Instructions for Installation, Operation and Maintenance of Magnum SB Insulated Case Low Voltage Power Circuit Breakers

⚠️ WARNING
DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING. ALWAYS FOLLOW SAFETY PROCEDURES. EATON IS NOT LIABLE FOR THE MISAPPLICATION OR MISINSTALLATION OF ITS PRODUCTS.

⚠️ WARNING
OBSERVE ALL RECOMMENDATIONS, NOTES, CAUTIONS, AND WARNINGS RELATING TO THE SAFETY OF PERSONNEL AND EQUIPMENT. OBSERVE AND COMPLY WITH ALL GENERAL AND LOCAL HEALTH AND SAFETY LAWS, CODES, AND PROCEDURES.

⚠️ CAUTION
TESTING A CIRCUIT BREAKER WHILE IN-SERVICE AND CARRYING LOAD CURRENT IS NOT RECOMMENDED FOR POWER AND MEDIUM VOLTAGE CIRCUIT BREAKERS. TESTING THAT RESULTS IN THE TRIPPING OF THE CIRCUIT BREAKER SHOULD BE DONE ONLY WITH THE CIRCUIT BREAKER IN A DEENERGIZED SYSTEM OR IN THE TEST OR DISCONNECTED CELL POSITIONS OR WHILE IT IS ON A TEST BENCH. PERFORMING TESTS WITHOUT THE EATON-APPROVED TEST KIT MAY DAMAGE THE TRIP UNIT.
### Instructional Leaflet IB2C12063H03

**Effective March 2012**

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Purpose
This instruction manual is expressly intended to cover the installation, operation and maintenance of Magnum SB Power Circuit Breakers. These circuit breakers may be supplied as part of complete switchboard assemblies or as separate components. This manual applies only to the circuit breaker and (if drawout) its mating cassette. Magnum SB circuit breakers may also be supplied as fixed mounted devices. In the case of fixed versions of Magnum SB circuit breakers, certain sections of this manual, referring to such items as position interlocks and the drawout mechanism, will not apply.

Trip units associated with Magnum SB Power Circuit Breakers will be addressed in a general manner in this manual. Specific trip unit details and time-current characteristic curves are covered in separate documents specific to the trip units.

Magnum SB and circuit breaker accessory items are discussed briefly in this manual. Field installation instructions for such items, however, are covered in individual instruction leaflets specific to the accessory. This information is also available from the Eaton website at www.EatonElectrical.com.

For application information, consult Eaton or see applicable Product Guides, Technical Documents, Application Publications and/or Industry Standards.

Safety
All safety codes, safety standards and/or regulations must be strictly observed in the installation, operation and maintenance of this equipment.

⚠️ WARNING
THE WARNINGS AND CAUTIONS INCLUDED AS PART OF THE PROCEDURAL STEPS IN THIS MANUAL ARE FOR PERSONNEL SAFETY AND PROTECTION OF EQUIPMENT FROM DAMAGE. AN EXAMPLE OF A TYPICAL WARNING LABEL HEADING IS SHOWN ABOVE TO FAMILIARIZE PERSONNEL WITH THE STYLE OF PRESENTATION. THIS WILL HELP TO INSURE THAT PERSONNEL ARE ALERT TO WARNINGS. IN ADDITION, CAUTIONS ARE ALL UPPER CASE AND BOLDFACE.

⚠️ CAUTION
PLEASE READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE ATTEMPTING TO UNPACK, INSTALL, OPERATE OR MAINTAIN THIS EQUIPMENT. STUDY THE BREAKER AND ITS MECHANISM CAREFULLY BEFORE ATTEMPTING TO OPERATE IT ON AN ENERGIZED CIRCUIT.

⚠️ WARNING
MAGNUM SB CIRCUIT BREAKERS SHOULD NOT UNDER ANY CIRCUMSTANCES BE APPLIED OUTSIDE THEIR NAMEPLATE RATINGS. OPERATION OUTSIDE OF THESE RATINGS COULD RESULT IN DEATH, BODILY INJURY OR PROPERTY DAMAGE.

Section 1: Introduction
General Information
The Magnum SB Power Circuit Breaker can be fixed or drawout air circuit breaker utilizing an electronic tripping system. It is designed for use in both switchboard and metal-enclosed switchgear assemblies having maximum voltages of 635 volts ac. Magnum SB circuit breakers are available in three physical frame sizes with continuous current ratings from 800 through 5000A, and interrupting capacities from 50 kA to 150 kA. The three physical frame sizes have common height and depth dimensions, differing only in width (Figure 1). The circuit breaker nameplate provides complete rating information. All Magnum SB circuit breakers are 100 percent rated, UL listed, and are built and tested in an ISO 9002 certified facility to applicable NEMA, ANSI, IEEE and UL standards (Table 1, Figures 2 and 3).

Magnum SB circuit breakers use a rigid frame housing of engineered thermoset composite resins which has high strength structural properties, excellent dielectric characteristics and arc tracking resistance. The drawout Magnum SB circuit breaker is a through-the-door design having three breaker positions with the compartment door closed (CONNECT, TEST, DISCONNECT) and one position out of its compartment on extension rails (REMOVE). The operating mechanism is a two-step stored energy mechanism, either manually or electrically operated.

When withdrawn on captive compartment cassette extension rails, Magnum SB circuit breakers can be inspected, accessory items added, and minor maintenance performed. The inside of the compartment can also be inspected with the circuit breaker on its extension rails.
Safety Features

Magnum SB circuit breakers and associated drawout equipment are manufactured with built-in interlocks and safety related features. They are provided to reduce hazards to operating personnel and provide proper operating sequences.
Table 1. Magnum SB Ratings

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In is defined by the current sensor and rating plug combination
© Short Time Rating at 635v is 65kA

WARNING

MAGNUM SB CIRCUIT BREAKERS ARE ROBUST AND ARE PROVIDED WITH SAFETY FEATURES. NEVERTHELESS, THE VOLTAGES, CURRENTS AND POWER LEVELS AVAILABLE IN AND AROUND THIS EQUIPMENT WHEN IT IS IN OPERATION ARE EXTREMELY DANGEROUS AND COULD BE FATAL. UNDER NO CIRCUMSTANCES SHOULD INTERLOCKS AND OTHER SAFETY FEATURES BE MADE INOPERATIVE, AS THIS MAY RESULT IN DEATH, BODILY INJURY OR PROPERTY DAMAGE.

Safety Practices

To protect personnel associated with the installation, operation and maintenance of this equipment, the following practices must be followed:
1. Only qualified electrical personnel familiar with the equipment, its operation and the associated hazards should be permitted to work on the equipment. Additionally, only qualified personnel should be permitted to install or operate the equipment.

2. Always be certain that the primary and secondary circuits are de-energized or the circuit breaker is removed to a safe work location before attempting any maintenance.

3. For maximum safety, only insert a completely assembled breaker into an energized cell.

4. Always ensure that drawout circuit breakers are in one of their designed cell positions, such as Connect, Test, Disconnect or Remove. A circuit breaker permitted to remain in an intermediate position could result in control circuits being improperly connected resulting in electrical failures.

Qualified Personnel

For the purpose of operating and maintaining low voltage power circuit breakers, a person should not be considered qualified if the individual is not thoroughly trained in the operation of the circuit breaker and how it interfaces with the assembly in which it is used. In addition, the individual should have knowledge of the connected loads.

For the purpose of installing and inspecting circuit breakers and their associated assembly, a qualified person should also be trained with respect to the hazards inherent to working with electricity and the proper way to perform such work. The individual should be able to deenergize, clear and tag circuits in accordance with established safety practices.

Other Publications And Documentation

In addition to this instruction manual, other printed information and documentation is available and supplied as appropriate. This additional information can include, but not necessarily be limited to, an instruction manual for a specific electronic trip unit, instruction leaflets for accessory items, renewal parts information, necessary dimensional drawings and a Product (application) Guide. Specific reference documents associated with Magnum SB circuit breakers are listed in a separate document entitled Engineering Data TD01301004E.
Unpacking Circuit Breaker

Before beginning to unpack new Magnum SB circuit breakers, read and understand these directions. Following the directions will ensure that no damage is caused.

Shipping containers should be inspected for obvious signs of rough handling and/or external damage incurred during the transportation phase. Record any observed damage for reporting to the transportation carrier and Eaton, once the inspection is completed. All reports and claims should be as specific as possible and include the order number and other applicable nameplate information.

Every effort is made to ensure that Magnum SB circuit breakers arrive at their destination undamaged and ready for installation. Care should be exercised, however, to protect the breakers from impact at all times. Do not remove protective packaging until the breakers are ready for inspection, testing and/or installation.

When ready to inspect and install a Magnum SB circuit breaker, carefully remove the banding straps and lift off the cardboard box. Remove any additional packing material and internally packed documentation. The circuit breaker and/or cassette are mounted to a wooden shipping pallet.

On drawout circuit breakers shipped without a cassette, two shipping clamps hook into the breaker side plates and are held to the pallet with 4 lag screws (Figure 4). Remove the lag screws and clamps. Save the screws and clamps for future shipment of the breaker. On empty cassettes, remove the 4 or 5 lag screws and/or machine screws which pass through the floorpan of the cassette holding it to the wooden pallet. On drawout breakers shipped in a cassette, first remove the breaker from the cassette using the levering mechanism and drawout rails. After the breaker is removed the machine screws passing through the floorpan can be removed.

Storing Circuit Breaker

If it is necessary to store a circuit breaker before installation, do so in its original shipping container. Keep the circuit breaker in a clean dry place. Ensure there is ample air circulation and heat, if necessary, to prevent condensation. It is very important that the circuit breaker not be exposed to dirt or moisture.

⚠️ CAUTION

A CIRCUIT BREAKER THAT HAS BEEN STORED FOR ANY LENGTH OF TIME SHOULD BE OPERATED A MINIMUM OF FIVE TIMES BEFORE IT IS PLACED IN SERVICE.
Lifting Circuit Breaker

**CAUTION**

**DO NOT ATTEMPT TO LIFT CIRCUIT BREAKERS WITH ORDINARY CRANE HOOKS, ROPES, CHAINS OR OTHER SUCH DEVICES. FAILURE TO FOLLOW THIS CAUTION COULD RESULT IN DAMAGE TO VITAL PARTS SUCH AS ARC CHUTES, BARRIERS AND WIRING OR THE ENTIRE CIRCUIT BREAKER.**

To closely examine, install or just become more familiar with the circuit breaker, carefully lift and place the circuit breaker on a solid work surface capable of handling the circuit breaker’s weight (Table 2) or on the captive drawout extension rails of the breaker compartment (Figure 5). This is accomplished by using the appropriate lifting yoke and lifter. The lifting yoke consists of two steel hooks specially shaped to hook under the integral molded lifting handles on both sides of the circuit breaker (Figure 5). Every effort should be made during lifting to minimize circuit breaker swing and tilt.

If the circuit breaker is to be lifted onto compartment extension rails, follow the instructions on page 11 entitled “Installing Drawout Circuit Breaker.”

### Table 2. Basic Circuit Breaker Weights

<table>
<thead>
<tr>
<th>Breaker Model</th>
<th>Fixed 3P</th>
<th>4P</th>
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<th>4P</th>
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</table>
Circuit Breaker Inspection

All circuit breakers, once removed from their shipping containers, should be visually inspected for any obvious damage.

The current rating of the rating plug installed in the trip unit should match the current rating of the sensors mounted on the lower primary stabs of the circuit breaker. Check to make sure that this match exists. The rating plug rating can be viewed from the front of the circuit breaker (Figure 20). The sensor rating can be viewed through the viewing windows at the rear of the circuit breaker (Figure 6). Sensors and rating plugs can be easily changed as described in Section 6.

Installing Drawout Circuit Breaker

In structures equipped for drawout circuit breakers, a bolted-in cassette with movable extension rails supports the circuit breaker (Figures 5 and 7). The extension rails must first be pulled all the way out. Once the rails are fully extended, the circuit breaker can be carefully placed on the extension rails.

**CAUTION**

IT IS IMPORTANT TO TAKE GREAT CARE WHEN PLACING A DRAWOUT CIRCUIT BREAKER ON ITS EXTENSION RAILS. IF THE CIRCUIT BREAKER IS NOT PROPERLY SEATED ON THE EXTENSION RAILS, IT COULD FALL FROM THE RAILS CAUSING EQUIPMENT DAMAGE AND/OR BODILY INJURY.

Carefully lower the circuit breaker down onto the extension rails. Be certain that the circuit breaker’s four molded drawout rail supports are fully seated in the extension rail cutouts on both sides (Figure 7). Do not remove the lifting yoke from the circuit breaker until it is properly seated on the rails.

Once the circuit breaker is on the extension rails and the lifting yoke is removed, proceed with the rest of the circuit breaker installation.

Rejection Interlocks

Within any one physical frame size Magnum type drawout circuit breakers come in a variety of continuous current and interruption ratings, some of which are incompatible with others. Double wide circuit breakers also come with several phase sequence options which are also incompatible. To prevent the insertion of circuit breakers with (1) inadequate interrupting capability, (2) with physically incompatible primary disconnects or (3) with an incompatible phase sequence, rejection interlock key plates are provided on both the circuit breaker and cassette. The key plate on the circuit breaker is pre-assembled at the factory; but the cassette-side rejection plate and key pattern must be assembled and installed by the switchboard builder.

![Molded Rail Supports](image)

![Extension Rail Cutout](image)

Figure 6. Rear View Showing Current Sensor Rating Through Viewing Window

Figure 7. One Side of Drawout Circuit Breaker Properly Seated on Extension Rail
**CAUTION**

DO NOT DISABLE REJECTION INTERLOCKS. DOING SO AND USING A LOWER CAPACITY CIRCUIT BREAKER IN AN INCOMPATIBLE CASSETTE COULD RESULT IN AN ELECTRICAL FAULT WHICH COULD RESULT IN DEATH, BODILY INJURY AND/OR EQUIPMENT DAMAGE.

The rejection interlocks are steel pins in the floor of the circuit breaker cassette. As the circuit breaker is pushed into the structure, the mating pins on the bottom of the circuit breaker move past a set of corresponding pins in the cassette, if the circuit breaker and cassette are compatible. If the circuit breaker and the cassette are mismatched, the rejection pins will block the insertion of the circuit breaker into the cassette before the levering-in mechanism is engaged.

Before attempting to push the circuit breaker into the DISCONNECT position, compare the positioning of the rejection interlock pins in the cassette in keeping with those outlined in Table 1 of IL2C113863 (for MDN/SBN breakers) and/or Table 1 of IL2C15760 (for MDS/SBS breakers), and the information supplied on the circuit breaker’s nameplate. Proceed if the circuit breaker and cassette are compatible.

**Table 3. Rejection Interlock Pin Locations for Standard and Double-wide Frames**

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From Table 3, make a pin location comparison. Stop nuts should be torqued to 8-10 Ft.-Lb.

**Table 4. Rejection Interlock Bracket Bolt Locations for Narrow Frames**

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<thead>
<tr>
<th>Cell For</th>
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<th>B</th>
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From Table 4, make certain the two bolts are in the correct locations.

**Figure 8. Cassette Rejection Interlock Pin Positioning/Installation for Standard and Double-wide Frames**

**Figure 9. Cassette Rejection Interlock Bracket Location/Installation for Narrow Frames**
Figure 10. Remove Position

Figure 11. Disconnect Position

Figure 12. Test Position
With the breaker solidly positioned on the cassette’s extension rails and the levering-in mechanism in the DISCONNECT position, carefully and firmly push the circuit breaker into the compartment as far as it will go. The outer (recessed) portion of the circuit breaker face plate should align with the GREEN target line (labelled DISC) on the inside top left wall of the cassette (Figure 14).

**Levering Circuit Breaker**

**CAUTION**

DO NOT DISABLE REJECTION INTERLOCKS. DOING SO AND USING A LOWER CAPACITY CIRCUIT BREAKER IN AN INCOMPATIBLE CASSETTE COULD RESULT IN AN ELECTRICAL FAULT WHICH COULD RESULT IN DEATH, BODILY INJURY AND/OR EQUIPMENT DAMAGE.

The circuit breaker is now ready to be levered. With the circuit breaker OPEN, the levering device access door can be raised. The levering device is hand operated using a standard 3/8” square drive and ratchet, which is not provided (Figure 15). As long as the access door is raised, the circuit breaker is held trip free. Begin by rotating the levering-in screw to the full counterclockwise (DISCONNECT) position.

Close the compartment door and begin levering the breaker into its different positions using a clockwise ratcheting motion. When the circuit breaker is levered fully to the DISCONNECT or CONNECT position the levering shaft hits a hard stop; do not exceed 25 ft.lb. of torque or the levering mechanism may be damaged. The circuit breaker can be levered with the compartment door open or closed, but it is advisable to close the door prior to levering. The position of the circuit breaker within its compartment is indicated by color coded position indicators (Red = Connect, Yellow = Test, Green = Disconnect) (Figures 15 and 20). To remove the circuit breaker from its compartment, follow the procedure just described using a counterclockwise ratcheting motion.
Fixed Circuit Breaker

Magnum SB fixed type circuit breakers differ from the drawout version in that it has no levering device, primary disconnects and secondary contact connector (Figure 16). In addition, a fixed circuit breaker does not have a standard feature to hold the breaker in a trip free position. To ensure the proper sequence of operation between two or more circuit breakers, an optional key interlock is mounted through the front panel (Figure 70).

Circuit breaker terminals have holes for making bolted horizontal primary bus connections. Adapters are available for making vertical primary bus connections. Secondary connections can be made through standard terminal blocks or a special connector compatible with the drawout circuit breaker’s type secondary connector. Both secondary connection devices are mounted at the top front of the circuit breaker.

⚠️ CAUTION

THE CIRCUIT BREAKER MECHANISM IS INTERLOCKED SUCH THAT CHARGED CLOSING SPRINGS ARE AUTOMATICALLY DISCHARGED IF THE CIRCUIT BREAKER IS LEVERED INTO OR OUT OF THE CELL. DISCHARGE TAKES PLACE BETWEEN THE DISCONNECT AND TEST POSITION.

Circuit Breaker Operation

Circuit breakers should be operated manually and/or electrically before they are put into service. This can be done during the installation process or at some later date prior to start-up. To check circuit breaker operation, follow the operational procedures outlined in Section 3 for both manually operated and electrically operated circuit breakers.

⚠️ CAUTION

REFER TO THE CIRCUIT BREAKER WEIGHTS IN TABLE 2.1 TO ENSURE THAT THE PANEL ON WHICH A FIXED CIRCUIT BREAKER IS TO BE MOUNTED IS CAPABLE OF SUPPORTING THE WEIGHT.
Section 3: Circuit Breaker Description and Operation

Introduction

Magnum SB circuit breakers are available in both drawout and fixed mounting configurations (Figures 17 and 18). A majority of features are common to all configurations, and will be discussed in this section. The mounting features unique to the drawout and fixed configurations will be covered individually in Sections 4 and 5 respectively.

Controls and indicators for both drawout and fixed circuit breakers are functionally grouped on the front of the circuit breaker. The front escutcheon (faceplate) is common for all Magnum frame sizes up through 5000 amperes.

Double Wide frame circuit breakers utilize six (or eight) sets of rear primary connections; these circuit breakers are available from the factory with several different phase sequences, distinguishable by the sixth character in the model number. The phase sequence is also labeled on the rear of the circuit breaker (Figure 19). For drawout breakers, phase sequence labels are also supplied with the cassette and must be applied by the switchgear builder. Circuit breakers with different phase sequences are not interchangeable. Drawout breakers with differing phase sequence are prevented from insertion into the cassette by properly assembled rejection key plates (Refer to “Rejection Interlocks” on page 11).

1. Baffled Arc Chute Cover
2. Secondary Disconnects (Contacts)
3. Faceplate (Front Cover)
4. Drawout Rail Supports
5. Integral Lifting Handle

6. Primary Disconnect Finger Cluster
7. Arc Chamber
8. Primary Vertical Adapter
9. Sensor Rating Viewing Window
10. Levering Device Bearing Plate
11. Padlockable Levering Device Access Door
12. Circuit Breaker Nameplate

Figure 17. Typical Drawout Circuit Breaker Features (Front and Rear Views)
Instructions for Installation, Operation and Maintenance of Magnum SB Insulated Case Low Voltage Power Circuit Breakers

6. Fixed Primary Terminal (with optional Vertical Adapter)
7. Arc Chamber
8. Sensor Rating Viewing Window
9. Mounting Foot
10. Circuit Breaker Nameplate

Figure 18. Typical SBS/SBSE Fixed Circuit Breaker Features (Front and Rear Views) (SBSE shown without required arc hood)
1. Baffled Arc Chute Cover
2. Secondary Contact Connector
3. Faceplate (Front Cover)
4. Integral Lifting Handle
5. Fixed Vertical Primary Terminals with Optional Vertical Adaptor
6. Arc Chamber
7. Mounting Foot
8. Circuit Breaker Nameplate
9. Phase Identification Labels

Figure 19. Typical Double-wide SBS/SBSE Standard Frame Fixed Circuit Breaker Features (Front and Rear Views) (SBSE shown without required arc hood)
1. Trip Flag (Pop Out Indicator)
2. Three Accessory Windows
3. Trip Unit
4. Rating Plug
5. Contact Status (Open-Close)
6. Spring Status (Charged-Discharged)
7. Manual “OFF” Button (Push)
8. Manual “ON” Button (Push)
9. Manual Charge Handle
10. Optional Operation Counter
11. Padlockable Levering Device Access Door for Drawout Breaker
12. Color-Coded Breaker Position Indicator
13. Nameplate
14. Trip Unit Test Port
15. Trip Unit Cover with Two Mounting Screws (Mounting Screws will Accept Customer Supplied Lead Security Meter Seals)

Figure 20. Typical Magnum SB Drawout Circuit Breaker Front Cover
Basic Circuit Breaker Assembly

Magnum SB circuit breakers use a rigid frame housing construction of engineered thermoset composite resins. This construction provides high strength structural properties, excellent dielectric characteristics and resistance to arc tracking.

The 3-piece construction approach provides support while isolating and insulating power conductors (Figure 21):

1. A 2-piece engineered thermoset composite resin case encloses current paths and arc chambers. The chambers act to channel arc gases up and out of the circuit breaker during interruption.

2. The operating mechanism sits on the front of the case and is electrically isolated and insulated from current contact structures. It is covered by an insulating front cover.

Pole Units

A current carrying pole unit is individually enclosed and rigidly supported by the case. The individual chambers provide for pole unit isolation and insulation from one another. Each pole unit has one primary contact assembly, which consists of a moving portion and a fixed portion. The exact design configuration depends upon the breaker’s frame size. Circuit breakers with frame sizes of 4000 amperes and higher use two pole units and arc chute assemblies connected mechanically and electrically in parallel to form one phase.

Primary Moving Contacts

Depending upon the frame size, each primary moving contact assembly is comprised of multiple individual copper contact fingers connected to the load conductor through flexible braided connectors (Figure 22). Two flexible connectors are used to connect each finger to the load conductor. The number of fingers used depends upon the circuit breaker’s continuous and short-circuit current ratings (Figures 23 and 25). On some ratings fingers are removed and replaced with spacers.

The single contact finger performs both the main and arcing contact functions on different parts of the same finger (Figure 22). A highly conductive alloy pad is part of the contact finger and functions as the moving main contact, and is called the “Heel.” The tip of the same contact finger functions as the moving arcing contact, and is called the “Toe.”

In addition to the contact finger information given above, SBSE utilizes an inner and outer carriage design to facilitate a fast opening blow open contact structure (Figure 24). The contact fingers mounted in the inner contact carrier can move independently from both the outer carrier and the opening mechanism in the breaker. This independence is the core design feature of its fast opening blow open contact structure.
Primary Stationary Contacts

The primary stationary contact is a combination of two items (Figure 26). One is a conductive pad mounted on the line conductor which functions as the stationary main contact. The other is an arc runner, also connected to the line conductor. The integral arc runner serves a dual purpose:

- Fixed arcing contact
- Part of the arc chute

Figure 23. Narrow Frame (8-finger) Moving Conductor Assembly

Figure 24. SBSE Moving Contact Assembly

Figure 25. Standard Frame (12-finger) Moving Conductor Assembly

Figure 26. Partial Cross-Sectional View (Shown in Closed Position)
Operating Mechanism

The Magnum SB operating mechanism is based on the proven cam and spring design of the DSII power circuit breaker. It is easily accessed by removing four cover screws and the front cover (Figure 27). The mechanism is a two-step stored energy mechanism. Potential energy is stored to close the circuit breaker. Sufficient energy to open the circuit breaker remains available after a closing operation.

Manual Operation

On manually operated circuit breakers, the closing spring can only be charged manually. To manually charge the spring, insert one finger in the recess behind the charging handle and pull out. This permits a gloved hand to grasp the handle and begin charging (Figure 28). It takes from 5 to 7 downward strokes on the charging handle to complete the manual charging process. It is possible to manually recharge the spring immediately after closing the circuit breaker and before it has been tripped open.

Standard manually operated circuit breakers are closed and opened by hand using the Manual “ON” and Manual “OFF” buttons respectively located on the front of the circuit breaker (Figure 20). Performing either operation is accomplished by pressing and releasing the appropriate button. Access to these pushbuttons can be limited by the use of an optional, padlockable cover. In addition, complete access to the “ON” button can be prevented with an optional prevent close cover. The status of the springs and the primary contacts are always indicated in an indicator window just above the pushbuttons.

Electrically operated optional devices are available to automatically close or trip a manually operated circuit breaker. An electrical spring release is available to close a manually operated circuit breaker. Two optional devices, a shunt trip and an undervoltage release, are available to automatically trip (open) a manually operated circuit breaker. All of these UL listed optional devices can be installed easily in the field. For more details on these devices, refer to “Accessory Devices” on page 48 of this manual.

An electrical operator which is used to charge the closing spring automatically can be added to a manually operated circuit breaker in the field (Figure 29). Manually operated circuit breakers are pre-wired to accept this addition.

Figure 27. Typical Electrically Operated Drawout Circuit Breaker with Front Cover Removed

1. Secondary Wiring Points
2. Field Installable Accessories (3 maximum)
3. Trip Unit
4. Electric Charging Motor
5. Manual Charge Handle
6. Operations Counter (optional)
7. Padlockable Levering Device Access Door
8. Breaker Position Indicator
Electrical Operation

For electrically operated circuit breakers, the springs are normally charged through the use of an electrical operator (Figure 29). The springs can, however, be charged manually as just described in the previous paragraph (Figure 28).

Like the manually operated circuit breaker in the previous paragraph, electrically operated circuit breakers can also be manually closed and opened through the use of the front mounted Manual “ON” and Manual “OFF” buttons.

An electrically operated circuit breaker from the factory is also equipped as standard with a spring release to close the circuit breaker electrically. An optional shunt trip and undervoltage release are also available to trip (open) an electrically operated circuit breaker. Refer to “Accessory Devices” on page 48 for more details on both standard and optional devices.

Anti-Pump Feature

The Magnum SB circuit breaker has both mechanical and electrical anti-pump features. If the circuit breaker is closed on a fault condition (and trips open while the CLOSE signal is maintained), using either the mechanical pushbutton or the spring release, it will not make subsequent attempts to close until the close command is removed and reapplied. Note that if the close signal is applied prematurely (before the breaker is completely charged and latched), the close command will be ignored until it is removed and reapplied. For electrical closing, a Latch Check Switch (LCS) option is available (Refer to page 49 for details) which will block the application of the electrical close command until the breaker is ready to close.

Arc Chambers

The Magnum SB circuit breaker utilizes arc chambers to insulate and isolate individual poles from one another, from the rest of the circuit breaker, and from operating personnel (Figure 17). Arc chambers are molded and integral parts of the circuit breaker frame. Enclosed within each arc chamber is an arc chute which mounts over each set of primary contacts.

After the main contacts part, any remaining current is driven to the arcing contacts (Figure 30). Magnetic action draws the arc to the arc chute. As the arcing contacts separate, the moving arcing contacts discharge into the arc chute plates while the integral arc runner also helps to draw the arc into the arc chute (Figure 32).

Arc Chute

The Magnum SB arc chute mounts down over the arcing contact. V-shaped arc chute plates attract the arc and interrupt it. The top arc plate, which is a part of the arc chute itself, also helps to attract the arc away from the moving arcing contact and up into the arc chute’s V-shaped plates (Figure 31). Arc chute components are assembled in an insulating jacket, which is removable from the top of the circuit breaker. Each arc chute has a baffled top cover.
Electronic Tripping System
The Magnum SB circuit breaker utilizes a three part tripping system (Figure 33):
- Microprocessor-based trip unit
- Current Sensors
- Trip Actuator
All three parts of the tripping system are discussed here, except that the trip unit itself is not discussed in detail. For detailed information pertaining to the different trip unit models available with Magnum SB circuit breakers, refer to the specific instruction leaflet dedicated to the trip units (IL70C1036 and IL70C1037).

Microprocessor-Based Trip Unit
Magnum circuit breakers use any one of a family of Digitrip RMS trip units whose main features are summarized in Table 5. Model 520 is plug compatible and interchangeable in the field.
The electronic trip units are self-powered. When the circuit breaker is closed, no external power is required to operate their protective systems. Current signal levels and the control power are derived from the current sensors integrally mounted in the circuit breaker.

A functional local test of a major portion of the trip unit’s electronic circuitry and the circuit breaker’s mechanical tripping action can be verified through the trip unit’s test receptacle (Figure 34). This is accomplished using a Digitrip (DS Type) Test Kit which provides a secondary injection test that simulates the current sensors. A small hand held Magnum functional Test Kit can also be used to check circuitry and mechanical tripping functions (Figure 35).

When the circuit breaker is shipped from the factory, the trip unit’s protective functions are normally set at minimum values. For specific overload tripping characteristics and time/current curves to coordinate with a load or system, refer to the trip unit instruction book.

### Table 5. Magnum Digitrip Trip Units

<table>
<thead>
<tr>
<th>Functions</th>
<th>520</th>
<th>520M</th>
<th>520MC</th>
<th>1150</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSIG Protection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Disable (I)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GF Protection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GF Alarm</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Display</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Programmable</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Metering</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Power and Energy Values</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Power Quality</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Communication</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- One-line, (four characters per line) LCD display.
- Three-line, (eight characters per line) LED display.
- Phase, neutral, ground, and high load current only.
- Available control voltages are 24/48Vdc, 125Vdc, 120Vac and 240Vac.
Rating Plug
All Magnum SB circuit breaker trip units use a fixed type rating plug. The current rating of the rating plug must match the current rating of the integrally mounted current sensors (Figures 6 and 34 and Table 6). The rating plug performs several functions:

1. It tells the trip unit what the rating is of the current sensors. A label on the front of the rating plug clearly indicates that the rating plug and sensors must have the same rating.
2. It determines the maximum instantaneous setting which is a function of the current sensor rating.
3. The National Electrical Code (NEC) requires that the maximum ground fault pickup value not exceed 1200 amperes. A properly matched rating plug accomplishes this requirement for higher ampere sensors by incorporating circuitry to identify that level by sensor rating.

If the rating plug is removed from the trip unit, the circuit breaker will trip if it is carrying current. Make certain the rating plug is secured in position with its retaining screw. Do not torque the retaining screw beyond 15 In-Oz.

Refer to Table 6 for a tabulation of the available rating plugs.

Current Sensors
Three toroidally wound current sensors are installed at the rear of the circuit breaker on the lower terminals (Figure 36). The sensors produce an output current proportional to the load current. Under preselected conditions of current magnitude and time, the sensors furnish the trip unit with a signal and the energy required to trip the circuit breaker.

Neutral current sensors are available for customer installation. The additional sensor is not supplied with the circuit breaker and must be ordered separately. They are wired to the trip unit through the secondary contacts of the circuit breaker.

Refer to Table 6 for a tabulation of the available current sensor ratings.
Trip Actuator

The trip actuator is a small cylindrically shaped electromagnetic device which acts mechanically to trip the circuit breaker (Figure 33). In general, it is comprised of a permanent magnet, a spring loaded rod to produce the mechanical tripping, and a lever for resetting the actuator after tripping occurs. The electronic trip unit provides a pulse which counteracts the effect of the permanent magnet, allowing the spring loaded rod to act mechanically. The device is reset when the circuit breaker opens.

Mechanical Trip Flag

A red, pop out mechanical trip indicator is an optional Magnum SB feature. It is located above the trip unit on the breaker’s front faceplate (Figure 34). It operates by releasing and popping out any time the circuit breaker trips due to an overcurrent condition. Note that the mechanical trip indicator will not prevent the breaker from being reclosed. The indicator is reset manually by pushing it back in. If the indicator is not reset the circuit breaker will operate normally, but future mechanical trip indication will be lost.

An optional overcurrent trip switch (bell alarm) that operates off the position of the mechanical trip indicator is also available. The switch is reset when the trip indicator is reset.

On optional Digitrip models with LED cause-of-trip indicators, these indicators should also be reset (by pushing momentarily) after the cause of the fault has been diagnosed; this will preserve the internal battery. On trip units equipped for communication the LED reset function can be performed remotely using INCOM commands.

Making Current Release

All Magnum SB Double-wide circuit breaker trip units have a making current release function. This safety feature prevents the circuit breaker from being closed and latched on a faulted circuit. The non-adjustable release is preset at a peak instantaneous current of 25 x In; this corresponds to an rms current of 11 x In with maximum asymmetry.

The making current release is enabled only for the first 2 cycles following a circuit breaker closing operation. The making current release will trip the circuit breaker instantaneously, release the mechanical (pop-out) indicator and flash the instantaneous LED trip indicator, if so equipped.

Fixed Instantaneous Non-Adjustable Setting

Magnum SB 800-3000 ampere breakers through 100kA AIC rating have a fixed instantaneous non-adjustable setting. This value is set at 18 x In symmetrical rms. In is defined by the current sensor and rating plug combination. This setting is always active, regardless of the instantaneous setting.

High Instantaneous Trip

The high instantaneous trip option is installed on all SBSE breakers. On the Magnum SBSE standard frame circuit breakers (800-2000A) this rating is set at 30kA. On the Magnum SBSE Double-wide frame circuit breakers (2500-5000A) this rating is set at 50kA. In general, the high instantaneous trip is comprised of three small air core sensors, one in each phase, which produce a signal and transmits it back to the trip unit when the rating of the circuit breaker is exceeded. The result is an instantaneous trip by the circuit breaker. This high instantaneous trip option permits the Magnum SBSE circuit breakers to be applied where a 150kA fault is possible, while selectivity up to the high instantaneous trip value is maintained.
Voltage Taps

On circuit breakers with Digitrip 1150 trip units potential taps are required to monitor the three phase voltages. Voltage taps may be placed on either the line (top) or load (bottom) terminals of the breaker at the factory. Figure 37 illustrates line-side voltage taps.

Secondary Contacts And Connection Diagrams

A maximum of sixty secondary wiring connection points are available on the standard frame circuit breaker (48 on narrow frame), each dedicated to a specific function (Figure 38). The wiring points are finger safe with no more than two wires per terminal.

Up to two secondary contact plug-in connectors (AMP), each with 30 secondary points, are mounted on the top rear portion of the circuit breaker. The plug-in connectors are protected by a molded hood (Figure 39). How many connectors are mounted depends upon a number of considerations, such as whether the circuit breaker is electrically or manually operated and how many features are required. When the front cover of the circuit breaker is removed, the top of each plug-in connector is exposed. A label on each connector identifies the wiring points.
Drawout type circuit breakers: Compatible secondary plug-in connectors are mounted on the top front portion of the drawout cassette (Figure 40). These connectors match and plug into the circuit breaker mounted connectors. Contact points are wired from the cassette’s plug-in connectors to cassette mounted terminal blocks. The terminal blocks are also mounted on the top front portion of the cassette. The secondary terminals have finger-proof hinged covers with small holes for probe testing.

Fixed type circuit breakers: There are two secondary connection options:

1. Without Terminal Block
2. With Terminal Block

1 Without Terminal Block - If a terminal block for customer use is not required, the circuit breaker is supplied with both plug-in connectors (male and female) just described in the two previous paragraphs. The plug-in connectors are joined and attached to the top portion of the circuit breaker. The customer can plug secondary wiring with crimp-on connectors into back of the plug-in connectors; subsequently the connections to the circuit breaker can be quickly joined or separated as required.

2 With Terminal Block - For those customers preferring to wire to a terminal block, terminal blocks with finger-proof hinged covers are added to the secondary configuration just described for a fixed circuit breaker “without a terminal block.” The terminal blocks are wired to the plug-in connectors and also permanently attached to the upper rear portion of the circuit breaker (Figures 18 and 19).

A standard tool is available from the plug-in connector manufacturer (AMP) to facilitate the removal of secondary wiring from a plug-in connector, or contact Cutler-Hammer for assistance (Figure 41). The connector halves must be separated to use this tool.

Connection Diagrams

The connection diagrams for all Magnum SB circuit breakers using Digitrip RMS trip units are shown in Figures 42 through 59.
1. 2 & 3 (NA)
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN “NON-TRIPPED” STATE (OTS SWITCHES).
5. THE SPRING RELEASE ACCESSORY CONSISTS OF A “SR” COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A 0.20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL LATCH CHECK SWITCH ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE. THE CLOSING (CLOSING) CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND SPRING NOT CHARGED (OTS SWITCHES).
6. THE SPRING RELEASE ACCESSORY CONSISTS OF A “SR” COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A 0.20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL LATCH CHECK SWITCH ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE. THE PRINTED CIRCUIT BOARD PROVIDES A .20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL LATCH CHECK SWITCH ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE.
7. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
8. SECOND SHUNT TRIP...SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.
9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRING THE SAME AS THE PHASE SENSORS AND IS LOCATED IN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4 & B-5 ARE NOT WIRING!
11. SECOND SHUNT TRIP MAY BE INSTALLED USING A-7. ALL CONTACT IN PLACE OF LHR. THIRD AUXILIARY SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE.
12. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-28, B-29, B-30) IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 5 FOR SPRING RELEASE LATCH CHECK SWITCH.
13. THESE CONTACTS ARE PROVIDED FOR DIGITRIP 520M AS OPTIONAL ACCESSORY. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM ON GROUND TRIP FUNCTION FOR LSIG TRIP STYLE. HOWEVER, FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARM.

Figure 42. Connection Diagram for Narrow and Standard Frame with Digitrip 520 and 520M
1. 4 WIRE CRIMP CONNECTION
2. (NA)
3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL “HANG UNCONNECTED” IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN “NON-TRIPPED” STATE ON SWITCHES.
5. THE SPRING RELEASE ACCESSORY CONSISTS OF A “SR” COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A .20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL LATCH CHECK SWITCH (LCS) ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE. THE LCS DELAYS THE SPRING RELEASE PULSE UNTIL THE BREAKER MECHANISM IS READY TO CLOSE (CHARGED AND RESET). VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION.
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-7 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
8. (NA)
9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRED OUT.
11. SECOND SHUNT TRIP MAY BE INSTALLED USING A-7, A8 CONTACTS IN PLACE OF UVR. THIRD AUXILIARY SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.
12. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH 12, B-9, B-30 IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 5 FOR SPRING RELEASE LATCH CHECK SWITCH.
13. THESE CONTACTS ARE PROVIDED FOR DIGITRIP SBMC AS STANDARD OR 520M AS OPTIONAL ACCESSORY. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM ON GROUND TRIP FUNCTION FOR LSI TRIP STYLE. HOWEVER, FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARM.
15. CONNECTING A-12 TO B-7 VIA A REMOTE MAINTENANCE MODE SWITCH (GOLD CONTACTS) WILL ALSO ACTIVATE RELAY CONTACT A-9.
1. (NA)
2. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES) AND SPRINGS NOT CHARGED.
4. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
5. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS 8-A AND 8-B WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
6. NORMALLY OPENED CONTACT PROGRAMMED AS RELAY A. VIA DIGITRIP FRONT PANEL (ALARCONTACT). THIS CAN ALSO BE ASSIGNED TO INDICATE MAINTENANCE MODE FEATURE IS IN USE.
7. NORMALLY CLOSED CONTACT PROGRAMMED AS RELAY B. VIA DIGITRIP FRONT PANEL (BLOCK CLOSE CONTACT).
8. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY C. VIA DIGITRIP FRONT PANEL (LATCHING CONTACT).
9. (NA)
10. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
11. ON A POLE BREAKER, THE NEUTRAL CURRENT SENSOR IS THE SAME AS THE PHASE SENSORS. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRED OUT.
12. FOUR POINT SOCKET USED HERE.
13. SECOND SHUNT TRIP MAY BE INSTALLED (USING A-7, A-8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP.
14. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-29, B-30) IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 3 FOR SPRING RELEASE LATCH CHECK SWITCH.
15. THE OTS (OVERCURRENT TRIP SWITCHES) WILL OPERATE DIRECTLY FROM THE DIGITRIP DRIVING THE TA (TRIP ACTUATOR).
1. **4 WIRE CRIMP CONNECTION.**

2. **3 WIRE CRIMP IF HIGH INST TRIP MODULE IS SUPPLIED.**

3. **SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL “HANG UNCONNECTED’ IF DIGITRIP 220 OR 520 IS SUPPLIED.**

4. **ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN “NON-TRIPPED” STATE (OTS SWITCHES).**


6. **TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.**

7. **ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.**

8. **THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.**

9. **MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.**


11. **SECOND SHUNT TRIP MAY BE INSTALLED (USING A-7, A-8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.**

12. **ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-29, B-30) IN SERIES WITH SPRING RELEASE (SR) COIL WILL DEFECT ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED.**


Figure 45. Connection Diagram for Standard SBSE Frame with Digitrip 520 and 520M
1. **4 WIRE CRIMP CONNECTION**

2. **3 WIRE CRIMP IF HIGH INST. TRIP MODULE IS SUPPLIED.**

3. **SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL "HANG UNCONNECTED" IF DIGITRIP 220 OR 520 IS SUPPLIED.**

4. **ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES).**


6. **TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.**

7. **ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.**

8. **THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.**

9. **MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.**

10. **ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRED OUT.**

11. **SECOND SHUNT TRIP MAY BE INSTALLED (USING A-7, A-8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.**

12. **ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-28, B-29, B-30) IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 5 FOR SPRING RELEASE LATCH CHECK SWITCH.**

13. **THE CONTACTS ARE PROVIDED FOR DIGITRIP 520MC AS STANDARD OR 520M AS OPTIONAL ACCESSORY. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM ON GROUND TRIP FUNCTION FOR LSIG TRIP STYLE. HOWEVER, FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARM.**


15. **CONNECTING A-12 TO B-7 VIA A REMOTE MAINTENANCE MODE SWITCH (GOLD CONTACTS) WILL ALSO ACTIVATE RELAY A-9.**

---

**Figure 46. Connection Diagram for Standard SBSE Frame with Digitrip 520MC**
1. 3 WIRE CRIMP IF HIGH INST. TRIP MODULE IS SUPPLIED.
2. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES) AND SPRINGS NOT CHARGED.
3. THE SPRING RELEASE ACCESSORY CONSISTS OF A "SR" COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A 0.20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL LATCH CHECK SWITCH (LCS) ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE. THE CLOSED LCS DELAYS THE SPRING RELEASE PULSE ENTIRELY THE BREAK MECHANISMS REMAIN TO CLOSURE CHARGED AND THE LCS OPEN. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION.
4. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
5. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLES RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
6. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY A VIA DIGITRIP FRONT PANEL (ALARM CONTACT). THIS CAN ALSO BE ASSIGNED TO INDICATE MAINTENANCE MODE FEATURE IS IN USE.
7. NORMALLY CLOSED CONTACT PROGRAMMED AS RELAY B VIA DIGITRIP FRONT PANEL (BLOCK CONTACT).
8. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY A VIA DIGITRIP FRONT PANEL (LATCHING CONTACT).
9. FOUR POINT SOCKET USED HERE.
10. SECOND SHUNT TRIP MAY BE INSTALLED (USING A-7, A-8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHORT TRIP.
11. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRED OUT.
12. ALTERNATE (FORM C) AUX. SWITCHES
1. 4 WIRE CRIMP CONNECTION
2. 3 WIRE CRIMP IF HIGH INST TRIP MODULE IS SUPPLIED.
3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL "HANG UNCONNECTED" IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN "NON-TRIPPED" STATE, IF SWITCHES ARE IN PLACE OF LVMS. 3033
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
8. THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.
9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRED OUT.
11. SECOND SHUNT TRIP MAY BE INSTALLED IN PLACE OF LCS CONTACTS IN SERIES WITH SPRING RELEASE. THE LCS DELAYS THE SPRING RELEASE PULSE UNTIL THE BREAKER MECHANISM IS READY TO CLOSE (CHARGED AND RESET). VOLTAGE MUST BE REMOVED AND REAPPLIED TO THE SPRING RELEASE FOR SUBSEQUENT OPERATION.
12. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH B-29, B-30 IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED.SEE NOTE 3 FOR SPRING RELEASE LATCH CHECK SWITCH.
13. THESE CONTACTS ARE PROVIDED FOR DIGITRIP 520MC AS STANDARD OR 520M AS OPTIONAL ACCESSORY. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM OR GROUND TRIP FUNCTIONS FOR LSIG TRIP STYLE. HOWEVER FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARM.
15. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
1. 4 WIRE CRIMP CONNECTION
2. 3 WIRE CRIMP HIGH INST. TRIP MODULE IS SUPPLIED.
3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL "HANG UNCONNECTED" IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES)
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTRUSION APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
8. THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY
9. M.T.O OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRERED.
11. SECOND SHUNT TRIP MAY BE INSTALLED USING A7, A8 CONTACTS IN PLACE OF UV, THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.
12. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRERED.
13. SECOND SHUNT TRIP MAY BE INSTALLED USING A7, A8 CONTACTS IN PLACE OF UV, THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.
14. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRERED.
15. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRERED.
16. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRERED.
1. On three pole breakers only (not eight physical poles), having ground fault functionality, a jumper installed from B-6 to B-7 will enable source ground fault sensing and disable residual ground fault sensing. Inputs B-4 and B-5 will be reassigned for source ground sensor inputs.

2. All contacts shown with breaker in open position and with trip unit in "non-tripped" state (OTS switches) and spring not charged.

3. The spring release accessory consists of a "SR" coil and a PC Board. The printed circuit board provides a 20 second pulse for the closing operation. Voltage must be removed and then reapplied for subsequent operation. An optional latch check switch (LCS) accessory may be connected to the spring release. The (closed) LCS delays the spring release pulse until the breaker mechanism is ready to close (charged and reset). If voltage is maintained to the spring release, the closing pulse will occur when the mechanism is charged and reset (LCS open). Voltage must be removed and reapplied to the spring release for subsequent operation.

4. To provide selected time delays for short time and/or ground time functions for testing or non-zone interlocking applications, a jumper from B-8 to B-9 is required.

5. Three wire crimp if high instantaneous module is supplied.

6. Normally open contact programmed as relay A via Digitrip front panel (alarm contact). This can also be assigned to indicate maintenance mode feature in use.

7. Normally closed contact programmed as relay B via Digitrip front panel (block close contact).

8. Normally open contact programmed as relay C via Digitrip front panel (latching contact).

9. On 4-pole breakers (actually 8 physical poles), the neutral current sensors are located within the breaker frame. The secondary contacts B-4 and B-5 are not wired out.

10. Motor operator switch shown with breaker closing spring discharged.

11. Four point socket used here.

12. Second shunt trip may be installed (using A-7, A-8 contacts) in place of UVR. Third aux switch not available with second shunt trip. Shunt trip may be standard or continuous duty type. Secondary wiring is identical.

13. Only one latch check switch may be installed. Switch to customer accessory latch check switch (HPC-28) in series with spring release defeats anti-pump function and is not recommended. See note 3 for spring release latch check switch.

14. The overcurrent trip switches will operate directly from the Digitrip driving the TA (trip actuator) to trip the circuit breaker. The standard OTS requires a manual local reset via red button depression. The auto reset OTS does not require manual reset and if so configured, occupies the make-co-m secondary terminals A-4 and A-5.

15. For circuit breakers built after July 2006 and Digitrip 1150 units of firmware rev 20 decimal or greater, the maintenance mode feature (ARMS) is supplied. The reverse power de-selection is front panel programmable only.

16. The high instantaneous module is supplied on MDSX/SPSE breakers and is optional on others. The module provides 50kA high instantaneous trip.
Instructions for Installation, Operation and Maintenance of Magnum SB Insulated Case Low Voltage Power Circuit Breakers

1. 4 WIRE CRIMP CONNECTION
2. 3 WIRE CRIMP IF HIGH INST TRIP MODULE IS SUPPLIED.
3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL “HANG UNCONNECTED” IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN “NON-TRIPPED” STATE (OTS SWITCHES).
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
8. THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.
9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSORS ARE THE SAME STYLE AND WIRE THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONDUCTORS B-4, B-5, ARE NOT WIRED OUT.
11. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
1. 4 wire crimp connection
2. 3 wire crimp high inst. trip module is supplied.
3. Socket used with Digitrip 520M ground alarm power supply module will “hang unconnected” If Digitrip 220 or 520 is supplied.
4. All contacts shown with breaker in open position and with spring not charged and with trip unit in “non-tripped” state (OTS switches).
5. The spring release accessory consists of a “SR” coil and a P.C. board. The printed circuit board provides a 20 second pulse for the closing operation. Voltage must be removed and then reapplied for subsequent operation. An optional latch check switch (LCS) accessory may be connected to the spring release. The closed LCS delays the spring release pulse until the breaker mechanism (is ready to close charged and reset). This will insure that the latch will always be in the proper state before the spring release pulse is initiated. If voltage is maintained to the spring release the closing pulse will occur when the mechanism is charged and reset LCS (open). Voltage must be removed and reapplied to the spring release for subsequent operation.
6. To provide selected time delays for short time and/or ground time functions for testing or non-zone interlocking applications, a jumper from B-6 to B-7 is required.
7. On three pole breakers only, ground fault functionality, a jumper installed from B-6 to B-7 will enable source ground fault sensing and disable residual ground fault sensing. Inputs B-4 and B-5 will be reassigned for source ground sensor inputs.
8. This lead supplied on G62 style high instantaneous trip module only.
9. Motor operator switch shown with breaker closing spring discharged.
10. On 4 pole breakers, the neutral current sensor is the same style and wired the same as the phase sensors and is located within the breaker frame. The secondary contacts B-4, B-5A, are not wired out.
11. Second shunt trip may be installed using A-7, A-8 contacts in place of LMC. Third aux switch not available with second shunt trip. Shunt trip may be standard or continuous duty type. Secondary wiring is identical.
12. Only one latch check switch may be installed. Use of customer accessible latch check switch (B-28, B-30) in series with spring release defeats anti-pump function and is not recommended. See Note 5 for spring release latch check switch.
13. These contacts are provided for Digitrip 520MC as standard. The contacts are assigned for ground alarm on ground trip function for LSI-G2 trip style. However, for a LSI style trip unit, the contacts are assigned as a high load alarm.
14. The high instantaneous trip switches will operate directly from the Digitrip driving the TA (Trip Actuator) to trip the circuit breaker. The OTS requires a manual local reset via red button depression. The auto reset OTS does not require manual reset, and if so configured, occupies the make-com secondary terminals A-4 and A-5.
15. Connecting A-12 to B-7 via a remote maintenance mode switch (gold contacts) will also activate relay contact A-9.
16. The high instantaneous module is supplied on MSX/SPE breakees and is optional on others. The module provides 50KA high instantaneous trip.
1. ON THREE POLE BREAKERS ONLY (NOT EIGHT PHYSICAL POLES), HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.

2. ALL AUX SWITCH CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH TRIP UNIT IN “NON-TRIPPED” STATE (OTS SWITCHES) AND SPRING NOT CHARGED.


4. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.

5. 3 WIRE CRIMP IF HIGH INST MODULE IS SUPPLIED.

6. NORMALLY OPENED CONTACT PROGRAMMED AS RELAY A. VIA DIGITRIP FRONT PANEL. (ALARM CONTACT). THIS CAN ALSO BE ASSIGNED TO INDICATE MAINTENANCE MODE FEATURE IN USE.

7. NORMALLY CLOSED CONTACT PROGRAMMED AS RELAY B. VIA DIGITRIP FRONT PANEL. (BLOCK CLOSE CONTACT).

8. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY C. VIA DIGITRIP FRONT PANEL. (LATCHING CONTACT).

9. ON 4-POLE BREAKERS (ACTUALLY 8 PHYSICAL POLES), THE NEUTRAL CURRENT SENSORS ARE LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY RELAYS B-4, B-5, ARE NOT WIRED OUT.

10. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.

11. FOUR POINT SOCKET USED HERE.

12. SECOND SHUNT TRIP MAY BE INSTALLED (USING A-7, A-8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. WIRING IS IDENTICAL.

13. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-29, B-30) IN SERIES WITH SPRING RELEASE DEFIES ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 3 FOR SPRING RELEASE LATCH CHECK SWITCH.


15. FOR CIRCUIT BREAKERS BUILT AFTER JULY 2006 AND DIGITRIP 1150 UNITS OF FIRMWARE REV. 20.00 (OR GREATER), THE MAINTENANCE MODE FEATURE (ARMS) IS SUPPLIED. THE REVERSE POWER DESELECTION IS FRONT PANEL PROGRAMMABLE ONLY.

16. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
1. 4 WIRE CRIMP CONNECTION
2. 3 WIRE CRIMP HIG. INST. TRIP MODULE IS SUPPLIED.
3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL "HANG UNCONNECTED" IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES).
5. THE SPRING RELEASE ACCESSORY CONSISTS OF A "SR" COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A .20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL LATCH CHECK SWITCH (LCS) ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE. THE (CLOSED) LCS DELAYS THE SPRING RELEASE PULSE UNTIL THE BREAKER MECHANISM IS READY TO CLOSE (CHARGED AND RESET). (THIS WILL INSURE THAT THE LATCH WILL ALWAYS BE IN THE PROPER STATE BEFORE THE SPRING RELEASE PULSE IS INITIATED. IF VOLTAGE IS MAIN AIDED TO THE SPRING RELEASE, THE CLOSING PULSE WILL OCCUR WHEN THE MECHANISM IS CHARGED AND RESET LCS OPEN VOLTAGE MUST BE REMOVED AND REAPPLIED TO THE SPRING RELEASE FOR SUBSEQUENT OPERATION.
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-6 TO B-7 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
8. THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.
9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4-B-5 ARE NOT WIRING.
11. SECOND SHUNT TRIP MAY BE INSTALLED (USING A7, A8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP IS STANDARD OR CONTINUOUS DUTY TYPE.
12. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-29, B-30) IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 5 FOR SPRING RELEASE LATCH CHECK SWITCH.
13. THESE CONTACTS ARE PROVIDED FOR DIGITRIP 520 MC AS STANDARD OR 520 M AS OPTIONAL ACCESSORY. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM ON GROUND TRIP FUNCTION FOR LSIG TRIP STYLE. HOWEVER, FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARM.
15. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
1. 4 WIRE CRIMP CONNECTION
2. 3 WIRE CRIMP IF HIGH INST. TRIP MODULE IS SUPPLIED.
3. SOCKET USED WITH DIGITRIP 520MC GROUND ALARM POWER SUPPLY MODULE WILL "HANG UNCONNECTED" IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN CLOSED POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES).
5. THE SPRING RELEASE ACCESSORY CONSISTS OF A "SP" COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A 20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION. AN OPTIONAL SR-LATCH CHECK SWITCH (LCS) ACCESSORY MAY BE CONNECTED TO THE SPRING RELEASE. THE PRINTED CIRCUIT BOARD PROVIDES A .20 SECOND PULSE FOR THE CLOSING OPERATION.
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
1. ON THREE POLE BREAKERS ONLY (NOT EIGHT PHYSICAL POLES), HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.

2. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES) AND SPRING NOT CHARGED.


4. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.

5. 3 WIRE CRIMP IF HIGH INST MODULE IS SUPPLIED.

6. NORMALLY OPENED CONTACT PROGRAMMED AS RELAY A※ VIA DIGITRIP FRONT PANEL. (ALARM CONTACT). THIS CAN ALSO BE ASSIGNED TO INDICATE MAINTENANCE MODE FEATURE IN USE.

7. NORMALLY CLOSED CONTACT PROGRAMMED AS RELAY B※ VIA DIGITRIP FRONT PANEL. (BLOCK CLOSE CONTACT).

8. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY C※ VIA DIGITRIP FRONT PANEL. (LATCHING CONTACT).

9. ON 4-POLE BREAKERS (ACTUALLY 8 PHYSICAL POLES), THE NEUTRAL CURRENT SENSORS ARE LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.

10. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.

11. FOUR POINT SOCKET USED HERE.

12. SECOND SHUNT TRIP MAY BE INSTALLED (USING A-7, A-8 CONTACTS) IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.

13. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH B-23, B-30 IN SERIES WITH SPRING RELEASE DEACTIVATES ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 3 FOR SPRING RELEASE LATCH CHECK SWITCH.


15. FOR CIRCUIT BREAKERS BUILT AFTER JULY 2008 AND DIGITRIP 1150 UNITS OF FIRMWARE REV 20 decimal OR GREATER, THE MAINTENANCE MODE FEATURE IS SUPPLIED. THE REVERSE POWER DESELECTED FRONT PANEL PROGRAMMABLE ONLY.

16. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
1. 4 WIRE CRIMP CONNECTION

2. 3 WIRE CRIMP IF HIGH INST. TRIP MODULE IS SUPPLIED.

3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL “HANG UNCONNECTED” IF DIGITRIP 220 OR 520 IS SUPPLIED.

4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH SPRING NOT CHARGED AND WITH TRIP UNIT IN “NON-TRIPPED” STATE.

5. THE SPRING RELEASE ACCESSORY CONSISTS OF A “SR” COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A .20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION.

6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.

7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.

8. THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.

9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.


11. SECOND SHUNT TRIP MAY BE INSTALLED USING A-2, A-4 CONTACTS IN PLACE OF GVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.

12. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH (B-29, B-30) IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 5 FOR SPRING RELEASE LATCH CHECK SWITCH.

13. THE CONTACTS ARE PROVIDED FOR DIGITRIP 520M AS STANDARD OR 520M AS OPTIONAL ACCESSORY. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM ON GROUND TRIP FUNCTION FOR LSI TRIP STYLE. HOWEVER, FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARM.


15. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
1. 4 WIRE CRIMP CONNECTION
2. 3 WIRE CRIMP IF HIGH INST. TRIP MODULE IS SUPPLIED.
3. SOCKET USED WITH DIGITRIP 520M GROUND ALARM POWER SUPPLY MODULE WILL "HANG UNCONNECTED" IF DIGITRIP 220 OR 520 IS SUPPLIED.
4. ALL CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND SPRING NOT CHARGED AND WITH TRIP UNIT IN "NON-TRIPPED" STATE (OTS SWITCHES).
5. THE SPRING RELEASE ACCESSORY CONSISTS OF A "SR" COIL AND A P.C. BOARD. THE PRINTED CIRCUIT BOARD PROVIDES A .20 SECOND PULSE FOR THE CLOSING OPERATION. VOLTAGE MUST BE REMOVED AND THEN REAPPLIED FOR SUBSEQUENT OPERATION.
6. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.
7. ON THREE POLE BREAKERS ONLY, HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENDING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.
8. THIS LEAD SUPPLIED ON G62 STYLE HIGH INSTANTANEOUS TRIP MODULE ONLY.
9. MOTOR OPERATOR SWITCH SHOWN WITH BREAKER CLOSING SPRING DISCHARGED.
10. ON 4-POLE BREAKERS, THE NEUTRAL CURRENT SENSOR IS THE SAME STYLE AND WIRED THE SAME AS THE PHASE SENSORS AND IS LOCATED WITHIN THE BREAKER FRAME. THE SECONDARY CONTACTS B-4, B-5, ARE NOT WIRED OUT.
11. SECOND SHUNT TRIP MAY BE INSTALLED USING A-7, A-8 CONTACTS IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.
12. ONLY ONE LATCH CHECK SWITCH MAY BE INSTALLED. USE OF CUSTOMER ACCESSIBLE LATCH CHECK SWITCH B-30 IN SERIES WITH SPRING RELEASE DEFEATS ANTI-PUMP FUNCTION AND IS NOT RECOMMENDED. SEE NOTE 5 FOR SPRING RELEASE LATCH CHECK SWITCH.
13. THESE CONTACTS ARE PROVIDED FOR DIGITRIP 520MC AS STANDARD. THE CONTACTS ARE ASSIGNED FOR GROUND ALARM ON GROUND TRIP FUNCTION FOR LSIG TRIP STYLE. HOWEVER, FOR A LSI STYLE TRIP UNIT, THE CONTACTS ARE ASSIGNED AS A HIGH LOAD ALARMA.
14. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.

**Figure 58. Connection Diagram for SBSE Double-wide Frame with Digitrip 520MC with AABBCC Configuration**
1. ON THREE POLE BREAKERS ONLY (NOT EIGHT PHYSICAL POLES), HAVING GROUND FAULT FUNCTIONALITY, A JUMPER INSTALLED FROM B-6 TO B-7 WILL ENABLE SOURCE GROUND FAULT SENSING AND DISABLE RESIDUAL GROUND FAULT SENSING. INPUTS B-4 AND B-5 WILL BE REASSIGNED FOR SOURCE GROUND SENSOR INPUTS.

2. ALL AUX. SWITCH CONTACTS SHOWN WITH BREAKER IN OPEN POSITION AND WITH TRIP UNIT IN “NON-TRIPPED” STATE (OTS SWITCHES) AND SPRING NOT CHARGED.


4. TO PROVIDE SELECTED TIME DELAYS FOR SHORT TIME AND/OR GROUND TIME FUNCTIONS FOR TESTING OR NON-ZONE INTERLOCKING APPLICATIONS, A JUMPER FROM B-8 TO B-9 IS REQUIRED.

5. NORMALLY OPENED CONTACT PROGRAMMED AS RELAY A. VIA DIGITRIP FRONT PANEL. (ALARM CONTACT). THIS CAN ALSO BE ASSIGNED TO Indicate MAINTENANCE MODE FEATURE IN USE.

6. NORMALLY CLOSED CONTACT PROGRAMMED AS RELAY B. VIA DIGITRIP FRONT PANEL. (BLOCK CLOSE CONTACT).

7. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY C. VIA DIGITRIP FRONT PANEL. (LATCHING CONTACT).

8. NORMALLY OPEN CONTACT PROGRAMMED AS RELAY A VIA DIGITRIP FRONT PANEL. (LATCHING CONTACT).

9. SECOND SHUNT TRIP MAY BE INSTALLED UTILIZING CONNECTOR A-7, A-8 CONTACTS IN PLACE OF UVR. THIRD AUX SWITCH NOT AVAILABLE WITH SECOND SHUNT TRIP. SHUNT TRIP MAY BE STANDARD OR CONTINUOUS DUTY TYPE. SECONDARY WIRING IS IDENTICAL.

10. FOR FOUR POLE SOCKET USED HERE.


12. FOR CIRCUIT BREAKERS BUILT AFTER JULY 2006 AND DIGITRIP 1150 UNITS OF FIRMWARE REV 27 decimal OR GREATER, THE MAINTENANCE MODE FEATURE (ARMS) IS SUPPLIED. THE Reverse POWER DESELECTIONS FRONT PANEL PROGRAMMABLE ONLY.

13. THE HIGH INSTANTANEOUS MODULE IS SUPPLIED ON MDSX/SPSE BREAKERS AND IS OPTIONAL ON OTHERS. THE MODULE PROVIDES 50KA HIGH INSTANTANEOUS TRIP.
Accessory Devices

A variety of accessory devices are available for use with Magnum SB circuit breakers. Unless otherwise stated, they are all considered optional devices in the sense that they are not provided as standard on a manually operated circuit breaker. Available accessories are identified here and discussed in general terms. For more detailed information and/or installation instructions, refer to individual instruction leaflets dedicated to the accessories.

Magnum SB circuit breaker accessories are designed to fit all frame sizes. The accessories fall into one of three categories:

- Plug-in electrical
- Internal electrical
- Mechanical

Plug-In Electrical Accessories

There are four Magnum SB Plug-In electrical accessories. Three can be viewed for identification by name and rating through viewing windows located in the right front of the circuit breaker (Figure 60). All four are plug-in type and can be factory installed or field installed using a UL listed kit.

The four Plug-In accessories are:

- Shunt Trip (ST)
- Spring Release (SR)
- Undervoltage Release (UVR)
- Auxiliary Switch

Shunt Trip

The shunt trip is an optional device on circuit breakers (Figures 61 and 62). It opens the circuit breaker instantaneously when its coil is energized by a voltage input (Table 7). A total of two shunt trips can be mounted on a Magnum circuit breaker.

<table>
<thead>
<tr>
<th>Control Voltages</th>
<th>Operational Voltage Range 70-110%</th>
<th>Inrush Power Consumption</th>
<th>Opening Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
<td>17-26 Vdc</td>
<td>250 W</td>
<td>35</td>
</tr>
<tr>
<td>48 Vdc</td>
<td>34-53 Vdc</td>
<td>250 W</td>
<td>35</td>
</tr>
<tr>
<td>110-125 Vdc</td>
<td>77-138 Vdc</td>
<td>450 W</td>
<td>35</td>
</tr>
<tr>
<td>220-250 Vdc</td>
<td>154-275 Vdc</td>
<td>450 W</td>
<td>35</td>
</tr>
<tr>
<td>110-127 Vac</td>
<td>77-140 Vac</td>
<td>450 VA</td>
<td>35</td>
</tr>
<tr>
<td>208-240 Vac</td>
<td>146-264 Vac</td>
<td>450 VA</td>
<td>35</td>
</tr>
</tbody>
</table>

@ Required for less than 35 ms
Spring Release

The spring release is an optional device (Figure 63). It remotely closes the circuit breaker when the coil is energized by a voltage input (Table 8). The closing spring must be fully charged and the trip latch reset (not held in the tripped position) for the SR to operate. If these two conditions are not met the close signal will be ignored until it is removed and re-applied.

An optional Latch Check Switch (LCS) can be installed to indicate when the circuit breaker is ready to close. Two versions of the LCS are available.

The Latch Check Switch wired to the Spring Release will not permit activation of the Spring Release until the circuit breaker is fully charged and the trip latch is reset (Figure 63). If power is applied and maintained to the Spring Release, an activation will occur when the circuit breaker is “ready to close”.

The Latch Check Switch for Remote Indication consists of 1 Form C contact wired to the circuit breaker secondary contacts for integration into external control schemes. Note that wiring the LCS for Remote Indication directly in series with the SR accessory is not recommended as this will override the “anti-pump” feature of the electrical charging/closing system.

Undervoltage Release

The undervoltage release is an optional device on both manually and electrically operated circuit breakers (Figure 64). It opens the circuit breaker when its supply voltage falls to between 35-60% of rated voltage. If the release is not energized to 85% of its supply voltage, the circuit breaker cannot be closed electrically or manually (Table 10).

Auxiliary Switch

An auxiliary switch is an optional device providing remote electrical indication if the circuit breaker is open or closed (Figure 66). Up to 3 auxiliary switches can be mounted in the circuit breaker. Each switch has 2 normally open (“a”) and 2 normally closed (“b”) contacts for a total of 12 available contacts (Table 9).

Table 8. Spring Release Ratings

<table>
<thead>
<tr>
<th>Control Voltages</th>
<th>Operational Voltage Range</th>
<th>Inrush Power Consumption</th>
<th>Closing Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
<td>17-26 Vdc</td>
<td>250 W</td>
<td>40</td>
</tr>
<tr>
<td>48 Vdc</td>
<td>34-53 Vdc</td>
<td>250 W</td>
<td>40</td>
</tr>
<tr>
<td>110-125 Vdc</td>
<td>77-138 Vdc</td>
<td>450 W</td>
<td>40</td>
</tr>
<tr>
<td>220-250 Vdc</td>
<td>154-275 Vdc</td>
<td>450 W</td>
<td>40</td>
</tr>
<tr>
<td>110-127 Vac</td>
<td>77-140 Vac</td>
<td>450 VA</td>
<td>40</td>
</tr>
<tr>
<td>208-240 Vac</td>
<td>146-264 Vac</td>
<td>450 VA</td>
<td>40</td>
</tr>
</tbody>
</table>

© Required for less than 200 ms
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Instructional Leaflet IB2C12063H03
Effective March 2012

Figure 66. Auxiliary Switch (2A/2B)

Table 9. Auxiliary Switch, Overcurrent Trip Switch and Cell Switch Contact Ratings

<table>
<thead>
<tr>
<th>Control Voltages</th>
<th>Contact Rating Inductive Load (amperes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 Vac</td>
<td>10</td>
</tr>
<tr>
<td>125 Vdc</td>
<td>0.5</td>
</tr>
<tr>
<td>250 Vdc</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Table 10. Undervoltage Release

<table>
<thead>
<tr>
<th>Control Voltages</th>
<th>Operational Voltage Range 85-110%</th>
<th>Dropout Volts 30-60%</th>
<th>Inrush/Continuous Power Consumption</th>
<th>Opening Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc ⊗</td>
<td>20-26 Vdc</td>
<td>7-14 Vdc</td>
<td>250 W/18 W</td>
<td>70</td>
</tr>
<tr>
<td>32 Vdc ⊗</td>
<td>27-35 Vdc</td>
<td>10-19 Vdc</td>
<td>275 W/15 W</td>
<td>70</td>
</tr>
<tr>
<td>48 Vdc ⊗</td>
<td>41-53 Vdc</td>
<td>14-29 Vdc</td>
<td>275 W/15 W</td>
<td>70</td>
</tr>
<tr>
<td>110-125 Vdc ⊗</td>
<td>94-138 Vdc</td>
<td>33-75 Vdc</td>
<td>450 W/10 W</td>
<td>70</td>
</tr>
<tr>
<td>220-250 Vdc ⊗</td>
<td>187-275 Vdc</td>
<td>66-150 Vdc</td>
<td>450 W/10 W</td>
<td>70</td>
</tr>
<tr>
<td>110-127 Vac ⊗</td>
<td>94-140 Vac</td>
<td>33-76 Vac</td>
<td>450 VA/10 VA</td>
<td>70</td>
</tr>
<tr>
<td>208-240 Vac ⊗</td>
<td>177-264 Vac</td>
<td>62-144 Vac</td>
<td>400 VA/10 VA</td>
<td>70</td>
</tr>
<tr>
<td>380-415 Vac ⊗</td>
<td>323-457 Vac</td>
<td>114-249 Vac</td>
<td>480 VA/10 VA</td>
<td>70</td>
</tr>
<tr>
<td>480 Vac ⊗</td>
<td>408-528 Vac</td>
<td>144-288 Vac</td>
<td>400 VA/10 VA</td>
<td>70</td>
</tr>
<tr>
<td>600 Vac ⊗</td>
<td>510-650 Vac</td>
<td>180-360 Vac</td>
<td>400 VA/10 VA</td>
<td>70</td>
</tr>
</tbody>
</table>

 ⊗ Required for 200 ms
 ⊙ Required for 400 ms

Internal Electrical Accessories

Other electrical accessories are mounted inside the circuit breaker. They can be factory or site installed. There are two different internally mounted accessories:

- Overcurrent Trip Switch (Bell Alarm)
- Motor Operator

Overcurrent Trip Switch (Bell Alarm)

An overcurrent trip switch (bell alarm) is an optional device (Figure 67). It provides an electrical indication when a circuit breaker trips as a result of the trip unit reacting to an overcurrent condition. Opening as a result of a circuit breaker’s manual open button, shunt trip or undervoltage release does not cause the overcurrent trip switch to operate. The overcurrent trip switch has (2a 2b) Form C contacts (Table 9).
The status of the contacts changes when the trip indicator pops out. This permits the switch to be used as an alarm or in conjunction with a spring release to block a subsequent remote electrical closing signal.

Motor Operator

A Motor operator is an electric motor assembly internally mounted in the circuit breaker (Figures 68 and 69). It charges the closing springs electrically for remote or local operation. The motor operator can be factory or site installed (Table 11).

To convert a manually operated circuit breaker to an electrically operated circuit breaker, a UL listed motor operator kit is available.

Table 11. Motor Operator

<table>
<thead>
<tr>
<th>Control Volumes</th>
<th>Operational Voltage Range 85-110%</th>
<th>Running Current (A. avg.)</th>
<th>Typical Inrush Current</th>
<th>Power Consumption (watts or VA)</th>
<th>Maximum Charging Time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc</td>
<td>20-26</td>
<td>12.0</td>
<td>300% of Running</td>
<td>300</td>
<td>5</td>
</tr>
<tr>
<td>48 Vdc</td>
<td>41-53</td>
<td>5.0</td>
<td>500% of Running</td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td>110-125 Vdc</td>
<td>94-138</td>
<td>2.0</td>
<td>600% of Running</td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td>220-250 Vdc</td>
<td>187-225</td>
<td>1.0</td>
<td>600% of Running</td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td>110-127 Vac</td>
<td>94-140</td>
<td>2.0</td>
<td>600% of Running</td>
<td>250</td>
<td>5</td>
</tr>
<tr>
<td>208-240 Vac</td>
<td>177-264</td>
<td>1.0</td>
<td>600% of Running</td>
<td>250</td>
<td>5</td>
</tr>
</tbody>
</table>

AC voltages are 50/60Hz

Figure 69. Motor Operator Installed in Narrow Frame Circuit Breaker

Figure 70. Cover Mounted Key Lock and Operations Counter

Figure 68. Motor Operator Kit
Mechanical Accessories
There are eight optional mechanical type accessories:
• Operations Counter
• Off Key Lock
• Cassette Lock
• Pushbutton Cover
• Prevent Close Cover
• Cassette Safety Shutters
• Cassette Cell Switch
• Door Escutcheon
• Waterproof Cover
• Mechanical Interlock

Operations Counter
The operations counter is a mechanical device used to provide a record of the number of circuit operations. It is mounted in the lower right portion of the circuit breaker and can be viewed through the front cover (Figure 70).

Off Key Lock
The “off” key lock secures the circuit breaker in the “OFF” position. It is mounted in the lower right portion of the circuit breaker and can be viewed through the front cover (Figure 70). The customer supplies the key lock. The provisions available are for Kirk, Castell, Ronis or CES.

Cassette Lock
A cassette mounted lock can be used in conjunction with different interlocking schemes (such as main-tie-main) (Figure 71). The lock holds the circuit breaker trip-free in the connected position, preventing it from being closed.

Figure 71. Cassette Mounted Key Lock

Up to three lock cylinders can be installed on one cassette. Eaton supplies the lock provisions only. The customer is responsible for the locks, which can be Kirk, Castell, Ronis or CES.

Pushbutton Cover
Padlockable covers are available to limit access to the “ON” and “OFF” pushbuttons (Figure 72). They can be installed with either or both pushbutton covers in place.

Prevent Close Cover
All access to the “ON” pushbutton can be prevented by adding the fixed Prevent Close Cover to the pushbutton cover.

Lockout Cover
When padlocked, it maintains the “OFF” button in the actuated position which prevents closure of the breaker.

Figure 72. ON-OFF Pushbutton Lockable Cover Plate
Cassette Safety Shutters
Automatically operated insulating type safety shutters are available for use with the drawout cassette. When the drawout circuit breaker is levered from the CONNECT position, the shutters automatically close to cover the fixed primary contacts (Figure 73). When the circuit breaker is levered into the cassette, the shutters automatically open permitting primary connections to be made (Figure 74).

Figure 73. Typical Safety Shutters in Closed Position

Figure 74. Typical Safety Shutters in Open Position

Cassette Cell Switch
The cassette cell switch is a compartment position switch for drawout circuit breakers. It is available in a 2a2b or 4a4b contact configuration, and mounts on the right side of the cassette (Figure 75 and 76). Refer to Table 9 for cell switch contact information. The cell switch changes status between the TEST and CONNECT positions.

Door Escutcheon
The door escutcheon is a molded frame used to seal the space between the circuit breaker and the compartment door cutout. It is supplied with a mounting gasket (Figure 77).

Figure 75. Cell Switch (Drawout Position Indicator) Unmounted

Figure 76. Cell Switches Mounted on Cassette

Figure 77. Door Escutcheon and Gasket
IP54 Waterproof Cover

A hinged dome shaped waterproof cover attaches to the metal compartment door to provide waterproof protection for the circuit breaker (Figure 78).

Mechanical Interlock

A family of mechanical interlocks are available to interlock the closing of two or three Magnum SB circuit breakers. The mechanical interlock holds one or more circuit breakers tripped (prevents closure) when others are closed. A lever assembly is mounted on each breaker which interfaces with the pole shaft and the tripper bar. The lever assemblies are interconnected with either cables or rods, depending upon the relative orientation of the breakers. Rods can be used only when the circuit breakers to be interlocked are vertically stacked. Cables can be used for any orientation of the breakers. Mechanical interlocks are available for both fixed and drawout circuit breakers and in both 2-way and 3-way versions. An illustration of a 2-way cable interlock mounted on two drawout circuit breakers is shown in Figure 79.
Section 4: Drawout Circuit Breaker And Cassette

General

Section 3 discussed topics and features common to all Magnum SB circuit breakers, no matter what the mounting configuration or type. In this section, features unique to the drawout type circuit breaker and drawout cassette, not covered elsewhere, are discussed. Drawings and dimensions associated with all circuit breakers, drawout cassettes and any appropriate primary bus connections can be found in a separate document entitled Engineering Data TD01301004E. The installation and levering of a drawout circuit breaker were discussed in Section 2. If necessary, review that information, since it will not be repeated here.

Figure 80. Drawout Circuit Breaker in Cassette

Drawout Cassette

A drawout circuit breaker is used in combination with a fixed drawout cassette (Figures 80 and 82). The drawout circuit breaker is equipped with automatic primary disconnects (Figure 81). The cassette provides all of the necessary interfaces to the drawout circuit breaker including automatic primary and secondary connections. For the narrow frame circuit breaker a single cassette style using horizontal stabs and horizontal customer bus bar terminals is available (Figure 83). For the standard and double-wide circuit breakers three cassette styles, all with vertical stabs, are available: basic, standard, and universal. The standard cassette supplies vertical stab/terminals only (Figure 85). The basic cassette omits the copper stab/terminals so that these pieces can be integrated with vertical bus bars provided by the switchgear builder (Figure 84). The universal cassette provides a set of flat pad terminals on the rear of the cassette that can be adapted to vertical, horizontal or front connection (Figures 86). Mounting locations for cell (TOC) switches, safety shutters, mechanical interlocks and key interlocks are provided on the cassette.

Figure 81. Drawout Circuit Breaker with Automatic Primary Disconnects
1. Extension Rails
2. Extension Rail Cutout
3. Secondary Plug-in Connectors
4. Secondary Terminal Blocks
5. Arc Hood
6. Optional Cell (TOC) Switch Mounting
7. Optional Key Interlock Mounting Location
8. Grounding Bar

Figure 82. Typical Drawout Cassette Features
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Drawout Circuit Breaker Dimensions
The Magnum SB drawout circuit breaker connects to the fixed primary stabs of the drawout cassette through the primary finger clusters attached to the rear of the circuit breaker. Three different frame sizes cover all Magnum SB circuit breakers from an overall dimensional standpoint. Circuit breaker drawings can be found in Engineering Data TD01301004E.

Figure 83. Typical Narrow Frame Cassette (Horizontal Terminals)

Figure 84. Typical Basic Cassette (Without Stabs)

Drawout Cassette Dimensions
Cassette drawings provide all the dimensional information required for all mounting configurations and can also be found in Engineering Data TD01301004E. Review carefully for a specific installation.

Figure 85. Typical Standard Cassette (Vertical Terminals)

Figure 86. Typical Universal Cassette, 4-Pole (Flat Terminal Pads)
Section 5: Fixed Circuit Breaker

General

Section 3 discussed topics and features common to all Magnum SB circuit breakers, no matter what the mounting configuration or type. In this section, features unique to the fixed configuration not covered elsewhere are covered. Drawings and dimensions associated with all fixed circuit breakers and any appropriate primary bus connections can be found in a separate document entitled Engineering Data TD01301004E. The installation of a fixed circuit breaker was discussed in Section 2. If necessary, review that information, since it will not be repeated here.

⚠️ WARNING

FAILURE TO COMPLY WITH INSTALLATION OF THE FIXED MOUNTED SBSE ARC HOOD ASSEMBLY COULD RESULT IN EQUIPMENT DAMAGE, BODILY INJURY OR EVEN DEATH.

The SBSE fixed mounted breaker is shipped with a factory installed arc hood assembly. This assembly is required to be installed on the top of the breaker prior to the unit being placed in service.

Fixed Circuit Breaker Dimensions

The standard fixed circuit breaker is supplied with horizontally mounted primary connections (Figure 87). Optional vertical primary adaptors are available for different bus configurations. Refer to Engineering Data TD01301004E for fixed circuit breaker dimensions, vertical adaptor dimensions and vertical adaptor assembly details.
Section 6: Inspection And Maintenance

General

⚠️ WARNING

FAILURE TO INSPECT, CLEAN AND MAINTAIN CIRCUIT BREAKERS CAN REDUCE EQUIPMENT LIFE OR CAUSE THE EQUIPMENT NOT TO OPERATE PROPERLY UNDER FAULT CONDITIONS. THIS COULD RESULT IN EQUIPMENT DAMAGE, BODILY INJURY OR EVEN DEATH.

⚠️ WARNING

INSPECTION AND MAINTENANCE PROCEDURES SHOULD BE CARRIED OUT ONLY BY PERSONNEL FAMILIAR WITH THE HAZARDS ASSOCIATED WITH WORKING ON POWER CIRCUIT BREAKERS. ADDITIONALLY, THEY SHOULD BECOME FAMILIAR WITH THE SPECIFICS ASSOCIATED WITH TYPE MAGNUM DS CIRCUIT BREAKERS AS PRESENTED IN THIS INSTRUCTION BOOK.

Magnum circuit breakers are “Top of the Line” equipment. This means they are manufactured under a high degree of quality control, with the best available materials and with a high degree of tooling for accuracy and parts interchangeability. Design tests and actual installation experience show them to have durability well beyond minimum standards requirements. However, because of the variability of application conditions and the great dependence placed upon these circuit breakers for protection and the assurance of service continuity, inspection and maintenance activities should take place on a regularly scheduled basis.

Since maintenance of these circuit breakers consists mainly of keeping them clean, the frequency of scheduled inspection and maintenance depends to some degree on the cleanliness of the surroundings. Cleaning and preventive measures are a part of any good maintenance program. Plant operating and local conditions can vary to such an extent that the actual schedule should be tailored to the conditions. When the equipment is subject to a clean and dry environment, cleaning is not required as frequently as when the environment is humid with a significant amount of dust and other foreign matter.

It is recommended that maintenance record sheets be completed for the equipment. Careful and accurate documentation of all maintenance activities provides a valuable historical reference on equipment condition over time.

General Cleaning Recommendations

Circuit breaker cleaning activities should be a part of an overall activity that includes the assembly in which the circuit breaker is installed. Loose dust and dirt can be removed from external surfaces using an industrial quality vacuum cleaner and/or lint free cloth. Unless otherwise indicated, never use high pressure blowing air, since dirt or foreign objects can be driven into areas, such as the breaker mechanism, where additional friction sources could create problems. Never use a wire brush to clean any part of the circuit breaker.

When To Inspect

Do not wait for specific scheduled periods to visually inspect the equipment, if there are earlier opportunities. If possible, make a visual inspection each time a circuit breaker compartment door is opened, and especially when a circuit breaker is withdrawn on its compartment extension rails. This preventive measure could help to avoid future problems.

Industry standards for this type of equipment recommend a general inspection and lubrication after the number of operations listed in Table 12 of this section. This should also be conducted at the end of the first six months of service, if the number of operations has not been reached.

Table 12. Inspection Frequency

<table>
<thead>
<tr>
<th>Breaker Frame Size</th>
<th>Interval (Breaker Cycles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 amperes and below</td>
<td>1750</td>
</tr>
<tr>
<td>Between 800 and 3000 amperes</td>
<td>500</td>
</tr>
<tr>
<td>3000 amperes and above</td>
<td>250</td>
</tr>
</tbody>
</table>

Breaker Cycle = one no load open/close operation

After the first inspection, inspect at least once a year. If these recommended inspections show no maintenance requirements, the period may be extended to a more economical point. Conversely, if the recommended inspection shows, for instance, a heavy accumulation of dirt or other foreign matter that might cause mechanical, insulation or other electrical damage, the inspection and maintenance interval should be decreased.
What To Inspect

What to inspect and to what extent is dictated by the nature of the maintenance function. Routine inspections require one type of observation. Inspections following a known high level fault require more detailed inspections.

A drawout type circuit breaker should first be withdrawn from its compartment onto the compartment’s extension rails. When the inspection is complete, the circuit breaker can be levered to the TEST position to check the electrical operations of the circuit breaker.

During the leveraging out and leveraging in of the circuit breaker, be aware for any signs that would indicate that this process is not working properly.

During the inspection of fixed type circuit breakers, bus systems supplying the fixed circuit breakers should be de-energized for convenience and safety.

For functional testing of the trip unit, refer to the separate detailed instruction book dedicated to the trip unit.

Once the circuit breaker has been cleaned as described on the previous page, visually inspect it for any signs of damage, missing or loose parts and unusual wear. Be especially alert for foreign matter that must be removed. On drawout circuit breakers, inspect the primary disconnect finger clusters for signs of wear and erosion. Make appropriate corrections to anything found out of order.

Table 13. Field Service Tool List

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Where Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm 1/4-inch drive socket</td>
<td>All 6 mm bolts</td>
</tr>
<tr>
<td>1/4-inch universal</td>
<td>Mechanism mounting</td>
</tr>
<tr>
<td>1/4-inch 6-inch drive extension</td>
<td>As needed</td>
</tr>
<tr>
<td>10 mm combination wrench</td>
<td>Primary disconnects</td>
</tr>
<tr>
<td>1/4-inch drive ratchet</td>
<td>As needed</td>
</tr>
<tr>
<td>3/8-inch drive ratchet</td>
<td>As needed</td>
</tr>
<tr>
<td>3/8-inch 17 mm socket</td>
<td>Load conductors</td>
</tr>
<tr>
<td>3/8-inch 6-inch extension</td>
<td>Levering-in</td>
</tr>
<tr>
<td>17 mm combination wrench</td>
<td>Load conductors</td>
</tr>
<tr>
<td>3/8 drive 8 mm or 5/16 long ball driver</td>
<td>Line conductor/arc runner</td>
</tr>
<tr>
<td>AMP extraction tool 4051B3</td>
<td>Secondary contacts</td>
</tr>
<tr>
<td>AMP extraction tool #4058222-2</td>
<td>Current sensors/shunt trip</td>
</tr>
<tr>
<td>#3 Pozzi-drive screwdriver</td>
<td>Levering-in</td>
</tr>
<tr>
<td>#2 Philips screwdriver</td>
<td>As needed</td>
</tr>
<tr>
<td>#1 Philips screwdriver</td>
<td>As needed</td>
</tr>
<tr>
<td>Long (8-inch) 3/16-inch straight blade screwdriver</td>
<td>Motor operator installation</td>
</tr>
<tr>
<td>7/16-inch combination or adj. wrench</td>
<td>Motor operator stand-off installation</td>
</tr>
<tr>
<td>1/4-inch straight blade screwdriver</td>
<td>Rating plug</td>
</tr>
<tr>
<td>Pocket size, straight blade screwdriver</td>
<td>Trip unit setting</td>
</tr>
<tr>
<td>Eaton test kit and adapter</td>
<td>Digitrip trip unit</td>
</tr>
</tbody>
</table>

It will also be necessary to have a full compliment of standard field service tools available including, pliers, cutters, soldering tools, multi-meter, and so on.

Functional Field Testing

**NOTICE**

BEFORE DOING ANY WORK ON DRAWOUT TYPE CIRCUIT BREAKERS, MAKE SURE THE BREAKER IS LEVERED OUT TO THE TEST OR DISCONNECT POSITION. DURING THE LEVERING OUT AND LEVERING IN OF THE CIRCUIT BREAKER, BE AWARE OF ANY SIGNS THAT WOULD INDICATE THAT THE LEVERING PROCESS IS NOT WORKING PROPERLY. IF WORKING ON A FIXED CIRCUIT BREAKER, BUS SYSTEMS SHOULD BE DE-ENERGIZED FOR CONVENIENCE AND SAFETY. THE CIRCUIT BREAKER SHOULD BE SWITCHED TO THE OFF POSITION AND THE MECHANISM SPRINGS DISCHARGED.

Eaton Cutler-Hammer recommends that the following functional tests be performed on Magnum circuit breakers as part of any maintenance procedure. The circuit breaker should be removed from service and Cutler-Hammer notified if the circuit breaker fails to perform any of these tests successfully. Please be prepared to provide the number of operations the circuit breaker has to date as well as the following nameplate information (Figure 88):

![Figure 88. SB Nameplate](#)

A. Low voltage power circuit breaker family name  
B. Breaker family designation number  
C. Breaker frame size in amperes  
D. Interrupting capacity rating  
E. Factory Equipped Accessories
Manual Operation Functional Test

Charge the breaker mechanism springs either using the charging handle or the motor operator. Press the ON pushbutton to close the breaker manually and verify closing by noting the state of the indicating flag. Charge the breaker mechanism springs either using the charging handle or the motor operator. If using the motor operator, disconnect power to it to prevent automatic recharging. Press the OFF pushbutton to manually open the breaker. Press the ON pushbutton to manually close the breaker. Is the breaker closed? Press the OFF pushbutton to manually open the breaker. Is the breaker open? Repeat this entire described test procedure three times.

Electrical Operation Functional Test

This test procedure is based on the assumption that the breaker is equipped with optional shunt trip, UVR, and/or spring release accessories. If one accessory is missing, substitute the manual button to replace the accessory’s function.

Charge the breaker mechanism springs either using the charging handle or the motor operator. Close the breaker by applying rated voltage to the spring release accessory and verify closing by noting the state of the indicating flag. Charge the breaker mechanism springs either using the charging handle or the motor operator. If using the motor operator, disconnect power to it to prevent automatic recharging. Open the breaker by applying rated voltage to the shunt trip accessory or removing power from undervoltage release. Close the breaker using the spring release accessory. Is the breaker closed? Open the breaker using the shunt trip or undervoltage release. Is the breaker open? Repeat this entire described test procedure three times.

Trip Unit Overload Functional Test

An overload simulation for trip unit functional testing can be achieved by using one of the following test methods:

1. Hand-Held Functional Test Kit: Catalog Ordering Number MTST230V.
3. Digitrip 1150 models include an integral functional tester (see corresponding instruction manual for Magnum 1150 trip units).

Charge the breaker mechanism springs either using the charging handle or the motor operator. Press the ON pushbutton to close the breaker manually and verify closing by noting the state of the indicating flag. Charge the breaker mechanism springs either using the charging handle or the motor operator. If using the motor operator, disconnect power to it to prevent automatic recharging. Trip the breaker with a trip unit test. Verify that the trip indicator pop out button (if so equipped) is “out” and then reset it. Press the ON pushbutton to manually close the breaker. Is the breaker closed? Trip the breaker with a trip unit test. Verify that the trip indicator pop out button (if so equipped) is “out” and then reset it. Repeat this entire described test procedure three times. Reset the blinking red cause of trip LED on the trip unit by pressing the Reset/Battery Test pushbutton.

Arc Chute Inspection

When a circuit breaker experiences a high level fault or during regularly scheduled maintenance periods, the circuit breaker’s arc chutes and arc chambers should be inspected for any kind of damage or dirt. Be especially alert for signs of significant erosion of the V-shaped plates inside the arc chute.

Arc chutes fit inside the arc chambers and down over a primary contacts. Each arc chute is held in place by either 1 (SB) or 4 (SBSE) top inserted screws (Figure 89 shows SBS). Begin by removing the arc chute screws and all three arc chutes. Turn each arc chute upside down to visually inspect the inside (Figure 90).

Since the arc chutes are removed, this is an ideal time to inspect primary contacts for wear using the circuit breaker’s contact wear indicators. The details associated with primary contact inspection are presented in the next paragraph.
### WARNING

**ARC CHUTES MUST ALWAYS BE SECURED PROPERLY IN PLACE BEFORE A CIRCUIT BREAKER IS INSTALLED IN A CIRCUIT BREAKER COMPARTMENT. FAILURE TO DO THIS COULD RESULT IN EQUIPMENT DAMAGE, BODILY INJURY OR EVEN DEATH.**

When the inspections are complete, position each arc chute down over its respective set of primary contacts, and secure in place with the screw removed earlier. Torque the arc chute screws to 35 to 45 in-lb.

**Primary Contact Inspection**

With the arc chutes removed, visually inspect each primary contact structure for signs of wear and/or damage. The primary contacts with the circuit breaker open can be viewed by looking directly down into the arc chamber (Figures 91 and 92).

A contact wear indicator is provided for each primary contact and indicates whether or not the contact should be replaced. Inspection of the contacts using the contact wear indicators is conducted only with the circuit breaker closed (Figures 93).

### NOTICE

**WHEN MAKING A CONTACT WEAR INSPECTION, ALWAYS MAKE THE INSPECTION BY LOOKING STRAIGHT DOWN INTO THE ARC CHAMBER FOR THE PROPER PERSPECTIVE. VIEWING THE CONTACT WEAR AREA FROM AN ANGLE COULD DISTORT THE VIEW.**
The contact wear indicator is the relative position of the individual contact fingers to a narrow, side-to-side ledge inside the arc chamber. The ledge is actually part of the arc chamber. When the circuit breaker is closed and the contacts are in good condition, the narrow ledge is covered by the back end of the contacts (Figure 93). If the back end of the contacts do not totally cover the ledge, the contacts should be replaced.

**WARNING**

ARC CHUTES MUST ALWAYS BE SECURED PROPERLY IN PLACE BEFORE A CIRCUIT BREAKER IS INSTALLED IN A CIRCUIT BREAKER COMPARTMENT. FAILURE TO DO THIS COULD RESULT IN EQUIPMENT DAMAGE, BODILY INJURY OR EVEN DEATH.

Once the inspection is complete, be sure the arc chutes are properly replaced as previously described on this page.

![Figure 93. Use of Contact Wear Indicator with Circuit Breaker Closed](image)

**Breaker Frame Inspection**

The breaker frame and wiring should be inspected for nicked wires, for cracks in plastic parts, and for loose screws. Screws or bolts should be tightened to levels outlined in Table 14. Loose screws inserted into plastic parts will require thread-locking compound (such as Loctite 242). All nicked wiring should be replaced.
Table 14. Magnum Breaker Torque List

<table>
<thead>
<tr>
<th>Subassembly</th>
<th>lb-in</th>
<th>Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc chute</td>
<td>35-45</td>
<td>3.95-5.08</td>
</tr>
<tr>
<td>Front cover</td>
<td>25-35</td>
<td>2.82-3.95</td>
</tr>
<tr>
<td>Rating plug</td>
<td>Hand tight</td>
<td>Hand tight</td>
</tr>
<tr>
<td>Rear housing</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Line conductor (internal)</td>
<td>100-150</td>
<td>11.30-16.95</td>
</tr>
<tr>
<td>Load conductor (internal)</td>
<td>100-150</td>
<td>11.30-16.95</td>
</tr>
<tr>
<td>Levering-in to mech bolt</td>
<td>Hand tight</td>
<td>Hand tight</td>
</tr>
<tr>
<td>Motor operator</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Poleshaft bearing plates</td>
<td>110-130</td>
<td>12.43-14.69</td>
</tr>
<tr>
<td>Current sensor cover screws</td>
<td>18-22</td>
<td>2.03-2.49</td>
</tr>
<tr>
<td>Fixed mount foot bolts</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Primary disconnect</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Trip unit mounting deck</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Trip unit mounting plate</td>
<td>18-22</td>
<td>2.03-2.49</td>
</tr>
<tr>
<td>Secondary bracket</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Reject bracket</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Mechanism mounting</td>
<td>75-85</td>
<td>8.47-9.60</td>
</tr>
<tr>
<td>Terminal adapters</td>
<td>444-516</td>
<td>50.17-58.30</td>
</tr>
</tbody>
</table>

Breaker Mechanism Inspection

Torque values of mechanism and motor mounting hardware should be inspected for accuracy. Refer to Table 14 for the correct values. Next, inspect all sliding rolling parts for clean and adequate lubrication. Refer to Table 15 and Figure 94 through Figure 101.

Table 15. Greases Used on Magnum

<table>
<thead>
<tr>
<th>Grease Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnalube</strong>-G</td>
<td></td>
</tr>
<tr>
<td>Eaton standards</td>
<td>#53701AI</td>
</tr>
<tr>
<td>Color</td>
<td>Green</td>
</tr>
<tr>
<td>Manufactured by</td>
<td>Saunders Enterprises Inc.</td>
</tr>
<tr>
<td></td>
<td>11-51 44th Road, Long Island City, New York 11101</td>
</tr>
<tr>
<td></td>
<td>Phone (718) 729-1000</td>
</tr>
<tr>
<td></td>
<td>Fax (718) 723-2990</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.magnalube.com">www.magnalube.com</a></td>
</tr>
<tr>
<td><strong>Molykote</strong></td>
<td></td>
</tr>
<tr>
<td>Eaton Standards</td>
<td>#53701QB</td>
</tr>
<tr>
<td>Color</td>
<td>Black</td>
</tr>
<tr>
<td>Manufactured by</td>
<td>Dow Corning Corporation</td>
</tr>
<tr>
<td></td>
<td>Midland, Michigan 4866-0994</td>
</tr>
<tr>
<td></td>
<td>(888) 636-1000</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.dowcorning.com/content/molykote/">www.dowcorning.com/content/molykote/</a></td>
</tr>
</tbody>
</table>

Figure 94. Magnum DS Lubrication

Figure 95. Magnum DS Lubrication
Figure 96. Magnum DS Lubrication (Not applicable to Fixed-Mount Breakers)

Figure 97. Magnum DS Lubrication

Figure 98. Magnum DS Lubrication

Figure 99. Magnum DS Lubrication
Circuit Breaker Modifications And Changes

The topics discussed here will relate to those actions that can be taken in the field to change, update, maintain or repair a Magnum SB circuit breaker. This information does not, however, include most accessory devices. Their installation is covered by separate instruction leaflets dedicated to the individual devices. The tasks described here do not, under ordinary circumstances, require any assistance beyond the appropriate instructional material. If further assistance is required, however, contact your Eaton representative.

Rating Plug Replacement

Note: If a rating plug is not installed in the trip unit, the trip unit will trip when energized. Also remember that the trip unit’s rating plug and the circuit breaker’s current sensors must have matching ratings.

To remove the rating plug from the trip unit, open the small rating plug door located on the right side of the trip unit (Figure 102). The trip unit’s battery cavity is also located behind this door. Use a 1/8” wide screwdriver to remove the M4 screw holding the rating plug in position. Pull the door to release the rating plug from the trip unit.

To install a new rating plug, insert the rating plug into the cavity where the other rating plug was removed. Make sure the three pins on the rating plug are aligned with the sockets in the cavity. The rating plug should fit with a slight insertion force.

**CAUTION**

TO PREVENT DAMAGE TO THE RATING PLUG, DO NOT FORCE IT INTO THE MOUNTING CAVITY.

Use the same 1/8” screwdriver to tighten the M4 screw and secure the rating plug in the trip unit. The maximum torque on the mounting screw is 15 in-oz. Close the rating plug door.
Current Sensor Replacement

**NOTICE**

**REMEMBER THAT THE TRIP UNIT’S RATING PLUG AND THE CIRCUIT BREAKER’S CURRENT SENSORS MUST HAVE MATCHING RATINGS.**

The three current sensors are installed at the rear of the circuit breaker on the lower terminals. A cover with sensor rating viewing windows covers the sensors and is held in place with screws (Figure 103). Remove the cover by removing the screws.

The current sensors are removed by pulling them off of the terminals and unplugging the wiring plugs from the sensors (Figure 104).

Install new current sensors by connecting the wiring plugs to the sensors and sliding the sensors over the terminals. Reinstall the cover over the sensors and secure in place with the screws previously removed.

Reinstall the previously removed vertical adaptors to the terminals using the removed hardware and 40 ft-lb of tightening torque. Make sure the vertical adaptors are square to the rear housing. Slip the primary disconnects on to the vertical adaptors. Make sure the primary disconnects are fully inserted on to the vertical adaptors. Tighten the two retention bolts to 40 in-oz of torque. Properly engaged and secured retention bolts should engage the slots or holes in the vertical adaptors.

If the circuit breaker is a drawout configuration, the lower primary disconnect finger clusters and the vertical adaptors must first be removed from frame sizes up to 3000A. On the 3000A frame, both the upper and lower primary disconnects and vertical adaptors must be removed. Each primary disconnect finger cluster is removed by loosening the two hex-head bolts with a 10 mm wrench. These bolts do not have to be completely removed to slide the primary disconnects off of the terminals. Remove the vertical adaptors next from the circuit breaker terminals by removing the two or three 10 mm bolts holding them in place (Figure 104).
### Section 7: Troubleshooting

#### Introduction

Table 16 will help determine the probable causes of simple circuit breaker problems and possible corrective actions. Possible problems associated with the electronic trip unit are covered in companion publications, IL70C1037H05 and IL70C1036H06. If the problem cannot be resolved with the aid of one or both of these guides, contact the Cutler-Hammer service center for more in-depth assistance.

#### Table 16. Circuit Breaker Troubleshooting Guide

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable Cause</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The circuit breaker trips open (red fault indicator button is out and/or fault indicator LED is lighted) when closed on a load current</td>
<td>Rating plug not installed and load current through the breaker</td>
<td>Install rating plug that corresponds to current sensors</td>
</tr>
<tr>
<td>Repeated closing on transient (in-rush) current with thermal memory active</td>
<td>Wait for circuit breaker (and loads) to cool before re-closing</td>
<td>Use status and fault indicators to help locate and remove overload or fault condition</td>
</tr>
<tr>
<td>An overload or fault current condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker opens (fault indicator button is not out)</td>
<td>Undervoltage release operates; voltage too low or zero</td>
<td>Check and correct the UVR supply voltage (85-110% rated voltage)</td>
</tr>
<tr>
<td>Shunt trip operates</td>
<td>Check control signal(s) to shunt trip, correct if necessary</td>
<td></td>
</tr>
<tr>
<td>Trip latch is defective</td>
<td>Inspect latch condition and engagement before closing; consult Cutler-Hammer service center</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker cannot be opened remotely (can be closed locally)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker cannot be opened remotely, but can be opened locally</td>
<td>Shunt trip control signal absent or too low</td>
<td>Check supply voltage exceeds 70% of rated voltage when signal is applied to shunt trip</td>
</tr>
<tr>
<td>Shunt trip is faulty or improperly installed</td>
<td>Remove front cover; check voltage supplied to shunt trip; make sure shunt trip is seated and retention snapped into place. Check for shunt trip motion; replace shunt trip if faulty</td>
<td></td>
</tr>
<tr>
<td>Secondary contact wiring problem</td>
<td>Make sure electrical pin and socket connectors are properly seated in molded plug. Verify proper wiring</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker cannot be opened locally</td>
<td>OPEN pushbutton locked</td>
<td>Remove lock</td>
</tr>
<tr>
<td>Faulty mechanism or main contacts welded</td>
<td>Contact Cutler-Hammer service center</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker does not recharge electrically but will recharge manually</td>
<td>Charging motor supply voltage absent or too low (&lt;85%)</td>
<td>Check charging motor electrical circuit voltage (check under load)</td>
</tr>
<tr>
<td>Circuit breaker does not fully enter cell (cell rejection code plate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker rating plug not lever-in</td>
<td>Levering-in screw not in fully DISCONNECT position at insertion</td>
<td></td>
</tr>
<tr>
<td>Levering-in screw in DISCONNECT position but not pushed in far enough</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective boots covering stationary disconnects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shutter jammed or locked</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker makes no attempt to close with either local (manual) or remote controls; springs do not discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closing spring not fully charged (check SPRING CHARGED indicator)</td>
<td>Charge spring manually; check voltage to electrical operator; replace electrical operator if faulty</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker locked in OPEN position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Make sure that circuit breaker is at a position that permits closure; door is open check that shutter (door) over the levering screw is fully closed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker interlocked with another circuit breaker or device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit breaker cannot be closed locally</td>
<td>Circuit breaker cannot be closed remotely (can be closed locally)</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker cannot be closed locally (but can be closed remotely)</td>
<td>Opening and/or closing pushbuttons locked</td>
<td>Check reason for lock</td>
</tr>
<tr>
<td>Unplug undervoltage release from mounting deck and retry closing operation; if OK, check voltage supply to undervoltage release (&gt;85%); replace undervoltage release if faulty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charge spring manually; check voltage to electrical operator; replace electrical operator if faulty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear Digitrip 1150 relay contact</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Section 8: Renewal Parts

General

All renewal parts and/or spare parts recommendations for Type Magnum SB Circuit Breakers are supplied in separate Renewal Parts Documentation, not this instruction manual. Refer to the most recent version of this documentation for specific assistance.

When ordering parts, always specify, if known, the part name and style number. If the style number is not known, it would help to refer to a pictorial and/or graphic reference. Also include the circuit breaker type, General Order number and other information as shown on the nameplate on the front cover of the circuit breaker (Figures 2 and 20).

Some detailed parts shown in the figures in this manual may only be available as a part of a sub-assembly. Certain parts may not be available at all for field installation. Some parts in the figures are illustrated just to show their function and location in the assembly. The Renewal Parts Documentation indicates which parts are available and in what form. For additional information, visit the Eaton website at www.EatonElectrical.com.
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