

October 1997
Mailed to: E/29-100A

Time/Current Characteristic Curves for
Westinghouse Series C® R-Frame
Circuit Breakers

Westinghouse Series C® Molded Case Circuit Breakers R-Frame

Breaker Description	Curve No.	Page
Series C Types RD, CRD, RDC, CRDC Circuit Breakers Equipped With Digitrip RMS 310 Trip Uni		
Typical Instantaneous Time-Phase Current Characteristic Curve Based on I_n	SC-5629-93	2
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Long Delay I^2t , Short Delay I^2t	SC-6336-96	9
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Series C R-Frame Circuit Breakers Equipped With 2500A Digitrip OPTIM Trip Units		
Long Delay I^2t , Short Delay I^2t	SC-6339-96	12
Long Delay I^2t , Short Delay Flat	SC-6340-96	13
Long Delay I^4t , Short Delay Flat	SC-6341-96	14
Instantaneous and Override	SC-6344-96	17
Ground Fault or Ground Fault Alarm Only	SC-6347-96	20

Definitions

I_n is the maximum value of continuous current for which the trip unit can be set.
 I_n is the basis (or reference) for both the Instantaneous and the Ground protection current settings.
The value of the rating plug is printed on the Rating Plug.

I_r is the basis for both the Long Delay and the Short Delay (if provided) protection current settings.
The value of I_r is the Long Delay Current Setting x I_n .

Individual oversize copies of curves listed above printed on onion-skin paper are available in limited quantity from:

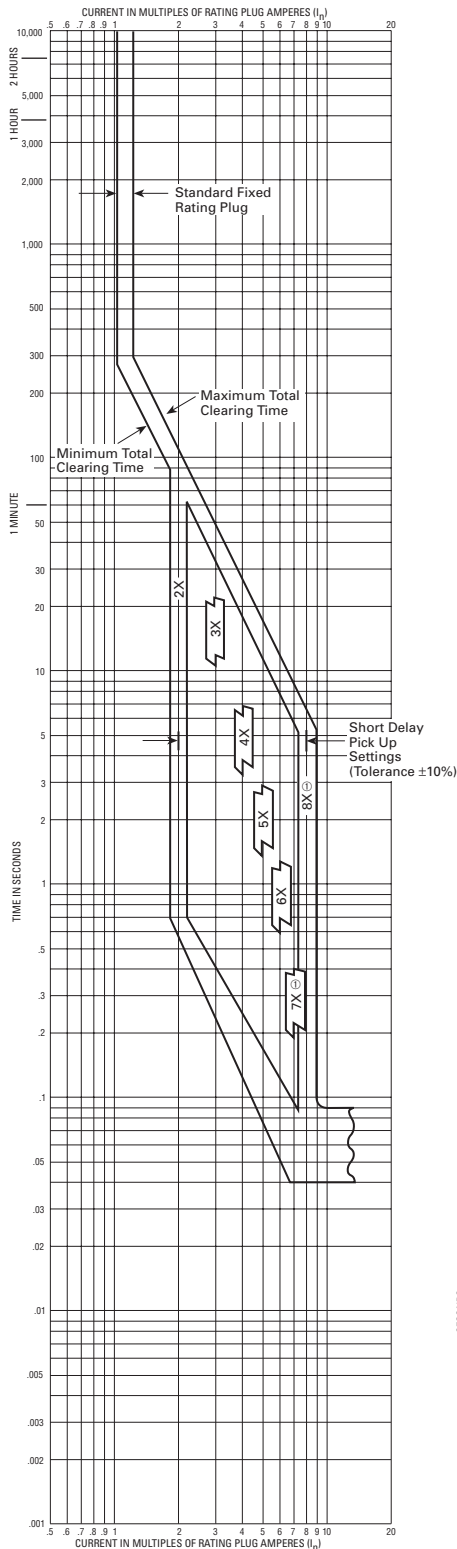
Cutler-Hammer
Westinghouse &
Cutler-Hammer Products
Five Parkway Center
Pittsburgh, PA 15220

When ordering onion-skin curves, use number at bottom of page where curve appears, i.e., SC-5629-93. **Requests for full sets of curves will not be honored.**



AB DE-ION Circuit Breakers

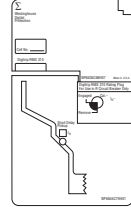
Types RD, CRD, RDC, CRDC Equipped With Digitrip RMS 310 Trip Units. Typical Instantaneous Time-Phase Current Characteristic Curve Based on I_n



Circuit Breaker Time/Current Curves (Phase Current) ④

Series C® R-Frame Circuit Breakers
Equipped With Type Digitrip RMS 310 Trip Units

Typical Trip Unit Nameplate



For use with Trip Unit Catalog Numbers

1600A Max.	2000A Max.	2500A Max.
RES1600LS	RES2000LS	RES2500LS
RES1600LSG	RES2000LSG	RES2500LSG
RES1600LS	RES2000LS	RES2500LS

Frame Rating Amperes (Max.)	Available Rating Plugs Amperes Rating (I_n)	Type	Catalog Number	Short Delay Pickup Range Amperes	
1600	1600	Fixed	16RES16T	3200-12800	
	1400	Fixed	16RES14T	2800-11200	
	1250	Fixed	16RES125T [Ⓢ]	2500-10000	
	1200	Fixed	16RES12T	2400-9600	
	1000	Fixed	16RES10T	2000-8000	
	800	Fixed	16RES08T	1600-6400	
	800, 1000, 1200, 1600	Adj.	A16RES16T1	1600-12800	
	800, 1000, 1250, 1600	Adj.	A16RES16T2 [Ⓢ]	1600-12800	
	2000	2000	Fixed	20RES20T	4000-16000
		1800	Fixed	20RES18T	3200-12800
1400		Fixed	20RES14T	2800-11200	
1250		Fixed	20RES125T [Ⓢ]	2500-10000	
1200		Fixed	20RES12T	2400-9600	
1000		Fixed	20RES10T	2000-8000	
1000, 1200, 1600, 2000		Adj.	A20RES20T1	2000-16000	
1000, 1250, 1600, 2000		Adj.	A20RES20T2 [Ⓢ]	2000-16000	
2500		2500	Fixed	25RES25T	5000-15000
		2000	Fixed	25RES20T	4000-12000
	1600	Fixed	25RES16T	3200-9600	
	1250	Fixed	25RES125T [Ⓢ]	2500-7500	
	1200	Fixed	25RES12T	2400-7200	
	1200, 1600, 2000, 2500	Adj.	A25RES25T1	24000-15000	
	1250, 1600, 2000, 2500	Adj.	A25RES25T2 [Ⓢ]	2500-15000	

Interrupting Ratings - 50/60 Hz

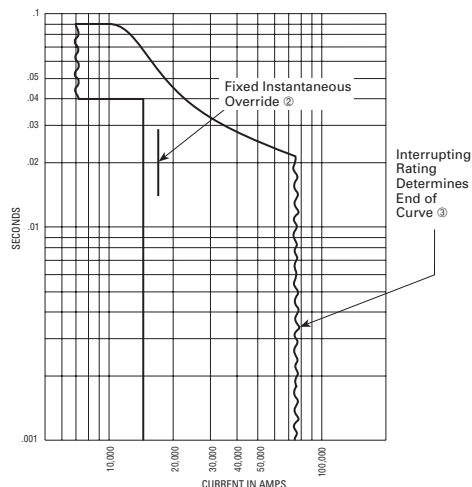
Breaker Type	UL/CSA RMS Sym. Amperes (kA)			IEC 947-2 (kA)		
	240V	480V	600V	220-240V	380-415V	500V
RD, CRD	125	65	50	125	65	42
RDC, CRDC	200	100	65	200	100	65

Utilization Category A
 $I_{cs} = 0.25 I_{cu}$
 $U_{imp} = 8 \text{ kV}$

Notes
Curve accuracy applies from -20°C to +55°C ambient. For possible ampere derating for ambient above 40°C, refer to Cutler-Hammer.

Digitrip RMS 310 trip units are suitable for functional field testing with test kit Cat. No. STK2. For field testing using primary injection methods, follow NEMA publication AB-4-1991.

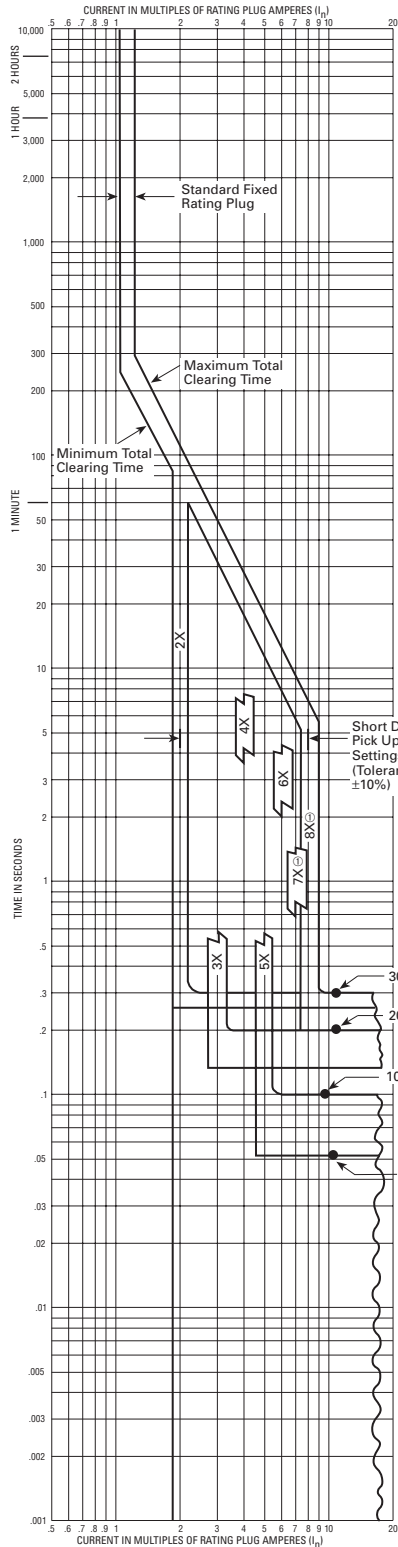
- ① For 2500A styles, maximum short delay pickup setting = 6X.
- ② For high fault current levels a fixed instantaneous override is provided at 17,500A (Tolerance ±15%).
- ③ The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
- ④ For ground fault time-current curves see SC-5631-93.
- Ⓢ Not UL/CSA Listed.





AB DE-ION Circuit Breakers

Types RD, CRD, RDC, CRDC Equipped With Digitrip RMS 310 Trip Units. Typical Long Delay/Short Delay Time-Phase Current Characteristic Curve Based on I_n



Circuit Breaker Time/Current Curves (Phase Current) ④

Series C® R-Frame Circuit Breakers
Equipped With Type Digitrip RMS 310 Trip Units

For use with Trip Unit Catalog Numbers

1600A Max.	2000A Max.	2500A Max.
RES1600LSI	RES2000LSI	RES2500LSI
RES1600LSIG	RES2000LSIG	RES2500LSIG
RES1600LSI	RES2000LSI	RES2500LSI

Typical Trip Unit Nameplate

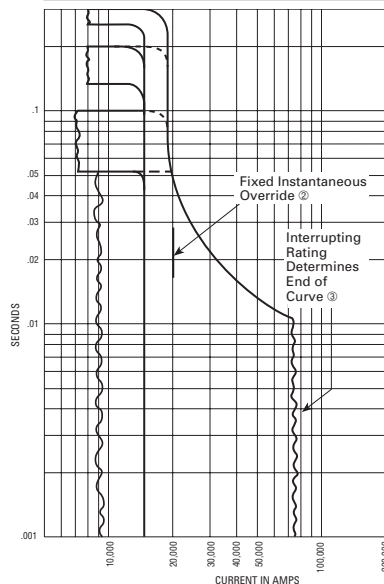
Frame Rating Amperes (Max.)	Available Rating Plugs Ampere Rating (I_n)	Type	Catalog Number	Short Delay Pickup Range Amperes	
1600	1600	Fixed	16RS16T	3200-12800	
	1400	Fixed	16RS14T	2800-11200	
	1250	Fixed	16RS125T ^⑤	2500-10000	
	1200	Fixed	16RS12T	2400-9600	
	1000	Fixed	16RS10T	2000-8000	
	800	Fixed	16RS08T	1600-6400	
	800, 1000, 1200, 1600	Adj.	A16RS16T1	1600-12800	
	800, 1000, 1250, 1600	Adj.	A16RS16T2 ^⑥	1600-12800	
	2000	2000	Fixed	20RS20T	4000-16000
		1600	Fixed	20RS16T	3200-12800
1400		Fixed	20RS14T	2800-11200	
1250		Fixed	20RS125T ^⑤	2500-10000	
1200		Fixed	20RS12T	2400-9600	
1000		Fixed	20RS10T	2000-8000	
1000, 1200, 1600, 2000		Adj.	A20RS20T1	2000-16000	
1000, 1250, 1600, 2000		Adj.	A20RS20T2 ^⑥	2000-16000	
2500	2500	Fixed	25RES25T	5000-15000	
	2000	Fixed	25RES20T	4000-12000	
	1600	Fixed	25RES16T	3200-9600	
	1250	Fixed	25RES125T ^⑤	2500-7500	
	1200	Fixed	25RES12T	2400-7200	
	1200, 1600, 2000, 2500	Adj.	A25RES25T1	24000-15000	
	1250, 1600, 2000, 2500	Adj.	A25RES25T2 ^⑥	2500-15000	

Interrupting Ratings - 50/60 Hz
RMS Sym. Amperes (kA)

Breaker Type	UL/CSA			IEC 947-2			$(I_{cu})^1$ 500V
	240V	480V	600V	220-240V	380-415V	500V	
RD, CRD	125	65	50	125	65	42	
RDC, CRDC	200	100	65	200	100	65	

Utilization Category A
 $I_{cs} = 0.25 I_{cu}$
 $U_{imp} = 8 \text{ kV}$

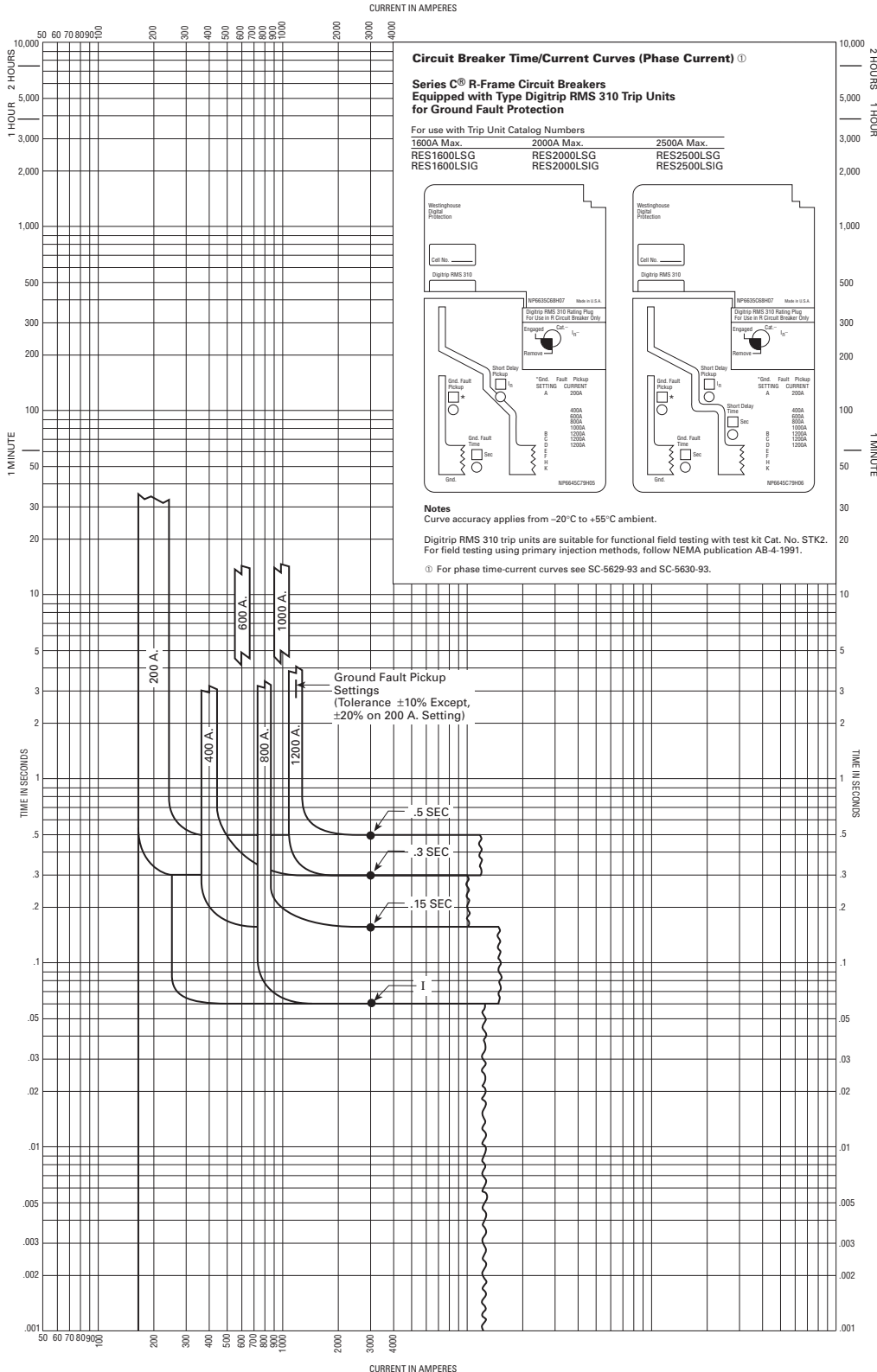
Notes
Curve accuracy applies from -20°C to $+55^\circ\text{C}$ ambient. For possible ampere derating for ambient above 40°C , refer to Cutler-Hammer.
Digitrip RMS 310 trip units are suitable for functional field testing with test kit Cat. No. STK2. For field testing using primary injection methods, follow NEMA publication AB-4-1991.
① For 2500A styles, maximum short delay pickup setting = 6X.
② For high fault current levels a fixed instantaneous override is provided at 17,500A (Tolerance $\pm 15\%$).
③ The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
④ For ground fault time-current curves see SC-5631-93.
⑤ Not UL/CSA Listed.





AB DE-ION Circuit Breakers

Types RD, CRD, RDC, CRDC Equipped With Digitrip RMS 310 Trip Units. Typical Ground Fault/Protection Time/Current Characteristic Curve Based on I_n





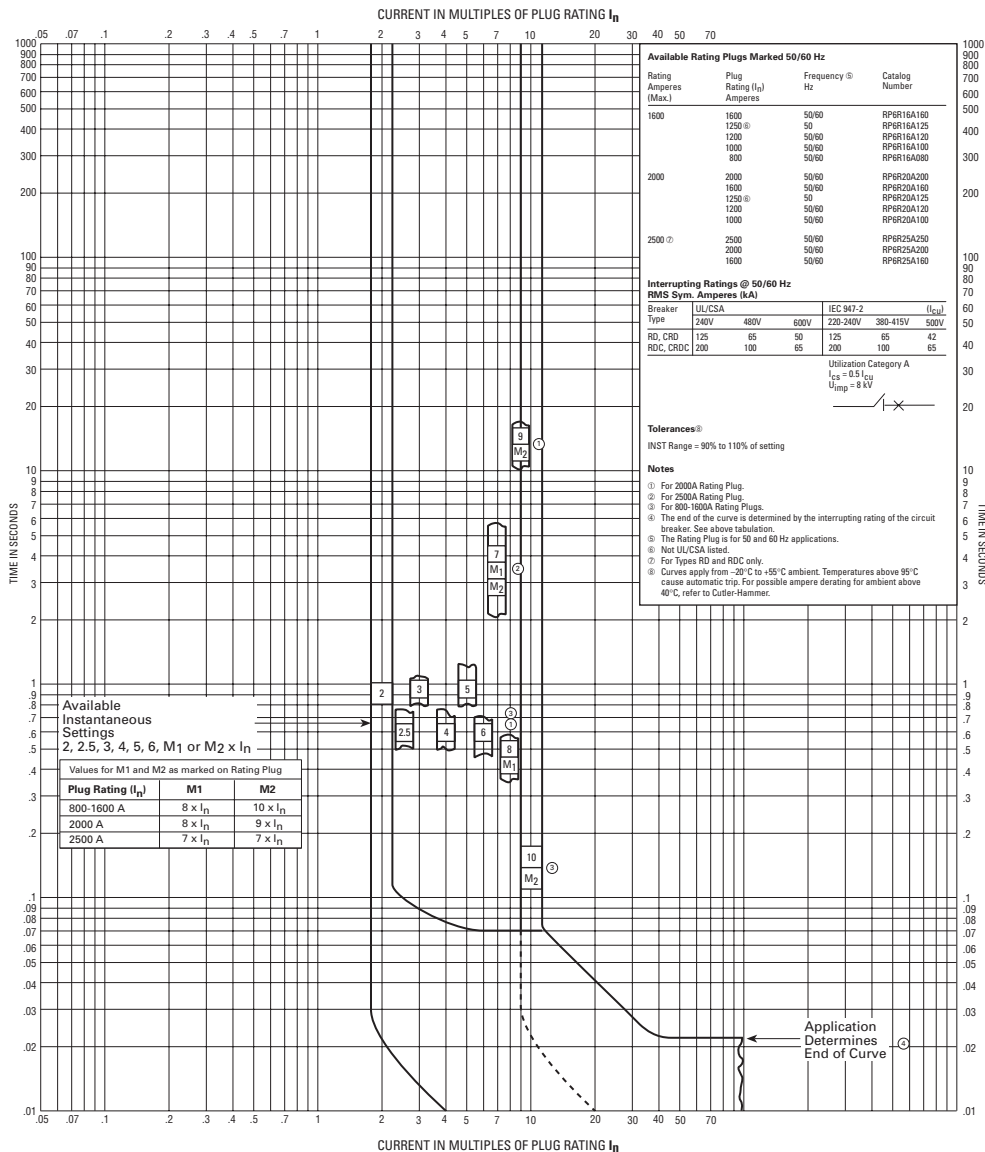
AB DE-ION Circuit Breakers

Types RD, CRD, RDC, CRDC Equipped With Digitrip RMS 510/610/810 Trip Units. Typical Instantaneous Time-Phase Current Characteristic Curve Based on I_n

IMPORTANT

TRIP UNITS ARE NOT AVAILABLE WITH ONLY INSTANTANEOUS PROTECTION. THIS CURVE MUST BE USED in conjunction WITH Curve No. SC-5627-93 for LONG DELAY (and if applicable SHORT DELAY) PROTECTION to obtain the complete time-current characteristic.

Series C[®] R-Frame Circuit Breakers with DIGITRIP RMS 510/610/810 Trip Units Typical Instantaneous Time-Phase Current Characteristic Curve (I)

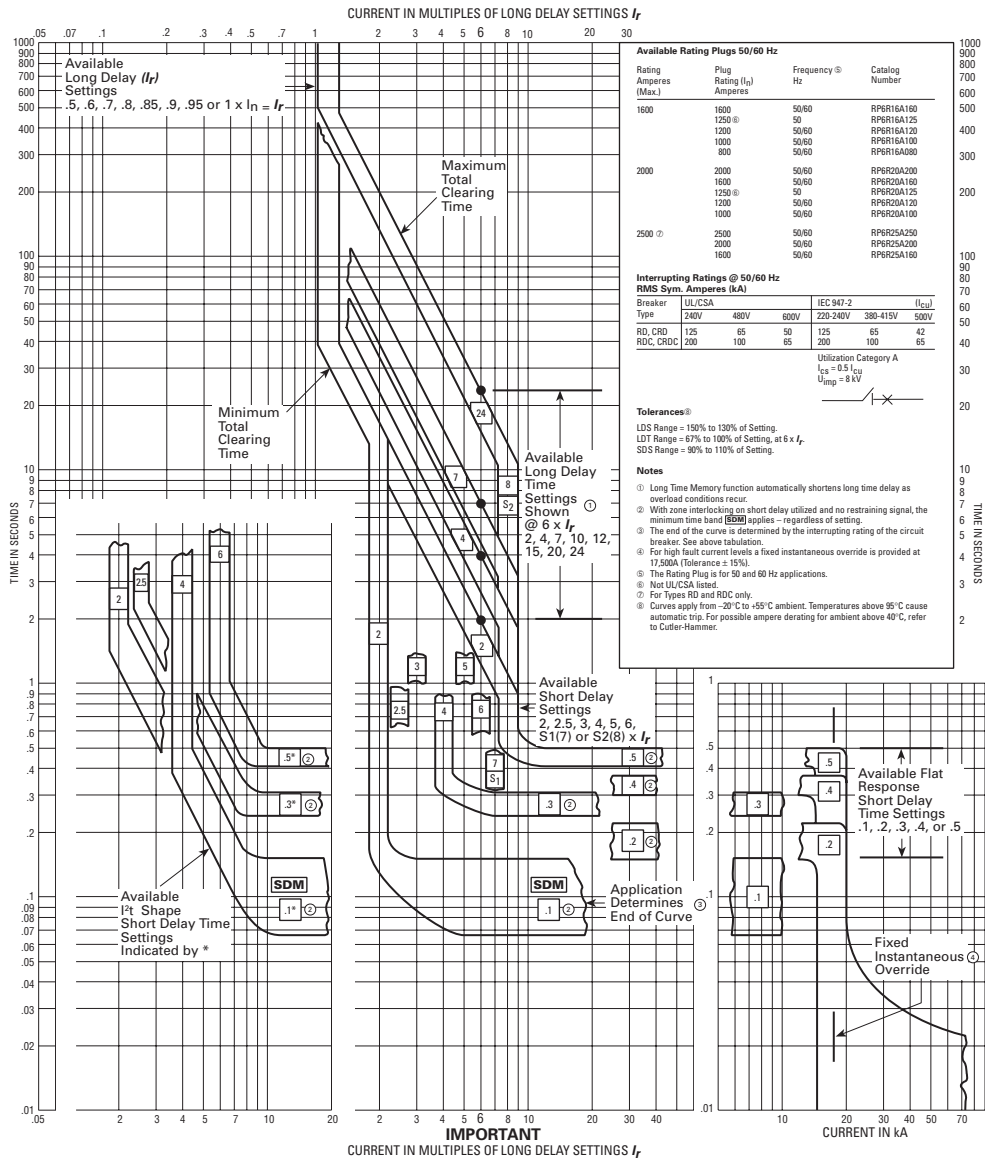




AB DE-ION Circuit Breakers

Types RD, CRD, RDC, CRDC Equipped With Digitrip RMS 510/610/810 Trip Units. Typical Long Delay/Short Delay Time-Phase Current Characteristic Curve Based on I_r

Series C[®] R-Frame Circuit Breakers with DIGITRIP RMS 510/610/810 Trip Units Typical Long Delay and Short Delay Time-Phase Current Characteristic Curve (LS)



Available Rating Plugs 50/60 Hz

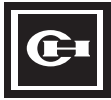
Rating Amperes (Max.)	Plug Rating (I_n) Amperes	Frequency ① Hz	Catalog Number
1600	1600 ②	50/60	RPR16A160
	1250 ③	50	RPR16A125
	1200	50/60	RPR16A120
	1000	50/60	RPR16A100
2000	2000	50/60	RPR20A200
	1600	50/60	RPR20A160
	1250 ③	50	RPR20A125
	1200	50/60	RPR20A120
2500 ④	2500	50/60	RPR25A250
	2000	50/60	RPR25A200
	1600	50/60	RPR25A160
	1000	50/60	RPR25A100

Interrupting Ratings @ 50/60 Hz

Breaker Type	UL/CSA	IEC 947-2	I_{cu}
RD, CRD	125	125	65
RDC, CRDC	200	100	42

Utilization Category A
 $I_{cs} = 0.5 I_{cu}$
 $U_{imp} = 8 kV$

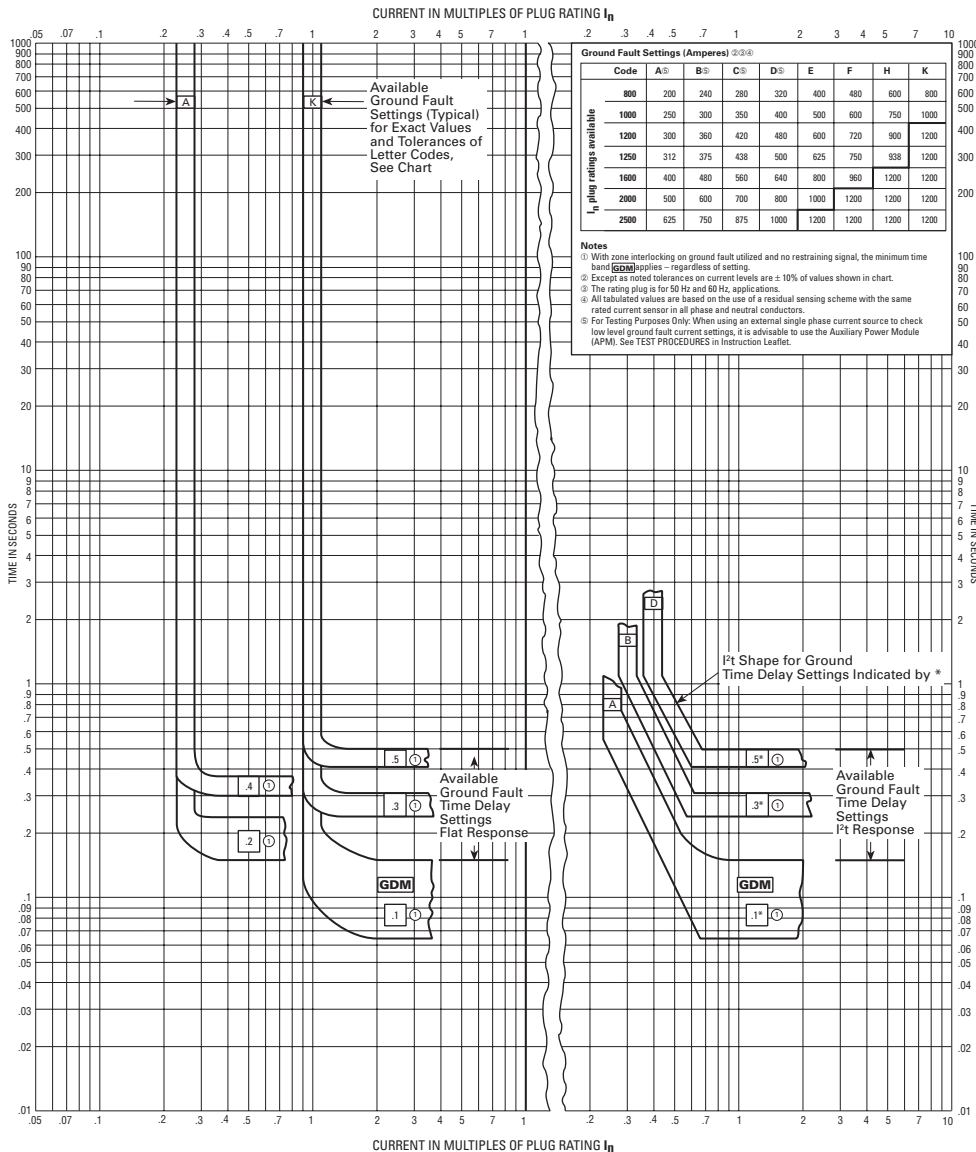
- Tolerances ⑤**
- LDS Range = 150% to 130% of Setting.
 - LDT Range = 87% to 100% of Setting, at $6 \times I_r$.
 - SDS Range = 90% to 110% of Setting.
- Notes**
- Long Time Memory function automatically shortens long time delay as overload conditions recur.
 - With zone interlocking on short delay utilized and no restraining signal, the minimum time band (SDM) applies – regardless of setting.
 - The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
 - For high fault current levels a fixed instantaneous override is provided at 17,500A (Tolerance ± 15%).
 - The Rating Plug is for 50 and 60 Hz applications.
 - Not UL/CSA listed.
 - For Types RD and RDC only.
 - Curves apply from -20°C to +55°C ambient. Temperatures above 95°C cause automatic trip. For possible ampere derating for ambient above 40°C, refer to Cutler-Hammer.



AB DE-ION Circuit Breakers

Types RD, CRD, RDC, CRDC Equipped With Digitrip RMS 510/610/810 Trip Units. Typical Ground Fault/Protection Time/Current Characteristic Curve Based on I_n

Series C[®] R-Frame Circuit Breakers with DIGITRIP RMS 510/610/810 Trip Units Typical Time-Ground Current Characteristic Curve (G)





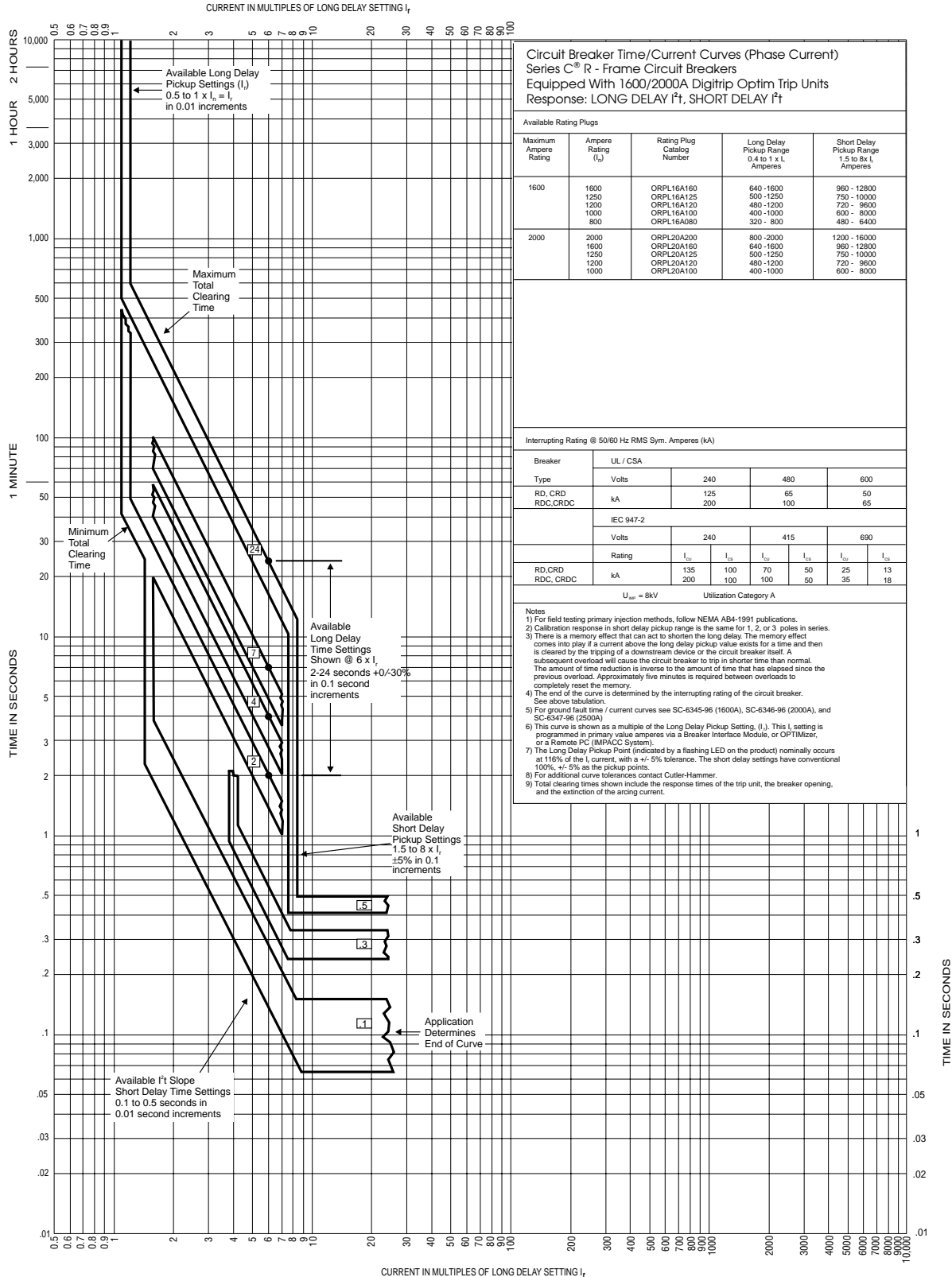
AB DE-ION Circuit Breakers

Cutler-Hammer
Westinghouse &
Cutler-Hammer Products
Five Parkway Center
Pittsburgh, Pennsylvania, U.S.A. 15220



AB DE-ION Circuit Breakers

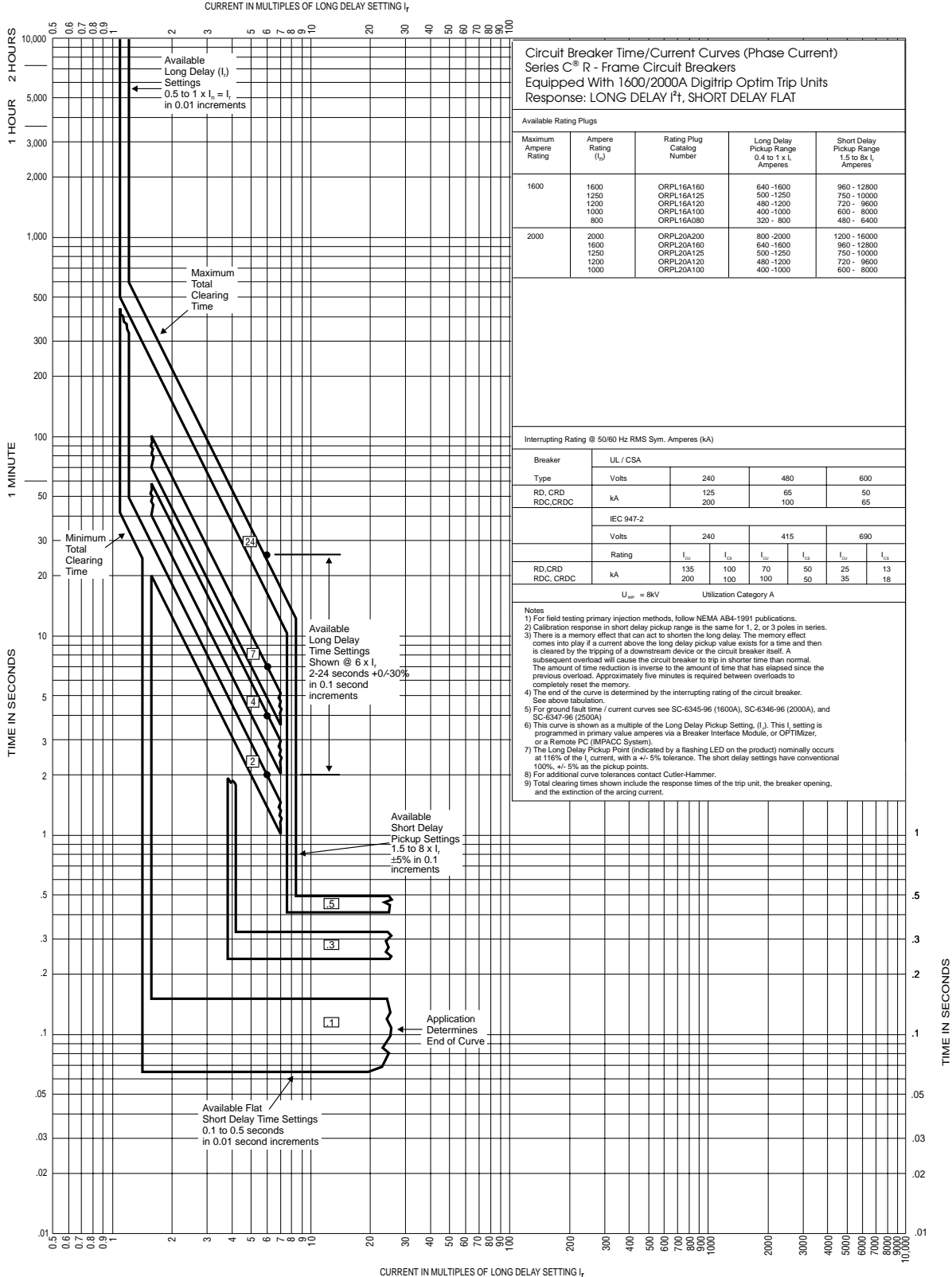
R-Frame Circuit Breakers Equipped with 1600/2000A Digitrip OPTIM Trip Units; Long Delay I²t, Short Delay I²t





AB DE-ION Circuit Breakers

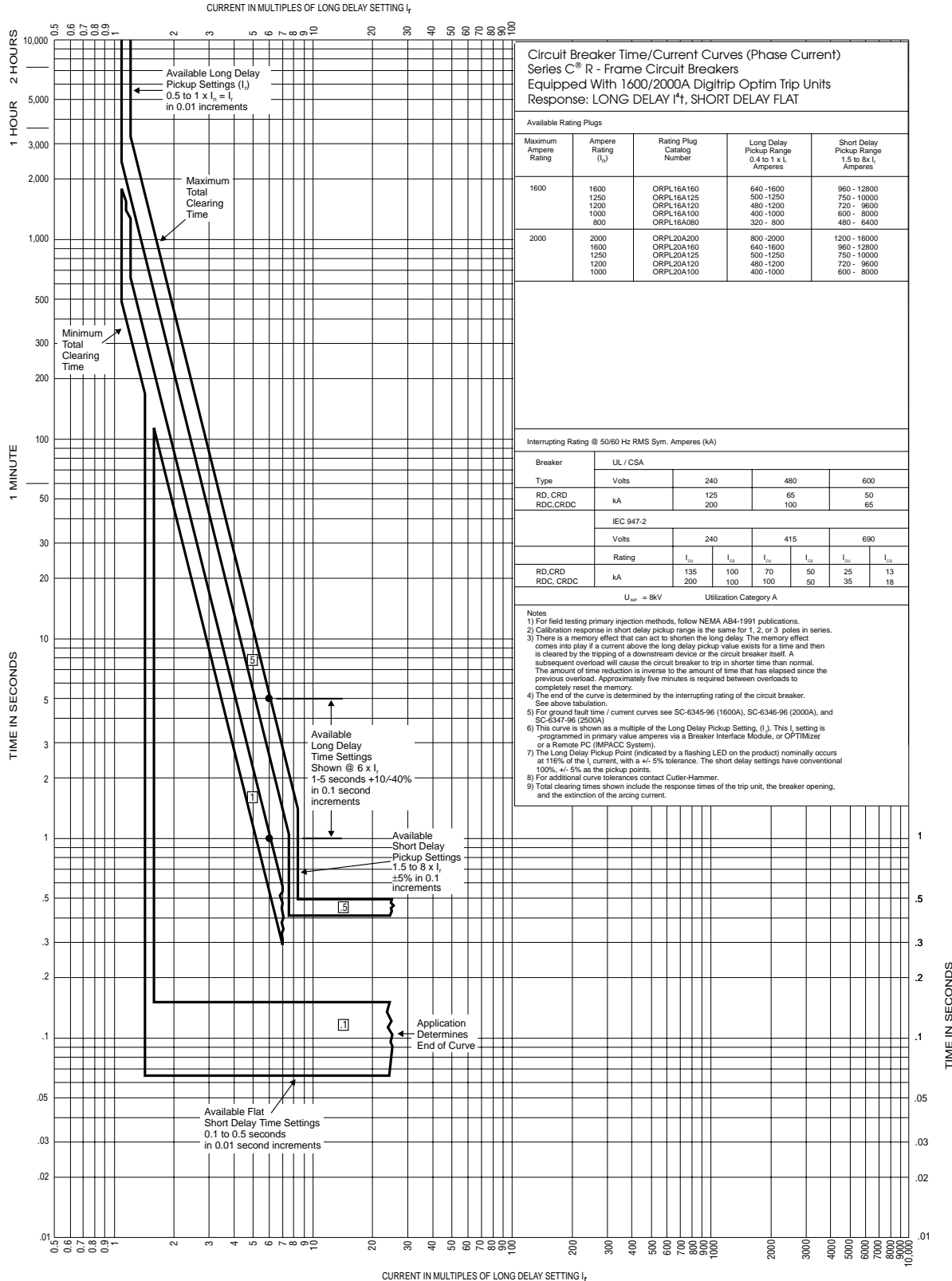
R-Frame Circuit Breakers Equipped with 1600/2000A Digitrip OPTIM Trip Units; Long Delay I²t, Short Delay Flat





AB DE-ION Circuit Breakers

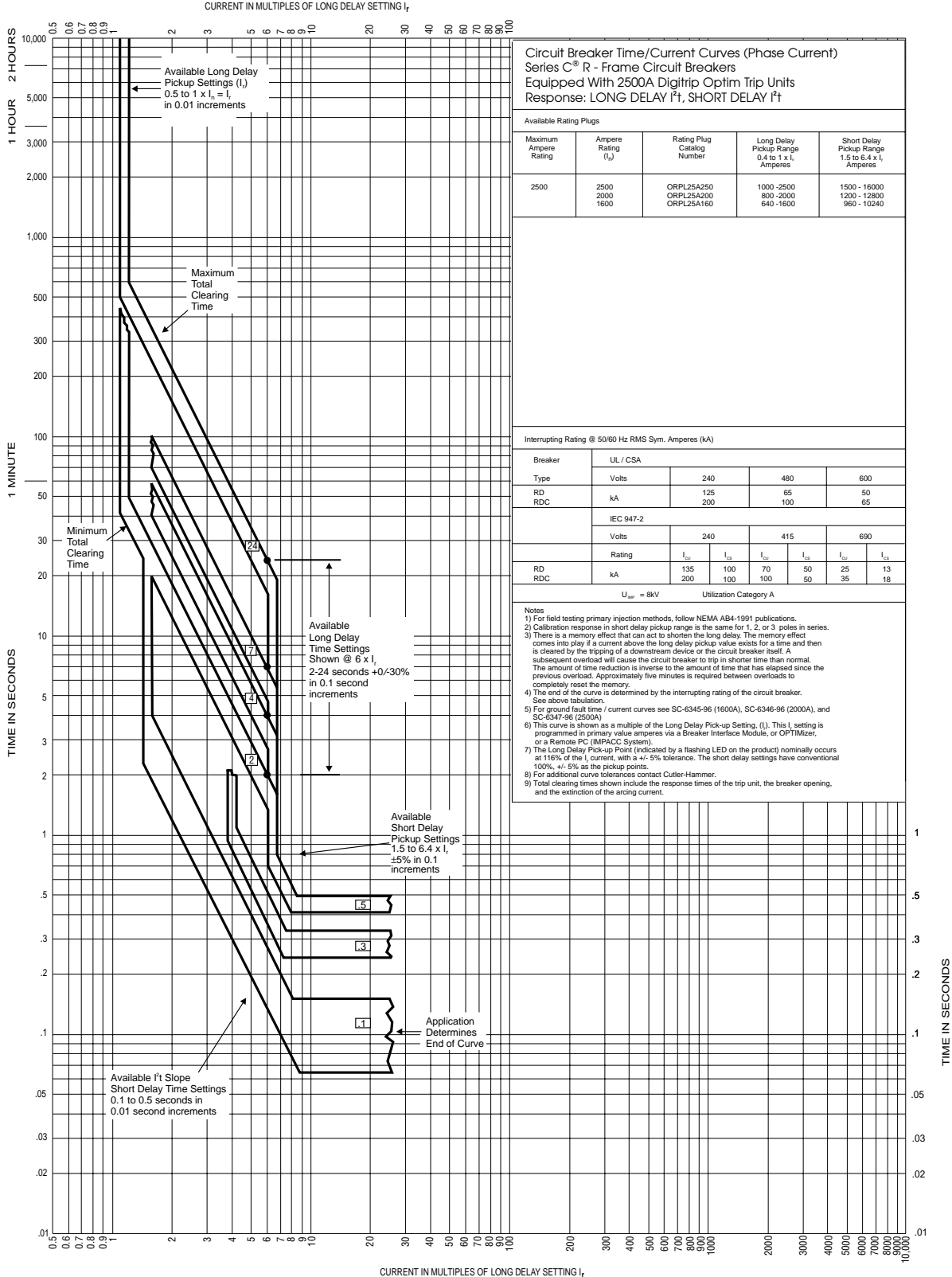
R-Frame Circuit Breakers Equipped with 1600/2000A Digitrip OPTIM Trip Units; Long Delay I^t, Short Delay Flat





AB DE-ION Circuit Breakers

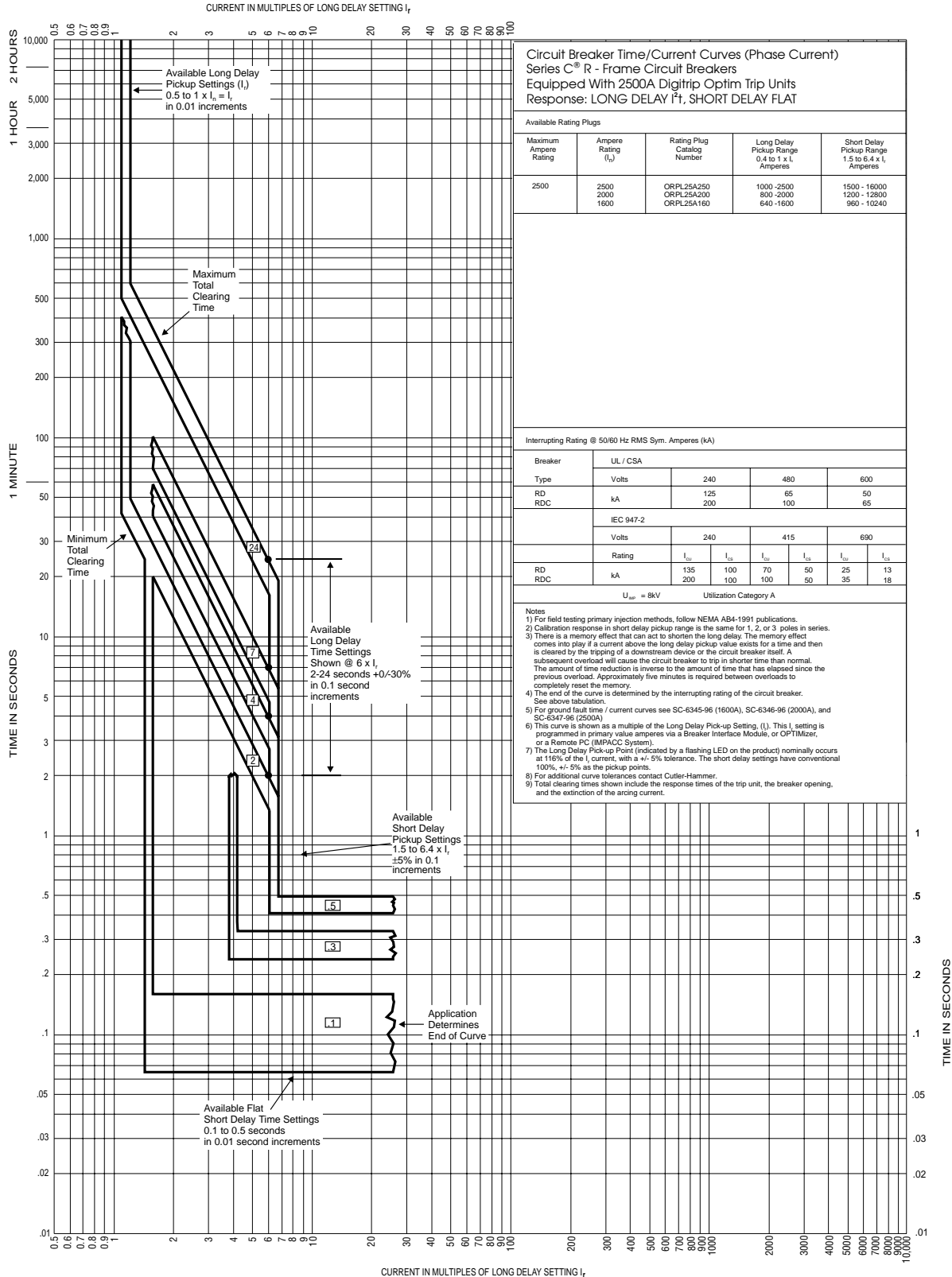
R-Frame Circuit Breakers Equipped with 2500A Digitrip OPTIM Trip Units; Long Delay I²t, Short Delay I²t





AB DE-ION Circuit Breakers

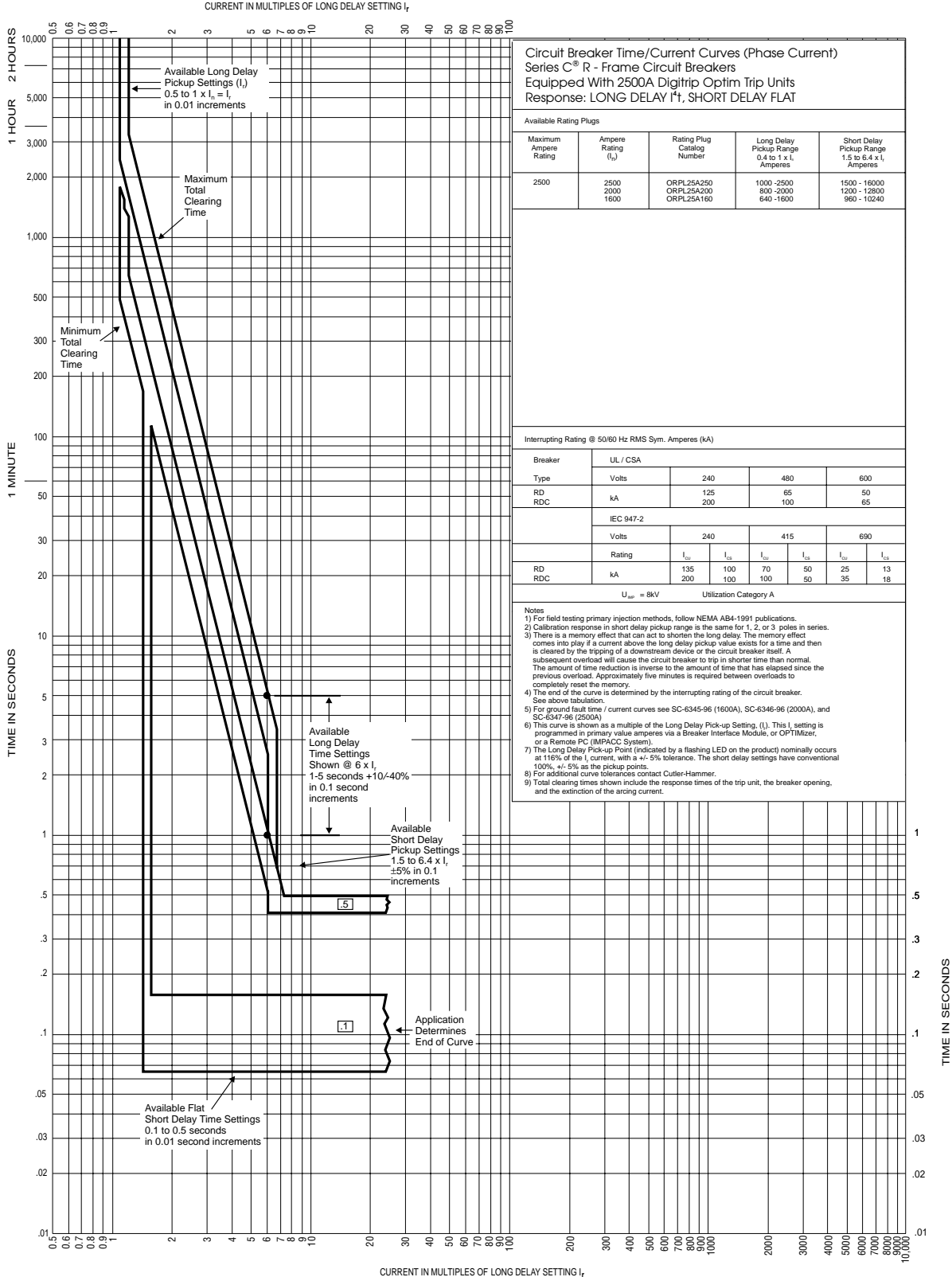
R-Frame Circuit Breakers Equipped with 2500A Digitrip OPTIM Trip Units; Long Delay I²t, Short Delay Flat





AB DE-ION Circuit Breakers

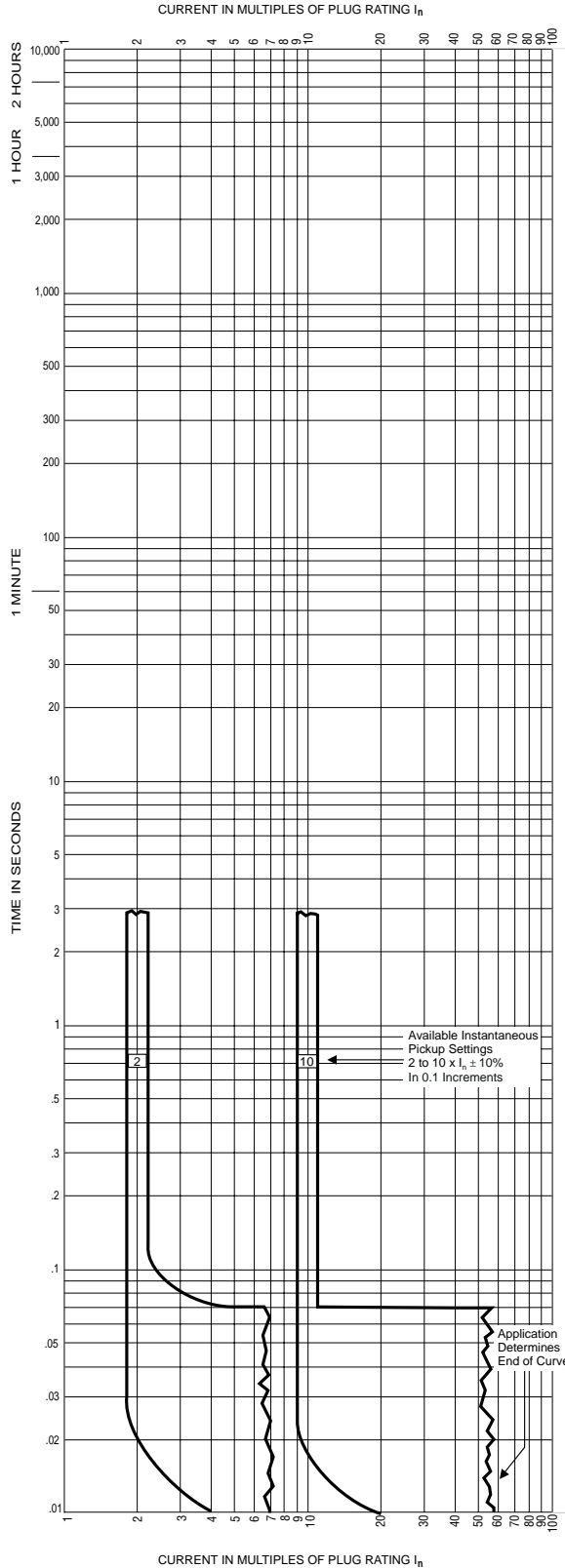
R-Frame Circuit Breakers Equipped with 2500A Digitrip OPTIM Trip Units; Long Delay I⁴t, Short Delay Flat





AB DE-ION Circuit Breakers

R-Frame Circuit Breakers Equipped with 1600A Digitrip OPTIM Trip Units; Instantaneous and Override



Circuit Breaker Time/Current Curves (Phase Current)
Series C[®] R - Frame Circuit Breakers
Equipped With 1600A Digitrip Optim Trip Units
Response: INSTANTANEOUS AND OVERRIDE

Available Rating Plugs

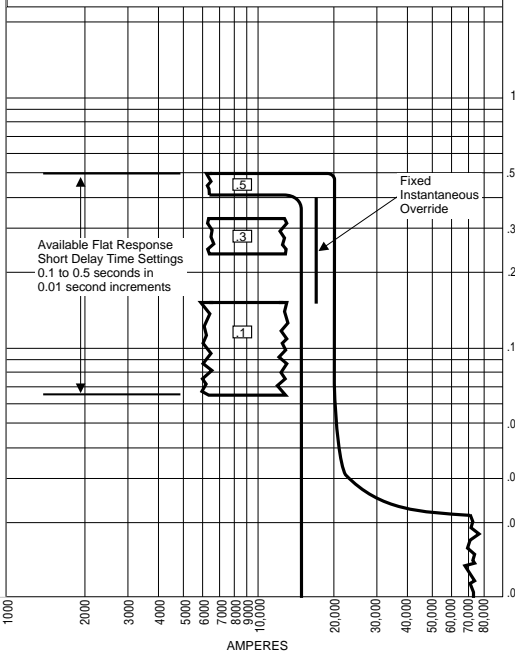
Maximum Ampere Rating	Ampere Rating (I _n)	Rating Plug Catalog Number	Instantaneous Pickup Range 2 to 10 x I _n Amperes	Override Amperes
1600	1600	ORPL16A160	3200 - 16000	14875 - 20125
	1250	ORPL16A125	2500 - 12500	14875 - 20125
	1200	ORPL16A120	2400 - 12000	14875 - 20125
	1000	ORPL16A100	2000 - 10000	14875 - 20125
	800	ORPL16A080	1600 - 8000	14875 - 20125

Interrupting Rating @ 50/60 Hz RMS Sym. Amperes (kA)

Breaker Type	UL / CSA						
	240		480		600		
RD, CRD	125		65		50		
RDC, CRDC	200		100		65		
IEC 947-2							
Volts							
Rating		240		415		690	
RD, CRD	kA	I _{cu}	I _{cs}	I _{cu}	I _{cs}	I _{cu}	I _{cs}
		200	100	70	50	25	13
RDC, CRDC	kA	I _{cu}	I _{cs}	I _{cu}	I _{cs}	I _{cu}	I _{cs}
		200	100	100	50	35	18

U_{imp} = 8kV Utilization Category A

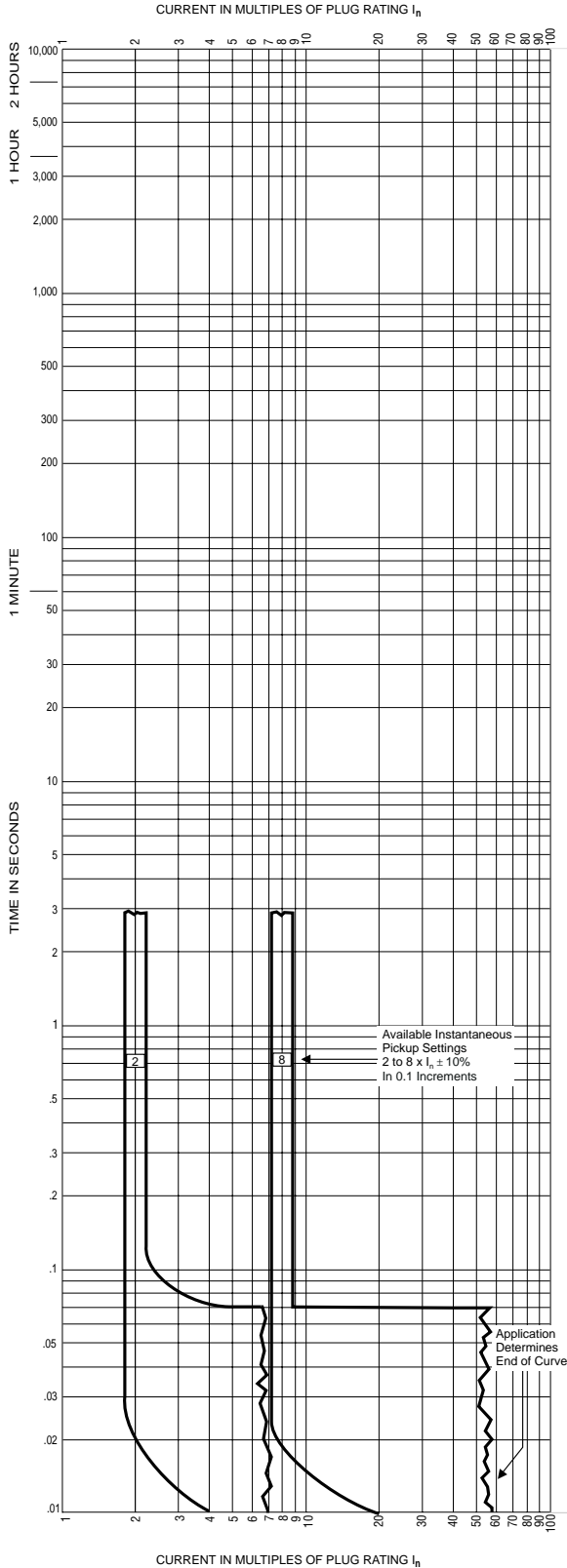
- Notes
- 1) For field testing primary injection methods, follow NEMA AB4-1991 publications.
 - 2) Calibration response in short delay pickup range is the same for 1, 2, or 3 poles in series.
 - 3) There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.
 - 4) The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
 - 5) For ground fault time / current curves see SC-6345-96 (1600A), SC-6346-96 (2000A), and SC-6347-96 (2500A).
 - 6) The instantaneous settings have conventional 100%, ± 10% as the pickup points.
 - 7) For additional curve tolerances contact Cutler-Hammer.
 - 8) Total clearing times shown include the response times of the trip unit, the breaker opening, and the extinction of the arcing current.





AB DE-ION Circuit Breakers

R-Frame Circuit Breakers Equipped with 2000A Digitrip OPTIM Trip Units; Instantaneous and Override



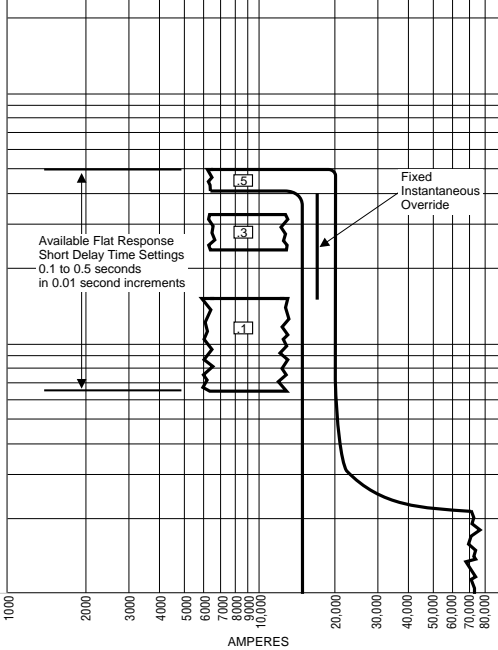
Circuit Breaker Time/Current Curves (Phase Current)
 Series C® R - Frame Circuit Breakers
 Equipped With 2000A Digitrip Optim Trip Units
 Response: INSTANTANEOUS AND OVERRIDE

Available Rating Plugs				
Maximum Ampere Rating	Ampere Rating (I _n)	Rating Plug Catalog Number	Instantaneous Pickup Range 2 to 8 x I _n Amperes ¹⁾	Override Amperes
2000	2000	ORPL20A200	4000 - 16000	14875 - 20125
	1600	ORPL20A160	3200 - 12800	14875 - 20125
	1250	ORPL20A125	2500 - 10000	14875 - 20125
	1200	ORPL20A120	2400 - 9600	14875 - 20125
	1000	ORPL20A100	2000 - 8000	14875 - 20125

Interrupting Rating @ 50/60 Hz RMS Sym. Amperes (kA)						
Breaker Type	UL / CSA					
	240		480		600	
RD, CRD	125		65		50	
RDC, CRDC	200		100		65	
Breaker Type	IEC 947-2					
	240		415		690	
Rating	I _{cs}	I _{cs}	I _{cs}	I _{cs}	I _{cs}	I _{cs}
	RD, CRD	135	100	70	50	25
RDC, CRDC	200	100	100	50	35	18

U_{max} = 8KV Utilization Category A

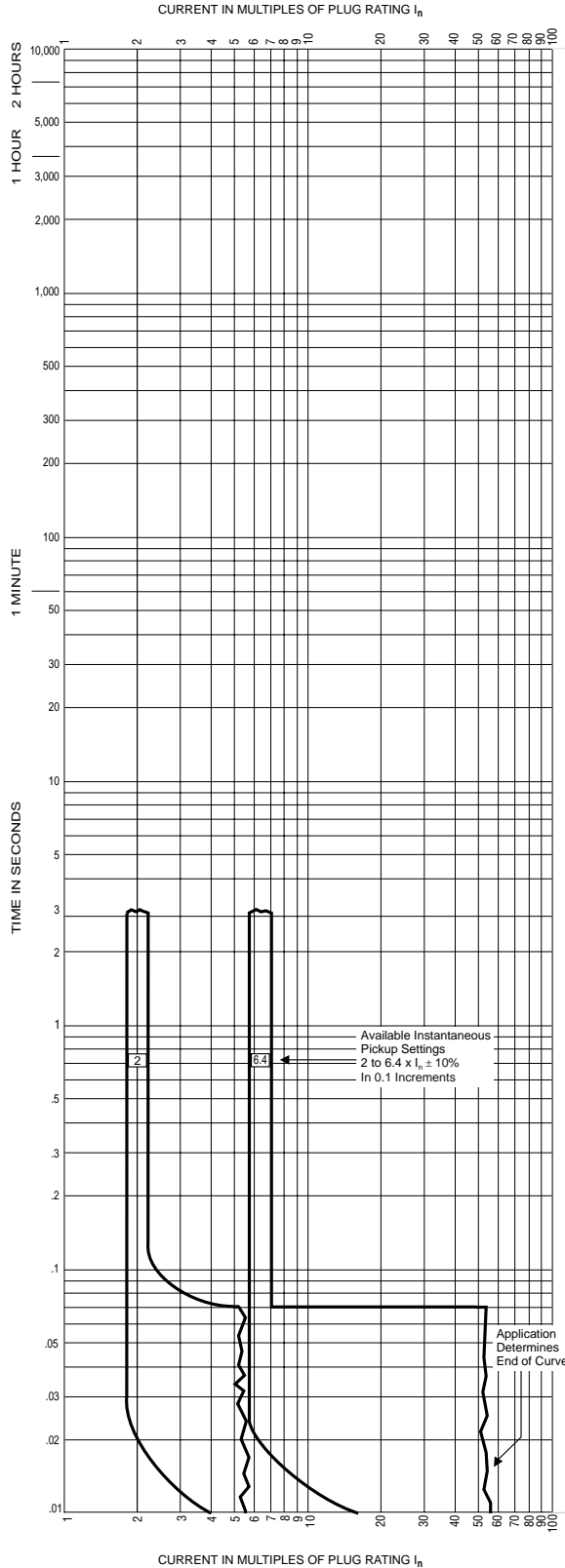
- Notes
- 1) For field testing primary injection methods, follow NEMA AB4-1991 publications.
 - 2) Calibration response in short delay pickup range is the same for 1, 2, or 3 poles in series.
 - 3) There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.
 - 4) The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
 - 5) For ground fault time / current curves see SC-6345-96 (1600A), SC-6346-96 (2000A), and SC-6347-96 (2500A).
 - 6) The instantaneous settings have conventional 100%, +/- 10% as the pickup points.
 - 7) For additional curve tolerances contact Cutler-Hammer.
 - 8) Total clearing times shown include the response times of the trip unit, the breaker opening, and the extinction of the arcing current.





AB DE-ION Circuit Breakers

R-Frame Circuit Breakers Equipped with 2500A Digitrip OPTIM Trip Units; Instantaneous and Override



Circuit Breaker Time/Current Curves (Phase Current)
Series C[®] R - Frame Circuit Breakers
Equipped With 2500A Digitrip Optim Trip Units
Response: INSTANTANEOUS AND OVERRIDE

Available Rating Plug

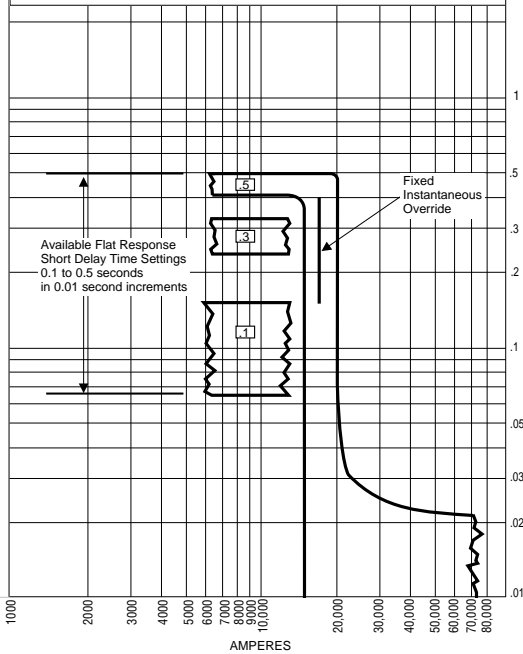
Maximum Ampere Rating	Ampere Rating (I_n)	Rating Plug Catalog Number	Instantaneous Pickup Range 2 to 6.4 x I_n Amperes	Override Amperes
2500	2500	ORPL25A250	5000 -16000	14875 -20125
	2000	ORPL25A200	4000 -12800	14875 -20125
	1600	ORPL25A160	3200 -10240	14875 -20125

Interrupting Rating @ 50/60 Hz RMS Sym. Amperes (kA)

Breaker	UL / CSA					
	240		415		690	
Type	Volts		Volts		Volts	
RD	125		65		50	
RDC	200		100		65	
IEC 947-2						
Volts						
Rating						
RD	135	100	70	50	25	13
RDC	200	100	100	50	35	18

$U_{sp} = 8kV$ Utilization Category A

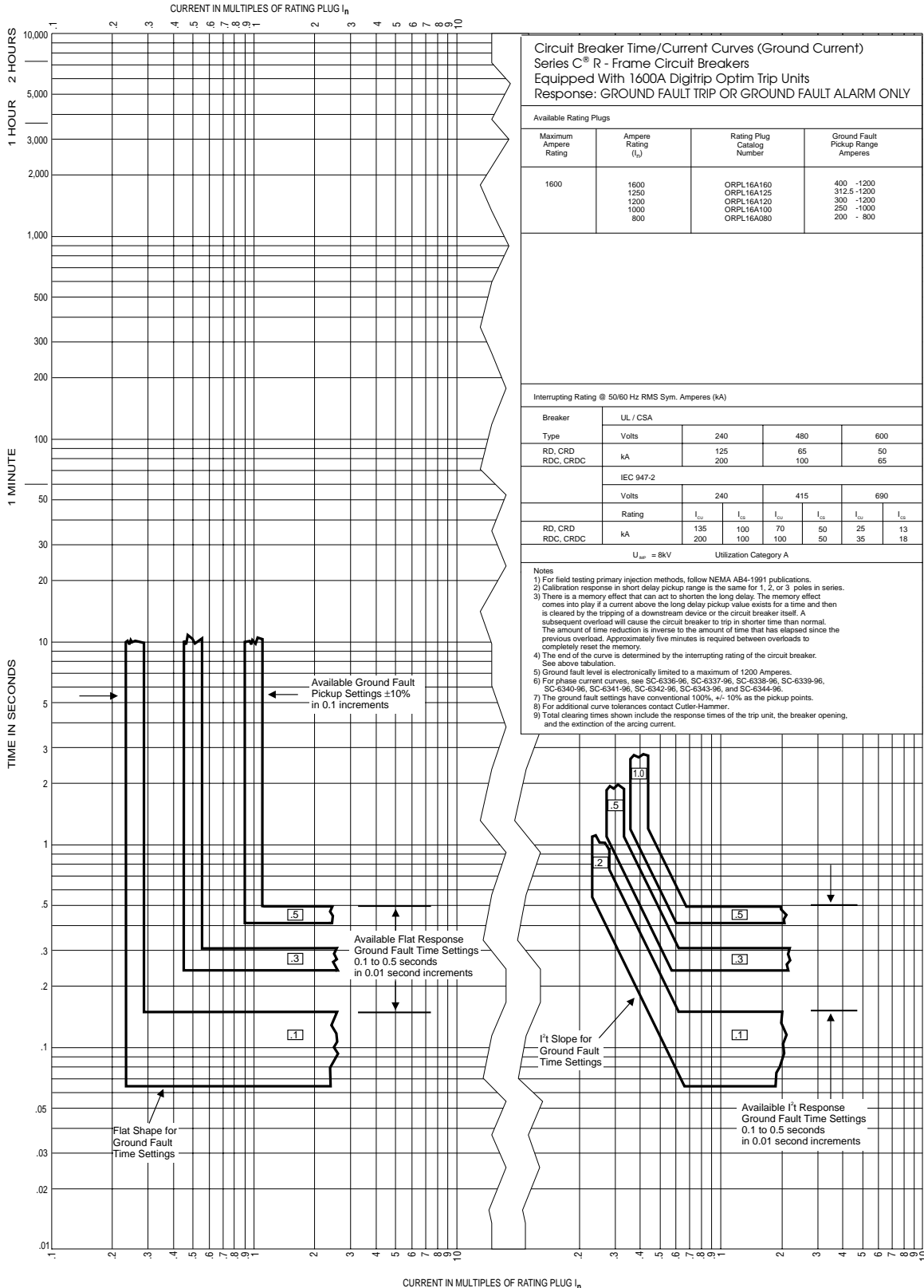
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- 1) For field testing primary injection methods, follow NEMA AB4-1991 publications.
 - 2) Calibration response in short delay pickup range is the same for 1, 2, or 3 poles in series.
 - 3) There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.
 - 4) The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
 - 5) For ground fault time / current curves see SC-6345-96 (1600A), SC-6346-96 (2000A), and SC-6347-96 (2500A).
 - 6) The instantaneous settings have conventional 100%, +/- 10% as the pickup points.
 - 7) For additional curve tolerances contact Cutler-Hammer.
 - 8) Total clearing times shown include the response times of the trip unit, the breaker opening, and the extinction of the arcing current.





AB DE-ION Circuit Breakers

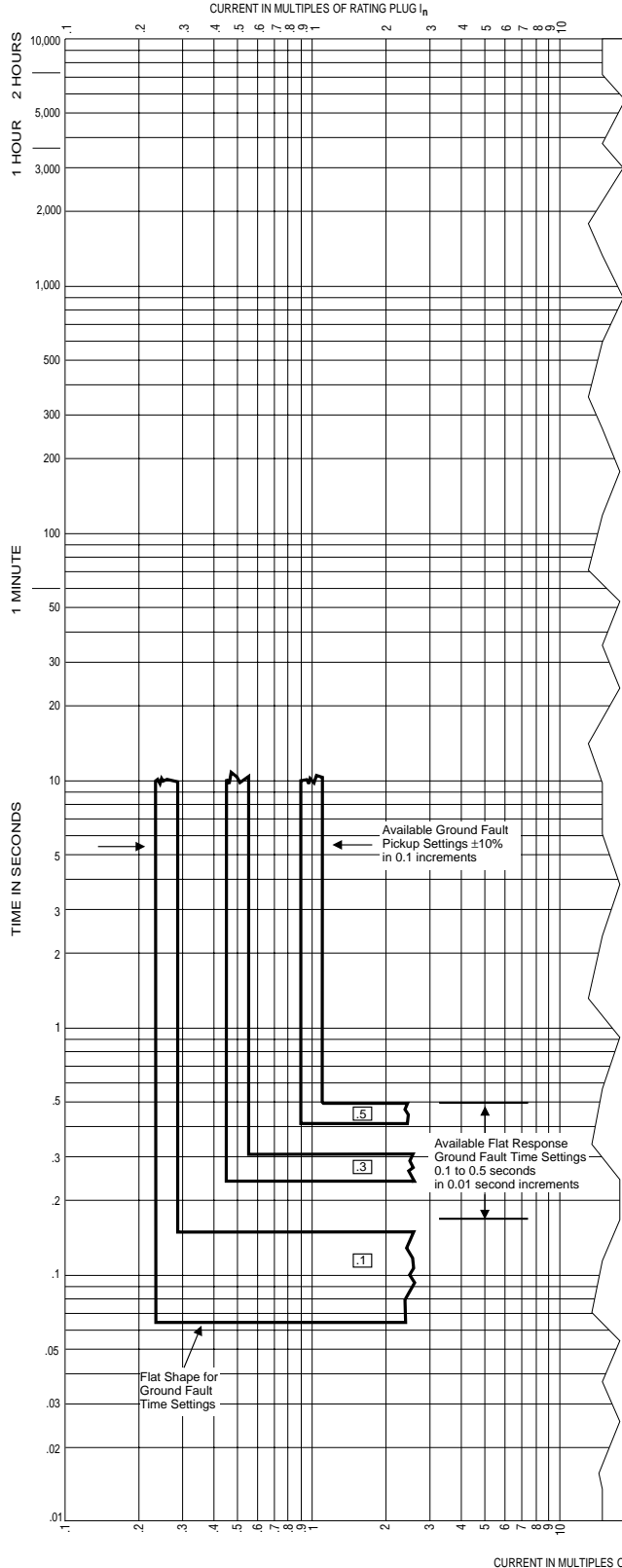
R-Frame Circuit Breakers Equipped with 1600A Digitrip OPTIM Trip Units; Ground Fault or Ground Fault Alarm Only





AB DE-ION Circuit Breakers

R-Frame Circuit Breakers Equipped with 2000A Digitrip OPTIM Trip Units; Ground Fault or Ground Fault Alarm Only



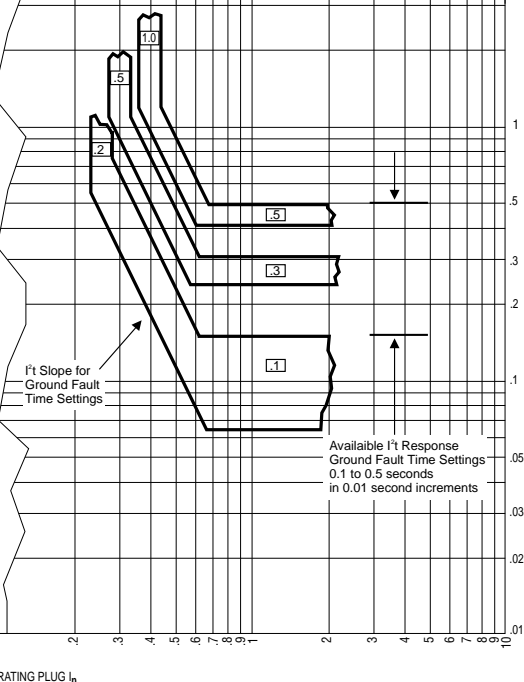
Circuit Breaker Time/Current Curves (Ground Current)
Series C® R - Frame Circuit Breakers
Equipped With 2000A Digitrip Optim Trip Units
Response: GROUND FAULT TRIP OR GROUND FAULT ALARM ONLY

Available Rating Plugs			
Maximum Ampere Rating	Ampere Rating (I _n)	Rating Plug Catalog Number	Ground Fault Pickup Range Amperes
2000	2000	ORPL20A200	500 -1200
	1600	ORPL20A160	400 -1200
	1250	ORPL20A125	312.5 -1200
	1000	ORPL20A100	300 -1200
	1000	ORPL20A100	250 -1000

Interrupting Rating @ 50/60 Hz RMS Sym. Amperes (KA)						
Breaker Type	UL / CSA					
	Volts	240	480	600		
RD, CRD	kA	125	65	50		
RDC, CRDC	kA	200	100	65		
IEC 947-2						
Breaker Type	Volts					
	Rating	240	415	690		
RD, CRD	kA	135	100	70	50	25
RDC, CRDC	kA	200	100	100	50	35

U_{imp} = 8kV Utilization Category A

- Notes
- 1) For field testing primary injection methods, follow NEMA AB4-1991 publications.
 - 2) Calibration response in short delay pickup range is the same for 1, 2, or 3 poles in series.
 - 3) There is a memory effect that can act to shorten the long delay. The memory effect comes into play if a current above the long delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in shorter time than normal. The amount of time reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately five minutes is required between overloads to completely reset the memory.
 - 4) The end of the curve is determined by the interrupting rating of the circuit breaker. See above tabulation.
 - 5) Ground fault level is electronically limited to a maximum of 1200 Amperes.
 - 6) For phase current curves, see SC-6336-96, SC-6337-96, SC-6338-96, SC-6339-96, SC-6340-96, SC-6341-96, SC-6342-96, SC-6343-96, and SC-6344-96.
 - 7) The ground fault settings have conventional 100%, +/- 10% as the pickup points.
 - 8) For additional curve tolerances contact Cutler-Hammer.
 - 9) Total clearing times shown include the response times of the trip unit, the breaker opening, and the extinction of the arcing current.





AB DE-ION Circuit Breakers

R-Frame Circuit Breakers Equipped with 2500A Digitrip OPTIM Trip Units; Ground Fault or Ground Fault Alarm Only

