

# SIEMENS

## I-T-E<sup>®</sup> Molded Case Circuit Breakers

FD-Frame  
Information and  
Instruction Guide



# Information and Instruction Guide

## General Information

### General

FD-Frame Sentron™ Series circuit breakers, as shown on pages 5 and 6 are for use in individual enclosures, switchboards and panelboards. They are available as thermal magnetic with interchangeable trip unit (types FD6-A, HFD6), thermal magnetic with non-interchangeable trip unit (type FXD6-A), suitable for reverse feed applications, current limiting (type CFD6) instantaneous magnetic only (motor circuit protectors—types FXD6-ETI, CFD6-ETI) and molded case switches (types FXD6, CFD6).

HHFD6 and HHFXD6 type circuit breakers have been designed to extend the interruption capabilities without the use of a second set of contacts as used in the current limiting CFD6 design. HFD6, HFXD6, HHFXD6 and HHFD6 type circuit breakers meet current limiting criteria at 240 and 480 VAC.

CFD6 circuit breakers combine thermal magnetic construction for overload protection and an additional set of “blow-apart” contacts in conjunction with the FD-Frame’s standard “blow-apart” contacts. This arrangement provides for current limiting protection under high fault interrupting conditions as outlined in the National Electric Code, Article 240-11<sup>①</sup> and UL 489<sup>②</sup> standards. CFD6 circuit breakers are fuseless and therefore require no blown fuses to be located and replaced should a high current fault occur. The common trip feature of the circuit breakers is completely retained so that all poles of the circuit breaker are open when caused to trip due to and overload or short circuit.

Pressure wire connectors, suitable for use with aluminum or copper wire, are available for all FD-Frame circuit breakers. Rear connection studs or plug-in connector assemblies are also available (2 and 3-pole). The latter mounting arrangement permits removal of the circuit breaker from a circuit without removing wiring leads. Special features such as a shunt trip, auxiliary and alarm switches and undervoltage trip devices are available for field adaptation. The installation and removal of these devices are mounted internally and Underwriters Laboratories listed, page 54. Information concerning these special devices is found on pages 18-23 and 53.

### Thermal Magnetic

FXD6-A, FD6-A, HFD6, HFXD6, HHFD6, HHFXD6, CFD6 type circuit breakers provide complete overload and short circuit protection when applied within their design parameters. Overload and short circuit tripout is accomplished by time-delay thermal trip elements and instantaneous magnetic trip devices. Nominal instantaneous trip values are externally adjustable with eight trip points as shown below.

Breaker Ampere Rating	Nominal Instantaneous Values <sup>③</sup>							
	Low	2	3	4	5	6	7	High
70 - 90	600	640	690	730	770	810	850	900
100 - 110	700	770	840	920	990	1060	1140	1200
125 - 150	800	800	1000	1100	1200	1300	1400	1500
175 - 200	900	1060	1210	1370	1520	1780	1930	2000
225 - 250	1100	1100	1500	1700	1900	2100	2300	2500

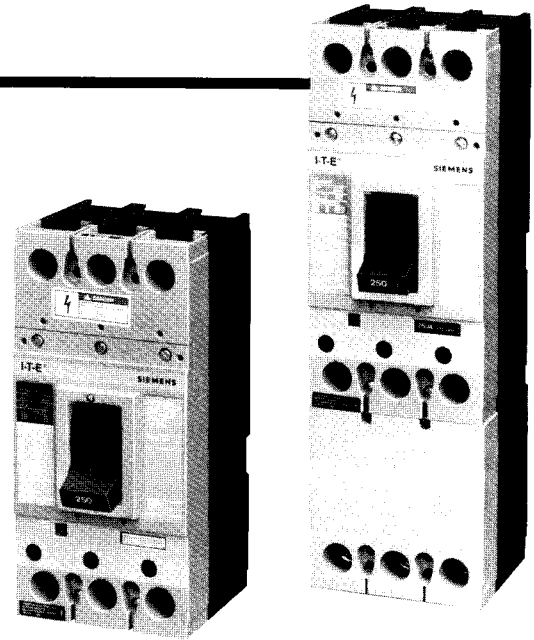
<sup>①</sup> National Electric Code (240-11)

“A current limiting overcurrent protective device, which when interrupting currents in its current limiting range, will reduce the current flowing in the faulted circuit to a magnitude substantially less than that obtainable in the same circuit, if the device were replaced with a solid conductor having comparable impedance.”

<sup>②</sup> Underwriters Laboratories (UL 489, Par. 2.5)

“A circuit breaker that does not employ a fusible element and that when operating within its current limiting range, limits the let-through  $I^2t$  to a value less than the  $I^2t$  of a 1/2 cycle wave of the symmetrical prospective current.”

<sup>③</sup> All values based on tolerance levels covered by UL 489 standards.



Circuit breakers are calibrated at the factory, under controlled temperature conditions for application at 40°C (104°F) ambient to meet requirements as outlined in UL 489 Standard for molded case circuit breakers. The cover on the trip unit is sealed to prevent access to the trip elements. Alterations of the calibration of these elements should not be attempted. Removal of the special sealed line cover voids the Underwriters Laboratories, Inc. listing for that specific circuit breaker. Catalog information is found on pages 50-52.

### Molded Case Switch

A molded case switch is available in the FXD6 and CFD6 type circuit breakers. This device employs the same operating mechanism as the thermal magnetic and magnetic only units. A preset instantaneous function is factory installed to allow the switch to trip and protect itself at a high fault condition. No overload or low fault current protection is provided. This protection must be supplied by separate overcurrent devices. Catalog information is located on pages 50 and 51.

### Interrupting Ratings—Symmetrical RMS Amperes (kA) Based on UL 489 Standards, UL File #E10848

Breaker Type	RMS Symmetrical Amperes (kA)				
	UL A.I.R.				
	AC			DC	
	240	480	600	250	500 <sup>②</sup>
FXD6-A, FD6-A	65	35	22	30 (2-P)	18 (3-P)
HFD6, HFXD6	100	65	25	30 (2-P)	25 (3-P)
HHFD6, HHFXD6	200	100	25	—	—
CFD6	200	200	100	30 (2-P)	50 (3-P)

Breaker Type	RMS Symmetrical Amperes (kA)					
	IEC A.I.R. <sup>①</sup>					
	Volts AC (50/60 Hz)					
	220/240		380/415		500	
	(lcu)	(lcs)	(lcs)	(lcs)	(lcu)	(lcs)
FXD6-A, FD6-A	65	33	35	18	20	10
HFD6, HFXD6	100	50	65	33	42	21
HHFD6, HHFXD6	200	100	100	50	65	33
CFD6	—	—	—	—	—	—

<sup>①</sup> Meets requirements of IEC 947-2.

<sup>②</sup> For 500 V dc application the customer’s power supply and load must be wired as shown in Figure 1 on page 4. Interrupting ratings only apply to breakers used in UPS systems.

# Information and Instructions

## Operation and Maintenance

### Instantaneous Trip

ETI motor circuit interrupters, types FXD6-ETI, CFD6-ETI (adjustable instantaneous magnetic trip only) are designed for use in welding circuits, motor circuits and combination starters where short circuit protection only is required. When used in combination starters, they serve in conjunction with motor protective relays to offer complete protection. The relays guard against motor overloads and the circuit breaker provides short circuit protection. Catalog information is located on page 53.

### Instantaneous Trip Adjustments

Motor Full Load Amperes	ETI Trip Setting <sup>①</sup>		Ampere Rating
	Adjustment	Amperes	
30.76- 35.37	Low	400	150 Low
35.38- 39.99	2	460	
40.00- 44.60	3	520	
44.51- 49.23	4	580	
49.23- 53.83	5	640	
53.84- 58.45	6	700	
58.46- 63.06	7	760	
63.07- 74.50	High	820	
61.53- 69.22	Low	800	150 Standard
69.23- 76.91	2	900	
76.92- 84.60	3	1000	
84.61- 92.99	4	1100	
92.30- 99.99	5	1200	
100.00- 108	6	1300	
108- 115	7	1400	
115- 136	High	1500	
85- 100	Low	1100	250 Standard
100- 115	2	1300	
115- 130	3	1500	
131- 146	4	1700	
146- 162	5	1900	
162- 177	6	2100	
177- 192	7	2300	
192- 227	High	2500	

<sup>①</sup> All values calibrated within guidelines of UL 489.  
Low setting: -20%, +30%  
High setting: -20%, +30%

### Circuit Breaker Operation

With the mechanism latched and the contacts open, the operating handle will be in the OFF position. Moving the handle to the ON position closes the contacts and establishes a circuit through the breaker. Under overload or short circuit conditions sufficient to automatically trip or open the breaker, the operating handle moves to a position between ON and OFF. To relatch the circuit breaker after automatic operation, move the operating handle to the extreme OFF position. The circuit breaker is now ready for reclosing.

The overcenter toggle mechanism is trip free of the operating handle. The circuit breaker, therefore, cannot be held closed by means of the handle should a tripping condition exist. After automatic operation, the handle assumes an intermediate position between ON and OFF, displaying a clear indication of tripping.

### Maintenance

Experience has shown that properly applied molded case circuit breakers normally do not require maintenance. However, some industrial users may choose to establish an inspection and maintenance procedure to be carried out on a regular basis. For detailed information, consult applicable NEMA publications or your local Siemens sales office.

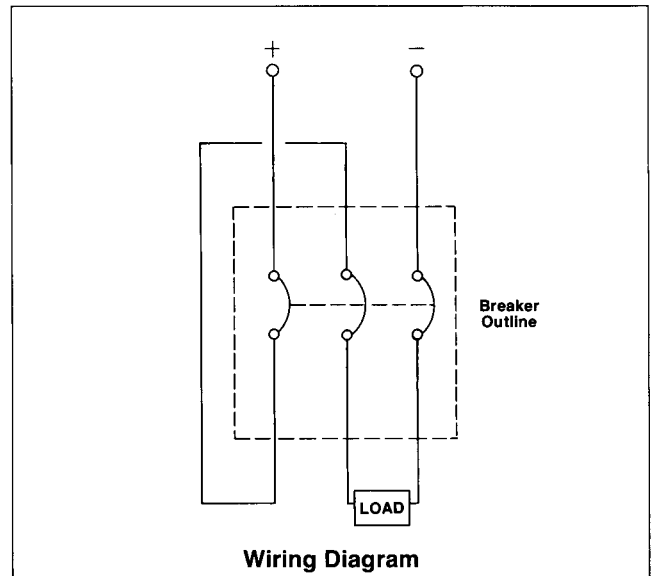


Figure 1

### SPECIAL NOTE:

FXD6-A, HFXD6, HHFXD6, AND CFD6 circuit breakers are not UL listed as interchangeable trips—DO NOT REMOVE TRIP UNIT and replace with another. Removal of trip unit voids UL listing.

FXD6-A, HFXD6, and HHFXD6 circuit breakers are also UL listed for reverse feed applications.

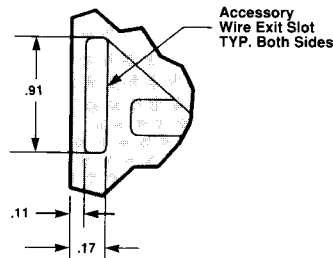
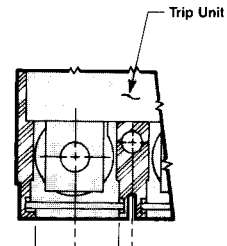
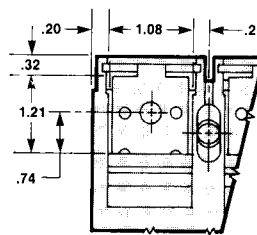
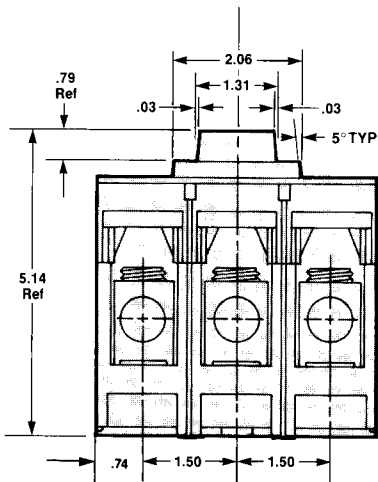
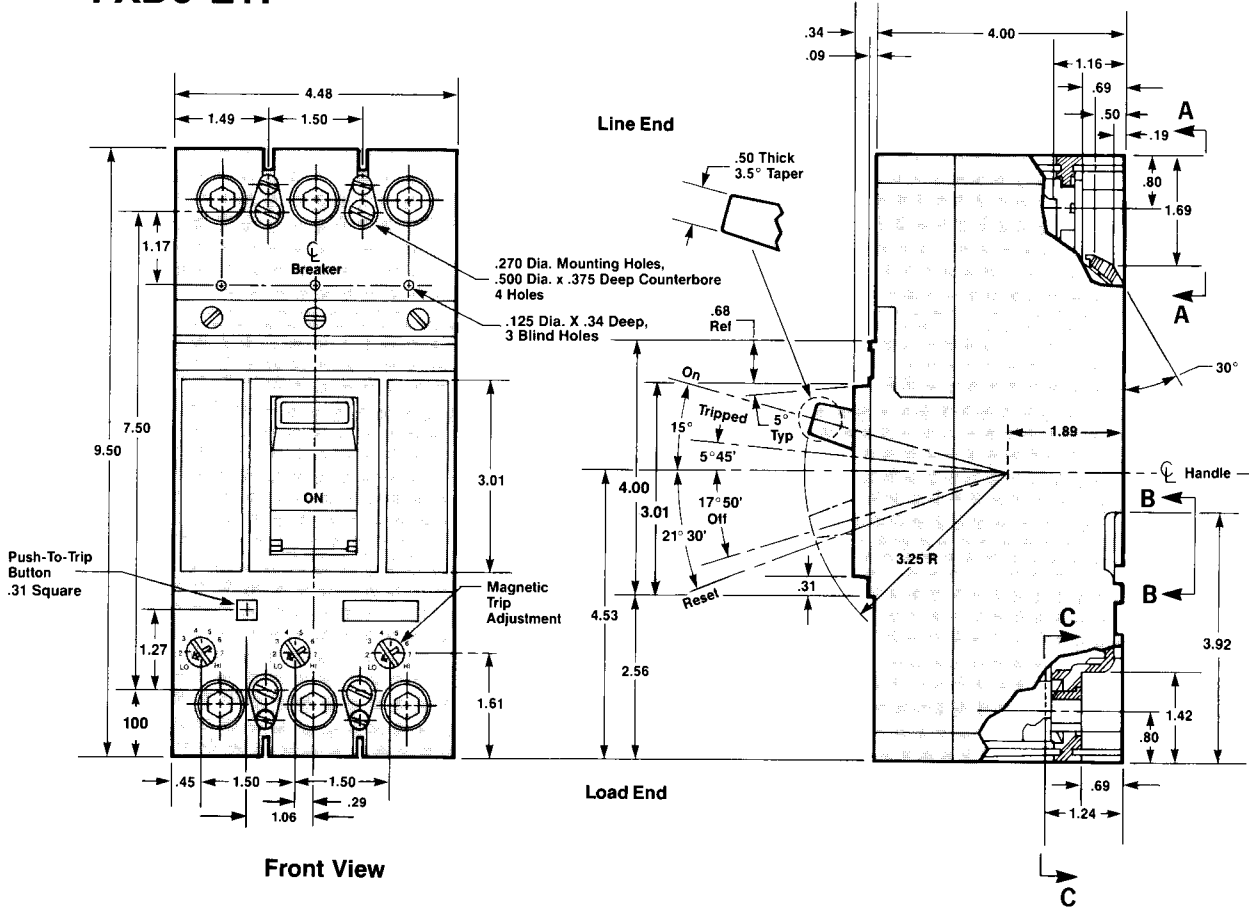
**Note:** Molded case circuit breakers are designed and tested to be applied in accordance to applicable portions of the National Electric code. For example, all molded case thermal magnetic circuit breakers are rated for 80% duty at 40°C unless marked otherwise.

Molded case circuit breakers are to be connected with 60°C or 70°C wire for circuit breakers having a rated ampacity of 125 amperes or less. Circuit breakers having a rated ampacity greater than 125 amperes shall only be cabled with 75°C cable.

Exceptions to this rule are outlined in article 110, section 110-14C (1) and (2) of the National Electric Code.

# I-T-E FD-Frame Outline Drawings<sup>①</sup>—2 and 3-Pole<sup>②</sup>

Types FXD6, FD6, FXD6A, FD6A, HFD6, HFXD6, HHFD6, HHFXD6, FXD6-ETI



## Handle Operating Forces

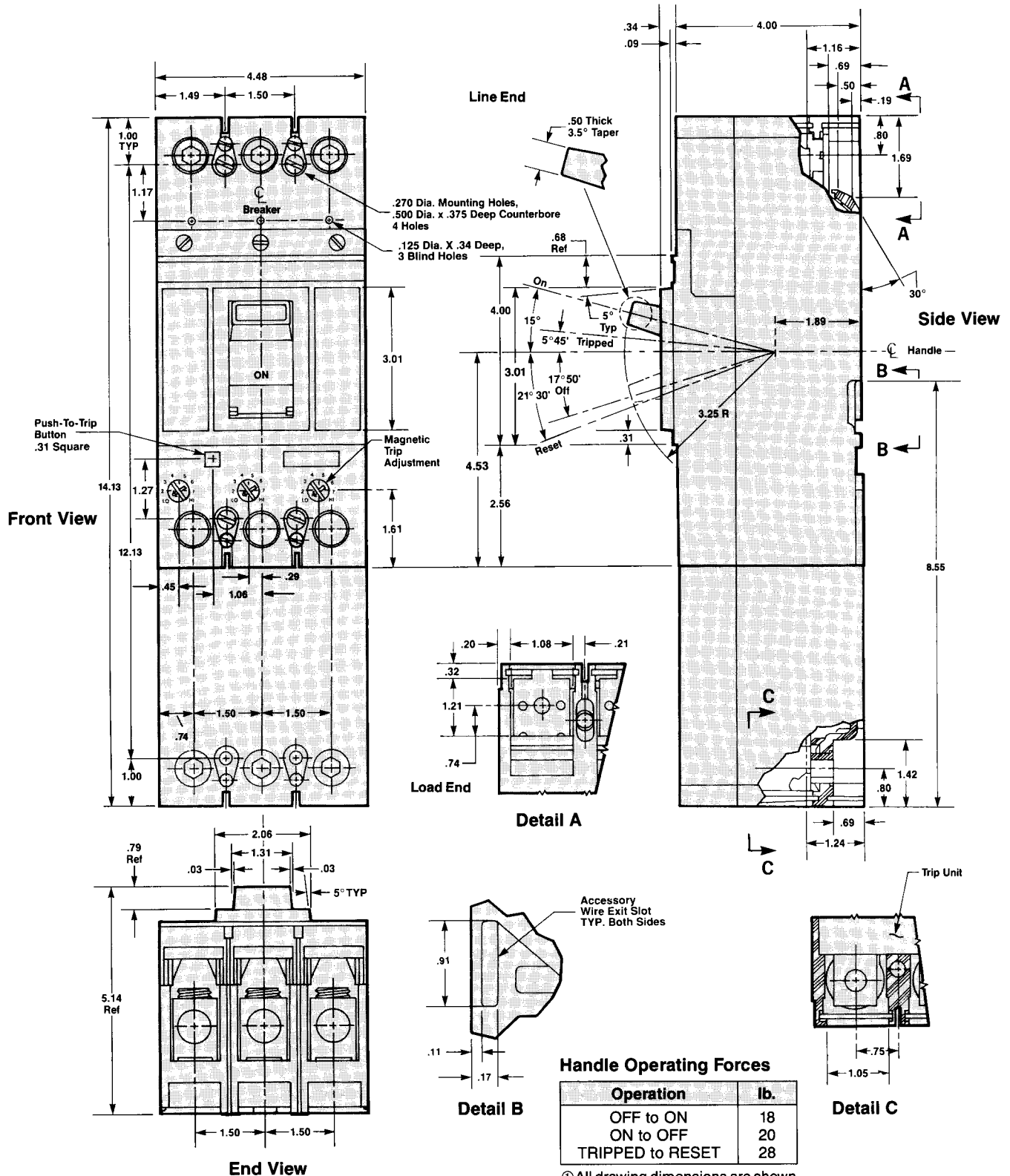
Operation	Ib.
OFF to ON	18
ON to OFF	20
TRIPPED to RESET	28

① All drawing dimensions are shown in inches.


② Two and 3-pole breakers are the same physical size. Current carrying parts are omitted from the center pole in 2-pole breakers.

# I-T-E FD-Frame Outline Drawings<sup>①</sup>—2 and 3-Pole<sup>②</sup>

## Types CFD6, CFD6-ETI



# I-T-E Pressure Wire Connectors



**⚠ DANGER**  
**Hazardous Voltage.**  
**Will cause death or severe injury.**

Turn power off supplying switch-board or panel before installing.

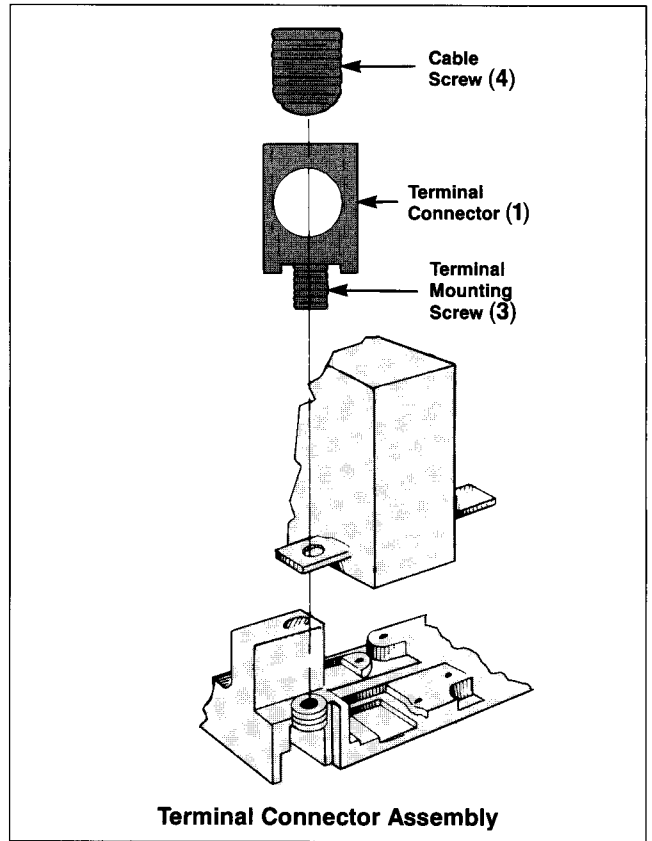
**⚠ SAFETY INSTRUCTIONS**

- A. Place terminal connector body (1) (Figure 1) into terminal cavities (2) (Figure 2).
- B. Torque terminal mounting screw (3) to specified torque value.
- C. Place cable set screw (4) into threaded body opening. After cable has been inserted into cable cavity, torque cable set screw to specified value.

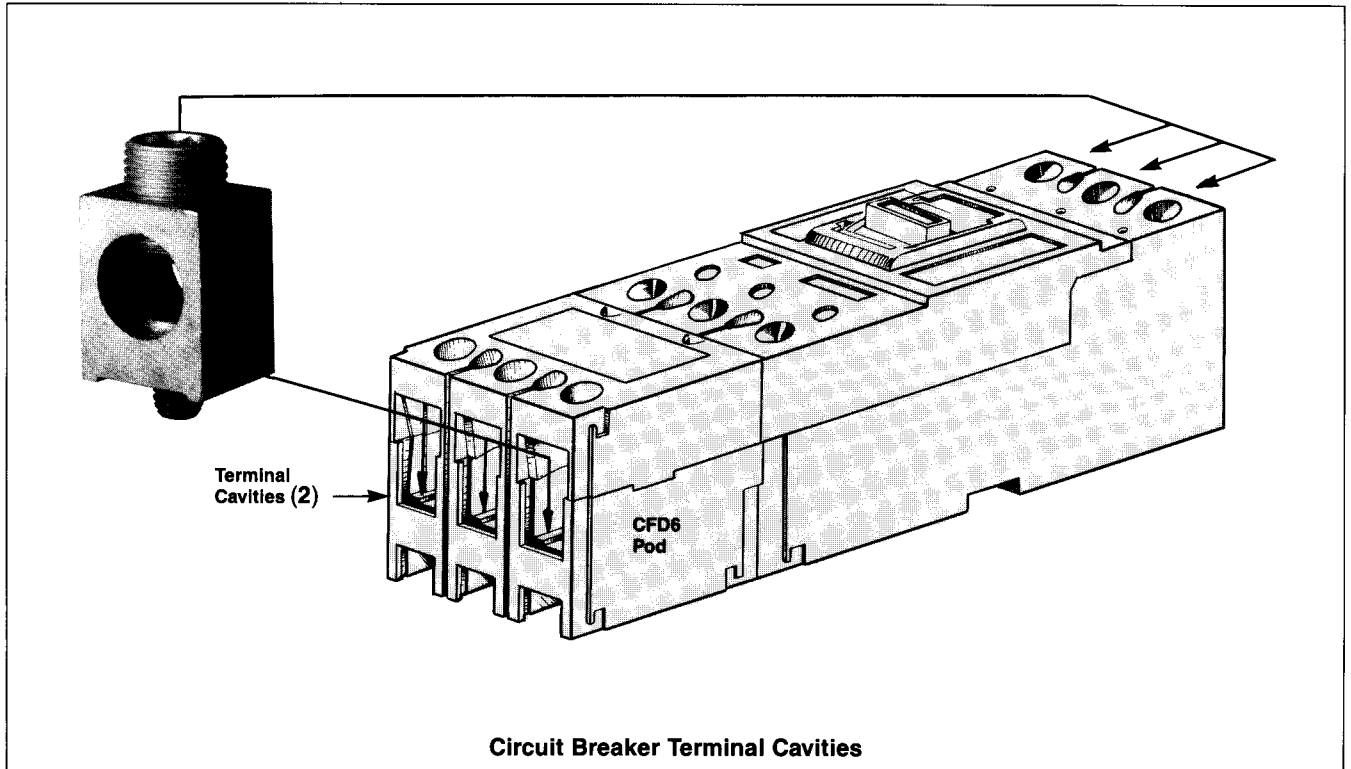
**Solderless Connector Torque Values**

Catalog Number	Terminal Screw Torque	Cable Screw Torque	Cable Range
TA1F 350	175 in. lb.	375 in. lb.	#6-350 kcmil Cu #4-350 kcmil Al
TC1F 350	175 in. lb.	375 in. lb.	#6-350 kcmil Cu
TA1FD 350	①	①	#6-350 kcmil Cu #4-350 kcmil Al
TC1FD 350	①	①	#6-350 kcmil Cu

① Consult instructions supplied with connector body.



**Figure 1**



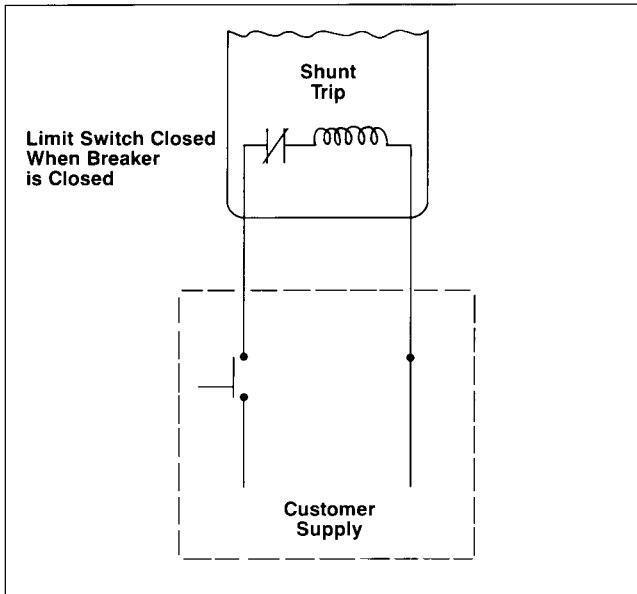
**Figure 2**

# I-T-E Shunt Trip and Undervoltage Trip

## Electrical Check

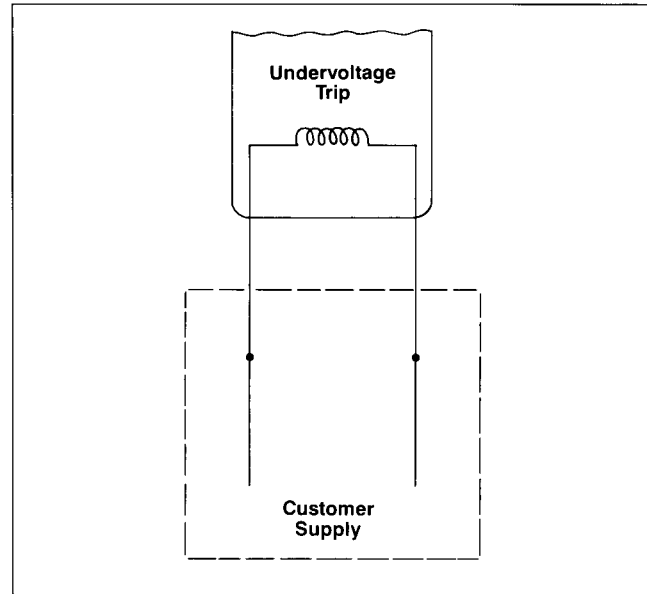
### Shunt Trip

- Reset and turn circuit breaker ON.
- Attach test circuit to accessory leads. When the test voltage reaches 55 percent or more of the rated coil voltage, the circuit breaker should trip.
- With breaker TRIPPED or OFF, check to make sure coil circuit has opened.



### Undervoltage Trip

- With breaker in TRIPPED position, connect test circuit to accessory leads. Energize undervoltage trip device at 85 percent of the marked rated voltage of the coil. Reset and turn breaker handle ON.
- Reduce voltage to 35 percent of rated coil voltage. Circuit breaker must trip. (Undervoltage device must trip between 70 and 35 percent of rated voltage.)



### Electrical Data For Shunt Trip

Coil Voltage	Inrush Current At Rated Voltage (Amperes)		Catalog Number
	60 Cycles AC	UL (60 Hz) / IEC 947-2 (50 Hz)	
12	3.9	4.6	S19FD60
24	1.2	2.0	S17FD60
48	.8	1.0	S18FD60
120	0.395	.462/.577	S01FD60
208	0.265	—	S02FD60
240	0.165	.206/.237	S03FD60
277	0.190	—	S15FD60
480	0.145	.123/.187	S04FD60
600	0.080	—	S06FD60
<b>DC</b>			
12	—	4.3	S16FD60
24	2.2	2.2	S07FD60
48	1.2	1.2	S09FD60
125	0.5	.57/.66	S11FD60
250	0.35	.39/.45	S13FD60

### Electrical Data For Undervoltage (UV) Trip<sup>① ②</sup>

Coil Voltage	Sealed-In Current At Rated Voltage (Amperes)	Catalog Number	
		1 UV Trip Plus 1 Aux. Sw.	1 UV Trip Only
<b>60 Cycles AC</b>			
120	.03	W01FD64	U01FD60
208	.018	W02FD64	U02FD60
240	.016	W03FD64	U03FD60
277	.013	W16FD64	U16FD60
480	.008	W06FD64	U06FD60
600 <sup>③</sup>	.008	W08FD64	U08FD60
<b>DC</b>			
24	.11	W13FD64	U13FD60
48	.06	W14FD64	U14FD60
125	.027	W10FD64	U10FD60
250 <sup>④</sup>	.02	W12FD64	U12FD60

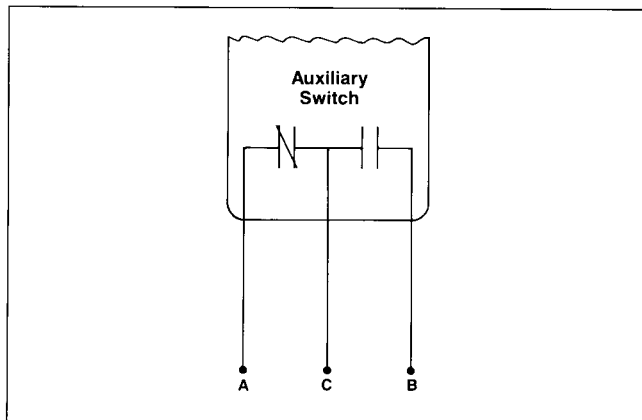
- Resistor to be mounted externally and connected by installer in series with undervoltage supply circuit.
- All auxiliary switch ratings are the same as auxiliary switch kit A01FD64.
- Kit includes a 30k ohm, 25 watt resistor (Clarostat Cat. No. VP-25-K or equivalent).
- Kit includes a 2.5k ohm, 25 watt resistor (Clarostat Cat. No. VP-25-K or equivalent).

# I-T-E Auxiliary Switch and Bell Alarm

## Electrical Check

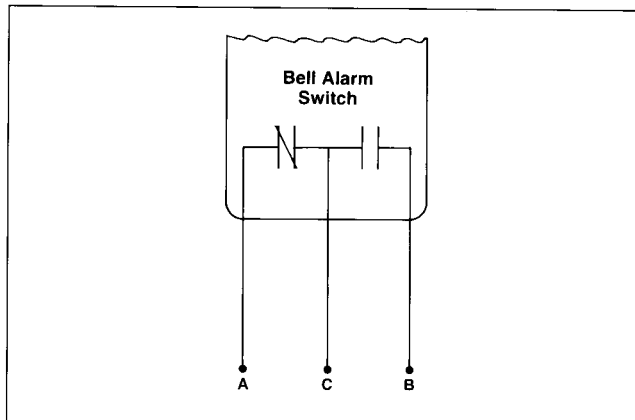
### Auxiliary Switch Kits

Catalog Number	Number of Switches	Ampere Rating of Switch				
		Volts AC			Volts DC	
		120	240	480	125	250
A01FD62	1	7.2	7.2	—	0.5	0.25
A02FD62	2	7.2	7.2	—	0.5	0.25
A01FD64	1	7.2	7.2	7.2	0.5	0.25
A02FD64	2	7.2	7.2	7.2	0.5	0.25



### Bell Alarm Switch Kits

Catalog Number	Number Of Auxiliary Switches	Ampere Rating of Switch				
		Volts AC			Volts DC	
		125	250	480	125	250
B00FD64	0	7.2	7.2	7.2	0.50	0.25
C01FD64	1	7.2	7.2	7.2	0.50	0.25



### Switch Identification (All With Three Leads)

Wire Markings	Wire Color	Switch Terminals or Contacts
C or C1	White	C - Common terminal
A or A1	Black	N.O. - Contact open when breaker is open, closed when breaker is closed.
B or B1	Red	N.C. - Contact closed when breaker is open, open when breaker is closed.

Accessory units that employ a combination will have the same wiring colors or identifiers. A double auxiliary switch combination will use wiring markings A-A1, B-B1 and C-C1.

#### Auxiliary Switch ①

- Use a buzzer or light indicator attached to switch leads A and C. With breaker in ON position, indicator light or buzzer should operate.
- Move handle to OFF position. Indicator light or buzzer should turn off.
- Attach test to leads B and C. Light or buzzer should turn on.
- Repeat steps A through C using leads A1, B1 and C1.
- Move handle to ON position. Indicator light or buzzer should turn off.

① Should the indicator not function properly during "check" procedure, check for incorrect installation or wiring.

### Bell Alarm Identification (All With Three Leads)

Wire Markings	Wire Color	Switch Terminals or Contacts
C	White	C - Common terminal
A	Yellow	N.C. - Normally closed contact (Closed when circuit breaker is tripped.)
B	Brown	N.O. - Normally open contact (Open when circuit breaker is tripped.)

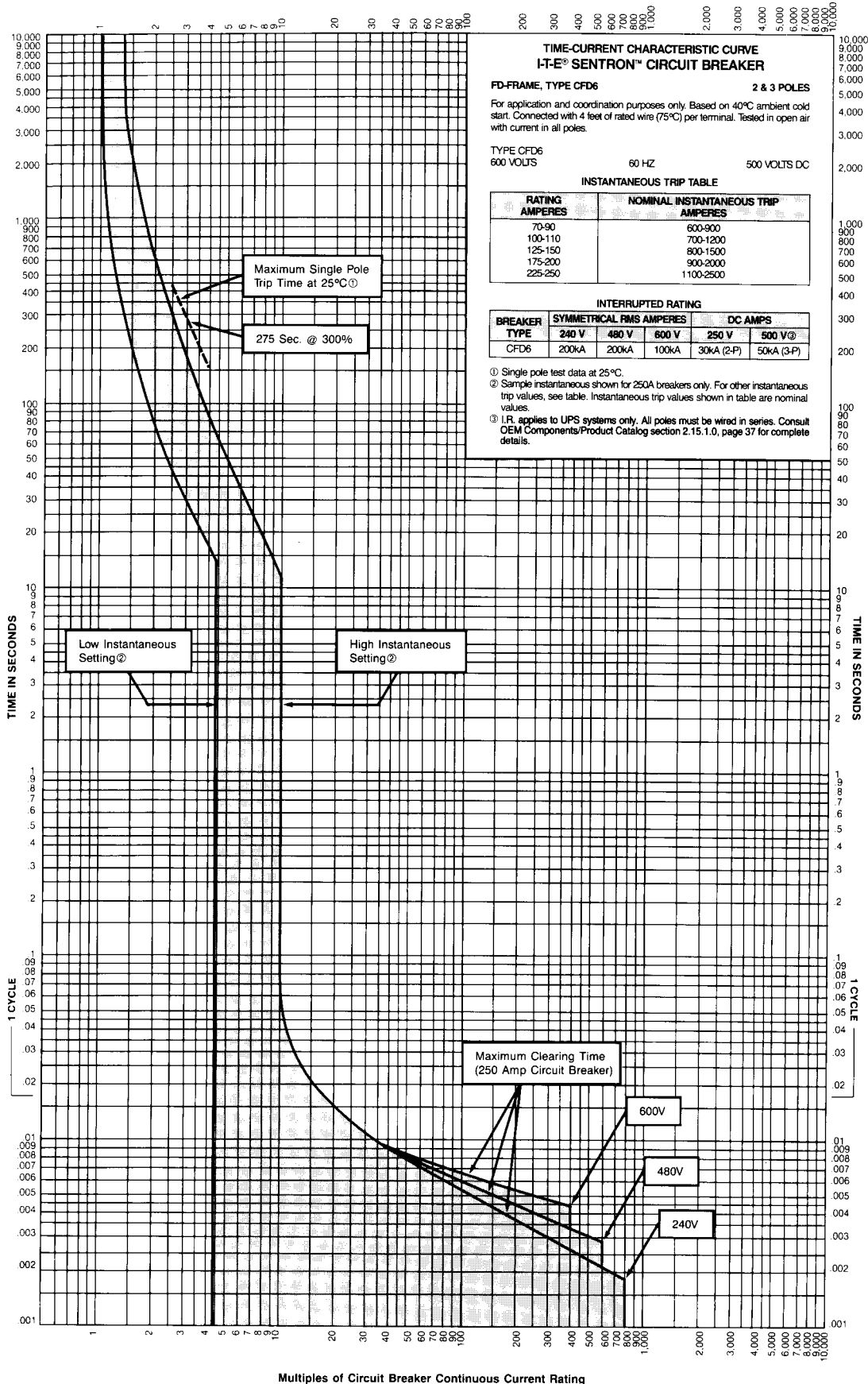
#### Bell Alarm Switch ①

- Use a buzzer or light indicator attached to switch leads A and C. With breaker in ON position, trip breaker by depressing red PUSH TO TRIP button. Indicator light or buzzer should operate.
- Reset breaker to OFF. Indicator light or buzzer should turn off.
- Move breaker handle to ON. Indicator light or buzzer should remain off.



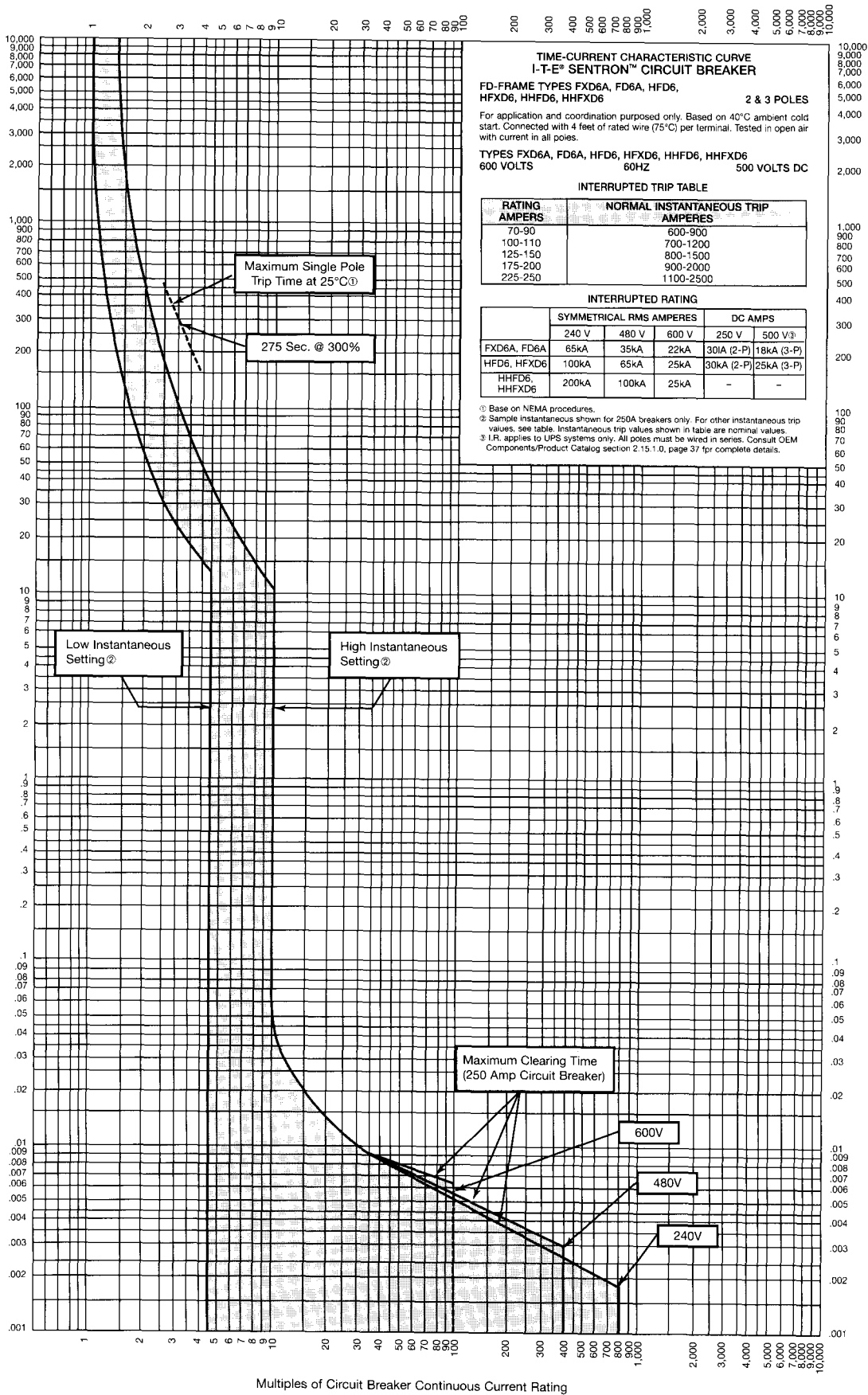
# FD-Frame Time Current Curve

## Type CFD6



# FD-Frame Time Current Curve

## Types FXD6A, FD6A, HFXD6, HFD6, HHFD6, HHFXD6A



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