

/// FR Circuit breaker, hydraulic magnetic, very high current

Rugged circuit breaker for extreme reliability, within long endurance applications and harsh environments

FR Circuit breaker



Features

- Ideal for very high current applications
- Precise, temperature independent operation
- Panel mount
- Integrated auxiliary contacts (optional)
- Up to 3 poles configuration
- High interrupting capacities due to unique arc chute method
- Mid-trip handle for electrical trip indication (optional)
- Immediate resetting possible
- Wide current range: 100 - 700 A
- Wide choice of time delays
- Maximum voltage 137.5 VDC / 277 VAC
- High contact pressure & longer contact life due to wiping self-cleaning contacts
- Flexibility by many options

Description

Hydraulic magnetic circuit breaker for very high current railway applications to protect electronic equipment and components against unintended high currents. Optional with integrated auxiliary contacts to monitor the circuit.

The trip point is always at maximum allowable current, independent of ambient temperature. Mid-trip handle to indicate clearly a breaker operation caused by electrical fault. With unique arc chute design which results in high interrupting capacities. Up to 3 poles which all break its electronic circuits when 1 breaker trips, for optimal protection of the system. Wide range of currents from 100 A to 700 A and many options available.

Application

To be used in every high current application where electrical systems, circuits or components must be protected against too high currents. This situation can occur, when under strained or heavy use a motor or other load-generating component within the equipment will draw additional current from the power source. High currents cause the wires or components to overheat and ultimately burn up.

A circuit protection device should be employed at any point where a conductor size changes. Many electronic circuits and components like transformers have a lower overload withstand threshold level than conductors such as wires and cables. These components require circuit protection devices featuring very fast overload sensing and opening capabilities. The FR circuit breaker can be used in all Railway applications where protection against overload and short circuit is necessary, for example HVAC systems, (door) control systems, braking systems, passenger information systems, etc..



Railway compliancy

All our circuit breakers are designed according
EN 50155

IEC 60077 - 1/2/3/4 NF F 62-001 - 1/2/3

IEC 61373 NF F61-010

EN 50124-1 IEC 60068-2-30

EN 45545-2 IEC 60068-2-52

IEC 60947-2 MIL-STD-202G Method 107D, condition A

NF F16-101/102 MIL-STD-202G Method 106D

Technical specifications

Electrical characteristics

Application voltage Rated voltage Min. operating voltage Max. operating voltage	DC for 1-3 poles	AC for 1-3 poles															
	12 - 110 VDC 8.4 VDC 137.5 VDC	12 - 251 VAC 10.8 VAC 277 VAC															
	Remark: DC applications: max. 250 A for 1 pole 300 A - 450 A for 2 poles (parallel pole construction) 500 A - 700 A for 3 poles (parallel pole construction) AC applications: max. 250 A for 1-3 poles																
Current ratings	100 - 700 A. Other ratings on request.																
Dielectric strength	1960 VAC, 50/60 Hz for 1 minute between all electrically isolated terminals.																
Creepage and clearance	EN 50124-1 8 mm spacing requirements from hazardous voltage to operator accessible surfaces, between adjacent poles and from main circuits to auxiliary circuits.																
Insulation resistance	Minimum of 100 MΩ @ 500 VDC																
Operating frequency	50/60 Hz, DC																
Max. interrupting cap.	IEC 60947-2 UL 489 UL 489A UL 489	25.000 A @ 125 VDC, 50 - 250 A 50.000 A @ 125 VDC, 50 - 250 A 50.000 A @ 125 VDC, 251 - 700 A 10.000 A @ 277 VDC, 100 - 250 A															
Auxiliary switch	Integrated, load side. SPST. Auxiliary switch senses the on-off position of circuit breaker handle, as well as the open-closed position of breaker contact.																
		<table border="0"> <tr> <td></td> <td style="text-align: center;">Silver auxiliary contacts</td> <td style="text-align: center;">Gold auxiliary contacts</td> </tr> <tr> <td>AC min. switching cap.</td> <td>5 - 20 VAC: 100 mA ≥ 20 VAC: 10 mA</td> <td>5 mA / 5 VAC</td> </tr> <tr> <td>AC max. switching cap.</td> <td>5 A / 125 VAC</td> <td>100 mA / 125 VAC</td> </tr> <tr> <td>DC min switching cap.</td> <td>≤ 20 VDC: 100 mA ≥ 20 VDC: 10 mA</td> <td>5 mA / 5 VDC</td> </tr> <tr> <td>DC max. switching cap.</td> <td>3 A / 32 VDC 100 mA / 125 VDC (max. 2000 cycles)</td> <td>100 mA / 32 VDC 2 mA / 110 VDC (max. 2000 cycles)</td> </tr> </table>		Silver auxiliary contacts	Gold auxiliary contacts	AC min. switching cap.	5 - 20 VAC: 100 mA ≥ 20 VAC: 10 mA	5 mA / 5 VAC	AC max. switching cap.	5 A / 125 VAC	100 mA / 125 VAC	DC min switching cap.	≤ 20 VDC: 100 mA ≥ 20 VDC: 10 mA	5 mA / 5 VDC	DC max. switching cap.	3 A / 32 VDC 100 mA / 125 VDC (max. 2000 cycles)	100 mA / 32 VDC 2 mA / 110 VDC (max. 2000 cycles)
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	All loads mentioned are resistive loads.																

General characteristics

Number of poles	1, 2 or 3 poles
Terminals	Stud / screw / box wire connector, see circuit & terminal diagrams.
Auxiliary contacts	Faston or solder type, see circuit & terminal diagrams.
Mounting	The hydraulic-magnetic circuit breakers of Mors Smitt can be mounted in any position. A hydraulic-magnetic breaker is designed to "must hold" at 100% of the breaker's current rating and is calibrated to "must trip" at 125% of the breaker's current rating. If the mounting position is +90 degrees from a vertical panel mount (handle facing down, ceiling mount position) the trip and must hold rating is reduced by 10%.
Body	Blue colour
Actuator	Handle, white or black with "I O" and/or "On-off" legends
Int. circuit configuration	Series trip
Weight	950 gram per pole (average, depending on configuration)
Width per pole	38.1 mm
Material	Half shell - BMC 605 Handle - Valox 420SEO UL94V0 Terminals - Brass with acid tin plate

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Mechanical characteristics

Endurance	Single or multipole: 8.000 operations @ 5 per minute (4.000 "ON-OFF" operations with rated current and voltage + 4.000 operations with no load). Parallel pole construction: 1.000 operations with rated current and voltage @ 5 per minute.
Trip indication: Standard (no mid-trip)	When manually moving the operating handle from OFF to ON position, an auxiliary switch is actuated. When an overload or a short circuit causes the circuit breaker to trip, the operating handle moves positively to the OFF position and the auxiliary switch is actuated.
Mid trip	When manually moving the operating handle from OFF to ON position, an auxiliary switch is actuated. When an overload or a short circuit causes the circuit breaker to trip, the operating handle moves positively to the mid position and the auxiliary switch is actuated.
Mid-trip with alarm switch	When manually moving the operating handle from OFF to ON position, an auxiliary switch is not actuated. When an overload or a short circuit causes the circuit breaker to trip, the operating handle moves positively to the mid position and the auxiliary switch is actuated. In this case the auxiliary switch is only actuated by an electrical trip, not by manually operating the handle. Remark: It is possible to manually switch the circuit breaker to the mid-trip position when the handle is switched from OFF to ON position quickly and with strong upwards force. Normally this won't occur in standard use. This is a normal phenomenon related to the design of the product.

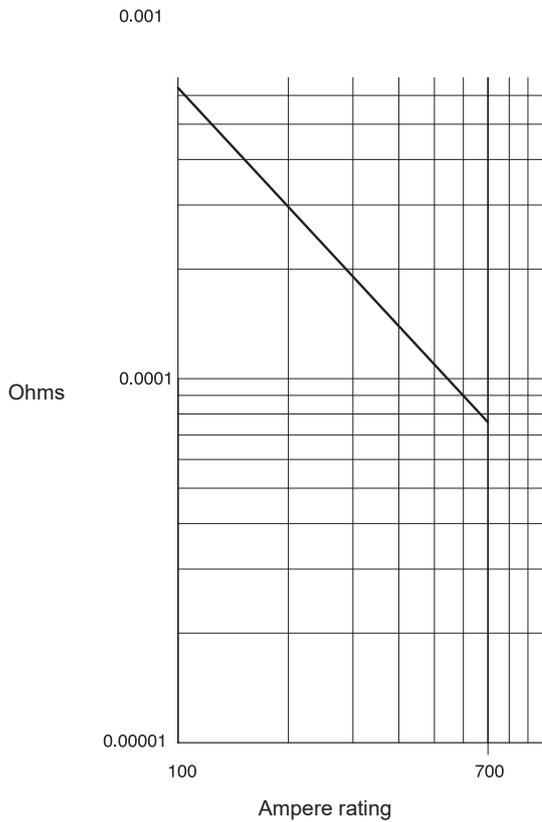
Environmental characteristics

Environmental	Complies to EN 50125-1 and IEC 60077-1
Operating temperature	-50 °C...+85 °C
Vibration	IEC 61373, Category 1, class B body mounted
Shock	IEC 61373, Category 1, class A & B body mounted
Thermal shock	Complies to MIL-PRF-55629 & MIL-STD-202
Salt mist	Complies to MIL-PRF-55629 & MIL-STD-202
Fire & smoke	Complies to NF F 16101, NF F 16102
Protection	IEC 60529, IP40 when a panel is mounted over the circuit breaker
Moisture resistance / humidity	Complies to MIL-PRF-55629 & MIL-STD-202

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Resistance, impedance

Resistance, impedance values from Line to Load terminals
(Values based on series trip circuit breaker)



Current (amps)	Tolerance (%)
100-700	± 50%

Table of time delay values

TRIP TIME (SECONDS)	PERCENT OF RATED CURRENT								
	Delay	100%	125%	150%	200%	400%	600%	800%	1000%
11	No Trip	.013 - .125	.010 - .070	.008 - .032	.006 - .020	.005 - .020	.004 - .020	.004 - .020	.004 - .020
12	No Trip	.475 - 10.0	.275 - 2.80	.140 - .850	.030 - .190	.015 - .125	.010 - .050	.008 - .038	.008 - .038
14	No Trip	10.0 - 110	6.00 - 40.0	2.50 - 15.0	.500 - 3.00	.180 - 1.00	.010 - .280	.008 - .080	.008 - .080
16	No Trip	110 - 1000	60.0 - 400	22.0 - 150	4.00 - 25.0	1.00 - 5.50	.010 - 1.80	.008 - .390	.008 - .390
22	No Trip	.700 - 12.0	.350 - 4.00	.130 - 1.30	.027 - .220	.008 - .130	.004 - .090	.004 - .045	.004 - .045
24	No Trip	10.0 - 160	6.00 - 60.0	.220 - 20.0	.300 - 3.00	.050 - 1.30	.007 - .500	.005 - .060	.005 - .060
26	No Trip	50.0 - 700	32.0 - 350	10.0 - 90.0	1.50 - 15.0	.500 - 7.00	.020 - 3.00	.006 - 2.00	.006 - 2.00

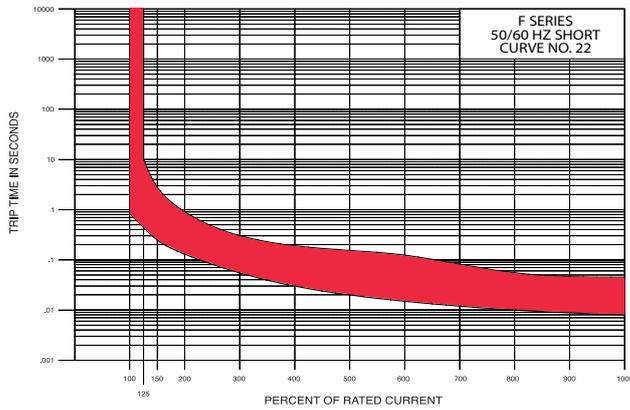
Notes:

- Delay curves 11, 12, 14, 16, 21, 22, 24, 26: Breakers to hold 100% and must trip at 125% of rated current and greater within the time limit shown in this curve
- All curves: Curve data shown represents breaker response at ambient temperature of 25 °C (77 °F) with no preloading. Breakers are mounted in standard wall-mount position. Delay times may vary at different temperature, the trip current rating remains unchanged
- The minimum inrush pulse tolerance handling capabilities is 10 times rated current based on a 60 Hz 1/2 cycle, 8.33 ms pulse

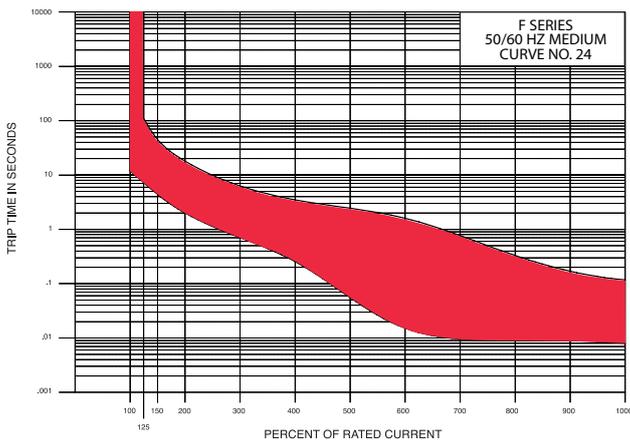
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Time delay values

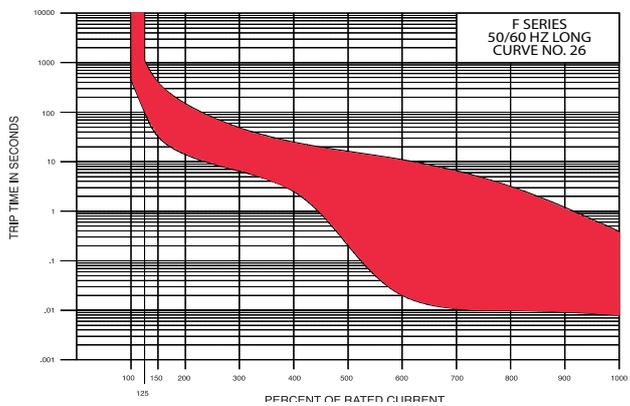
Short



Medium

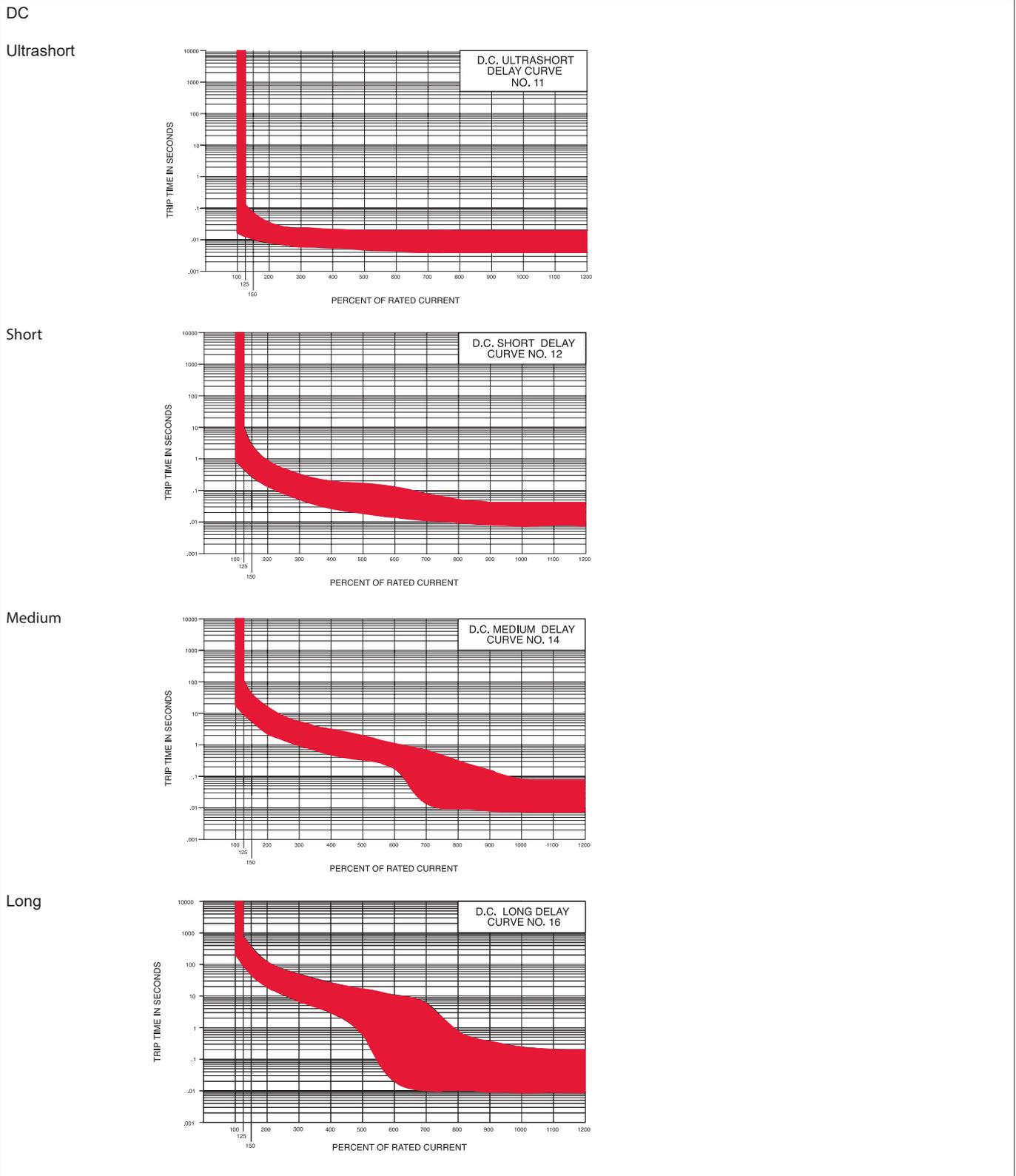


Long



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Time delay values

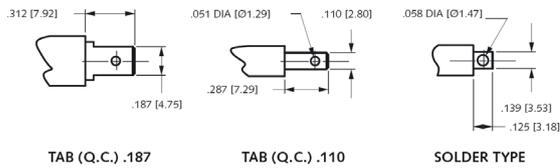


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Circuit & terminal diagrams

HANDLE POSITION VS. AUX/ALARM SWITCH MODE						
CIRCUIT BREAKER MODE	STANDARD C/B		MID TRIP C/B		MID TRIP C/B + ALARM SWITCH MODE	
	HANDLE POSITION	AUX. SWITCH MODE	HANDLE POSITION	AUX. SWITCH MODE	HANDLE POSITION	AUX. SWITCH MODE
OFF						
ON						
ELECTRICAL TRIP						

AUXILIARY / ALARM SWITCH TERMINAL DETAIL



Notes:

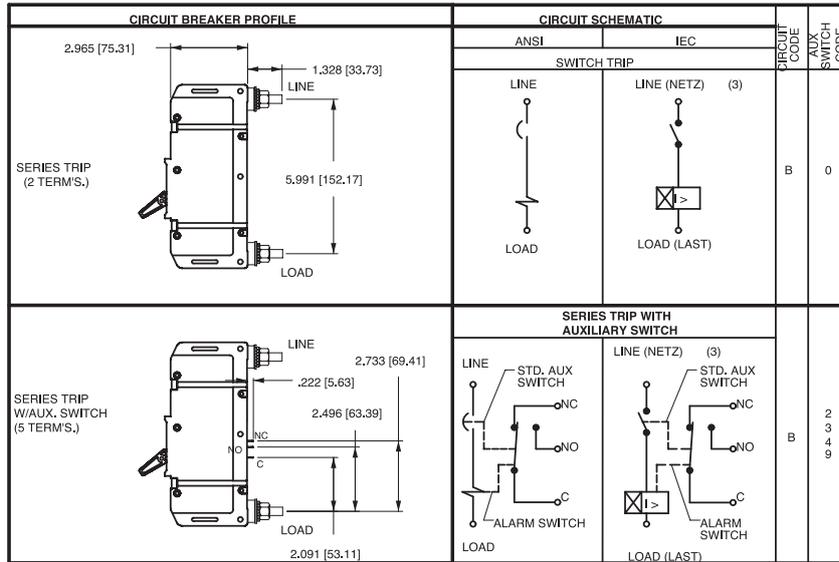
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2. Tolerance ± 0.020 [0.51] unless otherwise specified

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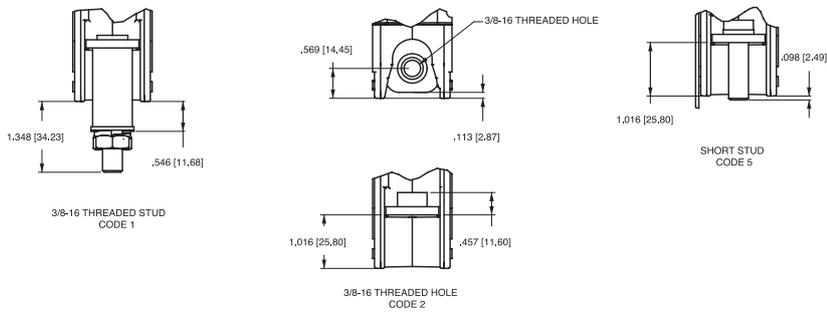
Circuit & terminal diagrams

Non-parallel pole construction (1-3 pole)

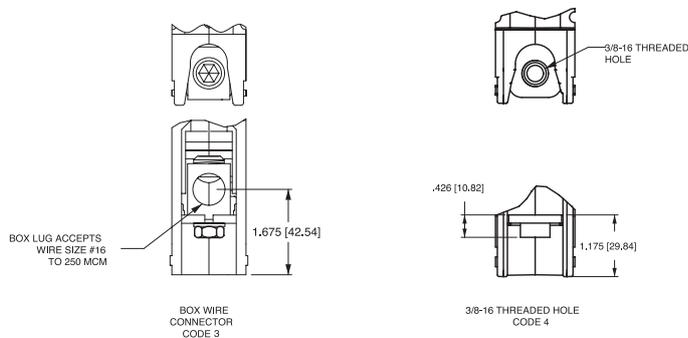


TERMINAL DETAILS

BACK CONNECT



FRONT CONNECT



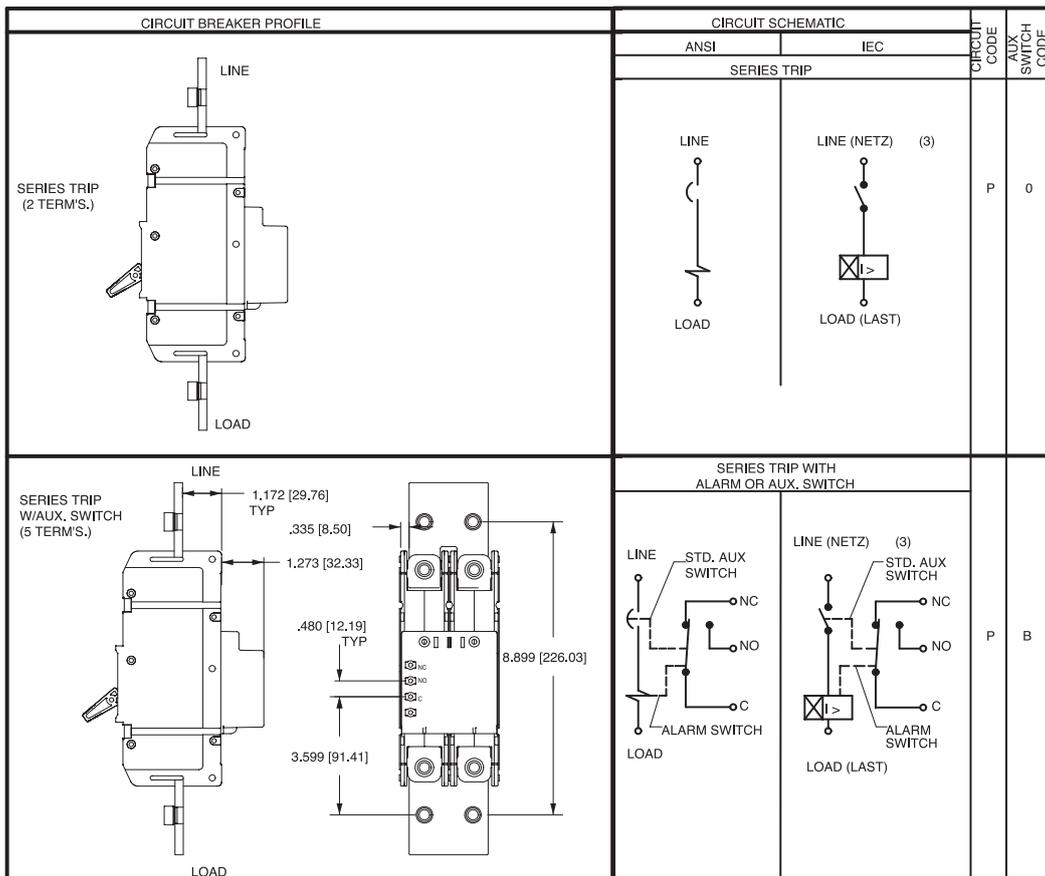
Notes:

1. All dimensions are in inches [millimeters]
2. Tolerance ± 0.020 [0.51] unless otherwise specified

Circuit breaker FR

Circuit & terminal diagrams

Parallel pole construction (2-3 pole)



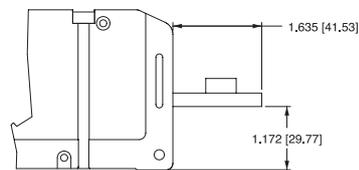
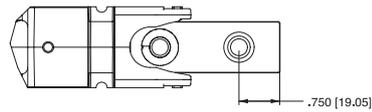
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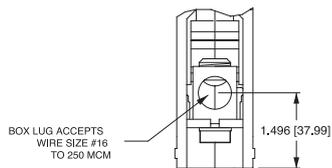
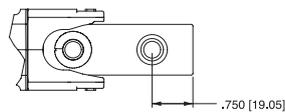
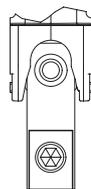
Circuit & terminal diagrams

TERMINAL DETAILS BACK CONNECT

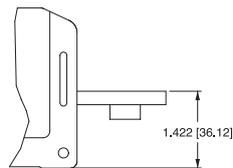


3/8-16 THREADED HOLE
CODE 2

FRONT CONNECT



BOX WIRE
CONNECTOR
CODE 3



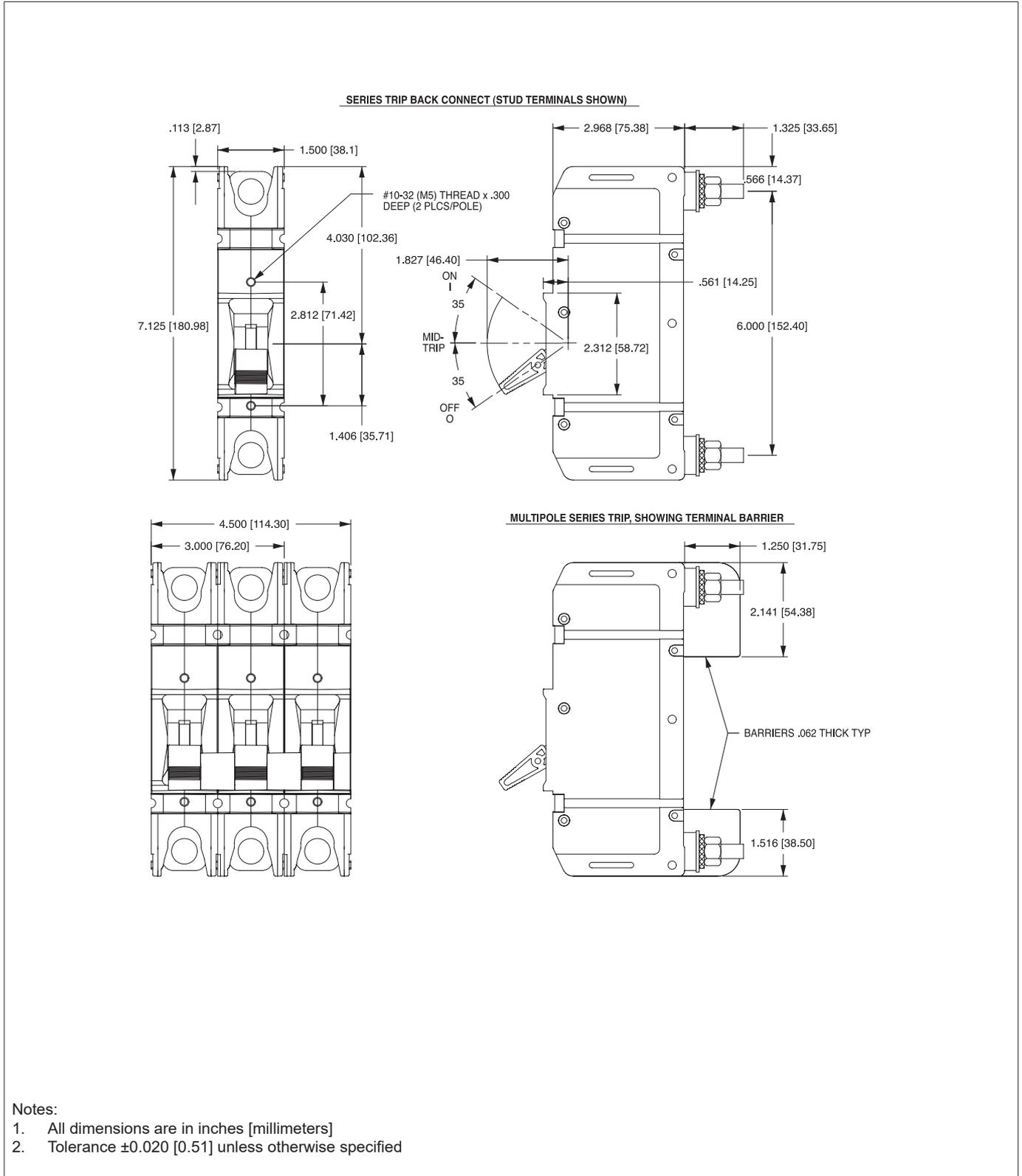
3/8-16 THREADED HOLE
CODE 4

Notes:

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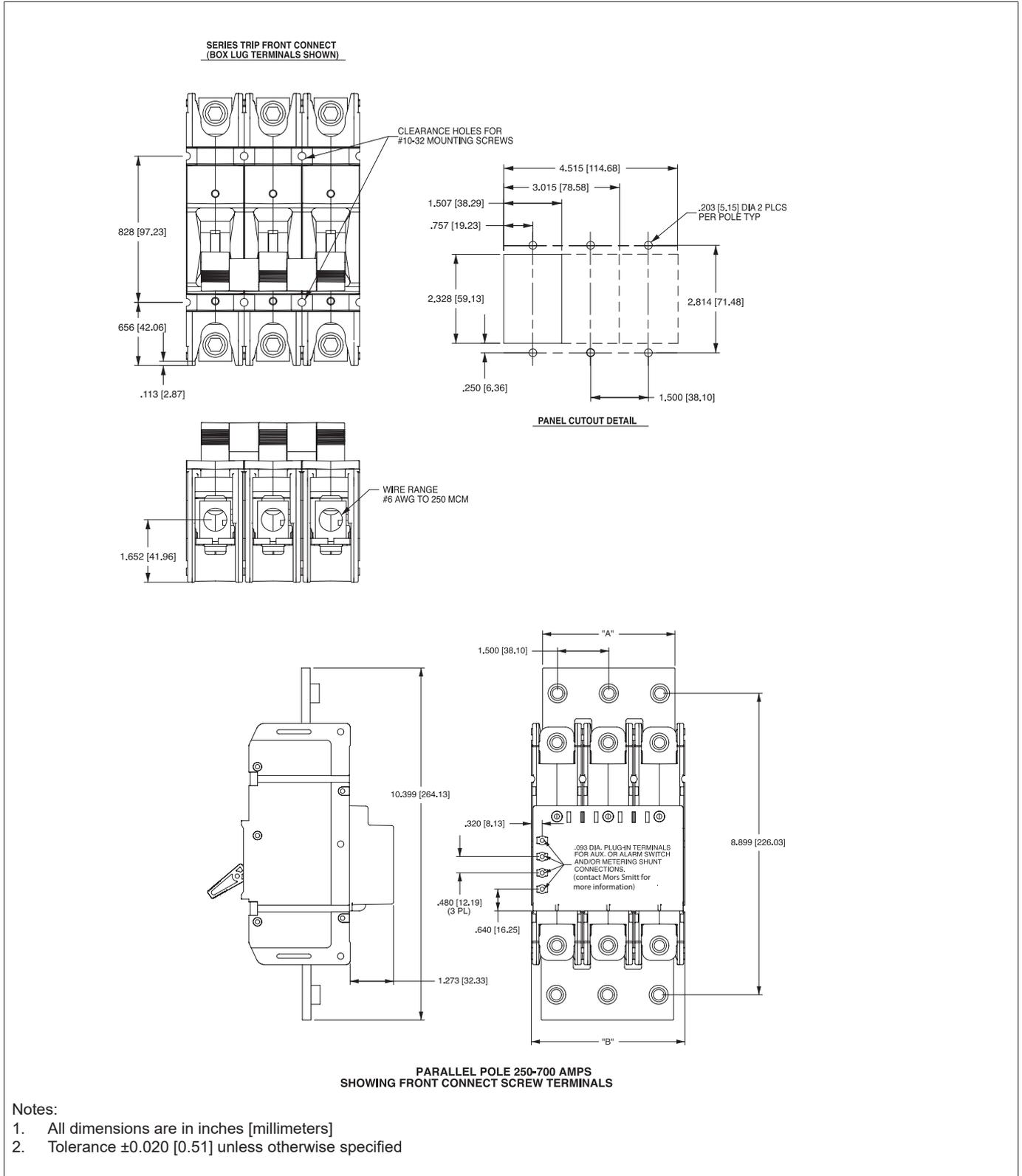
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Circuit & terminal diagrams



Circuit breaker FR

Circuit & terminal diagrams



Circuit breaker

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Ordering scheme FR - page 1

FR		-	-	-code continues on next page.....
Poles	1				1 pole
	2				2 poles
	3				3 poles
Current rating (amperes) ¹		810			100.0
		812			120.0
		912			125.0
		815			150.0
		917			175.0
		820			200.0
		922			225.0
		825			250.0
		830 ¹¹			300.0
		835 ¹¹			350.0
		840 ¹¹			400.0
		845 ¹¹			450.0
		850 ¹¹			500.0
	860 ¹¹			600.0	
	870 ¹¹			700.0	
Frequency & delay			11		DC ultra short
			12		DC short
			14		DC medium
			16		DC long
			22		50/60 Hz short
			24		50/60 Hz medium
		26		50/60 Hz long	

Circuit breaker

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Ordering scheme FR - page 2

.....
Circuit	B							
	P ¹							
Actuator ²		A						
		S						
		T						
Actuator colour & legend			..					
Auxiliary switch ⁸			0					
			2					
			3					
			4					
			9					
			B ⁴					
Terminal				1 ⁵				
				2 ⁶				
				5 ⁶				
				3				
				4 ⁶				
Mounting					A			
					B			
Maximum application rating						B		
						C ⁸		
						F		
						7 ⁹		
Agency approval							A	No approval ¹⁰

Special configurations, not covered by this ordering scheme, on request.

Example : FR2-820-14-B-A-2-0-1-A-B-A

Notes:

- Parallel pole constructions are supplied with factory installed busbar on line and load
- Actuator code:
S: Handle moves to mid-position only upon electrical trip of the breaker
T: Handle moves to mid-position and alarm switch activates only upon electrical trip of the breaker
- On multi-pole breakers, one auxiliary switch is supplied, mounted in the extreme right pole (rear view) On parallel pole construction breakers, one auxiliary switch is supplied, mounted in the extreme left pole (rear view) Back mounted breakers require special mounting provisions when an auxiliary switch is specified
- Only available for and must be used with parallel pole construction
- An 'anti-flash over barrier' is supplied between poles on multipole breakers with 3/8 - 16 stud terminals
Recommended torque value stud terminals is 180-200" lbs (=20.3-22.6 Nm)
- Terminals 2, 4 & 5 are shipped without terminals hardware
- Box wire connector will accept #6 through 250 MCM copper wire
- 2- or 3-pole circuit breaker required for 120/240 VAC rating
- 3-pole circuit breaker required for 120/208 VAC rating
- TUV certified: possible on request
- Ratings over 250 amps are parallel pole constructions (circuit code P): 300-450 amp ratings are available on two pole breakers. 500-700 amp ratings are available on three pole breakers
- Recommended torque value mounting inserts is 15-20" lbs (1.7-2.3 Nm)

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 **Over 10 million Mors Smitt relays in use in rail transport applications worldwide!**

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