CHAPTER 15

EQUIPMENT, EQUIPMENT HANDLING, AND CABINETS

This chapter provides information and descriptions of equipment cabinets and racks and related items such as panels, drawers, slides, and hardware used in the mounting of electronics equipments at Naval shore installations. The methods of mounting cabinets and racks to various type floors and bases are covered as well as factors affecting equipment and cabinet ventilation. Also, equipment handling instructions are provided to minimize in-transit damage to all types of electronic components.

15.1 BASIC CABINET STRUCTURE

Equipment cabinets are constructed in various widths to accommodate specific size panels (19-inch, 24-inch, 30-inch) (see figure 15-1). The 19-inch panel is most commonly used. Cabinets are available with depths of 18 and 24 inches.

The basic cabinet framework has a box skeleton configuration constructed of heavy gauge steel channel (usually 14 or 16 gauge). Two sets of vertical panel-mounting rails or angles are normally supplied with a cabinet. These rails may be permanently attached to the framework, or they may be adjustable from front to back to accommodate various cabinet accessories.

Mounting rails are drilled and tapped for machine screws. These tapped holes are spaced to permit attachment of standard panels. (See figure 15-2.) Additional rails may be installed in most cabinets, if required. Panels, sides, doors, and other cabinet components and accessories (discussed in later paragraphs of this chapter) are attached to the basic frame to form a complete cabinet. Vertical side supports or stiffeners are often attached to the basic frame to give added strength.

15.2 STANDARD NAVY CABINETS

15.2.1 Cabinet CY-597A/G

The CY-597A/G cabinet (figure 15-3) is a standard cabinet used extensively throughout the Navy shore communications facilities for the housing of rack-mounted electronic equipment. The cabinet is 86-3/4 inches high, 22-3/8 inches wide, and 24 inches deep and is usually mounted on a 4 x 4 wooden platform in accordance with the installation details shown on NAVELEX standard plan No. 01 00328. The panel mounting space is 77 inches high for the standard 19 inch rack panels. The cabinet is equipped with seven horizontal mounting rails, spaced 10-1/2 inches apart, to permit the attachment of adjustable, vertical mounting rails. A cable hanger, a vertical power outlet strip with 12 outlets (wiremold plug-in channel), an AC power outlet box with a front-mounted convenience outlet, and a switch panel assembly are part of the basic unit.

The switch panel assembly contains fuses, switches, and additional power outlets. A trouble light, fed from the switch panel, is also provided. This cabinet, finished in bonderized gray enamel, has a rear door, side panels, and a roof panel with ventilators. A front door is not provided with this cabinet. A cable duct is mounted on top of the cabinet at the rear.

15.2.2 Cabinet CY-614/G

The CY-614/G cabinet (see figure 15-3) is essentially the same as the CY-597A/G with the exception that doors are mounted both at the front and the rear. Each door can be locked thereby providing a means of limiting access to the interior of the cabinet to designated individuals.

15.2.3 Cabinet CY-2675/G

The CY-2675/G electrical equipment cabinet is a knock-down version of the standard cabinet which can be assembled on site. It is supplied in the knock-down version to reduce shipping costs to overseas locations. The basic components consists of 1 top assembly, 1 full door, 2 side frames and panels, 1 bottom section and optional features such as AC power outlets, wired junction box, and right hand and left hand slides. When completely assembled, it has the identical overall and inside dimensions of the CY-597A/G. It may also be used as an open-type rack by omitting the two side panels and door. The cable entry can be made in the base or at the top of the cabinet.

15.3 OTHER EQUIPMENT CONFIGURATIONS

15.3.1 Open-Type Relay Rack

Open-type relay racks (figure 15-4) are used to mount electrical equipments and assemblies when an enclosure cabinet is either not available or unnecessary. The racks consist of two vertical panel mounting channels with a base and supporting angle brackets and straps. The racks are available in several standard sizes. The nominal rack heights and panel clearance heights for each size are listed in table 15-1. The rack may be bolted to the floor or used with casters. The standard open-type rack in general use throughout Navy installations is the RR-197 rack.

15.4 RADIO OPERATOR'S DESK

The standard radio operator's desk is approximately 39 inches wide and 35 inches deep. A typical CW operating position is shown in figure 15-5. The equipments installed in the rack situated above the desk would normally include one or two radio receivers, a transmitter control unit, a receiver control unit, and a loud-speaker amplifier unit. A telegraph key would be mounted on the right side of the desk, a typewriter in the center well of the desk, and a headphone jack on the left leg of the desk.

15.5 CABLE ENTRY TO CABINETS

Power and signal cables may gain entry into the cabinets from ducts, conduit or ladder type trays mounted on the top of cabinets or from cable troughs built in the wooden base of the cabinet or floor. Most cabinets have removable panels or knockouts in various parts of the cabinet to permit cable entry. See paragraph 15.12 for a further discussion of cable ducts.

15.6 POWER OUTLETS

The power outlets available in the equipment cabinets include a vertical strip with 12, 110 VAC, outlets inside the cabinets and a convenience outlet at the front base of the cabinet. Another outlet is available at the rear as part of the SA/238/G. A modification to the CY-614/G is sometimes performed which separates the non-technical convenience outlet panel from the technical equipment convenience outlet strip thereby reducing equipment downtime. Figure 15-6 illustrates this modification.

15.7 EQUIPMENT HANDLING

Improper handling of electronic equipment will cause serious damage to the integral components of any electronic unit. The following paragraphs will aid the installer in the identification of crated equipment, provide typical procedures for proper carrying and hoisting, and give instructions for correct methods of uncrating and unpacking.

CAUTION

Electronic personnel should be in attendance to advise the rigging personnel of any improper handling procedures during the entire installation phase.

15.7.1 Marking of Equipment

a. General. The following military standards and specifications contain the guidance and instructions regarding the packing, packaging, preservation, and marking of military supplies. Electronic equipment handling and marking instructions are contained in these documents and in other specification for specialized items such as electron tubes, klystrons, or magnetrons.

MIL-STD-129, "Marking for Shipment and Storage"
MIL-P-116, "Methods of Preservation"
MIL-E-17555G, "Packaging and Packing of Electronic and Electrical Equipment"

b. Batteries. When electronic equipment contains a battery, the type will be plainly marked directly under the description of the crate contents as shown below:

(1) Wet battery charged

(2) Unfilled battery - not charged

(3) Unfilled battery - charged

(4) Dry cell battery

Note that cells or units of cells of substantial weights are usually packed in individual cartons and strapped to a wooden pallet. Cut the cartons and lift the cell by the use of a sling placed beneath the cell, and a spreader block to prevent crushing. (See figure 15-7.) Never lift a battery by the cell posts.

c. Electrolyte. When battery electrolyte is shipped, the crate or carton will be conspicuously marked with the words "CONTAINS ELECTROLYTE CORROSIVE LIQUID PACKED IN ACCORDANCE WITH DOD REGULATIONS." All necessary safety precautions warning workers of the principal hazards of the electrolyte should be posted.

d. Center of Balance and Sling Points. When crates are over ten feet in length, or when a crate is an unbalanced load, the crate shall be marked with a 1/2 inch wide vertical line on both sides of the bottom edge of the crate. This line shall be marked with the phrase "CENTER OF BALANCE" and should be slung from these points for lifting purposes. Uncrated items will be conspicuously marked with the words "SLING POINTS."

e. Magnetic Materials. Crates suitable for air shipment containing magnetron tubes, magnetron magnets, and magnets will be conspicuously marked on two opposite sides with a red "CAUTION" label and white lettering as shown in figure 15-8A.

Crates not suitable for air shipment containing magnetron tubes, magnetron magnets, and magnets will be conspicuously marked on two opposite sides with a red "CAUTION" label and white lettering as shown in figure 15-8B.

It should be noted that certain types of magnetrons must be kept away from ferromagnetic articles, such as steel tools, table tops, floors, etc. Each tube of this type has a warning label to indicate the minimum proximity permissible for ferromagnetic materials. Although the magnetron magnet is stabilized prior to shipment, it can be demagnetized by severe mechanical shock or being in close proximity to ferromagnetic materials.

15.7.2 Uncrating

a. General. Electronic equipment is carefully packed in crates and other types of containers to avoid damage. The fragile nature of electronic equipment necessitates the use of many types of cushioning, strapping, nailing, and shoring to prevent damage. The same careful attention given during crating is required in dismantling the shipping containers in order to avoid damage to the equipment.

b. Uncrating Sequence. All equipment manufacturers and Navy manufacturing facilities are required by the various packaging specifications to package and crate equipments and/or systems in a logical sequence that will expedite the installation process. It is beneficial, therefore, to arrange the shipping containers in "box number sequence" to expedite the installation effort by virtue of the pre-planned packaging scheme. The shipping manifest should be checked off on an "item-by-item" basis to assure that all containers have been accounted for prior to the start of the installation effort.

c. Equipment Handling. When the equipment to be handled is excessively heavy, a hoist must be used to lift the cabinets from the pallets or cases. When a hoist is not available, the uncrating area should be large enough to permit an adequate number of personnel to lift and handle the equipment safely.

d. Removing Straps and Bands. Straps and bands should be removed from the crates through the use of tin snips. Caution should be exercised in this operation to avoid the backlash of the straps and bands. Do not use pinch bars to break the straps or bands. Nails should be removed from the top and at least three sides of the crate with a nail puller. Do not use a hammer or a pinch bar to remove nails. Remove the vapor barrier bag or paper and carefully inspect the equipment for in-transit damage. All damaged or missing parts should be properly documented and forwarded to the cognizant authority. If the equipment is mounted on a pallet, leave it in place until such time as the equipment is in its final resting place.

e. Storage. During the interim between uncrating and final installation, the electronics equipment should be protected from harmful elements and unnecessary further handling. Cushioning and protective packing material should be left in place if possible until just before final installation. In addition, the equipment should be covered with canvas cloths or plastic bags to keep out such elements as sand, dust, or dirt.

f. Salvage. All crates, crate sides, and cardboard containers which housed the electronic equipment during shipping should be turned over to the base supply department for possible future shipping use. Those containers designed specifically to provide in-transit protection to delicate or "warranty type" electronic equipment should be retained on-site. In the event the delicate or warranty type equipment must be re-shipped, re-use of the original shipping container will preclude any manufacturer warranty violation claims regarding poor packaging practice.

15.7.3 Carrying

Electronic equipment must be protected against damage due to undue force or exposure while in transit. Damage, no matter how slight, affects the useful life span of the equipment. In extreme cases the equipment may be damaged beyond repair.

a. Forces. Some types of damage which may result from hazardous forces encountered in handling during loading, unloading, or transit operations are:

- o Manual Handling. Dropping and puncture
- o Forklift Truck Handling. Dropping and puncture
- o Cargo Nets. Dropping, crushing, and twisting
- o Grab Hooks. Crushing and puncture
- o Slings. Crushing, dropping, and wracking
- o Conveyors. Jarring, smashing, and dropping.

b. Exposure. Exposure to the different climate conditions and weather hazards such as high humidity, rain, salt spray, extreme cold, dry intense heat, and the cycling of these weather conditions will tend to accelerate the breakdown or deterioration of unprotected equipment. Protection from these conditions must be furnished by the use of proper protective materials while the equipment is in transit.

c. Cushioning. The proper use of cushioning materials will provide protection from physical and mechanical damage. Resilient or elastic materials will absorb energy caused by shock and vibration from external sources. The more important functions of cushioning are:

(1) Impact Shock Absorption. The shock energy is absorbed as the cushioning material is compressed. The extent of absorbing shocks will depend upon the degree of compressibility of the cushioning material and the thickness in which it is used.

(2) Force Distribution. The damaging forces are distributed over a larger area, thus reducing the energy concentration at any one point on the equipment.

(3) Movement and Vibration Limitation. Cushioning, when properly used, limits free movement of the equipment and tends to dampen vibrations due to external forces.

(4) Surface Abrasion Prevention. Proper use of cushioning will prevent abrasion or other damage to the external finished surface of the equipment.

d. Precautions. When moving the equipment onto the truck, care should be taken to prevent damage to the equipment and injury to personnel. Weight alone is not an indication that the service of a rigger is required. Size also must be taken into consideration. It is evident that a light and large and bulky equipment cannot easily be handled by one man. A weight of 50 pounds for one man, or 100 pounds for two men is usually considered as a safe limit for carrying. When lifting a piece of equipment, bend the knees, keep the back straight, and lift with the legs. Lifting in this manner will prevent back strain.

15.7.4 Hoisting

Hoisting of electronic equipment should be done by qualified riggers under the supervision of electronic engineers.

a. Rigging. Riggers should perform the actual rigging of the electronic equipment while it is still aboard its means of conveyance (i.e., truck, ship, airplane).

(1) Sling Installation. Eye-bolts alone should not be used for hoisting purposes. Slings, preferably comprised of wire rope, should be taken under and around the equipment to prevent pulling out at the eye-bolts and to prevent it from slipping. A "tag" or steadying line should be attached to the equipment to move it while it is out of reach. See figure 15-9 for a typical sling arrangement.

(2) Protection From Slings. Where slings fit against the equipment they should be covered with leather, canvas, or rubber hose. Any special devices available should be used for hoisting. Where finely machined surfaces are encountered, zinc strips, lead-lined clamps, or clean manila line should be used.

(3) Spreaders. Spreaders should be used on the slings where practicable. Spreaders are used to prevent the lashings from pressing against the equipment caused by the strain of lifting.

(4) Mousing. The shackle or eyesplice should be secured to the hoof of the hoist and the hook "moused." "Mousing" the hook consists of tying off the open end with a few turns of marlin or line.

b. Equipment Transfer. Every effort should be made to perform the equipment transfer in close proximity to its final destination. When hoisting procedures must be abandoned due to obstructions of one kind or another, dollys and chain falls should be on hand to transport the electronic equipment to its final destination.

c. Scaffolding. It should be noted that when a particular installation requires scaffolding, a safe work platform should be in place prior to the hoisting operation. Equipment manufacturers'recommendations for the type of scaffolding required should be closely followed and at the same time good safety practices should be observed.

15.8 METHODS OF MOUNTING EQUIPMENT

There are many fastening devices, used for anchoring equipment to walls and/or floors available on the commercial market. (Chapter 14 of this manual discusses the various fastening devices utilized in anchoring equipment to mobile or transportable installations.) Equipment anchoring discussions will cover, in the main, those techniques presently in use for the various types of masonry encountered in the field. It should be noted that the holding power of a fastener is directly related to both proper installation of the fastener and the compressive strength of the concrete or masonry. (Masonry fasteners are rated by their "Proof Test Loads." Most Standards recommend one-fourth (1/4) of the proof test load as a safe working load. Ratings are based on a fastener properly installed in a good grade of concrete of 2,000 psi compressive strength.)

Where the static load or shock load is excessive, or where the actual load is doubtful, use additional fasteners to insure secure anchorage of the installation.

The following paragraphs discuss some of the more commonly used masonry fastening devices.

15.8.1 Lead Expansion Anchors

Lead expansion anchors (see figure 15-10) are for general purpose use, medium duty and are designed for use with standard machine screws or bolts. Table 15-2 provides information regarding typical proof test loads and the various sizes available. They are installed as follows:

- STEP 1. Select the proper concrete drill for the size of expansion anchor bolt to be used. (See table 15-2.)

- STEP 2. Drill a hole 1/8 inch deeper than the length of the expansion anchor. Either a hammer-driven star drill or a power-operated drill motor with a carbide twist, masonry drill may be used.

- STEP 3. Insert expansion anchor into hole.

- STEP 4. Place the end of the setting tool in the anchor. Expand the lead sleeve of the anchor by several light taps of a hammer on the setting tool

- STEP 5. Install a washer on the bolt and insert the bolt into the anchor. (Be careful to select the proper size bolt as too long a bolt will loosen the shield.)

15.8.2 Toggle Bolts

Toggle bolts (see figure 15-11) are used to anchor an item to a hollow wall or ceiling. When the mounting surface is composed of something other than masonry block, consideration must be given to the ability of the plaster or gypsum board or other like material to support a given load. Table 15-3 provides information regarding typical proof test loads in masonry and the various sizes available. They are installed as follows:

- STEP 1. Locate the anchoring points

- STEP 2. Select a toggle bolt that will provide adequate anchoring strength for the item to be fastened. (See table 15-3.)

- STEP 3. Drill a hole that is just large enough to permit passage of the toggle bolt wings through the wall

- STEP 4. Remove wing portion of toggle bolt, place a washer on the toggle bolt, insert the bolt through the item to be mounted, and screw the bolt into the wings a few turns

o STEP 5. Push toggle bolt wings through hole in wall.

o STEP 6. Tighten toggle bolt. It may be necessary to pull the toggle bolt against the wall to prevent the wings from turning during initial tightening.

o STEP 7. When the toggle bolt must be completely removed, the bolt is unscrewed from the wings. The wings drop into the wall space. A new toggle bolt must then be used for re-installation.

15.8.3 Lag Screws

Lag screws (see figure 15-12) may be used for anchoring equipment in studded hollow walls or floors by locating the stud and screwing the lag screw directly into the stud. Lag screws, when used with expansion shields, also provide a means for anchoring in masonry. Installation of lag screws with expansion shields is as follows:

o STEP 1. Select the proper concrete drill for the size expansion shield to be used. (See table 15-4.)

o STEP 2. Drill a hole to a depth equal to the length of the expansion shield plus a (1/2") or more.

o STEP 3. Clean out the dust and cuttings in the hole.

o STEP 4. Place the expansion shield, ribbed end first, into the hole. The protruding portion of the expansion shield should be hammered into the hole until flush with the surface.

o STEP 5. Position the item to be anchored over the expansion shield and screw-in the lag screw. The lag screw will begin to tighten before the head of the lag screw makes contact with the item being fastened. At this point, drive the shield deeper into the hole by hammering the head of the lag screw until it makes contact with the item being fastened.

o STEP 6. Retighten the lag screw to complete the expansion of the shield and to secure the item being anchored.

15.8.4 Self-Drilling Anchors

Self-drilling anchors (see figure 15-13) consist of a tubular steel expansion shield with drilling teeth and a cone shaped expander plug on one end and internal threads on the other. The flush end type is designed for hand tool installations while chuck end, rod hanger, and tie wire types are designed to be used with power tools. (See table 15-5.) The following steps describe the installation procedure when using an air or electric impact hammer. (See figure 15-14.)

o STEP 1. Select the desired anchor and insert in chuck. Drill until chuck is 1/16 inch from surface of concrete. Rotate the chuck handle back and forth while drilling to clear chips and dust.

o STEP 2. Lift the hammer, with the anchor still attached, and run it briefly to dislodge the cuttings from the core. Clean out hole. Insert the cone shaped expansion plug in the tooth end of the anchor.

o STEP 3. Tap the expansion plug lightly to hold the plug in place and reinsert the anchor in the hole. Do not rotate the chuck and drive the shield fully into the hole with the impact tool.

o STEP 4. Remove chuck from hammer and break snapoff end of the anchor with lateral movement of chuck handle. A sledge or hammer must be used for shields 1/2 inch or larger.

15.8.5 Explosive-Set Studs

Studs (see figure 15-15) set in masonry by an explosive charge may be used for anchoring medium and light weight equipments. Because the explosive charges must be selected for each application, their use must be limited to qualified personnel only.

15.9 INSTALLATION OF CABINETS

A floor plan or equipment layout drawing shall be referred to in determining where the equipment is to be installed. The floor should be measured and marked with reference lines to show the precise location of the cabinets. The anchoring locations for the wooden nominal 4-inch x 4-inch bases will be marked and the bases installed in accordance with the engineering drawings and instructions listed on NAVELEX Standard Plan 0100328. The anchoring devices or holes for the cabinet are then installed prior to placing the cabinet on the base. The equipment cabinet is then installed as follows:

o The cabinet is moved to the installation position, exercising care to avoid personal injury or damage. Material handling equipment must be used in the case of heavy cabinets. The cabinet is then placed on the mounting anchors. Adjoining cabinets shall, if possible, be bolted together as shown in figure 15-16.

o Install the hardware in the anchor inserts but do not tighten completely.

o Align the cabinet with the chalk base lines.

o Attach a plumb bob to the upper horizontal member. The attachment point should be near a vertical corner member. (See figure 15-17.)

o Measure the distances from the plumb bob string to the vertical member at the top and at the bottom of the unit. If the measurements are not the same, use shims under the base to level the cabinet.

o Secure and tighten all anchor fasteners and verify that the equipment plumb has not changed during the tightening procedure.

15.10 INSTALLATION OF OPEN-TYPE RACKS

Open-type relay racks are received in disassembled condition. An inventory should be made to verify receipt of all component parts. Reference should be made to floor plans or equipment layout drawings to determine the installation location of the rack. The installation should proceed as follows:

- o Measure and mark the floor with reference lines; install anchoring devices for the wooden base for the rack. Fasten wooden base securely to floor
- o Place the rack base on the wooden platform and align the rack base using a spirit level to determine if the base is level. Use shims to level the base, if necessary
- o Fasten the rack base securely to the wooden base by tightening all anchor fasteners
- o Attach the vertical upright sections to the base using the hardware specified in the assembly drawings
- o Attach the top section to the vertical uprights
- o Plumb the erected rack and securely tighten all assembly bolts
- o Install any horizontal or angle supporting structural members indicated in drawings or specifications
- o Touch up the floor bay and rack frame with matching paint, if required.

15.11 INSTALLATION OF CABINET ACCESSORIES

Cabinet accessories such as panels, brackets, doors, sides, and slides are attached to the basic cabinet frame. The specific application of the cabinet determines which accessories are required.

Proper selection of machine screws is critical since most cabinet accessories are manufactured to close tolerances. The proper screw size for most accessory mounting is 10 x 32 UNF2A x length required. Use of improper machine screws can create major fitting problems. Items to be considered during machine screw installation are as follows:

- o Do not permit machine screws to extend beyond nut or mounting rails by more than 1-1/2 to 3 threads
- o Use oval head machine screws with fiber washers to mount panels. For small panels, the use of pan head screws is adequate
- o When specific hardware is not designated by the accessory manufacturer, selection may be made by reference to chapter 3.

o Do not drill additional holes or enlarge existing holes in the mounting rails without obtaining the concurrence of the project engineer.

15.11.1 Panels

a. Panels are special purpose assemblies which are mounted directly to the front mounting rails of the cabinet. Panels come supplied in a variety of ways such as speaker panels, drawer panels, desk panels, blank panels and other special types (see figure 15-18).

b. Panels are available in various heights from 1-3/4 to 35 inches and in widths conforming to standard cabinet widths; they are available in thicknesses of 1/8, 3/16, 1/4, and 5/16 inch with the 1/8 inch panel recommended for use whenever possible. Panels are supplied in one of two ways regarding screw accommodations - either holes or edge slots. Figure 15-19 illustrates the dimensions of the various size panels and the spacing of the screw holes-slots.

c. The mounting holes-slots of each type panel will match with the tapped 10-32 holes in the mounting rails of the cabinet. The mounting hardware used in the installation consists of oval head machine screws and non-metallic fiber washers. Pan head screws with finishing washers are another popular method. The method of panel installation is illustrated in part A of figure 15-20.

d. If panels with differing thicknesses are used, the panels must be aligned after installation. One method of alignment is to place machine screws in unused mounting rail holes. The screws are installed with the heads extending back into the cabinet. By careful adjustment of the length of thread extending beyond the rail, alignment of all thin panels with the thickest panel can be accomplished. A locking nut shall be used between the screw head and rail. (See part B, figure 15-19.) When proper alignment is attained, this nut shall be tightened securely against the rail to prevent movement of the screw.

e. Adjacent location of two panels that have 15/16-inch spacing from their edges to the end slots should be avoided due to overlapping of cup washers. If this situation cannot be avoided, the cup washers and fiber washers shall be trimmed as shown in part C of figure 15-20.

15.11.2 Cable Retractors

a. Cable retractors are used with sliding type chassis or drawer mechanism to prevent extended cable loops from entangling with and possibly damaging components located below.

b. A type of cable retractor recommended is one which mounts directly on the rear panel mounting rail with machine screws. This type can adjust automatically from minimum to maximum extension and provide a positive stop on the return swing. It can be mounted in the left, right, or reversed position and has mounting holes which fit all rail spacing. Adequate cabling must be provided to permit the chassis to be fully extended and to be tilted up or down. This retractor is illustrated in figure 15-21.

15.11.3 Slide Mechanism

a. Slide mechanisms are installed where there is a requirement to extend or remove an equipment chassis or drawer for inspection or maintenance from an equipment cabinet or rack. Tilt and non-tilt versions to support different weight and size requirements are available. Also, detent types which tilt and lock in many different service positions up and down, as well as in the horizontal position are available. The chassis of any length can be fully extended and tilted to any locked position without disconnecting the rear cables.

b. Slide mechanisms are attached to the front and rear mounting rails. A stop device presents a fully-extended assembly from accidently disengaging from the slide mechanism but there is a quick-release function which permits complete removal of the chassis from the cabinet or rack. Figure 15-22 illustrates the detent type of slide with drawer attached.

(1) Slide Selection. The primary considerations when selecting a slide for a specific application are as follows:

o The slide must adequately support the mounted equipment during repeated extensions. (It must be remembered that a longer slide travel results in a smaller load capacity for the extended slide.)

o The slide must permit the desired length of travel

o The slide is the desired tilt or non-tilt type

o The slide can be readily mounted in the selected cabinet or rack

o The slide contains an automatic latching device to stop the chassis from unwanted withdrawal beyond the servicing position

o The slide is the type to allow complete removal of the mounted equipment when required.

(2) Mounting of Slides. Slides are mounted directly on the vertical panel mounting rails. (See figure 15-23.) The procedure for the installation of slides follows:

o STEP 1. Attach rear mounting brackets to rear mounting rails of cabinet

o STEP 2. Attach slides to front mounting rails

o STEP 3. Attach slides to rear mounting brackets

o STEP 4. Measure the spacing between the slides at the front and at the rear of the cabinet. The measured distance should not vary more than 1/32 of an inch. If the variance is greater, add shims until the difference falls within tolerance

o STEP 5. Measure the distance from the bottom of the cabinet front to the lower part of each slide. If necessary, adjust mounting position of slides to place them the same distance from the bottom of the cabinet. Repeat this procedure at the rear of the cabinet.

c. Combinations of various adapter brackets and slotted holes permit slides of various lengths to be mounted on the panel mounting rails. When heavy components are to be slide mounted, installation of additional vertical mounting rails or vertical side supports is advisable.

(3) Attaching Chassis to Slides. A chassis may be attached to the slides by several methods. The most common method of attaching to non-tilt type slides is to bolt the slides of the chassis directly to the slides. (See figure 15-24.)

An alternate method of attaching a chassis to non-tilt slides is figure 15-24. A locating pin is used to position the chassis on the flange of the slide. Lateral movement of the chassis is prevented by the locating pin and by the machine screws that secure the chassis panel to the rack. This type of slide permits the chassis to be removed for servicing by lifting it off the locating pin.

Tilt-type slides are connected to the chassis by the method shown in figure 15-24. One type permits the chassis to be tilted in the up direction only. (See figure 15-24A.) A pivot screw attaches the chassis to the slide. A tilt stop limits the amount of chassis tilt.

An alternative type (figure 15-25) permits the chassis to be tilted both upward and downward. Pivot screws are used to connect the chassis to the slides. The particular slide illustrated contains a detent mechanism to allow the chassis to be locked in one of several tilt positions.

15.11.4 Chassis Support Angles

Chassis support angles are used to distribute the weight of the chassis to the panel mounting rails of the cabinet or rack and thus relieve undue stress on the panel itself. The angles are attached directly to the tapped holes in the front and rear of the vertical panel mounting rails. As shown in figure 15-26, slotted hole versions permit vertical adjustment and alignment.

15.11.5 Chassis Mounting Brackets

Chassis mounting brackets provide a means of attaching a chassis or assembly to the front panel mounting rails. Two basic types are used. The standard type is slotted for a chassis of either 3 or 4 inch depth and permits the chassis to be mounted flush against the panel. A triangular bracket is used where heavy weights are involved. See figure 15-27.

15.11.6 Vertical Side Supports

Vertical side supports (see figure 15-38) are used to strengthen the frame of the cabinet, and are attached to the several horizontal members of the cabinet. Holes must be drilled through one side of the vertical member to permit attachment to the horizontal side. The other surface of the vertical side support is drilled and tapped for machine screws at standard intervals to permit attachment and adjustment of accessories such as brackets, shelves, slides, and support angles.

15.11.7 Rack Shelves

Rack shelves are installed when it is necessary to provide additional support for components such as power supplies, modulator units, or other heavy and bulky items. The rack shelves are mounted directly on the chassis support angles as described in paragraph 15.11.4.

15.11.8 Sliding Drawers, Desk Tops and Work Shelves

Sliding accessories such as drawers, desk tops, and work shelves are mounted on support brackets attached to the panel mounting rails of the cabinet. When the accessory is retracted, the unit fits flush with the cabinet. Base, roller, or solid bearing features in the slide assures free movement of the drawer, top, or shelf. Some sliding brackets are attached to the front and rear mounting rails while others require attachment at the front rail only. (See figure 15-29.)

15.11.9 Vertical Panel Mounting Rails

When heavy components must be mounted in an equipment cabinet, additional support may be provided by the installation of additional vertical panel mounting rails. These rails are bolted to the top, bottom, and intermediate horizontal side members of the cabinets. The number of additional rails required is dependent on the total weight of the components in the cabinet.

15.11.10 Side Panels

Side panels are attached by two basic methods: clip type brackets and machine screws. The clip brackets slip into slots in the cabinet frame or over cabinet frame members. The side panel is lifted upward and then pulled outward to disengage the clips. An alternate mounting method is to bolt the side panels to the cabinet frame with machine screws. Tapped holes are provided in the cabinet frame for this purpose. A combination of these methods is also used; a clip bracket holds the bottom of the panel, and machine screws secure the top.

15.11.11 Doors

Cabinet doors of the plain, louvered, or filter installed type are available to be mounted on the front or rear of any size and style of cabinet in use. Both left- and right-hand mounted doors with a choice of locking or non-locking handles are available.

Doors may be mounted on loose pin type hinges to permit rapid removal of the door or may contain piano type hinges that are provided with holes punched to match the spacing of the vertical panel mounting rails.

15.11.12 Bases

Equipment cabinets are usually mounted on wooden bases of 4" x 4" lumber, covered with cove moulding (vinyl) in accordance with the instructions and installation details shown on NAVELEX standard plan 0100328. The base for a single cabinet installation is shown in figure 15-30. The cabinet is mounted to the base on a wooden floor with lag screws and on a concrete floor with the lag screws inserted into concrete anchors.

The base mounting for a group of equipment cabinets can be made in a manner similar to that of a single base by using longer 4" x 4" lumber sections cut to the desired length for the number of cabinets to be installed. Figure 15-31 shows the detail instructions for an installation of a row of two to eight cabinets.

15.11.13 Blowers

Blower assemblies are installed in equipment cabinets to aid in the removal of excess heat generated by the equipment and to keep the inside temperature of the cabinet from rising above the desired operating level. There are a large variety of rack-mounted blowers available with a front panel which permits easy installation on the standard 19 inch cabinet rack. (See figure 15-32.)

The blower assembly should be located at the air inlet to the equipment to be cooled rather than the outlet. Preferably, it should be placed at the bottom to aid natural convection as the air warms and is evacuated at the top of the cabinet. In this way the cabinet is pressurized with filtered air preventing dust from entering through cracks and the air will have greater turbulence which aids in the transfer of heat from the equipment to the air.

Filters are placed at the air intake to remove dust and other particles from the air entering the blower. A discussion of filter characteristics is covered in paragraph 15.15 of this chapter.

The size of the blower required for a given installation is a design and engineering determination based upon the analysis of many factors, foremost of which are, the heat generating characteristics of the equipment, room temperature and air conditions, available air space within the enclosure, and the velocity of the air over the equipment being cooled. The size blower and specific speed settings for a given installation will generally be specified in the installation instructions.

15.12 INSTALLATION OF CABLE INTO CABINETS

Cable ducts may be used to route power and signal cables from the distribution panels to the cabinets and between the cabinets. Separate duct systems are installed to accommodate the power and signal distribution systems. The signal system, in turn,

has separate ducts for the RED secure circuits and another for the BLACK circuits and are of steel construction to provide ferrous shielding for the signal circuits. The National Electric Code should be referenced to determine the maximum number of cables that may be installed in a certain size duct for power applications.

The duct size installed at any location is determined by the cable loading requirements. The sizes in general use are 4 x 4, 4 x 6, and 4 x 12 inches in 10 foot long sections which can be cut to the required length at each location. When initially installed, the duct system should be designed for 50 percent cable loading to allow space for additional cable runs that may be required in a future expansion of the system.

The cable ducts may be top-mounted above the cabinets or installed beneath using the false floor or cabinet bases for the cable duct runs.

15.12.1 Conduit and Cable Trays

An alternate means of cable entry into cabinets is with conduits as is shown in NAVELEX standard plan RW10F2407, for cabinets CY-597A/G and CY-614/G and the use of ladder trays such as depicted in standard plan RW10F2391.

15.12.2 Top Mounting

Cable ducts may be installed directly on the top of a row of cabinets or they may be supported by brackets attached to the ceiling. The most common manner is to bolt them directly to the top of the cabinet. Overhead duct provides a greater degree of flexibility in the arrangement of cables, trouble-shooting and servicing of cables is simplified, and expansion of cable system is made easier.

Cable access to the cabinet is gained through knock-out holes in the bottom of the duct or at the top of the cabinet. Care must be taken to protect the cables from damage by the sharp edges of the holes in the ducts and cabinets. A method of accomplishing cable entry into a cabinet from top-mounted ducts is shown in A of figure 15-33. The signal cables are brought into a terminal board for distribution. The power cables enter by means of flexible conduit and connect directly to a plugmold strip.

Rows of cabinets can be interconnected with overhead cable trays or ducts as shown in B of figure 15-33.

15.13 CABINET MODIFICATIONS

Holes should not be drilled in a cabinet for the mounting of hardware or for cable entry except in panels or plates specifically designated for the purpose. The standard Navy cabinets in current use provide adequate means for mounting hardware and have provisions for access or knock-out plates for cable entry.

There may be infrequent occasions when due to unusual requirements of installing cables and plugs of non-standard size, additional holes must be made to permit routing and installation of these items. When this becomes necessary, any holes made

must be lined with a rubber or plastic grommet to prevent damage by the sharp edges of the hole. They are readily available on the commercial market to fit any hole shape.

15.14 EQUIPMENT AND CABINET VENTILATION

Electronic equipment generates a considerable amount of heat which must be evacuated or dissipated in order to provide continuous and satisfactory operational performance. The reliability of equipment is directly related to the adequacy of the cooling and ventilation conditions encountered. Communication facilities specify conditions of controlled temperature and humidity within prescribed limits as a requirement to improved reliability and performance.

The determination of the size and type of air conditioning equipment required at a communication facility is the responsibility of the Naval Facilities Engineering Command (NAVFAC). Factors such as the heat generating and dissipating rate of all equipment installed, the desired operational temperature range of the equipment, the ambient temperature requirements of the personnel, local weather conditions encountered, and any other factors having a bearing on air conditioning requirements are analyzed. The installation and maintenance of the air conditioning equipment is performed by the Public Works organization supporting the communication facility.

This portion covers those factors governing the ventilation of equipment and cabinets including a discussion of filters and forced-air ventilation for which the electronic technician is responsible.

15.15 FILTERS

Filters are used in ventilation systems to remove dust, dirt, and other foreign matter from the air entering the equipment or cabinet. Filters should be located where it is readily accessible for cleaning or replacement and in such a position that the air enters the filter perpendicular to the filter face to permit a uniform flow over the filter area to the equipment.

Filters must be kept clean in order to maintain their effectiveness. The time period must be established for each application as the amount of dust and dirt will vary with equipment or cabinet location. The correct interval may be determined by frequent inspections during the period following initial installation of the equipment and an average period of operation between cleanings established. Unusual operating conditions encountered may require a more frequent schedule, such as during dust or wind storms.

15.15.1 Dry Filters

These filters consist of dry materials (cellulose, cloth, felt, wood fibers, glass) that contain minute air passages. The effectiveness of their filtering is dependent upon the size and shape of the air passages.

Some dry-type filters are mounted in inexpensive frames and are replaced when dirty; others have renewable units mounted in permanent frames. The latter may be cleaned by jarring or vibrating, by vacuuming, or by washing in water or chemical solvents. The period of operation between cleanings is usually from two to three months.

15.15.2 Viscous Impingement Filters

Viscous impingement filters consist of multiple layers of coarse material coated with a non-drying adhesive especially compounded for the purpose. In operation the air flows through rather large spaces, but is deflected so that entrained dust impinges onto the coated surfaces and is retained. Such filters have the advantage of low static losses, high dirt-holding capability, and may be cleanable or disposable. Cleanable types are generally of all-metal construction and are sturdy enough to withstand wash cleaning, recoating with adhesive, and continued use. The advantage of having a clean filter when needed (no resupply necessary as for the disposable type) more than offsets the additional cost of such filters and the cleaning chores required. These filters require cleaning about every eight weeks in normal use or at such time as locally determined. The cleaning method to be used is:

- STEP 1. Remove unit

- STEP 2. Clean the filter. If the proper adhesive was used it will be water-soluble and flushing with cold water in a reverse direction through the filter will be adequate; warm water, hot water, or steam will improve and expedite the cleaning. If mineral oils have been used, solvent or detergent compounds in water will be necessary to clean the filter and the cleaning will be much more difficult.

- STEP 3. Allow to dry

- STEP 4. Recoat the filter with adhesive manufactured for this purpose. Such materials are water-soluble, odorless, non-flammable, and contain mold-spore and bacteria inhibitors. As an emergency measure, mineral or lubricating oils having an SAE viscosity of 20 or heavier can be used.

- STEP 5. Allow to drain for 10 to 12 hours unless an aerosol-can dispensed coating is used, in which case the filter may be reinstalled for immediate use.

- STEP 6. Reinstall filter.

15.16 INSPECTION OF A VENTILATION SYSTEM

The following procedure should be followed in the inspection of a ventilation system prior to operation:

- Check all equipment that contains moving parts to ensure that nothing impedes free movement.

o Check ducts to ensure that they are free of foreign matter, dust, or dirt. Use a vacuum cleaner with a long hose where necessary. If material cannot be dislodged, the area must be disassembled for cleaning.

o Check electrical power-operated equipment for proper power source connection.

o Inspect filters for proper installation and cleanliness. Viscous filters should have an oil coating over the dust-collecting area. Service or change filters as necessary.

o Turn on blower fan to ensure it is in operating condition and the flow of air is in the proper direction.

o Examine all drive belts for proper installation and evidence of wear.

o Assure that motors have been oiled and greased properly.

o Check all protective devices and interlocks for proper operation.

o Determine that all doors and panels being used with ducts and filter units are properly installed.

15.17 FORCED AIR VENTILATION

Forced-air ventilating systems are installed in equipment cabinets to supply fresh cooler air when the natural cabinet ventilation is insufficient to remove the heat and maintain the equipment at the desired operating temperature. The volume of air provided by the blower assembly may be adjusted by a variable-speed motor and ducts are used to direct the greater volume of air to critical sections of the cabinet. (See paragraph 15.11.13 for a discussion on blowers.)

A forced-air ventilating system depends upon convection as the primary means for heat transfer. Since most electronic parts are designed for cooling by natural ventilation, the external shapes of these parts are not ideally suited for forced-air ventilation; however, because of their comparatively low unit-heat dissipation, most parts can be cooled by forced air.

The blower system for one specific type of cabinet (figure 15-34) contains a panel-mounted blower and a side air-flow panel, which consists of a thin air duct provided with 2 x 2 inch openings. Snap-in enclosures may be used to close these openings when an air outlet at that part of the cabinet is not required. Snap-in scoops shall be placed in openings to direct the cooling air to temperature-critical areas of the cabinet. These scoops shall be installed in openings which are located below the area to be ventilated so that the air will be directed by the scoop toward that area.

The air intake for the cabinet is the blower panel. Air is forced into the air-flow panel by the blower, it enters the cabinet area through panel openings, circulates through the cabinet, and is exhausted through a louvered top. Blowers are available with left or right openings; therefore, ensure that the air-flow panel is located on the same side of the cabinet as the blower opening. The blower opening has a polyurethene gasket that is pressed against the air-flow panel to prevent air leakage directly into the cabinet.

15.18 LIQUID COOLING SYSTEM

A liquid-cooling system cools equipment by circulating a coolant that either contacts the equipment directly or that merely circulates through the area immediately surrounding the equipment. With the latter method, the heat is transferred to the coolant by natural convection, conduction, and radiation.

15.18.1 Checking Liquid-Cooling System for Leaks

After the liquid-cooling system has been installed, the following procedure shall be observed:

- STEP 1. Attach an air compressor to the cooling system, and place an air-pressure gage in the coolant line.

- STEP 2. Pressurize the system. The amount of pressure to be used will depend upon the specific system. A pressure of at least twice the normal operating pressure shall be used, if possible. DO NOT exceed the maximum allowable pressure of the system.

- STEP 3. Examine the system for leaks. If leaks are readily detected, repairs shall be made before additional steps are performed. Leaks in joints may be detected by applying a liquid soap and water mixture to the joints and watching for bubbles; the presence of bubbles indicates an air leak.

- STEP 4. Repeat step 3 until the coolant system appears to be tight.

- STEP 5. Allow the system to remain under high pressure for a 24-hour period.

- STEP 6. Measure the pressure and compare it with the initial air-pressure reading.

- STEP 7. Check the system again for leaks if the pressure has dropped appreciably (a small pressure drop is normal).

- STEP 8. Repair leaks. (A small leak may be difficult to locate; therefore, use extreme care when checking for leaks.)

- STEP 9. Permit air to escape from the system.

o STEP 10. Connect an auxiliary water pump to the system. (Use of another pump will preclude the use of the system pump at this time.)

o STEP 11. Fill system with water at the design pressure.

o STEP 12. Allow system to remain under pressure for 24 hours.

o STEP 13. Check all joints and connections for presence of water.

o STEP 14. Repair leaks.

o STEP 15: Replace water. If system is to be located in an area where freezing occurs, use mixture of water and ethylene glycol.

15.18.2 Preoperational Checking of Liquid-Cooling System

Before the system is put into operation, certain checks must be performed.

o Check all valves to ensure they are properly positioned.

o Check motor belts to ensure they are properly installed.

o Check to ascertain that all equipment hold-down straps and bolts have been removed.

o Check heat exchanger water pan to ensure it is clean.

o Check system's filters and screens to ensure they are clean.

o Check piping to ensure that all sections have been properly joined.

o Check liquid coolant to ensure mixture of ethylene glycol and water is correct.

o Check all joints and flexible couplings to ensure there are no leaks.

o Check system to ensure direction of water flow is correct for specific components; for example, for the tubes.

o Check moving parts (fans, pumps) of system to ensure proper operation.

o Check coolant to ensure that system has been properly bled; most systems contain petcock valves at all points of the piping where air might be trapped.

o Check coolant to ensure that the system is free from scale and other foreign matter.

15.19 CABINET DUSTPROOFING

Cabinets in desert or similar installation areas must be dustproofed to prevent the infiltration of sand and dust into their interiors. Accomplish dustproofing in the following manner:

a. Seal the joints between nonremovable panels and cabinet frame by welding the seam, or by use of a sealing compound. This sealer may be applied by brush, caulking gun, or pressure-extruding equipment; it is applied as a bead along the inside edges of the seam (figure 15-35). Complete hardness is attained in one to three days.

b. Seal cabinet access doors with adhesive-backed sponge-rubber shim stripping. This material is applied around the front of the cabinet (figure 15-36) on the portion against which the door closes, and adheres by means of the pressure-sensitive adhesive backing.

c. Seal all removable panels with neoprene sealing strips. This material is attached with a glue as shown in figure 15-37. If electromagnetic interference suppression is required, a combination gasket that has a metallic shielding mesh, shall be used.

d. Use double sections filters at all inlet and outlet ports of the cabinet. Filters are required at the outlet ports to prevent the entrance of dust when the blower system is not in operation. Figure 15-38 illustrates a method of installing a double filter unit on the inlet ports of a cabinet. A similar method may be used for the outlet ports.

e. Maintain a cabinet pressure that is higher than normal atmospheric pressure.

Generally it will be found to be easier and better to dustproof the room insofar as practicable along with the supply and return or ventilation openings to it than to alter the design of existing cabinets.

Table 15-1. Nominal Rack Heights

MIL-STD-189 RACK SIZE	FRAME HEIGHT	PANEL CLEARANCE HEIGHT
A	21-21/32	17-21/32
B	28-21/32	24-21/32
C	35-21/32	31-21/32
D	42-21/32	38-21/32
E	49-21/32	45-21/32
F	56-21/32	52-21/32
G	63-21/32	59-21/32
H	70-21/32	66-21/32
J	77-21/32	73-21/32
K	84-21/32	80-21/32

AIAG629

Table 15-2. Typical Expansion Anchor Sizes and Load Capacity

SIZE OF BOLT OR SCREW WITH WHICH SHIELD IS USED	DIMENSIONS OF MINIMUM HOLES REQUIRED		PROOF TEST LOAD (POUNDS)
	DIAMETER (DRILL SIZE) (INCHES)	DEPTH (LENGTH OF ANCHOR) (INCHES)	
6-32	5/16	1/2	150
8-32	5/16	1/2	250
10-24	3/8	5/8	300
12-24	1/2	7/8	400
1/4"-20	1/2	7/8	500
5/16"-18	5/8	1	850
3/8"-16	3/4	1-1/4	1250
7/16"-14	7/8	1-1/2	1650
1/2"-13	7/8	1-1/2	2300
5/8"-11	1-1/8	1-3/4	3200
3/4"-10	1-1/4	2-1/4	4000

AIAG630

Table 15-3. Typical Toggle Bolt Sizes and Load Capacity

BOLT SIZES (INCHES)		SIZE DRILL REQUIRED (MASONRY) (INCHES)	PROOF TEST LOAD (MASONRY) (POUNDS)
DIAMETER	LENGTH		
6-32 or (1/8)	2 3 4	1/8	175
10-24 or (3/16)	2 3 3-1/2 4 5 6	1/2	350
1/4-20 or	3 3-1/2 4 5 6	5/8	600
5/16-18 or (5/16)	3 4 5 6	7/8	900
3/8-16 or	3 4 5 6	7/8	1100

AIAG631

Table 15-4. Typical Lag Screw and Expansion Shield Sizes and Load Capacity

STANDARD SIZES	DIAMETER OF LAG SCREW WITH WHICH SHIELD IS USED (INCHES)	LENGTH OF SHIELD (INCHES)	OUTSIDE DIAMETER AND DRILL REQUIRED (INCHES)	PROOF TEST LOADS (POUNDS)
LONG	1/4	1-1/2	1/2	200
	5/16	1-3/4	1/2	480
	3/8	2-1/2	5/8	960
	1/2	3	3/4	1600
	5/8	3-1/2	7/8	1725
	3/4	3-1/2	1	1850
SHORT	1/4	1	1/2	160
	5/16	1-1/4	1/2	380
	3/8	1-3/4	5/8	640
	1/2	2	3/4	1300
	5/8	2	7/8	1400
	3/4	2	1	1500

AIAG632

Table 15-5. Typical Self-Drilling Anchor Sizes and Load Capacity

CHUCK END TYPE				
Bolt Size (Inches)	Outside Diameter (Inches)	Depth of Hole (Inches)	Depth of Thread (Inches)	Proof Test Load (Pounds)
1/4	7/16	1-3/32	3/8	1600
5/16	15/32	1-5/16	15/32	1800
3/8	9/16	1-17/32	9/16	2500
1/2	11/16	2-1/32	13/16	3700
5/8	27/32	2-15/32	15/16	5100
3/4	1	3-1/4	1-7/32	7100
7/8	1-1/8	3-11/16	1-13/32	7800

FLUSH END TYPE				
Bolt Size (Inches)	Outside Diameter (Inches)	Length of Self Drill (Inches)	Depth of Thread (Inches)	Proof Test Load (Pounds)
1/4	7/16	1-1/4	13/32	1600
5/16	15/32	1-7/32	3/8	1800
3/8	9/16	1-7/16	15/32	2500
1/2	11/16	1-15/16	23/32	3700
5/8	27/32	2-3/8	7/8	5100
3/4	1	3	1-1/8	7100

TIE WIRE TYPE			
Diameter of Tie Wire Hole (Inches)	Outside Diameter Drill Required (Inches)	Depth of Hole (Inches)	Proof Test Load (Pounds)
7/32	15/32	1-1/8	1800

ROD HANGER TYPE				
Bolt Size (Inches)	Outside Diameter (Inches)	Length of Self Drill (Inches)	Depth of Thread (Inches)	Proof Test Load (Pounds)
1/4	7/16	1-17/32	27/32	1600
3/8	9/16	1-7/8	15/16	2500
1/2	11/16	2-1/2	1-1/4	3700
5/8	@27/32	3	1-17/32	5100
3/4	1	3-3/4	1-15/16	7100

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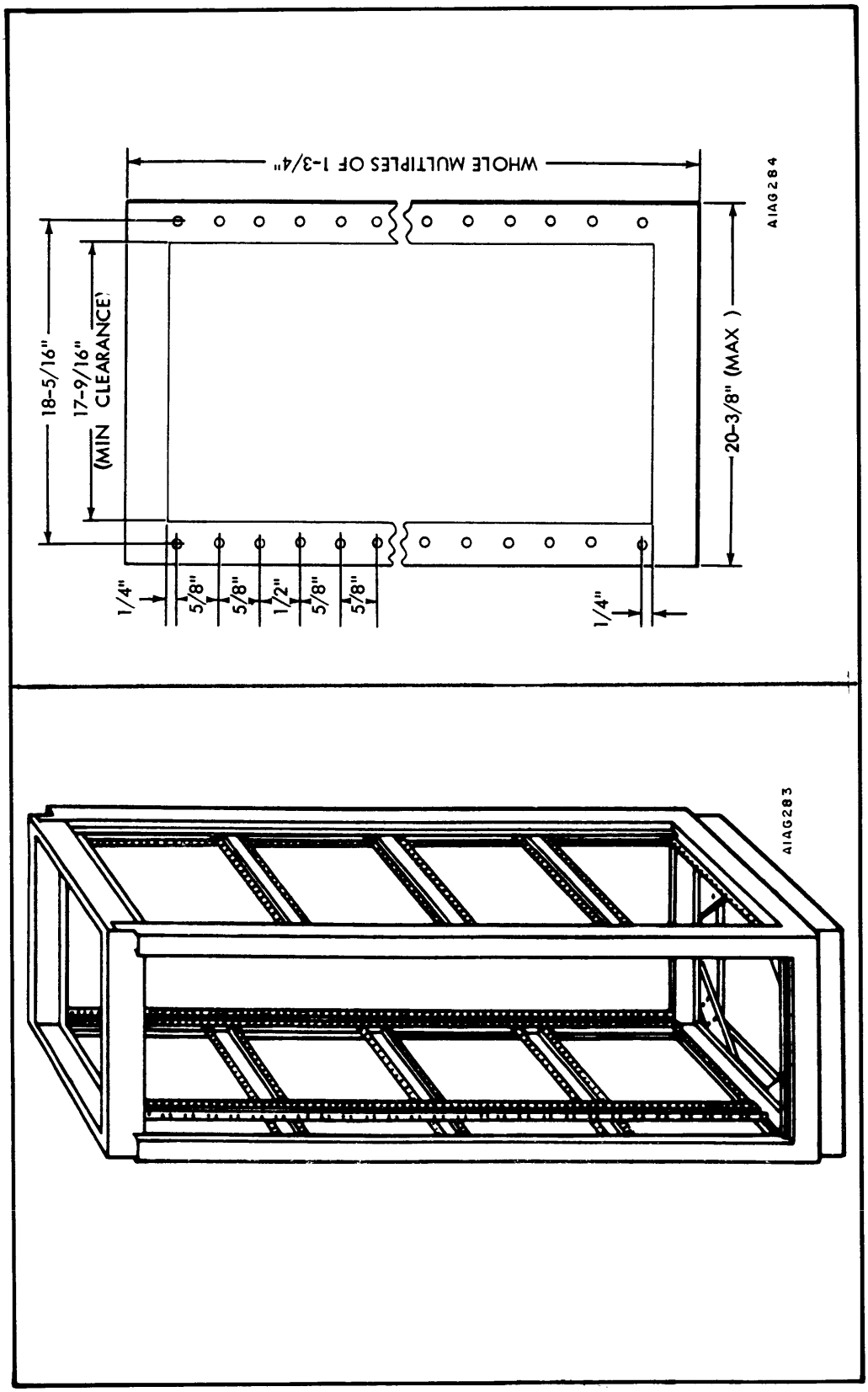


Figure 15-1. Basic Cabinet Structure

Figure 15-2. Spacing of Rail Mounting Holes

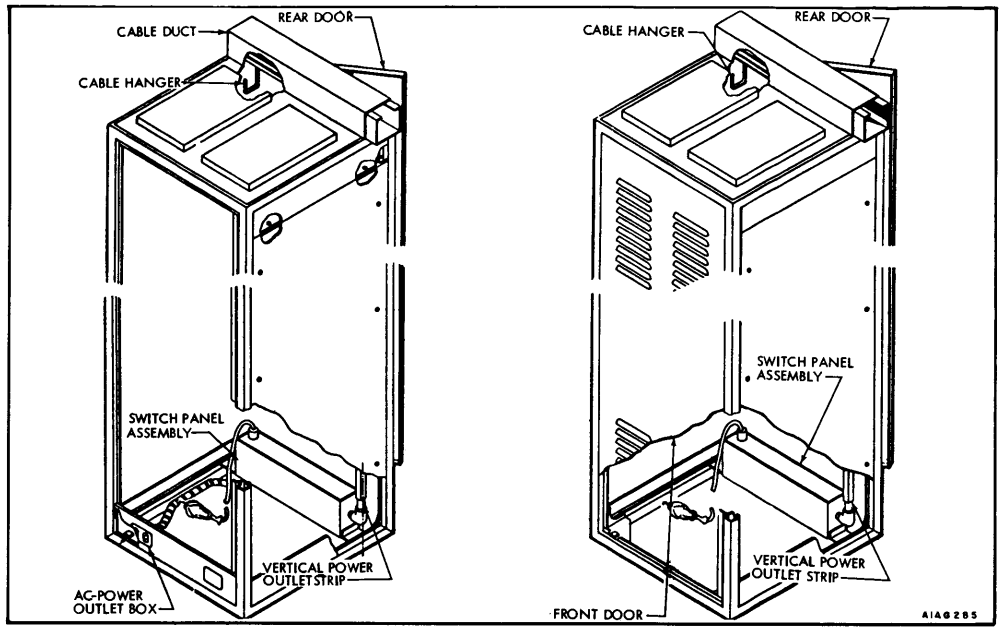


Figure 15-3. Type CY-597 A/G Cabinet

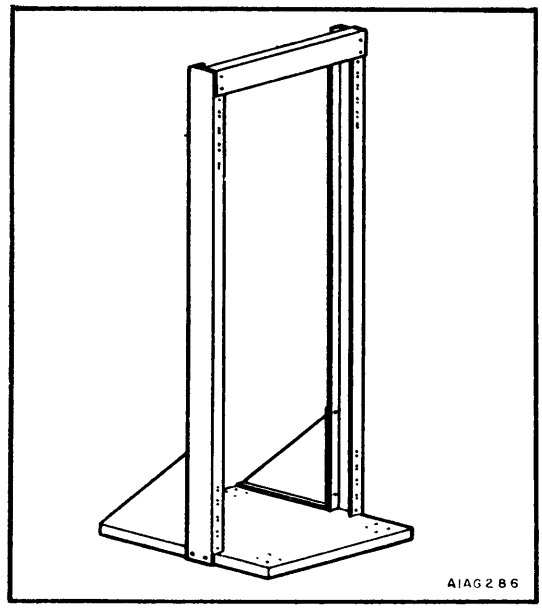


Figure 15-4. Open-Type Relay Racks

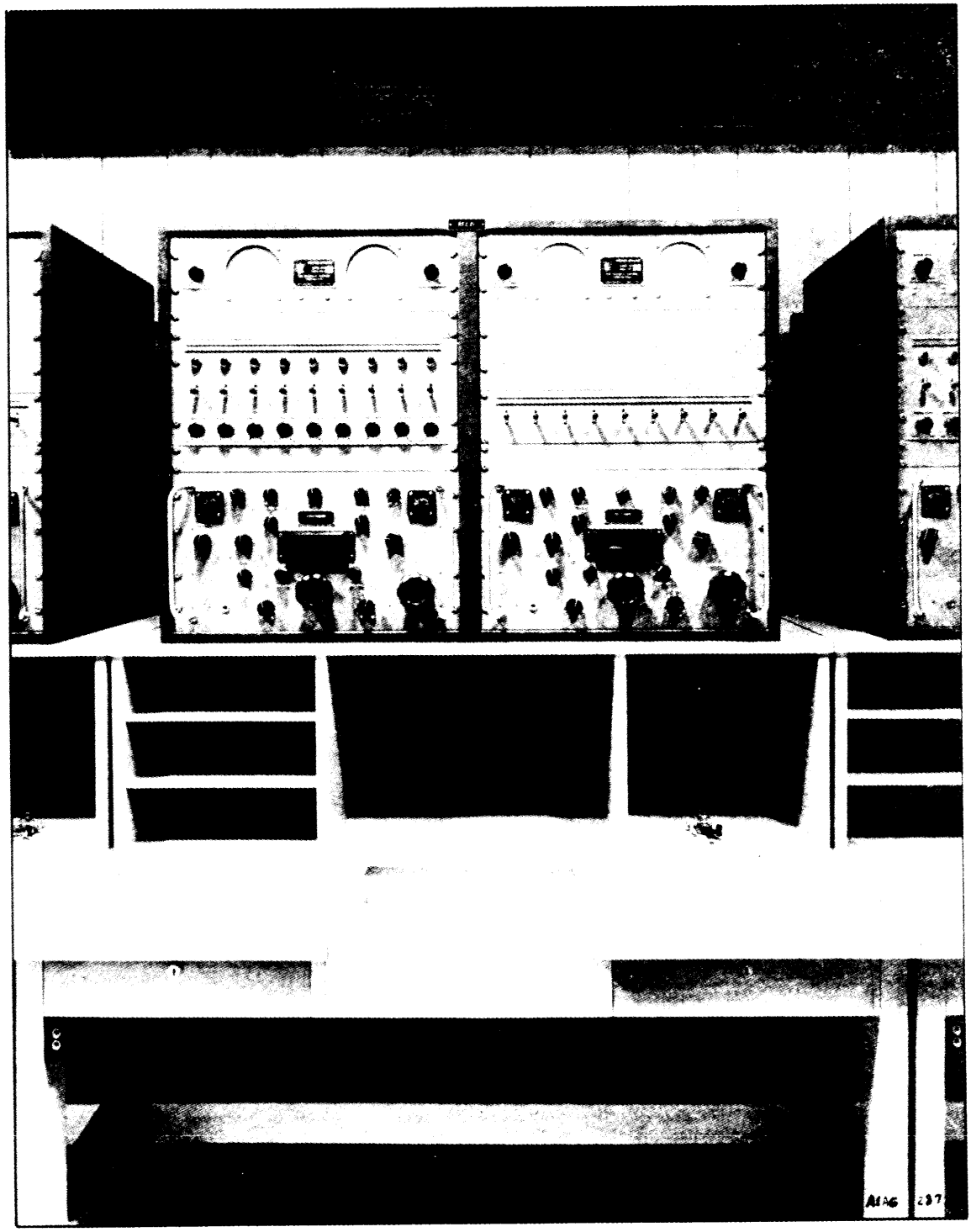


Figure 15-5. Radio Operator's Desk

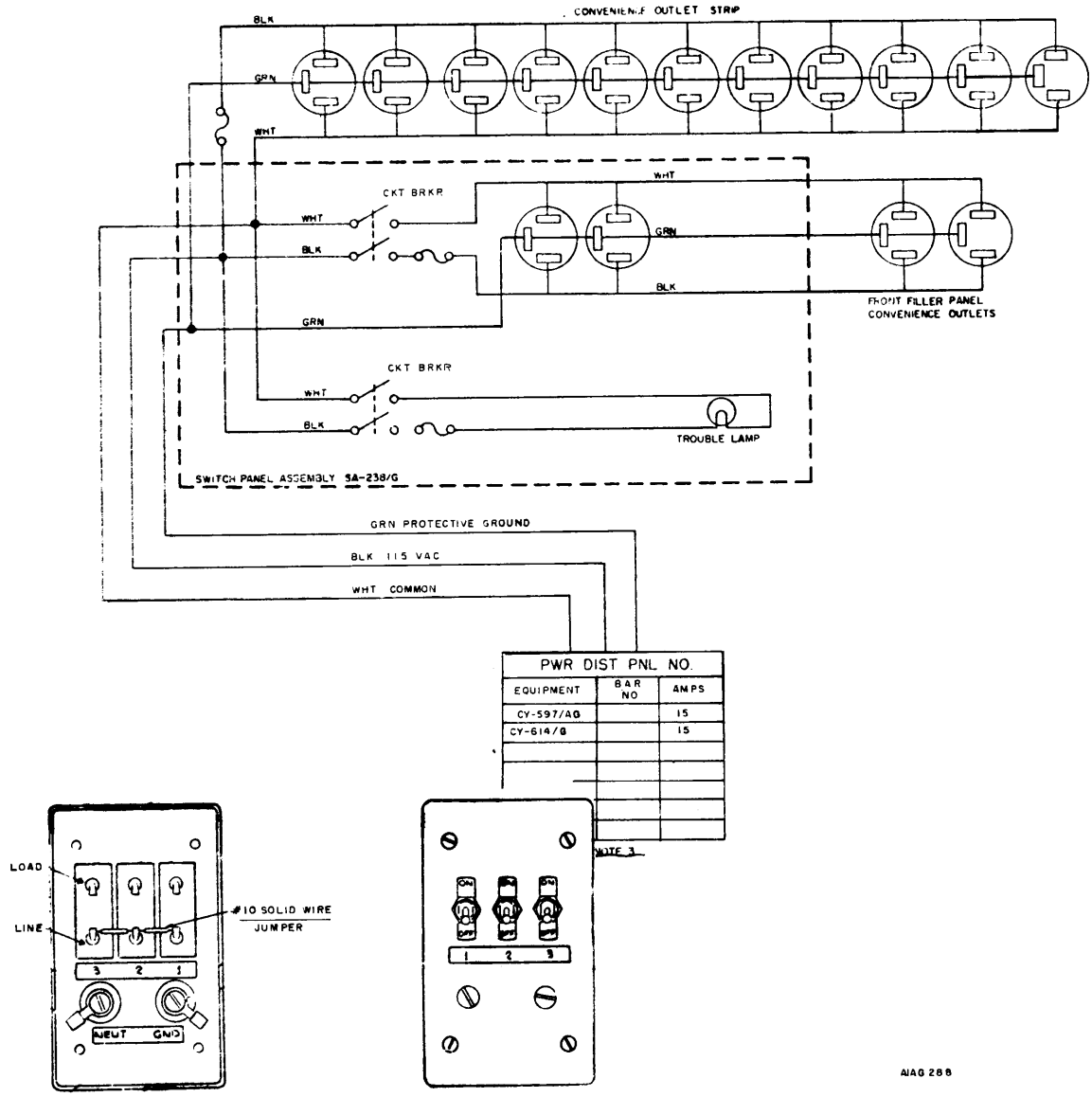


Figure 15-6. Schematic Diagram of CY-597A/G and CY-614/G Wiring Modification

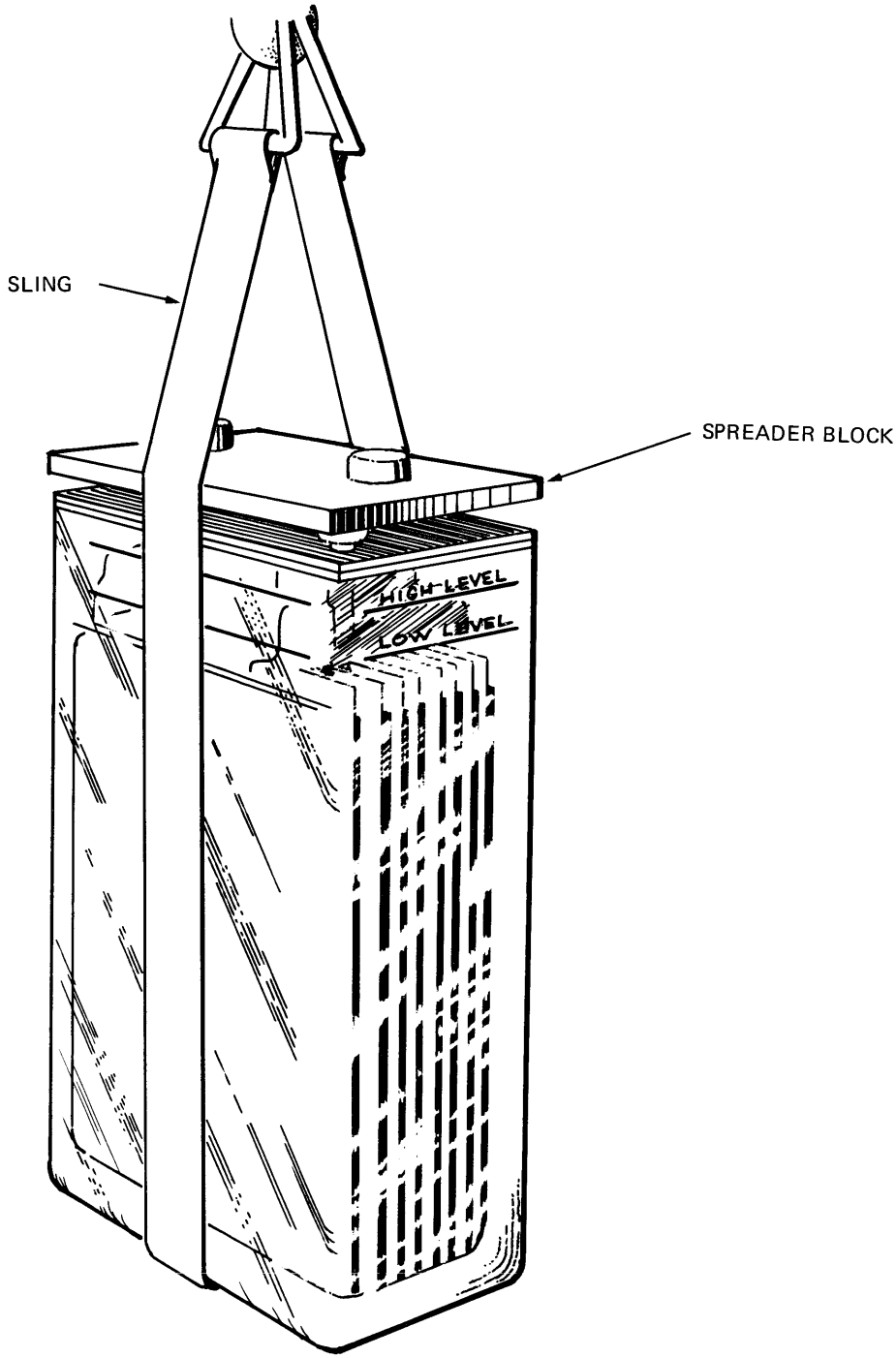
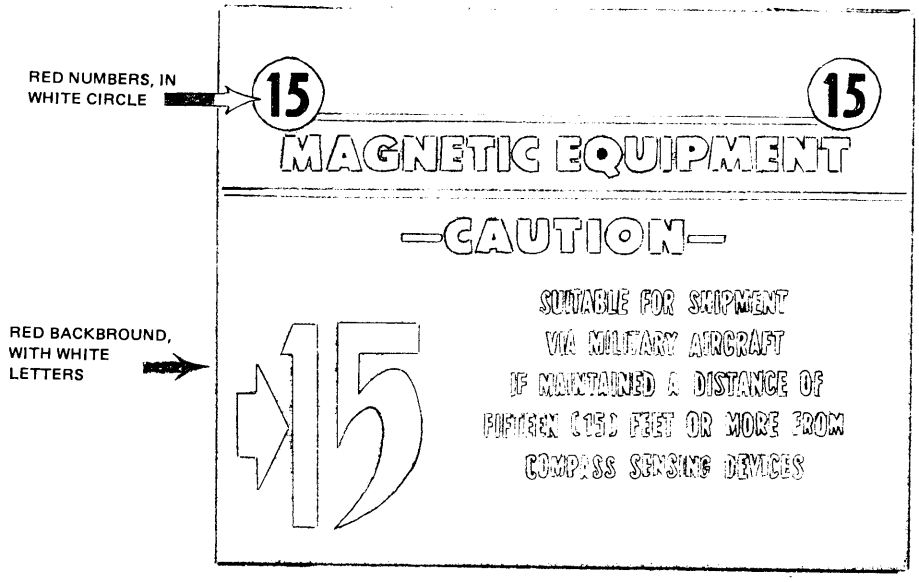
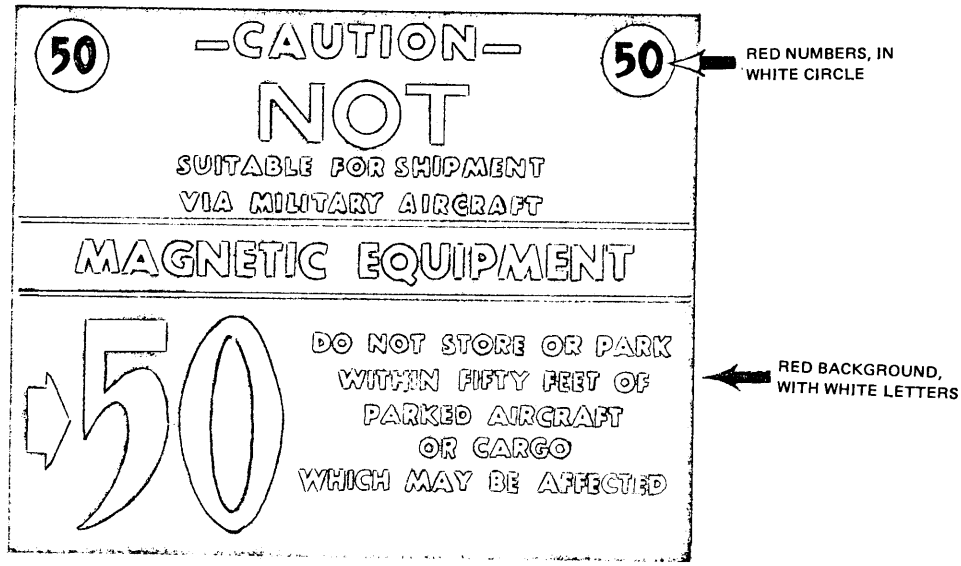


Figure 15-7. Battery Slinging Arrangement



A. CAUTION LABEL FOR MAGNETIC EQUIPMENT SUITABLE FOR AIR SHIPMENT



B. CAUTION LABEL FOR MAGNETIC EQUIPMENT NOT SUITABLE FOR AIR SHIPMENT

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Figure 15-8. Typical Caution Signs

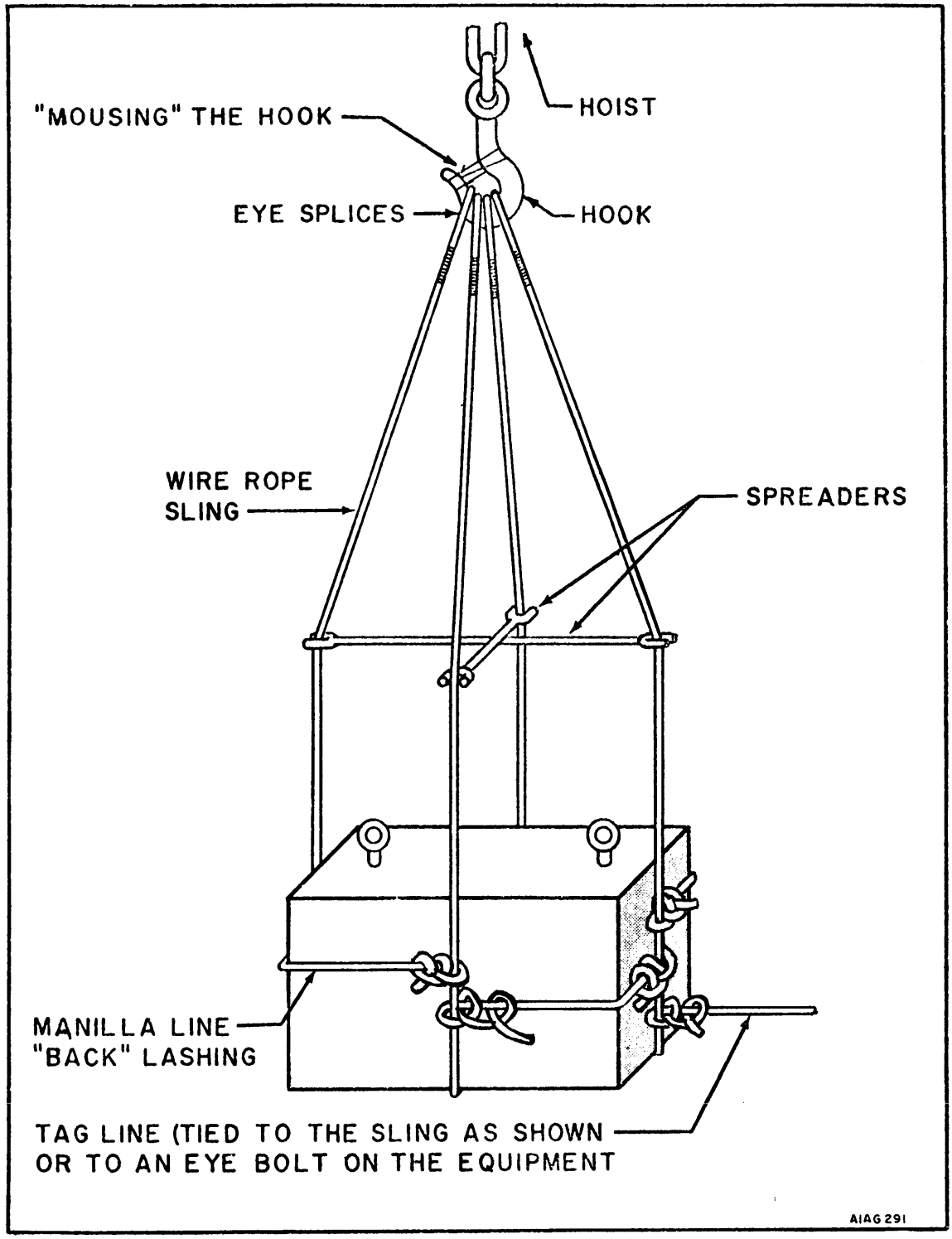


Figure 15-9. Typical Sling Arrangement

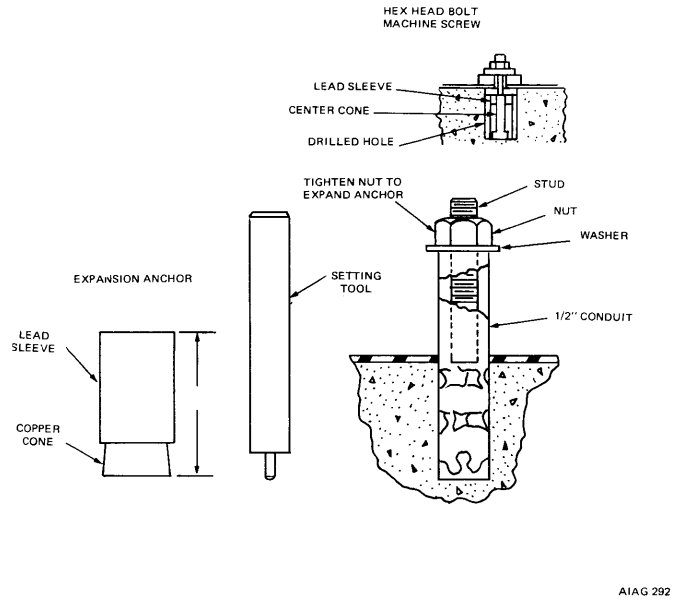


Figure 15-10. Expansion Anchors and Setting Tools

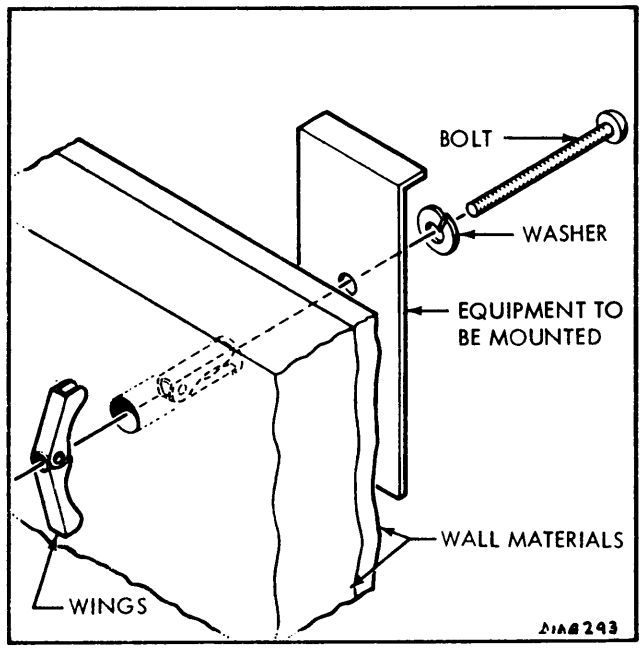


Figure 15-11. Toggle Bolt Installation

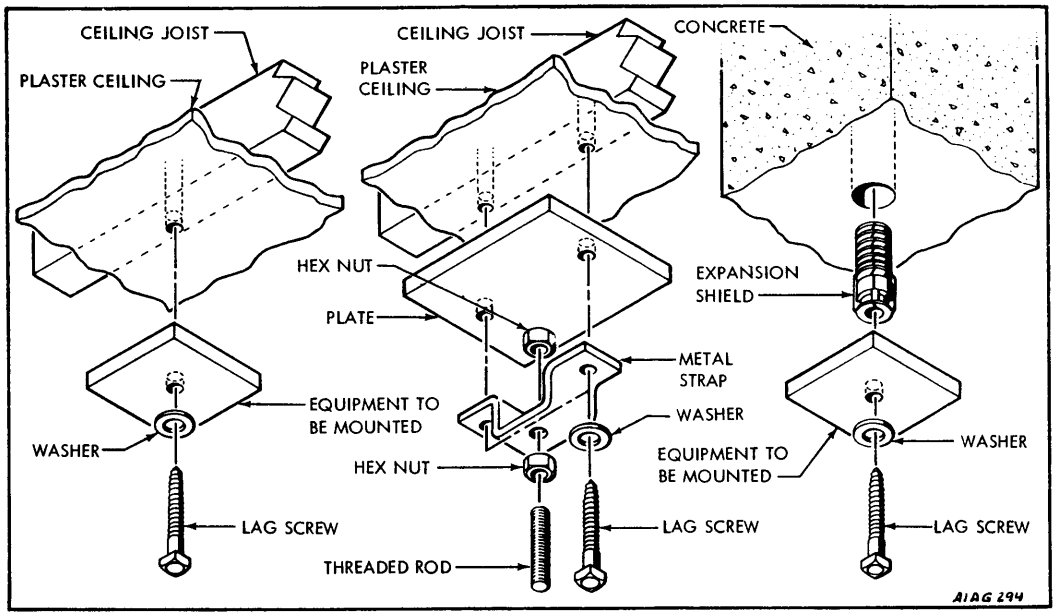


Figure 15-12. Typical Lag Screw Installation

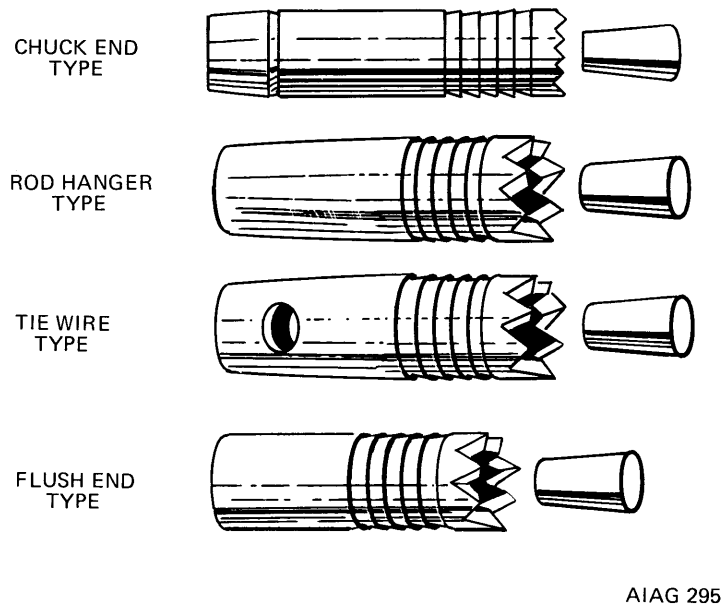


Figure 15-13. Self Drilling Anchors

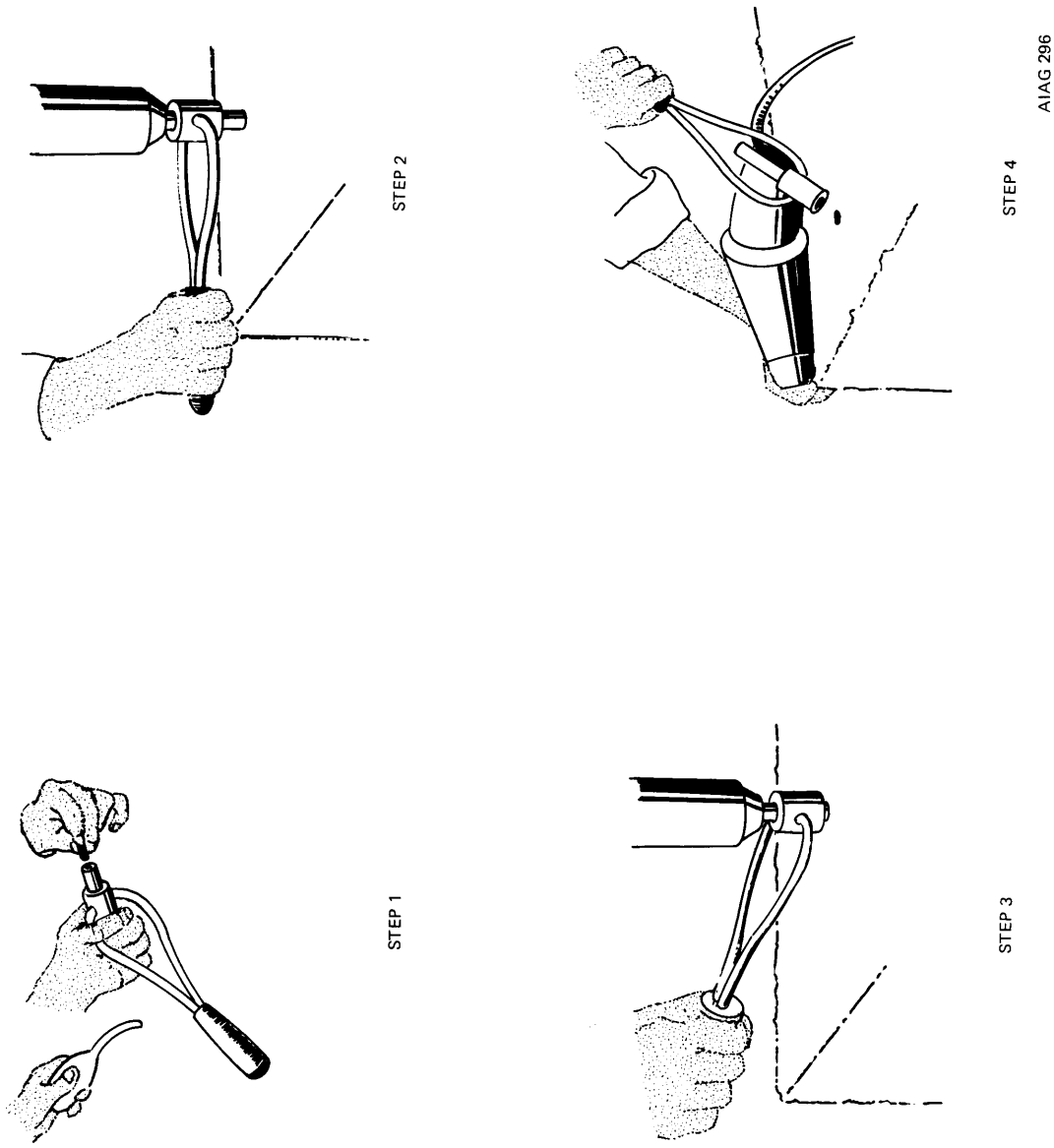


Figure 15-14. Self Drilling Anchor Installation Procedure

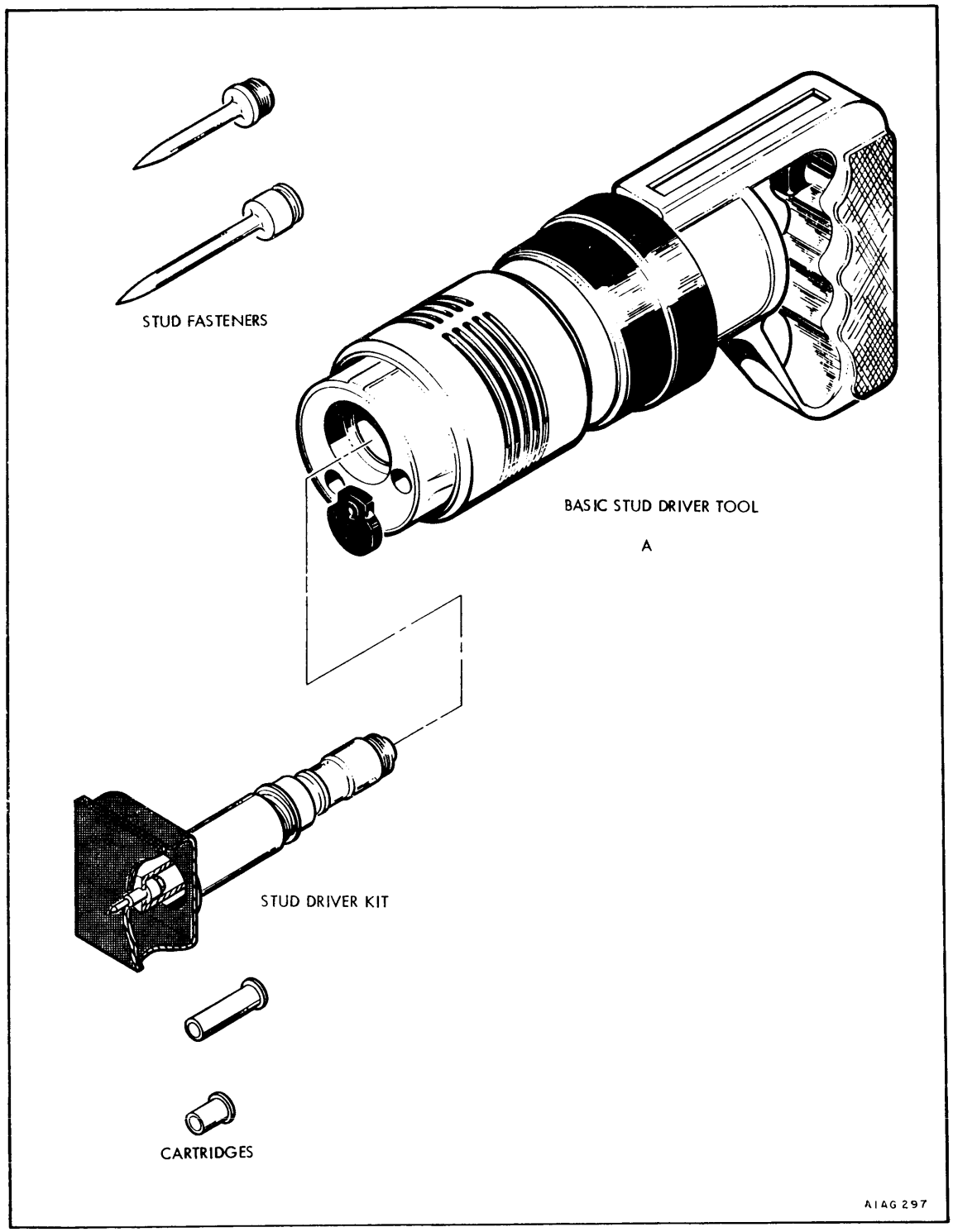


Figure 15-15. Typical Explosive Stud Driver

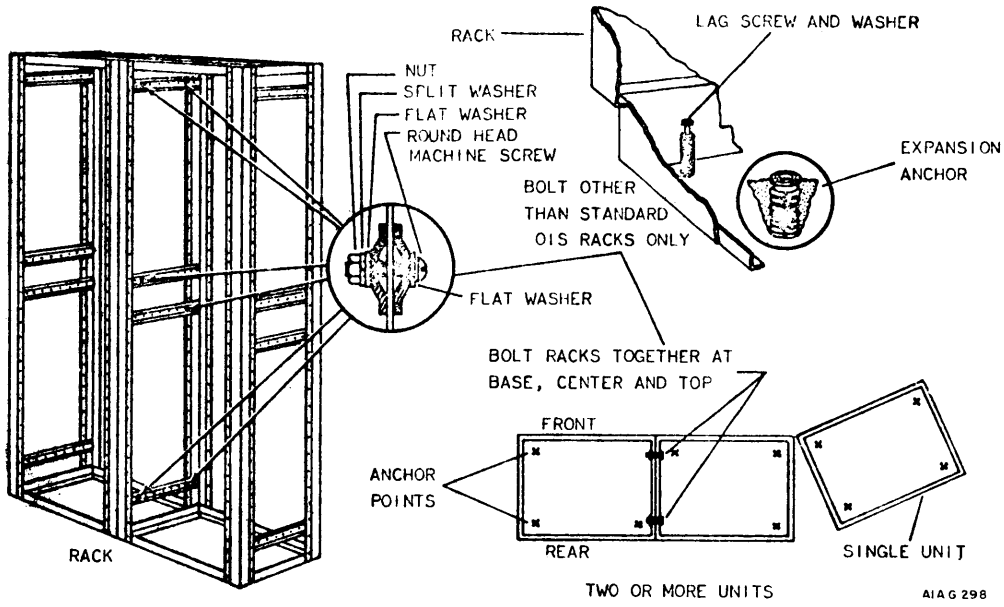


Figure 15-16. Anchoring and Joining Points for Cabinets

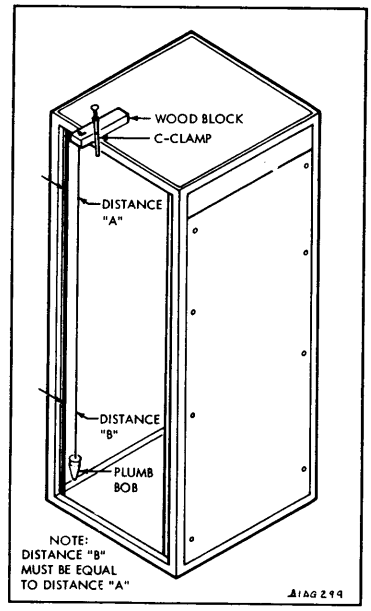


Figure 15-17. Plumbing a Cabinet

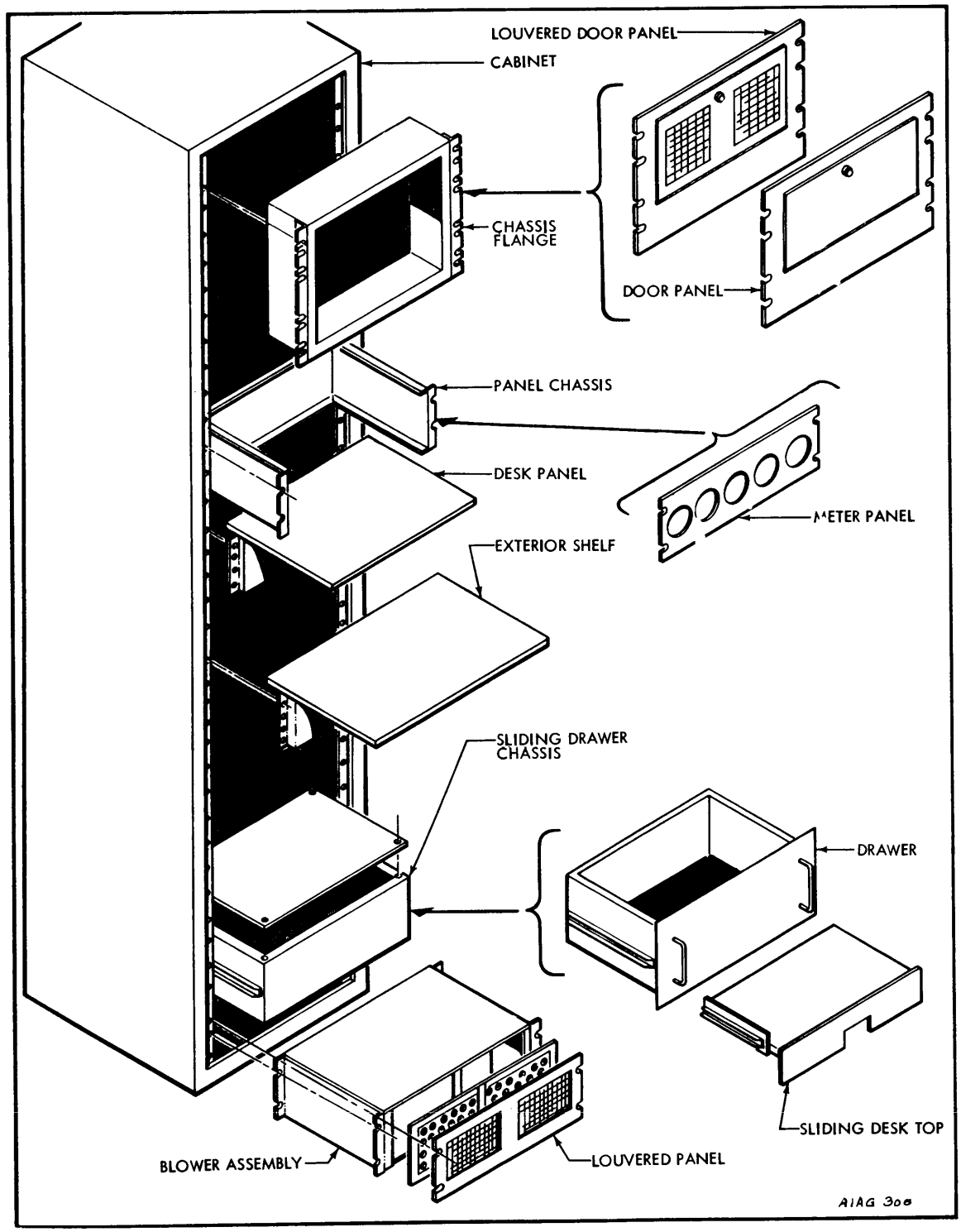
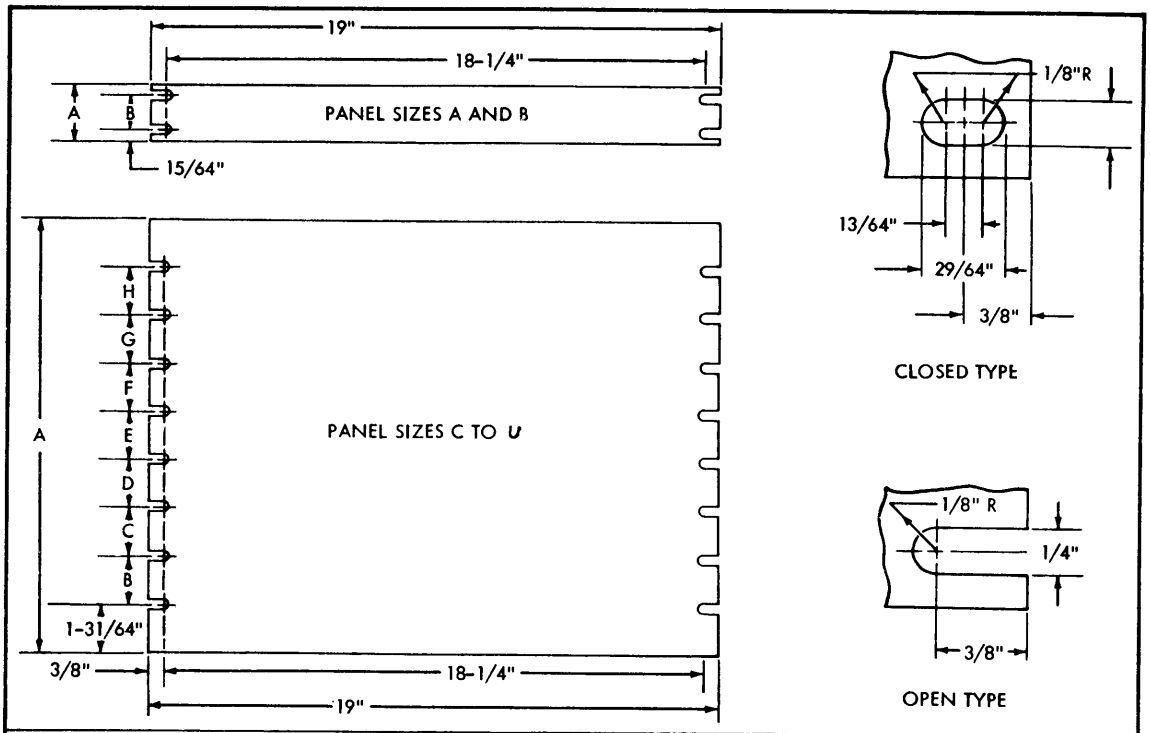


Figure 15-18. Typical Panels



PANEL SLOT DETAILS

PANEL SIZE	A	B	C	D	E	F	G	H
A	1-23/32	1-1/4						
B	3-15/32	3						
C	5-7/32	2-1/4						
D	6-31/32	4						
E	8-23/32	1-3/4	2-1/4	1-3/4				
F	10-15/32	2-1/4	3	2-1/4				
G	12-7/32	1-3/4	5-3/4	1-3/4				
H	13-31/32	3-1/2	4	3-1/2				
J	15-23/32	3-1/2	5-3/4	3-1/2				
K	17-15/32	3-1/2	7-1/2	3-1/2				
L	19-7/32	5-1/4	5-3/4	5-1/4				
M	20-31/32	1-3/4	5-1/4	4	5-1/4	1-3/4		
N	22-23/32	5-1/4	1-3/4	5-3/4	1-3/4	5-1/4		
P	24-15/32	1-3/4	5-1/4	7-1/2	5-1/4	1-3/4		
R	26-7/32	1-3/4	7	5-3/4	7	1-3/4		
S	27-31/32	1-3/4	5-1/4	3-1/2	4	3-1/2	5-1/4	1-3/4
T	29-23/32	1-3/4	5-1/4	3-1/2	5-3/4	3-1/2	5-1/4	1-3/4
U	31-15/32	1-3/4	5-1/4	3-1/2	7-1/2	3-1/2	5-1/4	1-3/4

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Figure 15-19. Panel Dimensions

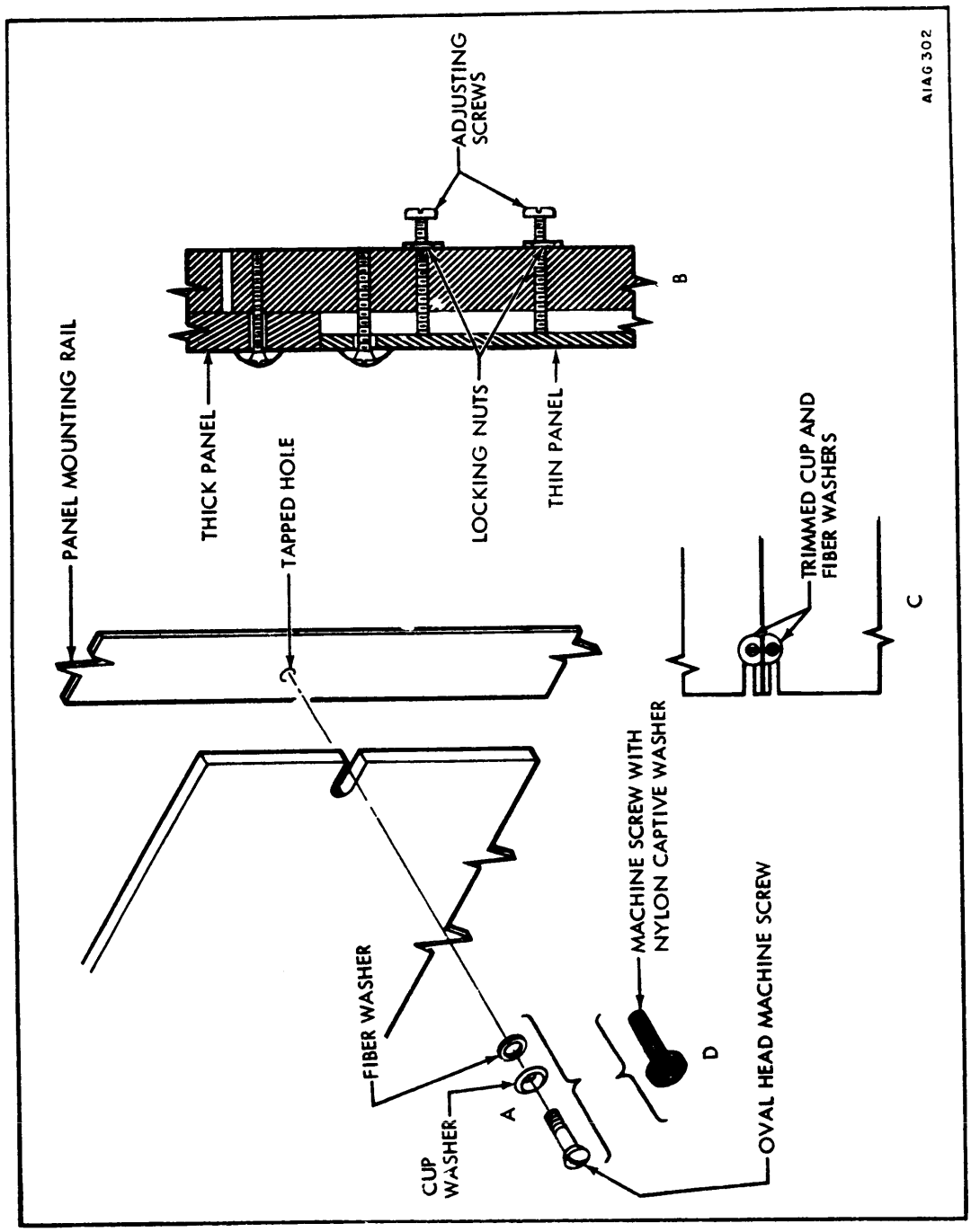

Figure 15-20. Panel Installation

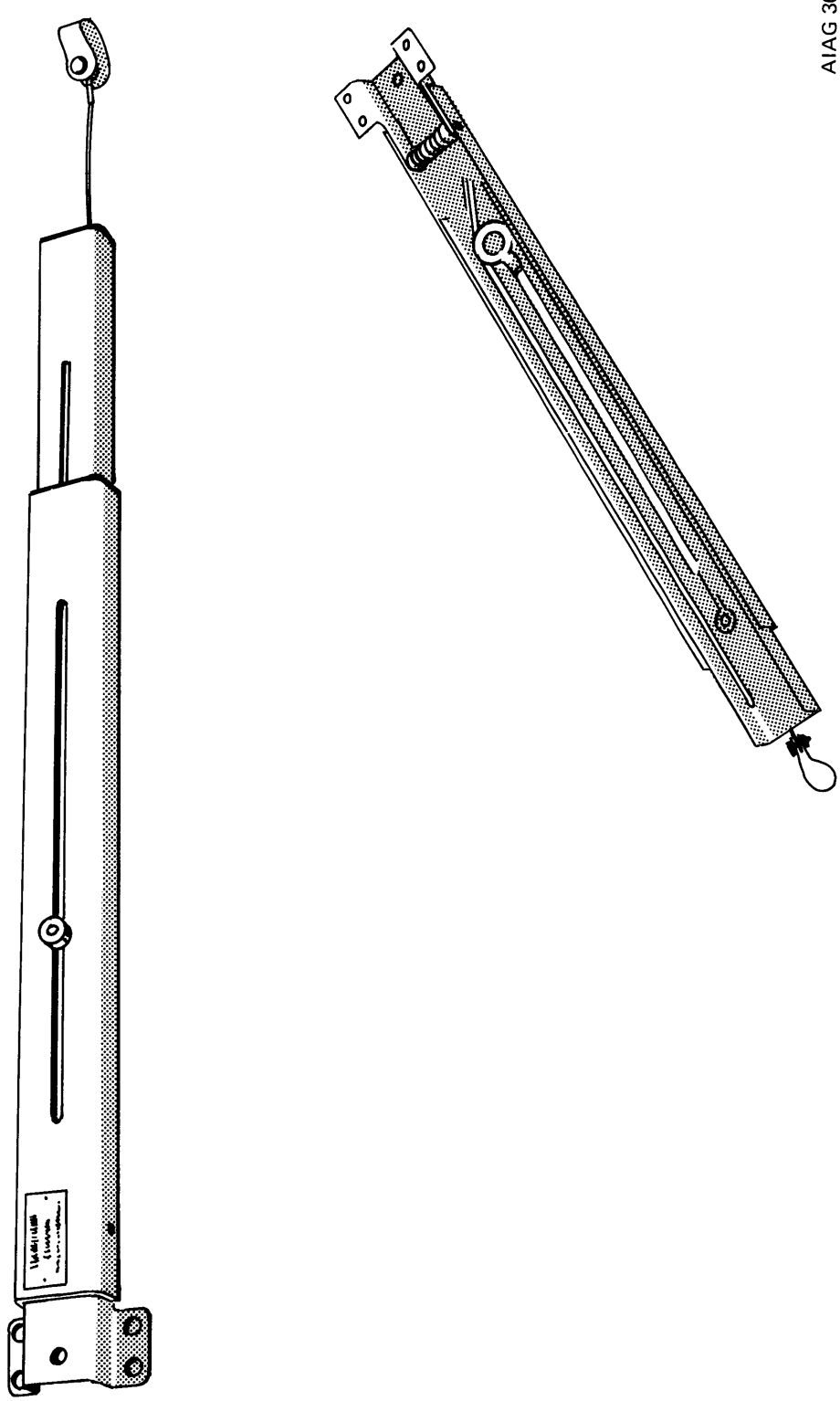

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Figure 15-21. Typical Cable Retractor

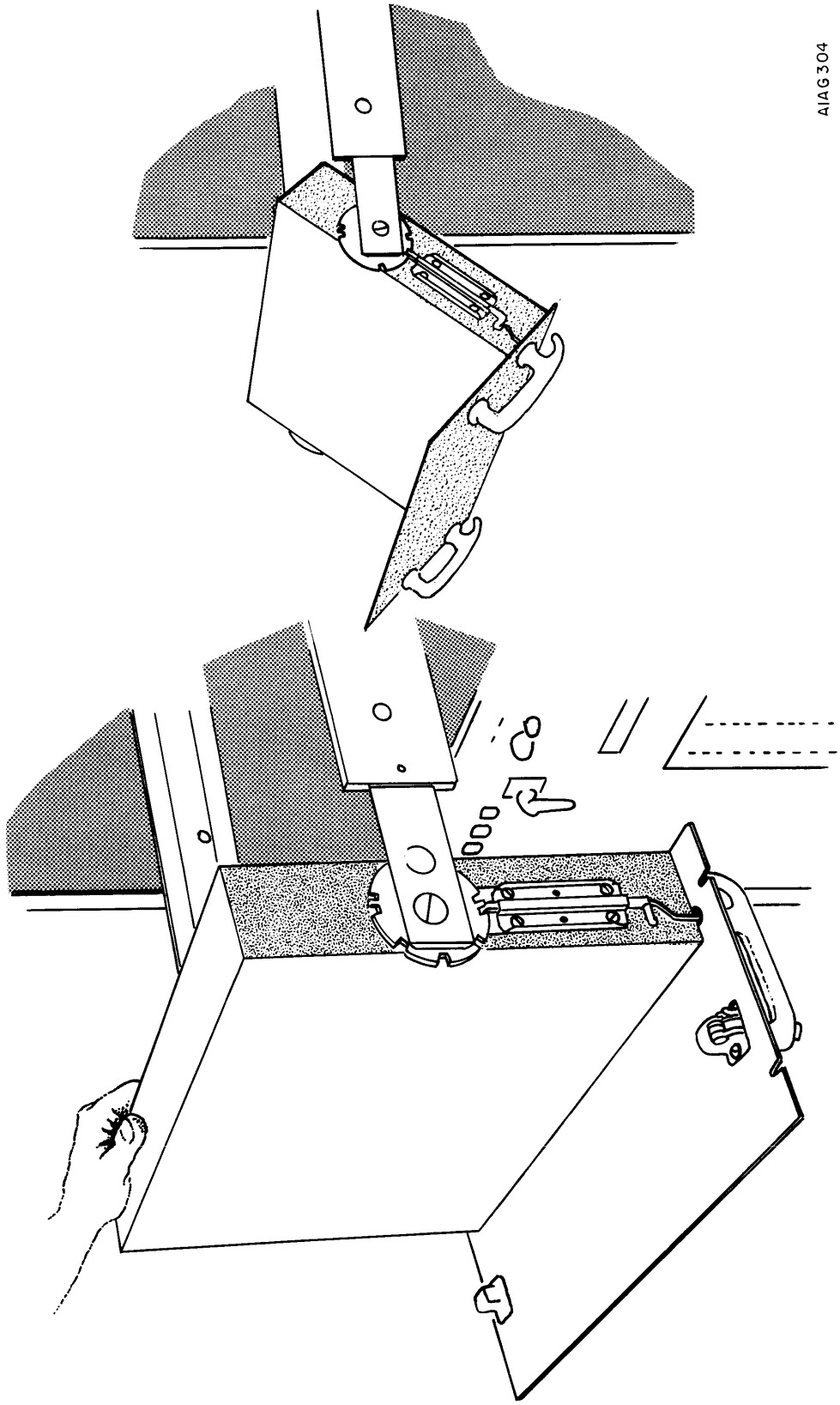

Figure 15-22. Detent Slide with Drawer

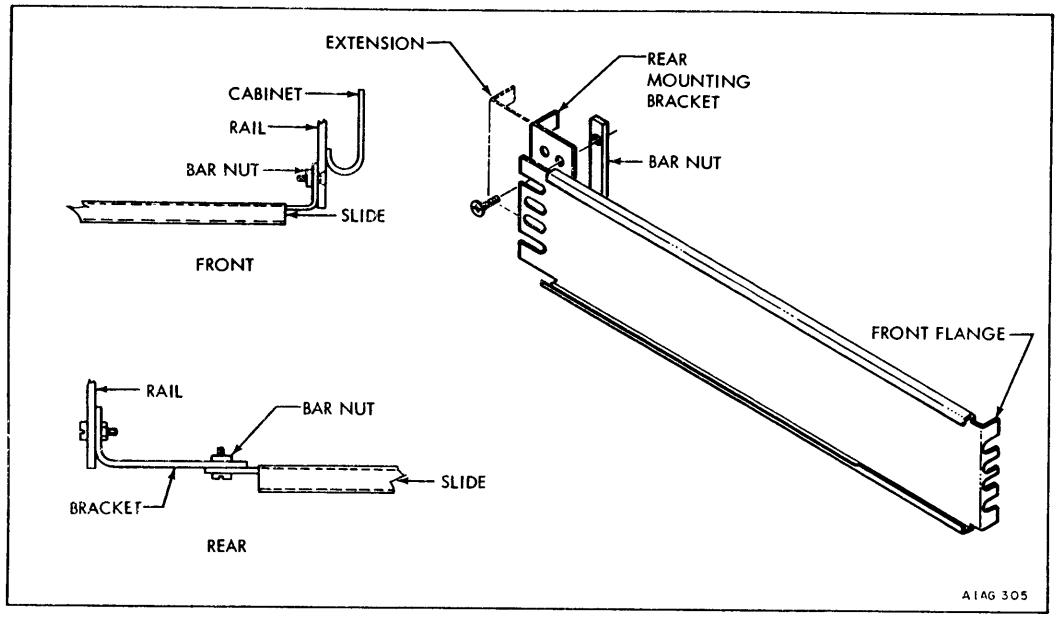

Figure 15-23. Mounting of Slides

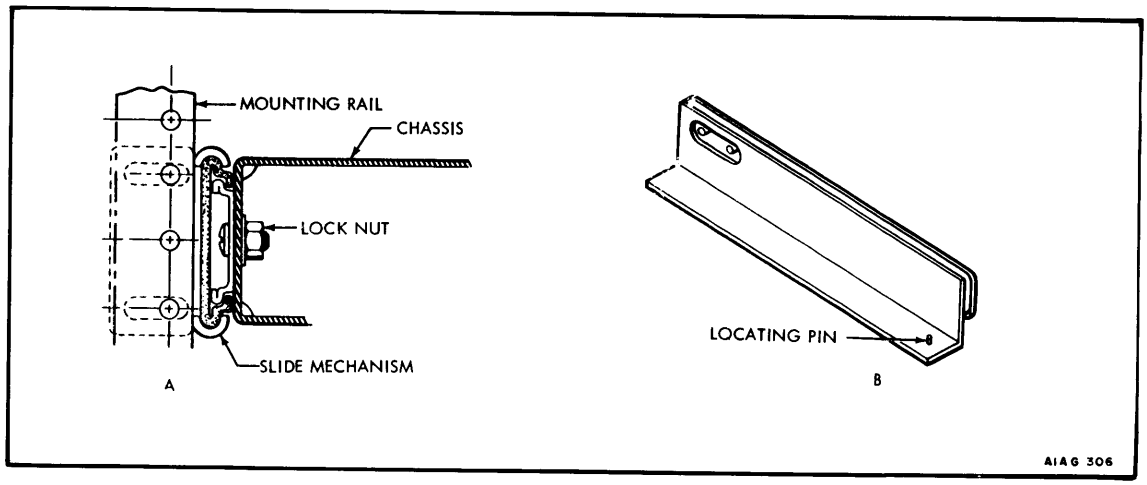

Figure 15-24. Attaching Chassis to Slide

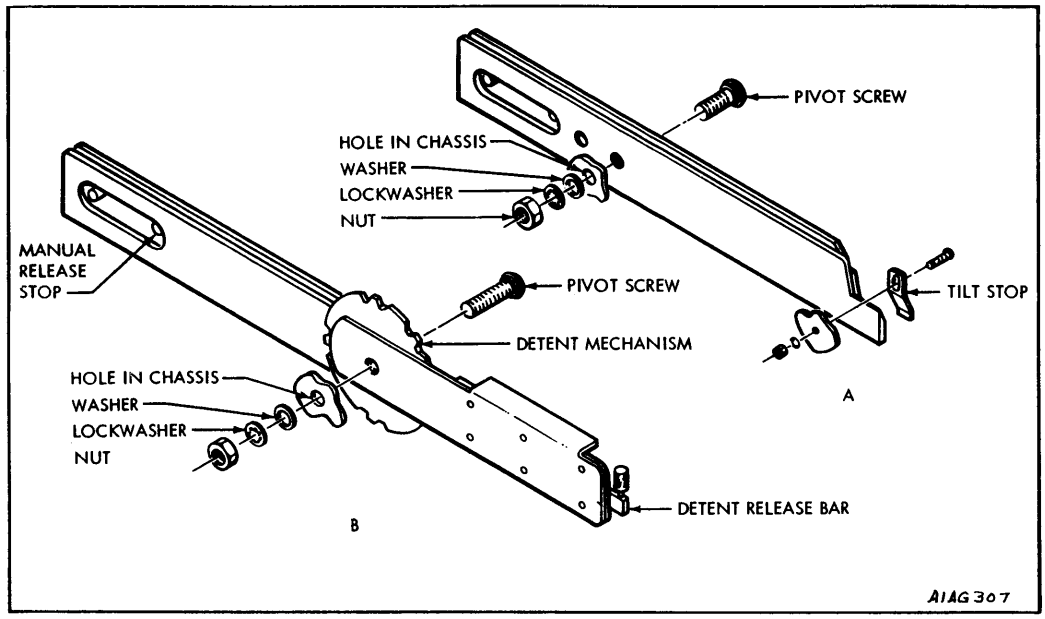

Figure 15-25. Attaching Chassis to Tilt-Type Slide

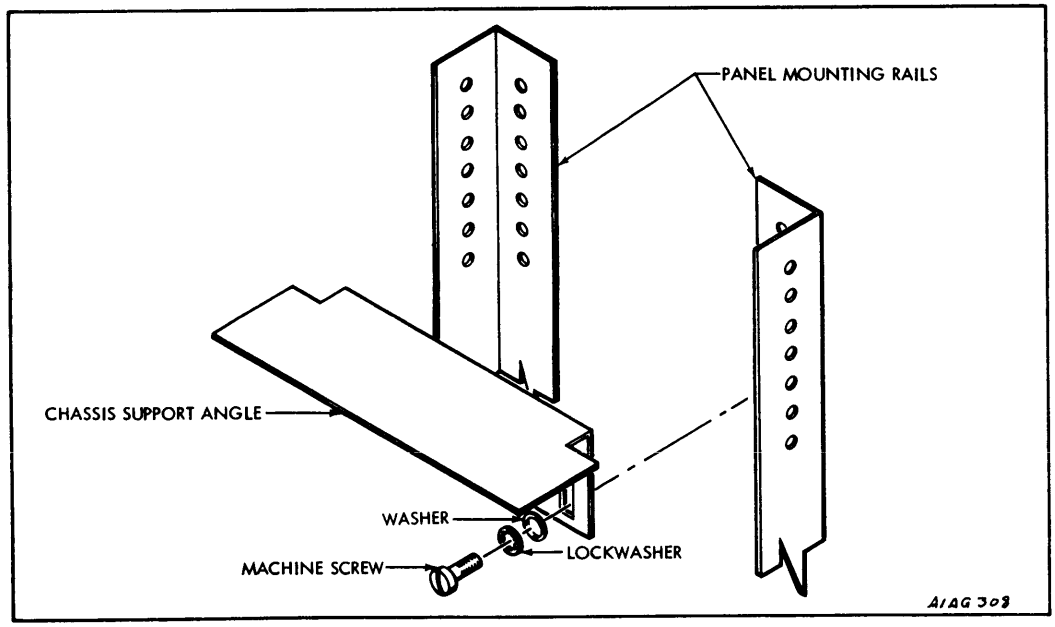

Figure 15-26. Installation of Chassis Support Angles

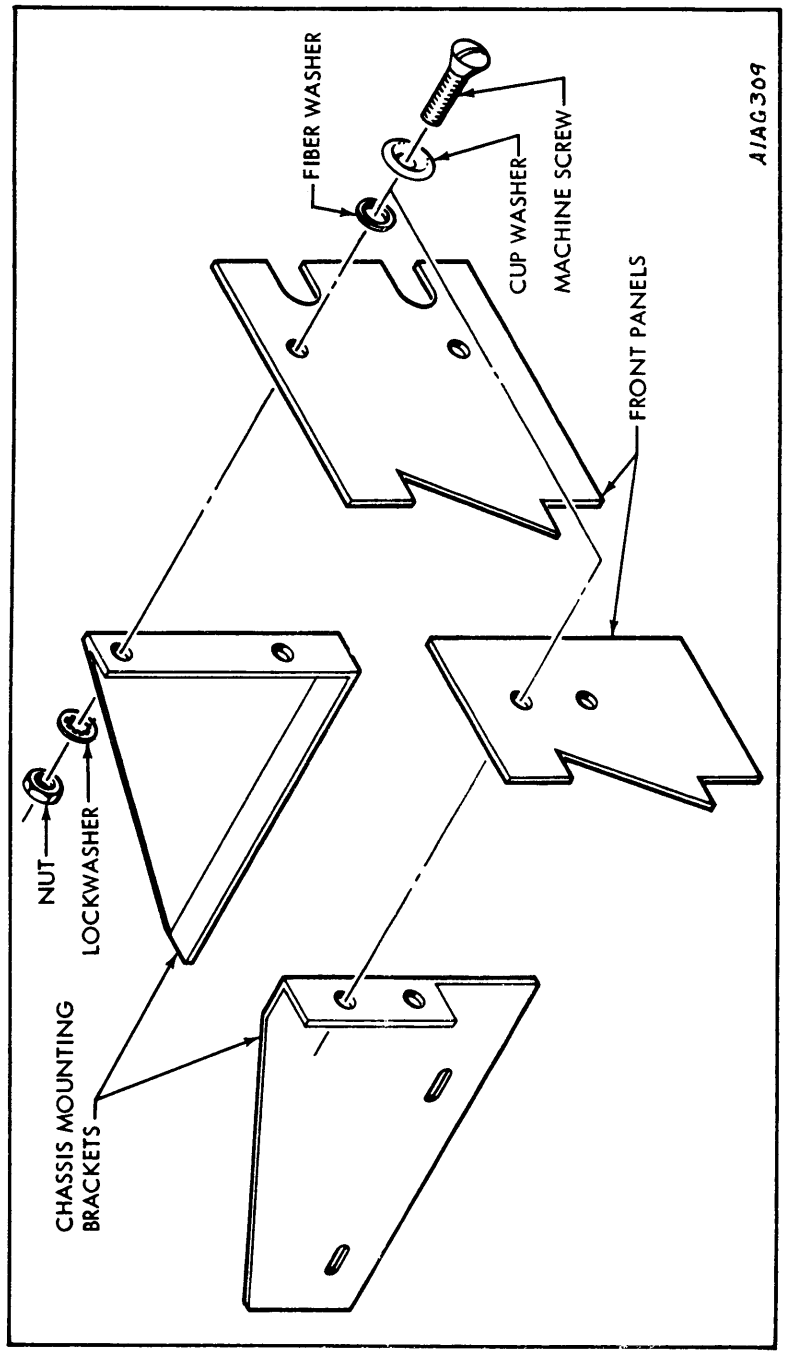

Figure 15-27. Installation of Chassis Mounting Brackets

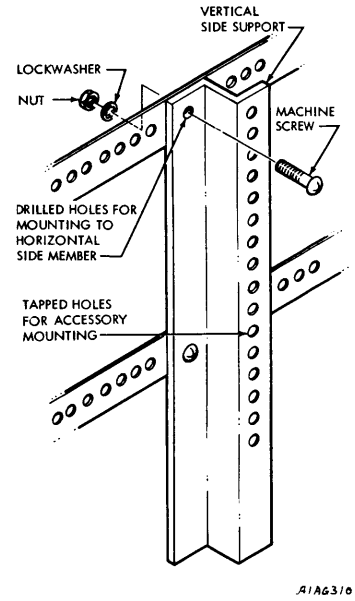

Figure 15-28. Installation of Vertical Side Supports

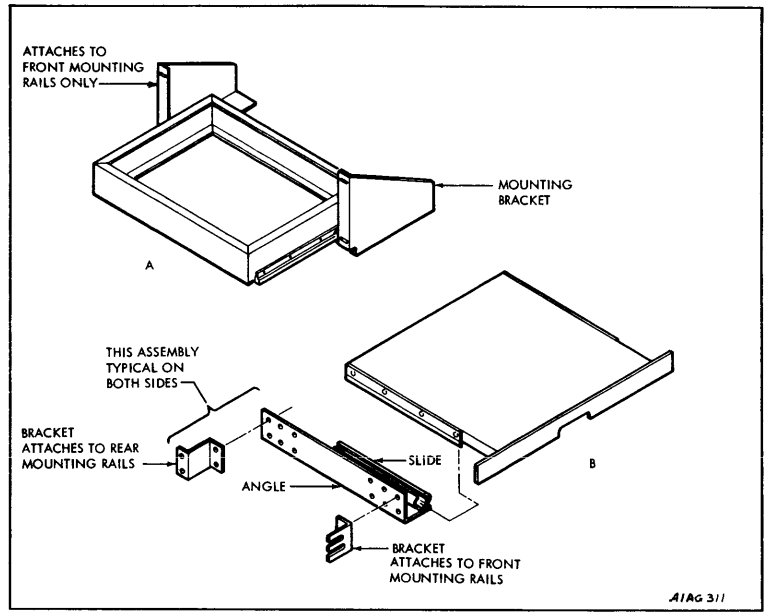

Figure 15-29. Mounting of Sliding Accessories

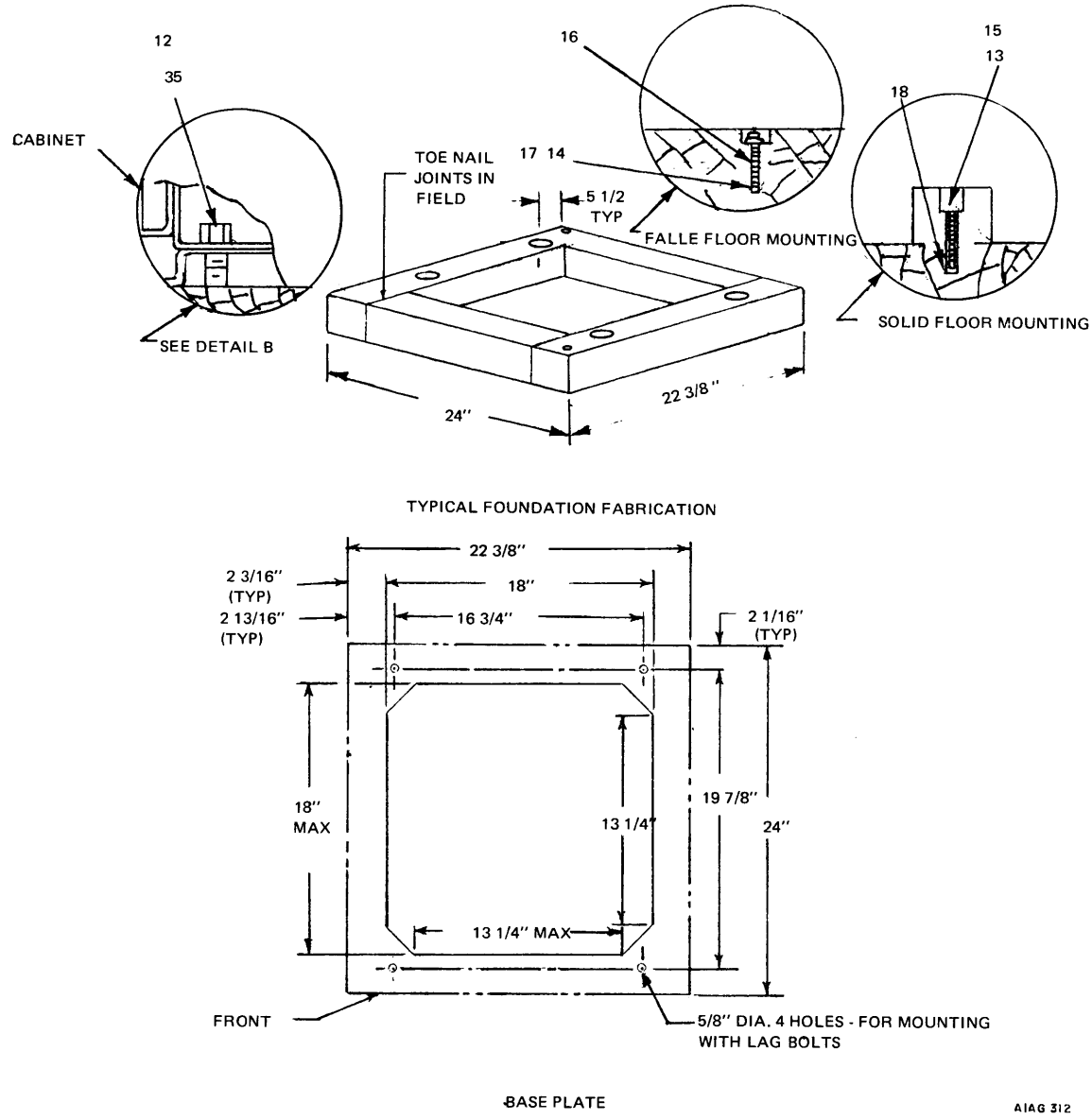

Figure 15-30. Cabinet Foundation

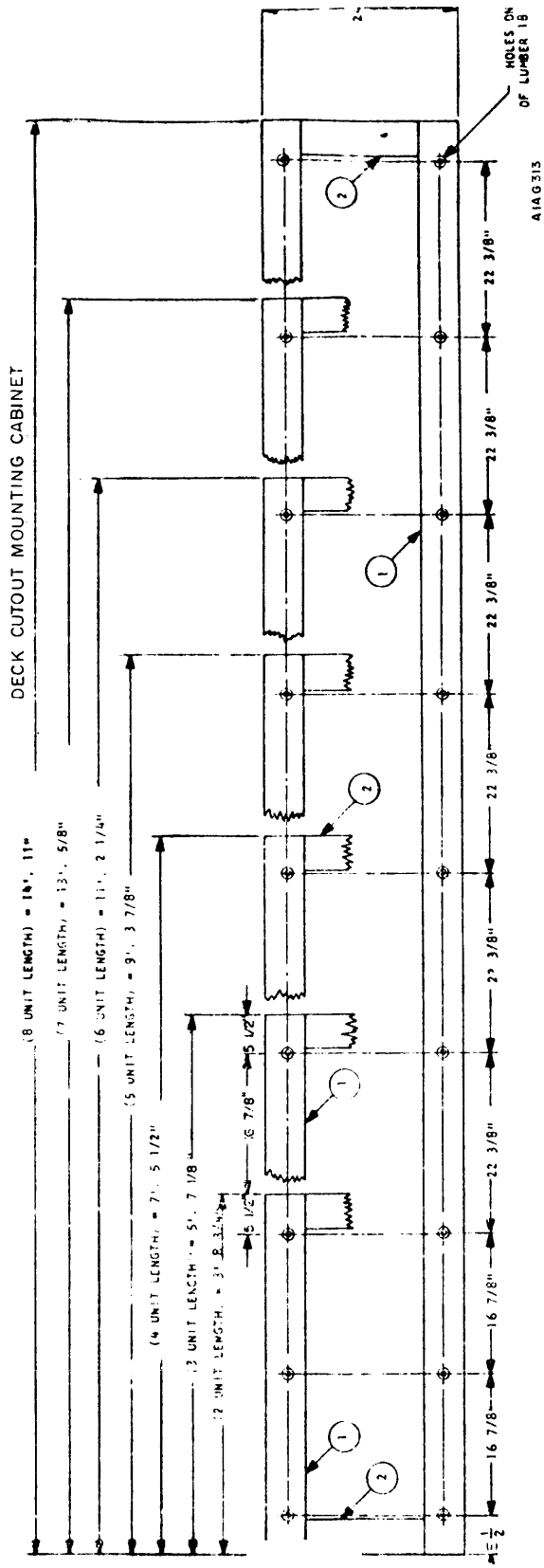

Figure 15-31. Multi-Cabinet Foundation

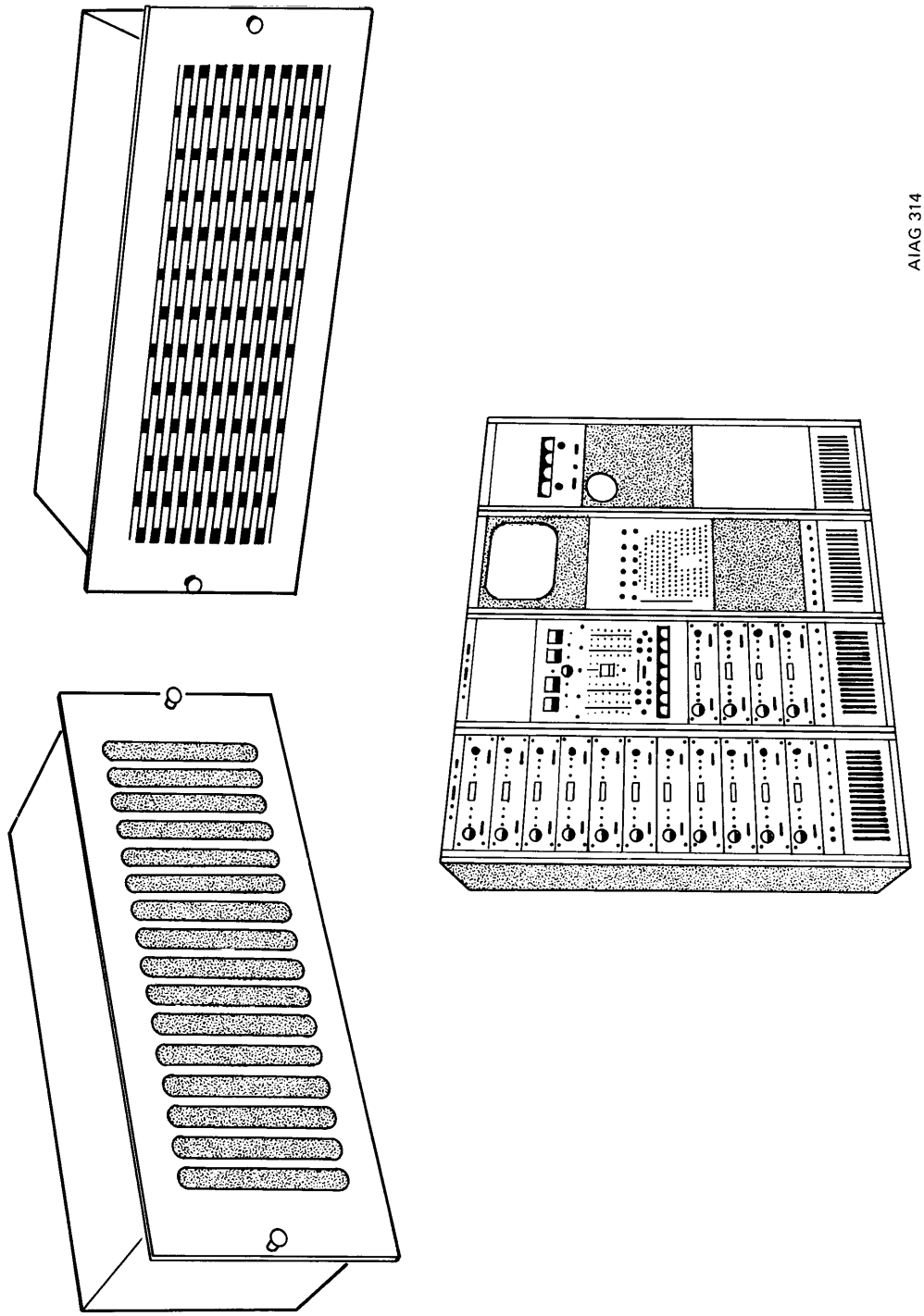

Figure 15-32. Standard Cabinet Blowers Installed in Base

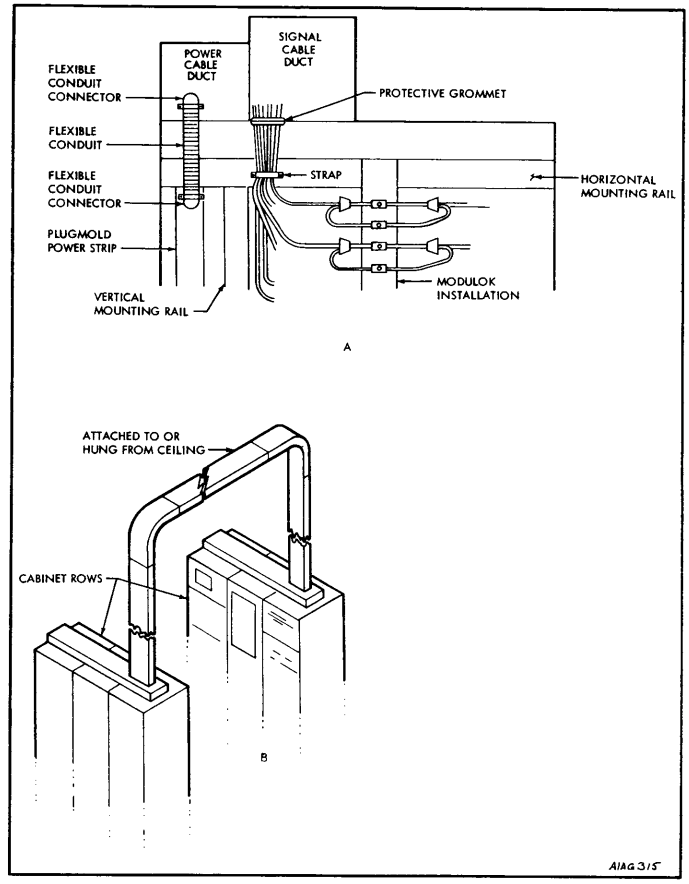

Figure 15-33. Duct Mounted on Cabinet Top

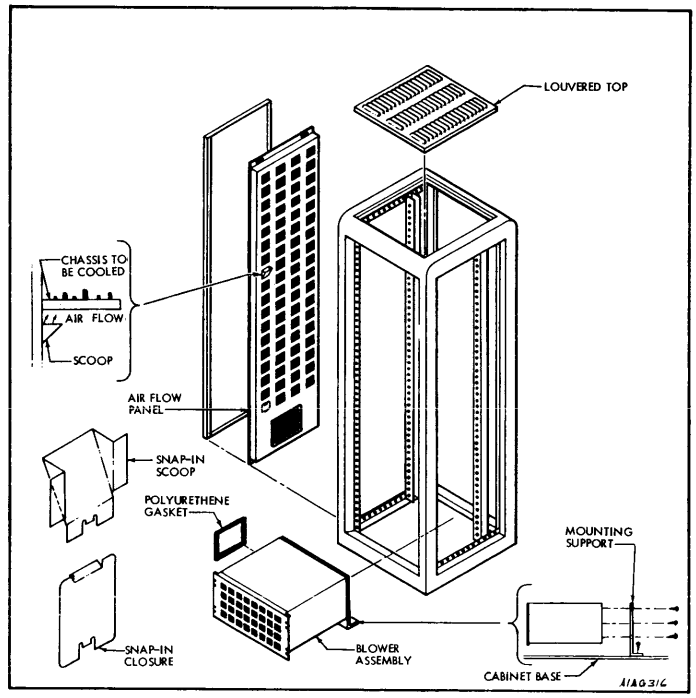

Figure 15-34. Air-Flow Panel Cabinet

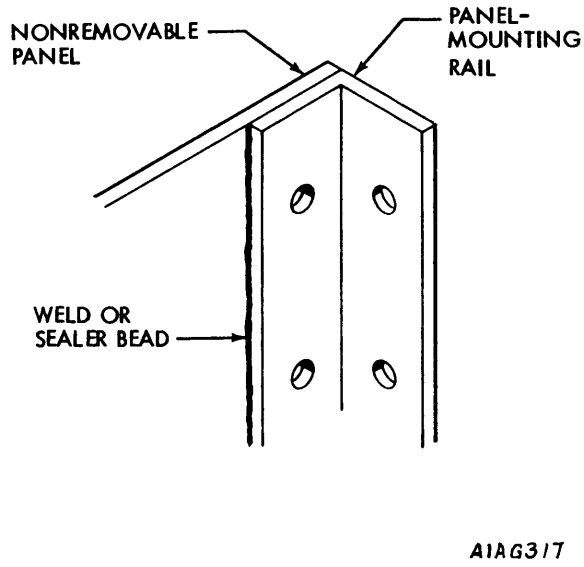

Figure 15-35. Applying Sealing Compound to Cabinet Seams

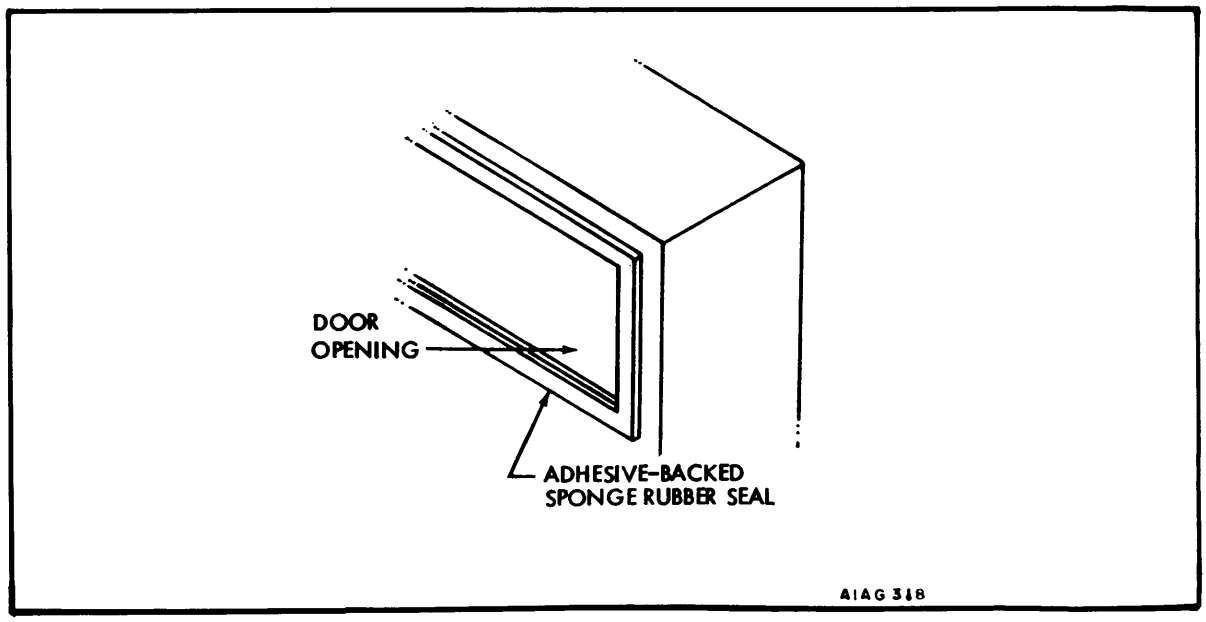

Figure 15-36. Sealing Cabinet Doors

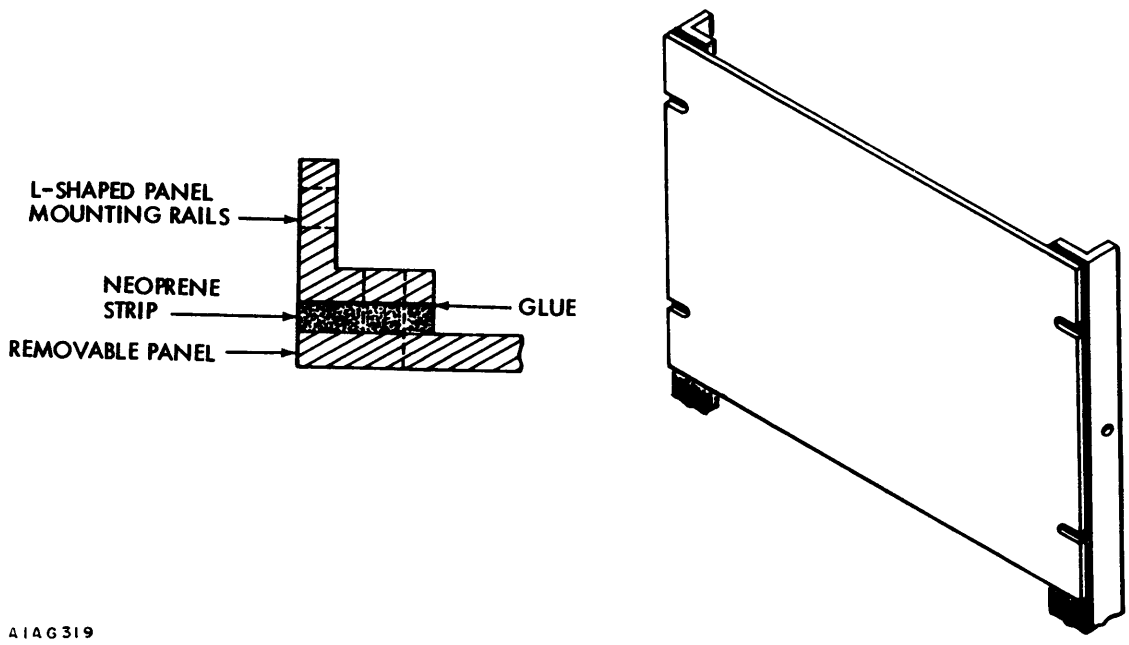

Figure 15-37. Sealing Cabinet Removable Panels

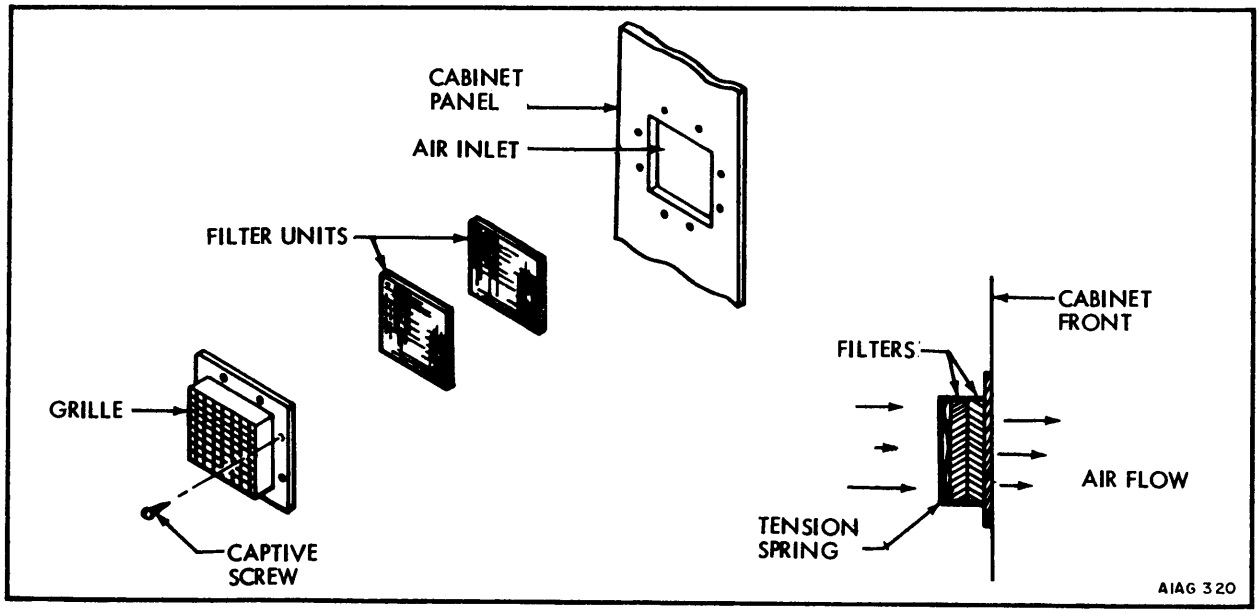

Figure 15-38. Installation of Cabinet Double Filters