Data Bulletin

Enhancing Short Circuit Selective Coordination with Low Voltage Circuit Breakers

Retain for future use.

INTRODUCTION

<u>The purpose of this data bulletin</u> is to present techniques for improving the short circuit selective coordination of low voltage circuit breakers used in electrical distribution systems.

It is a myth that only fuse based low voltage systems can be selectively coordinated. Modern molded case, insulated case and low voltage power circuit breakers provide the performance necessary to deliver higher levels of coordination than some have previously thought possible. This data bulletin demonstrates this fact.

<u>The scope of this data bulletin</u> encompasses only breaker to breaker short circuit selective coordination. Coordination with fuses and the protection of motors, transformers and other devices, as well as coordinated ground fault protection, is not discussed. See the **Reference** section, **on page 10**, for other data bulletins.

DEFINITIONS

See the **Glossary** in **Appendix—B**, on page 21, for a list of terms used in this data bulletin.

ASSUMPTIONS

A few assumptions have been made in the writing of this data bulletin:

Circuit Breaker Contact Position

It is assumed that all circuit breakers in the system, with the possible exception of the branch breaker nearest to the fault, are in the closed (ON) position when the fault occurs. Some circuit breakers, notably insulated case and low voltage power circuit breakers, may incorporate a making current release (MCR) trip function set slightly below the circuit breaker's close and latch rating. The MCR trip level may be below that of the adjustable instantaneous or instantaneous selective override trip functions.

Instantaneous Trip Setting

In order to maximize selective coordination, it is assumed that the instantaneous trip setting on all main and feeder breakers in the system, if adjustable, will be set to the highest position. It is also assumed that if the instantaneous trip function on electronic trip mains and feeders can be turned off it will be.

Turning off the instantaneous trip function does not mean that the circuit breaker loses its ability to protect against short circuits. Square $D^{@}$ electronic trip circuit breakers that have an OFF position on the instantaneous switch are also equipped with a short time pick-up and delay function, and may also be equipped with an instantaneous selective override function if necessary for the proper functioning of the circuit breaker.

CIRCUIT BREAKER BASICS

Before embarking on improving the design of a low voltage distribution system using circuit breakers so as to improve short circuit selective





coordination, it would be helpful to know a few simple facts about circuit breakers that relate to selective coordination.

What a Circuit Breaker Must Protect

The primary function of a circuit breaker is to protect the downstream conductors connected to it. That is why virtually all circuit breakers are tested with a length of wire. However, the trip system inside the circuit breaker must also be able to protect the circuit breaker itself, as excessive current levels could damage the circuit breaker, rendering it unable to perform it's intended function. For this reason, circuit breakers with electronic trip systems may incorporate a making current release and/or an instantaneous selective override. When conducting a short circuit coordination study, the instantaneous selective override level needs to be considered.

This is not to say, of course, that circuit breakers are never applied in load protection applications as opposed to conductor protection applications. Certainly they are, but special protection studies must be conducted in such instances utilizing the circuit breaker trip curves and are not within the scope of this guide.

Continuous Current Rating Overlap

Circuit breaker manufacturers typically provide some overlap in the continuous current (handle) ratings of progressively larger frame size circuit breakers. For example, current ratings for 150, 250 and 400 A circuit breaker frames might be 15–150 A, 150–250 A, and 250–400 A respectively.

Electronic Trip Systems

The advantages of being able to adjust the trip curve of a circuit breaker equipped with an electronic trip system are obvious. But there are other advantages, such as being able to turn the instantaneous trip function off on some circuit breakers and models of trip units and the ability to select lower rated current sensors.

Adjustable Trip Settings

It should be noted that all adjustable trip settings on Square D[®] low voltage circuit breakers, with the exception of the ampere rating switch (also known as Ir or long time pick-up), are set to their lowest position in the factory prior to shipment. Thus, in order to realize the selective coordination planned, these settings may need to be adjusted in the field.

Series Ratings

The adjustment of trip settings does not affect any series rating that may be employed as UL® requires series ratings tests to be conducted with the instantaneous trip adjustment set to its highest position.

BASIC INFORMATION NEEDED

System One-line Diagram

A one-line diagram of the system to be studied is absolutely necessary in order to determine the level of system coordination.

System Voltage

While the system voltage, in and of itself, has no impact on selective coordination, it does impact circuit breaker selection, which in turn impacts coordination; thus the system voltage needs to be known.

Circuit Ampacity

The instantaneous trip characteristics of a circuit breaker are more often a function of the frame or current sensor rating rather than the current rating of the circuit breaker. However, the current rating required to meet the ampacity of the circuit drives the circuit breaker selection, thus it needs to be known. (See NEC® Articles 210, 215, 220, 225 and 230.)

Available Short Circuit Current

The available short circuit current at each point in the system should be determined in order to select circuit breakers with the proper interrupting rating and in turn to determine the level of selective coordination.

DETERMINING THE SELECTIVE COORDINATION LEVEL

Based on the system one-line diagram, select the circuit breakers required throughout the system using catalog information or selection tools provided by the manufacturer. This will yield what will hence be referred to as the "standard" circuit breaker selection.

Determine Selective Coordination Levels

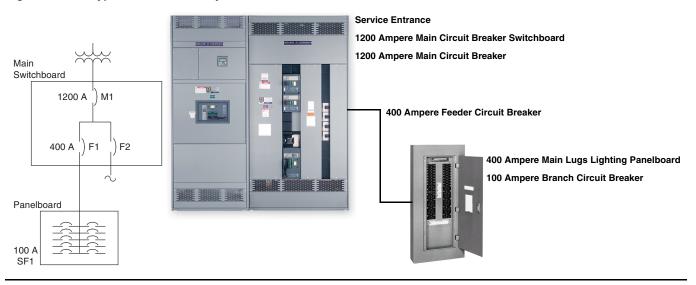
Determine the selective coordination of the standard circuit breaker selection by using trip curves, selective coordination software tools provided by the manufacturer or third parties, or the data presented in **Appendix—A**, **on page 11**.

Example

One manufacturer has published an example of a three tiered system consisting of a 1200 A molded case circuit breaker over a 400 A circuit breaker over a 100 A circuit breaker. The selective coordination analysis based on published trip curves showed the main breaker selectively coordinated up to 7,200 A. System voltage, available short circuit currents, and the type of equipment housing each circuit breaker, were not specified.

Figure 1, below, proposes what such an arrangement might look like in the real world, namely a 1200 A main breaker switchboard with a 400 A feeder breaker feeding a 400 A main lugs lighting panelboard with a 100 A branch breaker. Based on this configuration, a selective coordination study was conducted utilizing the method outlined above at 208 Y / 120 Vac and a 480 Y / 277 Vac with an assumed available short circuit current at the service entrance of 65 kA. Square D^{\circledR} circuit breakers and equipment were used in the analysis.

Figure 1: A Typical Three-tiered System



As can be seen in **Table 1** below, with no short circuit study and a standard circuit breaker selection, the system is selectively coordinated up to 21,600 A at the main and up to 3,000 A at the feeder on the 208 Y / 120 Vac system. On the 480 Y / 277 Vac system the circuit breakers are selectively coordinated up to 9,000 A at the main and up to 2,400 A at the feeder. These levels are "worst case," taking into account the tolerances of the instantaneous trip functions.

Table 1: Selective Coordination with a Standard Circuit Breaker Selection

One-line Diagram	Available Short Circuit Current (kA)	Circuit Breaker Ampacity (A)	Square D [®] Equipment	Square D [®] Circuit Breaker	Instantaneous Trip ¹ (Amperes)	Instantaneous Selective Override Trip ² (Amperes)	Maximum Selective Coordination Level ³ (Amperes)
208 Y / 120 Vac 65	kA Available Sho	ort Circuit Curre	ent				
	65	1200	I-Line [®] Switchboard	PGA36120U33A	OFF	21,600–26,400	21,600
	65	400	I-Line [®] Switchboard	LH36400	3,000–4,800	None	3,000
ĺ							
	65	100	NF Panelboard	EGB34100	1,725–2,760	None	_
	Fault						
480 Y / 277 Vac 65	kA Available Sh	ort Circuit Curre	ent				
	65	1200	I-Line [®] Switchboard	PJA36120U44A	OFF	9,000-11,000	9,000
	65	400	I-Line [®] Switchboard	LC36400	2,400–3,840	None	2,400
ĺ							
	65	100	NF Panelboard	EJB34100	1,725–2,760	None	
	Fault						

Range shown is UL[®] 489 maximum allowable.

² Range shown is from published literature.

³ Value shown takes into account the minimum tolerance of the upstream circuit breaker and the maximum tolerance of the downstream circuit breaker.

One might argue that "in the real world" a 500 kVA transformer might feed a 1200 A 208 Y / 120 Vac system. Assuming a standard impedance of 5.0%, unlimited short circuit kVA available on the primary and 50% motor load, the secondary short circuit current would be only 30,600 A. Similarly, a 1000 kVA transformer might feed a 1200 A 480 Y / 277 Vac system. Assuming a standard impedance of 5.75%, unlimited short circuit kVA available on the primary and 100% motor load, the secondary short circuit current would be only 25,700 A. But for the purposes of illustrating how selective coordination can be improved to even higher levels than these, the assumed 65 kA available short circuit current level will continue to be used.

OPTIMIZING THE SELECTIVE COORDINATION LEVEL

Here are some suggestions on how to optimize selective coordination of a circuit breaker based low voltage system. **Appendix—A**, **on page 11**, lists the instantaneous trip levels of various Square D[®] low voltage circuit breakers and other pertinent information necessary to employ the suggestions listed below. The sample system illustrated in **Figure 1**, **on page 3**, is used to illustrate these techniques.

Conduct A Short Circuit Study

Conducting a short circuit study may reveal that lower interrupting rated circuit breakers can be selected at the feeder and branch levels, possibly resulting in higher withstand ratings.

Tables 2, 3 and 4 show standard rated branch breakers (10 kAIR for the 208 Y / 120 Vac system and 18 kAIR for the 480 Y / 277 Vac system). Is this assumption reasonable? Yes it is, as only 125 feet of #2 THHN in the 208 Vac system and 53 feet in the 480 Vac system would drop the available short circuit current at the branch to 10,000 A or 18,000 A respectively.

A Square D[®] PowerPact[®] PG circuit breaker has an instantaneous selective override set at 24,000 A nominal while the higher interrupting rated PJ circuit breaker has an instantaneous selective override set at 10,000 A nominal. Thus, had the lighting panel feeder breaker been located some distance from the service entrance, a lower interrupting rated PG circuit breaker might have been selected, increasing the maximum level of selective coordination.

Increase Frame Size

As can be seen in **Table 2** below, by increasing the frame size of the main, the selective coordination at that level in the system can be increased from 21,600 A to 51,300 A and from 9,000 A to 43,200 A on the 208 Vac and 480 Vac systems respectively. This is possible because a 1200 A rating is available on the 2500 A PowerPact[®] R-frame unit mount circuit breaker. (Note that in a Square D[®] I-Line[®] switchboard, a 1200A PowerPact[®] R-frame I-Line[®] circuit breaker could also be selected as a back-fed main.)

By increasing the frame size of the feeder breaker, selective coordination at the feeder can be increased from 3,000 A to 21,600 A and from 2,400 to 9,000 A on the 208 Vac and 480 Vac systems respectively. This is possible because a 400 A rating is available on the 1200 A PowerPact[®] P-frame I-Line[®] circuit breaker.

Table 2: Improving Selective Coordination by Increasing the Frame Size of the Main and Feeder Circuit Breakers

One-line Diagram	Available Short Circuit Current (kA)	Circuit Breaker Ampacity (A)	Square D [®] Equipment	Square D [®] Circuit Breaker	Instantaneous Trip ¹ (Amperes)	Instantaneous Selective Override Trip ² (Amperes)	Maximum Selective Coordination Level ³ (Amperes)
208 Y / 120 Vac 65 k	A Available Sho	ort Circuit Curre	ent at Service E	intrance			
	65	1200	I-Line [®] Switchboard	RGF36120U33A	OFF	51,300–62,700	51,300
	65	400	I-Line [®] Switchboard	PGA36040U33A	OFF	21,600–26,400	21,600
ľ							
	10	100	NQOD Panelboard	QOB3100	1,125–1,800	None	
	Fault						
480 Y / 277 Vac 65 k	A Available Sho	ort Circuit Curre	ent at Service E	intrance			
	65	1200	I-Line [®] Switchboard	RJF36120U44A	OFF	43,200–52,800	43,200
ĺ							
	65	400	I-Line [®] Switchboard	PJA36040U33A	OFF	9,000-11,000	9,000
ľ							
	18	100	NF Panelboard	EDB34100	1,725–2,760	None	_
	Fault						

¹ Range shown is UL[®] 489 maximum allowable.

² Range shown is from published literature.

³ Value shown takes into account the minimum tolerance of the upstream circuit breaker and the maximum tolerance of the downstream circuit breaker.

Table 3, below, illustrates what would result if the feeder breaker was a PowerPact[®] R-frame circuit breaker. In this case, the selective coordination level would be 51,300 A at 208 Vac and 43,200 A at 480 Vac. This is possible because PowerPact[®] R-frame I-Line[®] circuit breaker is available with a 600 A sensor and an adjustable rating plug that can be set to 0.75.

Table 3: Improving Selective Coordination by Increasing the Frame Size of the Feeder Circuit Breaker

One-line Diagram	Available Short Circuit Current (kA)	Circuit Breaker Ampacity (A)	Square D [®] Equipment	Square D [®] Circuit Breaker	Instantaneous Trip ¹ (Amperes)	Instantaneous Selective Override Trip ² (Amperes)	Maximum Selective Coordination Level ³ (Amperes)
8 Y / 120 Vac 65 k	A Available Sho	ort Circuit Curre	ent at Service E	Intrance			
	65	1200	I-Line [®] Switchboard	RGF36120U33A	OFF	51,300–62,700	51,300
	65	400	I-Line [®] Switchboard	RGA36040CU33A	OFF	51,300–62,700	51,300
	10	100	NQOD Panelboard	QOB3100	1,125–1,800	None	_
	Fault						
0 Y / 277 Vac 65 k	A Available Sho	ort Circuit Curre	ent at Service E	Entrance			
	65	1200	I-Line [®] Switchboard	RJF36120U44A	OFF	43,200–52,800	43,200
	65	400	I-Line [®] Switchboard	RJA36040CU33A	OFF	43,200–52,800	43,200
ľ							
	18	100	NF Panelboard	EDB34100	1,725–2,760	None	_
	Fault						

¹ Range shown is UL[®] 489 maximum allowable.

² Range shown is from published literature.

³ Value shown takes into account the minimum tolerance of the upstream circuit breaker and the maximum tolerance of the downstream circuit breaker.

Change Circuit Breaker Type

As can be seen in **Table 4** below, by changing the main from a molded case to an insulated case circuit breaker, the selective coordination at that level in the system can be increased from 21,600 A to 58,500 A and from 9,000 A to 58,500 A on the 208 Vac and 480 Vac systems respectively. Once again, note that these levels are "worst case," taking into account the tolerances of the instantaneous trip functions. But if the nominal instantaneous selective override trip level of 65,000 A was considered instead, the main breaker could be considered to be fully selective!

Table 4: Improving Selective Coordination by Changing the Main Circuit Breaker Type

One-line Diagram	Available Short Circuit Current (kA)	Circuit Breaker Ampacity (A)	Square D [®] Equipment	Square D [®] Circuit Breaker	Instantaneous Trip ¹ (Amperes)	Instantaneous Selective Override Trip ² (Amperes)	Maximum Selective Coordination Level ³ (Amperes)
208 Y / 120 Vac 65 k	A Available Sho	ort Circuit Curre	ent				
	65	1200	I-Line [®] Switchboard	NW1200H	OFF	58,500-71,500	58,500
	65	400	I-Line [®] Switchboard	RGA36040CU33A	OFF	51,300–62,700	51,300
ĺ							
	10	100	NQOD Panelboard	QOB3100	1,125–1,800	None	_
	Fault						
480 Y / 277 Vac 65 k	A Available Sho	ort Circuit Curre	ent				
	65	1200	I-Line [®] Switchboard	NW1200H	OFF	58,500-71,500	58,500
ĺ							
	65	400	I-Line [®] Switchboard	RJA36040CU33A	OFF	43,200–52,800	43,200
ĺ							
	18	100	NF Panelboard	EDB34100	1,725–2,760	None	_
	Fault						

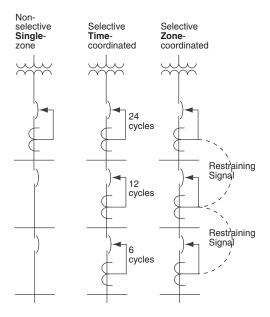
Range shown is UL[®] 489 maximum allowable.

Range shown is from published literature.

Value shown takes into account the minimum tolerance of the upstream circuit breaker and the maximum tolerance of the downstream circuit breaker.

Although not illustrated, selective coordination on the 208 Vac system at the feeder can also be improved by changing from the standard Square D^{\otimes} LH circuit breaker to the LH-MC Mission Critical circuit breaker that has a higher withstand, and hence instantaneous trip level. Doing this would increase selective coordination at the feeder from 3,000 A to 5,400 A.

GROUND FAULT PROTECTION



Requirements and Use

Ground faults are one of the most common low voltage electrical system failures; thus ground fault protection is a good idea at any voltage. But on solidly grounded wye systems of more than 150 Vac to ground but not exceeding 600 Vac phase-to-phase, the National Electrical Code[®] (Article 230.95) requires the use of ground fault protection on service disconnects rated 1000 A or more. And, in health care facilities, the NEC[®] requires two levels of ground fault protection (Article 517.17), and requires them to be selectively coordinated.

Employing ground fault protection on feeder and branch circuits can not only minimize system damage but can interrupt the flow of fault current when it is still at a low level, thus preventing the possibility that upstream circuit breakers may trip. It is better to interrupt a fault current early when it is a low level ground fault rather than later when it has escalated into a high level phase-to-phase fault. Thus adding ground fault protection on feeder and branch breakers can improve selective coordination.

Zone Selective Interlocking

Selective ground fault protection coordination can be achieved by setting progressively higher pick-ups and time delays on upstream devices. But in order to minimize system damage should a ground fault occur somewhere in the "middle" of the system, such as in between the main and feeder, ZSI should be employed. Note that ZSI, in and of itself, does not provide selective coordination. Proper pick-up and time delay settings are required for coordination, with or without ZSI.

CONCLUSION

<u>Consider the functions and characteristics</u> of circuit breakers in order to enhance the design of selectively coordinated low voltage systems. As previously discussed, these include:

- Instantaneous Trip Setting—Some electronic trip units provide an OFF
 position on the instantaneous trip adjustment. This position can be used
 to enhance selective coordination without sacrificing the interrupting
 rating of the circuit breaker or any series ratings that may be available
 on the equipment in which the breaker is installed.
- Continuous Current Rating Overlap—The availability of lower continuous current ratings on higher amp frame circuit breakers can be used to enhance selective coordination as higher amp frame circuit breakers often have higher instantaneous trip levels.
- **Field Adjustment**—Do not neglect to properly adjust circuit breakers in the field as they are often shipped from the factory with all but the ampere-rating switch in the lowest position.

<u>The methodology for evaluating</u> the level of selective coordination between low voltage circuit breakers, is as follows:

- Obtain a one-line diagram of the system to be studied.
- Determine the system voltage and circuit ampacities.

- · Make initial circuit breaker selections.
- **Determine the selective coordination levels** between adjacent pairs of circuit breakers in the system.

<u>Several optimizing techniques</u> for enhancing the level of short circuit selective coordination in a low voltage circuit breaker system include:

- Conduct a study to determine the level of short circuit current available at various points in the system. This may allow the selection of circuit breakers with a lower interrupting rating and a higher instantaneous trip level.
- Increase the frame size of main or feeder breakers, thus increasing the instantaneous trip level of these breakers.
- Change the type of main or feeder breakers from molded case to insulated case or low voltage power, thus increasing the instantaneous trip level of these breakers.
- Incorporate ground fault protection into feeder and branch circuits so
 that low level ground faults will be cleared before they escalate into high
 level phase-to-phase faults.

<u>Significant improvements</u> in the selective coordination of low voltage circuit breaker based electrical distribution systems can be achieved by changing the circuit breaker selection. And as the examples have shown, very high levels of selectivity can be achieved.

REFERENCE

Overcurrent Protection

Document Number: 0600DB0301

Reducing Fault Stress with Zone-selective Interlocking

Document Number: 0600DB0001

APPENDICES

APPENDIX—A

Instantaneous Trip Data for Square D[®] Low Voltage Circuit Breakers

Table 5: 240 Volt Circuit Breakers

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantar Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
Molded Case (Circuit Breakers	s: UL [®] 489 Stan	dard	<u>'</u>		•		
					15–30	275–600		
		25	FA	[35–50	400–850		
		25	I A	[60–80	800–1450		
					90–100	900–1700		
					15–30	275–600		
		65	FH		35–50	400–850		
	100				60–80 800–1450			
	100] [90–100	900–1700		
		100	GJL]]	15–40	600–1200		
		.00	GOL	1	50–100	800–1400		
				ļ	20–30	275–600		
		200	FI	ļ	35–50	400–850		
					60–80	800–1450		
] [90–100	900–1700		
				ļ ļ	15–30	270–875		
		25	ED		35–70	630–1800		
					80–125	1000–2300		
		65			15–30	270–875		
	125		EG		35–70	630–1800		
240					T-M 80-	80–125	1000–2300	Fixed
			100 EJ	15–30		270–875		
		100]	35–70	630–1800		
				<u> </u>	80–125	1000–2300		
					15–30	350–750		
		25	HD		35–50	400–850		
		20	110		60–90	800–1450		
					100–150	900–1700		
					15–30	350–750		
		65	HG	ļ ļ	35–50	400–850		
		00	110	ļ ļ	60–90	800–1450		
	150			1	100–150	900–1700		
	100				15–30	350–750		
		100	HJ	ļ	35–50	400–850		
		100		Ĺ	60–90	800–1450		
] [100–150	900–1700		
				Į	15–30	350–750		
		125	н	Į Į	35–50	400–850		
		125	HL		60–90	800–1450		
					100–150	900–1700		

Table 5: 240 Volt Circuit Breakers (continued)

	240 Voit Circu	·	•		0 "			
Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantar Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
		25	JD					
		65	JG	1	150–250			
		100	JJ		150-250	5-10 x CCR	Adjustable	
		125	JL			<u> </u>		
		200	KI		110–250			
		10	QB		70–90	1000–1800	ļ	
	250		-,-		100–250	1200–2400		
		25	QD		70–90	1000–1800		
		-			100–250	1200–2400	Fixed	
		65	QG	Т-М	70–90	1000-1800	ļ	None
					100–250	1200–2400		
		100	QJ^3		70–90	1000-1800	ļ	
		0.5	0.4	∤	100–250	1200–2400		
		25	Q4		250–400	5-10 x CCR	– Fixed	
		40	LA		125-400	17 00 × CCD		
	400	42	LA-MC		200–250 400	17–20 x CCR		
	400		LH	1		15–18 x CCR	Adiustable	
		65	LN	-	250–400 200–250	5–10 x CCR 17–20 x CCR	Adjustable	
		03	LH-MC		400	15–18 x CCR	Fixed	
				STR23SP	100	9 x In	Fixed	
		65	DG	STR53UP	150,600	1.5–7 x ln	Adjustable	
240				STR23SP	150–600	9 x In	Fixed	6,000
			DJ	STR53UP		1.5–7 x ln	Adjustable	
		100	LC	T-M	300–400	5 x CCR- 3,200		None
		100		1-101	450–600	5 x CCR- 4,200	Adjustable	None
	600		LE	Micrologic [®]	100–600	OFF ⁴		9 x P–11 x P
			LX	·		2.5–8 x P		
		125	DL	STR23SP	150-600	9 x ln	Fixed	6,000
				STR53UP		1.5–7 x ln	Adjustable	
					300–400	5 x CCR- 3,200		
		200	LI	T-M	450–600	5 x CCR- 4,200		None
			LXI	Micrologic [®]	100–600	2.5–8 x P		9 x P–11 x P
	800	65 100	MG MJ	ET1.01	300–800	5–10 x CCR	Adjustable	None
		65	PG, PK	ET1.01	600–1200	5-10 x CCR		21,600–26,400
		00	ru, rk	Micrologic [®]	100–1200	OFF ⁴		21,000-20,400
	1200	100	PJ	ET1.01	600–1200	5-10 x CCR	CR	
	1200	100	1 0	Micrologic [®]	100–1200	OFF ⁴		9,000–11,000
		125	PL	ET1.01	600–1200	5-10 x CCR]	3,000-11,000
		120	1 L	Micrologic [®]	100–1200	OFF ⁴		

Table 5: 240 Volt Circuit Breakers (continued)

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instanta Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
		65	RG, RK ⁵	ET1.01	1200–2500	5-10 x CCR		51,300–62,700
		05	nu, nn	Micrologic [®]	240-2500	OFF ⁴		31,300-02,700
240 2500	100	RJ ⁵	ET1.01	1200–2500	5-10 x CCR	Adjustable		
				Micrologic [®]	240–2500	OFF ⁴	, tajaotas.o	43,200–52,800
		125	RL ⁵	ET1.01	1200–2500	5–10 x CCR		,,
	- Oliverit Durelle			Micrologic [®]	240–2500	OFF ⁴		
insulated Cas	Se Circuit Breake): UL 489 NT-N	Standard				
		50 65	NT-H	-				36,000-44,000
	800_1200	100	NT-L1	1	100–1200			
	000 1200	100	NT-L	-	100 1200			9,000-11,000
		200	NT-LF	-				0,000 11,000
		65	NW-N	1 1		1		
		100	NW-H	1	100–2000			36,000–44,000
240				Micrologic [®]	100–250	OFF ⁴	Adjustable	21,600–26,400
	800–2000		NW-L		400–1600	1	,	31,500–38,500
		200			2000	1		58,500-71,500
			NW-LF	1 1	100–2000	i		19,800–24,200
	0500 0000	100	NW-H	1	1000 0000	1		F0 F00 74 F00
	2500-3000	200	NW-L		1200–3000			58,500–71,500
	4000 6000	100	NW-H	1	2000–6000	1		67 500 90 500
		200	NW-L					67,500–82,500
Low Voltage	Power Circuit Br	eakers (Master		[®] 1066 / ANSI C3	7 Standards			
			NT-N1		100-800			None ⁶
		42	NT-L1F] [9,000–11,000
			NW-N1]	100–250	ļ		21,600–26,400
					400–800	4		None ⁶
		65	NW-H1		100–250	_		21,600–26,400
	800				400-800	-		None ⁶
		85	NW-H2	}	100–250	-		21,600–26,400 None ⁶
		100	NIM LIO		400–800	4		
		100	NW-H3		100–800 100–250	-		76,500–93,500 21,600–26,400
		200	NW-L1	ŀ	400–800	1		31,500–38,500
		200	NW-L1F	1 1	100–800	1		21,600–26,400
		42	NW-N1	1	100 000	-		21,000 20,100
254		65	NW-H1	Micrologic [®]		OFF ⁴	Adjustable	None ⁶
		85	NW-H2				, , , , , , , , , , , , , , , , , , , ,	
	1600	100	NW-H3	1	800–1600			76,500–93,500
			NW-L1	1				31,500–38,500
		200	NW-L1F					21,600–26,400
		65	NW-H1	1		1		None ⁶
		85	NW-H2]				inone
	2000	100	NW-H3		1000–2000			76,500–93,500
		200	NW-L1]				31,500–38,500
_		200	NW-L1F					21,600–26,400
		65	NW-H1] [None ⁶
						1		INCHE
	3200	85	NW-H2]	1600-3200			
	3200	85 100 200	NW-H2 NW-H3 NW-L1		1600–3200			76,500–93,500 105,300–128,700

Table 5: 240 Volt Circuit Breakers (continued)

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantar Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
		85	NW-H2					None ⁶
	4000	100	NW-H3		2500-4000			76,500–93,500
254		200	NW-L1	Micrologic [®]		OFF ⁴	Adjustable	105,300-128,700
254		85	NW-H2	Micrologic		OFF	Aujustable	None ⁶
	5000	100	NW-H3		2500-5000			76,500–93,500
		200	NW-L1					105,300-128,700

For thermal-magnetic circuit breakers with fixed instantaneous trip, the lower number is the "must hold" and the higher number the "must trip" value. For thermal-magnetic circuit breakers with adjustable instantaneous trip, the adjustment range shown is a function of the continuous current rating (CCR, aka ampere or handle rating) of the circuit breaker. The allowable UL tolerances are -20% (low) and +30% (high) from the nominal values shown. For electronic trip circuit breakers, the adjustment range shown is a function of the rating plug (P) or the sensor (In). Tolerances are +/-10% on both the low and high end of the range.

Table 6: 480 Volt Circuit Breakers

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantan Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
Molded Case (Circuit Breakers	s: UL [®] 489 Stan	dard					
					15–30	270–875		
		18	ED		35–70	630–1800		
					80–125	1000–2300		
480 Y / 277					15–30	270–875		
Vac	125	35	EG		35–70	630–1800		
					80–125	1000–2300		
					15–30	270–875		
		65	EJ		35–70	630–1800		
					80–125	1000–2300		
					15–30	275–600		
		18	FA		35–50	400–850		
		10	171	T-M	60–80	800–1450	Fixed	None
					90–100	900–1700		
					15–30	275–600		
		25	FH		35–50	400–850		
480	100	20			60–80	800–1450		
400	100				90–100	900–1700		
		65	GJL		15–40	600–1200		
			GOL		50–100	800–1400		
					20–30	275–600		
		200	FI		35–50	400–850		
		200	, ,		60–80	800–1450		
					90–100	900–1700		

² The range shown reflects manufacturing tolerances.

³ Rated 208 Y / 120 Vac.

⁴ Turning the instantaneous setting to OFF on Micrologic[®] electronic trip units will maximize short circuit selective coordination. An OFF setting is available on Micrologic[®] trip units with LSI or LSIG protection.

 $^{^{5}}$ 1200 amperes maximum in I-Line $^{\mathbb{B}}$.

⁶ This circuit breaker, with the instantaneous set to OFF, is fully selective up to the interrupting rating of the circuit breaker.

Table 6: 480 Volt Circuit Breakers (continued)

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantaı Triç		Instantaneous Selective Override			
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²			
					15–30	350–750					
		10	LID	ĺ	35–50	400-850	ĺ				
		18	HD	ĺ	60–90	800-1450	Ì				
				ĺ	100–150	900–1700	Ì				
					15–30	350-750					
		0.5	110		35–50	400–850	1				
		35	HG		60–90	800-1450	1				
	150			ĺ	100–150	900-1700	i Fired				
	150]	15–30	350-750	Fixed				
		0.5		l	35–50	400-850	j				
	65	65	65	65	65	HJ	l	60–90	800–1450	1	
				l	100–150	900–1700	1				
				1	15–30	350–750					
				T-M	35–50	400–850	1	None			
		100	HL	l	60–90	800–1450	1				
		1		l	100–150	900–1700	1				
		18 35	JD JG		150–250						
	250	65	JJ	1		5–10 x CCR					
	250	100	JL			0 10 % 0011	rajuotable				
		200	KI		110–250	-					
		200	LA	•	125–400	5-10 x CCR	Adjustable				
400		30	30 LA		200–250	17–20 x CCR	rajustable				
480			LA-MC	}	400	15–18 x CCR	Fixed				
	400		LH		250–400	5–10 x CCR	Adjustable				
		35	LII	 	200–250	17–20 x CCR	Aujustable				
		33	LH-MC	}	400	15–18 x CCR	Fixed				
				STR23SP	400	9 x ln	Fixed				
		35	DG	STR53SP		1.5–7 x ln	Adjustable				
				STR23SP	150-600	9 x ln	Fixed	6,000			
			DJ	STR53SP		1.5–7 x ln	Adjustable				
				31h333F	300–400	5 x CCR- 3,200	Aujustable				
		65	LC	T-M	450–600	5 x CCR- 4,200	Adjustable	None			
	600		LE			OFF ³					
			LX	Micrologic [®]	100–600	2.5–8 x P		9 x P–11 x P			
				STR23SP		9 x In	Fixed				
		100	DL	STR53SP	150–600	1.5–7 x ln	Adjustable	6,000			
					300–400	5 x CCR- 3,200	rajuotabio				
		200	LI	T-M	450–600	5 x CCR- 4,200	Adjustable	None			
			LXI	Micrologic [®]	100–600	2.5–8 x P	1	9 x P–11 x P			
	000	35	MG	ET1.01	300–800	5–10 x CCR	Adjustable				
	800	65	MJ	J ⊢ I 7 ()1	300_800	1 5-10 v CCR	I Adulistable	None			

Table 6: 480 Volt Circuit Breakers (continued)

1200	Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantaı Trip		Instantaneous Selective Override
1200			60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
1200			25	DC.		600–1200			Selective Override Trip Range (Amperes) ² 21,600–26,400 9,000–11,000 51,300–62,700 43,200–52,800 36,000–44,000 9,000–11,000 36,000–44,000 21,600–26,400 31,500–38,500 58,500–71,500 19,800–24,200 58,500–71,500 67,500–82,500 None ⁵ 9,000–11,000
1200			35	PG	Micrologic [®]	100–1200	OFF ³	1	21 600 26 400
1200			50	DΚ		600–1200]	21,600-20,400
AB0		1200	50	FK	Micrologic [®]	100-1200	OFF ³		
100		1200	65	DI		600-1200			
100			03	1 0	Micrologic [®]	100–1200			9 000_11 000
All			100	DI		600–1200			9,000-11,000
Second S	480		100	1 L		100–1200		Δdiustahla	
Solidaria Soli	400		35	RG ⁴		1200–2500		Aujustable	
Solid				Tid	Micrologic [®]	240–2500	OFF ³		51 300_62 700
2500			50	BK⁴]	31,000 02,700
First 1200-500 5-10 x CCR Micrologic® 240-2500 OFF³ CTI.01 1200-2500 OFF³ CTI.01 1200-2500 OFF³ CTI.01 1200-2500 OFF³ CTI.01 CTI.01		2500		1110					
Number N		2000	65	R.I ⁴		1200–500		ļ	
100 Fil.4 ET1.01 1200-2500 5-10 x CCR Micrologic® 240-2500 OFF3				110					43 200-52 800
Solidated Case Circuit Breakers (Masterpact**): UL** 489 Standard			100	RI ⁴]	40,200 02,000
S0					Micrologic [®]	240–2500	OFF ³		
Solid	Insulated Cas	e Circuit Break			Standard		_	_	
Adjustable 100									36,000–44,000 9,000–11,000 36,000–44,000 21,600–26,400 31,500–38,500
480 800-2000				NT-H					
480		800–1200	65			100–1200			
480			100						9,000-11,000
A80			100						
100 NW-H Micrologic 100-250 Adjustable 21,600-26,400 31,500-38,500 58,500-71,500 19,800-24,200 150 NW-L 1200-3000 150 NW-L 100-800 100-250 400-]	100-2000			36 000–44 000
Sob			100	NW-H					, ,
150 NW-L NW-LF 2500-3000 100 NW-H 150 NW-L 4000-6000 150 NW-L 4000-6000 150 NW-L 150 NW-L 2000-6000 1200-3000 67,500-82,500 100-800 100-800 100-250 400-800 100 NW-H 100-800 100-250 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 100-38,500	480	800-2000			Micrologic [®]		OFF ³	Adjustable	9,000–11,000 36,000–44,000 21,600–26,400 31,500–38,500
100		2000	150	NW-L					
100			100						
150 NW-L 1200-3000 58,500-71,500 58,500-71,500 67,500-82,500 67,						100–2000			19,800–24,200
150 NW-L 2000-6000 67,500-82,500		2500-3000				1200-3000			58 500-71 500
None						1200 0000			
150 NW-L NW-L NW-L NW-L NW-L NW-L NOne ⁵		4000-6000				2000–6000			67 500-82 500
NT-N1									07,000 02,000
100-800 9,000-11,000 21,600-26,400 None ⁶	Low Voltage F	Power Circuit B	reakers (Mastei		⁹ 1066 / ANSI C	37 Standards	T		
800 Micrologic NW-H1						100-800			
800 NW-N1			42	NT-L1F					
508 800 65 NW-H1 Micrologic® 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 21,600-26,400 76,500-93,500 21,600-26,400 31,500-38,500				NW-N1					
508 800 85 NW-H1 Micrologic® 400-800 OFF3 Adjustable 21,600-26,400 None ⁵ 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 31,500-38,500				1444 141		400–800			None ⁶
800 85 NW-H2 Micrologic® 400-800 / 100-250 / 400-800 OFF³ Adjustable 21,600-26,400 / None⁵ 100 NW-H3 100-800 / 100-250 / 400-800 100-250 / 400-800 21,600-26,400 / 21,600-26,400 200 NW-L1 400-800 31,500-38,500			65	NW-H1]		
85 NW-H2	508	800	35	14.7	Micrologic [®]		OFF ³	Adjustable	
100 NW-H3 100-800 76,500-93,500 21,600-26,400 31,500-38,500	550		85	NW-H2	wiiorologio]	, tajastabie	
NW-L1 100-250 21,600-26,400 31,500-38,500						400–800	_		None ⁵
200 NW-L1 400-800 31,500-38,500			100	NW-H3					
200 400–800 31,500–38,500				N\\/_I 1		100–250	_		21,600–26,400
NW-L1F 100–800 21,600–26,400			200						
				NW-L1F		100–800			21,600–26,400

Table 6: 480 Volt Circuit Breakers (continued)

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantar Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
		42	NW-N1					_
		65	NW-H1					None ⁵
	1600	85	NW-H2		800–1600			
	1000	100	NW-H3		000 1000			76,500–93,500
		200	NW-L1					31,500–38,500
		200	NW-L1F					21,600–26,400
		65	NW-H1					None ⁵
		85	NW-H2					None
	2000	100	NW-H3		1000–2000			76,500–93,500
		200	NW-L1			_		31,500–38,500
508			NW-L1F	Micrologic [®]		OFF ³	Adjustable	21,600–26,400
		65	NWH1					None ⁵
	3200	85	NWH2		1600–3200			140110
	0200	100	NWH3		1000 0200			76,500–93,500
		200	NWL1					105,300–128,700
		85	NW-H2					None ⁵
	4000	100	NW-H3		2000–4000			76,500–93,500
		200	NW-L1					105,300-128,700
		85	NW-H2					None ⁵
	5000	100	NW-H3		2500–5000			76,500–93,500
		200	NW-L1					105,300-128,700

For thermal-magnetic circuit breakers with fixed instantaneous trip, the lower number is the "must hold" and the higher number the "must trip" value. For thermal-magnetic circuit breakers with adjustable instantaneous trip, the adjustment range shown is a function of the continuous current rating (CCR, aka ampere or handle rating) of the circuit breaker. The allowable UL tolerances are -20% (low) and +30% (high) from the nominal values shown. For electronic trip circuit breakers, the adjustment range shown is a function of the rating plug (P) or the sensor (In). Tolerances are +/-10% on both the low and high end of the range.

Table 7: 600 Volt Circuit Breakers

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantaneous Trip		Instantaneous Selective Override		
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²		
Molded Case C	Molded Case Circuit Breakers: UL® 489 Standard									
	100	18	GJL		15–40	600–1200				
					50–100	800–1400				
	110	14	ED	Т-М	15–30	270–875				
					35–70	630-1800				
600 V / 047					80–125	1000–2300				
600 Y / 347 Vac		18	EG		15–30	270–875	Fixed	None		
vac					35–70	630–1800				
					80–125	1000–2300				
		25			15–30	270–875				
			EJ		35–70	630-1800				
					80–125	1000–2300				

The range shown reflects manufacturing tolerances.

Turning the instantaneous setting to OFF on Micrologic[®] electronic trip units will maximize short circuit selective coordination. An OFF setting is available on Micrologic[®] trip units with LSI or LSIG protection.

^{4 1200} amperes maximum in I-Line[®].

⁵ This circuit breaker, with the instantaneous set to OFF, is fully selective up to the interrupting rating of the circuit breaker.

⁶ This circuit breaker, with the instantaneous set to OFF, is fully selective up to the interrupting rating of the circuit breaker.

Table 7: 600 Volt Circuit Breakers (continued)

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range (Amperes)	Instantaneous Trip		Instantaneous Selective Override
						Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
					15–30	275–600		
		4.4			35–50	400-850	1	None
		14	FA		60–80	800-1450		
					90–100	900–1700		
					15–30	275–600		
	100	18	FH		35–50	400–850		
	100	10	ГП		60–80	800–1450		
					90–100	900–1700		
					20–30	275–600]	
		100	FI		35–50	400-850	Fixed	
		100	Г		60–80	800–1450		
					90–100	900-1700		
		14	HD		15–30	350–750		
					35–50	400–850		
					60–90	800–1450		
					100–150	900–1700		
		18	HG		15–30	350-750		
					35–50	400-850		
	150				60–90	800-1450		
600				T-M	100–150	900-1700		
		25	HJ	1 1	15–30	350–750		
					35–50	400–850		
					60–90	800–1450		
				İ	100–150	900–1700		
		50	HL		15–30	350–750		
					35–50	400–850		
					60–90	800–1450		
					100–150	900–1700		
		14	JD	†	150–250		Adjustable	
		18	JG JJ	1		5–10 x CCR		
_	250	25		1				
		50	JL					
		100	KI		110–250			
		LA LA-MC	†	125–400	5-10 x CCR	Adjustable		
				1	200–250	17-20 x CCR	Fixed	
					400	15–18 x CCR		
	400		LH	1 1	250–400	5-10 x CCR	Adjustable	
		25			200–250	17-20 x CCR		
			LH-MC	,	400	15–18 x CCR	Fixed	

Table 7: 600 Volt Circuit Breakers (continued)

Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantaneous Trip		Instantaneous Selective Override
		60 Hz			(Amperes)	Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
		18	DG	STR23SP	150–600	9 x ln	Fixed	
		10	DG	STR53UP		1.5–7 x ln	Adjustable	6,000
			DJ	STR23SP	130 000	9 x In	Fixed	0,000
		35		STR53UP		1.5–7 x ln	Adjustable	
			LC	T-M	300–400	5 x CCR- 3,200		None
	600				450–600	5 x CCR– 4,200		
			LE LX	- Micrologic [®]	100–600	OFF ³ 2.5–8 x P		9 x P–11 x P
		100	LI	T-M	300–400	5 x CCR- 3,200		None
					450–600	5 x CCR- 4,200		
			LXI	Micrologic [®]	100–600	2.5–8 x P		9 x P–11 x P
600	800	18 25	MG MJ	ET1.01	300–800	5–10 x CCR	Adjustable	None
		18	PG	ET1.01	600–1200	5-10 x CCR		21,600–26,400
	1200			Micrologic [®]	100–1200	OFF		21,000-20,400
		25	PJ	ET1.01	600–1200	5-10 x CCR		9,000–11,000
	1200			Micrologic [®]	100–1200	OFF ³		
		50	PK	ET1.01	600–1200	5-10 x CCR		21,600–26,400
				Micrologic [®]	100–1200	OFF ³		, , , , , , , , , , , , , , , , , , , ,
		18	RG ⁴	ET1.01	1200–2500	5-10 x CCR		51,300-62,700
	2500	25	RJ ⁴	Micrologic®	240–2500	OFF ³		
				ET1.01	1200–2500	5-10 x CCR		
		50	RL ⁴	Micrologic [®]	240–2500	OFF ³		43,200-52,800
				ET1.01	1200–2500	5–10 x CCR OFF ³		
			RK ⁴	Micrologic [®]	240–2500			
				ET1.01 Micrologic [®]	1200–2500 240–2500	5–10 x CCR OFF ³		51,300-62,700
Inculated Cas	e Circuit Breake	re (Maeternact	 ®\- ® ⊿80		240-2500	OFF		
modifice Cas	JIICUIL DICARE	35). UL 4 03	Candalu				
600	800-1200	50	NT-H	-H '-N '-H	100–1200	OFF ³		
	800-2000	50	NW-N					36,000–44,000
		85	NW-H		100–2000			
		100 NV	1444 11		100–250		Adjustable	21,600–26,400
			NW-L		400–1600			31,500–38,500
				Micrologic [®]	2000			58,500–71,500
			NW-LF	j i	100–2000			19,800–24,200
	2500-3000	85	NW-H	1				
		100	NW-L		1200–3000			58,500–71,500
	4000 0000	85	NW-H]	2000 0000			67 500 92 500
	4000-6000	100	NW-L		2000–6000			67,500–82,500

Table 7: 600 Volt Circuit Breakers (continued)

Comparison Com	Voltage Rating	Frame Size (Amperes)	Interrupting Rating (kA)	Circuit Breaker	Trip Unit Type	Continuous Current Range	Instantaneous Trip		Instantaneous Selective Override
A2							Range (Amperes) ¹	Туре	Trip Range (Amperes) ²
A2 NW-H1 A00-800 100-250 A1,600-26,400 None ⁵ 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 A00-800 A	Low Voltage P	ower Circuit Br	eakers (Master	pact [®]): UL [®]	[®] 1066 / ANSI C3	37 Standards			
65 NW-H1 800 85 NW-H2 NW-H3 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 100-250 400-800 76,500-93,500 21,600-26,400 None ⁵ 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 100-250 130 NW-L1 100-800 100-800 100-800 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 31,500-38,500 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 130 NW-L1 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500			42	NIW-NI1		100–250			
65 NW-H1 800 85 NW-H2 NW-H3 100-250 400-800 100-250 400-800 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 21,600-26,400 None ⁵ 76,500-93,500 31,500-38,500 21,600-26,400 None ⁵ 76,500-93,500 130 NW-L1 NW-H2 4000 85 NW-H2 4000 85 NW-H2 1000-2000 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500			72	1444 141					
800 85 NW-H2 NW-H3 130 NW-L1 130 NW-L1 142 NW-H2 NW-N1 65 NW-H2 NW-H3 130 NW-L1 NW-L1F 85 NW-H2 NW-H2 NW-H3 130 NW-L1 NW-L1F 85 NW-H3 130 NW-L1 NW-L1F 85 NW-H3 130 NW-H2 NW-H3 130 NW-H2 NW-H3 130 NW-L1 NW-H3 130 NW-H2 NW-H2 NW-H3 130 NW-H2 NW-H3 130 NW-H2 NW-H3 130 NW-H2 NW-H3 130 NW-H2 NW-H2 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500			65	NW-H1					
85				1444 111					
130		800		NW-H2				Adjustable	
130 NW-L1 NW-L1F NW-L1F 1600 85 NW-H1 NW-L1F NW-L1F NW-L1F NW-L1F NW-L1F NW-H2 NW-H3 NW-H2 NW-H3 NW-H2 NW-H3 NW-L1F NW-H3 NW-H2 NW-H3 NW-H3 NW-H2 NW-H3 NW-H2 NW-H3 NW-H3 NW-H2 NW-H3 NW-H3 NW-H3 NW-H3 NW-H2 NW-H3 NW-H		000	85	1444-112					
635 130				NW-H3					
130 NW-L1F 42 NW-N1 65 NW-H2 NW-L1F NW-H2 NW-H2 NW-H3 130 NW-L1 NW-H3 130 NW-L1 NW-H3 130 NW-L1 NW-H2 NW-H3 130 NW-L1 NW-H3 130 NW-H2 NW-H3 130 NW-L1 NW-H3 130 NW-H2 NW-H3 130 NW-H3 N							OFF ³		, ,
1600			130						
65 NW-H1 NW-L17 NW-L17 NW-L18 2000 65 NW-H1 NW-L16 85 NW-H1 NW-L17 NW-H3 130 NW-L1 NW-L17 NW-H2 NW-H2 NW-H2 NW-H3 130 NW-L1 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500					1	100–800			21,600–26,400
1600 85		1600							_
1600 85 NW-H3			65						None ⁵
130 NW-L1 NW-L1F NW-H2 NW-H3 N			85		Micrologic [®]				
635 NW-L1F Micrologic® OFF3 Adjustable 21,600-26,400 None5									
635 NW-L1F Micrologic OFF3 Adjustable 21,600-26,400									
2000 85 NW-H2 NW-H3 130 NW-L1 NW-L1F 65 NW-H2 None ⁵ 1600-2000 85 NW-H2 None ⁵ 1600-3200 130 NW-L1 4000 85 NW-H2 NW-H3 130 NW-L1 2000-4000 85 NW-H2 NW-H3 130 NW-L1 85 NW-H2 NW-H3 130 NW-L1 2000-4000 130 NW-L1 85 NW-H2 None ⁵ 76,500-93,500 105,300-128,700 105,300-128,700 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500	635								21,600-26,400
2000 85 NW-H3 130 NW-L1 NW-L1F 65 NW-H1 NW-H3 130 NW-H2 NW-H3 4000 85 NW-H2 NW-H3 130 NW-L1 4000 85 NW-H2 NW-H3 1500-3200 85 NW-H2 NW-H3 1600-3200 160		2000	65						None ⁵
130 NW-L1 NW-L1F 65 NW-H1 NW-H2 NW-H3 1600-3200 85 NW-H2 NW-H3 4000 85 NW-H2 NW-H3 1600-3200 130 NW-L1 2000-4000 130 NW-L1 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500 105,300-128,700 None ⁵ 76,500-93,500			130						
130 NW-L1F 65 NW-H1 85 NW-H2 NV-H3 14000 85 NW-H2 NW-H3 1500 NW-L1 85 NW-H2 NW-H3 1600–3200 130 NW-L1 None ⁵ 76,500–93,500 176,500–93,500 176,500–93,500 176,500–93,500 176,500–93,500 176,500–93,500 176,500–93,500 176,500–93,500									
3200 85 NW-H1 None ⁵ 85 NW-H2 NW-H3 1600–3200 130 NW-L1 None ⁵ 4000 85 NW-H2 None ⁵ NW-H2 None ⁵ 130 NW-H3 2000–4000 130 NW-L1 None ⁵ 76,500–93,500 105,300–128,700 105,300–128,700 None ⁵ 76,500–93,500 105,300–128,700 None ⁵ 76,500–93,500									
3200 85 NW-H2 None ³ 1600-3200 130 NW-L1 105,300-128,700 130 NW-H2 None ⁵ NW-H3 2000-4000 130 NW-L1 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700									21,600-26,400
3200 85 NW-H3 1600-3200 76,500-93,500 130 NW-L1 None ⁵ 76,500-93,500 105,300-128,700 105,300-			85						None ⁵
130 NW-L1 85 NW-H2 105,300-128,700 None ⁵ 76,500-93,500 130 NW-L1 85 NW-H2 None ⁵ 76,500-93,500 None ⁵ None ⁵ 76,500-93,500 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700 105,300-128,700						1600–3200			70.500.00.500
85 NW-H2 None ⁵ 76,500–93,500 130 NW-L1 None ⁵ 76,500–93,500 105,300–128,700 None ⁵ None ⁵ 76,500–93,500 76,500–93,500									
4000 85 NW-H3 2000-4000 76,500-93,500 130 NW-L1 105,300-128,700 NW-H2 None ⁵ 76,500-93,500 76,500-93,500					1	2000–4000			
130 NW-L1 85 NW-H2 NW-H3 2500-5000 105,300-128,700 None ⁵ 76,500-93,500					į				
85 NW-H2 None ⁵ 76,500–93,500									
5000 85 NW-H3 2500–5000 76,500–93,500			130		-				
1,7,1,1,1,1		5000	85			2500 5000			
		5000	130	NW-L1		2000-0000			105,300–93,500

For thermal-magnetic circuit breakers with fixed instantaneous trip, the lower number is the "must hold" and the higher number the "must trip" value. For thermal-magnetic circuit breakers with adjustable instantaneous trip, the adjustment range shown is a function of the continuous current rating (CCR, aka ampere or handle rating) of the circuit breaker. The allowable UL tolerances are -20% (low) and +30% (high) from the nominal values shown. For electronic trip circuit breakers, the adjustment range shown is a function of the rating plug (P) or the sensor (In). Tolerances are +/-10% on both the low and high end of the range.

² The range shown reflects manufacturing tolerances.

Turning the instantaneous setting to OFF on Micrologic[®] electronic trip units will maximize short circuit selective coordination. An OFF setting is available on Micrologic[®] trip units with LSI or LSIG protection.

^{4 1200} amperes maximum in I-Line[®].

⁵ This circuit breaker, with the instantaneous set to OFF, is fully selective up to the interrupting rating of the circuit breaker.

APPENDIX—B

Glossary

ampacity The RMS current, in amperes, that a conductor or circuit breaker can carry continuously under the conditions of use without exceeding its temperature rating.

ampere rating See continuous current rating.

branch circuit
The circuit between the final overcurrent device protecting the circuit and the outlet(s) or loads.

<u>circuit breaker</u> A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on an overcurrent without damage to itself when properly applied within its rating.

circuit breaker frame (1) The circuit breaker housing which contains the current carrying components, the current sensing components, and the tripping and operating mechanism. (2) That portion of an interchangeable trip molded case circuit breaker remaining when the interchangeable trip unit is removed.

close and latch rating The maximum level of current a circuit breaker can be closed on and still have the mechanism latch in the fully closed position.

<u>continuous current rating</u> The designated RMS alternating or direct current in amperes which a device or assembly will carry continuously in free air without tripping or exceeding temperature limits.

<u>current sensor</u> A component which is able to sense the level of current flowing in a circuit breaker conductor and input a proportional signal into the trip unit of the circuit breaker.

<u>feeder circuit</u> A circuit between the main overcurrent-protecting device and the final branch circuit overcurrent protective devices.

frame size The largest ampere rating available in a group of circuit breakers of similar physical configuration.

ground fault An unintentional current path, through a grounded conductor, enclosure, raceway or the earth, back to the source.

handle rating See continuous current rating.

instantaneous selective override A fixed, non-adjustable, instantaneous trip function set just below a circuit breakers withstand capability.

<u>instantaneous trip</u> A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker during short-circuit conditions.

<u>insulated case circuit breaker (ICCB)</u> UL Standard 489 Listed nonfused molded case circuit breakers which utilize a two-step stored energy closing mechanism, electronic trip system and optional draw-out construction.

<u>interrupting rating</u> The highest current at rated voltage that the circuit breaker is rated to interrupt in RMS symmetrical amperes. When the circuit breaker can be used at more than one voltage, the interrupting rating will be shown on the circuit breaker for each voltage level. The interrupting rating of a circuit breaker must be equal to or greater than the available short-circuit current at the point at which the circuit breaker is applied to the system.

<u>making current release</u> A fixed, non-adjustable, instantaneous trip function set just below a circuit breakers close and latch rating.

molded case circuit breaker (MCCB) A circuit breaker which is assembled as an integral unit in a supportive and enclosed housing of

insulating material, generally 20 to 3000 A in size and used in systems up to 600 Vac and 500 Vdc.

selective coordination Localization of an overcurrent condition to restrict an outage to the circuit or equipment affected, accomplished by the choice of overcurrent protective devices and their ratings or settings. (NEC 100 – Definitions)

zone-selective interlocking (ZSI) A communication capability between electronic trip systems and ground-fault relays which permits a short circuit or ground fault to be isolated and cleared by the nearest upstream device with no intentional time delay.

Schneider Electric USA 3700 Sixth St SW Cedar Rapids IA 52404 1-888-SquareD (1-888-778-2733) www.us.SquareD.com

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

© 2005 Schneider Electric All Rights Reserved



