Magnum DS Switchgear

19.1 Low Voltage Switchgear

Magnum DS Metal-Enclosed

Magnum DS Switchgear with Molded Case Circuit Breaker Feeder Section

Contents

Cross-Reference

Eaton's Electrical Sector has an organization dedicated to the support of current and vintage switchgear breakers and parts that date as far back as the 1950s. These include the Magnum DS, DSII, DS and DB families. For more information, refer to *YES* Catalog No. CA08105000E or call 1-800-BKR-FAST (257-3278).

Available in NEMA® 3R walk-in and non-walk-in configurations.

Product Description

Eaton's Magnum™ DS Switchgear is backed by 50 years of power circuit breaker and switchgear development that have set industry standards for quality, reliability, maintainability and extended operating life.

Magnum DS Switchgear is an assembly of metal enclosures housing power circuit breakers, and normally include control and measuring devices such as relays, instruments, meters and the necessary power bus work and control wiring for AC systems applications up to 600 volts.

Application Description

Switchgear is used in the protection, controlling and monitoring of low voltage distribution systems. Although used as "standalone" distribution assemblies, they are quite often incorporated into secondary unit substations so that the equipment can be located more closely to the point of power usage. Magnum DS Switchgear is ideally suited to applications calling for all types of industrial, commercial and utility users having distribution systems rated 600 volts or below, 200,000 amperes or below bus bracing, and 10,000 amperes or below continuous loads.

Features, Benefits and Functions

Standard Finish—The light gray paint finish (ANSI 61) uses a modern, completely automated and continuously monitored electrostatic powder coating. This continuously monitored system includes spray de-grease and clean, spray rinse, iron phosphate spray coating spray rinse, non-chemical seal, oven drying, electrostatic powder spray paint coating and oven curing.

Integral Base—The rugged formed base greatly increases the rigidity of the structure and reduces the possibility of damage during the installation of the equipment and is suitable for rolling, jacking and handling. A lifting angle is permanently welded into the bus compartment structure for increased strength.

Heavy-Duty Door Hinges—Each breaker door is mounted with hinge pins. Removal of the door is easily accomplished by just lifting the hinge pin. This allows easy access to the breaker internal compartment for inspection and maintenance.

Rear Cover/Doors—In Magnum DS Switchgear, standard rear covers with captive hardware are the bolt-on type. They are split into two sections to facilitate handling during removal and installation. Optional rear doors are also available.

Through-the-Door Design—The following functions may be performed without the need to open the circuit breaker door: levering the breaker between positions, operate manual charging system and view the spring charge status flag, close and open breaker, view and adjust trip unit, and read the breaker rating nameplate.

Through-the-Door Design

Front Accessible—When the door is open or removed, each breaker compartment provides front access to isolated, vertical wireways, primary disconnects, cell current transformers and other breaker compartment accessories for ease of field wiring and troubleshooting field connections.

Four-Position Drawout—Breakers can be in connected, test, disconnected or removed position. The breaker compartment door can be closed in the connected, test and disconnected positions.

Closing Spring Automatic Discharge—Mechanical interlocking automatically discharges the closing springs when the breaker is removed from its compartment.

Breaker Cell

Breaker Inspection—When withdrawn on the rails, breaker is completely accessible for visual inspection; tilting is not necessary. The rails are permanent parts of every breaker compartment.

Interference interlocks are supplied on breakers and in compartments where the compartments are of the same physical size to ensure that an incorrect breaker cannot be inserted.

Features—Bus

Buses and Connections—Vertical and cross bus ratings in Magnum DS Switchgear are based on a UL® and ANSI standard temperature rise of 65°C above a maximum ambient air temperature of 40°C.

Bus Ampacities—Vertical and cross bus ratings in Magnum DS are 2000, 3200, 4000, 5000 and 6000 amperes. In addition, 8000 and 10,000 amperes continuous cross bus ratings are also available.

Bus Bracing—Unique vertical bus configuration provides an optional short-circuit withstand rating of 150,000 amperes without the need for preceding current limiting fuses. Standard bracing is 100,000 amperes. The U-shaped bar is the heart of the Magnum DS vertical bus. This configuration provides a much higher mechanical strength. To further demonstrate the strength and rigidity of this bus system, it has been verified through testing to withstand 85,000 amperes short circuit for a full 60 cycles.

Silver Plating—Bolted, silver-plated copper main buses are standard. The plating is over the entire length of the bar, not just at the joints. Optional tin-plated copper buses are available.

Bus Joints—All joints are bolted and secured with Belleville-type spring washers for maximum joint integrity. These washers reduce the potential of joint hardware loosening during the change of joint temperature associated with variations of the loads. As an option, maintenance-free hardware can be provided.

Full Neutral—For four-wire applications, the neutral bus is rated 100% of main bus rating as standard.

Ground—A ground bus is furnished for the full length of the switchgear assembly and is fitted with terminals for purchaser's connections.

Glass-Reinforced Polyester Stand-Off Insulation System—Glass-reinforced polyester has been used on both low and medium voltage switchgear for decades. By combining this industry-proven material with our other insulation materials, a total system providing exceptional mechanical and dielectric withstand strength, as well as high resistance to heat, flame and moisture, is produced. Substantial testing to demonstrate accelerated effects of heating and cooling on the mechanical and dielectric properties of this system prove it to provide superior performance for decades of trouble-free operation.

Features—Wiring

Cable Compartment—The cable compartment gives ample room for terminating the power cables. Removable top roof sheets allow for easy conduit hub installation. The floor of the cable compartment is open to allow cable entry from underground duct banks. Optional floor plates are available.

Lug Pad—The lugs are located on the breaker run-backs to accommodate lug orientations at a 45° angle to reduce the bending radius of the cable needed for making the connections, thus reducing installation and maintenance time. Mechanical setscrew type lugs are standard. Optional NEMA two-hole compression lugs are available as an option.

Control Wireway—An isolated vertical wireway is provided for routing of factory and field wiring in each switchgear section. Breaker secondary terminal blocks are mounted as standard above each circuit breaker. The terminal blocks are rated 30 amperes and will accept bare wire, ring or spade terminals for wire size ranges of #22 to #10. Extruded loops are punched in side sheets of the vertical wireway to allow securing of customer control wiring without the use of adhesive wire anchors.

Control Wireway

Control Wire—Standard wire is Type SIS insulated stranded copper, extra flexible No. 14 AWG minimum.

Control Wire Marking—Each wire is imprinted with ink cured under ultraviolet light for durability and for easy identification by the user. The enhanced solvent resistance and durability of the aerospace-grade UV cure ink has been tested for severe environments. The imprinting is made periodically along the length of the wire, with the ends being imprinted more frequently. The point of origin, wire designation and point of destination are imprinted in the following format: <origin zone/wire name/destination zone>. Each device has a uniquely designated zone. "<" indicates the direction of the wire origination and ">" indicates the direction of the wire destination. As an option, wire marking can be made using sleeve type or heat shrink sleeve type.

Control Wire Marking

Secondary Terminal Compartment Door—The customer's secondary terminal connections are located behind a separate door providing access to these connections without the need to open the breaker compartment door.

Shipping Split Connection—At each shipping split, the control connections are made with plug-in terminal blocks rated 600 volts, 40 amperes. The terminal blocks interlock mechanically without removing the line or load connections. This method of making the shipping split control connections increases the speed of installation and reduces the potential of incorrect connections.

Features—Breaker

Contacts—The Magnum DS has silver tungsten moving contacts and silver graphite stationary contacts. The contacts provide a long-wearing, low-resistance joint. The contacts are protected from arcing damage even after repeated interruptions by the "heel-toe" action that causes the integral arcing contacts to mate before the main contacts part. The arcing contacts then part last, striking the arc away from the main contacts.

The main contacts are of the butt type and are composed of a multiplicity of fingers to give many points of contact without alignment being critical.

Magnum DS Breaker Contacts (Arc Chutes Removed)

Stored-Energy Mechanism—A cam-type closing mechanism closes the breaker. It receives its energy from a spring that can be charged by a manual handle on the front of the breaker or by a universal electric motor.

Release of the stored energy is accomplished by manually depressing a button on the front of the breaker or electrically energizing a releasing solenoid.

Arc Chute—There are three basic means of extinguishing an arc: lengthening the arc path; cooling by gas blast or contraction; and deionizing or physically removing the conduction particles from the arc path.

The DE-ION® principle is incorporated in all Magnum DS circuit breakers. This makes possible faster arc extinction for a given contact travel, and ensures positive interruption and minimum contact burning.

Levering Mechanism—The worm gear levering mechanism is self-contained on the breaker drawout element and engages slots in the breaker compartment. A removable crank is used to lever the breaker between the connected, test and disconnected positions.

Mechanical interlocking is arranged so that levering cannot be accomplished unless the breaker is in the opened position.

Protection During Levering Operation—When levering the breaker between the connected, test and disconnected positions, the operator is protected from contact with live parts by the breaker door.

Levering Magnum DS Breaker

True Two-Step Stored Energy Closing—This sequence is required to charge and close the breaker.

The breaker closing springs are charged either through the manual-charging handle or by the optional charging motor. The breaker is mechanically interlocked to prevent closing of the breaker until the closing springs are fully charged.

With the closing springs fully charged, the breaker can then be closed by pressing the manual close pushbutton on the breaker, or by the optional spring release coil through a remote electrical signal.

This means that the energy required to open the breaker is always prestored following a closing operation.

"Stored energy" is energy held in waiting, ready to open or close the breaker within five cycles or less. The unique cam and spring design provides necessary energy for a single close-open sequence, as well as the energy for multiple charge-close operations such as this possible sequence: charge-close-recharge-open-close-open.

The closing springs are interlocked with the breaker racking mechanism to ensure that the closing springs are discharged before the breaker can be removed from the compartment.

Manually Operated Breakers—Manually operated breakers are equipped with a manual charging handle to charge the closing springs. Manual closing and tripping pushbuttons are utilized to operate the breaker. Remote closing and tripping can be accomplished by installing optional electric spring release and shunt trip coils. The breaker closing springs must be charged manually, then remote closing and tripping signals can be sent to the breaker.

Electrically Operated Breakers—Electrically operated breakers are equipped with a spring charging motor and electrically operated spring release and shunt trip coils. The breaker manual charging handle can be used to charge the closing springs when power is not available to the charging motor.

Provisions for Padlocking—All breakers include provision for padlocking open to prevent electrical or manual closing. This padlocking can secure the breaker in the connected, test or disconnected position by preventing levering of the breaker.

Ease of Inspection and Maintenance—Magnum DS breakers are designed for maximum accessibility and the utmost ease of inspection and maintenance.

Magnum DS Switchgear—Trip Units

Digitrip™ RMS Trip Unit—The Digitrip RMS trip units feature a dependent curve that is depicted in the nameplate by a blue shaded area of the trip curve. The dependent curve affords better protection flexibility. Additionally, all of the trip units have, as standard, thermal memory, 50/60 Hz operation and thermal self-protection at 90°C.

Digitrip RMS Integral Microprocessor-Based Breaker Overcurrent Trip Systems—These systems provide maximum reliability with true rms sensing as standard, gives excellent repeatability, and requires minimum maintenance. No external control source is required for its protective functions.

Trip Functions—Magnum DS trip units provide the maximum in flexibility and are available in the following configurations: LSI, LSIG and LSIA (ground fault alarm only). In each case, either the short delay or the instantaneous function (not both) may be defeated. This reduces the need for spare breaker inventories and provides maximum utilization of interchangeable breakers.

Options

Special Designs

The Magnum DS design allows Eaton to provide special solutions to meet our customer's needs. For example, as shown below, here we embedded molded case circuit breakers into a switchgear lineup for a customer.

Magnum DS Switchgear with Molded Case Circuit Breaker Feeder Section

Refer to TD01901001E for application data.

Standards and Certifications

Magnum DS Switchgear assemblies have undergone an extensive seismic qualification program. The test program utilized ANSI standard C37.81, the Uniform Building Code® (UBC) and the California Building Code (CBC) as a basis for the test program. The assemblies have been tested and qualified to exceed these requirements.

Magnum DS Switchgear conforms to the following standards: CSA®, ANSI C37.20.1, C37.51, and UL Standard 1558, and is built in an ISO® certified facility.

American Bureau of Shipping (ABS) certification is also available.

Contact Eaton for details and part numbers for CSA-approved units.

Product Selection

Refer to TD01901001E for application data.

Contact Eaton for configurations, pricing and availability.

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Technical Data and Specifications

Product Specifications

Refer to Section 16426A of the *Product Specification Guide*.

Available Bus Ratings

Cross Bus Ampacity	Bus Bracing kA	Vertical Bus Ampacity
2000	100, 150, 200	2000
3200	100, 150, 200	3200
4000	100, 150, 200	4000
5000	100, 150, 200	5000
6000	100, 150, 200	—
8000	100, 150, 200	—
10,000	100, 150, 200	—

Vertical section bus is sized per main cross bus maximum rating or by ANSI C37.20.1 Section 7.4.13 Table 11 to a maximum of 5000 amperes.

Note: In addition to the available bus bracings shown above, the bus has been tested for short circuit values of 85,000 amperes for a full 60 cycles.

Ratings of Magnum DS Breakers

		Ratings, rms Symmetrical Amperes					
		Interrupting Rating ①			Short Time Rating		
Breaker Type	Frame Amperes	208–240 Volts	480 Volts	600 Volts	208–240 Volts	480 Volts	600 Volts
MDS-408	800	42,000	42,000	42,000	42,000	42,000	42,000
MDS-608	800	65,000	65,000	65,000	65,000	65,000	65,000
MDS-808	800	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C08	800	100,000	100,000	100,000	85,000	85,000	85,000
MDS-616	1600	65,000	65,000	65,000	65,000	65,000	65,000
MDS-816	1600	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C16	1600	100,000	100,000	100,000	85,000	85,000	85,000
MDS-620	2000	65,000	65,000	65,000	65,000	65,000	65,000
MDS-820	2000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C20	2000	100,000	100,000	100,000	85,000	85,000	85,000
MDS-632	3200	65,000	65,000	65,000	65,000	65,000	65,000
MDS-832	3200	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C32	3200	100,000	100,000	100,000	85,000	85,000	85,000
MDS-840	4000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C40	4000	100,000	100,000	100,000	100,000	100,000	100,000
MDS-850	5000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C50	5000	100,000	100,000	100,000	100,000	100,000	100,000
MDS-860	6000	85,000	85,000	85,000	85,000	85,000	85,000
MDS-C60	6000	100,000	100,000	100,000	100,000	100,000	100,000

Note

① 200 kA available; contact Eaton.

MVS Primary Switch and Low Voltage Metal-Enclosed Switchgear

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Product Description

Unit Substations

Most switchgear assemblies are configured as unit substations.

A unit substation, as referred to in this publication, is defined as a coordinated assembly consisting of three-phase transformers with high-voltage incoming line sections and an assembly of low voltage distribution sections.

Liquid-Filled Transformers

- Mineral oil
- FR3
- BIOTEMP®
- Silicon

Dry-Type Transformers

- VPI
- VPE
- RESIBLOC®
- Cast coil

Secondary Unit Substations

- Liquid-filled or dry-type transformer
- Transformer kVA 112.5 through 3750
- Low voltage—208, 240, 480 or 600V

Primary Unit Substations

- Liquid-filled or dry-type transformer
- Transformer kVA 500 through 20 MVA
- Low voltage—2400V through 24.5 kV

Unit substations may be indoor or outdoor, with a selection of high voltage incoming sections, a choice of transformer types and an arrangement of switchgear to suit the application.

Eaton's unit substations follow the system concept of locating transformers as close as practicable to areas of load concentration at usage voltages, thus minimizing the lengths of secondary distribution cables and buses. This concept provides several basic advantages, such as:

- Reduced power losses
- Improved voltage regulation
- Improved service continuity
- Reduced likelihood of faults
- Increased flexibility
- Minimized installation expense
- Elimination of the need for vaults due to availability of non-flammable types of transformers
- Efficient space utilization

Application Description

Advantages of Unit Substations

- Complete coordination, both mechanical and electrical
- Extreme flexibility with wide choice of components and ratings to meet exact application requirements
- Optimum safety to operators
- Modern design
- Meets all applicable ANSI, IEEE®, NEMA and UL standards

Features, Benefits and Functions

Refer to TD.49A.01.T.E for primary unit substations and TD.49A.02.T.E for secondary unit substations.

Options

Refer to TD.49A.01.T.E for primary unit substations and TD.49A.02.T.E for secondary unit substations.

Standards and Certifications

Refer to TD.49A.01.T.E for primary unit substations and TD.49A.02.T.E for secondary unit substations.

Contact Eaton for details and part numbers for CSA-approved units.

Product Selection

Unit substations are engineered to order and have multiple configurations. Contact Eaton for configurations, pricing and availability.

Technical Data and Specifications

Refer to TD.49A.01.T.E for primary unit substations and TD.49A.02.T.E for secondary unit substations.

Product Specifications

Refer to Section 16312 of the *Product Specification Guide* for primary unit substations and Section 16311 of the *Product Specification Guide* for secondary unit substations.