

MCC 3000

Motor Control Center

Installation, Operation and Maintenance Manual



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Foreward

The purpose of this manual is to instruct personnel in the proper installation, operation and maintenance of the MCC 3000 motor control center.

This manual should be read thoroughly before attempting any work on the motor control center and should be kept for future reference once the installation is complete.

Moeller Electric takes great care in the manufacturing and testing of it's motor control equipment. However, proper and periodic maintenance of any electrical equipment is essential to ensure problem-free operation.

For additional general instructions, refer to NEMA Standards Publication ICS 2.3-1995: "Instructions for the handling, installation, operation, and maintenance of motor control centers rated not more than 600V".

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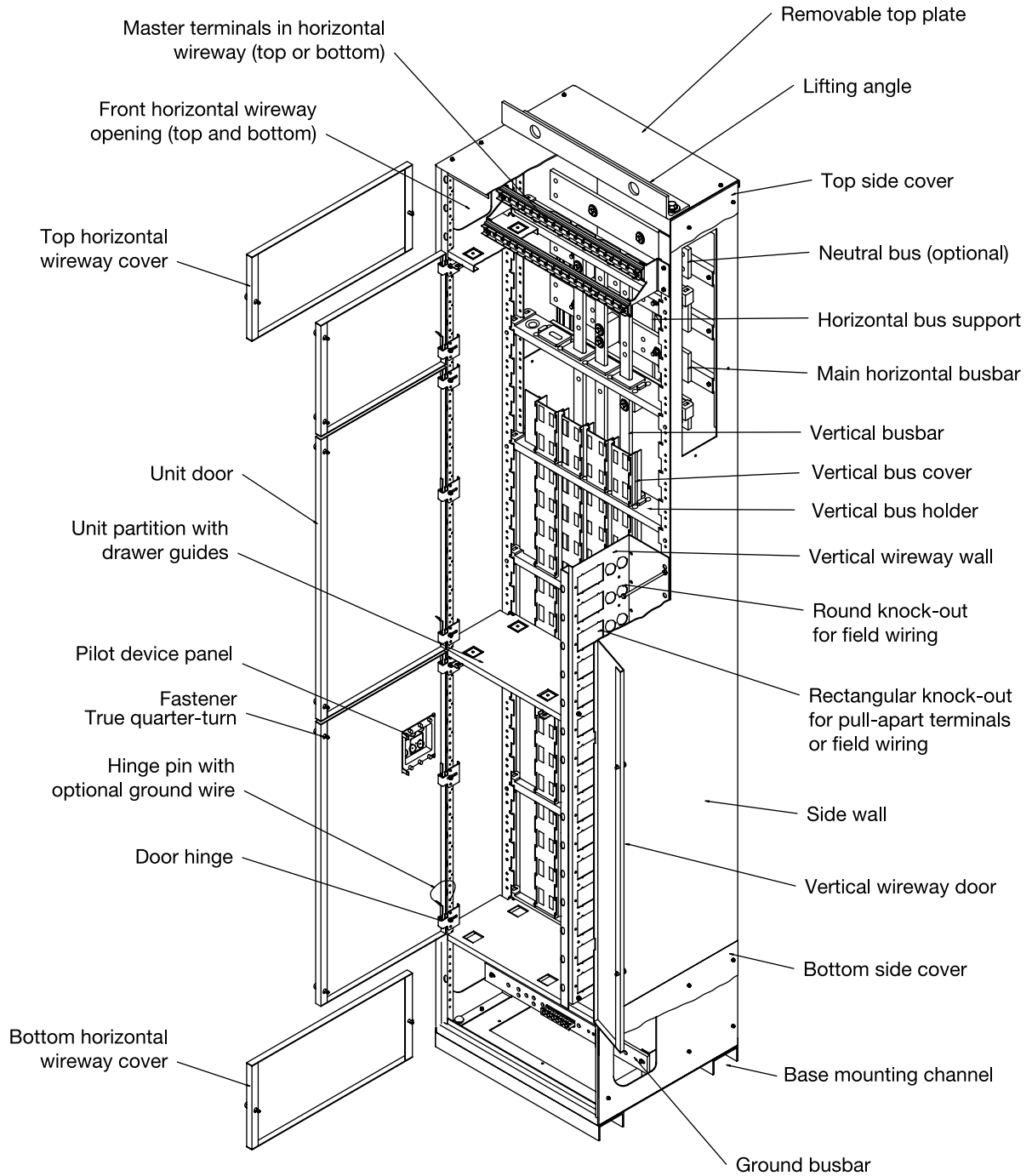
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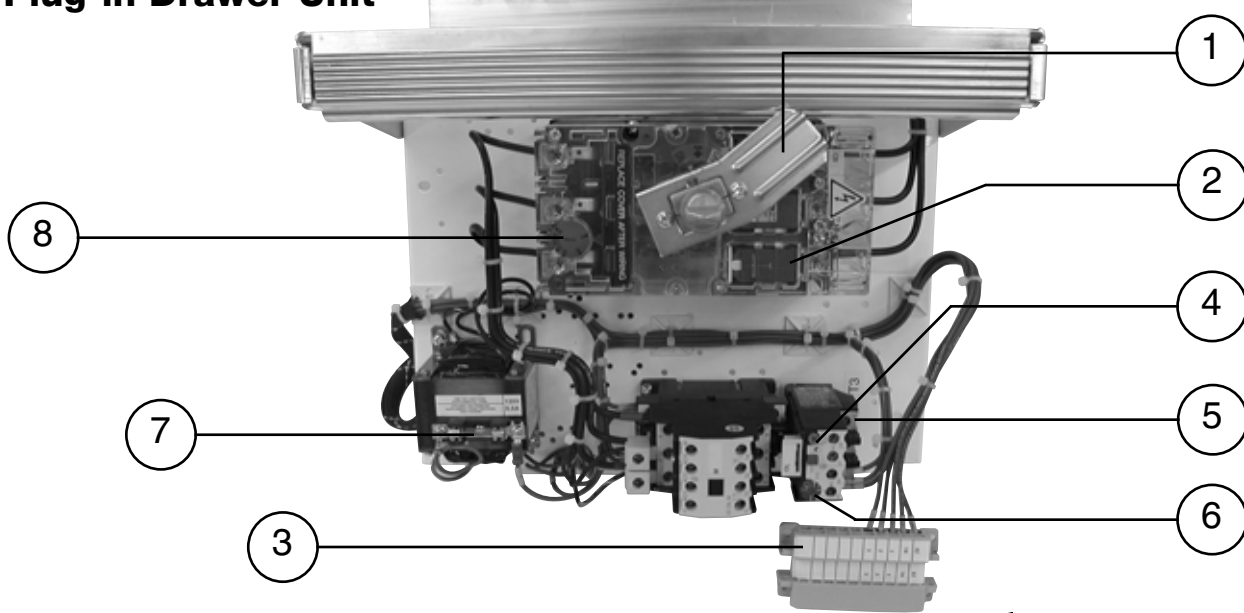
MCC 3000

Motor Control Center

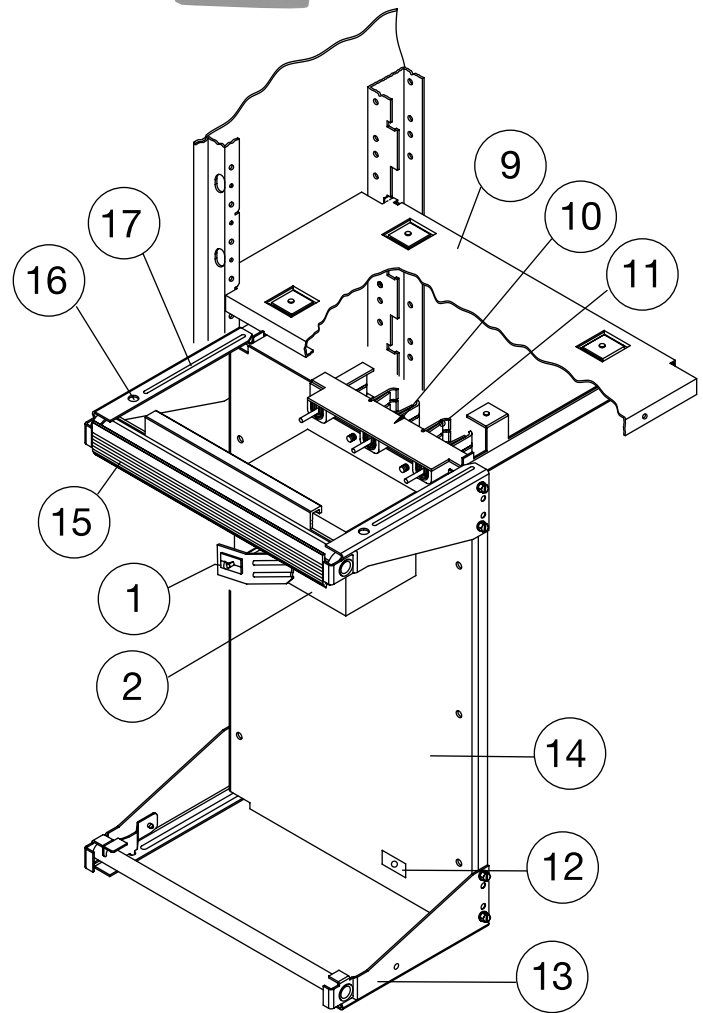
MCC 3000 Motor Control Center



Plug-in Drawer Unit



1. Extension shaft, with drawer safety interlock
2. Disconnect
3. Control terminals
4. Thermal overload relay reset button
5. Load terminals
6. Thermal overload relay setting dial
7. Control circuit fuse
8. Magnetic trip setting dials



9. Unit partition with drawer guides
10. Bus stab holder
11. Bus stab
12. Unit rating label
13. Drawer bottom frame
14. Mounting plate
15. Drawer top frame with latching handle/lever
16. Padlocking hole
17. Drawer frame grounding embossment

1.1 Receiving

Before leaving the factory, the motor control center is given a complete mechanical and electrical inspection and is then carefully packaged in order that it may reach the final user in perfect condition.

Upon receipt of the motor control center, an immediate inspection should be made in order to detect any damage or loss of equipment in transit. All claims to the carrier must be made by the buyer as soon as possible after receipt of the shipment. Moeller Electric will assist in securing adjustment of such transport damage claims.

1.2 Handling

MCC 3000 motor control centers are shipped upright in single vertical sections or in shipping splits of up to 2000 mm wide. Sections should always remain in an upright position during all handling.

Never attempt to lift or move the motor control center at points other than the lifting angle or mounting channels. If possible, the motor control center should remain in its original packaging until final installation site is reached.

The following are preferred handling methods:

A. Overhead Lifting

Each motor control center shipping section is provided with a removable lifting angle. Always use safety hooks or load rated shackles in the support holes of the lifting angle for maximum security.

The legs of the sling should not be less than 45° from the horizontal plane, as shown in Fig. 1.

The lifting angle can be removed during installation, but it should be retained for possible future use.

The retaining bolts should be reinserted in order to prevent foreign material from entering the structure.

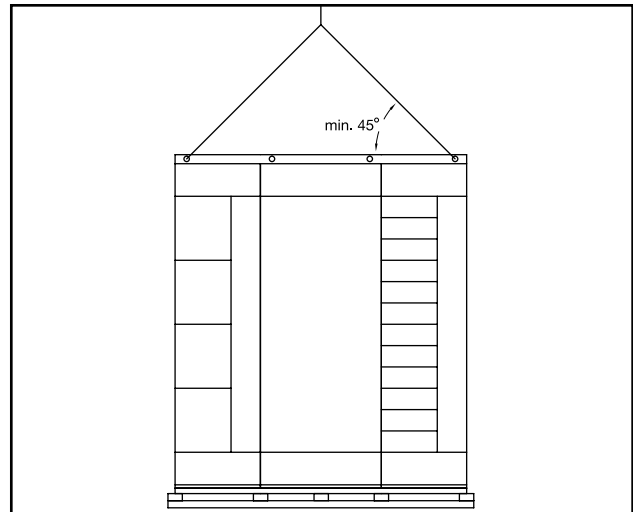


FIG. 1

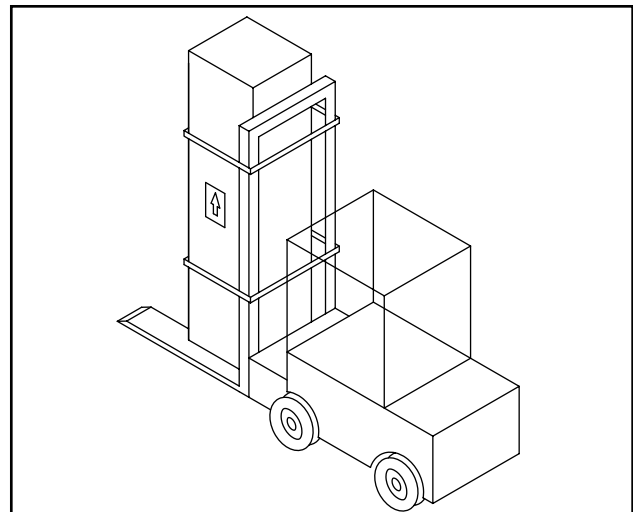


FIG. 2

Average weight per section: 600 lbs (273 kg)

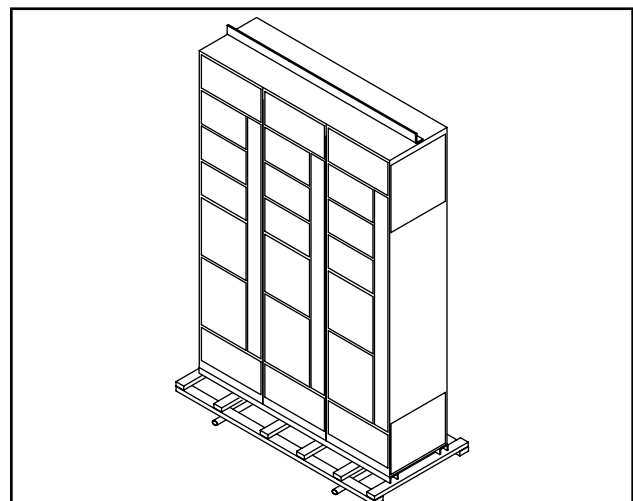


FIG. 3

B. Wooden Skids

Each motor control center shipping section is bolted to wooden skids. These skids are suitable for lift truck handling and for the “pipe rolling” technique (see Fig. 3). Care must be exercised in order to keep the control center stabilized during handling.

A fork-lift may offer a more convenient method of handling the motor control center. It may also be used to move the motor control center between levels. Balance the load carefully and use a safety strap to secure the motor control center to the fork lift (see Fig. 2).

1.3 Storage

When it is necessary to store the motor control center for any length of time, the following precautionary measures should be taken:

1. Store in a clean, dry area at moderate temperature. Never leave the equipment outdoors.
2. Leave the motor control center on it’s wooden skid for subsequent moving. Cover it with a suitable heavy duty plastic sheet to prevent the entrance of foreign particles.

3. If the storage area is damp or cool, place a 100 to 150 Watt space heater in the bottom of each vertical section in order to prevent condensation. All loose packaging or flammable materials must be removed before energizing the space heaters.

1.4 Location Planning

The motor control center should not be installed in hazardous locations where flammable vapors or electrically conductive dust may be present. The location plan should take into account overall dimensions of the motor control center (see Fig. 4), securing provisions, cable entry conduits, alignment with other equipment, and future needs.

1.5 Securing

Once the motor control center has reached the installation site and is ready for installation, carefully unpack it and discard the wooden skid.

The motor control center should always be installed on a level floor in order to prevent structural distortions. If bottom entry conduits are used, they should be stubbed approximately 50mm (2 inches) above the finished floor. All cables should be pulled through the conduits to a position where they will be accessible once the motor control center is in place.

The motor control center should be secured by the mounting channel bolts. The hole patterns in the mounting channels are shown in Figures 5.1 and 5.2.

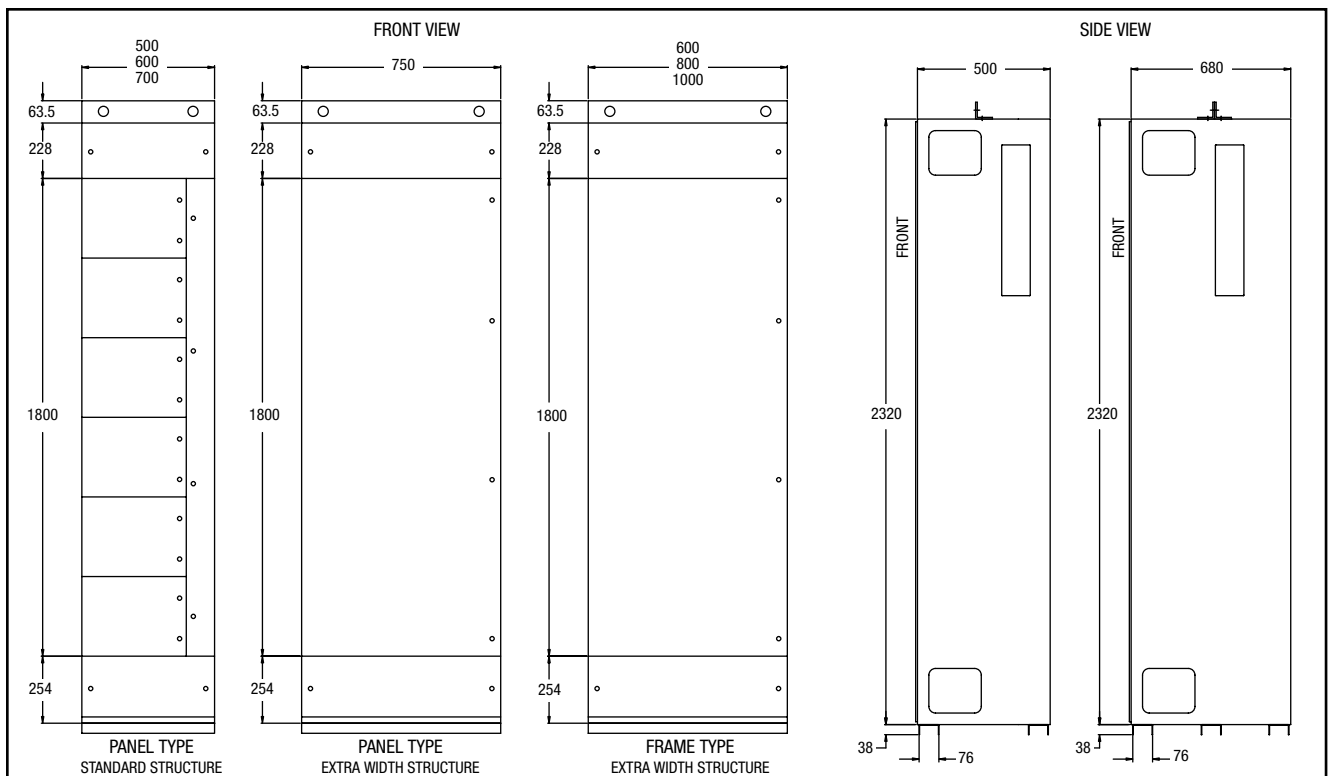
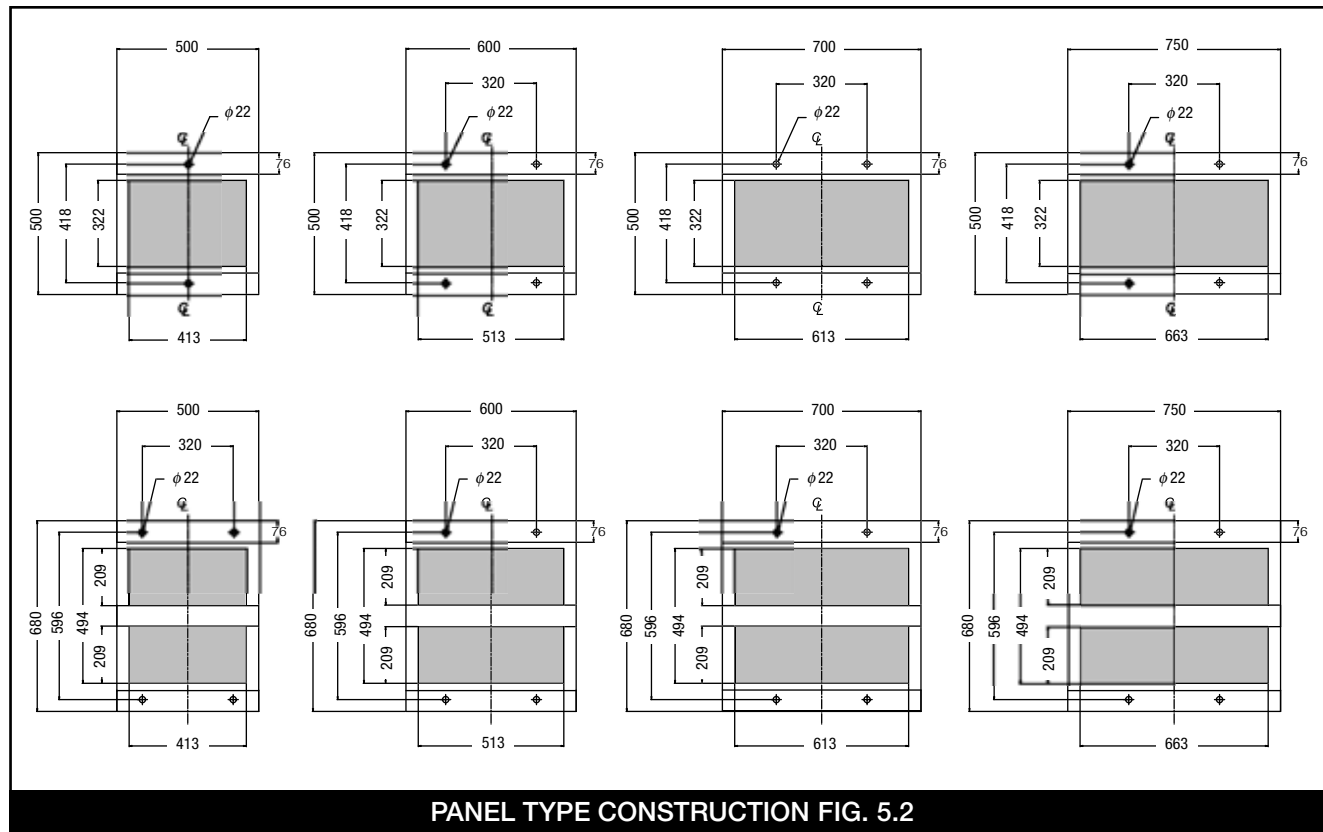
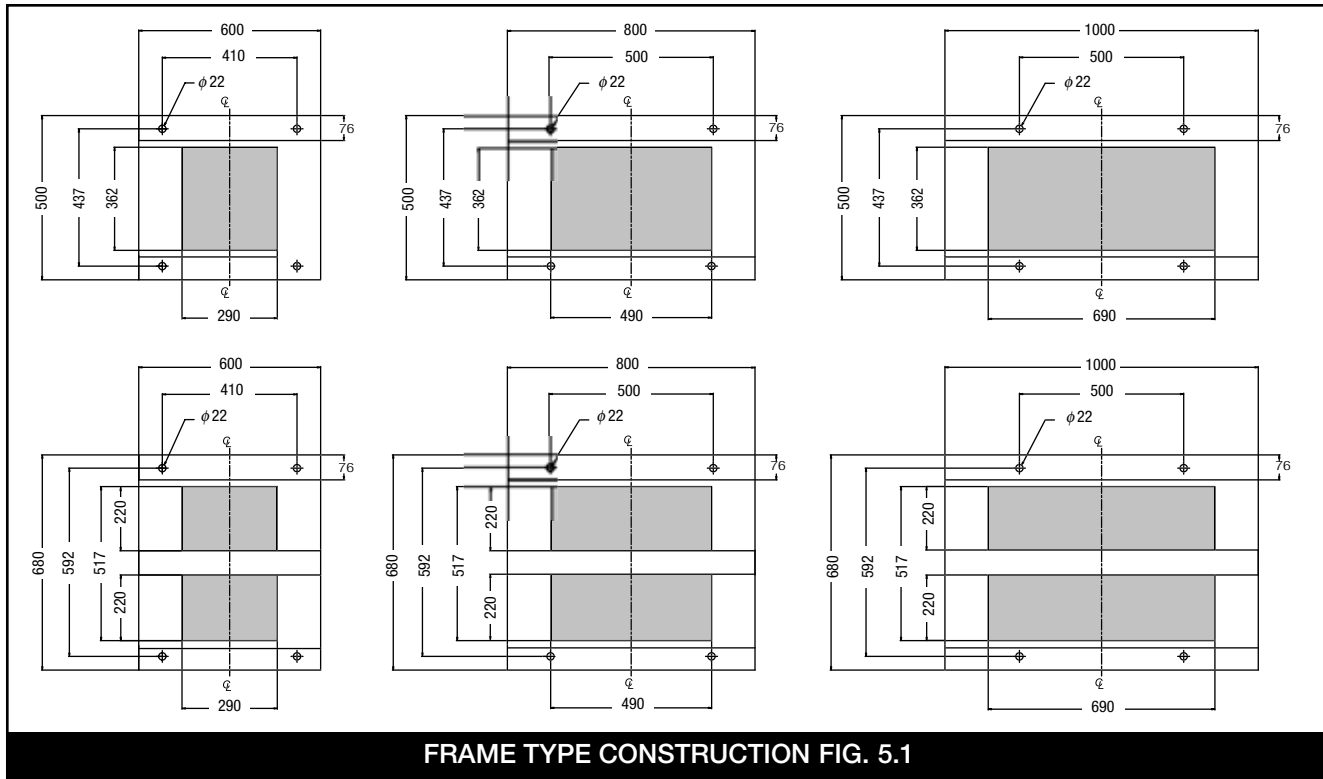


FIG. 4

Base plan



1.6 Joining of Shipping Splits

When joining Shipping Splits of MCC 3000 motor control centers, refer to the installation instructions. It is important that the correct tightening torques, as specified in the installation instructions, be used. If the joint has been properly tightened at the time of installation, then no further tightening or checking is necessary.

1.7 Adding Sections to Existing Motor Control Centers

- A - When adding MCC 3000 sections to a MCC 3000 motor control center, follow the instructions given in AWA-4640-302 GB/F-NA
- B - When adding MCC 3000 sections to a Modan 3000 motor control center, follow the instructions given in AWA-4640-303 GB/F-NA
- C - When adding MCC 3000 sections to a Series 200 motor control center, follow the instructions given in AWA-4640-304 GB/F-NA

1.8 Installation of Cable Entry Conduits

A - Bottom Entry Conduits

Space available for bottom entry conduits is shown in figures 5.1 and 5.2 by the shaded area. If optional bottom plates are supplied, they can be removed for drilling of conduit holes.

B - Top Entry Conduits

Space available for the top entry conduits is shown by the shaded area in Fig. 5.3. Lifting angle and top cover plate must always be removed before drilling conduit holes in order to prevent metal chips from falling into the structure and causing serious damage.

Replace the top cover plate and lifting angle bolts to avoid dust from entering the structure.

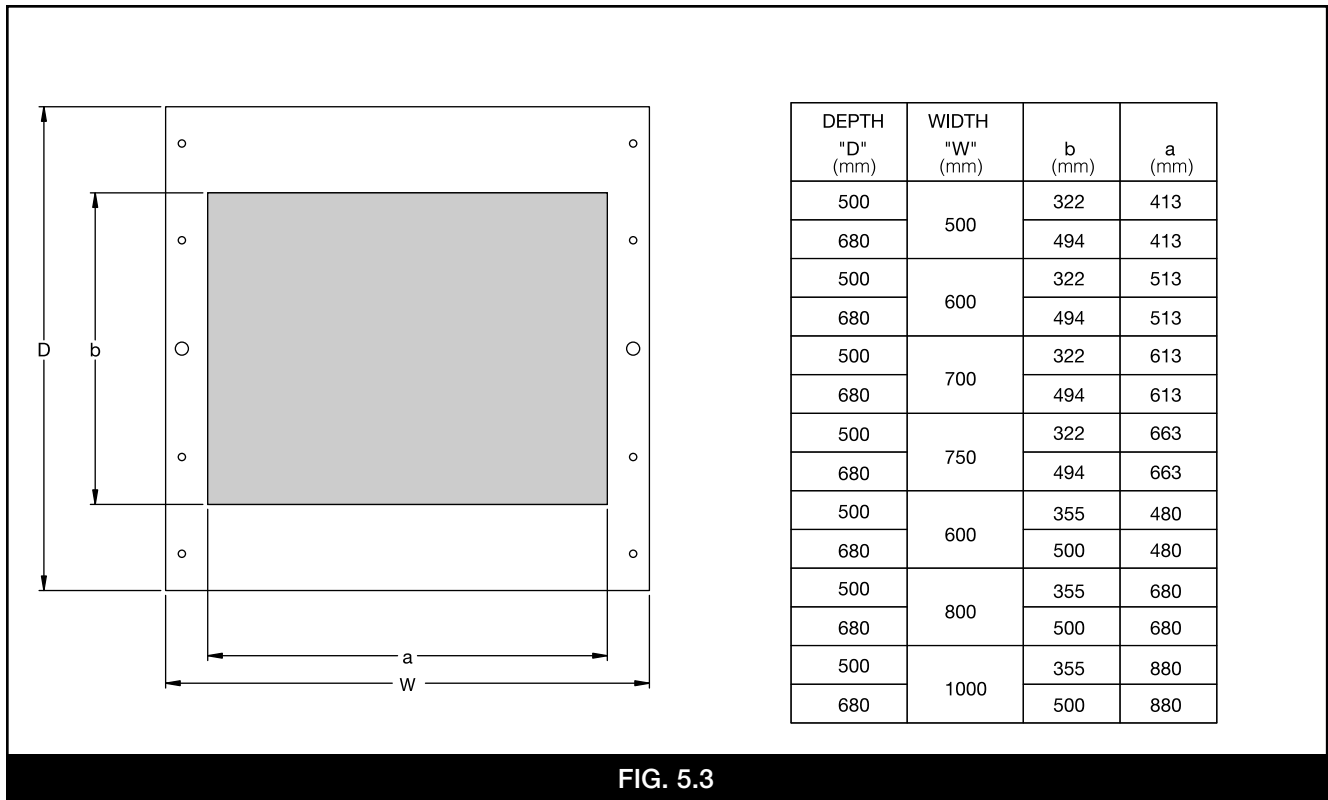


FIG. 5.3

1.9 Equipment Wiring

1.9.1 Main incoming power cables

Main incoming cables normally terminate at the motor control center main disconnect or at the cable entry lugs. All cable entries are supplied with lugs suitable for both copper and aluminum cables.

For cable entry of 600A, lugs are located in 150mm (6 inches) or 225mm (9 inches) full width compartment adjacent to either top or bottom horizontal wireway (Fig. 6). For cable entries of 800 to 1600A, lugs are located in the first 450mm (18 inches) full width compartment adjacent to either top or bottom horizontal wireway.

Top cable entry box with removable top, front, rear, and side plates can be provided for large size incoming conductors.

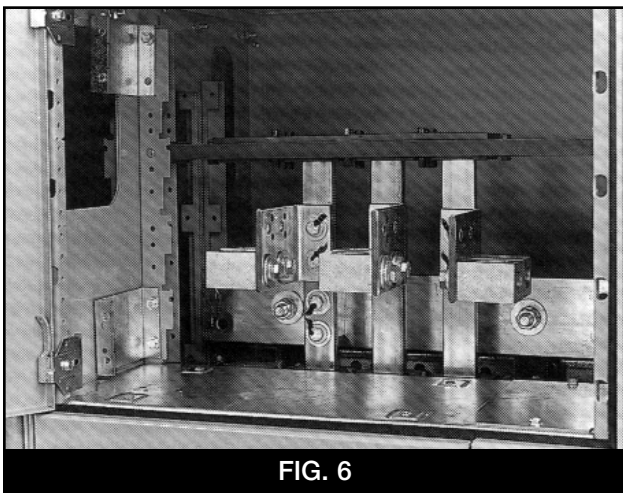


FIG. 6

When main incoming cables are terminated at the cable entry lugs, they should be tightened with the recommended torques shown in Table 2.

If the connections have been properly tightened at the time of installation, then no further tightening or checking is necessary.

When main incoming cables are terminated at the main disconnect, use information given in table 3, page 18.

Type of Connection	Wire Size AWG MCM	Tightening Torques	
		Pound-Inches	N.m.
Connectors with Slotted Screws	8	30	3.4
	6 and 4	35	4.0
	3 to 4/0 incl.	40	4.5
Connectors for External Drive Wrench	1/0	175	20
	2/0	175	20
	3/0	250	28
	4/0	250	28
	250	350	40
	300	350	40
	350	350	40
	400	350	40
	500	400	45
	600	400	45
	700	400	45
	750	400	45
800	450	50	
900	450	50	
1000	450	50	

TABLE 2

1.9.2 Individual control unit wiring

A vertical wireway is provided at the right of all control units for wiring of control units.

The vertical wireway is accessible by a separate vertical wireway door or by the control unit door in the case of a full width door.

For ease of wiring, the vertical wireway door can be removed by first opening the front top cover and then lifting the wireway door off its hinges.

To facilitate the laying in of wire harnesses, remove bottom bracing strut (see Fig. 7) by simply loosening the retaining screw and lifting the bracing strut upwards (strut must be replaced after wiring is complete).

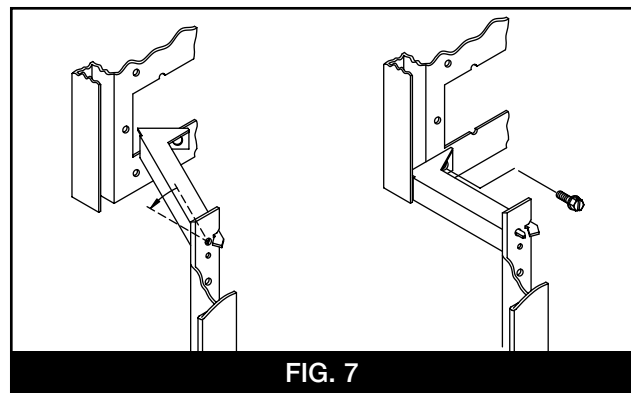


FIG. 7

Load and control wires from the control units should be bundled separately and tied to the wire retaining bolts (see Fig. 8).

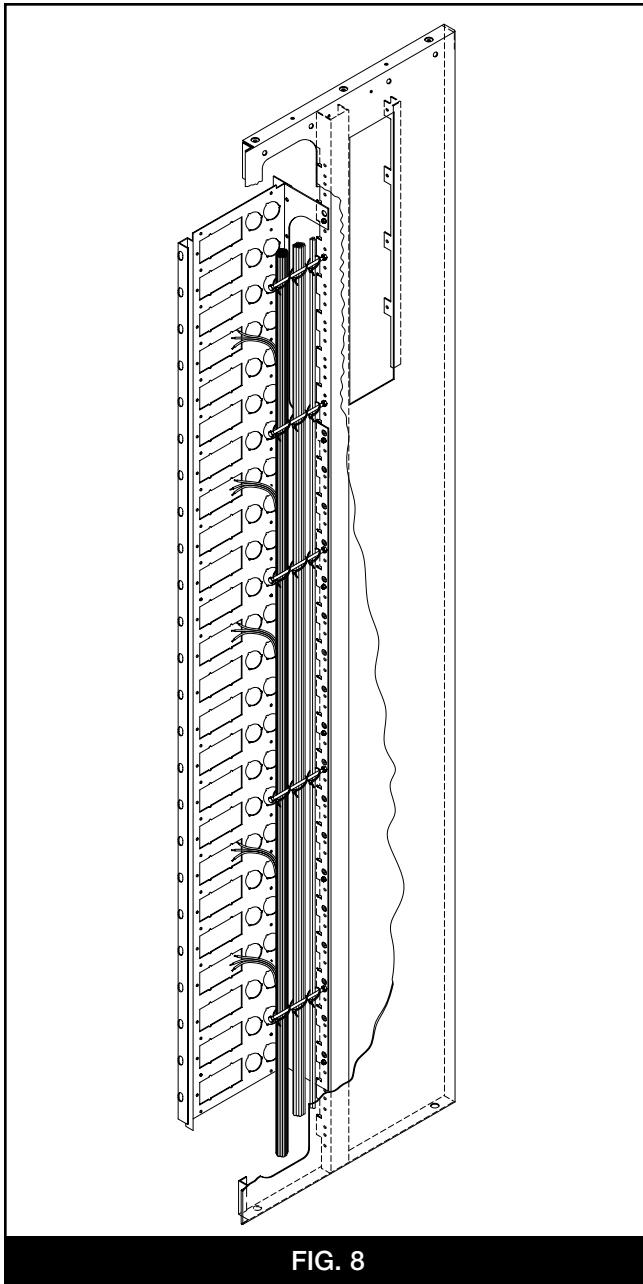


FIG. 8

Vertical wireway openings are provided with plastic inserts as standard in order to avoid wire insulation damage. Spread the openings in the inserts only by the amount required to pass the power and control wires. Phase A, B and C power cables must always enter the control unit through the same wireway opening.

All wiring should be made according to wiring diagrams supplied.

1.9.3 Master control and load terminals

Master terminals are located in either top or bottom horizontal wireway compartments. For added convenience when wiring the outgoing cables, each master terminal mounting rail can be easily removed by removing its mounting screws, (see Fig. 9).

Cables connected to these terminals should have sufficient slack in them to allow removal of the master terminals during maintenance.

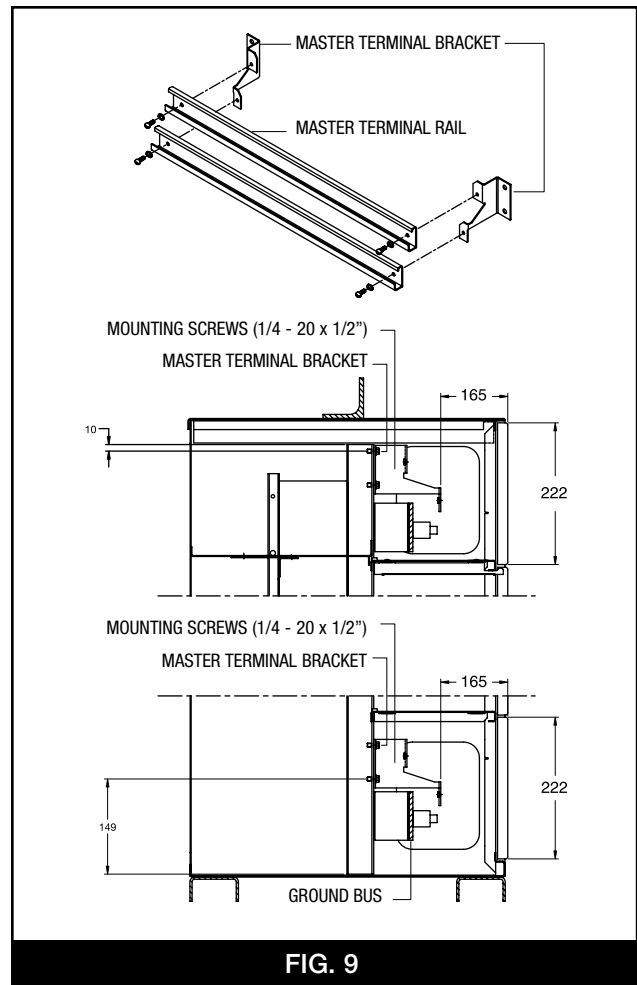


FIG. 9

1.9.4 Wiring between sections

Continuous horizontal wireways are provided at top and bottom of sections for wiring between sections.

The bottom horizontal wireway which is normally 254mm (10 inches) high can be ordered as 179mm (7 inches) in order to allow an extra module of unit mounting space. In this case, the height of the bottom openings is reduced from 168mm to 132mm.

1.9.5 Grounding of structure

Ground bus is always supplied to accommodate customers' incoming and outgoing ground terminals. Connect ground conductors (sized in accordance with governing electrical code) to horizontal ground bus.

1.10 Steps to be taken before energizing the motor control center

Every motor control center is carefully inspected and tested before leaving our factory. However, due to problems that may arise during transportation, storage, handling, installation and the normal construction site hazards, we recommend that you conduct the following inspections once the equipment is installed and wired and before putting it into service.

A – Inspection

1. Remove all loose drawings and bits of packing material from the interior of all sections.
2. Inspect the interior of the motor control center for dirt or metal particles, and vacuum clean (do not use compressed air as it contains moisture).
3. If moisture has penetrated inside the sections, it will be necessary to dry out the motor control center with space heaters.
4. Check the starter nameplates with the latest layout plan of the MCC to ensure that they are correct as to description and location.
5. Check to see that all components used are as per the latest data listing.
6. Check the overload relays to ensure that they are correctly adjusted to the connected motor full load current.
7. Check the magnetic trip adjustment of circuit breakers where required (dials should be set to lowest value that will not cause nuisance tripping and in no case higher than 13 times motor full load current).
8. For reduced voltage starters, check that time delay relays are adjusted to the following values:

Part-winding starters:	adjust to 1 second
Star-delta starters:	adjust to 6 seconds
Autotransformer starters:	adjust to 6 seconds
9. Check that all mechanical fasteners are in place and properly tightened.

10. Ensure that all necessary electrical connections have been made.
11. Check the operation of disconnect handles to ensure that they are functional.
12. Check to ensure that the proper value of fuse has been used in each control circuit and that the green ground wire, when used, is properly fastened.
13. Operate all magnetic devices by hand to verify that all moving parts operate freely. Check all electrical interlocks for proper contact operation.
14. Current transformers are shipped with a shunt across the secondary when the circuit cannot be completed in our factory. Remove the shunt after having completed connections to the transformer secondary.
15. Check that all necessary horizontal busbar couplers have been installed at shipping splits (refer to page 20 for details).
16. Check that the motor control center has been properly grounded as per section 1.9.5.
17. Check and re-tighten (if necessary) all electrical connections within the busbar system. Refer to page 20 for recommended tightening torque values. Check the integrity of busbar holders and supports.

B – Electrical Testing

Conduct an electrical insulation resistance test on all busbars and terminals (use 500 or 1000 volt megger). Instruments or control devices sensitive to megger voltage should be isolated from the circuit. A reading of 50 megohms is normal for the main bus on indoor installations in a dry atmosphere. Insulation resistance may be lower if the motor control center has been stored in a damp location. The motor control center should not be energized if the reading is less than 1 megohm.

1.11 Energizing the motor control center

Make sure that all barriers are back in place, plug-in drawer units are in the latched position, all doors and covers are closed. All unit disconnects should be in the OFF position before energizing the motor control center.

Starters should be actuated one at a time. Check that pilot lights are indicating proper status. If remote auxiliary control devices are used, check that they energize at the proper time.

In order to minimize risk of injury or damage, there should be no load on the motor control center when it is energized. Turn off all of the downstream loads, including those such as distribution equipment and other devices which are remote from the motor control center. Energize the motor control center by starting at the source end of the system and working toward the load end. Energize in the following sequence:

- a. main devices
- b. feeder devices
- c. branch circuit devices

Operate disconnect device handles with a firm, positive action. Do not attempt to ‘tease’ into the closed position.

After all disconnect devices have been closed, energize loads such as lighting circuits, starters, contactors, heaters, and motors.

2.1 Control Units

2.1.1 Opening Door

To open the unit door, place the disconnect handle in the OFF position and turn the quarter-turn fasteners counter-clockwise so that the arrow indicator on the screw head points towards the top of the control unit. If the disconnect operating handle is a Moeller Type H6(9)(10)(12), it must be fully turned to the RESET position in order to open the door.

IMPORTANT: Always check for live circuits before attempting any work in the units. Even though the unit disconnect has been turned to the OFF position, some units might have a control circuit fed from a remote supply.

Disconnect handles are fitted with a 'defeater provision' to permit opening the door with the disconnect in the ON position.

CAUTION:

Opening a unit door with the disconnect in the ON position is considered HAZARDOUS. This should be done only when absolutely necessary and only by authorized personnel.

Disconnect handles can be padlocked in the OFF position with up to three 6-8mm shank padlocks. This also prevents the door from being opened (see Fig. 10).



FIG. 10

2.1.2 Door removal

Proceed as follows to remove a unit door without removing adjacent doors.

1. Open the door to a full 90° position.
2. Remove pilot device panel from the door (if equipped).
3. Remove ground wire from side panel (if equipped).
4. Loosen hinge screws (do not remove screws from the side panel).
5. Pull hinge and door forward and re-tighten the screws.
6. Lift and remove the door.

If the door is too difficult to remove, swing it back and forth while lifting it up.

Doors can also be removed by removing the top door and lifting them off their hinges in sequence from top to bottom.

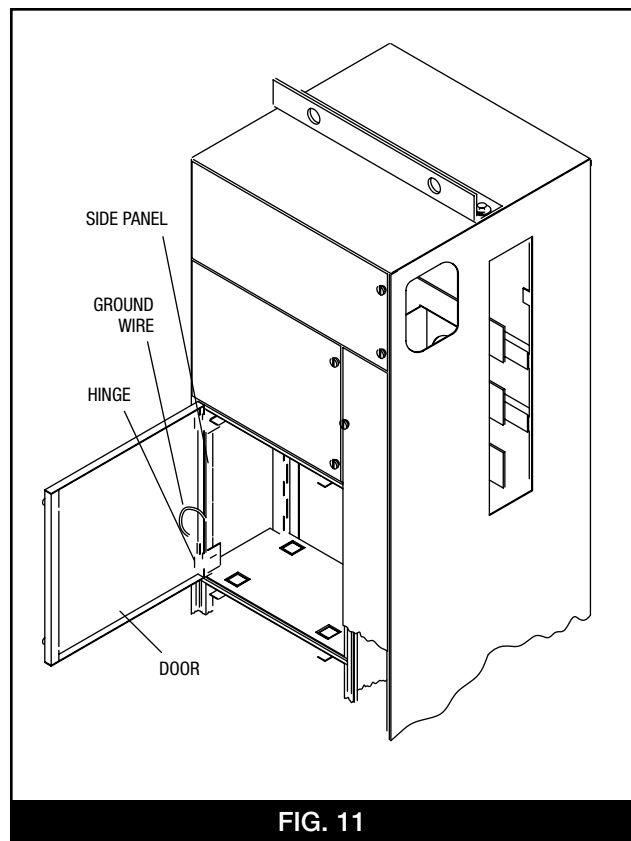
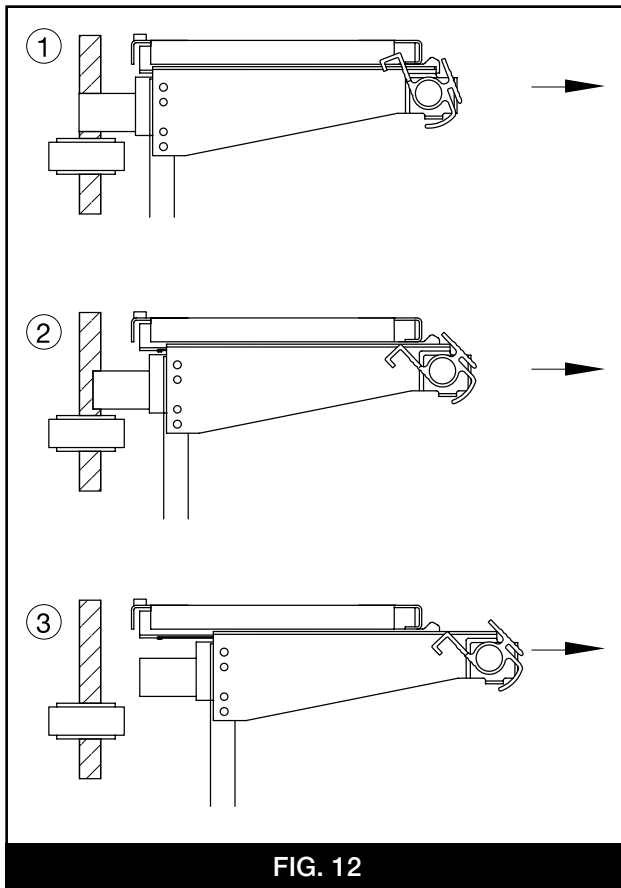


FIG. 11

2.1.3 Plug-in drawer removal

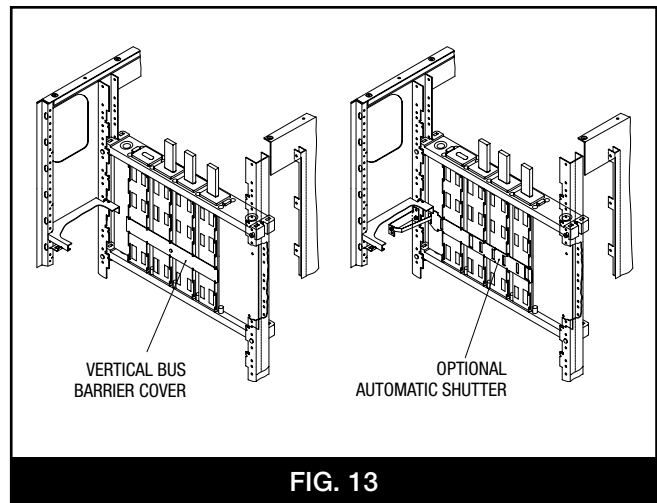
The following procedure applies when removing a plug-in drawer:

1. Place the disconnect handle in the OFF position and de-energize any remote power supply before opening the door.
2. Properly identify outgoing wires for future reference before disconnecting them. The wires should be pushed inside the vertical wireway.



3. If a pilot device panel has been installed on the door, remove it and place it inside the drawer unit.
4. Unlatch the drawer unit by turning the drawer lever and pulling it towards you (Fig.12).

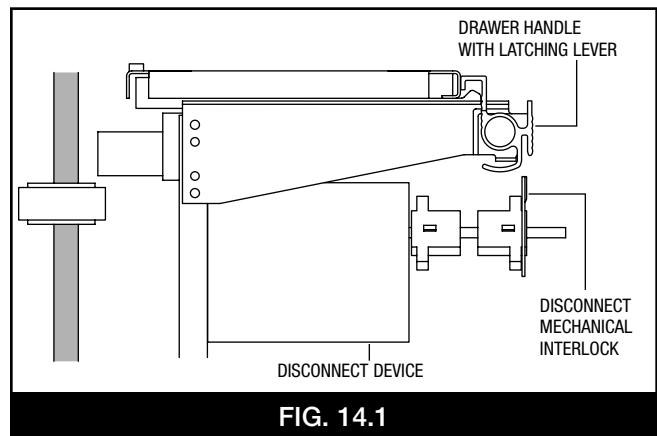
If the space unit is to be left without a unit for any length of time, vertical bus barrier cover or automatic shutter is to be used for closing slots in busbar barriers (available from Moeller, Fig.13).



2.1.4 Test position

To place the drawer unit in the test position, proceed as follows:

1. Place the disconnect handle in the OFF position and open the control unit door.



2. Unlatch the drawer unit by turning the top drawer handle.
3. Pull the drawer toward you until the padlocking holes in the drawer frame are past the unit partition edge. The stabs are no longer in contact with the vertical busbars.
4. The drawer can be latched in TEST position by turning the drawer lever until it points toward the top of the control unit (Fig.14.1).

For added safety, the drawer may be padlocked in the TEST position as shown in Fig.14.2.

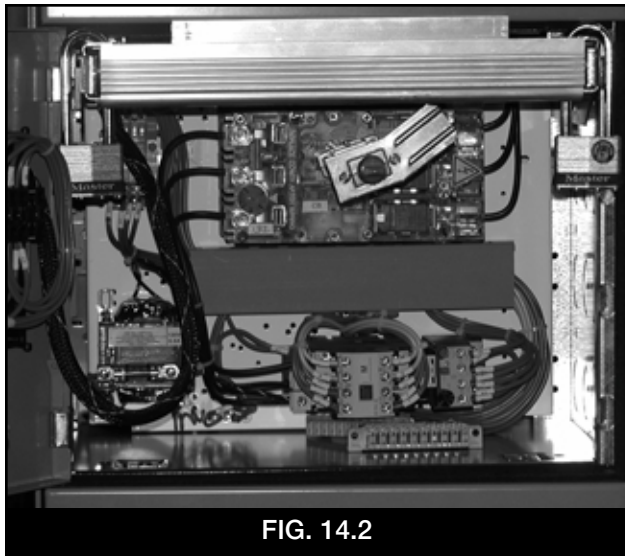


FIG. 14.2

2.1.5 Installation of plug-in drawer

To install a plug-in drawer in the motor control center, the following procedure should be followed:

1. Open the unit door.
2. If the vertical bus barrier covers have been installed, remove the top row vertical bus barrier cover and save it for future use. If automatic shutters are present, simply insert the drawer.
3. The unit disconnect should be in the OFF position and make sure that the drawer lever is pointing toward the bottom of the control unit (Fig.15).
4. Place the drawer top frames on the top partition drawer guides and push the drawer fully in.
5. Latch the drawer by turning the drawer lever toward the top of the control unit.
6. Install the pilot device panel (if provided) by fastening the retaining screws.
7. If remote power supply for control circuits is used, it should be de-energized. Connect all control and load wires.
8. Close the unit door and turn quarter-turn latches so that the arrow indicator points toward the vertical wireway.

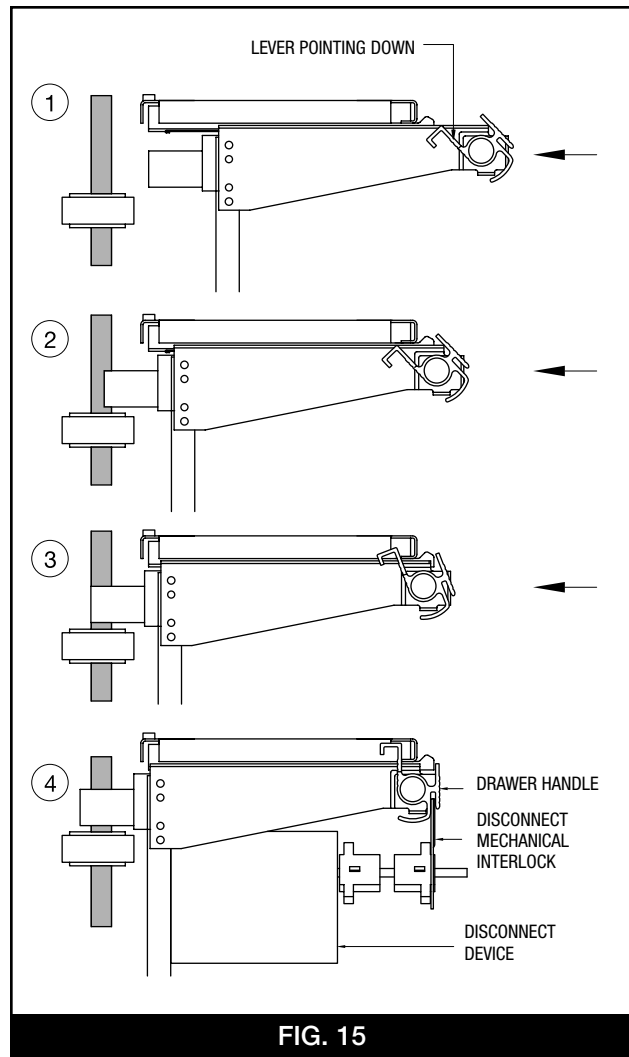


FIG. 15

2.2 Structure modification

The motor control center may have been provided with space for future additions of units. If the unit is to be added in a correctly sized empty space, remove the blank door (see section 2.1.2) and install the new door by reversing the instructions given in section 2.1.2. Install plug-in drawer unit as described in section 2.1.5.

To install a plug-in drawer in an oversized space, a unit partition and a blank door will be needed. Proceed as follows:

1. Remove blank door (see section 2.1.2).
2. Using the new door as a gauge, locate the position of the bottom hinge. Hang the door on the bottom hinge, then locate and assemble the top hinge.
3. Install the unit partition by first positioning the front left slots (see Fig.16), then the left rear slots. Push down the right side of the partition until completely horizontal. Fasten the partition to the vertical wireway wall with two 1/4-28 x 3/8 self-tapping screws provided (screws should be installed from the vertical wireway).
4. The vertical bus barrier covers are to be installed over all unused drawer power plug stab openings and the optional automatic shutter is to be installed on the used drawer power plug openings, (available from Moeller, see Fig.13).
5. Install the plug-in drawer as previously described in section 2.1.5.
6. Install blank door over the remaining unused space.



FIG. 16

3.1 Preventative Maintenance Program

The end user should establish a preventative maintenance program consisting of a checklist of items to be covered periodically. Such a program should result in less downtime caused by neglected equipment. The frequency of maintenance required will vary with the equipment usage and environmental conditions. However, the following items should be included in the checklist.

CAUTION: DE-ENERGIZE THE MOTOR CONTROL CENTER BEFORE WORKING ON EQUIPMENT.

1. Check and re-tighten (if necessary) all electrical connections within the busbar system. Refer to page 20 for recommended tightening torque values.
2. Any dust accumulation inside the motor control center must be removed. Remove all plug-in drawers (see section 2.1.3 for procedure). If starters are mounted on fixed mounting plates, they are to be removed in the same way except that the line power cables should also be removed from the disconnect terminals and the mounting plate retaining screws unfastened. Remove the front vertical busbar barriers by first removing barrier pins on the supports. It may be necessary to remove some of the unit partitions in order to remove these barriers.

Remove dust accumulation from horizontal and vertical busbar holders and starter units with a clean and dry cloth, brush or vacuum cleaner. Do not use compressed air for dust removal inside the motor control center.
3. When filters are provided with ventilated top and bottom covers, these should be removed and cleaned with compressed air.
4. Check that moisture has not formed inside the motor control center. Eliminate the source of any dripping on the enclosure and any other source of moisture. Replace or thoroughly dry and clean any insulating material which is damp or wet.
5. Check all wiring for deterioration of insulation and any signs of loose connections. Tightening torques for cable entries are given in section 1.9.1 while those for circuit breakers and fusible switches are given in the following table.

Disconnect	No of Cables	Cable Size	Tightening Torques	
			Pound-inches	N.m.
PKZ 2/SP	1	# 14 - # 6	16	1.8
NZMH 4	1	# 14 - # 3	36	4
N(ZM)(H)6(b)-63	1	# 14 - # 1/0	90	10
N(ZM)(H)6-100	1	# 14 - # 1/0	90	10
N(ZM)(H)6-160	1	# 14 - # 3/0	133	15
N(ZM)(H)9-250	1	# 8 - 300 MCM	350	40
NZM10+K300*	1	250 - 500 MCM	72	8
NZM10+K2x120*	2	3/0 - 250 MCM	72	8
NZM10+K2x240*	2	2/0 - 500 MCM	440	50
N(ZM)12-630 & N(ZM)12-800	1	250 MCM - 600 MCM	440	50
	2	3/0 - 500 MCM	440	50
	3	250 MCM - 400 MCM	440	50
N(ZM)12-1250	4	# 2 a 500 MCM	440	50
P 2-30	1	# 14 - # 6	36	4
P 2-60	1	# 10 - # 1/0	90	10
P 2-100	1	# 10 - # 1/0	90	10

(* terminals for NZM 10)

TABLE 3

6. Check that all components are securely tightened to the mounting plate (especially in high vibration environments).
7. Contactors are selected on the basis of matching the life span of the motor under normal duty, without undergoing any change of contacts or maintenance. If a contactor is suspected of requiring replacement, check its contacts for wear. Should premature replacement be required, the characteristics of the load should be investigated for possible misapplication, (eg: heavy or extreme switching duty). Consult your nearest Moeller Electric sales office for contactor replacement policy information.
8. Check contactors for friction or binding of moving parts. Do not apply grease or oil on contactors. Moeller does not recommend the use of sprays or solutions on DIL contactors or any other Moeller device for the purpose of displacing moisture.
9. Check the operation of thermal overload relays.
10. Check the settings of thermal overload relays and magnetic trips.

11. Check control circuit and power fuses. If replacement is required, always use the same type and rating as supplied with the motor control center.
12. Verify circuit breakers in the following manner:
 - a) The case and cover should be examined for cracking and bubbling, especially if it has tripped due to an overcurrent.
 - b) Operate circuit breaker in the ON and OFF position several times to ensure that the mechanism operates. If the circuit breaker was equipped with a shunt or undervoltage trip accessory, operate the accessory several times.
 - c) Do not apply lubrication to the operating mechanism or tripping elements.
13. Install all starters, barriers and covers previously removed. Drawers must be in latched position and doors closed.
14. Check disconnect operating handles and thermal overload relay reset buttons for proper operation (check door interlock feature of operating handles).
15. Energize the motor control center as described in section 1.11.
16. Check all pilot lights for proper operation.

3.2 Spare parts

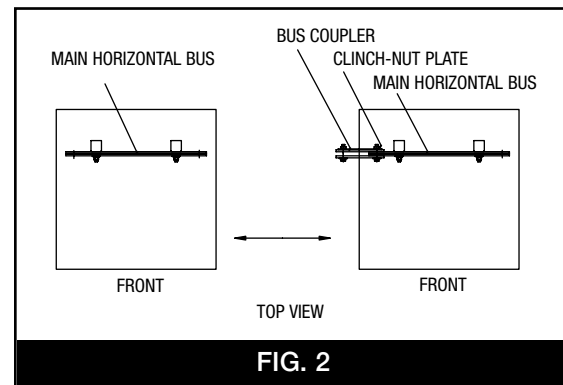
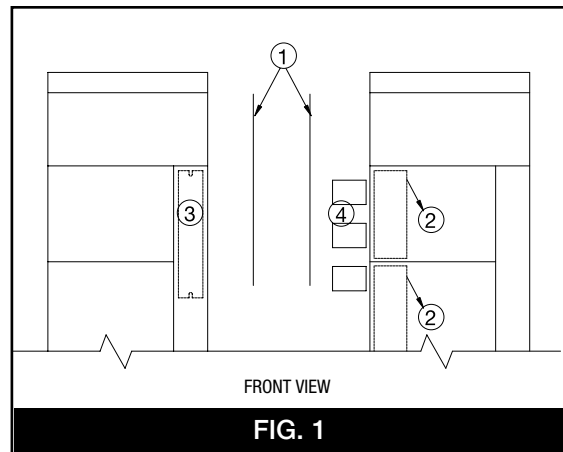
Due to the wide variation of components supplied in MCC 3000 motor control centers, stock of spare parts will vary. The following is a suggested list of items which should normally be part of your stock of spare parts. Your Moeller Electric office will gladly assist you in the preparation of a spare parts list for your specific installation.

This is only a partial list of items available from Moeller and you should consult with us if you have special requirements not covered in this list:

1. Overload relays
2. Circuit breakers
3. Contactors
4. Control circuit and power fuses
5. Contactor coils
6. Lamps for control devices
7. Pushbuttons
8. Control transformers
9. Power plug units
10. Complete starters and/or empty plug-in drawer units
11. Touch-up paint: ANSI 61 grey

A - Standard Phases A, B, and C busbars

1. Remove side covers (1) (Fig.1) when provided.
2. Remove starters in front of the main horizontal busbars, access plate(s) on busbar barrier (2) and/or trough plate (3) inside the vertical wireway (Fig.1).
3. Bolt the sections together using the 5/16" bolts, washers and nuts provided (Fig.3). Tighten to a torque of 20 ft. lbs. (27Nm).
4. Make busbar coupler (4) connections (Fig.1) using couplers, clinch nut plates, and 3/8" bolts and washers provided (Fig.2). Each bolt must be tightened to a torque of 28 ft. lbs. (38Nm).
5. Re-install access plate(s) and trough plate prior to re-inserting starters.
6. For 2000A to 3000A horizontal bus, use insulating barriers and cable ties provided to wrap the busbar couplers (Fig.4).
7. All joining configurations are shown in Fig.5.



B - Neutral Bus (optional)

1. The neutral bus, if supplied, is located in the top horizontal wireway, behind the steel barrier.
2. Remove the steel barrier by unfastening the four screws.
3. Join the neutral busbars in the same way as described for phase A, B, and C busbars.
4. Re-install the steel barrier.

C - Ground Bus (standard)

1. The ground bus can be located in the bottom horizontal wireway. Alternatively, it can also be located in the top horizontal wireway.
2. Unfasten the 1/4"-20 screws and re-install the bus coupler with the same hardware, (Fig.6).
3. Tightening torque should be 9 ft lbs. (12 Nm).

