Central Offices (CO's). The selection of the actual tools to be used is left to the discretion of the site supervisor or installation foreman, as applicable, and subject to telephone company approval and to local ordinances:

(a) Two-speed hammer drill kit equipped with a 10-foot, heavy-duty, two-wire cord and plug assembly. It is also supplied with a dual-type chuck and impact adjuster that

accommodates 3/8-inch shank drill bits. Refer to Section 075-220-104 for the description and use of these tools.

(b) A 3/4-inch tapered chuck hammer drill kit equipped with a selector ring arrangement providing conventional or rotary drilling. Refer to Section 075-308-107 for the description and use of this tool.

(c) Power-assisted hammer drive tools. Refer to Section 075-220-103 or 075-220-106 for the description and use of these tools.

(d) Hand hammer drive tool. Refer to Section 075-220-101 for the description and use of this tool.

(e) Dual-Action Masonry Carbide - tipped drill bits (AEG 9/16 M.C. 573119.

(f) Star Drills (4 point), 572964-l/4 inch, 572968-1/2 inch.

(9) A #755 Mas (4 point), 572964 - Masonry Drill Holder, M.C. 575200.

(h) Anchor Setting Tool, M.C. 578942.

Anchoring Devices

2.04 Some of the anchoring devices or fasteners that may be required in the erection of wall angles and channel braces are listed below:

(a) Toggle bolts. Used in hollow wall or cinder block.

(b) Hammer drive anchors with double-headed nails. Used in concrete, cinder blocks, stone, or brick.

(c) Molly anchors. Used in hollow wall or cinder block.

(d) Lag screws with expansion shield. Used in concrete, cinder block, stone, or brick.

(e) Ackerman, Rawl and other machine bolt with expansion shield. Used in concrete, cinder block, stone, or brick (i.e., expansion anchor 3/8-inch -16 X MC-762926).

(f) Lag Screws. Used in wood studs or floors.

(9) Threaded studs. Used in concrete or stone.

(h) Conical pins. Used in concrete or steel.

(i) Hex nut, red head anchor and sleeve. Used in hollow or solid concrete.

2.05 Prior to selecting a particular anchoring device, the density of the material to be anchored into must be determined. If a first attempt to determine density indicates an insufficient amount of solid material to enable the successful use of lead-sheathed anchors, threaded studs, or conical pins, use toggle bolts, molly anchors, or lag screws. Use extreme care when drilling into and tightening expansion shield-type fasteners into concrete or cinder blocks, because this material tends to be brittle and may crack apart. This causes expensive and time-consuming repair and may not provide a secure anchoring action.

3. OFFICE PREPARATION

3.01 Standard safety precautions and housekeeping procedures to be observed during installation procedures are provided in Section 200-001-000.

3.02 Before proceeding with anchoring or erecting floor angles, wall angles, channel braces, channel brace supports, or any frame within the office, it is recommended

that the office floor be entirely laid out and marked. The procedure to be followed for laying out the floor is provided in Section 237-050-201.

NOTE: Make the superstructure overlay at this time to determine if changes are required in either the superstructure or floor plan.

3.03 Remove all angles, braces, etc, from their boxes and place them in proper position on the floor. Figures 1 and 2 show the method of locating floor angles. To determine the approximate locations and lengths of the wall angles, channel braces, bay uprights, and frame uprights used within the office, the installer must lay out the Floor/Cable Runway (FCR) Job Drawing (ID-XXXXX-FCR). This drawing shows the approximate locations of the wall angles, channel braces, channel brace supports, and office frames, as well as the location of cable runway or cable grid.

3.04 Figure 3 is a typical FCR drawing for a nonelectronic office. Figure 4 is a typical FCR drawing using cable grid for an electronic office. Assembly drawing H-440000-A provides the identification symbols and definitions that are used in the drawing to identify wall angles, channel braces, and channel brace supports. If an individual CR drawing is being used, compare it with the floor plan (F) job drawing (JD-XXXXX-F/FCR) for more specific length and spacing

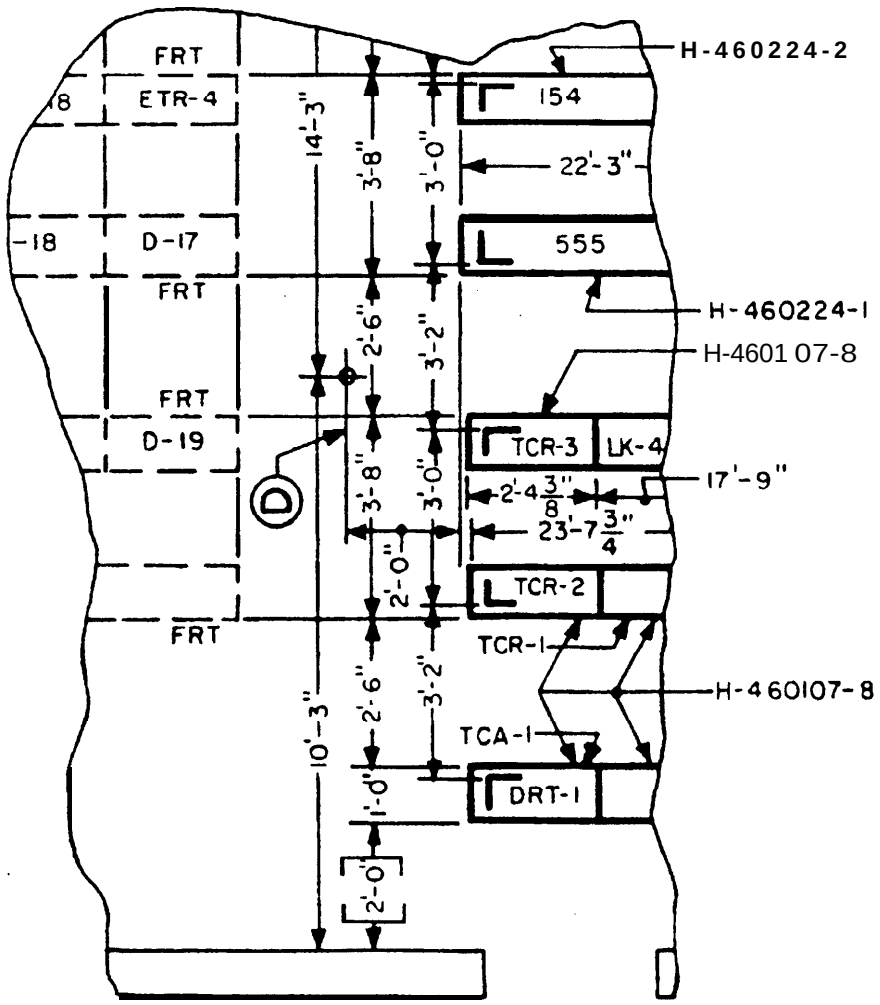


Figure 1. Portion of F Drawing Showing Location of Floor Angles.

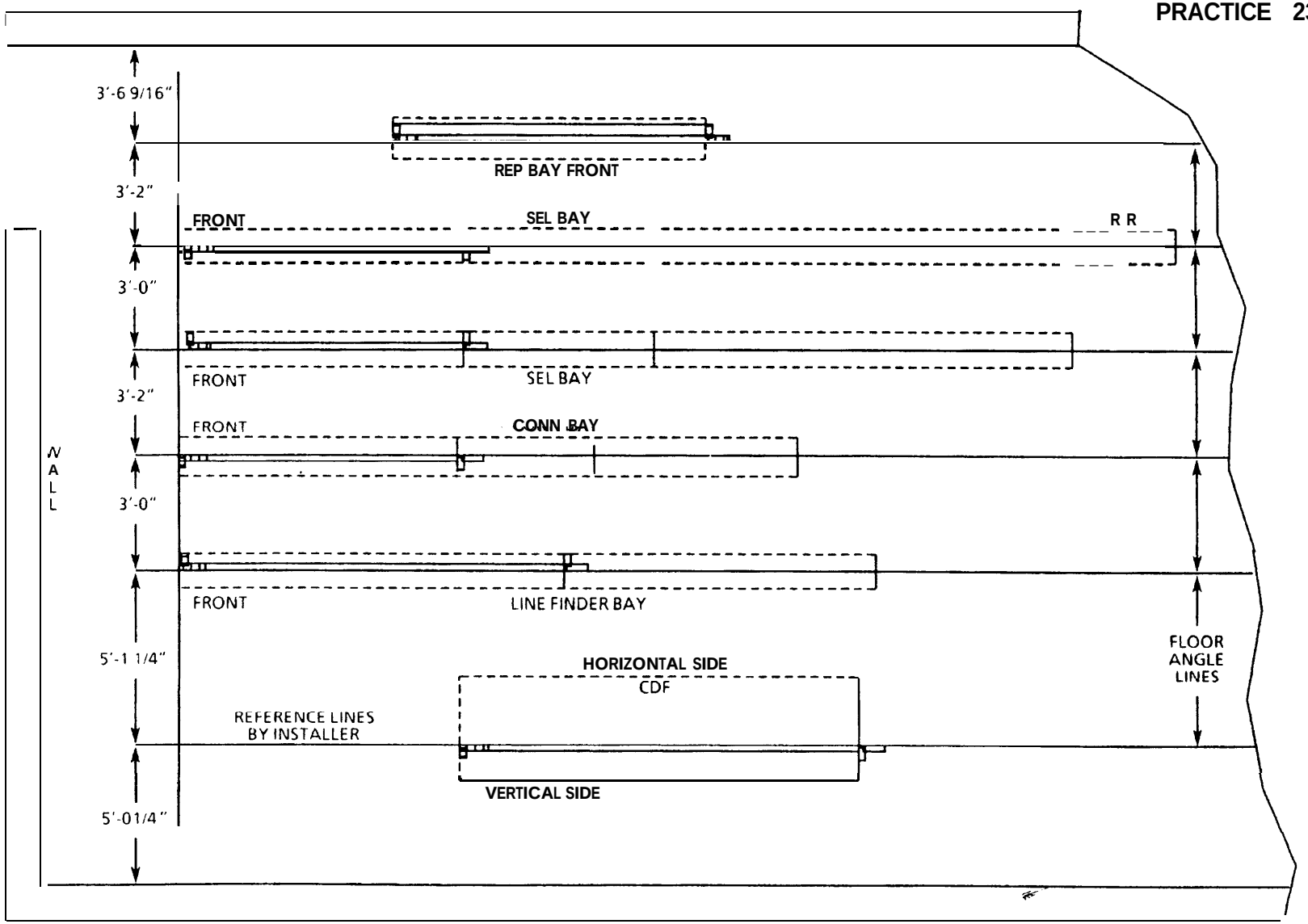


Figure 2. Locating Floor Angles.

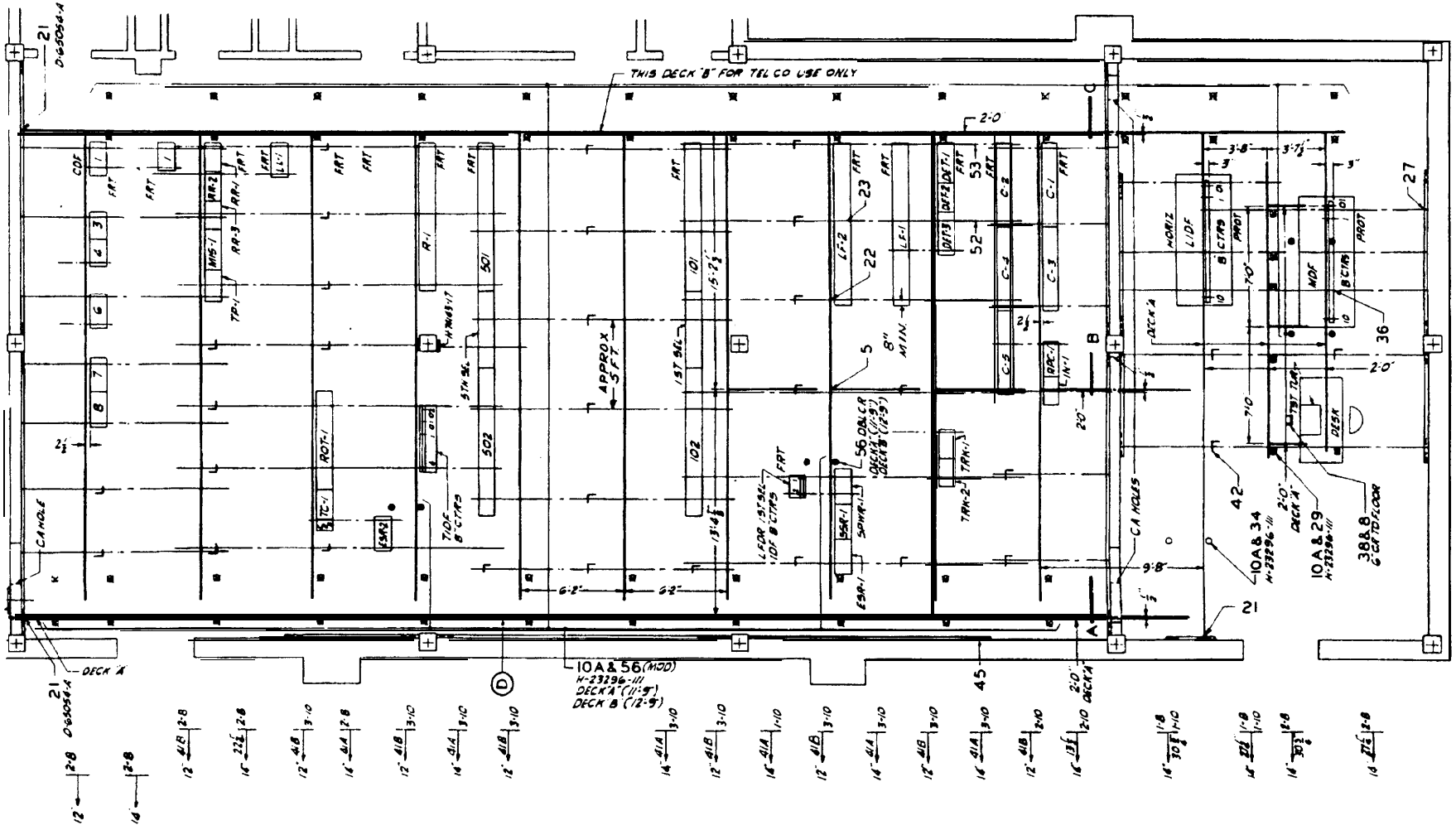


Figure 3. Typical CR Drawing S x S Office.

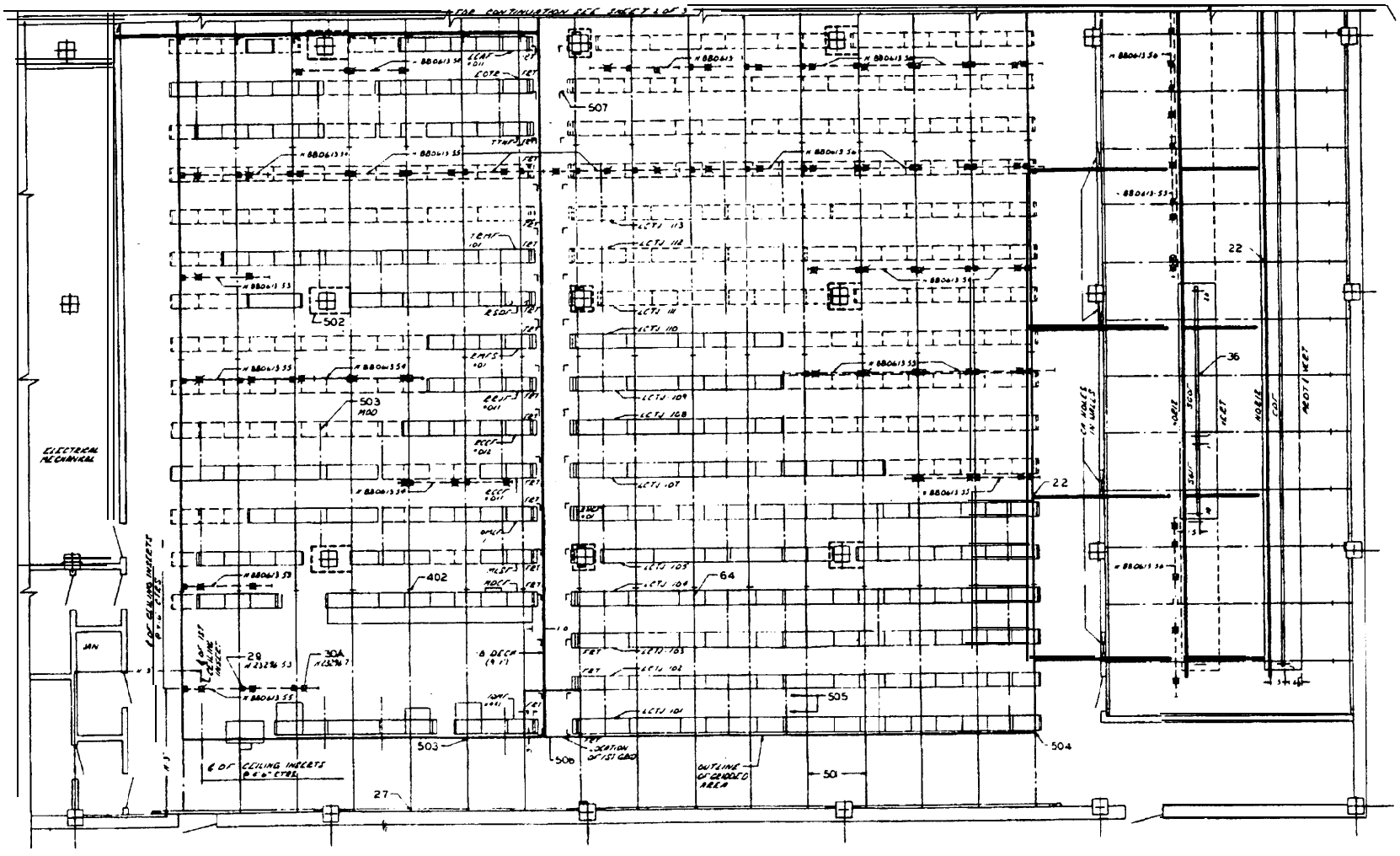


Figure 4. Typical CR Drawing Using Cable Grid - Electronic Office.

dimensions. Figure 5 shows a portion of a typical F/FCR drawing locating wall angle and channel braces.

3.05 Before drilling holes or locating the studs for securing the floor angles of the Main Distributing Frame (MDF), check the location of the cable holes or ducts. Refer to the F drawing and the following for location of the floor angles:

(a) Where the outside cable goes to protectors on Type B frames, place the floor angles so the frame uprights allow the cable to go through the cable hole and straight up the vertical side of the frame upright just behind and to the left as viewed from the front (Figure 6) of the protector fanning strip.

(b) Where the outside cable terminates on terminal blocks (horizontal side) on Type A frames, place the floor angles so that the frame uprights allow the cable to go through the cable hole and straight up and to the left as viewed from the front (Figure 6) of the vertical side of the frame near the floor angle.

3.06 The recommended erection sequence of Central Office Equipment (COE), based upon the assumption of immediate availability of all the office components, is as follows:

(a) Anchor floor angle.

(b) Erect wall angle.

(c) Erect office bays and frames and channel brace supports.

NOTE: In nonelectronic offices, frames are not free standing as they are

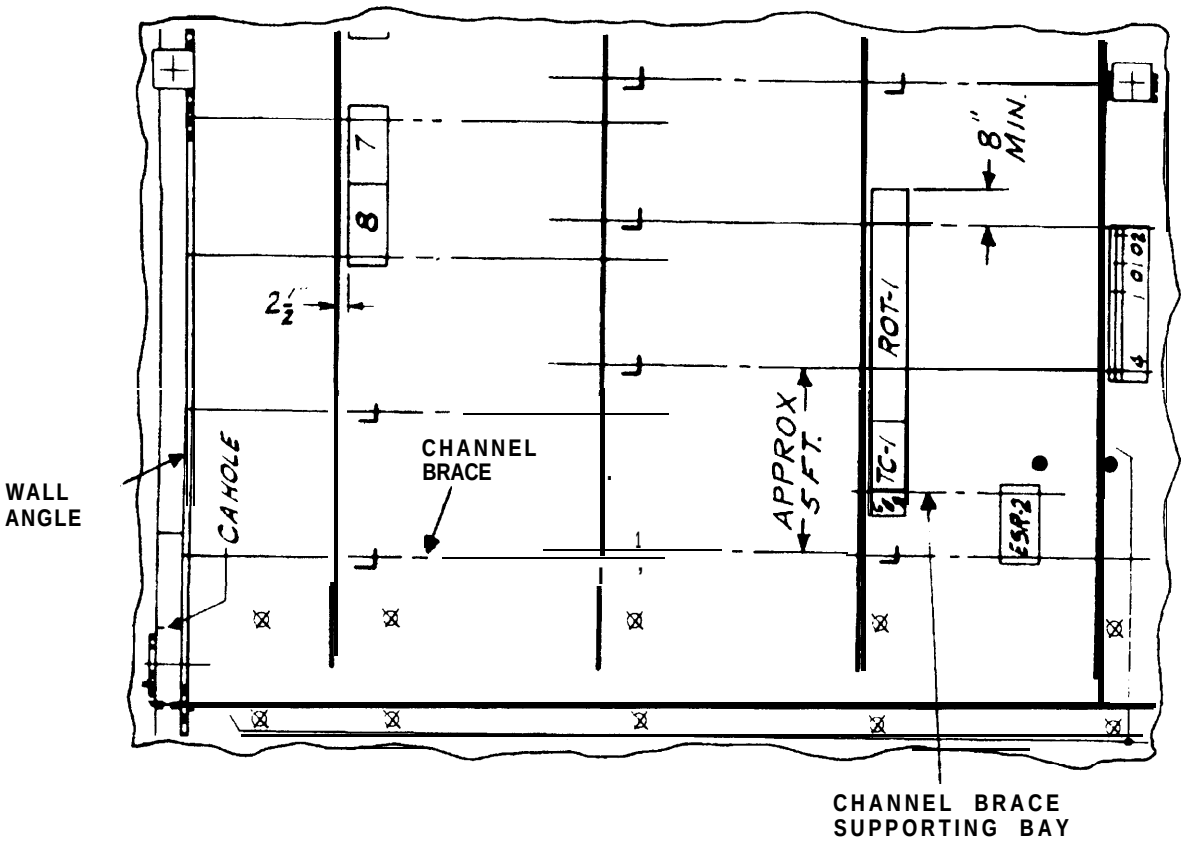


Figure 5. Portion of F Drawing Showing Location of Channel Brace and Wall Angles.

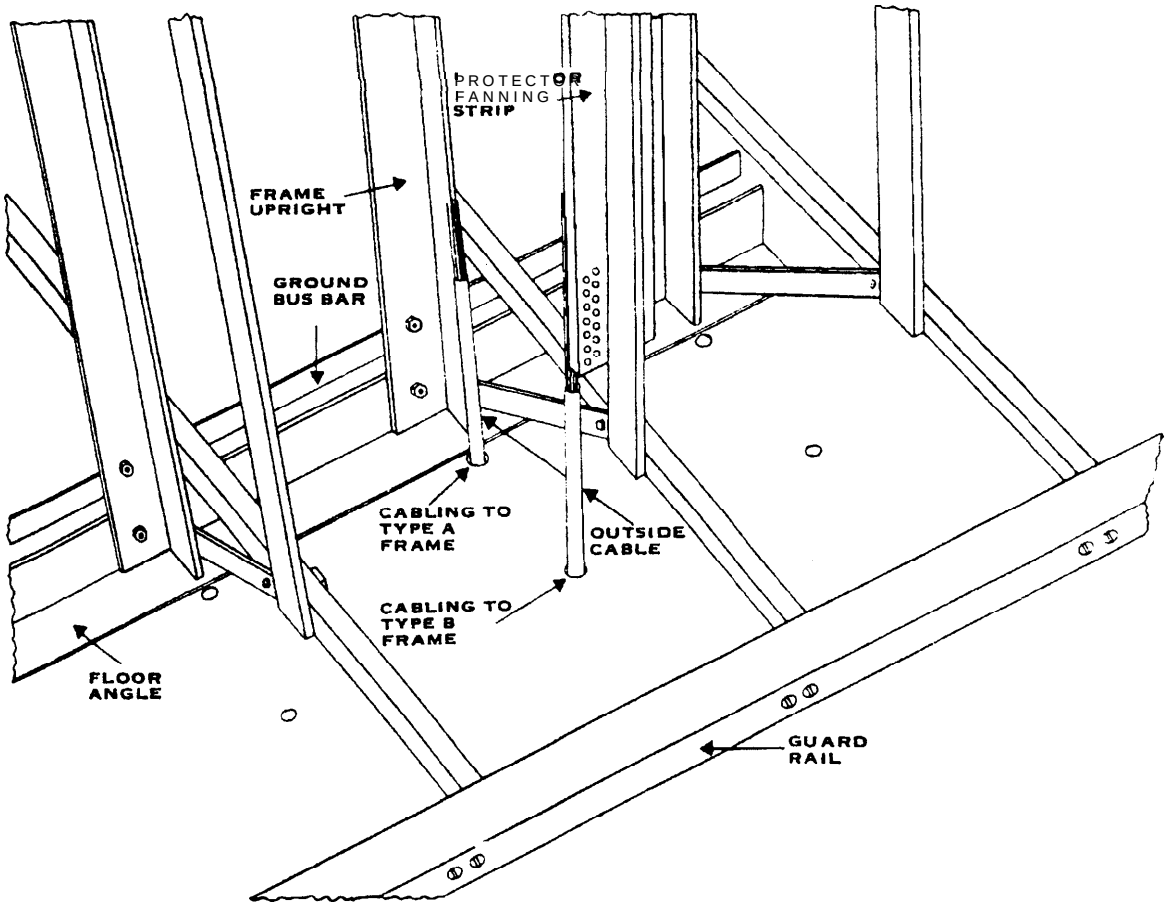


Figure 6. Locating Frame Over Cable Holes.

in electronic offices. Therefore, in the non-electronic offices, the frames, channel brace supports, and channel braces are erected at the same time so that when a frame is erected it is supported by the channel brace.

(d) Erect channel braces.

NOTE: The frames in electronic offices are free standing because of the base design and are only braced against sway by the channel braces. The prime purpose of the channel braces in an electronic office is to support the cable runways or cable grid (in nonearthquake zones).

(e) Erect cable runway or cable grid.

4. ANCHORING FRAMES

4.01 This part covers the installation of the floor angles, wall angles, channel brace supports, channel braces, bay uprights and frame uprights. The erection of other necessary CO equipment is covered in other sections in the 237-050 subdivision, with the exception of the power equipment that is covered in the 205 Sections.

Anchoring EAX Frames to the Floor

4.02 When anchoring frames to the floor, follow this procedure:

(a) Drill 5/16-inch holes over 2 inches deep into the concrete for all frames in the office as shown in Figure 7. in earthquake zones, this requirement may vary due to the

size of anchor used. Refer to 4.03 and Section 780-740-070.

(b) Refer to drawing H-440000-K for the proper ground isolation material and placement of the ground isolation material when anchoring the frames to the floor.

(c) Place the mounting holes of each frame being anchored over the holes drilled in the concrete.

(d) Add a D-17087-A washer under the washer furnished with the 5/1 6-inch sleeve expansion anchor. The greater diameter of this washer will support the frame.

(e) Inset-t the sleeve expansion anchors with the D-17087-A washers through the frame mounting holes into the holes in the concrete. Refer to Figure 7.

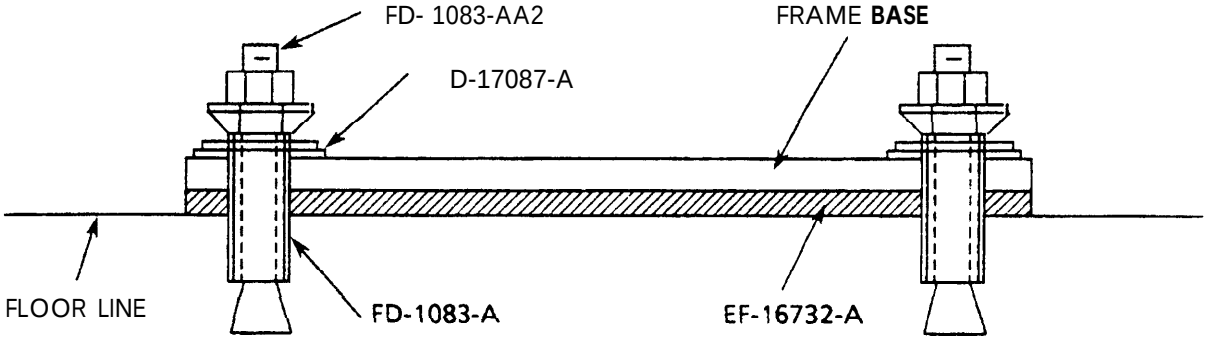
(f) Tighten the hex nut snugly on the sleeve expansion anchor. This will expand the sleeve portion of the anchor and provide a secure hold in the concrete. Do not over-tighten to the final tightness at this time.

(g) The two end EAX frames in each lineup must be supported by four anchors (two in each foot).

(h) Each EAX frame in every lineup between the two end frames must be supported by two anchors (one in the upper left-hand corner of one foot and one in the lower right-hand corner of the other foot. (Refer to Figure 8.)

Floor Anchor Fastening Using the J-38 Red Head Expansion Anchor

4.03 In earthquake zones, use four J-38 Red Head Expansion Anchors per each



LEGEND: 2 - EF-16732-A FRAME BASE INSULATOR

FOUR EACH OF THE FOLLOWING ARE REQUIRED FQR THE FIRST AND LAST FRAME IN EACH LINEUP, AND SPACES BETWEEN. TWO EACH ARE REQUIRED FOR EACH FRAME WITHIN A LINEUP:

FD- 1083-AA2	SCREW ANCHOR
FD- 1083-EC1	NYLON HD SLV & WASHER
D-17087-A	WASHER

Figure 7. Isolating SHES Frame From Floor (Standard, Queen, and PCDF 400 and 600 Amperes).

frame. (Refer to Figure 8.) Earthquake zones are defined in Section 780-740-070. In some cases, a manufacturer will include a different type of floor anchor as part of an equipment installation package. Do not use if they are not J-38 Red Head Expansion Anchors. Observe the following:

(a) The typical floor anchor is a 3/8 inch - 16 x 15/32 inch Nondrilling Expansion type, M.C. 762926 (50 BX). (Nondrilling means that the anchor itself will not drill concrete.)

(b) The hole should be drilled to a depth of 1-11-16 inches. This depth will leave the anchor flush with the surface of the concrete floor, and not the floor tile. Use an AEG 3/8-inch Masonry Drill, M.C. 573119, or equivalent. Do not drill oversize holes. The drill bit size must match the anchor size.

(c) If abnormal resistance is encountered while drilling, relieve the pressure that is being exerted on the drill, but maintain a firm grip on the Roto-Hammer. Proceed with caution until the resistance is no longer felt. If the resistance is not relieved, it may be necessary to use a manual percussion Masonry Star Drill 1/4 inch (MC. 572964) or Star Drill 1/2 inch (M.C. 572968), E/W the Masonry Drill Holder #755 M.C. 575200, to break the rock, etc.

(d) If at all possible, make certain to avoid all reinforcing bars or other metal objects that may be encountered when drilling. This can be detected by noticing that concrete residue stops and drill will not progress.

(e) A vacuum cleaner is to be used to remove concrete drilling residue.

(f) After the concrete residue is removed, insert the wedge into the J-38 red head anchor and place in

WARNING
DO NOT DRILL THROUGH CONDUIT.

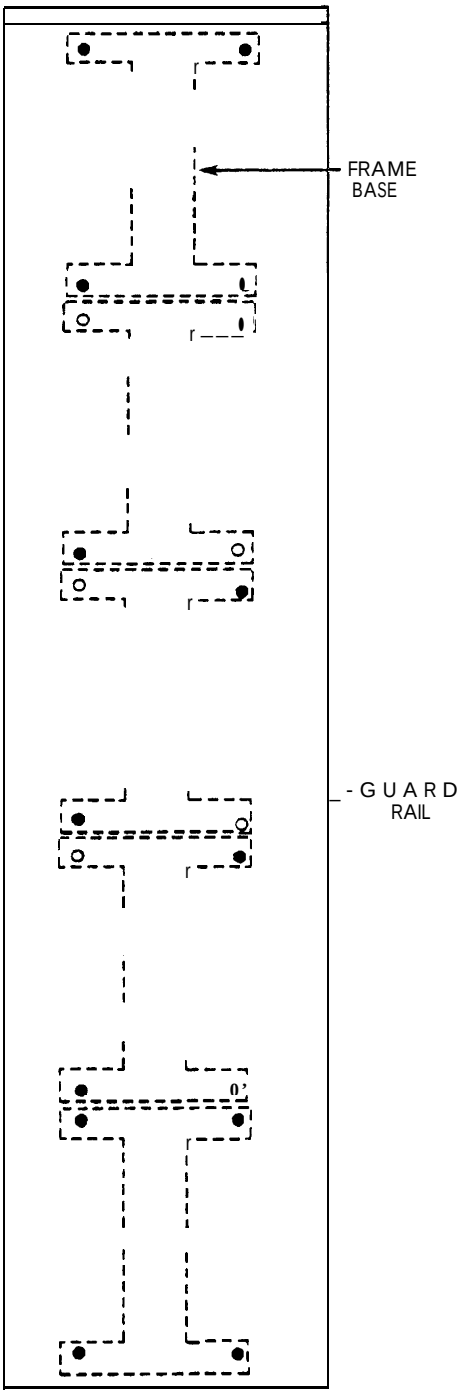


Figure 8. Anchor Locations for Frames Within a Lineup in Nonearthquake Zones.

CAUTION
DO NOT ATTEMPT TO DRILL THROUGH **IRON.**

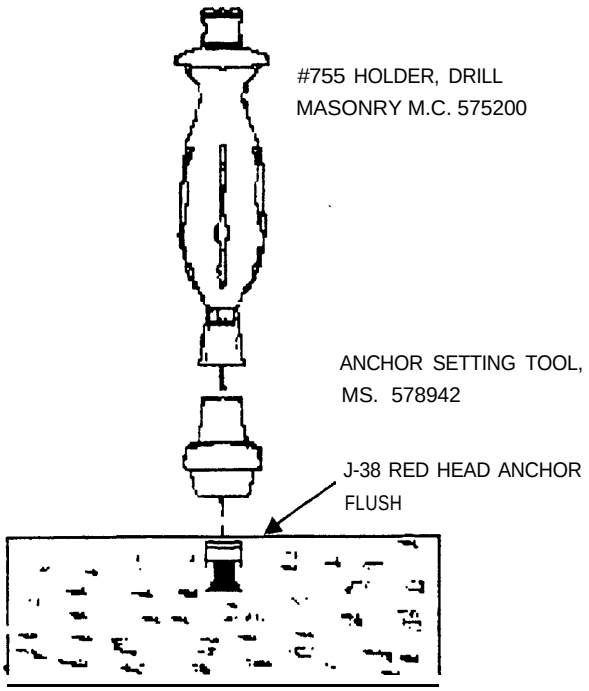


Figure 9. Anchor Setting Tool.

Table 1. Screw Types.

SCREW HHC 3/8"-16		
LENGTH	**UNIT**	**MTRL. CODE**
3 / 4 "	BOX/100	**760526**
7/8"	BOX/100	**760527**
1"	BOX/100	**760528**
1-1/4"	BOX/100	760503
1-1/2"	BOX/100	760529
1-3/4"	EACH	760530

the hole. Use a GTC-1993 Anchor Setting Tool M.C. 578942, equipped with the Masonry Drill Holder #755 M.C. 575200. Hammer the J-38 red head anchor into the hole until it is firmly set (Figure 9).

(9) Select a screw that is long enough to secure the equipment to the floor and extend 7/16 inch into the anchor. (See Figure 10 and Table 1.)

NOTE: When this configuration is used for frames requiring isolation, use H-440000-K, Figure 900 Material (Figure 11).

(h) When a predrilled hole in a base angle exceeds the size of the screw head used with the expansion anchor, add a larger washer under the washer normally used (Figure 10).

Anchoring Angles and Channel Brace Supports

4.04 When anchoring angles and channel brace supports to the floor, foilow this procedure:

(a) Drill a hole 5/8 inch by 1-1/4 inches deep for each Rawl Hammer set or a 5/16-inch hole for other compatible anchors to support floor angles and channel brace supports.

(b) Refer to drawing H-440000-K for the proper ground isolation material and placement of ground isolation material when anchoring angles and channel brace supports to the floor in a GTD-5 EAX switch installation.

(c) Drop the narrow end of the anchor or other compatible anchor into the drilled holes.

(d) Use an anchor setting tool to tap the anchors down flush or slightly below the level of the floor. Other compatible anchors will drop into the holes.

(e) Place the mounting holes of the angle or channel brace support being anchored over the holes drilled in the concrete.

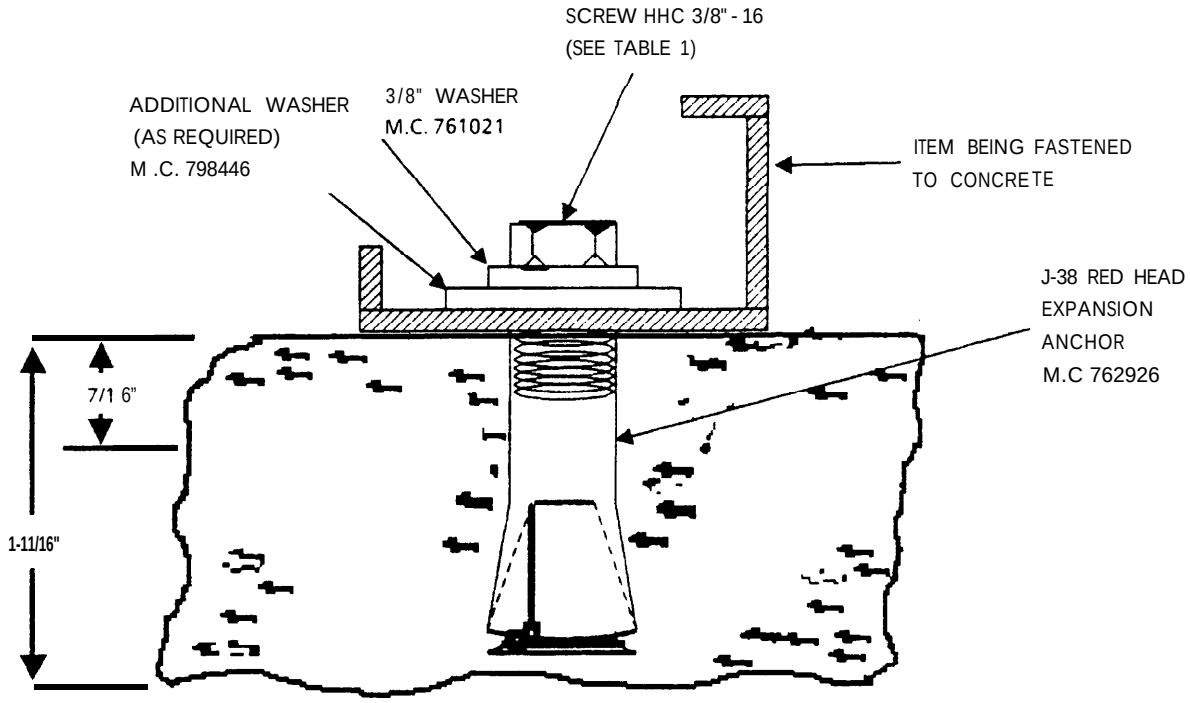


Figure 10. J-38 Red Head (MC-762926) Expansion Anchor Fastening.

(f) Use the screw **and washer or** nut **and** washer supplied with each anchor to attach the angle or channel brace support to the anchor.

(g) Tighten the screw or nut. This will expand the sleeve portion of the anchor and provide a secure hold in the concrete. Do not over-tighten.

Floor Anchor Removal

4.05 When fioor anchors must be removed by installing a hex head cap, screw in the floor anchor until tight and continue turning until the anchor turns **freely. It can now** be removed by prying under the screw head until the anchor just begins to come out. At this point, caution must be taken to prevent injury to the employee **when the anchor suddenly becomes** free. Do not **"beat down" and leave the anchor; always** remove it.

4.06 When **floor** anchors are removed the holes must be patched. The buildings department must be contacted to perform the patching and replace the tiles.

4.07 When there are several floor anchors extending above the tile, special arrangements must be made with the buildings department to grind the anchors to the concrete level and re-tile. If this method will delay the completion of the work order, the anchors can be removed by the conventional method, prying.

4.08 When installing equipment in an **area where** floor anchors exist and a floor anchor is encountered, repiace it and set the new anchor deeper. Use a longer hex head screw to secure the equipment. In some instances that floor anchor may have to be left out.

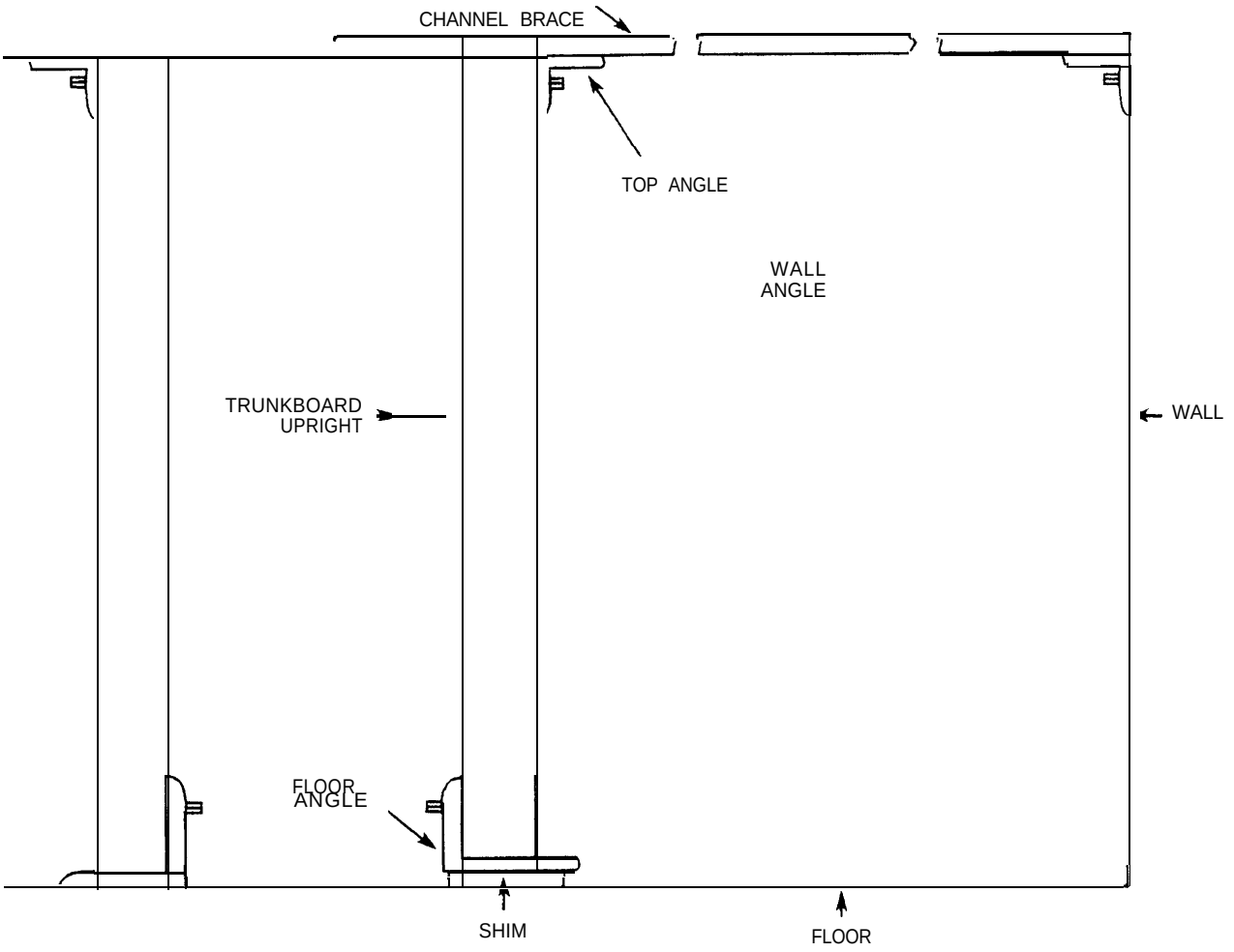


Figure 11. Shim Placed Under Floor Angle.

Junctioning, Shimming, and Securing Frames

4.09 Refer to drawing H-440000-K for the proper ground isolation material and placement of the ground isolation material when junctioning, shimming, and securing the frames in the following procedures:

(a) Level the **two end frames in each lineup in both directions using a plumb bob or level, and tighten permanently to the floor before junctioning the frames in between.**

(b) Roughly align each frame by eye and loosely tighten the J bolts holding the channel braces to the frames so they will not tip over.

(c) Start from the end of the aisle and junction all frames in the lineup to each other using the places and self tapping screws provided.

(d) Stretch a string around the two end frames over the wooden card **supports.**

4.10 When leveling is required because of uneven floors, etc, place lead or metal shims under the floor angles at the place where the uprights will be located (Figure 11). These shims must not extend

outside the floor angles, and follow these steps:

(a) Level the frames one at a time down the lineup by measuring from both sides of the frame to the string. Use shims, as required, and permanently tighten each frame to the floor. Be certain each stud has the correct size washer for the hole.

(b) The frames can now be permanently fastened to the channel braces by tightening the J bolts.

4.11 If extensive shimming is required when erecting the frames, trunk boards, and/or channel supports, perform the following:

(a) Erect one of the pieces of equipment or a support that requires maximum shimming.

(b) Measure from the top of this piece of equipment or support to the proposed location of the wall angle.

(c) Mark the wall at this point rather than marking from the floor (Figure 12).

(d) Use a section of channel extending from the top of the frame or support to the wall.

(e) Check the channel brace angle with a level before marking the wall for the location of the wall angle.

Conditions for Double-Sided Tape Usage in Securing Equipment to the Floor

4.12 The conditional use of 3M Company double sided tape part number 4032 (MC-760598) as an option to the anchor/bolt method is outlined as follows:

(a) Double-sided tape is not to be used in earthquake zones.

(b) The mating surface must be even/level, and clean, dry and must not to be used where the floor quality does not allow for a good mating surface.

(c) Two layers of tape (minimum) are to be used between all materials (i.e., frame to floor, frame to shim, shim to isolation material, and isolating material to floor).

(d) Where floor isolation materials are required as specified in the specific procedures, two layers of tape are to be installed on both sides of the floor isolators.

(e) Tape must cover the entire surface of the base angle, frame feet, etc, for both length and width.

(f) Since the tape is only as strong as the surface it is adhered to, ensure complete frame-to-frame junctioning and frame-to-superstructure securing.

(g) Avoid contact with water, solvents, etc, to maximize bonding strength.

5. ERECTING WALL ANGLE

5.01 The main purpose of the wall angle is to support the ends of the channel braces. Prior to marking the walls of the CO for the height and location of the wall angle, the level condition of the CO floor and the necessity of frame and/or channel brace support shims and their locations must be determined.

5.02 If little or no shimming is required when erecting the frames, trunkboards, and/or channel supports, measure the wall, from theofficefloor up, to locate the height

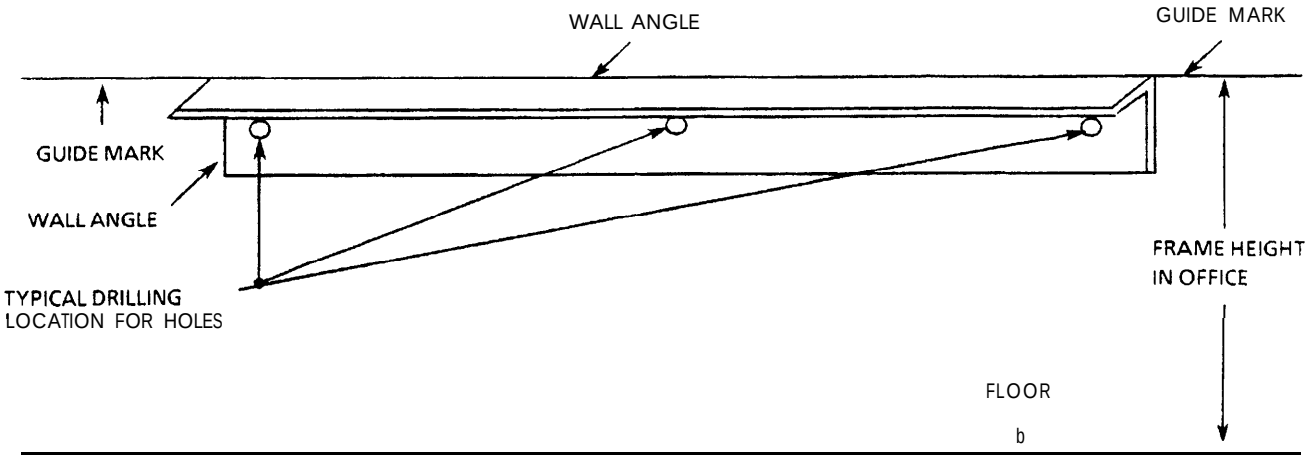


Figure 12. Marking for Wall Angle (Level Floor).

position for the top of the wall angle and mark the wall at this point (Flgure 13). The height of the wall angles in nonelectronic offices varies throughout the office, depending upon the height of the specific equipment in the various areas of the office.

5.03 The various equipment or frame heights in nonelectronic offices are 6 feet 6 inches, 7 feet 6 inches, 9 feet, and/or 11 feet 8 inches. The equipment height for the various areas must be determined

before marking the wall angle height. In electronic offices, the normal height of electronic frames and equipment is 8 feet, therefore, the height of the wall angles throughout the office remains relatively constant. Add one-eighth inch when isolation materials are required.

NOTE: Electronic offices may have equipment frames in differing heights within the office, such as 8-foot-high equipment, 6-foot 6-inch high power board, and 9-feet and/or 1 l-foot 8-inch high distributing frames.

5.04 After guide marking the wall at each end of the proposed wall angle location (Figures 12 and 13), proceed as follows:

(a) Cut the wall angle to the required length.

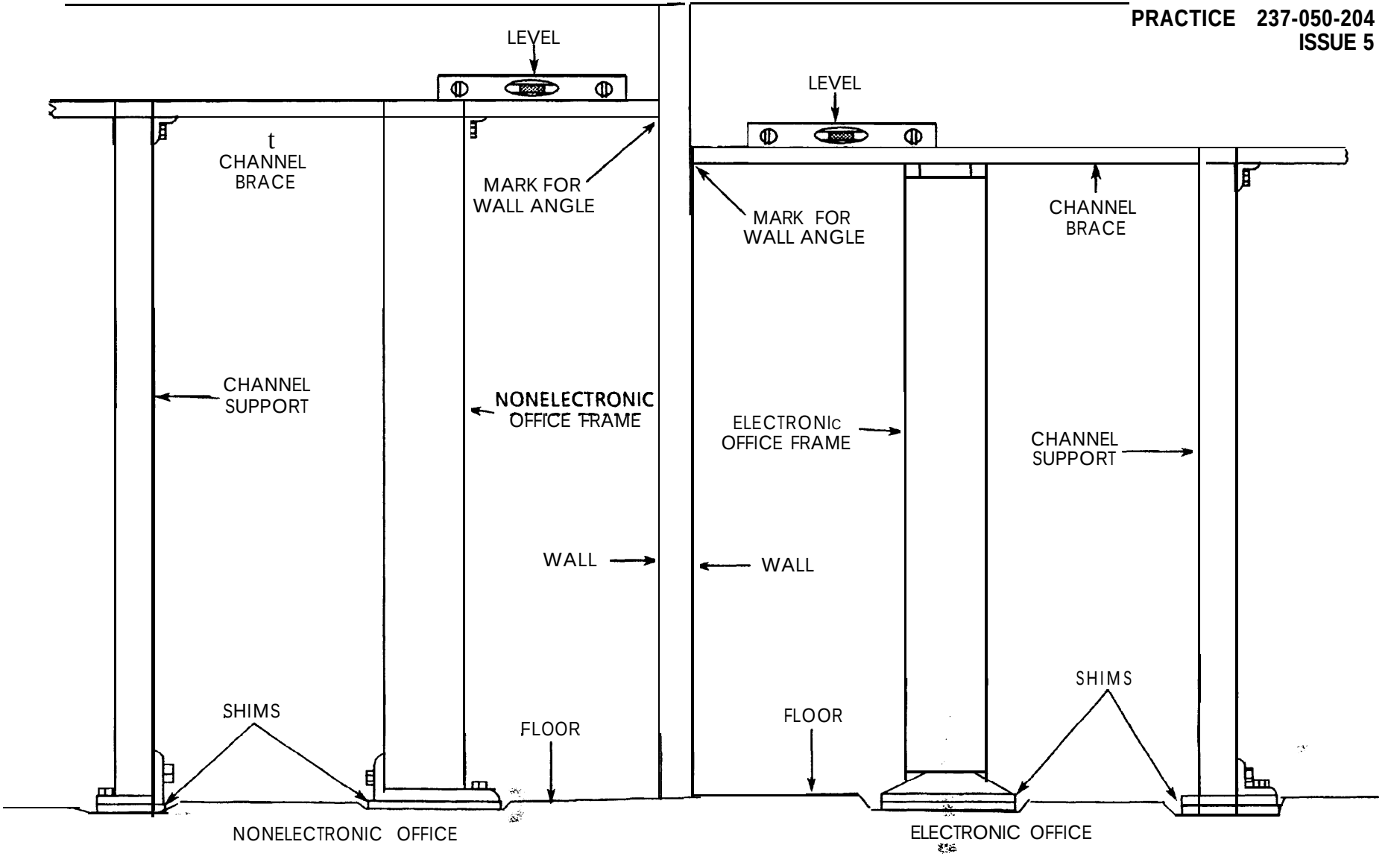
(b) Hold the length of wall angle against the wall so that the top angle of the wall angle is held on the guide marks at each end. Several people may be required to perform this task properly.

(c) Strike a line on the wall the entire length of the wall angle section that is to be fastened to the wall.

(d) Determine the best location for the anchoring devices to be placed in the wall throughout the length of the wall angle.

(e) Mark the wall angle and the wall at these locations for drilling purposes.

5.05 If the wall angle is to be mounted on hollow walls or similar surfaces, locate the wall studs and insert (at a later time) lag screws into the studs in preference to toggle bolts or molly anchors. If concrete or cinder block construction is encountered, place the anchors as near the mortared joints as possible to ensure penetration into a solid portion of the block. It is not recommended that power-assisted drive tool powered fasteners or



(WALL ANGLE MARKING TO BE LEVEL WITH FRAMES AND SUPPORTS)

Figure 13. Marking for Wall Angle (Uneven Floor).

similar devices be used to secure wall angles to concrete block or cinder block wall construction.

5.06 An anchoring device must be located within 12 inches from each end of the wait angle, when practicable, to provide a balanced support for the channel braces. An adequate quantity of anchors should be used throughout the length of wall angle to sufficiently support it and to hold the quantity of channel braces that will be supported. In no case should the anchoring devices be spaced more than 4 feet from each other. All the anchors should be as evenly spaced as possible along the length of the wall angle. This even spacing may vary depending on the consistency of wall material or studs to provide a secure hold in the wall.

5.07 The length of each bolt or rod beyond the hex nut must be less than one-half inch, and no less than flush with the bottom of the nut. File all bolts that are cut.

5.08 Touch up all angles without complete paint coverage including those requiring filing. Cover any stenciling on the wail angles with paint.

5.09 To erect wall angles, perform the following:

(a) Measure the required height in 12 places around the office walls.

(b) Draw a chalk tine around the office at the required height.

(c) Cut the wall angle to the required length.

(d) Hold the length of wall angle against the wall so that the top flange of the wail angle is held on the chalk line. Several people may be required for this task.

(d) Determine the best location for the anchoring devices to be placed in the wall throughout the length of the wail angle.

(f) Drill the angle in the premarked anchoring locations with hole sizes that are compatible with the size of the anchoring devices to be used.

(g) Mark the wall for drilling through the holes drilled in the angle.

(h) Hold the angle on the wail in the proper position.

(i) Securely mount the angle to the wall with the anchors. It is recommended that the anchors be placed in the angle from the center of the angle first and then out to each end. This procedure prevents any bow from occurring in the section of angle that may cause an unnecessary pulling action on the anchoring devices, thus lessening their holding power.

5.10 It is recommended that all wall angles be erected at the same time to al low a consistent erection procedure and so that all the necessary tools, anchors, and wall angle lengths are available as required.

6. CHANNEL BRACE SUPPORTS

6.01 Channel brace supports are normally used in CO's or equipment areas where frames are not being used but where cable runway or cable grid is to be placed. The channel brace supports pro-vide the necessary bracing for the cable runway or cable grid within an office. The differences between the channel brace supports in nonelectronic offices and those used in electronic offices are the height of the supports, the painted finish color, use of ground isolation materials, and the part number.

6.02 The channel brace supports in nonelectronic offices may be obtained in various heights depending upon the equipment being used in the office. The channel brace supports used in electronic offices are available only in 8-foot lengths. Spacing will be done to prevent sag in the superstructure. Good judgment and safety considerations are a must.

6.03 Channel brace supports are furnished unassembled. The required component parts, such as the post, top angle, floor angle, J bolts, screws, nuts, and lockwashers, are packaged with each channel brace support. The ground isolation material is ordered and shipped separately. Refer to the appropriate figures on drawings H-440000-K. Table 2 lists the part numbers for the various sizes of channel brace supports that are used in both the nonelectronic and electronic CO's.

6.04 Channel brace supports are also used when the applicable or future frames to be installed are not available to support the channel braces. These supports are considered temporary but are installed in a permanent manner to provide adequate support to the channel braces to keep the CO free from hazards.

6.05 Table 3 provides a list of the basic components that are furnished with each channel support. Also provided are the AGCS part numbers, component descriptions, quantities per support, and the type of CO system with which each component is used.

6.06 The channel brace supports (see paragraph 4.04) are to be erected in the locations as indicated on the FCR or CR drawing for the specific job site. Erect channel supports, as required, in the approximate locations where missing frames are eventually to be placed. This temporary channel brace support location can be determined by referring to the applicable FCR drawing and comparing it to the dimensions indicated on the F or FCR drawing for the particular job site.

NOTE: If additional channel brace supports are not available for the temporary locations, the cable runway or grid that is intended to be supported by the channel braces can be supported temporarily from ceiling supports (refer to Section 237-050-206). The ceiling supports for the runway may be removed later and replaced by the intended channel braces when the applicable frames are erected.

6.07 Assemble the top angle and floor angle to the channel brace support by using the screws, lockwashers, and hex nuts furnished with channel brace support. Insert the J bolts into the holes provided in the top angle and start the hex nuts onto the threaded Portion of the J bolts. The J

Table 2. Channel Brace Support Part Numbers and Sizes.

GTE CSC PART NO.	HEIGHT		SYSTEM TYPE
	FEET	INCHES	
H-883879-1	11	8	Nonelectronic
H-883879-2	9	0	Nonelectronic
H-883879-3	7	6	Nonelectronic
H-883879-9	6	6	Nonelectronic
H-888743-1	8	0	Electronic

bolts are used to fasten the channel brace to the top angle of the channel brace support, as explained in part 7, therefore do not thread the hex nut to the top of the threaded portion of the J bolts at this time.

6.08 Anchor the channel brace support (paragraph 4.04) to the floor in the predetermined location by using the type and size of anchors recommended by the site supervisor or installation foreman. Make certain that shims and isolation materials, if required, are placed under both the floor angle and support post of the channel brace support prior to securing the anchor device that holds the floor angle to the office floor (Figures 11 and 13). Verify that the top angle of the channel brace support is facing the correct position so that the channel brace is secured properly by the J bolts on the top angle.

7. INSTALLING CHANNEL BRACES

7.01 Channel braces are primarily used in an office to support cable runway or grids. The channel braces also ensure equipment frame rigidity and maintain equal spacing from top to bottom in the CO equipment aisles.

Location Considerations

7.02 To determine the approximate location of the channel braces in the office, refer to the CR drawing. Compare the CR drawing to the F drawing to determine dimensions and measurements of the channel braces to be used in the office.

7.03 Channel braces must be installed not more than 5 feet apart to provide adequate support to the cable runways or

Table 3. Components Furnished with Channel Brace Supports.

GTE CSC PART NO.	DESCRIPTION	QUANTITY PER SUPPORT	SYSTEM USED WITH	
			ELECTRONIC	NON-ELECTRONIC
H-883879-7	Floor angle	1		X
H-883879-8	Top angle	1		X
H-888742-7	Floor angle	1	X	
H-888742-8	Top angle	1	X	
D-17026-C	Lockwasher	4	X	X
D-7778-A	HEX NUT 1/4-20	4	X	X
H-74143-10	J BOLT 14-20 X 1-3/4	2	X	X
D-762068-E	HHICS 14-20 X 10 X 1	2	X	X
FD-1083-AA2	Screw anchor and washer	2	X	
EF-16728-A	Top pad insulator	2	X	
EF-16738-A	Power rack insulator	1	X	
FD-1083-EC1	Nylon head sleeve and washer	2	X	
FD-1083-EC2	Nylon head sleeve and washer	4	X	

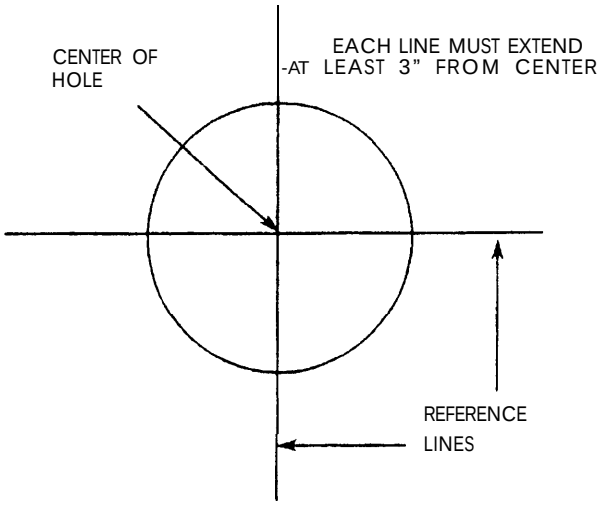


Figure 14. Reference Lines Used When Aligning Power-Assisted Drive Tool for Stud Location.

grid. The channel braces must not be located closer than 8 inches from the cable breakoff end of any frame. This space normally allows sufficient area for the cables to drop off the runway or grid to the frames without interference by the channel braces. future cable runs must also be considered when making this space allowance between the channel braces and the cable breaking into or alongside the frames, as applicable.

7.04 After the wall angles, office frames, and channel brace supports are installed and the frames are plumb, align the channel braces by locating them parallel to the end reference line of each equipment aisle and at right angles to the frame top angles (Figure 14). Use the same reference line that is used when laying out the office floor as described in Section 237-050-201.

7.05 The channel braces can be properly located by hanging a plumb line from the channel brace to the floor and then measuring with the plumb bob to the reference line from various points along the channel brace. The angle of the channel brace can then be checked with a square placed between the junction of the channel brace and the frame top angle.

7.06 The length of each bolt or J bolt beyond the hex nut must not be more than one-half inch or less than flush with the bottom of the nut. All bolts that are cut must be filed.

7.07 Do not overtighten the hex nuts when securing the J bolts to the channel braces. Overtightening can affect the holding power by bending the plate or J bolts.

Fastening Channel Braces - General

7.08 Channel braces must be fastened, as applicable, to wall angles, the top of equipment frames (frame to angles), and channel brace support top angles within the office. In some instances, when channel brace supports or equipment frames are not used in certain areas of the office to support the channel braces, they are supported from the office ceiling.

7.09 The following paragraphs and the associated illustrations explain the various methods that can be used to fasten the channel braces in both nonelectronic and electronic office installations.

Fastening to Wall Angles

7.10 There is no procedural difference in fastening channel braces to wall angles in a nonelectronic office or an electronic office.

7.11 The procedure for fastening channel brace to wall angle follows (Figure 15):

(a) Locate the section of channel brace to be fastened to the wall angle by the method stated in paragraph 6.04. Use the wall angle in place of one of the frame top angles referenced.

NOTE: If necessary, cut the channel brace section to the proper length, as indicated on the FCR or CR drawings.

(b) Mark the wall angle (Figure 15a) to indicate the location of the channel brace. Remove the section of channel brace from the wail angle.

(c) Mark and drill two 5/16-inch holes in the wall angle, 1 inch out from the wail and 2-1/4 inches apart. Mark and drill the holes an equal distance from each side of the marked 2-inch width of the channel brace (Figure 15a).

(d) Replace the section of channel brace in its marked location on the wall angle.

(e) Insert a J bolt through each of the two drilled 5/16-inch holes in the wall angle. Locate the loop of each J bolt over each edge of channel brace section (Figure 15b).

(f) Tighten the channel brace securely to the wall angle by one of the lockwashers, hex nuts, and J bolts (Figure 15b).

CAUTION

TO AVOID A SAFETY HAZARD WITHIN THE OFFICE, THE EXCESS THREADED PORTION OF THE J BOLT (IF MORE THAN ONE-HALF INCH BELOW THE HEX NUT) MUST BE REMOVED. CUT THIS PORTION OFF WITH A BOLT CUTTER.

Fastening Channel Braces to Top Frames in Nonelectronic Office

7.12 There are three possible methods to fasten channel brace to the tops of frames in nonelectronic offices. The following paragraphs and procedures explain each method.

7.13 The following procedure fastens the channel brace to frame top angle, where drilling of the top angle is not available because of working circuits, etc:

(a) Locate the section of channel brace **to** be fastened to the frame top angle by the method described in paragraphs 7.01 through 7.10.

(b) Mark the frame top angle so that the correct position of **the** channel brace is indicated on the top angle.

(c) Place the H-74143-12 plate on top of the channel brace.

(d) Insert the J bolts up through the holes in the plate, one at a time, and fasten the J bolts in position by using the lockwashers and hex nuts. Tighten the hex nuts evenly on both sides and check that the loops of the J bolts grip the bottom of the frame top angle securely.

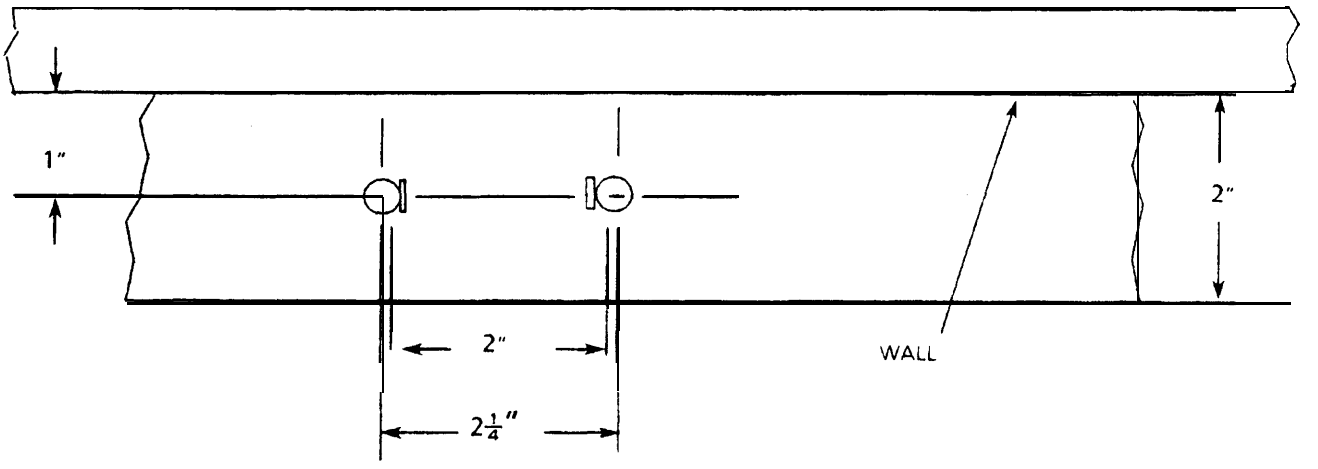
NOTE: Do not over-tighten the hex nut when securing the J bolts. This may bend the plate of J bolt loops, lessening the holding power on the channel braces.

7.14 An alternate procedure for fastening channel braces to frame top angles, where drilling of the frame top angle is suggested by the site supervisor or installation foreman is described below:

(a) Locate the section of channel brace to be fastened to the frame top angle by the method described in paragraphs 7.01 through 7.10.

(b) Mark the frame top angle so that the correct position of the channel brace is indicated on the top angle. Remove the section of channel brace from the frame top angles.

(c) Mark and drill two 5/16-inch holes in the frame top angle, 1 inch out from the rear of the top angle and 2-1/2 inches apart. Mark and drill the holes an equal distance from



NOTE : INSTALLER SHALL DRILL TWO 5/16-INCH HOLES IN WALL ANGLES. ONE INCH OUT FROM EACH CHANNEL BRACE WIDTH MARK AND 2-1/4 INCHES APART.

Figure 15a. Marking and Drilling Wall Angles for Channel, Brace Mounting.

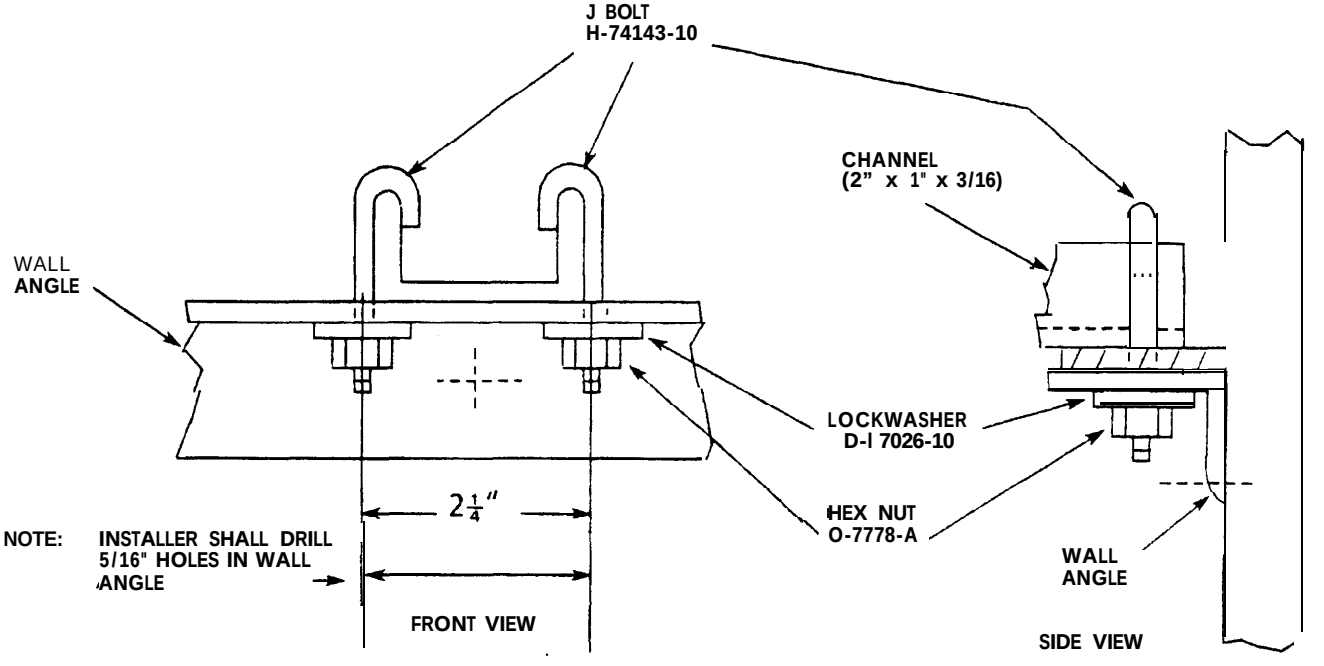


Figure 15b. Side View and Front of Channel Brace Fastened to Wall Angle.

Figure 15. Fastening Channel Brace to Wall Angle.

reach side of the marked 2-inch width of the channel brace.

(d) Replace the section of channel brace in it marked location on the frame top angle.

(e) Insert a J bolt through each of the drilled 5/16-inch boles in the frame top angle. Check that the loop of each J bolt is located over the edge of the section of channel brace.

(f) **Tighten the channel brace securely to the frame top angle by using the lockwashers, hex nuts, and J bolts.**

7.15 The following procedure fastens channel brace to nonelectronic office frames having a top bar in place of a top angle:

NOTE: No drilling is required in this **procedure.**

(a) Locate the section of channel brace to be fastened to the frame top bar by the method described in paragraphs 7.01 through 7.10.

NOTE: If necessary, cut the channel brace section to the proper length indicated on the CR drawing.

(b) Mark the frame top bar so that the correct position of the channel brace is indicated on the top bar.

(c) Place **the H-74143-1 2 plate on the top of the channel brace.**

(d) **Insert the two J bolts up through the holes in the plate, one at a time, and fasten them in position by the lockwashers and hex nuts. Check that the loops of the J bolts grip the bottom of the frame top bar** securely. Tighten the hex nut evenly on both **sides.**

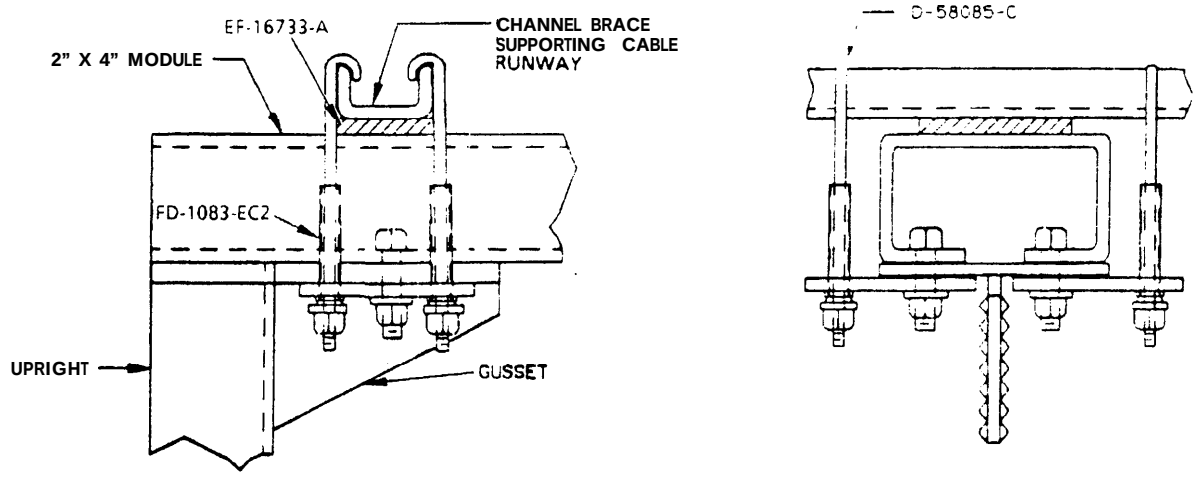
CAUTION

TO AVOID A SAFETY HAZARD WITHIN THE OFFICE, ANY EXCESS THREADED PORTION OF THE J BOLT BELOW THE HEX NUTS (MORE THAN ONE-HALF INCH) MUST BE REMOVED. CUT THE EXCESS THREADED PORTION OFF WITH A BOLT CUTTER.

NOTE: Do not overtighten the hex nuts when securing the J bolts. This may bend the plate orJ bolt loops, lessening the holding power on the channel braces.

Fastening to Top of Frames in Electronic Digital Office

7.16 The construction of **the** Standard Hardware Electronic Systems (SHES)



4-0-58085-C "J" BOLT
4-FD-1083-EC2 NYLON HEAD SLEEVE & WASHER
1-EF- 16733-A CHANNEL INSULATOR

Figure 16. Isolating Channel to Top of GTD-5 EAX Queen Frames When Channel is Over Metal Gusset.

formerly SHAE) frames is of an entirely different configuration than the previously covered nonelectronic system frames.

7.17 The method of fastening channel brace sections to the top of SHES frames also varies. Methods of fastening channel to the top of frames in earthquake zone areas is covered in Section 780-740-070, Earthquake Bracing, and in H-440000-J, Method of installing Cable Runway/Grid and Associated Ironwork.

7.18 The following procedure is used in an electronic office when fastening channel brace to frame tops:

(a) Locate the section of channel brace to be fastened to the frame top by the method described in paragraphs 7.01 through 7.10.

(b) Mark the frame top so that the correct position of the channel brace is indicated on the frame top.

(c) Hook the loops of isolated J bolts over the edge of the channel brace (Figures 16 and 17). Figure 17 shows the placement of the J bolt fasteners on SHES frames when one section of channel brace spans more than one frame.

(d) Use four J bolts to clamp the channel brace to the top of each electronic module or frame whenever possible. Previously, the requirement was to use two J bolts per frame alternately except at the end of channel where four J bolts were required. This new procedure eliminates any possible twisting of the channel brace in the run and promotes a solid, level support for the cable runway or grid.

(e) Hold the H-888742-l plate in the correct location and insert the threaded end of each J bolt through its respective hole in the plate.

(f) Fasten the plate underneath the frame top by using the lockwashers and hex nuts.

(9) Ensure use of isolation material per drawing H-440000-K.

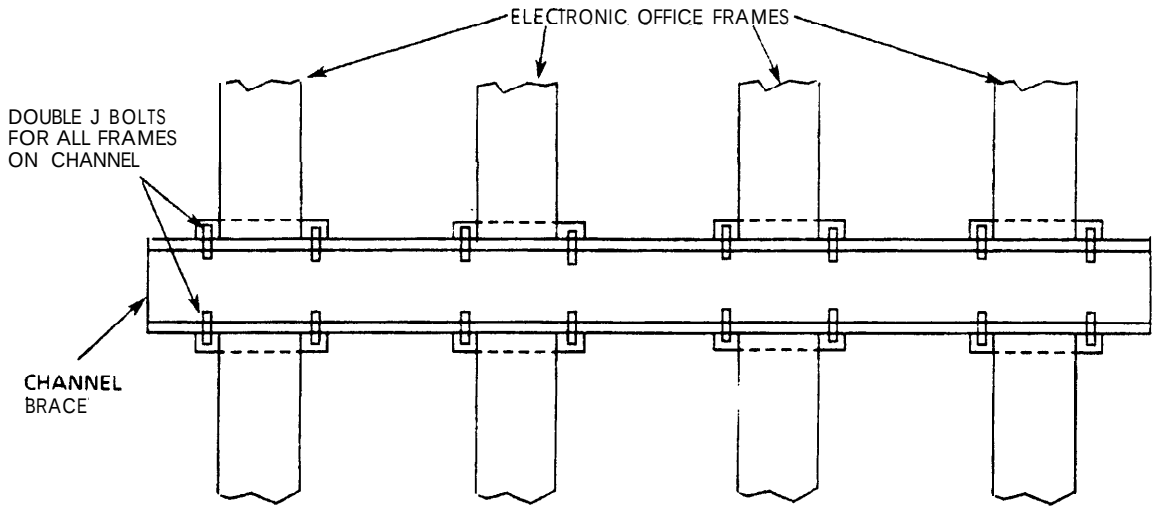


Figure 17. Placing J Bolts on Electronic Office Multiple Channel Brace Runs.

NOTE: Check that the loops remain in proper position over the edge of the channel brace. Do not overtighten the hex nuts when securing the channel brace. This may bend the plate or J bolt loops, lessening the holding power on the channel brace.

Fastening Channel Brace to Supports

7.19 As stated in part 6, channel brace supports are used in CO areas **where** equipment frames are not installed but where it will be necessary to locate cable runway or grid. These channel brace supports may be replaced by equipment frames at a later date.

7.20 The method of fastening channel brace to the channel brace supports for electronic and nonelectronic offices is as follows:

(a) Locate the channel brace section to be fastened to the channel brace support between the predrilled holes in the channel brace support top angle.

NOTE: Cut the channel brace section to the proper length, if necessary, as indicated in the FCR drawing.

(b) Insert the threaded portion of **the** two J bolts through the two pre drilled holes in the channel brace support top angle, if not inserted when the channel brace support was erected (paragraph 6.06). Check that the loops of the J bolts are located over each channel brace section.

(c) Tighten the channel brace section securely in place on the channel brace support top angle by using the lockwashers and hex nuts.

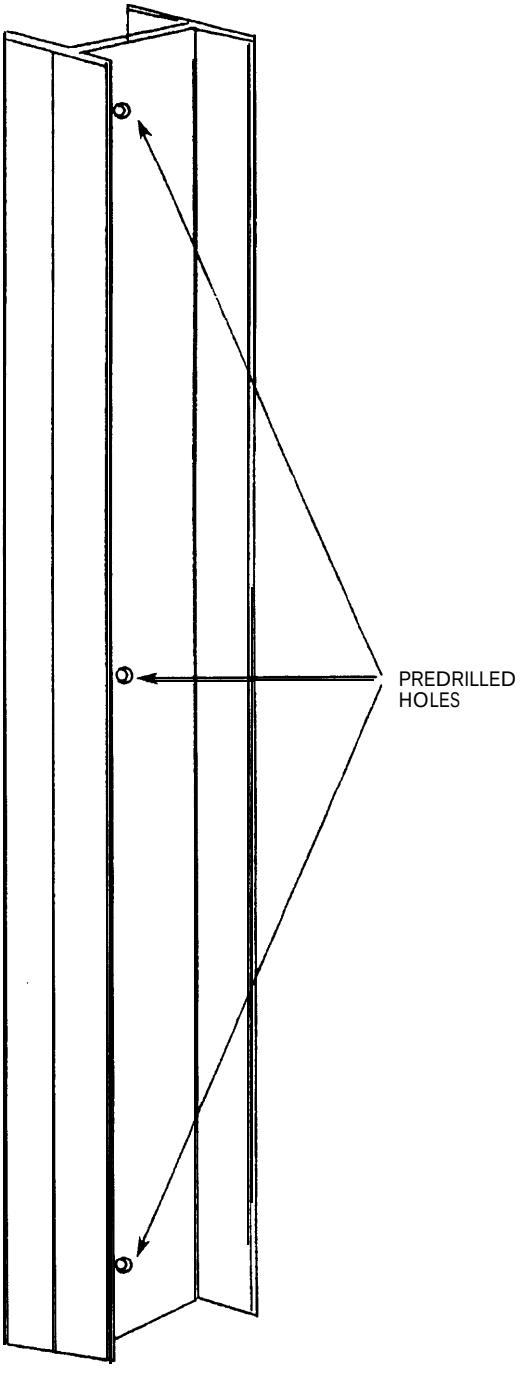


Figure 18. **Predrilled Holes in Upright to Allow Junctioning.**

NOTE: Do not overtighten the hex nuts. This may bend the J bolt loops, thus lessening the holding power on the channel brace.

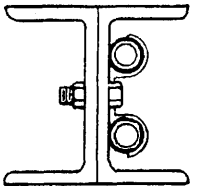


Figure 19. Method of Bolting Uprights Together Where Power Feeders Are Mounted.

Supporting Channel Brace From Office Ceiling

7.21 In some instances, it may be necessary to support some of the channel braces from the office ceiling. Three methods can accomplish this type of channel brace supporting. The site supervisor or installation foreman must determine the most applicable method or methods for the specific office, or as indicated on the FCR drawing. Any of the three methods described in the following paragraphs may be used, as applicable, in electronic or nonelectronic offices with only minimal modifications.

7.22 The following channel support angle method is shown in drawing H-440000-A series:

(a) Refer o the appropriate figure in drawing H-440000-A series and select the section of the main channel brace that is to be used. Cut the main channel brace section to the required length as Indicated on the FCR drawing.

(b) Select and cut a section of support channel brace. Cut the support channel brace to a length that is sufficient to provide support for the main channel brace at the required height in the office.

NOTE: When measuring for the correct length of the support channel brace, allow for the additional lengths of the channel support angles.

(c) Position the main and support channel brace sections. Lay the upper and lower channel support angles in the positions indicated in the H-440000-A drawing (inside the U-shaped channel brace sections). Mark the main and support channel brace sections through the pre drilled holes in both channe support angles.

(d) Remove the channel support angles from the channel brace sections and drill an 11/32-inch hole in each marked location in the channel brace sections.

(e) Secure the upper channel support angle to the top portion of the support channel brace section.

(f) Secure the lower support channel angle to the lower portion of the support channel brace section.

(g) Hold the support channel brace section (with the upper and lower channel support angles attached) onto the office ceiling in the exact location where it is to be attached. Mark the ceiling through the predrilled hole in the upper channel support angle.

(h) Drill the office ceiling in the marked location to accommodate the anchoring device and secure the upper channel support angle to the ceiling.

(i) Support the extending end of the main channel brace section, and secure the other end of the main channel brace section to the lower channel support angle.

7.23 The ceiling bracket and rod method can be used in nonelectronic and electronic office installations. This requires a change in the ceiling bracket. If this method is used in a nonelectronic installation, part No. H-

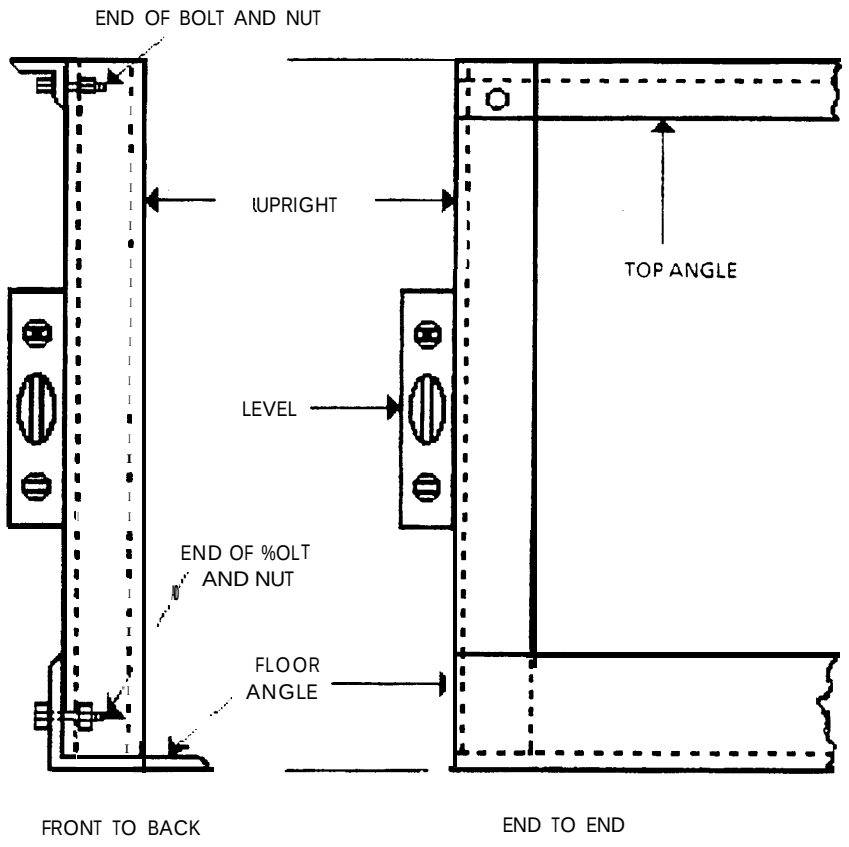


Figure 20. Location of Nuts and Bolts and Level Placements.

CAUTION

TO AVOID A SAFETY HAZARD WITHIN THE OFFICE, REMOVE ANY EXCESS THREADED PORTION OF THE J BOLT BELOW THE HEX NUTS (MORE THAN ONE-HALF INCH). CUT THE EXCESS THREADED PORTION OFF WITH A BOLT CUTTER.

43719-7 ceiling bracket must be used. If the installation is in an electronic office, part No.' **H-43719-9** ceiling bracket must be used.

(a) Select from drawing H-440000-A series, the applicable ceiling bracket that is **to be used** in the particular installation.

(b) Measure the distance from the office ceiling to the height that the section of channel brace is to be placed within the specific office area.

(c) Refer to Table 4 and select the length of threaded rod required for the installation. The threaded rod selected must be of sufficient length to allow completion of the assembly. A rod slightly longer than actually required is recommended.

NOTE: The threaded rod is not (at this time) to be cut to the exact size required. The cutting of the rod may damage the threads on the

Table 4. **Changer Rod Part Numbers and Rod Lengths.**

HANGER ROD GTE CSC PART NO.	THREADED ROD LENGTH	
	FEET	INCHES
H-23296-1	1	9
H-23296-7	0	7
H-23296-8	1	5
H-23296-9	0	11
H-23296-22	1	11-7/8
H-23296-29	0	9
H-23296-53	3	11-7/8
H-23296-59	1	1
H-23296-63	6	0
H-23296-65	7	0
H-23296-80	3	0
H-23296-110	2	6
H-23296-111	5	0
H-23296-116	2	1/
H-23296-124	4	3/4
H-23296-130	3	1/4
H-23296-131	8	0
H-23296-132	3	3/4
H-23296-133	2	3/4
H-23296-143	10	0

rod and make it unusable on the assembly.

(d) Insert the threaded rod through the predrilled hole in the center U portion of the ceiling bracket. Secure the rod to the bracket with two hex nuts.

NOTE: The length of the upper threaded portion of the rod that extends through the U portion of the ceiling bracket must be below the arms of the ceiling bracket so that the rod does not touch the ceiling. The total remaining length of the rod must be sufficient to mount the channel brace at the correct height, considering the balance of the assembly.

(e) Temporarily locate the mounting plate on the threaded rod. The mounting plate must be positioned at the correct height for the equipment in the office area.

(f) Hold the ceiling bracket in its position on the office ceiling using the attached threaded rod. Check that the section of the mounting plate that will eventually hold the channel brace is in the correct location for future placement of the channel brace section.

(g) Mark the ceiling through the two predrilled holes located in the arms of the ceiling bracket.

(h) Remove the ceiling bracket assembly from the ceiling and drill in the marked locations to accommodate the anchoring devices.

(i) Secure the ceiling bracket and assembly to the ceiling.

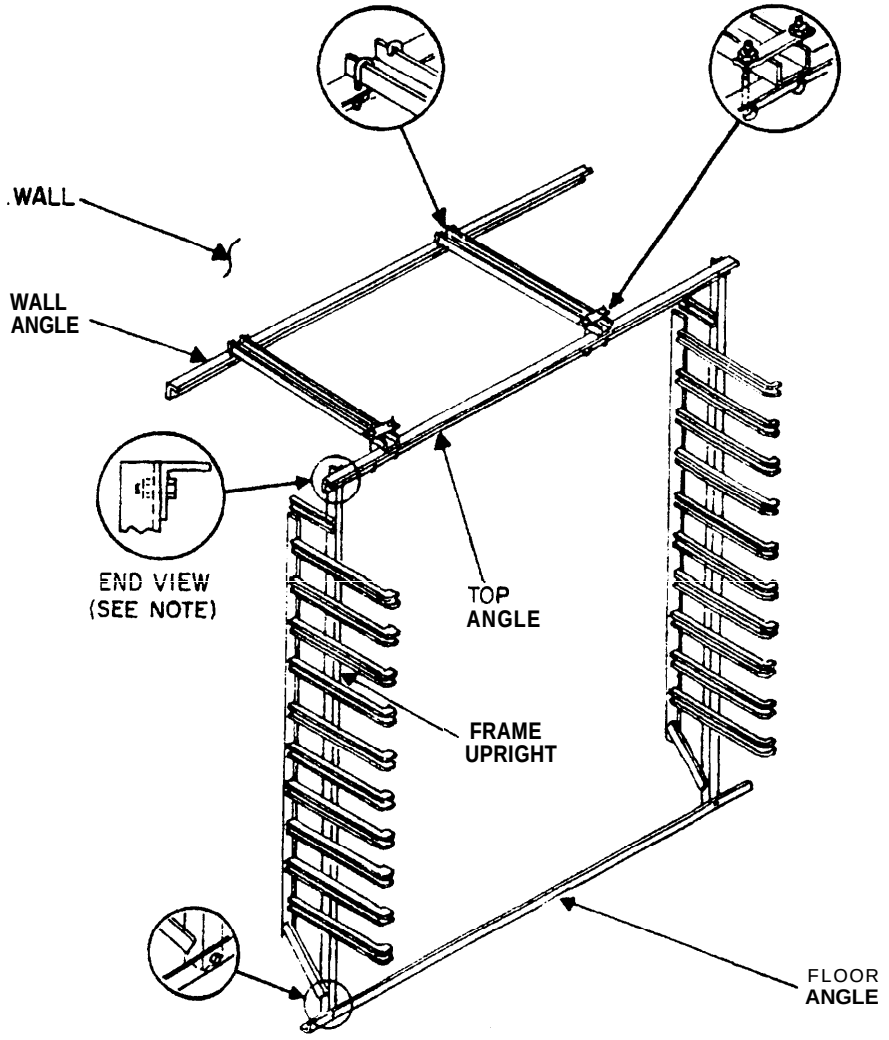
(j) Lay the channel brace section on the mounting plate between the two predrilled J-bolt holes located **in the mounting plate. Support the channel brace section so that it remains on the mounting plate during the balance of the assembly procedure.**

(k) Insert the **J bolts through the predrilled holes in the mounting plate so that the loop of each J bolt grips each edge of the U-shaped channel brace section.**

(l) Secure the J bolts to the channel brace by means of the lockwashers and hex nuts.

NOTE: **Do not over-tighten the hex nuts. This may bend the J bolt loops, lessening the holding power on the channel brace.**

(m) Verify the height of the channel brace section in relation to the other equipment in the office.



NOTE:
THE BOLTS WILL BE PLACED THROUGH THE HOLES SO THE NUTS ARE ON THE INSIDE OF THE FRAME UPRIGHTS.

Figure 21. Temporary Support of Trunkboard Upright With Channel and Method of Using Channel for Temporary Bracing.

Adjust the height, as required, using the lower hex nuts holding the mounting plate on the threaded rod.

7.24 The ceiling inserts are normally placed in the office ceiling by the building contractor during construction of the building. These ceiling inserts are normally spaced at 5-foot intervals within the building (which is the recommended spacing of the channel braces also) and accommodate the 5/8-inch diameter thread of part No. H-23296 (Table 4) threaded rod.

7.25 If the ceiling insert locations meet the requirements of the planned office configuration (refer to the CR and F drawings for the job site), they may be used to erect the channel braces (where applicable) in place of the ceiling bracket and rod method or the channel support angle method. This method can be used in nonelectronic and/or electronic office

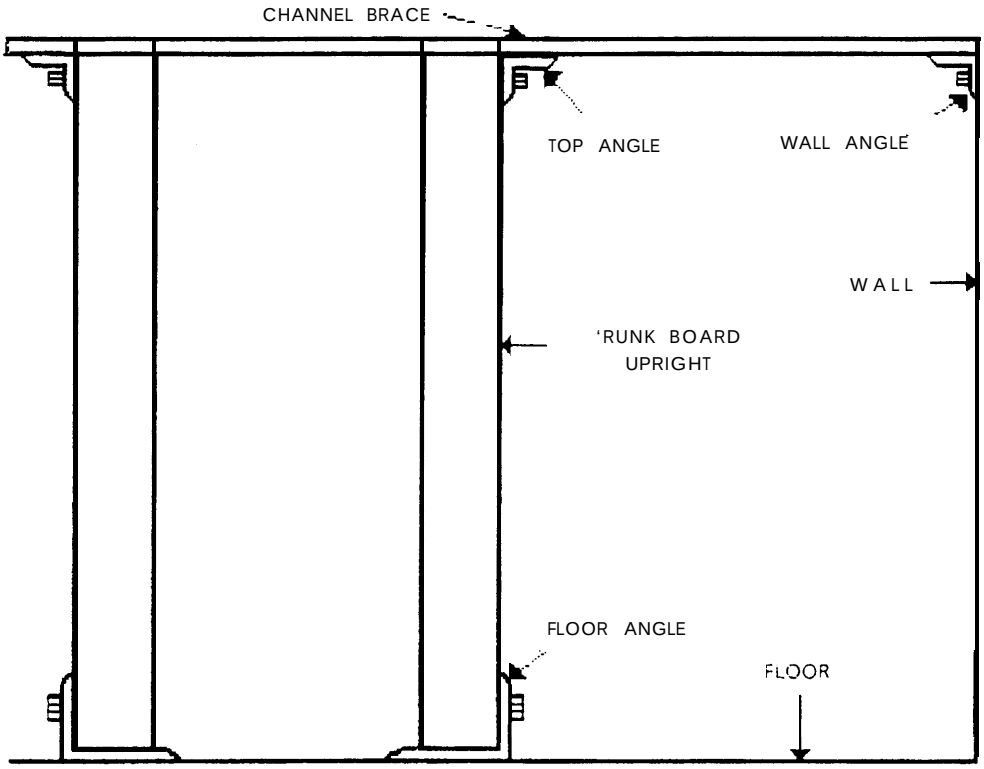


Figure 22. Supporting Uprights and Top Angle With Channel Brace and Wall Angle.

CAUTION
TO AVOID A SAFETY HAZARD WITHIN THE OFFICE, REMOVE ANY EXCESS THREADED PORTION OF THE J BOLT BELOW THE HEX NUTS (MORE THAN ONE-HALF INCH). CUT THE EXCESS THREADED PORTION OFF WITH A BOLT CUTTER.

installations without modification for either type of office. The installation procedure for this method is as follows:

(a) Measure the distance from the office ceiling to the height that the section of channel brace is to be placed within.

(b) Refer to Table 4. Select the length of the threaded rod that is required for the installation. The threaded rod selected must be of sufficient length to allow **the** assembly to be completed. A threaded rod slightly longer than is actually required is recommended.

NOTE: The threaded rod is not (at this **time) to be** cut to the exact length required. The cutting of **the** rod may damage the threads on the rod and make it not usable on the assembly.

(c) Screw the threaded rod into the ceiling insert.

(d) Secure the threaded rod to the ceiling insert by using the **flat**-washer and hex nuts.

(e) Temporarily locate the mounting plate on the threaded rod. The mounting plate must be positioned at the correct height on the rod, so that the channel brace will be

located at the correct height for the equipment in the office area.

(f) Refer to paragraph 7.21, steps (j), (k), (l), (m), and the precautionary note to complete the final installation of the channel brace section by the ceiling insert method.

Junctioning Channel Brace Sections

7.26 Junctioning of channel brace sections may be required in certain areas of an installation. There are two methods of junctioning channel brace sections. The methods are either end to end (to extend the length of the specific run of channel brace) or side to end (to branch one channel brace section perpendicular to another channel brace section in the same plane). Both methods can be used in nonelectronic or electronic office installations.

7.27 The type of junctioning required and the location of the junctioning areas within the office are indicated on the job site CR drawing. Junctioning may also be added (if not on the CR drawing) by the site supervisor or installation foreman based upon the requirements of the office configuration and/or the peculiarities of the actual installation processes.

7.28 Installation procedures for proper cable runway support, and end-to-end and side-to-end junctioning methods for offices is provided in drawing H-440000-A.

8. ERECTING BAY AND FRAME UPRIGHTS

Trunkboards

8.01 To erect a trunkboard after installing top and floor angles, perform the following:

(a) Erect the verticals on each trunkboard and tighten the floor angle bolts supporting the uprights.

(b) Secure the top angles to the uprights. Use a level to be sure the bay is plumb before tightening the bolts.

(c) Form a junction of the bay uprights by placing the 3/8-inch by 16-7/8 inch HHICS and the 3/8-inch by 16-inch hex nuts (Figure 18).

(d) Form a junction of the adjoining bays (using the junction material) by inserting all bolts between the uprights and tighten. The end of the bolt and nut should extend inside the channel or angle of the equipment opposite the side where power feeders are mounted (Figure 19).

NOTE: With all bays in the lineup junctioned together, the last upright should also be plumb. If there is any variation between the first and the last upright, the difference should be split between both ends.

(e) Plumb all trunk board uprights using an accurate level. Place the level vertically in the center of the first upright and plumb the upright front to back and end to end (Figure 20). Tighten the channel braces to the top angle. After all trunk board uprights are plumbed, braced, and completely assembled, make sure all bolts are tight.

8.02 If temporary support is required when erecting trunkboards, short pieces of channel may be used. Support uprights and the top angle as required with pieces of channel attached to the wall angle (Figure 21). For permanent bracing, use preinstalled channel (Figure 22).

Uncrating and Lifting EAX Queen-Sized Frames

8.03 If the Electronic Van Shipment (EVS) method is not used, the gantry can be used for uncrating and lifting the queen size frames.

8.04 If EVS is used, the freight company personnel will position the frames on the office floor. When EVS is not used and the gantry is not available, additional installers may be required to unpack, lift, and position the frames.

Typical Procedure for Moving EAX Frames to Lineups Using the Dolly

8.05 Use the following procedure when moving equipment frames using a dolly:

(a) With the frame standing erect, insert the two sections of the dolly through the space between the bottom frame file and the channel base support (Figure 23).

(b) Position the frame channel base support between each set of J bolts assembled to each section of the dolly. Tighten each J bolt to the closest channel base support flange (Figure 24).

(c) Turn the bolts attached to the wheels of the dolly to lift the frame from the floor (Figure 25).

(d) Roll the frame to its assigned location of the floor, lower the frame and remove the dolly (Figure 26).

Distributing Frame Erection

8.06 Before erecting distributing frame uprights, remove all paint on the uprights where the ground bar will be mounted. In many cases, the portion of the uprights where the ground bar is to be mounted is covered by tape. Remove the tape and determine that the mounting area is not painted and is free of foreign elements before installing the ground bar.

8.07 The location of the distributing frame depends on the location of the outside cable ducts. Figure 6 shows where the distributing frame should be located if the outside cable goes to protectors (type B) or to horizontal blocks (type A).

8.08 When erecting distributing frames after anchoring the floor angles as described in paragraph 4.04, erect the outside (end) uprights and the top angle of each section. A section is the portion of the distributing frame that includes a predrilled floor angle and top angle for a given number of frame verticals (uprights). A section may vary in size depending upon engineered requirements. The intermediate uprights may now be erected individually. Insert all bolts and jumper rings. Refer to drawing H-440000-K for the proper ground isolation material and placement of the ground isolation material when erecting the distributing frame.

NOTE: Do not use temporary bracing of wood or other material (excluding channel) that is not to be part of the complete installation. Permanent bracing is supplied by the previously installed channel and wall angle (parts 4 through 7). When temporary distributing frame bracing is needed, use short pieces of channel attached to the wall angle and the frame top angle, as shown in Figure 21.

8.09 Plumb the distributing frames by using an accurate level on the end uprights. Tighten all bolts and jumper rings after plumbing the uprights.

8.10 Sections of the distributing frame can also be assembled horizontally while resting on the floor and then be stood vertically to be joined.

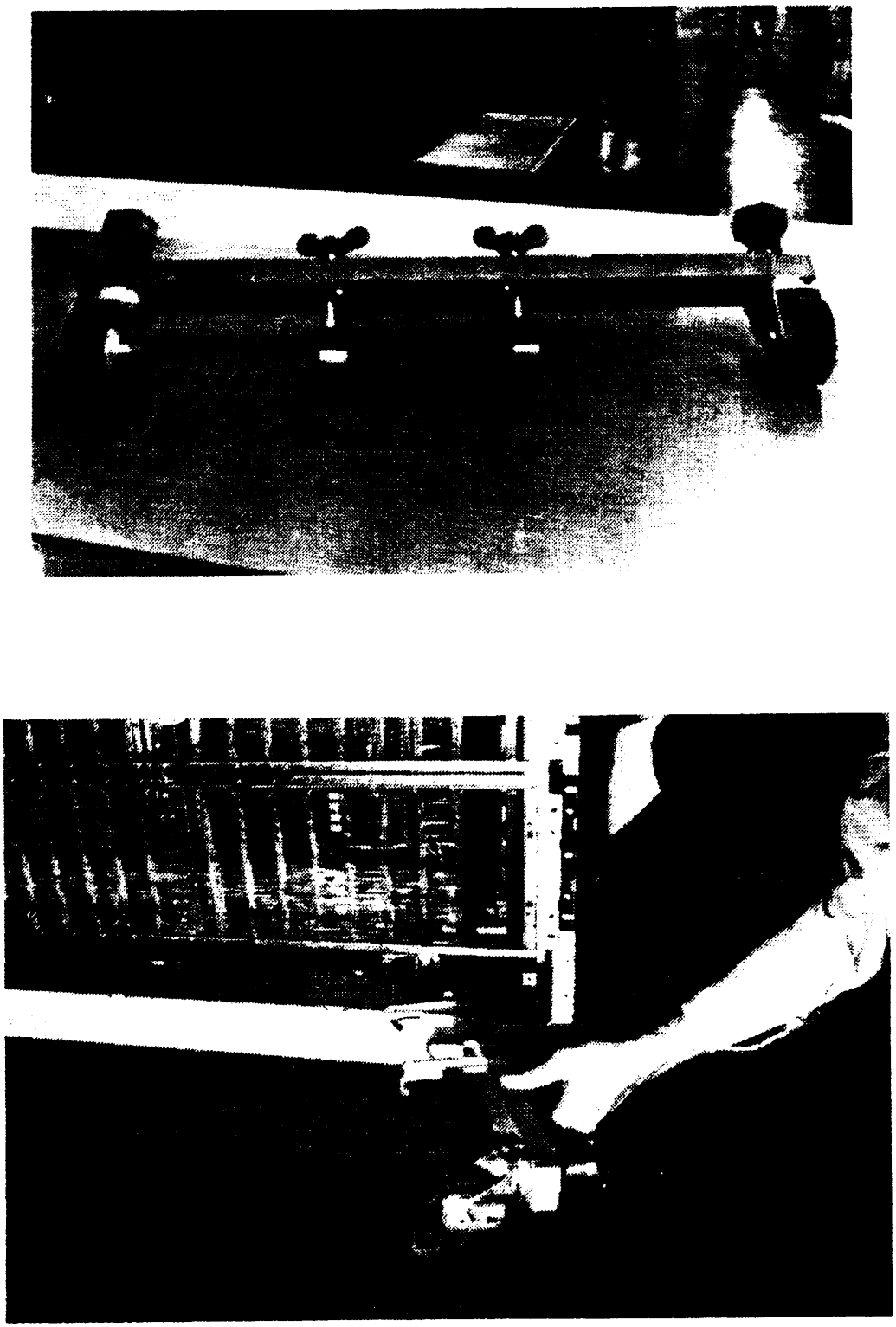


Figure 23. Use of the Dolly, Step 1.

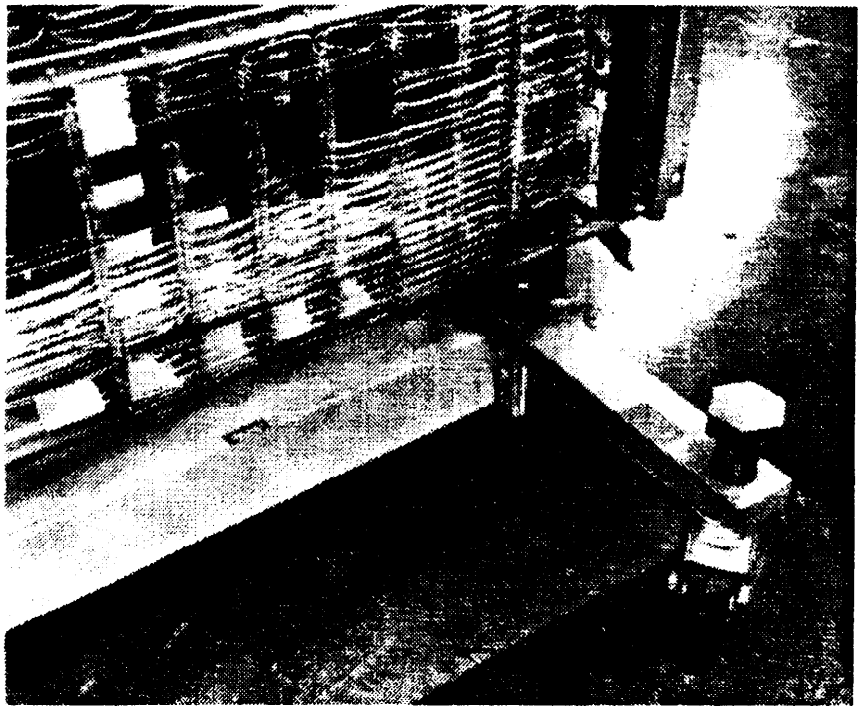


Figure 24. Use of the Dolly, **Step** 2.

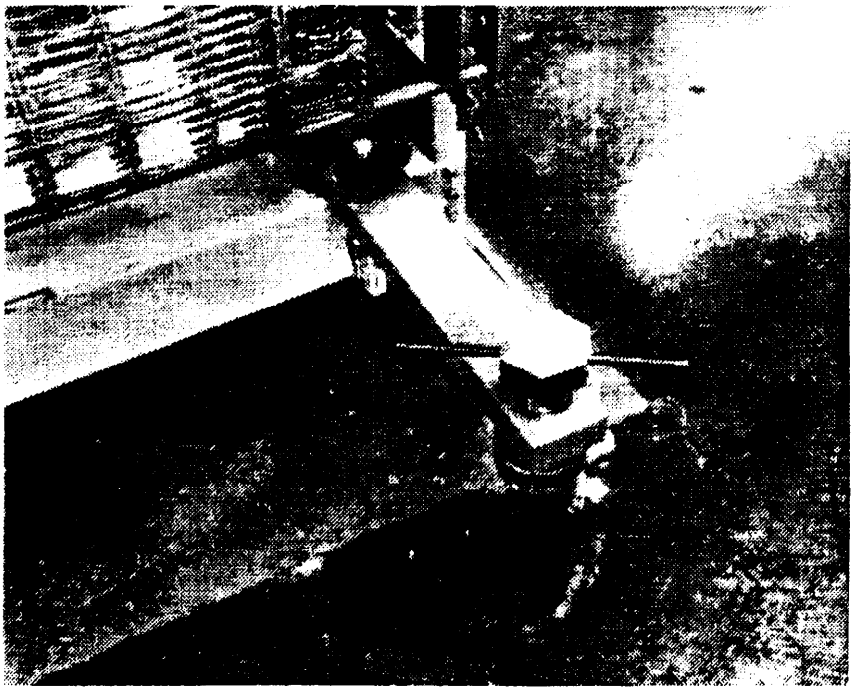


Figure 25. Use of the Dolly, Step 3.

Figure 26. Use of the Dolly, Step 4.

9. MOUNTING ASSOCIATED MATERIAL

9.01 Assemble the guardrails and end guards in accordance with the associated method of assembly drawings and tighten securely. A typical method of using guardrail supports as end guards is shown in Figure 27. In some circumstances, when a bay terminates close to a wall or when two bays terminate near each other but are not adjoining, end guards may not be used and guardrail supports are used if a safety or operational hazard does not exist. When a continuing guardrail is to be installed, use the end mounting hole in the continuing guard rail (Figure 28).

9.02 The correct method of mounting end guards (ladder guards) is shown in Figure 29. In some cases, end guards will not be installed until the other equipmenthas been mounted. This is usually done as a temporary measure during hanging of shelves- or other operations where end guards may hamper installation. In this situation, guardrail supports may be used to support the guardrails until the end guards are mounted. Identify the area as an area of caution with safety lines, safety cones, tiger tape, etc.

9.03 Miscellaneous items, such as designation printed wiring card holders, mounting materials, etc, shall be stored until all wiring is complete or until the items are needed. At this time, these items are assembled on the trunk boards. In some cases, the line finder and connector bank designation card records are not used. If this occurs, they shall be turned over to the coordinator for disposal.

9.04 If protectors, terminater blocks, etc, extend beyond the distributing frame guardrail, contact the Engineering Department immediately for additional corrective action to prevent a potential hazard from developing.

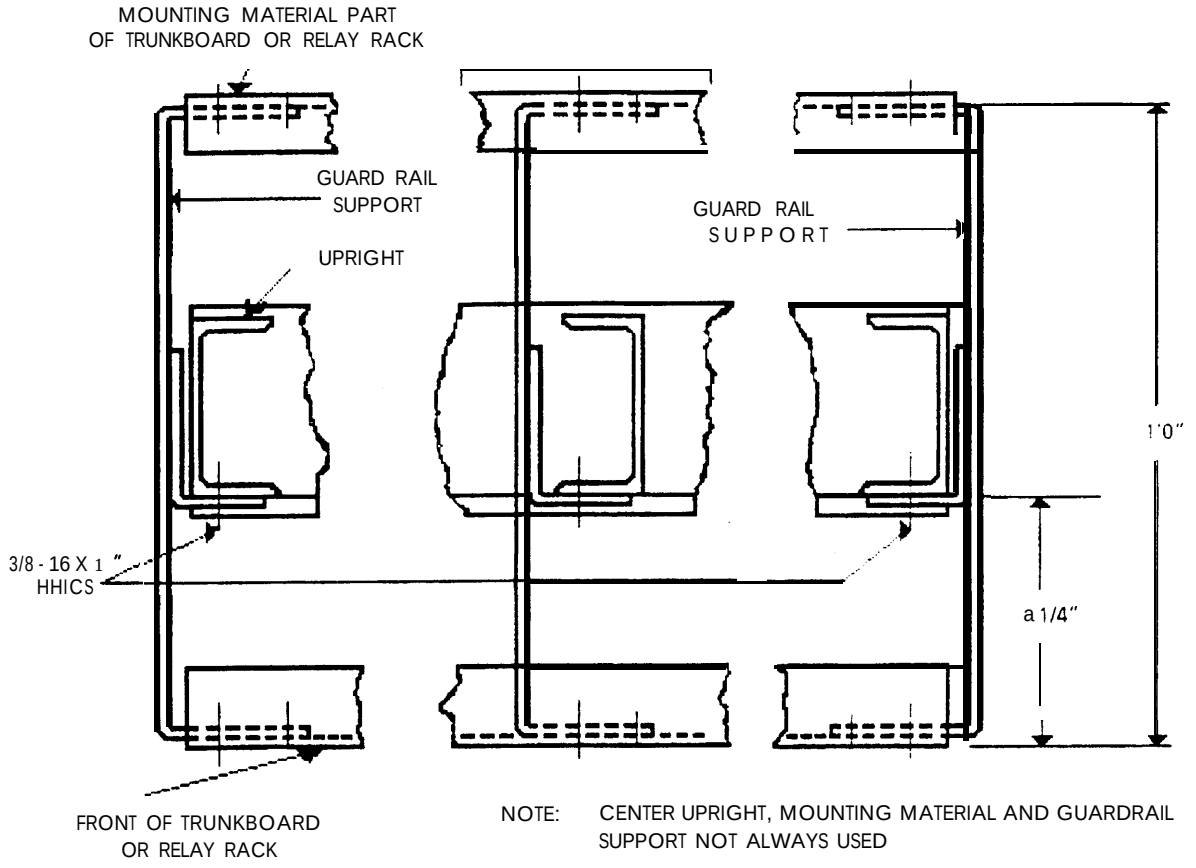


Figure 27. Typical Method of Using Guardrail Support as End Guards.

10. INSTALLING POWER FEEDERS

10.01 The power feeder cables are attached to the bay uprights, routed below the top angle and taped (Figure 30). This method of doubling back the ends of the power feeders and wrapping them with electrical tape is shown in Figure 30. Keep the cables as straight and tight as possible to prevent a loose cable from, being snagged and pulled from position.

10.02 Each battery and ground lead is formed in a pigtail. Pigtails (Figure 30) are made by coiling the cable around a pencil, spudger, or similar object. After all the cable is coiled, remove the pencil or spudger. The pigtails must be located so that they are a slight distance below the fuse panel where they will be connected (Figure 31).

10.03 Figure 3 1 shows power feeders after pigtails are made. In this figure, the first two battery and ground feeders were not secured with cable ties. These feeders will be connected shelves that will be mounted immediately. The bottom three feeders are individually taped then cable tied to keep them out of the working area. These feeders are to remain tied until future use.

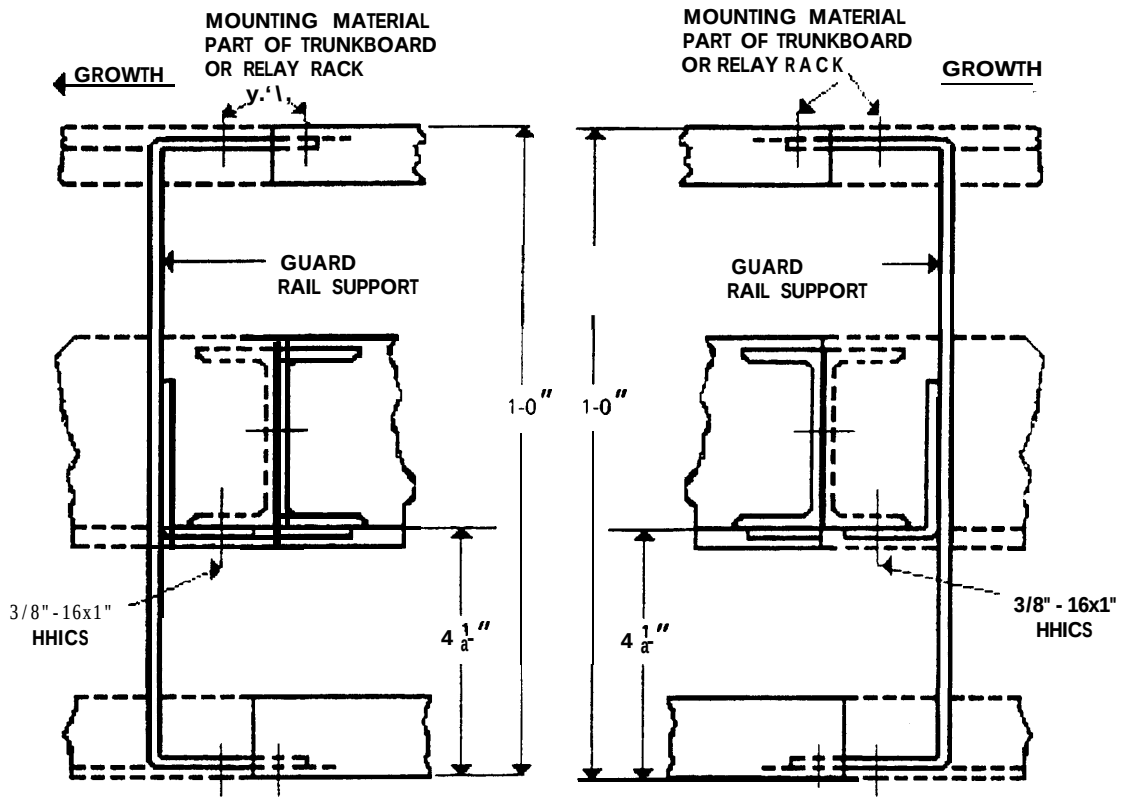


Figure 28. Typical Method of Mounting Guardrail Supports.

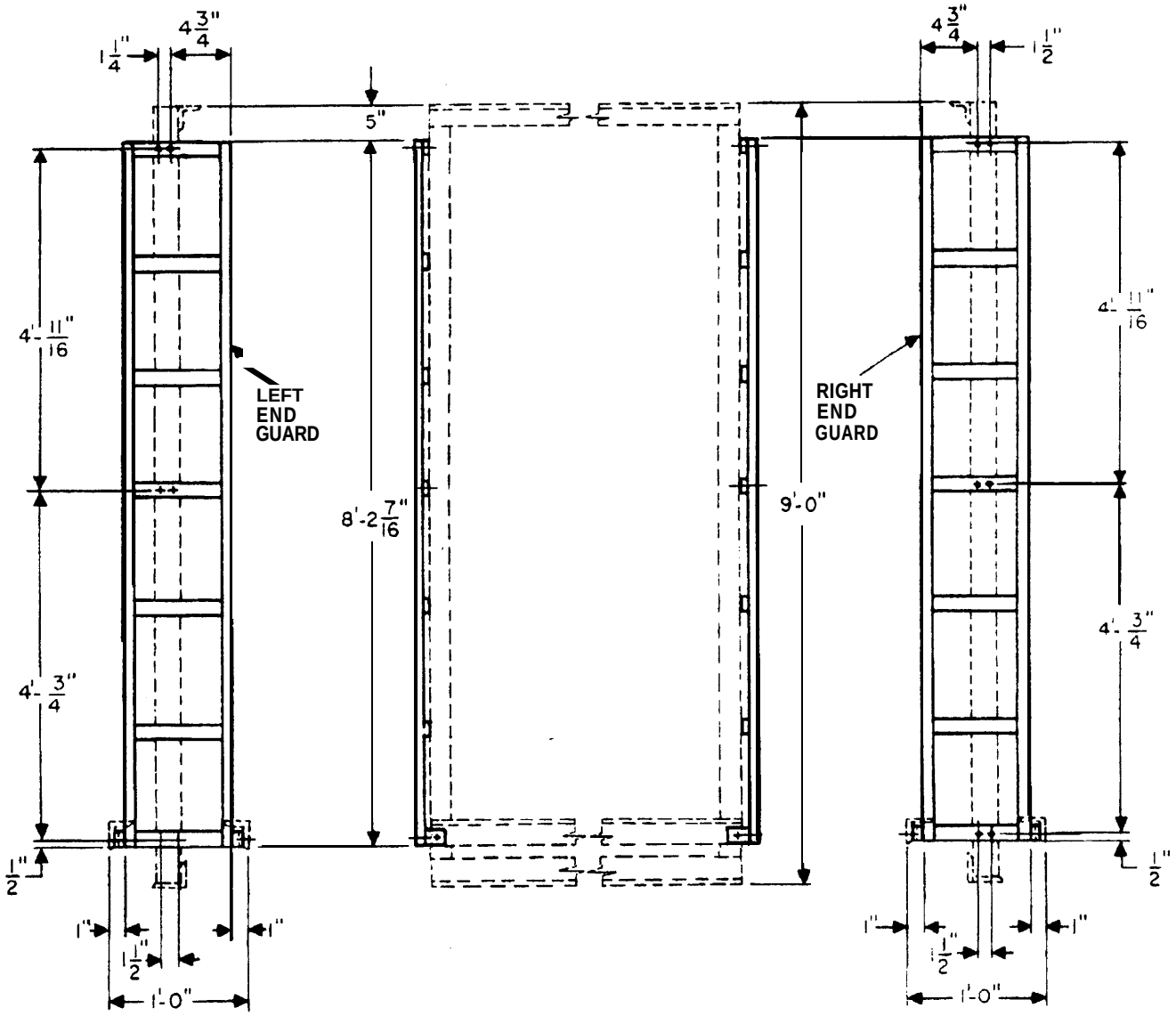


Figure 29. Mounting End Guards.

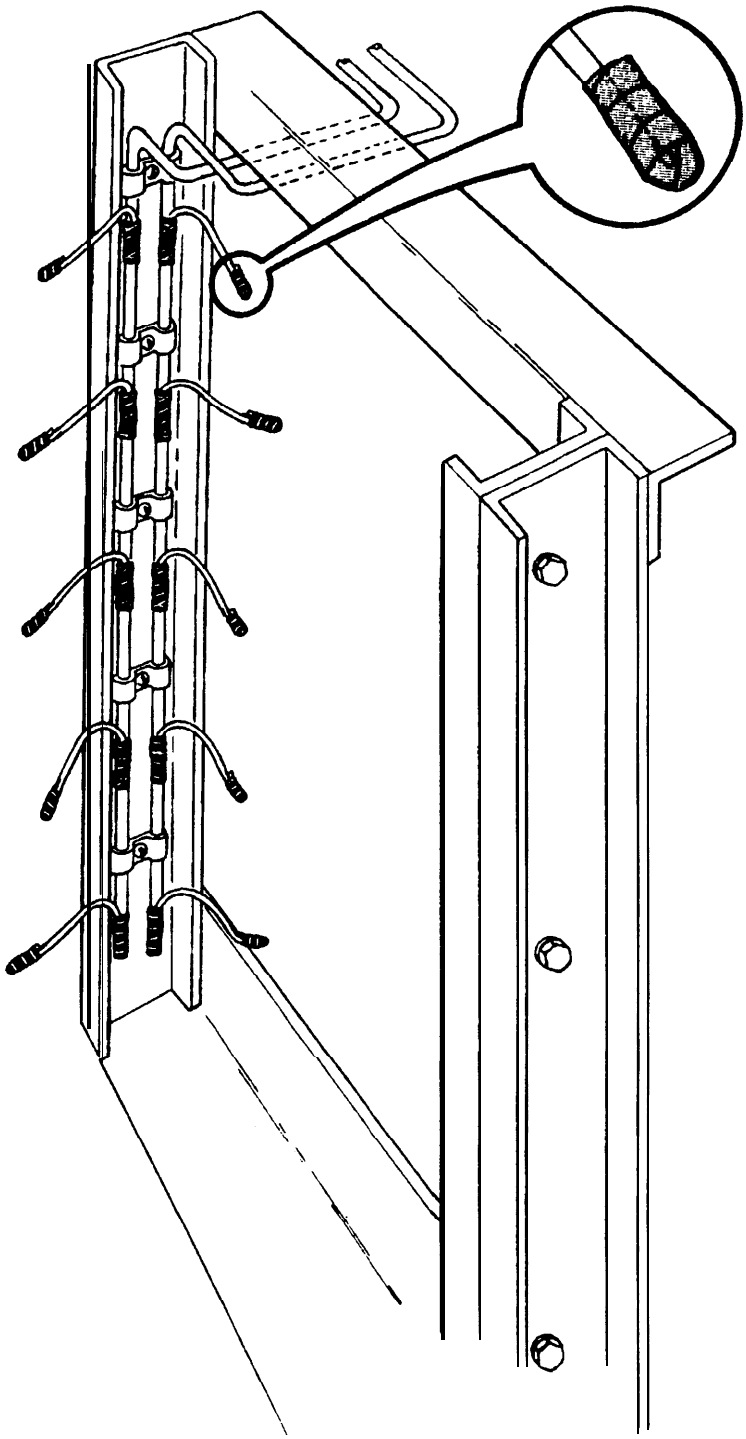


Figure 30. Taping Power Feeder Ends.

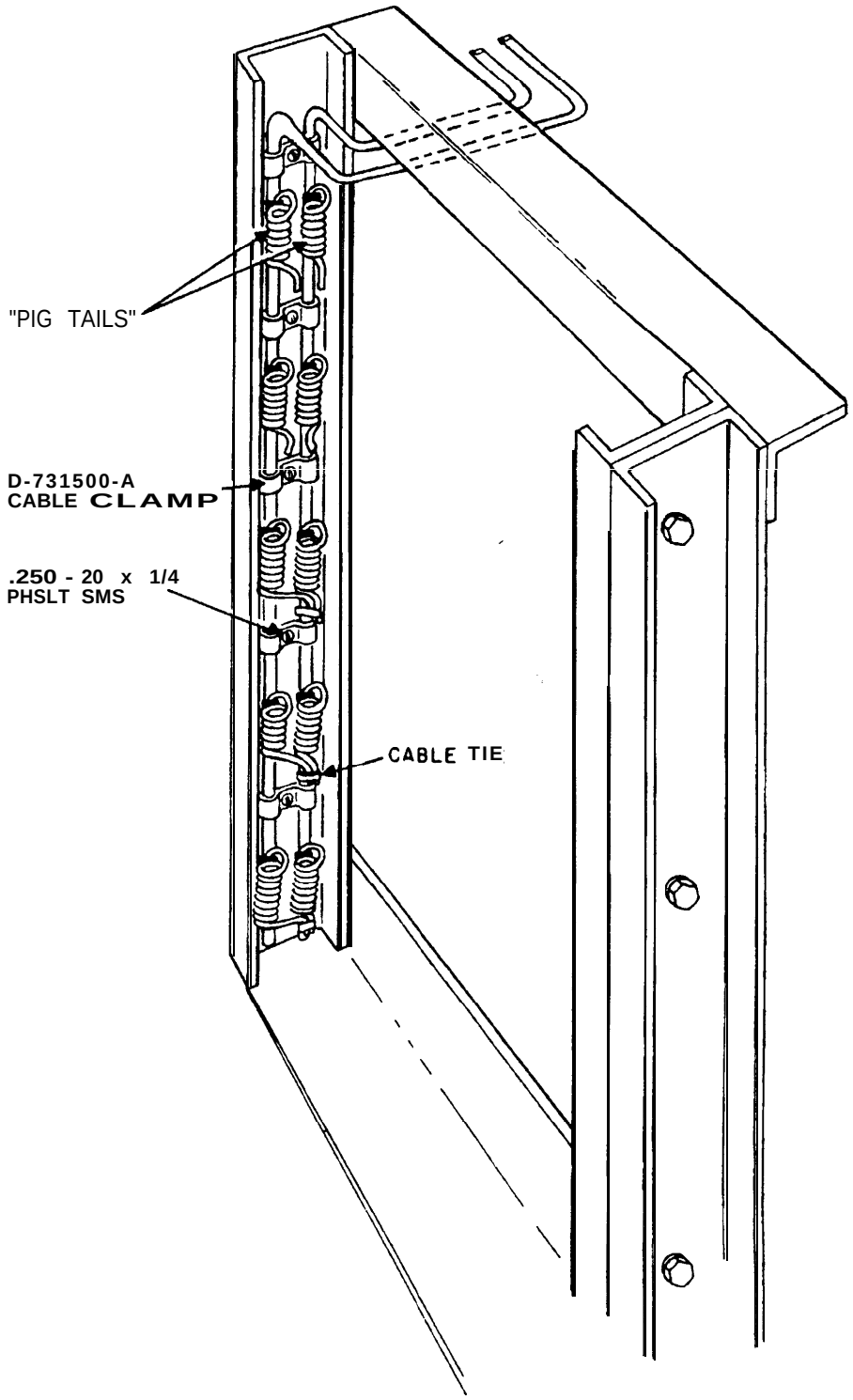


Figure 31. Method of Forming Pigtails.