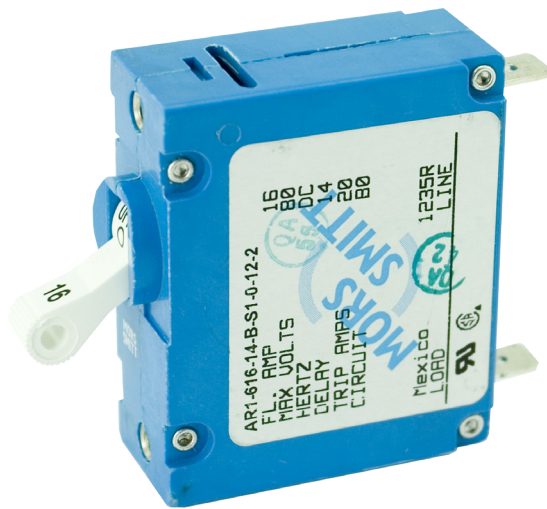


AR circuit breaker - Hydraulic magnetic, railway, small

Datasheet



Description

Small hydraulic magnetic circuit breaker for 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 6 poles which all break its electronic circuits when 1 breaker trips, for optimal protection of the system. Wide range of currents and options available.

Application

To be used in every 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 AR 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.

Features

- Precise, temperature independent operation
- Panel mount
- Integrated auxiliary contacts (optional)
- Small design
- Up to 6 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: 0.1 - 50 A
- Wide choice of time delays
- Maximum voltage 90 VDC / 277 VAC
- High contact pressure & longer contact life due to wiping self-cleaning contacts
- Flexibility by many options

Benefits

- Proven reliable
- Long term availability
- Low life cycle cost
- No maintenance

Railway compliancy

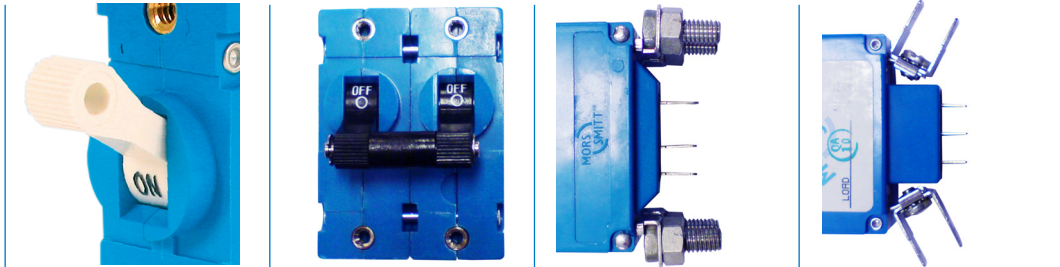
All our circuit breakers are designed according:

- IEC 60077-1/2/3/4
- IEC 60947-2
- NF F62-001 - 1/2/3
- NF F16-101/102
- EN 45545-2
- EN 50155
- EN 61373
- EN 50124-1
- IEC 60068-2-30
- IEC 60068-2-52
- NF F61-010
- MIL-STD-202G, method 106D
- MIL-STD-202G, method 107D, test condition A



AR circuit breakers

Technical specifications



Electrical characteristics

Application voltage	DC for 1-6 poles	AC for 1-6 poles
Rated voltage	12 - 72 VDC	12 - 251 VAC
Min. operating voltage	8.4 VDC	10.8 VAC
Max. operating voltage	90 VDC	277 VAC
	Remark: 8.4-80 VDC: max 50 A 80-90 VDC: max 40 A	
Current ratings	0.1 – 50 A. Other ratings on request	
Voltage coils	6 - 65 VDC, 6 - 240 VAC. Other ratings on request	
Dielectric strength	1500 VAC, 60 Hz for 1 minute between all electrically isolated terminals	
Insulation resistance	Minimum of 100 MΩ @ 500 VDC	
Operating frequency	50/60 Hz, DC	
Max. interrupting cap.	UL 1077	7500 A @ 80 VDC, 0.1 - 50 A 3000 A @ 250 VAC, 0.1 - 50 A 5000 A @ 250 VAC, 0.1 - 50 A (with backup fuse) 5000 A @ 277 VAC, 0.1 - 30 A (with backup fuse)
	IEC 60934	3000 A @ 65 VDC, 0.1 - 50 A 5000 A @ 65 VDC, 0.1 - 50 A (with backup fuse) 1500 A @ 80 VDC, 0.1 - 50 A 3000 A @ 80 VDC, 0.1 - 50 A (with backup fuse) 3000 A @ 250 VAC, 0.1 - 50 A 5000 A @ 250 VAC, 0.1 - 30 A (with backup fuse)
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.	
		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)
	All loads mentioned are resistive loads.	



AR circuit breakers

Technical specifications

General characteristics

Number of poles	1, 2, 3, 4, 5 or 6 poles For DC and AC applications: 1-2 poles ≤ 50 A 3-6 poles ≤ 30 A
Terminals	Stud / screw / double faston, 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%. In ceiling mount position 10% should be added to the rated current. In table mount position (handle facing up) the same rated current can be used as in wall mount position.
Body	Blue colour
Actuator handle	Several colours with “I O” and “On-off” legends
Int. circuit configuration	Series trip, shunt trip & switch only
Weight (average, depending on configuration)	65 g per pole
Width per pole	19.2 mm
Material	Half shell - BMC 605 Handle - Valox 420SEO UL94V0 Terminals - Brass with acid tin plate

Mechanical characteristics

Endurance Trip free mechanism	10.000 ‘ON-OFF’ operations @ 6 per minute with rated current & voltage. Trips on short-circuit or on overload, even when the actuator is forcibly held in the ON position.
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.



AR circuit breakers

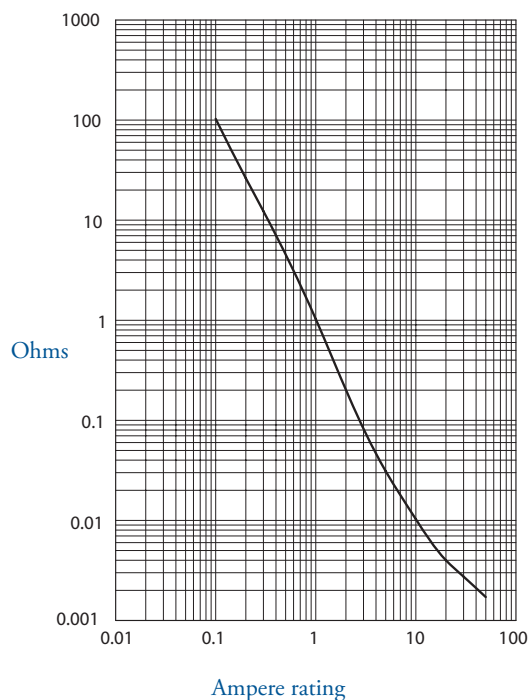
Technical specifications

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-STD 202 G method 107D, test condition A
Salt mist	Complies to IEC 60068-2-52 severity level 3
Damp heat	Complies to IEC 60068-2-30 test method Db variant 1
Fire & smoke	Complies to NFF 16101, NFF 16102
Protection	IEC 60529, IP40 when a panel is mounted over the circuit breaker
Moisture resistance / humidity	Complies to MIL-STD 202G method 106D

Resistance, impedance

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



Current (amps)	Tolerance (%)
0.10 - 5.0	± 15%
5.1 - 20.0	± 25 %
20.1 - 50.0	± 35 %



AR circuit breakers

Technical specifications

Inrush pulse tolerance

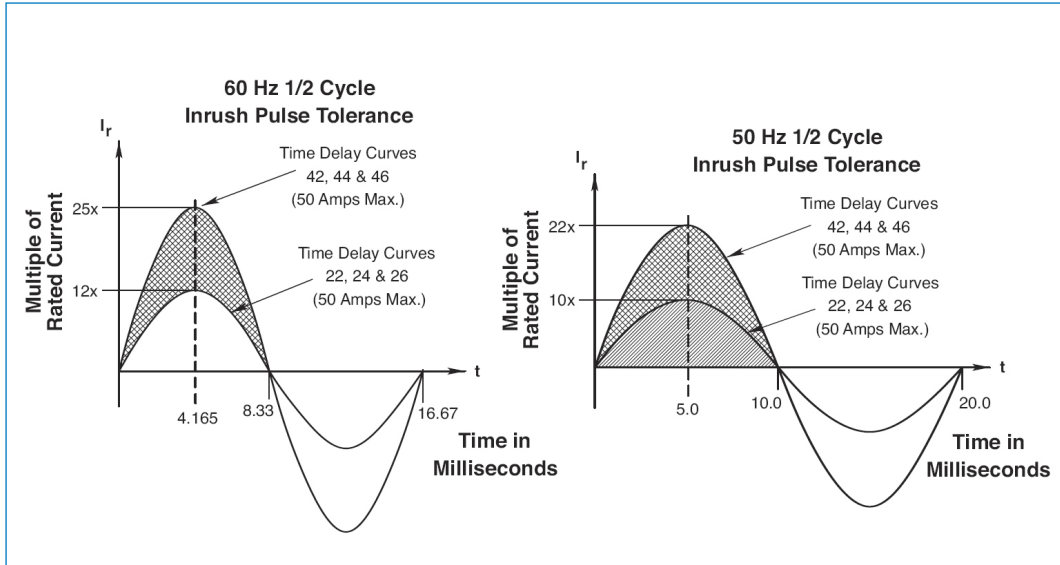


Table of time delay values

TRIP TIME (SECONDS)	DELAY	PERCENT OF RATED CURRENT									
		100%	125%	135%	150%	200%	400%	600%	800%	1000%	1200%
	10	No Trip	May Trip	---	.032 MAX	.024 MAX	.020 MAX	.018 MAX	.016 MAX	.015 MAX	.013 MAX
	11	No Trip	.013 - .125	---	.010 - .070	.008 - .032	.006 - .020	.005 - .020	.004 - .020	.004 - .020	.004 - .020
	12	No Trip	.500 - 6.50	---	.300 - 3.00	.130 - 1.20	.031 - .220	.011 - .120	.004 - .090	.004 - .060	.004 - .040
	14	No Trip	2.00 - 60.0	---	1.20 - 40.0	.600 - 20.0	.150 - 3.00	.030 - 1.30	.004 - .600	.004 - .100	.004 - .100
	16	No Trip	45.0 - 345	---	20.0 - 150	9.00 - 60.0	1.40 - 11.4	.150 - 5.80	.009 - 3.70	.005 - 1.70	.005 - .500
	20	No Trip	May Trip	---	.040 MAX	.035 MAX	.030 MAX	.025 MAX	.020 MAX	.017 MAX	.015 MAX
	21	No Trip	.014 - .150	---	.011 - .095	.008 - .055	.006 - .035	.005 - .027	.005 - .021	.004 - .018	.004 - .017
	22	No Trip	.700 - 12.0	---	.350 - 4.00	.130 - 1.30	.027 - .220	.008 - .130	.004 - .090	.004 - .045	.004 - .040
	24	No Trip	10.0 - 160	---	6.00 - 60.0	2.20 - 20.0	.300 - 3.00	.050 - 1.30	.007 - .500	.005 - .060	.005 - .040
	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	.005 - 1.00
	42	No Trip	.700 - 12.0	---	.400 - 6.00	.180 - 2.30	.050 - .600	.026 - .300	.018 - .200	.014 - .150	.012 - .130
	44	No Trip	7.00 - 100	---	3.00 - 50.0	1.10 - 18.0	.220 - 3.00	.120 - 1.70	.075 - 1.20	.050 - .850	.042 - .720
	46	No Trip	50.0 - 700	---	31.0 - 350	12.0 - 150	1.50 - 20.0	.700 - 10.0	.404 - 7.90	.260 - 6.50	.198 - 5.80
	52	No Trip	.500 - 6.50	---	.340 - 4.50	.180 - 2.30	.051 - .600	.030 - .320	.018 - .220	.014 - .200	.012 - .130
	54	No Trip	1.50 - 50.0	---	.750 - 35.0	.350 - 18.0	.110 - 3.00	.070 - 1.70	.045 - 1.40	.039 - 1.30	.035 - 1.30
	56	No Trip	45.0 - 345	---	19.0 - 170	8.50 - 100	1.24 - 15.0	.410 - 9.00	.256 - 8.00	.210 - 5.50	.198 - 2.90

Notes:

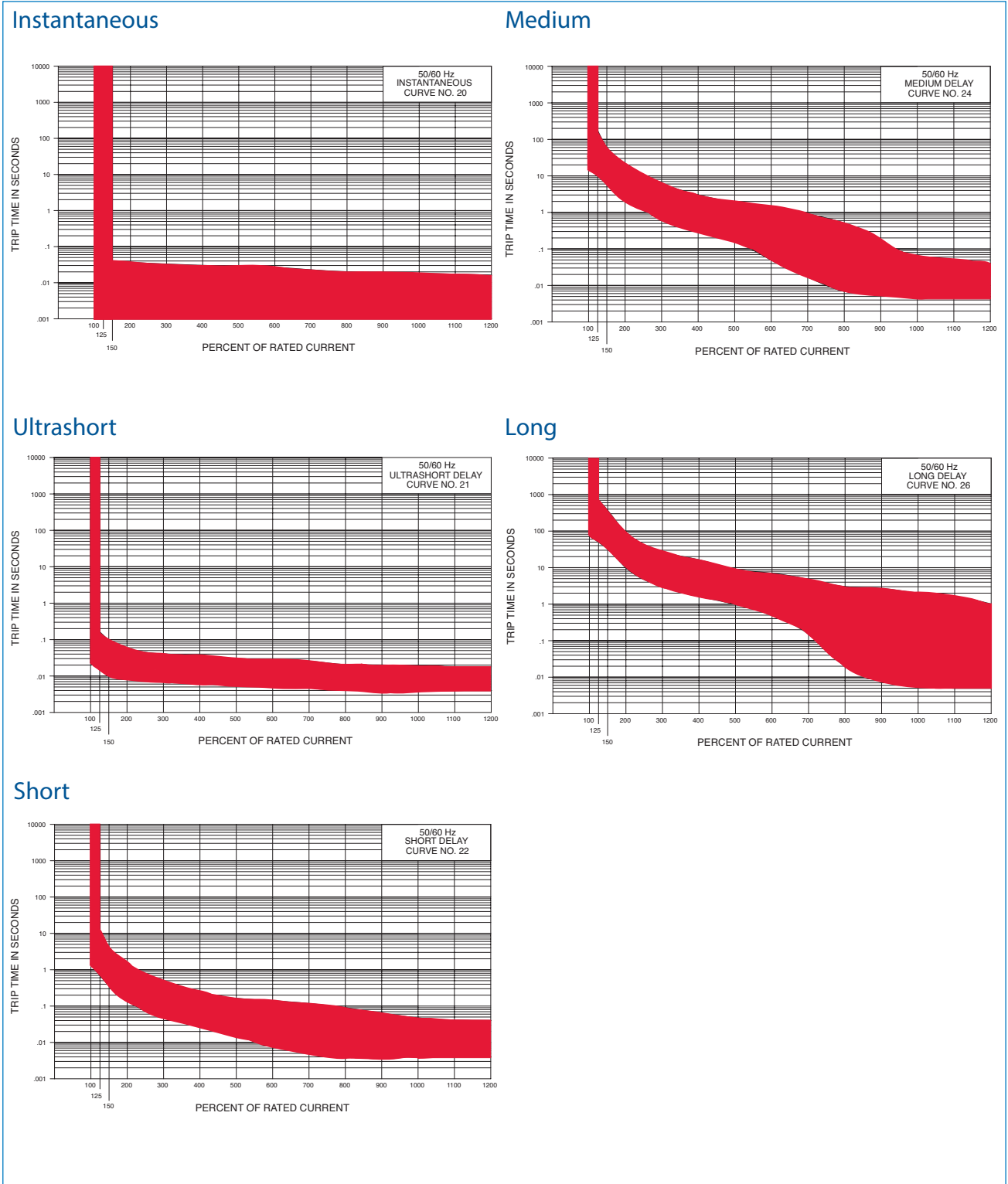
- Delay curves 11, 12, 14, 16, 21, 22, 24, 26, 42, 44, 46, 52, 54, 56: Breakers to hold 100% and must trip at 125% of rated current and greater within the time limit shown in this curve.
- Delay curves 10, 20: Breakers to hold 100% and must trip at 150% of rated current and greater within the time limit 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.
- On 50 amp and less current ratings, the minimum inrush pulse tolerance handling capability is 12 times the rated current on standard delays and 25 times the rated current on high inrush delays. These values are based on a 60 Hz 1/2 cycle, 8.33 ms pulse. High inrush delays should be specified for applications with high initial surge currents of short duration such as switching power supplies, highly capacitive loads and transformer loads.



AR circuit breakers

Time delay values

AC

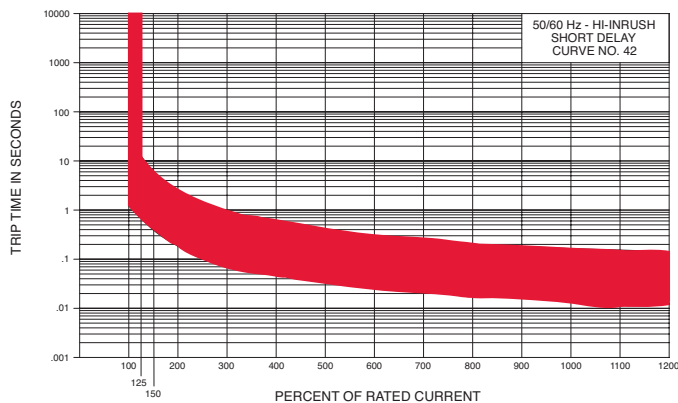


AR circuit breakers

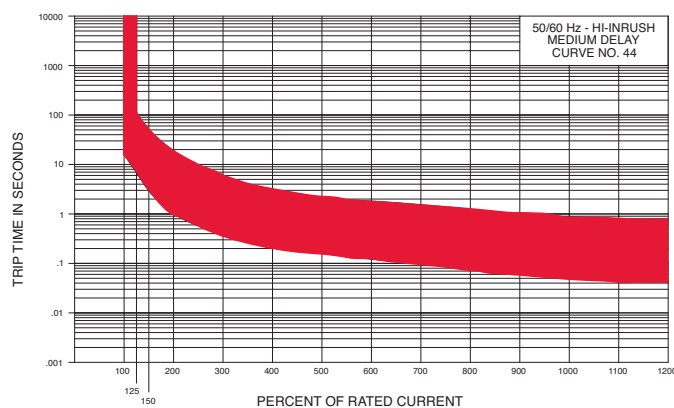
Time delay values

High Inrush AC

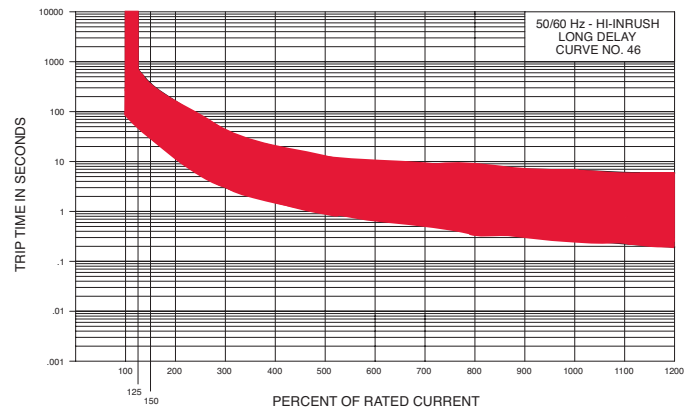
Short



Medium



Long

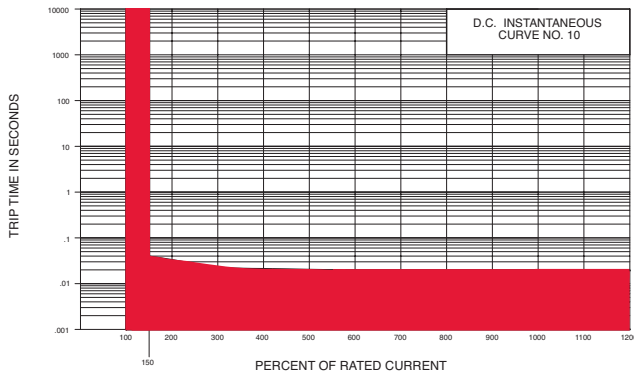


AR circuit breakers

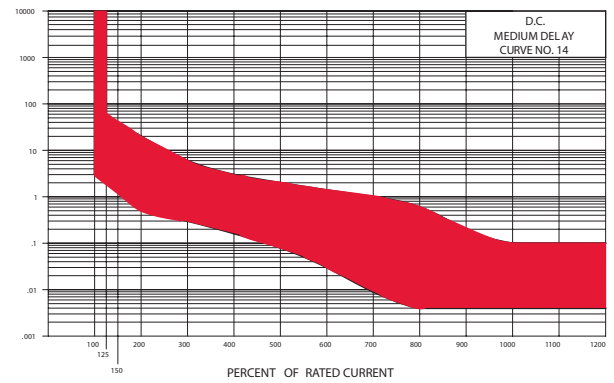
Time delay values

DC

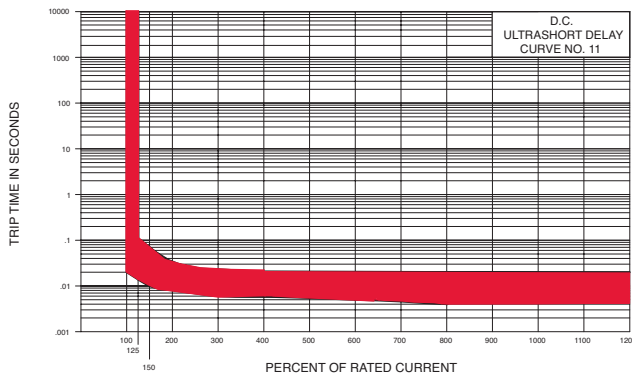
Instantaneous



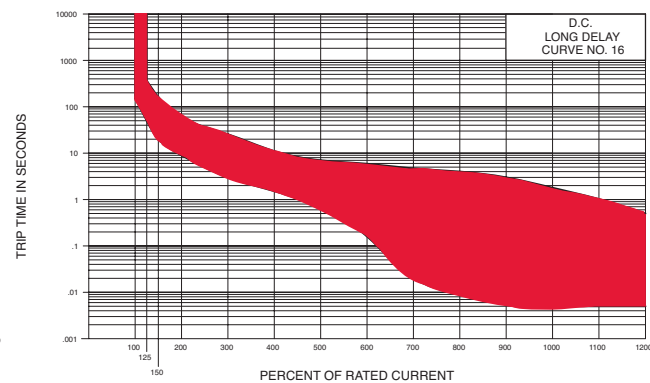
Medium



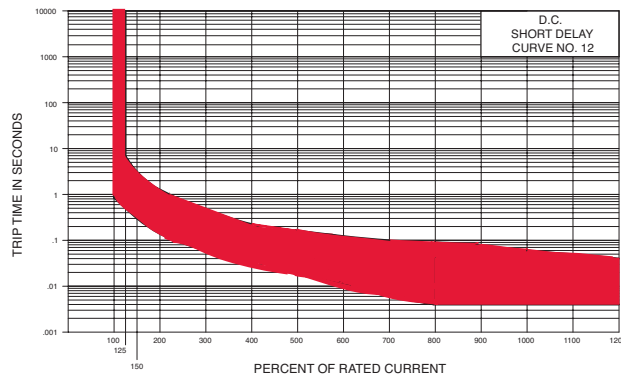
Ultrashort



Long



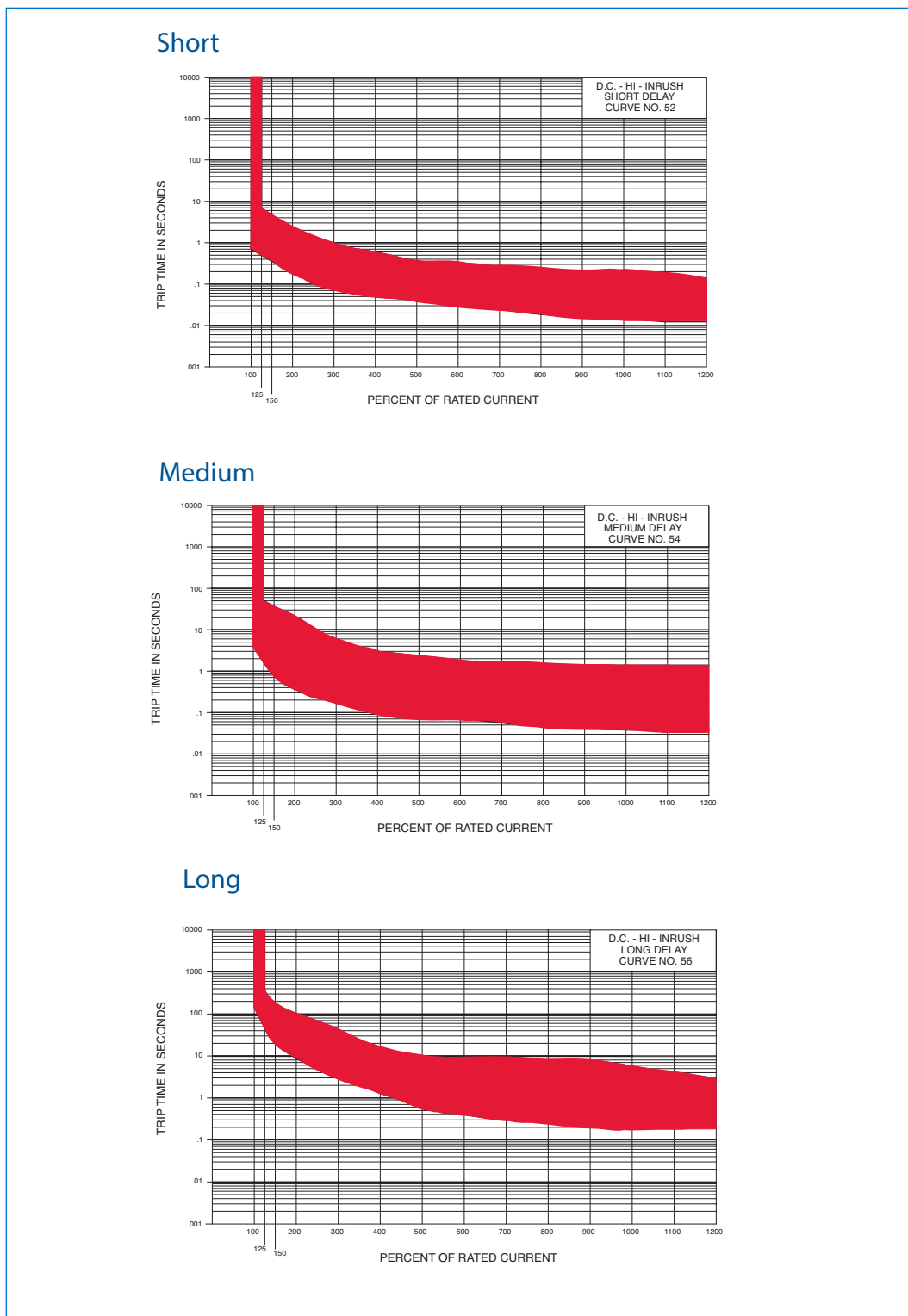
Short



AR circuit breakers

Time delay values

High Inrush DC



AR circuit breakers

Circuits & terminal diagrams

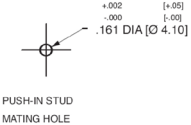
CIRCUIT BREAKER PROFILE	CIRCUIT SCHEMATIC		CIRCUIT SCHEMATIC			
	ANSI	CIRCUIT CODE	ANSI	CIRCUIT CODE		
2 TERMINALS 	SWITCH ONLY (NO COIL) 	A	0	SERIES TRIP 	BC	0
5 TERMINALS 	SWITCH ONLY (NO COIL) WITH AUXILIARY SWITCH 	A	2 3 4 A B	SERIES TRIP WITH (3) AUXILIARY/ALARM SWITCH 	BC	2 3 4 A B
3 TERMINALS 	SHUNT TRIP 	DE	0	DUAL COIL; SERIES TRIP CURRENT COIL, SHUNT TRIP VOLTAGE COIL 	H	0

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						



AR circuit breakers

Form & fit drawings

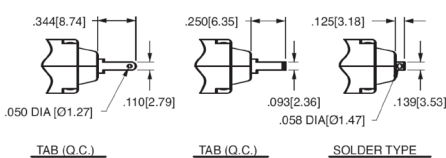


PUSH-IN STUD
MATING HOLE

$+0.02$
 -0.00
.161 DIA [Ø 4.10]

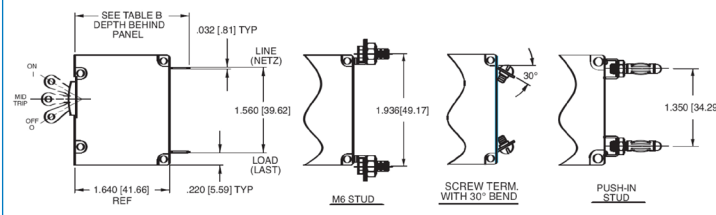
$+0.05$
 -0.00

AUXILIARY/ALARM SWITCH TERMINAL DETAIL



TAB (Q.C.)
TAB (Q.C.)
SOLDER TYPE

TABLE A TIGHTENING TORQUE SPECIFICATIONS	
THREAD SIZE	TORQUE
#6-32 & M3 MOUNTING HARDWARE	7-9 IN-LBS [0.8- 1.0 NM]
#8-32 & M4 THREAD TERMINAL SCREW	12-15 IN-LBS [1.4-1.7 NM]
#10-32 & M5 THREAD TERMINAL SCREW	15-20 IN-LB [1.7-2.3 NM]



SEE TABLE B
DEPTH BEHIND PANEL

0.32 [.81] TYP

LINE (NETZ)

1.560 [39.62]

LOAD (LAST)

1.640 [41.66] REF

.220 [5.59] TYP

M6 STUD

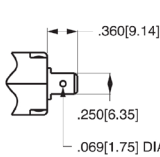
SCREW TERM. WITH 30° BEND

PUSH-IN STUD

TABLE B	
TERMINAL DESCRIPTION	DEPTH BEHIND PANEL
MAIN TAB (Q.C.)	2.000 [50.80]
MAIN SCREW TYPE	2.032 [51.61]
SHUNT & DUAL COIL TAB (Q.C.)	2.207 [56.10]
SHUNT & DUAL COIL SCREW #8-32 W/UP-TURNED LUGS	2.364 [60.05]
AUX. SWITCH* .093 TAB (Q.C.)	2.095 [53.20]
AUX. SWITCH* .110 TAB (Q.C.)	2.189 [55.60]
AUX. SWITCH* SOLDER TYPE	1.970 [50.00]

* AVAILABLE ON SERIES TRIP AND SWITCH ONLY CIRCUITS. WHEN CALLED FOR ON MULTI-POLE UNITS, ONLY ONE AUX. SWITCH IS NORMALLY SUPPLIED.

TERMINAL DIMENSIONAL DETAIL & RATING

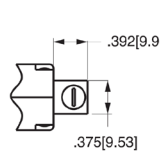


.360[9.14]

.250[6.35]

.069[1.75] DIA

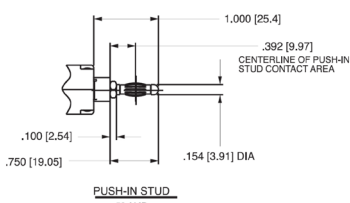
TAB (Q.C.)
≤ 30AMP



.392[9.96]

.375[9.53]

BUS
#8-32 ≤ 30 AMP
#10-32 ≤ 50 AMP
M5 ≤ 30 AMP
M4 ≤ 50 AMP



1.000 [25.4]

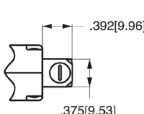
.392 [9.97]
CENTERLINE OF PUSH-IN STUD CONTACT AREA

.100 [2.54]

.750 [19.05]

.154 [3.91] DIA

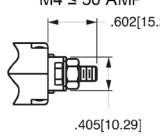
PUSH-IN STUD
≤ 50 AMP



.392[9.96]

.375[9.53]

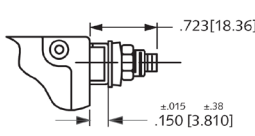
UPTURN LUG
#8-32 ≤ 30 AMP
#10-32 ≤ 30 AMP
M5 ≤ 30 AMP
M4 ≤ 30 AMP



.602[15.29]

.405[10.29]

M6 STUD
≤ 50 AMP



.723[18.36]

±.015 ±.38

.150 [3.810]

M6 Threaded 17mm Stud
(With NFF washers & nut)
≤ 50 AMP

Notes:

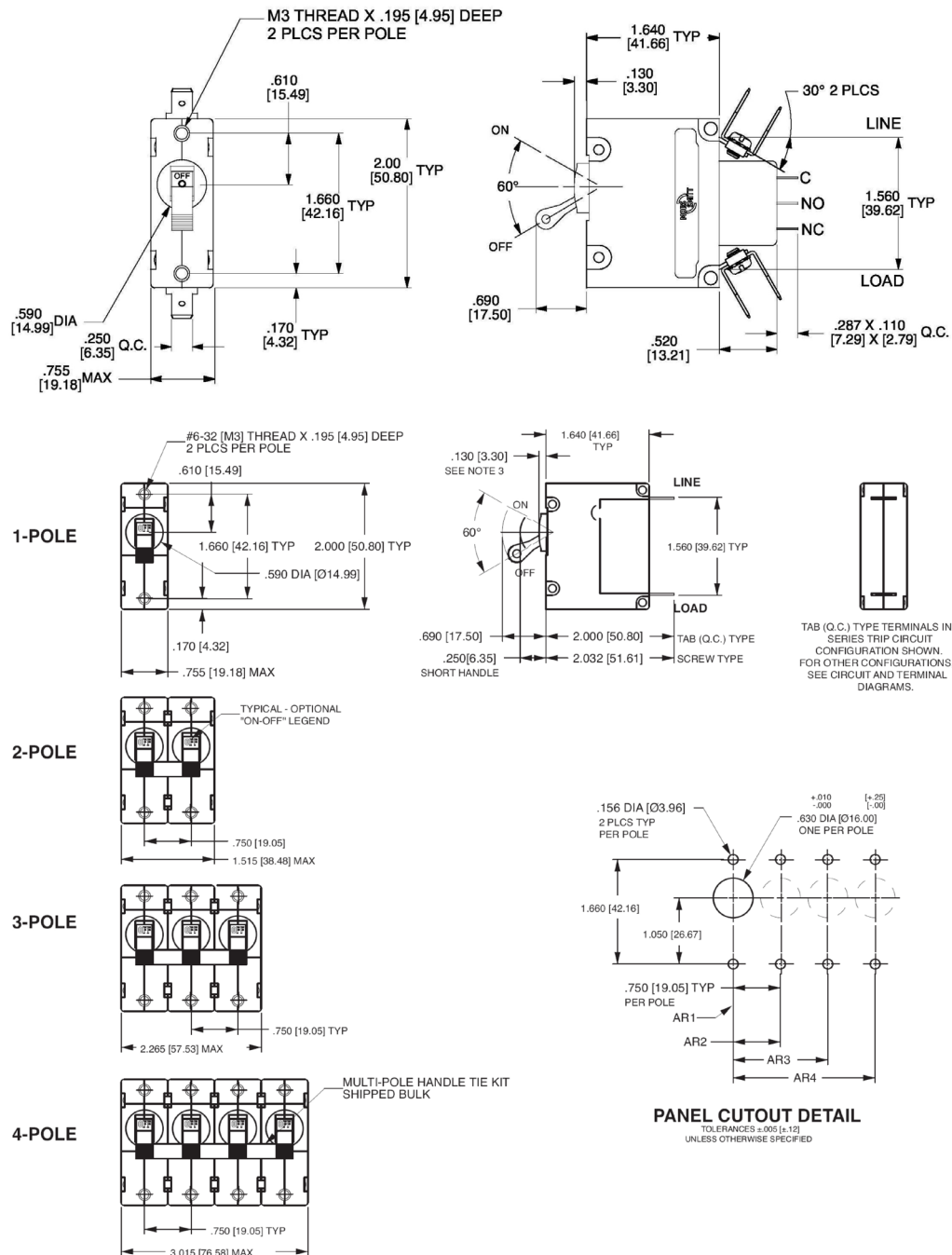
1. All dimensions are in inches [millimeters]
2. Tolerance ± 0.020 [0.51] unless otherwise specified



AR circuit breakers

Form & fit drawings

AR Series breaker with option U Double Fast On Terminals



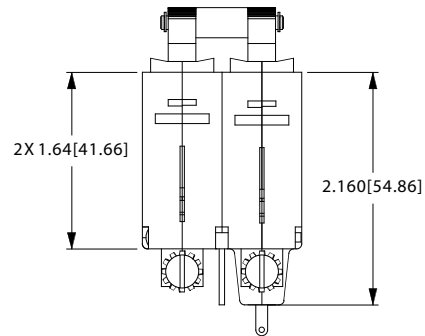
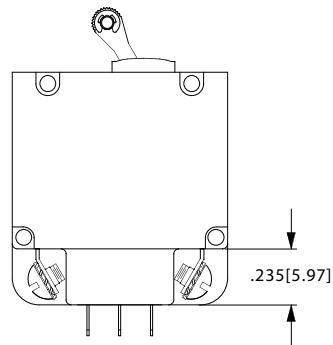
- Notes:
1. All dimensions are in inches [millimeters]
 2. Tolerance ± 0.020 [0.51] unless otherwise specified



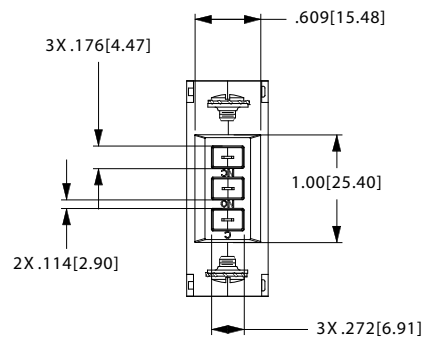
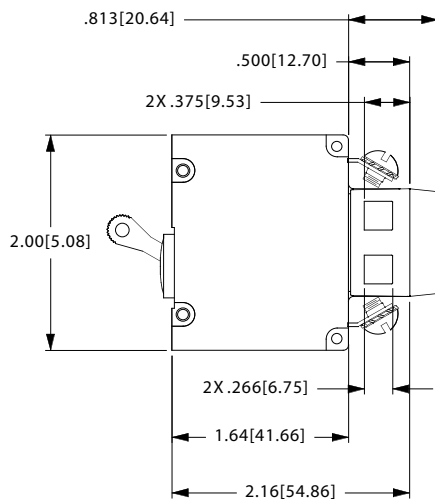
AR circuit breakers

Form & fit drawings

Terminal barriers



Mounted cover auxiliary switch

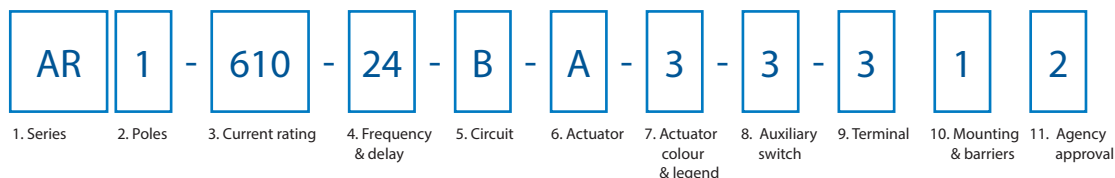


- Notes:
1. All dimensions are in inches [millimeters]
 2. Tolerance ± 0.020 [0.51] unless otherwise specified



AR circuit breakers

Ordering scheme



1 Series

AR

2 Poles

1 One	4 Four
2 Two	5 Five
3 Three	6 Six

3 Current rating (amperes)

210 0.100	512 1.250	485 8.500
215 0.150	415 1.500	490 9.000
220 0.200	517 1.750	495 9.500
225 0.250	420 2.000	610 10.000
230 0.300	522 2.250	615 15.000
235 0.500	425 2.500	616 16.000
240 0.400	527 2.750	617 17.000
245 0.450	430 3.000	618 18.000
250 0.500	435 3.500	620 20.000
260 0.600	440 4.000	622 22.000
265 0.650	445 4.500	624 24.000
270 0.700	450 5.000	625 25.000
275 0.750	455 5.500	630 30.000
280 0.800	460 6.000	635 35.000 ¹
285 0.850	465 6.500	640 40.000 ¹
290 0.900	470 7.000	650 50.000 ¹
295 0.950	475 7.500	
410 1.000	480 8.000	

Or voltage coil (nominal rated voltage)²

A06 6 DC	J06 6 AC
A12 12 DC	J12 12 AC
A18 18 DC	J18 18 AC
A24 24 DC	J24 24 AC
A32 32 DC	J48 48 AC
A48 48 DC	J65 65 AC
A65 65 DC	K20 120 AC
	L40 240 AC

Other values on request

4 Frequency & delay

03	DC, 50/60 Hz, switch only
10	DC instantaneous
11	DC ultra short
12	DC short
14	DC medium
16	DC long
20	50/60 Hz instantaneous
21	50/60 Hz ultra short
22	50/60 Hz short
24	50/60 Hz medium
26	50/60 Hz long
42 ³	50/60 Hz short, hi-inrush
44 ³	50/60 Hz medium, hi-inrush
46 ³	50/60 Hz long, hi-inrush
52 ³	DC, short, hi-inrush
54 ³	DC, medium, hi-inrush
56 ³	DC, long, hi-inrush

5 Circuit

A ⁴	Switch only (no coil)
B	Series trip (current)
C	Series trip (voltage)
D ⁵	Shunt trip (current)
E ⁵	Shunt trip (voltage)
H ^{5,6}	Dual coil with shunt trip voltage coil

6 Actuator⁷

A	Handle, one per pole
B	Handle, one per multipole unit
S	Mid-trip handle, one per pole
T	Mid-trip handle, one per pole & alarm switch

7 Actuator colour & legend

Actuator colour	I-O	ON-OFF	Dual	Legend colour
White	A	B	1	Black
Black	C	D	2	White
Red	F	G	3	White
Green	H	J	4	White
Blue	K	L	5	White
Yellow	M	N	6	Black
Grey	P	Q	7	Black
Orange	R	S	8	Black
White (short handle) ⁸	V	W	0	Black



AR circuit breakers

Ordering scheme

8 Auxiliary switch⁹

0	Without auxiliary switch
2	SPDT, 0.110 QC term.
3	SPDT, 0.139 solder lug
4	SPDT, 0.110 QC term. (gold contacts)
A	SPDT, 0.110 QC term. with mounted cover
B	SPDT, 0.110 QC term. (gold contacts) with mounted cover

9 Terminal¹⁰

1 ¹¹	Push on, 0.250 tab (Q.C.)
2	Screw 8-32 with upturned lugs
3 ¹²	Screw 8-32 (bus type)
4	Screw 10-32 with upturned lugs
5 ¹²	Screw 10-32 (bus type)
6	Screw 8-32 with upturned lugs and 30° bend
7 ¹²	Screw 8-32 (bus type) and 30° bend
8	Screw 10-32 with upturned lugs and 30° bend
9 ¹²	Screw 8-32 (bus type) and 30° bend
B	Screw M5 with upturned lugs
C	Screw M4 with upturned lugs
E ¹²	Screw M4 (bus type)
F	Screw M5 with upturned lugs and 30° bend
G ¹²	Screw M5 (bus type) and 30° bend
H ¹²	Screw M5 (bus type)
M ¹²	M6 threaded stud
Q	Push-in stud
R	Screw M4 with upturned lugs and 30° bend
T	Screw M4 (bus type) and 30° bend
U	Double faston 0.25" / 6.3 mm
V	M6 threaded stud 17 mm long with NFF washers and nut

10 Mounting & barriers

	Mounting style	Barriers
	threaded insert, 2 per pole	
1	6-32 x 0.195 inch	No
A	6-32 x 0.195 inch	Yes (between poles only)
2	ISO M3 x 5 mm	No
B	ISO M3 x 5 mm	Yes (between poles only)

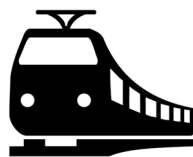
12 Agency approval

2 ¹³	TUV certified, UL recognized
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Notes:

- Available up to two poles with AC or DC delays
- Separate pole type voltage coils not rated for continuous duty. Available only with delay codes 10, 20 & 30
- Available with circuit codes B & D only
- For 0.1 - 30 A: select current code 630
For 35 - 50 A: select current code 650
- Available with terminal codes 1, 2 & 3. Current rating limited to 30 A maximum
- Consult Mors Smitt for available dual coil options, as special catalogue number is required. With shunt construction, dual coils will trip instantaneously on line voltage. Dual coils require 30 VA minimum power to trip and are rated for intermittent duty only
- Actuator code:
S: Handle moves to mid-position only upon electrical trip of the breaker, available with all circuit codes, except switch only
T: Handle moves to mid-position and alarm switch activates only upon electrical trip of the breaker, available with circuit codes B & C
- Single pole only
- On multi-pole breakers, one auxiliary switch is supplied, mounted in the extreme right pole (rear view)
- Screw terminals are recommended on ratings higher than 20 A
Ratings over 30 A are only available with terminals codes 5, 9, G and H
- Terminal code 1; up to 30 A, but not recommended over 20 A
- Terminal codes 3, 5, 7, 9, E, G and H (bus type) are supplied with lock washers
Terminals code M (M6 threaded stud) is supplied with lock and flat washers
- TUV certified: not for switch only circuit and only for actuator legend 'I-O' and dual legend
UL recognized: for most applications, not all
Special applications without approvals: agency approval code A





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