



# Spectrum EBM™ Motor Control Series Combination Line Starters, Motor Starters, Circuit Breakers

## Installation & Maintenance Information

# IF 1150

**SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE**

### APPLICATION

The Spectrum EBM motor control series is used for across-the-line starting of polyphase AC induction motors. It provides disconnecting means, motor branch circuit protection, motor running protection, under voltage protection and remote starting and stopping by means of a combination of thermal-magnetic circuit breakers and magnetic motor starters.

Spectrum EBM series enclosures are suitable for use in Class I, Groups B, C, D; Class II, Groups E, F, G and Class III hazardous (classified) areas as defined by the National Electrical Code®

(NEC) article 500.

Spectrum EBM series enclosures should be installed, inspected, and serviced by qualified and competent personnel.

Read entire instructions before starting installation of this product. Contact your Crouse-Hinds ECM Sales representative, Sales/ Service Syracuse, or your Crouse-Hinds ECM distributor if you have any questions.

### ENCLOSURE INSTALLATION

#### WARNING

To provide protection against fire or shock hazard, the electrical power must be OFF before and during installation and maintenance.

1. It is **not necessary** nor recommended to remove the cover during enclosure installation. If it becomes necessary, see Removing and Reinstalling Cover on page 2.
2. Select a mounting location that will provide suitable strength and rigidity for supporting the enclosure, all contained wiring and control devices. Figure 1 shows mounting dimensions.
3. Install four 1/2" (enclosures A, B, D, G, H) or 5/8" (enclosures K, L, M) diameter mounting bolts in the mounting surface. Then remove the top two in preparation for placing the enclosure in position.
4. Install detachable mounting feet while enclosure is on the floor or work bench. (See Figure 2).
  - Insert four wedge shaped mounting feet into dovetail slots in enclosure body.
  - Tap each foot to securely tighten into slot.
5. With the larger Spectrum EBM enclosures (sizes G, H, K, L and M) a mechanical lifting means is included. This **STEEL PLATE** is attached to the backside of the body flange with (2) 5/16-18 stainless steel bolts.

#### CAUTION

Before attempting to lift the enclosure using this plate be sure that the (2) 5/16-18 bolts are torqued to 17 ft-lbs.

After the enclosure is positioned and secured in its permanent location (Steps 6 and 7 below) the plate and (2) 5/16-18 bolts should be discarded.

#### WARNING

The steel plate provided for lifting the enclosure during installation, is designed to accept a maximum 2 ton hook.

6. Position enclosure on surface with mounting feet on the lower two mounting bolts. While continuing to support the enclosure in position, install the top two bolts. Tighten all four mounting bolts securely in place.

7. Securely fasten enclosure to the mounting location, then attach into conduit system. Install approved conduit sealing fittings as required by the NEC plus any other applicable codes. Use explosionproof RE reducers for conduit smaller than tapped opening.

#### CAUTION

Conduit sealing fittings are required on all conduit entrances (within eighteen inches of the enclosure) for Spectrum EBM series enclosures when used in Class I, Groups, B, C, D hazardous areas. Use Crouse-Hinds type EYS seals. For other sealing requirements, consult the National Electrical Code.

#### CAUTION

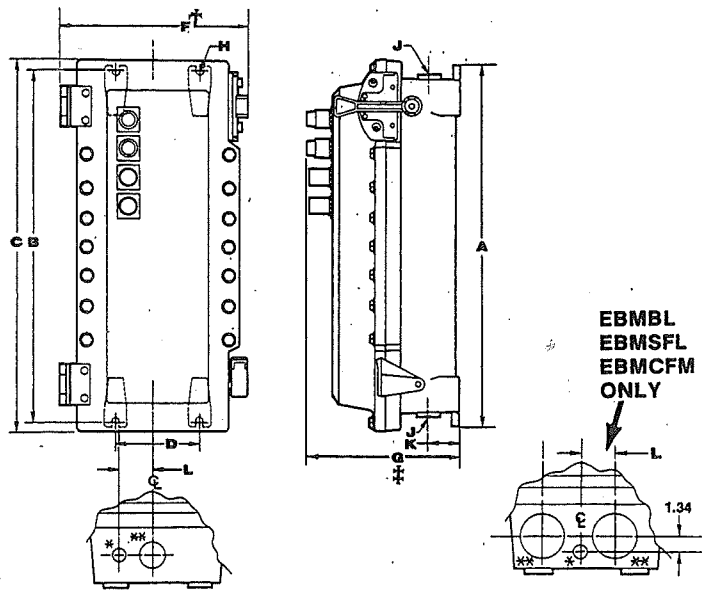
Sealing fittings must be installed in accordance with the NEC and properly poured. See instructions supplied with sealing fittings. NOTE: Select nipple lengths sufficient to permit sealing fittings and unions to clear the flange.

#### CAUTION

- Hazardous location information specifying class and group is marked on the nameplate of each enclosure.
- No conduit openings are to be added in the field.
- All unused conduit openings must be plugged with explosionproof plugs. Plugs must be a minimum of 1/8 inch thick, such as Crouse-Hinds type PLG, and engage a minimum of five full threads.

#### CAUTION

To prevent external fire or explosion, **DO NOT** connect to a supply circuit capable of delivering more than 65,000@ 240V, 50,000@ 480V, and 25,000@ 600V RMS symmetrical amperes. **DO NOT** install equipment which will produce external surface temperatures exceeding the ignition temperature of the flammable or combustible materials which may surround the enclosure. Circuit-interrupting devices, such as switches, relays and circuit breakers which may be installed in the enclosure, may fail electrically or mechanically unless they have been investigated and found suitable for operation in the hazardous locations involved.



\* 1" CONDUIT ENTRANCE FOR CONTROL CONDUCTORS (BOTTOM ONLY)  
 \*\* CONDUIT ENTRANCE FOR POWER CONDUCTORS (TOP & BOTTOM)  
 (ALL CONDUIT ENTRANCES SUPPLIED WITH RE REDUCER & PLG PLUG)

Figure 1

Encl. Size Symbol	Enclosure Only Cat. No.	DIMENSIONS						**J Conduit Entry Trade Size		K	L
		A	B	C	D	F	G	D&T	w/RE		
B	EBMCFB	25.75	24.75	26.50	6.50	14.06	12.13	2"	1 1/2"	2.88	3.13
D	EBMCFD	28.25	27.25	29.00	6.50	14.06	12.13	2"	1 1/2"	2.88	3.13
H	EBMCFH	37.50	36.50	38.25	8.38	15.75	13.94	3"	2 1/2"	3.12	3.94
L	EBMCFL	53.47	52.47	52.88	11.38	19.37	14.75	3"	2 1/2"	3.75	5.56
M	EBMCFM	64.22	63.22	63.63	11.38	18.82	14.75	(2) 4"	(2) 3 1/2"	3.75	5.56
A	EBMBA	18.25	17.25	19.00	6.50	14.00	10.38±	2"	1 1/2"	2.88	3.13
B	EBMBB	25.75	24.75	26.50	6.50	14.06	10.38±	2"	1 1/2"	2.88	3.13
G	EBMBG	38.13	37.13	38.88	6.50	14.06	10.38±	2 1/2"	2"	3.00	3.13
K	EBMBK	43.12	42.12	43.87	11.00	19.24	10.67±	3"	2 1/2"	3.25	3.93
L	EBMBL	53.47	52.47	52.88	11.38	19.37	12.78±	(2) 4"	(2) 3 1/2"	3.75	5.56
A	EBMSFA	18.25	17.25	19.00	6.50	14.00±	12.13	1 1/2"	1"	3.00	3.13
B	EBMSFB	25.75	24.75	26.50	6.50	14.00±	12.13	2"	1 1/2"	3.12	3.13
H	EBMSFH	37.50	36.50	38.25	8.38	15.88	13.94	3"	2 1/2"	2.88	3.94
L	EBMSFL	53.47	52.47	52.88	11.38	19.37	14.75	(2) 4"	(2) 3 1/2"	3.75	5.56

±For EBMBBA, EBMBBB, EBMBGG, EBMBKK, & EBMBLL (circuit breaker only) enclosures. Dim. G is to top of cover not over control devices as shown.  
 †For EBMSFA, EBMSFB, EBMSFH, & EBMSFL (motor starter only) enclosures Dim. F is to the starter reset handle not breaker handle as shown.  
 "H" - Use 1/2" diameter bolts for enclosures A, B, D, G, H. Use 5/8" diameter bolts for enclosures K, L, M.

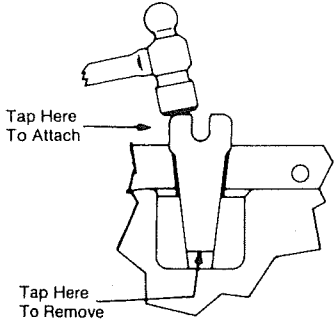


Figure 2. Mounting Feet

**REMOVING AND REINSTALLING COVER**

Covers and bodies are matched and inspected as a pair at the factory. If more than one enclosure is being installed, take care **not** to mix covers and bodies. Replace the cover on the body it was shipped with from the factory. If necessary, mark covers and bodies before disassembling to keep them properly matched.

- Place the enclosure on a flat horizontal surface. Loosen all cover bolts until each bolt is fully retracted into the cover by the stainless steel spring under the bolt head. Next, remove the two 5/16-18 hinge bolts that attach each hinge to the cover. Do **not** remove the two 5/16-18 bolts that attach hinge to body. Grasp the cover under opposite edges and lift from body.

**CAUTION**  
 Do not use cover bolts as a means to lift the enclosure. Excessive force on the fully retracted cover bolts may damage the bolt/spring assembly.

- To replace cover, make sure cover and body ground joint surfaces are clean and not scratched. Orient cover so hinge side of cover will align with hinge on body. Lift cover to approximate position, and line up bolt holes of cover with body. **Avoid** sliding cover ground joint surface over ground joint surface of body. Cover/body bolt holes must match up. Hand start the corner bolts. Fully tighten all cover bolts (torque to 40-45 ft. lbs.) and then reinstall the two 5/16-18 hinge bolts (torque to 8 ft. lbs.) in the cover. Follow procedures in Opening and Closing Cover sections once hinges are reinstalled.

**OPENING COVER**

Spectrum EBM enclosures are furnished with captive triple lead bolts, that utilize a spring to aid and indicate full retraction of the bolts into the cover when opening and closing. Make sure all cover bolts are fully retracted into the cover before attempting to open or close the cover,

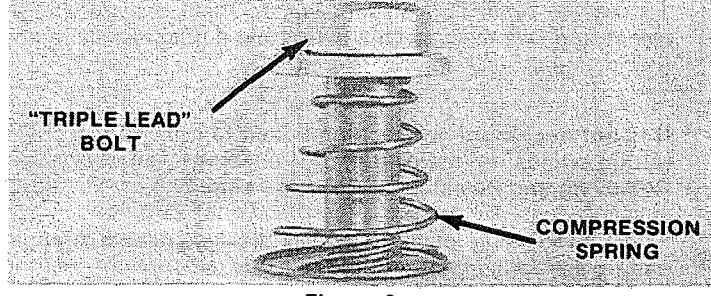


Figure 3.

When bolts are disengaged from the body flange threads, the bolts will withdraw and be held in this position by the spring and washer under the bolt heads. (See Figure 3)

After all bolts are fully disengaged, firmly grasp the bottom and right side of the cover and carefully swing cover aside to prevent damage to the ground joint surface. Avoid striking cover, or devices in cover, on neighboring enclosures or structures.

**CAUTION**  
 Hammers or prying tools must not be allowed to damage the flat ground joint surfaces. Do not handle cover roughly, or, if removed, place it on surfaces that might damage or scratch the flat ground joint surfaces.

**GROUNDING AND BONDING**

Grounding and bonding of the conduit and equipment is required by the National Electrical Code. A grounding conductor, when used, must be connected to the grounding lug(s), furnished.

**WARNING**  
 Spectrum EBM series enclosures must be securely attached into a permanently grounded system in accordance with Article 501-16, 502-16 of the National Electrical Code.

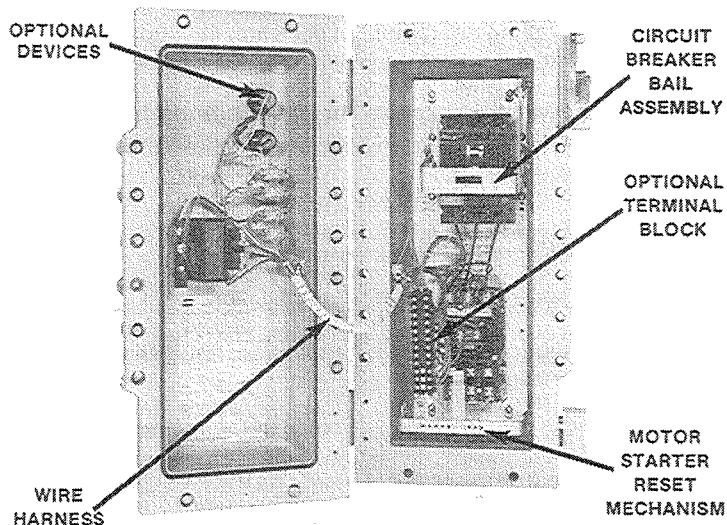
Determine the type of distribution system to be used that will comply with NEC requirements and ensure grounding continuity.

All conductive materials that enclose the electrical conductors or attached equipment or forming part of such equipment must be grounded. A permanent conducting connection must be made between all such equipment and the earth.

## INSTALLATION OF INTERNAL COMPONENTS

If enclosure only (without motor starter and/or circuit breaker) is supplied, the internal operating mechanism (bail assembly) for the circuit breaker must be removed prior to circuit breaker installation. Motor starter reset mechanism DOES NOT have to be removed for starter installation. (See Figure 4)

**NOTE:** The interior equipment mounting panel may be removed to aid in the installation of the circuit breaker and/or motor starter or other optional equipment. Before removing mounting panel, follow step #1 of Circuit Breaker Installation and/or Reset Mechanism Removal, for removing the linkage between operating mechanisms and the enclosure.



**COMBINATION LINE STARTER  
EBMCFB with NEMA SIZE 1 COMPONENTS  
& FACTORY WIRING SHOWN**

**Figure 4.**

### Circuit Breaker Installation

Consult instructions from circuit breaker manufacturer before beginning installation.

The mounting plate and operating mechanism will accommodate General Electric, Square D, and Westinghouse circuit breakers.

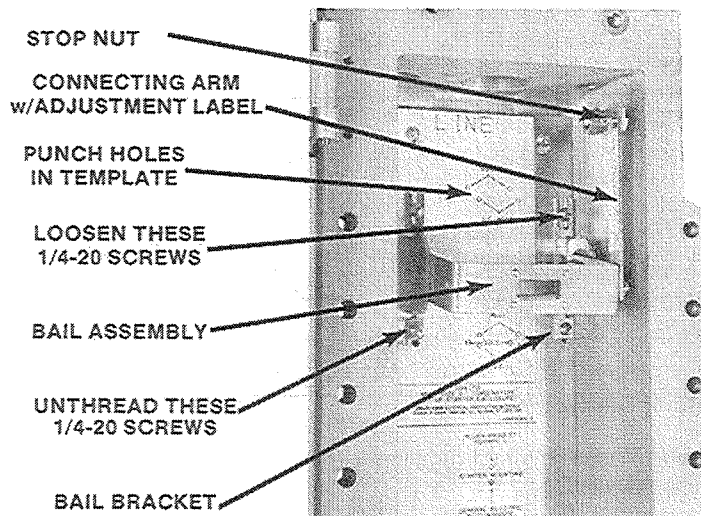
1. To remove bail assembly, unfasten stop nut (from shoulder screw) that joins the connecting arms together. Slide the longer connecting arm off the shoulder screw. [Do not remove hex nut that secures the shorter connecting arm to the threaded shaft.] See Figure 5.
2. Loosen but do not remove the top two 1/4-20 round head screws, which secure the bail brackets to the mounting plate.
3. Unthread the bottom two 1/4-20 round head screws from the equipment mounting panel.

#### NOTES:

1. In enclosures A, B, D, and G the bottom two screws are captive to the bail brackets. Do not attempt to remove them.
2. In enclosures H, K, L, and M the bottom two screws **are not** captive. The bail brackets in these enclosures are slotted on both the top and bottom.

The bail assembly is now moved until the bracket slots are clear of the top two screws.

4. Set aside the bail assembly and install circuit breaker LINE side up. To facilitate circuit breaker installation, select the correct manufacturers mounting holes (those that agree with breaker being installed) on equipment panel, and punch template holes, before positioning circuit breaker on equipment panel. Secure breaker to equipment panel with screws provided from circuit breaker manufacturer.
5. After circuit breaker is installed, reattach the connecting arms with shoulder screw and stop nut removed in Step 1. Check printed label on the longer connecting arm for hole alignment with the particular breaker manufacturer being used. See Figure 5.



**EBMBB with 150 AMP FRAME SIZE  
CIRCUIT BREAKER BAIL ASSEMBLY SHOWN  
Figure 5.**

6. Reposition bail assembly over toggle arm of circuit breaker. At the same time slide bail brackets under the top two 1/4-20 screws in the mounting plate.
7. Align bail assembly mounting holes/slots (bottom two 1/4-20 screws) over the holes in the equipment panel labeled for the manufacturer's circuit breaker you are installing.
8. Securely fasten all four 1/4-20 screws on the bail assembly.
9. Visually inspect for proper alignment and acute mechanism for correct operation. If necessary (to prevent over/under toggle travel and allow resetting of tripped breaker) adjust the circuit breaker stops as follows: (See Figure 6)
  - Locate adjustable stop buttons in the appropriate holes for the specific breaker manufacturer to be used as charted below. (See Figure 6)

CIRCUIT BREAKER FRAME SIZE	MANUFACTURERS HOLE CALLOUTS		
	WESTINGHOUSE	GENERAL ELECTRIC	SQUARE D
100 Amp	A, D	A, E	B, E
150 Amp	A, D	A, E	—
225 Amp	—	A, E	—
250 Amp	C, E	—	B, E
400 Amp	B, F	A, D	A, E
600 Amp	B, E	B, E	B, E
800 Amp	B, E	B, E	B, E
1000 Amp			B, E

- Move breaker handle to the extreme "OFF" (Reset) position and adjust stop button so that it just touches the handle.

- Manually trip the breaker and check to see that toggle travel will allow resetting.
- Move breaker handle to the "ON" position and adjust stop button so that it just touches the handle.
- Move breaker handle "ON" then "OFF" checking operation.

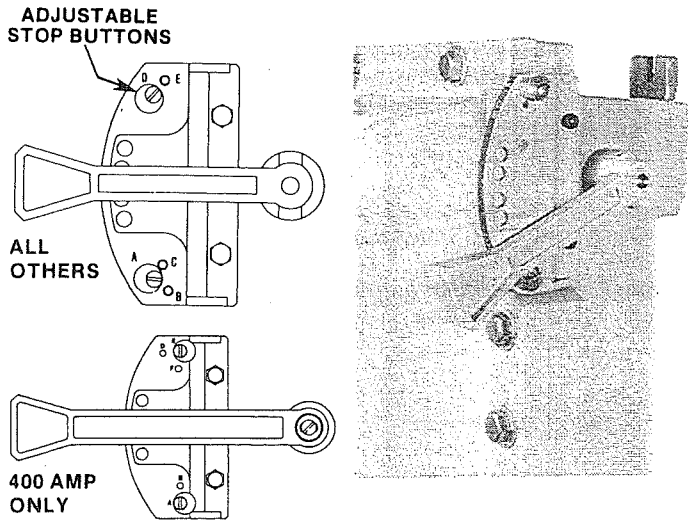


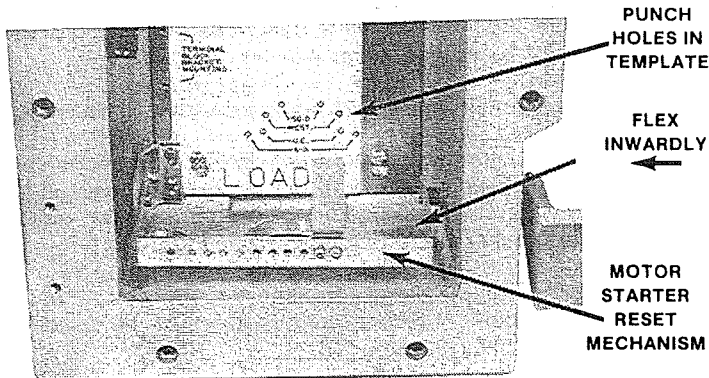
Figure 6.

### Motor Starter Installation

Consult instructions from starter manufacturer before beginning installation.

Mounting plate and operating mechanism will accommodate Allen-Bradley, General Electric, Square D, and Westinghouse motor starters.

1. To facilitate motor starter installation, select the correct manufacturer's mounting holes (those that agree with starter being installed) on equipment panel, and punch template holes, before positioning motor starter on equipment panel. Secure starter to equipment panel with screws provided.



NEMA SIZE 0, 1, 2 STARTER RESET MECHANISM SHOWN

Figure 7.

2. The reset fingers and hardware are shipped unattached. Follow illustration, located on printed label on inside of cover for correct placement of fingers. (Location of reset fingers varies depending on starter manufacturer.)

Select heater elements from tables supplied with motor starter.

### RESET MECHANISM REMOVAL

Remove reset mechanism only if equipment panel must be removed.

- To remove reset mechanism in NEMA size 0, 1 and 2 enclosures, flex mechanism (on the handle side of enclosure) inwardly until it snaps off the threaded shaft. See Figure 7.
- After reinstalling equipment panel, align mechanism with threaded shaft and snap mechanism back in position.
- To remove reset mechanism in NEMA size 3, 4, and 5 enclosures, remove the #12-24 shoulder screw that connects the reset shaft linkage to the connecting arm.
- After reinstalling equipment panel, align the connecting arm and reset shaft linkage and reinstall the #12-24 shoulder screw.

It is **not necessary** to remove the #10-32 round head screws which secure the reset mechanism to the equipment panel.

Check for correct operation.

### WIRING CONNECTIONS

1. Establish a wiring pattern for your system.
2. **Before** pulling any wires into enclosure, reinstall equipment panel (if previously removed).
3. Connect grounding conductor. Pull all phase conductors into enclosure and make connections as shown in breaker and/or starter manufacturer's instructions. All electrical connections should be tightened to torque values specified in manufacturers literature and comply with the National Electrical Code and all local codes.
4. When connecting control wiring to devices mounted in the cover, use wire clamps and harness supplied. Route wires in a manner that they will not be cut or pinched when opening or closing the cover. Check wire routing by opening cover as wide as possible and then closely observing whether the wires rub on the flange surface. (See Figure 4)
5. Test wiring for correctness with continuity checks and also for unwanted grounds with an insulation resistance check.

### CLOSING COVER

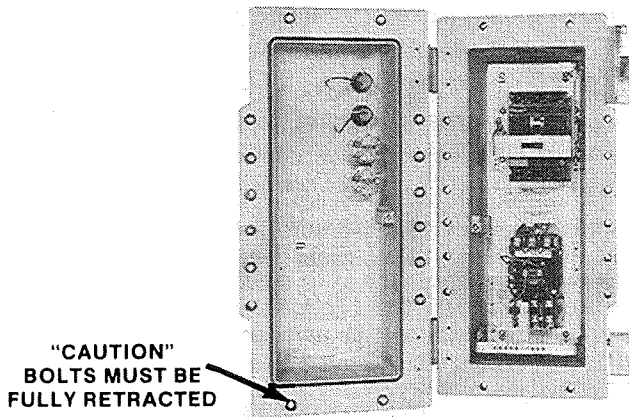
#### CAUTION

Clean both ground joint surfaces of body and cover before closing. Dirt or foreign material must not accumulate on flat ground joint surfaces. Surfaces must seat fully against each other to provide a proper explosionproof joint.

#### CAUTION

Before closing cover, be certain all bolts are retracted fully into the cover flange and do not project beyond the ground surface. This is important to prevent damage to the ground joint surface by the bolts as the cover is being closed. (See Figure 8) When closing cover be sure wiring is not pinched between body and cover flanges.

When cover is closed, push cover bolts into body and start thread engagement. Start all threads by hand before wrenching any bolts tight. Torque to 40-45 ft. lbs. Use **ONLY** bolts supplied with the enclosure. These are special bolts (marked EBM-1) and substitutes for them may impair the explosionproof safety of the enclosure.



**EBMCFB WITH SIZE 1 COMPONENTS SHOWN**  
**Figure 8.**

**SEALS**

Pour sealing compound into sealing fittings (when required) in accordance with the instructions supplied with each of the approved fittings and sealing compound.

**INSTALLATION**  
**EMP CONTROL DEVICE(S)**

Due in part to the semi-clamshell enclosure design and ample wiring room the EMP control devices if not installed at the factory can be installed either **before** or **after** components are secured to the mounting plate.

Listed below are the Crouse-Hinds approved EMP and EMPS control devices which are available for use with Spectrum EBM motor controls. Consult C-H Catalog 4700 for specifics.

- Pilot Light:** EMP009†
- Pushbuttons:** EMPS019  
 EMPS029  
 EMPS039  
 EMP098 (maintained contact)
- Selector Switches:** EMPS049  
 EMPS059  
 EMPS069  
 EMPS079  
 EMPS089

† Colors available: red, green, amber, opal, clear, blue

**NOTE:** When installing EMP (pilot light only) and EMPS devices (short assemblies only) in EBM covers, refer to the installation instructions contained in this Instruction Sheet, NOT the instructions shipped with the EMP/EMPS devices (IF872). Use IF872 for reference only.

**WARNING**

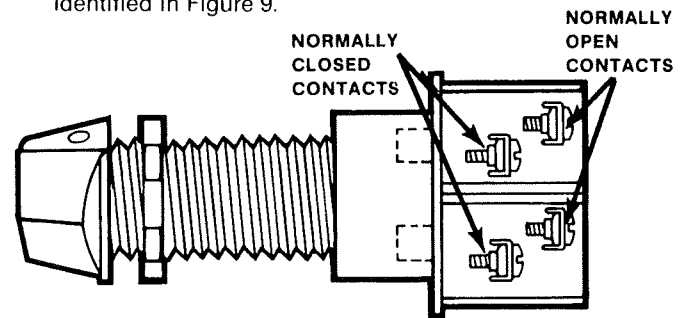
Electrical power must be OFF before and during installation and maintenance.

1. Remove threaded guards, handles, jewels, legend plates, outer locknuts, etc. to allow barrels to be threaded into EBM covers. (Note: Discard legend plate packed with EMP device.)
2. Thread barrel assembly into threaded hole of EBM cover from rear so that it protrudes through the front.
3. Adjust the distance which the barrel protrudes through the front of the cover. See Figures 10, 11, and 12.

**CAUTION**

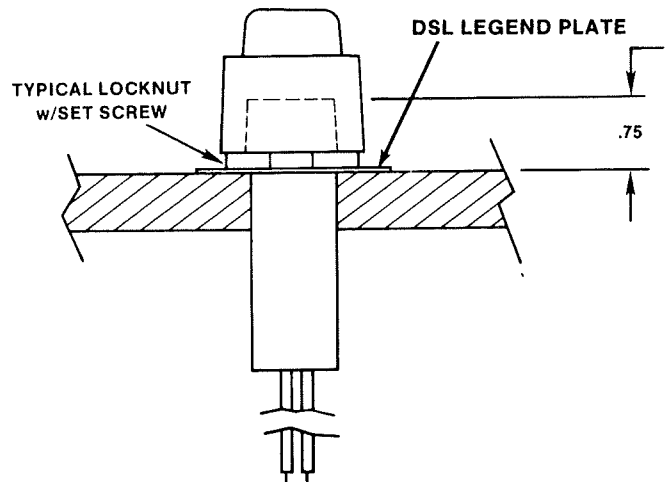
EMP/EMPS devices must not protrude more than 2.75" maximum inside cover.

4. Install DSL legend plate over the barrel to the front of the EBM cover.
5. Thread locknut with set screw onto the EMP device and against DSL legend plate (finger tight only). Do not tighten set screw at this time.
6. Align switch contacts for proper clearance by turning threaded barrel to the proper position.
7. Tighten outer locknut securely against DSL legend plate making sure EMP/S barrel does not rotate.
8. Check to ensure that switches are still in proper alignment, then tighten set screw in locknut securely against DSL legend plate.
9. Replace threaded guards, handles, or jewels which were removed in step 1.
10. Make electrical connections to switch terminals following the wiring scheme established for your system.
  - EMP and EMPS pushbutton and selector switch devices are provided with binding screw terminals that will accommodate conductors in sizes from #16 AWG to #12 AWG. Normally open contacts and normally closed contacts are identified in Figure 9.

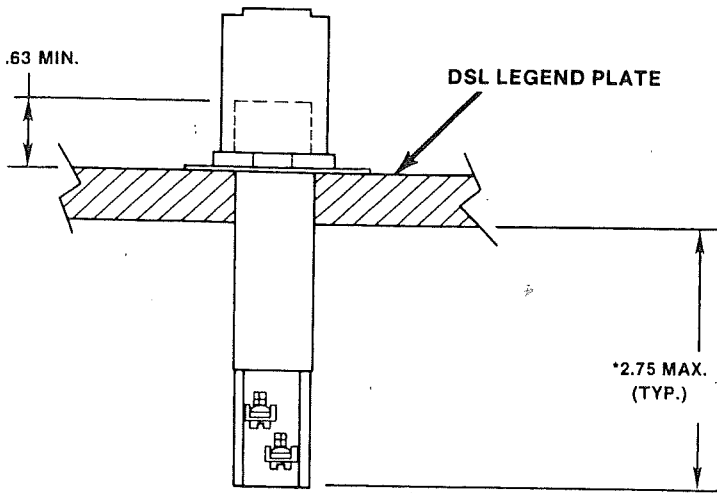


**CONTACT IDENTIFICATION**  
**Figure 9.**

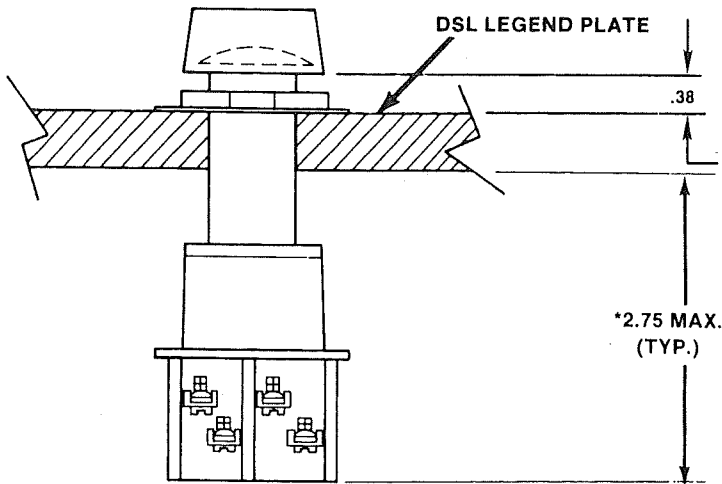
11. Test circuits for continuity and unwanted grounds.



**EMP009 PILOT LIGHT**  
**Figure 10.**



**PUSHBUTTON**  
Figure 11.



**SELECTOR SWITCH**  
Figure 12.

\*EMP/EMPS devices are not to protrude more than 2.75" inside cover.

## MAINTENANCE

### WARNING

Always disconnect primary power source before opening enclosure for inspection or service.

1. Frequent inspection should be made. A schedule for maintenance checks should be determined by the environment and frequency of use. It is recommended that it should be at least once a year.

2. Perform visual, electrical, and mechanical checks on all components on a regular basis.

- Visually check for undue heating evidenced by discoloration of wires or other components, damaged or worn parts, or leakage evidenced by water or corrosion in the interior.

- Electrically check to make sure that all connections are clean and tight and that contacts in the components make or break as required.

- Mechanically check that all parts are properly assembled, and operating mechanisms move freely.

3. A Waterguard desiccant packet has been installed in this enclosure at the factory. The purpose of the desiccant is to absorb and remove water on contact or from the atmosphere, and protect the enclosed equipment from damage. The desiccant packet will expand 3 to 4 times its original size. Desiccant should be checked and replaced at regular equipment service intervals or every 3 to 6 months.

For replacement desiccant packets, order Cat. # WG22 (protects 2 to 3 cubic feet of air space); or Cat. # WG33 (protects 4 to 5 cubic feet of air space).

Waterguard is non-toxic, emits no fumes, and generates no heat during use. No gloves, masks or special clothing is required to handle this product.

4. Make sure all cover bolts are fully retracted into cover before closing cover on body. Close cover and start cover bolt threads by hand. Torque all cover bolts securely to 40 - 45 ft. lbs.

### CAUTION

Clean both ground joint surfaces of body and cover before closing. Dirt or foreign material must not accumulate on flat ground joint surfaces. Surfaces must seat fully against each other to provide a proper explosionproof seal.

Replacement parts are available through your area Crouse-Hinds distributor. Replace main circuit breaker only with Westinghouse JDB type breakers of the proper rating. Similarly, 480 Volt and 600 Volt branch breakers should be replaced only with Westinghouse EHD and FDB breakers respectively.

5. We recommend an Electrical Preventive Maintenance program as described in the National Fire Protection Association Bulletin NFPA No. 70B.

All statements, technical information and recommendations contained herein are based on information and tests we believe to be reliable. The accuracy or completeness thereof are not guaranteed. In accordance with Crouse-Hinds "Terms and Conditions of Sale", and since conditions of use are outside our control, the purchaser should determine the suitability of the product for his intended use and assumes all risk and liability whatsoever in connection therewith.