

POWER CIRCUIT BREAKERS

PRODUCT GUIDE

Magnum DS Low Voltage Air Circuit Breakers



Cutler-Hammer

EAT•N

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- Introduction
- Magnum DS Visuals
- Magnum DS Ratings, Characteristics, Weights and Dimensions

Introduction

The Magnum DS Low Voltage Power Circuit Breaker affords customers the opportunity to meet the increasing requirements of complex distribution systems. It is designed and tested primarily for use in low voltage drawout assemblies applied at nominal voltages of 240, 480, and 600 volts ac, although it is also available in a fixed configuration. High interrupting ratings up to 100kA without fuses and six continuous current ratings from 800 through 5000 amperes are covered by only two different frame sizes.

Magnum DS circuit breakers are 100 percent rated, UL listed, and are built and tested in an ISO 9000 certified facility. The circuit breakers meet or exceed all applicable ANSI, NEMA, UL and CSA standards including:

- ANSI C37.13, C37.16, C37.17 and C37.50
- NEMA SG3 and UL 1066
- Suitable in UL 1558 LV Switchgear
- Suitable in UL 891 Switchboards
- Suitable in UL CSA 22.2.31 LV Assemblies

Controls and indicators are functionally grouped on the circuit breaker's front cover. The through-the-door drawout design permits easy and safe access to the front cover controls, as well as the trip unit and racking device.

Magnum DS circuit breakers utilize one of a family of microprocessor-based Digitrip RMS electronic, rms sensing and programmable trip units to provide system selectivity, advanced coordination and communications.

Functional and Flexible

- Rigid frame of high strength engineered thermoset composite resins
- Compact and lightweight
- Rugged, maintainable construction
- Only two frame sizes
- Four position drawout or fixed
- Through the door drawout mounting
- Common height, depth and door cutout
- Spring stored energy mechanism
- Electrical or manual operation (field convertible)
- Field installed accessories

Performance Plus

- Designed and tested to ANSI, NEMA, UL and CSA Standards
- Six continuous current frame sizes (800 through 5000A without fans)
- High interrupting ratings
- High withstand ratings
- 100% rated for continuous operation
- 3 cycle closing

Intelligence Systems

- Digitrip microprocessor-based true rms sensing trip units
- Protection and coordination
- Energy monitoring and power quality
- Communications
- Protective relay features
- Integral testing and test kit

Special Application Circuit Breakers

- Non-automatic circuit breakers - a non-automatic circuit breaker does not include a trip unit, sensors or overcurrent release.
- Contact Cutler-Hammer for other special applications.

Functional Techniques

- Patented "Heal-Toe" contact structure
- Improved contact material
- "C" Loop current path
- Braided current path connections
- Sealed arc chambers

Reliability, Maintenance and Safety

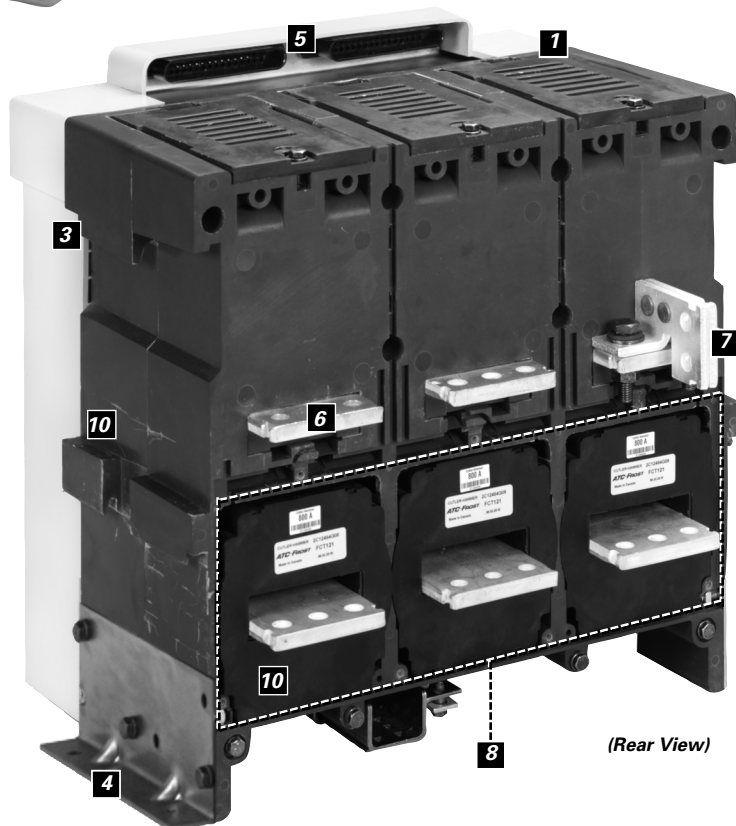
- Front accessible and dedicated secondary wiring
- Finger proof secondary contacts
- Drawout rail construction
- Front mounted, plug-in accessories
- Accessory viewing windows
- Proven operating mechanism
- Fewer individual parts
- Mechanical main contact wear indicator
- One piece arc chutes and covers
- Insulating and isolating arc chambers

Magnum DS Fixed Low Voltage Power Circuit Breaker 800-3200A Size (Front and Rear Views)



(Front View)

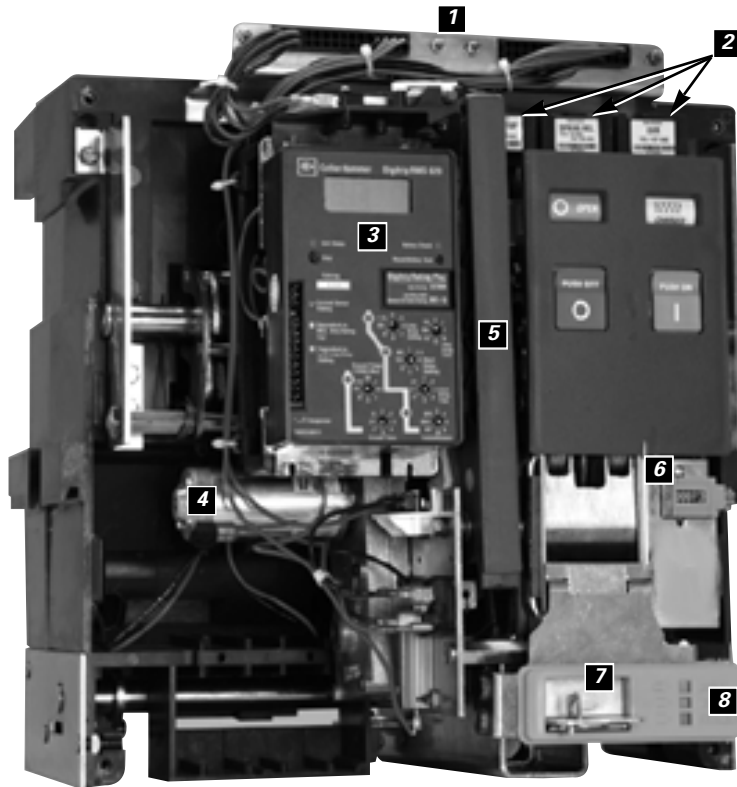
- 1** Baffled Arc Chute Cover
- 2** Faceplate (Front Cover)
- 3** Integral Lifting Handle
- 4** Mounting Foot
- 5** Secondary Disconnect



(Rear View)

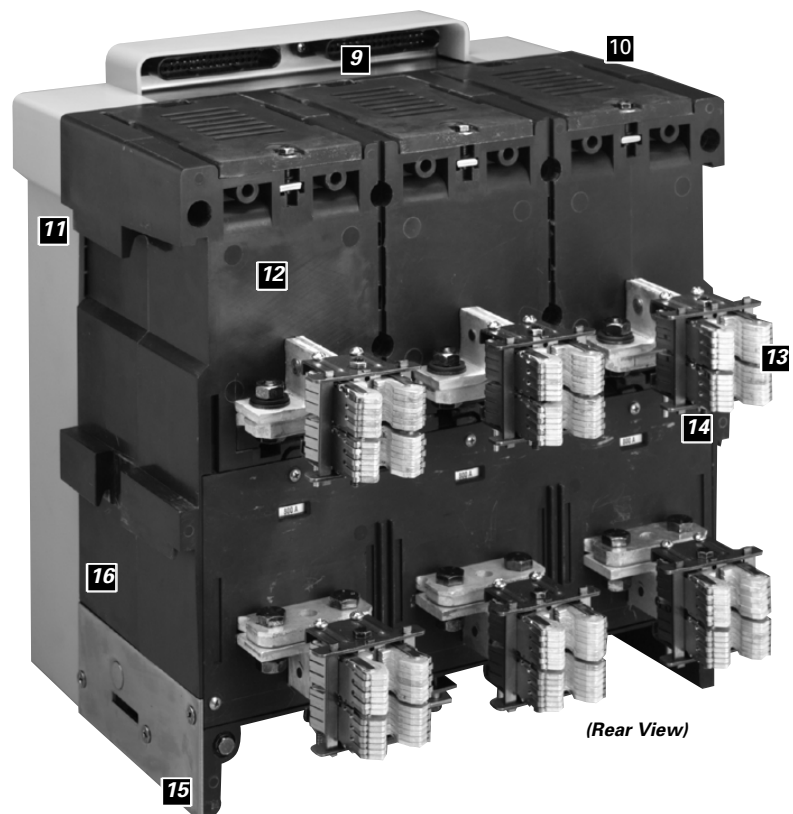
- 6** Fixed Horizontal Primary Terminal
- 7** Optional Vertical Adapter
- 8** Sensor Cover Plate Removed for Sensor Access
- 9** Circuit Breaker Nameplate
- 10** Current Sensor

Magnum DS Drawout Low Voltage Power Circuit Breaker 800-3200A Size (Front with Cover Removed and Rear Views)



(Magnum DS Front Accessible Operating Mechanism)

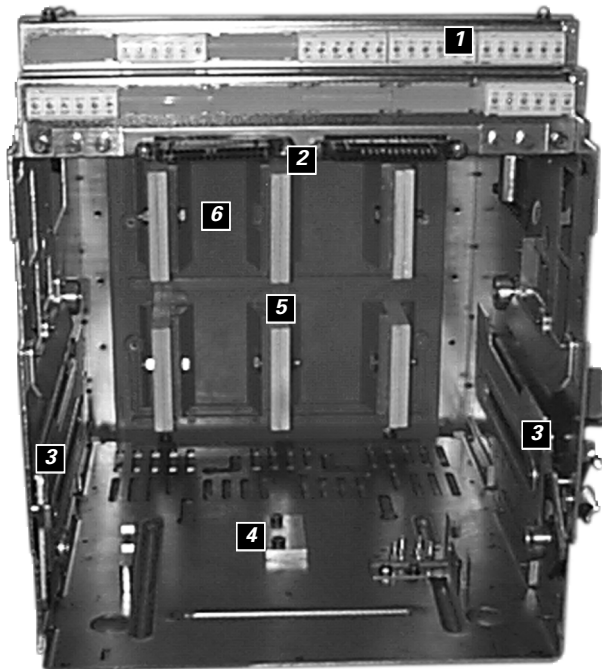
- 1** Secondary Wiring Points
- 2** Through-The-Window Accessories (3 Maximum)
- 3** Trip Unit
- 4** Motor Operator
- 5** Manual Charging Handle
- 6** Operations Counter (optional)
- 7** Padlockable Levering Device Access Door
- 8** Breaker Position Indicator



(Rear View)

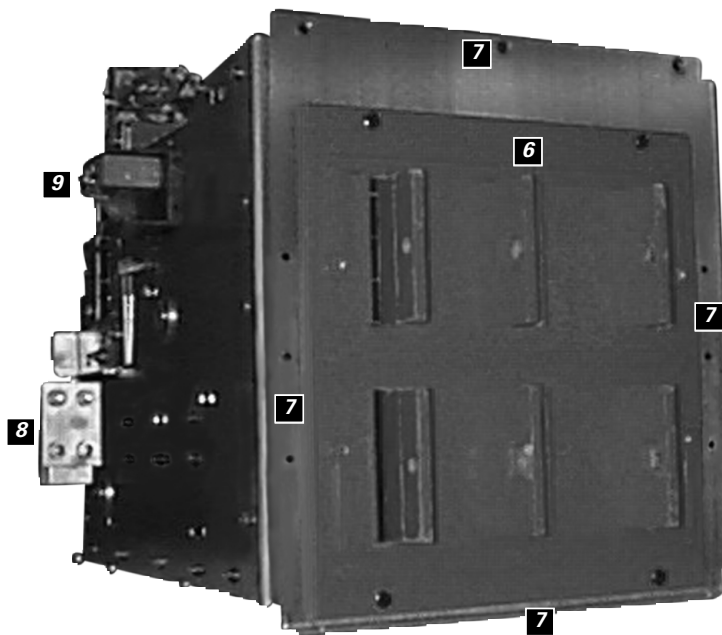
- 9** Secondary Disconnects
- 10** Baffled Arc Chute Cover
- 11** Integral Lifting Handle
- 12** Arc Chamber
- 13** Primary Disconnect Finger Cluster
- 14** Sensor Rating Viewing Window
- 15** Levering Device Bearing Plate
- 16** Drawout Rail Support

Magnum DS Drawout Cassette 800-3200A Size (Front and Rear Views)



(Front View with Stabs)

- 1** Front Mounted Secondary Contacts
- 2** Secondary Plug-in Connectors
- 3** Extension Rails
- 4** Ground Bar



(Rear View without Stabs)

- 5** Fixed Vertical Primary Terminal
- 6** Insulating Primary Terminal Support
- 7** Mounting Holes
- 8** Rear of Cassette Mounted Locks
- 9** Cell Switch

Magnum DS Ratings, Characteristics, Weights and Dimensions

Electrical characteristics							
Number of poles				3, 4			
Continuous Current (A)		In	40°C	800			
Rating of 4th pole (A)				800			
Rated Maximum Voltage (V)			AC 50/60Hz	635			
Circuit Breaker Type ^{②③}				MDS-408	MDS-608	MDS-808	MDS-C08
Interrupting Rating (kA rms) ^①		AC 50/60Hz	208/240V	42	65	85	100
			480V	42	65	85	100
			600V	42	65	85	100
Short Time (Withstand) Rating (kA rms) ^①		AC 50/60Hz	208/240V	42	65	85	85
			480V	42	65	85	85
			600V	42	65	85	85
Maximum Break Time (msec)				35	35	35	35
Maximum Closing Time (msec)				50	50	50	50
Maximum Spring Charging Time (sec)				5.0	5.0	5.0	5.0
Mechanical Endurance without maintenance		Operating cycles (C-O) x 1000		2.8	2.8	2.8	2.8
Electrical Endurance without maintenance		Operating cycles (C-O) x 1000		9.7	9.7	9.7	9.7
Total Endurance without maintenance		Operating cycles (C-O) x 1000		12.5	12.5	12.5	12.5
Circuit Breaker Maximum Weight (lb)		Drawout	3 Pole	138	138	138	138
			4 Pole	182	182	204	204
(fixed with adaptors)		Fixed	3 Pole	116	116	127	127
			4 Pole	149	149	149	149
Circuit Breaker Dimensions (in)		Drawout	3 Pole	H	16.5	16.5	16.5
(drawout with finger clusters)				D	18.2	18.2	18.2
				W	16.2	16.2	16.2
			4 Pole	H	16.5	16.5	16.5
				D	18.2	18.2	18.2
				W	21.2	21.2	21.2
(fixed without adaptors)		Fixed	3 Pole	H	16.5	16.5	16.5
				D	14.6	14.6	14.6
				W	16.2	16.2	16.2
			4 Pole	H	16.5	16.5	16.5
				D	14.6	14.6	14.6
				W	21.2	21.2	21.2

① Forward or Reverse Fed

② Non-automatic circuit breakers also available in rated currents. A non-automatic circuit breaker does not have a trip unit, sensors or an overcurrent release.

③ For all other special applications, please contact Cutler-Hammer.

Magnum DS Ratings, Characteristics, Weights and Dimensions (Continued from previous page)

3, 4			3, 4			3, 4			3,4			
1600			2000			3200			4000			
1600			2000			3200			4000			
635			635			635			635			
MDS-616	MDS-816	MDS-C16	MDS-620	MDS-820	MDS-C20	MDS-632	MDS-832	MDS-C32	MDS-640	MDS-840	MDS-C40	MDS-E40
65	85	100	65	85	100	65	85	100	65	85	100	130
65	85	100	65	85	100	65	85	100	65	85	100	130
65	85	100	65	85	100	65	85	100	65	85	100	130
65	85	85	65	85	85	65	85	85	65	85	100	130
65	85	85	65	85	85	65	85	85	65	85	100	130
65	85	85	65	85	85	65	85	85	65	85	100	130
35	35	35	35	35	35	30	30	30	40	40	40	40
50	50	50	50	50	50	50	50	50	70	70	70	70
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
0.8	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4
3.2	3.2	3.2	3.2	3.2	3.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1
4.0	4.0	4.0	4.0	4.0	4.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5
138	149	149	157	157	157	200	200	200	303	303	303	303
182	204	204	212	212	212	255	255	255	391	391	391	391
116	127	127	135	135	135	163	163	163	248	248	248	248
149	171	171	179	179	179	196	196	196	314	314	314	314
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	34.9	34.9	34.9	34.9
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	44.9	44.9	44.9	44.9
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	34.9	34.9	34.9	34.9
16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	44.9	44.9	44.9	44.9

Magnum DS Ratings, Characteristics, Weights and Dimensions (Continued from previous page)

Electrical characteristics							
Number of poles				3, 4			
Continuous Current (A)		In	40°C		5000		
Rating of 4th pole (A)					5000		
Rated Maximum Voltage (V)		AC 50/60Hz			635		
Circuit Breaker Type ^{②③}				MDS-850	MDS-C50	MDS-E50	
Interrupting Rating (kA rms) ^①		AC 50/60Hz	208/240V		85	100	130
			480V		85	100	130
			600V		85	100	130
Short Time (Withstand) Rating (kA rms) ^①		AC 50/60Hz	208/240V		85	100	130
			480V		85	100	130
			600V		85	100	130
Maximum Break Time (msec)				40	40	40	
Maximum Closing Time (msec)				70	70	70	
Maximum Spring Charging Time (sec)				5.0	5.0	5.0	
Mechanical Endurance without maintenance		Operating cycles (C-O) x 100		0.4	0.4	0.4	
Electrical Endurance without maintenance		Operating cycles (C-O) x 1000		1.1	1.1	1.1	
Total Endurance without maintenance		Operating cycles (C-O) x 1000		1.5	1.5	1.5	
Circuit Breaker Maximum Weight lb		Drawout	3 Pole		359	359	359
			4 Pole		447	447	447
(fixed with adaptors)		Fixed	3 Pole		293	293	293
			4 Pole		370	370	370
Circuit Breaker Dimensions in		Drawout	3 Pole	H	16.5	16.5	16.5
(drawout with finger clusters)				D	18.2	18.2	18.2
				W	34.9	34.9	34.9
			4 Pole	H	16.5	16.5	16.5
				D	18.2	18.2	18.2
				W	44.9	44.9	44.9
(fixed without adaptors)		Fixed	3 Pole	H	16.5	16.5	16.5
				D	14.6	14.6	14.6
				W	34.9	34.9	34.9
			4 Pole	H	16.5	16.5	16.5
				D	14.6	14.6	14.6
				W	44.9	44.9	44.9

① Forward or Reverse Fed

② Non-automatic circuit breakers also available in rated currents. A non-automatic circuit breaker does not have a trip unit, sensors or an overcurrent release.

③ For all other special applications, please contact Cutler-Hammer.

■ Introduction

■ ANSI C37.50 Testing

Introduction

The Magnum DS power circuit breaker was designed and tested to meet the requirements of the world market. It is a 100% rated device, designed to carry 100% of its nameplate current rating in an enclosure without derating.

Magnum DS circuit breakers are UL Listed, and tested to all applicable NEMA, ANSI, IEEE and UL standards. Specifically, the circuit breakers comply with the following:

- ANSI C37.13 (Low Voltage AC Power Circuit Breakers Used In Enclosures)
- ANSI C37.16 (Preferred Ratings, Related Requirements And Application Recommendations For Low Voltage Power Circuit Breakers And AC Power Circuit Protectors)
- ANSI C37.17 (Trip Devices For AC And General Purpose DC Low Voltage Power Circuit Breakers)
- ANSI C37.50 (Test Procedures For Low Voltage AC Power Circuit Breakers Used In Enclosures)

- UL 1066 (Standard For Low Voltage AC And DC Power Circuit Breakers Used In Enclosures)

- NEMA SG3 (This Standard Adopts ANSI C37.16 In Its Entirety)

In addition, Magnum DS is suitable for use in:

- UL 1558 LV Switchgear
- UL 891 LV Switchboards
- UL CSA 22.2.31 LV Assemblies

Magnum DS circuit breakers are applicable to forward or reverse feed applications.

Keep in mind that the standards just outlined establish the minimum requirements. There is nothing prohibiting a circuit breaker design from exceeding standards by offering additional features and/or higher levels of performance. Magnum DS does this in a number of areas.

ANSI 37.50 Testing

Low voltage power circuit breakers are applied at their nameplate rating. That nameplate rating is a result of having successfully completed a series of rigorous tests. This is the 100% rating.

ANSI C37.50 testing is demanding and consists of four test sequences. All tests are performed using a draw-out circuit breaker in its enclosure for each frame size. The first three tests are similar in a number of ways to tests performed on other types of low voltage circuit breakers, such as molded case circuit breakers. It is the fourth test sequence that differentiates the power circuit breaker from other circuit breakers.

Test Sequence 1

This test sequence consists of a temperature rise test, an overload calibration, and then a short circuit test.

Test Sequence 2

This test sequence consists of a series of short circuit tests.

Test Sequence 3

This test sequence is a test of endurance.

Test Sequence 4

This test sequence is a momentary rating test. Other types of low voltage circuit breakers are not subjected to this type of test and, therefore, have no full 30 cycle short time rating.

Magnum DS low voltage power circuit breakers are applied at their nameplate ratings. Nameplates are prominently displayed on the front of the circuit breaker, and provide important information relative to that specific circuit breaker.

A Magnum DS circuit breaker is easily identified by its specific designation.

Magnum DS Designation Example

MDS

Circuit Breaker Type

MDS - Magnum DS

C32

Interrupting Capacity

4 - 42,000
6 - 65,000
8 - 85,000
C - 100,000
E - 130,000

Frame Size

08 - 800 Amps
16 - 1600 Amps
20 - 2000 Amps
32 - 3200 Amps
40 - 4000 Amps
50 - 5000 Amps

Typical Magnum DS Nameplate

A

Magnum DS

B

MDSC32

Low Voltage AC Power Circuit Breaker

C

3200 Amp Frame 3 Pole 50/60 Hz

D

Interrupting Ratings in Amps*		
Max Volts	Inst Trip	Short Delay
635	100,000A	85,000A
508	100,000A	85,000A
254	100,000A	85,000A

E

Accessories

Motor Operator 120VAC
OTS Reset 2A 2B
Trip Unit Power Supply 120VAC

G.O. #
Cust. P.O.
IT:
Code 06/16/98 115002
Cat.# MDS8323WEA 32MUA AA6N NNNXX
Enclosure Requirements Dwg: 2C13090
Installation and Operating Instructions: 2C12060

A

Low voltage power circuit breaker family name

B

Breaker family designation number

C

Breaker frame size in amperes

D

Interrupting capacity rating

E

Accessories

Magnum DS low voltage power circuit breakers are designed for simplified installation and use.

- Two physical frame sizes through 5000 amperes
 - More circuit breakers per square foot
 - Increased ratings in less space
 - Installation economy of time, material and space

- Four position drawout and fixed mountings
 - Customer flexibility
- Fixed mounting with horizontal or vertical bus bar connections
 - Accommodate different bus configurations
- Through-the-door drawout
 - Clear access to trip unit, controls and indicators

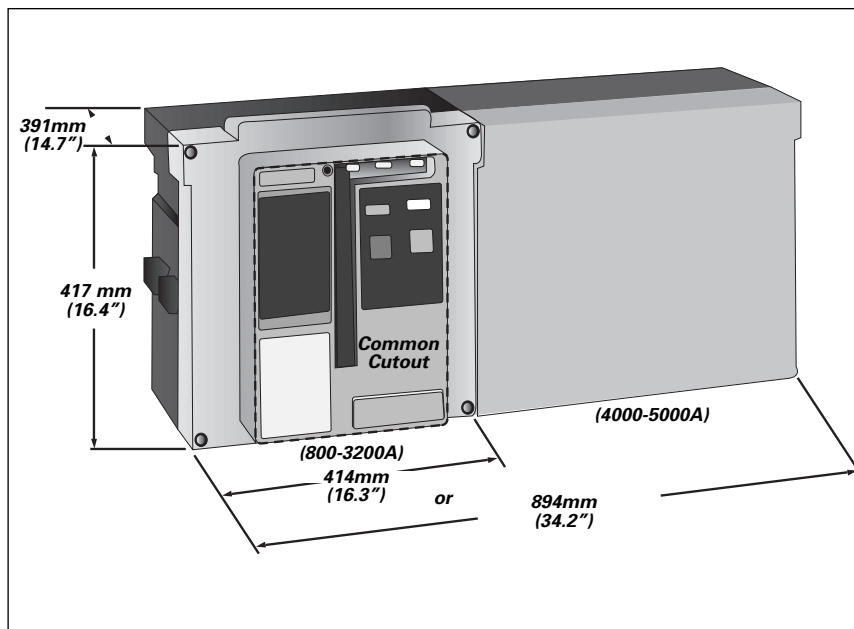
- Closed door circuit breaker leveraging

- DISCONNECT, TEST and CONNECT with door closed

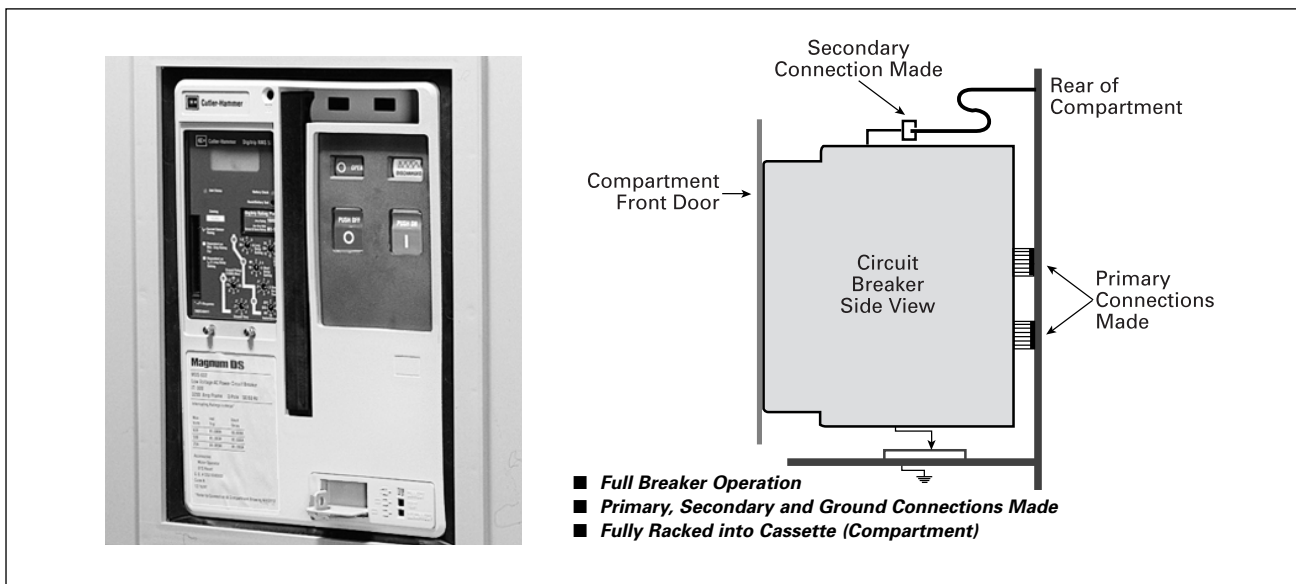
- Common height, depth and door cutout
 - Installation ease and economy

- Zero clearance mounting with drawout cassette
 - Vertical stacking economy

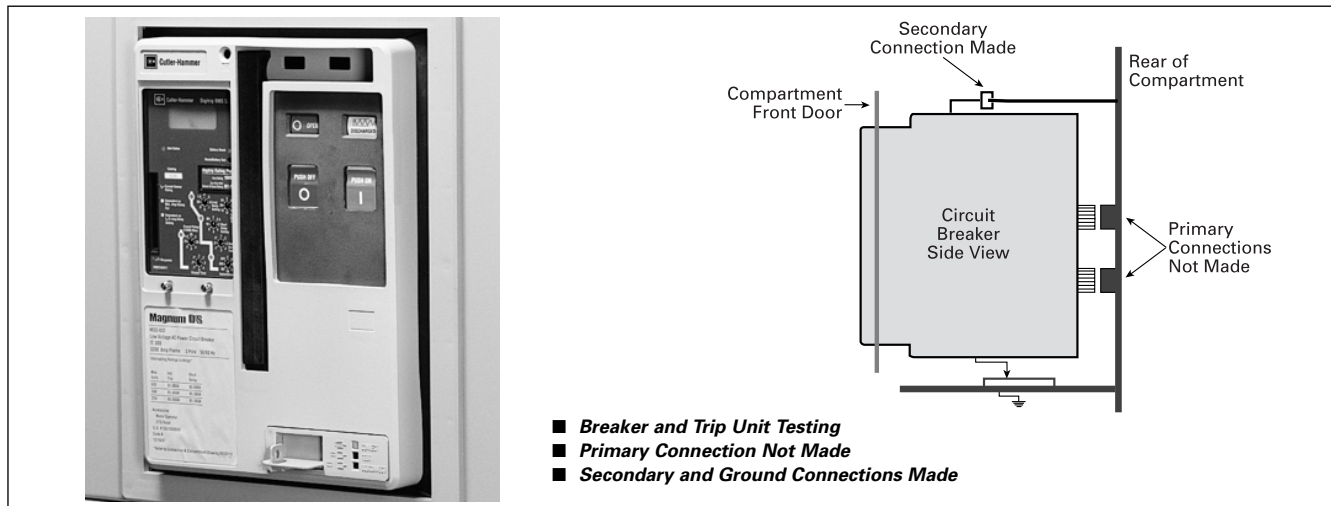
Common Height, Depth and Cutout



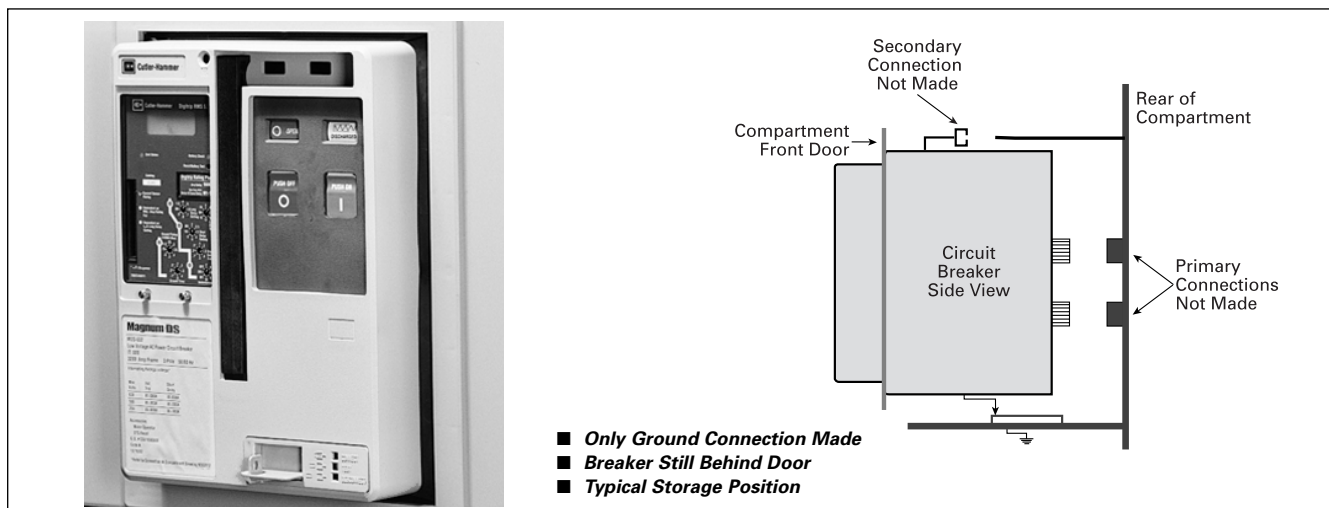
Through-the-Door Drawout (Connect Position)



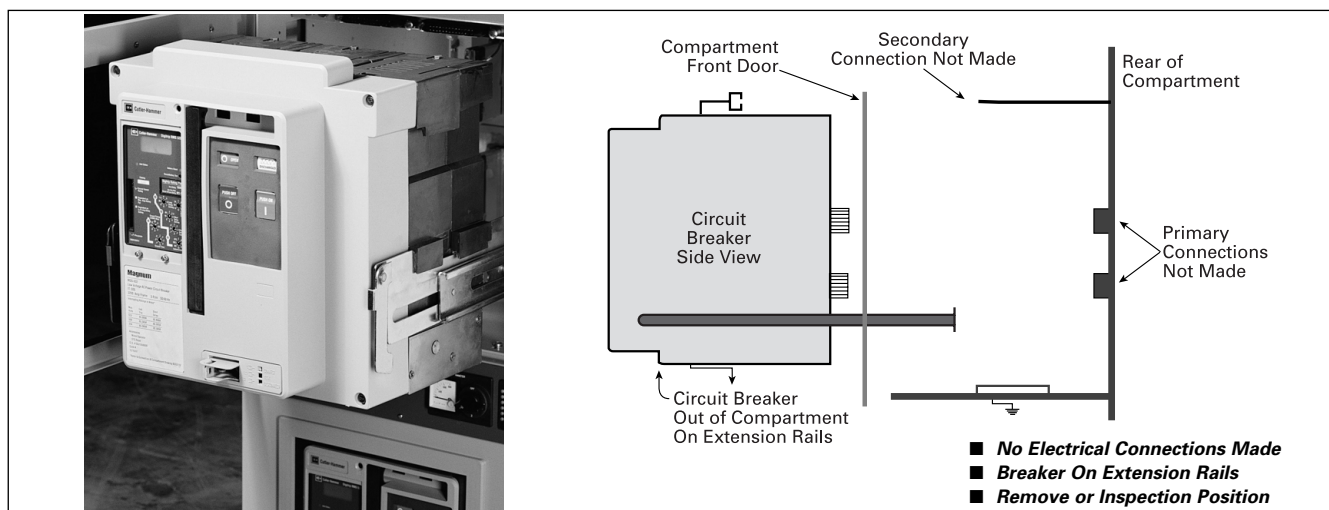
Through-the-Door Drawout (Test Position)



Through-the-Door Drawout (Disconnect Position)



Through-the-Door Drawout (Remove Position)



- Rigid Frame Housing
- Operating Panel
- Main Contact System
- Contact Wear Indicator
- Arc Chambers
- Operation
- Secondary Wiring

Rigid Frame Housing

Magnum DS circuit breakers use a rigid frame housing construction of engineered thermoset composite resins. This material is strong and lightweight having a strength to weight ratio twice that of steel. In addition to high strength structural properties, this material has excellent dielectric characteristics and resists arc tracking.

The 3-piece construction provides support while isolating and insulating power conductors:

- 1 A 2-piece case encloses current paths and arc chambers. The

chambers act to channel arc gases up and out during interruption.

- 2 The operating mechanism sits on the front of the case and is covered by an insulating front cover.

The overall strength and rigidity of the design also contributes to higher performance capabilities:

- Higher Withstand
- Higher Interrupting

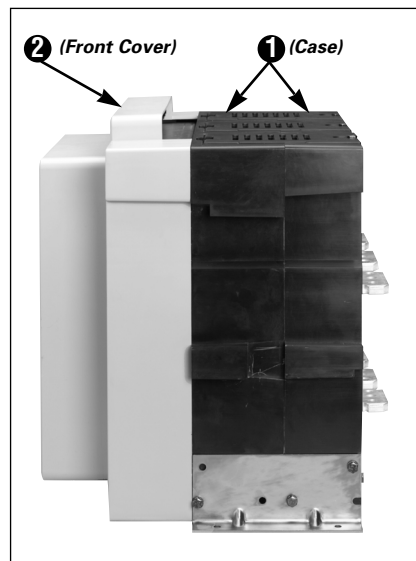
The Magnum DS rigid frame housing design allows for precise construction, eliminating the need for adjustments. The significantly reduced frame deflection during operation along with stiff component mounting results in a longer life operating mechanism.

Operating Panel

The Magnum DS front cover (next page) contains a convenient operating panel with clear words and symbols indicating functions and guiding operations. Field instal-

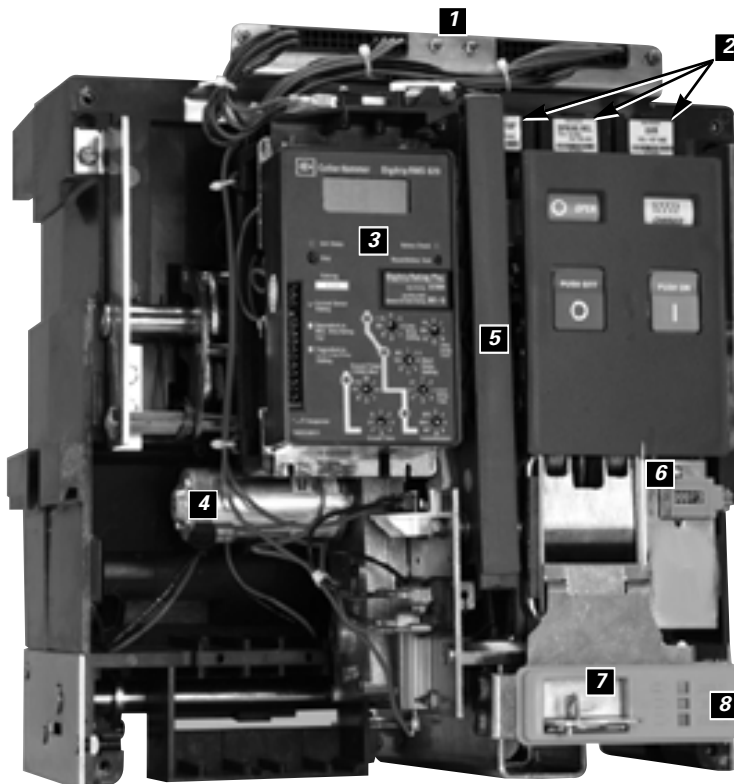
lable accessory items can be identified by name and rating through viewing windows. An optional padlockable cover limits access to the "ON" and "OFF" pushbuttons. Complete access to the "ON" pushbutton can be prevented with an optional prevent close cover.

Magnum DS Rigid Frame Construction

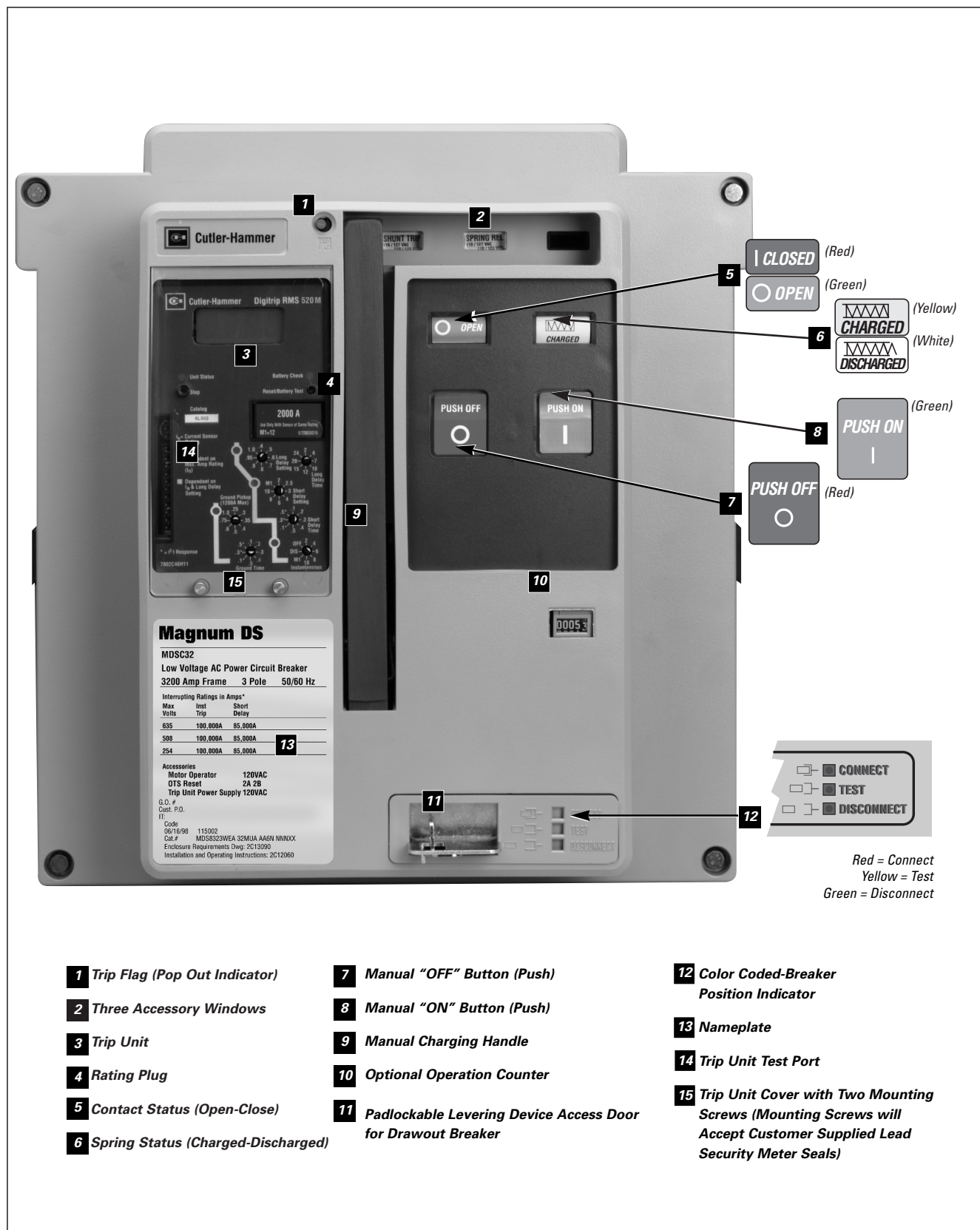


Magnum DS Front Accessible Operating Mechanism

- 1 Secondary Wiring Points
- 2 Through-The-Window Accessories (3 maximum)
- 3 Trip Unit
- 4 Motor Operator (optional)
- 5 Manual Charging Handle
- 6 Operations Counter (optional)
- 7 Padlockable Levering Device Access Door
- 8 Breaker Position Indicator



Magnum DS Drawout Circuit Breaker Front Cover



Main Contact System

Single Contact Finger

The performance characteristics of the Magnum DS air circuit breaker are primarily attributed to the contact design and its movement. A single contact finger is the focal point of the moving contact. This single contact performs both the main and arcing contact functions on different parts of the same finger.

A complete movable contact assembly is merely a combination of a number of single contact fingers. The exact number of contact fingers required depends upon the frame size and interrupting rating of the circuit breaker.

The braided connectors (flexible shunts) used to attach each contact finger serve several important purposes:

- Eliminate bolted joints reducing hot spots
- Reduce required mounting space for primary contacts
- Allow contact finger motion for "Heel - Toe" rocking

Heel-Toe Action

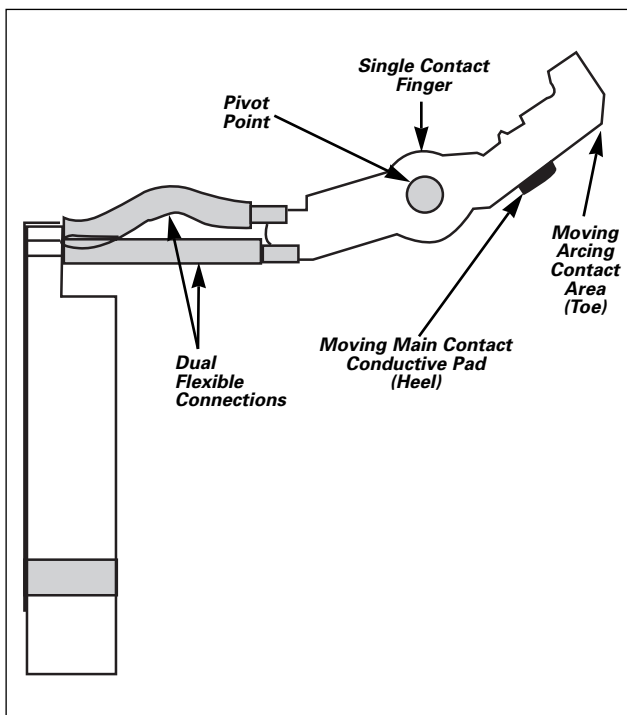
The "Heel-Toe" movement of the contact fingers is a critical factor in the efficiency of the Magnum DS main contact system. The main contact portion can be viewed as the "Heel" and the arcing portion the "Toe." Its movement is similar to the rocking of a foot forward and

backward from heel to toe and toe to heel. When the circuit breaker is closed, the "Heel" (main contact portion) is in contact with the stationary contact and carrying current. At the same time, the "Toe" (arcing contact portion) is separated from the stationary arcing contact.

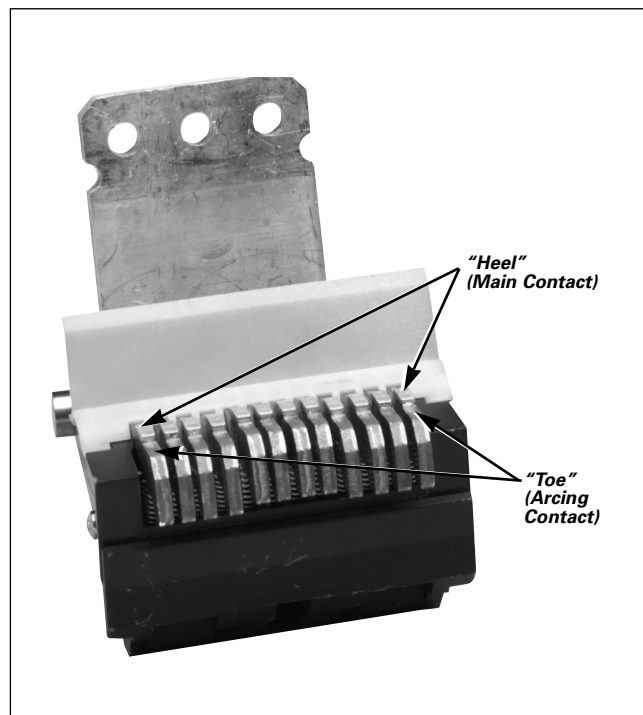
A compact "C Loop" current path permits electromagnetic forces, primarily produced as a result of a fault current, to supplement the closing contact forces provided by the operating mechanism. This helps to accomplish two important things:

- Operating mechanism does not have to be as large or heavy
- Higher short time ratings (withstand) are achievable

Graphic of Single Magnum DS Contact Finger



Magnum DS Multi-finger Contact Assembly



Integral Arc Runner

The integral arc runner serves a dual purpose:

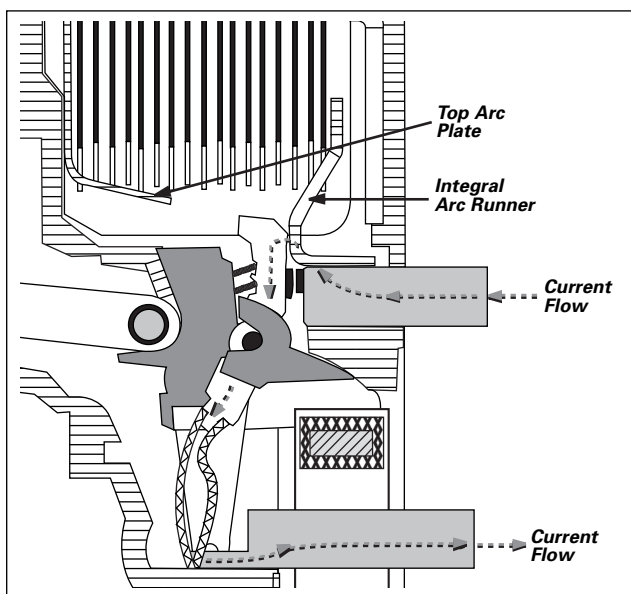
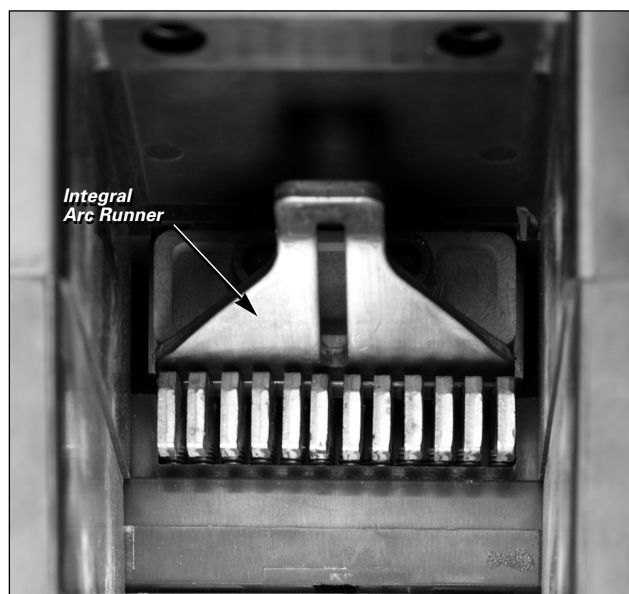
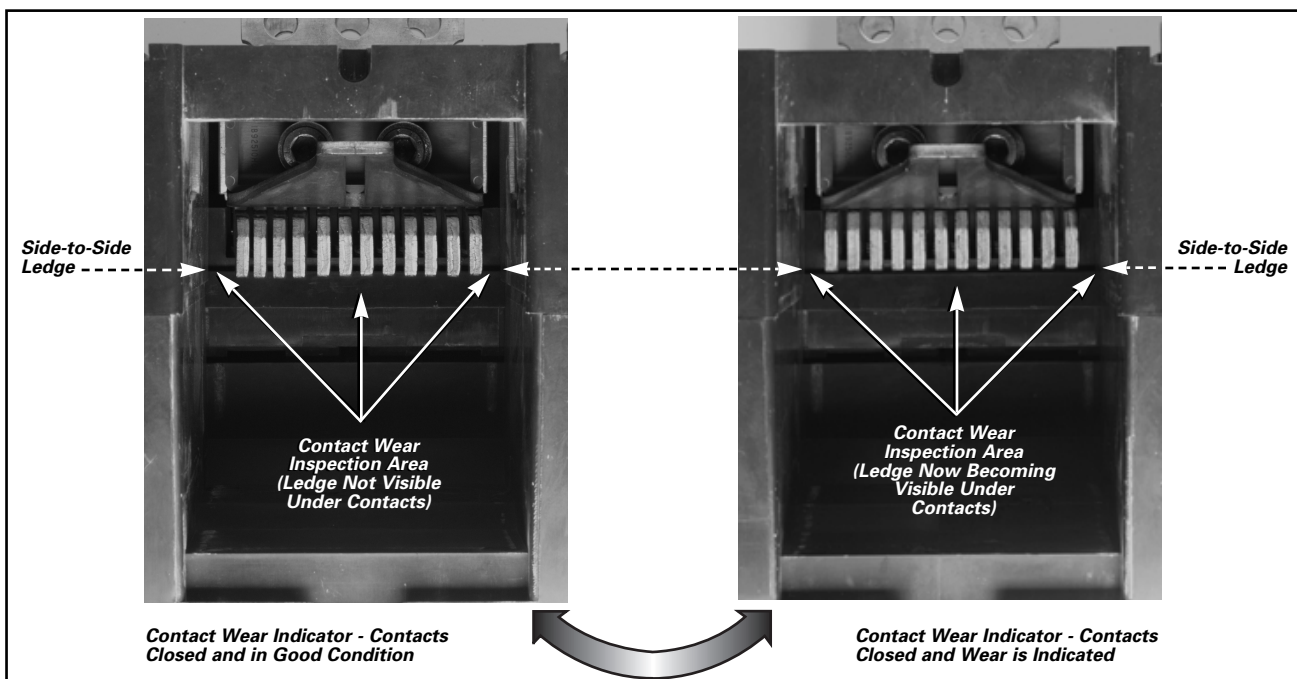
- Functions as circuit breaker' fixed arcing contact
- Functions as a critical part of the arc chute

Contact Wear Indicator

A contact wear indicator provided for each primary contact structure permits their condition to be determined. This is accomplished by viewing the contacts while in the **closed position only**.

The contact wear indicator is the relative position of the individual

contact fingers to a narrow, **side-to-side ledge** inside the arc chamber. When the contacts are in good condition, the narrow ledge is covered by the back end of the contacts and not visible. When the narrow ledge becomes visible with the primary contacts closed, contact replacement is indicated.

Magnum DS Arc Running System**Integral Arc Runner Viewed From Top of Circuit Breaker****Contact Wear Indication**

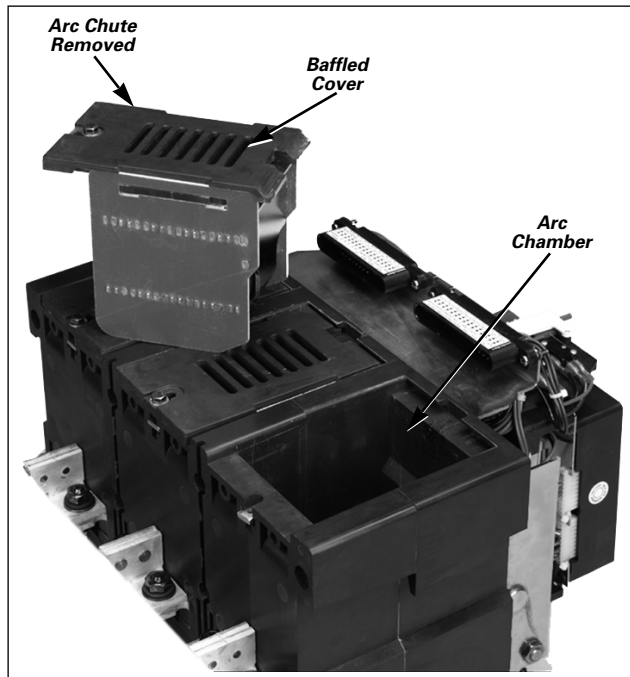
Arc Chambers

Arc chambers, one per pole, are used to insulate and isolate each pole from one another, from the rest of the circuit breaker, and from operating personnel.

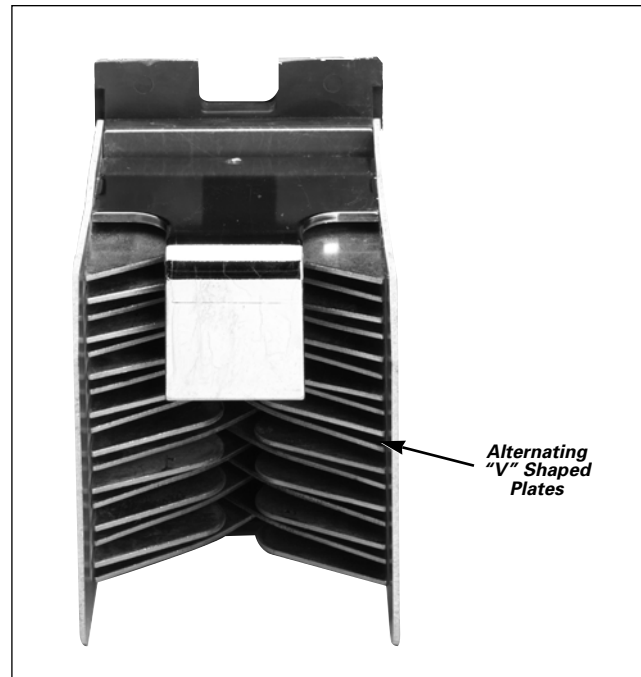
Arc Chute

Enclosed within each arc chamber is an arc chute which mounts over each set of primary contacts. Alternating V-shaped arc chute plates effectively attract the arc and interrupt it. Each arc chute has a baffled cover to assist with the speed and efficiency of the interruption.

Partial Top Rear View of Magnum DS Circuit Breaker



Bottom View of Arc Chute



Manual Operation

On manually operated circuit breakers, the closing spring is only charged manually. This is accomplished through the use of the front mounted spring-charge handle. It takes from 5 to 7 downward strokes on the handle to complete the charging process.

Standard manually operated circuit breakers are closed and open by hand using the front mounted Manual "ON" and Manual "OFF" buttons respectively. Access to these buttons can be limited by the use of an optional, padlockable cover. Complete access to the "ON" button can be prevented with an optional prevent close cover. Spring and primary contact status indicator windows are located just above the pushbuttons.

Optional electrically operated devices are available to automatically close or trip open manually operated circuit breakers, and are field installable.

An optional motor operator is used to charge the closing spring automatically. It can be field installed in a manually operated circuit breaker. Manual circuit breakers are pre-wired for this addition.

Electrical Operation

The closing spring is charged automatically by the optional motor operator. It can also be manually charged.

Manual "ON" and Manual "OFF" buttons are also provided as described under manual operation.

Through the use of a mechanical anti-pump feature, an open circuit breaker only accepts one attempt to reclose even if the close command continues, preventing motor operator burnout.

A standard circuit breaker with electrical operation also has optional electrically operated devices available to automatically close or trip open the circuit breaker.

Magnum DS Circuit Breaker Being Manually Charged**Field Installable Motor Operator**