

DC Rated Thermal-Magnetic Molded Case Circuit Breakers Class 601

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Introduction

This data bulletin provides selection and application information for Square D™ by Schneider Electric thermal-magnetic molded case circuit breakers (MCCBs) when applied on grounded or ungrounded direct current (dc) systems.

DC system short-circuit and overload characteristics are much different than those of alternating current (ac) systems. Understanding these differences is important to ensure adequate circuit protection when selecting ac circuit breakers for application in a dc system.

Short-Circuit Current

Generator dc systems produce a short-circuit current with a rapid current rise that quickly reaches a steady state. DC battery systems produce a short circuit with a rapid rise to its maximum level that then decays as a function of the battery's chemistry.

All circuit breakers used in generator, rectifier, or battery systems require a dc rating greater than or equal to the system voltage. In addition, the interrupting rating must be greater than or equal to the available short circuit current.

Overload Protection

Systems that use batteries as a power source, such as uninterruptible power supplies (UPS), require special considerations when specifying overload protection. Typically, the protective device must interrupt overloads of 300–400% of rated full-load current in less than five seconds to prevent internal damage to the batteries.

Standard ac circuit breakers in frame sizes of 250–1000 amperes have an adjustable instantaneous trip range from five to ten times the continuous current rating of the circuit breaker. Even at the lowest instantaneous trip setting, a circuit breaker that is sized for appropriate thermal protection has an instantaneous trip range that is 500% of the circuit breaker continuous current rating and is thus too high to protect the battery.

Battery manufacturers can provide specific recommendations on overload protection.

Selection and Application

Ungrounded DC Systems

The following text, tables, and illustrations provide selection and application information for applying Square D thermal-magnetic circuit breakers in grounded and ungrounded systems.

Square D circuit breakers are designed for use only in an ungrounded dc system using an uninterruptible power supply (UPS), with a nominal short-circuit voltage of 500 Vdc or a maximum floating (unloaded) voltage of 600 Vdc.

This dual voltage rating allows the use of the following circuit breakers in battery-powered systems that have 20 kA and 50 kA short-circuit ratings.

- PowerPact H (30–70 A)
- PowerPact J (100–250 A)
- PowerPact L Three Pole (300–600 A)
- PowerPact L Four Pole (700–1200 A)

PowerPact H- and J-frame circuit breakers are UL® Listed only if three poles are connected externally in series, as shown in Figures 7 and 8 (see page 6).

PowerPact L-frame three-pole circuit breakers (300–600 A) have two- and three-pole wiring configurations. PowerPact L-frame four-pole circuit breakers (700–1200 A) have two-pole wiring configurations only.

J- and L-frame circuit breakers have an adjustable instantaneous trip with a single adjustment on the face of the circuit breaker (see Table 1).

**Table 1: UL-Listed¹ DC Rated Circuit Breaker Selection—
Ungrounded 500 Vdc Systems**

Circuit Breaker Number	Handle Rating	Adjustable Magnetic Trip Range DC Amperes		Short Circuit Rating (kA)
		Low	High	
HGL37030D81	30	—	—	20
HGL37050D81	50	—	—	20
HGL37070D81	70	—	—	20
JGL37100D81	100	400	600	20
JGL37125D81	125	400	600	20
JGL37150D81	150	400	600	20
JGL37175D81	175	400	600	20
JGL37200D82	200	500	850	20
JGL37225D82	225	500	850	20
JGL37250D82	250	500	850	20
LGL37030D27	300	750	1500	20
LGL37035D29	350	875	1750	20
LGL37040D30	400	1000	2000	20
LGL37045D31	450	1125	2250	20
LGL37050D32	500	1250	2500	20
LGL37060D33	600	1500	3000	20
LGL47070D35	700	1750	3500	20
LGL47080D36	800	2000	4000	20
LGL47090D86	900	2250	4500	20
LGL47100D40	1000	2500	5000	20

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**Table 1: UL-Listed¹ DC Rated Circuit Breaker Selection—
Ungrounded 500 Vdc Systems (continued)**

Circuit Breaker Number	Handle Rating	Adjustable Magnetic Trip Range DC Amperes		Short Circuit Rating (kA)
		Low	High	
LGL47120D42	1200	3000	6000	20
HLL37030D81	30	—	—	50
HLL37050D81	50	—	—	50
HLL37070D81	70	—	—	50
JLL37100D81	100	400	600	50
JLL37125D81	125	400	600	50
JLL37150D81	150	400	600	50
JLL37175D81	175	400	600	50
JLL37200D82	200	500	850	50
JLL37225D82	225	500	850	50
JLL37250D82	250	500	850	50
LLL37030D27	300	750	1500	50
LLL37035D29	350	875	1750	50
LLL37040D30	400	1000	2000	50
LLL37045D31	450	1125	2250	50
LLL37050D32	500	1250	2500	50
LLL37060D33	600	1500	3000	50
LLL47070D35	700	1750	3500	50
LLL47080D36	800	2000	4000	50
LLL47090D86	900	2250	4500	50
LLL47100D40	1000	2500	5000	50
LLL47120D42	1200	3000	6000	50

¹ Rated for 500 Vdc; UL Listed only for protection of uninterruptible power systems.

Grounded DC Systems

Standard dual-rated ac/dc thermal-magnetic circuit breakers may be used in dc system applications and will provide thermal (overload) protection as shown on the ac time-current characteristics curve. The instantaneous tripping performance provided by the magnetic feature is determined by a multiplier as listed in Table 2.

Standard ac/dc circuit breakers are UL Listed for application in dc systems using the dc instantaneous trip multiplier for the ac time-current characteristic curve. These circuit breakers may be used on grounded or ungrounded dc systems.

Table 2: AC-to-DC Instantaneous Trip Conversion

Circuit Breaker Prefix	DC Instantaneous Trip Multiplier	
	Low Setting	High Setting
QO/QOB	1.200	N/A
QOU	1.200	N/A
FA/FH	1.115	1.115
LA/LH	1.400	1.200
H (15–50 A)	1.2	N/A
H (60–150 A)	1.6	N/A
J	1.6	1.6

Table 3: DC System Device Selection

Circuit Breaker Prefix	Number of Poles	Ampere Rating	System Vdc	Ampere Interrupting Rating (kA)	Recognition	Circuit Connection Figure Number
QO/QOB	1	10–70	48	5	UL/CSA	1
	2	10–70	48	5	UL/CSA	5
	3	10–60	48	5	UL/CSA	6
	1, 2	15–30	125	4	Square D Certified	2 ¹
	1, 2	35–70	125	10	Square D Certified	2 ¹
	3	15–60	125	8	Square D Certified	3
QOU	1	10–70	48	5	UL/CSA	1
	2	10–70	48	5	UL/CSA	5
	3	10–60	48	5	UL/CSA	6
	1	80–100	60	5	UL/CSA	1
	2	80–125	60	5	UL/CSA	5
	3	70–100	60	5	UL/CSA	6
	1, 2	15–20	125	4	Square D Certified	2 ¹
	1, 2	25–70	125	10	Square D Certified	2 ¹
3	15–50	125	8	Square D Certified	3	
FA (240 Vac)	1	15–100	125	5	UL/CSA	1
	2, 3	15–100	125	5	UL/CSA	2, 3
	2, 3	15–100	250	5	UL/CSA	2, 3
FA (480 Vac)	1	15–100	125	10	UL/CSA	1
	2, 3	15–100	125	10	UL/CSA	2, 3
	2, 3	15–100	250	10	UL/CSA	2, 3

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Table 3: DC System Device Selection (continued)

Circuit Breaker Prefix	Number of Poles	Ampere Rating	System Vdc	Ampere Interrupting Rating (kA)	Recognition	Circuit Connection Figure Number
FA (600 Vac)	1	15–100	125	10	UL/CSA	1
	2, 3	15–100	125	10	UL/CSA	2, 3
	2, 3	15–100	250	10	UL/CSA	2, 3
	3	15–100	600	10	Square D Certified	4
FH	1	15–100	125	10	UL/CSA	1
	2, 3	15–100	125	10	UL/CSA	2, 3
	2, 3	15–100	250	50	UL/CSA	2, 3
FH (600 Vac)	2, 3	15–100	300	25	Square D Certified	2, 3
PowerPact HD/HG/HJ/HL	2, 3	15–150	250	20	UL/CSA	2, 3
	2, 3	15–150	250	20	UL/CSA	2, 3
	2, 3	15–150	250	20	UL/CSA	2, 3
	2, 3	15–150	250	20	UL/CSA	2, 3
PowerPact H-Frame 500 Vdc HG/HL ²	3	30-70	500	20	UL/CSA	7,8
	3	30-70	500	50	UL/CSA	7,8
PowerPact J-Frame 500 Vdc JG/JL ²	3	100-250	500	20	UL/CSA	7,8
	3	100-250	500	50	UL/CSA	7,8
PowerPact JD/JG/JJ/JL	2, 3	150–250	250	20	UL/CSA	2, 3
	2, 3	150–250	250	20	UL/CSA	2, 3
	2, 3	150–250	250	20	UL/CSA	2, 3
	2, 3	150–250	250	20	UL/CSA	2, 3
PowerPact L-Frame 500 Vdc LG/LL ²	3	300-600	500	20	UL/CSA	9
	3	300-600	500	50	UL/CSA	9
PowerPact L-Frame 500 Vdc LG/LL ²	4	700-1200	500	20	UL/CSA	10
	4	700-1200	500	50	UL/CSA	10

¹ Single-pole circuit breakers are connected in pairs.

² UL Listed for 500 Vdc nom. 600 Vdc max. rating; for use with ungrounded UPS systems.

Circuit Connections

Figure 1: Single-Pole Circuit Breaker

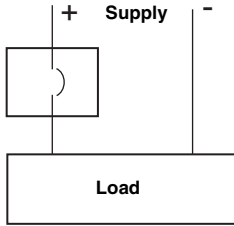


Figure 2: Two-Pole Circuit Breaker (Two Poles in Series)

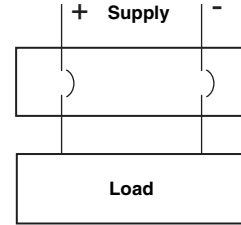


Figure 3: Three-Pole Circuit Breaker (Two Poles in Series)

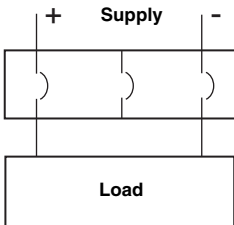


Figure 4: Three-Pole Circuit Breaker (Three Poles in Series)

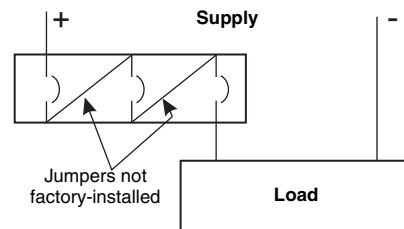


Figure 5: Two-Pole Circuit Breaker (Single Pole)

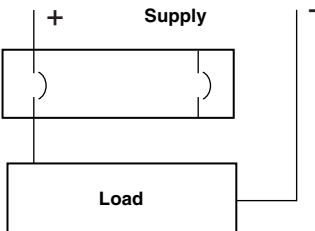


Figure 6: Three-Pole Circuit Breaker (Single Pole)

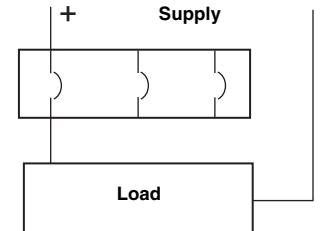


Figure 7: Three-Pole Circuit Breaker (Three Poles in Series)

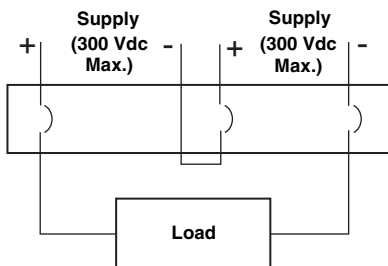


Figure 8: Three-Pole Circuit Breaker (Three Poles in Series)

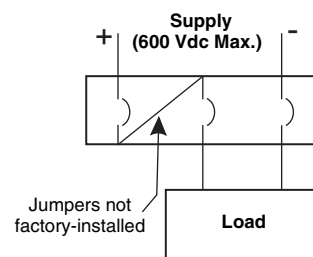


Figure 9: Three-Pole PowerPact L-Frame Circuit Breaker (300–600 A)

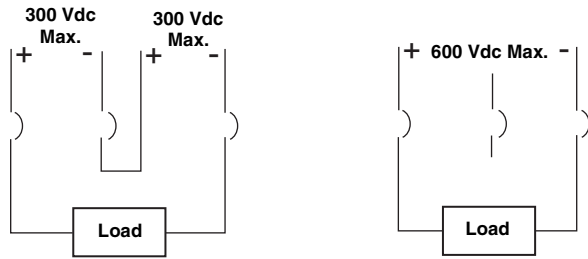
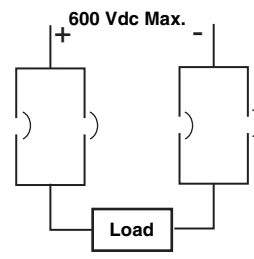


Figure 10: Four-Pole PowerPact L-Frame Circuit Breaker (700–1200 A)



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