

## F-Frame

## F-Frame



Typical F-Frame Breaker



F-Frame Breaker with Electronic Trip Unit

### Product Description

- All Eaton's Cutler-Hammer F-Frame Circuit Breakers by are HACR rated.
- All circuit breakers 10 through 30 amperes are suitable for HID (high intensity discharge) use.
- All F-Frame circuit breakers are suitable for reverse feed use

### Technical Data and Specifications

Table 12-148. UL 489 Interrupting Capacity Ratings

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA Symmetrical Amperes)					
		Volts ac (50/60 Hz)				Volts dc <sup>①</sup>	
		240	277	480	600	125	250 <sup>②③</sup>
EDB	2, 3	22	—	—	—	10	—
EDS	2, 3	42	—	—	—	10	—
ED	2, 3	65	—	—	—	10	—
EDH	2, 3	100	—	—	—	10	—
EDC	2, 3	200	—	—	—	10	—
EHD	1	—	4	—	—	10	—
	2, 3	18	—	14	—	—	10
FDB	2, 3, 4	18	—	14	14	—	10
FD,	1	—	35	—	—	10	—
FDE <sup>④</sup>	2, 3, 4	65	—	35	18	—	10
HFD,	1	—	65	—	—	10	—
HFDE <sup>④</sup>	2, 3, 4	100	—	65	25	—	22
FDC <sup>⑤</sup> ,	2, 3, 4	200	—	100	25	—	22
FDCE <sup>④⑤⑥</sup>							

<sup>①</sup> dc ratings apply to substantially non-inductive circuits.

<sup>②</sup> 2-pole circuit breaker, or two poles of 3-pole circuit breaker.

<sup>③</sup> Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.

<sup>④</sup> Electronics available on 3-pole only, no dc rating for FDE, HFDE, FDCE.

<sup>⑤</sup> Current limiting.

<sup>⑥</sup> Check with Eaton for availability.

Table 12-149. IEC 157-1 (P1) Interrupting Capacity Ratings (P1)

Circuit Breaker Type	Number of Poles	Interrupting Capacity (kA Symmetrical Amperes)					
		Volts ac (50/60 Hz)				Volts dc <sup>⑦</sup>	
		220, 240	380, 415	440	500	125	250 <sup>⑧⑨</sup>
EDB	2, 3	22	—	—	—	10	—
EDS	2, 3	42	—	—	—	10	—
ED	2, 3	65	—	—	—	10	—
EDH	2, 3	100	—	—	—	10	—
EDC	2, 3	200	—	—	—	10	—
EHD	1	—	14	—	—	10	—
	2, 3	18	—	14	—	—	10
FDB	2, 3, 4	18	14	14	14	—	10
FD	1	35	—	—	—	10	—
	2, 3, 4	65	35	35	18	—	10
HFD	1	65	—	—	—	10	—
	2, 3, 4	100	65	65	25	—	22
FDC	2, 3, 4	200	100	100	35	—	22

<sup>⑦</sup> dc ratings apply to substantially non-inductive circuits.

<sup>⑧</sup> 2-pole circuit breaker, or two poles of 3-pole circuit breaker.

<sup>⑨</sup> Time constant is 3 milliseconds minimum at 10 kA and 8 milliseconds minimum at 22 kA.

Table 12-150. Digitrip Electronic Trip Units

Circuit Breaker Type	Frame	Ratings
FDE, HFDE, FDCE	225	100, 110, 125, 150, 160, 175, 200, 225
FDE, HFDE, FDCE	160	60, 70, 80, 90, 100, 125, 150, 160
FDE, HFDE, FDCE	80	15, 20, 30, 40, 50, 60, 70, 80

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**Table 12-151. F-Frame Digitrip Specifications**

Trip Unit Type	Digitrip RMS 310+	
rms Sensing	Yes	
<b>Breaker Type</b>		
Frame Ampere Range Interrupting Rating at 480 V	FDE 15 – 225 A 35, 65, 100 (kA)	
<b>Protection</b>		
Ordering Options	LS LSG	LSI LSIG
Fixed Rated Plug ( $I_n$ ) Overtemperature Trip	No Yes	
<b>Long Delay Protection (L)</b>		
Adjustable Rating Plug ( $I_n$ ) Long Delay Pickup Long Delay Time $I^2t$	No 40 – 100% Frame 2 – 24 Seconds	
Long Delay Time $I^4t$ Long Delay Thermal Memory High Load Alarm	No Yes Yes	
<b>Short Delay Protection (S)</b>		
Short Delay Pickup	200 – 1000% x ( $I_r$ )	
Short Delay Time $I^2t$ Short Delay Time Flat	Yes No	No Inst – 300 ms
Short Delay Time Z.S.I.	Yes <sup>①</sup>	
<b>Instantaneous Protection (I)</b>		
Instantaneous Pickup Discriminator Instantaneous Override	No No Yes	
<b>Ground Fault Protection (G)</b>		
Ground Fault Alarm Ground Fault Pickup Ground Fault Delay $I^2t$	No 20 – 100% Frame No	
Ground Fault Delay Flat Ground Fault Z.S.I. Ground Fault Thermal Memory	Inst – 300 ms Yes <sup>①</sup> Yes	
<b>System Diagnostics</b>		
Cause of Trip LEDs Magnitude of Trip Information Remote Signal Contacts	No No No	
<b>System Monitoring</b>		
Digital Display Current Voltage	No No No	
Power and Energy Power Quality Harmonics Power Factor	No No No	
<b>Communications</b>		
PowerNet	No	
<b>Testing</b>		
Testing Method	Test Kit	

<sup>①</sup> ZSI (Zone Selective Interlocking) is optional. Must order with ZSI. Standard 310+ does not come with ZSI.

**Legend:**  $I_n$  = Rating Plug  
 $I_r$  = Long Delay Pickup Setting x  $I_n$

**Dimensions/Weights**

**Table 12-152. Dimensions in Inches (mm)**

Number of Poles	Width	Height	Depth
1	1.38 (35.1)	6.00 (152.4)	3.38 (86.0)
2	2.75 (70.0)	6.00 (152.4)	3.38 (86.0)
3	4.13 (105.0)	6.00 (152.4)	3.38 (86.0)
4	5.50 (139.7)	6.00 (152.4)	3.38 (86.0)

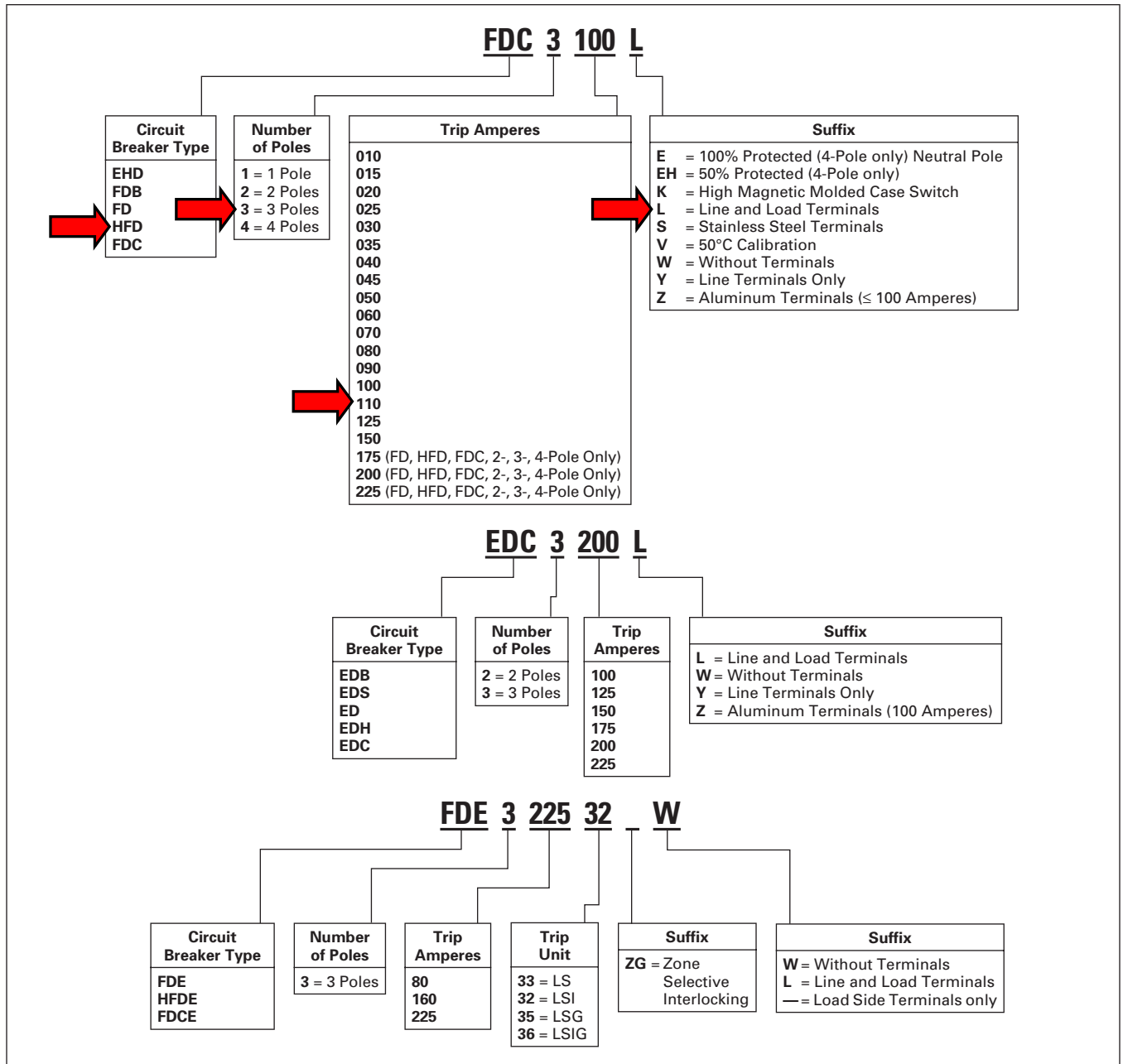
**Table 12-153. Approximate Shipping Weight, Lbs. (kg)**

Breaker Type	Number of Poles			
	1	2	3	4
ED, EDB, EDS, EDH, EDC	—	3 (1.4)	4.5 (2.0)	—
EHD, FDB, FD, HFD, FDC	2 (.9)	3 (1.4)	4.5 (2.0)	6 (2.7)
FDE, HFDE, FDCE	—	—	4.5 (2.0)	—

**Product Selection**

This information is presented only as an aid to understanding Catalog Numbers. It is not to be used to build Catalog Numbers for circuit breakers or trip units.

**Table 12-154. Circuit Breaker Catalog Numbering System**



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**Table 12-158. Type FD Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units**

Max. Cont. Ampere Rating at 40°C	600 Vac Maximum, 250 Vdc						277 Vac Maximum, 125 Vdc		600 Vac Maximum, 250 Vdc					
	14 kAIC at 600 Vac						35 kAIC at 277 Vac		35 kAIC at 480 Vac					
	Type FDB (Includes Terminals on Load End Only)						Type FD (Includes Terminals on Load End Only)							
	2-Pole		3-Pole		4-Pole		1-Pole		2-Pole		3-Pole		4-Pole	
Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	
10 ①	FDB2010		FDB3010		FDB4010		FD1010		—		—		—	
15	FDB2015		FDB3015		FDB4015		FD1015 ②		FD2015		FD3015		FD4015	
20	FDB2020		FDB3020		FDB4020		FD1020 ②		FD2020		FD3020		FD4020	
25	FDB2025		FDB3025		FDB4025		FD1025		FD2025		FD3025		FD4025	
30	FDB2030		FDB3030		FDB4030		FD1030		FD2030		FD3030		FD4030	
35	FDB2035		FDB3035		FDB4035		FD1035		FD2035		FD3035		FD4035	
40	FDB2040		FDB3040		FDB4040		FD1040		FD2040		FD3040		FD4040	
45	FDB2045		FDB3045		FDB4045		FD1045		FD2045		FD3045		FD4045	
50	FDB2050		FDB3050		FDB4050		FD1050		FD2050		FD3050		FD4050	
60	FDB2060		FDB3060		FDB4060		FD1060		FD2060		FD3060		FD4060	
70	FDB2070		FDB3070		FDB4070		FD1070		FD2070		FD3070		FD4070	
80	FDB2080		FDB3080		FDB4080		FD1080		FD2080		FD3080		FD4080	
90	FDB2090		FDB3090		FDB4090		FD1090		FD2090		FD3090		FD4090	
100	FDB2100		FDB3100		FDB4100		FD1100		FD2100		FD3100		FD4100	
110	FDB2110		FDB3110		FDB4110		FD1110		FD2110		FD3110		FD4110	
125	FDB2125		FDB3125		FDB4125		FD1125		FD2125		FD3125		FD4125	
150	FDB2150		FDB3150		FDB4150		FD1150		FD2150		FD3150		FD4150	
175	—		—		—		—		FD2175		FD3175		FD4175	
200	—		—		—		—		FD2200		FD3200		FD4200	
225	—		—		—		—		FD2225		FD3225		FD4225	

① Not UL listed. 5 kAIC interrupting rating.  
 ② UL listed for SWD applications, see NEC Article 240-83(d).

**Table 12-159. Types HFD and FDC Thermal-Magnetic Circuit Breakers with Non-Interchangeable Trip Units**

Max. Cont. Ampere Rating at 40°C	277 Vac Maximum, 125 Vdc				600 Vac Maximum, 250 Vdc				600 Vac Maximum, 250 Vdc					
	65 kAIC at 277 Vac				65 kAIC at 480 Vac				100 kAIC at 480 Vac					
	Type HFD (Includes Terminals on Load End Only)								Type FDC Current Limiting (Includes Terminals on Load End Only)					
	1-Pole		2-Pole		3-Pole		4-Pole		2-Pole		3-Pole		4-Pole	
Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	
15	HFD1015 ③		HFD2015		HFD3015		HFD4015		FDC2015		FDC3015		FDC4015	
20	HFD1020 ③		HFD2020		HFD3020		HFD4020		FDC2020		FDC3020		FDC4020	
25	HFD1025		HFD2025		HFD3025		HFD4025		FDC2025		FDC3025		FDC4025	
30	HFD1030		HFD2030		HFD3030		HFD4030		FDC2030		FDC3030		FDC4030	
35	HFD1035		HFD2035		HFD3035		HFD4035		FDC2035		FDC3035		FDC4035	
40	HFD1040		HFD2040		HFD3040		HFD4040		FDC2040		FDC3040		FDC4040	
45	HFD1045		HFD2045		HFD3045		HFD4045		FDC2045		FDC3045		FDC4045	
50	HFD1050		HFD2050		HFD3050		HFD4050		FDC2050		FDC3050		FDC4050	
60	HFD1060		HFD2060		HFD3060		HFD4060		FDC2060		FDC3060		FDC4060	
70	HFD1070		HFD2070		HFD3070		HFD4070		FDC2070		FDC3070		FDC4070	
80	HFD1080		HFD2080		HFD3080		HFD4080		FDC2080		FDC3080		FDC4080	
90	HFD1090		HFD2090		HFD3090		HFD4090		FDC2090		FDC3090		FDC4090	
100	HFD1100		HFD2100		HFD3100		HFD4100		FDC2100		FDC3100		FDC4100	
110	HFD1110		HFD2110		HFD3110		HFD4110		FDC2110		FDC3110		FDC4110	
125	HFD1125		HFD2125		HFD3125		HFD4125		FDC2125		FDC3125		FDC4125	
150	HFD1150		HFD2150		HFD3150		HFD4150		FDC2150		FDC3150		FDC4150	
175	—		HFD2175		HFD3175		HFD4175		FDC2175		FDC3175		FDC4175	
200	—		HFD2200		HFD3200		HFD4200		FDC2200		FDC3200		FDC4200	
225	—		HFD2225		HFD3225		HFD4225		FDC2225		FDC3225		FDC4225	

③ UL listed for SWD applications, see NEC Article 240-83(d).

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Table 12-160. Types FDE, HFDE and FDCE Electronic Circuit Breakers with Non-Interchangeable Trip Units

Maximum Ampere Rating	Neutral CT for LSG and LSIG	LS		LSI		LSG		LSIG	
		Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$
<b>IC Rating 35 kAIC at 480 Vac</b>									
80	CTF080	FDE308033		FDE308032		FDE308035		FDE308036	
160	CTF160	FDE316033		FDE316032		FDE316035		FDE316036	
225	CTF225	FDE322533		FDE322532		FDE322535		FDE322536	
<b>IC Rating 65 kAIC at 480 Vac</b>									
80	CTF080	HFDE308033		HFDE308032		HFDE308035		HFDE308036	
160	CTF160	HFDE316033		HFDE316032		HFDE316035		HFDE316036	
225	CTF225	HFDE322533		HFDE322532		HFDE322535		HFDE322536	
<b>IC Rating 100 kAIC at 480 Vac ①</b>									
80	CTF080	FDCE308033		FDCE308032		FDCE308035		FDCE308036	
160	CTF160	FDCE316033		FDCE316032		FDCE316035		FDCE316036	
225	CTF225	FDCE322533		FDCE322532		FDCE322535		FDCE322536	

① Check with Eaton for availability.

Molded Case Switches

Eaton’s Cutler-Hammer molded case switches are used as compact switches in applications requiring high current switching capabilities. Molded case switches are constructed of circuit breaker components and are of the high instantaneous automatic type. Molded case switches are listed in accordance with Underwriters Laboratories Inc., Standard UL 1087.

Line and Load Terminals

Line and load terminals provide wire connecting capabilities for specific ranges of continuous current ratings and wire types. Except as noted, terminals comply with Underwriters Laboratories Inc., Standards UL 486A and UL 486B. Unless otherwise specified, F-Frame circuit breakers are factory equipped with load terminals only.

Ordering Information

F-Frame circuit breakers and molded case switches have load terminals only as standard equipment. When standard line-end terminals (same as standard load-end terminals) are required, add Suffix **L** to the circuit breaker Catalog Number. When non-standard or optional line and/or load terminals are required, order by style number. Specify if factory installation is required.

Table 12-161. FDE Electronic Breaker with Zone Selective Interlocking

Ampere Rating	Catalog Number			
	LSI w/ZSI	Price U.S. \$	LSIG w/ZSI	Price U.S. \$
<b>35 kAIC at 480 Vac</b>				
80	FDE308032ZG		FDE308036ZG	
160	FDE316032ZG		FDE316036ZG	
225	FDE322532ZG		FDE322536ZG	
<b>65 kAIC at 480 Vac</b>				
80	HFDE308032ZG		HFDE308036ZG	
160	HFDE316032ZG		HFDE316036ZG	
225	HFDE322532ZG		HFDE322536ZG	

Table 12-162. Molded Case Switches

Maximum Continuous Ampere Rating at 40°C	Complete Circuit Breaker with Load Side Terminals Only					
	480 Vac Maximum, 250 Vdc		600 Vac Maximum, 250 Vdc			
	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$
<b>2-Pole</b>						
100	EHD2100K		FD2100K		HFD2100K	
150	—		FD2150K		HFD2150K	
225	—		FD2225K		HFD2225K	
<b>3-Pole</b>						
100	EHD3100K		FD3100K		HFD3100K	
150	—		FD3150K		HFD3150K	
225	—		FD3225K		HFD3225K	
<b>4-Pole</b>						
100	—		FD4100K		HFD4100K	
150	—		FD4150K		HFD4150K	
225	—		FD4225K		HFD4225K	

Note: Molded Case Switches will open above 1800 amperes.

Table 12-163. Breaker Mount Ammeter

Description	Catalog Number	Price U.S. \$
Breaker Mount Ammeter	DIGIVIEW	

Note: Use on FDE, HFDE and FDCE electronic trip only.



Ammeter

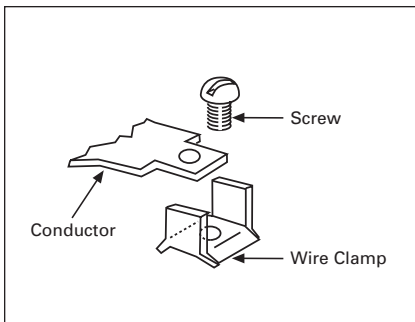
**Line and Load Terminals (Continued)**

**Table 12-164. Line and Load Terminals**

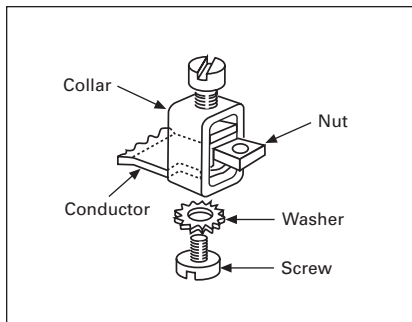
Maximum Breaker Amperes	Terminal Body Material	Wire Type	AWG Wire Range	Metric Wire Range mm <sup>2</sup>	Package of 3 Terminals	
					Catalog Number	Price U.S. \$
<b>Standard Pressure Type Terminals</b>						
20 (EHD)	Steel	Cu/Al	14 – 10	2.5 – 4	<b>3T20FB</b> ①	
100	Steel	Cu/Al	14 – 1/0	2.5 – 50	<b>3T100FB</b>	
225	Aluminum	Cu/Al	4 – 4/0	25 – 95	<b>3TA225FD</b>	
<b>Optional Pressure Terminals</b>						
50	Aluminum	Cu/Al	14 – 4	2.5 – 25	<b>3TA50FB</b> ①	
100	Aluminum	Cu/Al	14 – 1/0	2.5 – 50	<b>3TA100FD</b>	
200	Stainless Steel	Cu	4 – 4/0	25 – 95	<b>3T150FB</b>	
225	Copper	Cu	4 – 4/0	25 – 95	<b>3T225FD</b>	
225	Aluminum	Cu/Al	6 – 300 kcmil	16 – 150	<b>3TA225FDK</b> ②	

① Not for use with ED, EDH, EDC breakers.

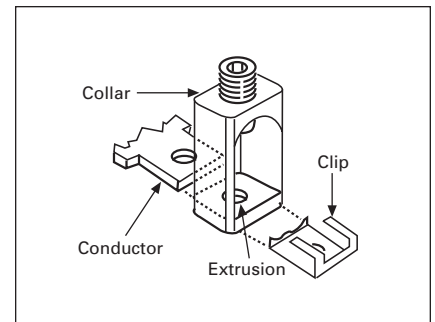
② Includes terminal shield kit. Adds approximately 3 inches (76.2) to breaker height. Available for use on 3-pole breaker only.



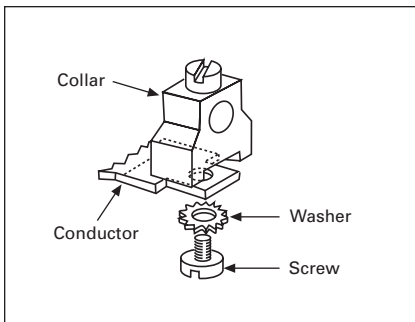
**Figure 12-15. 3T20FB**  
Assemble wire clamp to bottom of conductor as shown.



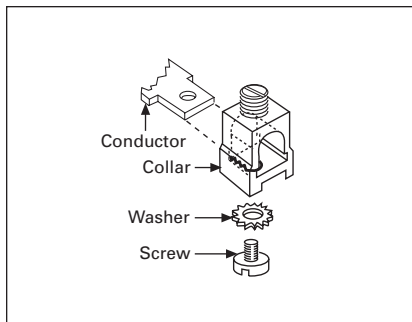
**Figure 12-16. 3T100FB, 3T150FB**  
Insert collar enclosing conductor as shown. Locate nut on top of conductor and tighten securely with screw and washer. **Caution:** Collar must surround conductor.



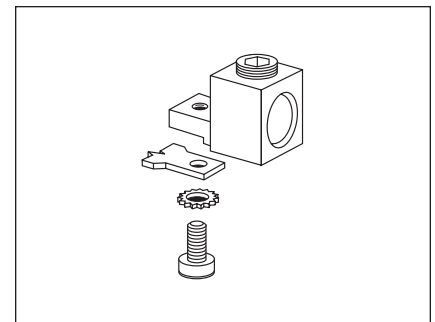
**Figure 12-17. 3TA225FD**  
Insert collar enclosing conductor and center on extrusion on collar. Install clip with legs on top of conductor and snap end around bottom of collar.



**Figure 12-18. 3TA50FB**  
Assemble collar on top of conductor as shown. Tighten securely with screw and washer.



**Figure 12-19. 3TA100FD**  
Collar slides onto conductor and is held in position by a screw and lockwasher.



**Figure 12-20. 3TA225FDK (Up to 150 mm<sup>2</sup>)**  
Assemble collar on top of conductor as shown. Tighten securely with screw and washer. Terminal shield must be used with this collar.

**Note:** For 185 mm<sup>2</sup>, use 3TA225FDK1.

## F-Frame

## Allowable Accessory Combinations

Different combinations of accessories can be supplied, depending on the types of accessories and the number of poles in the circuit breaker.

Table 12-165. Accessories

Description	Reference Page	1-Pole			2-Pole			3-Pole ①			4-Pole			
		Center	Left	Right	Left	Right	Center	Left	Center	Right	Left	Center	Right	Neutral
<b>Internal Accessories (Only one internal accessory per pole)</b>														
Alarm Lockout Switch (Make Only)	12-217	■												
Alarm Lockout (Make/Break)	12-217			■	□			□	■					
Alarm Lockout (2Make/2Break)	12-217			■	□			□	■					
Auxiliary Switch (1A, 1B)	12-220			■	■			■	■					■
Auxiliary Switch (2A, 2B)	12-220			■	■			■	■					■
Auxiliary Switch and Alarm Switch Combination	12-223			■	□			□	■					
Shunt Trip — Standard	12-226			■	■			■	■					■
Shunt Trip — Low Energy	12-231			■	■			■	■					
Undervoltage Release Mechanism	12-232			■	■			■	■					
<b>External Accessories</b>														
End Cap Kit	12-243			●				●						●
Keeper Nut	12-243	●		●				●						●
Control Wire Terminal Kit	12-244	●		●				●						●
Multiwire Connectors	12-245	●		●				●						●
Base Mounting Hardware	12-246	●		●				●						●
Terminal Shields	12-248	●		●				●						●
Terminal End Covers	12-249							●						
Interphase Barriers	12-249			●				●						●
Non-Padlockable Handle Block	12-251	■		■				■					■	
Snap-on Padlockable Handle Lock Hasp	12-251	■		■				■					■	
Padlockable Handle Lock Hasp	12-252				■	□			□	□				□
Cylinder Lock	12-252					■								
Key Interlock Kit	12-253				■	□			□	□				□
Sliding Bar Interlock — Requires Two Breakers	12-254							●						
Walking Beam Interlock — Requires Two Breakers	12-254							●						●
Electrical (Solenoid and Motor) Operators	12-255							●						●
Plug-in Adapters	12-257			●				●						●
Rear Connecting Studs	12-258	●		●				●						●
Panelboard Connecting Straps	12-261	●		●				●						●
Handle Mechanisms	12-262							●						
LFD Current Limiter	12-268							●						
IQ Energy Sentinel	12-268			●				●						
<b>Modifications (Refer to Eaton)</b>														
Special Calibration	—	●		●				●						●
Moisture Fungus Treatment	12-73	●		●				●						●
Freeze-Tested Circuit Breakers	—	●		●				●						●
Marine Application	—	●		●				●						●

■ Applicable in indicated pole position

□ May be mounted on left or right pole — not both

● Accessory available/Modification available

① Internal accessories are listed with Underwriters Laboratories (UL) for factory installation. They are not listed with UL for field installation. Any one internal accessory may be mounted in the left pole. Only a specialty built 1A/1B auxiliary switch may be mounted in the right pole. Factory reference part number for the 1A/1B auxiliary switch is A1X1RPKFDE.