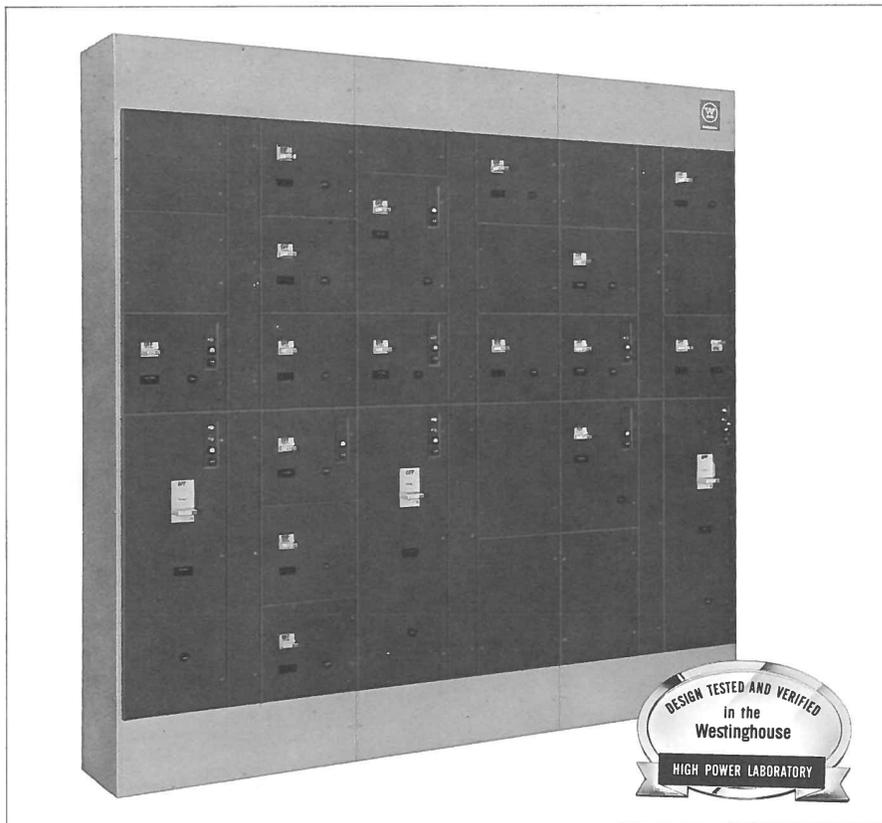


Instructions for Type W Control Centers



Westinghouse Electric Corporation

Control Center Division - Chicago, Illinois 60632

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This industrial type control is designed to be installed, operated, and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

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DESCRIPTION

The Westinghouse Type W control center consists of one or more totally enclosed, dead front, free-standing structural assemblies 90" high which are compartmentized for housing control unit assemblies. With units mounted in the front side only, the structure is 15 inches deep. For mounting units back-to-back the structure is 20 inches deep. Refer to Figures 1 & 2.

Each control center contains a main horizontal bus (min. capacity 600 A.) which runs the entire length of the control center. Vertical busses with a minimum rating of 300 A. are connected to the horizontal bus to feed vertical compartments housing unit assemblies. Both the vertical and horizontal bus are held rigidly within the structure by bus supports which have high dielectric qualities (Figure 3).

Each structure contains a horizontal wireway at the top. It is isolated from the horizontal bus and is readily accessible by removal of its cover-plate. Adequate space is provided for conduit and cables to enter it from above (Figure 4).

A vertical wireway covered by hinged doors is adjacent to each vertical unit compartment. This wireway is common to two compartments, right and left of it, unless special structural arrangement dictate otherwise. The wireways are free of components and other live parts and are provided with cable tie straps for supporting wire bundles and cables (Figure 5).

Vertical compartments for mounting control units are incremented to allow a maximum of six starter units to be mounted in one vertical assembly.

Drawout units for motor control basically consist of a cell assembly complete with a stab assembly for connection to the vertical bus (Figure 6), a circuit breaker or fused switch as a primary disconnect device with its operating mechanism, and a linestarter assembly complete with overload relays (Figure 7). A separate door assembly provides complete enclosure and allows access for inspection and maintenance. Unit guide rails insure proper alignment of the stabs with the vertical bus.

RECEIVING

Control centers are built from two modular structure arrangements:

1. One compartment with its individual wireway.
2. Two compartments with a common wireway.

Each shipping section is bolted to wooden skids and enclosed on the sides and top by heavy corrugated cardboard. Immediately upon receipt of the control center a thorough inspection of each section should be made to detect any damage which might have been incurred during shipment. Any damage should be reported at once to the carrier. It is recommended that the shipping enclosure be replaced after inspection for protection of the equipment until installation time.

HANDLING

Lifting facilities for handling by crane are bolted to the top of each shipping assembly. After the shipping section is near its final location the shipping carton and the lifting irons should be removed and discarded. The mounting hardware for these angles should be replaced to prevent the entrance of dirt. Where crane facilities are not available, the structure can be positioned by using rollers under the shipping skids. The skids provided with each shipping section should be left in place until the structure is in position. They should then be removed.

STORAGE

When the control center cannot be placed in service reasonably soon after its receipt, it should be stored in a clean, dry, ventilated building. The storage area should be free from condensation or other injurious environmental conditions. Freedom from condensation is essential and may be accomplished by the use of auxiliary heaters if necessary. Outdoor storage, even when protected by a tarpaulin, is inadequate. The equipment must also be protected from excessive dust.

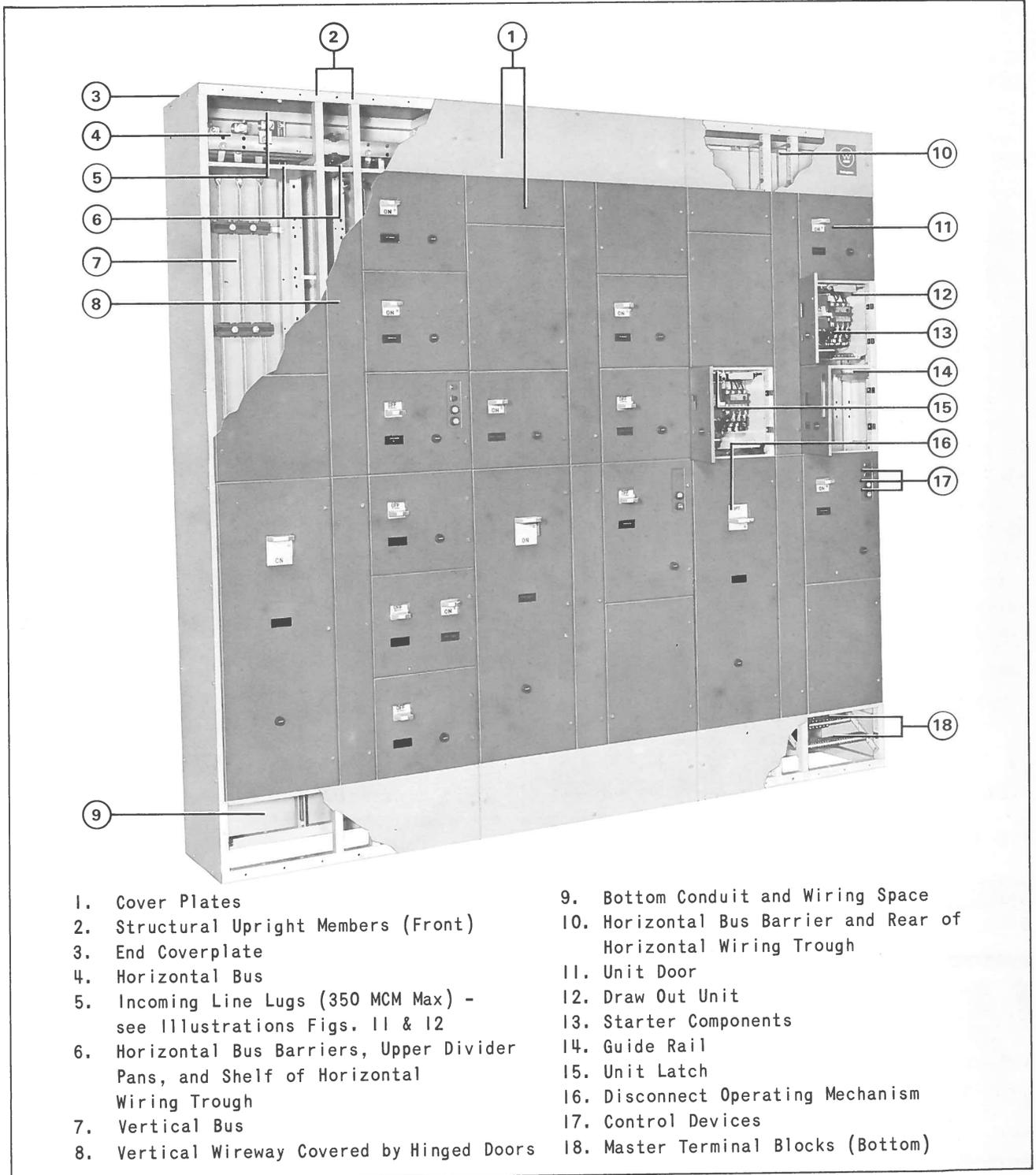


Fig. 1 Cutaway of Control Center

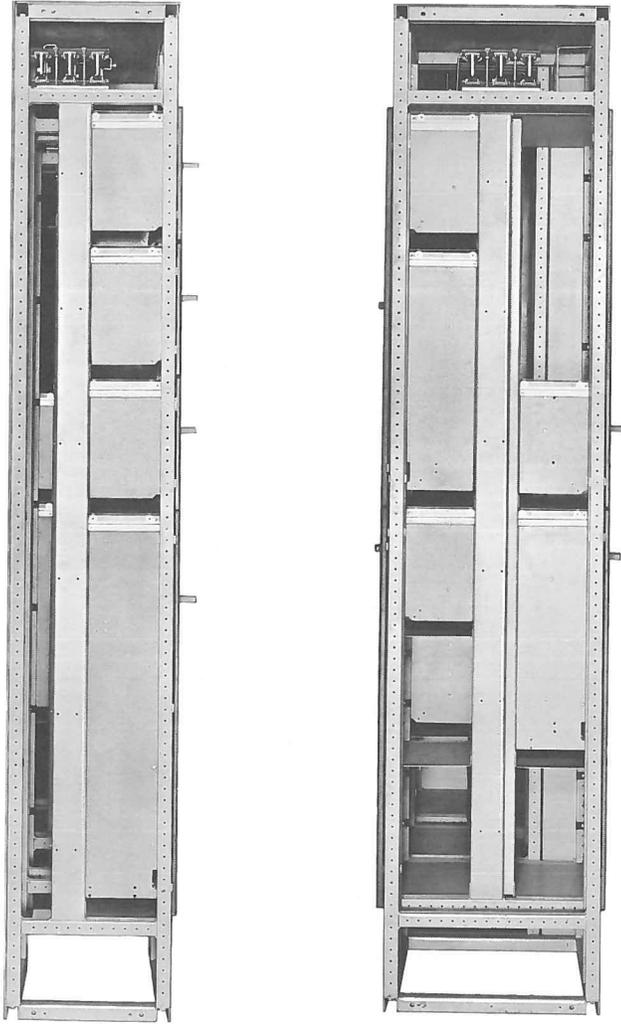


Fig. 2 15 and 20-Inch Deep Structures

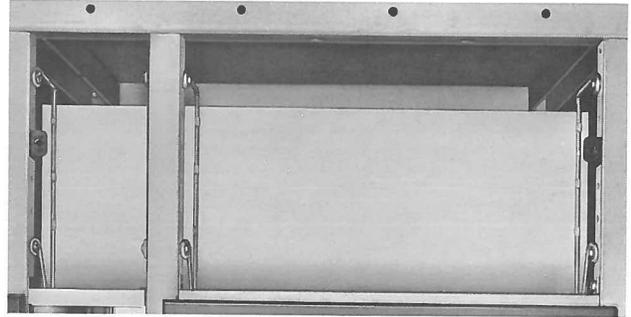


Fig. 4 Horizontal Wiring Trough

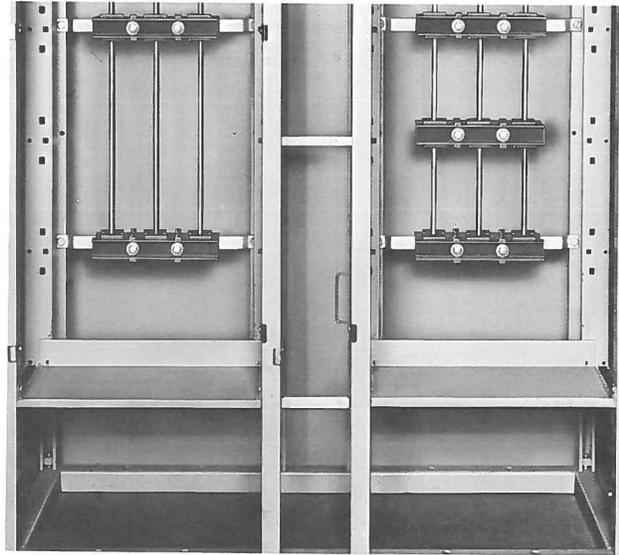


Fig. 5 Bottom Conduit Space & Vertical Wireway

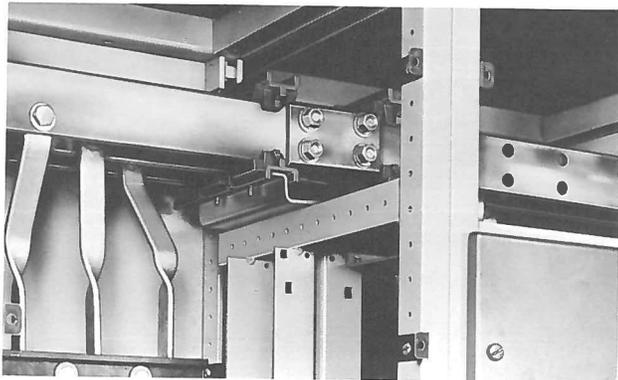


Fig. 3 Horizontal and Vertical Bus

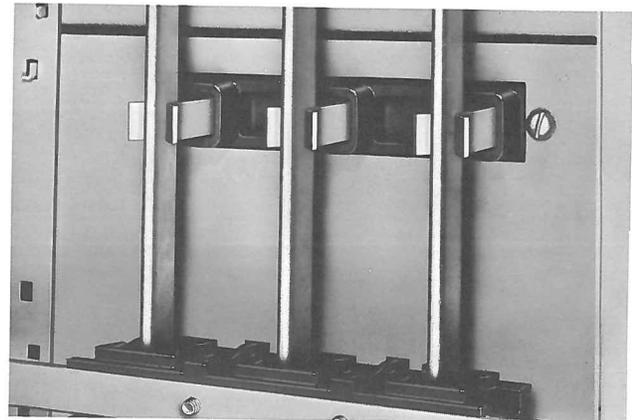
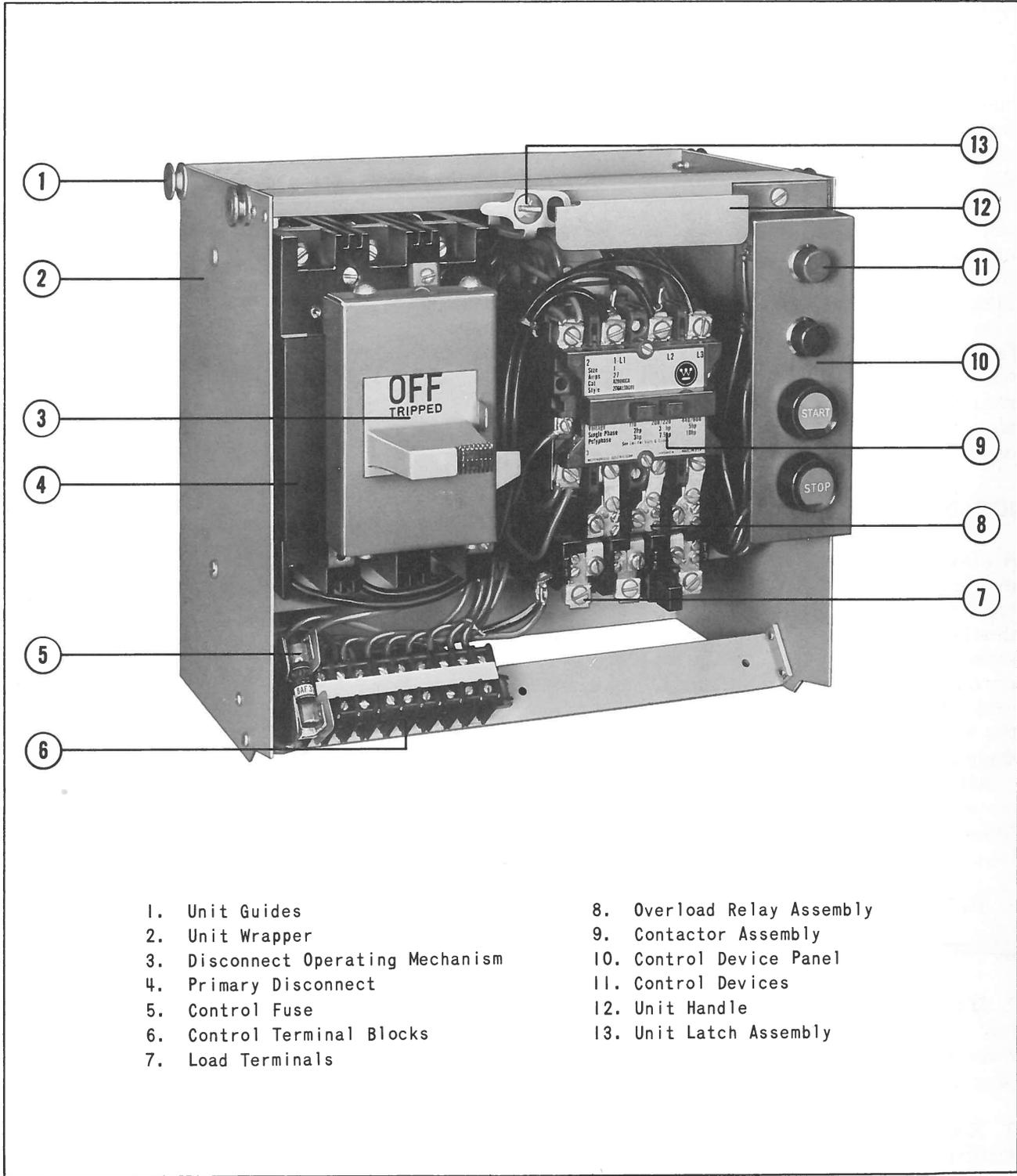


Fig. 6 Stab Assembly



- | | |
|-----------------------------------|----------------------------|
| 1. Unit Guides | 8. Overload Relay Assembly |
| 2. Unit Wrapper | 9. Contactor Assembly |
| 3. Disconnect Operating Mechanism | 10. Control Device Panel |
| 4. Primary Disconnect | 11. Control Devices |
| 5. Control Fuse | 12. Unit Handle |
| 6. Control Terminal Blocks | 13. Unit Latch Assembly |
| 7. Load Terminals | |

Fig. 7 Drawout Unit

INSTALLATION

Control centers are assembled at the factory on smooth and level surfaces to assure correct alignment of all parts. The foundation furnished by the purchaser must be true and level, or the bottom frames must be shimmed to support the entire base in a true plane. An uneven foundation can cause misalignment of shipping sections, units and doors. It is recommended that leveled channel sills under both the front and rear of the control center base be used to provide this level base. They should be drilled and tapped for 1/2" mounting bolts in accordance with the applicable floor plan drawing and then either installed level with, or on top of, the finished floor. If sills are grouted in concrete, the mounting bolts should be screwed in place and remain until the concrete has hardened.

JOINING SECTIONS

A maximum of six compartments can be shipped in one shipping section. If two or more sections are to be joined into an integral assembly they should be bolted as shown in Figure 8 and the main bus should be connected with splice plates provided. The bus splice plates and all connection hardware are packed in a carton and secured in the horizontal wireway near the bus end of one shipping section.

After the shipping sections to be joined are moved into place and secured to the floor sills the following tie-bolting procedure should be followed. (Refer to Figure 8).

1. Remove upper and lower flat front coverplates adjacent to the shipping break. These covers are secured by three screws each.
2. If the rear is accessible it is desirable to remove the rear coverplates to provide working room from both the front and rear of the adjacent shipping sections.
3. Remove horizontal bus barriers in each end section to provide access to the end frame and bus bars. They are held in place by four screws through their wire supports.
4. Bolt top frames together using (2) 3/8 - 16 through bolts, nuts, and washers.
5. Using "U" type frame clamps provided, clamp adjacent front and adjacent rear upright members together near the bottom and near the vertical center of the frames. Each clamp should be secured with (4) .190 - 32 pan head thread cutting screws. (It may be necessary to remove one or two drawout units for easier installation of clamps. Refer to paragraph "Unit Removal".)
6. Bolt splicers to the bus ends with 3/8 - 16 - 1-1/8" long bolts with wide washers and nuts (Figure 3). These bolts should be torqued to 20 ft. lbs. to assure adequate electrical contact pressure.
7. If a neutral and/or ground bus is in the control center they will normally be located near the bottom. Splicers should be connected in a similar manner.
8. Make a thorough inspection to assure that no tools, loose hardware or other foreign material is left within the enclosure.
9. The front to rear bottom frame members of each structure is factory assembled. These members are bolted to gusset plates at each corner. After the control center is securely in place any or all of the intermediate members may be removed and discarded to provide maximum unrestricted conduit space at the bottom.
10. Replace horizontal bus barriers, drawout units and coverplates.

When a section is to be added to either end of an existing type W control center, the full length end cover on the existing structure should be removed prior to putting the new structure in place. It should be relocated on the end of the new structure with the existing hardware.

Should the existing bus be oxidized, a good contact area should be prepared by sanding lightly with a fine aluminum oxide paper. (*Caution:* Never use emery cloth or any abrasive containing metal.)

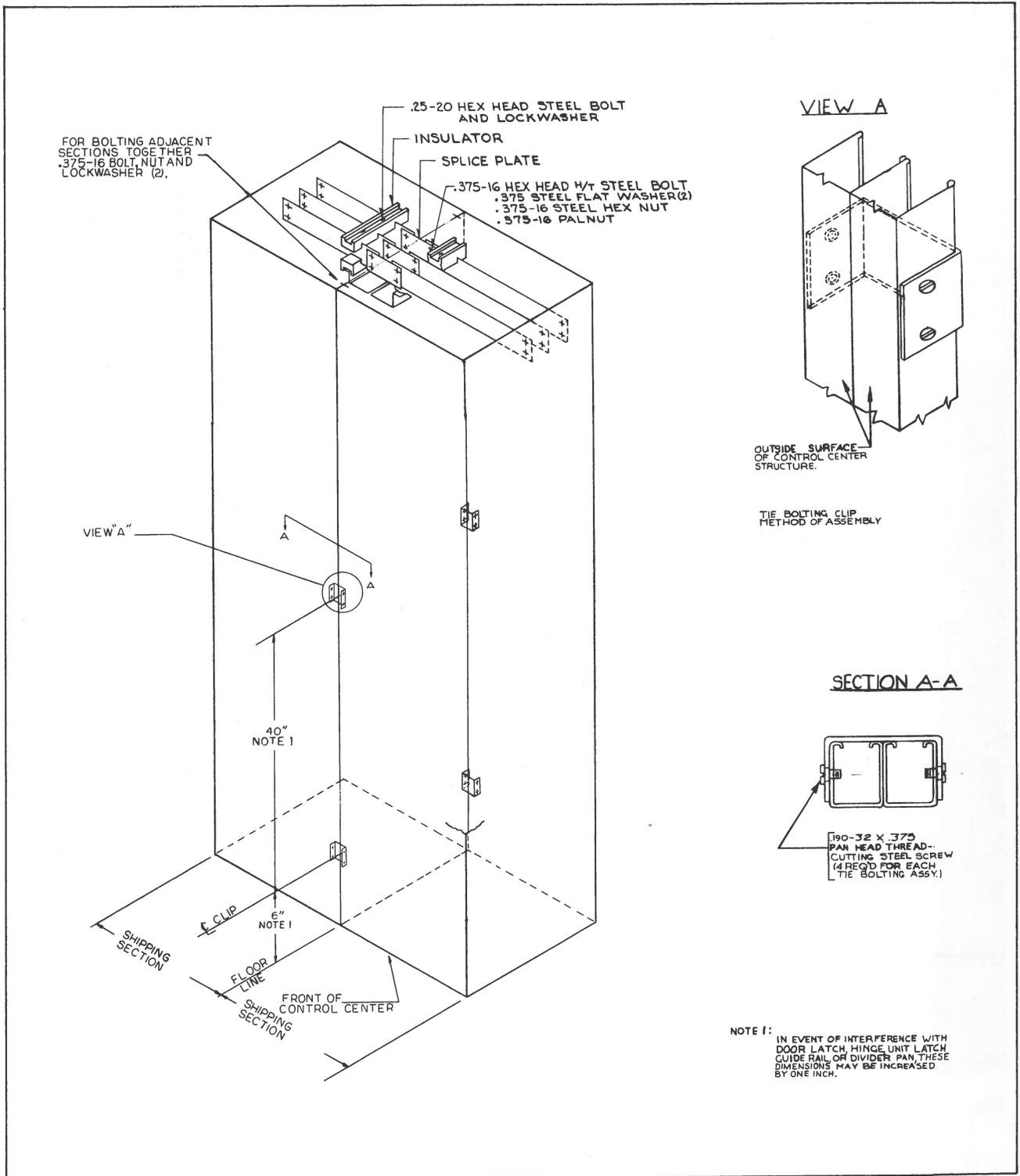


Fig. 8 Tie Bolting Assemblies

For connection of the Type W control center to an existing Westinghouse Class 11-300, separate instructions furnished with each order should be followed.

INCOMING LINE CONNECTIONS

For control centers having an incoming line circuit breaker or disconnect switch, the incoming line leads should be connected directly to the terminal lugs on the circuit breaker or switch. Figure 9 shows a typical connection to an incoming line breaker.

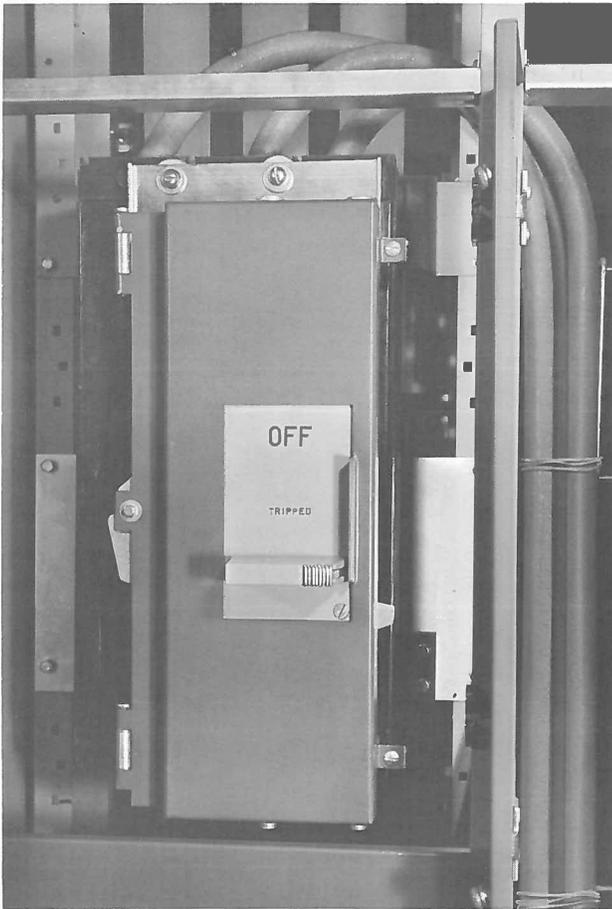


Fig. 9 *Incoming Line Breaker Connection*

Access to the terminals of the breaker or switch may be gained by opening the unit door covering it and unlatching the operating mech-

anism. It will then swing free on its hinges (Figure 10). On breakers 400A. and above with interchangeable trip units the breaker cover must also be removed. For space to bend cables to the terminals the upper front coverplate may be removed.

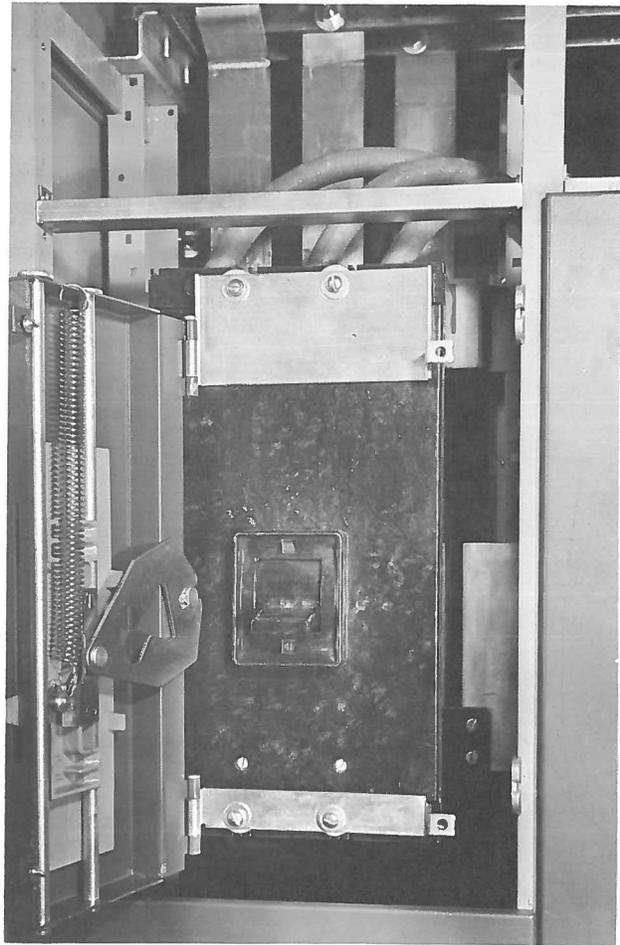


Fig. 10 *Incoming Line Breaker with Mechanism Hinged Open*

Incoming line arrangements for connections directly to the bus differ, based on size of cables - entrance top or bottom - and accessibility to the rear. For #6 through 350 MCM cable sizes, either 1 or 2 cables per phase, pressure type terminals are mounted directly on the horizontal bus and are accessible from the front of the control center by removal of the upper front coverplate. For

cables larger than 350 MCM the lugs are mounted on copper adapters extending down from the bus.

For incoming lines entering from the top to #6 through 350 MCM lugs, conduit entry should be made to the top cover above the vertical wireway or compartment adjacent to the lug section so cables bend only 90° into side connected lugs (Figure 11).

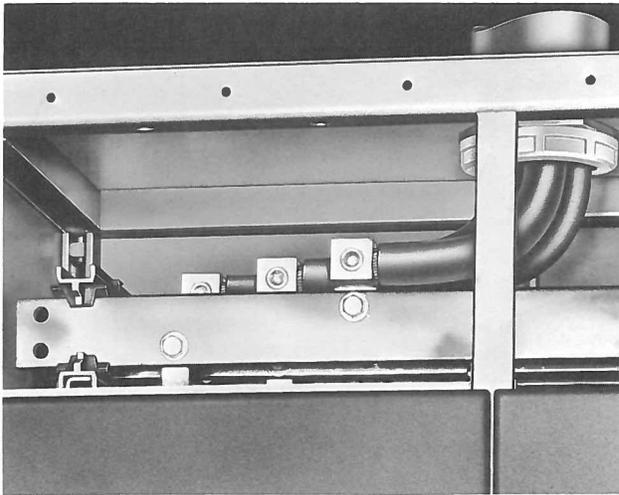


Fig. 11 *Incoming Line Lugs*

The following illustrations show the various lug arrangements and recommended conduit and cable connections with either 1 or 2 cables per phase for 15" or 20" deep structures.

Arrangement #1 - Figure 12a-#6 through 350 MCM Bottom Entry.

Arrangement #2 - Figure 12b-#6 through 350 MCM Top Entry.

Arrangement #3 - Figure 12c above 350 through 750 MCM - Bottom Entry - Rear Accessible.

Arrangement #4 - Figure 12d above 350 through 750 MCM - Top Entry - Rear Accessible - 20" deep Structure.

Arrangement #5 - Figure 12e above 350 through 750 MCM - Bottom Entry - Rear Inaccessible.

Arrangement #6 - Figure 12f above 350 through 750 MCM - Top Entry - Rear Inaccessible.

Figures 13a-b-c-d show outline and floor plans for 15" deep and 20" deep structures. The cross hatched areas show available conduit space at the top and bottom.

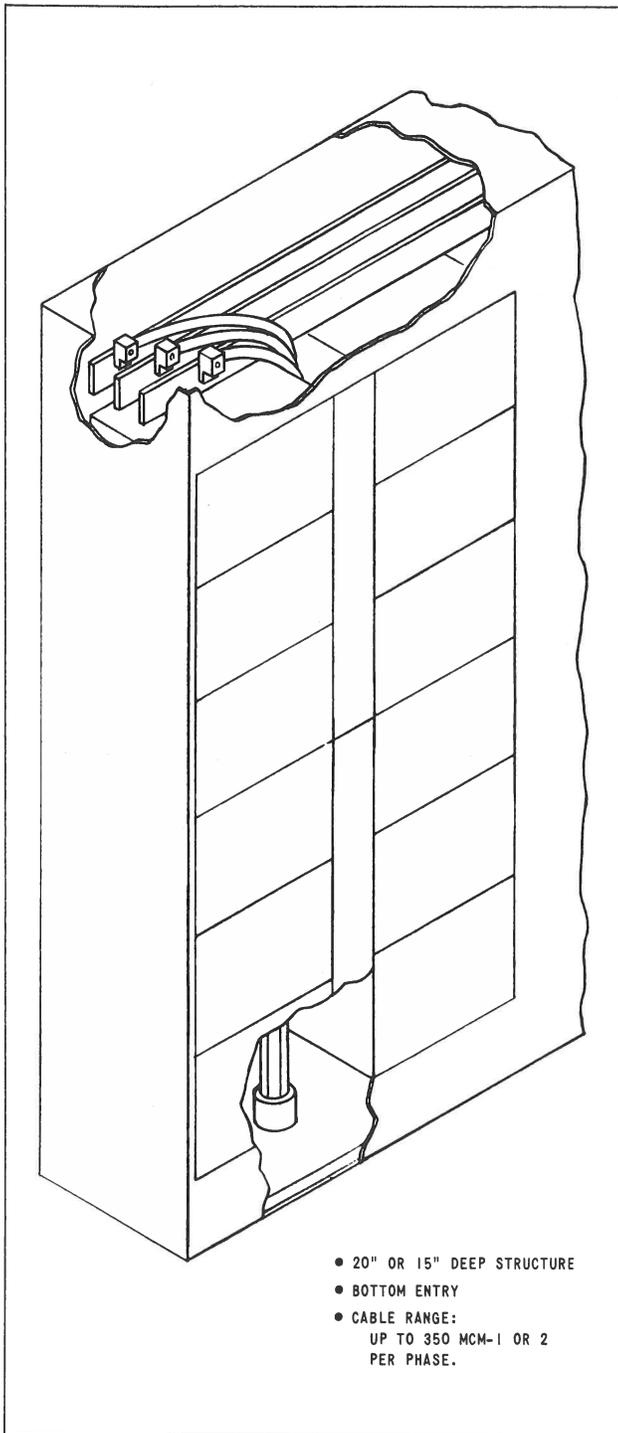


Fig. 12a Incoming Line Arrangement No. 1

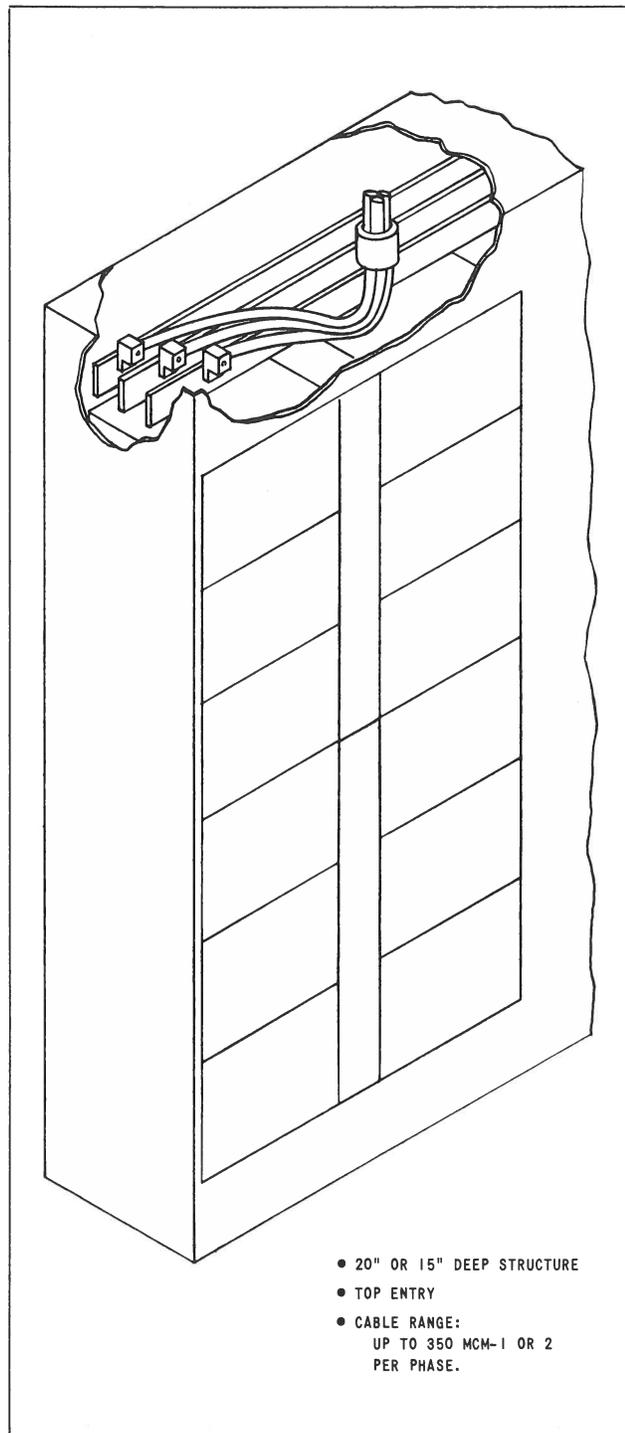


Fig. 12b Incoming Line Arrangement No. 2

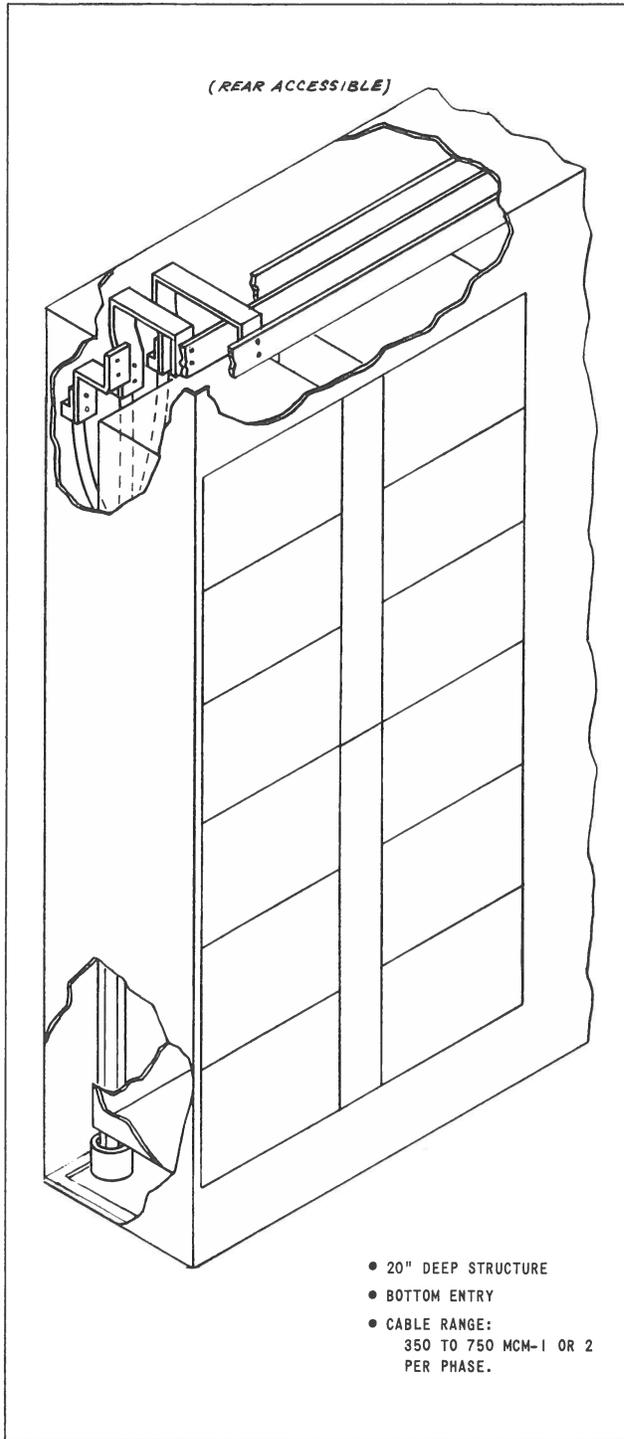


Fig. 12c Incoming Line Arrangement No. 3

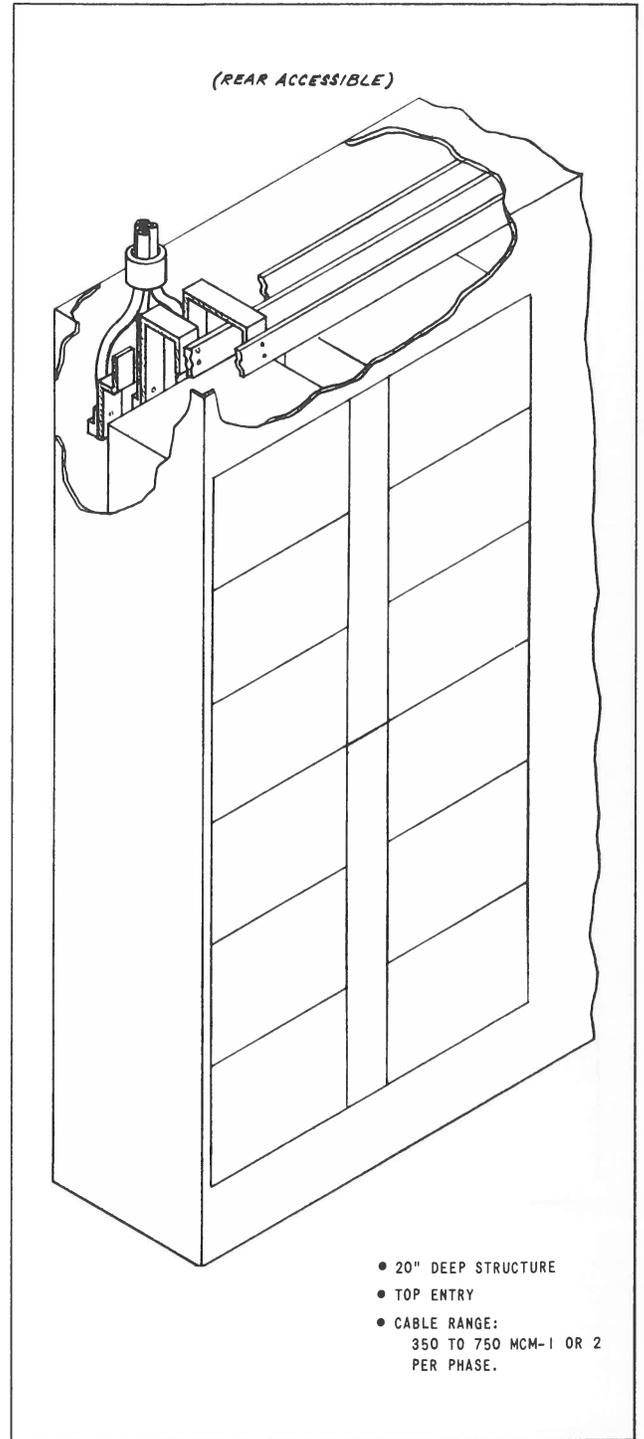


Fig. 12d Incoming Line Arrangement No. 4

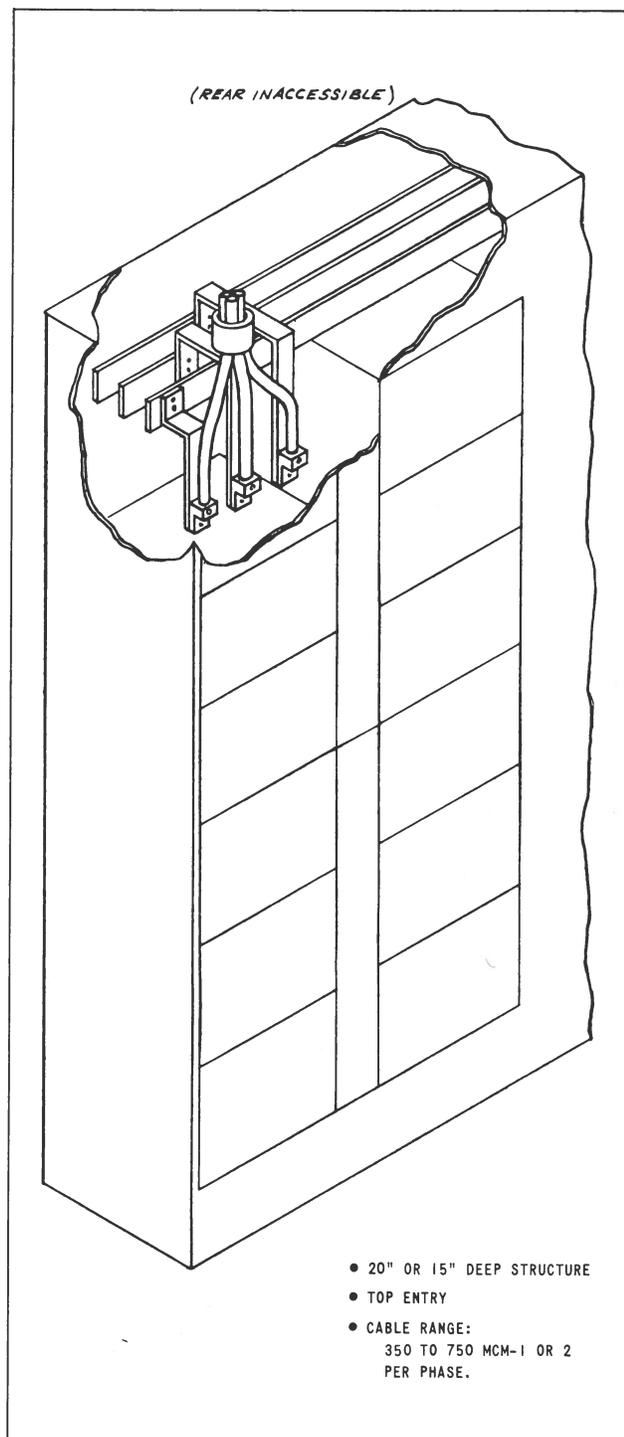
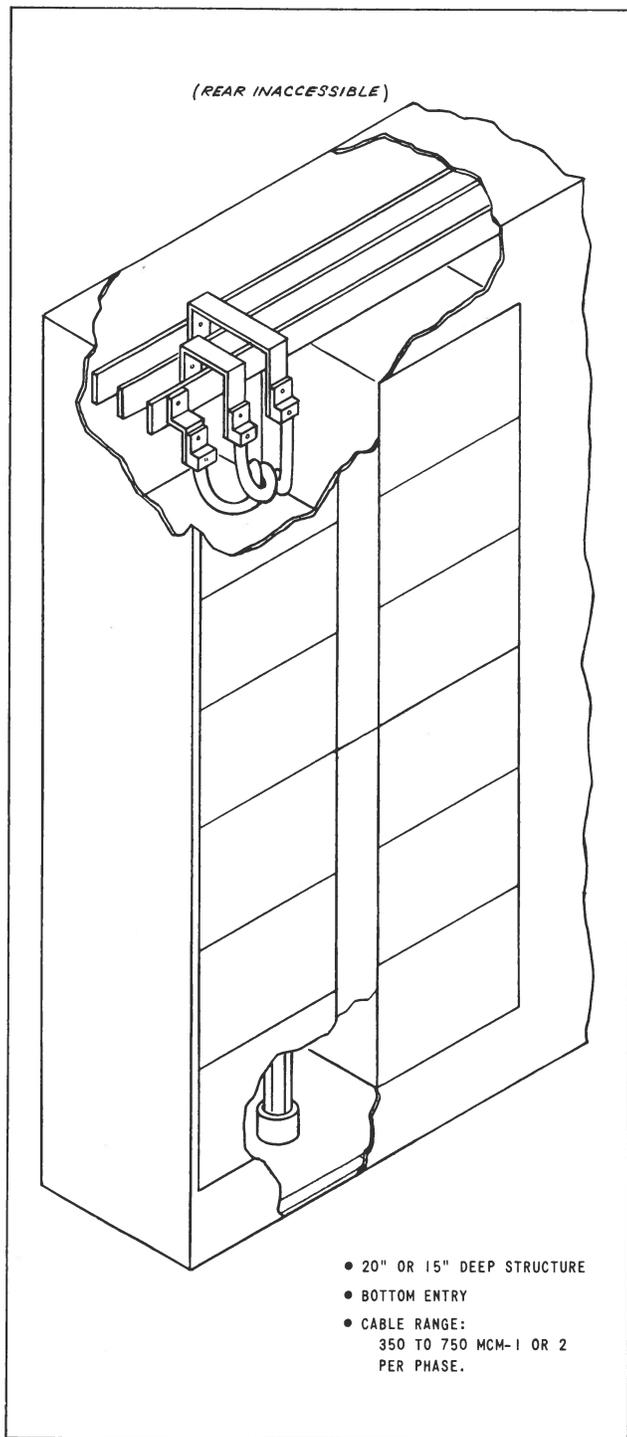
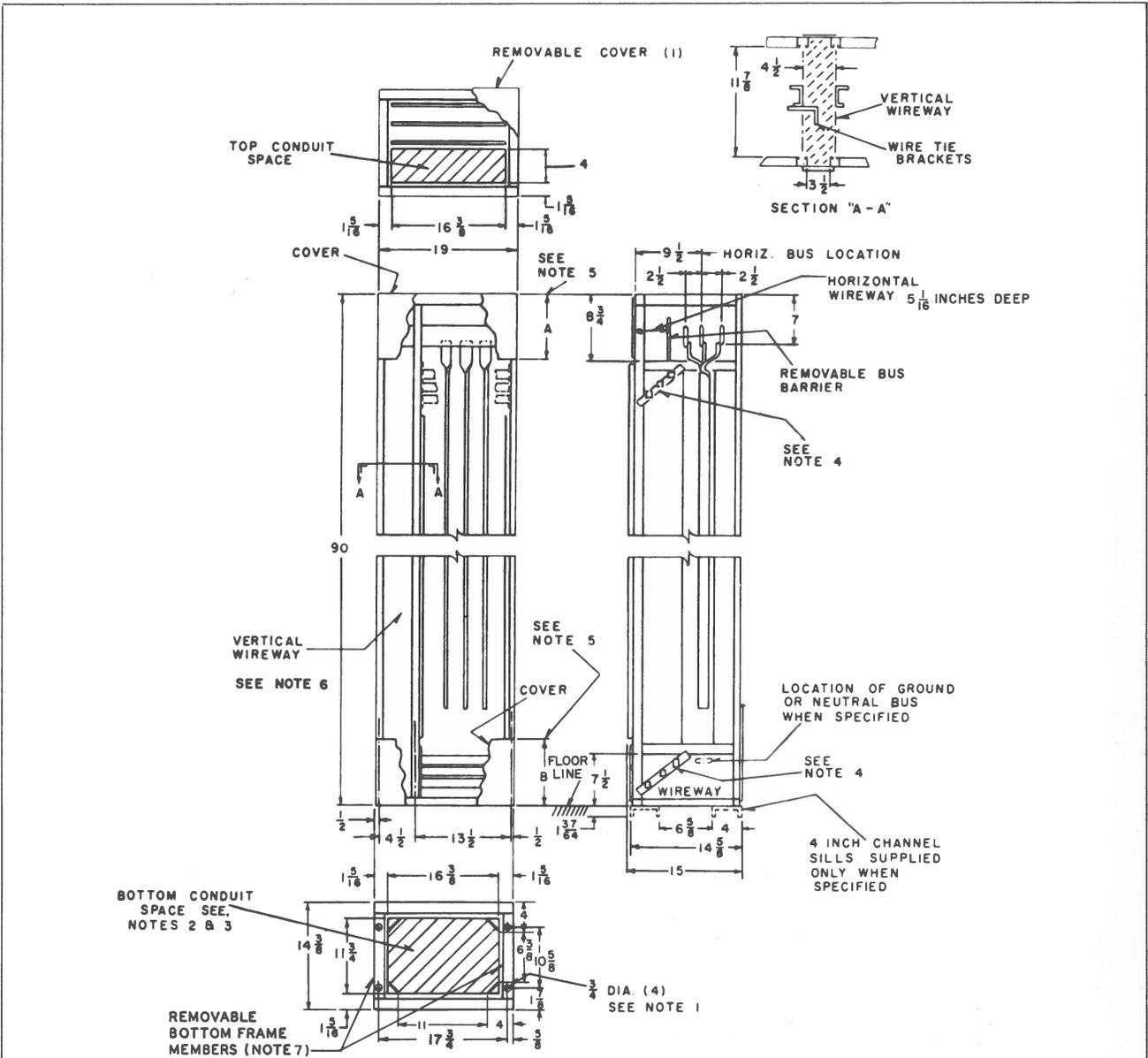


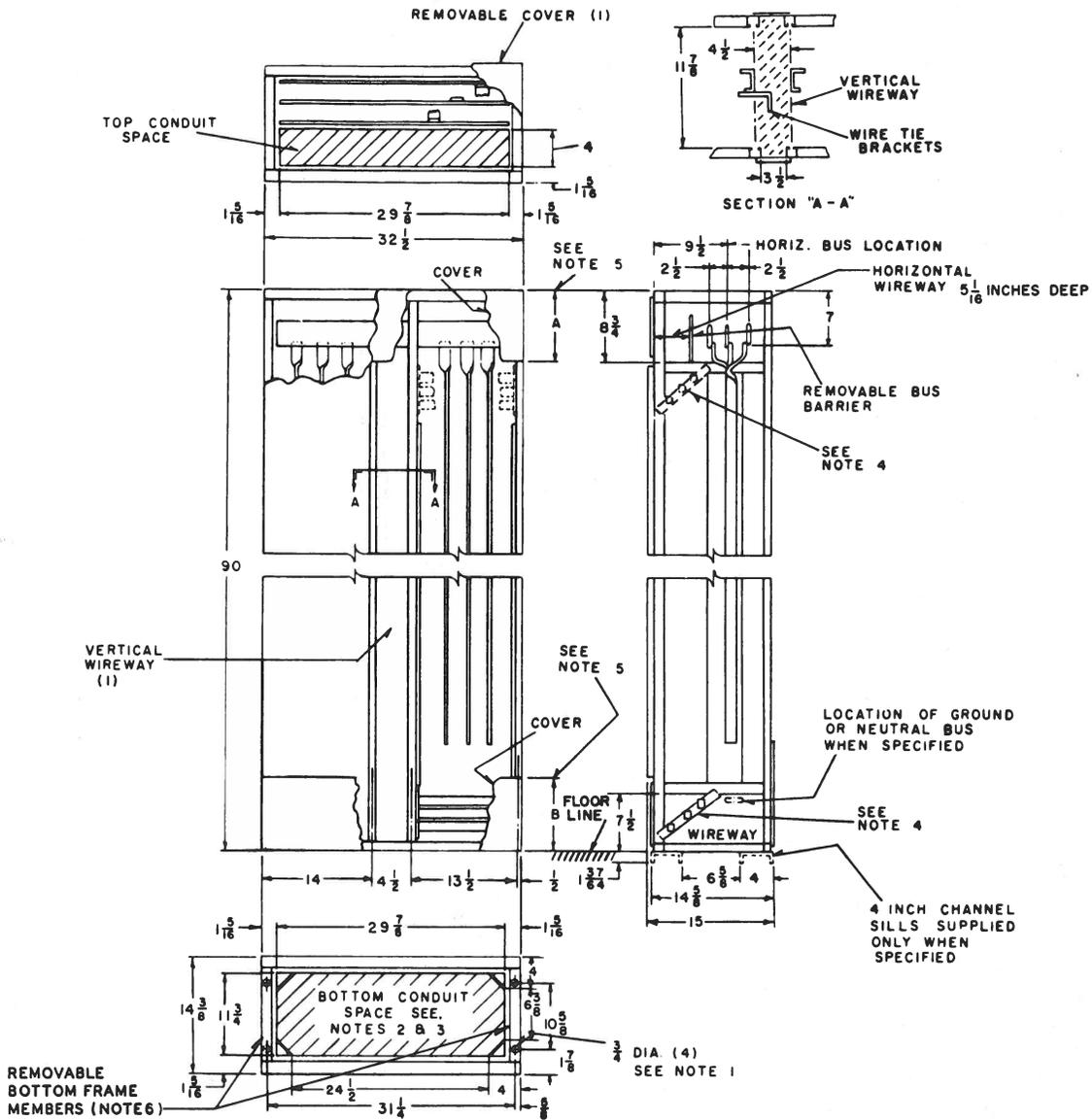
Fig. 12e Incoming Line Arrangement No. 5

Fig. 12f Incoming Line Arrangement No. 6



- NOTES:**
1. MIN. LENGTH OF ANCHOR BOLT 2 INCHES ($\frac{1}{2}$ "-13 RECOMMENDED).
 2. RECOMMENDED MAX. CONDUIT HEIGHT ABOVE FLOOR LINE $3\frac{1}{2}$ INCHES.
 3. MAX. CONDUIT SPACE WITH CHANNEL SILLS $16\frac{3}{8}$ X $6\frac{5}{8}$ INCHES.
 4. MASTER TERMINAL BLOCK ASSEMBLY FURNISHED FOR TYPE C WIRING ONLY, WHEN LOCATION NOT SPECIFIED MTB SUPPLIED AT THE BOTTOM.
 5. FOR STANDARD STRUCTURE ARRANGEMENT "A & B" DIM. = 9 INCHES, FOR SPECIAL ARRANGEMENT WITH MASTER TERMINAL BLOCKS AT THE TOP "A" DIM. = 15 INCHES & "B" DIM. = 3 INCHES.
 6. VERTICAL WIRE TROUGH MAY BE ON RIGHT OR LEFT ; FOR SPECIAL SECTIONS WIRE TROUGH MAY BE OMITTED.
 7. FOR MULTIPLE STRUCTURE ASSEMBLIES, EITHER ONE OR BOTH OF THESE MEMBERS MAY BE REMOVED TO PROVIDE MAXIMUM UN-RESTRICTED CONDUIT SPACE AT BOTTOM.

Fig. 13a Outline & Floor Plan - 15 Inch Deep One Compartment - One Wireway



NOTES:

1. MIN. LENGTH OF ANCHOR BOLT 2 INCHES ($\frac{1}{2}$ - 13 RECOMMENDED).
2. RECOMMENDED MAX. CONDUIT HEIGHT ABOVE FLOOR LINE $3\frac{1}{2}$ INCHES.
3. MAX. CONDUIT SPACE WITH CHANNEL SILLS $29\frac{7}{8}$ X $6\frac{5}{8}$ INCHES.
4. MASTER TERMINAL BLOCK ASSEMBLY FURNISHED FOR TYPE C WIRING ONLY, WHEN LOCATION NOT SPECIFIED MTB SUPPLIED AT THE BOTTOM.
5. FOR STANDARD STRUCTURE ARRANGEMENT "A & B" DIM. = 9 INCHES. FOR SPECIAL ARRANGEMENT WITH MASTER TERMINAL BLOCKS AT THE TOP "A" DIM. = 15 INCHES & "B" DIM. = 3 INCHES.
6. FOR MULTIPLE STRUCTURE ASSEMBLIES, EITHER ONE OR BOTH OF THESE MEMBERS MAY BE REMOVED TO PROVIDE MAXIMUM UN-RESTRICTED CONDUIT SPACE AT BOTTOM.

Fig. 13b Outline & Floor Plan - 15 Inch Deep Two Compartments - One Wireway

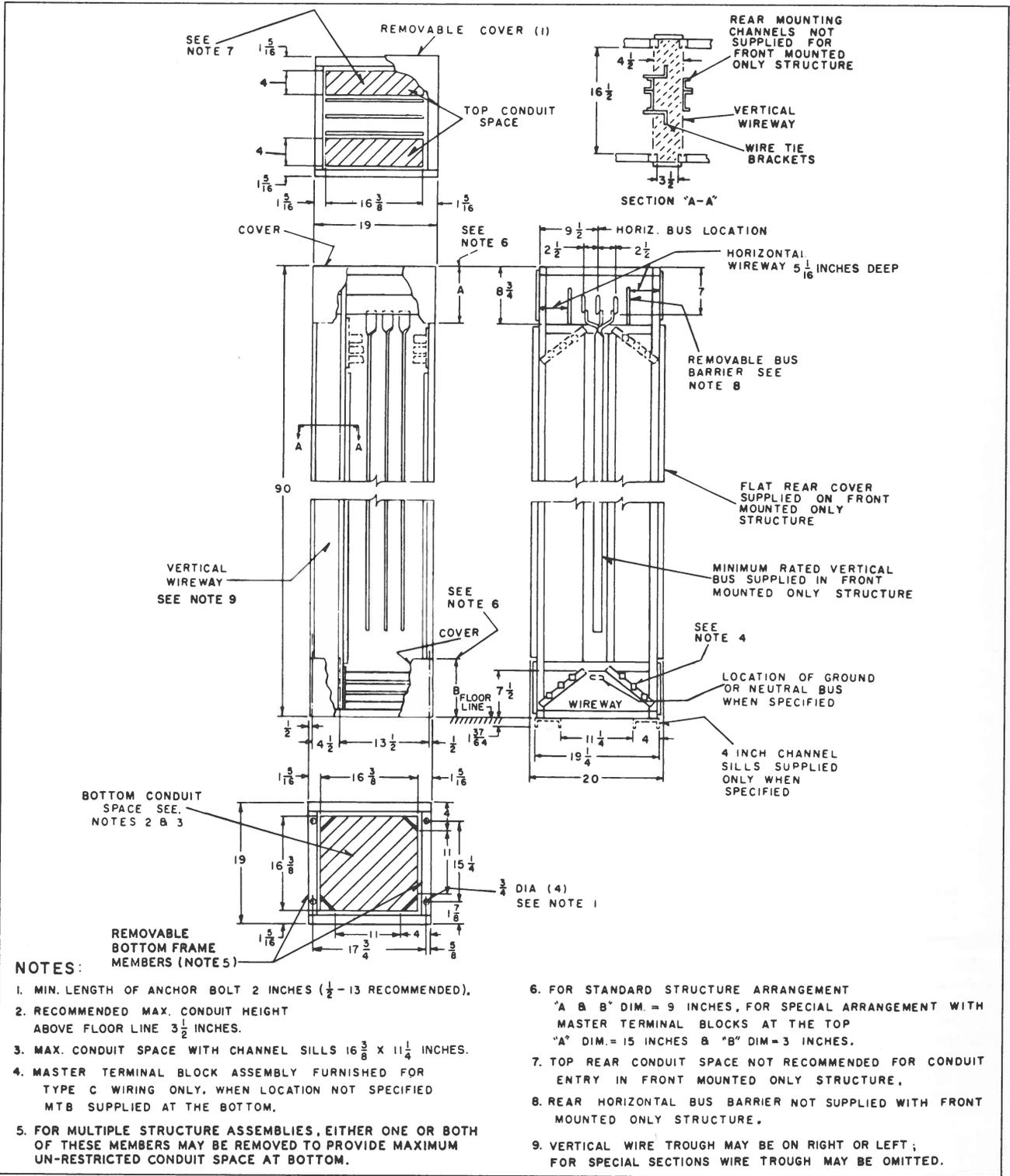


Fig. 13c Outline & Floor Plan - 20 Inch Deep One Compartment - One Wireway

MOTOR AND CONTROL CONNECTIONS

Figure 14 shows a two compartment structure with the vertical wireway doors removed to provide maximum access for pulling cables and making wiring connections. The left hand unit has fixed terminal blocks for the control terminations and with the motor leads T1-T2-T3 connected directly to the controller. This arrangement is standard for all drawout units with fixed type terminal blocks.

The right hand unit is equipped with pull apart terminal blocks. When these terminals are specified, the motor leads of starter sizes 1 and 2 are also terminated and disconnectable with the adjacent control terminals.

For control circuit connections refer to the unit wiring drawings which are furnished with

each control center. Connections to feeder tap units are made directly to the load terminals of the circuit breaker or fused disconnect switch.

For making NEMA type C wiring connections it is necessary to refer to the master terminal block arrangement drawing. The terminal block markings designate the unit and wire number. Figure 21 shows a typical master terminal block assembly at the bottom.

INSPECTION BEFORE ENERGIZING

Before energizing the control center, it will be necessary to conduct a thorough inspection to make certain that all foreign materials such as tools, scraps or wire or other debris is removed from all units and the structure. Any accumulation of dust and dirt should be removed with a

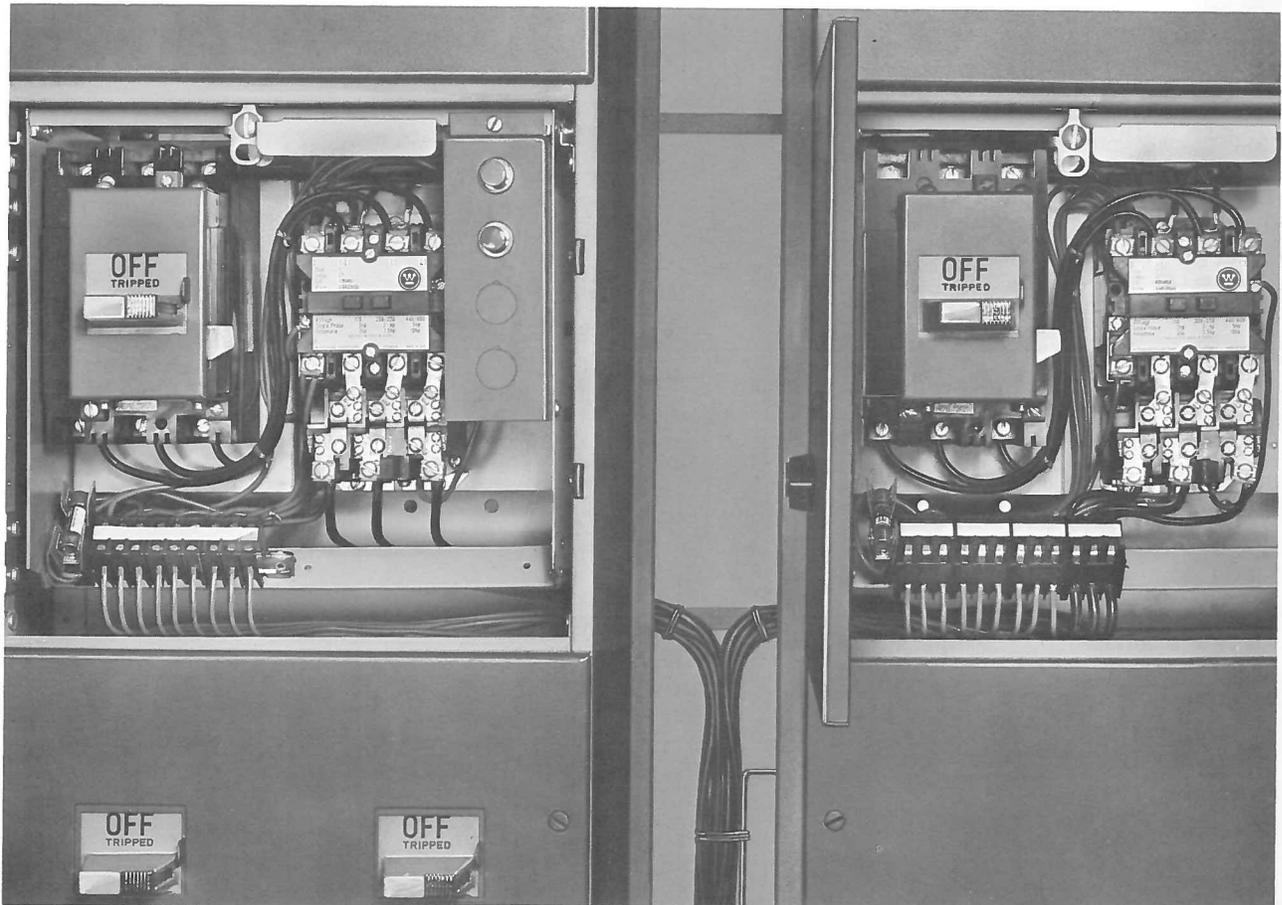


Fig. 14 *Vertical Wireway with Units Right and Left*

vacuum cleaner if available, otherwise this material can be blown out with an air hose or manually cleaned.

All circuit connections are tightened at time of assembly by power driven tools with controlled torque. However, the vibrations experienced in transit may loosen some of these connections. It is recommended that at least 10% of the total connections be checked for a tight connection. Should this spot check reveal some loose connections then it will be necessary to check all connection points. The connections include bus hardware, circuit breaker and switch terminals, contactor and relay terminals and terminal blocks. A necessary check in any event should include the incoming line connections.

All relays should be inspected to make sure that any blocking for shipment is removed and that the armature moves freely. Power circuit fuses are normally furnished by the purchaser and must be installed in the field. Each fuse should be checked for correct rating in accordance with National Electric Code application requirements.

Finally, all mechanical latches, operating mechanisms and door assemblies should be checked for proper alignment and operation. Mishandling in transit can cause misalignment. The doors can be adjusted by loosening the screws on the hinge leaves attached to the structural members. A final check on the proper positioning of each door dictates that the disconnect operating mechanism operates correctly without mechanical interference in both the "ON" and "OFF" positions. When the mechanism is in the "ON" position, the door should not open. Figure 15c shows the door interlock on the rear of the door and its method of adjustment. Turning the defeater screw below the operating handle a quarter turn counterclockwise will defeat this door interlock (Fig. 15a).

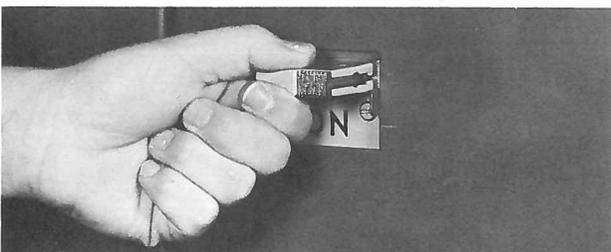


Fig. 15a Operating Handle and Defeater Screw

MOTOR CIRCUIT PROTECTOR (MCP)

The MCP is an adjustable, magnetic only, circuit breaker used in combination starters specifically for fault protection of motor circuits.

Because each MCP must be adjusted by actual motor full load amps, (FLA), it is supplied from the factory unadjusted. At installation it is necessary to set for tripping by any current which exceeds starting inrush. This provides low level fault protection.

A screwdriver adjustment is near the lower left corner around which are seven circled adjustment points calibrated in trip amperes. A pin is provided loose for insertion at the point of correct adjustment. Adjustment should never exceed 13 times FLA which is in accordance with N.E.C. requirements for magnetic only breakers. Due to the breaker operating mechanism location, the maximum pin setting without the mechanism removal is at the fifth pin location. Two adjustments are possible beyond this point.

Adjustment should be made as follows:

1. Obtain FLA from motor nameplate.
2. Multiply FLA by 13.
3. Find nearest trip setting to the calculated figure in Item 2. This is the maximum pin location.
4. Depress and turn screwdriver adjustment counterclockwise to the setting one notch above starting inrush current tripping point--usually 7-11 times FLA.
5. Push pin through Decal at location in Item 4. This should always be at no higher point than the maximum location per Item 3. This acts as a stop for adjustment nearest the tripping point to provide maximum overcurrent protection and to prevent unauthorized increase from this adjustment without change in motor characteristics.

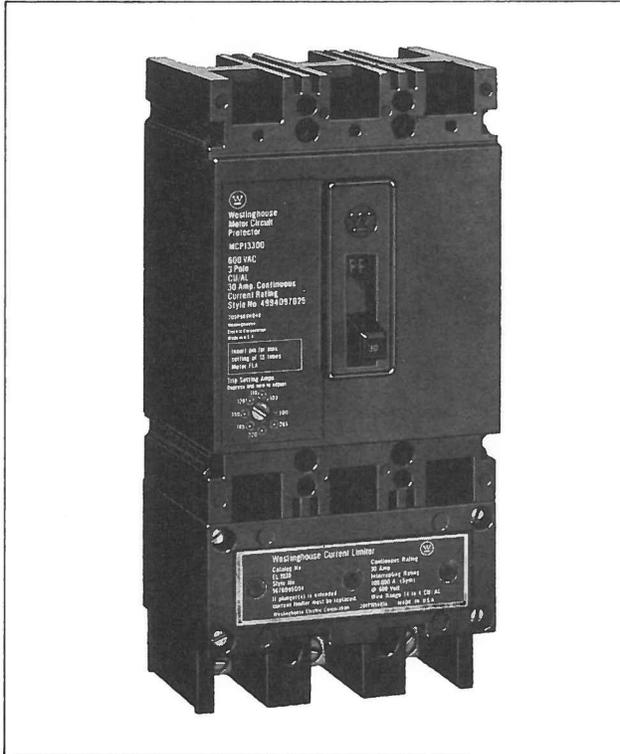


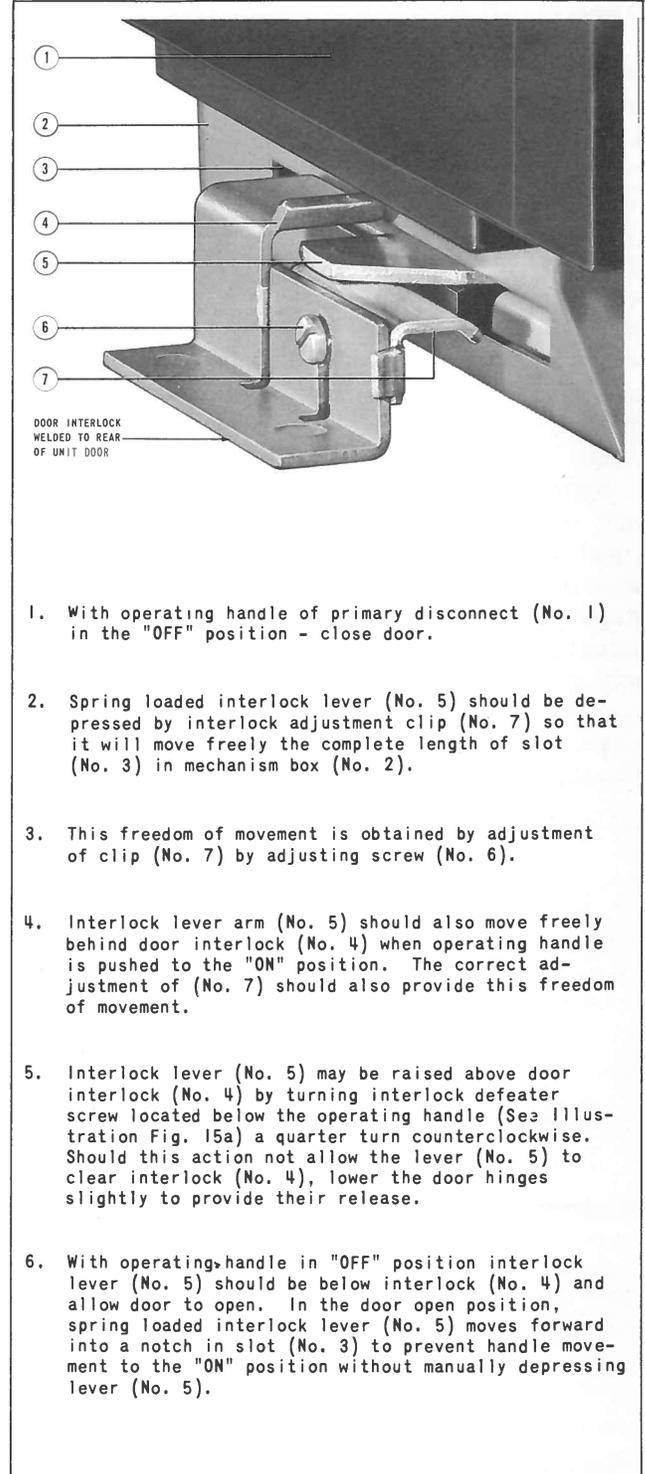
Fig. 15b *MCP with Current Limiter*

CURRENT LIMITERS FOR USE WITH MCP AND FB BREAKERS

This device, when added, provides interrupting capacity above the range handled by the MCP in motor starters or by FB Thermal Magnetic feeder breakers.

Each MCP or FB current range has its own current limiter to provide co-ordinated protection against faults up to 100,000A RMS.

Built-in trip indicators in each phase immediately show when a fault has blown the current limiter. These faults also magnetically trip the circuit breaker. This provides protection against single phasing. After interrupting such faults the current limiter will require replacement. This is easily accomplished by the removal of three screws and after the fault has been cleared the breaker may be reset to provide for subsequent high current protection.



1. With operating handle of primary disconnect (No. 1) in the "OFF" position - close door.
2. Spring loaded interlock lever (No. 5) should be depressed by interlock adjustment clip (No. 7) so that it will move freely the complete length of slot (No. 3) in mechanism box (No. 2).
3. This freedom of movement is obtained by adjustment of clip (No. 7) by adjusting screw (No. 6).
4. Interlock lever arm (No. 5) should also move freely behind door interlock (No. 4) when operating handle is pushed to the "ON" position. The correct adjustment of (No. 7) should also provide this freedom of movement.
5. Interlock lever (No. 5) may be raised above door interlock (No. 4) by turning interlock defeater screw located below the operating handle (See illustration Fig. 15a) a quarter turn counterclockwise. Should this action not allow the lever (No. 5) to clear interlock (No. 4), lower the door hinges slightly to provide their release.
6. With operating handle in "OFF" position interlock lever (No. 5) should be below interlock (No. 4) and allow door to open. In the door open position, spring loaded interlock lever (No. 5) moves forward into a notch in slot (No. 3) to prevent handle movement to the "ON" position without manually depressing lever (No. 5).

Fig. 15c *Door Interlock Showing Adjustment Screw*

OVERLOAD HEATER APPLICATION

Heaters are selected for 40 C rise open motors having full-load current values as shown on the National Electric Code Table 430-150 unless specific motor information is furnished with the order. The heater code numbers for each starter is recorded on the unit data drawing furnished with the order. Heaters should be installed in the overload relay assemblies with the two screws provided. Figure 16a shows a type A overload relay with one of the heaters being installed. Heaters must be installed with the diagonal cut corners matching the relay contact area and securing screws must be drawn down tight.

Before energizing the starter the full load current shown on each motor nameplate should be checked with the heater application tables in this manual to assure the heaters furnished with each starter unit agrees with this table and with the actual motor protection requirements. Do not rely on code marking on the heater to indicate current rating. In making this check the following notes 1 through 5 regarding special conditions should be considered.

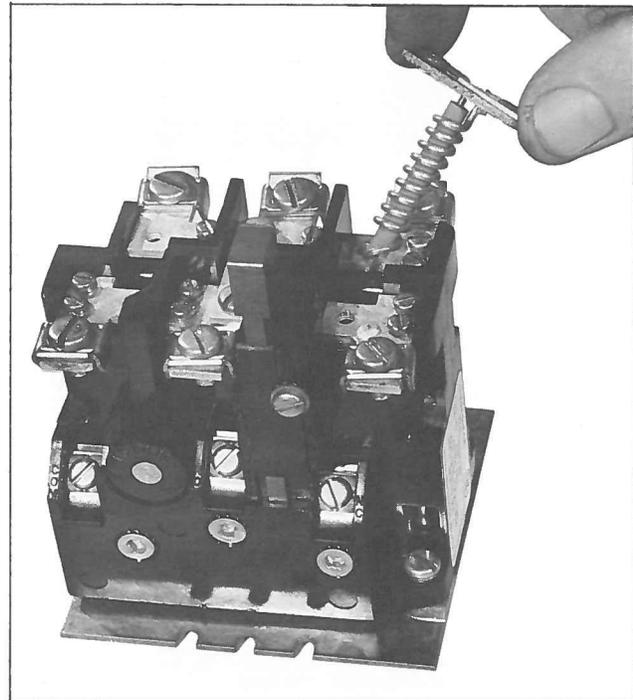


Fig. 16a *Type A Overload Relay Heater Installation*

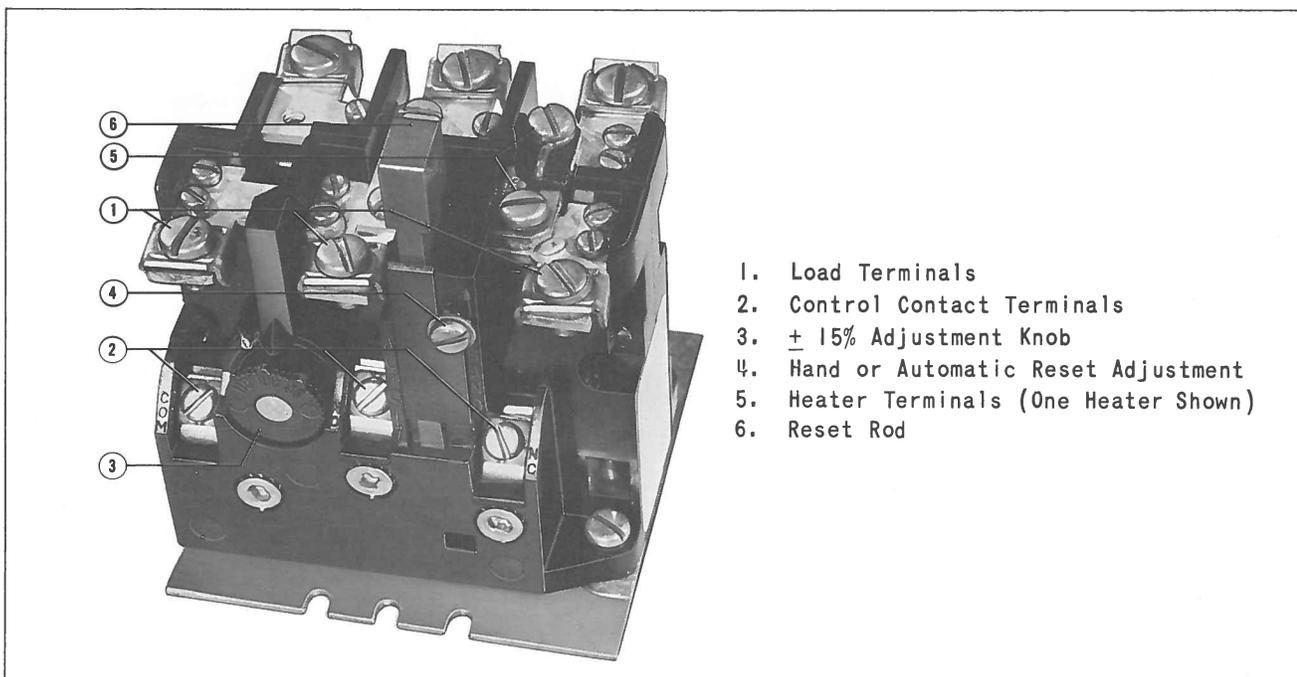


Fig. 16b *Type A Overload Relay*

NOTES ON OVERLOAD HEATER APPLICATION

Note 1 - The Heater Application Tables provide 115% to 125% protection for motors rated 40°C having a service factor of 1.15 to 1.25.

Note 2 - Use one size smaller heater when:

A - The motor is rated 50° or 55°C.

B - The motor has a service factor of 1.00.

C - A maximum of 115% protection is desired.

Note 3 - Overload relays have an adjusting knob that may be used to adjust a trip setting based on operating conditions $\pm 15\%$.

For Non-Compensated Overload Relays

Note 4 - When the motor operates in a significantly higher or lower ambient temperature than

the MCC, an adjusted motor current should be used for selection of heaters. The adjusted values are obtained as follows:

A - DECREASE the rated motor current by 1% for each degree C the motor ambient exceeds the MCC ambient.

B - INCREASE the rated motor current by 1% for each degree C the MCC ambient exceeds the motor ambient.

For Ambient Compensated Overload Relays

Note 5 - Select the heaters based on motor current disregarding ambient temperature differences.

**Heater Application Table
Starter Size 1**

Motor Full Load Current In Amperes					
Non-Compensated Relay		Ambient Compensated Relay		Heaters	
2 Pole Overload Protection	3 Pole Overload Protection	2 Pole Overload Protection	3 Pole Overload Protection	Code Marking	Style Number
0.56 - 0.60	0.48 - 0.51	0.59 - 0.64	0.51 - 0.55	✓ H10	503C553G10
0.61 - 0.67	0.52 - 0.57	0.65 - 0.71	0.56 - 0.62	H11	G11
0.68 - 0.75	0.58 - 0.63	0.72 - 0.79	0.63 - 0.68	H12	G12
0.76 - 0.82	0.64 - 0.70	0.80 - 0.87	0.69 - 0.75	H13	G13
0.83 - 0.91	0.71 - 0.77	0.88 - 0.96	0.76 - 0.83	H14	G14
0.92 - 0.99	0.78 - 0.85	0.97 - 1.06	0.84 - 0.91	H15	G15
1.00 - 1.09	0.86 - 0.93	1.07 - 1.16	0.92 - 1.00	H16	G16
1.10 - 1.20	0.94 - 1.03	1.17 - 1.28	1.01 - 1.11	H17	G17
1.21 - 1.32	1.04 - 1.13	1.29 - 1.41	1.12 - 1.22	H18	G18
1.33 - 1.46	1.14 - 1.25	1.42 - 1.55	1.23 - 1.34	H19	G19
1.47 - 1.60	1.26 - 1.37	1.56 - 1.71	1.35 - 1.47	H20	G20
1.61 - 1.76	1.38 - 1.51	1.72 - 1.87	1.48 - 1.62	H21	G21
1.77 - 1.93	1.52 - 1.65	1.88 - 2.06	1.63 - 1.78	H22	G22
1.94 - 2.12	1.66 - 1.81	2.07 - 2.26	1.79 - 1.95	H23	G23
2.13 - 2.33	1.82 - 1.99	2.27 - 2.48	1.96 - 2.15	H24	G24

Heater Application Table (Continued)
Starters Size 1 & 2

Motor Full Load Current In Amperes					
Non-Compensated Relay		Ambient Compensated Relay		Heaters	
2 Pole Overload Protection	3 Pole Overload Protection	2 Pole Overload Protection	3 Pole Overload Protection	Code Marking	Style Number
2.34 - 2.55	2.00 - 2.19	2.49 - 2.72	2.16 - 2.35	H25	503C553G25
2.56 - 2.80	2.20 - 2.39	2.73 - 2.99	2.36 - 2.58	H26	G26
2.81 - 3.08	2.40 - 2.63	3.00 - 3.28	2.59 - 2.83	H27	G27
3.09 - 3.39	2.64 - 2.89	3.29 - 3.60	2.84 - 3.11	H28	G28
3.40 - 3.71	2.90 - 3.17	3.61 - 3.95	3.12 - 3.42	H29	G29
3.72 - 4.07	3.18 - 3.47	3.96 - 4.31	3.43 - 3.73	H30	G30
4.08 - 4.39	3.48 - 3.79	4.32 - 4.71	3.74 - 4.07	H31	G31
4.40 - 4.79	3.80 - 4.11	4.72 - 5.14	4.08 - 4.39	H32	G32
4.80 - 5.3	4.12 - 4.55	5.15 - 5.6	4.40 - 4.87	H33	G33
5.4 - 5.8	4.56 - 5.00	5.7 - 6.2	4.88 - 5.3	H34	G34
5.9 - 6.4	5.1 - 5.5	6.3 - 6.8	5.4 - 5.9	H35	G35
6.5 - 7.0	5.6 - 5.9	6.9 - 7.5	6.0 - 6.4	H36	G36
7.1 - 7.7	6.0 - 6.6	7.6 - 8.2	6.5 - 7.1	H37	G37
7.8 - 8.4	6.7 - 7.2	8.3 - 9.0	7.2 - 7.8	H38	G38
8.5 - 9.3	7.3 - 7.9	9.1 - 9.9	7.9 - 8.5	H39	G39
9.4 - 10.2	8.0 - 8.7	10.0 - 10.8	8.6 - 9.4	H40	G40
10.3 - 11.2	8.8 - 9.5	10.9 - 11.9	9.5 - 10.3	H41	G41
11.3 - 12.3	9.6 - 10.5	12.0 - 13.1	10.4 - 11.3	H42	G42
12.4 - 13.5	10.6 - 11.5	13.2 - 14.3	11.4 - 12.4	H43	G43
13.6 - 14.7	11.6 - 12.6	14.4 - 15.7	12.5 - 13.5	H44	G44
14.8 - 16.2	12.7 - 13.8	15.8 - 17.2	13.6 - 14.9	H45	G45
16.3 - 17.8	13.9 - 15.1	17.3 - 18.9	15.0 - 16.3	H46	G46
17.9 - 19.5	15.2 - 16.7	19.0 - 20.8	16.4 - 18.0	H47	G47
19.6 - 21.5	16.8 - 18.3	20.9 - 22.9	18.1 - 19.8	H48	G48
21.6 - 23.6	18.4 - 20.2	23.0 - 25.2	19.9 - 21.7	H49	G49
23.7 - 25.9	20.3 - 22.2	25.3 - 27.6	21.8 - 23.9	H50	G50
26.0 - 28.5	22.3 - 24.3	27.7 - 30.3	24.0 - 26.2	H51	G51
28.6 - 31.1	24.4 - 26.6	30.4 - 33.3	26.3 - 28.7	H52	G52
31.2 - 34.2	26.7 - 29.1	33.4 - 36.4	28.8 - 31.4	H53	G53
34.3 - 37.5	29.2 - 32.0	36.5 - 39.9	31.5 - 34.5	H54	G54
37.6 - 41.3	32.1 - 35.2	40.0 - 43.9	34.6 - 37.9	H55	G55
41.4 - 45.1	35.3 - 38.5	44.0 - 48.2	38.0 - 41.5	H56	G56
45.2 - 49.5	38.6 - 42.3	48.3 - 52.7	41.6 - 45.5	H57	G57
49.6 - 54.0	42.4 - 46.0	52.8 - 56.0	45.6 - 50.0	H58	G58

**Heater Application Table (Continued)
Starters Size 3 & 4**

Motor Full Load Current In Amperes		Heaters	
Non-Compensated Relay	Ambient Compensated Relay	Code Marking	Style Number
2 & 3 Pole Overload Protection	2 & 3 Pole Overload Protection		
17.5 - 19.1	19.0 - 20.8	H72	504C972G02
19.2 - 21.1	20.9 - 22.9	H73	G03
21.2 - 23.2	23.0 - 25.2	H74	G04
23.3 - 25.6	25.3 - 27.8	H75	G05
25.7 - 28.1	27.9 - 30.6	H76	G06
28.2 - 30.8	30.7 - 33.5	H77	G07
30.9 - 34.5	33.6 - 37.5	H78	G08
34.6 - 38.2	37.6 - 41.5	H79	G09
38.3 - 42.6	41.6 - 46.3	H80	G10
42.7 - 46.0	46.4 - 50.0	H81	G11
47.0 - 51.0	51.0 - 55.0	H82	G12
52.0 - 56.0	56.0 - 61.0	H83	G13
57.0 - 61.0	62.0 - 66.0	H84	G14
62.0 - 67.0	67.0 - 73.0	H85	G15
68.0 - 73.0	74.0 - 79.0	H86	G16
74.0 - 80.0	80.0 - 87.0	H87	G17
81.0 - 87.0	88.0 - 95.0	H88	G18
88.0 - 95.0	96.0 - 105.0	H89	G19
96.0 - 105.0	106.0 - 116.0	H90	G20
106.0 - 116.0	117.0 - 128.0	H91	G21
117.0 - 127.0	129.0 - 135.0	H92	G22
128.0 - 135.0		H93	G23

**Heater Application Table for Type AA
Ambient Compensated Overload Relay with Type GCA Starters**

Size 5 with 300/5 Current Transf.		Size 6 with 600/5 Current Transf.		Heaters	
Motor Full Load Current in Amperes				Code	Style No.
2 Pole O/L Protection	3 Pole O/L Protection	2 Pole O/L Protection	3 Pole O/L Protection		
113 - 124	98.0 - 107	226 - 247	196 - 214	H22	503C553G22
125 - 136	108 - 118	248 - 271	215 - 234	H23	G23
137 - 149	119 - 129	272 - 298	235 - 258	H24	G24
150 - 163	130 - 141	299 - 326	259 - 282	H25	G25
164 - 179	142 - 155	327 - 359	283 - 310	H26	G26
180 - 197	156 - 170	360 - 394	311 - 340	H27	G27
198 - 216	171 - 187	395 - 432	341 - 373	H28	G28
217 - 237	188 - 205	433 - 474	374 - 410	H29	G29
239 - 259	206 - 224	475 - 517	411 - 448	H30	G30
260 - 283	225 - 244	518 - 565	449 - 488	H31	G31
284 - 300	245 - 263	566 - 600	489 - 527	H32	G32
	264 - 292		528 - 584	H33	G33
	292 - 300		585 - 600	H34	G34

MAINTENANCE

When servicing and adjusting the electrical equipment, refer to the applicable drawings covering the specific control center and any other related interconnection drawings. Follow any instructions which may be given for each device. A list of instruction leaflets covering standard components is shown on page 32 of this manual. Any of these leaflets may be obtained by contacting your nearest Westinghouse Representative.

In addition, the following items should be noted when servicing equipment.

1. **WARNING** - All circuits should be de-energized and disconnect devices locked open when working on unit equipment.
2. The equipment should be kept clean at all times. Any accumulation of dust and dirt should be removed by an industrial vacuum cleaner if available, or by manual cleaning while the bus is de-energized.
3. Periodic inspection should be made of all devices to insure that the apparatus is functioning in proper order.
4. Badly worn or pitted contacts should be replaced as soon as possible for safety reasons and as a part of preventive maintenance.
5. In no instance is lubrication to be applied to any part of any electrical device.
6. It is not recommended that emery paper, sandpaper or file be used to clean or dress up any portion of the electrical equipment. For applications requiring a sanding operation use Aluminum Oxide Paper. This will not leave sand or metal particles on contact surface areas.
7. The silver cadmium contact points of line-starters must not be sanded. In the event of wear, replace all contacts as a group to avoid misalignment problems.
8. Keep connections tight. Special attention should be given to the overload relay thermal element (heater) connections to assure proper functioning.
9. Authorized personnel may open the door while the starter unit is energized. This is accomplished by defeating the mechanical interlock between the operating mechanism and the unit door. A quarter turn counterclockwise of the slotted head screw located below the operating handle will allow the door to open.
10. To positively lock the operating mechanism in either the "ON" or "OFF" position and to prevent the door opening, a metal locking bar recessed at the handle end may be extended and padlocked with from one to three padlocks (Figure 17).
11. With the door open and the disconnect device "OFF" it is mechanically interlocked to prevent inadvertently being pushed "ON". To defeat this the interlock lever on the right side of the mechanism should be pushed slightly allowing the handle to travel upward to the "ON" position. Padlocking to prevent this handle movement may be accomplished by the same method as described in Item 10.

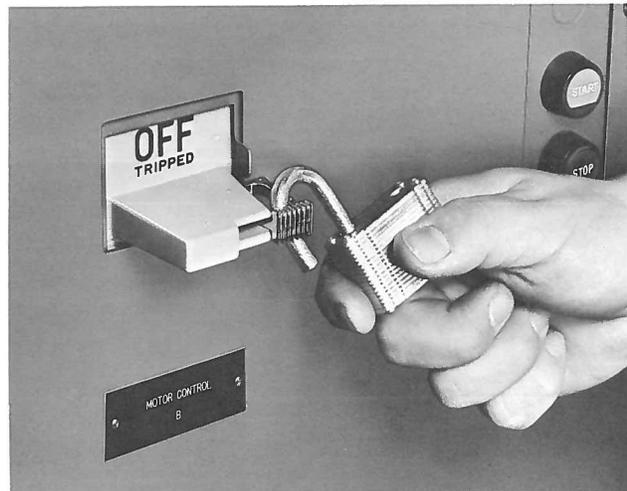


Fig. 17 Padlocking of Handle

UNIT REMOVAL

To remove the unit from the control center, the following sequence of operation should be followed.

1. Push the disconnect operating handle to the "OFF" position.
2. Using a screwdriver with a wide bit turn the quarterturn fasteners located on the vertical edge of the door counterclockwise to the slot-vertical position.
3. Open door.
4. The unit latching device is located at the top center of each unit. Using a screwdriver with a wide blade, turn fastener a quarter-turn counterclockwise. On drawout units having a module height greater than 12", one additional screw on each side near the bottom of the unit should be disengaged.
5. Grip handle and pull forward with a slight snapping motion until the unit guides are near the end of its guide rail.
6. Relatch the unit in this position by turning the latch assembly another quarter-turn counterclockwise into the slot in the pan above. It may be padlocked in this disconnected position if desired (Figure 18).

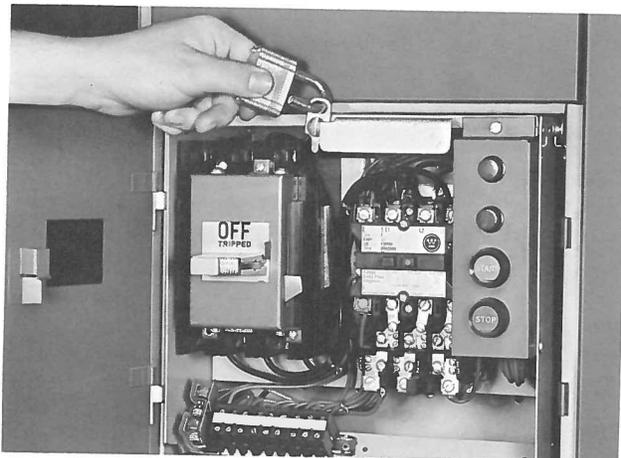


Fig. 18 Padlock of Unit Disconnect Position

7. Disconnect all wires, tag and push into the wireway. (With pull apart terminal blocks wires do not need to be disconnected - Pull out disconnect assemblies by loosening each section - Blocks of three terminals - And putting complete assembly into the wireways intact.)

8. Unlatch unit by turning latching device a quarter-turn clockwise.
9. Pull unit forward until the unit guides are completely out of guide rails (Figure 19).

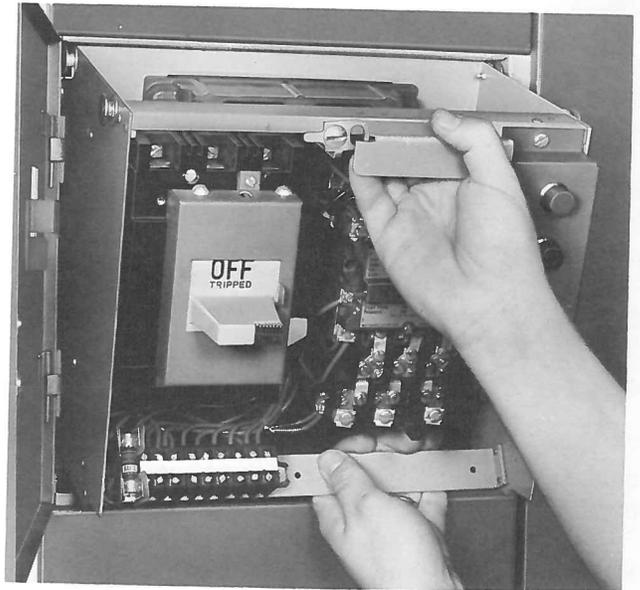


Fig. 19 Unit Removal

10. With the unit completely out of the structure it should never be layed on its back supported by the stabs. They can become damaged or misaligned from this treatment.

CAUTION

Before disconnecting any wiring, be sure that no portion of the control circuit or electrical interlocks are energized from a remote source. If there is any doubt, use a voltage tester.

UNIT REPLACEMENT

To replace a unit in the structure this sequence of operations should be followed:

1. BE SURE the operating mechanism is in the "OFF" position and the unit latching assembly tab is turned to a horizontal position.
2. Open door to unit space by releasing fasteners on the vertical edge of the door. (Slot Vertical)
3. Lift unit into unit space and rest the unit guides on the guide rails.
4. Push unit in until all four unit guides are on the rails and the slot in the pan above is aligned with rear tab on the unit latch.
5. Latch unit in this position by turning latch a quarter-turn counterclockwise and engaged in the pan above.
6. Bring wires in from adjacent vertical wireway (right or left side) and make all power and control connections.
7. Release unit latch assembly by turning a quarter-turn clockwise with tab in the horizontal position.
8. Push unit in with a quick motion to engage stabs to the bus.
9. Latch assembly is spring loaded. Push in with a wide blade screwdriver and turn a quarter-turn clockwise engaging front tab with slot in the pan above.
10. Close and lock door by turning door latches to the slot horizontal position.

INSTALLING A NEW UNIT

It is recommended that new units be installed either directly below an existing unit or in a space at the top of any vertical compartment. Based on this recommendation being followed the following sequence of operations will be required:

1. Remove cover(s) from a selected space at least equal in height to the unit module height. These covers are secured with four or more screws.
2. Remove the clips attached to the structure frame used for supporting the cover.
3. Guide rails should be installed 1-1/2" below the door above as follows:
 - (a) Insert tang of guide rails into the lower slots (in the pattern of 3) in each vertical channel at the rear of the unit space (Figure 5).
 - (b) Fasten guide rails to the front structural members with .190 - 32 X 3/8" long pan head thread-cutting screws.
4. A divider pan providing a door stop and a bottom for each unit is supplied as a part of the unit assembly. This pan also serves as top for the unit below. If the unit space selected does not contain one of these pans both top and bottom it should be assembled as follows:
 - (a) Measure down from the upper pan, the unit height to be installed (increments of 6" - smallest unit 12" high).
 - (b) Insert tabs at the back of the pan into the center slot of the group of three in each vertical channel at the rear of the unit space (Figure 5).
 - (c) Fasten pans to front structural members on each side with .190 - 32 thread cutting screws in prepunched holes. Proper holes can be determined by leveling the pan after inserting the tab end.
5. Mount door on left hand structural member using hinges and .190 - 32 thread cutting screws. The following procedure should be followed:
 - (a) Holding the door in place and resting on the upper pin of the lower hinge, locate the correct holes in the left hand structural member for this hinge location.
 - (b) Put hinge on with (2) .190 - 32 thread cutting screws but do not tighten.

(c) Resting hinge leaf in the door on the upper hinge pin adjust up and down and in and out until the door swings free and is centered in its location (approx. 1/8" above and below the adjacent doors or covers.)

(d) Tighten screws holding lower hinge.

(e) Holding the door in place put on the upper hinge in a similar manner and tighten (Figure 20).

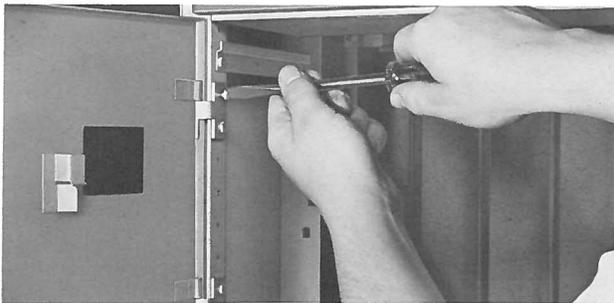


Fig. 20 *Assembly of Hinges and Guides*

The door latch plates should be located on the right hand structural member in line with the door fastener holes. They should be put on with Flat Head .190 - 32 thread cutting screws. With these in place the quarter-turn fasteners should latch perfectly however, if any adjustment is required it should be done on the hinge side as the latches are not adjustable.

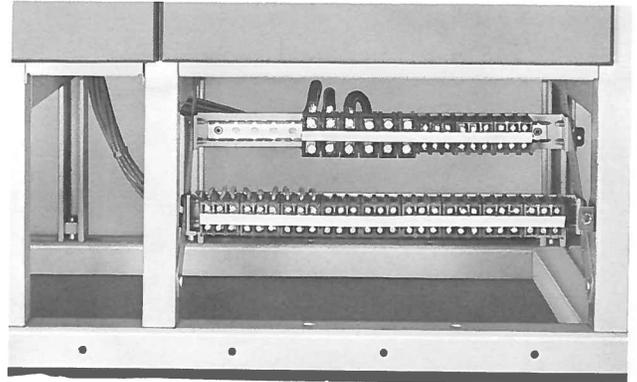


Fig. 21 *Master Terminal Block Assembly*

6. If the unit installed is smaller than the space cover(s) removed, an additional cover may be required to cover the unused portion of the vertical compartment. This space should be measured and a blank cover ordered by Style Number listed in the Renewal Parts section of this book

INQUIRIES

When ordering parts or making an inquiry concerning the Type W control center or any components, furnish the order number shown on a plate adhered to the inside of the upper vertical wire-way door nearest the left end of the control center.

If the question refers to a specific unit the unit designation shown on the unit Data Drawing should also be included.

Address all inquiries and requests to the nearest Westinghouse Sales Office.

RENEWAL PARTS

Name of Part	Style No.
Bus Insulator (Glass Polyester) - Horizontal and Vertical Bus	112B100H01
Offset Mounting Bracket for Horizontal Bus Insulator	412A968H02
Mounting Clip Assy. (3" Flat Cover at Bottom) R.H.	412A989G01
Mounting Clip Assy. (3" Flat Cover at Bottom) L.H.	412A989G02
Mounting Clip Assy. (Formed Cover Blank)	412A966H02
(Flat Cover Blank)	412A966G01
Wire Tie Bracket (In Vertical Wireways)	412A949H01
Unit Guide Rail	412A948H01
Quarter Turn Latch Assembly for All Doors:	412A998G01
Consisting of: 1 Latch Socket	412A595H01
1 Latch Stud	412A596H01
1 Latch Pin	412A597H01
2 Bowed Washer	412A598H01
1 Flat Washer	412A599H01
Unit Divider Pan 12-1/2 Inches Wide - For Mounting at Top of Structure	112B171H01
Unit Divider Pan 12-1/2 Inches Wide - For All Units	112B171H03
Blank Formed Covers 6 Inches High x 13-3/8 Wide - (2 MTG Clips Req'd.)	112C286H01
12 Inches High x 13-3/8 Wide - (4 MTG Clips Req'd.)	112C286H02
18 Inches High x 13-3/8 Wide - (4 MTG Clips Req'd.)	112C286H03
24 Inches High x 13-3/8 Wide - (6 MTG Clips Req'd.)	112C286H04
Small Oper. Mech. Assy. MCP & FB Bkr., 15-150A Trip NEMA 1	112D650G01
30-60 Amp De-Ion Switch NEMA 1	112C386G01
30-60 Amp DS Switch NEMA 1	112D661G01
100 Amp De-Ion Switch NEMA 1	412A100G05
MCP & FB Bkr., 15-150A Trip NEMA 12	112D650G02
30-60 Amp De-Ion Switch NEMA 12	112C386G04
30-60 Amp DS Switch NEMA 12	112D661G02
100 Amp De-Ion Switch NEMA 12	412A099G05
Medium Operating Mechanism Assy. JA and KA 225A Bkr. NEMA 1	412A888G01
200A De-Ion Switch NEMA 1	412A888G02
JA and KA 225A Bkr. NEMA 12	412A889G01
200A De-Ion Switch NEMA 12	412A889G02
Large Operating Mech. Assy. LA 400A Bkr. NEMA 1	412A888G04
MA 800A Bkr. NEMA 1	412A888G06
LA 400A Bkr. NEMA 12	412A889G04
MA 800A Bkr. NEMA 12	412A889G06
Stab Block Assembly	112C279G02
Structure Tie Bracket (For Clamping Shipping Sections Together)	412A333H01
Unit Latch Locking Clip	412A942H01

Name of Part	Style No.
Locking Clip Bolt	412A943H01
Spring	412A940H02
Pushnut Fastener	412A233H01
NEMA 12 Door Gasketing (Specify Door Size)	412A703H03

CONTROL TRANSFORMERS - TYPE MTW

50VA	} 240/480 Volts to 120 Volts 60 Hertz	} 112D631H01	
75VA			112D631H02
100VA			112D631H03
150VA			112D631H04
200VA			112D631H05
250VA			112D631H06
300VA	112D631H07		
50VA	575 Volts to 115 Volts 50/60 Hertz	112D631H16	
75VA	575 Volts to 115 Volts 50/60 Hertz	112D631H17	
100VA	575 Volts to 115 Volts 50/60 Hertz	112D631H18	
150VA	575 Volts to 115 Volts 50/60 Hertz	112D631H19	
200VA	575 Volts to 115 Volts 50/60 Hertz	112D631H20	
250VA	575 Volts to 115 Volts 50/60 Hertz	112D631H21	

FUSE BLOCK..... *TBAF*

For use with above transformers.
Will accept type BAF or KTK miniature fuses.

CONTROL DEVICES - TYPE OT

Pushbutton Operator (Black)	371D950G01
Pushbutton Operator (Red)	371D950G02
Pushbutton Maint. Contact	505C056G03
Contact Block (1-NO)	373D003G01
Contact Block (1-NC)	373D003G02
Contact Block (2-NO)	373D003G03
Contact Block (2-NC)	373D003G04
Contact Block (1-NO - 1NC)	373D003G05
Selector Switch (2 Pos.)	371D142G07
Selector Switch (3 Pos.)	371D142G06
Indicating Light 120 V (No Transformer)	177C512G10
Indicating Light 120 V (With Transformer)	377D682G01
Indicating Light 240 V (With Transformer)	377D682G02
480 V (With Transformer)	377D682G03
Red Lens only	207B293G02
Green Lens only	207B293G03
Amber Lens only	207B293G05

**INSTRUCTION LEAFLETS OF DEVICES COMMONLY
USED IN TYPE "W" CONTROL CENTERS**

	Descriptive Bulletin	Instruction Booklet
Linestarter, Type A - Size 1	CS 8220	IL 13633
Linestarter, Type A - Size 2	CS 8220	IL 13191
Linestarter, Type A - Size 1 Reversing	CS 8220	IL 13194
Linestarter, Type A - Size 2 Reversing	CS 8220	IL 13197
Contactor, Type A - Size 1	---	IL 13144
Contactor, Type A - Size 2	---	IL 13158
Contactor, Type A - Size 3 & 4	CS 8220	IL 13238
Contactor, Type A - Size 1 & 2 Reversing	---	IL 13187
Contactor, Type A - Size 3 & 4 Reversing	CS 8220	IL 13241
Contactor, Type GPA - Size 5	---	RPD 16-100-A5
Contactor, Type GCA - Size 5	PL 16-121	RPD 16-100-B5
Contactor, Type GCA - Size 6	PL 16-121	RPD 16-100-B6
Overload Relay, Type AN & AA, Size 1 & 2	CS 8220	IL 14482
Overload Relay, Type AN & AA, Size 3 & 4	CS 8220	IL 13299
Overload Relay, Type MW, Size 5 (Type GPA)	---	RPD 16-100-A5
Control Relay, Type BF	CS 16-321	---
Control Relay, Type AF	CS 16-321	---
Timing Relay, Type BT	CS 16-321	---
Timing Relay, Type AM	CS 16-321	---
Control Transformer, Type MTC	PL 46-530	---
Circuit Breakers	DB 29-150	AD 29-160
Deion Switches	PL 29-122	---
Terminal Blocks	CS 16-921	---
Electrical Interlocks, Type L-56, Sizes 1-4	CS 8220	IL 13134
Mechanical Interlocks, Type M-33, Sizes 1 & 2	CS 8220	IL 13189
Mechanical Interlocks, Type M-34, Sizes 3 & 4	CS 8220	IL 13189
Pushbuttons, Type A-200	---	IL 13200
Selector Switch, Type A-200	---	IL 13201
Pushbuttons & Selector Switches, Type OT-1	PL 15-121	---