Instructional Booklet **IB2C12060H12**

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Magnum low voltage power circuit breakers user manual (DS, DC, DSX, DSL, and MDE)

For use in ANSI/UL applications

Double-wide frame

Standard frame

Double narrow frame

Narrow frame

Powering Business Worldwide

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Purpose

This instructional booklet is expressly intended to cover the installation, operation, and maintenance of Magnum DS® (MDS, MDN, MDE), Magnum DC (DAS, DBS), DSX (MDSX), and Magnum DSL (MDSL) 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. The Magnum DSL circuit breaker can only be supplied as a drawout device. In the case of fixed versions of Magnum DS 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 DS, DSX, and DSL 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 DS, DC, DSX, and DSL circuit breaker accessory items are discussed briefly in this manual. Field installation instructions for such items, however, are covered in individual instructional leaflets specific to the accessory. This information is also available from the Eaton website at www.eaton.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 ENSURE THAT PERSONNEL ARE ALERT TO WARNINGS. IN ADDITION, CAUTIONS ARE ALL UPPER CASE AND BOLDFACE.

All possible contingencies that may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding the particular installation, operation, or maintenance of particular equipment, contact the local Eaton representative.

Section 1: Introduction

General information

The Magnum DS, DC, and DSX power circuit breakers can be fixed or drawout air circuit breakers using an electronic tripping system. The Magnum DSL circuit breaker uses the same tripping system, but is available only in the drawout configuration. MDSL and MDSX versions have current-limiting characteristics as indicated by the "Current Limiting" badge on the front covers. All breakers are designed for use in both switchboard and metal-enclosed switchgear assemblies having maximum voltages of 635 Vac or Vdc for MDS type breakers, 600 Vac for MDSL type breakers, and 480 Vac for MDSX type breakers. Magnum DS circuit breakers are available in three physical frame sizes with continuous current ratings from 800 A through 6000 A, and interrupting capacities from 42 kA to 200 kA. The three MDS physical frame sizes have common height and depth dimensions, differing only in width (**Figure 1**). Magnum DSL circuit breakers are available in one frame size with continuous current ratings from 800 A through 2000 A and an interrupting capacity up to 200,000 A (**Figure 5**). Circuit breaker nameplates provide complete rating information. All Magnum DS, Magnum DC, Magnum DSX, and Magnum DSL circuit breakers are 100% rated, UL® Listed, and are built and tested in an ISO® 9002 certified facility to applicable NEMA®, ANSI, IEEE®, and UL standards (**Table 1** and **Table 3**, **Figure 2**, **Figure 3**, and **Figure 4**).

Magnum circuit breakers use a rigid frame housing of engineered thermoset composite resins that has high-strength structural properties, excellent dielectric characteristics, and arc tracking resistance.

MDS, DAS, DBS, MDSX, and MDSL drawout circuit breakers are 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, MDS, DAS, DBS, MDSX, and MDSL 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.

⚠ NOTICE

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 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.

Figure 1. Family of Magnum DS (MDS) low voltage power fixed and drawout circuit breakers (800–5000 A)

Safety features

Magnum DS, DC, DSX, and DSL 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.

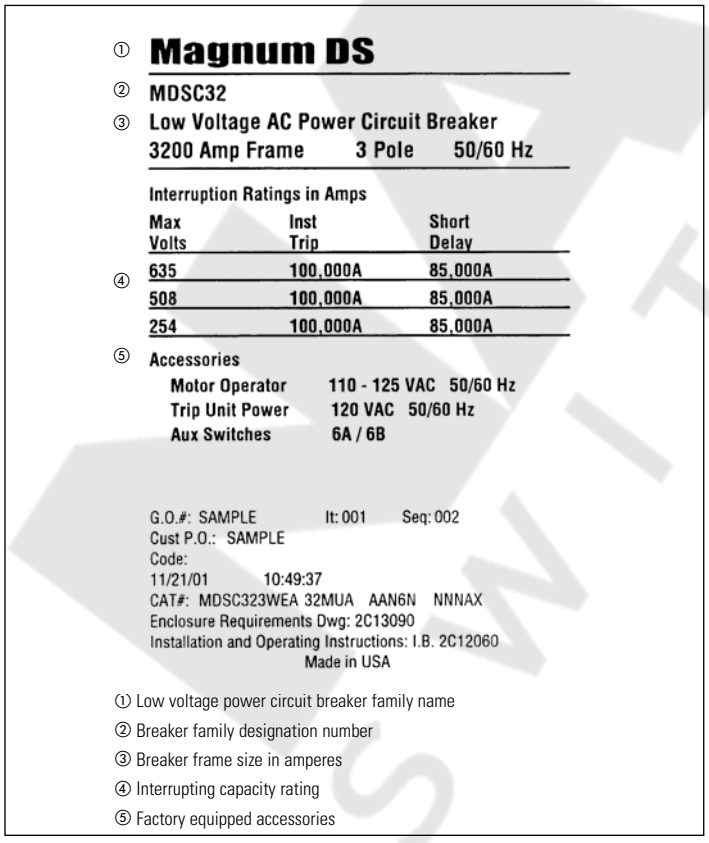


Figure 2. Typical Magnum DS (MDS) nameplate

⚠ WARNING

MAGNUM DS, DC, DSX, AND DSL 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.

Table 1. Magnum DS/DSX ratings at 240, 480, 600 V

Maximum amperes	Breaker designation	Interrupting rating	Short-time rating
800	MDN-408	42 kA	42 kA
	MDN-508	50 kA	50 kA
	MDN-608	65 kA	65 kA
	MDN-C08	100 kA (240 V, 480 V) ①	20 kA
	MDS-X08	200 kA (240 V, 480 V)	30 kA
	MDS-408	42 kA	42 kA
	MDS-508	50 kA	50 kA
	MDS-608	65 kA	65 kA
	MDS-808	85 kA	85 kA
	MDS-C08	100 kA	85 kA
	MDS-H08	130 kA	85 kA
1200	MDN-412	42 kA	42 kA
	MDN-512	50 kA	50 kA
	MDN-612	65 kA	65 kA
	MDN-C12	100 kA (240 V, 480 V) ①	25 kA
	MDS-X12	200 kA (240 V, 480 V) ①	30 kA
	MDS-512	50 kA	50 kA
	MDS-612	65 kA	65 kA
	MDS-812	85 kA	85 kA
	MDS-C12	100 kA	85 kA
	MDS-H12	130 kA	85 kA
1600	MDN-416	42 kA	42 kA
	MDN-516	50 kA	50 kA
	MDN-616	65 kA	65 kA
	MDN-C16	100 kA (240 V, 480 V) ①	30 kA
	MDS-X16	200 kA (240 V, 480 V) ①	30 kA
	MDS-516	50 kA	50 kA
	MDS-616	65 kA	65 kA
	MDS-816	85 kA	85 kA
	MDS-C16	100 kA	85 kA
	MDS-H16	130 kA	85 kA
2000	MDN-620	65 kA	65 kA
	MDN-C20	100 kA (240 V, 480 V) ①	35 kA
	MDS-X20	200 kA (240 V, 480 V)	30 kA
	MDS-620	65 kA	65 kA
	MDS-820	85 kA	85 kA
	MDS-C20	100 kA	85 kA
	MDS-H20	130 kA	85 kA
2500	MDS-X25	200 kA (240 V, 480 V)	50 kA
	MDS-625	65 kA	65 kA
	MDS-825	85 kA	85 kA
	MDS-C25	100 kA	85 kA
	MDS-H25	130 kA	85 kA
3000	MDS-630	65 kA	65 kA
	MDS-830	85 kA	85 kA
	MDS-C30	100 kA	85 kA
3200	MDS-X32, 3N	200 kA (240 V, 480 V)	50 kA
	MDS-632	65 kA	65 kA
	MDS-832	85 kA	85 kA
	MDS-C32	100 kA	85 kA
	MDS-H32	130 kA	85 kA

① For 600 Vac, interrupting rating is 65 kA.

Table 1. Magnum DS/DSX ratings at 240, 480, 600 V (continued)

Maximum amperes	Breaker designation	Interrupting rating	Short-time rating
4000	MDD-X40, X4N	200 kA (240 V, 480 V) ②	100 kA
	MDS-X40	200 kA (240 V, 480 V)	50 kA
	MDS-840, 84N	85 kA	85 kA
	MDS-C40, C4N	100 kA	100 kA
	MDN840, 4N ②	85 kA	85 kA
	MDNC40, 4N ②	100 kA	100 kA
	MDN640, 4N ②	65 kA	65 kA
	MDS-H40, H4N	130 kA	130 kA
5000	MDD-X50, X5N	200 kA (240 V, 480 V) ②	100 kA
	MDS-X50	200 kA (240 V, 480 V)	50 kA
	MDS-850, 85N	85 kA	85 kA
	MDS-C50, C5N	100 kA	100 kA
	MDS-H50, H5N	130 kA	130 kA
	MDN-65N	65 kA	65 kA
	MDN-85N	85 kA (240 V, 480 V) ①	85 kA
	MDN-C5N	100 kA (240 V, 480 V) ①	100 kA
6000	MDD-X60, X6N	200 kA (240 V, 480 V) ②	100 kA
	MDS-860, 86N	85 kA	85 kA
	MDS-C60, C6N	100 kA	100 kA
	MDS-H60, H6N	130 kA	130 kA

① For 600 Vac, interrupting rating is 65 kA.

② For 600 Vac, interrupting rating is 100 kA.

Table 2. Magnum DC switch ratings

Frame rating	Breaker designation	DC voltage / interrupting rating / withstand rating
1600 A	DAS-516	300 V / 50 kA / 50 kA
2000 A	DAS-520	300 V / 50 kA / 50 kA
3200 A	DAS-532	300 V / 50 kA / 50 kA
	DBS	600 V / 50 kA / 50 kA

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 de-energize, clear, and tag circuits in accordance with established safety practices.

Other publications and documentation

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

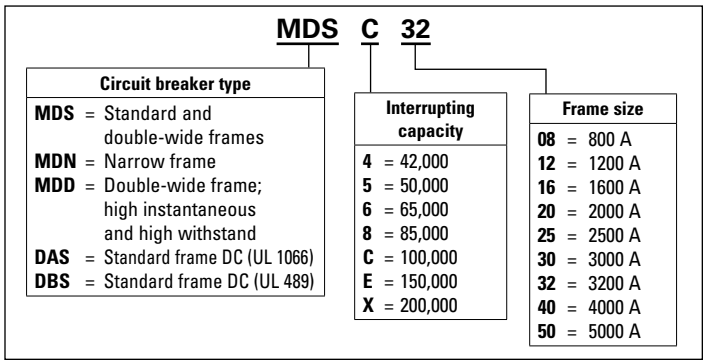


Figure 3. Typical Magnum DS designation example

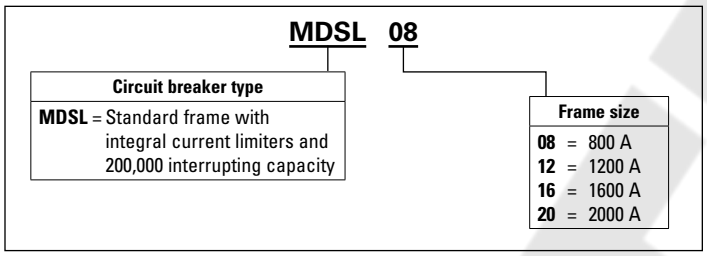


Figure 4. Typical Magnum DSL designation example

Table 3. Magnum DSL ratings at 600 V and below

Breaker designation	Frame size amperes	Max. interrupting rating, rms sym. amp., system voltage 600 or below
MDSL08	800	200,000
MDSL12	1200	200,000
MDSL16	1600	200,000
MDSL20	2000	200,000

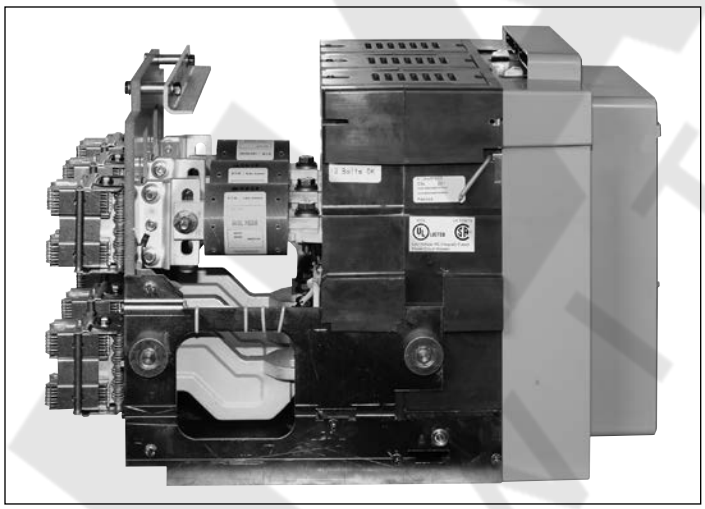


Figure 5. Typical Magnum DSL (MDSL) drawout circuit breaker with integral current limiters

Section 2: Receiving, handling, and installation

General information

Magnum DS, DC, DSX, and DSL power circuit breakers, when supplied as part of an assembly, may be shipped already installed in their respective breaker compartments. Receiving and handling of this equipment is addressed in an assembly instruction manual supplied with the assembled equipment. This instruction manual applies to only the circuit breakers.

Suggested tools

A large number of different tools are not required to properly install and maintain Magnum DS, DC, DSX, and DSL circuit breakers. The following tools are, however, suggested:

- Flat blade screwdriver
- Phillips head screwdriver
- 3/8-inch socket (ratchet) wrench
- 10 mm socket
- 17 mm socket
- Secondary wiring removal tool

Unpacking the circuit breaker

Before beginning to unpack new Magnum 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 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 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 four lag screws (**Figure 6**). Remove the lag screws and clamps. Save the screws and clamps for future shipment of the breaker. On empty cassettes, remove the four or five lag screws and/or machine screws that pass through the floor pan 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 floor pan can be removed.

On fixed breakers, remove the lag screws passing through the mounting feet that hold the breaker to the pallet.

Circuit breakers are designed to be easily lifted from the wooden pallet using an appropriate lifting yoke and overhead or portable lifting device (**Figure 7**).

Figure 6. Shipping clamps for drawout circuit breaker

Figure 7. Magnum DS circuit breaker with lifting yoke attached

Storing the 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.

⚠ NOTICE

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 4**) or on the captive drawout extension rails of the breaker compartment (**Figure 7**). 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 18**). 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 10**, "Installing the drawout circuit breaker."

Table 4. Basic circuit breaker weights

	Weight (lb)					
	Fixed		Drawout		Universal cassette	
Breaker model	Three-pole	Four-pole	Three-pole	Four-pole	Three-pole	Four-pole
MDN-408	95	120	107	136	61	70
MDN-508	95	120	107	136	61	70
MDN-608	95	120	107	136	61	70
MDN-C08	95	120	108	136	61	70
MDS-408	114	141	130	161	117	123
MDS-508	118	146	138	172	117	123
MDS-608	118	146	138	172	117	123
MDS-808	128	160	155	194	117	123
MDS-C08	128	160	155	194	117	123
MDS-H08	150	190	193	245	123	150
MDN-412	95	120	107	136	61	70
MDN-512	95	120	107	136	61	70
MDN-612	95	120	107	136	61	70
MDN-C12	95	120	108	136	61	70
MDS-512	118	146	138	172	117	123
MDS-612	118	146	138	172	117	123
MDS-812	128	160	155	194	117	123
MDS-C12	128	160	155	194	117	123
MDS-H12	150	190	193	245	123	150
MDN-416	95	120	107	136	61	70
MDN-516	95	120	107	136	61	70
MDN-616	95	120	107	136	61	70
MDN-C16	95	120	108	136	61	70
MDS-516	118	146	138	172	117	123
MDS-616	118	146	138	172	117	123
MDS-816	128	160	155	194	117	123
MDS-C16	128	160	155	194	117	123
MDS-H16	150	190	193	245	123	150
MDN-620	95	120	107	N/A	61	70
MDN-C20	95	120	N/A	136	N/A	N/A
MDS-620	128	160	155	194	117	123
MDS-820	128	160	155	194	117	123
MDS-C20	128	160	155	194	117	123
MDS-H20	150	190	193	245	123	150

Table 4. Basic circuit breaker weights (continued)

	Weight (lb)					
	Fixed		Drawout		Universal cassette	
Breaker model	Three-pole	Four-pole	Three-pole	Four-pole	Three-pole	Four-pole
MDS-525	150	190	189	240	123	150
MDS-625	150	190	189	240	123	150
MDS-630	150	190	189	240	123	150
MDS-632	150	190	189	240	123	150
MDS-825	150	190	189	240	123	150
MDS-830	150	190	189	240	123	150
MDS-832	150	190	189	240	123	150
MDS-C25	150	190	189	240	123	150
MDS-H25	150	190	193	245	123	150
MDS-C30	150	190	189	240	123	150
MDS-C32	150	190	189	240	123	150
MDS-H32	150	190	193	245	123	150
MDS-840, 84N	237	319	303	366	199	250
MDS-C40, C4N	237	319	303	366	199	250
MDS-E40, E4N	276	360	343	441	212	266
MDS-H40, H4N	276	360	343	441	212	266
MDS-850, 85N	276	360	343	441	212	266
MDS-860, 86N	276	360	343	441	212	266
MDS-C50, C5N	276	360	343	441	212	266
MDS-H50, H5N	276	360	343	441	212	266
MDS-C60, C6N	276	360	343	441	212	266
MDS-E50, E5N	276	360	343	441	212	266
MDS-E60, E6N	276	360	343	441	212	266
MDS-H60, H6N	276	360	343	441	212	266
MDSL08	N/A	N/A	180	N/A	124	N/A
MDSL12	N/A	N/A	200	N/A	124	N/A
MDSL16	N/A	N/A	200	N/A	124	N/A
MDSL20	N/A	N/A	215	N/A	131	N/A
MDS-X08	169	N/A	210	N/A	140	N/A
MDS-X12	169	N/A	210	N/A	140	N/A
MDS-X16	169	N/A	210	N/A	140	N/A
MDS-X20	169	N/A	210	N/A	140	N/A
MDS-X25	169	N/A	210	N/A	140	N/A
MDS-X32, X3N	169	N/A	210	N/A	140	N/A
MDS-X40, X4N	279	N/A	345	N/A	210	N/A
MDS-X50, X5N	279	N/A	345	N/A	210	N/A
MDD-X60, X6N	279	N/A	345	N/A	210	N/A
MDN-840	177	225	214	271	106	125
MDN-C40	177	225	214	271	106	125
MDN-65N	177	225	295	393	106	125
MDN-85N	177	225	295	393	106	125
MDN-C5N	177	225	295	393	106	125

Table 5. DC switch weights

	Weight (lb)					
	Fixed		Drawout		Universal cassette	
Breaker model	Three-pole	Four-pole	Three-pole	Four-pole	Three-pole	Four-pole
DAS-516	128	160	155	194	N/A	N/A
DAS-520	128	160	155	194	N/A	N/A
DAS-532	150	190	189	240	N/A	N/A
DBS	150	190	189	240	N/A	N/A

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 21**). The sensor rating can be viewed through the viewing windows at the rear of the circuit breaker (**Figure 8**). Sensors and rating plugs can be easily changed as described in Section 7.

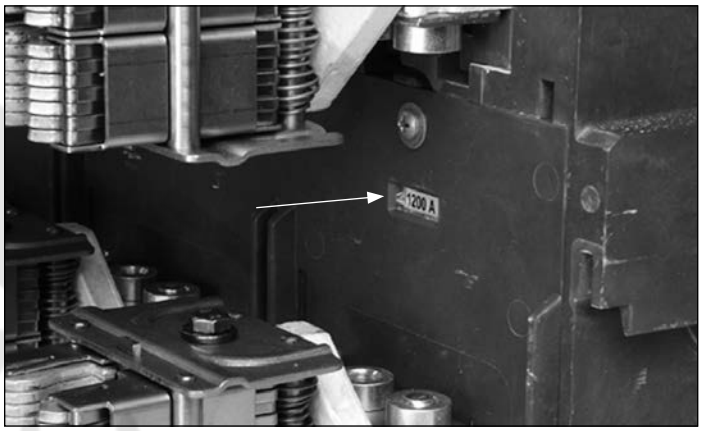


Figure 8. Rear view showing current sensor rating through viewing window

Installing the drawout circuit breaker

In structures equipped for drawout circuit breakers, a bolted-in cassette with movable extension rails supports the circuit breaker (**Figure 7** and **Figure 9**). 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 9**). 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.

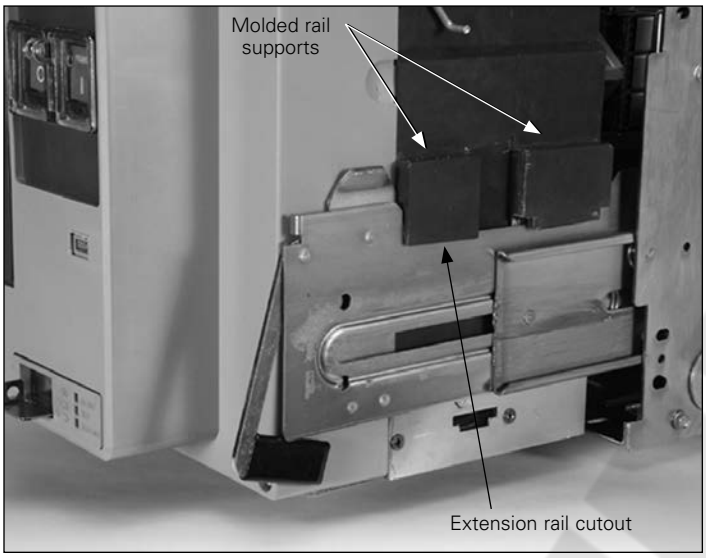


Figure 9. One side of drawout MDS/MDSX circuit breaker properly seated on extension rail

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 that 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 the cassette. The key plate on the circuit breaker is pre-assembled at the factory; but the cassette-side rejection plate and the key pattern must be assembled and installed by the switchboard builder.

⚠ 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 the 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 rejection interlock pins in the cassette in keeping with those outlined in Table 1 of IL2C13863 (for MDN/SBN breakers) and/or Table 1 of IL2C15760 (for MDS/SBS breakers), and the information supplied on the circuit breaker's name-plate. Proceed if the circuit breaker and the cassette are compatible.

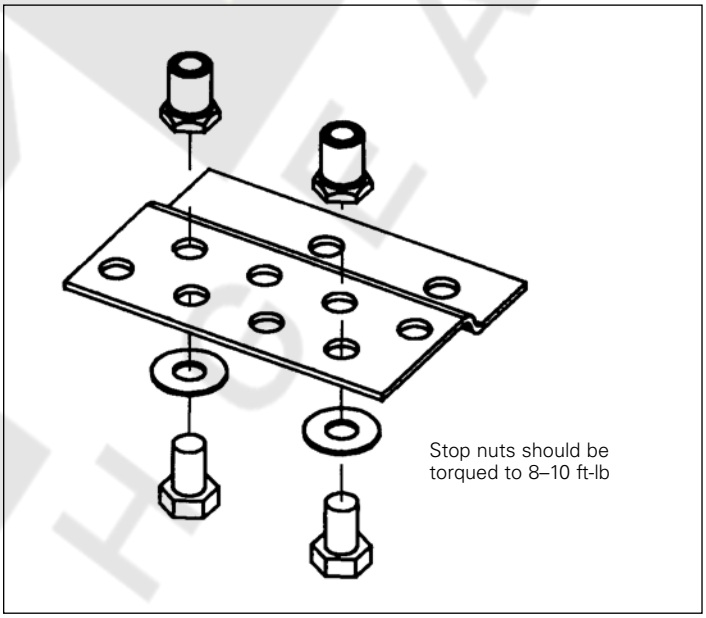


Figure 10. Cassette rejection interlock pin positioning/installation

Circuit breaker positioning

Magnum DS, DSX, and DSL drawout circuit breakers have four normal positions:

- REMOVE (withdrawn) (**Figure 11**)
- DISCONNECT (**Figure 12**)
- TEST (**Figure 13**)
- CONNECT (**Figure 14**)

The REMOVE position is a position outside the compartment on the cassette's drawout rails where the circuit breaker is not engaged with the levering mechanism. The DISCONNECT, TEST, and CONNECT positions are reached by means of the levering mechanism.

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 faceplate should align with the GREEN target line (labeled DISC) on the inside top left wall of the cassette (**Figure 15**).

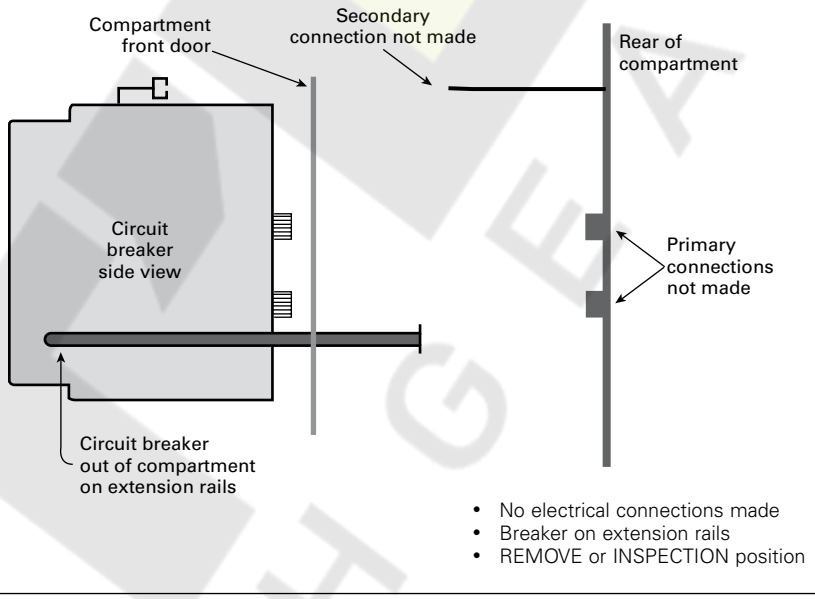


Figure 11. REMOVE position

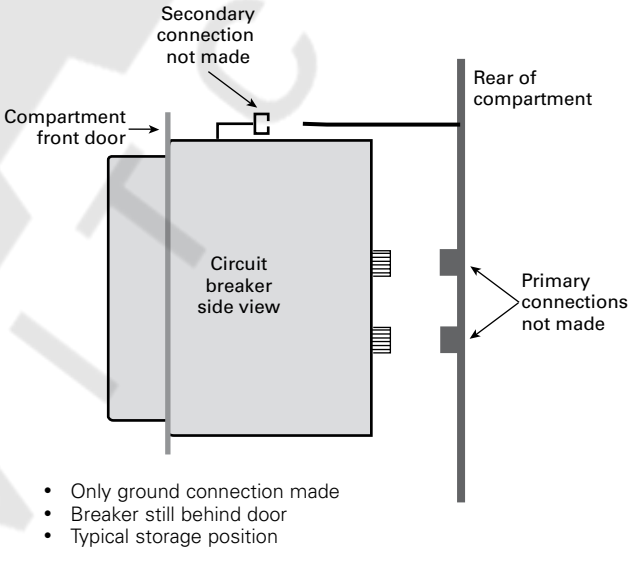
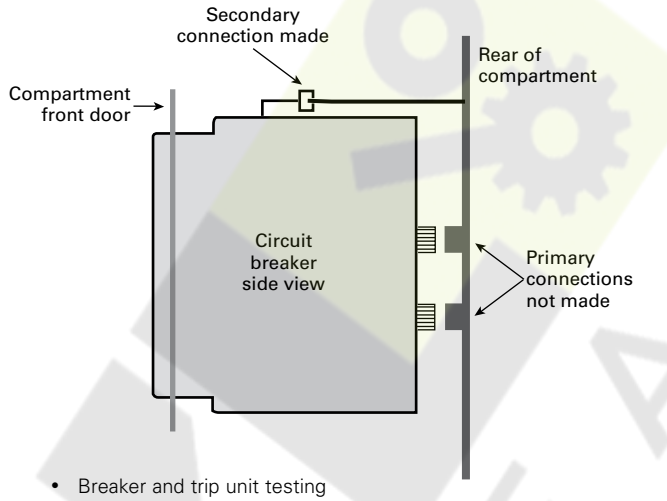
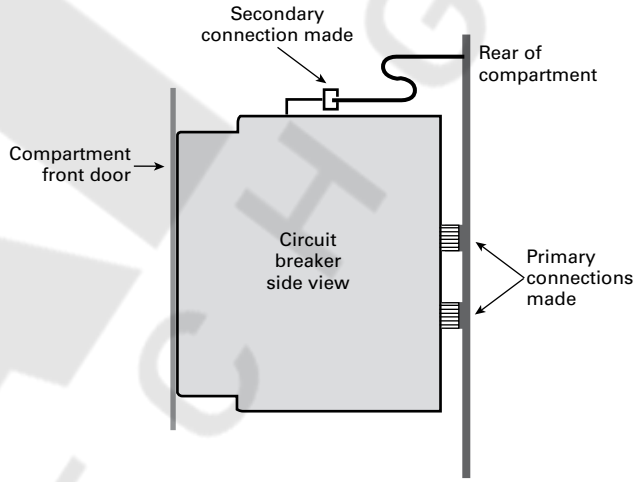


Figure 12. DISCONNECT position



- Breaker and trip unit testing
- Primary connection not made
- Secondary and ground connections made

Figure 13. TEST position



- Full breaker operation
- Primary, secondary, and ground connections made
- Full racked into cassette (compartment)

Figure 14. CONNECT position

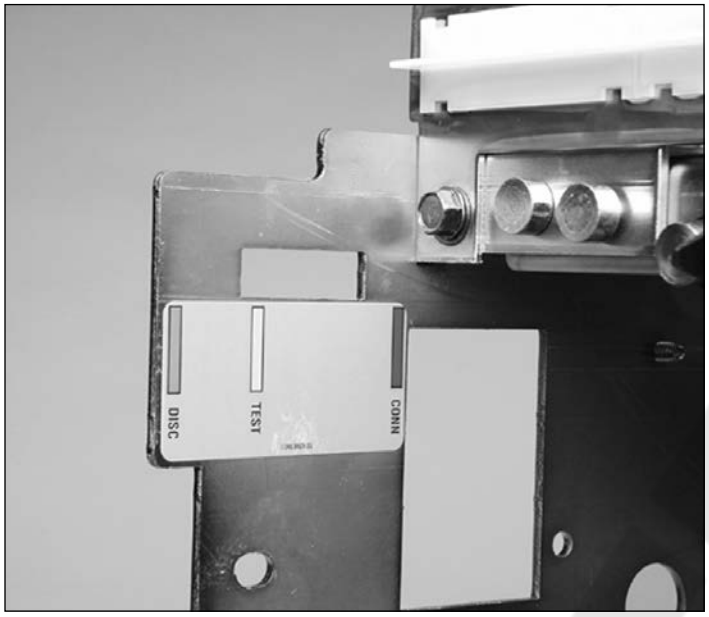


Figure 15. Cassette label showing DISCONNECTED, TEST, and CONNECTED position of recessed cover

Figure 16. Levering position indication

Levering circuit breaker

⚠ CAUTION

MAKE CERTAIN THAT THE CIRCUIT BREAKER IS FULLY INSERTED INTO ITS COMPARTMENT BEFORE ANY ATTEMPT IS MADE TO LEVER THE CIRCUIT BREAKER. ATTEMPTING TO LEVER THE CIRCUIT BREAKER IN BEFORE IT IS FULLY POSITIONED INSIDE ITS COMPARTMENT CAN RESULT IN DAMAGE TO BOTH THE CIRCUIT BREAKER AND THE COMPARTMENT.

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-inch square drive and ratchet, which is not provided (**Figure 16**). 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 the 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) (**Figure 16** and **Figure 22**). To remove the circuit breaker from its compartment, follow the procedure just described using a counterclockwise ratcheting motion.

⚠ NOTICE

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 THE TEST POSITION.

Fixed circuit breaker

The Magnum DS fixed type circuit breaker differs from the drawout version in that it has no levering device, primary disconnects, and secondary disconnects (**Figure 17**). 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.

⚠ WARNING

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

Figure 17. Typical fixed Magnum DS circuit breaker

The MDSX fixed-mounted breaker is shipped with an included arc hood assembly. This assembly is required to be installed on the top of the breaker prior to the unit being placed in service.

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.

The fixed circuit breaker frame has two mounting feet, one on each side, to permit the fixed circuit breaker to be securely mounted. Each mounting foot has two slotted mounting holes that are used to bolt the circuit breaker securely in place. Use either M10 or 3/8-inch bolts for this purpose. Refer to the dimensional drawings referred to in Section 6 (Fixed circuit breakers) for circuit breaker and bus stab dimensions.

⚠ NOTICE

REFER TO THE CIRCUIT BREAKER WEIGHTS IN TABLE 3 TO ENSURE THAT THE PANEL ON WHICH A FIXED CIRCUIT BREAKER IS TO BE MOUNTED IS CAPABLE OF SUPPORTING THE WEIGHT.

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 some later date prior to startup. To check circuit breaker operation, follow the operational procedures outlined in Section 3 for both manually operated and electrically operated circuit breakers.

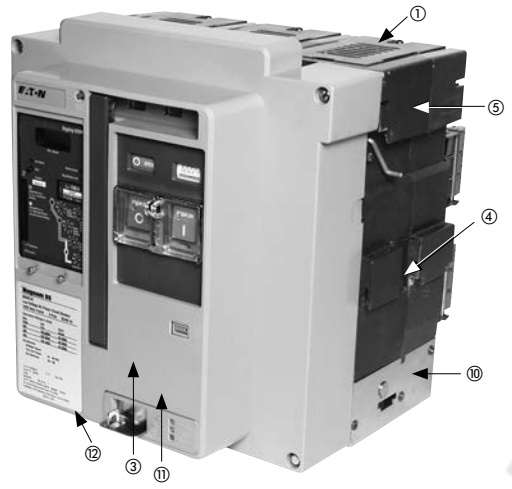
Section 3: Circuit breaker description and operation

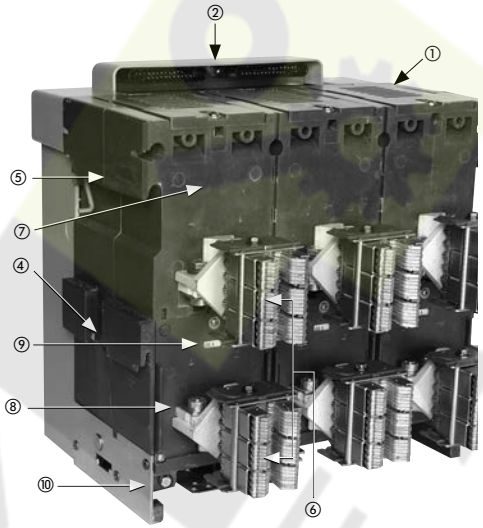
Introduction

Magnum DS (MDS), DC (DAS, DBS), and DSX (MDSX) circuit breakers are available in both drawout and fixed mounting configurations (**Figure 18** and **Figure 19**). Magnum DSL (MDSL) circuit breakers with integral current limiters are available only in a drawout configuration (**Figure 20**). 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 5 and 6 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 to 5000 A. Double-wide DS and DSX frame circuit breakers use 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 21**). For these DS and DSX 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. DS and DSX drawout breakers with differing phase sequence are prevented from insertion into the cassette by properly assembled rejection key plates (see Section 2).

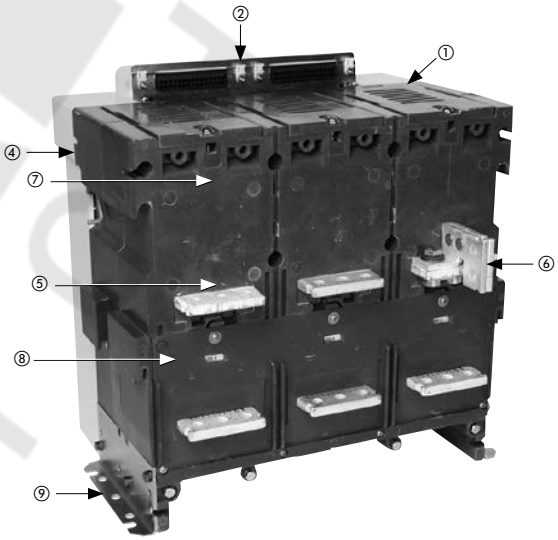
The Magnum DSL (MDSL) drawout circuit breaker is available only in a three-pole single-wide standard configuration. The MDSL is a coordinated combination of a standard Magnum DS circuit breaker and series-connected current limiters. The primary purpose of the current limiters is to extend the interrupting rating of the MDS circuit breaker up to 200,000 A.





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 18. Typical MDS/MDSX drawout circuit breaker features (front and rear views)



① Baffled arc chute cover
② Secondary disconnect
③ Faceplate (front cover)
④ Integral lifting handle
⑤ Fixed horizontal primary terminal
⑥ Fixed primary terminal (with optional vertical adapter)
⑦ Arc chamber
⑧ Sensor rating viewing window
⑨ Mounting foot
⑩ Circuit breaker nameplate

Figure 19. Typical MDS/MDSX fixed circuit breaker features (front and rear views) (MDSX shown without required arc hood)

Figure 20. Typical MDSL drawout circuit breaker features (front and rear views)

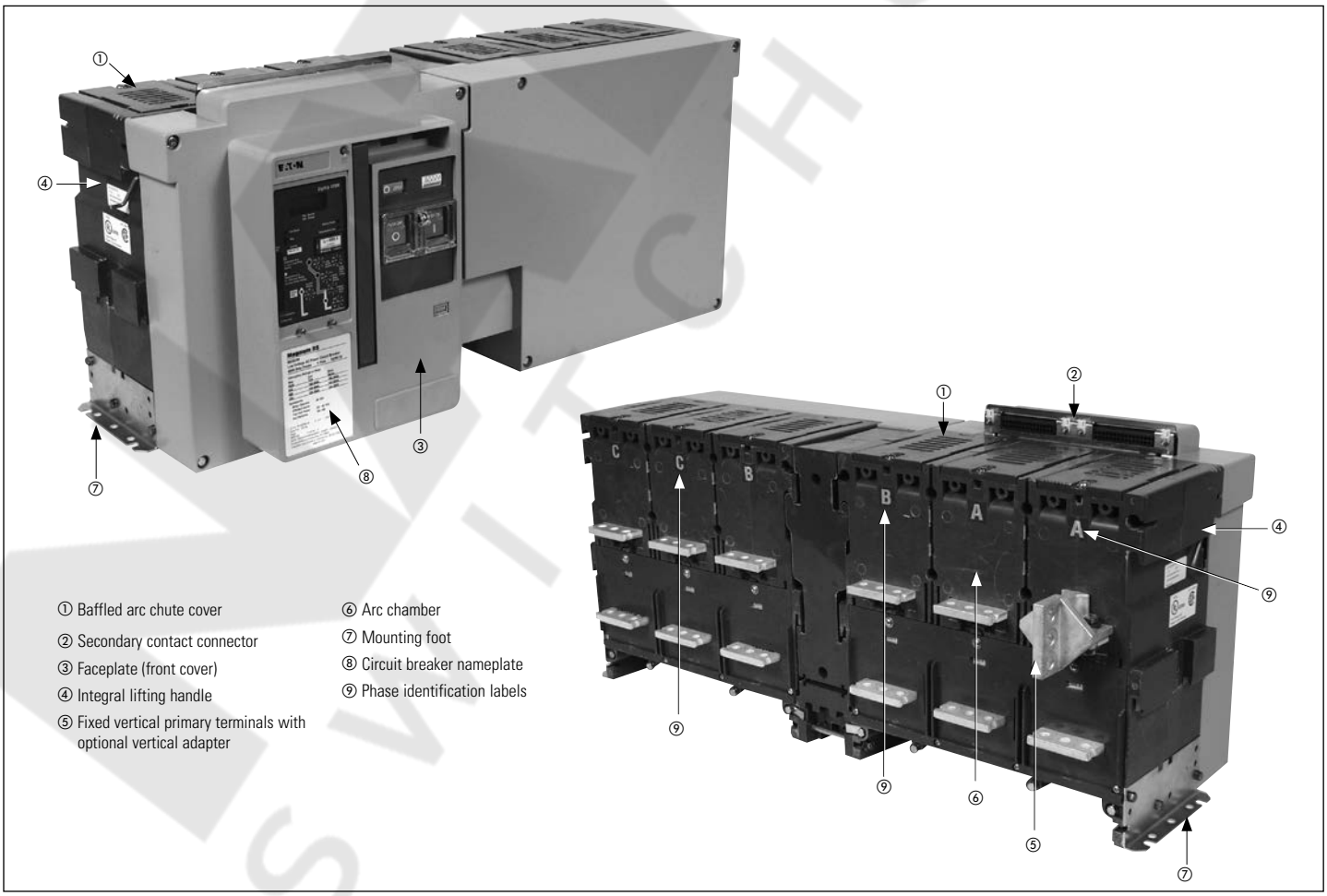


Figure 21. Typical double-wide MDS/MDSX standard frame fixed circuit breaker features (front and rear views) (MDSX shown without required arc hood)

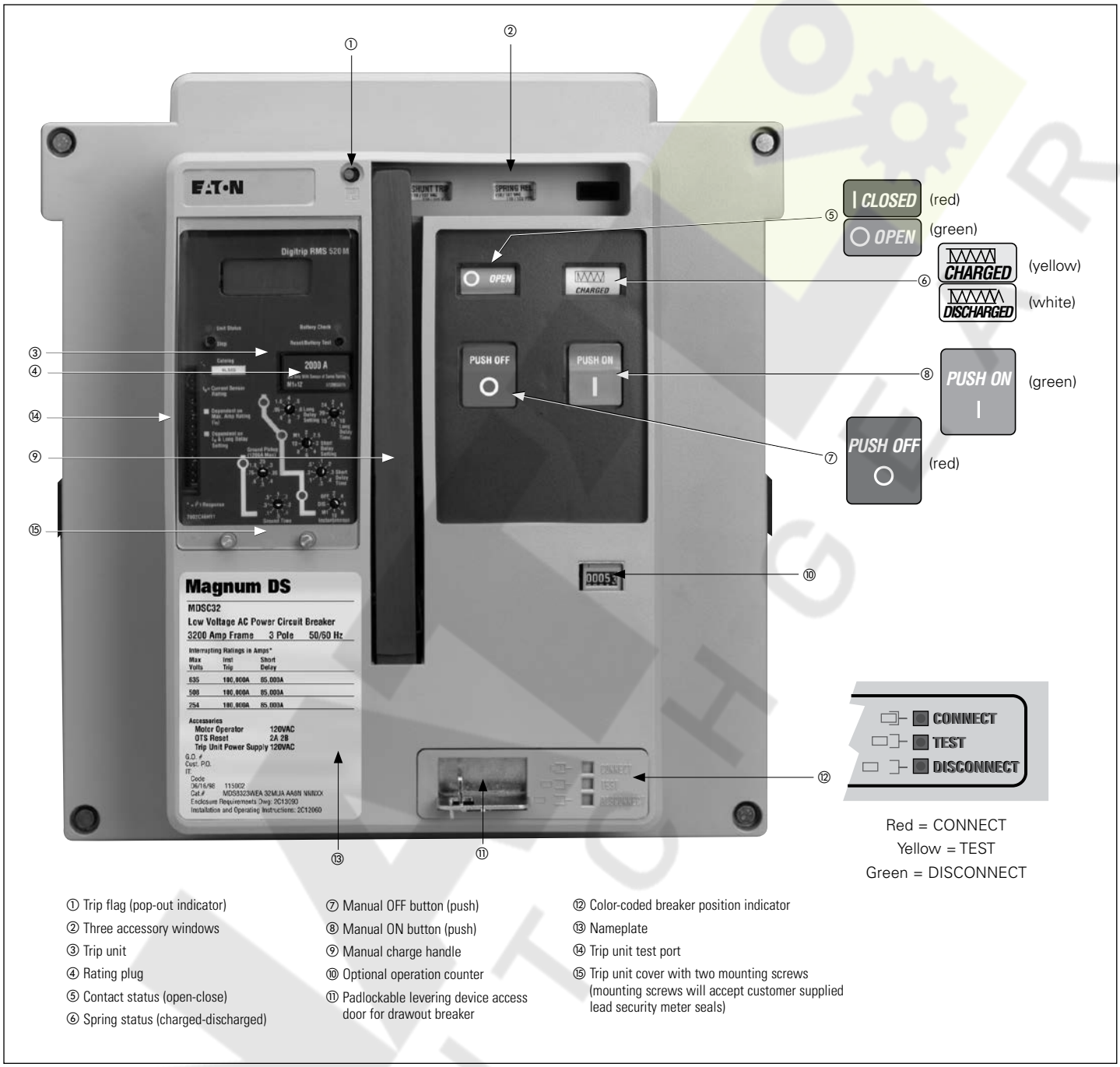


Figure 22. Magnum DS/DSX drawout circuit breaker front cover

MDSL application/operation

MDSL circuit breakers are intended for applications requiring the overload protection and switching functions of air circuit breakers on systems whose available fault currents (1) exceed the interrupting ratings of the circuit breakers alone and/or (2) exceed the withstand and interrupting ratings of downstream circuit components.

The 800 A through 2000 A frame MDSL circuit breakers have integrally mounted limiters on the drawout breaker element. On overloads and faults within the circuit breaker interrupting rating, the circuit breaker protects the limiters. On higher fault currents exceeding the circuit breaker rating, the limiters protect the circuit breaker.

Interlock arrangements trip the circuit breaker whenever any limiter blows. The circuit breaker cannot be reclosed on a live source unless there are three unblown limiters on the circuit. The blown fuse indicator, located on the front of the circuit breaker, provides a visual indication when a current limiter in any phase has interrupted a short circuit. In addition, a blown limiter sensing circuit ensures that a circuit breaker will be tripped when any current limiter has blown, preventing single phasing.

The MDSL circuit breaker must be completely withdrawn from its compartment onto the compartment's extension rails, thus ensuring complete isolation, before the integral current limiters are accessible.

Additional information concerning current limiter ratings, limiter replacement, and blown fuse operation is provided later in this chapter.

Basic circuit breaker assembly

All Magnum 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 three-piece construction approach provides support while isolating and insulating power conductors (**Figure 23**).

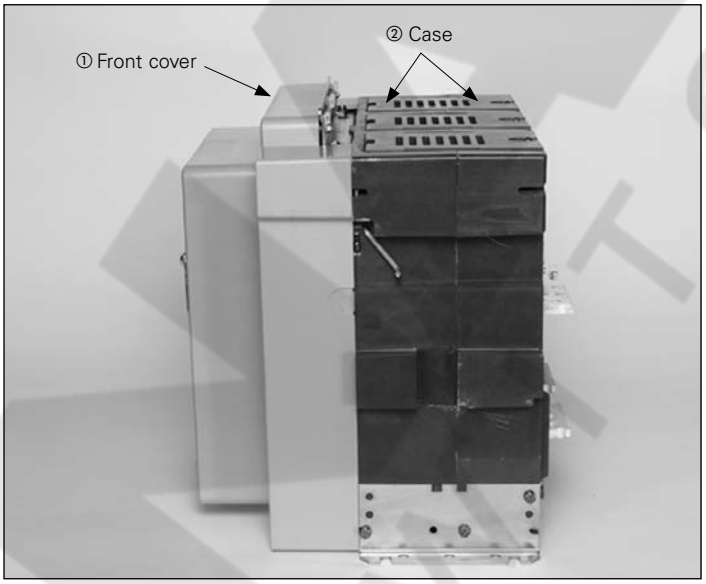


Figure 23. Typical Magnum construction (right side view)

① A two-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 A 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 25**). 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 (**Figure 25** and **Figure 26**). 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 24**). 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, DSX (MDSX) uses an inner and outer carriage design to facilitate a fast opening blow-open contact structure (**Figure 27**). 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.

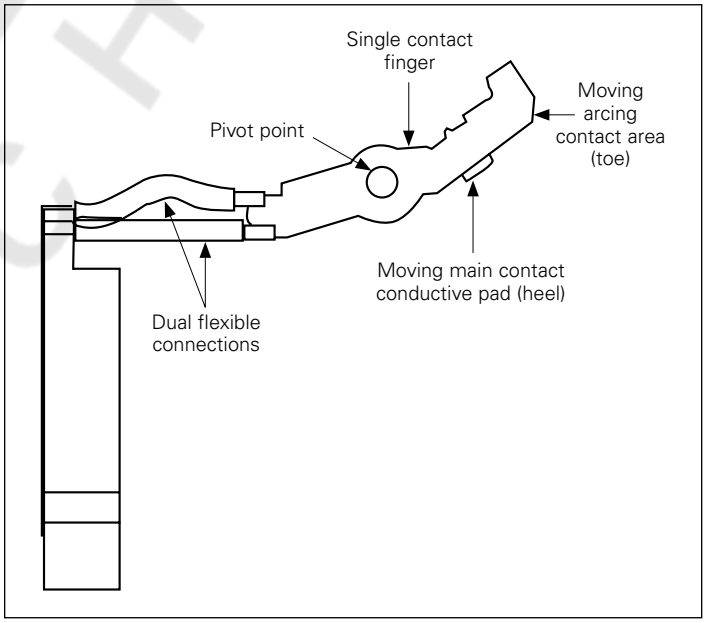


Figure 24. Features of Magnum moving conductor assembly

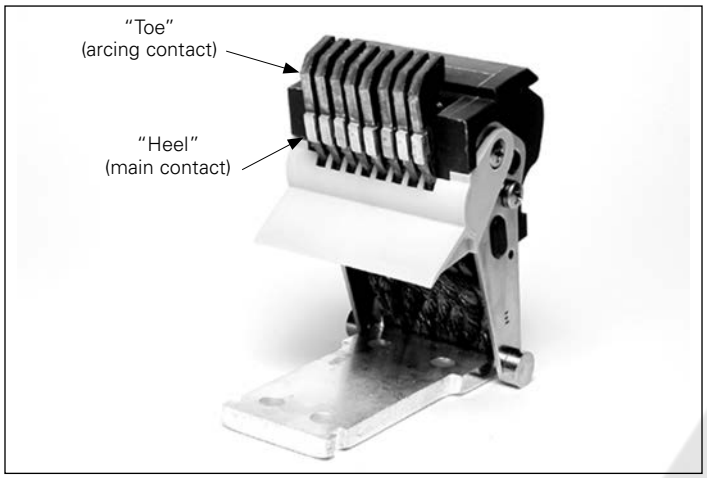


Figure 25. Narrow frame (8-finger) moving conductor assembly

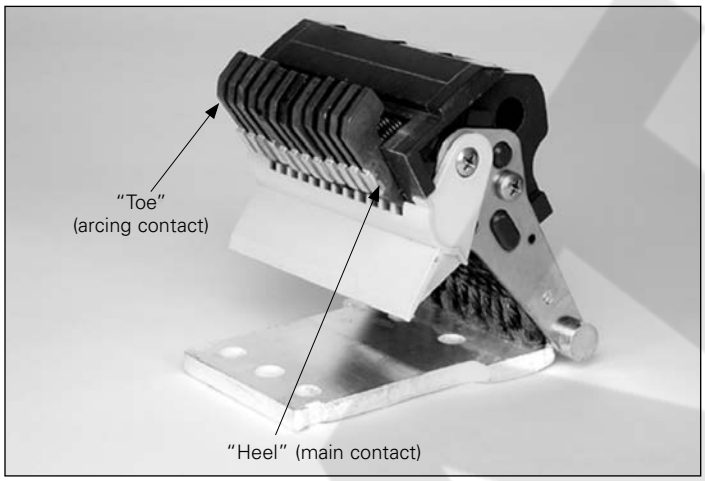


Figure 26. Standard frame DS (12-finger) moving conductor assembly

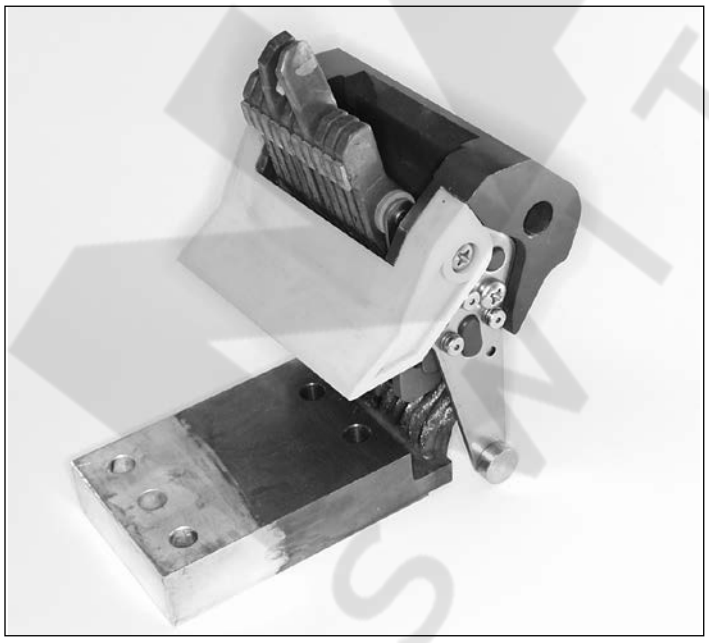


Figure 27. MDSX moving contact assembly

Primary stationary contacts

The primary stationary contact is a combination of two items (**Figure 28**). One is a conductive pad mounted on the line conductor that 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

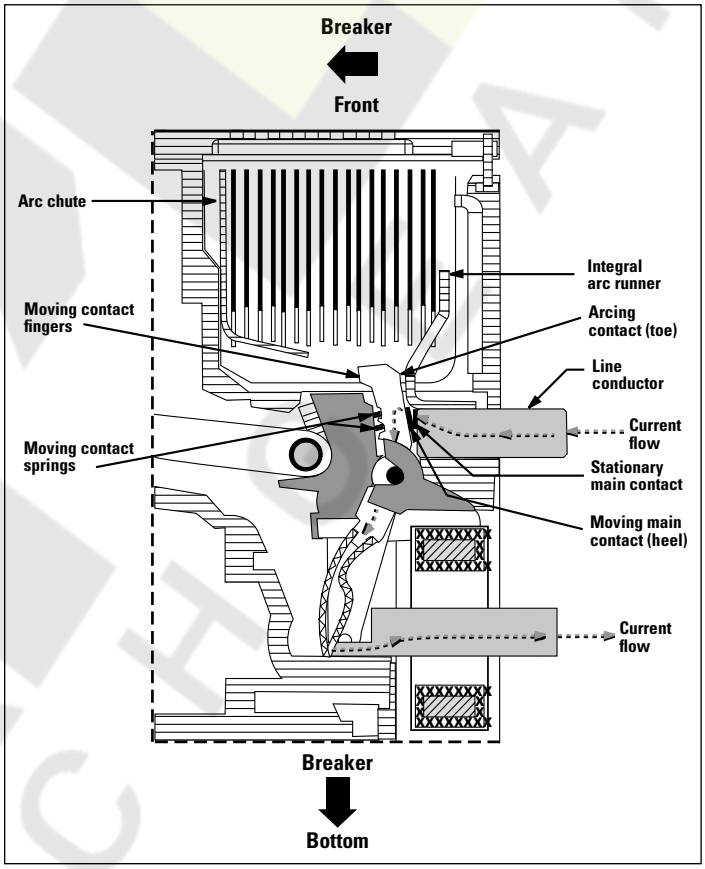


Figure 28. General partial cross-sectional view (shown in closed position) (not specific to any family/frame)

Operating mechanism

The Magnum DS/DC/DSX/DSL 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 29**). 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 30**). 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 22**). 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 **page 26**, "Accessory devices" in 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 31**). Manually operated circuit breakers are pre-wired to accept this addition.

Figure 29. Typical electrically operated drawout MDS/MDSX circuit breaker with front cover removed

Figure 30. Circuit breaker closing springs being manually charged

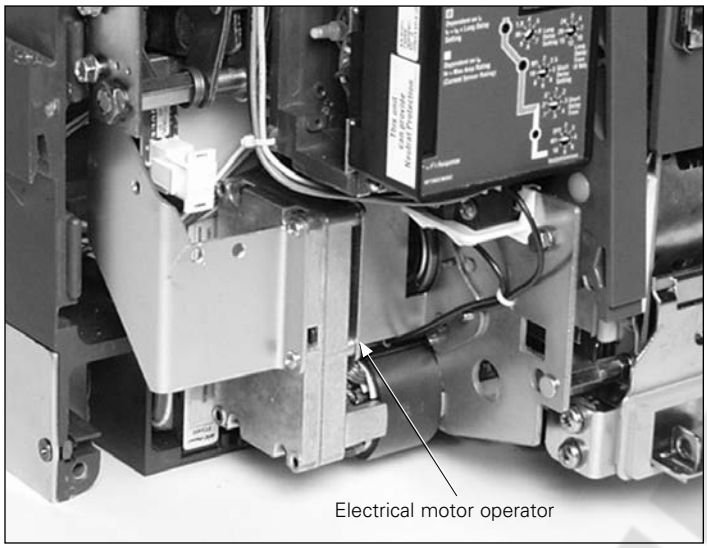


Figure 31. Electrical motor operator to charge closing spring

Electrical operation

For electrically operated circuit breakers, the springs are normally charged through the use of an electrical operator (**Figure 31**). The springs can, however, be charged manually as just described in the previous paragraph (**Figure 30**).

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 **page 26**, "Accessory devices" for more details on both standard and optional devices.

Anti-pump feature

The Magnum 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 attempt to close until the CLOSE command is removed and reapplied.

Note: 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 (see **page 27**), which will block the application of the electrical CLOSE command until the breaker is ready to close.

Arc chambers

The Magnum DS/DC/DSX/DSL circuit breakers use arc chambers to insulate and isolate individual poles from one another, from the rest of the circuit breaker, and from operating personnel (**Figure 18**). Arc chambers are molded and integral parts of the circuit breaker frame. Enclosed within each arc chamber is an arc chute that mounts over each set of primary contacts.

After the main contacts part, any remaining current is driven to the arcing contacts (**Figure 32**). 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 33**).

Arc chute

The Magnum DS/DC/DSX/DSL arc chutes mount 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 34** and **Figure 35**).

Arc chute components are assembled in an insulating jacket, which is removable from the top of the circuit breaker, as previously described on 9, "Lifting circuit breaker." Each arc chute has a baffled top cover. Magnum DC breakers are equipped with an arc baffling arc chute top.

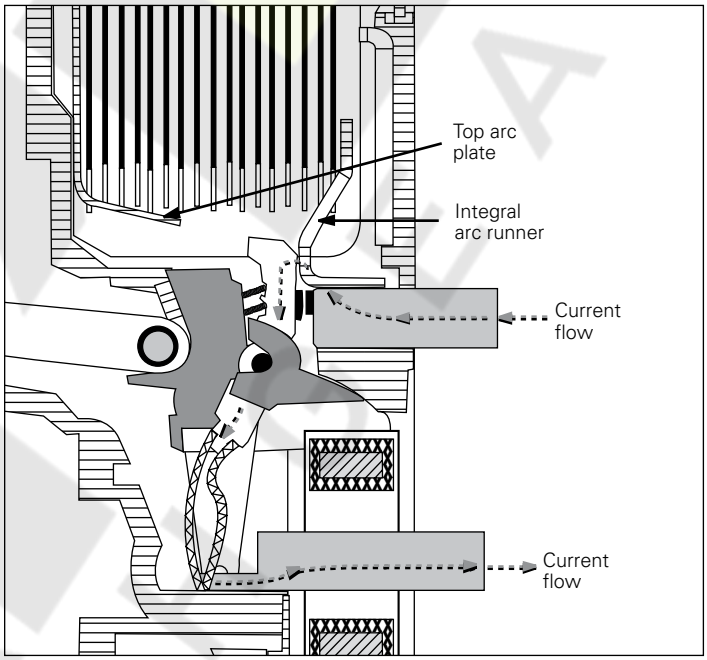


Figure 32. Cross section of conductor and arc control system

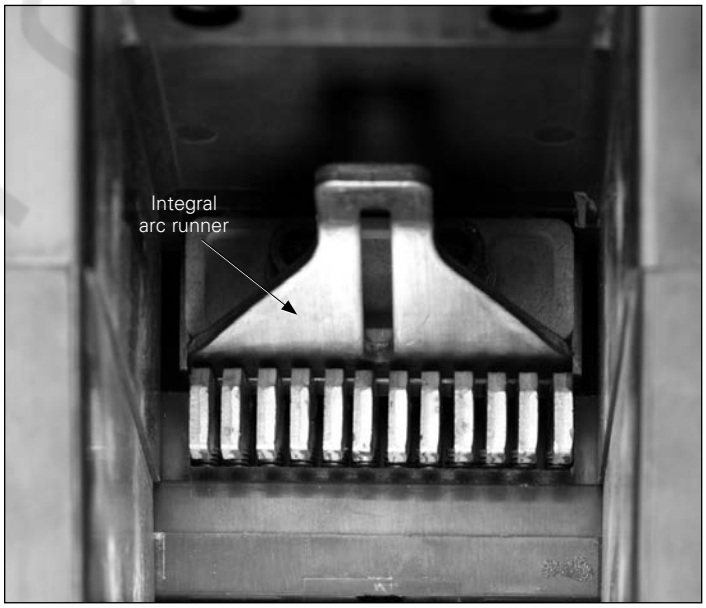


Figure 33. Integral arc runner viewed from top of arc chamber (arc chute removed, circuit breaker closed)

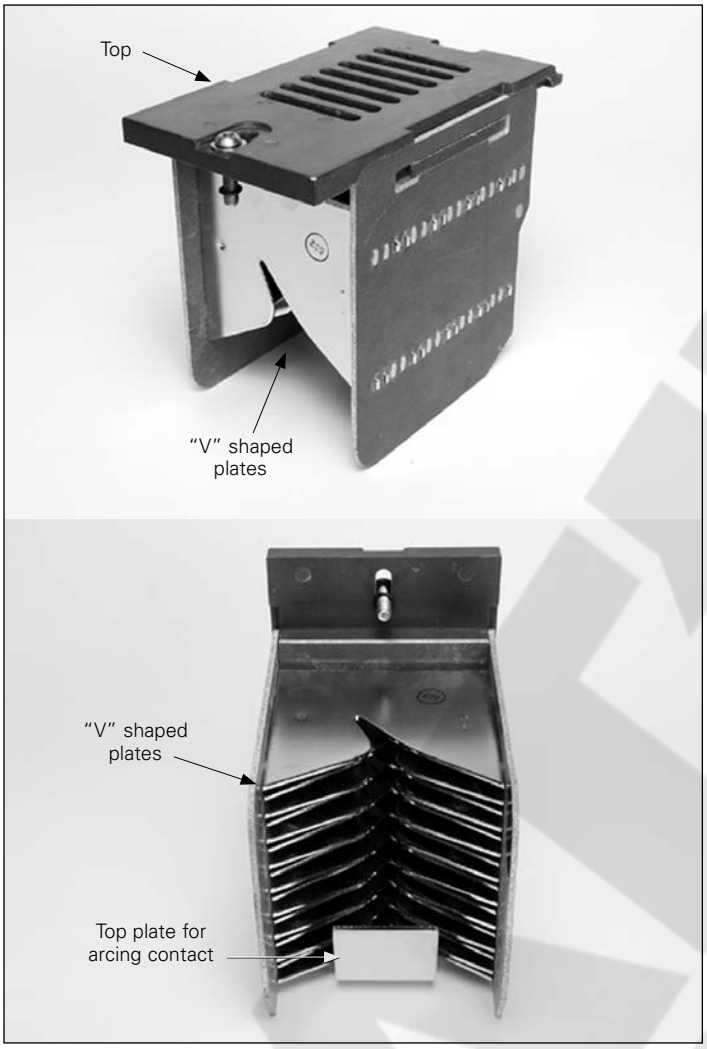


Figure 34. Magnum arc plate assembly

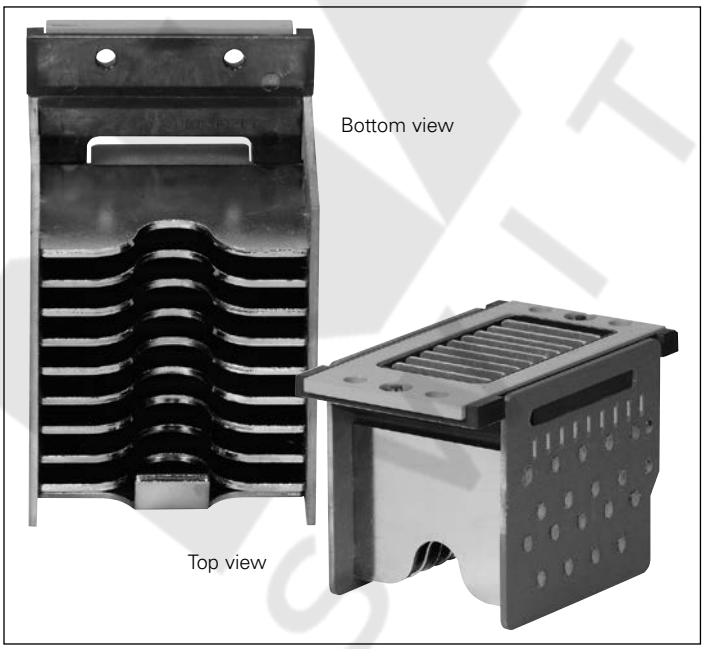


Figure 35. Magnum DSX arc chute

Electronic tripping system

The Magnum DS/DSX/DSL circuit breakers use a three-part tripping system (**Figure 36**):

- 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 DS/DSX/DSL circuit breakers, refer to the specific instructional leaflet dedicated to the trip units (I.L. 70C1036 and I.L. 70C1037).

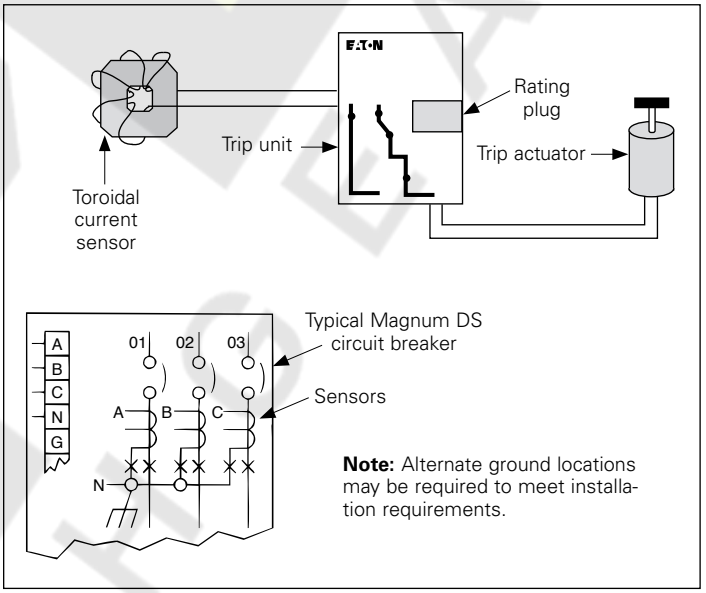


Figure 36. Pictorial diagram of typical current sensing, processing, and tripping system

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 6**. Also, the MDSX family of breakers is intended to be used only with trip units manufactured after May 1, 2005.

Table 6. Magnum Digitrip trip units

Functions	520	520M ①	520MC ①	1150 ①
LSIG protection	Yes	Yes	Yes	Yes
Disable (I)	Yes	Yes	Yes	Yes
GF protection	Yes	Yes	Yes	Yes
GF alarm	No	Yes	Yes	Yes
Display	No	Yes ②	Yes ②	Yes ②
Programmable	No	No	No	Yes
Metering	No	Yes ③	Yes ③	Yes
Power and energy values	No	No	No	Yes
Power quality	No	No	No	Yes
Communication	No	No	Yes	Yes

① Available control voltages are 24/48 Vdc, 125 Vdc, 120 Vac, and 240 Vac.

② One-line (four characters per line) LCD display.

③ Phase, neutral, ground, and high load current only.

Model 520 is plug compatible and interchangeable in the field. Circuit breakers with these trip units can be upgraded to Models 520M and/or 520MC in the field; however, additional wiring (for power supply and communications) may be required to take full advantage of the additional features. Contact Eaton for upgrading to Model 1150.

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 37**). This is accomplished using a Digitrip (DS Type) test kit that 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 38**).

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.

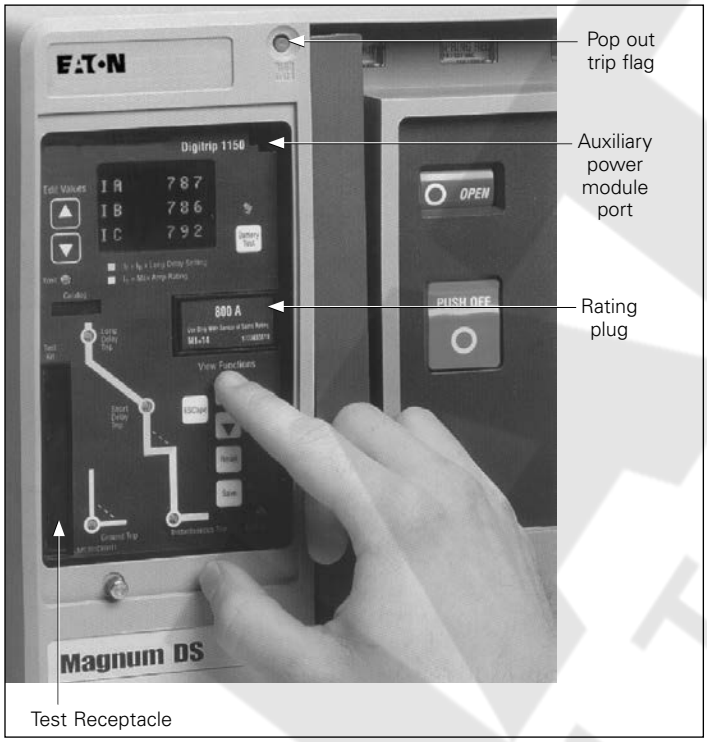


Figure 37. Digitrip RMS 1150 programmable trip unit installed in Magnum DS circuit breaker

Figure 38. Hand-held tester

Rating plug

All Magnum DS/DSX/DSL 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 (**Figure 8**, **Figure 37**, and **Table 7**). 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 A. 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 that the rating plug is secured in position with its retaining screw. Do not torque the retaining screw beyond 15 in-oz.

Refer to **Table 7** for a tabulation of the available rating plugs.

Table 7. Magnum current sensors and matching rating plugs

Current rating in amperes		
200	800	2500
250	1000	3000
300	1200	3200
400	1600	4000
600	2000	5000

Current sensors

Three toroidally wound current sensors are installed at the rear of the circuit breaker on the lower terminals (**Figure 39**). 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 7** for a tabulation of the available current sensor ratings.

Figure 39. Replaceable current sensors shown with bottom adapters and cover plate removed

Trip actuator

The trip actuator is a small cylindrically shaped electromagnetic device that acts mechanically to trip the circuit breaker (**Figure 36**). In general, it is composed 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 that 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 feature. It is located above the trip unit on the breaker's front faceplate (**Figure 37**). It operates by releasing and popping out any time the circuit breaker trips due to an overcurrent condition.

The pop-out mechanical trip indicator is available in two versions:

Interlocking trip indicator—When activated via a tripping event, the interlocked version of the trip indicator acts to provide local visual indication that the breaker has tripped, change the OTS contact position, and interlock the breaker such that the breaker cannot be reclosed until the mechanical trip indicator is reset.

Non-interlocking trip indicator—This version acts only to provide visual local indication of a tripping event and change the OTS contact position.

When using an interlocking trip indicator, a remote trip reset option is available to electrically reset the trip indicator by applying the proper rated control voltage. The remote trip reset feature is very useful in applications where direct access to the circuit breaker is limited, for example a wind turbine. The remote trip reset will act to reset the trip indicator and OTS but will not reset the trip unit status LEDs that can be reset via communications.

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 DS/DSX/DSL 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 I_n; this corresponds to an rms current of 11 x I_n with maximum asymmetry.

The making current release is enabled only for the first two 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.

High instantaneous trip option (Magnum DS only)

The high instantaneous trip option is installed in 800 to 3200 A Magnum DS/DSX circuit breakers with a 100 kA or 130 kA interrupting capacity. In general, the high instantaneous trip is composed of three small air core sensors, one in each phase, which produce a signal and transmit it back to the trip unit when the 85 kA withstand rating of the circuit breaker is exceeded. The result is an instantaneous trip by the circuit breaker. This high instantaneous trip option permits the 800 to 3200 A Magnum DS circuit breakers to be applied where a 100 kA or 130 kA fault is possible, while selectivity up to 85 kA 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 40** illustrates line-side voltage taps.

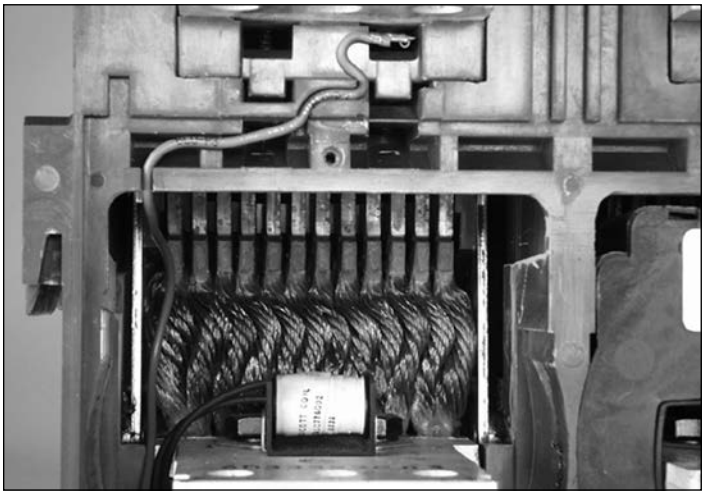


Figure 40. Line-side voltage tap for 1150 trip unit

Accessory devices

A variety of accessory devices are available for use with Magnum 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 instructional leaflets dedicated to the accessories.

Magnum 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 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 41**). 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

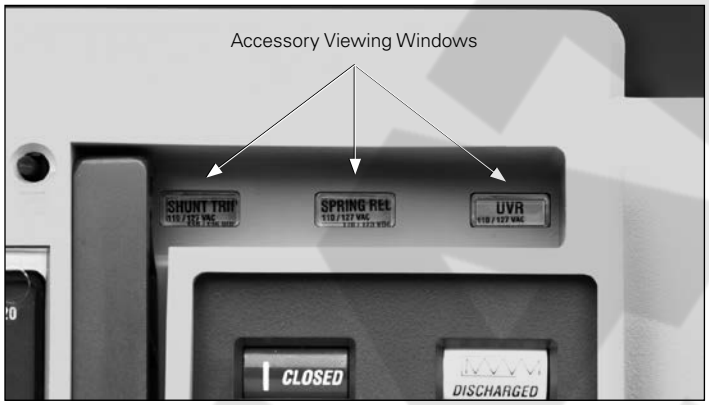


Figure 41. Through-the-window electrical accessories

Shunt trip—The shunt trip is an optional device on circuit breakers (**Figure 42** and **Figure 43**). It opens the circuit breaker instantaneously when its coil is energized by a voltage input (**Table 8**). A total of two shunt trips can be mounted on a Magnum circuit breaker. Shunt trips are available with a continuous duty coil or a cutoff switch. A continuous duty (or 100% rated) shunt trip can be continuously energized and is useful in applications where it is desired to keep the breaker tripped open. Shunt trips that have a cutoff switch remove voltage from the coil once the breaker contacts are opened.

Table 8. Shunt trip ratings

Control voltages	Operational voltage range 70–110%	Inrush power consumption ①	Opening time (ms)
24 Vdc	17–26 Vdc	250 W	35
48 Vdc	34–53 Vdc	250 W	35
60 Vdc	42–66 Vdc	300 W	35
110–125 Vdc	77–138 Vdc	450 W	35
220–250 Vdc	154–275 Vdc	450 W	35
110–127 Vac	77–140 Vac	450 VA	35
208–240 Vac	146–264 Vac	450 VA	35

① Required for less than 35 ms.

Table 9. Continuous duty shunt trip

Control voltages	Operational voltage range 70–110%	Inrush/continuous power consumption	Opening time
24 Vdc	17–26	250 W / 18 W	35
48 Vdc	34–53	275 W / 18 W	35
60 Vdc	42–66	275 W / 18 W	35
110–125 Vdc	77–138	450 W /1 0 W	35
220–250 Vdc	154–275	450 W / 10 W	35
110–127 Vac	77–140	450 VA / 10 VA	35
208–240 Vac	146–264	400 VA / 10 VA	35

Figure 42. Shunt trip with cutoff switch

Figure 43. Shunt trip switch installed

Spring release—The spring release is an optional device (**Figure 44**). It remotely closes the circuit breaker when the coil is energized by a voltage input (**Table 10**). 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.

Table 10. Spring release ratings

Control voltages	Operational voltage range 85–110%	Inrush power consumption	Closing time (ms)
24 Vdc	20–26 Vdc	250 W	40
48 Vdc	41–53 Vdc	250 W	40
60 Vdc	51–66 Vdc	300 W	40
110–125 Vdc	93–138 Vdc	450 W	40
220–250 Vdc	187–275 Vdc	450 W	40
110–127 Vac	93–140 Vac	450 VA	40
208–240 Vac	177–264 Vac	450 VA	40

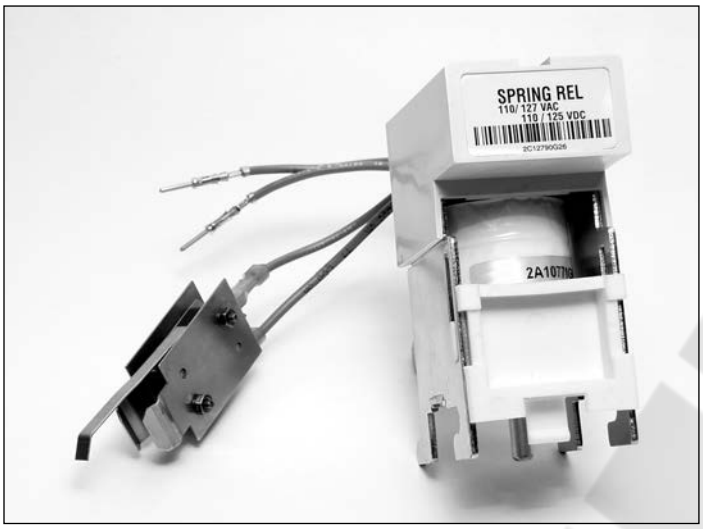


Figure 44. Spring release with optional latch switch

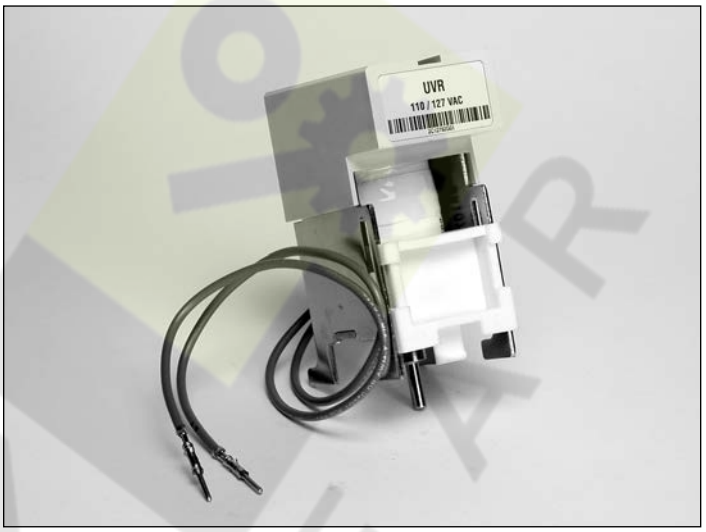


Figure 45. Undervoltage release

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 LCS 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 44**). If power is applied and maintained to the spring release, an activation will occur when the circuit breaker is "ready to close."

The LCS for remote indication consists of one Form C contact wired to the circuit breaker secondary contacts for integration into external control schemes.

Note: 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 42**). 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 11**).

Table 11. Undervoltage release

Control voltages	Operational voltage range 85–110%	Dropout voltage 30–60%	Inrush/ continuous power consumption ①②	Opening time (ms)
24 Vdc	20–26 Vdc	7–14 Vdc	250 W / 18 W	70
32 Vdc	27–35 Vdc	10–19 Vdc	275 W / 15 W	70
48 Vdc	41–53 Vdc	14–29 Vdc	275 W / 18 W	70
60 Vdc	51–66 Vdc	18–42 Vdc	275 W / 18 W	70
110–125 Vdc	94–138 Vdc	33–75 Vdc	450 W / 10 W	70
220–250 Vdc	187–275 Vdc	66–150 Vdc	450 W / 10 W	70
110–127 Vac ②	94–140 Vac	33–76 Vac	450 VA / 10 VA	70
208–240 Vac ②	177–264 Vac	62–144 Vac	400 VA / 10 VA	70
380–415 Vac ②	323–457 Vac	114–249 Vac	480 VA / 10 VA	70
480 Vac ②	408–528 Vac	144–288 Vac	400 VA / 10 VA	70
600 Vac ②	510–660 Vac	180–360 Vac	400 VA / 10 VA	70

① Required for 200 ms.

② Required for 400 ms.

Figure 46. Shunt trip, spring release, and undervoltage release installed

Auxiliary switch—An auxiliary switch is an optional device providing remote electrical indication if the circuit breaker is open or closed (**Figure 47**). Up to three auxiliary switches can be mounted in the circuit breaker. Each switch has two normally open ("A") and two normally closed ("B") contacts for a total of 12 available contacts (**Table 12**).

Table 12. Auxiliary switch, overcurrent trip switch, and cell switch contact ratings

Control voltages	Contact rating inductive load (amperes)
250 Vac	10
125 Vdc	0.5
250 Vdc	0.25

Figure 47. Auxiliary switch (2A/2B)

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 48**). 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 12**). 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.

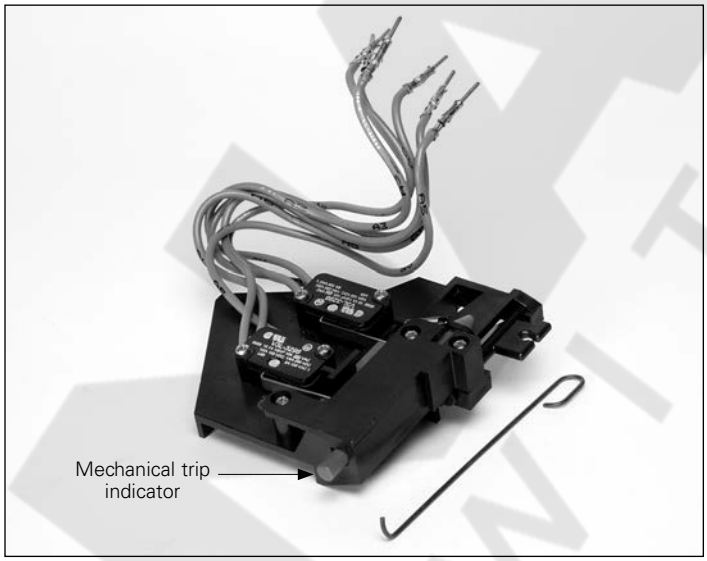


Figure 48. Mechanical trip indicator with associated overcurrent trip switch

Motor operator—A motor operator is an electric motor assembly internally mounted in the circuit breaker (**Figure 49** and **Figure 50**). It charges the closing springs electrically for remote or local operation. The motor operator can be factory or site installed (**Table 13**).

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

Table 13. Compact motor operator

Control voltages ①	Operational voltage range 85–110%	Running current (A. avg.)	Typical inrush current	Power consumption (W or VA)	Maximum charging time (seconds)
24 Vdc	20–26	12	300% of running	300	5
48 Vdc	41–53	5	500% of running	250	5
60 Vdc	51–66	3	600% of running	250	5
110–125 Vdc	94–138	2	600% of running	250	5
220–250 Vdc	187–275	1	600% of running	250	5
110–127 Vac	94–140	2	600% of running	250	5
208–277 Vac	177–305	1	600% of running	250	5

① AC voltages are 50/60 Hz.

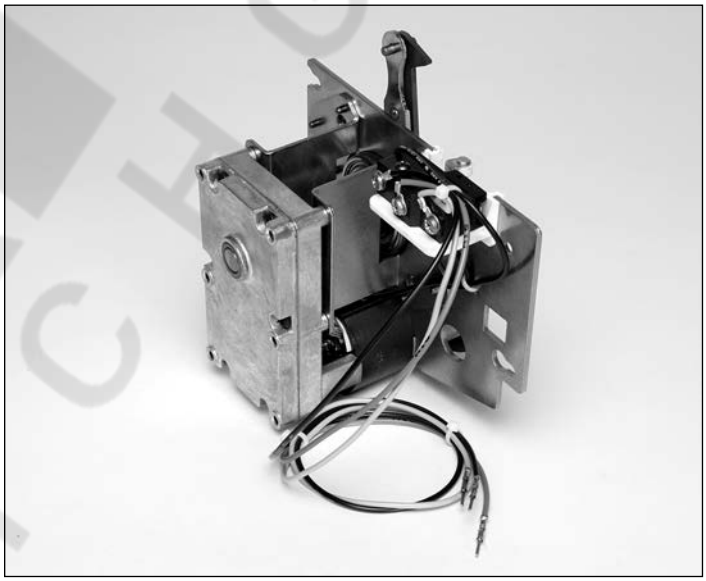


Figure 49. Motor operator kit

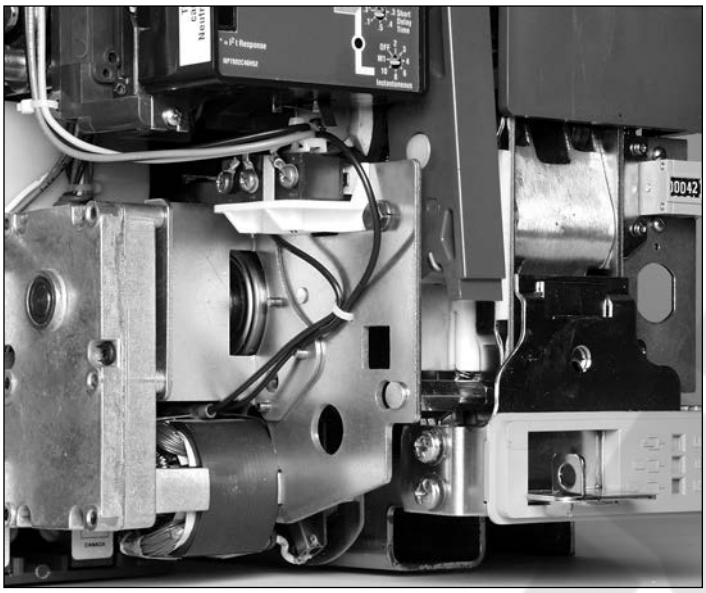


Figure 50. Motor operator installed in narrow frame circuit breaker

Figure 51. Cover mounted key lock and operations counter

Mechanical accessories

There are 10 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 51**).

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 51**). 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 52**). The lock holds the circuit breaker trip-free in the CONNECTED position, preventing it from being closed.

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 or Castell.

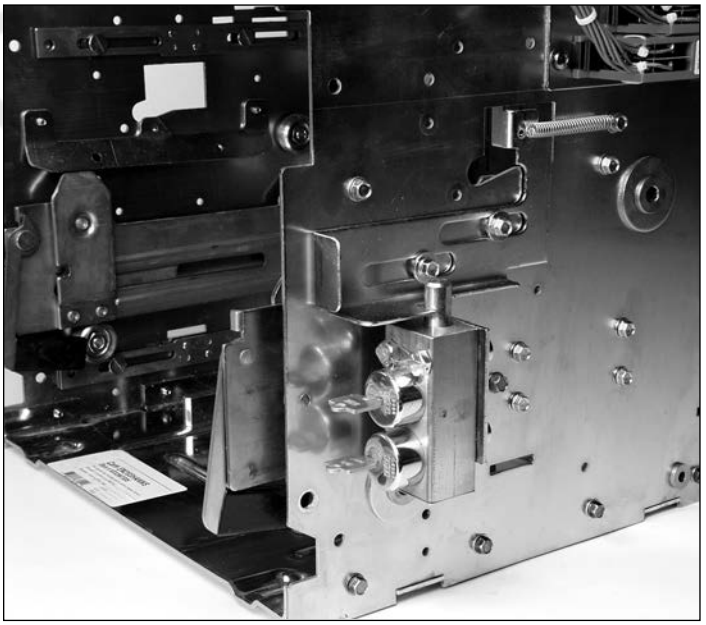


Figure 52. Cassette-mounted key lock

Pushbutton cover—Padlockable covers are available to limit access to the ON and OFF pushbuttons (**Figure 53**). They can be installed with either or both pushbutton covers in place.

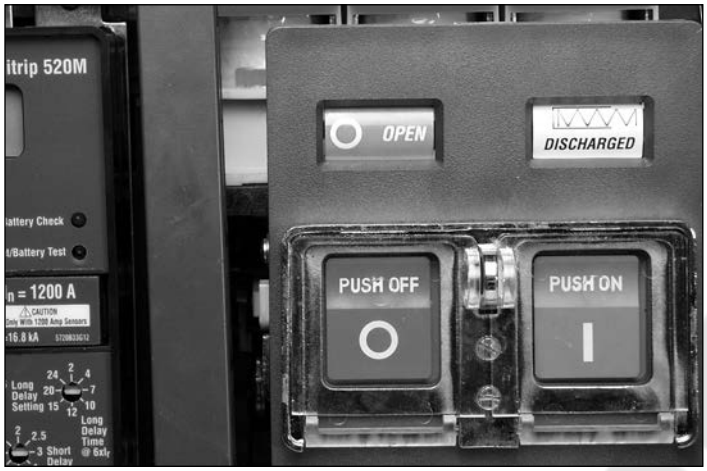


Figure 53. ON–OFF pushbutton lockable cover plate

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.

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 41**). When the circuit breaker is levered into the cassette, the shutters automatically open, permitting primary connections to be made (**Figure 55**).

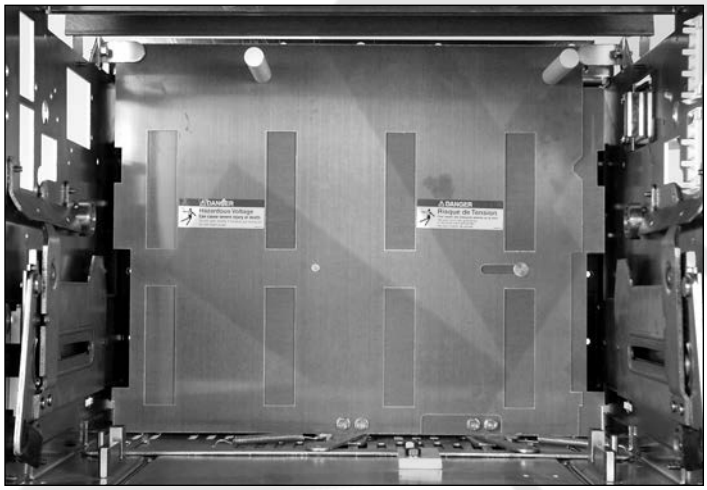


Figure 54. Typical safety shutters in CLOSED position

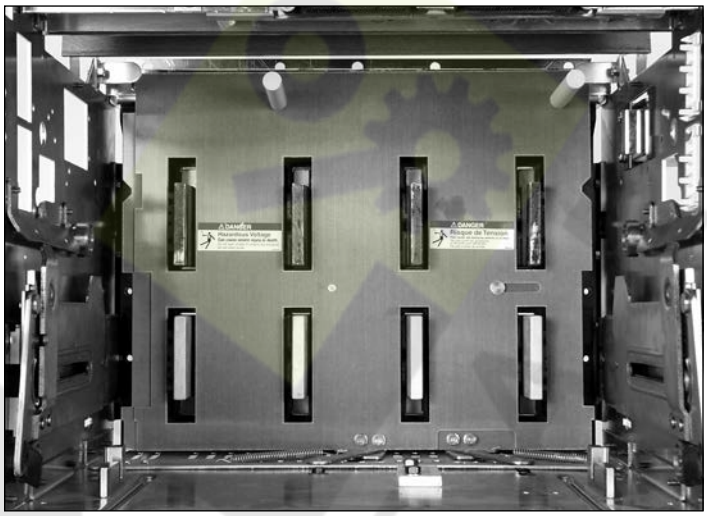


Figure 55. Typical safety shutters in OPEN position

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 56** and **Figure 57**). Refer to the ratings in **Table 12** for cell switch contact information. The cell switch changes status between the TEST and CONNECT positions.

Figure 56. Cell switch (drawout position indicator) unmounted

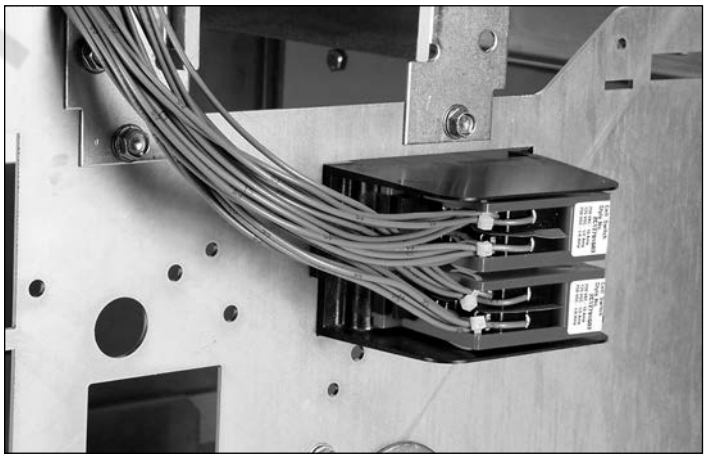


Figure 57. Cell switches mounted on cassette

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 58**). The door escutcheon and gasket have an IP41 rating.

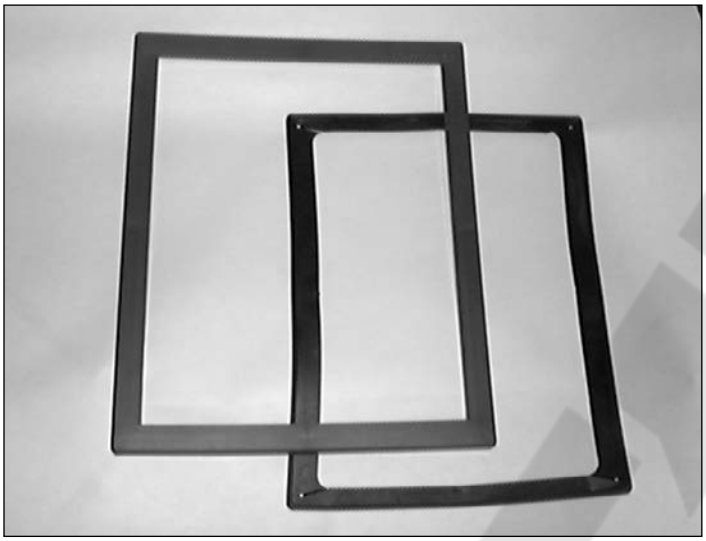


Figure 58. Door escutcheon and gasket

IP55 waterproof cover—A hinged dome-shaped waterproof cover attaches to the metal compartment door to provide waterproof protection for the circuit breaker (**Figure 59**).

Figure 59. IP55 waterproof cover

Mechanical interlock—A family of mechanical interlocks are available to interlock the closing of two or three Magnum 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 two-way and three-way versions. An illustration of a two-way cable interlock mounted on two drawout circuit breakers is shown in **Figure 60**.

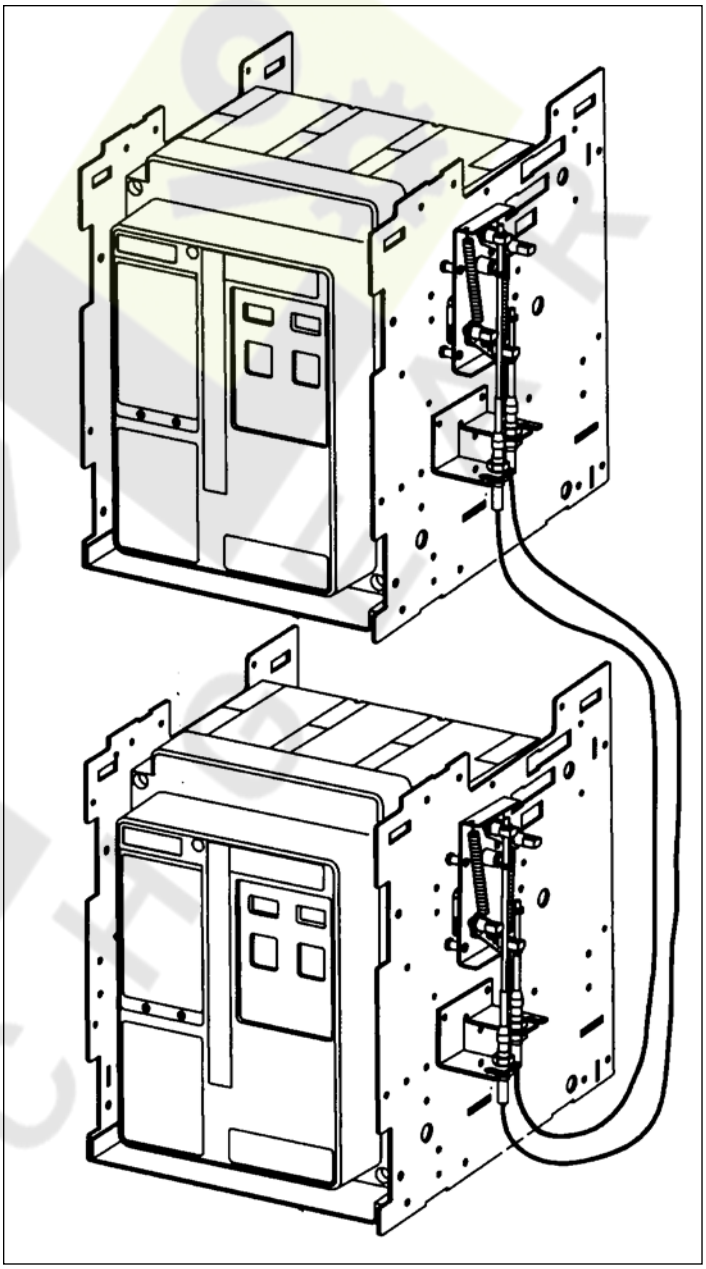


Figure 60. Cassette-mounted two-way cable interlock

MDSL limiters/blown limiter indication

An overall description of Magnum DSL circuit breakers was provided in Section 3. More detailed information is provided here relative to application, current limiters, and blown limiter indication.

If current limiters are sized in keeping with **Table 14** recommendations, the circuit breaker will function and interrupt routine fault currents. Infrequent high faults are cleared by the limiters. The limiters protect the circuit breaker on faults above the rating of the breaker. The limiters, will blow below the circuit breaker short-time rating, if the fault currents equal the system maximum capacity.

In some applications, the current limiters are sized smaller than necessary for protection of the MDSL circuit breaker in order to provide protection from downstream equipment. When this is done, the current limiter will blow on fault currents that could have been satisfactorily interrupted by the basic circuit breaker.

MDSL current limiters

Do not replace limiters with sizes other than permitted by **Table 14**. MDSL current limiters have been UL tested and approved for use in MDSL circuit breakers when applied according to **Table 14**. They are not electrically or physically interchangeable with current-limiting fuses of any other design.

The current limiters are held in place in an extension provided on the back of the circuit breaker (**Figure 61**). This extension makes the circuit breaker 6.00 inches deeper than the corresponding Magnum DS circuit breaker. The current limiters can only be removed from the circuit breaker and replaced when the MDSL circuit breaker is removed from its associated compartment. For this reason, there is no fixed-mounted version of the MDSL circuit breaker.

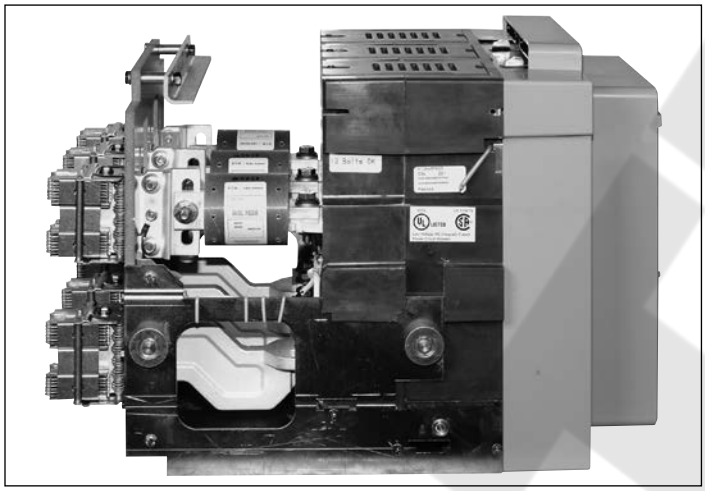


Figure 61. Magnum DSL circuit breaker (side view)

Blown limiter sensing

The blown limiter indicator provides a visual indication on the front of the MDSL circuit breaker when a current limiter in any phase has interrupted a short circuit. It is the visual element of the circuit that ensures that the circuit breaker will be tripped when any current limiter has blown. This prevents single-phase power from being applied to a three-phase load.

The indicator itself is a red pop-out button located on the lower left portion of the breaker's front cover (**Figure 62**). A transformer is connected in parallel with the limiter. When a limiter is blown, the resulting voltage across the open limiter energizes the transformer. The transformer feeds a PC board to provide an output to the direct trip actuator to trip the circuit breaker, and an output to the indicator causing the button to pop out.

Figure 62. Blown fuse indicator

Table 14. MDSL integral current limiter selection (for optimal performance and highest fault levels)

Magnum DSL breaker continuous current frame rating (amperes) ①				Sensor and rating plug (I_n)	Available MDSL current limiters ②										
800	1200	1500	2000		Minimum size ③	Recommended size ④	Maximum size ⑤	Other available sizes (in addition to minimum, recommended, and maximum sizes)							
MDSL08	MDSL12	MDSL16		200	MA250	MA600	MD3000	MA300	MA400	MA800	MB1200	MB1600	MB2000	MD2500	
MDSL08	MDSL12	MDSL16		250	MA400	MA800	MD3000	MA600	MB1200	MB1600	MB2000	MD2500			
MDSL08	MDSL12	MDSL16		300	MA400	MA800	MD3000	MA600	MB1200	MB1600	MB2000	MD2500			
MDSL08	MDSL12	MDSL16		400	MA600	MB1200	MD3000	MA800	MB1600	MB2000	MD2500				
MDSL08	MDSL12	MDSL16		600	MA800	MB2000	MD3000	MB1200	MB1600	MD2500					
MDSL08	MDSL12	MDSL16		800	MB1200	MD2500	MD3000	MB1600	MB2000						
	MDSL12	MDSL16		1000	MB1600	MD2500	MD3000	MB2000							
	MDSL12	MDSL16		1200	MB2000	MD2500	MD3000								
		MDSL16	MDSL20	1600	MD3000	MD3000	MD3000								
			MDSL20 ⑥	2000 ⑥	MD3000 ⑥	MD3000 ⑥	MD3000 ⑥								

① Select the Magnum breaker frame, then the current sensor and rating plug, and finally the current limiter. Current limiters are mounted integral to the circuit breaker. Refer non-automatic MDSL breaker application requests to Eaton.

② Refer to MDSL current limiter curves for let-through and time characteristics.

③ The minimum selection provides for the lowest current let-through, but trip unit settings must be considered to avoid nuisance operation.

④ The recommended selection avoids nuisance limiter operation and allows for system coordination within the trip unit settings while minimizing let-through.

⑤ The maximum selection provides for maximum system coordination with let-through characteristics per the limiter selected.

⑥ Heat sinks applied in conjunction with current limiters on this breaker rating.

Section 4: Master connection diagrams

Secondary contacts and connection diagrams

A maximum of 60 secondary wiring connection points are available on the standard frame circuit breaker (48 on narrow frame), each dedicated to a specific function (**Figure 64**). The wiring points are finger safe with no more than two wires per terminal.

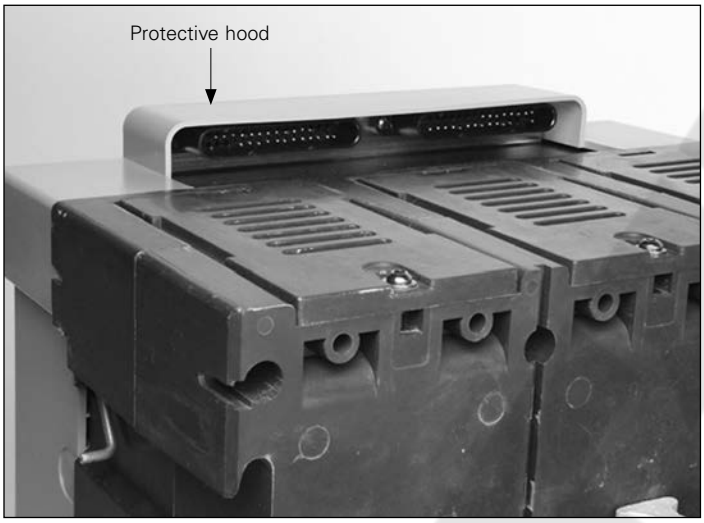
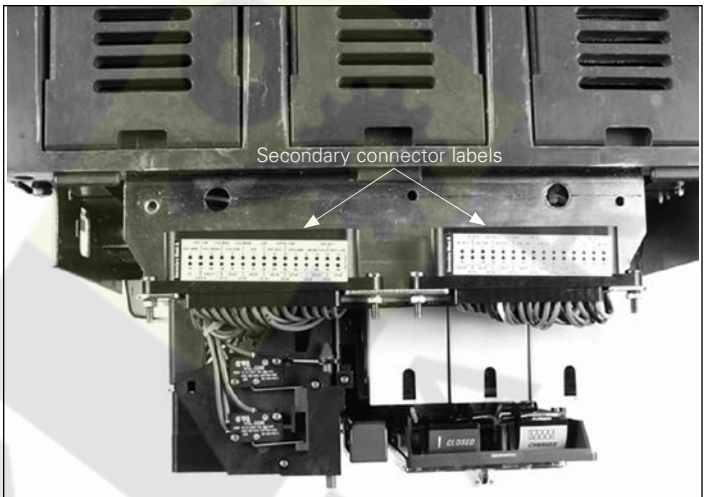


Figure 63. Secondary connector protective hood

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 63**). 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.



Labels Legend

OTS	Overcurrent trip switch
UVR	Undervoltage Release
ATR	Automatic trip relay (520M and 1150 trip units only)
INCOM	PowerNet communications network
A BUS	(Future use)
A/S	Auxiliary contacts
NEUTRAL	Neutral sensor input
GF SGND	Source ground input
ZONE	Zone interlocking
ST	Shunt trip
SR	Spring release
MOTOR	Charging motor
LCS	Latch check switch

Figure 64. Top view secondary connectors

Drawout type circuit breakers: Compatible secondary plug-in connectors are mounted on the top front portion of the drawout cassette (**Figure 65**). 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.

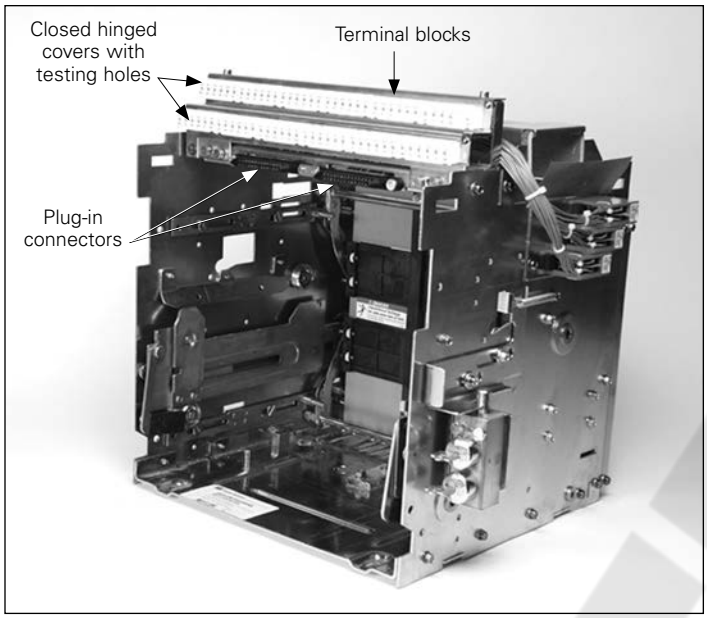


Figure 65. Typical cassette-mounted secondary wiring

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

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 the 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 (**Figure 19** and **Figure 21**).

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 Eaton for assistance (**Figure 66**). The connector halves must be separated to use this tool.

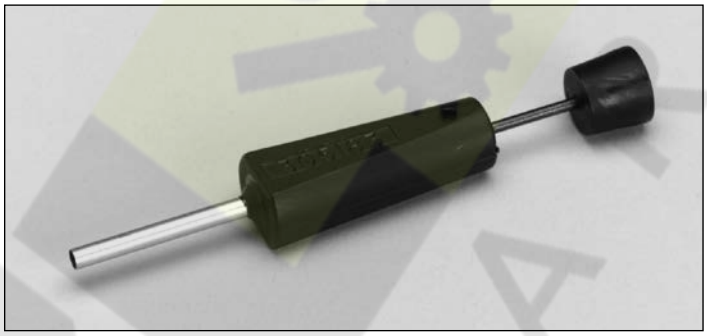
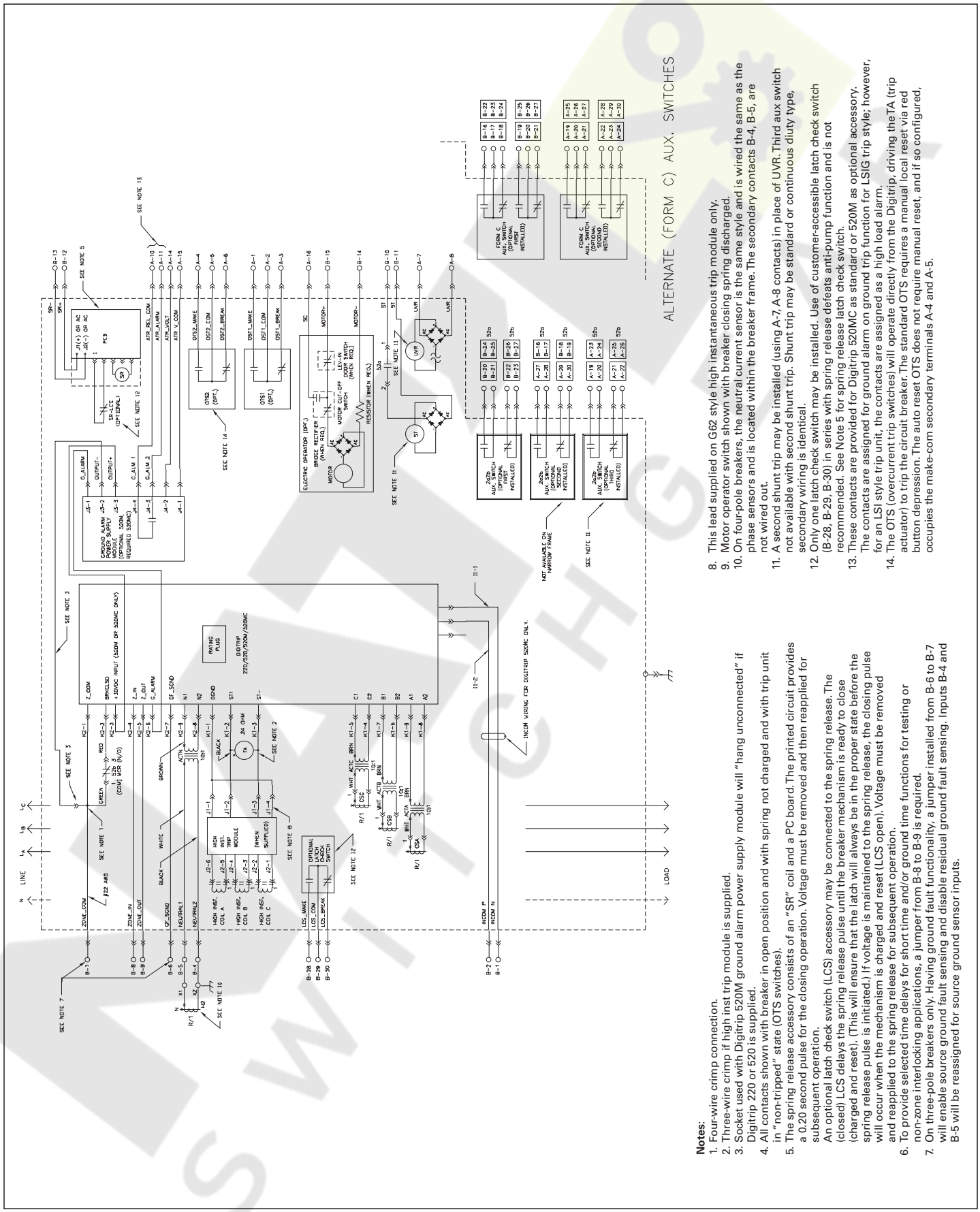


Figure 66. AMP secondary wiring removal tool

Connection diagrams

The connection diagrams for all Magnum circuit breakers using Digitrip RMS trip units are shown in **Figure 67** through **Figure 81**.



Notes:

1. Four-wire crimp connection.
2. Three-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).
5. The spring release accessory consists of an "SR" coil and a PC board. The printed circuit 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 until the breaker mechanism is ready to close (charged and reset). (This will ensure 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-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 four-pole breakers, the neutral current sensor is the same style and is 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. A 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 diuty 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. These 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 an LSI style trip unit, the contacts are assigned as a high load alarm.
14. The OTS (overcurrent trip switches) will operate directly from the Digitrip, driving theTA (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-com secondary terminals A-4 and A-5.

Figure 67. Digitrip 520/520M/520MC standard and narrow (except 100 kA) frames (6D32315SH01)

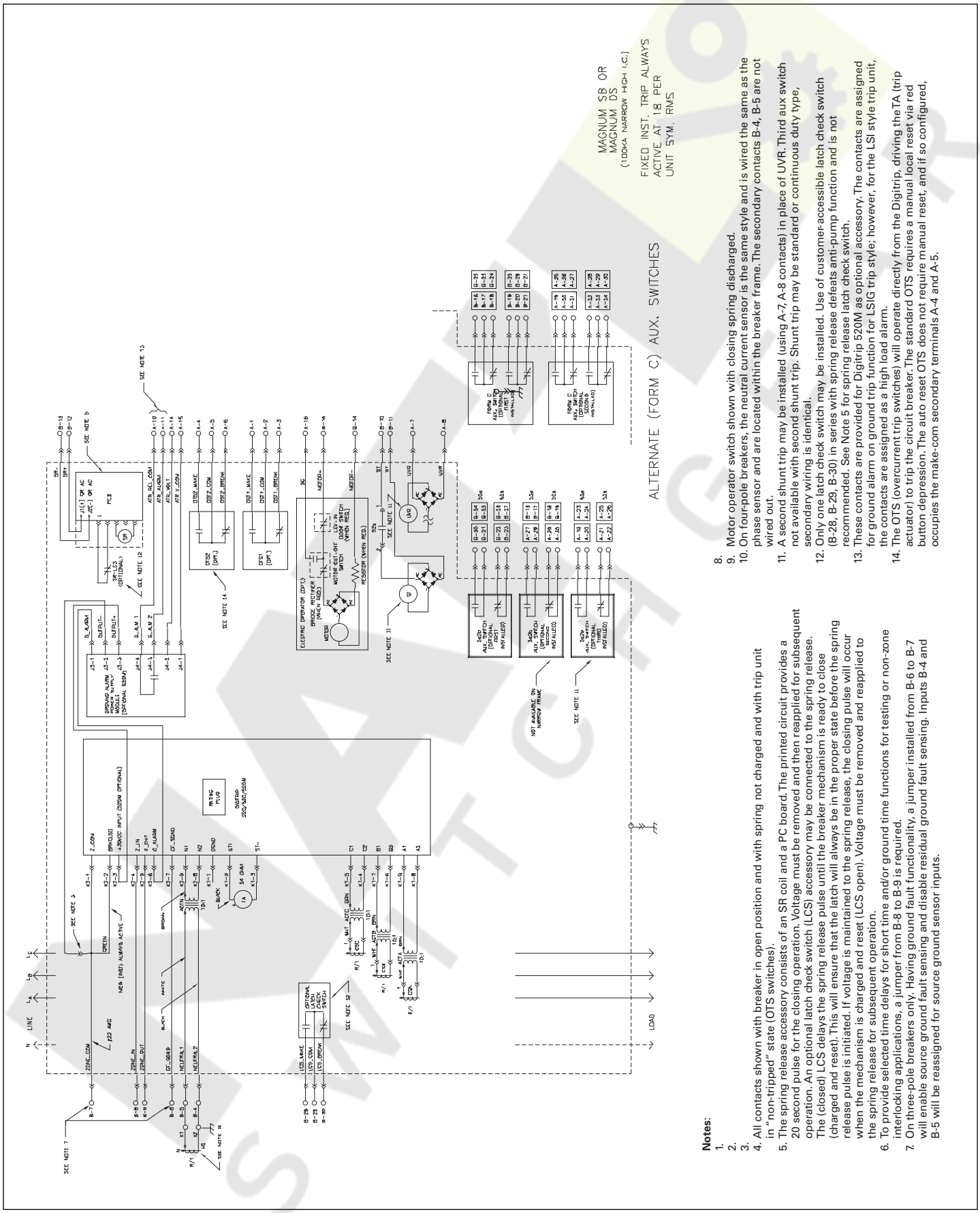
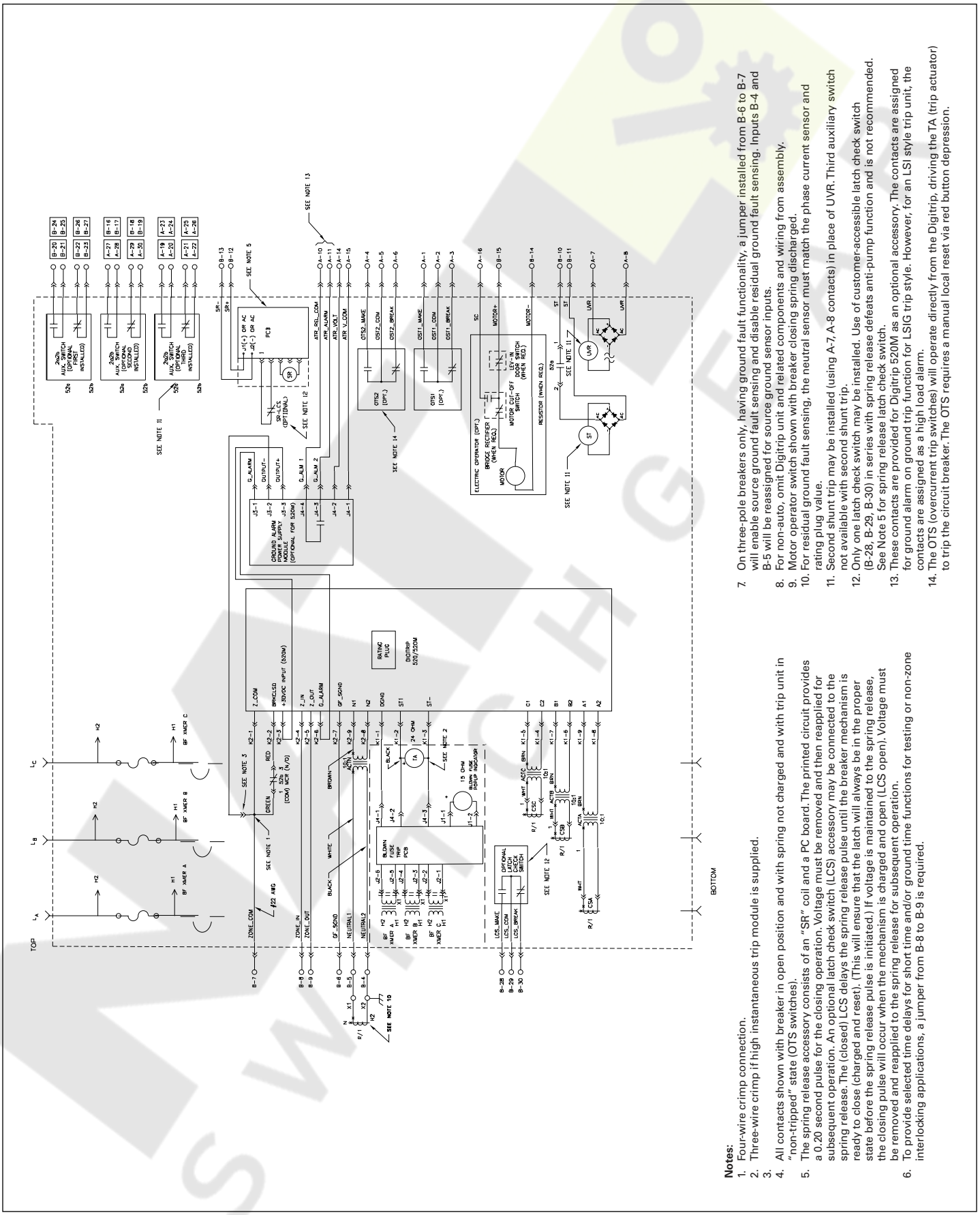


Figure 68. Digitrip 520/520M narrow 100 kA frame (6D32315SH02)



Notes:

1. Four-wire crimp connection.
2. Three-wire crimp if high instantaneous trip module is supplied.
3.
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 an "SR" coil and a PC board. The printed circuit 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 until the breaker mechanism is ready to close (charged and reset). (This will ensure 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 open (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-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. For non-auto, omit Digitrip unit and related components and wiring from assembly.
9. Motor operator switch shown with breaker closing spring discharged.
10. For residual ground fault sensing, the neutral sensor must match the phase current sensor and rating plug value.
11. Second shunt trip may be installed (using A-7, A-8 contacts) in place of UVR. Third auxiliary switch not available with second shunt trip.
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 an optional accessory. The contacts are assigned for ground alarm on ground trip function for LSIG trip style. However, for an LSI style trip unit, the contacts are assigned as a high load alarm.
14. The OTS (overcurrent 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.

Figure 69. MDSL Digitrip 520/520M with blown fuse trip (6D32373SH01)

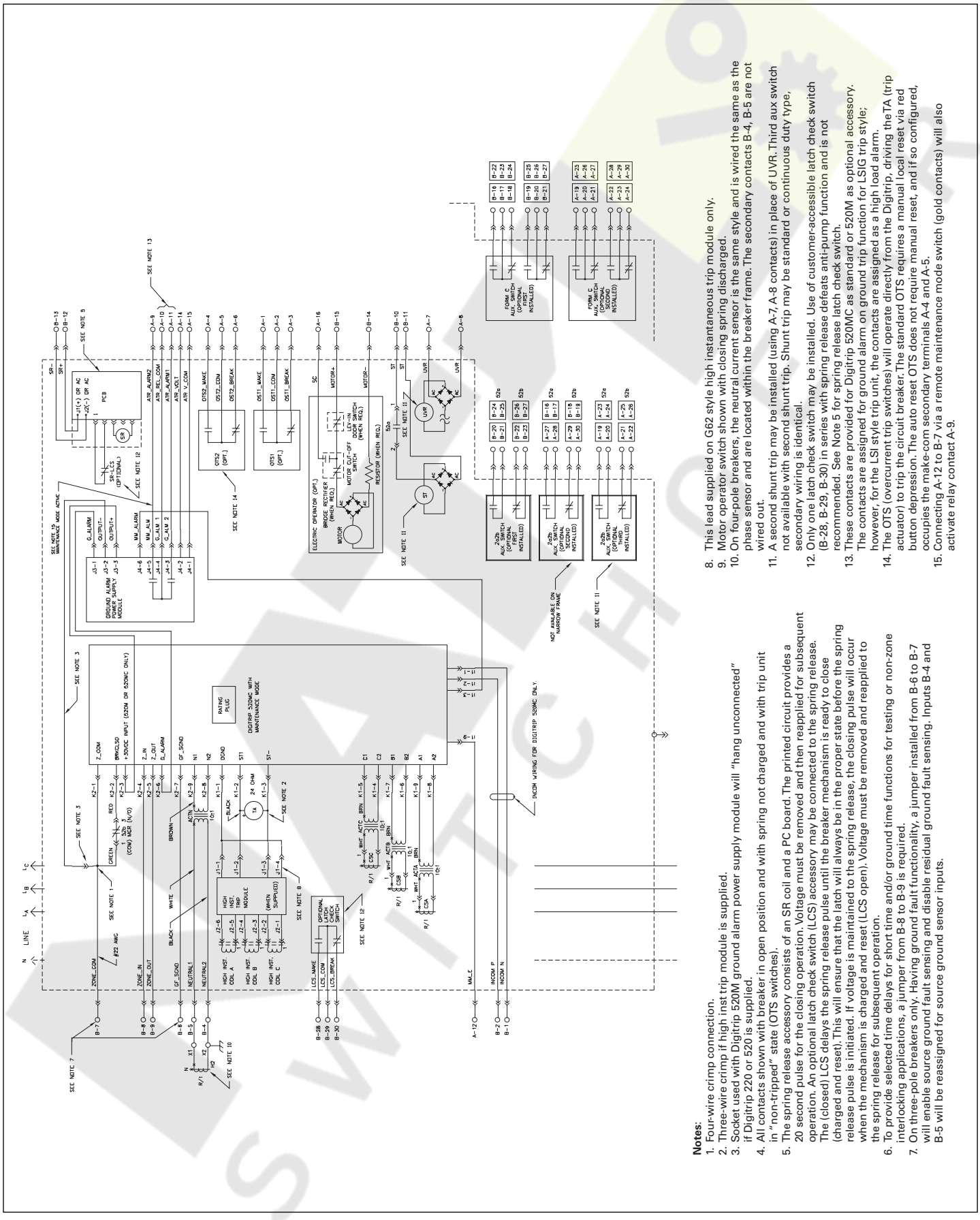
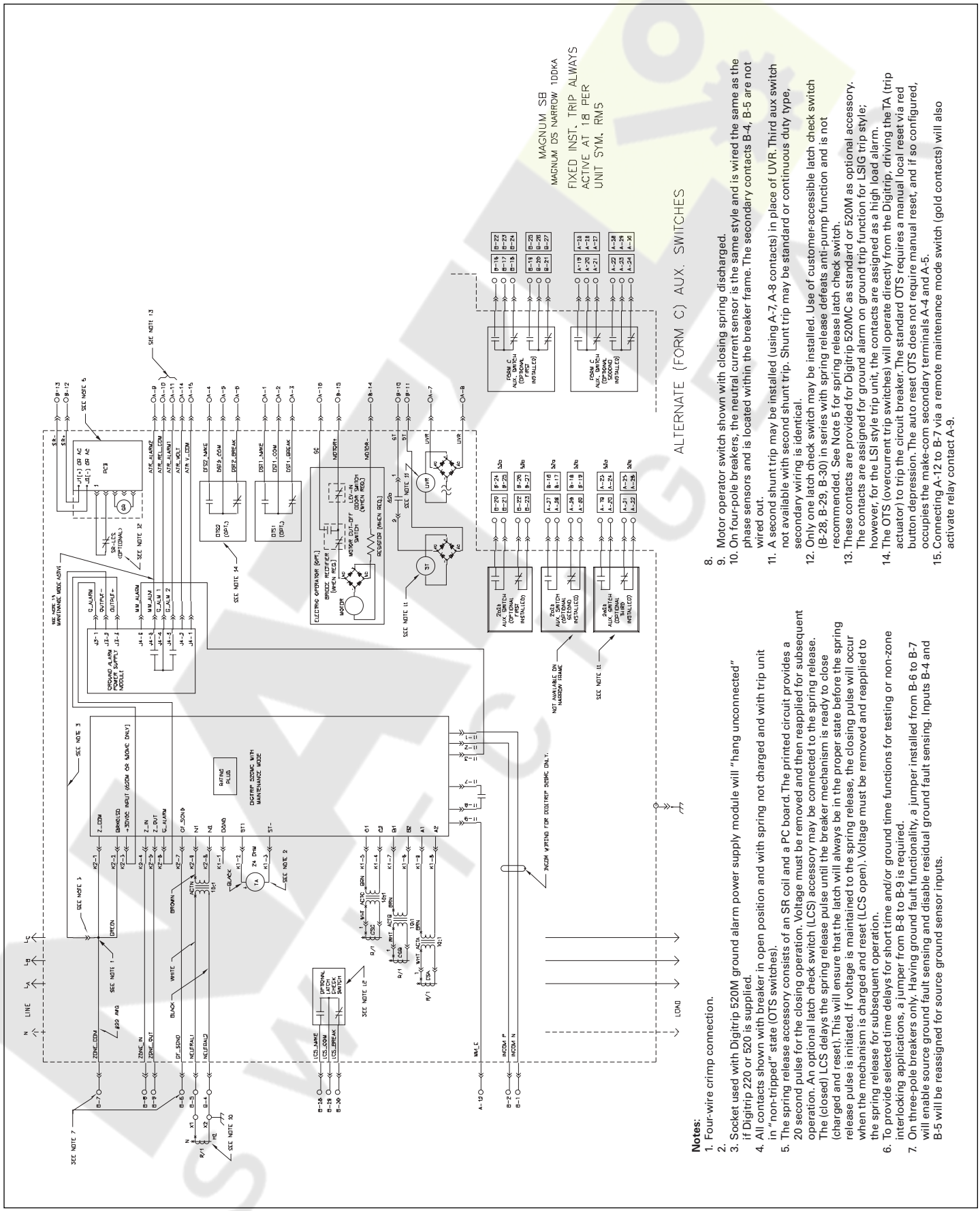


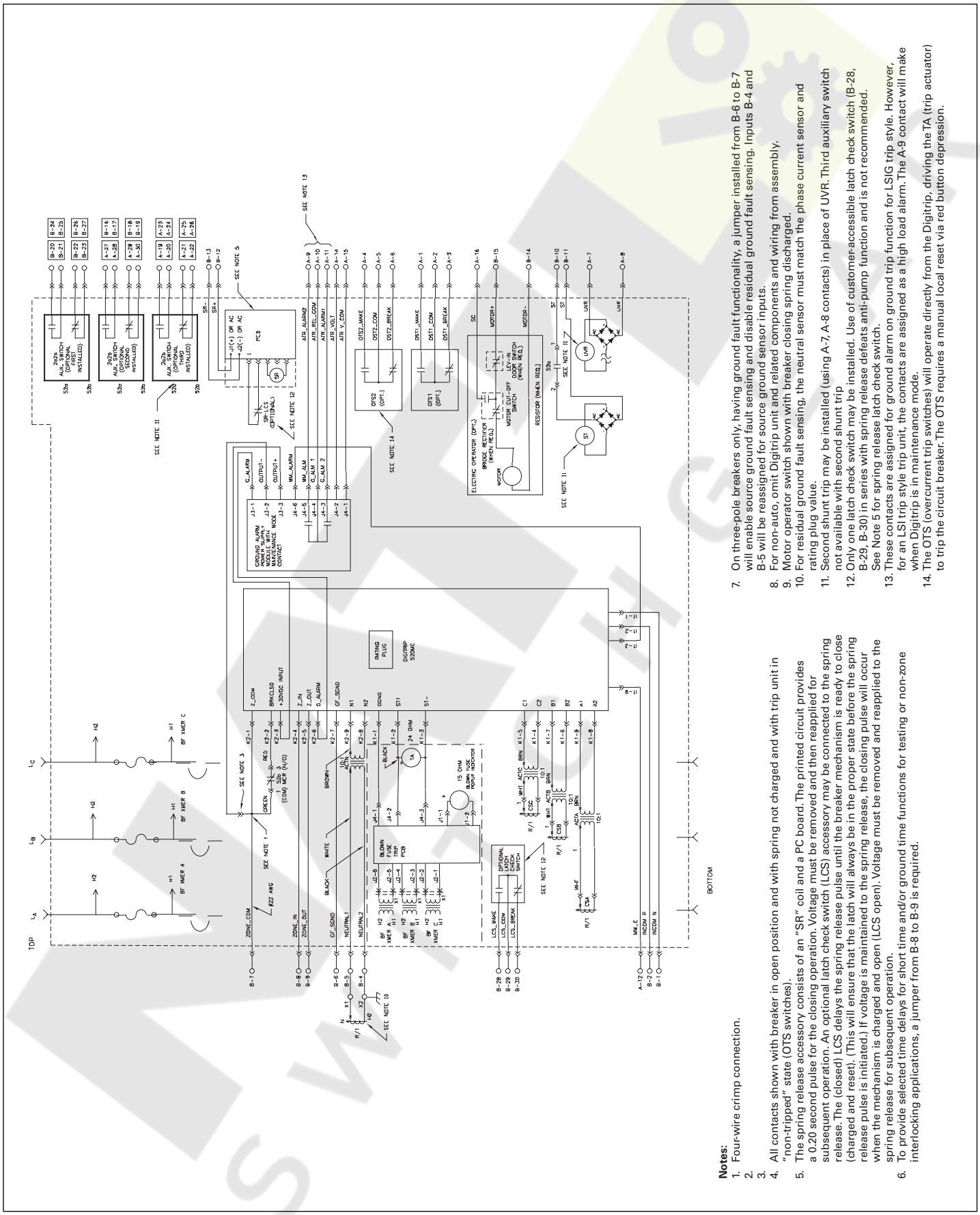
Figure 70. Digitrip 520MC/ARMS standard and narrow (except 100 kA) frames (6D32315SH03)



Notes:

1. Four-wire crimp connection.
2.
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 an SR coil and a PC board. The printed circuit 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 ensure 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-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.
9. Motor operator switch shown with closing spring discharged.
10. On four-pole breakers, the neutral current sensor is the same style and is 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. A 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. These 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 the LSI style trip unit, the contacts are assigned as a high load alarm.
14. The OTS (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-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.

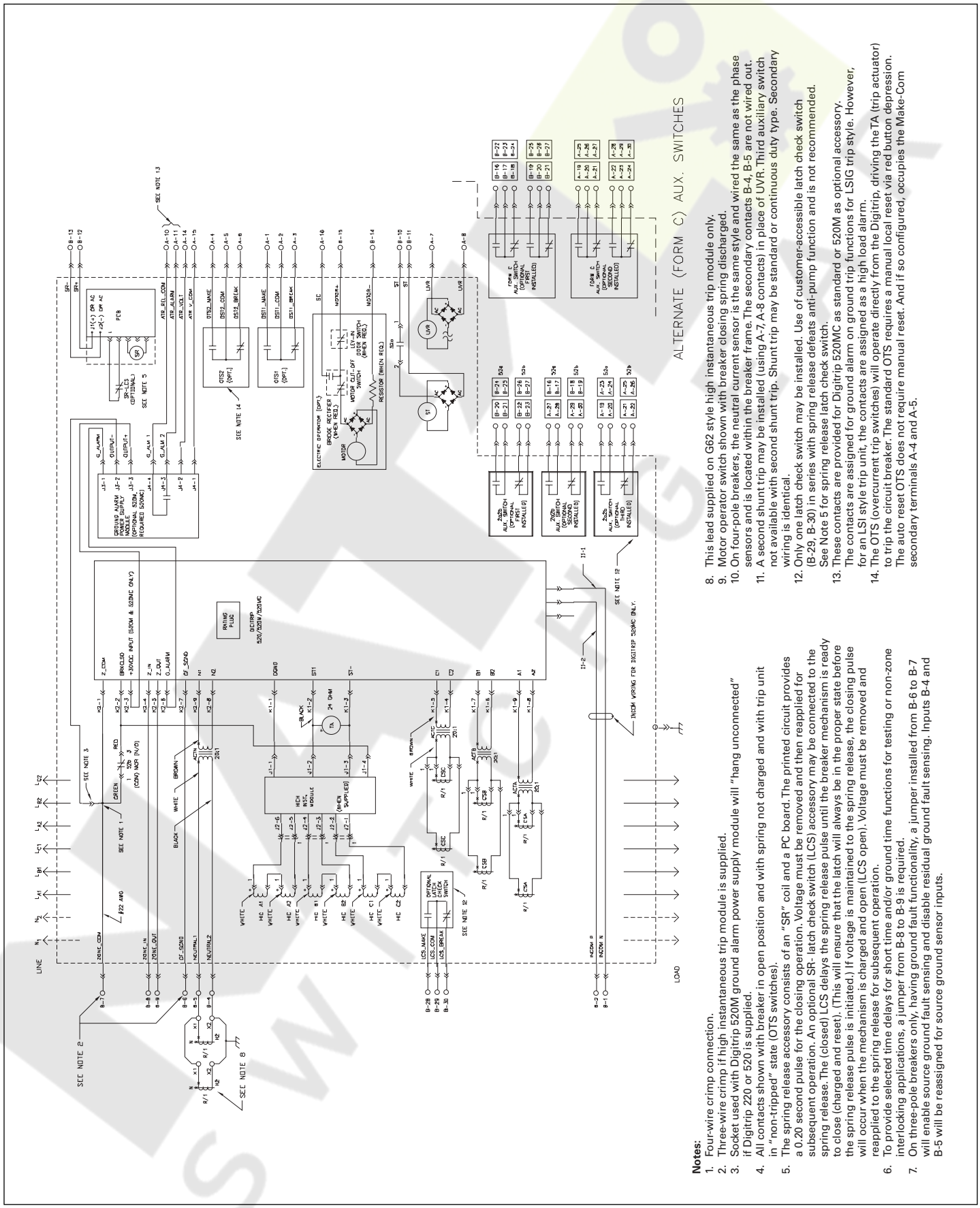
Figure 71. Digitrip 520MC/ARMS narrow 100 kA frame (6D32315SH04)



Notes:

1. Four-wire crimp connection.
2.
3.
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 an "SR" coil and a PC board. The printed circuit 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 until the breaker mechanism is ready to close (charged and reset). (This will ensure 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 open (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-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. For non-auto, omit Digitrip unit and related components and wiring from assembly.
9. Motor operator switch shown with breaker closing spring discharged.
10. For residual ground fault sensing, the neutral sensor must match the phase current sensor and rating plug value.
11. Second shunt trip may be installed (using A-7, A-8 contacts) in place of UVR. Third auxiliary switch not available with second shunt trip
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 assigned for ground alarm on ground trip function for LSIG trip style. However, for an LSI trip style trip unit, the contacts are assigned as a high load alarm. The A-9 contact will make when Digitrip is in maintenance mode.
14. The OTS (overcurrent 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.

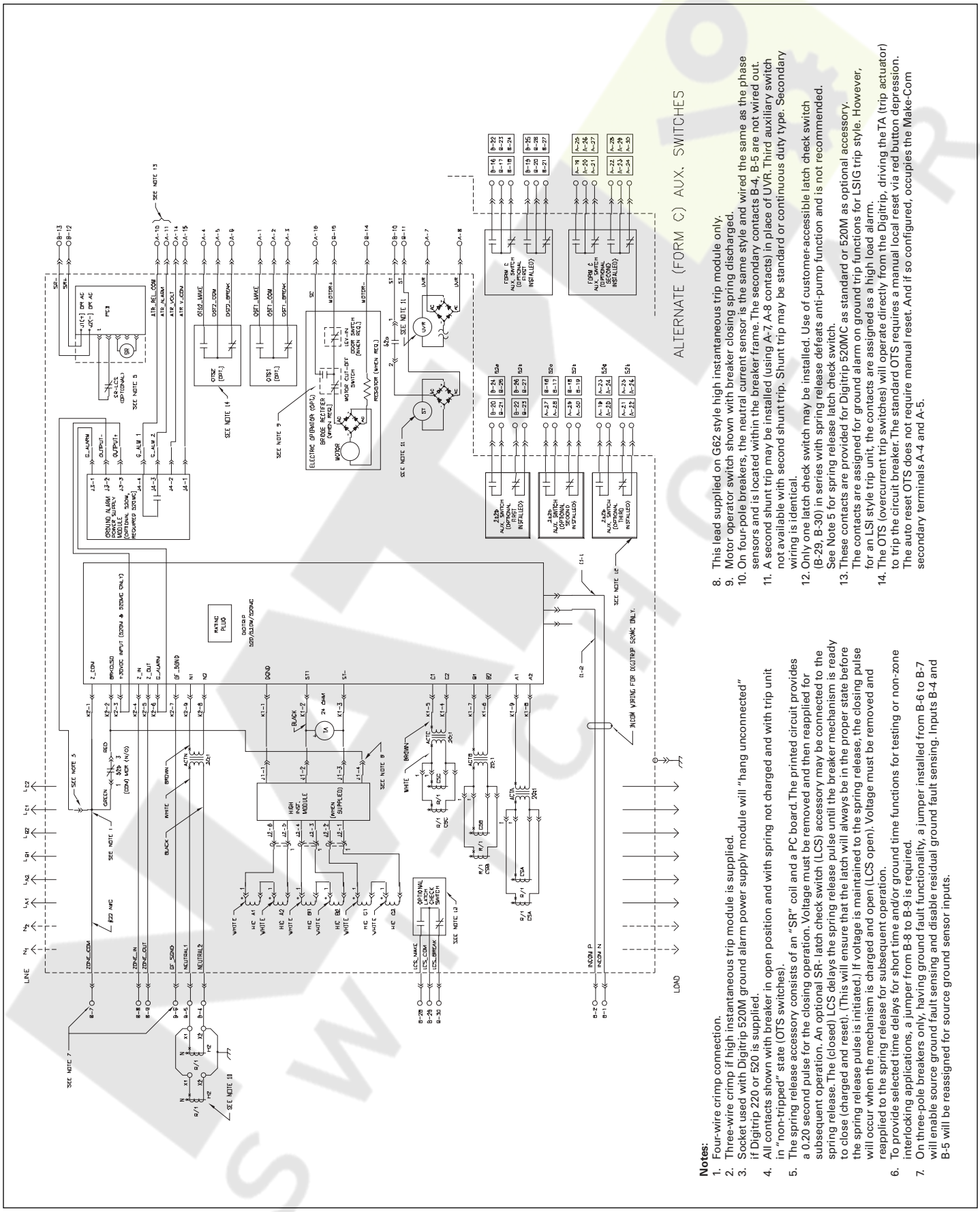
Figure 72. MDSL Digitrip 520MC/ARMS with blown fuse trip (6D32373SH02)



Notes:

1. Four-wire crimp connection.
2. Three-wire crimp if high instantaneous 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 an "SR" coil and a PC board. The printed circuit provides a 0.20 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 (closed) LCS delays the spring release pulse until the breaker mechanism is ready to close (charged and reset). (This will ensure 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 open (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-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 four-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. A second shunt trip may be installed (using A-7, A-8 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 (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 520MC as standard or 520M as optional accessory. The contacts are assigned for ground alarm on ground trip functions for LSIG trip style. However, for an LSI style trip unit, the contacts are assigned as a high load alarm.
14. The OTS (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-Com secondary terminals A-4 and A-5.

Figure 73. Digitrip 520/520M/520MC double-narrow double-standard frame, ABCABC configuration (6D32320SH01)



Notes:

1. Four-wire crimp connection.
2. Three-wire crimp if high instantaneous 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 an "SR" coil and a PC board. The printed circuit provides a 0.20 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 (closed) LCS delays the spring release pulse until the breaker mechanism is ready to close (charged and reset). (This will ensure 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 open (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-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 four-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. A second shunt trip may be installed (using A-7, A-8 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 (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 520MC as standard or 520M as optional accessory. The contacts are assigned for ground alarm on ground trip functions for LSIG trip style. However, for an LSI style trip unit, the contacts are assigned as a high load alarm.
14. The OTS (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-Com secondary terminals A-4 and A-5.

Figure 74. Digitrip 520/520M/520MC double-narrow double-standard frame, AABBCC configuration (6D32320SH02)

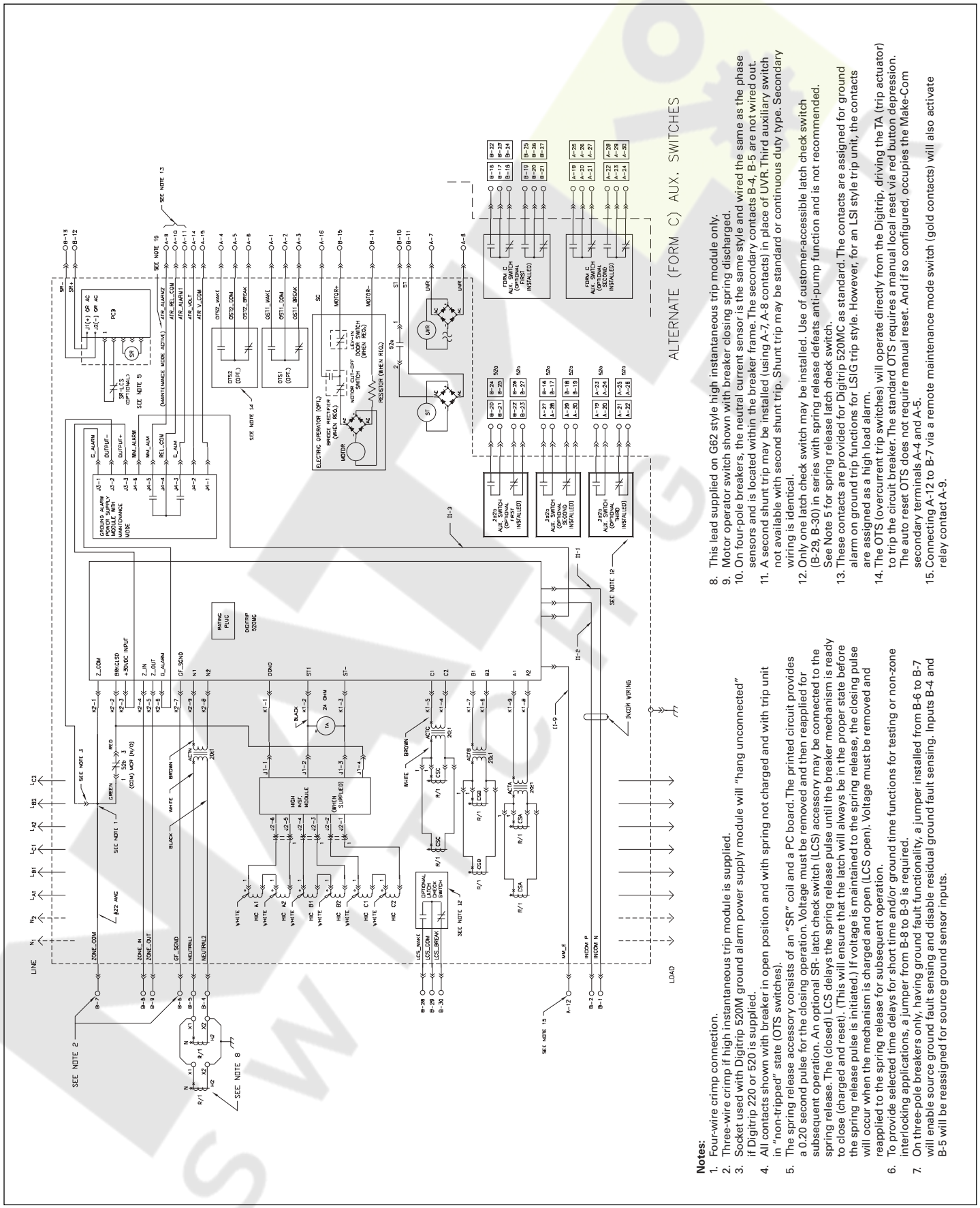
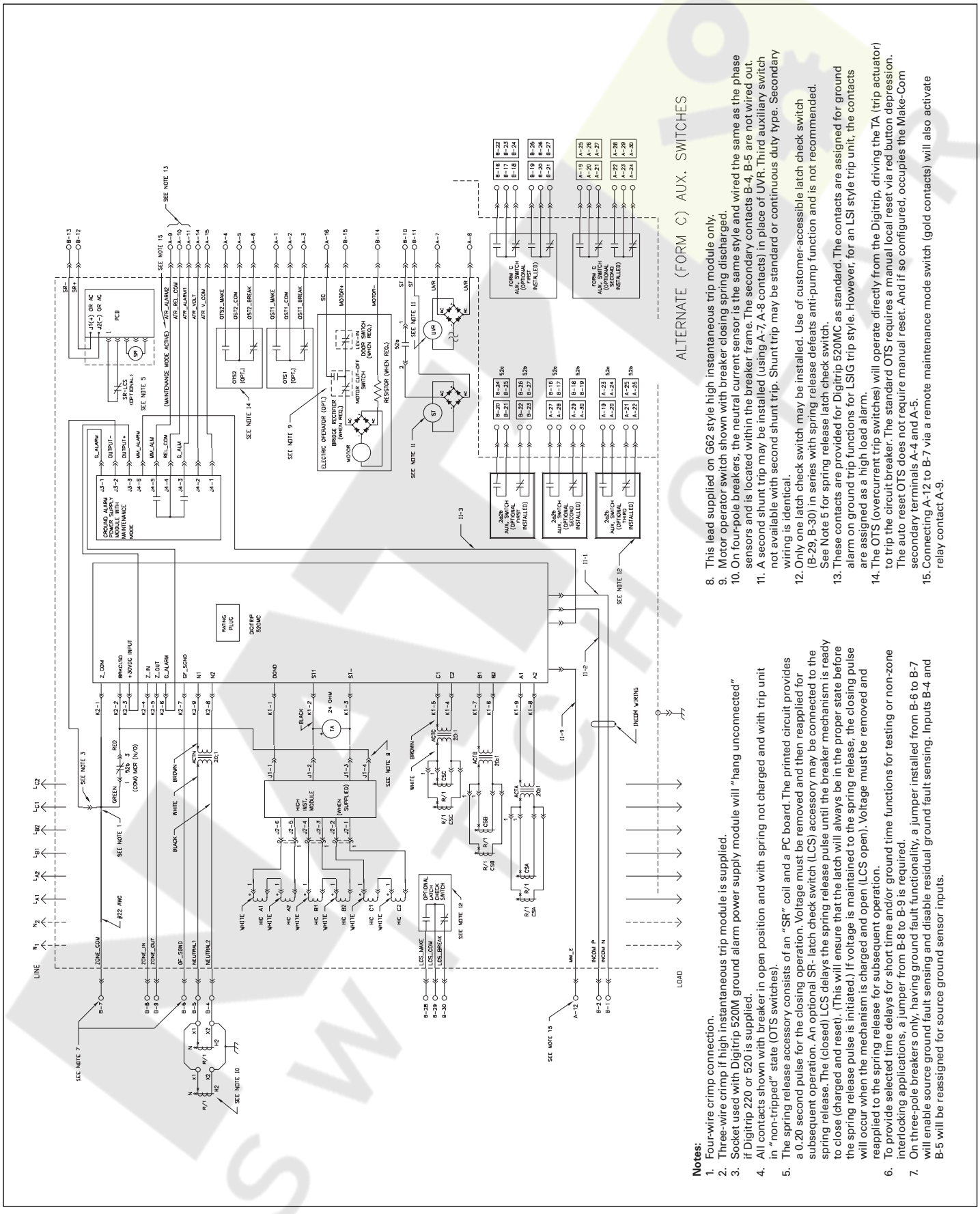


Figure 75. Digitrip 520MC/ARMS double-narrow double-standard frame, ABCABC configuration (6D32320SH03)



Notes:

1. Four-wire crimp connection.
2. Three-wire crimp if high instantaneous 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 an "SR" coil and a PC board. The printed circuit provides a 0.20 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 (closed) LCS delays the spring release pulse until the breaker mechanism is ready to close (charged and reset). (This will ensure 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 open (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-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 four-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. A second shunt trip may be installed (using A-7, A-8 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 (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 520MC as standard. The contacts are assigned for ground alarm on ground trip functions for LSIG trip style. However, for an LSI style trip unit, the contacts are assigned as a high load alarm.
14. The OTS (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-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.

Figure 76. Digitrip 520MC/ARMS double-narrow double-standard frame, AABBCC configuration (6D32320SH04)

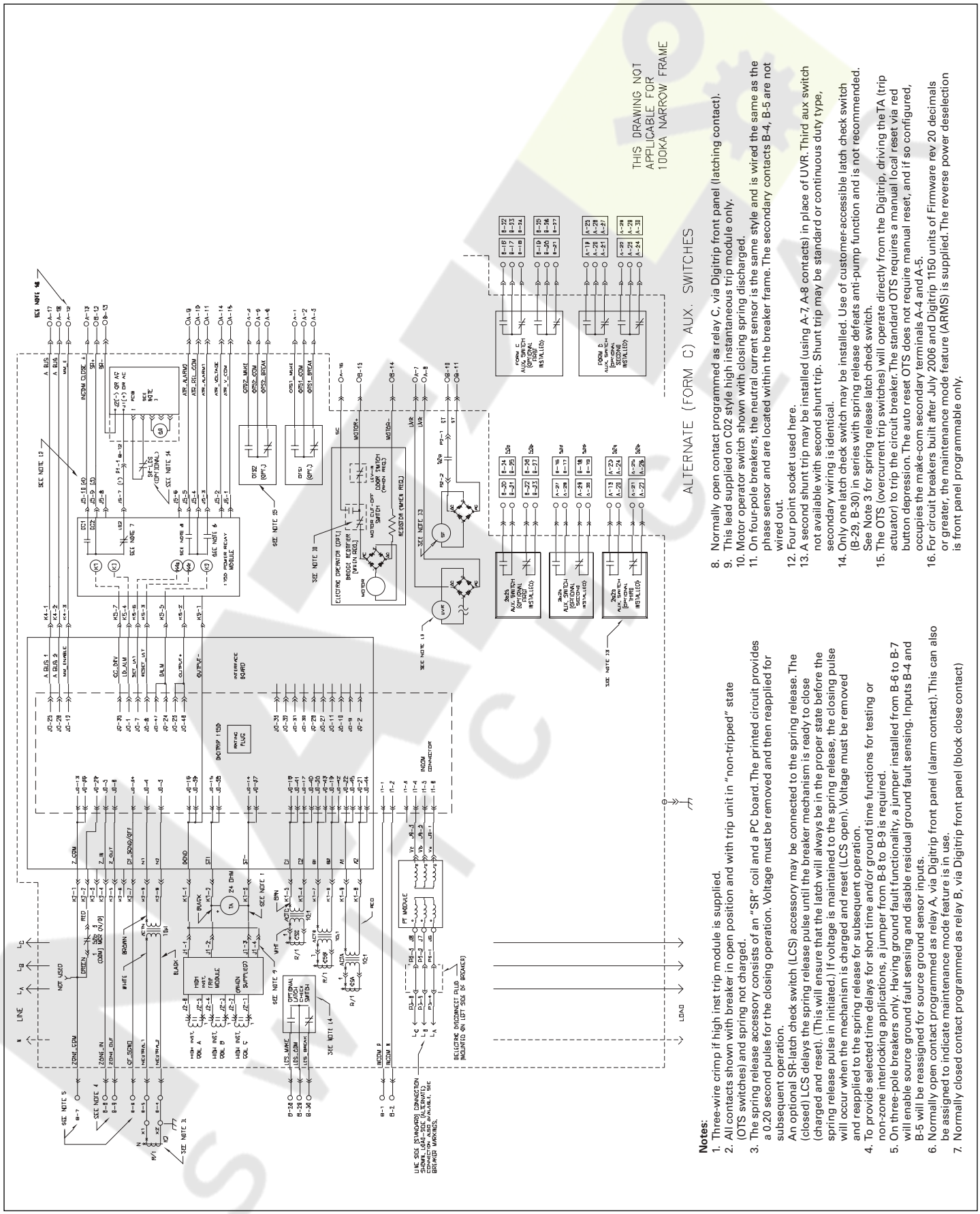
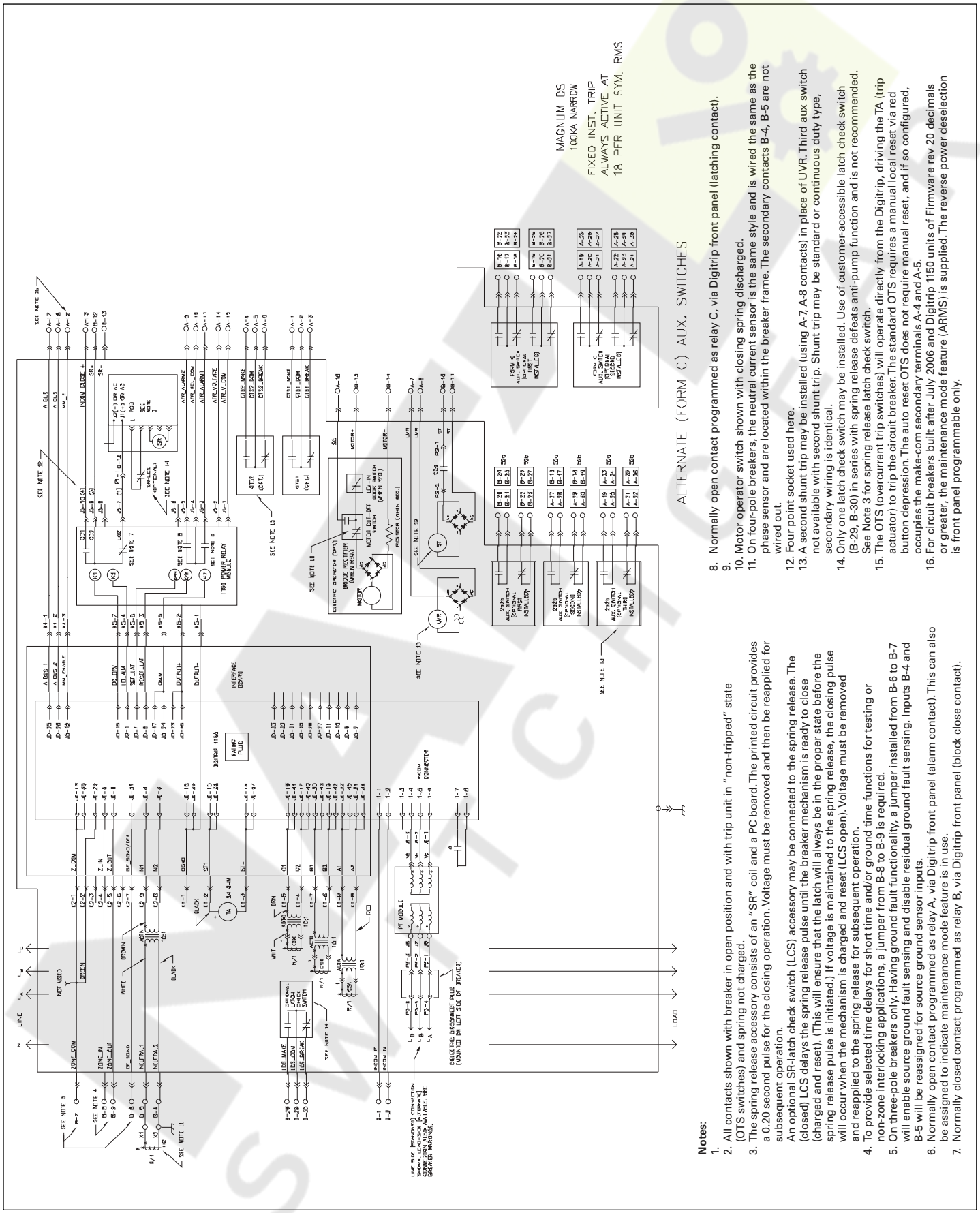


Figure 77. Digitrip 1150/ARMS standard and narrow (except 100 kA) frames (6D32314SH02)



Notes:

1.
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 an "SR" coil and a PC board. The printed circuit provides a 0.20 second pulse for the closing operation. Voltage must be removed and then be reapplied for subsequent operation.
   An optional SR-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 ensure 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.
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 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 close contact).
8. Normally open contact programmed as relay C, via Digitrip front panel (latching contact).
9.
10. Motor operator switch shown with closing spring discharged.
11. On four-pole breakers, the neutral current sensor is the same style and is wired the same as the phase sensor and are located within the breaker frame. The secondary contacts B-4, B-5 are not wired out.
12. Four point socket used here.
13. A 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.
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) 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-com secondary terminals A-4 and A-5.
16. For circuit breakers built after July 2006 and Digitrip 1150 units of Firmware rev 20 decimals or greater, the maintenance mode feature (ARMS) is supplied. The reverse power deselection is front panel programmable only.

Figure 78. Digitrip 1150/ARMS narrow 100 kA frame (6D32314SH04)

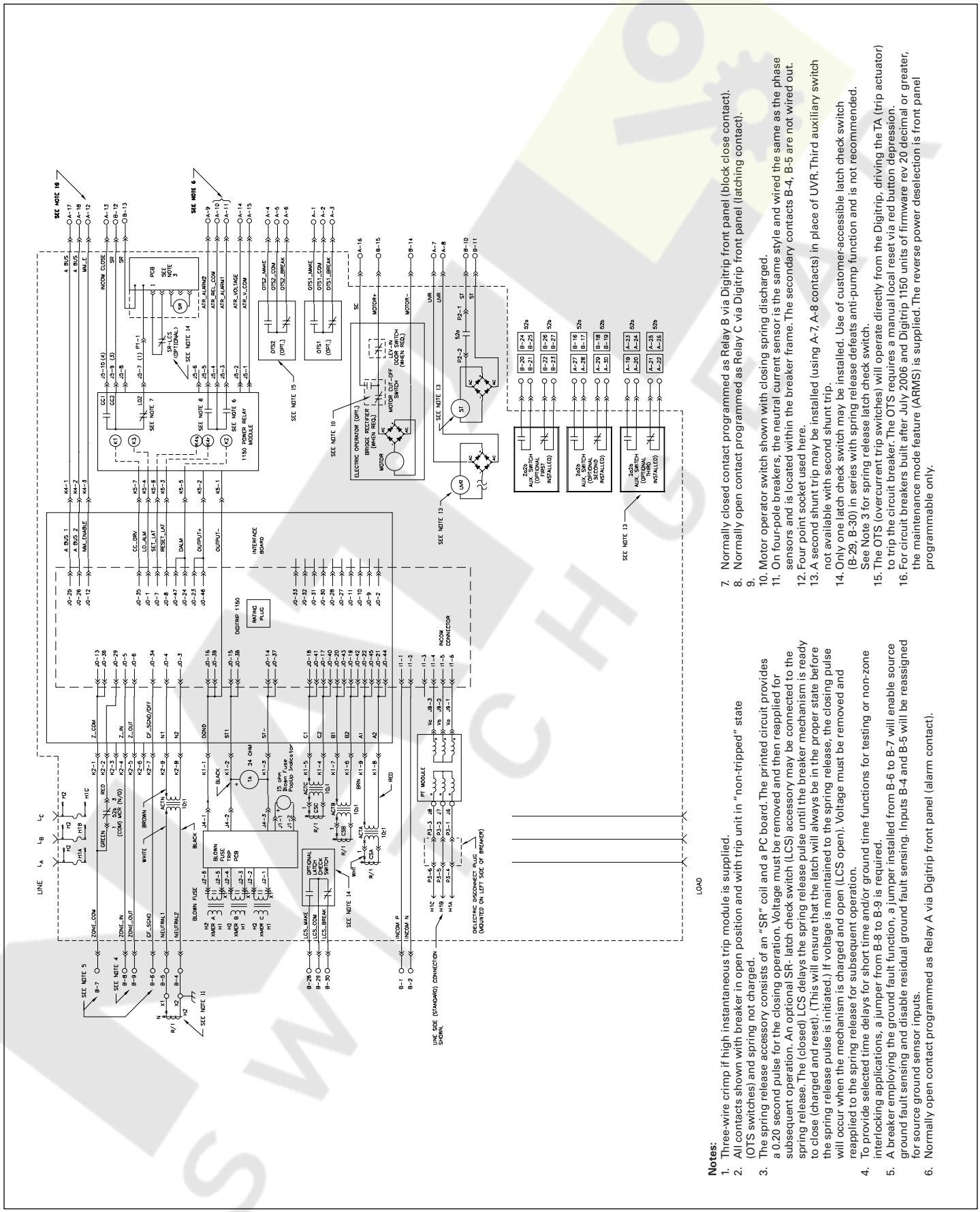


Figure 79. MDSL Digitrip 1150/ARMS with blown fuse trip (6D32374SH02)

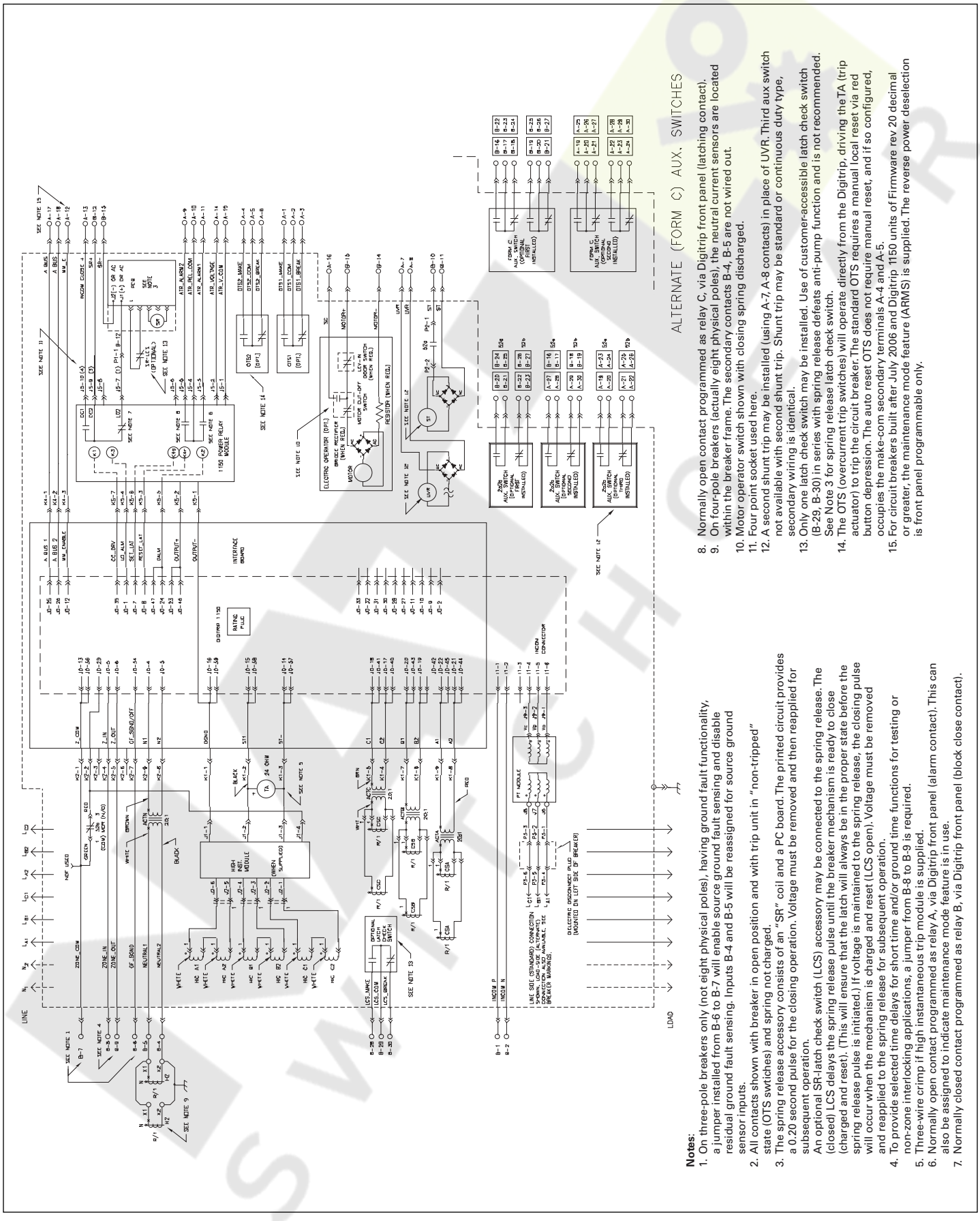


Figure 80. Digitrip 1150/ARMS double-narrow double-standard frame, ABCABC configuration (6D32319SH03)

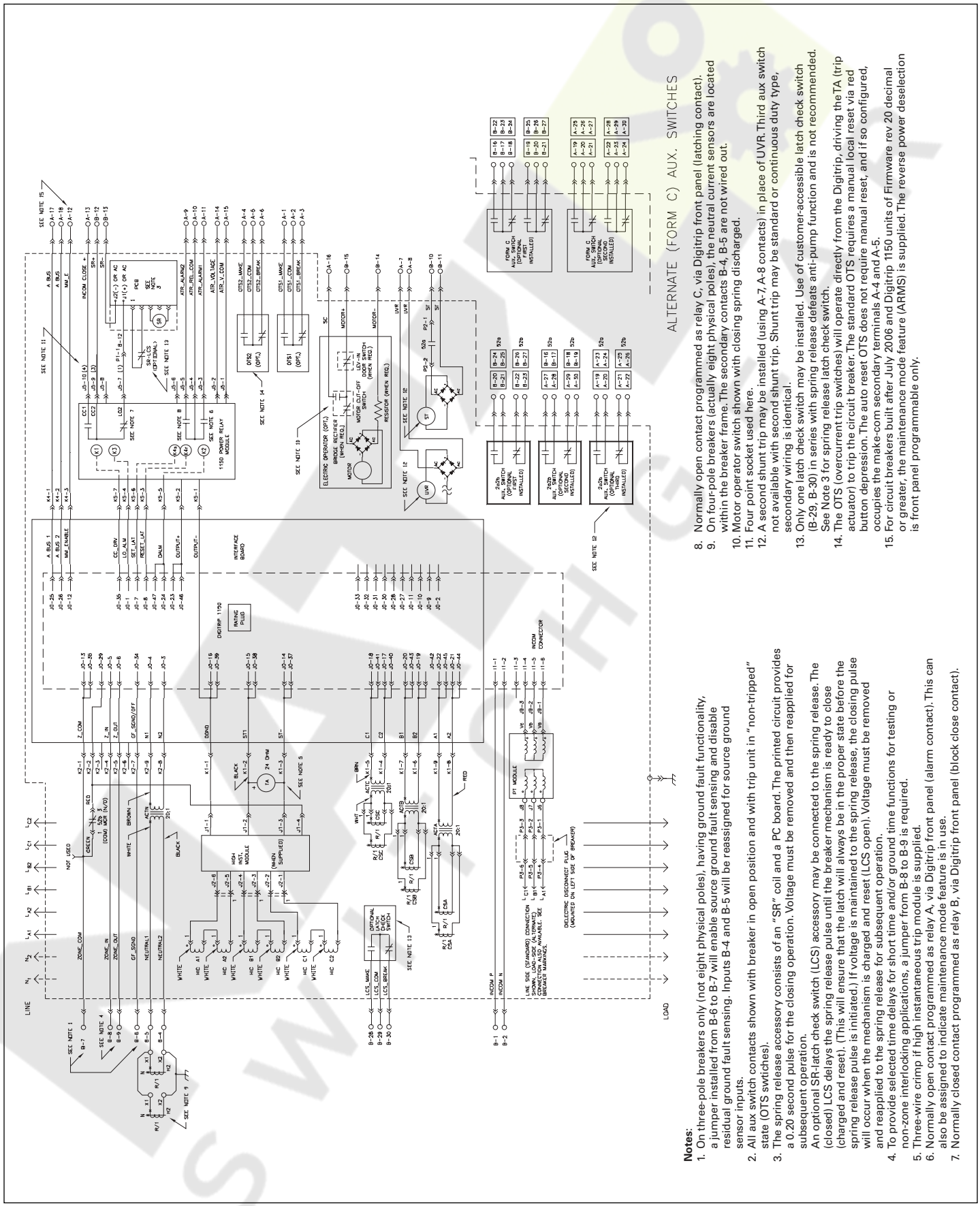


Figure 81. Digitrip 1150/ARMS double-narrow double-standard frame, AABBCC configuration (6D32319SH04)

Section 5: Drawout circuit breaker and cassette

General

Section 3 discussed topics and features common to all Magnum circuit breakers, no matter what the mounting configuration or type (drawout or fixed, MDS, MDSX, or MDSL). In this section, features unique to the drawout type circuit breaker and drawout cassette, not covered elsewhere, are discussed. Section 6 covers features unique to MDS and MDSX fixed type circuit breakers only. 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 the levering of a drawout circuit breaker were discussed in Section 2. If necessary, review that information, because it will not be repeated here.

Drawout cassette

A drawout circuit breaker is used in combination with a fixed drawout cassette (**Figure 82** and **Figure 84**); the drawout circuit breaker is equipped with automatic primary disconnects (**Figure 83**). The cassette provides all of the necessary interfaces to the drawout circuit breaker, including automatic primary and secondary connections. For the MDS narrow frame circuit breaker, a single cassette style using horizontal stabs and horizontal customer busbar terminals is available (**Figure 85**). For the MDS and MDSX 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 86**). The basic cassette omits the copper stab/terminals so that these pieces can be integrated with vertical busbars provided by the switchgear builder (**Figure 87**). 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 (**Figure 88**). The MDSL circuit breaker with integral current limiters is 6.00 inches deeper than the MDS or MDSX circuit breaker, and uses a cassette similar to the MDS and MDSX standard type cassette, except 6.00 inches deeper (**Figure 89** and **Figure 90**). Mounting locations for cell (TOC) switches, safety shutters, mechanical interlocks, and key interlocks are provided on the cassette.

Figure 82. MDS/MDSX drawout circuit breaker in cassette

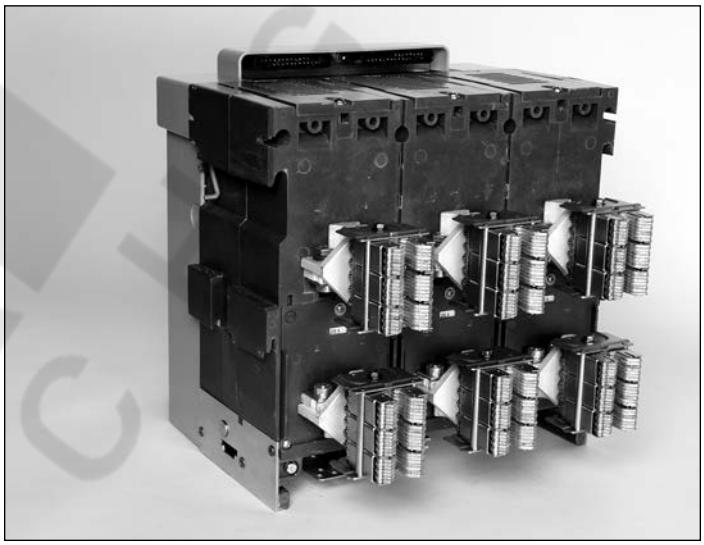


Figure 83. MDS/MDSX drawout circuit breaker with automatic primary disconnects

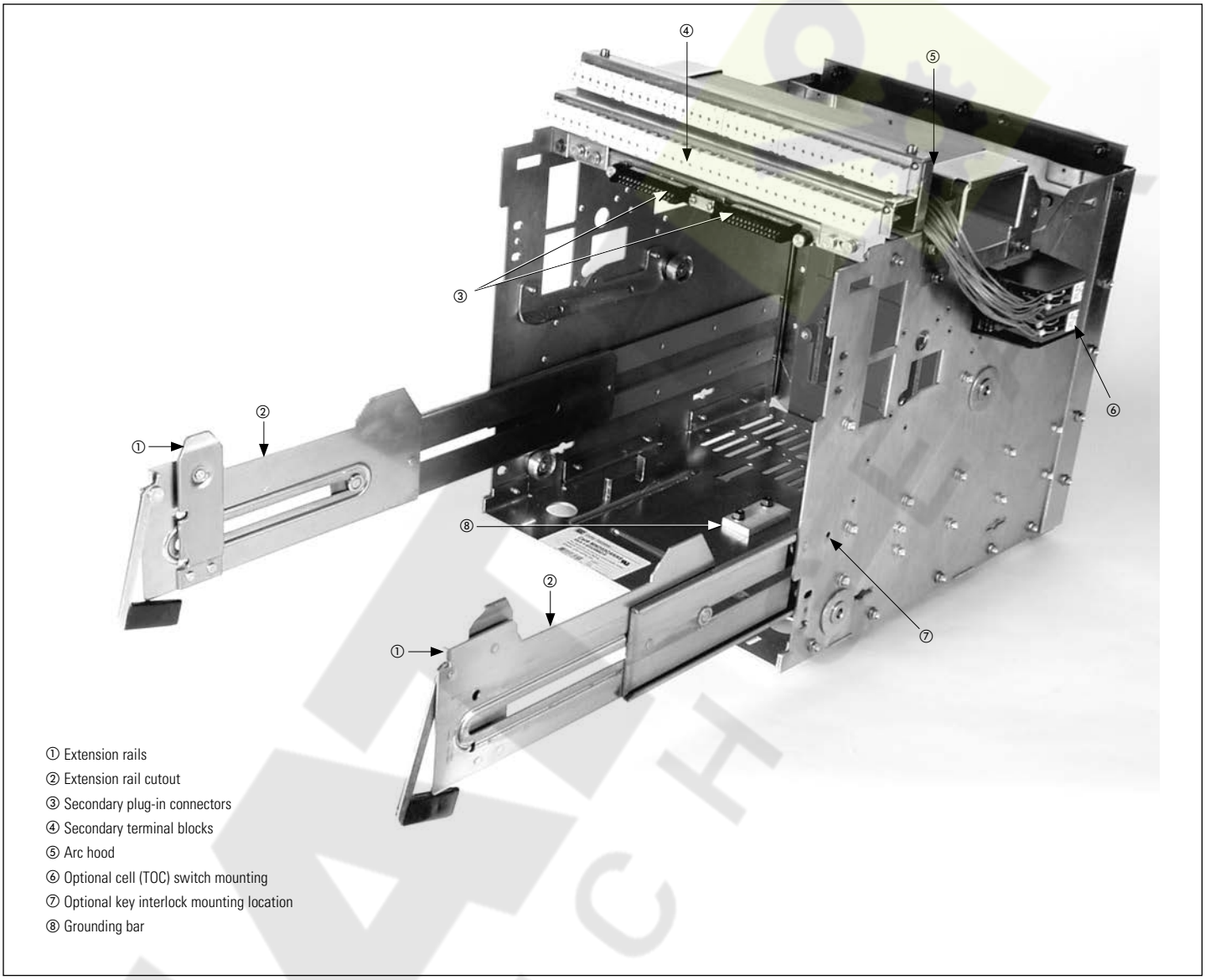


Figure 84. Typical drawout cassette features

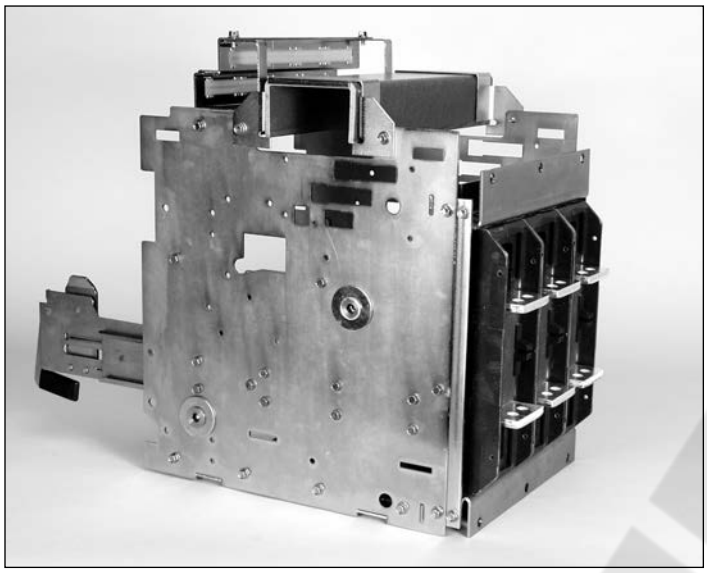


Figure 85. Typical MDS narrow frame cassette (horizontal terminals)

Figure 87. Typical MDS/MDSX basic cassette (without stabs) (shown with MDS type arc hood)

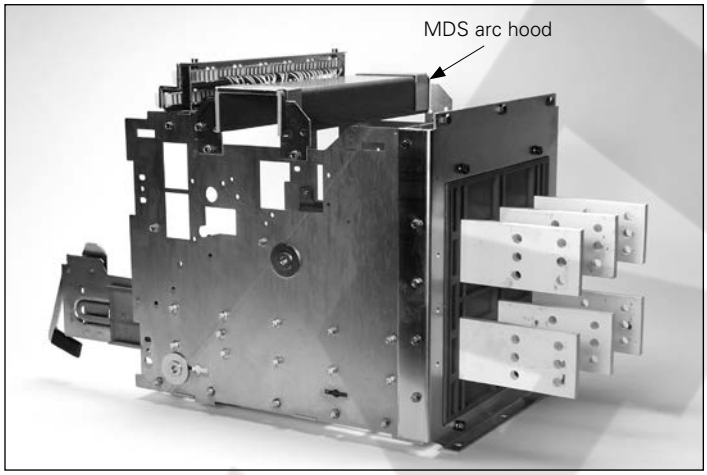


Figure 86. Typical MDS/MDSX standard cassette (vertical terminals) (shown with MDS type arc hood)

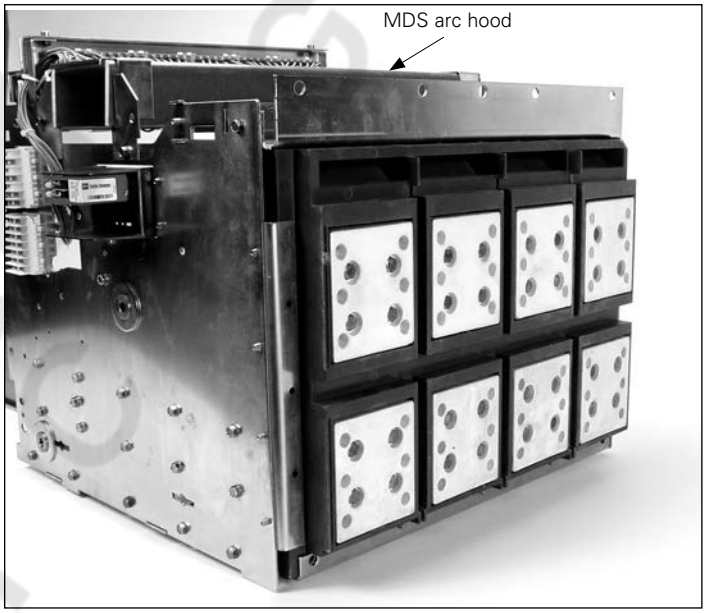


Figure 88. Typical MDS/MDSX universal cassette, four-pole (flat terminal pads) (shown with MDS type arc hood)

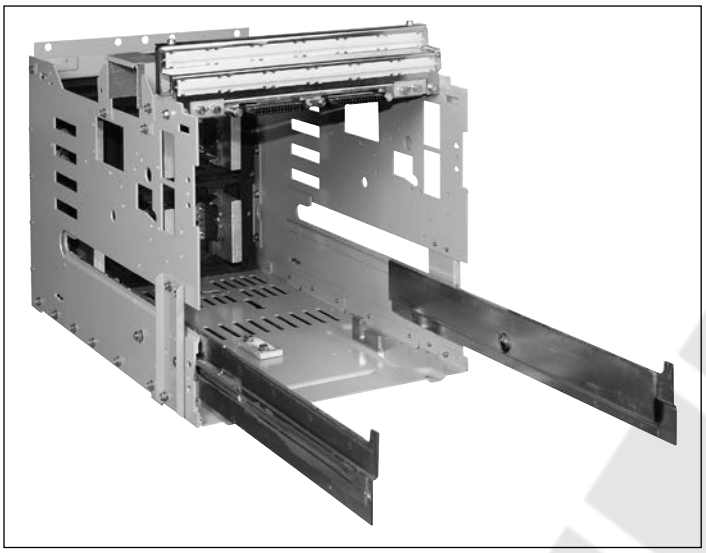


Figure 89. Typical MDSL standard cassette (front view)

Figure 90. Typical MDSL standard cassette (rear view)

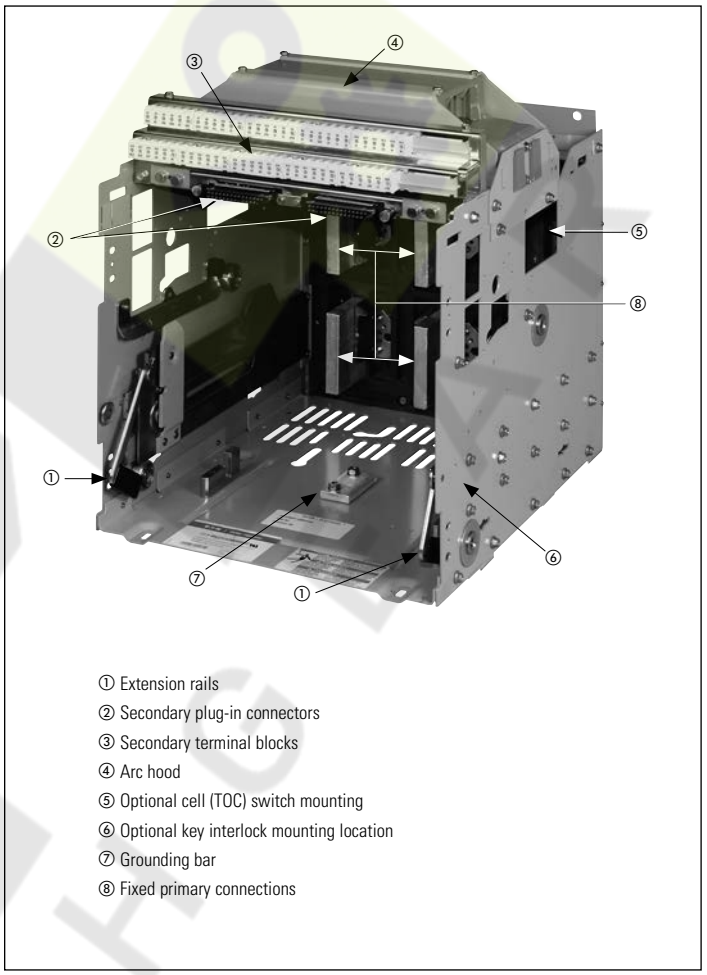


Figure 91. Typical MDSX type drawout cassette

Drawout circuit breaker dimensions

The Magnum 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 circuit breakers from an overall dimensional standpoint. Circuit breaker drawings can be found in Engineering Data TD01301004E.

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.

Section 6: Fixed circuit breaker

General

Section 3 discussed topics and features common to all Magnum circuit breakers, no matter what the mounting configuration or type. In this section, features unique to the fixed configuration (MDS/MDSX only) 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, because it will not be repeated here.

⚠ WARNING

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

The MDSX 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 92**). Optional vertical primary adapters are available for different bus configurations. Refer to Engineering Data TD01301004E for fixed circuit breaker dimensions, vertical adapter dimensions, and vertical adapter assembly details.

Figure 92. Fixed MDS/MDSX circuit breaker with available vertical adapter

Section 7: Importance of maintenance

General

Magnum circuit breakers are manufactured under a high degree of quality control, with the best available materials, and with a high degree of tooling for accuracy and part interchangeability. Design tests and actual 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, Eaton recommends that inspection and maintenance activities take place on a regularly scheduled basis.

This section explains what Magnum components need to be maintained, when they should be inspected, and step-by-step procedures for completing required inspections and tests. The following maintenance recommendations apply to all families of Magnum breakers (DS, SB, IEC, DC) and all compatible Digitrip trip units.

Eaton's history of producing high-quality electrical components has made Eaton a leader in the industry and a contributing member of many governing standards agencies. The basis for the information provided in this guide comes from the National Electrical Manufacturers Association (NEMA) standard, NEMA AB4, and the National Fire Protection Association (NFPA) standard, NFPA 70B. If further assistance or information is required, please contact Eaton Electrical Services and Systems at 1-877-386-2273 (1-877-ETN-CARE).

It is recommended that maintenance record sheets be completed each time maintenance is performed on the circuit breaker. Careful and accurate documentation of all maintenance activities provides a valuable historical reference on equipment over time. Examples are provided on **page 66** and **page 67**.

This document cannot, and is not intended to, ensure proper electrical performance of a Magnum breaker that has been modified in any way that is not authorized by Eaton.

Safety precautions

⚠ 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 HARM, OR EVEN DEATH.

Only workers with electrical training and familiarity with power circuit breakers and their associated hazards should perform work on a Magnum circuit breaker. Workers should also become familiar with the specifics associated with Magnum circuit breakers as presented in this maintenance section. Be sure to follow all safety guidelines and wear proper personal protective equipment when performing maintenance on a circuit breaker.

Unless otherwise specified in this guide, inspection, preventative maintenance, and testing must always be performed on equipment that is in an electrically-safe working condition (as defined in Article 120 of NFPA 70E-2015) and at a distance beyond the arc flash boundary of energized electrical conductors. Verify that there is no voltage present on incoming terminals (or on control power terminals, if present) and between these terminals and ground to positively ascertain that the equipment is totally in an electrically safe working condition. The disconnecting or isolating means on the line side of the isolation devices being checked or tested should be in the open state to assure that the equipment will remain in an electrically safe working condition during these procedures by exercising approved Lock-Out-Tag-Out procedures. Refer to the Hazardous Energy Control procedures as described in OSHA and NFPA 70C-2015, Article 120.2 (D) for clarification.

Low voltage AC power circuit breakers should be installed, operated, and maintained by qualified personnel as defined by OSHA 29CFR1910 subpart 5.

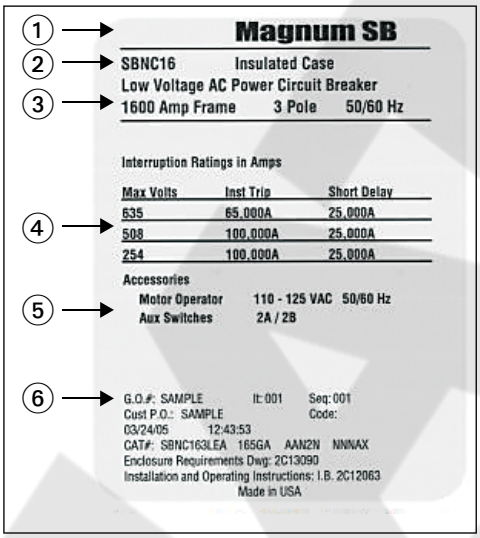
General cleaning recommendations

Circuit breaker cleaning activities should be 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 air because dirt or foreign products 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.

Functional tests

Eaton recommends that the following functional tests be performed on Magnum circuit breakers as part of any maintenance procedure. These tests are meant to check the basic functionality of the breaker components. The circuit breaker should be removed from service and Eaton should be notified if the circuit breaker fails to perform any of these tests successfully. Please be prepared to provide the estimated number of operations the circuit breaker has to date, (or exact number, if equipped with an operations counter) as well as the following nameplate information if possible.

Magnum nameplate information



① Low voltage power circuit breaker family name
② Breaker family designation
③ Breaker frame size in amperes
④ Interrupting capacity rating
⑤ Factory equipped accessories
⑥ General order number, item, and sequence

Before doing any work on drawout type circuit breakers, confirm that the breaker is levered out to the TEST or DISCONNECT position. To test the electrical operations of the circuit breaker accessories, the breaker must be levered out to the TEST position. For breaker control wiring information, refer to **Figure 67** through **Figure 81**. During the levering process, 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 must be in an electrically safe working condition for convenience and safety. The circuit breaker should be switched to the OPEN state and the mechanism springs discharged.

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

Manual operation functional test

Procedure

1. Charge the breaker mechanism springs either using the charging handle or the motor operator.
2. Press the ON pushbutton to close the breaker manually and verify closing by noting the state of the indicating flag (**Figure 93**).
3. 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.
4. Press the OFF pushbutton to manually open the breaker.
5. Press the ON pushbutton to manually close the breaker. Is the breaker closed?
6. Press the OFF pushbutton to manually open the breaker. Is the breaker open?

Note: Repeat this entire described test procedure three times.

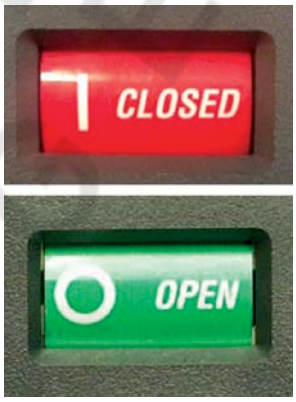


Figure 93. CLOSED and OPEN indicators

Electrical operation functional test

Note: Breaker accessory voltages can vary within the same breaker. Be sure to review the accessory voltage rating before energizing as damage may occur.

This test procedure is based on the assumption that the breaker is equipped with optional shunt trip (ST), undervoltage release (UVR), and/or spring release (SR) accessories (**Figure 94**). If one accessory is missing, substitute the manual button or manual charge handle to replace the accessory's function. If equipped with a motor operator, the voltage is listed on the breaker nameplate.

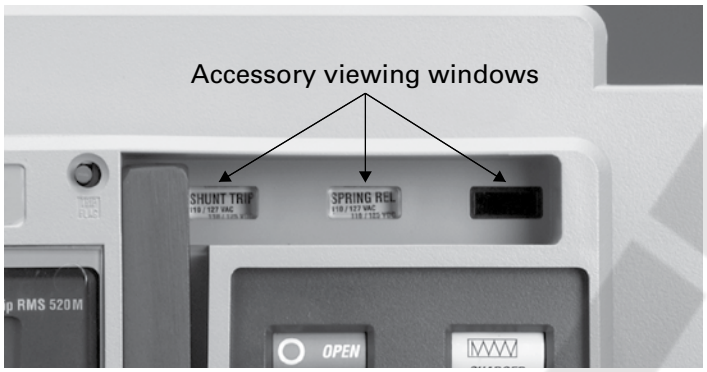


Figure 94. Accessory viewing windows

Procedure

1. Charge the breaker mechanism springs using the motor operator, then if equipped with a UVR, energize the UVR with the rated voltage.
2. Close the breaker by applying rated voltage to the spring release accessory and verify closing by noting the state of the indicating flag.
3. Charge the breaker mechanism springs using the motor operator. If using the motor operator, after charging, remove power to the motor operator to prevent automatic recharging.
4. Open the breaker by applying rated voltage to the shunt trip accessory.

Note: If UVR is not installed, proceed to step 7.

5. With UVR energized, close the breaker using the spring release accessory. The breaker should now be closed.
6. Open the breaker by removing power from the UVR. The breaker should now be open.
7. Repeat this entire described test procedure three times.

Trip unit overload functional test

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

1. Hand-Held Functional Test Kit: Catalog Ordering Number MTST230V (**Figure 95**).
2. Digitrip 1150 models include an integral functional tester (see corresponding instruction manual for Digitrip 1150 trip units).

Figure 95. Trip unit test kit

Procedure

1. Charge the breaker mechanism springs either using the charging handle or the motor operator.
2. Close the breaker by applying rated voltage to the spring release accessory and verify closing by noting the state of the indicating flag.
3. Charge the breaker mechanism springs either by using the charging handle or the motor operator. If using the motor operator, disconnect power to it to prevent automatic recharging.
4. Check the state of the pop-out trip indicator (if so equipped) is "out" and then reset it.
5. Press the ON pushbutton to manually close the breaker. If the indicator is "out", then reset it.
6. Use the Functional Test Kit to trip the breaker by setting its SELECT TEST switch to INST, then pressing its PUSH TO TEST button. Verify that the trip indicator pop-out button (if so equipped) is "out" and then reset it by pressing the pop-out button. The trip unit then needs to be reset by the Reset/Battery Test pushbutton on the front of the trip unit.

Note: Repeat this entire described test procedure three times. Digitrip 520 trip units require power to the trip units to be reset.

Note: For instructions on proper use of the Hand-Held Functional Test Kit, please see Eaton document IL5721B13H07.

Maintenance schedule

Normal operating conditions

When determining how often a Magnum breaker should be inspected, the environmental and operating conditions must be taken into consideration.

Table 15. Normal operating conditions

Normal operating conditions	
Temperature	Ambient temperature between 15 °C to 30 °C (59 °F to 86 °F)
Percent load	<80% of I_n (sensor rating)
Relative humidity	40–70% in a noncondensing environment
Corrosive atmosphere	Clean, dry, noncorrosive atmosphere
Salt environment	No salt mist
Dust	Protected by switchboard or switchgear assembly with proper ventilation
Vibration	Continuous vibration <0.2 g

Table 16 serves as a baseline for developing a maintenance schedule. Under these conditions, the recommended maintenance frequencies should be followed as written below.

Table 16. Normal maintenance frequency

Test/inspection	Frequency
Arc chute inspection	1 year
Primary contact inspection	1 year or after a short circuit interruption
Internal mechanism inspection	Every 250 operations or 3 years
Primary disconnect inspection (drawout applications only)	Every time breaker is racked out
Secondary connection inspection	Every time breaker is racked out
Interlocks inspection	Every 250 operations or 3 years
Trip unit testing (primary injection)	5 years
Trip unit testing (secondary injection)	2–3 years

Adjusting maintenance frequency

Although Magnum breakers are designed and manufactured to operate in a wide variety of applications and environments, there are some conditions that may require inspection frequency to be increased.

Table 17. Increased frequency conditions

Factor	Condition limits	Recommended action
Operating conditions		
High cycling	Greater than one operation every 2 minutes	Inspect every 1500 operations
Low cycling	Less than one operation per year	Double the normal inspection frequency
Repeated interruptions or overloads	Three interruptions or 50 overloads (28 overloads for >2000 A breakers)	Double the normal inspection frequency
Capacitive switching	>135% of the capacitive bank load	Double the normal inspection frequency
Environmental conditions		
Temperature	Ambient temperature is above or below 15 °C to 30 °C (59° F to 86° F)	Double the normal inspection frequency
Temperature	Breaker is placed in an area with a strong solar influence	Double the normal inspection frequency
Dirt and contaminants	Visible dirt or contaminants	Remove contaminants from the breaker and double the normal inspection frequency
Corrosive atmospheres	Breaker is used in water or wastewater, pulp and paper, petrochemical, or other harsh industrial atmospheres	Double the normal inspection frequency
Altitude	>2000 m (6562 ft)	Use appropriate voltage and current correction factors. See **Table 18** for rating factors. Short circuit current is not affected as long as the voltage is rated in accordance with the table.
Humidity	Breaker is placed in a condensing environment	Double the normal inspection frequency and inspect for rust

Use this table for ratings factor.

Table 18. Altitude rating factors

Altitude (meters)	Voltage correction	Current correction
2000	1.000	1.000
2100	0.989	0.998
2300	0.976	0.995
2450	0.963	0.993
2600	0.950	0.990
2750	0.933	0.987
2900	0.917	0.983
3050	0.900	0.980
3200	0.883	0.977
3350	0.867	0.973
3500	0.850	0.970
3650	0.833	0.967
3800	0.817	0.963
3950	0.800	0.960
5000	0.700	0.940

Inspection procedures

Arc chute inspection

Table 19. Pre-inspection conditions

Device	Position of poles		Mechanism		Device position in cassette			
Fixed	**Open**	*Closed*	*Charged*	**Discharged**	—	—	—	—
Drawout	**Open**	*Closed*	*Charged*	**Discharged**	*Connected*	*Test*	*Disconnected*	**Removed**

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 plated inside the arc chute.

Arc chutes fit inside the arc chambers and down over the primary contacts. Each arc chute is held in place by either 1 (SB) or 4 (SBSE) top inserted screws.

Procedure

1. Remove arc chute screws and all arc chutes from the arc chamber.
2. Turn each arc chute upside down and visually inspect the inside.
3. Be sure to look for erosion and sooty discoloration on the splitter plates and insulating jacket. If arc chutes show severe signs of erosion or discoloration, replace with a new arc chute.

Note: Because the arc chutes are removed, this is an ideal time to inspect the primary contacts for wear (See Primary Contact Inspection procedure on **page 59**)

4. When the inspections are complete, position each arc chute over its respective set of primary contacts, and secure in place with the screw(s) removed earlier. Be sure to torque arc chute screws to 35 to 45 in-lb.

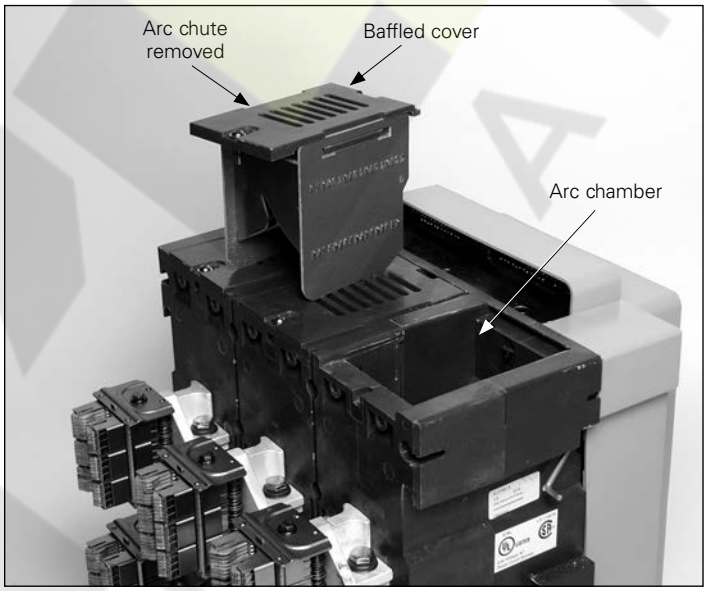


Figure 96. Top rear view of circuit breaker with one arc chute removed

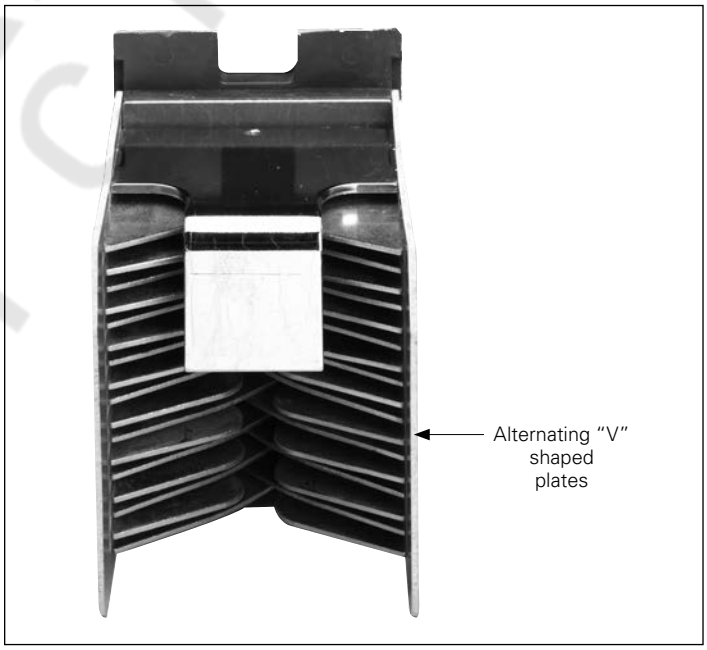


Figure 97. Bottom view of arc chute

Primary contact inspection

Table 20. Pre-inspection conditions

Device	Position of poles		Mechanism		Device position in cassette			
Fixed	**Open**	*Closed*	*Charged*	**Discharged**	—	—	—	—
Drawout	**Open**	*Closed*	*Charged*	**Discharged**	*Connected*	*Test*	*Disconnected*	**Removed**

Procedure

Note: Using the mating line of the housing halves as a reference guide will assist in this visual inspection.

1. With the arc chutes removed, look directly down into the arc chamber (**Figure 98**), and visually inspect each primary contact structure for signs of wear and/or damage.
2. Use the contact wear indicator to inspect each contact. 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 each of the contact fingers (**Figure 99**). If the back end of any of the contacts are below the ledge, the contact assembly should be replaced.
3. Once the inspection is complete, be sure to verify the arc chutes are properly replaced as previously described in the Arc Chute Inspection procedure.

⚠ WARNING

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

Figure 98. Primary contacts with circuit breaker open (not used for contact wear inspection)

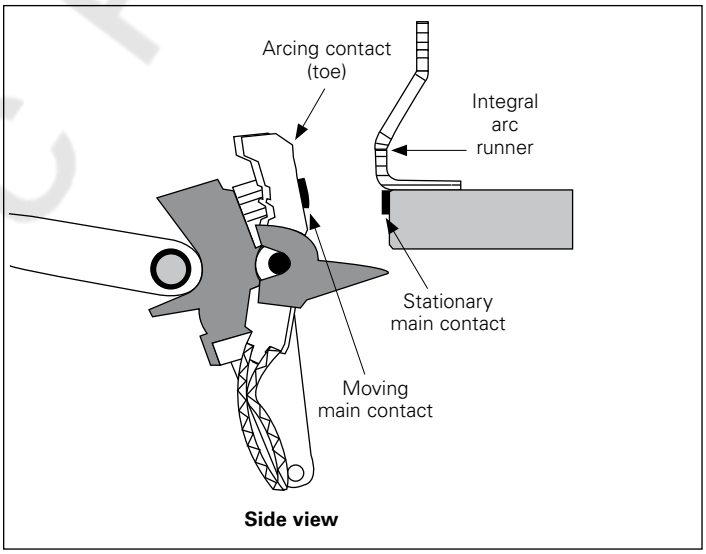


Figure 99. Contact inspection area with circuit breaker open

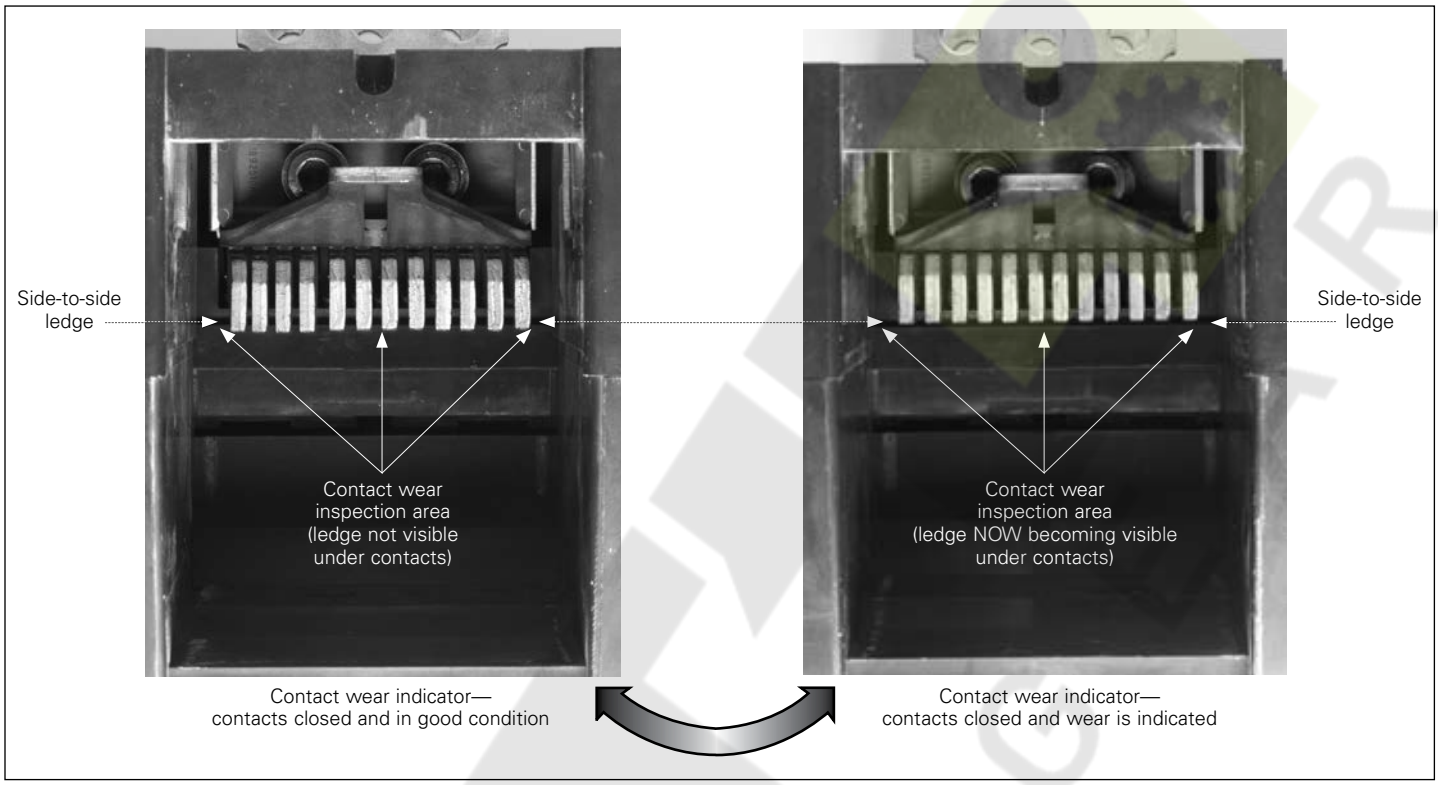


Figure 100. Use of contact wear indicator with circuit breaker closed

Internal mechanism inspection

Table 21. Pre-inspection conditions

Device	Position of poles		Mechanism		Device position in cassette			
Fixed	**Open**	*Closed*	*Charged*	**Discharged**	—	—	—	—
Drawout	**Open**	*Closed*	*Charged*	**Discharged**	*Connected*	*Test*	*Disconnected*	**Removed**

Procedure

1. Inspect the breaker for nicked wires, cracks in plastic parts, and loose screws. Screws or bolts should be tightened to levels outlined in **Table 22** .Loose screws inserted into plastic parts will require thread-locking compound (such as Loctite 242). All nicked wiring should be replaced or repaired in accordance with accepted industry practices.
2. Ensure that the torque values of the operating mechanism and motor mounting hardware are within the recommended values in **Table 18**.
3. Inspect all sliding or rolling parts for cleanliness and adequate lubrication. Refer to **Table 23** and **Figure 101**—**Figure 106**.

Table 22. Magnum breaker torque list

Subassembly	lb-in	Nm
Arc chute	35–45	3.95–5.08
Front cover	25–35	2.82–3.95
Rating plug	Hand tight	Hand tight
Rear housing	75–85	8.47–9.60
Motor operator	75–85	8.47–9.60
Current sensor cover screws	18–22	2.03–2.49
Fixed mount feet bolts	75–85	8.47–9.60
Primary disconnect	75–85	8.47–9.60

Table 23. Greases used on Magnum

Grease type	Description
Magnalube®-G	
Eaton standards	#53701AI
Color	Green
Manufactured by	Saunders Enterprises inc. 11-51 44th Road, Long Island City, New York 11101 Phone (718) 729-1000 Fax (718) 729-2690 www.magnalube.com
Molykote®	
Eaton standards	#53701QB
Color	Black
Manufactured by	Dow Corning Company Midland, Michigan 48686-0994 (989) 636-1000 www.dowcorning.com/content/molykote

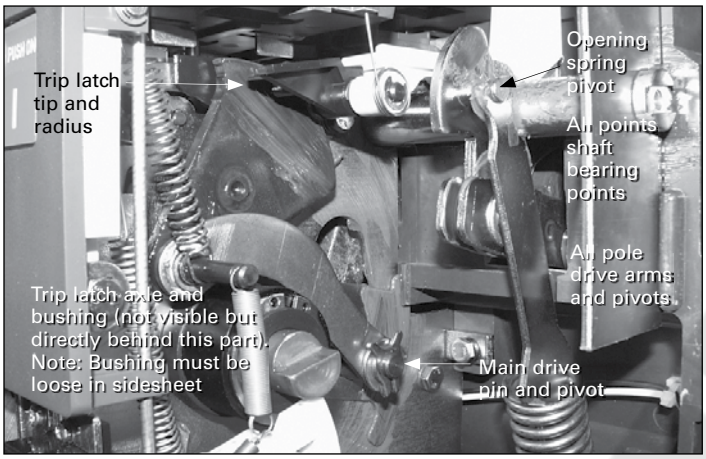


Figure 101. Magnum DS lubrication

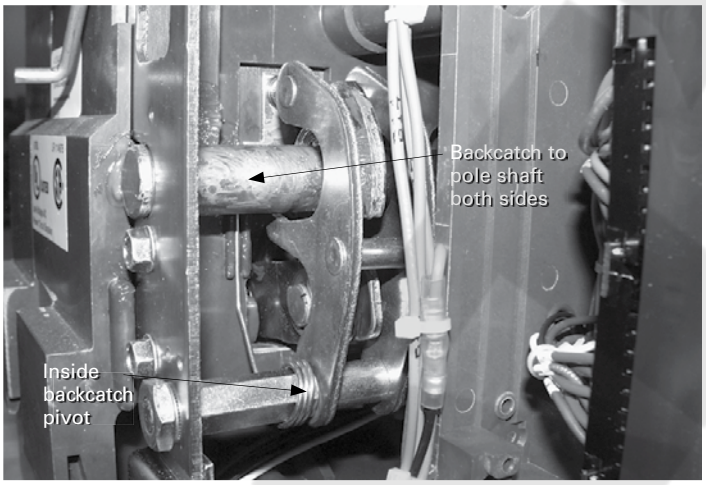


Figure 102. Magnum DS lubrication

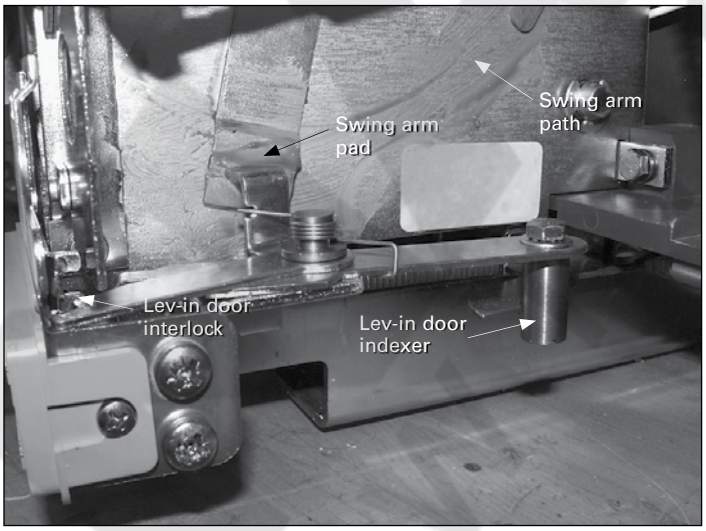


Figure 103. Magnum DS lubrication (not applicable to MDE or fixed-mount breakers)

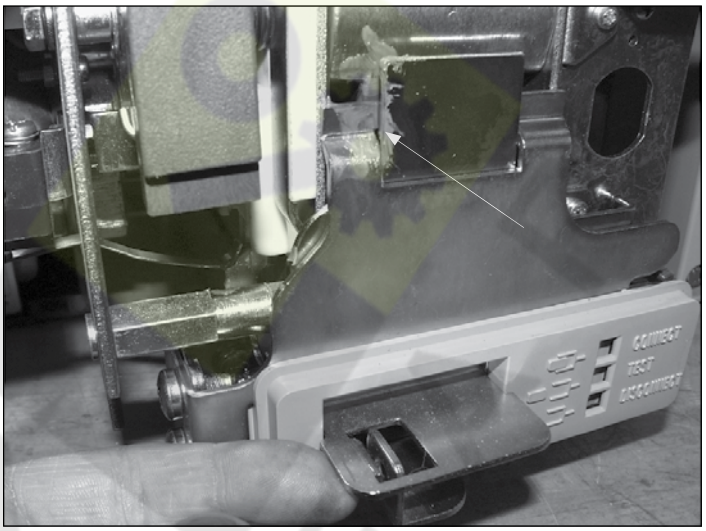


Figure 104. Magnum DS lubrication

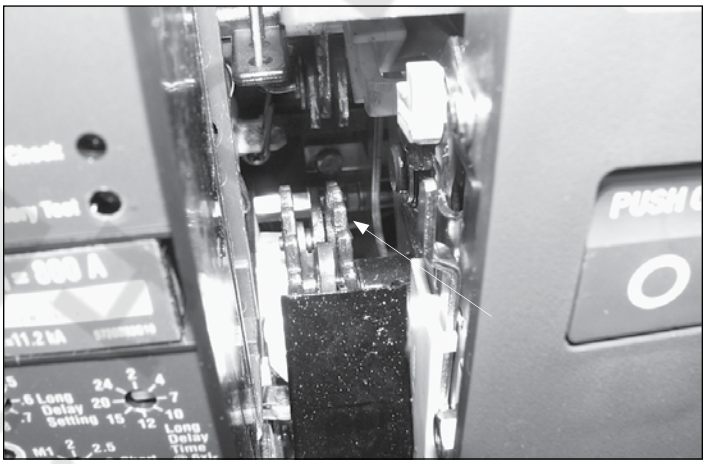


Figure 105. Magnum DS lubrication

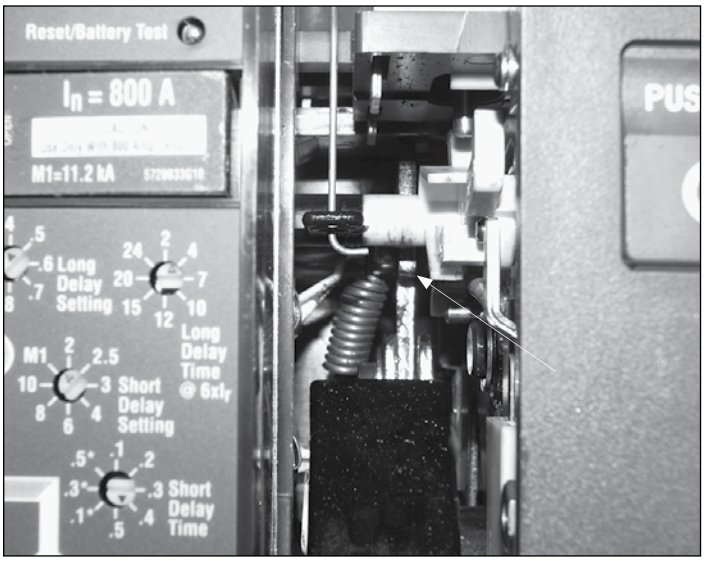


Figure 106. Magnum DS lubrication

Primary disconnect inspection

Table 24. Pre-inspection conditions

Device	Position of poles		Mechanism		Device position in cassette			
Fixed	**Open**	*Closed*	*Charged*	**Discharged**	—	—	—	—
Drawout	**Open**	*Closed*	*Charged*	**Discharged**	*Connected*	*Test*	*Disconnected*	**Removed**

Procedure

For Magnum breakers with vertically mounted primary disconnects:

1. With breaker removed from cell, verify that vertical adapter nuts and bolts are torqued to 37–43 lb-ft.

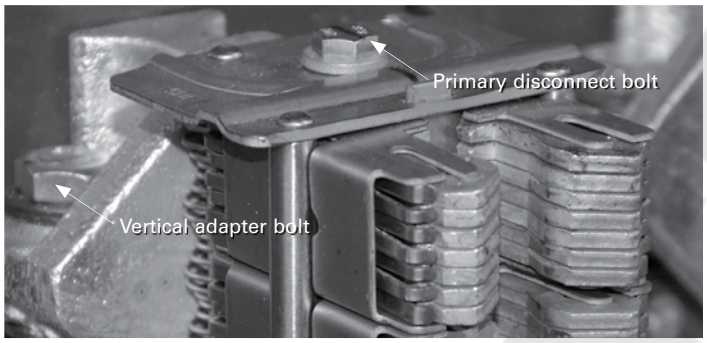


Figure 107. Primary disconnects

For all Magnum breakers primary disconnects:

1. Remove the primary disconnect.
2. Inspect primary disconnect contact surfaces for indications of plating wear, corrosion, or arcing and pitting. Replace primary disconnect if there is evidence of any exposed copper.
3. Inspect finger springs for broken, cracked, or misalignment with fingers.
4. Remove loose contaminates.
5. Reinstall and tighten the M6 screw (refer back to **Table 22**) to retain the primary disconnect. Verify that the primary disconnect is free to rotate about the screw, and return to the home position.
6. Be certain that the retaining screw is in the proper position and does not deform the end plates on the primary disconnects.

Secondary disconnect inspection

Table 25. Pre-inspection conditions

Device	Position of poles		Mechanism		Device position in cassette			
Fixed	**Open**	*Closed*	*Charged*	**Discharged**	—	—	—	—
Drawout	**Open**	*Closed*	*Charged*	**Discharged**	*Connected*	*Test*	*Disconnected*	**Removed**

Procedure

Breaker:

1. Remove the breaker cover.
2. With breaker removed from cell, verify that the breaker secondary disconnect pins are fully seated and locked into position by lightly pulling on each wire individually.

Note: Do not exceed 1 lb of force or damage to pin or housing may occur.

3. Ensure all pins are straight without bends, corrosion, or show evidence of arcing.
4. Damaged pins are to be replaced. Refer to renewal parts catalog.

⚠ WARNING

REMOVE ALL POWER TO THE CASSETTE SECONDARY PINS.

Cassette:

1. On the cassette side of the secondary disconnect, ensure all sockets are fully seated and locked into position by lightly pressing on each socket.
2. Visually inspect each socket for evidence of arcing, corrosion, or foreign objects.
3. Damaged sockets are to be replaced.
4. Ensure that socket housings are free to move to allow self-aligning with the breaker side secondary housing.

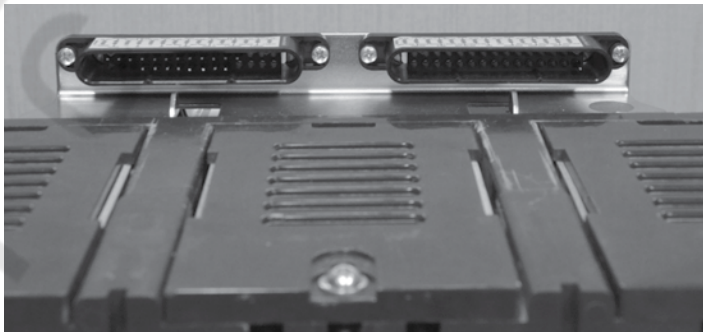


Figure 108. Breaker secondary

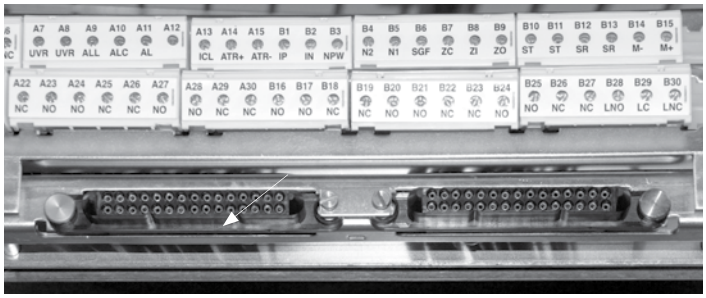


Figure 109. Cassette secondary

Interlocks inspection

Table 26. Pre-inspection conditions

Device	Position of poles		Mechanism		Device position in cassette			
Fixed	**Open**	*Closed*	*Charged*	**Discharged**	—	—	—	—
Drawout	**Open**	*Closed*	*Charged*	**Discharged**	*Connected*	*Test*	*Disconnected*	**Removed**

⚠ WARNING

REMOVE THE DRAWOUT CIRCUIT BREAKERS FROM THE CASSETTE FOR THE FOLLOWING TESTS. FOR FIXED MOUNTED CIRCUIT BREAKERS, ALL PRIMARY AND SECONDARY POWER IS TO BE REMOVED.

Procedure

Note: The circuit breaker will be required to be charged, closed, and opened during this inspection procedure.

1. Remove the breaker cover.
2. Verify that the breaker is in working order by charging the breaker, close the breaker, recharge the breaker, and open the breaker.

Note: The breaker will need to be charged and opened for this inspection procedure.

3. Verify that the circuit breaker will not close if any of the following mechanical conditions exist:
   a. If the breaker is equipped with an Undervoltage Release that is NOT energized, and the breaker is charged and opened, depress the ON (close) pushbutton. The breaker should not close.

Note: Remove the Undervoltage Release for the remainder of the interlock testing if installed.

   b. For drawout breakers, lift the levering-in screw access door. With door open or not fully closed depress the ON (close) button. The breaker should not close.
   c. Rotate the levering-in screw and verify that the door does not close in intermediate positions. The door should only close in the full disconnect, test, and connect positions.
   d. Return the drawout levering in screw to the disconnected position.
   e. Depress and hold the breakers OFF (open) pushbutton and then depress the ON (close) pushbutton. The breaker should not close.
4. If the breaker is equipped with an internal key lock, engage the lock and remove the key. Depress the ON (close) button. The breaker should not close. Reinsert the key and disengage the key lock. Close the breaker. Attempt to engage the key lock; the key should not rotate fully and the breaker should remain in the closed position. Open the breaker, but do not recharge.
5. Depress and hold the ON (close) pushbutton while charging the breaker. The breaker should not close when the breaker is fully charged. Release and re-press the ON (close) button. The breaker should close. Do not open the breaker until instructed to do so.

Figure 110. Charged and opened

Figure 111. Push to close

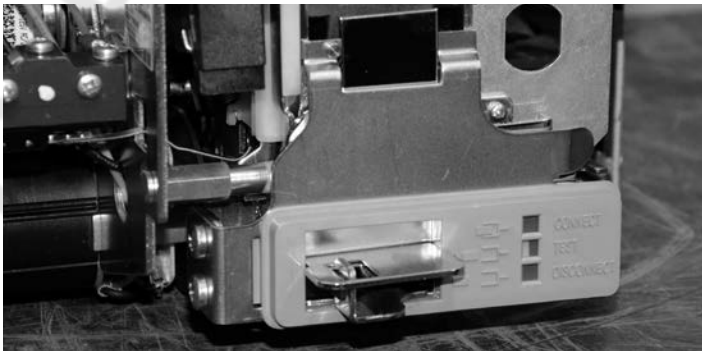


Figure 112. Levering-in door in position between disconnect and test

There are NO impediments to tripping/opening. The Magnum circuit breaker will always be permitted to open on command of the following:

- OFF (open) pushbutton is depressed
- Shunt trip (electrical)
- External trip interlock (cassette)
- UVR being de-energized (electrical)
- Trip unit signal (overcurrent etc.)
- Rotating the interlock wire form
- For breakers used in multi-way interlocks with other breakers, testing should be performed as described in the appropriate instruction manual

Note: Drawout breakers must be installed in their cassette. To verify proper operation of multi-way interlocks, the breaker will be required to close and open while installed in the switchgear.

Troubleshooting

Table 27. Spring charging

Problem	Possible root cause	Actions
Breaker won't charge mechanically	Charge handle broken	Install replacement handle kit
	Manual charge handle unable to be pulled	Verify breaker is not charged. If problem persists, a possible mechanism issue may be present, contact Eaton Electrical Services & Systems
	Manual charging handle not engaging	Check to see if breaker is already charged
	Possible worn parts will not allow manual charge to engage	Install replacement handle kit
	Manual charge handle engages, but cannot reach full charge	Apply force to manual charging not to exceed 120 lb
	Manual arm not consistently engaging	Install replacement handle kit
	Charging mechanism jamming	Contact Eaton Electrical Services & Systems
Breaker won't charge electrically	Motor operator skips during charging cycle due to gear teeth being out of alignment	Contact Eaton Electrical Services & Systems
	Improper motor operator mounting	Tighten motor mounting hardware
	Incorrect motor mounting	Verify proper orientation of motor operator standoffs to mechanism, verify motor operator mounting
	Insufficient voltage/current to load or leads	Verify supply to motor
	Levering device door switch out of adjustment	Adjust switch to pick mating surface on lev in door
	Secondary breaker contacts not engaged	Adjust switch lever and check secondary contact terminal condition
	Loose terminal screws on cutoff switches	Tighten all terminal screws
	Motor continuously runs	Contact Eaton Electrical Services & Systems

Table 28. Contact closing

Problem	Possible root cause	Actions
Breaker will not to close	Breaker is already closed with flag indication error	Contact Eaton Electrical Services & Systems
	An external interlock such as a key or cable	Clear all external interlocks
	Continuous shunt trip energized	De-energize continuous duty shunt trip
	Undervoltage release (UVR) de-energized	Energize UVR
	Mechanical obstructions	Remove arc chutes and remove obstructions
	Broken trip actuator (TA) resetter or reset spring	Contact Eaton Electrical Services & Systems
	Accessory connections not correct	Verify and correct accessory connections
	Trip indicator (also known as overcurrent trip switch) not reset	Reset trip indicator
	Other unidentified issues	Contact Eaton Electrical Services & Systems
Breaker will not stay closed (opens immediately)	Lev in door slightly opened and acting upon interlock	Ensure lev in door is complete closed
	Voltage present at the shunt trip terminals	Verify and remove remote open signal
	Off pushbutton not full returned	Clear obstruction
	Loose key interlock linkage assembly or interference with key interlock cable	Tighten mounting hardware or clear cable obstruction
	Trip unit rating plug not fully installed or absent	Ensure rating plug is present and properly installed
	Breaker attempts to close on overload or fault currents	Investigate and clear cause of fault
	Neutral sensor polarity incorrect (ground fault)	Reverse polarity
	Shunt trip coil is burned causing armature to remain extended	Replace shunt trip
	Other unidentified issues	Contact Eaton Electrical Services & Systems

Table 29. Contact opening

Problem	Possible root cause	Actions
Breaker will not open on expected trip unit settings	Pinched or damaged wires	Repair damage
	Damaged trip actuator (TA)	Contact Eaton Electrical Services & Systems
	Broken TA tripper	Contact Eaton Electrical Services & Systems
	Trip unit settings not as desired	Reset trip unit to proper settings
	Trip unit not communicating correctly	Check communication devices and wiring
Breaker will not open by way of accessories	Voltage at shunt trip too low	Excessive voltage drop in control wiring
	Mis-wired open accessories	Correct secondary wire connections
	Accessory not fully seated	Fully seat and lock accessory
	Shunt trip cutoff switch not connected, present, or damaged (instantaneous shunt trip only)	Connect, install, or replace shunt trip cutoff switch
	Accessory Deck broken or not locked down	Replace or lock down accessory deck
	Other unidentified causes	Contact Eaton Electrical Services & Systems
Breaker will not open mechanically	Obstruction behind off pushbutton	Remove obstruction
	Other unidentified causes	Contact Eaton Electrical Services & Systems

Table 30. Levering-in/-out (drawout applications only)

Problem	Possible root cause	Actions
Breaker will not rack in	Breaker does not push to stops evenly	Assure breaker is square against stops by pushing evenly on both sides of the breaker
	Cassette floor pan mounting bolts in wrong location or not low profile	Remove bolt and replace with low profile
	Arc hood displaced and interfering with breaker movement	Replace arc hood
	Cassette secondary sliding bracket not free to move with breaker	Remove wire obstruction or lubricate slide bushings and pin
	Lev in device require re-lubrication	Lubricate lev in device
	Excessive drive screw torque causing stripping or bending of key components	Contact Eaton Electrical Services & Systems
	Racking screw not in full retracted position before pushing breaker into cell	Rotate to full counterclockwise stop
Breaker will not rack out	Other unidentified causes	Contact Eaton Electrical Services & Systems

MAGNUM AIR CIRCUIT BREAKER INSPECTION RECORD

Location _____ Date _____

Position_____ Serial No. _____

Switchgear Mfr. _____ Cat # _____

As Found Condition:

Cleanliness _____ Arc Chute Wear _____ Contact Wear _____ Lubrication _____

Broken or missing parts _____ Wiring Condition _____

Functional Checks - Manual Operation

Manual Charging _____ On Push Button _____ OFF Push Button _____

Levering In Device _____ Counter advancing on Charge _____

OPEN/CLOSED Flag operation_____ CHARGED/DISCHARGED Flag operation _____

Functional Checks - Electrical (at reduced nominal if possible)

Motor operator @ 85% Voltage _____ Spring Release @ 85% _____ Undervoltage Release Dropout @ 35% < 60% _____

Power Relay Module @ 85% _____ Shunt Trip @ 70% _____ Undervoltage Release Pickup @ 85% _____

Trip Indicator Electrical Reset @ 85% _____

Trip Unit Functional Check with Hand-Held Test Kit _____

Trip Unit Primary Injection Test (see MAGNUM AIR CIRCUIT BREAKER TRIP UNIT FIELD TEST FORM) _____

Interlock Checks

Wire Form Interlock _____ Trip Free Interlock _____ Levering In Door Interlock _____

Interlocking Trip Indicator _____ Key Interlock _____ Cable/Rod Interlock _____

Remarks (Report action/repairs made):

_____

_____

_____

Other repairs recommended:

_____

_____

_____

Magnum air circuit breaker inspection record

MAGNUM AIR CIRCUIT BREAKER TRIP UNIT FIELD TEST FORM

Reference Documents IL 70C1036 and 70C1037

Location _____ Date_____

Position _____ Switchgear Mfr_____ Load Reading _____

Breaker GO# _____ Item # _____ Seq # _____

Breaker Data

Breaker Catalog Number. _____ Trip Unit Cat Number_____

Rating Plug/Sensor _____ Amperes

Trip unit settings as found Long Delay Setting (LDS) _____ Long Delay Time (LDT) _____ Short Delay Setting (SDPU) _____

Short Delay Time (SDT) _____ Instantaneous (INST) _____

Ground Fault Settin (GFPU) _____ Ground Fault Time (GFT) _____

Long Delay Memory Jumper (LD Mem)(In/Out) _____

Trip unit test settings **LDS - 0.5 LDT - 4 SDPU - 2.5 SDT - 0.5 INST - 2 GFPU - 0.4 GFT - 0.5**

LD Mem - IN Zone Interlock Jumper (B8-B9) IN Source Ground Jumper (B6-B7) (if equipped with GF) IN

Maintenance Mode setting (if equpped) - R5 Maintenance Mode 0/1

Test Data

Date of Test Inspector's Initials			**Left Pole (A phase)**	**Center Pole (B phase)**	**Right Pole (C phase)**	**Observations**	**Time Range from Curve in seconds**
Long Delay Test A phase % of Rating Plug 100%	Amperes _____					Long Delay LED Fast Blink during test	Trip 26-34
Long Delay Memory Test A phase (immediately following previous test) % of Rating Plug 100%	Amperes _____					Long Delay LED slow Blink after test	Trip <10
Instantaneous Test B phase No trip % of Rating Plug 180%	Amperes _____					Long Delay LED Fast Blink during test	No Trip
Instantaneous Test B phase Trip % of Rating Plug 220%	Amperes _____					Instantaneous LED slow blink after test	Trip <0 .06
Short Delay Test C phase No trip % of Rating Plug 120%	Amperes _____					Long Delay LED Fast Blink during test	No Trip
Short Delay test C phase Trip % of Rating Plug 131%	Amperes _____					Short Delay LED slow blink after test	Trip 0.4 to 0.555
Maintenance Mode Test C phase (if equipped) No Trip % of Rating Plug 150%	Amperes _____	Set Maintenance Mode to ON Set Instantaneous to OFF				Blue LED on	No Trip < 0.4
Maintenance Mode Test C phase (if equipped) Trip Set % of Rating Plug 287%	Amperes _____	Maintenance Mode to ON Set Instantaneous to OFF				Blue LED on Instantaneous LED Slow blink after test	Trip < 0.06
Ground Fault C phase or N if 4 Pole No Trip (if equipped) % of Rating Plug 36%	Amperes _____	Remove jumper B5-B6					No Trip
Ground Fault C phase or N if 4 Pole Trip (if equipped) % of Rating Plug 44%	Amperes _____	Remove jumper B5-B6				Ground Fault LED slow blink after test	Trip 0.4 to 0.555

Reset all trip unit settings back to as found positions

Remarks (record unusual conditions, corrections, needed repairs, etc; use separate form to record annual breaker inspection details):

_____

_____

_____

_____

_____

Magnum air circuit breaker trip unit field test form

Section 8: Renewal parts

General

All renewal parts and/or spare parts recommendations for type Magnum DS, Magnum DSX, and Magnum DSL 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 (**Figure 2** and **Figure 22**).

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 Web site at www.eaton.com.

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