

**Instructions for Field Assembly
of Shelterfor-M Outdoor
Metal Clad Switchgear**



Westinghouse Electric Corporation

Assembled Switchgear & Devices Division, East Pittsburgh, Pa.
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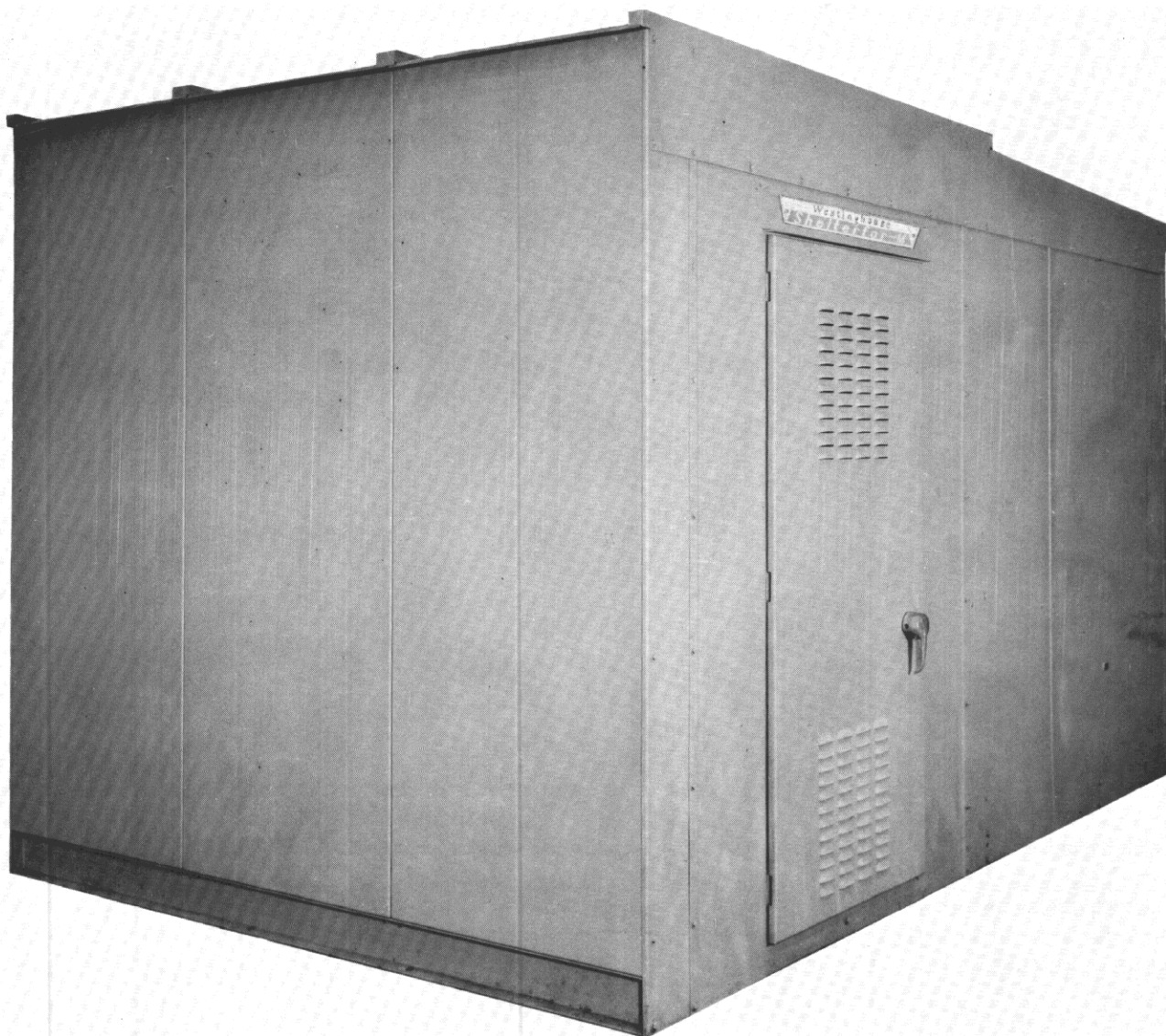


Fig. 1. Shelterfor-M Switchgear

INTRODUCTION

This instruction book has been prepared to familiarize the Purchaser's engineering, installation and operating staffs with the Shelterfor-M (pronounced shelterform) outdoor metal-clad switchgear supplied by Westinghouse Electric Corporation for this installation. Personnel responsible for installation of this equipment should be given copies of this book well in advance of the starting date for the installation work. Also those responsible for supervision, operation, or maintenance should have copies.

The descriptions herein apply to standard Shelterfor-M construction. If unusual conditions or problems are encountered, which are not covered in these instructions, they should be referred to the nearest District Office where trained personnel are available for additional assistance.

DESCRIPTION

Shelterfor-M switchgear is basically indoor metal-clad switchgear to which has been

added weatherproofing and includes a sheltered aisle space for switchgear operation, breaker removal and maintenance.

The description herein will apply only to the weatherproof enclosure. A description of the metal-clad cells, their installation and operation, is given in the instruction book "Metal-Clad Switchgear with Type "DH" Air Circuit Breakers".

The weatherproof enclosures are constructed of formed sections of steel sheet. Weatherproof hinged doors, are provided at each end of the enclosure aisle. The doors are equipped with "crash" hardware for safety so that they can be opened by a touch from inside even if padlocked on the outside.

RECEIVING, HANDLING AND STORING

The switchgear is shipped with the cell units completely assembled. The outdoor enclosure aisle front panels are assembled across the front of the shipping group to protect the metal-clad units during transportation. Since outdoor enclosure front panel is not required in double bus arrangements using a common aisle, a protective structure will cover the instrument panels in this case. The aisle and its enclosure, which includes the two door assemblies, floor plates and aisle roof sections, are manufactured on a "per unit" basis and shipped separately. Normally the shipping groups consist of as many units as can be handled and shipped together, unless the Purchaser has specified smaller groups. The drawout breaker elements, accessories, and installation materials are also packed and crated separately from the housings.

RECEIVING

When the switchgear arrives, the Purchaser should check the material actually received against the shipping list to be sure that all parts have been received. This will avoid delays in installation.

All hardware items and other small parts required for field assembly are shipped in cloth bags and tagged for identification. Care must be taken that these are not discarded when the crates are unpacked. It is also good practice to retain the identification tag with the material for reference during installation.

If the metal-clad switchgear is to be installed as soon as received, it is recommended that the unpacking be done as required for installation as outlined under the paragraphs which follow. If the switchgear is to be stored or held for sometime before installing, it is advisable to unpack the shipment sufficiently to check the shipment for completeness and condition.

HANDLING

At the bottom of each shipping group are lifting angles for handling by a crane.

Each group is also provided with shipping angles near the roof at each end. During shipment, these angles are used for cross bracing to the freight car. In lifting with a crane, they act as spreaders for the cable slings which are placed in the notches at the ends of the angles. The shipping angles must NOT be used for lifting alone.

If a crane is not available for lifting the units into position, they can be skidded into place on rollers made from conduit or pipe. The four foundation channels running the length of the group may be used for moving lengthwise; but for front to back movement, suitable timbers must be placed between the rollers and the foundation channels. When removing the rollers, the units must be gently lowered into place on the concrete foundation. Jacks may be placed under the lifting angles of the first group. In moving in subsequent groups, the shipping and lifting angles must be removed before placing next to the first group.

One method of lowering the group from the rollers and timbers is the use of long wedges under the foundation channels at each

Table No. 1 Approximate Weights of Shelterfor-M Switchgear Units.

TYPE OF UNIT	CURRENT RATING AMPS.	DEAD WEIGHT INCLUDING BREAKER POUNDS	TOTAL IMPACT AND DEAD WEIGHT POUNDS
50-DH-75 BREAKER 20" WIDE	1200	2600	2850
50-DH-75 AUX. 26" WIDE	--	2200	--
36" WIDE	--	2400	--
50-DH-150/250 BREAKER 26" WIDE	1200	3500	4050
36" WIDE	2000	4100	4750
50-DH-150/250 AUX. 26" WIDE	--	3200	--
36" WIDE	--	3600	--
50-DH-350 BREAKER 26" WIDE	1200	6700	7850
36" WIDE	3000	6900	8150
50-DH-350 AUX. 26" WIDE	--	3300	--
36" WIDE	--	3900	--
75-DH-250/500 BREAKER	1200	5200	6250
	2000	5600	6750
150-DH-150/250/500 BREAKER	1200	5000	5950
	2000	5400	6450
75/150-DH-150/250/500 AUX.	--	4100	--
150-DH-750 BREAKER	1200	5900	7150
	2000	6300	7650
150-DH-750 AUX.	--	4500	--
150-DH-1000 BREAKER	1200	6400	7050
	3000	7700	8650
150-DH-1000 AUX.	--	5400	--

Note: Actual weights of units will vary in proportion to amount and type of auxiliary equipment in the units.

corner. These may be fabricated from sections of 4 X 4's approximately 40 to 50 inches long cut on the diagonal. With the use of a large crow bar, each corner in turn is lowered a fraction of an inch.

STORING

If the Shelterfor-M switchgear is received before installation is scheduled, or if the switchgear is not immediately energized after installation, temporary power must be made available for the operation of the heaters. This is to provide dry warm air to prevent condensation inside the switchgear until placed in service. Temporary power may be connected to the heater in the cable compartment of any feeder unit by bringing the cable in through the main cable opening located at the bottom rear of

the unit. This power must be of the correct voltage and should be fused and brought into each shipping group. Refer to Fig.19. The unit rear gasketed sheet is removed by taking out the 5/16-18 X 3/4 inch bolts. Care being taken to prevent damage to the 1/4 X 1/4 inch sponge neoprene gasket. The perforated aluminum rear floor sheet and apron may then be removed and drilled at a position that will be suitable for the future main cable entrance. This cover must be replaced to prevent entrance of rodents during storage.

CAUTION: If the shipping groups are stored where they will be exposed to the sun or other source of heat sufficient to cause the inside temperature of the enclosure to exceed 120°F. for a sustained period, the strippable plastic coating supplied on the hinged instrument panels

of the metal-clad units **MUST BE REMOVED WITHIN 30 DAYS.**

INSTALLATION

Foundation. It is only necessary to install a suitable foundation on which to set the Shelterfor-M switchgear since channels are included as part of the switchgear. This foundation may be a solid concrete pad or pillars. The pillars may run in the same direction as the channels or perpendicular to them.

The concrete foundation or pillars upon which the switchgear is to be erected must be designed for sufficient strength to withstand the weight of the structure plus the shock of the breakers opening under short circuit conditions. Table No. 1 gives approximate dead and impact weights for the various ratings of Shelterfor-M switchgear. Actual weights will vary somewhat with the individual units, depending on the type and amount of auxiliary equipment that is specified for the unit. Adequate safety factors must, of course, be used in designing the floor or foundation.

Conduit Layout and Switchgear Floor Plan. Provisions must be made in the floor or foundation for the conduits which carry main cables, control wiring, and ground cable when such conduits enter the switchgear from below. A floor plan and base plan drawing is made for each Shelterfor-M switchgear order. These drawings must be used for determining the final conduit layout, location of anchor bolts, spacing of floor channels, and floor space required for each Shelterfor-M switchgear structure. Anchor bolts and hardware are not included as they will vary with the type of concrete construction. However, hold down lugs Style No. 1584102 are included.

Conduits should project above the finished floor by approximately eight inches and be located according to the floor plan and base plan prepared especially for the individual Shelterfor-M switchgear order. If one or more control cable conduits is

required per unit, these should be aligned in the space allotted for them on the floor plan. It will simplify moving the units into place if these are terminated approximately flush with the concrete, and extension conduits added after the units are in their final location. Otherwise it will be necessary to raise the units on timbers a sufficient height for the pipe rollers to clear the tops of the conduits.

Installation of Shelterfor-M Switchgear. The following suggestions and general order of operations will assist in installing Shelterfor-M switchgear.

1. When three or more shipping groups of Shelterfor-M switchgear are to be arranged in one continuous assembly, the center shipping group should be the first located. The other shipping groups should then be installed in successive order in each direction from the center of the structure.

When installing a unit substation, the power transformer and the adjacent metal-clad group should first be lined up and set in position in accordance with the dimensions on the base plan drawing for the installation. The additional groups should then be installed.

2. Move the first group of units into position according to paragraph 1 and Handling Instructions previously covered. If main cables enter at the bottom of any of the units in the group, it will be necessary to remove the unit rear gasketed sheet and the perforated aluminum rear floor sheet as previously described and shown in Fig. 19. As the bottom rear cable entrance compartment will then be completely open, the units may be moved over the projecting conduits.

3. Establish a base line a few inches in front of the group of housings and parallel with the desired front of the structure. Equalize the distances from the front of the housings to the base line, thus making the face of the group parallel to the base line.

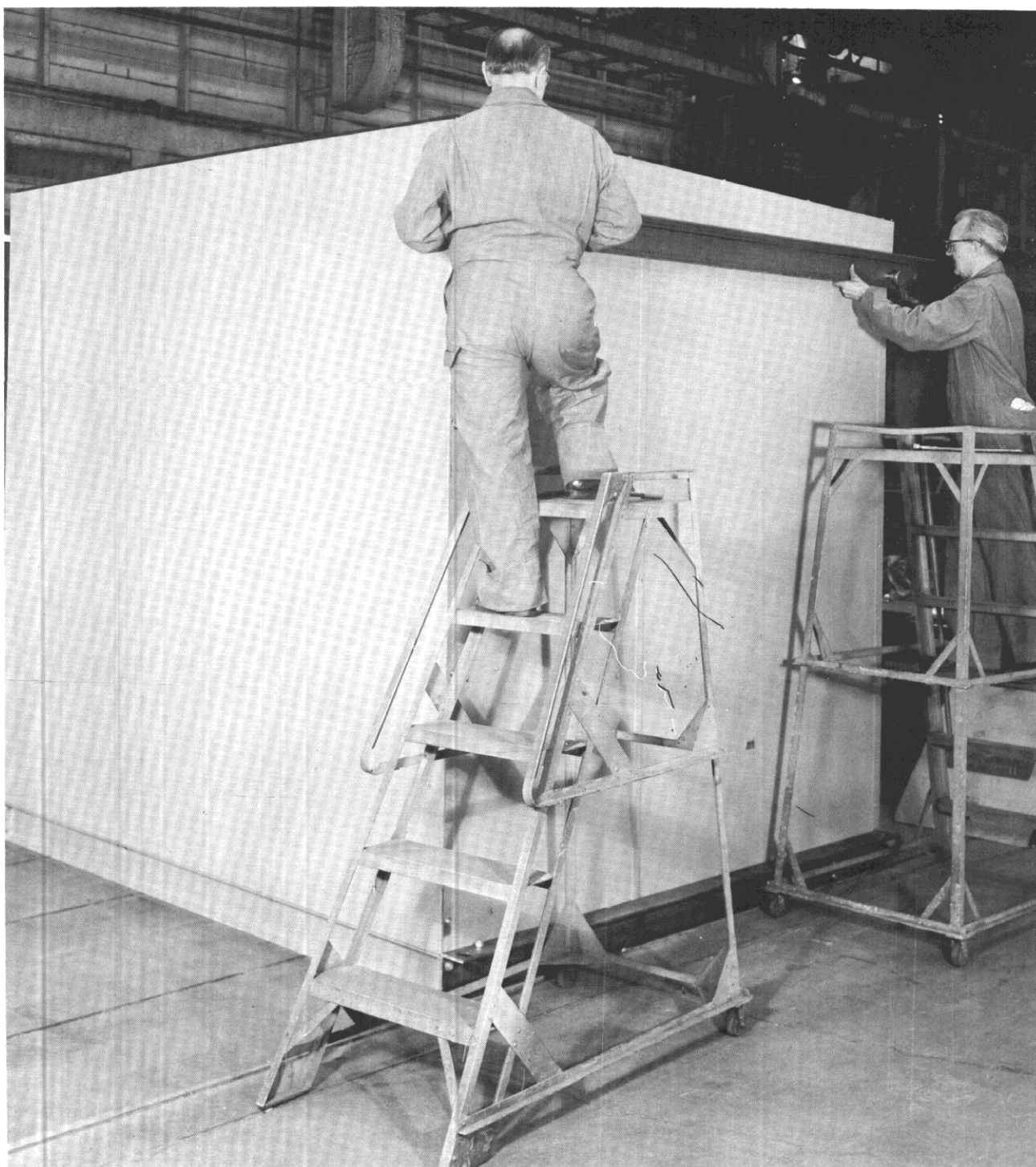


Fig. 2. Remove Shipping and Lifting Angles

4. Remove the shipping and lifting angles from the shipping group as shown in Fig. 2. If these are at the end of the switch-gear lineup, replace bolts that held the top

shipping angle with 1/2-13 X 7/8 inch hex head bolts and flat washers as indicated on the Bolting Diagram, Fig. 18. Use the 1/2-13 X 1-1/2 inch bolts removed from

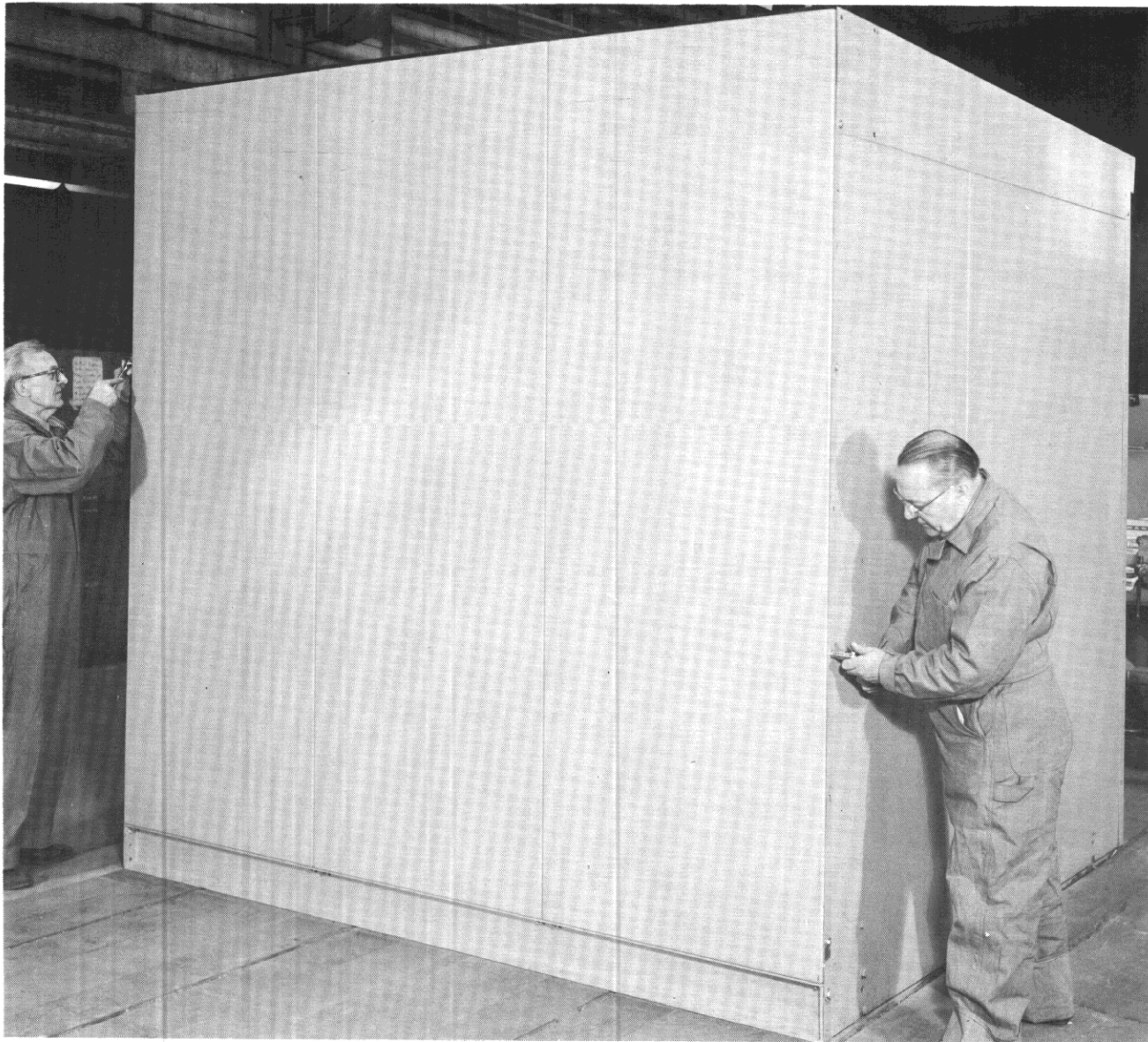


Fig. 3. Remove Shipping Bolts Holding Aisle Front Panels in Place

the lifting angle to fill the holes at the bottom of the unit end sheets.

5. In the case of single row Shelterfor-M, the enclosure front panel assembly is unbolted from the metal-clad compartments as shown in Fig. 3. These panels are factory bolted to their foundation channel, and should not be removed from it.

6. The panel assembly is then removed from the shipping group, see Fig. 4, and placed in position in accordance with the

dimensions on the base plan drawing. This must be braced at the top to prevent being blown over by the wind. One method is to temporarily install an aisle roof section with its studs as later explained in paragraph 16 or to bolt several flat steel bars between the top flange and the unit roof flange. Remove the 5/16 Tinnerman Speednuts from the vertical flanges and discard.

In the case of the double row common aisle arrangement in which one lineup of switchgear faces another, there is no front

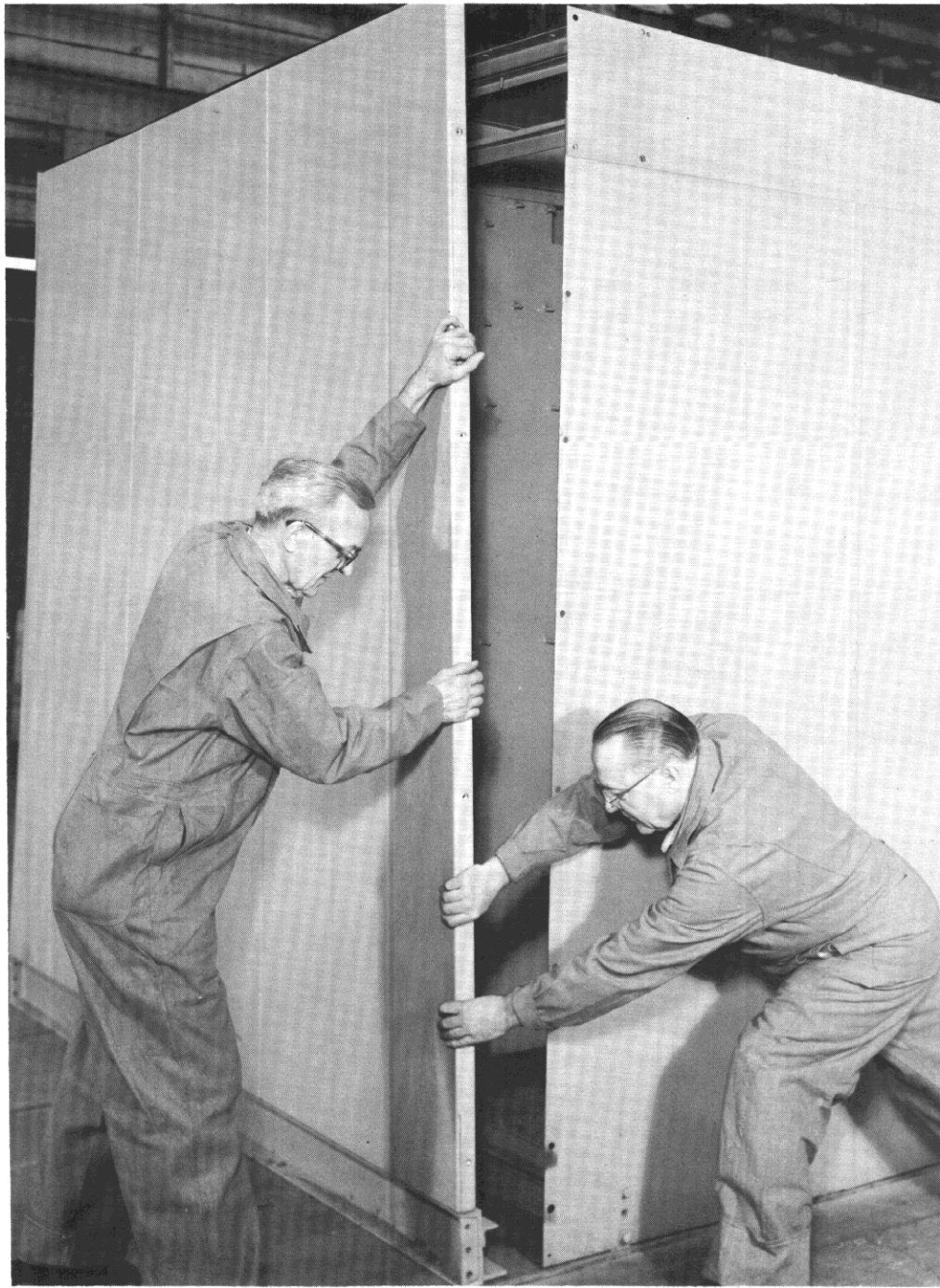


Fig. 4. Remove Aisle Front Panel Assembly

panel assembly. The crating is removed at this time, and great care must be taken so as not to damage any of the delicate instruments and relays which may be mounted on the switchgear.

7. The center foundation channel supporting the aisle floor plates is placed in position as indicated in Fig. 5 with the flanges of this channel turned toward the aisle front panels.

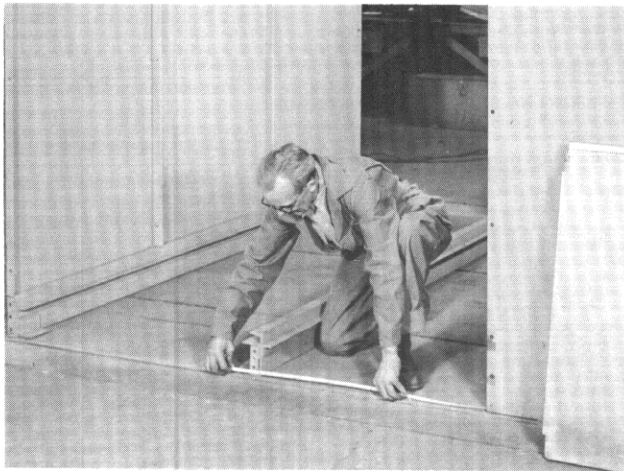


Fig. 5. Locate Aisle Center Foundation Channel

8. The hold down lugs, Style No. 1584102 are placed over the anchor bolts as detailed in the enlarged view of Fig. 6. These are located along the channel at the front of the units directly below the hinged instrument panels, along the channel at the

rear of the units, and the remaining two channels supporting the aisle floor plates. A flat washer, lockwasher, and nut should be used on each anchor bolt. The nuts must be securely tightened after all parts are rechecked for proper alignment.

9. When there is more than one shipping group, the above procedure should be followed for each.

10. The foundation channels at the aisle front panel, aisle center, and unit rear are bolted together at each shipping break with two $3/8$ -16 X $1-3/4$ inch hex head steel bolts through the $1/2$ inch tapped holes. Flat washers are used on each side of the channel tie plates with a lockwasher and nut completing the assembly.

11. The metal-clad units are tied together at the shipping break with nine $3/8$ -16 X $1-1/2$ inch steel bolts. However, before tightening the four bolts in the rear vertical angles, the unit rear seal tubing is placed

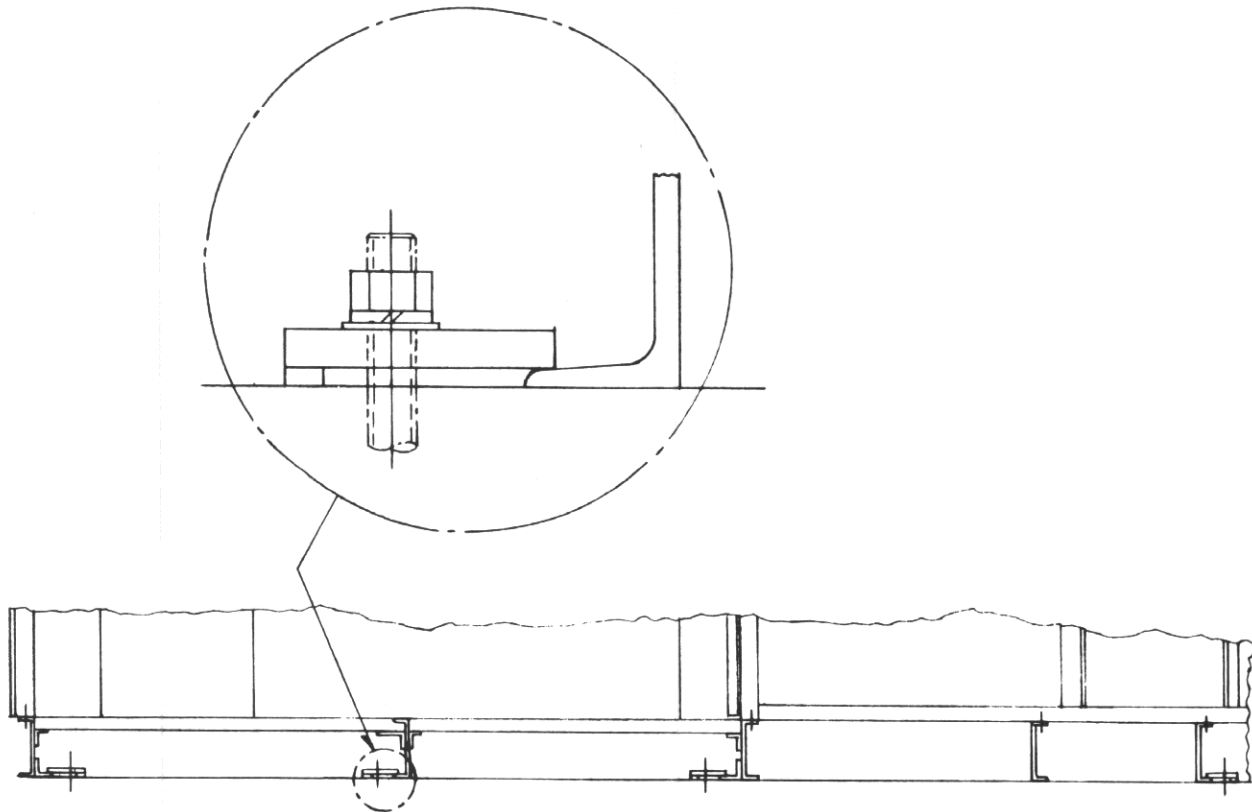


Fig. 6. Channel Hold Down Lug

in the 1/8 inch wide gap to the rear of the unit side sheet. This is shown in Fig. 7.

12. The vertical joint between adjacent front panel assemblies is made weather-proof by capping with the front panel seal strip. Refer to Fig. 8. Four 3/8-16 X 1-1/2 inch steel bolts are used to clamp the seal in place.

13. The aisle floor plates are now installed with the aisle center channel and the metal-clad compartment providing the anchor points for the rear plates. The center channel and the enclosure front panel assembly provide the anchor points for the front plates.

14. The following sequence of putting down the aisle floor plates must be followed, refer to Figs. 9 and 10.

A. The rear left hand floor plate is placed in position first, with the two notched cor-

ners under the front hinged instrument panel of the left end unit. This plate also has a pocket for the left aisle door latch.

B. The rear intermediate floor plates are placed in position starting from the left and proceeding toward the right.

C. The rear right hand floor plate containing the pocket for the right aisle door latch completes the floor immediately in front of the metal-clad units.

D. The floor plates adjacent to the aisle front panels are next placed in position starting with the plate next to the right hand aisle door.

E. The front left hand plate is the last to be placed in position.

15. The aisle door frames are placed in position as shown in Fig. 11. It is standard for both doors to hinge on the side toward

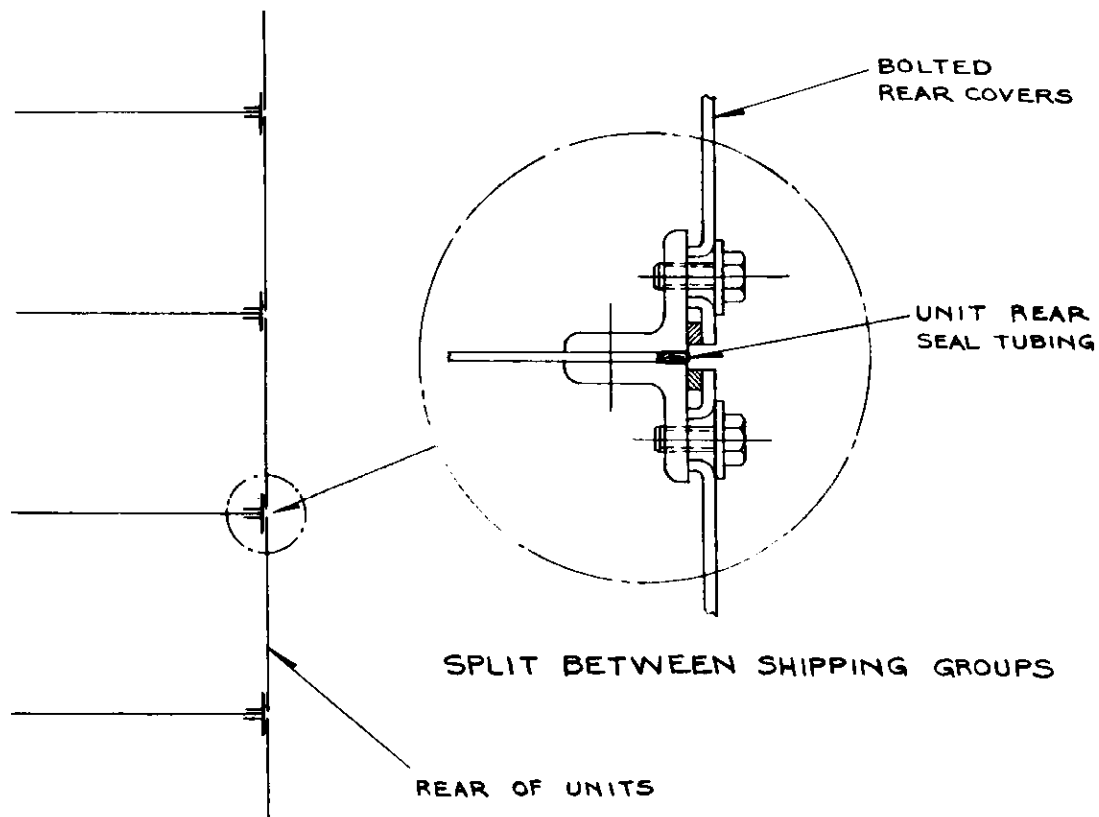


Fig. 7. Unit Rear Seal Installation



Fig. 8. Aisle Front Panel Joint Seal

the aisle front panels and latch on the side toward the metal-clad units. The doors are shipped assembled on their frames. If it is desired to remove the doors from their frames during field assembly, first disconnect the link from the door by removing the cotter pin and washer. Return these to the pin in the end of the link for safe-

keeping. The pins are tapped from the three hinges while supporting the door.

The door frame and filler strip mounting bolt holes are aligned with the corresponding clearance holes in the metal-clad unit end sheet and aisle front panel flange. 5/16-18 hex head steel bolts are used at locations shown on Bolting Diagram, Fig. 18. A flat washer is used under each bolt head on the outside of the sheets with a second flat washer, a lockwasher, and nut on the inside of the enclosure.

16. The aisle roof assembly is composed of flanged panels of unit width, each to align with its corresponding metal-clad unit. Before lifting the roofs to their locations, the 5/16-18 X 1-1/4 inch steel studs are screwed into the tapped holes in the two steel spacer bars on the underside of the roof panel. Two studs are used on each end of the 20 and 26 inch wide panels while three are used on the ends of the 36 inch wide panel.

A 5/8 X 1-3/4 inch sponge neoprene gasket is placed on top of the aisle roof flanges 1/4 inch from the front edge as shown in Fig. 14. This gasket is supplied in one piece equal to the total length of the

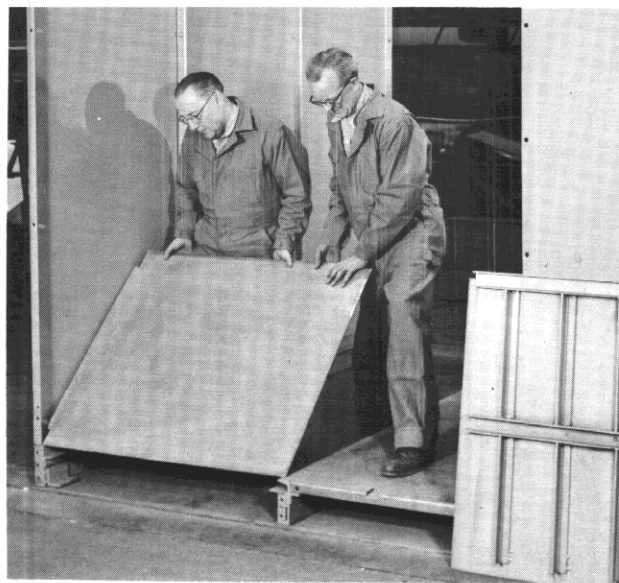


Fig. 9. Aisle Floor Plate Installation

switchgear lineup. One side is coated with an adhesive that holds it in place until the roofs are installed. The adhesive is exposed by removing a plastic strip.

Two 1/8 inch thick neoprene gaskets are located on diagonal corners of each roof section. Care must be exercised that these are not displaced during installation.

NOTE: The roof sections used with the "Wide Aisle" (87 inches from hinged instrument panel to aisle front panel) are symmetrical. However, the roofs for the "Narrow Aisle" (57 inches) used with type 50DH75 metal-clad switchgear, and the "Extra Wide Aisle" (97 inches) used with type 150DH1000 metal-clad switchgear are not symmetrical. On these units the roof should be placed over the aisle so that the centerline of

the aisle lamp mounting bracket (two 1/4-20 tapped holes on 6 inch centers) is 41-5/8 inches from the hinged instrument panel as shown in Fig. 17.

The 5/16-18 X 1-1/4 inch studs should be only finger tight in the steel bar. A flat washer, lockwasher and nut are loosely placed on the studs to allow for minor adjustments when placing the joint seal strips in position.

17. The aisle roof joint covers are set in place and the holes aligned with the 5/16-18 tapped holes in the roof flanges. See Fig. 15. It is best to start with the roof nearest the center of the lineup and work toward each end. Each cover is held in place by ten special 5/16-18 X 3/4 inch gasketed bolts.

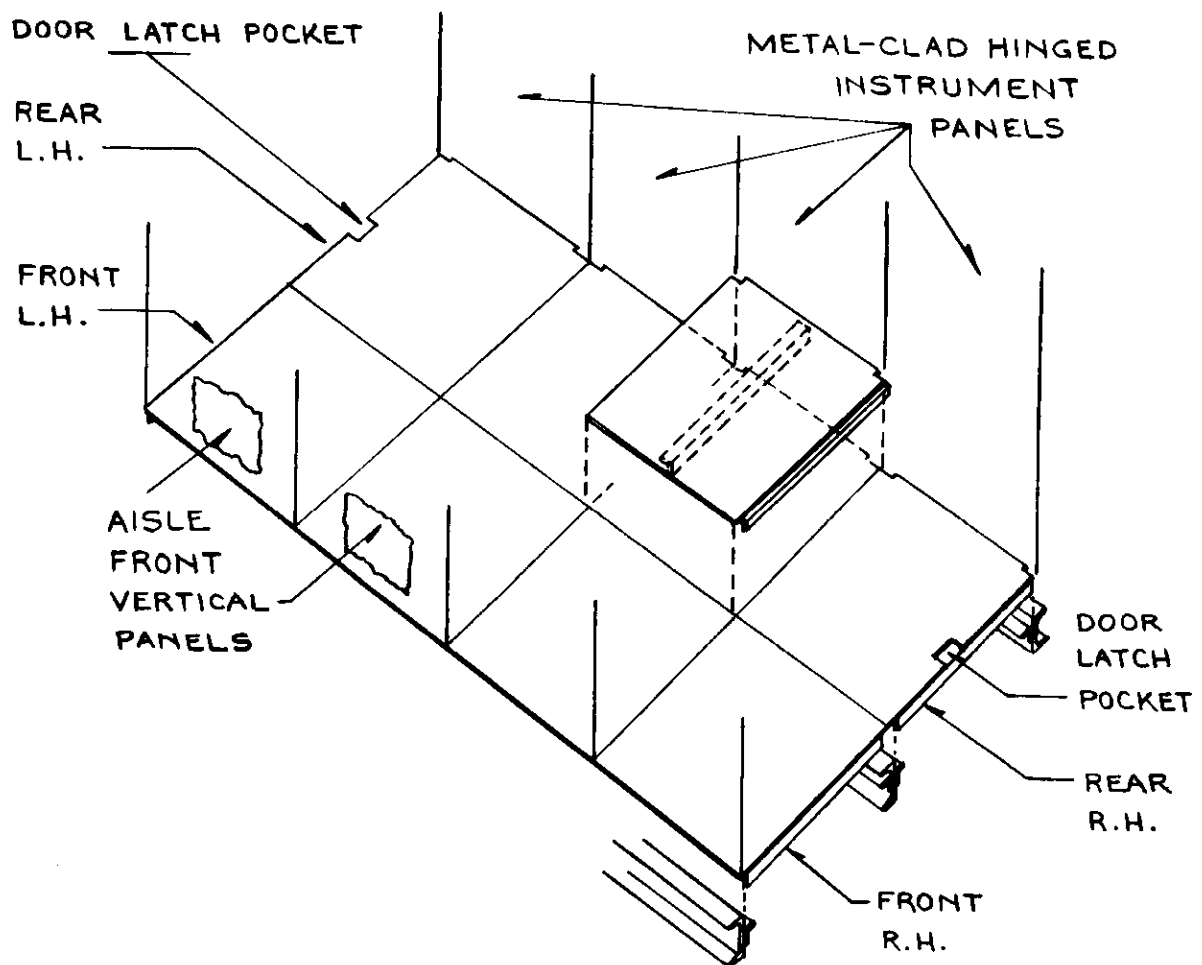


Fig. 10. Aisle Floor Plate Assembly Sequence



Fig. 11. Installing Door Frame

CAUTION: Tighten the gasketed bolts only until the gasket begins to compress. If they are tightened too much, the washers, which are initially concave downward, will dish in the opposite direction and break the weatherproof seal.

18. The joint between unit roofs at the shipping break must similarly be covered as instructed above. Two additional 5/16-18 X 3/4 inch hex head bolts with plain flat captive washers are used on the rear overhang.

19. The aisle roof end trim is hooked over the roof flange and rotated into place as shown in Fig. 16. Care must be taken that the neoprene gaskets inside these sheets are not disturbed.

20. The "L" shaped aisle door frame mounting spacer is located under each roof end trim only at the aisle front panel end. This

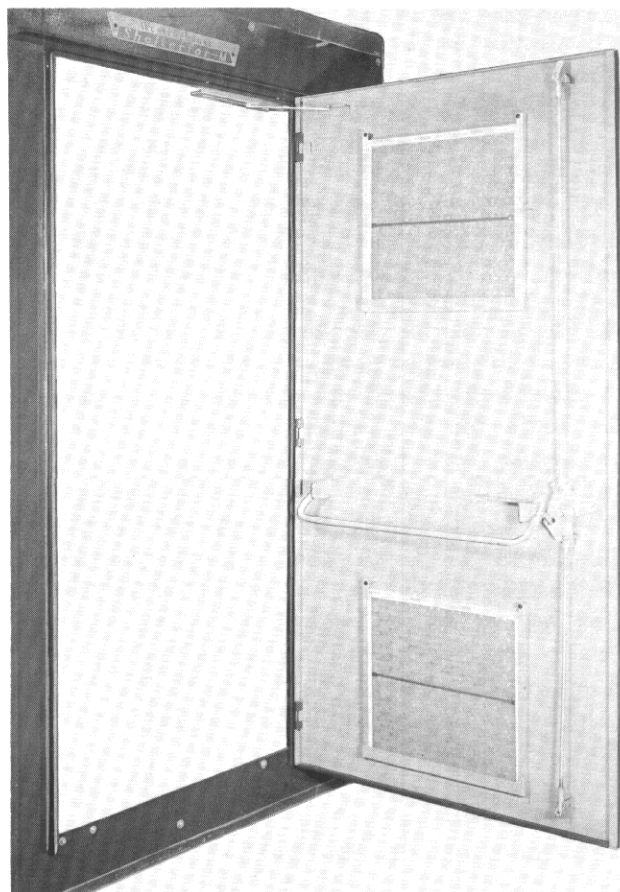


Fig. 12. Aisle Door "Crash Hardware"

spacer is 1/4 inch thick and has two clearance holes in the vertical leg that align with the end holes in the roof end trim. Refer to the Bolting Diagram, Fig. 18 for the hardware used at these locations.

21. The nuts on the 5/16-18 X 1-1/4 inch studs holding the aisle roofs in place, covered by Section 16, are now securely tightened.

22. The aisle door "Crash Hardware" is assembled and adjusted before leaving the factory, and should require no further maintenance other than an occasional drop of oil on the bearing parts. DO NOT OVER LUBRICATE.

Door Operation: The following description covers the door on the left end of the aisle as shown in Fig. 12. The right hand aisle door operates in the opposite manner.

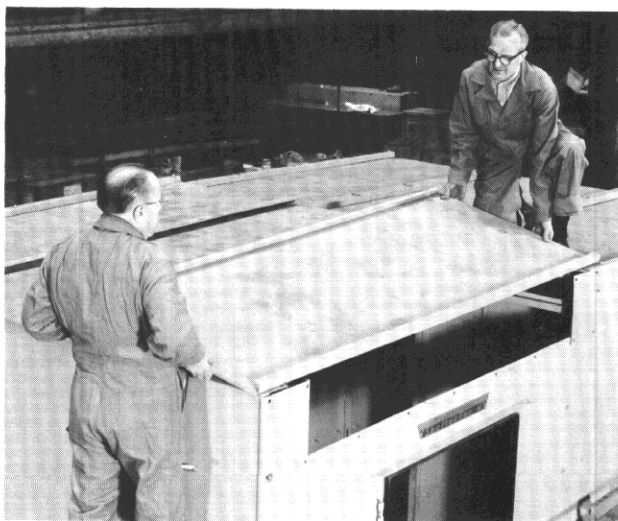


Fig. 13. Installing Roof Sheets

A. To open the left door from the outside, rotate the weatherproof handle counterclockwise approximately 60 degrees. The latches will be released, and the door will open.

B. To close the left door from the outside, first rotate the weatherproof handle counterclockwise until the top and bottom latches are pulled inward sufficiently to clear the top and bottom door frame members. Close the door. Rotate the weatherproof handle clockwise approximately 60 degrees beyond the center position. Return the handle to the center position and padlock.

C. To open the door from the inside, move the "crash bar" downward and the door will be released.

GASKET : INSTALLED
IN FIELD

GASKET : PART OF ROOF
ASSY BY SHOP

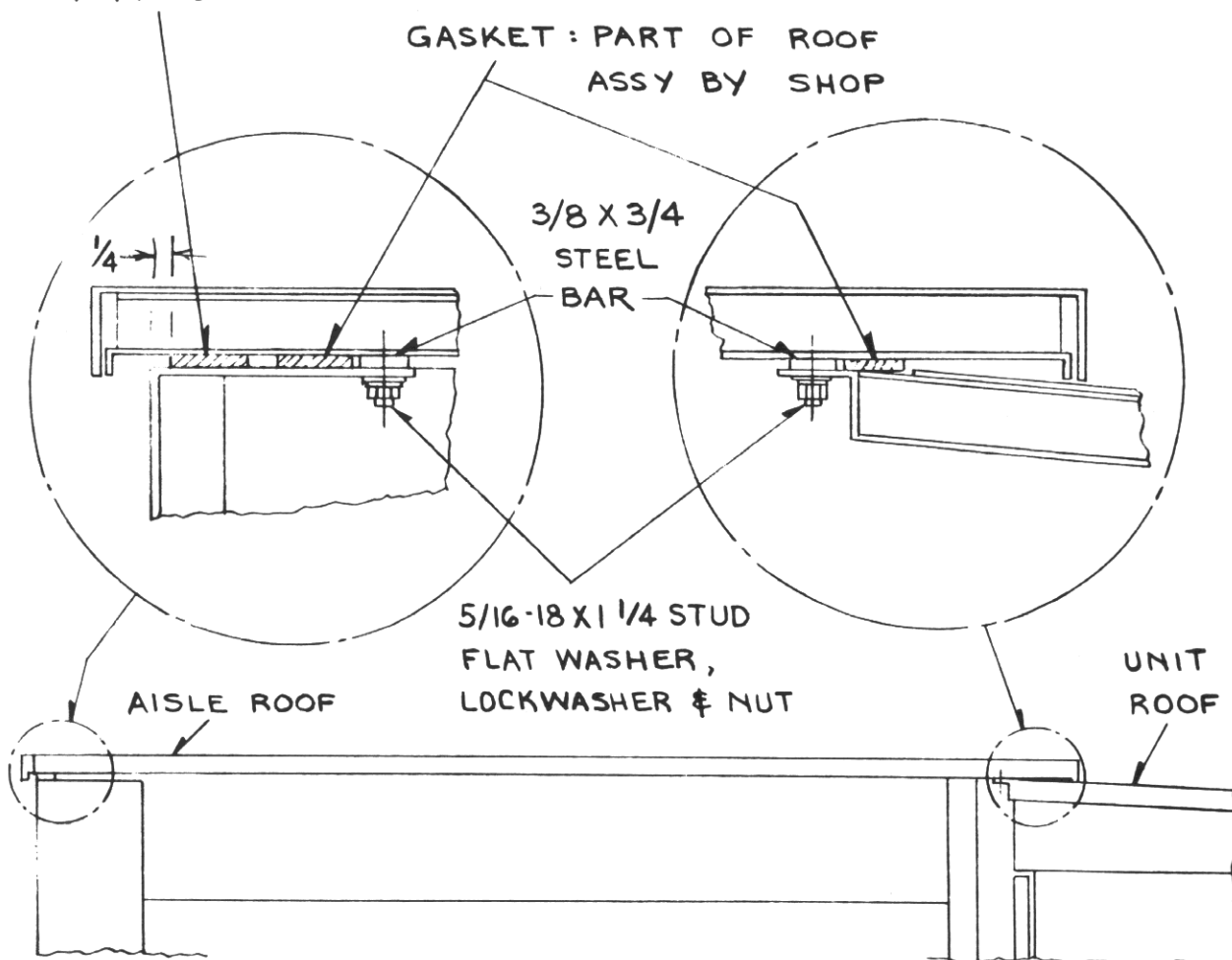


Fig. 14. Roof Sheet Bolting Studs and Gaskets



Fig. 15. Roof Joint Seal Strips

D. To close the door from the inside, move the "crash bar" downward to a vertical position. Pull the door closed by grasping the fixed handle while checking that the top and bottom latches clear the door frame members. Raise handle to lock.

NOTE: The door may be operated from the inside per C & D above without removing the padlock from the outside handle.

23. The aisle lamps are located in front of each "odd numbered" metal-clad unit. Refer to Fig. 17. The knock-out on the centerline of the unit roof adapter should be removed. The nut on the 1/4-20 X 1/2 inch bolt is removed from the lamp assembly mounting bar and discarded. Thread the two wires and the conduit through the knock-out, and fasten the lamp mounting bracket to the mounting strip at the center



Fig. 16. Roof End Trim and Door Frame Mounting Spacer

of the aisle roof with the 1/4-20 bolt and washers. Remove the perforated baffle at the top front of the unit and thread the wires through the rubber grommet into the control compartment of the unit. Connect the two leads to terminals number L3 and 30 on the cross panel terminal block. Train the leads and tie in place where necessary so that they do not interfere with control equipment in this compartment.

24. Use the paint that is supplied with the switchgear to cover the external bolts and washers and to touch up the exterior as required to achieve maximum protection.

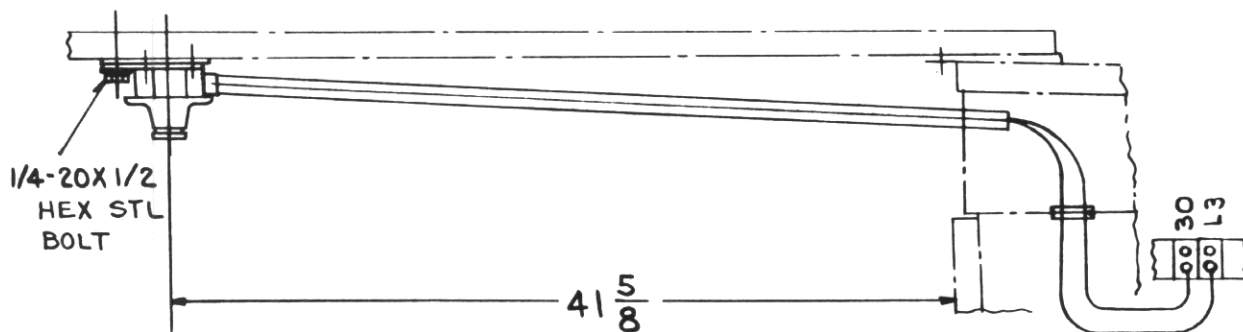
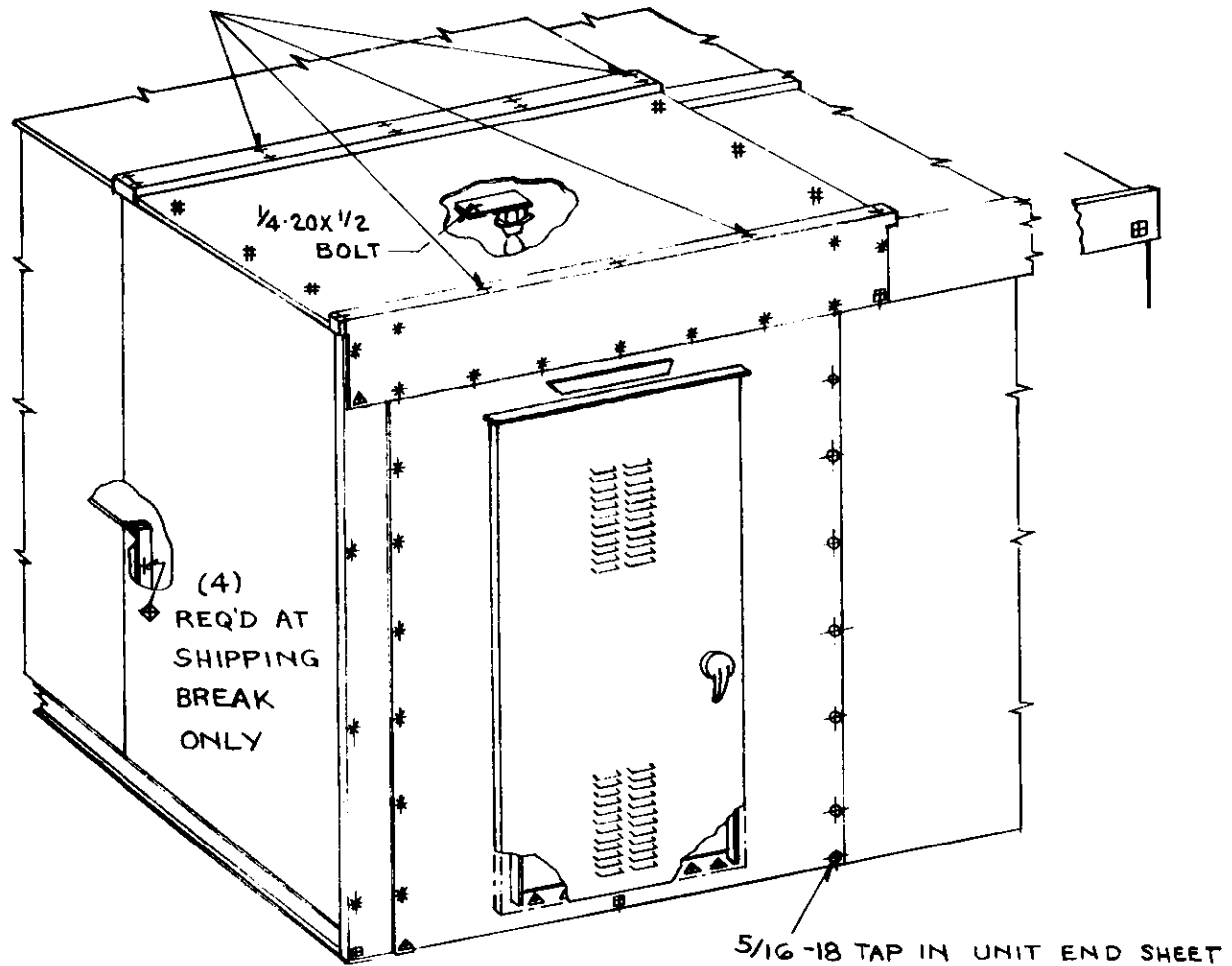


Fig. 17. Aisle Lamp Mounting

ALL EXTERNAL ROOF BOLTING
TO USE $5/16$ -18 X $3/4$ BOLTS S#120A876G15
WITH GASKETED WASHERS



- * - $5/16$ X $7/8$ BOLTS WITH TWO $5/16$ WIDE WASHERS, LOCKWASHERS & NUTS
- ⊙ - $5/16$ X $3/4$ BOLTS WITH TWO $5/16$ WIDE WASHERS, LOCKWASHERS & NUTS
- ▲ - $5/16$ X $3/4$ BOLTS WITH CAPTIVE WASHERS
- ⊞ - $1/2$ X $7/8$ BOLTS WITH $1/2$ WIDE WASHERS
- ◆ - $3/8$ X $1-1/2$ BOLTS WITH TWO $3/8$ WIDE WASHERS, LOCKWASHERS & NUTS
- # - $5/16$ X $1-1/4$ STUDS WITH $5/16$ WIDE WASHERS, LOCKWASHERS & NUTS
ON AISLE ROOF BOTTOM

Fig. 18. Aisle Bolting Diagram

UNIT VENTILATION

In Shelterfor-M switchgear the air enters at the bottom rear of the units through the cable compartment. A perforated aluminum

sheet covers this section, and must be in place to prevent entrance of rodents and foreign matter. Figure 19 shows this plate. During operation, the units should be checked periodically to determine that debris is not blocking this area.



Fig. 19. Cable Entrance Compartment and Air Inlet

For those units in which the main cables enter at the bottom, this plate is removed to allow the shipping group to be moved backward into place over the conduits protruding above the concrete foundation. The perforated plate is then marked and drilled so that it may be slipped over the conduits and bolted back in place.

The air leaves the top rear of the units through a series of baffles. The perforated baffle shown in Fig. 20 prevents the entrance of insects and helps to break up any wind driven rain before it enters the baffle area.

To remove the upper screen for cleaning, it is only necessary to remove four 5/16-18 bolts. The center bolts use nuts while the two outer bolts enter tapped holes. The solid inner baffle may be removed if necessary by taking out two 1/4-20 bolts in each end. These **MUST BE REPLACED**.

In order to prevent excessive condensation in the Shelterfor-M switchgear,

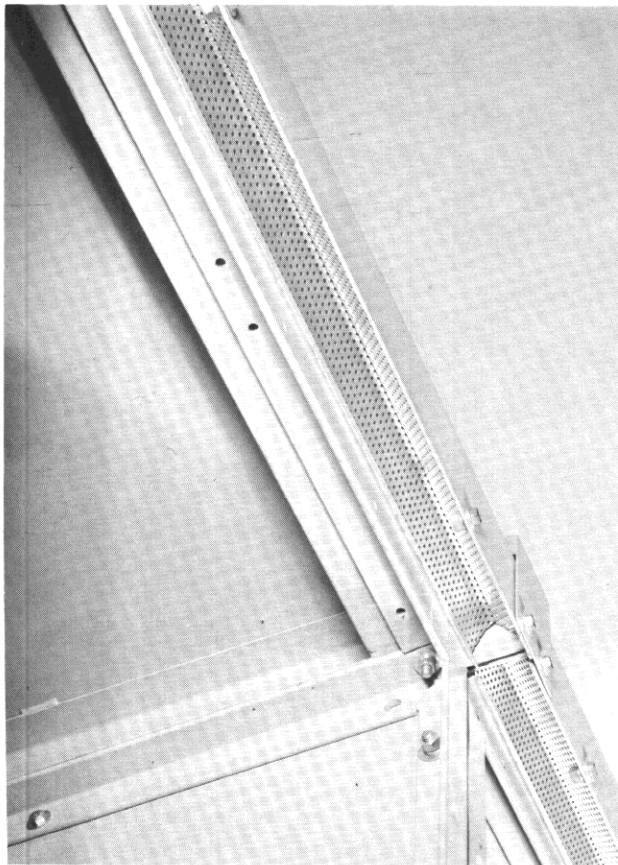


Fig. 20. Rear Ventilation Screen

the aisle doors are provided with louvers and filters at the top and bottom. The ventilation in the rear of the units is equivalent to that provided on indoor metal-clad switchgear.

HEATERS

Space heaters are provided in the units and should be used to prevent condensation during weather when high humidity prevails, or whenever there is a probability of condensation within the equipment. The purpose of the heaters is to safeguard the equipment, and it is important that they be used.

IMPORTANT: It is recommended that the heaters be energized for a period of 24 hours after the installation is complete before the equipment is energized.